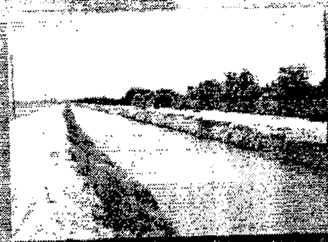
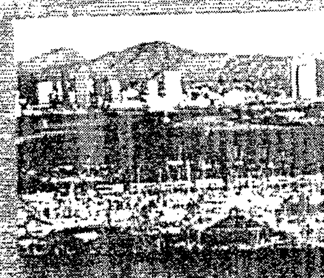
Imperial Irrigation District
Water Conservation and Transfer Project

Draft
Habitat Conservation Plan

Draft
Environmental Impact Report/
Environmental Impact Statement



Volume 2 - Appendices



Prepared for

Imperial Irrigation District

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Summary of IID/SDCWA Transfer Agreement

SUMMARY OF
IID/SDCWA TRANSFER AGREEMENT
[Revised as of 12/18/01]

The following summarizes the terms of the 1998 Agreement for Transfer of Conserved Water between IID and SDCWA, as amended by the First, Second and Third Amendments thereto (collectively, IID/SDCWA Transfer Agreement or Agreement). The Agreement, complete with 11 exhibits, addresses the following subjects: conditions, transfer mechanism, quantity, limit on IID's diversions, term and renewal, pricing, and shortage sharing.

1. **Conditions**.

Four major conditions must be satisfied before the Agreement becomes effective:

1.1. **Environmental Review**. First, environmental review must be completed. IID is designated as the Lead Agency for environmental compliance under CEQA. IID intends to work in close coordination with the federal lead agency designated for purposes of compliance under NEPA. Article 9 of the Agreement requires IID and SDCWA to complete the environmental review and assessment required by CEQA and NEPA. The transfer of conserved water to SDCWA is expressly contingent upon a determination by IID and SDCWA to proceed with implementation of the activities described in the Agreement, which determination will be made only after completion of such environmental assessment and incorporation of any project alternatives and/or mitigation measures which those agencies consider appropriate or which are legally required by any other state or federal agency. IID is responsible for the mitigation of any environmental impacts of water conservation efforts within Imperial County (excluding the Colorado River between Imperial Dam and the northern county border) and upon the Salton Sea, except that IID has the right to terminate the Agreement in lieu of implementing such mitigation measures if the present value of projected mitigation expenditures might exceed $15 million at the time of completion of environmental review. Once water transfers commence, if the present value of the cost of original mitigation obligations and unanticipated environmental consequences combined exceeds $30 million, IID may void the Agreement and terminate any further transfer of conserved water. SDCWA is responsible for the mitigation of any environmental impacts on the Colorado River between Imperial Dam and Lake Havasu resulting from the transportation of the conserved water from Imperial Dam to SDCWA and any impacts in San Diego County. SDCWA has the right to terminate the Agreement in lieu of implementing such mitigation measures if the estimated mitigation costs exceed $1 million at the time of completion of environmental review or $2 million after transfers commence. Each party has a right, but no obligation, to contribute money to pay the other party's costs that exceed the specified limits, in which case the Agreement would not be terminated.

1.2. **Wheeling Arrangements**. Second, SDCWA must obtain, from MWD or otherwise, the ability to wheel the conserved water through MWD's Colorado River Aqueduct (CRA) to San Diego County. The Agreement specifies a formula for the base wheeling rate based on the amortized capital costs, O&M, replacement costs, and net power costs for the CRA facilities actually used to convey the water. The Agreement also provides that SDCWA pay a "supplemental wheeling rate" to MWD when the wheeling of the conserved water would prevent

MWD from diverting all the flood control releases available to MWD pursuant to the reservoir operating criteria specified in the 1984 Field Working Agreement between the U.S. Army Corps of Engineers and Reclamation. The supplemental wheeling rate may not exceed $60 per AF. If the wheeling condition is not satisfied, either party may void the Agreement. As with the environmental condition, both parties have a right, but no obligation, to contribute money to pay the other party's share of wheeling costs that exceed the limits, in which case the Agreement would not be terminated.

1.3. **Approval by SWRCB and Reclamation**. Third, the Agreement must receive necessary approvals from the State Water Resources Control Board (SWRCB) and the Bureau of Reclamation (Reclamation). SWRCB's approval must include findings that: (1) California Water Code §§ 1011, 1012 and 1013 apply to and govern the transfer; (2) the conserved water retains the same priority as if it were diverted and used by IID; (3) IID's water rights are unaffected by the transfer; (4) the transfer is in furtherance of earlier SWRCB decisions and orders concerning IID's reasonable and beneficial water use and of Article X, § 2 of the California Constitution and California Water Code §§ 100 and 109; (5) the water conservation will be verified by IID reducing its diversions from the Colorado River in the amount of conserved water transferred, and (6) junior right holders will be protected by forbearance by IID under its Priority 3 Colorado River water right from diverting in excess of 3.1 MAFY during the term of the Agreement. Reclamation approval must find: (1) the transfer is consistent with federal law; (2) Reclamation will account for the conserved water under the decree as part of IID's net diversions under IID's priority for use of Colorado River water; (3) IID's water rights are unaffected by the transfer; (4) recognition of the SWRCB findings concerning IID's reasonable and beneficial use of water and SWRCB verification of conserved water, which includes forbearance by IID of its Priority 3 Colorado River water right at 3.1 MAFY during the term of the Agreement; and (5) diversion of the conserved water by SDCWA at Lake Havasu is permissible.

1.4. **Landowner Subscription**. Fourth, within 18 months of April 29, 1998, IID must enter into conditional subscriptions of interest with landowners desirous of participating in on-farm conservation expressly conditioned on IID's compliance with environmental laws pursuant to Article 9 of the Agreement. Within 120 days of IID's certification of the EIR, participating landowners must enter into contracts which commit the landowners to collectively conserve at least 130,000 AFY. The Agreement specifically provides that the contracts with participating landowners will prohibit fallowing as a water conservation method.

2. **Transfer Mechanism**.

Subject to the terms and conditions of the Agreement, IID may undertake and agrees to contract with landowners to undertake water conservation efforts and divert less Colorado River water by an amount equal to the conserved water created. The transfer occurs by IID leaving water in the river in the amount of conserved water created for SDCWA to divert and deliver to its service area. SDCWA pays IID for the quantity of water so transferred.

3. **Quantity.**

Water will be conserved and transferred pursuant to Water Code §§ 1011 and 1012 . The conserved water will retain the senior priority of the IID's water rights. There are two transfer schedules: the primary transfer and a discretionary additional transfer. The primary transfer quantity will commence only after the satisfaction of all four conditions discussed above. The quantity transferred in the first year will be 20,000 AFY, increasing each year by 20,000 AF until a "stabilized primary quantity" (e.g., maximum annual primary transfer) is reached. That quantity is between 130,000 AFY and 200,000 AFY, as determined by the IID in its complete discretion.

A discretionary additional transfer of up to 100,000 AFY may occur, but no sooner than the start of the 11th year after transfers commence. The quantity of the discretionary additional transfer is conditioned by a determination of availability by IID and a determination of need by SDCWA. The discretionary additional transfer is subject to the right of IID to transfer the additional discretionary amount to settle disputes with MWD or Coachella Valley Water District (CVWD). IID may enter into agreements with CVWD on any terms and conditions acceptable to IID, provided CVWD covenants not to transfer the water received, directly or indirectly, for use outside CVWD's jurisdictional boundaries. IID may enter into agreements with MWD, provided that either: (1) MWD permanently waives all existing legal disputes related to the approval conditions under the Agreement, or (2) MWD pays a price equal to or greater than the price SDCWA pays during the same year. The amount of discretionary additional water potentially available to SDCWA is up to 100,000 AFY, less any amount transferred to MWD or CVWD.

During the period of the potential availability of discretionary additional transfers, IID and SDCWA have a mutual right of first refusal. IID has an exclusion for transfers to MWD and CVWD. SDCWA has an exclusion for purchases from MWD and for transfers with other third parties for water quality purposes and drought transactions. The Agreement includes a number of specific criteria for these transactions and limits on the quantity and duration of such transactions.

If the proposed Quantification Settlement Agreement (QSA) among IID, MWD and CVWD is approved and fully implemented, SDCWA would be limited to the primary amount (up to 200 KAFY) of conserved water, and CVWD and/or MWD would have the option to acquire the discretionary amount (up to 100 KAFY) pursuant to the terms of the QSA. Also, after negotiation of the QSA, IID and SDCWA amended the Agreement to provide for the early transfer of an additional 10,000 AF (Early Transfer Water), contingent upon satisfaction of all conditions precedent and implementation of the QSA. The Early Transfer Water will be made available to SDCWA at Imperial Dam in the following increments: 2,500 AF in 2002, 5,000 AF in 2003, and 2,500 AF in 2004. There is no restriction on fallowing or requirement for landowner subscriptions in connection with the Early Transfer Water.

4. **Limit on IID's Diversions.**

IID's reduced diversions at Imperial Dam (less return flows), for each calendar year during the term of the Agreement, will be measured by subtracting from 3.1 MAF the sum of

[IID's actual diversions (less return flows) during that year under its Priority 3 water right plus the amount of water transferred to MWD under the 1988 IID/MWD Agreement] and disregarding IID's actual diversions (less return flows) during that year, if any, under its Priority 6 or 7 water right. To assist the administration of diversions on the Colorado River and insulate junior right holders from any possible impact during the term of the Agreement, IID will forbear under its Priority 3 water right from diverting (less return flows) in excess of 3.1 MAFY and from diverting (less return flows) in excess of ninety percent (90%) of the water available under its Priority 6 and 7 water right.

5. **Term And Renewal**.

The Agreement has an initial term of 45 years. Subject to a material change provision concerning the continued ability and terms for the cost of conveying the conserved water through the CRA, each party has a unilateral option to renew the Agreement for a renewal term of 30 years. At the renewal, IID may recapture up to 34,000 AFY, provided that the 1988 IID/MWD Agreement has expired or terminated. The Agreement also includes a meet and confer obligation for the parties to negotiate a potential extension of the Agreement after the end of the renewal term on any terms and conditions acceptable to the parties. At termination of the Agreement, SDCWA has no claim to any further conserved water.

6. **Pricing**.

The Agreement has three pricing provisions: base contract price, shortage premium, and price redetermination. The pricing under the Agreement starts with the base contract price and shortage premium.

6.1. **Base Contract Price**. The base contract price is determined by a series of formulae which depend on actual MWD rates and charges, the concept of a "base wheeling rate", and the actual wheeling rate for conveying the conserved water through MWD's CRA to San Diego:

Base Contract Price = (MWD Full Water Rate-Base Wheeling Rate) x (1-Discount) + 50% (Base Wheeling Rate - Actual Wheeling Rate)

The formula for the MWD Full Water Rate is:

MWD Full Water Rate = MWD Rate for untreated noninterruptible water service +

per acre-foot valuation of other MWD rates and charges that vary with volume +

other MWD rates and charges that do not vary with volume/4-year running average of the Authority purchases from MWD and IID

Certain MWD charges are excluded from the MWD Full Water Rate, including currently assessed property taxes.

The actual wheeling rate equals the base wheeling rate plus a "supplemental wheeling rate" specified in the transportation conditions of the Agreement. The discount starts at 25% in the first year, declines to 15% by the 10th year, and declines to its long-term value of 5 % by the 17th year. Here are some sample calculations of the base contract price when the supplemental wheeling rate is not paid:

Assumptions of Sample Calculation	*Base Contract Price*
Year 1: initial projections of Full MWD Water Rate ($400/AF) and Base Wheeling Rate ($68.50/AF)	$249/AF
Year 10:	
initial projections of full water and base wheeling rates	$282/AF
$10/AF increase in base wheeling rate	$273/AF
$10/AF increase in MWD untreated water rate	$290/AF

In years when SDCWA pays the "supplemental wheeling rate," the base contract price declines by 50% of the supplemental wheeling rate.

6.2. <u>Shortage Premium</u>. SDCWA will make an additional "shortage premium" payment over the base contract price when there are significant shortfalls in California water supplies. The payment is made when any one of these three conditions exist:

(1) Northern California experiences a critical year condition;

(2) The Secretary of the Interior declares a shortage in the Lower Colorado River Basin; or

(3) SDCWA imposes mandatory rationing or conservation.

If SDCWA does not impose mandatory rationing or conservation, then SDCWA pays a shortage premium equal to 5% if Northern California experiences a critical year condition, 25% for a declared shortage in the Lower Colorado River Basin, or 30% if both conditions prevail. If SDCWA does impose mandatory rationing or conservation, then SDCWA pays the maximum of the above amount or the premium specified in the table below.

Authority Shortage	Premium
5% to <10%	10%
10% to <15%	15%
15% to <20%	30%
20% to <25%	40%

25% to <30%	50%
≥ 30%	100%

6.3. **Price Redetermination**. A price redetermination process will adjust the base contract price and the shortage premium to assure that the pricing provisions reflect the market value of IID water. The adjustments will be based on financial valuations of other transactions that meet a defined set of eligibility criteria. The market value of IID water will be estimated by adjusting the valuations of the other transactions to reflect differences between the IID/SDCWA transaction and the other transactions (such as supply reliability, water quality, and the time the other transactions were negotiated relative to the date of the price redetermination). The first price redetermination can be no sooner than 10 years after the start of the transfer of conserved water and provided that there are at least 10 transactions meeting the eligibility criteria and the volume in the California market exceeds 240,000 AFY. Thereafter, price redeterminations would generally occur no sooner than every 10 years; however, if a previous redetermination were based on fewer than 15 transactions, the next redetermination could be accelerated once information from more than 20 eligible transactions becomes available.

The pricing provisions of the Agreement are adjusted when a financial valuation of the existing pricing provisions is not consistent with the estimated market value of IID water under the redetermination process. The Agreement includes a defined quantitative criterion for making this determination. The new contract pricing provisions would be a weighted average of the existing price and the valuation of IID water estimated in the price redetermination. The weight given to the price redetermination grows with the scale of transactions in the California water market.

6.4. **Early Transfer Water Price**. The price for the Early Transfer Water is $125 per AF in 1999 Dollars, to be adjusted for inflation, without reduction or adjustment for wheeling costs. As additional consideration, SDCWA will reimburse CVWD for certain environmental mitigation costs payable by CVWD in connection with its acquisition of water conserved by IID pursuant to the QSA.

7. **Shortage Sharing**.

IID and SDCWA will share pro rata any reductions in water available to IID under its Priority 3 right to Colorado River water when the Secretary of the Interior declares a shortage in the Lower Colorado River Basin. When the amount of water in usable storage in Lake Mead is less than 15 million AF and the unregulated inflow into Lake Powell is forecasted to be less than 8.8 million AF, the parties will also meet and confer to attempt to negotiate a supplemental water transfer agreement in anticipation of a shortage on the Colorado River of sufficient magnitude to reduce the availability of water to IID under its senior water rights.

Summary of Proposed Quantification Settlement Agreement

SUMMARY OF
PROPOSED QUANTIFICATION SETTLEMENT AGREEMENT

The following generally summarizes the purpose and intent of the Quantification Settlement Agreement (QSA) among Imperial Irrigation District (IID), Coachella Valley Water District (CVWD), and Metropolitan Water District of Southern California (MWD) (collectively, the Parties), and describes those actions contemplated by the QSA and a number of related agreements.

1. **Purpose and Intent**. The QSA is intended (1) to consensually settle longstanding disputes regarding the priority, use and transfer of Colorado River water among the Parties, (2) to establish by agreement the terms for the further distribution of Colorado River water among the Parties for up to 75 years based upon agreed water budgets, (3) to facilitate agreements and actions which will enhance the certainty and reliability of Colorado River water supplies available to the Parties and assist the Parties in meeting their water demands within California's apportionment of Colorado River water by identifying the terms, conditions and incentives for the conservation and transfer of Colorado River water within California. IID seeks to settle disputes with CVWD and MWD and to use proceeds from the acquisition of Conserved Water (as defined in the QSA) to improve the reliability, efficiency and management of its Colorado River water supply. CVWD seeks to settle disputes with IID and MWD and to acquire Conserved Water for agricultural uses to accommodate anticipated reductions in groundwater extraction. MWD seeks to settle disputes with IID and CVWD and to ensure the reliability of its Colorado River supplies.

2. **Term**. The QSA must become effective on or before December 31, 2002, and will terminate upon the earlier of (1) a non-consensual termination of the 1998 IID/SDCWA Transfer Agreement or (2) December 31 of year 75 of the QSA.

3. **Related Agreements**. The QSA provides for a number of agreements, activities and transactions. The QSA anticipates certain related agreements (Related Agreements) which will implement components of the QSA. The Related Agreements include:

(1) The Acquisition Agreements, which document various water transfers including the 1998 IID/SDCWA Transfer Agreement, as amended, the IID/CVWD Acquisition Agreement, the IID/MWD Acquisition Agreement, the CVWD Acquisition Agreement, and the MWD/CVWD Transfer and Exchange Agreement;

(2) The 1988 IID/MWD Agreement;

(3) The 1989 IID/MWD/CVWD/PVID Approval Agreement;

(4) The 1989 CVWD/MWD Supplemental Agreement;

(5) The Allocation Agreement (for allocation of the Conserved Water resulting from lining of the All-American Canal (AAC Lining Project) and the lining of the Coachella Canal (CC Lining Project);

(6) The Implementation Agreement (the agreement among IID, CVWD, MWD, SDCWA and the Secretary of the Interior (Secretary) containing the terms of agreement by the Secretary to honor the terms of the QSA and the Related Agreements);

(7) The Environmental Cost Sharing Agreement; and

(8) The Protest Dismissal Agreement, relating to the State Water Resources Control Board (SWRCB) proceeding.

The key components of the QSA and Related Agreements are described in succeeding sections.

4. Water Budgets. Currently, IID, CVWD and PVID (each of which serves agricultural water users) collectively have the right to consumptively use 3.85 million acre-feet per year (MAFY) of Colorado River water under Priorities 1, 2 and 3 of the priority system which applies to California holders of Colorado River water rights; however, there are no separate individual limits and CVWD's entitlement is subordinate to IID's. The QSA establishes water budgets that will govern Consumptive Use (as defined in the QSA) of Colorado River water by the Parties during the term of the QSA, including a quantified division of Priority 3a.

The QSA defines "Consumptive Use" as the diversion of water from the main stream of the Colorado River, including water drawn from the main stream by underground pumping, net of measured and unmeasured return flows. The QSA defines "Conserved Water" as water made available for acquisition under the QSA and the Related Agreements attributable to (1) temporary land fallowing or crop rotation for up to the term of the QSA, if an allowed use is for irrigation, or (2) projects or programs that enable the use of less water to accomplish the same purpose or purposes of allowed use, subject in both cases to further restrictions.

The net effect of the QSA water budgets is to individually cap IID's and CVWD's Priority 3a rights during the QSA term to a total of 3.430 MAFY, and to specify quantities and priorities to Priority 6 water among MWD, IID and CVWD. All the Parties will forbear enough Consumptive Use from their respective Priorities to permit the Secretary to satisfy the water rights of holders of Indian reserved rights and miscellaneous present perfected rights.

4.1. IID's Priority 3a Cap. IID's Consumptive Use entitlement under its share of Priority 3a will be capped at 3.1 MAFY at Imperial Dam, less (1) the Conserved Water made available by IID for use by others under the QSA, and (2) the water made available by IID for use by Indian reserved rights and by individual holders of miscellaneous present perfected rights, to the extent charged to Priority 3a (see Section 4.4 below), and plus any Conserved Water made available to IID as a result of the AAC Lining Project and the

CC Lining Project (see Section 6.1 below). The cap will be subject to adjustment as permitted under the Inadvertent Overrun Program (IOP). Any Colorado River water acquired from any party pursuant to a transaction permitted under the QSA (see Section 6.2 below) will be in addition to this cap.

4.2. **CVWD's Priority 3a Cap**. CVWD's Consumptive Use entitlement under its share of Priority 3a will be capped at 330 thousand acre-feet per year (KAFY) at Imperial Dam, less (1) Conserved Water made available from the CC Lining Project and (2) the water made available by CVWD for use by Indian reserved rights and by individual holders of miscellaneous present perfected rights, to the extent charged to Priority 3a. This cap will be subject to adjustment as permitted under the IOP. Any Colorado River water acquired from any party pursuant to a transaction contemplated or permitted by the QSA will be in addition to this cap.

4.3. **MWD's Priority 4 and 5 Cap**. MWD's Consumptive Use entitlements under Priorities 4 and 5 will be capped by the QSA at 550 KAFY and 662 KAFY, respectively, at Lake Havasu, less any water made available for use by Indian reserved rights and individual holders of miscellaneous present perfected rights, to the extent charged to Priority 4 or 5. The cap will be subject to adjustment as permitted under the IOP. Water made available by MWD to CVWD in any year pursuant to the QSA can be charged, at MWD's option, to any water available to MWD in that year. Any Colorado River water acquired from any party pursuant to a transaction contemplated or permitted by the QSA will be in addition to this cap.

4.4. **Indian Reserved Rights and Miscellaneous Present Perfected Rights**. IID and CVWD shall forbear Consumptive Use, up to a maximum of 11.5 KAFY and 3 KAFY, respectively, when necessary, in conjunction with the IOP, to permit the Secretary to make water available for Consumptive Use to holders of Indian reserved rights and miscellaneous present perfected Colorado River water rights in the aggregate amount sufficient to satisfy such rights. The obligation of IID to forbear use of water for this purpose may be charged, at IID's option, to its rights under Priorities 6a, 7 or 3a, as available. The obligation of CVWD to forbear use of water for this purpose may be charged, at CVWD's option, to its rights under Priorities 6, 7 or 3, as available. In the event that it is not necessary in any year for IID and CVWD to collectively forbear a total of 14.5 KAF for this purpose, then a credit equal to the difference between 14.5 KAF and the amount of actual necessary forbearance shall be shared 75 percent to IID and 25 percent to CVWD.

MWD shall forbear Consumptive Use, when necessary, in an amount in excess of the 14.5 KAFY forborne by IID and CVWD, collectively, in conjunction with the IOP, in the aggregate amount necessary to permit the Secretary to make water available for Consumptive Use to satisfy the rights of holders of Indian reserved rights and miscellaneous present perfected rights. MWD's obligation to forbear Consumptive Use for this purpose shall be charged at MWD's option to any Priority pursuant to which MWD has water available.

4.5. **IID and CVWD Priority 6 Forbearance and Priority 7 Use**. IID and CVWD agree to forbear Consumptive Use under Priority 6a sufficient to enable IID, CVWD and MWD to consumptively use Priority 6a water as it may be available in accordance with the following order of use, except as provided in the Interim Surplus Guidelines adopted by the Bureau of Reclamation:

(1) 38 KAFY to MWD;

(2) 63 KAFY to IID;

(3) 119 KAFY to CVWD; and

(4) Any balance of Priority 6a and 7 water available in accordance with the priorities identified in IID's, CVWD's and MWD's contracts with the Secretary for delivery of Colorado River water.

If IID, CVWD or MWD does not Consumptively Use all or any of the Priority 6a or 7 water available to it under the above priority schedule, any unused volume will be available in the above order to meet the next lower order Consumptive Use needs.

4.6. **MWD's Responsibility for Overruns in Priorities 1, 2 and 3**. The historical average annual Consumptive Use of Priorities 1, 2, and 3b is 420 KAFY. If the actual total Consumptive Use of Priorities 1, 2, and 3b exceeds 3.85 MAFY and actual total Consumptive Use of Priorities 1, 2 and 3b exceeds 420 KAFY, MWD shall repay the overrun of Priorities 1, 2 and 3b, in conjunction with the IOP. To the extent that the actual total Consumptive Use of Priorities 1, 2 and 3b is less than 420 KAFY, MWD shall have the exclusive right to Consumptively Use such unused water.

5. **Acquisition of Water By the Parties**. The QSA and the Related Agreements state the terms of a number of approved water transfers among the Parties to the QSA (IID, MWD and CVWD) and the San Diego County Water Authority (SDCWA). The transfers and the applicable governing agreements are:

(1) The transfer of 130 KAFY to 200 KAFY of Conserved Water from IID to SDCWA, governed by the 1998 IID/SDCWA Transfer Agreement, as amended.

(2) The transfer of up to 100 KAFY of Conserved Water from IID to CVWD, governed by the IID/CVWD Acquisition Agreement.

(3) The transfer of up to 100 KAFY of Conserved Water from IID to MWD (only to the extent that CVWD does not exercise its right to the 100 KAFY as described in item 2 above), governed by the IID/MWD Acquisition Agreement.

(4) The acquisition of up to 50 KAFY of water by CVWD from MWD after IID's obligation to provide 50 KAFY of Conserved Water to CVWD expires after year 45 of the QSA term.

(5) The transfer of 35 KAFY of MWD's State Water Project (SWP) water in exchange for a portion of CVWD's Colorado River water supplies, governed by the

CVWD/MWD Acquisition Agreement and the MWD/CVWD 35,000 AF Exchange Agreement.

These transfers will help California stay within its 4.4 MAFY normal-year allocation of Colorado River water by conserving water currently being used for agricultural uses and transferring it to more urban use.

6. **Other Provisions.**

6.1. **All-American Canal and Coachella Canal Water for San Luis Rey Indian Water Rights Settlement Act Purposes**. The lining of the All-American Canal (AAC Lining Project) will produce 67.7 KAFY of Conserved Water, and the lining of the Coachella Canal (CC Lining Project) will produce 26 KAFY of Conserved Water. After the effective date of the QSA, up to 16 KAFY of Conserved Water attributable to the AAC Lining Project and the CC Lining Project will be made available to the Secretary to facilitate implementation of the San Luis Rey Indian Water Rights Settlement Act. The volume available to the Secretary from each canal lining project will be in proportion to its percentage of the total water conserved, 11.5 KAFY from the AAC Lining Project and 4.5 KAFY from the CC Lining Project. The remaining Conserved Water will be made available to MWD and, during surplus years, to IID. As the Conserved Water to be made available by the AAC Lining Project and the CC Lining Project is produced, it will be made available 83 percent to MWD (or IID) and 17 percent to the Secretary. For decree accounting purposes, Consumptive Use of this Conserved Water will be assigned to the Secretary and not charged to IID or CVWD, but will be deducted from IID's Consumptive Use cap and CVWD's Consumptive Use cap in proportion to the Conserved Water made available from the AAC Lining Project and the CC Lining Project, respectively.

6.2. **Acquisition of Colorado River Water**. During the term of the QSA, IID, CVWD, and MWD may acquire Colorado River water from persons other than from each other, without objection by any of the three agencies, so long as such acquisition is not inconsistent with the QSA and Related Agreements and does not materially reduce the water available to the Parties.

6.3. **CVWD Utilization of Water**. Except as provided in the IID/CVWD Acquisition Agreement, CVWD will not utilize its water budget to facilitate any water use outside of Improvement District No. 1 other than for direct and in-lieu recharge, and shall use its best efforts to utilize its water budget to address the groundwater overdraft problem in Improvement District No. 1, and to implement a program designed to help achieve a safe yield within Improvement District No. 1 by approximately year 31 of the QSA term. IID and MWD will not object to the utilization of Colorado River water in the Coachella Valley, but outside Improvement District No. 1, in order to maximize the effectiveness of Improvement District No. 1's water use and recharge programs. CVWD will make no claim as a matter of right to any additional Colorado River water in Priorities 3 or 6.

6.4. **CVWD Groundwater Storage of IID Water**. Subject to the physical availability of storage in the Coachella Valley after accounting for the storage to be utilized by CVWD for the MWD/CVWD conjunctive use program, if implemented, CVWD will provide groundwater storage for IID's use in accordance with the IID/CVWD Acquisition Agreement.

6.5. Public Awareness Program. IID, CVWD, and MWD will each implement and maintain a water conservation public awareness program.

6.6. Shortage and Sharing of Reduced Water Availability. If for any reason there is less than 3.85 MAF available to Priorities 1, 2 and 3 in any year, the QSA will not terminate and shortages will be shared as set forth in the Acquisition Agreements and the Allocation Agreement.

6.7. MWD Mitigation of Certain Effects of Interim Surplus Guidelines. If application of the Interim Surplus Guidelines reduces Priority 3a Consumptive Use by IID and CVWD, MWD shall assume IID's and CVWD's responsibility for any payback of overruns as a result of such reduction, but limited by the aggregate amount of surplus water allocated to and Consumptively Used by MWD under Full Domestic Surplus and/or Partial Domestic Surplus conditions, as determined by the Secretary under the Interim Surplus Guidelines.

7. Conditions to the Parties' QSA Obligations. IID, MWD, and CVWD's obligations under the QSA are subject to the satisfaction or waiver of a number of conditions on or before December 31, 2002, including those set forth below.

7.1. General Conditions.

(1) **Environmental Review**. The Parties shall have completed all environmental review and assessment required under the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), and applicable federal, state and agency regulations implementing the same, to the extent required to authorize implementation of the activities contemplated by the QSA.

(2) **Resource Approvals**. All permits, approvals and authorizations pursuant to the federal Endangered Species Act (ESA), the California Endangered Species Act (CESA), any other federal or state resource protection laws, and any regulations implementing the same, shall have been finalized to the extent required to authorize IID's conservation and transfer activities and Consumptive Use cap, including a habitat conservation plan covering IID's conservation and water use activities and impacts on the Salton Sea, and "No Surprises" assurances pursuant to ESA Section 10(a) shall have been provided for IID and CVWD in connection with the IID/CVWD Acquisition Agreement.

(3) **Approval of Environmental Requirements**. Each Party shall have approved and accepted the terms and conditions and mitigation measures of the environmental review processes and the resource approvals, to the extent such Party is responsible, in whole or in part, for compliance, performance or payment of the costs thereof.

(4) **Inadvertent Overrun and Payback Program**. Reclamation shall have adopted on or before December 31, 2002, standards and procedures for an IOP to

be implemented during the first 30 years of the QSA term, which Program is in all material respects acceptable to the Parties.

(5) **Interim Surplus Guidelines**. Interim Surplus Guidelines, implemented pursuant to the Secretary's Record of Decision dated January 16, 2001, shall be in full force and effect.

(6) **PVID Waiver**. PVID shall have agreed for the term of the QSA: (a) to waive any call rights on Conserved Water from the AAC Lining Project and the CC Lining Project, (b) to limit use on the PVID Mesa, (c) to forego any rights to Priority 6b water, and (d) to the amendment to the 1989 Approved Agreement.

(7) **Execution of the Acquisition Agreements**. The Acquisition Agreements shall have been executed for delivery as of the Closing Date, which shall occur no later than December 31, 2000.

(8) **SWRCB Approval**. The SWRCB shall have entered a final order of approval of the Petition for Change relating to the 1998 IID/SDCWA Transfer Agreement and the IID/CVWD Acquisition Agreement upon terms and conditions set forth in the QSA.

(9) **Other Agreements in Effect**. Certain Agreements shall be in effect, including the 1998 IID/SDCWA Transfer Agreement, the Environmental Cost Sharing Agreement among the Parties, and the Implementation Agreement to be executed by the Secretary.

7.2. Particular Conditions to IID's Obligations. IID shall have determined that its responsibility for environmental process and mitigation costs shall not exceed $15,000,000 in 1998 Dollars.

7.3. Particular Conditions to CVWD's Obligations. The Amendment to the contract between the USA and CVWD for replacing a portion of the Coachella Canal shall have been executed by the USA.

7.4. Particular Conditions to MWD's Obligations.

(1) **Decree Accounting**. Reclamation shall have agreed with the Parties to develop a process for establishing a statistically significant trend test for increases in Priorities 1, 2 and 3b.

(2) **Waiver**. SDCWA shall have waived any rights under the 1998 IID/SDCWA Transfer Agreement with respect to Conserved Water that may be acquired by MWD pursuant to the IID/MWD Acquisition Agreement, in conjunction with MWD's agreement that, should IID transfer less than 200 KAFY to SDCWA, but later make available additional Conserved Water for transfer to SDCWA, MWD would exchange such additional amounts up to a total of 200 KAFY under the terms of the 1998 Agreement between MWD and SDCWA for the Exchange of Water.

(3) **Environmental Costs**. MWD shall have determined that its responsibility for environmental process and mitigation costs shall not exceed $5,000,000 in 2001 Dollars.

Public Notices

Notice of Preparation
Environmental Impact Report/Environmental Impact Statement
for the IID/San Diego County Water Authority
Water Conservation and Transfer Project,
Imperial Irrigation District, Imperial, California

To:
State of California
State Clearinghouse
Office of Planning and Research
1400 10th Street, Room 121
Sacramento, CA 95814

From:
Imperial Irrigation District
333 East Barioni Blvd.
P.O. Box 937
Imperial, CA 92251

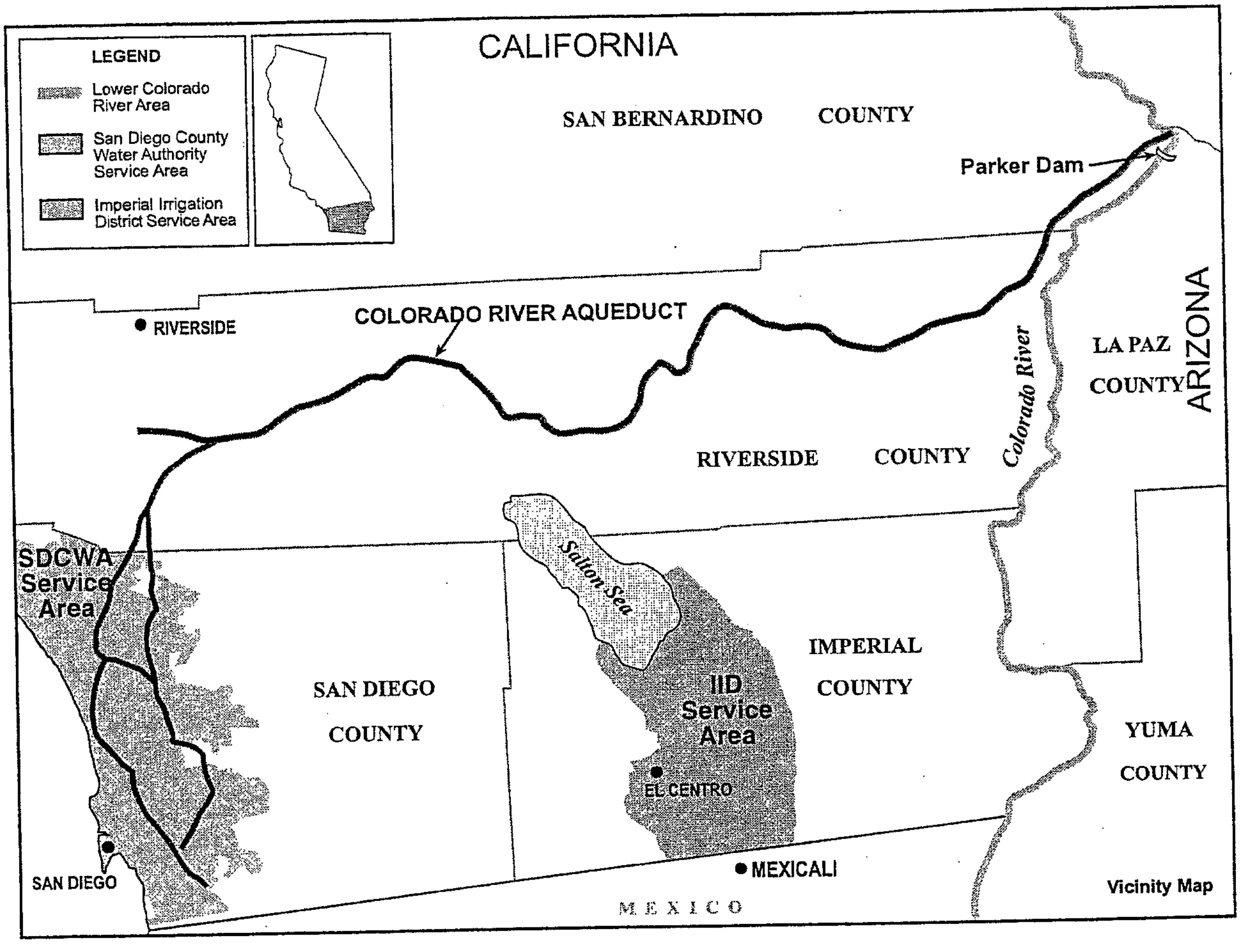
INTRODUCTION:

Pursuant to section 102 (2) (c) of the National Environmental Policy Act (NEPA) and the State of California Environmental Quality Act (CEQA), the Bureau of Reclamation (Reclamation) and Imperial Irrigation District (IID or District) will prepare a joint Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) to assess the impacts of the proposed IID/San Diego County Water Authority (SDCWA) Water Conservation and Transfer Project. The proposed project consists of the conservation by IID of up to 300,000 acre-feet of Colorado River water per year (af/yr), and the subsequent transfer of all or a portion of the diverted water to the SDCWA and, under certain circumstances, other designees (See Map). IID and Reclamation are holding public scoping meetings soliciting input from the public on the types of issues and extent of analysis that should be contained in the EIR/EIS.

Reclamation will serve as the Federal lead agency for the preparation of the EIR/EIS under NEPA. IID is the Lead Agency for CEQA purposes. As required by Section 15082 of the CEQA Guidelines, IID is submitting this Notice of Preparation (NOP) to responsible agencies, trustee agencies, other key agencies, private organizations, and individuals. The draft EIR/EIS is expected to be completed by a target date of April 3, 2000. Availability of the draft EIR/EIS for public review and comment will be announced and noticed in the local media.

DESCRIPTION OF THE PROPOSED PROJECT:

IID was organized in 1911 to deliver Colorado River water to lands within the Imperial Valley, California for agricultural, domestic, industrial, and other beneficial uses. Water is delivered via the All American Canal and flows through the Colorado River at Imperial Dam based upon water rights obtained prior to the beginning of this century under state law, pursuant to a 1932 water delivery contract for permanent service, for potable and irrigation purposes within the boundaries of the District, with the Secretary of the Interior under the Boulder Canyon Project Act of 1928 [45 Stat. 1057, as amended, 43 U.S.C. 617 et seq.], and pursuant to appropriations applications filed with the state between 1933 and 1936. Water flows through the Imperial Valley in a complex system of delivery canals, laterals, and drains serving over 450,000 acres of some of the most intensively farmed land in the nation. Agricultural drainage water flows into the New and Alamo Rivers and into the Salton Sea, a designated reservoir for irrigation drainage.



IID seeks to develop a long-term program for the conservation of up to 300,000 af/yr. IID proposes to transfer all or a portion of the conserved water to SDCWA and, under certain circumstances, other designees for beneficial use and to meet current and projected water supply needs. The proposed conservation program will include the participation of Imperial Valley landowners and tenants in order to implement on-farm conservation methods, such as improved or alternative water management techniques and revised irrigation methods. The program may also include system-based conservation methods implemented by IID, which improve distribution and drainage facilities.

IID intends that the transferred water will retain IID's priority among Colorado River water users and that the transfer will not affect IID's historic water rights. IID, the Department of Interior, and other potentially affected water rights holders are engaged in quantification discussions regarding Colorado River water.

On April 29, 1998, IID and SDCWA executed an Agreement for Transfer of Conserved Water (Agreement). The Agreement provides parameters for the water conservation and transfer transaction. The Agreement calls for IID to conserve and transfer an annual amount of water (the "primary" transfer) not to exceed 20,000 af in the first year. The primary transfer would increase in quantity in subsequent years until a stabilized annual primary quantity is established by IID, which shall be not less than 130,000 af/yr or more than 200,000 af/yr. After at least 10 years of primary transfers, an additional discretionary component not to exceed 100,000 af/yr may be transferred to SDCWA or, at IID's option, to the Metropolitan Water District of Southern California or Coachella Valley Water District in connection with the settlement of water rights disputes between IID and these agencies. The initial term of the project is 45 years after transfers first commence. Each party has the option to extend the term for an additional 30 years.

The Water Conservation and Transfer Project is the result of a collaboration between IID and SDCWA. The purpose and need for the proposed project is to advance objectives of both agencies, consistent with the Law of the River for the Colorado River, relating to water availability and management. IID has identified specific objectives for the proposed project. The District proposes to sell the conserved water in a market-based transaction in order to provide IID with sufficient funds to implement a water conservation program, including the cost of on-farm and system improvements, environmental mitigation costs, and other implementation costs. IID intends to implement a conservation program which includes participation of Imperial Valley landowners and tenants so that on-farm, in addition to system-based conservation methods, can be implemented efficiently. IID seeks to maintain its historic senior priority water rights in a manner consistent with state and federal law during project implementation and operation. Additional IID objectives include providing an economic stimulus to Imperial Valley's agricultural economy and the surrounding community and lessen increased demand for water for southern California from the State Water Project.

SDCWA has also identified specific project objectives. SDCWA seeks to acquire an independent, reliable alternate long-term water supply to provide drought protection and to accommodate current and projected demand for municipal, domestic, and agricultural water uses. In order to enhance the reliability of its water supply, SDCWA intends to diversify its sources of water supply and decrease its current dependence on a single source. Through the establishment of a stabilized source, SDCWA seeks to pay a fair, competitive price for its water supply and in the process lessen increased demand for water for southern California from the State Water Project.

A water transfer from IID to SDCWA is a key element of the "California Plan" which is being developed by the Colorado River Board of California and the California State Department of Water Resources, at the request of the Secretary of the Interior and the other Colorado River basin states. This Plan is intended to address the need for California reduce its reliance on Colorado River water to its legal entitlement of 4.4 million acre-feet of Colorado River water. California currently is diverting approximately 5.2 million acre-feet of Colorado River water per year.

Implementation of the proposed project will require certain state approvals, including approval by the State Water Resources Control Board and compliance with CEQA and the California Endangered Species Act. Implementation will also require certain federal approvals, including approval of the proposed transfer between IID and SDCWA, compliance with NEPA, the federal Endangered Species Act and other related federal environmental laws, statutes, Executive Orders, and regulations. Reclamation will act as the federal lead agency pursuant to NEPA because certain actions taken to facilitate the transfer will require approval by the Secretary of the Interior. Such actions could potentially include amendments to IID's contract with the Secretary, change in point of diversion of Colorado River water, change in type of use, change in place of use, verification or concurrence in the amount of water conserved by this Project, and verification of beneficial use of Colorado River water. Reclamation is therefore seeking comments from the comments from the public on the scope of issues and extent of analysis that should be evaluated in this EIR/EIS.

Additional information can be obtained from the project website at http://www.is.ch2m.com/iidweb.

ALTERNATIVES:

The EIR/EIS will evaluate other feasible project alternatives, including a range of alternative conservation measures, water supply and transfer alternatives, and various alternative measures in addition to the No Project/No Action Alternative.

Potential water supply alternatives that will be considered in the EIR/EIS include the following:

- Additional water conservation in the San Diego service area
- Additional water repurification and recycling
- Desalination
- Additional water transfers from Northern California
- Transfer of water conserved in another agricultural region with conveyance through the State Water Project and Metropolitan Water District system

POTENTIAL ENVIRONMENTAL EFFECTS:

The full range of environmental impacts has not been quantified temporally and spatially. Until specific conservation alternatives have been developed, potential environmental effects could include the following:

Lower Colorado River Area

- Reduction in Colorado River water flows between Parker and Imperial Dams
- Impacts to Colorado River water quality
- Impacts to wildlife, protected species and their habitats
- Cumulative impacts to water quality

San Diego County

- Growth-inducing impacts

Salton Sea

- Effects on water levels, salinty, and water quality
- Effects on fisheries habitat
- Impacts to wildlife, protected species and their habitats
- Impacts to recreational uses

Imperial Valley

- Impacts to water flow and quality
- Effects on selenium, boron, and pesticide concentrations
- Impacts to wildlife, protected species and their habitats
- Socio-economic impacts
- Air quality impacts

PUBLIC AGENCY AND SCOPING MEETINGS:

Six public scoping meetings will be held to discuss the project and scope of the EIR/EIS. The purpose of these meetings is to identify issues that should be addressed in the EIR/EIS. The public meetings will be open to all interested members of the public, and both written and oral comments will be accepted at the meetings. These scoping meetings will be held at the following locations and times:

1)	Northern Imperial Valley	Elks Lodge #1420 161 South Plaza Brawley, CA 92227 Tuesday, October 12, 1999 7 PM to 9 PM
2)	Salton Sea Area	Salton Sea Community Service District 2098 Frontage Road Salton City, CA 92275 Wednesday, October 13, 1999 7 PM to 9 PM
3)	Southern Imperial Valley	IID Board Room 1285 Broadway El Centro, CA 92243 Thursday, October 14, 1999 7 PM to 9 PM
4)	Lower Colorado River Region	Clark County Library 1401 East Flamingo Road Las Vegas, NV 89119 Monday, October 18, 1999 7 PM to 9 PM
5)	Northern San Diego County	Carlsbad Senior Center 799 Pine Avenue Carlsbad, CA 92008 Tuesday, October 19, 1999 7 PM to 9 PM

6) Southern San Diego County

SDCWA Building
3211 Fifth Avenue
San Diego, CA 92103
Wednesday, October 20, 1999
7 PM to 9 PM

Hearing impaired, visually impaired, and/or mobility impaired persons planning to attend the meeting(s) may arrange for necessary accommodations by calling Ms. Molly Sweat at (702) 293-8415 no later than September 27, 1999.

A public involvement program has been initiated and will be implemented throughout the EIR/EIS process. The goal is to keep the public and affected parties informed and actively involved in the environmental assessment of the project.

RESPONSES TO NOTICE:

In responding to this NOP, responsible agencies and other agencies having jurisdiction over the project or natural resources that may be affected by the project are requested to provide specific detail as to the scope and content of the environmental information related to that agency's statutory responsibilities which should be included in the draft EIR/EIS. Responding agencies are also asked to provide any quantitative, qualitative, or performance standards applicable to project activities that will be subject to review and/or approval of the responding agency. This information will be used to assist in the development of thresholds of significance to be used to evaluate the significance of environmental effects and in the development of mitigation measures to address any significant impacts. Responding agencies should identify a contact person for their agency.

Responses to this notice must be received no later than October 25, 1999. Please send your written comments or questions to:

Mr. Steven R. Knell
Special Projects Coordinator, Imperial Irrigation District
333 E. Barioni Boulevard.
P.O. Box 937
Imperial, CA 92251
(760) 339-9266

[Federal Register: September 27, 1999 (Volume 64, Number 186)]
[**Notices**]
[Page 52102-52104]
From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[DOCID:fr27se99-77]

DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

Imperial Irrigation District/San Diego County Water Authority Water Conservation and Transfer Project

AGENCY: Bureau of Reclamation, Interior.

ACTION: Notice of Intent to prepare an Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) and notice of public scoping meetings on the **Imperial Irrigation District**/San Diego County Water Authority Water Conservation and Transfer Project.

SUMMARY: Pursuant to section 102 (2) (c) of the National Environmental Policy Act (NEPA) and the State of California Environmental Quality Act (CEQA), the

[[Page 52103]]

Bureau of Reclamation (Reclamation) and **Imperial Irrigation District** (IID or **District**) will prepare a joint EIR/EIS to assess the impacts of the proposed IID/San Diego County Water Authority (SDCWA) Water Conservation and Transfer Project. The proposed project consists of the conservation by IID of up to 300,000 acre-feet of Colorado River water per year (af/yr), and the subsequent transfer of all or a portion of the diverted water to the SDCWA and, under certain circumstances, other designees. IID and Reclamation are holding public scoping meetings soliciting input from the public on the types of issues and extent of analysis that should be contained in the EIR/EIS.

DATES: Written comments on the NOI will be accepted until October 25, 1999. Public scoping meetings will be held at the following locations (both written and oral comments will be accepted at the public scoping meetings):

1. Northern **Imperial** Valley--Elks Lodge #1420, 161 South Plaza, Brawley, CA 92227, Tuesday, October 12, 1999, 7 PM to 9 PM.
2. Salton Sea Area--Salton Sea Community Service **District**, 2098 Frontage Road, Salton City, CA 92275, Wednesday, October 13, 1999, 7 PM to 9 PM..
3. Southern **Imperial** Valley--IID Board Room, 1285 Broadway, El Centro, CA 92243, Thursday, October 14, 1999, 7 PM to 9 PM.
4. Lower Colorado River Region--Clark County Library, 1401 East Flamingo Road, Las Vegas, NV 89119, Monday, October 18, 1999, 7 PM to 9 PM.
5. Northern San Diego County--Carlsbad Senior Center, 799 Pine

Avenue, Carlsbad, CA 92008, Tuesday, October 19, 1999, 7 PM to 9 PM.

6. Southern San Diego County--SDCWA Building, 3211 Fifth Avenue, San Diego, CA 92103, Wednesday, October 20, 1999, 7 PM to 9 PM.

Hearing impaired, visually impaired, and/or mobility impaired persons planning to attend the meeting(s) may arrange for necessary accommodations by calling Ms. Molly Sweat at (702) 293-8415 no later than October 6, 1999.

ADDRESSES: Written comments should be sent to: Bureau of Reclamation, Lower Colorado River Region, Boulder Canyon Operations Office, P.O. Box 61470, Boulder City, NV 89006-1470, Attn: William Rinne, BC-00-1000; or to: **Imperial Irrigation District**, 333 East Barioni Boulevard, P.O. Box 937, **Imperial** CA, 92251, Attn: Steven R. Knell.

FOR FURTHER INFORMATION CONTACT: Mr. William Rinne, at the Bureau of Reclamation (702) 293-8414; or Mr. Steven Knell, Special Projects Coordinator, **Imperial Irrigation District**, at (760) 339-9266. Further information can also be obtained on the website at http://www.is.ch2m.com/iidweb.

SUPPLEMENTARY INFORMATION: IID was organized in 1911 to deliver Colorado River water to lands within the **Imperial** Valley, California for agricultural, domestic, industrial, and other beneficial uses. Water is diverted via the All American Canal and flows through the Colorado River at **Imperial** Dam based upon water rights obtained prior to the beginning of this century under state law, pursuant to a 1932 water delivery contract for permanent service, for potable and **irrigation** purposes within the boundaries of the **District**, with the Secretary of the Interior under the Boulder Canyon Project Act of 1928 [45 Stat. 1057, as amended, 43 U.S.C. 617 et seq.], and pursuant to appropriations applications filed with the state between 1933 and 1936. Water flows through the **Imperial** Valley in a complex system of delivery canals, laterals, and drains serving over 450,000 acres of some of the most intensively farmed land in the nation. Agricultural drainage water flows into the New and Alamo Rivers and into the Salton Sea, a designated reservoir for **irrigation** drainage.

IID seeks to develop a long-term program for the conservation of up to 300,000 af/yr. IID proposes to transfer all or a portion of the conserved water to SDCWA and, under certain circumstances, other designees for beneficial use and to meet current and projected water supply needs. The proposed conservation program would include the participation of **Imperial** Valley landowners and tenants in order to implement on-farm conservation methods, such as improved or alternative water management techniques and revised **irrigation** methods. The program may also include system-based conservation methods implemented by IID, which improve distribution and drainage facilities.

IID intends that the transferred water will retain IID's priority among Colorado River water users and that the transfer will not affect IID's historic water rights. IID, the Department of Interior, and other potentially affected water rights holders are engaged in quantification discussions regarding Colorado River water.

On April 29, 1998, IID and SDCWA executed an Agreement for Transfer of Conserved Water (Agreement). The Agreement provides parameters for the water conservation and transfer transaction. The Agreement calls for IID to conserve and transfer an annual amount of water (the ``primary'' transfer) not to exceed 20,000 af in the first year. The primary transfer would increase in quantity in subsequent years until a stabilized annual primary quantity is established by IID, which shall be not less than 130,000 af/yr or more than 200,000 af/yr. After at least 10 years of primary transfers, an additional discretionary component not to exceed 100,000 af/yr may be transferred to SDCWA or, at IID's option, to the Metropolitan Water **District** of Southern California or Coachella Valley Water **District** in connection with the settlement of water rights disputes between IID and these agencies. The initial term of the project is 45 years after transfers first commence. Each party has the option to extend the term for an additional 30 years.

The Water Conservation and Transfer Project is the result of a collaboration between IID and SDCWA. The purpose and need for the proposed project is to advance objectives of both agencies, consistent with the Law of the River for the Colorado River, relating to water availability and management. IID has identified specific objectives for the proposed project. The **District** proposes to sell the conserved water in a market-based transaction in order to provide IID with sufficient funds to implement a water conservation program, including the cost of on-farm and system improvements, environmental mitigation costs, and other implementation costs. IID intends to implement a conservation program which includes participation of **Imperial** Valley landowners and tenants so that on-farm, in addition to system-based conservation methods, can be implemented efficiently. IID seeks to maintain its historic senior priority water rights in a manner consistent with state and federal law during project implementation and operation. Additional IID objectives include providing an economic stimulus to **Imperial** Valley's agricultural economy and the surrounding community and lessen increased demand for water for southern California from the State Water Project.

SDCWA has also identified specific project objectives. SDCWA seeks to acquire an independent, reliable alternate long-term water supply to provide drought protection and to accommodate current and projected demand for municipal, domestic, and agricultural water uses. In order to enhance the reliability of its water supply, SDCWA intends to diversify its

[[Page 52104]]

sources of water supply and decrease its current dependence on a single source. Through the establishment of a stabilized source, SDCWA seeks to pay a fair, competitive price for its water supply and in the process lessen increased demand for water for southern California from the State Water Project.

A water transfer from IID to SDCWA is a key element of the ``California 4.4 Plan'' which is being developed by the Colorado River Board of California and the California State Department of Water Resources, at the request of the Secretary of the Interior and the other Colorado River basin states. This Plan is intended to address the need for California to reduce its reliance on Colorado River water to its legal entitlement of 4.4 million acre-feet of Colorado River water. California currently is diverting approximately 5.2 million acre-feet of Colorado River water per year.

Implementation of the proposed project will require certain state approvals, including approval by the State Water Resources Control Board and compliance with CEQA and the California Endangered Species Act. Implementation will also require certain federal approvals, including approval of the proposed transfer between IID and SDCWA, compliance with NEPA, the federal Endangered Species Act and other related federal environmental laws, statutes, Executive Orders, and regulations. Reclamation will act as the federal lead agency pursuant to NEPA because certain actions taken to facilitate the transfer will require approval by the Secretary of the Interior. Such actions could potentially include amendments to IID's contract with the Secretary, change in the point of diversion of Colorado River water, change in type of use, change in place of use, verification or concurrence in the amount of water conserved by this Project, and verification of beneficial use of Colorado River water. Reclamation is therefore seeking comments from the public on the scope of the issues and extent of analysis that should be evaluated in the EIR/EIS.

Additional information can be obtained from the project website at http://www.is.ch2m.com/iidweb.

Alternatives

The EIR/EIS will evaluate other feasible project alternatives, including a range of alternative conservation measures, water supply and transfer alternatives, and various alternative measures in addition to the No Project/No Action Alternative.

Potential water supply alternatives that will be considered in the EIR/EIS include the following:

<bullet> Additional water conservation in the San Diego service area
<bullet> Additional water repurification and recycling
<bullet> Desalination
<bullet> Additional water transfers from Northern California
<bullet> Transfer of water conserved in another agricultural region with conveyance through the State Water Project and Metropolitan Water **District** system

Potential Environmental Effects

The full range of environmental impacts has not been quantified temporally and spatially. Until specific conservation alternatives have been developed, potential environmental effects could include the following:

Lower Colorado River Area

<bullet> Reduction in Colorado River water flows between Parker and **Imperial** Dams
<bullet> Impacts to Colorado River water quality
<bullet> Impacts to wildlife, protected species and their habitats
<bullet> Cumulative impacts to water quality

San Diego County

<bullet> Growth-inducing impacts
<bullet> Salton Sea
<bullet> Effects on water levels, salinity, and water quality
<bullet> Effects on fisheries habitat
<bullet> Impacts to wildlife, protected species and their habitats
<bullet> Impacts to recreational uses

Imperial Valley

<bullet> Impacts to water flow and quality
<bullet> Effects on selenium, boron, and pesticide concentrations
<bullet> Impacts to wildlife, protected species and their habitats
<bullet> Socio-economic impacts
<bullet> Air quality impacts

The draft EIR/EIS is expected to be completed by a target date of April 3, 2000. Availability of the draft EIR/EIS for public review and comment will be announced and noticed in the local media and by a Federal Register Notice.

Dated: September 23, 1999.
Steven Richardson,
Chief of Staff, Bureau of Reclamation.
[FR Doc. 99-25187 Filed 9-24-99; 8:45 am]
BILLING CODE 4310-94-P

[Federal Register: November 6, 2000 (Volume 65, Number 215)]
[Notices]
[Page 66557-66558]
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DEPARTMENT OF THE INTERIOR

Bureau of Reclamation

Notice of **Intent** to prepare an Environmental Impact Report (EIR)/ Environmental Impact Statement (EIS) on the Imperial Irrigation District/San Diego County Water Authority Water Conservation and Transfer Project

AGENCY: Bureau of Reclamation, Interior.

ACTION: Amended **Notice** of **Intent** to Prepare a Joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS).

SUMMARY: The Fish and Wildlife Service (Service) intends to be a cooperating agency (pursuant to 40 CFR section 1501.6) in the Bureau of Reclamation's (Bureau) preparation of a joint EIR/EIS pursuant to the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The joint EIR/EIS will be developed for: (1) the conservation and transfer of water from Imperial Irrigation District (IID) to the San Diego County Water Authority (SDCWA), the Coachella Valley Water District (CVWD) and/or the Metropolitan Water District of Southern California (MWD) and (2) approval of a Habitat Conservation Plan, and issuance of an incidental take permit, pursuant to section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended, including consideration of conservation measures or plans addressing State-listed species.

This **notice** is being furnished pursuant to the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR section 1501.22). Pursuant to regulations at 40 CFR (sections 1501.7 and 1508.22), the Bureau, as lead agency pursuant to NEPA, and the Service, as the Federally authorized permitting agency, are seeking suggestions and information from other agencies and the public on the scope of issues and alternatives to be considered in preparation of the joint EIR/EIS pertaining to possible issuance of a Federal incidental take permit. To satisfy both NEPA and CEQA, the Service, as a cooperator, with the Bureau as the Federal lead agency and IID as the State lead agency are conducting this additional scoping process for the preparation of the environmental documents.

DATES: In order to expedite the planning process, the above agencies request all scoping comments on this **notice** be received by December 6, 2000.

ADDRESSES: You should address written comments to Ms. Nancy Gilbert, Assistant Field Supervisor, Fish and Wildlife Service, 2730 Loker Avenue West, Carlsbad, California 92008. You may also send comments by facsimile to (760) 431-9618.

FOR FURTHER INFORMATION: Contact Ms. Carol Roberts, Salton Sea Coordinator, or Mr. Pete Sorensen, Division Chief, at the above Carlsbad address or by telephone at (760) 431-9440. Persons wishing to obtain background material may contact Mr. Steve Knell of the Imperial Irrigation District at 333 E. Barioni Blvd., P.O. Box 937, Imperial California 92251, or by telephone at (760) 339-9266.

SUPPLEMENTARY INFORMATION: The Bureau is publishing this **notice** to amend the September 27, 1999 **Notice** of **Intent** (see 64 FR 52102) to provide public **notice** that the project EIR/EIS will include an evaluation of the impacts associated with the potential issuance of an incidental take permit. This was not specifically addressed in the initial **Notice** of **Intent** provided for the project. The Habitat Conservation Plan will cover a broad array of activities including: water conservation, water conveyance and drainage, operation and maintenance, system improvements, miscellaneous activities, and third party activities required to achieve the conservation and transfer of up to 300,000 acre-feet of water per year from IID to the SDCWA and to meet the voluntary cap on IID's water use of 3.1 million acre-feet per year from the Colorado River. Up to 100,000 acre-feet of the water conserved by IID may be transferred to the CVWD and/or MWD, instead of SDCWA, as part of the proposed Quantification Settlement Agreement on the Colorado River. The EIR/EIS will evaluate transfer volumes up to 400,000 acre-feet per year. The IID (Applicant) intends to request an incidental take permit for up to 96 listed (Federal and State) and unlisted species of concern (fish, wildlife, and plants) under specific provisions of the permit. In the case of unlisted species, the permit will provide coverage should these species be listed in the future. The Plan will cover all areas of IID's water delivery and collection system from the Imperial Dam on the Colorado River throughout the Imperial Valley (approximately 470,000 acres) into the Salton Sea.

Availability of Documents

During the comment period the documents will be available for public inspection by appointment during normal business hours (8 a.m. to 5 p.m.,

[[Page 66558]]

Monday through Friday) at the Service's Carlsbad Fish and Wildlife Office, the Imperial Irrigation District headquarters in Imperial, and the San Diego County Water Authority office in San Diego. Availability of the draft EIR/EIS for public review and comment will be announced and noticed in the local media and by a Federal Register **notice**.

Background

IID is an irrigation district formed under California law which provides irrigation water and power to the lower southeastern portion of the California desert. IID was established in 1911 to deliver Colorado River water to lands within the Imperial Valley, California for agriculture, domestic, industrial and other beneficial uses. IID maintains a complex system of delivery canals, laterals, and drains which serve approximately 470,000 acres of intensive agriculture. The project area is approximately bounded by the All-American Canal to the south, the East Highline Canal to the east, the Westside Main Canal to the west, and the Salton Sea to the north. Agricultural drainage flows into the New and Alamo Rivers and into the Salton Sea, a designated repository for agricultural drainage.

On April 29, 1998, IID and SDCWA executed an agreement for the conservation and transfer of up to 300,000 acre-feet of Colorado River water per year from IID to SDCWA. As part of the project, IID intends to implement a conservation program that includes the participation of Imperial Valley land owners and tenants so that on-farm as well as system based conservation can be implemented to achieve the required level of conservation. This transfer is a key part of the California 4.4 Plan that will result in California water agencies using only their 4.4 million acre-foot apportionment of the Colorado River. California is currently diverting up to 5.2 million acre-feet of Colorado River water per year. Subsequent negotiations with other Colorado River water rights holders in California have resulted in a proposed Quantification Settlement Agreement among IID, MWD, and CVWD which would reduce the maximum amount of conserved water transferred to SDCWA to 200,000 acre-feet per year and would provide for the transfer of the additional 100,000 acre-feet to the CVWD and the MWD.

A joint EIR/EIS is being prepared by the Bureau and the IID with the Service as a cooperating agency to address the impacts associated with the project and with permit issuance for the project. Additional information on the project can be found in the original **Notice** of **Intent** published at 64 FR 52102. Scoping meetings were held in response to that **Notice** of **Intent** on October 12-20, 1999, and no additional scoping meetings are planned in response to this **notice**.

Section 9 of the Endangered Species Act and the Service regulations prohibit the ``take'' of threatened or endangered wildlife. Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect listed animal species, or attempt to engage in such conduct (16 U.S.C. 1538). Harm may include significant habitat modification that actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding and sheltering [50 CFR 17.3(c)]. The Service, however, may issue permits to take endangered and/or threatened wildlife incidental to, and not the purpose of, otherwise lawful activities. Regulations governing permits for endangered and threatened species are found at 50 CFR 17.22 and 17.32.

In anticipation of applying for an incidental take permit the IID is developing a Habitat Conservation Plan. Accordingly, under section 10 of the Endangered Species Act, the Service may issue a permit to the IID authorizing the take of listed and unlisted species incidental to the otherwise lawful conservation and transfer of up to 300,000 acre-feet of Colorado River water per year to the SDCWA, the CVWD, and the MWD, and additional conservation necessary to achieve the IID's voluntary cap of 3.1 million acre-feet/year on their use of Colorado River water.

The permit application will include a Habitat Conservation Plan (Plan) and an Implementation Agreement that define the responsibilities of all parties under the Plan. IID's Plan will cover roughly the area along the length of the All-American Canal and north of the All-American Canal to the Salton Sea bounded on the east by the East Highline Canal and on the west by the Westside Main Canal. The Plan will identify the species proposed for coverage under the Plan including federally-listed species for which take would be granted at the time of permit issuance as well as other species of concern for which take would be granted should those species be listed in the future. The Plan also describes alternatives to the action and includes measures to minimize and mitigate impacts to species covered in the Plan. The Plan will address minimization and mitigation using both a habitat based and a species by species approach. The joint EIR/EIS will consider IID's proposed project (Proposed Action Alternative) along with other alternatives and the No Action Alternative. Under the Proposed Action Alternative the Service would review IID's incidental take permit application under section 10(a)(1)(B) of the Endangered Species Act.

Environmental review of the Plan will be conducted in accordance with the requirements of the 1969 National Environmental Policy Act as amended (42 U.S.C. 4321 et seq.), National Environmental Policy Act regulations (40 CFR parts 1500-1508), other appropriate regulations, and Service procedures for compliance with those regulations. This **notice** is being furnished in accordance with section 1501.7 of the National Environmental Policy Act to obtain suggestions and information from other agencies and the public on the scope of issues to be addressed in the joint EIR/EIS.

The Service will utilize the joint EIR/EIS in its evaluation of the permit application, the Habitat Conservation Plan, Implementing Agreement, associated documents, and comments submitted thereon to determine whether the application meets the requirements of section 10(a) of the Endangered Species Act. If the Service determines that the requirements have been met, the Service will issue a permit for the incidental take of the covered listed species.

Dated: October 30, 2000.
Robert W. Johnson,
Regional Director.
[FR Doc. 00-28431 Filed 11-3-00; 8:45 am]
BILLING CODE 4310-MN-P

Scoping Summary Report

Final

IID/SDCWA Water Conservation and Transfer Project EIR/EIS

Scoping Summary Report

Prepared by

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March 10, 2000

Approved

IID____

Reclamation ____

SDCWA_____

Contents

Section Page

19737

Tables

Figures

Appendixes

Acronyms

AF	acre feet
af/yr	acre-feet per year
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CEQA	State of California Environmental Quality Act
CVWD	Coachella Valley Water District
Draft EIR/EIS	Draft Environmental Impact Report/Environmental Impact Statement
IID	Imperial Irrigation District
Key Terms	Key Terms for Quantification Settlement Among the State of California, IID, CVWD, and MWD
MWD	Metropolitan Water District
NEPA	National Environmental Policy Act
NOI/NOP	Notice of Intent/Notice of Preparation
proposed Project	IID/SDCWA Water Conservation and Transfer Project
Reclamation	U.S. Bureau of Reclamation
SDCWA	San Diego County Water Authority
SWRCB	State Water Resources Control Board
TDS	total dissolved solids

SECTION 1

Introduction and Background

The U.S. Bureau of Reclamation (Reclamation) and the Imperial Irrigation District (IID) are preparing a joint Draft Environmental Impact Report/ Environmental Impact Statement (Draft EIR/EIS) to assess the potential environmental impacts of the IID/San Diego County Water Authority (SDCWA) Water Conservation and Transfer Project (proposed Project). The Project Vicinity Map is shown in Figure 1-1. The Draft EIR/EIS is being prepared in accordance with the National Environmental Policy Act (NEPA) and the State of California Environmental Quality Act (CEQA). The proposed Project consists of the conservation by IID of up to 300,000 acre-feet per year (af/yr) of Colorado River water and the subsequent transfer of all or a portion of the conserved water to SDCWA, and under certain circumstances, other designees. Reclamation is the federal Lead Agency under NEPA, and IID is the state Lead Agency under CEQA.

The purpose of this Scoping Summary Report is to provide a summary of the proposed scope of the environmental analysis to be included in the Draft EIR/EIS, which is based, in part, on input received during the scoping process. This report also includes a summary of the comments received during the scoping process and presents responses to the comments that, among other things, identify how the issues raised will be addressed in the Draft EIR/EIS.

This report includes an introduction (Section 1), an overview of the purpose of the scoping process (Section 2), and a summary of the number and nature of comments received (Section 3). It also includes a section identifying how the issues raised in the scoping comments will be addressed in the Draft EIR/EIS and provides general responses to commonly raised issues (Section 4). In some cases, a determination has been made that the issues raised by certain comments are beyond the proposed scope of the environmental assessment required for the proposed Project; therefore, those issues will not be addressed in the Draft EIR/EIS. Issues of this type can generally be characterized by one of the following designations:

(1) The issue does not identify an "environmental impact" associated with the proposed Project;

(2) The issue identifies a potential environmental impact, but the Lead Agencies have determined that it is not "potentially significant;"

(3) The issue refers to a separate, unrelated project; or

(4) The issue makes a general information request.

For each issue determined to be outside the scope of the Draft EIR/EIS, an explanation is provided in Section 4.3 and Appendix K.

This report also provides the following supporting information, included as appendixes to this report:

Appendix A:	Notice of Intent/Notice of Preparation (NOI/NOP) Notification
Appendix B:	Notices of Public Scoping Meetings
Appendix C:	Public Scoping Meeting Sign-In Sheets
Appendix D:	Public Scoping Meeting Transcripts
Appendix E:	Scoping Meeting Handouts and Materials
Appendix F:	Speaker Cards
Appendix G:	Written Comments and Letters
Appendix H:	Methodology for Categorizing Scoping Comments
Appendix I:	Scoping Comments Database
Appendix J:	Draft EIR/EIS Outline
Appendix K:	Summary of Issues Determined to be Outside the Proposed Scope of the Draft EIR/EIS

Figure 1-1 Project Vicinity

SECTION 2
Scoping Process

This section presents the purpose of the scoping process for the proposed Project, identifies the notification process that was implemented for the scoping meetings, the details of the meeting locations, and meeting attendance.

2.1 Purpose and Notification

The scoping process for the proposed Project was designed to solicit input from the public; from federal, state, and local agencies; and from other interested parties on the scope of issues that should be addressed in the Draft EIR/EIS and to identify significant issues related to the proposed Project. The scoping meetings were attended by groups interested in potential water delivery system and on-farm conservation methods, and other aspects of the proposed Project, including potential impacts to the Lower Colorado River, the Salton Sea, and the SDCWA and IID service areas.

The NEPA NOI was published in the *Federal Register* on September 27, 1999, and the CEQA NOP was distributed by the State Clearinghouse on September 29, 1999. Copies of the NOI and NOP are in Appendix A. Additional notification was provided by publishing public notices in newspapers of general circulation. The public scoping meetings were advertised in six local newspapers: *Imperial Valley Press, Desert Sun, San Diego Union Tribune, Los Angeles Times, El Sol del Valle,* and *Las Vegas Review-Journal/Sun.* Appendix B contains the public scoping meeting notices published in each newspaper.

In accordance with NEPA and CEQA guidelines, a 30-day comment period on the NOI/NOP was established that would end on October 27, 1999. The purpose of this 30-day comment period is to provide ample opportunity for the public, agencies, and other interested parties to evaluate and comment on environmental issues related to the proposed Project, while providing a definitive time frame for the Lead Agencies to receive public reactions to the issues raised. This schedule facilitates the Lead Agencies' efforts to evaluate and respond to the comments in an efficient manner and to identify the proposed scope of the Draft EIR/EIS. A 30-day extension to the comment period was requested and granted, which extended the official comment period to November 27, 1999. The Lead Agencies will continue to coordinate with the public, agencies, and other interested parties to consider comments throughout the environmental review process.

2.2 Scoping Meetings

The Lead Agencies conducted six public scoping meetings between October 12 and October 20, 1999, to solicit input from the public on potential environmental impacts, the significance of impacts, the appropriate scope of the environmental assessment, proposed mitigation measures, and potential alternatives to the proposed Project. In general, the scoping process resulted in good participation by a cross section of the general public, including local business communities and special interest and environmental groups, as well as federal, state, and local agencies. The meetings were held at the following locations on the following dates. The number of attendees at each meeting is noted in parentheses.

1) Northern Imperial Valley
(27 attendees)
Elks Lodge #1420
161 South Plaza
Brawley, CA 92227
Tuesday, October 12, 1999

2) Salton Sea Area
(88 attendees)
Salton Sea Community Service District
2098 Frontage Road
Salton City, CA 92275
Wednesday, October 13, 1999

3) Southern Imperial Valley
(28 attendees)
Board of Supervisors' Board Room
640 West Main Street
El Centro, CA 92243
Thursday, October 14, 1999

4) Lower Colorado River Region
(8 attendees)
Clark County Library
1401 East Flamingo Road
Las Vegas, NV 89119
Monday, October 18, 1999

5) Northern San Diego County
(13 attendees)
Carlsbad Senior Center
799 Pine Avenue
Carlsbad, CA 92008
Tuesday, October 19, 1999

6) Southern San Diego County
(22 attendees)
SDCWA Building
3211 Fifth Avenue
San Diego, CA 92103
Wednesday, October 20, 1999

According to sign-in sheets, approximately 186 people attended the scoping meetings. Appendix C contains sign-in sheets from the scoping meetings. All six scoping meetings were recorded by a certified court reporter who provided written transcripts of the proceedings. Appendix D contains copies of the transcripts from the scoping meetings. In addition, for the two scoping meetings held in the Imperial Valley (Brawley and El Centro, California), a certified Spanish interpreter was present to provide simultaneous interpretation. The following documents were also made available as handouts at each scoping meeting.

- Scoping meeting agenda
- Project schedule
- NOI/NOP (in English and Spanish)
- Proposed Project map
- Written comment card
- Speaker card

Appendix E contains copies of the scoping meeting handouts and materials.

SECTION 3

Scoping Comments Received

This section presents a summary of the number and general content of the comments received during the scoping process. The majority of comments received will be addressed or considered in the Draft EIR/EIS.

3.1 Number of Comments

Of the 186 persons who attended the six scoping meetings, 49 provided oral testimony. Those who chose to speak at the scoping meetings were asked to fill out speaker cards to document the oral comments received during the scoping process. While not all oral commenters submitted speaker cards, Appendix F presents the 36 speaker cards that were received. In addition, a total of 44 written comment forms and letters were also received during the scoping comment period. See Appendix G for copies of the written comments. A breakdown of the number of commenters who provided written and/or oral testimony is presented in Table 3-1.

TABLE 3-1
Number of Commenters[1] Submitting Oral or Written Comments

	Federal Agency	State Agency	Local Agency	Special Interest/ Environmental Group	Individual	Local Business	Total
Public Scoping Meeting Commenters	0	1	8	4	33	3	49
Written Comments and Letters	3	6	12	8	15	0	44
Total	**3**	**7**	**20**	**12**	**48**	**3**	**93**

[1] Each comment letter or oral comment received from an agency, individual, or other interested party was counted as one, although numerous issues within one letter or oral comment may have been raised.

A review of the comment letters and meeting transcripts indicated that some of the commenters raised multiple issues during their testimony and/or in their written comments and letters. As a result, a total of 341 issues were identified during the scoping process. After reviewing the 341 issues, it was determined that many of them could be combined into overlapping comment categories because of the common issues raised. See Appendix H for a discussion of the methodology for categorizing and combining scoping comments. As a result of combining like comments, 122 issues were identified. See Appendix I, Scoping Comments Database, for a detailed discussion of the 122 issues.

The Lead Agencies received three comment letters from federal agencies during the scoping process. Five California state agencies and one Arizona state agency participated in the scoping process, submitting six comment letters and one oral comment on issues ranging from biological and air resources to recreation. Eleven local agencies submitted written comment letters, and eight local agencies submitted oral comments on various issues. Special interest/environmental groups submitted 12 comments primarily concerned with impacts to biological resources. Forty-eight individual comments raised issues on socioeconomic impacts and the health of the Salton Sea. Local businesses contributed three oral comments on the impact of the proposed Project on the local economy.

To facilitate the assessment of comments, those comments with common themes that raised similar issues or questions were organized and combined. Comments have been organized in the following categories: Water Quantity/Quality, Water Rights, Water Use, Groundwater, Air Quality, Biological Resources, Land Use, Recreation, Energy, Socioeconomics, Cost, Growth-Inducing Impacts, Cumulative Impacts, Mitigation/Monitoring, Alternatives, and Miscellaneous. The number of comments in each category is summarized in Table 3-2.

TABLE 3-2
Number of Comments by Resource Category

Resource Category	Total Number of Comments Received	Number of Issues
Water Quantity/Water Quality	63	17
Water Rights	26	13
Water Use	35	18
Groundwater	14	4
Air Quality	9	1
Biological Resources	46	8
Land Use	12	3
Recreation	7	3
Energy (Public Services and Utilities)	4	2
Socioeconomics	35	11
Cost	22	10
Growth-Inducing Impacts	9	3
Cumulative Impacts	13	3
Mitigation/Monitoring	12	6
Alternatives	11	4
Miscellaneous	23	16
Total	**341**	**122**

3.2 Summary of Comments

This section summarizes the content of the written and oral comments submitted during the scoping process. The first part of this section presents a summary of the comments organized by the applicable resource category. For each resource category, a summary of the commenters' concerns is presented. This is followed by a discussion of the ways in which the comments were combined to account for common issues within each resource category. The comment responses reflect the Lead Agencies' preliminary direction for how to address the issues in the Draft EIR/EIS.

The combined comments for each resource category are presented in detail in Appendix I, Scoping Comments Database. Comments raising issues that have been determined to fall outside the scope of the Draft EIR/EIS are addressed in Section 4.3.

Generally, commenters were primarily concerned with impacts to hydrology and water quality, biological resources, and socioeconomics. The letters from federal agencies raised issues with respect to impacts to hydrology, water quality, biological resources, and the ways in which the proposed action could affect various federal regulations, treaties, and water rights. State agency comments from California and Arizona raised issues covering impacts to biological resources, air quality, recreation, and growth. State agencies were also concerned about cumulative impacts and the plans of the proposed Project for mitigation and monitoring. Local agencies expressed concern about the impact of the proposed Project on the local economy and the cost of both cumulative impacts and mitigation and monitoring. Special interest and environmental groups primarily commented on impacts to biological resources. Oral comments and written letters from individuals of the general public raised a variety of issues. Concerns about the impact of the proposed Project to socioeconomic conditions in the Imperial Valley and biological impacts to the Salton Sea were commonly raised. Impacts to the local economy were of great concern to local businesses.

3.2.1 Water Quantity/Water Quality

Sixty-three water quantity/water quality comments that raised common issues or concerns were combined to identify 17 issues. These issues primarily concerned the effect of the proposed Project on the water quality and quantity of the Salton Sea, Colorado River, the Delta in Mexico, and other potentially affected streams and watercourses.

Overall, commenters stated that the EIR/EIS must contain an appropriate level of environmental analysis for impacts to water quality and quantity. It was requested that all beneficial uses of Colorado River water be analyzed by addressing the compliance of the proposed Project with surface and instream water quality standards established by federal, state, tribal, and local agencies. Several commenters asked that the EIR/EIS address the impacts of the proposed Project at different levels of water transferred (i.e., at 100,000 af/yr, 200,000 af/yr, and 300,000 af/yr) in order to adequately identify all potential impacts. A comparative water quality analysis was requested to evaluate the current water supply received by SDCWA (a combination of State Water Project and Colorado River Water) and the anticipated supply from the proposed Project, which the commenter suggested could contain a higher level of total dissolved solids (TDS) and affect current treatment and distribution practices in the San Diego area.

19747

A number of commenters requested clarification on the relationship of the proposed Project to the Salton Sea Restoration Project and whether the proposed Project would be beneficial to the Salton Sea (i.e., whether the Salton Sea would receive fresh water as a direct result of the proposed Project to reduce salinity levels). Several commenters suggested providing SDCWA with desalinated ocean water as an alternative to the water transfer from IID. Concerns were raised about whether sufficient water supplies for cities and districts in both the Imperial County and SDCWA service area could be guaranteed after the proposed Project is implemented.

3.2.2 Water Rights

Twenty-six water rights comments that raised common issues or concerns were combined to identify 13 issues. These issues expressed concern primarily over present and future water rights allocation and the relationship of the proposed Project to the California 4.4 Plan. Commenters requested clarification of relevant water rights laws, the Colorado River allocation process and regulations, and the history of water rights and the water supply allocation within the Project area. The desire to maintain IID's current and historic Colorado River priorities and water rights was expressed. It was also requested that the proposed Project description be revised to ensure conformance with the results of the recently announced "Quantification Settlement."

3.2.3 Water Use

Thirty-five water use comments that raised common issues or concerns were combined to identify 18 issues. These issues were primarily concerned with on-farm conservation methods and the assessment and monitoring of water management once the transfer to SDCWA occurs. Commenters stressed that the proposed Project should be in compliance with existing urban and agricultural water conservation plans. A few commenters suggested that SDCWA obtain needed water through a conservation plan within San Diego County rather than from the Imperial Valley. Overall, the majority of comments received asked for clarification on how the water would be conserved both on-farm and within the irrigation delivery system in Imperial Valley. Some commenters suggested the reuse of seepage and return flows and the use of unused gates in the Imperial Valley drainage system to conserve water. Additional comments received concerned Coachella Valley Water District (CVWD) water rights, importing sea water from the Gulf of Mexico, obtaining water supplies from central California to serve SDCWA, and the relationship of the proposed Project to the All American and Coachella Canals Lining Project.

3.2.4 Groundwater

Fourteen groundwater comments that raised common issues or concerns were combined to form four issues. These issues primarily concerned the impacts of the proposed Project on the availability of groundwater in the vicinity of the Salton Sea, near the Colorado River, in San Diego County, and in Mexico. Commenters from the Imperial Valley are interested in the impact to their aquifer after the water transfer to SDCWA occurs.

3.2.5 Air Quality

Eight air quality comments that raised common issues or concerns were combined to identify one issue concerning potential impacts to air quality. Commenters stated that potential increases in particulate matter could be caused by the decreasing elevation of the Salton Sea, land fallowing and other agricultural activities, and the increased use of desert landscape to conserve water. Commenters remarked on the importance of monitoring to establish baseline conditions and health risk studies. The need for integration of findings from the California Air Resources Control Board and the Salton Sea Science Subcommittee was also stressed.

3.2.6 Biological Resources

Forty-six biological resources comments that raised common issues or concerns were combined to identify eight issues. The majority of these issues were raised by federal and state agencies and environmental groups. The main concerns of these commenters were the potential impact of the proposed Project on rare, threatened, and endangered species; on wetland habitats; and on proposed mitigation measures to reduce the impacts to a level of insignificance. Particular species of concern include black rail (*Laterallus jamaicensis*), Yuma clapper rail (*Rallus longirostris yumanensis*), desert pupfish (*Cyprinodon macularius*), brown pelican (*Pelicanus occidentalis*), razorback sucker (*Xyrauchen texanus*), Coachella Valley fringe-toed lizard (*Uma inornata*), Coachella Valley milk vetch (*Astragalus lentiginosus* var. *coachellae*), flat-tailed horned lizard (*Phyrnosoma mcalli*), Palm Springs ground squirrel (*Spermophilus teritaudus chlorus*), Palm Springs pocket mouse (*Perognathus longimembris bangsi*), crissal thrasher (*Toxostoma crissale*), LeConte's thrasher (*Toxostoma lecontei*), burrowing owl (*Speotyto cunicularia*), and Peninsular bighorn sheep (*Ovis canadensis cremnobates*). Commenters raised concerns over inflows of high TDS entering the Salton Sea, resulting in impacts to fish and wildlife. Commenters also remarked on potential impacts to the rate of succession and conversion of wetland habitat to upland terrestrial habitat. The relationship and resulting cumulative impacts to other water supply and ecosystem restoration projects in the region seemed of particular importance.

3.2.7 Land Use

Twelve land use comments that raised common issues or concerns were combined to identify three issues. These issues primarily concerned the impact of the proposed Project on the productivity of Imperial Valley cropland and on agricultural resources and operations. Commenters expressed concern about the use of crop rotation and land fallowing to meet conservation requirements for the proposed Project. Interest in the evaluation of impacts to agricultural resources and operations as a result of the use of these methods was high. Commenters stressed the importance of compliance of the proposed Project with existing regional and local land use plans.

3.2.8 Recreation

Seven recreation comments that raised common issues or concerns were combined to identify three issues. These issues primarily concerned the impact of the proposed Project to navigation and boating (recreation) on the Colorado River and in the Salton Sea area. A potential reduction in the elevation of the Salton Sea level caused concerns about impacts to recreation in the Salton Sea area. Concern over the construction of new canals or pipelines through state park or wilderness lands was also expressed.

3.2.9 Energy (Public Services and Utilities)

Four energy comments that raised common issues or concerns were combined to identify two issues. These issues requested the Draft EIR/EIS to address potential impacts to energy resources. Commenters raised concern over the potential incompatibility of the proposed Project with existing energy conservation plans as a result of increasing the amount of energy required for groundwater pumping as water levels decline. Commenters stated that the diversion of water upstream of hydroelectric power facilities along the Colorado River could result in a reduction of hydropower generation at Parker Dam. One comment suggested the use of solar-powered sodium removal and sodium hypochlorite generation facilities to reduce impacts to energy resources and reduce salt levels in the Salton Sea.

3.2.10 Socioeconomics

Thirty-five socioeconomic comments that raised common issues or concerns were combined to identify 11 issues. These issues primarily concerned the impact of the proposed Project on the residents and local economy of the Salton Sea and Imperial Valley. However, one comment requested an analysis of impacts on cities such as Mecca, Thermal, Indio, Palm Desert, and La Quinta. It was requested that impacts to residents of Imperial Valley and the Salton Sea area be treated with equal concern as impacts to individual or corporate water rights holders. Numerous commenters asked that the potential impacts to the agricultural economy of the Imperial Valley be addressed in the EIR/EIS. Specifically, impacts to farm workers' jobs and labor skills, and on-farm-related businesses such as impacts to fertilizer, pesticides, seeds, equipment, and mechanic companies were emphasized. Also of concern were impacts to Indian Tribes and environmental justice issues affecting minority communities and low-income populations.

3.2.11 Cost

Twenty-two comments that raised common issues or concerns on Project costs were combined to identify 10 issues. These issues focused on the distribution of economic incentive benefits for conservation efforts and distribution of the revenue generated from the proposed Project. Comments pertaining to the cost of environmental mitigation and increases to SDCWA water rates were also raised. One comment requested a reduction in the cost of litigation associated with past and future water transfers in the Imperial Valley.

3.2.12 Growth-Inducing Impacts

Nine comments on growth-inducing impacts that raised common issues or concerns were combined to identify three issues. These issues concerned the impact of the proposed Project on growth in San Diego County and the Salton Sea area. Commenters requested that the EIR/EIS analyze the potential impact on growth in the Salton Sea area if sea levels drop and more land becomes available for development.

3.2.13 Cumulative Impacts

Thirteen comments on cumulative impacts that raised common issues or concerns were combined to identify three issues. These issues primarily concerned the relation of the proposed Project to the Salton Sea Restoration Project and potential direct, indirect, third-party, and cumulative impacts. One commenter emphasized the importance of the evaluation of the effects of similar, cumulative actions in addition to the proposed Project that would reduce Colorado River flows.

3.2.14 Mitigation/Monitoring

Twelve mitigation/monitoring comments that raised common issues or concerns were combined to identify six issues. These issues suggested that appropriate mitigation measures be developed and monitored and that mitigation responsibilities be appropriately assigned. Commenters emphasized that mitigation measures and mitigation monitoring and reporting for the proposed Project should fulfill requirements set by the California Department of Fish and Game (CDFG). The commenters also requested that the selected mitigation measures emphasize the evaluation and selection of alternatives that avoid or otherwise minimize impacts of the proposed Project. It was suggested that additional work might be needed to develop appropriate measures to mitigate adverse air quality effects resulting from the proposed Project. One commenter asked that specific mitigation measures be developed to address increasing salinity concentrations in agricultural soils.

3.2.15 Alternatives

Eleven comments on alternatives that raised common issues or concerns were combined to identify four issues that will be addressed in the Draft EIR/EIS. These issues generally requested that reasonable alternatives to the proposed Project, including alternative feasible water transfer mechanisms, be addressed in the Draft EIR/EIS. Commenters suggested that the Draft EIR/EIS consider the following alternatives to the proposed Project:

- No Action Alternative
- No Project Alternative
- Providing water to SDCWA from an alternate water supplier
- Water rationing
- Water conservation in the SDCWA service area
- Growth control in San Diego County
- Return of recycled water to the Colorado River by a canal or aqueduct
- Desalination of ocean water

In addition, one commenter requested that the Draft EIR/EIS consider a range of water transfer mechanisms to transport the water from the Imperial Valley to SDCWA, including tunneling or installing a pipeline or canal.

3.2.16 Miscellaneous

Twenty-three miscellaneous comments were received that raised common issues or concerns that could not be categorized under the first 15 resource issues. These 23 comments were combined to identify 16 general issues. In general, these issues requested: (1) extensions to the official comment period, (2) copies of the Public Notice, and (3) proper referencing of environmental documentation within the Draft EIR/EIS. In addition, commenters requested that public meetings concerning the proposed Project also be held in Calexico, California, and Yuma, Arizona. In addition, Salton Sea area residents requested additional opportunities to participate in the proposed Project environmental review process. One commenter was concerned that despite the terms of years written into the proposed Project definition, a water transfer of the magnitude of the proposed Project will become a permanent and irreversible transfer but not be assessed as such in the Draft EIR/EIS. Another commenter requested that after the Draft EIR/EIS is issued, the reviewing public be given definition of the exact purposes for which the Lead Agencies and other responsible agencies will use the assessment.

SECTION 4

Proposed Scope of the Draft EIR/EIS and General Responses to Comments

As discussed above in Section 3.1, comments received during the scoping process identified 122 issues that federal, state, and local agencies; special interest and environmental groups; individuals; and businesses felt should be addressed in the Draft EIR/EIS. After thorough consideration of these issues, an initial determination concerning the scope of the Draft EIR/EIS has been made. The categorization of comments facilitated the identification of potentially impacted resource categories and helped to determine the scope of the Draft EIR/EIS. A detailed discussion of the proposed scope of the Draft EIR/EIS is presented in Section 4.1, and an outline of the Draft EIR/EIS is included as Appendix J.

The Lead Agencies' initial responses to the issues raised by the comments received are set forth below and in Appendix I. General responses addressing the following resources include water rights issues, socioeconomics issues, transboundary issues, the State Water Resources Control Board (SWRCB) proceeding in connection with the proposed Project, other projects related to the proposed Project, and alternatives to the proposed Project. In addition, issues that are not answered by the general responses have been responded to on an individual basis in Appendix I, Scoping Comments Database. The responses are intended to provide the public with a greater understanding of how specific issues will be addressed in the Draft EIR/EIS.

4.1 Proposed Scope

The proposed scope of the Draft EIR/EIS has been determined after review and consideration of the written and oral comments received during the scoping process. These comments, in addition to feedback that will be received during agency consultation and coordination, will help determine the final scope of the Draft EIR/EIS. The preliminary scope of the Draft EIR/EIS is discussed below.

Chapter 1 of the Draft EIR/EIS will present a general introduction and overview of the proposed Project including background information. Chapter 1 will cover the consultation and coordination process, including the scoping process conducted with the public and the consultation and coordination conducted with Responsible, Cooperating, and Trustee Agencies, and Indian Tribes. The purpose and need for the proposed Project will also be presented in Chapter 1.

Chapter 2 of the Draft EIR/EIS will provide a detailed description of the proposed Project, including Project location and study area and identification of Project components. A discussion of Project alternatives will be presented, including the screening process for selection of alternatives according to the NEPA and CEQA requirements for alternatives.

Chapters 3 and 4 will present the environmental setting and the environmental impacts and subsequent mitigation measures for the following resources: Hydrology and Water Quality, Geology and Soils, Transportation and Traffic, Noise, Air Quality, Biological Resources, Aesthetics, Land Use and Planning, Agricultural Resources, Recreational Resources, Public Services and Utilities, Socioeconomics, Public Health and Environmental Hazards, Cultural Resources, Indian Trust Assets, and Transboundary Effects. The resources to be addressed in Chapters 3 and 4 were identified and refined after considering issues raised during the scoping process.

Chapter 3 presents the environmental setting for each resource category. This includes a description of the environmental baseline conditions and characteristics of the study region and Project area as they relate to each resource. Chapter 4 will identify potential environmental impacts and proposed mitigation measures. Unavoidable significant impacts of the proposed Project and alternatives, including the No Project/No Action Alternative, will be addressed. The methods of assessment, significance criteria, and regulatory setting of each resource will also be presented.

Chapter 5 will discuss other CEQA and NEPA topics, such as the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. Chapter 6 will analyze the cumulative impacts of the proposed Project and alternatives. The analysis will include a listing of the projects considered for the cumulative analysis. A detailed outline of the table of contents proposed for the Draft EIR/EIS is included as Appendix J of the scoping summary report on the Project web site.

4.2 General Responses

The Lead Agencies have developed the following general responses to issues raised by questions and comments on the following issues: water rights issues, socioeconomic issues, transboundary issues, the SWRCB proceeding in connection with the proposed Project, other projects related to the proposed Project, and alternatives to the proposed Project. These general responses were developed to address these issues because they were commonly raised during the scoping process. Comments or questions that raised other issues are responded to in Appendix I, Scoping Comments Database.

4.2.1 Water Rights

Several comments received during the scoping process requested clarification on the nature of the Colorado River water rights held by IID and others, and the effects of the proposed Project on those rights. The following background information is provided in response to those comments.

IID holds very senior rights to Colorado River water, which are respected under both state and federal law, known as the "Law of the River." Beginning in 1885, IID's predecessor started acquiring rights to Colorado River water under state law. Then, under the 1922 Colorado River Compact and the 1928 Boulder Canyon Project Act, California, Nevada, and Arizona (referred to as the Lower Basin States) were apportioned a total of 7.5 million acre feet (AF) of Colorado River water per year. This allocation is apportioned among those states as follows:

California	4,400,000 AF
Nevada	300,000 AF
Arizona	2,800,000 AF

The 7.5 million-AF allocation to the Lower Basin States does not include surplus water, which is apportioned 50 percent to California, 4 percent to Nevada, and 46 percent to Arizona.

California's apportionment of Colorado River water is divided among entitlement holders in accordance with a schedule of priorities agreed to in the 1931 Seven-Party Agreement. Each holder can divert Colorado River water, in priority order, up to the maximum amount stated for that priority, to the extent water is available. The apportionments and priorities are presented in Table 4-1 below.

TABEL 4-1
Colorado River Rights Apportionment and Priorities

Priority	Holder	Maximum Amount (Af/Yr)
1	Palo Verde Irrigation District—gross area of 104,500 acres	
2	Yuma Project (Reservation District)—not exceeding a gross area of 25,000 acres	
3a	IID and lands in Imperial and Coachella Valleys to be served by the All American Canal	3,850,000
3b	Palo Verde Irrigation District—16,000 acres of mesa lands	
4	Metropolitan Water District and/or City of Los Angeles and/or others on coastal plain	550,000
	SUBTOTAL	**4,400,000**
5a	Metropolitan Water District and/or City of Los Angeles and/or others on coastal plain	550,000
5b	City and/or County of San Diego	112,000
6a	IID and lands in Imperial and Coachella Valleys	300,000
6b	Palo Verde Irrigation District—16,000 acres of mesa lands	
7	Agricultural use	all remaining water
	TOTAL	**5,362,000**

This schedule shows that the holders of Priorities 1 through 3 (referred to as the "agricultural users") can divert, in priority order, up to an aggregate maximum amount not to exceed 3,850,000 af/yr. The historical average annual use for Priorities 1 and 2 is approximately 420,000 af/yr. CVWD's entitlement under Priority 3 is subordinated to IID's Priority 3 entitlement, pursuant to a 1934 agreement between the parties. This schedule does not reflect the entitlement of Indian or miscellaneous present perfected right holders to the Colorado River.

The proposed Project includes a voluntary commitment by IID to limit its Priority 3 Colorado River water diversions to 3.1 million af/yr during the term of the Project. IID intends, by this limitation, to ensure that the proposed water transfers will not adversely impact junior water rights holders. In particular, when Priorities 1 and 2 use their historical average, this limitation would make available 330,000 af/yr of Priority 3 water to CVWD, an amount equal to CVWD's recent historical average use of Colorado River water. State and federal water regulators will consider impacts on such junior water rights holders in connection with various federal and state implementation agreements and/or approvals required for the proposed Project.

The proposed Project, if viewed under state law, involves a transfer of conserved water, not a transfer of IID's water rights. The transfer is contingent upon the confirmation of all state regulatory authorities that the conserved water will retain its character as water diverted by IID and that the transfer will not change IID's Priority 3 right to the water (subject to the 3.1 million-AF limitation described above). The proposed Project, if viewed under federal law, involves the temporary limitation of IID's Priority 3 right to 3.1 million AF, and the agreement of IID to refrain from ordering an amount of water equivalent to that conserved by IID in accordance with the IID/SDCWA transfer agreement. The Secretary will, under federal law, deliver that water for SDCWA's use at the Colorado River Aqueduct and account for it accordingly during the term of the IID/SDCWA agreement and in accordance with an Implementation Agreement pursuant to the Quantification Settlement Agreement. It is an important objective of IID to retain its historic and senior water rights. The Secretary will agree that IID's right to the delivery of Priority 3 water will survive the termination of the IID/SDCWA transfer agreement. It is also an important objective of SDCWA that the transferred water be Priority 3 water in order to gain the benefit of seniority and reliability in times of shortage.

4.2.2 Socioeconomics

Several questions and comments were received concerning the impact of the proposed Project on the agricultural resources and socioeconomic attributes of the Imperial Valley. The following is provided in response to those comments.

The number of farmable acres in the Imperial Valley has remained relatively constant at approximately 480,000 acres, with total acreage in cultivation during any given year ranging from 450,000 to 470,000. Cropping patterns and frequencies within the valley have remained fairly constant over the past 10 years, with annual fluctuations being driven by anticipated changes in market prices based on short-term projections. The proposed Project assumes that the historic patterns of total irrigated acres in production, cropping patterns, and cropping frequencies will remain within the range of historical fluctuation. A discussion of the data used to identify the historic patterns will be included in the Agricultural Resources section of the EIR/EIS.

The Draft EIR/EIS will assess the potential socioeconomic impacts of the proposed Project in conformance with NEPA and CEQA requirements. Potential impacts to the regional economy will be identified at the County level. The County-level unit of analysis is used because this is generally the smallest unit of measurement for which economic data are collected and reported. Overall economic impacts of the proposed Project will be identified and assessed for aggregated sectors such as Agriculture, Manufacturing and Government (in terms of changes in employment), and personnel income and economic output for each aggregated sector. A full disclosure of the sources of data used and assumptions employed in the analysis will be provided in the EIR/EIS.

As an intermediate step in identifying the County-level regional economic impacts, changes in the costs of production and farm-level revenue streams will be identified. The Agricultural Resources section will provide a description of the assumptions used to identify impacts to farm-level economics, including the costs of production, values used for anticipated crop yields and prices, and any revenues received from the sale of conserved water. An analysis of the impact of the proposed Project on farm and nonfarm land values will be included in the EIR/EIS, including a qualitative discussion regarding the impacts to future nonagricultural economic development.

The potential impacts of the proposed Project on the Torres-Martinez Tribe and the trust responsibilities of the Department of Interior will be addressed within the Indian Trust Assets section of the EIR/EIS. An analysis of the potential Project impacts on low-income and minority populations will be conducted as part of the Socioeconomics section of the EIR/EIS.

4.2.3 Transboundary Issues

Within the context of the Draft EIR/EIS, transboundary issues refer to effects to Mexico caused by the proposed Project. The Council on Environmental Quality (CEQ), a branch of the Executive Office of the United States President, issued a recommendation stating that to be consistent with NEPA, transboundary effects to the environment resulting from proposed federal actions taking place in the United States should be considered. The guidance pertains to all federal agency actions that are normally subject to NEPA, whether covered by an international agreement or not. This guidance is a result of negotiations with the governments of Mexico and Canada to develop an agreement on transboundary environmental impact assessment authorized in Section 10.7 of the North American Agreement on Environmental Cooperation. The analysis should include reasonably foreseeable transboundary effects of federal actions. Impacts in Mexico are subject to Mexican laws and regulations. The federal actions for the Project are related to the change in the point of diversion on the Lower Colorado River. Direct and indirect effects of the federal action will be evaluated in the Draft EIR/EIS.

Transboundary effects may occur in any of the resource areas considered in the Draft EIR/EIS. The Draft EIR/EIS will address potential transboundary effects. Transboundary effects will also be cross referenced, as appropriate, to other resource sections that assess specific environmental resource issues (e.g., migratory birds, socioeconomic effects, water quality, and air quality).

4.2.4 SWRCB Proceeding

Several comments received during the scoping process requested information about the purpose of the SWRCB proceeding in connection with the proposed Project. IID believes the SWRCB proceeding is necessary under state law in order to implement the proposed Project. IID and SDCWA have requested SWRCB, among other things: (1) to approve the water transfer under Section 1011 of the California Water Code, (2) to confirm that the conserved water retains the same priority as IID's senior water rights, and (3) to make a determination that the transfer establishes reasonable and beneficial use of Colorado River water by IID. SWRCB's determination of these matters, as requested, must be obtained before IID and SDCWA will proceed with the proposed Project.

In reviewing this request, SWRCB will assess the impact of the transfer on the holders of Colorado River rights, which are junior to those of IID. As described in Section 4.2.1, Water Rights, the proposed Project includes a commitment by IID to limit its annual Priority 3 Colorado River water diversion to 3.1 million AF, for the benefit of junior rights holders, in order to facilitate SWRCB's approval.

4.2.5 Other Projects Related to the Proposed Project

Several commenters remarked on agreements, transfers, and other projects related to the proposed Project, including the Salton Sea Restoration Project, the California 4.4 Plan, the Quantification Settlement between IID, CVWD, and Metropolitan Water District (MWD), the All American and Coachella Canal Lining Projects, and Coachella Valley Resources. General responses that address these are discussed in more detail below.

Salton Sea Restoration Project. The Salton Sea Restoration Project is a separate project from the proposed Project and is authorized by 1998 legislation passed by Congress. The Salton Sea Reclamation Act directs Reclamation and the Salton Sea Authority to study potential solutions to improve the current conditions at the Salton Sea. The Salton Sea Authority is the state lead agency, and Reclamation is the federal lead agency. IID is a member of the Salton Sea Authority. A joint EIR/EIS is being prepared for the Salton Sea Restoration Project, and the Draft EIR/EIS was released in January 2000. The Lead Agencies for the proposed Project are coordinating with the project team for the Salton Sea Restoration Project in an effort to coordinate scientific analyses and to ensure that the EIR/EIS for the proposed Project includes an appropriate assessment of related and cumulative impacts to the Salton Sea.

California 4.4 Plan. The schedule of priorities and apportionments among California users of Colorado River water, which is shown Table 4-1, indicates that if the holders of Priorities 1 through 4 diverted their total entitlement (a total of 4.4 million af/yr), then California's nonsurplus allocation (also 4.4 million af/yr) would be exhausted, and no further water would be available to holders of lower priorities, including the holder of Priority 5, whose use is on the southern California coastal plain.

For many years, California has been diverting approximately 5.2 million af/yr, which was possible because Nevada and Arizona were not using their total apportionments and because surplus water has been available. Arizona and Nevada are now approaching the diversion of their full apportionments, and the future availability of surplus water is uncertain. Thus, there is a serious risk of a water shortage to California as a result of California's diversions declining from 5.2 to 4.4-million af/yr. The Colorado River Board of California, the agency comprised of California Colorado River water right holders, is preparing a framework plan called the "California 4.4 Plan," which is designed to bring California water use within the state's 4.4 million-AF apportionment. The California 4.4 Plan includes the Quantification Settlement, which provides for the satisfaction of miscellaneous and Indian present perfected right entitlements within California's 4.4 million-AF apportionment. The proposed conservation and transfer by IID of up to 300,000 af/yr for a substantial time period is a key component of the proposed Plan. By conserving water used in the IID area and transferring it for use to more urban areas, which previously depended on the availability of surplus water above 4.4 million af/yr, California is able to more easily live within its legal allocation.

Quantification Settlement. On October 15, 1999, the negotiating teams for IID, CVWD, and MWD executed a document titled "Key Terms for Quantification Settlement Among the State of California, IID, CVWD, and MWD" (Key Terms), which sets forth the key material terms of a proposed settlement relating to use of Colorado River water. The Key Terms will be used as the basis for drafting the legal documents that will set forth all of the definitive terms and conditions of the Quantification Settlement. The parties currently anticipate that the complete legal documents will not be available until April 2000.

Based upon the Key Terms, the settlement, to which the United States is not a party if written in terms of state law, would provide for, among other things: (1) IID's voluntary commitment to limit its annual Priority 3 water diversions to 3.1 million AF (a commitment that is also included in the proposed Project); (2) the transfer of 130,000 to 200,000 af/yr of the water conserved by IID as part of the proposed Project to SDCWA; (3) the transfer of up to 100,000 af/yr of the water conserved by IID, as part of the proposed Project, to CVWD and/or MWD; and (4) various other transfers and allocations of Colorado River water among other right holders. The Quantification Settlement will be contingent upon the Secretary of the Interior's contractual agreement under federal law to deliver Colorado River water in accordance with the terms of the settlement.

As the terms of the Quantification Settlement become more defined, the Lead Agencies for the proposed Project will coordinate with the parties to the proposed Quantification Settlement in order to ensure consistent and comprehensive environmental review of both projects, including related and cumulative impacts.

All American and Coachella Canal Lining Projects. The All American and Coachella Canal Lining Projects are separate projects that are not included in the proposed Project but are components of the overall water delivery network. An EIR/EIS has been prepared for the All American Canal Lining Project by Reclamation. A separate EIR/EIS is also being prepared for the Coachella Canal Lining Project. Environmental impacts of both canal lining projects, and any mitigation measures required, will be fully evaluated in the respective joint environmental documents.

The potential effects of the proposed Project on the operation of the All American and Coachella Canals will be addressed in the Draft EIR/EIS.

Coachella Valley Resources. Impacts of the proposed Project to the resources of the Coachella Valley will be addressed at a programmatic level within the Draft EIR/EIS. Project-level impacts of the proposed Project will be addressed separately in an EIR being prepared by CVWD.

4.2.6 Alternatives to the Proposed Project

Several comments received during the scoping process suggested providing SDCWA with water supplies from sources other than the Imperial Valley. Suggested alternatives to the proposed Project received during the scoping process include providing SDCWA with desalinated ocean water, water supplies from central California, or through the implementation of a water conservation program within San Diego County.

As set forth in the IID/SDCWA Water Conservation and Transfer EIR/EIS Public Participation Plan, which is available on the Project web site (http://www.is.ch2m.com.iidweb), the next step in the EIR/EIS process is to identify a reasonable range of alternatives to the proposed Project. The Draft EIR/EIS will assess and compare the environmental impacts of these alternatives, as well as those of the proposed Project. Comments received during the public scoping process relating to alternatives, such as comments on various conservation methods/programs and alternative water supplies for San Diego, will be considered during the alternatives development process. The public will be kept informed as alternatives are identified and evaluated. An Alternatives Report will be prepared that summarizes the process, meetings, and methodology used to arrive at the final set of alternatives that will be evaluated in the EIR/EIS. At least one public meeting will be conducted to review the Alternatives Report.

4.3 Issues not to be Considered in the Draft EIR/EIS

A small number of comments during the scoping process raised issues that have been determined to fall outside the proposed scope of the Draft EIR/EIS. These include: issues that do not identify an "environmental impact" associated with the proposed Project; issues that identify a potential environmental impact, but the Lead Agencies have determined that it is not "potentially significant;" issues regarding a separate, unrelated project; and comments that requested general information. These issues, and the explanations of why they are outside the scope of the proposed Project, are presented in Appendix K.

Draft

Habitat Conservation Plan IID Water Conservation and Transfer Project

December 2001

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Contents

Section **Page**

Tables

Figures

Appendicies

Acronyms and Abbreviations

μg/g dw	micrograms per gram for drinking water
μg/L	micrograms per Liter
AAC	All American Canal
AFY	acre-feet per year
BEPA	Bald Eagle and Golden Eagle Protection Act
BLM	Bureau of Land Management Sensitive Species
CDFG	California Department of Fish and Game
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CRIT	Colorado River Indian Tribe
CSC	California Species of Special Concern
CVWD	Coachella Valley Water District
CWHR	California Wildlife Habitat Relationship
DDD	dichloro-diphenyl-dichloroethane
DDE	dichlorophenyldichloro-ethene
DDT	dichloro-diphenyl-trichlorethane
DOI	Department of Interior
DOQQ	Digital Orthophoto Quarter Quadrangle
E	endangered
EIR/EIS	environmental impact report and environmental impact statement
ESA	Endangered Species Act
FESA	Federal Endangered Species Act of 1973
FP	fully protected
ft/s	foot per second
g/L	grams per liter
GIS	geographic information systems
GM	geometric mean
HCP	habitat conservation plan
IID	Imperial Irrigation District
IT	incidental take
ITP	incidental take permit
KAFY	thousand acre-feet per year

lb/acre	pounds per acre
LCR	Lower Colorado River
MAFY	million acre-feet per year
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MOU	Memorandum of Understanding
msl	mean sea level
MWD	Metropolitan Water District of Southern California
NEPA	National Environmental Policy Act
NNE	north-northeast
NPPA	Native Plant Protection Act
NWR	National Wildlife Refuge
O&M	operation and maintenance
ppb	parts per billion
ppm	parts per million
ppt	parts per trillion
PCB	polychlorinated biphenyl
PT	proposed threatened
QSA	Quantification Settlement Agreement
R	rare
Reclamation	Bureau of Reclamation
S	federal species of concern
SDCWA	San Diego County Water Authority
T	threatened
TDS	total dissolved solids
TSS	total suspended solids
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
WA	wildlife area

Executive Summary

Imperial Irrigation District Water Conservation and Transfer Project Habitat Conservation Plan

Preface

The Imperial Irrigation District (IID) prepared this Habitat Conservation Plan (HCP) to support its application for issuance of incidental take permits (ITP) under the federal Endangered Species Act of 1973 (FESA) and the California Endangered Species Act (CESA) in order to implement the conservation and transfer of Colorado River water to other California water agencies. Through this HCP, IID commits to certain management and other actions that will minimize and mitigate the potential impact of any *take* of covered species that may occur as a result of IID's implementation of the IID/San Diego County Water Authority (SDCWA) Transfer Agreement (Transfer Agreement) and the proposed Quantification Settlement Agreement (QSA), and related activities. The Transfer Agreement and QSA are, in turn, critical elements of California's Colorado River Water Use Plan (formerly the "4.4 Plan"). California has developed the 4.4 Plan to reduce California's use of water from the Colorado River in accordance with California's 4.4 MAFY apportionment of Colorado River water.

Introduction

IID delivers water from the Colorado River to agricultural and domestic water users within the boundaries of its water service area. This service area covers about 500,000 acres in the Imperial Valley in southeastern California. Irrigated agriculture is the primary economic enterprise within IID's service area and the primary use of water delivered by IID.

California's Colorado River Water Use Plan

The use of Colorado River water is allocated among the seven states that comprise the Colorado River Basin. In accordance with the laws governing use of Colorado River water, including court decree, California's apportionment of Colorado River water is 4.4 MAFY (plus 50 percent of any surplus water). Recent California diversions have been up to 800 KAFY above its normal year (i.e. non-surplus) apportionment. California recently published the Draft California Colorado River Water Use Plan (Water Use Plan) in which the steps necessary to reduce its use to 4.4 MAFY are outlined, including the need for cooperative water conservation and transfers from agricultural to urban use. The IID/SDCWA Water Conservation and Transfer Project is a key component of the Water Use Plan.

IID/SDCWA Transfer Agreement

In 1998, IID and SDCWA executed an Agreement for Transfer of Conserved Water. The IID/SDCWA Transfer Agreement is a long-term (75 years) transaction between IID and SDCWA involving the voluntary conservation by IID of up to 300 KAFY (300,000 acre-feet per year) and the subsequent transfer of all or a portion of the conserved water to SDCWA. The transferred, conserved water is intended for use within SDCWA's service area in San Diego County, California.

The conserved water will consist of Colorado River water that otherwise would be diverted by IID at Imperial Dam for use within IID's service area in Imperial County, California. IID's annual diversions of Colorado River water at Imperial Dam will be reduced by the amount of the conserved water. Water for transfer to SDCWA will be diverted at Parker Dam into the Colorado River Aqueduct operated by the Metropolitan Water District of Southern California (MWD), and SDCWA will receive an equivalent amount of water through MWD's distribution facilities pursuant to an Exchange Agreement between SDCWA and MWD.

Quantification Settlement Agreement

Subsequent to execution of the IID/SDCWA Transfer Agreement, a settlement was negotiated by and among IID, Coachella Valley Water District (CVWD), and MWD, with the participation of the State of California and the Department of Interior. The proposed terms of the settlement agreement are incorporated in a draft QSA, which is intended to settle, for a period of up to 75 years, long-standing disputes among IID, MWD, and CVWD regarding the priority, use, and transfer of Colorado River water. The QSA facilitates a number of component agreements and actions which, when implemented, will enhance the certainty and reliability of Colorado River water supplies available to the signatory agencies and will assist these agencies in meeting their water demands within California's normal-year apportionment of Colorado River water. The QSA thus implements the goals and key programs of the Water Use Plan.

Under the terms of the QSA, up to 100 KAFY of the water conserved by IID may be transferred to CVWD or MWD or both. The QSA also includes a voluntary contractual limitation of IID's total diversions of Colorado River water under its third-priority water right to 3.1 MAFY.

Purpose and Need for the HCP

The purpose and need for the HCP stems from the need to comply with FESA and CESA and also IID's need for long-term regulatory certainty (up to 75 years) in committing to the IID/SDCWA Transfer Agreement and the QSA. Both the IID/SDCWA Transfer Agreement and the QSA establish long-term water supply arrangements designed to implement the Water Use Plan. Implementation of these agreements will require changes in current farming practices and substantial capital investments in water conservation equipment and technologies. Long-term, no-surprises assurances regarding FESA and CESA compliance measures and costs are needed by IID to commit to the long-term obligations set forth in the IID/SDCWA Transfer Agreement and the QSA.

Area Covered by the HCP

IID conveys and delivers water diverted from the lower Colorado River at Imperial Dam to customers in the Imperial Valley in IID's service area via the All-American Canal (AAC). The HCP area includes all lands comprising the approximately 500,000 acres of IID's service area, lands owned by IID outside of its service area that are currently submerged by the

Salton Sea, and IID's rights-of-way along the AAC downstream from the point of diversion at Imperial Dam. In addition, the HCP covers any take of covered species using the Salton Sea that could occur as a result of IID's activities.

Species Covered by the HCP

The HCP covers 96 fish, wildlife, and plant species with the potential to occur in the HCP area. Several of these are federally and/or state listed species, while the remainder represent currently unlisted species that are present or potentially present in IID's service area, the Salton Sea, or along the AAC.

Term of the HCP

IID is proposing a 75-year term (2002 through 2077) for the HCP. This term is consistent with the term of the IID/SDCWA Transfer Agreement and the QSA.

Activities Covered by the HCP

The activities covered by the HCP include:

- Water conservation and water use activities, including irrigation and drainage of lands to which IID delivers water;
- Water conservation activities undertaken by IID, and the farmers, leaseholders or landowners of the Imperial Valley receiving IID water and participating in the conservation program;
- Activities of IID in connection with the diversion, conveyance, and delivery of Colorado River water to users within IID's service area, including the AAC; and
- Activities of IID in connection with the collection of unused irrigation or drainage waters within its service area and conveyance to the Salton Sea.

The covered activities specifically include all conservation and mitigation measures in connection with the conservation and transfer of up to 300 KAFY of Colorado River water pursuant to the IID/SDCWA Transfer Agreement and/or the QSA and compliance with the cap on IID's annual diversions of Colorado River water established by the QSA.

Biological Environment

The HCP area lies within the California Desert. Before European settlement, the area consisted of native desert vegetation and associated wildlife. Periodically, the Colorado River changed course and flowed northward into the Salton Trough forming a temporary, inland sea. These former seas persisted as long as water entered from the Colorado River, but evaporated when the river returned to its previous course. Thus, despite the periodic occurrence of a lake within the Salton Trough, the HCP area consisted predominantly of a desert ecosystem.

The Salton Sea represents the remnants of the most recent occurrence of flooding by the Colorado River, which, in 1905, breached an irrigation control structure and flowed into the Salton Trough, a dry desert basin. By 1920, agricultural production had increased in both the Imperial and Coachella valleys and the Salton Sea was receiving agricultural drainage water. In 1924 and 1928, presidential orders withdrew all federal lands below –220 msl "for the purpose of creating a reservoir in the Salton Sea for storage of waste and seepage water from irrigated land in Imperial Valley." Since its formation in 1905, the Salton Sea has been sustained by irrigation return flows from the Imperial, Coachella, and Mexicali valleys.

The availability of a reliable water supply affected by construction of Hoover and Imperial dams and the AAC facilitated sustained intensive cultivation within the Imperial Valley. To support agricultural production in the valley, an extensive network of canals and drains was constructed to convey water from the Colorado River to farms in the valley and subsequently to transport drainage water from the farms to the Salton Sea. The importation of water from the Colorado River and subsequent cultivation of the Imperial and Coachella valleys radically altered the Salton Trough from its native desert condition. The availability of water in the drains and canals supported the development of mesic (marsh-associated) vegetation and, in some locations, patches of marsh-like habitats (e.g., along the Salton Sea and seepage from canals). These mesic habitats, in addition to the productive agricultural fields and the Salton Sea, have attracted and currently support numerous species of wildlife that would be absent or only present in low numbers in the native desert habitat. Today, only isolated remnants of desert habitat remain in the HCP area, which is bounded by the main irrigation water delivery canals on the east and west sides of the IID water service area. The vast majority of the habitat supporting covered species is created and maintained by water imported to the Imperial Valley for agricultural production. Native desert habitat surrounding the IID water service area has not changed as a result of IID's activities and will not change as a result of the water conservation.

Habitat Conservation Plan Components

The draft HCP employs both habitat-based and species-specific approaches. The habitat-based component of the conservation strategy of the HCP focuses on mitigating the potential loss of habitat values (quality and quantity) of each habitat type within the HCP area. The overall conservation strategy for the IID HCP is to maintain or increase the value (amount and/or quality) of each habitat in the HCP area in addition to implementing measures to minimize direct effects to covered species from operation and maintenance (O&M) and construction activities. In addition to the habitat-based conservation approach of the HCP, a species-specific approach is used to address individual species or groups of species (i.e., burrowing owls, desert pupfish, and razorback suckers) that are not easily accommodated by habitat approach. Consistent with the guidance provided by the USFWS, all HCP effects are evaluated on a species-by-species basis.

IID's HCP contains specific conservation strategies for:

- Salton Sea habitat
- Tamarisk scrub habitat
- Drain habitat
- Desert habitat
- Agricultural field habitat
- Burrowing owls
- Desert pupfish
- Razorback sucker

General HCP Commitments

To ensure proper implementation of the HCP measures and the Monitoring and Adaptive Management Program, the HCP includes commitments by IID to:

- Hire a full-time biologist to oversee implementation of the HCP measures, and
- Establish and convene an HCP Implementation Team composed of representatives from the USFWS, CDFG, and IID to guide implementation of the mitigation and adaptive management elements of the HCP.

Salton Sea Conservation Strategy

Water conservation by IID is anticipated to reduce drain water discharge and accelerate the rate at which salinity increases in the Salton Sea. The increase in salinity is expected to eventually lead to conditions in the Salton Sea that would no longer support fish. Although the Salton Sea is projected to become too saline to support fish even in the absence of water conservation, the anticipated acceleration of salinization caused by water conservation would hasten the loss of fish in the Sea and lead to the discontinued use by piscivorous (fish-eating such as pelicans) birds. Current modeling projections suggest that average salinity in the Salton Sea under the IID/SDCWA Water Conservation and Transfer Project could reach a level that would no longer support viable populations of tilapia (the fish species in the Salton Sea that serves as the birds' primary forage base) about 11 years earlier than if the water conservation program were not implemented. The discontinued use of the Salton Sea by piscivorous birds could result in take as defined by the federal Endangered Species Act (ESA) by the U.S. Fish and Wildlife Service.

Minimizing and mitigating the impact of the anticipated take of piscivorous birds is complicated by the time element of the impact (i.e., impact occurring about 11 years earlier) and the magnitude and cost of the actions that would be required to address those impacts. The reduction in drainage water discharged to the Sea resulting from water conservation has an incremental effect on the Sea, but the actions necessary to offset this impact could require a commitment substantially greater than that increment. For example, the cost of constructing replacement habitat to support the current level of use by piscivorous birds would be same regardless of the length of the temporal impact. IID and others have developed and are considering various approaches for minimizing and mitigating the impact of the anticipated take of piscivorous birds. These mitigation approaches include creating replacement habitat, constructing and operating of hatcheries to augment food supplies for piscivorous birds, allowing conserved water to flow to the Sea, and sharing the mitigation responsibility with the state and federal governments.

IID has not identified a preferred approach for addressing piscivorous birds and presents two approaches under consideration in this HCP as means to seek input on which approach or combination of approaches is most appropriate. Approach 1 consists of constructing and operating a fish hatchery to stock fish in the Salton Sea as prey for piscivorous birds until the salinity becomes intolerable. At that point, IID would construct 5,000 acres of ponds and manage the ponds to produce fish through the end of the HCP term. Under Approach 2, IID would conserve sufficient additional water (beyond that conserved for transfer) and allow this water to flow to the Sea such that there would be no change in inflow to the Salton Sea as a result of the water conservation and transfer programs. This approach would avoid impacts related to change in salinity or surface water elevation.

Although the specific approach for minimizing and mitigating the impacts associated with increased salinity on piscivorous birds have not been defined, IID has committed to avoiding or mitigating take of other covered species resulting from increased salinity or reduced Sea level. The key elements are:

- Ensure an appropriate level of connectivity among pupfish populations in the drains if an increase in the salinity prevents movement of fish among drains
- Incorporation of nesting islands suitable for use by gull-billed terns and black skimmers into the design and construction of a portion of any ponds created to mitigate impacts to piscivorous birds
- Replace tamarisk scrub habitat lost as a result of reduced Sea levels caused by water conservation with native tree habitat consisting of mesquite bosque or cottonwood-willow habitat

Tamarisk Scrub Conservation Strategy

In the HCP area, tamarisk scrub is found along the New and Alamo rivers, sporadically along some drains, in seepage areas adjacent to the East Highline Canal and All American Canal, adjacent to the Salton Sea, and in other scattered and isolated patches throughout the HCP area wherever water is available. Although tamarisk is an exotic plant species and provides lower habitat value than native vegetation (e.g., mesquite and cottonwood), it dominates the plant community in portions of the HCP area and provides the only available habitat for some covered species. Implementation of water conservation and ongoing O&M activities have the potential to affect tamarisk scrub habitat and the covered species that use it. The biological goal of the Tamarisk Scrub Habitat Conservation Strategy is to maintain the species composition, relative abundance, and life history functions of covered species using tamarisk scrub habitats. The approach to the Tamarisk Scrub Habitat Conservation Strategy entails a combination of minimization and mitigation measures. The key elements are:

- Minimize take, including disturbance, of covered species as a result of construction activities
- Protect or create native tree habitat to mitigate the take of covered species resulting from loss of tamarisk scrub or native tree/shrub habitat permanently removed as a result of construction activities.

Drain Habitat Conservation Strategy

IID operates and maintains agricultural drains in the HCP area, portions of which support vegetation used by covered species. Implementation of water conservation and ongoing O&M has the potential to result in the take of covered species. The biological goal of the Drain Habitat Conservation Strategy is to maintain the species composition, relative abundance, and life history functions of covered species using drain habitat. The approach of the Drain Habitat Conservation Strategy is to create high quality managed marsh habitat to augment existing drain habitats and to implement measures to minimize the direct effects of O&M and construction activities on covered species. The key elements are:

- Create at least 190 acres of managed marsh habitat,
- Create up to an additional 462 acres of managed marsh habitat depending on the actual amount of covered species habitat in the drains determined by surveys
- Minimize disturbance and mortality/injury of covered species during dredging at the mouths of the New and Alamo Rivers

Desert Habitat Conservation Strategy

Desert habitat in the HCP area occurs in the rights-of-way of the AAC, East Highline and portions of the Westside Main, Thistle, and Trifolium Extension canals. IID's maintenance operations rarely affect desert habitat directly, but activities conducted adjacent to desert habitat could result in the take of a covered species. The biological objective of the Desert Habitat Conservation Strategy is to maintain viable populations of covered species that occupy desert habitats in the HCP area. This would be accomplished by avoiding and minimizing the potential for take of covered species, and improving habitat contiguity and persistence to compensate for changes in habitat quality or quantity caused by construction activities. The approach to the Desert Habitat Conservation Strategy is to implement a program to minimize the potential for take of covered species during O&M activities, and to compensate for habitat loss if construction activities impact desert habitat. The key elements are:

- Implement a worker education program
- Implement interim measures to avoid and minimize the potential for take of covered species during O&M activities
- Implement specific measures to avoid and minimize the potential for take of covered species during construction activities along the AAC, East Highline Canal, and portions of the Westside Main, Thistle, and Trifolium Extension canals.
- Conduct surveys to determine the occurrence of covered species
- Acquire and protect off-site desert habitat if construction activities permanently reduce the quality or availability of habitat

Burrowing Owl Conservation Strategy

The agricultural areas of the Imperial Valley support high densities of burrowing owls, particularly along the canal and drain system operated and maintained by IID. Although IID's maintenance activities contribute to the quality of burrowing owl habitat, these activities have the potential to take burrowing owls. The biological goal of the Burrowing Owl Conservation Strategy is to maintain a self-sustaining population of burrowing owls across the current range of the species in the HCP area. The approach consists of a combination of measures to minimize effects of O&M and construction activities on owls and their habitat, and measures to enhance habitat availability. The key elements are:

- Implement a worker education program

- Avoid and minimize the potential for covered activities to take individual owls by modifying maintenance activities in areas occupied by owls or scheduling activities during periods that would avoid the breeding season
- Continue maintenance practices that maintain and create suitable habitat conditions
- Initiate and implement a comprehensive population and demographic study to develop the information necessary to guide adjustments in the burrowing owl mitigation and management program
- Compensate for loss of burrows if construction activities would eliminate suitable burrows by installing replacement burrows
- Implement a farmer and public education program

Desert Pupfish Conservation Strategy

Desert pupfish have become established in many of the drains constructed and maintained by IID that discharge directly via gravity into the Salton Sea. Although IID routinely maintains adequate drainage in these channels by removing vegetation and sediment, these drains provide the habitat conditions necessary to support pupfish. IID's maintenance activities, while likely necessary to maintain the habitat characteristics that support pupfish, have the potential to result in the incidental take of pupfish. In addition, implementation of water conservation projects has the potential to change water quality in the drains occupied by pupfish and to adversely affect pupfish. The biological objective of the desert pupfish conservation strategy is to maintain or increase pupfish habitat in the drains relative to the current levels and to minimize the potential for IID's drain maintenance activities to result in take of pupfish. The key elements are:

- Operate and maintain the drainage system in a manner that will maintain the amount of drain habitat currently available (i.e., no net loss) in the portion of IID drains that flow directly to the Salton Sea
- Operate and maintain drain channels in a manner that minimizes the effects of water conservation on water quality, particularly concentrations of selenium
- Increase the amount of pupfish drain habitat by extending, modifying, or creating drain channels on land exposed if the elevation of the Salton Sea recedes
- Implement a study to evaluate the potential effect of routine drain maintenance on pupfish occupying the drains and to determine the efficacy of modifying current maintenance practices to avoid and minimize the potential for incidental take
- Avoid or minimize the potential for incidental take of pupfish by IID construction activities by implementing procedures for dewatering construction sites and salvaging and relocating pupfish potentially stranded by construction activities

Razorback Sucker Conservation Strategy

Razorback suckers are known to occur in the All-American and East Highline Canal systems as a result of movement by fish from the Colorado River into the system. Because they are isolated from the main population and are not known to be reproducing, razorback suckers in the HCP area are not contributing to the overall razorback sucker population. As a result, loss of these individuals would have no effect on the razorback sucker population. Although incidental take of individual razorback suckers in the IID canals system would not impact the species' population, IID will implement measures to minimize mortality of suckers as a result of canal dewatering. The key element of this approach is:

- Monitor segments of the canal system during dewatering operations and salvage and transport any stranded razorback suckers to the Colorado River.

Agricultural Field Habitat Conservation Strategy

Agricultural fields in the Imperial Valley attract a large variety and number of wildlife species, including some covered species. Foraging is the predominant use of agricultural fields by covered species, although fields also are used as resting habitats. Species that exploit agricultural habitats would benefit under the HCP from IID obtaining incidental take authorization and unlisted species assurances because such assurances would encourage continued agricultural production. The biological objective of the Agricultural Field Habitat Conservation Strategy is to maintain agriculture as the primary enterprise in IID's service area to continue to provide foraging habitat for covered species associated with agricultural field habitat. This objective is facilitated by the IID/SDCWA Water Transfer Agreement, the QSA, and the implementation of this HCP. In addition to the incentives to continue agriculture in the Imperial Valley provided by these actions, the approach includes a measure that will help avoid the potential for incidental take associated with implementation of on-farm water conservation techniques. This measure entails the installation of markers on any new power lines installed in association with the water conservation program (e.g., to serve pumps used for tail-water recovery ponds) to avoid or minimize the potential for collisions with wires by covered species.

Other Covered Species

Of the 96 species covered by this HCP, the USFWS and CDFG identified 25 species for which existing information on the ecology and distribution in the HCP area is limited or that might not occur in the HCP area. The approach to covering these species is to implement a research program to better understand the presence, distribution, and ecological requirements of these species in the HCP area. Based on the results of the research program, IID will implement measures to avoid, minimize, and mitigate the impacts of any take of these activities resulting from the covered activities.

Monitoring and Adaptive Management

Monitoring the effectiveness of the conservation measures and ensuring compliance with the terms of the conservation program are mandatory elements of an HCP. The HCP includes a comprehensive monitoring and adaptive management program to help ensure that compliance with the measures of the HCP is achieved, that the anticipated effectiveness of the measures is assessed, and that adjustments in the species conservation measures, where necessary, are made in response to new information. The monitoring requirements for each of the HCP elements are summarized in the following.

Salton Sea Conservation Strategy

- IID will demonstrate compliance with the measures for this strategy through the reporting requirements and involvement of the HCP IT.
- IID will evaluate the effectiveness of the measures for this strategy by monitoring fish production in the created ponds, fish populations in the Salton Sea, use of constructed nesting/roosting islands by covered bird species, and conducting baseline and periodic surveys to quantify net changes in the total amount of tamarisk in shoreline strand and adjacent wetland dominated by tamarisk.
- Based on the results of the effectiveness monitoring, IID and the HCP IT may recommend changes to one or more of the conservation measures. IID will submit a description of the actions to be implemented to the USFWS and CDFG for approval.

Tamarisk Scrub Habitat Conservation Strategy

- IID will demonstrate compliance with the measures for this strategy through the reporting requirements and involvement of the HCP IT.
- The involvement of the HCP IT and approval requirements from USFWS and CDFG will ensure that any property acquired or habitat created by IID will support use by the covered species associated with tamarisk scrub. IID will monitor use of the created habitat by covered bird species and other bird species. The HCP IT will develop the species requirements for monitoring, including the survey technique, timing of the surveys, and duration of the surveys following creation of the habitat.
- Adaptive management will be incorporated into the plans that address creation of native tree habitat. In the habitat creation plan, success criteria and the corrective actions that IID will take in the event that the success criteria are not met will be specified.

Drain Habitat Conservation Strategy

A baseline survey of the covered species will be conducted during a consecutive 3-year period to determine the presence or absence, distribution, relative abundance, and breeding status of covered species using drains in the HCP area.

- IID will demonstrate compliance with the measures for this strategy through the reporting requirements and involvement of the HCP IT.
- IID will conduct species-specific surveys for Yuma clapper rails and California black rails and conduct general surveys for other covered species in the created managed marsh habitat.
- IID will incorporate the refinements in management implemented on the refuges into management of its created habitat. Also, the HCP IT and HCP Implementation Biologist will work closely with refuge staff to develop and refine habitat management practices for clapper rails over the term of the permit.

Desert Habitat Conservation Strategy

A baseline survey of the covered species will be initiated within 1 year of issuance of the incidental take permit and conducted during a consecutive 3-year period to determine the presence or absence, distribution, relative abundance, and breeding status of covered species along the AAC, East Highline, Westside Main, Thistle and Trifolium Extension canals in the HCP area. Prior to conducting surveys for the covered species along these canals, IID will conduct a habitat survey to identify and map habitat and habitat features.

- IID will demonstrate compliance with the measures for this strategy through the reporting requirements and involvement of the HCP IT. The HCP Implementation Biologist will also periodically conduct random checks (during their routine duties) of workers conducting O&M activities to assess whether workers are following the standard operating procedures.

- Information on the effectiveness of the measures will come from the workers and HCP Implementation Biologist. Workers will be instructed to report any incidences of mortality or injury of a covered species. The biologist will be regularly coordinating with workers, monitoring construction activities, and checking on the effectiveness of the measures.

- The HCP IT will review the measures of the desert habitat conservation strategy annually for the first 3 years and every 3 years thereafter. The HCP IT may adjust the measures based on results of the species and habitat surveys, prevailing practices for avoiding take, observations/recommendations of the HCP Implementation Biologist, among others.

Burrowing Owl Conservation Strategy

- Submission of pre-construction checklists and copies of the worker education manual and updates of the manual to the USFWS and CDFG will serve as compliance monitoring for this strategy. In addition, the HCP Implementation Biologist will periodically conduct random checks (during their routine duties) of workers conducting O&M activities to assess whether workers are following the standard operating procedures for burrowing owls.

- Monitoring to evaluate the effectiveness of the measures for this strategy will include surveys of the drainage and conveyance system in such a manner as to provide a valley-wide perspective of the burrowing owl population each year for the term of the permit and conduct of a study of the burrowing owl population to understand the status of the population and estimate key population parameters.

- The results of the demographic study will be used to determine the population trend of the burrowing owl population. If the burrowing owl population is shown to be in decline, the HCP Implementation Team will have the option to access the Owl Contingency Fund. The contingency fund may be used to conduct focused studies to understand the factors influencing the burrowing owl population, implement management actions to benefit the population (e.g., creating burrows), continue the demographic study, or other actions recommended by the HCP IT.

Desert Pupfish Conservation Strategy

- IID will demonstrate compliance with the measures for this strategy through the reporting requirements and involvement of the HCP IT.
- The HCP IT will develop an appropriate protocol for monitoring pupfish presence in drains maintained by IID and in drain channels constructed as mitigation. IID will also monitor selenium concentrations in any drains modified as mitigation to determine the effectiveness of the action.
- The detailed plans for pupfish and selenium monitoring developed by the HCP IT will contain an adaptive management element that outlines how information developed by the monitoring will be used to adjust future management and habitat creation activities.

Razorback Sucker Conservation Strategy

- Whenever suckers are salvaged, IID will submit information on location, numbers, ages, and survival of salvaged suckers to the USFWS and CDFG within one week of salvaging the fish. Submission of this information will serve as compliance monitoring for this strategy.
- The reports submitted to USFWS and CDFG of the number of fish salvaged and the number surviving until release will allow an assessment of the effectiveness of the measure in avoiding mortality of razorback suckers.
- Over the term of the permit, the HCP IT may adjust the procedures to improve survival of fish during capture, transport and release. The HCP IT may adjust the procedure if the compliance monitoring shows a high level of mortality or for consistency with standard practices developed by the USFWS or CDFG.

Costs and Funding

The estimated cost of implementing the HCP ranges widely depending on the ultimate amount of habitat creation necessary under the Drain Habitat and Tamarisk Scrub Habitat Conservation Strategies, and for tamarisk adjacent to the Salton Sea under the Salton Sea Habitat Conservation strategy. Per commitments identified in the IID/SDCWA Water Conservation and Transfer Agreement and the QSA, approximately $22.5 million has been allocated for the environmental mitigation required to mitigate project impacts and to minimize the impact of the potential take of covered species. Any mitigation costs in excess of the $22.5 million estimated to minimize and mitigate project impacts could be funded through one or a combination of the following: revenue generated through conservation and transfer of water, additional funds contributed by the water agencies, and grants or funding provided by the federal and state governments.

Response to Emergencies

When an emergency occurs such that IID cannot comply with all of requirements of the HCP, IID will implement the following procedures.

- IID will notify the USFWS and CDFG within 24 hours of initiating emergency activities. In notifying the USFWS and CDFG, IID will describe the nature of the emergency and the actions necessary to correct the problem.

- The HCP Implementation Biologist will visit sites where emergency activities are being implemented as soon as possible. The biologist will take pictures of the damaged areas and note the general extent and species composition of any vegetation impacted by the emergency response activities. IID will use this information to restore or create replacement habitat in accordance with Tree Habitat – 1 and Desert Habitat – 3 and 5.
- For burrowing owls, the HCP Implementation Biologist will estimate the number of burrows impacted during the emergency activities based on the on-going surveys and the emergency action site visit. In accordance with Owl – 8, IID will install two burrows for every burrow permanently lost as a result of the emergency activities.

Changed and Unforeseen Circumstances

IID identified several circumstances under which changes could occur during the term of the ITP that would result in a substantial and adverse change in the status of a species covered by the HCP. These relate primarily to circumstances that influence IID's ability to carry out its obligations 1) on managed marsh and native tree habitats created and managed for mitigation, 2) in habitats supported by IID water (e.g., pupfish drains), and 3) in habitats acquired and managed for mitigation. These circumstances include:

- Seismic activity that affects IID's conveyance and drainage infrastructure and/or its ability to deliver or drain water
- Storm events that result in damage to IID infrastructure and substantial flooding
- Toxic spills that influence operations or directly affect species and habitat
- Introduction and invasion by exotic plant or animal species that affect covered species or their habitat
- Drought conditions in the Colorado River basin that influence the availability of water in the Imperial Valley

IID anticipates that these events could occur during the term of the HCP. Through the combination of implementing the emergency procedures and specific requirements outlined for each of these categories above, IID will ensure that the objectives of the HCP will continue to be met.

Alternatives

Section 10 of the ESA requires an applicant for an ITP to consider and describe "alternative actions to such takings" within the HCP. IID considered three alternatives in the process of developing the HCP that were determined to be inconsistent with its objectives and/or less likely to be successfully implemented. The alternatives to the HCP that were considered are listed below.

No Action Alternative

Under the No Action Alternative, IID would continue to meet the demands of farmers and other water users within its service area in the Imperial Valley using Colorado River water diverted in accordance with IID's existing water rights. IID would not engage in a program to conserve additional water for the purpose of transferring it outside the service area. IID has determined that this alternative could lead to the impairment of its ability to deliver water in the future and result in negative impacts to its customers, the biological resources, and the agricultural economy that depend on water delivery. Therefore, IID considered the No Action Alternative to not be practicable or feasible.

Modification of Water Conservation and Transfer Amounts

Two different levels of water conservation (conservation and transfer of 130 KAF and 230 KAF) were examined as alternative actions to the level of take anticipated under the proposed water conservation programs and the HCP. The underlying premise for considering these alternatives was that the potential for impact and the level of take are related to the amount of water conserved and transferred out of the system. Each of these alternatives was anticipated to have incrementally less impact relative to the Proposed Project. However, IID determined that reduced conservation and transfer amounts would not substantially reduce the level of take or mitigation requirements. For these reasons, a reduced HCP alternative was not adopted. However, reduced levels of conservation are Project Alternatives and HCP alternatives as described in the IID Water Conservation and Transfer Project EIR/EIS and HCP.

CHAPTER 1

Introduction

This Habitat Conservation Plan (HCP) was prepared in support of the Imperial Irrigation District's (IID's) application for Incidental Take Permits (ITPs) in conformance with Section 10 of the Federal Endangered Species Act of 1973 (FESA) and 2081(b) of the California Endangered Species Act (CESA). Through this HCP, IID is committing to certain management actions that will minimize and mitigate the impacts of any take of covered species that may occur as a result of IID's implementation of the IID/San Diego County Water Authority (SDCWA) Transfer Agreement and Quantification Settlement Agreement (QSA), and continuation of its operation and maintenance (O&M) activities.

1.1 Background

The IID was formed under California law to deliver water for irrigation and domestic purposes. IID delivers water from the Colorado River to agricultural and domestic water users within the boundaries of its service area. This service area covers about 500,000 acres in Imperial Valley. Irrigated agriculture is the primary economic enterprise within IID's service area and the primary use of water delivered by IID.

The Imperial Valley is part of the Colorado Desert and is located in the Salton Trough in Imperial County in Southeastern California. The Salton Sea is located in the northern portion of Imperial Valley, with portions of the Sea in both Imperial and Riverside counties. The Salton Sea serves as a drainage repository for agricultural and urban runoff from the Imperial, Coachella, and Mexicali Valleys.

IID's diversion of Colorado River water is based upon water rights obtained pursuant to state law, which were perfected in the early 1900s. IID's diversions from the Colorado River also are accomplished pursuant to a 1932 water delivery contract with the U.S. Bureau of Reclamation (Reclamation) under the Boulder Canyon Project Act of December 21, 1928 [45 Stat. 1057, as amended, 43 U.S.C. § 617 et seq.]. IID's senior water rights are part of California's apportionment of Colorado River water under the 1922 Colorado River Compact, the Boulder Canyon Project Act, and the U.S. Supreme Court decree in Arizona v. California, 373 U.S. 546 (1963).

IID diverts water from the Colorado River at Imperial Dam, located about 18 miles northeast of Yuma, Arizona. Water diverted at Imperial Dam first enters desilting basins, where sediment settles out of the water. IID operates both Imperial Dam and the desilting basins pursuant to a contract with Reclamation. From the desilting basins, the water enters the All American Canal (AAC). The 84-mile-long AAC runs in a westerly direction and conveys water to three main canals within IID's service area. These three canals (East Highline, Central Main, and Westside Main) generally run northerly and deliver water to lateral canal systems and subsequently to farm turnouts. IID owns and operates the canal and turnout system.

After the water is applied to farm fields for irrigation purposes, all unused water is collected in drains. Water may enter the drains as field runoff (tailwater) or through tile drains (tilewater). Tile drains collect salinized subsurface leach flow and convey it to the drains. The drains transport water directly to the Salton Sea or to the New or Alamo Rivers that discharge to the Salton Sea. IID maintains the network of drains. With no outlet, the Salton Sea is a terminal sink for drain water from Imperial Valley.

1.1.1 IID/SDCWA Water Conservation and Transfer Agreement

In mid-1995, IID and SDCWA began discussions regarding a water conservation and transfer agreement. As a result of these discussions, on April 29, 1998, IID and SDCWA executed an Agreement for Transfer of Conserved Water (IID/SDCWA Transfer Agreement; IID and SDCWA 1998). The IID/SDCWA Transfer Agreement is a long-term transaction between IID and SDCWA involving the voluntary conservation by IID of up to 300 KAFY (300,000 acre-feet per year) and the subsequent transfer of all or a portion of the conserved water to SDCWA. The transferred, conserved water is intended for use within SDCWA's service area in San Diego County, California. Under certain circumstances, up to 100 KAFY of the water conserved by IID may be transferred to the Coachella Valley Water District (CVWD), the Metropolitan Water District of Southern California (MWD), or both.

The conserved water will consist of Colorado River water that otherwise would be diverted by IID at Imperial Dam for use within IID's service area in Imperial County, California. For conserved water transferred to SDCWA or MWD, IID's annual diversions of Colorado River water at Imperial Dam will be reduced by the amount of the conserved water, and this amount will be diverted at MWD's Whitsett Intake at Lake Havasu on the Colorado River for delivery through MWD's Colorado River Aqueduct. The Colorado River Aqueduct operated by MWD provides the only existing facilities for conveyance of conserved water from the Colorado River to SDCWA's service area. For conserved water transferred to CVWD, IID's annual diversions of Colorado River water at Imperial Dam will also be reduced by the amount of the conserved water; however, the amount CVWD will divert at Imperial Dam will increase by this same amount. This amount will be diverted into the Coachella Canal from the AAC.

Conservation methods employed to effect the IID/SDCWA Water Conservation and Transfer Agreement may consist of: (1) on-farm measures implemented by landowners and tenants within IID's service area; and/or (2) system-based measures implemented by IID and affecting its distribution and drainage facilities. The IID/SDCWA Transfer Agreement anticipates that on-farm conservation measures will be the principal means of conserving water for transfer to SDCWA and requires on-farm conservation of at least 130 KAFY, unless SDCWA and IID agree on a lower amount. On-farm conservation requires the voluntary cooperation of landowners and tenants within IID's service area. On-farm conservation measures will be developed and managed under contracts between IID and landowners that elect to participate. If a sufficient number of landowners participate to meet the minimum conserved water (130 KAFY unless otherwise agreed) amount from on-farm conservation described above, then IID may elect to transfer additional conserved water using system-based conservation measures, on-farm measures, or a combination of these measures.

The IID/SDCWA Transfer Agreement is described in greater detail in the IID Water Conservation and Transfer Project EIR/EIS (IID 2001).

1.1.2 California's Colorado River Water Use Plan

The Colorado River Compact of 1922 quantified the allocation of Colorado River water among the seven states that comprise the Colorado River Basin. The compact allocates approximately 7.5 MAFY (7.5 million acre-feet per year) to the four Upper Basin states—Colorado, Utah, Wyoming, and New Mexico—and 7.5 MAFY to the three Lower Basin states—California, Nevada, and Arizona. Rapidly growing metropolitan areas and vast irrigated acreage have contributed to a history of contentious relations among the Lower Basin states and individual users in the states, as well as between the Upper and Lower Basins. Because of acrimonious and litigious relations among the Lower Basin states, they have not self-apportioned Colorado River supplies in the same manner as the Upper Basin states. As a result, the Secretary of the Interior (Secretary) acts as water master (typically through actions of Reclamation) for the Lower Colorado River (LCR; Arizona v. California, 1964). The decree of the court set California's apportionment at 4.4 MAF (plus 50 percent of any surplus water); Arizona at 2.8 MAF (plus 46 percent of any surplus); and Nevada at 300 KAF (and 4 percent of any surplus). Recent California diversions have been up to 800 KAF above its normal year (i.e., non-surplus) allocation. California's efforts to reduce its use to 4.4 MAFY were the subject of negotiations among the states and the Secretary.

California recently published the Draft California Water Use Plan (Water Use Plan), formerly known as the "4.4 Plan" in which the steps necessary to comply with the court decree were outlined. The Water Use Plan is a programmatic effort intended to reduce California's use of the Colorado River to comply with its Lower Basin entitlement. The Water Use Plan provides California's Colorado River water users with a framework by which programs, projects, and other activities will be cooperatively implemented to allow California to satisfy its annual water supply needs within its annual normal-year apportionment of Colorado River water. The Water Use Plan will require operational changes in the Colorado River to allow water wheeling and other actions necessary to transfer water among users.

The Water Use Plan identifies a suite of actions that will reduce total Colorado River water use in the state. Finalization of the Water Use Plan will require the four major linchpins:

- Cooperative water conservation and transfers from agricultural to urban use
- Further quantification of the third priority of the Seven-Party Agreement, which established the priority of use for California's 4.4 MAF among the seven major water users: Palo Verde Irrigation District, IID, CVWD, MWD, City of San Diego, City of Los Angeles, and the County of San Diego
- Improved reservoir management and operations
- Water storage and conjunctive use programs

The IID/SDCWA Water Conservation and Transfer project is an example of the first linchpin.

1.1.3

Quantification Settlement Agreement

Subsequent to execution of the IID/SDCWA Transfer Agreement, a settlement agreement was negotiated by and among IID, CVWD, and MWD, with the participation of the State of California and the Department of the Interior (DOI). The proposed terms of the settlement agreement are incorporated in a draft Quantification Settlement Agreement (QSA), which was released for public review in December 2000. [A copy of the draft QSA and a Summary of the QSA are included in Appendix B of the EIR/EIS for the IID Water Conservation and Transfer Project.] The QSA is intended to settle, for a period of up to 75 years, long-standing disputes among IID, MWD, and CVWD regarding the priority, use and transfer of Colorado River water by establishing a consensual sharing of Colorado River water among these agencies. The QSA facilitates a number of component agreements and actions which, when implemented, will enhance the certainty and reliability of Colorado River water supplies available to the signatory agencies and will assist these agencies in meeting their water demands within California's normal-year apportionment of Colorado River water. The QSA thus implements the goals and programs of the Water Use Plan.

In addition to establishing water budgets for IID, MWD, and CVWD, the QSA sets forth the approved parameters of various water transfers and exchanges, including the conservation by IID of up to 300 KAFY for transfer to SDCWA, CVWD, and/or MWD. The QSA allocates the water to be conserved by the AAC and Coachella Canal lining projects. The QSA also incorporates a consensual limit by IID on its total Priority 3 diversions of Colorado River water at 3.1 MAFY. IID's limit is further reduced by the amounts IID conserves and transfers to others under the QSA, by the amount to be conserved by the AAC lining project, and by any Priority 3 water made available by IID to holders of miscellaneous present perfected Colorado River water rights (PPRs) and Indian reserved rights. SVCN limits results in a net Priority 3 diversion of approximately 2.61 to 2.70 MAFY for use within the IID service area. The QSA also includes a consensual cap on CVWD's Priority 3 diversions at 330 KAFY, reduced by the amount to be conserved by the Coachella Canal lining project and by any Priority 3 water made available by CVWD for holders of miscellaneous PPRs and Indian reserved rights. A Program EIR is being prepared by IID, MWD, CVWD, and SDCWA, as joint lead agencies, to identify and assess the environmental impacts of the QSA program.

The Secretary of DOI, in its role as water master for the LCR, must implement the terms of the QSA by delivering Colorado River water in accordance with its terms. The actions required of the Secretary are set forth in a proposed Implementation Agreement (IA), which is intended to be effective concurrently with the QSA. As a condition precedent to implementation of the QSA, certain other federal actions are required, including the adoption of Interim Surplus Criteria and the adoption of an Inadvertent Overrun Program to facilitate the payback of inadvertent exceedances by IID or CVWD of their respective Priority 3 diversion caps. Reclamation has prepared a final EIS for the proposed Interim Surplus Criteria, and a Record of Decision (ROD) was signed in January 2001. Reclamation is preparing an EIS pursuant to NEPA to assess the environmental impacts of the IA and related federal actions.

If the QSA is finally approved and implemented, it would change the project described in the IID/SDCWA Transfer Agreement in certain respects. The QSA would limit the amount of conserved water transferable to SDCWA to a maximum of 200 KAFY, and would provide for CVWD's option to acquire up to 100 KAFY of water conserved by IID, in lieu of transfer of this increment of conserved water to SDCWA. The QSA also provides for MWD's option to acquire any portion of the 100 KAFY of conserved water available to, but not acquired by, CVWD. Under both the QSA and the IID/SDCWA Transfer Agreement, the conserved water transferred by IID to SDCWA, CVWD, and/or MWD retains the priority of IID's senior water rights. However, IID retains ownership of its water rights.

The EIR/EIS for the IID Water Conservation and Transfer Project addresses the environmental impacts of IID's consensual limit on its Priority 3 diversions and the conservation by IID of up to 300 KAFY for transfer pursuant to the IID/SDCWA Water Transfer Agreement and/or the QSA. This HCP is intended to support the issuance of ITPs for that project within the covered area (i.e., Imperial Valley, the Salton Sea, and the area of the AAC).

1.2 Purpose and Need for the HCP

The purpose and need for the HCP stem from IID's requirement for long-term regulatory certainty in committing to the IID/SDCWA Transfer Agreement and the QSA. Both the IID/SDCWA Transfer Agreement and the QSA establish long-term water supply arrangements designed to assist California in meeting its Colorado River entitlement of 4.4 MAFY. The IID/SDCWA Transfer Agreement continues in effect for an initial term of 45 years after transfers have commenced and provides for an optional renewal term of 30 additional years. A substantial term is required by SDCWA, so that it can rely upon the IID conserved water as a key element of its future water supply plans. To implement the transfer, SDCWA must enter into a long-term agreement with the MWD to provide for acceptance of the conserved water at the new point of diversion and conveyance through MWD's Colorado River aqueduct. Similarly, the QSA establishes water budgets for a period of up to 75 years, including long-term obligations on the part of IID to limit its overall Colorado River water diversions and to generate conserved water for transfer to SDCWA, CVWD, and/or MWD. Long-term, no-surprises assurances regarding ESA and CESA compliance measures and costs are needed by IID to commit to the long-term obligations set forth in the IID/SDCWA Transfer Agreement and the QSA.

Whether the IID/SDCWA Transfer Agreement becomes a reality depends largely on whether the IID and its participating farmers can conclude that the benefits of implementing the IID/SDCWA Transfer Agreement project are balanced by the risks and costs to be borne by the IID and farmers. The conservation of up to 300 KAF of water within the IID service area will require changes in current farming practices and substantial capital investments in water conservation equipment and technologies.

Of the initial 200 KAF anticipated to be conserved for transfer to SDCWA, 130 KAF is projected to come from on-farm conservation programs adopted by farmers in the Imperial Valley. The on-farm conservation programs are voluntary. Farmers will enter into agreements with IID ranging from 1 to 75 years, committing to the implementation of conservation measures. These measures, in turn, will require the farmers to make capital investments in various types of water conservation equipment and facilities. In many cases, farmers will be required to obtain financing and pay for construction costs and implement and maintain conservation measures. The farmers will be unable to obtain financing if they can not estimate the direct and indirect costs of implementing the water conservation programs.

As such, farmers may be unwilling to enter into binding agreements to undertake significant costs and risks associated with implementing on-farm conservation measures unless they can determine the total costs of the measures and the additional associated cost of complying with the ESA and CESA. The greater the cost of the mitigation program the fewer funds available for IID to compensate farmers for water conservation measures. In the absence of this certainty, IID and farmers within IID's service area will be at risk and the costs of implementing the water conservation measures could increase substantially in the future to address additional costs associated with (1) the listing of new species as endangered or threatened; (2) the designation of critical habitat for listed species; and (3) the imposition of additional mitigation obligations on IID in the event of changed or unforeseen circumstances. The IID seeks incidental take authorization and no surprises assurances to provide certainty and predictability regarding the habitat conservation measures that IID will be required to implement during the term of the IID/SDCWA Water Conservation and Transfer Agreement and QSA to comply with the state and federal endangered species acts.

The effect of the QSA is to establish obligations and incentives for the long-term conservation by IID of a substantial amount of Colorado River water. The agencies proposing to acquire conserved water from IID need to rely upon the long-term availability of the conserved water for water supply planning purposes. As a result, the QSA allows only very limited flexibility to modify or terminate IID's obligations. Therefore, IID must have certainty regarding the scope, feasibility, and cost of implementing the water conservation and transfer program, including the required environmental mitigation measures, on a long-term basis, prior to committing to implement the QSA. This HCP is intended to establish a definitive program, which will set forth the obligations of IID, and limitations on those obligations, to provide certainty regarding IID's ability to implement the program.

With respect to biological resources, the purpose of the HCP is to minimize and mitigate the effects of implementing the water conservation and transfer programs on covered species. The HCP consists of a combination of measures to minimize the effects of implementing the water conservation and transfer programs as well as measures that will ensure habitat availability for covered species over the term of the HCP. The commitments to create habitat under the HCP will provide a net benefit to covered species by improving habitat availability and quality.

1.3 Relationship to Other ESA Approvals

Implementation of the IID Water Conservation and Transfer Project requires changes in water management that could potentially influence habitats and species over a broad geographic area. In addition to the potential effects in areas (i.e., AAC, Imperial Valley, and the Salton Sea) covered by this HCP, potential effects on listed species could occur along the Lower Colorado River (LCR) between Parker and Imperial dams, in the Coachella Valley, in San Diego County and potentially in MWD's Service Area. To achieve compliance with the ESA and CESA, several regulatory approval processes in addition to this HCP will be required. Reclamation's changed operation in the Colorado River between Parker and Imperial dams, including implementation of the Interim Surplus Criteria and the change in the point of diversion required for the water transfer projects and the AAC and Coachella Canal lining projects pursuant to the QSA, is a federal action that is addressed through a Section 7 consultation. The Biological Opinion was issued by the USFWS on January 12, 2001, and provides incidental take authorization for federally listed species potentially affected by this change in operation. Coverage under CESA for state-listed species potentially affected by the change in the point of diversion on the Colorado River is expected to be obtained through a Section 2081 permit issued by CDFG for the benefit of IID, SDCWA, and MWD. It is anticipated that long-term coverage for state and federally listed species as well as selected unlisted species in the affected reach of the LCR will be provided by the LCR Multi-Species Conservation Plan.

Potential effects on state and federally listed species in the Coachella Valley resulting from use of conserved water transferred from IID will be addressed through separate ESA and CESA processes. Incidental take coverage as necessary for this element of the project will be obtained by CVWD through a regional HCP process or a process specific to the use of the transferred water.

Delivery of conserved water to San Diego County and MWD's Service Area is not anticipated to result in the take of any state or federally listed species. SDCWA has indicated that the conserved water transferred by IID will replace water that it otherwise would acquire from MWD, its primary supplier. Similarly, if water is transferred to MWD, the water would replace other historic supplies. The transferred water will retain IID's high-level Priority 3 status and thus will provide better protection from impacts of drought and increased reliability compared to SDCWA's existing supply. As such, the transfer of water from IID will not result in an increased water supply for SDCWA, although it will increase the reliability of water in the SDCWA service area. No additional ESA/CESA compliance actions are anticipated.

1.4 Area Covered by the HCP

IID conveys and delivers water diverted from the LCR at Imperial Dam to customers in the Imperial Valley in IID's service area via the AAC. The HCP area includes all lands comprising the approximately 500,000 acres of IID's service area (including canal rights-of-way), the Salton Sea, lands owned by IID outside of its service area that are currently submerged by the Salton Sea, and IID's rights-of-way along the AAC downstream from the point of diversion at Imperial Dam. In addition, the HCP covers any take of covered species using the Salton Sea that could occur as a result of IID's activities. Figure 1.4-1 shows the HCP area.

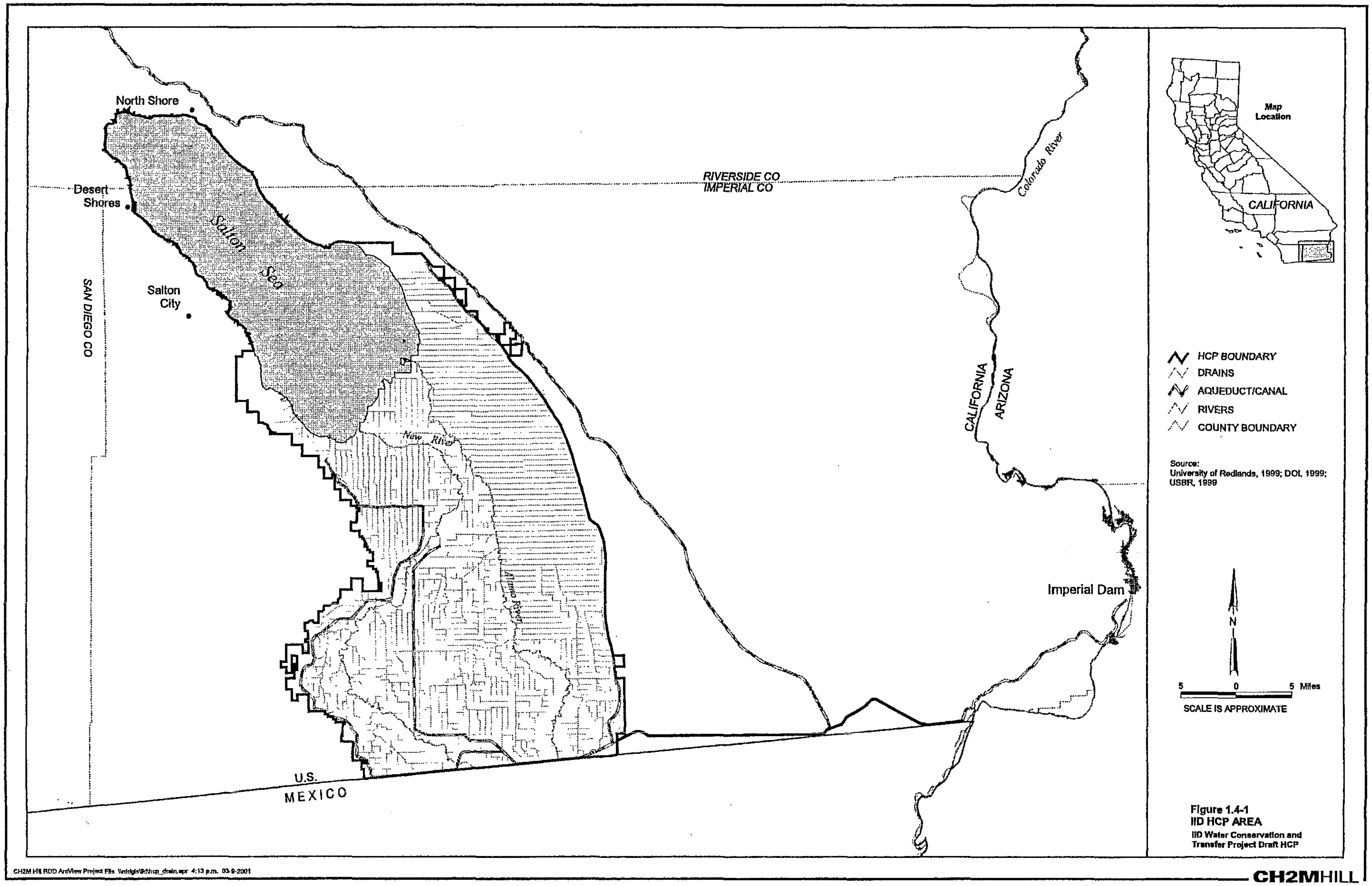

Figure 1.4-1
IID HCP AREA
IID Water Conservation and Transfer Project Draft HCP

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1.5 Species Covered by the HCP

The IID prepared this HCP in support of an application for ITPs from the USFWS and CDFG to cover federally and state listed species and certain unlisted species that are present or potentially present in IID's service area, the Salton Sea, or along the AAC. The HCP covers 96 fish, wildlife, and plant species with the potential to occur in the HCP area. These species and their current federal and state status are shown in Table 1.5-1.

TABLE 1.5-1
Species Covered by the IID HCP

Common Name	Scientific Name	Federal Status	State Status
Invertebrates			
Cheeseweed moth lacewing	*Oliarces clara*	S	-
Andrew's dune scarab beetle	*Pseudocatalpa andrewsi*	S	-
Fish			
Desert pupfish	*Cyprinodon macularius*	E	E
Razorback sucker	*Xyrauchen texanus*	E	E/FP
Amphibians and Reptiles			
Colorado River toad	*Bufo alvarius*	-	CSC
Desert tortoise	*Gopherus agassizi*	T	T
Banded gila monster	*Helodema suspectum cinctum*	-	CSC
Flat-tailed horned lizard	*Phrynosoma mcalli*	PT	CSC
Lowland leopard frog	*Rana yavapaiensis*	S	-
Western chuckwalla	*Sauromalus obesus obesus*	S	-
Couch's spadefoot toad	*Scaphiopus couchii*	-	CSC
Colorado desert fringed-toed lizard	*Uma notata notata*	S	CSC
Birds			
Cooper's hawk	*Accipiter cooperii*	-	CSC
Sharp-shinned hawk	*Accipiter striatus*	-	CSC
Tricolored blackbird	*Agelaius tricolor*	S	CSC
Golden eagle	*Aquila chrysaetos*	-	CSC/FP
Short-eared owl	*Asio flammeus*	-	CSC
Long-eared owl	*Asio otus*	-	CSC
Burrowing owl	*Athene cunicularia*	S	CSC
Aleutian Canada goose	*Branta canadensis leucopareia*	DM	-
Ferruginous hawk	*Buteo regalis*	S	CSC
Swainson's hawk	*Buteo swainsoni*	-	T
Western snowy plover	*Charadrius alexandrinus nivosus*	-	CSC
Mountain plover	*Charadrius montanus*	PT	CSC
Vaux's swift	*Chaetura vauxi*	-	CSC
Black tern	*Chlidonias niger*	S	-
Northern harrier	*Circus cyaneus*	-	CSC
Western yellow-billed cuckoo	*Coccyzus americanus*	-	E
Gilded flicker	*Colaptes chrysoides*	-	E
Black swift	*Cypseloides niger*	-	CSC

TABLE 1.5-1
Species Covered by the IID HCP

Common Name	Scientific Name	Federal Status	State Status
Fulvous whistling-duck	*Dendrocygna bicolor*	S	CSC
Yellow warbler	*Dendroica petechia*	-	CSC
Reddish egret	*Egretta rufescens*	S	-
White-tailed kite	*Elanus leucurus*	-	FP
Southwestern willow flycatcher	*Empidonax trailii extimus*	E	E
Merlin	*Falco columbarius*	-	CSC
Prairie falcon	*Falco mexicanus*	-	CSC
Peregrine falcon	*Falco peregrinus*	DM	E/FP
Greater sandhill crane	*Grus canadensis tadiba*	-	T/FP
Bald eagle	*Haliaeetus leucocephalus*	T	E/FP
Yellow-breasted chat	*Icteria virens*	-	CSC
Least bittern	*Ixobrychus exilis*	S	CSC
Loggerhead shrike	*Lanius ludovicianus*	S	-
Laughing gull	*Larus atricilla*	-	CSC
California black rail	*Laterallus jamaicensis coturniculus*	S	T/FP
Long-billed curlew	*Numenius americanus*	-	CSC
Osprey	*Pandion haliaetus*	-	CSC
Black skimmer	*Rhynchops niger*	-	CSC
Bank swallow	*Riparia riparia*	-	T
Gila woodpecker	*Melanerpes uropygialis*	-	E
Elf owl	*Micrathene whitneyi*	-	E
Wood stork	*Mycteria americana*	-	CSC
Brown-crested flycatcher	*Myiarchus tyrannulus*	-	CSC
Harris' hawk	*Parabuteo unicinctus*	-	CSC
Large-billed savannah sparrow	*Passerculus sandwichensis rostratus*	S	-
American white pelican	*Pelecanus erythrorhynchos*	-	CSC
Brown pelican	*Pelecanus occidentalis*	E	E/FP
Double-crested cormorant	*Phalacrocorax auritus*	-	CSC
Summer tanager	*Piranga rubra*	-	CSC
White-faced ibis	*Plegadis chihi*	S	CSC
Purple martin	*Progne subis*	-	CSC
Vermilion flycatcher	*Pyrocephalus rubinus*	-	CSC
Yuma clapper rail	*Rallus longirostris yumanesis*	E	T/FP
California least tern	*Sterna antillarum browni*	E	E/FP
Elegant tern	*Sterna elegans*	S	-
Van Rossem's gull-billed tern	*Sterna nilotica vanrossemi*	S	CSC
Crissal thrasher	*Toxostoma crissale*	-	CSC
LeConte's thrasher	*Toxostoma lecontei*	-	CSC
Arizona Bell's vireo	*Vireo bellii arizonae*	-	E
Least Bell's vireo	*Vireo bellii pusillus*	E	E
Mammals			
Pallid bat	*Antrozous pallidus*	-	CSC

TABLE 1.5-1
Species Covered by the IID HCP

Common Name	Scientific Name	Federal Status	State Status
Mexican long-tongued bat	*Choeronycteris mexicana*	S	CSC
Pale western big-eared bat	*Corynorhinus townsendii pallescens*	-	CSC
Spotted bat	*Euderma maculatum*	S	CSC
Western mastiff bat	*Eumops perotis californicus*	S	CSC
California leaf-nosed bat	*Macrotus californicus*	S	CSC
Western small-footed myotis	*Myotis ciliolabrum*	S	-
Occult little brown bat	*Myotis lucifugus occultus*	S	CSC
Southwestern cave myotis	*Myotis velifer brevis*	S	CSC
Yuma myotis	*Myotis yumanensis yumanensis*	S	CSC
Pocketed free-tailed bat	*Nyctinomops femorosaccus*	-	CSC
Big free-tailed bat	*Nyctinomops macrotis*	-	CSC
Nelson's bighorn sheep	*Ovis canadensis nelsoni*	BLMSS	
Jacumba little pocket mouse	*Perognathus longimembris internationalis*	S	CSC
Yuma Hispid cotton rat	*Sigmodon hispidus eremicus*	S	CSC
Colorado River hispid cotton rat	*Sigmodon arizonae plenus*	-	CSC
Plants			
Peirson's milk-vetch	*Astragalus magdalenae* var. *peirsonii*	T	E
Flat-seeded spurge	*Chamaesyce platysperma*	S	-
Wiggin's croton	*Croton wigginsii*	-	R
Foxtail cactus	*Escobaria vivipara* var. *alversonii*	S	-
Algodones Dunes sunflower	*Helianthus niveus* ssp. *tephrodes*	S	E
Munz's cactus	*Opuntia munzii*	S	
Giant Spanish needle	*Palafoxia arida* var. *gigantea*	S	-
Sand food	*Pholisma sonorae*	S	-
Orocopia sage	*Salvia greatae*	S	-
Orcutt's aster	*Xylorhiza orcuttii*	S	-

Status Codes:
BLMSS: Bureau of Land Management Sensitive Species
CSC: California Species of Special Concern
DM: Delisted – monitored
E: Endangered
FP: Fully protected
PT: Proposed threatened
R: Rare
S: Federal Species of Concern
T: Threatened

1.6 Term of the HCP

IID is applying for ITPs for 75 years (2002 through 2077). This HCP was prepared in support of IID's applications, and will be in effect for the full 75-year term of the ITPs.

The IID/SDCWA Transfer Agreement continues in effect for an initial term of 45 years with an optional renewal term of 30 additional years. The QSA remains in effect for a period of up to 75 years. Long-term assurances regarding ESA and CESA compliance measures and costs are needed by the parties to commit to the obligations required under the IID/SDCWA Transfer Agreement and the QSA. For this reason, IID is seeking coverage under this HCP for a 75-year term.

1.7 Activities Covered by the HCP

The activities covered by this HCP include the following:

- Water conservation and water use activities, including irrigation and drainage of lands to which IID delivers water
- Water conservation activities undertaken by IID
- Activities of IID in connection with the diversion, conveyance, and delivery of Colorado River water to users within IID's service area
- Activities of IID in connection with the collection of unused irrigation or drainage waters within its service area and conveyance to the Salton Sea

The covered activities specifically include all conservation and mitigation measures, whether undertaken by IID or by farmers, tenants, or landowners, in connection with either the conservation and transfer of up to 300 KAFY of Colorado River water pursuant to the IID/SDCWA Transfer Agreement and/or the QSA; or compliance with the cap on IID's annual diversions of Colorado River water established by the QSA.

1.7.1 Overview of Covered Activities

IID is an irrigation district, a limited purpose public agency, formed under the laws of the State of California. IID holds rights to take water from the Colorado River and deliver it to water users in Imperial County. To do so, IID diverts water from the Colorado River at Imperial Dam. After being desilted, this water is conveyed through the AAC to three main canals (Figure 1.7-1). The water is then diverted from the main canals into lateral canals. While a small number of farms take water directly from the AAC or main canals, most take water from lateral canals. Water is diverted out of the lateral canals and into farm fields by turnouts. Most farmers then use flood irrigation techniques after the water flows through the turnout.

The majority of water delivered to a field is absorbed and stored in the soil for use by the crops. The remaining water evaporates or leaves the field in the form of either tailwater or tilewater. Tailwater is surface runoff; tilewater is water that has leached through the soil and has been collected by drain pipes (called tile) installed underneath the field. The brackish tail and tile water are discharged into drains maintained by IID.

The drains carry three kinds of water: tailwater and tilewater discharged from farm fields, and operational discharge. Three kinds of water make up operational discharge: carriage water, lateral fluctuations, and change order. Carriage water is the extra volume of water needed in the laterals to deliver a specific volume of water to a turnout. Because open channel gravity flow water delivery is not exact, additional water is required to ensure deliveries are made in the amounts ordered. Lateral fluctuations are caused by delivery operations and maintenance activities. Laterals may need to be emptied for maintenance activities; the water that was in the lateral at the time must be removed and is discharged into a drain. Finally, a reduction or change by a farmer in his delivery order may not be timed exactly to efficiently implement the change by IID, resulting in extra water being delivered to a lateral or onto a field and then discharged into a drain.

Drains discharge water into one of three locations: the New River, Alamo River, or Salton Sea. Both the New and Alamo Rivers discharge to the Salton Sea. The Alamo River flows in a natural desert dry wash drainage channel, while the New River flows in a channel carved by the Colorado River to the Salton Sea. When the Colorado River flooded its banks in 1906, it flowed north and created the Salton Sea. The New River originates south of the International Boundary in the Mexicali Valley and conveys treated and untreated municipal and industrial wastewater, in addition to agricultural drainage from irrigated areas south of the border.

1.7.2 Water Use and Conservation Activities

As described in Section 1.1.1, IID will implement a water conservation program to generate up to 300 KAFY of conserved water for transfer to SDCWA, CVWD, and MWD. In addition, conservation measures or other water use activities also may be implemented by IID, farmers or landowners to comply with the annual cap on IID's Priority 3 diversions of Colorado River water established by the QSA. All water conservation and use activities by IID, farmers, tenants, and landowners and the effects of those activities are covered by this HCP.

Implementation of water conservation measures and transfer of the water to SDCWA, CVWD, and MWD would occur gradually. The IID/SDCWA Transfer Agreement and the QSA specify the quantities of water to be transferred and the ramp-up schedule for the transfer. The IID/SDCWA Water Conservation and Transfer Agreement requires a ramp-up of the conservation and transfer of water to SDCWA in increments of 20 KAFY. The QSA also specifies the amount and timing of transfers to CVWD and MWD. Based on the schedules in these agreements, a total conservation and transfer of 130 KAFY would be reached about six to seven years after initiation of the conservation and transfer program. About 10 years after initiation of the conservation and transfer program, 200 KAFY of water would be transferred with 300 KAFY of conservation and transfer achieved 24 years after the start of the water conservation and transfer programs.

Water conservation will be accomplished through a combination of on-farm and system-based conservation measures. On-farm measures consist of actions taken by individual farmers or landowners to conserve water under voluntary water conservation agreements with IID. System-based conservation measures consist of actions that would be undertaken by IID to conserve water. The exact mix of conservation methods that would be employed is anticipated to vary over the term of the HCP. The following describes the suite of conservation methods that could be implemented to conserve water.

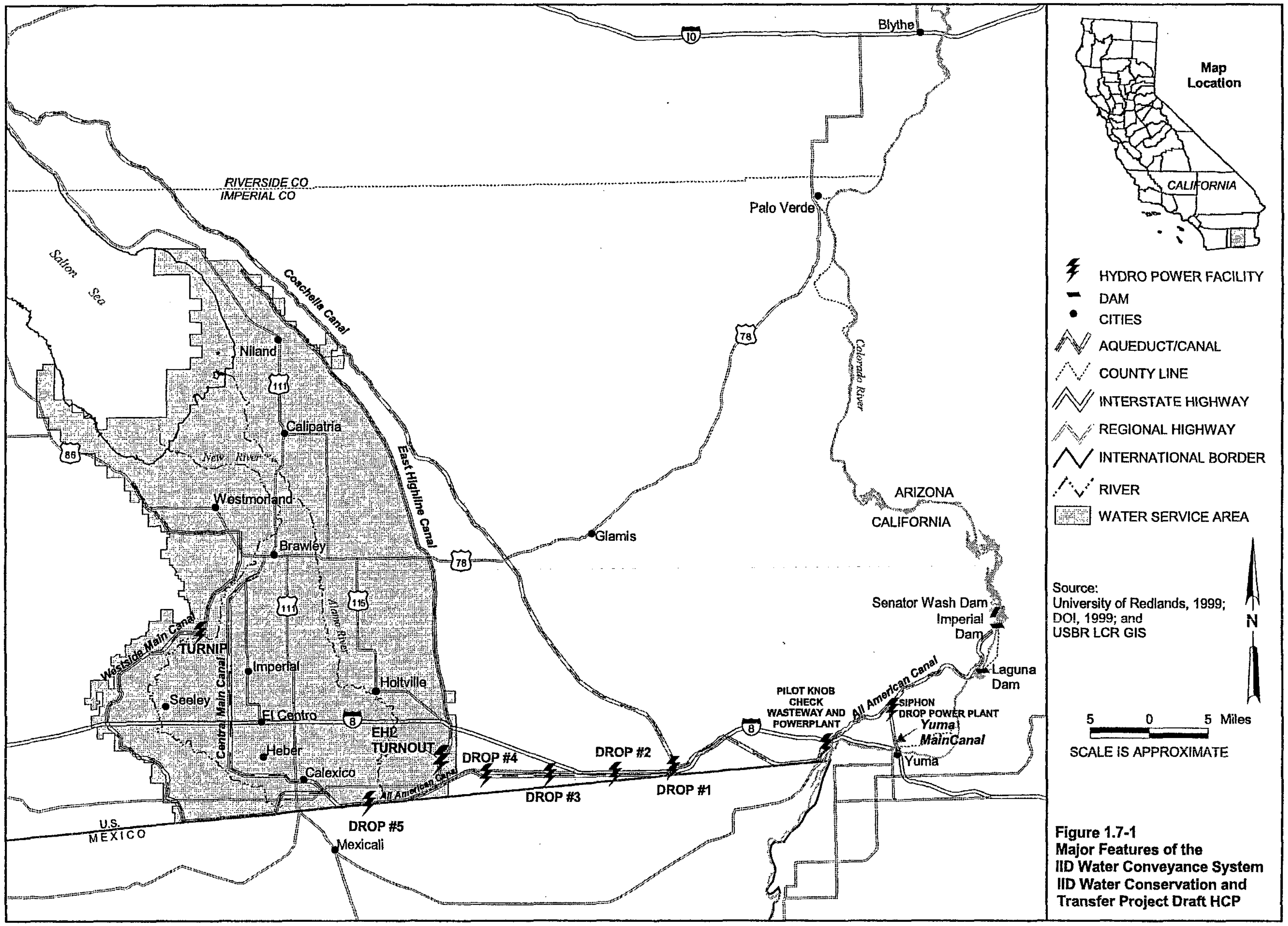

Figure 1.7-1
Major Features of the IID Water Conveyance System
IID Water Conservation and Transfer Project Draft HCP

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1.7.2.1 On-farm Water Use and Conservation Activities

To commit to implementing the IID Water Conservation and Transfer Project, IID and participating farmers within the IID service area must be able to conclude that the benefits of the project justify the risks and costs to be assumed by IID and farmers. The conservation of 200 to 300 KAF of water within the IID service area will require changes in current farming practices and substantial capital investments in water conservation equipment and technologies. Thus, covered activities include irrigation practices by farmers and landowners otherwise required by the QSA and water conservation measures undertaken by farmers participating in the water conservation program.

Of the 130 to 200 KAF to be conserved for transfer to SDCWA pursuant to the IID/SDCWA Water Transfer Agreement, at least 130 KAFY is anticipated to come from on-farm conservation programs adopted by farmers in the Imperial Valley. The on-farm conservation programs are voluntary. Farmers will enter into agreements with IID, committing to the implementation of conservation measures. These measures, in turn, will require the farmers to make capital investments in various types of water conservation equipment and facilities. In many cases, farmers will be required to obtain financing for construction costs to implement and maintain conservation measures. The farmers' ability to obtain financing will depend on the estimate of the direct and indirect costs of implementing the water conservation measures.

As such, farmers and lending institutions may be unwilling to enter into binding agreements to undertake significant costs and risks associated with implementing on-farm conservation measures unless they can determine the total costs of the measures and the associated additional cost of complying with the ESA and CESA. In the absence of this certainty, IID and farmers within IID's service area will be at risk that the costs of implementing the water conservation measures will increase substantially in the future. Therefore, incidental take authorization for water use and conservation activities is critical.

Many farmers own their own land within the IID service area. Some lease their land from third parties and others lease their land from IID. This HCP covers water use activities on land in the IID service area irrespective of who owns the land and who conducts the activities. Water use activities include all activities associated with moving water from IID's conveyance system to farm fields, irrigating crops, and draining water from fields into the IID drainage system.

As part of the conservation program described in Section 1.1.1, a portion of the conserved water will be generated by on-farm conservation measures implemented by individual farmers, tenants, and landowners. Participation in the program by farmers will be voluntary and will vary during the term of the permit, probably from year to year. The amount of water conserved and the on-farm conservation techniques used will be at the discretion of the individual farmer. The options for conserving water that are available to farmers generally fall into the following categories:

- Installation of structural or facility improvements, or conversion to irrigation systems that increase efficiency and reduce water losses
- Irrigation management

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- Land use practices

Compliance with the cap on IID's Priority 3 diversions of Colorado River water (see Section 1.1.3, Quantification Settlement Agreement) also may result in optional or mandatory conservation by farmers and landowners over the term of the permit. Compliance with the cap also may necessitate water conservation measures to pay back inadvertent overruns. All water conservation practices implemented by individual farmers, tenants, and landowners within the IID service area are covered under this HCP.

Installation of Structures/Facilities and Conversion of Irrigation Systems

On-farm water conservation can be achieved through various techniques using existing technology. On-farm conservation measures may include the following:

- Tailwater return systems
- Cascading tailwater systems
- Level basins
- Shorten furrows and border strip improvements
- Narrow border strips
- Cutbacks
- Laser leveling
- Multi-slope
- Drip irrigation

The techniques for achieving water conservation would be at the discretion of the individual farmer. It is expected that some combination of the techniques listed would be employed. These water conservation techniques are briefly described in Table 1.7-1 and depicted in Figure 1.7-2 Additional information is provided in Chapter 2 of the IID Water Conservation and Transfer EIR/EIS.

TABLE 1.7-1
On-Farm Water Conservation Techniques

Conservation Technique	Brief Description
Tailwater return or pump back systems	Pumps surface irrigation tailwater back to the head ditch reducing both the delivery requirement and the volume of water discharged to the drains.
Cascading tailwater	Allows the tailwater to cascade by gravity to the head ditch of a lower field adjacent to the tailwater ditch. This can be accomplished by placing drainpipes with drop box inlets through the embankment between the fields just upstream of each head ditch check.
Level basins	Dividing a field into basins and flooding each basin at a relatively high flow rate.
Shorten furrows and border strip improvements	The distribution uniformity of furrow and border strip irrigation can be improved by shortening the length of irrigation runs, particularly in soils with higher infiltration rates.
Narrow border strips	Narrowing the width of border strips can improve distribution uniformity both along the length of fields by improving the advance time, and across the width of fields by increasing the depth of flow.
Cutback	Irrigation is initiated with a high flow rate to advance the water down the field as quickly as possible without causing erosion.

TABLE 1.7-1
On-Farm Water Conservation Techniques

Conservation Technique	Brief Description
	When the water reaches a predetermined distance down the field, the flow is reduced to minimize tailwater.
Multi-slope	Distribution uniformity can be improved for furrow and border strip irrigation by varying the slope of the field with the head of the field having a greater slope than the end of the field.
Drip irrigation	Water is run through pipes (with holes in them) either buried or lying slightly above the ground next to the crop. Water slowly drips onto the crop roots and stems. Water can be directed only to the plants that need it, cutting back on tailwater runoff.

In addition, farmers have and continue to experiment with new and/or developing irrigation technology. Additionally, evolving crop technology often requires farmers to grow crops with varying methods to improve production. The activities associated with the installation and conversion of irrigation systems from one technology to another is covered under this HCP.

Irrigation Management

Certain farmers may be able to conserve water and cultivate the same acreage through better irrigation management without constructing facilities or changing irrigation methods. Irrigation management refers to controlling the timing and amount of each irrigation application to provide adequate crop water for maximum yield and to achieve adequate soil leaching. Irrigation management on-farm will continue to evolve as the science of crop/soil water develops and understanding of the farmers to put that knowledge to practical use increases. As greater demands are put on agricultural areas to conserve more water in California, IID expects that irrigation water management will become a more important tool for farmers to conserve water.

Land Use Practices

Fallowing could be used to meet water conservation objectives by reducing IID's requirement to deliver irrigation water in the service area. Fallowing can be described as the reduction or cessation of certain farmland operations for a specified or indefinite period of time. For the purposes of this HCP, fallowing is defined as:

- Long-term land retirement (greater than 1 year), whereby crop production ceases indefinitely or during the term of the water conservation and transfer agreements. A cover crop may be maintained during the period of inactivity or the land is returned to natural vegetation.
- Rotational fallowing, whereby crop production ceases for one calendar year. No water is applied, and no cover crop is grown.
- Single crop fallowing, whereby multiple crops are reduced to a single crop rotation on an annual or longer term basis.

The IID/SDWCWA Transfer Agreement provides that at least 130 KAFY of conserved water must be generated by on-farm conservation measures and fallowing is not an acceptable method of on-farm water conservation under landowner contracts. IID's Board of Directors has also adopted Resolution No. 5-96 stating that IID will not support fallowing programs for purposes of transferring water. However, there is no prohibition of fallowing under the terms of the QSA. Fallowing may be considered a potentially viable method to achieve water conservation to meet IID's obligations under the QSA to produce conserved water for transfer, to comply with the limit on total water diversions by IID and/or to comply with the Inadvertent Overrun Policy (which generally requires IID to make up in subsequent years for inadvertent overruns of the 3.1 MAF cap on annual diversions from the Colorado River). Therefore, this HCP covers take of covered species that could result from the fallowing described above for water conservation purposes by IID or farmers and landowners. In addition, the HCP covers take of covered species associated with returning fallowed land into agricultural production.

1.7.2.2 System-based Water Conservation Activities

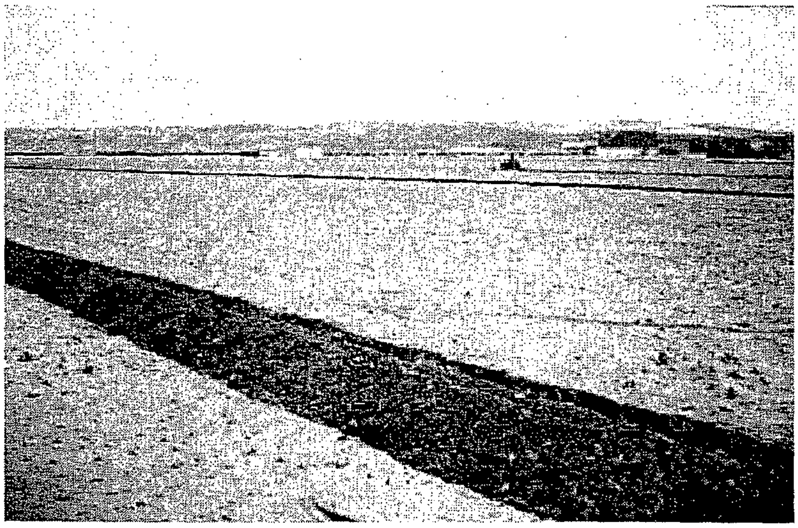
As part of the water conservation and transfer programs, IID will implement operational and structural improvements to conserve water and enhance water delivery and drainage system capabilities and service. The specific improvements to be undertaken are uncertain at this time; however, the types of improvements that IID could pursue include the following:

- Additional lining of canals and laterals
- Replacement of existing canal linings as normal maintenance
- Automation of flow control structures
- Installation of check gates in the laterals that are automated or manually operated
- Installation of nonleak gates
- Installation of additional lateral interceptors
- Installation of additional pipelines
- Installation of additional reservoirs, including small, mid-lateral reservoirs to provide temporary water storage
- Development of water reclamation systems
- Installation of pump or gravity-operated seepage recovery systems

Additional information on system-based conservation measures is provided in the IID Water Conservation and Transfer EIR/EIS. All water conservation practices implemented by IID and within IID's canal and drainage systems are covered under this HCP.

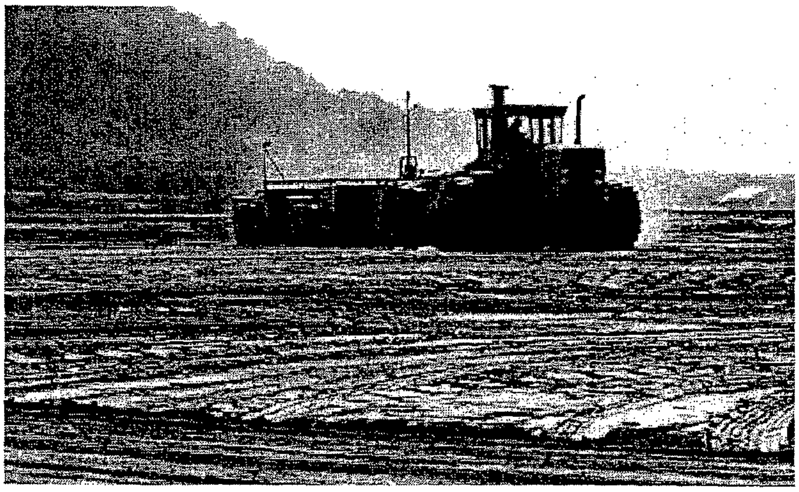
Canal Lining and Piping

Canal lining consists of lining canals with concrete or using pipelines to reduce seepage. About 537 miles of canals are currently unlined. Canal lining is currently contemplated for three canal sections in the IID service area totaling about 1.74 miles (Figure 1.7-3; Table 1.7-2). To line a canal, the existing canal is filled in and then trenched to form a trapezoidal channel. Concrete is then installed on the banks and bottom of the channel using a lining float. Construction activities can be conducted within the canal's right-of-way and affects an area about 70 feet wide centered on the canal. The canal rights-of-way consist of either roads, embankments or other disturbed ground. Table 1.7-2 shows the current anticipated acreage that would be affected under proposed canal lining. About one week is required to



Laser Leveling

USDA NRCS Practice Code 466



Multi-Slope

USDA NRCS Practice Code 464

Drip Irrigation

USDA NRCS Practice Code 441

Figure 1.7-2a
On-Farm Conservation Measures
IID Water Conservation and Transfer Project Draft HCP

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Laser Leveling

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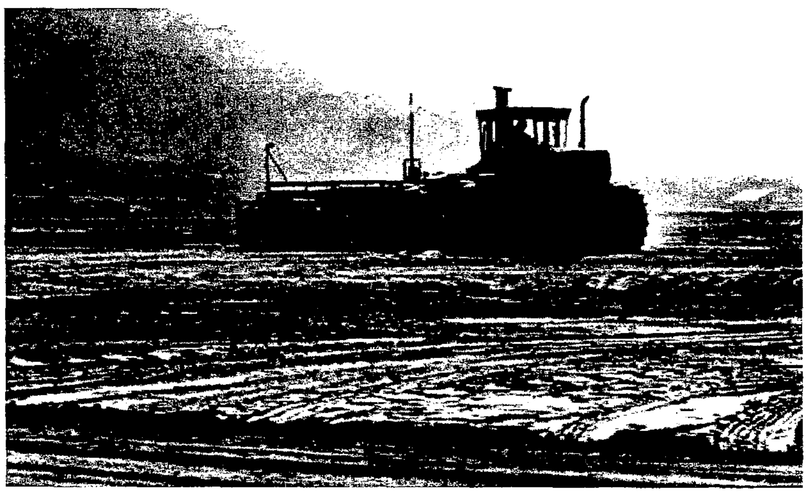

Multi-Slope

USDA NRCS Practice Code 464

Drip Irrigation

USDA NRCS Practice Code 441

Figure 1.7-2a
On-Farm Conservation Measures
IID Water Conservation and Transfer Project Draft HCP

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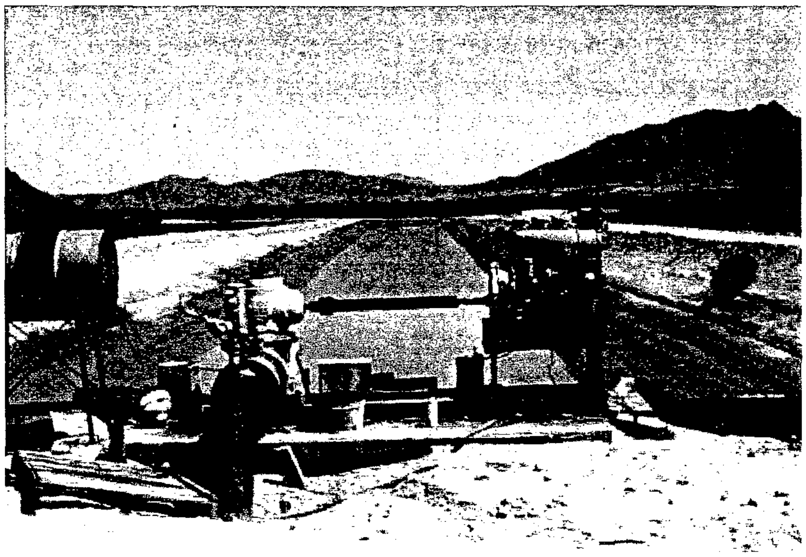

Tailwater Return or Pump Back System

USDA NRCS Practice Code 447

Shorten Furrow or
Border Strips,
Narrow Border Strips

USDA NRCS Practice Code 388

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Figure 1.7-2b
On-Farm Conservation Measures
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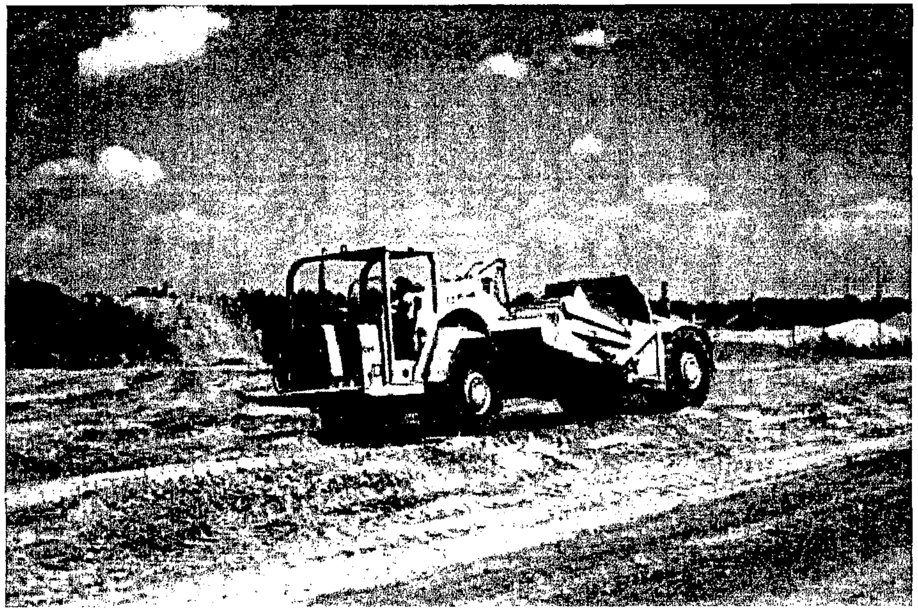

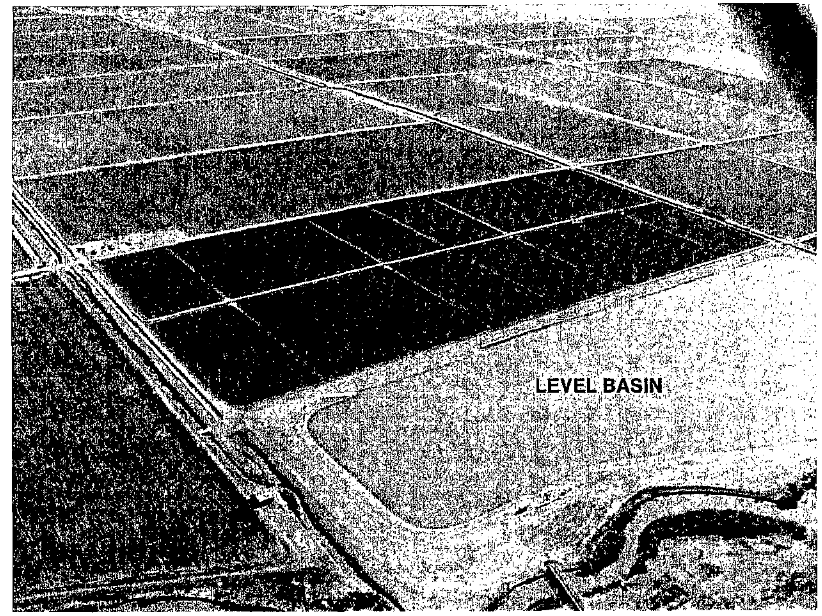

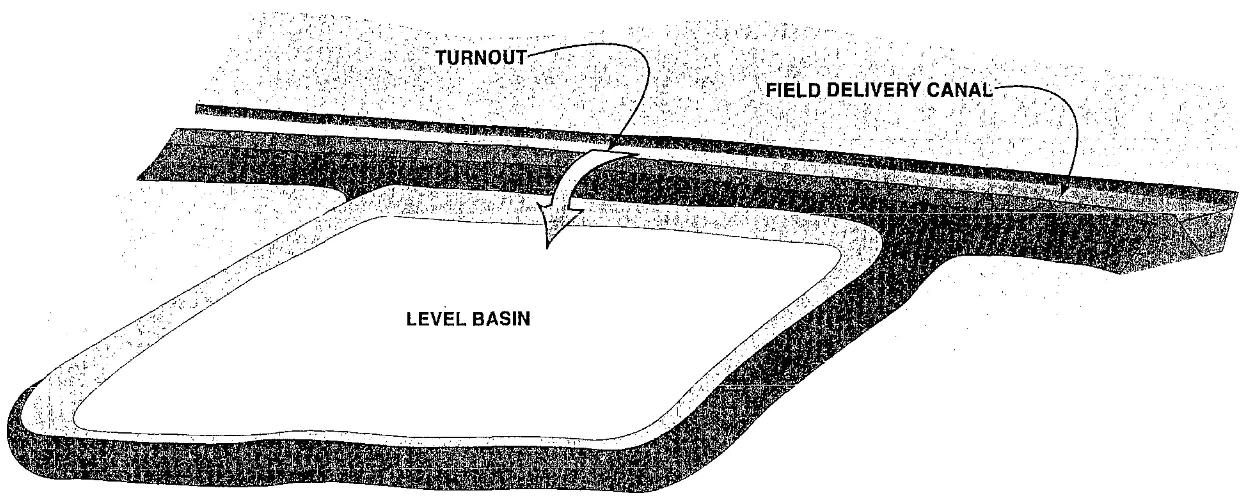

Figure 1.7-2c
Level Basin
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line a mile of canal. For the canal lining anticipated thus far, this work would be completed within two weeks. In addition, although no additional canals are planned or anticipated, IID may need to construct new canals over the term of the permit and line those as well. The exact location, size, and length of future canals are uncertain at this time; however, any new canals would be within IID's current water service area. To cover the potential for canal lining beyond that amount presently anticipated, IID is seeking coverage for lining the remaining laterals (up to 320 miles) over the term of the HCP. If IID lined these additional laterals, up to 2,700 acres could be temporarily disturbed. The temporarily disturbed area would be within IID's rights-of-way and would consist of previously disturbed areas such as roads and embankments.

TABLE 1.7-2
Canals Potentially Lined to Conserve Water and Area Temporarily Disturbed to Line Canals

Canal	Length (miles)	Acreage Affected
Rose Lateral 9	0.25	2.12
Ash Lateral 43	0.49	4.16
N Lateral	1.00	8.48
Total	**1.74**	**14.76**

Lateral Interceptors

A lateral interceptor system consists of new canals and reservoirs that collect operational spills from lateral canals. Lateral interceptors are lined canals or pipelines that generally run perpendicular to lateral canals at their terminus. The lateral interceptors capture operational spill water, unused water resulting from canal fluctuations, and return water from farmer delivery reductions or changes. The interceptors convey this captured water to regulating reservoirs where the water can be stored and reused in another canal serving another delivery system as needed. IID currently has four systems in operation and potentially could enlarge that to 16 additional systems under the water conservation and transfer programs (Figure 1.7-4; Table 1.7-3).

Installation of a lateral interceptor requires constructing and lining a canal, installing pipelines and constructing a minimum 40-surface-acre reservoir (Figure 1.7-5). An approximately 70-foot-wide area centered on the new interceptor would be affected by the construction. The affected area of the reservoir site would be only slightly larger than the reservoir itself. Table 1.7-3 shows the acreage potentially affected by each of the interceptors. The total acreage potentially affected by construction of lateral interceptors could be about 1,480 acres (i.e., about 840 acres of canals and 640 acres of reservoir).

TABLE 1.7-3
Proposed Lateral Interceptors and Acreage Affected by Construction

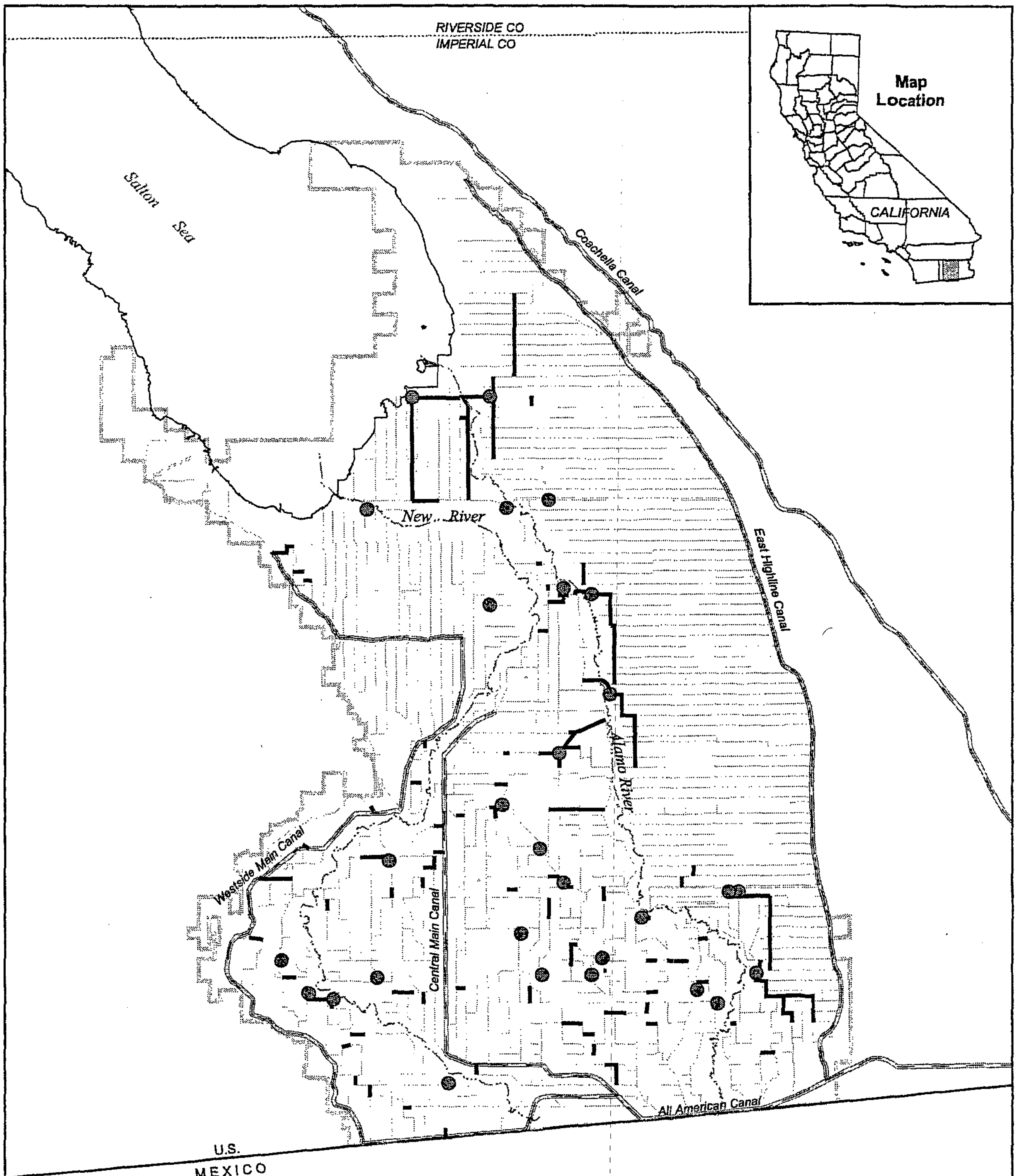
Interceptor	Type	Length (miles)	Acreage Affected
Acacia	Canal	8.62	73.12
Ash	Canal	4.55	38.57
	Pipe	1.00	8.52

TABLE 1.7-3
Proposed Lateral Interceptors and Acreage Affected by Construction

Interceptor	Type	Length (miles)	Acreage Affected
Elder	Canal	7.61	64.60
Fern	Canal	1.14	9.64
	Pipe	2.18	18.48
Holt	Canal	5.76	48.85
	Pipe	1.02	8.68
Niland	Canal	9.28	78.74
	Pipe	6.53	55.44
Orient-Oleander	Canal	4.17	35.35
	Pipe	1.52	12.86
Orita-Munyon	Canal	4.92	41.78
	Pipe	0.76	6.43
Peach	Canal	6.63	56.24
Redwood	Canal	8.52	72.31
	Pipe	2.01	17.03
Rockwood	Canal	1.00	8.52
	Pipe	0.50	4.26
Thistle	Pipe	0.80	6.75
Tri-City	Canal	5.00	42.42
	Pipe	0.50	4.26
Tri-Ex	Pipe	2.30	19.52
Vail	Canal	3.03	25.71
	Pipe	5.02	42.58
Wistaria	Canal	1.99	16.87
	Pipe	2.65	22.50
Total		**99.02**	**840.02**

Reservoirs

Two types of reservoirs can facilitate water conservation: (1) operational reservoirs (includes mid-lateral reservoirs) and (2) interceptor reservoirs. Operational reservoirs are generally placed in locations to take advantage of delivery system supply and demand needs and in some cases include locations of historical canal spills. These reservoirs are used to regulate canal flows in order to match or optimize demand flows to supply flows. Conservation is achieved by reducing operational spills as a result of this mismatch of flows by storing excess supply water and then releasing this water in times of shortage demand needs.



RESERVOIRS
LATERAL INTERCEPTOR SYSTEM
AQUEDUCT/CANAL
COUNTY LINE
INTERNATIONAL BORDER
RIVER
IID WATER SERVICE AREA

N

Source:
University of Redlands, 1999; DOI, 1999

5 0 5 Miles
SCALE IS APPROXIMATE

Figure 1.7-4
Proposed Lateral Interceptor Systems and Reservoirs in the IID Water Service Area

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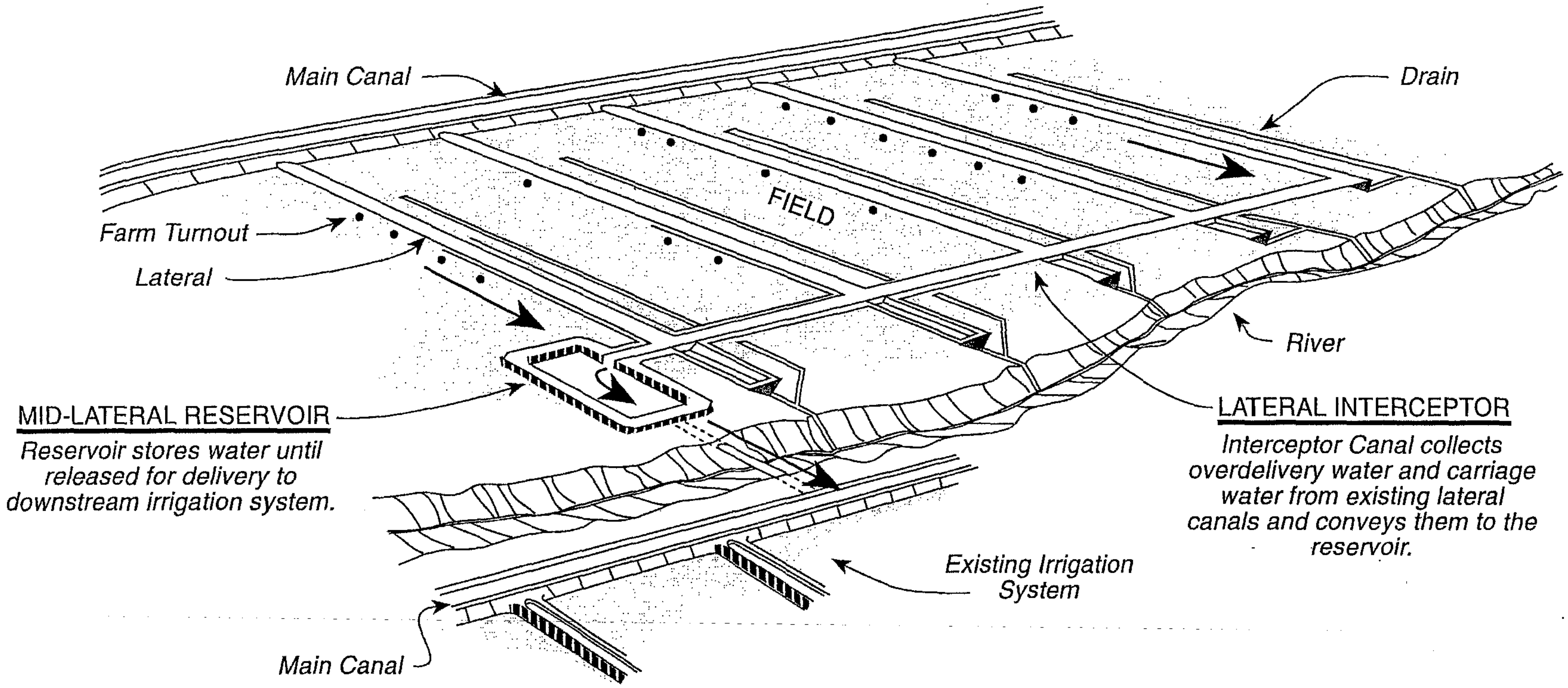

Figure 1.7-5
Conceptual Lateral Interceptor System and Mid-Lateral Reservoir
IID Water Conservation and Transfer Project Draft HCP

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Interceptor reservoirs enhance lateral interceptor system operations. They are typically placed at the end of the lateral interceptor canals to store intercepted flows (operational discharges) for reregulation rather than losing these flows to the drainage system. These stored flows are then later released for use in other delivery system canals as demand is required. These reservoirs would contain automated inlet and outlet structures that would enable the maintenance of the desired water flow. IID currently does not have any reservoirs in design, but anticipates constructing up to 100 reservoirs during the 75-year permit term. These reservoirs would be 1 to 10 acres in size, with a capacity ranging from about 5 to 30 AF. Construction of these reservoirs could encompass up to 1,000 acres.

In addition to reservoirs constructed and operated by IID, many farmers in the Imperial Valley likely will construct small regulating reservoirs to facilitate the conservation of water. These 1 to 2-acre reservoirs would be constructed at the upper end of agricultural fields and are used to better regulate irrigation water applied to fields and to settle suspended solids prior to introduction into drip irrigation systems. These reservoirs would contain water only during irrigation operations and would remain dry during the remainder of the year. IID anticipates that these reservoirs could be used on up to 50 percent of the agricultural land in its service area. A single reservoir services about 80 acres of land. Up to about 5,900 acres of agricultural land could be converted to regulating reservoirs.

Seepage Recovery Systems

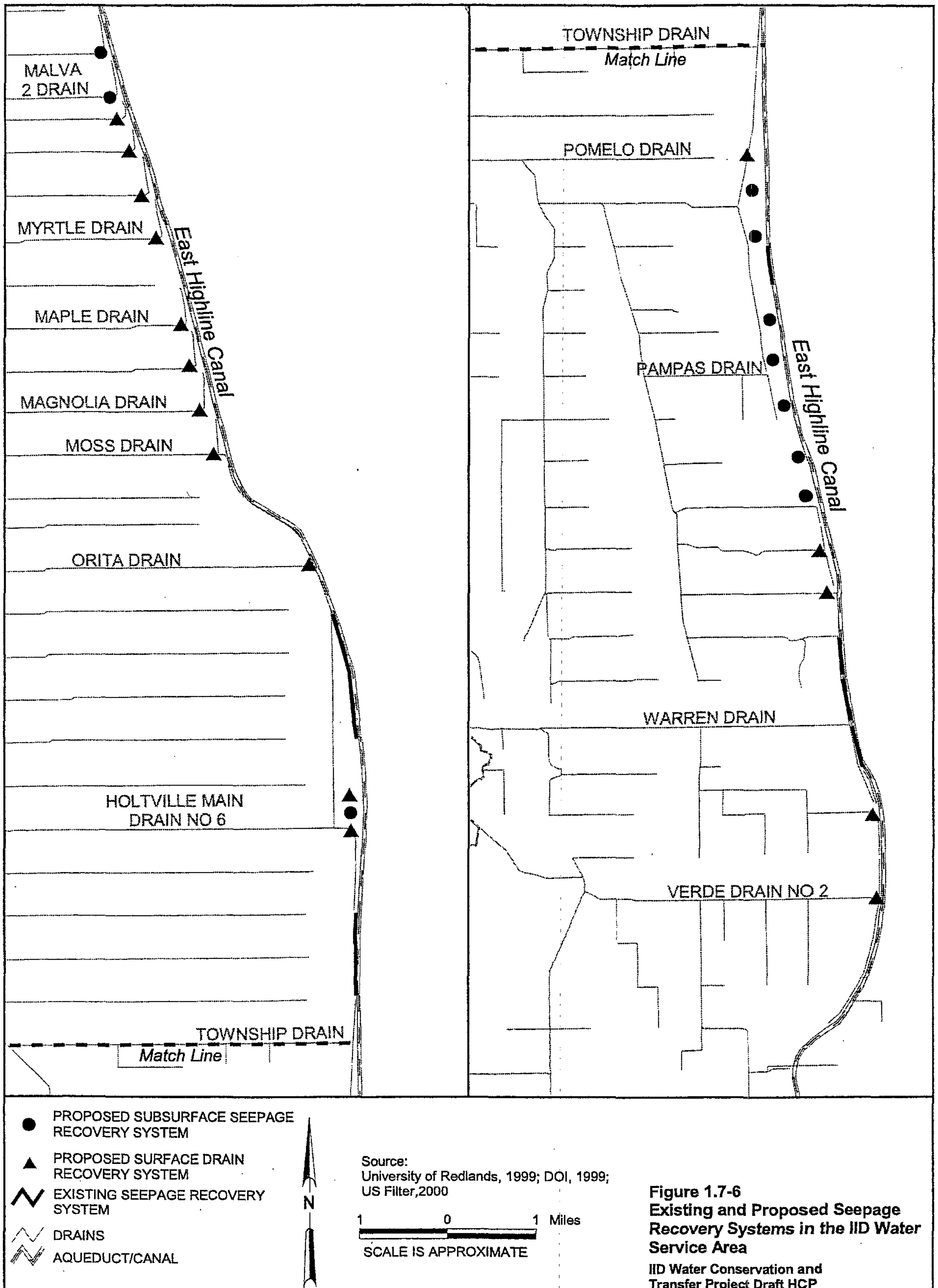
To conserve water, IID could install seepage recovery systems adjacent to the East Highline Canal. Existing and proposed locations of seepage recovery systems are shown in Figure 1.7-6. Surface and subsurface recovery systems conserve water by collecting canal leakage in sumps along a canal and pumping the water back into the same canal (Figure 1.7-7).

In a surface drain recovery system, seepage is captured and conveyed through open channels to a concrete sump. From there, it is pumped back into the canal. Construction required to install a surface recovery system is minimal. For a surface recovery system, a small check structure would be constructed in the existing parallel drain to pond water to a depth of about 3 feet. A pump station would return water to the East Highline Canal. These systems are proposed where there is an existing drain that collects seepage and directs the water to the drainage system.

In a subsurface recovery system, canal seepage flows are collected in a perforated pipe that then directs the water to a concrete sump. From there it is pumped back into a canal (Figure 1.7-7). Subsurface systems are proposed in areas lacking an existing parallel open drain. To install these systems, a trench is excavated and a pipe is laid in place. The pipeline outlets to a collection well consisting of an 8-foot-diameter vertical pipe from which the water is pumped back to the delivery canal. Construction disturbs an area about 70 feet wide along the pipeline. Table 1.7-4 shows the area that would be affected by construction of subsurface recovery systems. Following completion of the system, a right-of-way of about 70 feet along the pipeline is maintained free of deep-rooted vegetation.

TABLE 1.7-4
Proposed Seepage Collectors and Acreage Potentially Affected by Construction

Seepage Collector	Type	Length (miles)	Acreage Affected
EHL 14	Surface	0.19	<0.1
Holtville No.3	Surface	0.59	<0.1
Holtville No.6	Surface	0.51	<0.1
Holtville Main	Surface	0.55	<0.1
Magnolia	Surface	0.42	<0.1
Malva	Surface	0.19	<0.1
Maple	Surface	0.35	<0.1
Mesquite	Surface	0.42	<0.1
Moss	Surface	0.42	<0.1
Mulberry	Surface	0.26	<0.1
Munyon	Surface	0.42	<0.1
Myrtle	Surface	0.37	<0.1
Orita	Surface	0.42	<0.1
Oxalis Lateral	Surface	1.19	<0.1
Verde No.2 & 2-D	Surface	1.58	<0.1
Warren No.2	Surface	0.44	<0.1
Total Open Systems		**8.3**	**<1.6**
EHL 16 Lateral	Subsurface	0.48	4.1
Malva 2	Subsurface	0.48	4.1
Mayflower	Subsurface	0.48	4.1
Orchid	Subsurface	0.48	4.1
Palm	Subsurface	0.48	4.1
Pampas	Subsurface	0.48	4.1
Peach	Subsurface	0.48	4.1
Plum	Subsurface	0.48	4.1
Pomelo	Subsurface	0.48	4.1
Rositas Canal	Subsurface	0.48	4.1
Total Subsurface Systems		**4.8**	**41.0**
Total All Systems		**13.2**	**42.6**



Source:
University of Redlands, 1999; DOI, 1999; US Filter,2000

Figure 1.7-6
Existing and Proposed Seepage Recovery Systems in the IID Water Service Area

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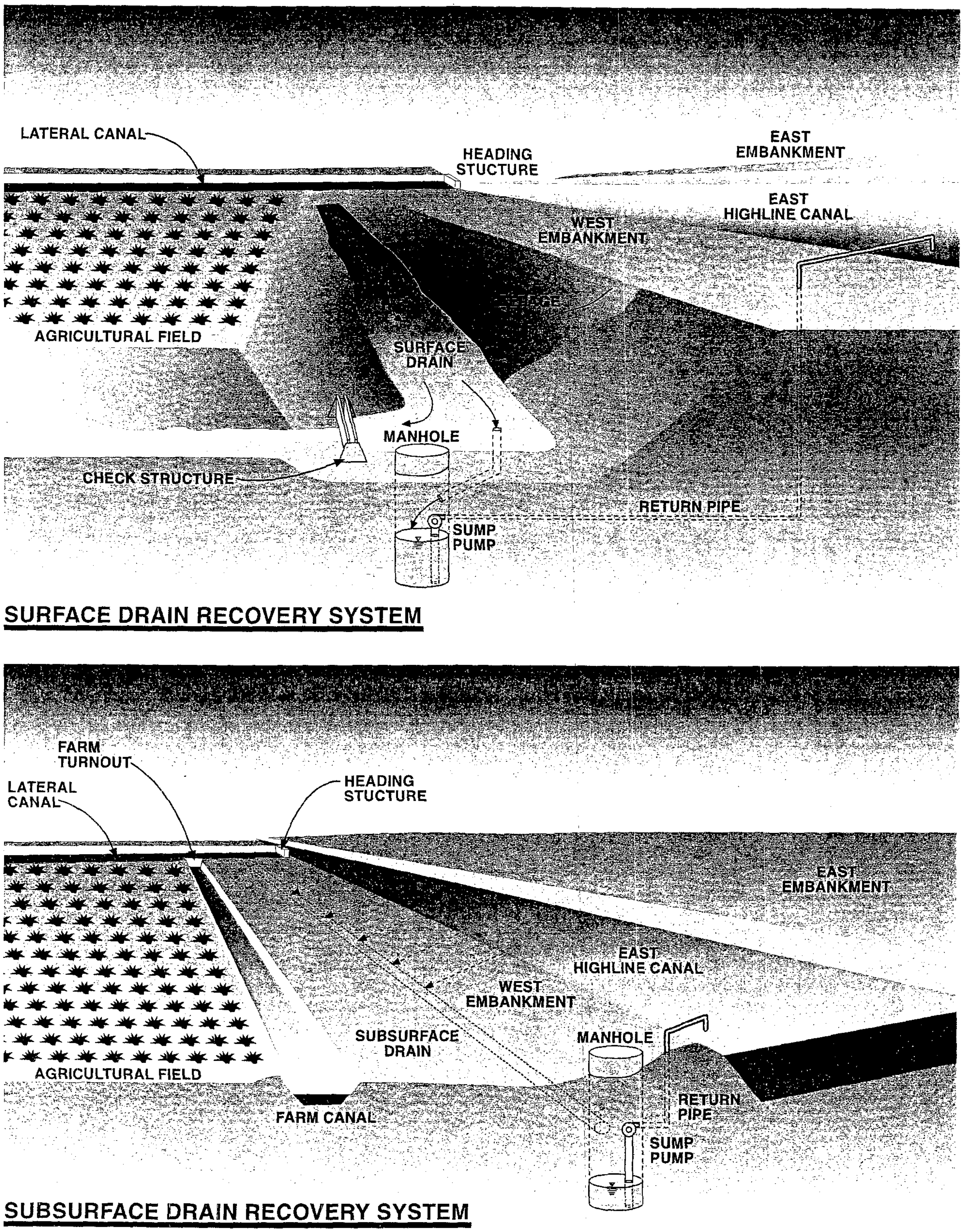

Figure 1.7-7
Conceptual Seepage Recovery Systems
IID Water Conservation and Transfer Project Draft HCP

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1.7.3 Operation and Maintenance Activities

The primary purpose of this HCP is to provide the ESA and CESA compliance and incidental take authorization required to implement IID's water conservation obligations under the IID/SDCWA Transfer Agreement and the QSA. The water conservation programs will be an integral part of IID's ongoing operation. To implement the conservation program on a long-term basis, IID needs certainty regarding its ability to operate and maintain its irrigation and drainage system. For this reason, the covered activities include the range of IID's normal activities as well as water conservation-related activities. IID's normal activities consist of O&M activities associated with the diversion, measurement, conveyance, and delivery of Colorado River water to customers within the IID service area and the collection, removal, measurement, and transport of drainage waters to the Salton Sea. These activities are described below.

1.7.3.1 Conveyance System Operation

Covered activities associated with the operation of the conveyance system encompass the following:

- Conveyance, measurement, and delivery of water through the entire AAC system beginning where water is diverted at Imperial Dam on the LCR to the Westside Main Canal turnout, located at the southwestern corner of the Imperial Valley
- Conveyance, measurement, and delivery of water to customers through the main and lateral canal system within the IID service area
- Canal operational activities involving the filling, draining, and movement of water through the canal system to accommodate maintenance and customer needs

IID delivers Colorado River water to lands within the Imperial Valley for agricultural, domestic, industrial, and other beneficial uses. Water is diverted from the Colorado River at Imperial Dam and is conveyed by gravity flow to Imperial Valley via the 82-mile-long AAC (Figure 1.7-1). The Coachella Canal branches off from the AAC about 37 miles west of Imperial Dam. The O&M activities associated with the Coachella Canal, which is operated by CVWD, are not covered by this HCP.

Three primary main canals (i.e., East Highline, Central Main, and Westside Main) branch off the AAC as it moves across the southern portion of the Imperial Valley. These main canals are owned and operated by IID and supply water to numerous lateral canals located throughout the irrigated service area of IID. The lateral canals carry water from the main canals to farm fields; turnouts are used on the canals and laterals to deliver water to individual farm fields. Canal segments may be dewatered between irrigation deliveries for maintenance purposes or to reduce moss and algal growth, which interferes with water deliveries.

In total, IID operates and maintains 1,667 miles of canals to deliver water to irrigated farmland in the Imperial Valley. Of the 1,667 miles of canals, 1,114 miles are concrete-lined, about 537 miles are unlined earthen canals, and the remaining 16 miles of the conveyance system are pipelined (cited from IID's Memorandum dated October 4, 2000) (Figure 2.3-5). IID does not anticipate constructing any new canals. However, occasionally a portion of a

19817

canal needs to be rerouted. On average, 0.25 miles of canal may be rerouted annually. Construction required to reroute a canal is the same as that required to install a lateral interceptor canal. Thus, about 2 acres could be disturbed each year to reroute canals for a total of 150 acres over the term of the permit.

1.7.3.2 Drainage System Operation

Covered activities associated with the operation of the drainage system include collection, conveyance, measurement, and discharge of drainage water through IID's main and lateral drain system to the rivers and the Salton Sea; and drain operational activities associated with the filling, draining, and movement of drain water through the main and lateral drain system to accommodate maintenance and customer needs.

IID is obliged, as stated in its rules and regulations covering drainage, to provide a drain outlet for every 160 acres of farmland within its service area. To do so, IID operates a complex drainage system within its service area consisting of 1,456 miles (cited from IID's Memorandum dated October 4, 2000) of open and closed (pipeline) drains and associated features, surface and subsurface drainage pumps, subsurface drains and associated collection pipelines, and water recovery systems. The IID drainage system is shown in Figure 2.3-1. Like the canal system, the drain system is composed of main and lateral drains.

Periodically, IID reroutes and constructs new drains. On average, about 2 miles of drains are rerouted or constructed within a 10-year period. Construction of a new drain entails trenching to a depth of about 7 feet and creating the roadways adjacent to the drain. The new drain and associated roadways fill the right-of-way for the drain. The right-of-way on lateral drains is 80 feet and on main drains is 120 feet. Drains to be rerouted or constructed primarily would be lateral drains. Construction of 2 miles of lateral drains would result in ground disturbance encompassing about 10 acres over a 10-year period. If the newly constructed drains were main drains, about 15 acres would be disturbed over a 10-year period. From 75 to 112 acres could be disturbed over the 75 year permit term.

On-farm irrigation water that percolates through the soil is collected by subsurface tile drains and, to a lesser extent, by surface drains. The open drains (mostly the lateral drains) collect tailwater and tilewater from area farms as well as operational discharge water emanating from IID's delivery system. Tailwater is irrigation water that runs off the lower end of the fields and is discharged into the drains. Tilewater is subsurface drainage water generated primarily through leaching operations performed by farmers. Currently, more than 35,000 miles of subsurface drainage tile have been installed by Imperial Valley farmers. Outlets for drainage tile into drains can occur at intervals as close as 660 feet, but are generally at quarter- to half-mile intervals, or tilewater is collected in sumps from which it is pumped to the nearest outlet, which is a drain, a river, or the Salton Sea. IID estimates that there are in excess of 14,000 outlets of tile drains into the IID drainage system from its customers. Most drain water discharges are into IID's surface drain system, although some discharge directly to the New or Alamo Rivers or the Salton Sea.

1.7.3.3 Maintenance Activities

Maintenance activities required for the conveyance and drainage systems include keeping existing irrigation, drainage, and related facilities in good repair and working condition, so that all parts of these facilities can fulfill the intended purpose for which they were originally designed. Minor improvements undertaken during the normal process of performing these activities also are included. Covered maintenance activities include the following activities relating to the irrigation and drainage system and associated facilities:

- Inspection activities
- Canal maintenance
- Right-of-way maintenance
- Seepage maintenance
- Structure maintenance
- Pipeline maintenance
- Reservoir maintenance
- Sediment removal from canals and drains
- Operation and maintenance of the desilting basins
- Mechanical, chemical, and biological weed control maintenance
- New and Alamo River maintenance
- Salton Sea dike maintenance
- Gravel and rock quarrying

Each of these activities is described below.

Inspection Activities

IID continuously inspects its canal and drainage system from access roads adjacent to the facilities to determine where and when maintenance is required.

Canal Maintenance

About 1,114 miles of the IID's conveyance system consist of concrete-lined channels. Concrete-lined canals, including the AAC when lined in the future, require periodic inspection and repair. The concrete-lined canals are segmented with contraction joints to resemble a series of concrete panels. The joints between the panels often are sealed with tar or another waterproof mastic. Repair consists of periodic concrete panel replacement or resealing joints. To replace concrete panels, the existing panels are removed and new concrete poured to create the panels. All activities are restricted to IID's right-of-way on the canal.

Portions of the concrete lining are replaced on an as needed basis. Thus, the frequency, magnitude, and location of this activity are highly variable. To replace or repair canal lining, the canal must be dewatered. IID attempts to dewater each canal every 2 months for about 3 days. However, on average, canals are typically dewatered every 3 to 4 months. Canal lining and repair are conducted during these periods. The amount of canal lining can vary from one or two panels covering several feet to one-half mile. IID anticipates that the concrete lining on currently lined canals will require replacement up to two times over the next 75 years.

Along the AAC, IID maintains and operates three existing seepage recovery systems. Two of these systems are located at Drop 4 and one is at Drop 3. The seepage recovery systems at Drop 4 are pumped, while the system at Drop 3 is a gravity system. About every 10 years, IID needs to clean vegetation out of these systems.

The preferred alternative for the AAC Lining Project is to construct a new canal parallel to the existing AAC from one mile west of Pilot Knob to Drop 3 (Reclamation and IID 1994). When completed, IID will operate and maintain the new canal section in the same manner as the existing canal. In the EIS/EIR for the AAC Lining Project, it was assumed that the old canal section would be retained and maintained for emergency use. The specific operation and maintenance activities required to maintain the canal for emergency use will be developed during project design. The Biological Opinion for the AAC Lining Project describes expected management of the abandoned section as follows.

> *The abandoned sections of the existing canal would be managed by IID as an emergency channel in the event of damage to the parallel canal or other catastrophic event. To accomplish this, a management plan for the old canal would be prepared during the project design phase in coordination with the BLM and other agencies. The plan would include the specific action needed to maintain the abandoned sections for the specified purpose of an emergency use channel. The plan would include actions needed to keep the abandoned canal prism and maintenance roads free of vegetation. Vegetation control may involve regular discing and the use of legally approved chemical herbicides.*

The HCP covers management of the abandoned section in a manner consistent with the management assumed in the EIS/EIR and Biological Opinion for the AAC Lining Project.

Right-of-Way Maintenance

Canals are generally constructed on a 50- to 70-foot-wide rights-of–way, while the right-of-way for drains is generally 80 to 120 feet wide, depending on whether it is a main or lateral facility. The rights-of-way for canals and drains consist of the drain or canal, roadways on both sides of the channel and the associated embankments. The right-of-way on piped sections of the conveyance and drainage systems are typically narrower, about 40 feet. Conveyance pipelines are used through developed areas and are typically covered by roads, parks, and other uses consisting of open space facilities. The rights-of-way of drainage pipelines are typically farmed.

Right-of-way maintenance involves maintaining the canal, drain, and siphons associated with the right-of-way clear of deep-rooted vegetation, debris, and trash, and maintaining the accessibility to facilities and the use of the roadways associated with the channels. This maintenance refers to that portion of the right-of-way outside the canal or drain prism; canal and drain maintenance within the prism is addressed separately. Right-of-way maintenance encompasses maintaining the roads and associated embankments in good repair and controlling vegetation. Vegetation control is described in more detail below. Debris and trash in the canals and drains are removed as needed.

The embankments of drains and canals require periodic maintenance. During sediment removal activities, silt is removed and deposited on the adjacent embankment and roadway. The embankments and associated roadways are later graded and groomed to blend the material into the embankment for the purpose of maintaining a surface that can accommodate vehicle traffic and equipment access. Grading also smoothes the embankment surface and removes rills that develop during rain storms, thus reducing the potential for erosion. IID maintains and operates five graders for maintaining embankments. The graders operate every day except when it rains and each grader can cover 3 miles per day. Thus, about 15 miles can be graded per day. Drain embankments are graded and groomed in association with drain maintenance activities that occur once every 5 years on average. The embankments of the main canals (e.g., East Highline, Westside Main, Central Main, and the AAC) are typically graded and groomed several times a year. The remaining canal embankments are graded and groomed once a year on average.

Other embankment maintenance activities include regular watering of the banks and roadways along the AAC, main and lateral canals, and drains with a water truck to minimize dust generation. Several segments of the main canals, including the AAC, are surrounded by chain link fencing. This fencing requires periodic repair and replacement and is considered part of right-of-way maintenance.

To maintain the canal and drain embankments, both within and outside the canal and drain prism, erosion problems need to be corrected. Erosion maintenance on the outside of the canal or drain occurs infrequently. Damage to the embankments from erosion is generally corrected during the embankment maintenance activities described above. Occasional intense storms can cause localized areas of erosion requiring immediate corrective actions; these are addressed as part of the emergency response activities. Erosion maintenance activities are limited to the rights-of-way of the canals or drains.

Along the portion of the AAC that traverses the Algodones Dunes, IID annually knocks down portions of the sand dunes, creating a flatter slope that allows sand to blow across the canal. In conducting this flattening, a dozer drags an I-beam back and forth across the peaks of the dunes to level them. The area where this activity is conducted begins at the Coachella Turnout (Sta. 1907+20) and extends to about Sidewinder Road at Pilot Knob (Sta. 1243+65), a distance of 12.56 miles. The area actually disturbed is about 50 to 75 feet wide yielding a total acreage disturbed of 76 to 114 acres. This operation begins in July every year and lasts about 6 weeks. In conjunction with flattening the dunes, the roadways along the AAC are cleared of accumulated sand. After the roads are opened up, they are immediately treated with herbicides for vegetation control. IID has been conducting these activities since the construction of the AAC in about 1945.

Erosion also can occur within drains or unlined canals. The erosion results from meandering channels of water from irrigation flow or drain water or stormwater runoff. Vegetation or sandbars can cause a change in water direction within a canal or drain and an associated erosion problem if not corrected by removal. Regular drain and canal maintenance activities (i.e., sediment removal and vegetation control) minimize the occurrence of erosion problems, and most erosion problems are corrected during regular maintenance. However, storm waters can result in embankment damage or loss that may necessitate the hauling and placement of fill material. This condition is addressed as part of the emergency response activities.

Right-of-way maintenance also consists of activities required for the maintenance and operation of power transmission facilities within the HCP area. These activities include regular inspection of facilities, clearing the power line rights-of-way, and repairing and replacing equipment as necessary. The power system within the HCP area is composed of nearly 3,000 miles of distribution and transmission lines and about 50 substations. The transmission and distribution lines exist in canal and drain rights-of-way and right-of-way maintenance for the drains and canals covers right-of-way maintenance for the transmission lines.

Additional transmission lines could be developed as a result of efforts to implement water conservation measures. For example, tailwater pumpback facilities constructed by individual farmers could encourage the extension of power transmission lines to operate the pumps. Currently, tailwater pumps typically are operated by diesel engines. IID anticipates that the relatively high cost associated with extending transmission lines will continue to discourage this practice in the Imperial Valley and that the installation of transmission lines to serve pumpback facilities will be infrequent. Further, any extension of transmission lines likely will occur in farmland along existing canal or drain rights-of-way.

Seepage Maintenance

Gophers or vegetation can cause leaks in the canal banks, although this occurs infrequently. Leaks also can be caused by earthquakes or seal breakage on a canal from cleaning. Activities to correct seepage problems are similar in each case. The embankment is cored, clay is mixed with the existing material, and the mixture is re-compacted. Seepage maintenance activities are focused on unlined canals and limited to the canal's right-of-way. On average, seepage maintenance activities are conducted on 5 to 10 miles of canal a year. Over the term of the permit, seepage maintenance activities could be conducted on all of the unlined canals (537 miles) at least once.

Structure Maintenance

In addition to the canals, about 20,000 structures within the canals and drains are required to convey water throughout the IID service area. These structures include, but are not limited to, delivery gates, checks, headings, turnouts, moss pipes, weep pipes, drainage sumps, irrigation pumps, numerous types of bridges, lifting devices, and flow measurement devices. O&M activities required for these structures include inspection, adjustments, and periodic or emergency repairs and replacement. IID estimates that about 200 structures need to be replaced each year, but historically fewer structures have been replaced. In the future, 300 structures could require replacement each year as the infrastructure ages. Activities associated with the repair and replacement of structures are conducted within the rights-of-way. Ground disturbance to replace structures on laterals is generally limited to a 75 by 75-foot area. On main canals, any ground disturbance generally occurs within a 150 by 150-foot area. If all of the structures are replaced during the term of the permit up to 2,970 acres could be temporarily disturbed.

There are 25 sites in and around cities and towns in the Imperial Valley that currently have trash screens on irrigation and drainage channel facilities. The screens typically exist at road siphons and pipeline entrances. The purpose of the screens is primarily for safety, but they also result in an accumulation of trash. These trash screens require frequent cleaning of debris to prevent water backup and inundation of tile lines in drains and possible minor flooding on adjacent properties where canals are involved.

Pipeline Maintenance

Portions of the conveyance (Figure 2.3-5) and drainage systems are contained in pipelines. Maintenance activities consist of maintaining the pipeline right-of-way and around the manholes that provide access to the pipelines clear of deep-rooted vegetation. Vegetation also is maintained at a height that allows visual access. Drain pipelines primarily occur in farm fields while conveyance system pipelines occur through developed areas. Thus, little vegetation control is necessary. In addition, the pipelines are periodically inspected, repaired, and replaced as necessary. Any activities are generally limited to the 40 feet wide right-of-way of the pipeline. It is anticipated that all pipelines will be replaced once during the 75-year permit term.

Reservoir Maintenance

The IID conveyance system contains 10 regulating reservoirs (Figure 2.3-5). Regulating reservoirs capture spills from a water delivery/conveyance facility and are used to match delivery flows with demand flows. The same types of maintenance activities required for canals are conducted at reservoirs. Vegetation is controlled around the reservoir using chemical methods. Infrequently riprap needs to be replaced or amended to maintain the structural integrity of the embankments. Also, the concrete lining of the reservoirs occasionally but infrequently requires repair or replacement. The reservoir embankments are graded, groomed, and stabilized, as necessary in the same manner as described under Right-of-way Maintenance. Embankment maintenance along reservoirs occurs about once every 5 years. On very rare occasions (e.g., once every 25 years), a reservoir may be drained and the sediment removed. Sediment from the reservoir is deposited and graded along canals. Chain link fencing surrounds the reservoirs and requires periodic repair and replacement. Automated reservoirs with control houses require frequent visitation by maintenance personnel to ensure proper operation.

Sediment Removal from Canals and Drains

The greatest single maintenance expense for IID is the removal of sediment from its canal and drainage systems, with the drainage system receiving the most attention. This is a mechanical process that requires the use of hydraulic excavators or small backhoes to remove the material. Dredged spoil is deposited along the side of the canal or drain, where it is allowed to dry before being groomed into the embankment by a dozer or grader. Drains are cleaned on an as-needed basis, depending on the extent of vegetative growth or sediment accumulation. Drains with the flattest bottom slope accumulate sediment most rapidly, and may require cleaning annually. Other drain segments may not require cleaning for periods of 10 years or more. On average, IID cleans approximately 300 miles of drains annually, but the amount varies from year to year. The drain embankments and road surface along the drain are re-contoured, graded, and groomed in association with drain cleaning or in emergency situations (e.g., bank sloughing during a storm) as described under Right-of-Way Maintenance.

Operation and Maintenance of the Desilting Basins

Colorado River water diverted at Imperial Dam immediately passes into one of three desilting basins used to remove silt and to clarify the water. Each of the desilting basins is 540 feet wide by 770 feet long and is equipped with 72 scrapers designed to remove 70,000 tons of silt per day. Silt removed at the facility is returned to the Colorado River downstream of Imperial Dam. Periodic maintenance of desilting basins requires dewatering of individual basins to performed repairs and routine maintenance.

Weed Control Maintenance

As noted above, maintenance of the canals, drains and various structures typically involves vegetation control. IID uses mechanical, chemical, and biological methods to control vegetation. To a lesser extent, IID occasionally uses controlled burning as a means to improve visibility of the drain channel during drain maintenance, improve the performance of herbicides, and to remove accumulations of dried plant material that impede the flow of water through the drain. These methods and their application to IID's facilities are described below.

Mechanical methods of vegetation control are used in canals. Canals accumulate moss and algae that must be removed periodically because it impedes water flow within the channel and at structures. In concrete-lined canal sections, moss carts and chains are pulled along the canal to remove algae and moss that develop on the bottom and sides of the canal. A backhoe follows and removes the vegetation collected by the moss cart. Moss carts are used for concrete-lined laterals while chaining is used to clear moss and algae from main canals and unlined lateral canals. If very thick moss and algae has developed in unlined canals, discing may be necessary to remove the vegetation. Use of a moss cart requires dewatering the canal. Thus, vegetation removal with a moss cart occurs in conjunction with the regular dewatering for most canals. Chaining does not require dewatering. Vegetation is removed from all canals at least once a year. However, about 10 to 15 percent of the canals accumulate large amounts of moss and algae and require cleaning as frequently as every two weeks.

Mechanical and chemical methods are used to control vegetation in the drain and canal rights-of-way and around IID's other facilities such as hydroelectric facilities, drop structures on the New and Alamo rivers. Chaining, discing, and side scraping (moss cart) are used to control vegetation on embankments and around other facilities. An excavator is used to remove vegetation from the drains. Vegetation removal in the drains occurs in association with sediment removal activities described above. In removing vegetation from the drains, an excavator is operated from the top of the bank where it is used to scrape vegetation from the side and bottom of the channel. Along drains, extensive vegetation can develop on top of the drain banks and access roads, requiring a bulldozer to grade and gain access to the drain prior to maintenance.

Biological control methods are used for aquatic weeds, such as hydrilla, sago pondweed, and Eurasian watermilfoil. Grass carp feed on these plants and triploid sterile grass carp are raised at IID hatchery facilities and stocked in the canals for the purpose of controlling aquatic vegetation. The use of grass carp reduces the frequency of the other control methods. Fish hatchery O&M activities are described in Section 1.7.4.1, Fish Hatchery Operations and Maintenance.

Chemical methods also are used to control vegetation in the drains, canals, and on the drain and canal banks. Take of covered species from changes in the amount or composition of vegetation resulting from herbicide use is covered by this HCP, but any take of covered species resulting from toxicological effects of herbicide use is not covered by this HCP. Chemical control methods are carried out by third parties under contract with the District and by its own staff. On a monthly basis, the District's Pest Control Advisor instructs the contractor on where to conduct control activities and advises on the chemicals to use. Within the general area identified by the District's Pest Control Advisor, the applicator has the discretion to decide where to work, which is generally influenced by the extent of weed growth and local wind conditions.

The chemicals currently used to control vegetation are Roundup®, Direx®, and Rodeo®. Rodeo® is applied where contact with water may occur; Direx® is used for woody plants, particularly salt cedar. Direx® is not used in applications where contact with water could occur. Chemical control of vegetation on the banks of the canal is supplemented with mechanical removal, as necessary. Vegetation is sprayed during March through August, and occasionally into September. All herbicide applications are carried out under a permit from the Imperial County Agricultural Commissioner and are subject to its conditions. The chemicals are applied in accordance with label instructions. About 565 miles of outer drain embankments are sprayed with a mixture of Roundup® and Direx® a year. About 1,430 miles of the outside banks of canals and drains are treated with Roundup® a year and about 980 miles of canals and drains are treated with Rodeo®. Rodeo® is the only chemical control used on drains and canals on the state and federal refuges.

In addition to the weed control measures described, IID occasionally uses controlled burning as a method for controlling unwanted vegetation in the drains. Drain burning, which has been used on a limited basis by IID since the turn of the century, is performed to improve visibility of the drain channel, improve the effectiveness of herbicides, and to remove accumulations of plant material from the drains. IID obtains an annual burn permit from the Agricultural Commissioner and only burns on designated burn days.

During the mechanical removal of sediment, it is necessary for excavator operators to have visual contact with the bottom of the drain. Visual contact allows the operator to avoid excavations that remove too little or too much material from the drain. Under excavations (removal of too little sediment) are corrected by conducting an additional sweep of the excavator arm and removing more material from the site. This results in a duplication of effort and contributes to inefficient use of labor and equipment time. Over excavations (removal of too much sediment) result in a series of deep and shallow areas within the flow path of the drain. These undulations in the channel create disruptions in the flow that create or accelerate erosion processes within the channel. The uneven channel bed and disrupted flow encourages the channel to meander, which contributes to drain bank erosion. In addition, poor visibility increases the potential for the operator to inadvertently pull material directly from the banks. This results in a long-term instability of the channel and can cause erosion and bank failure problems that can take years to correct in some drains.

Controlled burning in the drains also is used to improve the effectiveness of herbicide applications. Tall, old, and established vegetation requires a heavier single application of herbicide or a greater number of lighter applications than young vegetation to achieve the desired level of control. Controlled burning in the drain removes decadent vegetation and encourages sprouting and regrowth. Herbicides applied on the young growth are assimilated into the plant more effectively and provide better control at lower application rates.

In addition to improving visibility and increasing the performance of herbicides, IID uses controlled burning in certain circumstances to remove accumulations of dried plant material that impede the flow of drain water. This practice occurs primarily in dense stands of *Phragmites* where plants on the drain bank collapse and accumulate in the channel.

IID uses controlled burning as a drain vegetation control practice on a limited basis and only under conditions where alternative techniques are not as effective. Currently, IID uses controlled burning on approximately 0.5 to 1.0 miles of drains per year (up to 75 miles over the term of the permit).

New and Alamo River Maintenance

In addition to the constructed drain system, the New and Alamo Rivers carry drain water to the Salton Sea. The District has no legal authority to regulate activities in these rivers. To control erosion of the river, the District constructed and maintains 20 drop structures on the rivers most of which are on the Alamo River. Maintenance activities for the drop structures consist of weed control on the banks around the structures. Mechanical and chemical control methods are used to treat about 0.5 acres every year (0.25 acre on each bank), affecting 10 acres a year. IID also conducts bank protection measures as necessary along the rivers. Bank protection activities focus on specific bank failures or areas of erosion. Typically an area about 100 feet wide and 500 feet long (i.e., about 1 acre) is disturbed in conducting bank protection activities.

IID periodically dredges the New and Alamo River channels from the United States Geological Survey gaging stations on each river to the rivers' outlets at the Salton Sea. Six to eight feet of dredge material typically are removed from the river channel during this operation. The dredge spoils are pushed into deeper water in the Salton Sea creating a submerged river channel. Through this process, the channels of the New and Alamo Rivers have been extended about 1.75 and 2.5 miles into the Salton Sea, respectively. By moving the spoils into increasingly deeper water in the Salton Sea, the rate at which the channel fills with sediment and requires dredging is reduced. IID retains the vegetation on the riverbanks to minimize erosion; however, it is necessary to lay the vegetation (mostly *phragmites*) over on the banks with the dredging equipment in order to gain access. Dredging of the rivers' mouths occurs about once every four years. More frequently, areas around the gaging stations on the rivers are dredged. The area dredged extends from about 200 feet upstream of the gage to about 500 feet downstream of the gage. This dredging occurs about every two years on the New River and annually on the Alamo River. This dredging is currently conducted in the late summer or fall to avoid impacts to Yuma clapper rails.

Salton Sea Dike Maintenance

IID maintains about 20 miles of dikes along portions of the southern end of the Salton Sea to prevent inundation of lands as the Salton Sea rose. Most of the maintenance required for the dikes consists of pulling riprap that has shifted down back into place on the dike bank. This activity is conducted along the dikes at least once a year and sometimes three or four times a year in certain locations. Other maintenance activities include repairing sections damaged in storms, filling in and replacing riprap, and grading and grooming the embankments and road surfaces on the embankments. These activities are either conducted from the road surface along the dike or from the water immediately adjacent to the dike.

Gravel and Rock Quarrying

IID owns and operates two small rock and gravel mining operations to support its maintenance activities. The two quarries, Red Hill and Pumice Island, are located on the south shore of the Salton Sea. The quarries are barren and do not support vegetation. Each quarry occupies approximately 160 acres and was acquired by IID in the late 1930s from the Southern Pacific Railroad Company. They have been operated as quarries since that time. IID quarries rock and gravel from these areas on an as-needed basis for riprap and road construction and surfacing throughout IID's service area as part of maintenance and for emergency repairs.

1.7.4 Miscellaneous IID Activities

IID also conducts activities that do not fall within the categories previously described. These activities include the following:

- Fish hatchery O&M
- Recreational facilities
- Wetland creation projects
- Management of existing habitat for covered species
- Experimental projects
- Use of IID land
- Hydroelectric power generation facilities
- Emergency response activities
- HCP and project EIR/EIS mitigation measures
- Responses to changed and unforeseen circumstances

1.7.4.1 Fish Hatchery Operations and Maintenance

As described earlier, grass carp are stocked in the canal and drain systems to control aquatic weeds. The District operates a hatchery in El Centro and grow-out facilities in Niland to produce grass carp. On average the hatchery produces 20,000 stockable grass carp per year. As of January 1998, more than 200,000 fish had been stocked into the canal system. The District's goal is to stock 20,000 to 25,000 fish a year.

The hatchery operates under a Memorandum of Understanding (MOU) with the California Department of Fish and Game (CDFG). Under this MOU, the hatchery must meet specific requirements, including maintaining a security chain linked fence around the facilities, maintaining high/low water level alarms, and maintaining bird netting over the ponds and filtering of discharge water to minimize the potential for fish to escape. The MOU also prohibits stocking of grass carp in drains that support desert pupfish because of the potential for introducing parasites or diseases, direct competition, and interference behavior.

O&M activities include cleaning and disinfecting the ponds and pipelines, controlling weed growth around the ponds, flushing the ponds and pipelines, spawning the fish, transporting fry to grow-out ponds, and rearing and stocking the fish. Sterile triploid grass carp are produced for release to prevent establishment of a breeding population in the canals. Before release, every fish produced is given a blood test to confirm that it is triploid, and therefore sterile. Diploid grass carp, which are fertile, are destroyed after spawning.

1.7.4.2 Recreational Facilities

Five of the 10 regulating reservoirs and the canal system within IID's service area are open to recreational use. Fishing and bird watching are the primary recreational uses supported by the reservoirs. IID does not conduct any activities specifically to support recreation at the reservoirs and canals.

The District owns and maintains recreational facilities at Fig Lagoon, an approximately 80-acre pond created by IID. Maintenance activities at Fig Lagoon include dredging at the mouth of the drain inlet to the lagoon from Fig Drain. About every 60 days an area 30 feet wide, 4 feet deep and 600 feet long is dredged to maintain water flow from Fig Drain into the lagoon. Developed facilities at Fig Lagoon currently consist of several picnic tables, an information kiosk, and a latrine. The area is used for fishing, bird watching, and picnicking.

In addition to Fig Lagoon, IID owns and operates three recreational vehicle (RV) parks at Salton Sea Beach, Corvina Beach, and Bombay Beach. IID dredges at these RV parks about every 60 days to maintain boat access to the Salton Sea. IID also conducts dredging at the Red Hill Marina on request although the District does not own the marina. IID dredges at Red Hill Marina about every other year.

No additional recreational facilities are planned at this time, but could be pursued by IID during the permit term. Any additional recreational facilities developed by IID and covered by this HCP would be restricted to features developed to support fishing, wildlife viewing, picnicking, walking/jogging, bicycling and related activities at IID facilities. Construction of recreational facilities is a covered activity under this HCP, but take that could result from use of the facilities by third parties is not covered.

1.7.4.3 Use of IID Land by Lessees

The IID currently owns approximately 118,000 acres of land within the HCP/Salton Sea area. Approximately 6,600 acres are located in the irrigated portion of the service area and are not contiguous to the Salton Sea. The Salton Sea currently inundates about 105,000 acres and another 6,100 acres are contiguous to and surround the Salton Sea. IID leases its farmable lands to farmers engaged in the production of agricultural products and to federal and state wildlife agencies for wildlife management. IID seeks coverage under this HCP for whatever incidental take may be attributed to it as the lessor of the land. IID is not seeking coverage for activities conducted by lessees on IID land, except those activities directly related to the water conservation program described elsewhere in this HCP.

The acreages of land leased for these uses are shown in Table 1.7-5.

TABLE 1.7-5
Types of leases and approximate acreages of lands leased by IID to third parties in the HCP area

Type of Lease	Approximate Acreage
Agricultural	1,167
Recreational areas/facilities	7,278
Duck club	371
Wildlife management	4,857
Geothermal[a]	29,325
Archeological excavation	100
Telecommunication facilities	8 facilities
Other (e.g., storage sites, plants, dumps)	1,347

[a] Subsurface lease

1.7.4.4 Use of IID Land by IID

For the term of the permit, IID may convert land that it owns to a new use. As long as the new use is a covered activity, any incidental take of covered species resulting from changed land uses or land management activities will be covered.

1.7.4.5 Hydroelectric Power Generation Facilities

IID operates eight hydroelectric generation facilities on the canal system. Six of these facilities are located on the AAC, one on the Westside Main Canal, and one on the East Highline Canal (Figure 1.7-1). These hydroelectric generation facilities are situated on the canals and occupy a relatively small area. Maintenance activities include vegetation control on the facility grounds, removing debris from the trash racks upstream of the facilities, and occasional stabilization of the canal banks immediately downstream of the facilities.

1.7.4.6 Emergency Response

Emergency activities are actions that IID must take immediately and unpredictably to repair or prevent damage to its facilities in order to prevent property damage or protect human health and safety. Emergencies are situations under which IID cannot follow the normal procedures detailed under each of the conservation strategies (Chapter 3) to correct or prevent damage to property or risk to human health or safety. Emergency activities are most frequently required to respond to storm events or natural disaster (e.g., earthquakes) that result in damage to IID facilities (e.g. canal wash out, plugged siphon) and interrupt the distribution or collection of water. Actions required by IID in emergency situations will vary depending on the specific circumstances but typically include removing debris, hauling fill material, removing sediment, moving large amounts of earth, dewatering a canal section, repairing embankments, replacing/repairing damaged structures, and replacing rip rap.

1.7.4.7 HCP and Environmental Mitigation Measures

Any incidental take of covered species that results from activities associated with the implementation of the mitigation measures and monitoring program associated with the HCP, the Environmental Impact Report and Environmental Impact Statement (EIR/EIS) for the IID Water Conservation and Transfer project, the Program EIR for the QSA, and any other environmental assessment related to the covered activities are covered under this HCP. This includes mitigation and monitoring activities implemented by qualified third parties on behalf of IID.

1.8 Regulatory Context

1.8.1 Federal Endangered Species Act

The ESA, as amended, is administered by the Secretaries of the Interior and Commerce through the USFWS and the National Marine Fisheries Service[1] (NMFS), respectively. Species listed as endangered or threatened under the ESA are provided protection from federal actions that would jeopardize the species' continued existence or destroy or adversely modify critical habitat for the species.

[1] No species under the jurisdiction of NMFS are covered by this HCP.

Under Section 4 of the ESA, the USFWS must designate critical habitat for federally listed species, concurrent with listing that species, to the maximum extent prudent and determinable. The ESA requires designation of critical habitat for listed species to be based on those physical or biological features that are essential for the conservation of the species and according to the best scientific and commercial data available. As defined in the ESA, conservation means the use of all methods and procedures that are necessary to bring any listed species to the point at which the measures provided pursuant to the ESA are no longer needed. Critical habitat is protected under Section 7 of the ESA with regard to actions carried out, authorized, or funded by a federal agency. Federal agencies must ensure that their actions are not likely to result in the destruction or adverse modification of critical habitat.

Section 9 of the ESA and accompanying federal regulations prohibit the taking of fish and wildlife species listed as threatened or endangered by nonfederal agencies and private companies and individuals. As defined in the ESA, taking means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or to attempt to engage in such conduct." By regulation, the USFWS has defined harm as an act, "which actually kills or injures," listed wildlife; harm may include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering."

Section 9 of the ESA also offers limited protection for federally listed plants. Under Section 9, it is unlawful for any person, "subject to the jurisdiction of the United States," to "remove and reduce to possession, . . .maliciously damage . . . or destroy," any such plant species from areas under federal jurisdiction (such as national forests and park lands). It also is unlawful under Section 9 for any such person to "remove, cut, dig up, or damage or destroy any such species" on any other area "in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law." Under Section 9 of the ESA, therefore, plants are protected from these types of takings on private lands to the extent these species are protected under state law.

In recognition that take cannot always be avoided, Section 10(a) of the ESA includes provisions that allow for takings by nonfederal entities that are incidental to, but not the purpose of, otherwise lawful activities. Similar provisions are found in Section 7 for actions by federal agencies. Under Section 10(a), the USFWS is authorized to issue ITPs. Applicants for such permits must submit habitat conservation plans that specify the following:

- Impact(s) that will likely result from the taking
- Measures the applicant will take to minimize and mitigate the impacts
- Source of funding available to implement the measures
- Alternatives to the taking and the reason the alternatives were not chosen
- Any other measures considered by the Secretary of the Interior (i.e., USFWS) as necessary or appropriate for minimizing or mitigating the impacts of the taking

Upon review of a completed application and HCP, the USFWS must find all of the following before an ITP can be issued:

- Taking will be incidental to an otherwise lawful activity.
- Applicant will, to the maximum extent practicable, minimize and mitigate the impacts of the taking.
- Applicant will ensure that adequate funding for the conservation plan and procedures to deal with unforeseen circumstances will be provided.
- Taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.
- Applicant will ensure that other measures (if any) required by the approving agency will be met.
- Approving agency is assured that the conservation plan will be implemented.

Because issuance of an ITP is a federal action, the USFWS must comply with the consultation requirements of Section 7 of the ESA, the public review provisions of the ESA, and the environmental analysis and public review requirements of the National Environmental Policy Act of 1969 (NEPA), as amended.

Although phrased in terms of criteria for issuance of an ITP, Section 10(a)(1)(B) also was intended by Congress to authorize the USFWS to approve HCPs for unlisted as well as listed species. Moreover, if an HCP treats an unlisted species as if it were already listed, additional mitigation will not be required within the area covered by the HCP upon the listing of that species. As stated by the Conference Committee when Section 10 was added to the ESA in 1982:

"The committee intends that the Secretary [of the Interior] may utilize this provision to approve conservation plans which provide long-term commitments regarding the conservation of listed as well as unlisted species and long-term assurances to the proponent of the conservation plan that the terms of the plan will be adhered to and that further mitigation requirements will only be imposed in accordance with the terms of the plan. In the event that an unlisted species addressed in an approved conservation plan is subsequently listed pursuant to the Act, no further mitigation requirements should be imposed if the conservation plan addressed the conservation of the species and its habitat as if the species were listed pursuant to the Act (House of Representatives Conference Report No. 97-835, 97th Congress, 2d Session, p. 30)."

The No Surprises policy adopted by the U.S. Department of the Interior provides that landowners who have habitat for listed species on their property and agree to an HCP under the ESA will not be subject to later demands for more land, water or financial commitment if the HCP is adhered to, even if the needs of the species change over time (63 Fed. Reg. 8859).

1.8.2 Bald Eagle and Golden Eagle Protection Act

The Bald Eagle and Golden Eagle Protection Act (BEPA) explicitly protects the bald eagle and golden eagle and imposes its own prohibition on any taking of these species. As defined in the BEPA, take means to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb. Current USFWS policy is not to refer the incidental take of bald eagles for prosecution under the Bald Eagle and Golden Eagle Protection Act (USFWS 1996).

For golden eagles, the ITP would serve as a Special Purpose Permit should golden eagles become listed in the future (USFWS 1996).

1.8.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act makes it unlawful to pursue, hunt, capture, kill, or possess or attempt to do the same to any migratory bird or part, nest, or egg of such bird listed in wildlife protection treaties between the U.S. and Great Britain, United Mexican States, Japan, and the Union of Soviet States. As with the federal ESA, the act also authorizes the Secretary of the Interior to issue permits for take. The procedures for securing such permits are found in Title 50 of the Code of Federal Regulations (CFR), together with a list of the migratory birds covered by the act. The USFWS has determined that an ITP issued under Section 10 of the ESA also constitutes a Special Purpose Permit under 50 CFR 21.27 for migratory birds that are listed under the ESA. For unlisted migratory bird species, the ITP would serve as a Special Purpose Permit should a covered species become listed in the future. The USFWS has determined that take of listed migratory bird species allowed under an ITP will not be in violation of the Migratory Bird Treaty Act of 1918 (USFWS 1996).

1.8.4 National Environmental Policy Act

NEPA, as amended, requires the analysis and full public disclosure of the potential environmental impacts of a proposed federal action. The issuance of an ITP under Section 10(a) by the USFWS constitutes a federal action that requires NEPA compliance. The EIR/EIS for the IID Water Conservation and Transfer Project addresses the effects of issuance of an ITP to IID and fulfills the NEPA requirements associated with this federal action.

1.8.5 Salton Sea Restoration Project

Congress passed Public Law (PL) 102-575 in 1992. The law directs the Secretary of the Interior to "conduct a research project for the development of a method or combination of methods to reduce and control salinity, provide endangered species habitat, enhance fisheries, and protect human recreational values ... in the area of the Salton Sea." The Salton Sea Reclamation Act of 1998 (Public Law [PL] 105-372), developed in response to these conditions, directs the Secretary to do the following:

> *...complete all studies, including, but not limited to environmental and other reviews, of the feasibility and benefit-cost of various options that permit the continued use of the Salton Sea as a reservoir for irrigation drainage and: (i) reduce and stabilize the overall salinity of the Salton Sea; (ii) stabilize the surface elevation of the Salton Sea; (iii) reclaim, in the long term, healthy fish and wildlife resources and their habitats; and (iv) enhance the potential for recreational uses and economic development of the Salton Sea.*

The purpose and need for the Salton Sea Restoration Project is to maintain and restore ecological and socioeconomic values of the Salton Sea to the local and regional human community and to the biological resources dependent upon the Sea. These requirements are reflected in the directives of PL 105-372. The project is intended to have ecological, recreational, and economic benefits.

Prior to implementing the NEPA/CEQA process, the Salton Sea Authority and the Bureau of Reclamation, working jointly with stakeholders and members of the public, developed five goal statements. The goal statements are consistent with the direction contained in PL 105-372, address the underlying purpose and need for the project, and provide guidance for developing project alternatives. The five goals of the Salton Sea Restoration Project are as follows:

1. Maintain the Sea as a repository of agricultural drainage.
2. Provide a safe, productive environment at the Sea for resident and migratory birds and endangered species.
3. Restore recreational uses at the Sea.
4. Maintain a viable sport fishery at the Sea.
5. Enhance the Sea to provide economic development opportunities.

To implement the directive provided in PL 105-372, the Salton Sea Authority, as the lead California agency under CEQA, and Reclamation, as the lead Federal agency under NEPA, released a Draft EIS/EIR in January 2000, that evaluated alternative methods of restoring the Salton Sea. A revised Draft EIS/EIR that includes different alternatives and revised modeling and impact analysis is now being prepared.

1.8.6 California Endangered Species Act

The CESA is part of the California Fish and Game Code (Code). As a guide to state agencies, Section 2053 of the Code states that, " . . . it is the policy of the state that state agencies should not approve projects as proposed which would jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of those species, if there are reasonable and prudent alternatives consistent with conserving the species or its habitat which would prevent jeopardy." The CESA also states, however, that such reasonable and prudent measures must at the same time maintain the project purpose to the greatest extent possible.

Section 2080 of the CESA prohibits import, export, take, possession, purchase, or sale of listed plant and animal species except as otherwise provided in other provisions of the CESA or the Code. The state restrictions under CESA on take differ from those under the ESA in how take is defined. For CESA, take is defined to mean, "hunt, pursue, capture, or kill or attempt the same." Noticeably absent from this definition are certain types of takings prohibited under Section 9 of the ESA (i.e., to harm or harass a listed species). Accordingly, Section 2080 of CESA prohibits the direct take of listed species except as otherwise provided under CESA or the Code, including the Native Plant Protection Act. Take of state-listed species may be authorized under CESA Section 2081. As specifically regards plants, Section 2080 of CESA prohibits the direct take of listed species except as otherwise provided under CESA or the Code, including the Native Plant Protection Act (commencing with Section 1900 of the Code).

1.8.6.1 Section 2081

Under Section 2081(b), the Department may authorize, by permit, the take of state-listed endangered species, threatened species, and candidate species if all of the following conditions are met:

(a) The take is incidental to an otherwise lawful activity.

(b) The impacts of the authorized take are minimized and fully mitigated. The measures required to meet this obligation must be roughly proportional in extent to the impact of the authorized taking on the species. Where various measures are available to meet this obligation, the measures required shall maintain the applicant's objectives to the greatest extent possible. All required measures shall be capable of successful implementation.

(c) The permit is consistent with any Departmental regulations.

(d) The applicant must ensure adequate funding to implement the minimization and mitigation measures, and for monitoring compliance with, and effectiveness of, those measures.

(e) The permit will not jeopardize the continued existence of the species.

The Department will make this determination based on the best scientific and other information that is reasonably available, and shall include consideration of the species' capability to survive and reproduce, and any adverse impacts of the taking on those abilities in light of known population trends; known threats to the species; and reasonably foreseeable impacts on the species from other related projects and activities.

IID is seeking incidental take authorization under Section 2081 for take of state listed and unlisted species (Table 1.5-1) that could occur as a result of O&M activities and activities associated with the water conservation and transfers in the Imperial Valley, Salton Sea and along the AAC. This scope of take authorization is the same as would be authorized by the USFWS under the federal ESA. In addition, IID is seeking authorization under Section 2081 for incidental take of state-listed species that inhabit the LCR and could be affected by the change in the point of diversion of water conserved by IID and transferred to SDCWA or MWD. Appendix F contains the information and analyses necessary for the Department to issue the incidental take permit

1.8.7 California Environmental Quality Act

Similar to NEPA, the CEQA requires state agencies empowered to make discretionary permitting decisions to evaluate the environmental effects of a proposed project. Issuance of a 2081(b) permit constitutes a state action requiring compliance with CEQA. The EIR/EIS for the IID Water Conservation and Transfer project addresses the effects of issuance of a 2081(b) permit to IID and fulfills the CEQA requirements associated with this state action.

1.8.8 California Native Plant Protection Act

The California Native Plant Protection Act (NPPA) includes measures to preserve, protect, and enhance rare and endangered native plants in addition to those provided under CESA. The definitions of rare and endangered in the NPPA differ from those in the CESA, but the list of protected native plants encompasses federal ESA candidate, threatened, and endangered species. The act also includes its own restrictions on take, stating that, "[n]o person shall import into this state, or take, possess, or sell within this state," any rare or endangered native plant, except as provided in the NPPA. The exception is where landowners have been notified of the presence of protected plants by CDFG; they are required to notify CDFG at least 10 days in advance of changing land uses to allow CDFG an opportunity to salvage the plants.

1.8.9 California Fully Protected Species Statutes

Several proposed Covered Species are subject to the provisions of the fully protected species statutes in the California Fish Game Code. The fully protected species statute prohibits the "take" (as defined in the Fish and Game Code) of fully protected species and does not currently include a mechanism for authorizing take of fully protected species. The fully protected species in the HCP area are listed in Table 1.5-1.

CHAPTER 2

Existing Conditions in the HCP Area

2.1 Location and Regional Setting

IID is located in the Imperial Valley in the southeast corner of California, east of Los Angeles and San Diego. Imperial Valley lies within the Salton Trough (Cahuilla Basin), an area of very flat terrain. The Salton Trough encompasses a large portion of the Colorado Desert (a subdivision of the Sonoran Desert, extending through portions of Mexico and Southern Arizona) with much of the area below sea level.

2.2 Physical Environment

2.2.1 Climate

The Imperial Valley is one of the most arid regions in the U.S. The climate of the HCP area is that typical of desert regions, with hot, dry summers and high winds, with occasional thunderstorms and sandstorms. Summer air temperatures typically are above 100°F and can reach 120°F. Winter temperatures generally are mild, usually averaging above 40°F, but frost may occur occasionally.

The prevailing winds in Imperial Valley are from the west. Average wind speeds range from 4 to 7 miles per hour. However, at the Salton Sea, the winds are predominantly from the east in the northern portions of the sea, while in the southern portions of the sea, westerly winds predominate similar to the rest of the Imperial Valley.

The rain fall can occur from November through March, but because the area is in the rainshadow of the Peninsular Ranges, it receives little precipitation. The 85-year average annual rainfall is 2.93 inches. June is the driest month; precipitation in June has only occurred three times during the period of record. Precipitation in the form of snowfall was recorded only once.

2.2.2 Topography

The Salton Trough is a basin and the most dominant landform in Imperial County. Approximately 130 miles long and 70 miles wide, the Salton Trough is a seismically active rift valley, and encompasses the Imperial Valley, the Mexicali Valley, and the Gulf of California in Mexico in the south and the Coachella Valley in the north (Reclamation and SSA 2000). The Salton Sea is in the northern portion of the Salton Trough.

As discussed above, the basin topography is relatively flat with little topographic relief. The Sand Hills are an area of windblown sand deposits that form a 40-mile-long by 5-mile-wide belt of sand dunes extending along the east side of the Coachella Canal from the Mexican border northward. Within the Coachella and Imperial Valleys, an old lake shoreline (Lake Cahuilla) has been identified by the presence of lacustrine deposits. The Imperial Formation, which is marine in origin, underlies the sequence of sedimentary layers within the basin.

19836

The Imperial Formation is underlain by igneous and metamorphic basement rocks (Reclamation and SSA 2000).

In the dry climate of Imperial County, the soils of Imperial County, unless they are irrigated, have no potential for farming (County of Imperial 1997). Lacustrine basin soils in the Imperial Valley formed on nearly level old lake beds in the area of ancient Lake Cahuilla. These soils generally consist of silty clays, silty clay loams, and clay loams and are deep, highly calcareous, and usually contain gypsum and soluble salts. The central irrigated area served by the IID generally has fine-textured silts and is primarily used for cropland. Continued agricultural use of soils within IID required installation of subsurface tile drains to carry away water and salts that would otherwise build up in the soils and prevent crop growth. Tile drains discharge this flow to surface drains (IID 1994). Sandy soils, typical of the deserts in the southwest U.S., are predominant in higher elevations, such as the East and West Mesas, and generally are used for recreation and desert wildlife habitat. The irrigated portion of Imperial Valley generally is flat and has low levels of natural erosion.

The Imperial Valley is located within one of the most tectonically active regions in the U.S., and therefore is subject to potentially destructive and devastating earthquakes. Additionally, the Imperial Valley is susceptible to other geologic hazards including liquefaction and flooding.

2.2.3 Hydrology and Water Quality of the Imperial Valley

Surface water within the Imperial Valley comes primarily from two sources: the Colorado River and inflow across the International Boundary from Mexico via the New River. Agricultural production served by IID is almost entirely dependent on surface water that is diverted from the Colorado River and into the IID distribution system. After application to farm fields for irrigation purposes, the water is collected in drains. The drains transport water directly to the Salton Sea or to the New or Alamo Rivers that discharge to the Salton Sea. With no outlet, the Salton Sea is a terminal sink for drain water from Imperial Valley.

2.2.3.1 Water Quality

Irrigation Delivery Water

The IID water distribution system begins at the Colorado River where water is diverted at the Imperial Dam and conveyed by gravity through the AAC. The AAC discharges water to three major distribution canals in the IID service area - the East Highline, Central Main, and Westside Main Canals. These three canals serve as the main arteries of a system consisting of approximately 1,667 miles of canals and laterals that distribute irrigation water within IID's service area.

About 4.4 MAFY of water per year is diverted into the AAC at Imperial Dam. Of this total, flow measurements (collected form 1986 to 1999 at Drop No. 1, just before the AAC enters the IID Service Area) show that Colorado River irrigation deliveries generally range from approximately 2.4 MAFY to more than 3.2 MAFY. The average annual delivery of irrigation water during the same period is approximately 2.8 MAFY. The remaining balance of diverted water is discharged into the Yuma Main Canal, the Gila Gravity Main Canal, returned to the Colorado River for Mexico's use via Pilot Knob, diverted into the Coachella Canal or is lost to spillage, evaporation or seepage. Colorado River diversions account for approximately 90.5 percent of all water flowing through IID. The remaining water components flowing through IID include: flow from the New River across the International Boundary at approximately 5 percent, rainfall at approximately 4 percent, net groundwater discharge to the irrigation system of less than 1 percent, and flow from the Alamo River across the International Boundary at less than 0.1 percent.

The delivery of Colorado River water to IID is driven by user demand. This demand is not constant throughout the year, but varies because of a combination of influences such as changes in climate and local rainfall conditions, crop cycles, and government crop programs. Demand is typically highest in April and remains fairly high until August when it starts to decline.

Colorado River water imported by IID is either used consumptively, or is collected in surface drains or rivers. Consumptive use includes transpiration by crops and evaporation directly from soil or water surfaces. Approximately 66 percent of the water that is delivered for on-farm use is used for crop production and leaching and roughly 3 percent is lost to evaporation. The remaining water delivered for on-farm use discharges into the IID drainage system as surface runoff or is lost to shallow groundwater.

Drainage Water

The IID drainage system includes a network of surface and subsurface drains. Water entering the drainage system can originate from the following sources:

- Operational discharge (i.e., water that has traveled through portions of the IID water conveyance system and was not applied to land). The main components of operational discharge are canal seepage and canal and lateral spillage. Canal and lateral spillage refers to unused water that is discharged from the delivery system to the surface drains or river systems.
- On-farm tailwater runoff (i.e., surface water runoff occurring at the end of an irrigated field
- On-farm leaching (i.e., water passing the crop root zone that normally enters a tile drain; also referred to as tilewater)
- Stormwater runoff
- Groundwater

Water collected by the tile drainage systems either flows by gravity or is pumped to surface drains, which discharge to the Salton Sea either directly or via the New and Alamo Rivers. With the exception of drainage water that is returned to the fields as irrigation water or flow lost to shallow and deep groundwater aquifers (through deep percolation that is not captured by the tile drains), all flow collected by the IID drainage system is ultimately conveyed to the Salton Sea.

Water applied to the fields in IID serves two purposes: to replenish moisture in the crop root zone and to leach accumulated salts from the soils. According to a recent study by IID, approximately 15 percent of the water applied to IID fields runs off as tailwater. Except in those fields with tailwater recovery systems, this water is no longer available for on-farm use and is discharged into either surface drains or rivers. Approximately 16 percent of irrigation water delivered to fields is used for the leaching of salts accumulated in the soils.

This water percolates to the tile drainage system where it is collected and conveyed to the IID surface drains.

Collectively, tilewater and tailwater drainage accounts for roughly 67 percent (34 and 33 percent, respectively) of all of the IID drainage discharged to the Salton Sea either directly or via the New and Alamo Rivers. The Alamo River receives approximately 61 percent of the discharge from the IID drainage system, and the New River receives roughly 29 percent of the District's drainage. The remaining 10 percent is discharged from the drainage system directly to the Salton Sea. Total IID discharge to the Salton Sea has averaged about 1.16 MAFY during 1986 to 1999. Figure 2.2-1 shows the annual variability of IID's total surface discharge to the Salton Sea during 1986 to 1999.

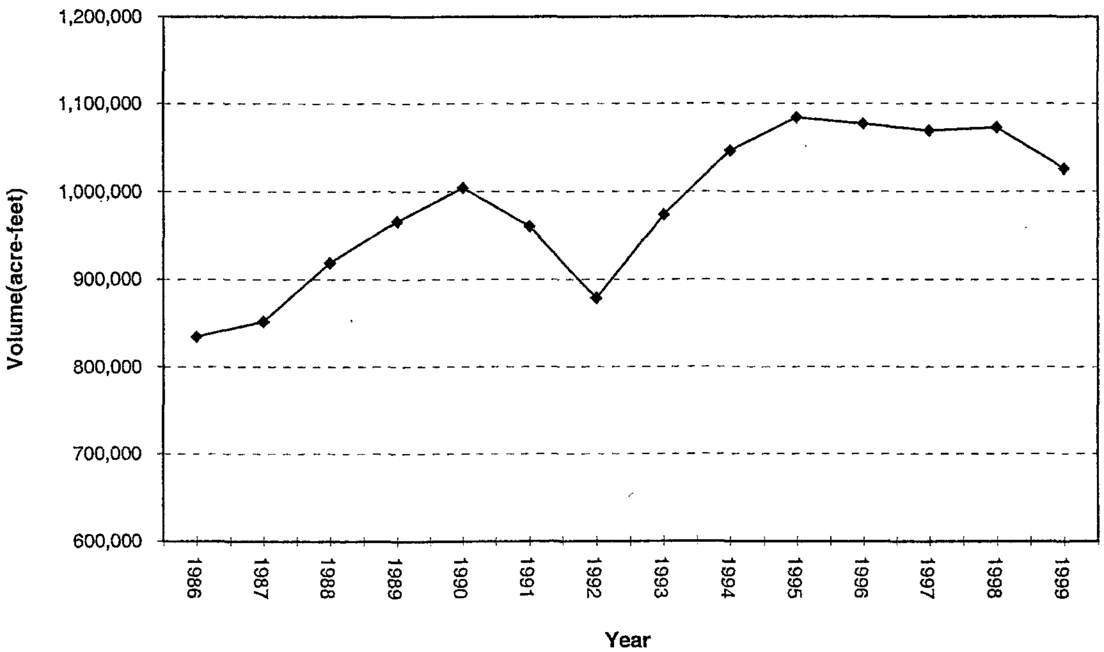

FIGURE 2.2-1
Total Farm Drainage from IID Discharging into the Salton Sea (1986-1999)

Alamo River

The Alamo River enters IID from Mexico. Currently, there is no flow in the Alamo River coming frommexico across the International Boundary because of the installation of a dam at the boundary in 1996 by Mexico. However, the previous 5-year average annual flow volume at the US/Mexico border was less than 2 KAFY. The Alamo River receives drainage from about 58 percent of the IID area and accounts for about 61 percent of IID's drainage discharge. Outflow from the Alamo River tot he Salton Sea is estimated at about 605 KAFY, with about 168 KAF from rainfall; municipal, industrial, and operational discharge; and seepage, 211 KAF from tailwater, and 223 KAF from tilewater.

New River

The New River also enters IID from Mexico, but unlike the Alamo River, the New River serves as an open conduit for untreated sewage, heavy metals, and pesticide residues from northern Mexico. Annual flows are affected by water demand and discharges in Mexico. Flow volumes at the border have changed dramatically over the period of record from a low of 100 KAFY up through the late 1970s, then increasing to 150 KAFY from 1979 through 1982 and from 1983 through 1987 to values higher than 250 KAFY. The average annual flow volume of the New River at the International Boundary during the period 1987 to 1998 was about 165 KAFY, which comprises approximately one-third of the total flow of the New River at its discharge to the Salton Sea. The New River receives nearly 30 percent of the drainage from IID, and accounts for about 29 percent of the total discharge from IID to the Salton Sea. The average annual flow from the New River to the Salton Sea is made up of approximately 81 KAFY from rainfall, municipal and industrial effluent, IID operational discharge, and groundwater seepage; 101 KAFY from tailwater; and 107 KAFY from on-farm tile drainage, for a total of 289 KAFY, with the remainder of the flow coming from Mexico.

2.2.3.2 Water Quality

Water quality in the HCP area is determined by the quality of water diverted from the Colorado River, the water quality of water in the New River as it crosses the International Boundary, and agricultural practices. The following sections summarize water quality information for:

Irrigation delivery water
Drainage water
Alamo River water
New River water

Additional information on water quality conditions in the HCP area is provided in Section 3.2 of the EIR/EIS.

Table 2.2-1 summarizes water quality data for irrigation delivery water, drainage water, New River, and Alamo River water. Information from two data sets is summarized: (1) "Recent" water quality data, and (2) "Long-term" water quality data. The "Recent" water quality data consists of data obtained during a coordinated monitoring effort at the following locations:

- AAC
- Surface drains that discharge to the Alamo River
  - South Central Drain
  - Holtville Main Drain
- Surface drains that discharge to the New River
  - Greeson Drain
  - Trifolium 12 Drain
- New River at the International Boundary
- New River at the outlet to the Salton Sea
- Alamo River at the outlet to the Salton Sea

19840

The water quality information contained in this data set was collected and compiled by the Colorado River Basin Regional Water Quality Control Board from 1996 through 1999. The information represents the most current water quality data available. The data were collected from each of the sampling locations listed above during the same time period.

The "long-term" water quality data set includes data collected during numerous monitoring events from sites located throughout the IID service area. This database was compiled for modeling purposes and was obtained from various sources, including the U.S. Environmental Protection Agency's Storage and Retrieval Environmental Data System, U.S. Geological Service's Water Quality Network, Colorado River Basin Regional Water Quality Control Board, and published and unpublished papers and documents. These sources contained water quality data collected within Imperial County over many years. However, for the modeling associated with the water conservation and transfer programs, the data were limited to those collected between 1970 and 1999.

TABLE 2.2-1
Recent[a] and Long-term[b] Mean Flows and Concentrations for Water Quality Parameters in IID's Service Area

	Colorado River Irrigation Delivery in AAC		New River							Alamo River						
	Long-term 1970-99	Recent 1996-99	Long-term 1970-99			Recent 1996-99				Long-term 1970-99			Recent 1996-99			
Parameter	AAC	AAC	Mexico Border	Surface Drains	Outlet to Salton Sea	Border	Greeson	Trifolium 12	Outlet to Salton Sea	Mexico Border	Surface Drains	Outlet to Salton Sea	Border	South Central	Holtville Main	Outlet to Salton Sea
Daily mean flow (cfs)	3,934	—	250	—	622	—	—	—	—	—	—	843	—	—	—	—
Instantaneous flow (cfs)	—	—	193	—	—	—	—	—	—	2	—	—	—	—	—	—
TDS (mg/L)	771	773	3,894	2,116	2,997	2,676	2,033	2,143	2,743	3,191	2,375	2,458	—	2,269	2,347	2,318
TSS (mg/L)	86	11	117	193	313	52	188	189	241	360	318	479	—	329	175	300
Se (μg/L)	2.5	2.12	3.0	7.4	7.1	ND	5.24	6.03	4.09	5.9	7.9	7.7	—	8.77	5.63	7.53
NO3 (mg/L)	0.28	0.4	0.84	7.49	4.37	0.5	4.2	13.0	4.3	1.87	8.14	7.81	—	9.9	8.3	6.4
Total phosphorus (mg/L)	0.05	0.13	1.42	0.78	0.81	2.00	0.77	0.37	1.26	0.47	0.84	0.63	—	0.74	0.61	0.75
Total P in sediment (mg/kg)	—	—	535	1,300	1,600	—	—	—	—	—	—	1,100	—	—	—	—
DDT (μg/L)	0.001	—	0.088	0.013	0.016	—	—	—	—	0.011	0.020	0.016	—	—	—	—
DDT in sediment (μg/kg)	—	—	0.1	2.6	11.0	—	—	—	—	0.1	14.6	0.1	—	—	—	—
DDD (μg/L)	0.001	—	0.046	0.010	0.017	—	—	—	—	0.011	0.017	0.011	—	—	—	—
DDD in sediment (μg/kg)	—	—	—	5.4	—	—	—	—	—	—	6.3	—	—	—	—	—
DDE (μg/L)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
DDE in sediment (μg/kg)	—	—	9.8	44.1	9.8	—	—	—	—	18.0	15.7	30.0	—	—	—	—

19842

TABLE 2.2-1
Recent[a] and Long-term[b] Mean Flows and Concentrations for Water Quality Parameters in IID's Service Area

	Colorado River Irrigation Delivery in AAC		New River							Alamo River						
	Long-term 1970-99	Recent 1996-99	Long-term 1970-99			Recent 1996-99				Long-term 1970-99			Recent 1996-99			
Parameter	**AAC**	**AAC**	**Mexico Border**	**Surface Drains**	**Outlet to Salton Sea**	**Border**	**Greeson**	**Trifolium 12**	**Outlet to Salton Sea**	**Mexico Border**	**Surface Drains**	**Outlet to Salton Sea**	**Border**	**South Central**	**Holtville Main**	**Outlet to Salton Sea**
Toxaphene (µg/L)	0.001	—	0.272	0.946	0.013	—	—	—	—	0.100	0.995	0.014	—	—	—	—
Toxaphene in sediment (µg/kg)	—	—	10.0	9.5	18.3	—	—	—	—	5.0	26.6	2.5	—	—	—	—
Diazinon (µg/L)	—	—	—	0.025	—	—	—	—	—	—	—	0.025	—	—	—	—
Chlorpyrifos (µg/L)	—	—	—	0.025	—	—	—	—	—	—	—	0.025	—	—	—	—
Dacthal (µg/L)	0.007	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Boron (µg/L)	170	143	1,600	804	1,172	—	456	584	905	1,798	683	695	—	438	609	558

[a] Data collected by the Colorado River Basin Regional Water Quality Control Board during 1996 through 1999.
[b] Data collected during 1970 to 1999 and compiled from various sources (see text for greater explanation).
— Data Not Available
ND Not Detected

19843

Although the long-term water quality data set contained many samples, the data tended to be collected sporadically in time and at readily accessible sites. Thus, even though the time period for sample collection ranges from 1970 to 1999, the samples were not collected at all sites, nor were they collected on a regular basis. Further, the numbers of analyses for any one constituent ranged from very few to several hundred. Because of the lack of good temporal coverage, the data were grouped by month through the entire study period. The data were then grouped spatially and assigned to distinct geographic locations to quantify the flow and constituent concentrations from each of the various sources that flow into and discharge out of the IID service area. As a result, the data are reported as mean concentrations of the cumulative flows at the following locations:

IID irrigation delivery water at the AAC
Alamo River drainage basin

- Alamo River at the International Boundary
- IID surface drain discharge to the Alamo River
- Alamo River at the Salton Sea

- New River drainage basin
  - New River at the International Boundary
  - IID surface drain discharge to the New River

- New River at the Salton Sea

Surface water that is diverted from the Colorado River is the only water available to IID for agricultural use with the exception of rainfall and minor contributions from groundwater sources. The chemical characteristics of the water entering the IID agricultural area change little between the source at the Colorado River and the points where the water enters the delivery systems of the individual fields.

Recent water quality data (1996 to 1999) collected from the AAC shows the following:

- Concentrations for selenium range from 1.94 to 2.42 µg/L, and concentrations for boron range from 110 to 190 µg/L. Mean concentrations for selenium and boron are 2.12 and 142.5 µg/L, respectively.

- The concentration of nitrate as nitrogen ranges from non-detectable (at 0.2 mg/L) to 0.40 mg/L. Phosphorous concentrations range from 0.05 to 0.21 mg/L, and the mean concentration of phosphorus is 0.13 mg/L.

- Mean concentrations for selenium and boron during the period 1970 through 1999 are similar to the concentrations shown in the recent data.

Water quality data for total dissolved solids (TDS) show that the annual mean concentration for the period 1970 through 1999 is 771 mg/L. Mean concentrations in the irrigation delivery water were highest during the late 1970s and early 1980s, with concentrations more than 850 mg/L. Starting in 1983, TDS concentrations in the influent decreased to a low of about 525 mg/L in 1986. The major factor contributing to this fluctuation was the unusually high flows carried by the Colorado River during the mid-1980s. Since 1986, TDS concentrations in

19844

the irrigation delivery water have gradually increased. Recent data from the 1996 to 1999 period show that TDS concentrations range from 720 to 820 mg/L, and the average concentration for TDS during this period is 772.5 mg/L.

Long-term mean concentrations for the organochlorine insecticides DDT, DDD, and toxaphene in IID irrigation delivery water are all at or below detection limits of 0.001 µg/L. The long-term mean concentration for organochlorine herbicide Dacthal is 0.007 µg/L.

Drainage Water

Water entering the drainage system primarily comes from three sources: operational discharge, tailwater, and tilewater. Analysis of water discharging to the drainage system indicates the following:

- Operational discharge is considered to have the best water quality because it is not applied to the land and, thus, it should be similar in quality to water entering the IID service area directly from the Colorado River.
- Tailwater is considered the next best in terms of quality. However, tailwater accumulates certain amounts of sediment and solutes (including agricultural chemicals such as fertilizers and pesticides) from the soil as it flows across the cultivated fields.
- Tilewater is generally considered the poorest of the water sources because dissolved salts and other constituents tend to concentrate in the water as it percolates through the root zone and is collected in the subsurface drainage collection system.

Water quality data has been recently (1996 to 1999) collected for four drains in the HCP area: South Central, Holtville Main, Greeson, and Trifolium 12. South Central and Holtville Main drain to the Alamo River while Greeson and Trifolium 12 discharge to the New River. In addition to these drains, sporadic information is available for a few other drains in the HCP area. Water quality of drain water is discussed separately for each drainage basin.

Alamo River Basin

Recent water quality data for South Central and Holtville Main drain show the following.

- Selenium concentrations in the South Central drain at its outlet range from 5.43 to 11.30 µg/L, and the mean concentration is 8.77 µg/L. Selenium concentrations in the Holtville Main drain range from 4.30 to 10.0 µg/L, and the mean concentration is 5.63 µg/L.
- Boron concentrations in the South Central drain range from 260 to 650 µg/L, and the mean concentration is 438 µg/L. Boron concentrations in the Holtville Main drain range from 330 to 740 µg/L, and the mean concentration is 609 µg/L.
- TDS concentrations in the South Central drain range from 1,510 to 3,000 mg/L, and the mean concentration is 2,269 mg/L. TDS concentrations in the Holtville Main drain range from 1,990 to 3,120 mg/L, and the mean concentration is 2,347 mg/L.
- Mean concentrations for total suspended solids (TSS), nitrate as nitrogen, and phosphorous in the South Central drain are 329, 9.9, and 0.7 mg/L, respectively. Mean concentrations of these constituents in the Holtville Main drain are 175, 8.3, and 0.6 mg/L, respectively.

19845

The recent data set for the South Central and Holtville Main drains is useful for comparing water quality trends and values in these drains. However, data from these two drains may not be representative of the entire Alamo River drainage system.

Long-term mean concentrations for selenium, boron, and TDS in surface drains in the Alamo River drainage basin are 7.9 µg/L, 683 µg/L, and 2,375 mg/L, respectively (Table 2.2.1). Long-term mean concentrations for DDT, DDD, and toxaphene in surface drains in the Alamo River drainage basin are 0.02, 0.017, and 0.99 µg/L, respectively.

New River Basin Drains

Based on the recent water quality data set, the range (minimum and maximum) and mean concentration values for selenium, boron, TDS, TSS, nitrate as nitrogen, and phosphorus in the Greeson and Trifolium 12 drains are discussed below.

- Selenium concentrations in the Greeson drain range from 3.58 to 6.76 µg/L, and the mean concentration is 5.24 µg/L. Selenium concentrations in the Trifolium 12 drain range from 3.01 to 15.0 µg/L, and the mean concentration is 6.03 µg/L.
- Boron concentrations in the Greeson drain range from 240 to 680 µg/L, and the mean concentration is 456 µg/L. Boron concentrations in the Trifolium 12 drain range from 250 to 1,000 µg/L, and the mean concentration is 584 µg/L.
- TDS concentrations in the Greeson drain range from 1,490 to 2,840 mg/L, and the mean concentration is 2,033 mg/L. TDS concentrations in the Trifolium 12 drain range from 1,260 to 4,380 mg/L, and the mean concentration is 2,143 mg/L.
- Mean concentrations for TSS, nitrate as nitrogen, and phosphorous in the Greeson drain are 188, 4.2, and 0.8 mg/L, respectively. Mean concentrations of these constituents in the Trifolium 12 drain are 189, 13.0, and 0.4 mg/L, respectively.

The recent data set for the Greeson and Trifolium drains is useful for comparing water quality trends and values in these drains. However, data from these two drains may not be representative of the entire New River drainage system.

Long-term mean concentrations for selenium, boron, and TDS in surface drains in the New River drainage basin are 7.4 µg/L, 804 µg/L, and 2,116 mg/L, respectively. Long-term mean concentrations for DDT, DDD, toxaphene, diazinon, and chloropyrifos in surface drains in the New River drainage basin are 0.013, 0.010, 0.95, 0.025, and 0.025 µg/L, respectively. Concentration values for DDE and Dacthal in drain discharge to the New River are unavailable for the long-term period. Overall, the long-term constituent concentration values in the New River drains are similar to the long-term concentration values observed in the Alamo River drains.

Flow at the International Boundary with Mexico is less than 1 percent of the Alamo River's discharge to the Salton Sea. As such, water quality and quantity at the Alamo River outlet are almost totally a function of drainage from IID. Based on the recent water quality data set, the range (minimum and maximum) and mean concentration values for selenium, boron, and TDS at the International Boundary are as follows.

- Selenium concentrations range from 3.0 to 10 µg/L, and the mean concentration is 5.9 µg/L.

- Boron concentrations range from 660 to 3,000 µg/L, and the mean concentration is 1,798 µg/L.
- TDS concentrations range from 1,866 to 4,260 mg/L, and the mean concentration is 3,191 mg/L.

Recent water quality data for the Alamo River at its outlet to Salton Sea show the following.

- Selenium concentrations range from 5.5 to 13.0 µg/L, and the mean concentration is 7.53 µg/L.
- Boron concentrations range from 320 to 800 µg/L, and the mean concentration is 558 µg/L.
- TDS concentrations range from 1,920 to 3,300 mg/L, and mean concentration is 2,318 mg/L.
- Mean concentrations for TSS, nitrate as nitrogen, and phosphorous in the Alamo River at the outlet to the Salton Sea are 300, 6.4, and 0.8 mg/L, respectively.

These concentrations are similar to the concentration values found in drains that discharge to the Alamo River.

Long-term mean concentrations for DDT, DDD, toxaphene, diazinon, and chloropyrifos in the Alamo River at the outlet to the Salton Sea are 0.016, 0.011, 0.014, 0.025, and 0.025 µg/L, respectively.

New River

The New River also enters IID from Mexico, but unlike the Alamo, the New River serves as an open conduit for untreated sewage, heavy metals, and pesticide residues from northern Mexico. Recent water quality data for the New River at the International Boundary show the following.

- Selenium was not detected, and boron was not analyzed in water quality samples collected at the International Boundary.
- TDS concentrations range from 1,970 to 3,480 mg/L, and the mean concentration is 2,676 mg/L.
- Mean concentrations for TSS, nitrate as nitrogen, and phosphorous at the International Boundary are 52.2, 0.5, and 2 mg/L, respectively.

Long-term mean concentrations for selenium, boron, and TDS in the New River at the International Boundary are 3 µg/L, 1,600 µg/L, and 3,894 mg/L, respectively. Long-term mean concentrations for TSS, nitrate as nitrogen, and phosphorous at the International Boundary are similar to the concentrations seen in the recent data. Long-term mean concentrations for DDT, DDD, and toxaphene are 0.088, 0.046, and 0.27 µg/L, respectively.

Recent water quality data (1996 to 1999) for the New River at its outlet with the Salton Sea generally show the following:

- Selenium concentrations range from 2.93 to 11.0 µg/L, and the mean concentration is 4.09 µg/L.

- Boron concentrations range from 530 to 1,200 µg/L, and the mean concentration is 905 µg/L.
- TDS concentrations range from 2,320 to 3,740 mg/L, and mean concentration is 2,743 mg/L.
- Mean concentrations for TSS, nitrate as nitrogen, and phosphorous measured in samples collected from the New River outlet to the Salton Sea are 241 mg/L, 4.3 mg/L, and 1.3 mg/L, respectively.

Long-term mean concentrations for selenium, boron, and TDS in the New River outlet to the Salton Sea are 7.1µg/L, 1,172 µg/L, and 2,997 mg/L, respectively. Long-term mean concentrations for DDT, DDD, and toxaphene are 0.016, 0.017, and 0.013 µg/L.

2.3 Biological Environment

2.3.1 Overview of the Biological Environment

The HCP area lies within the California Desert. Before European settlement, the area consisted of native desert vegetation and associated wildlife. Periodically, the Colorado River changed course and flowed northward into the Salton Trough forming a temporary, inland sea. These former seas persisted as long as water entered from the Colorado River, but evaporated when the river returned to its previous course. Thus, despite the periodic occurrence of a lake within the Salton Trough, the HCP area consisted predominantly of a desert ecosystem.

The Salton Sea represents the remnants of the most recent occurrence of flooding by the Colorado River when in 1905 the river breached an irrigation control structure and flowed into the Salton Trough. Initially, the surface elevation of the Salton Sea reached –197 ft mean sea level (msl), but evaporation reduced its elevation to –248 msl by 1920 (USFWS 1999a). By this time, agricultural production had increased in both the Imperial and Coachella Valleys and the Salton Sea was receiving drainage water. In 1924 and 1928, presidential orders withdrew all federal lands below –220 msl "for the purpose of creating a reservoir in the Salton Sea for storage of waste and seepage water from irrigated land in Imperial Valley." Since its formation in 1905, the Salton Sea has been sustained by irrigation return flows from the Imperial and Coachella Valleys.

The availability of a reliable water supply effected by construction of Hoover and Imperial Dams and the AAC, allowed the Imperial Valley to be brought into intensive cultivation. To support agricultural production in the valley, an extensive network of canals and drains was constructed to convey water from the Colorado River to farmers in the valley and subsequently to transport drainage water from the farms to the Salton Sea. The importation of water from the Colorado River and subsequent cultivation of the Imperial Valley radically altered the Salton Trough from its native desert condition. The availability of water in the drains and canals supported the development of mesic (marsh-associated) vegetation and in some locations patches of marsh-like habitats (e.g., along the Salton Sea and seepage from canals). These mesic habitats, in addition to the productive agricultural fields, attracted, and currently support numerous species of wildlife that would be absent or present in low numbers in the native desert habitat. Today, small areas of native desert

19848

habitat persist in the HCP area, but mainly the HCP area supports habitats created and maintained by water imported to Imperial Valley for agricultural production.

2.3.2 Wildlife Habitat

2.3.2.1 Drain Habitat

Wet area habitats within the HCP area are collectively referred to as "drain habitat." Drain habitat in the HCP area occurs in association with the drainage system, conveyance system, in managed marshes on the state and federal refuges and on private duck clubs, and as unmanaged vegetation adjacent to the Salton Sea.

Drainage System

Currently, IID operates and maintains 1,456 miles (cited from IID Memorandum, dated October 4, 2000) of agricultural drains (Figure 2.3-1). These drains typically are unlined, dirt channels with 65 miles of the drainage network in buried pipes. Main drain channels have an average depth of 8-11 feet with a typical side-slope embankment ratio of 1:1. Lateral ditches have an average depth of 7 feet, with a typical side-slope embankment ratio of 1:1. Some drainage channels are steep-sided with sloughing embankments from years of erosion prior to stabilization; others are sloped more gradually. Water flow in drains is determined by the collective irrigation practices on fields adjacent to the drains. Drains contain flows when irrigation occurs and storms may add to flows in the drains. Peak flows occur during storms and during the months of April and May.

Vegetation in the drains is limited to the embankment slope or sediments directly within the drain channel and typically consists of invasive species such as saltgrass, salt bush, bermuda grass, common reed, and salt cedar. Vegetation adjacent to the edge of the water typically is restricted to a narrow strip from 3- to 15-feet wide, with more drought-tolerant vegetation on drain embankments. Some drain banks are devoid of vegetation with only a narrow band of saltgrass or bermuda grass adjacent to the edge of the water. Cattail, bulrushes, rushes, and sedges, occur in drain channels, typically in sparse, isolated patches. More extensive stands of cattail/bulrush vegetation may persist where maintenance activities are infrequent. In addition, stands of common reed and cattails can occur at the mouths of drains where they empty into rivers or the Salton Sea. Table 2.3-2 lists typical plant species occurring in irrigation drains in the Imperial Valley.

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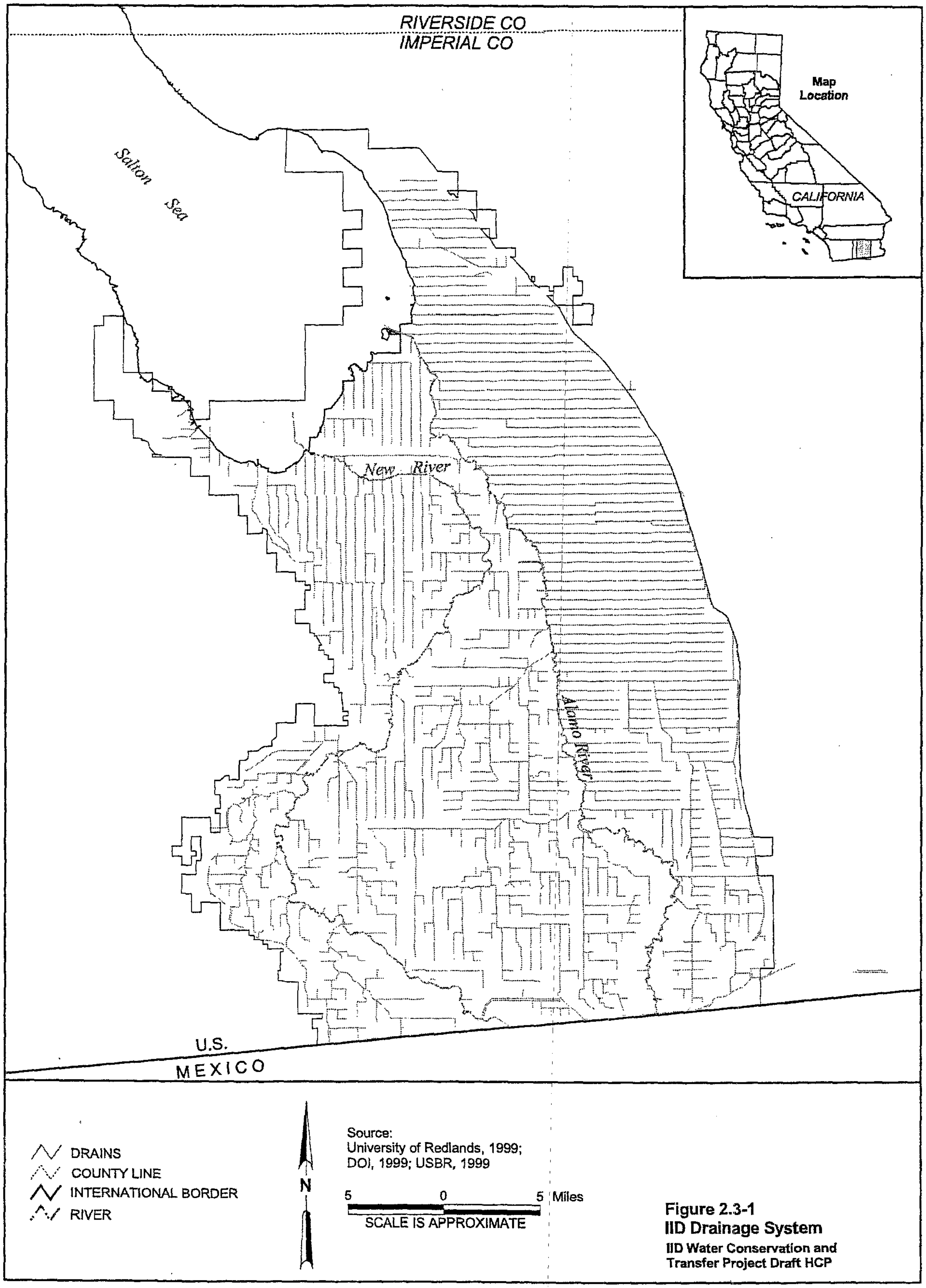


Figure 2.3-1
IID Drainage System
IID Water Conservation and Transfer Project Draft HCP

TABLE 2.3-1
Typical Plant Species Occurring in Drains in Imperial Valley

Species Name	
Adenophyllum porophylloides (false odora)	*Leptochloa uninerva* (mexican sprangletop)
Allenrolfea occidentalis (iodine bush)	*Malvella leprosa* (alkali mallow)
Aristida oligantha (prairie three awn)	*Paspalum dilatatum* (dallisgrass)
Atriplex sp. (saltbush)	*Phragmites communis* (common reed)
Baccharis emoryi (Emory's baccharis)	*Polygonum aviculare* (prostrate knotweed)
Bassia hyssopifolia (five-hook bassia)	*Polygonum* sp. (knotweed)
Carex sp. (sedge)	*Polygonum* sp. (beard grass)
Chamaesyce melanadenia (prostrate spurge)	*Prosopis* sp. (mesquite)
Croton californicus (croton)	*Psilostrophe cooperi* (paper-daisy)
Cryptantha sp. (popcorn flower)	*Rumex crispus* (curly dock)
Cynodon dactylon (desert tea)	*Salsola tragus* (Russian thistle)
Eriogonum sp. (buckwheat)	*Scirpus* sp. (bulrush)
Heliotropium curassavicum (alkali heliotrope)	*Sesbania exaltata* (Colorado river hemp)
Juncus sp. (rush)	*Suaeda moquinii* (sea-blite)
Lactuca serriola (prickly lettuce)	*Tamarix* sp. (salt cedar)
Larrea tridentata (creosote bush)	*Typha* sp. (cattail)
Leptochloa fascicularis (bearded sprangletop)	

Sources: IID 1994; Reclamation and SSA 2000.

Maintenance activities associated with the drains include ensuring the gravity flow of tilewater into the drains, maintaining conveyance capacity and efficiency, and maintaining structural integrity of the drains. Vegetation is cleared from drains primarily via mechanical means; occasionally vegetation is controlled by prescribed burns or by chemical and biological control methods. Drains are cleaned on an as-needed basis, depending on the extent of sediment and vegetation accumulation. Drains with the lowest gradient accumulate sediment more rapidly and may require cleaning annually. Other drain segments may not require cleaning for periods of 10 years or more. Maintenance activities limit the extent of vegetation supported in the drains.

As part of the development of an EIR for IID's Modified East Lowline and Trifoloium Interceptors, and Completion Projects (IID 1994), drains were surveyed in areas potentially affected by the projects (Figure 2.3-2). In all, about 506 miles of drain were surveyed. For each drain, the general vegetation characteristics were described with particular emphasis given to patches of cattail or bulrush vegetation. Although no quantitative data were collected, the surveys allow a qualitative assessment of the habitat conditions supported by the drains. Descriptions of the habitat conditions of the drains surveyed for the Lowline and Trifolium Interceptor, and Completion Projects project are provided in Table 2.3-2.

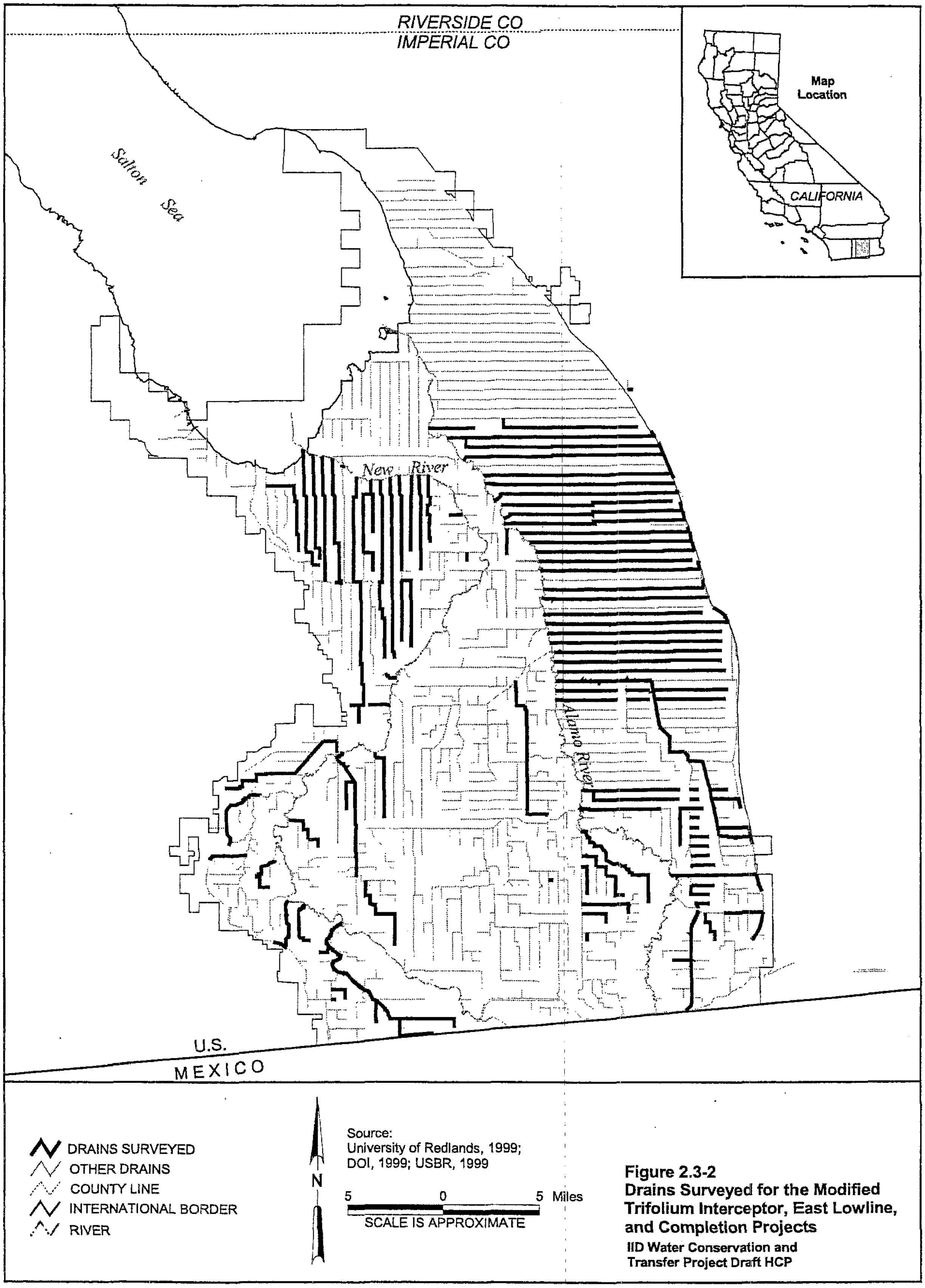
Hurlbert (1997) also surveyed drains in the HCP area. In this study, the percent cover for each of the major plant species (e.g., *Phrgamites*, *Tamarix*, *Pluchea*, *Typha*, and *Atriplex*) and habitat type (e.g., herbaceous, bare ground, and other) was estimated in 10 drains. Each drain was surveyed by driving its length and stopping every 0.1 mile. At each stop, percent

19851

coverage for each major vegetation species (*Phragmites, Tamarix, Pluchea, Typha,* and *Atriplex*) or habitat type (herbaceous, bare ground, and other) was determined within the area extending 100 feet on either side of the point. The survey was conducted in the winter (late 1994/early 1995) and spring (late May 1995). Based on these data, Hurlbert (1997) calculated the average percentage cover of each major vegetation species in each drain separately for the winter and spring surveys. The 10 drains surveyed were distributed throughout Imperial Valley and covered about 78 miles (Figure 2.3-3)[1].

Hurlbert (1997) summarized the data in two ways. First, the percentage of the total drain covered by the major vegetation species and cover categories was calculated (Table 2.3-3). This method provides the most accurate characterization of the plant species composition and percentage of the drain supporting vegetation. The second method of summarizing the data focused on habitat characteristics rather than plant species composition. In this method, survey locations with less than a median of 15 percent vegetation cover were classified as bare ground/herbaceous. Survey locations with between 15 and 37.5 percent vegetation cover were classified as sparse cover.

[1] Data for P Drain are believed to be reported incorrectly in Hurlbert (1997), and data from this drain were not used in this analysis. Without inclusion of P Drain, about 70 miles of drains were surveyed.



Source:
University of Redlands, 1999;
DOI, 1999; USBR, 1999

Figure 2.3-2
Drains Surveyed for the Modified Trifolium Interceptor, East Lowline, and Completion Projects
IID Water Conservation and Transfer Project Draft HCP

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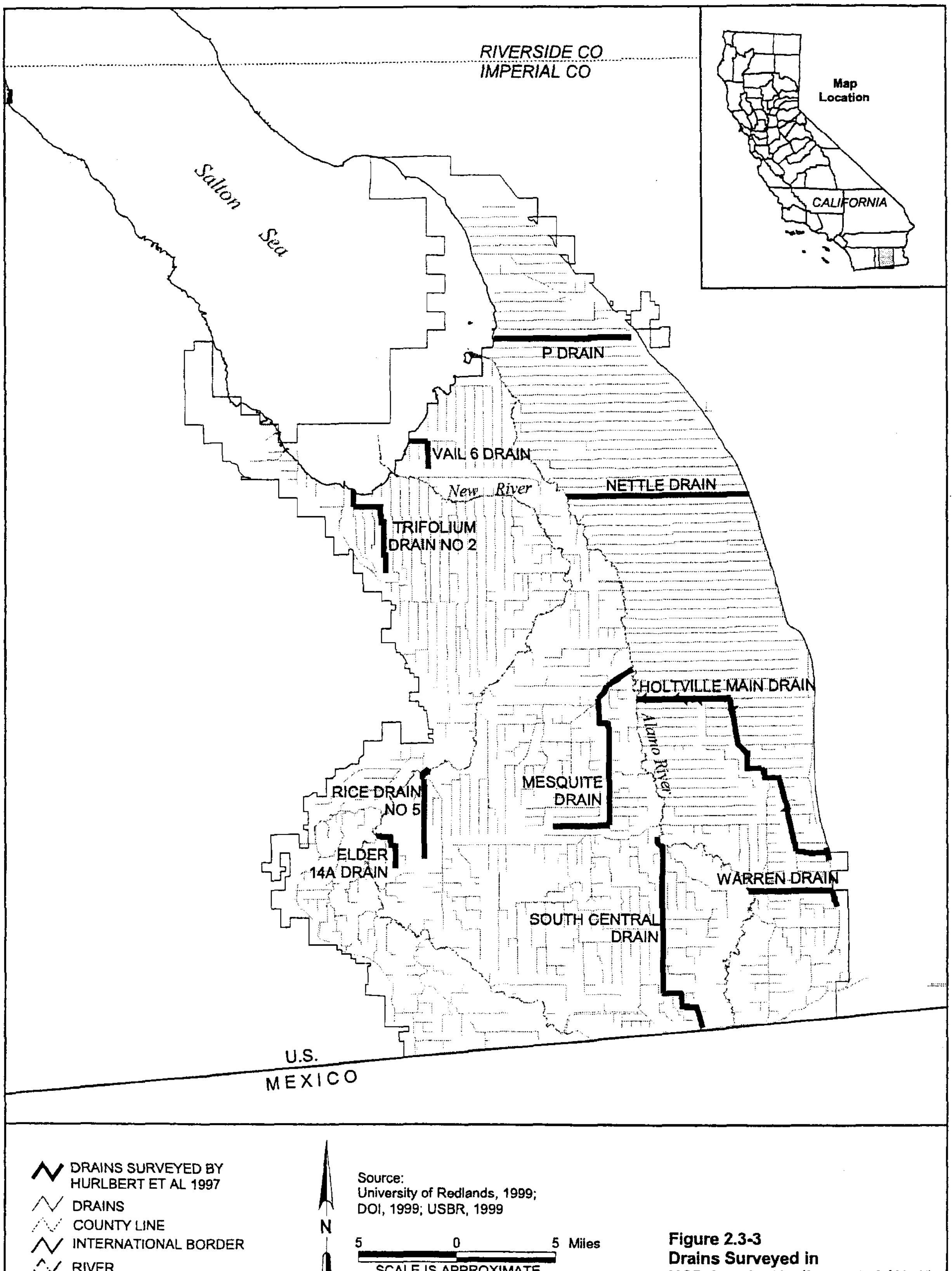

Figure 2.3-3
Drains Surveyed in HCP Area by Hurlbert, et al (1997)
IID Water Conservation and Transfer Project Draft HCP

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TABLE 2.3-2
Habitat Along Drains in the Imperial Valley

Drain	Habitat Description
Mulberry	The upstream reach of the Mulberry Drain along Rutherford Road is characterized by a narrow, deep channel, lined with rabbits-foot grass, saltgrass, and patches of bulrush. The banks of the drain are largely vegetated along the reach upstream from the drop structure near the Alamo River, although some of the vegetation was killed by herbicide. A drop structure is located about 150 feet upstream from the confluence with the Alamo River. A few scattered salt cedars and salt bushes are found on the banks of the drain channel in a highly disturbed area of mostly barren ground. The drain drops more than 10 feet to the river level. Erosion and bank slumping contribute to the barren banks in this area.
Malva II	The upper parts of the Malva II Drain are very steep-sided and exhibit bank sloughing and little vegetation. Drain bank slopes in the lower reach of the drain west of Park Road are dominated by stands of common reed and bands of bermuda grass or saltgrass. The common reed has been largely killed by herbicide application. A drain channel nears the Alamo River, there are two drop structures with a total drop of about 10 feet upstream from the discharge to the Alamo River. There are several small stands of cattails in the lower reach near the confluence.
Mayflower	The Mayflower Drain has saltgrass as the dominant cover along the steeply cut banks upstream of the first drop structure. Between the drop structure and the Alamo River, the banks of Mayflower Drain have thick stands of common reed and patches of saltgrass. The lower reach of this drain passes through a remnant band of creosote bush scrub before entering a salt cedar stand near the Alamo River. This drain is filled with a dense stand of cattails.
Marigold	The banks of the Marigold Drain are highly disturbed in the lower reach. Debris and grading of the banks have removed most of the vegetation near the Alamo River. Farther upstream are thin banks of saltgrass and dense patches of common reed occur along the banks. The drain passes through agricultural lands or barren ground near the river.
Standard	Upstream from the Alamo River, the Standard Drain forms a narrow channel that parallels the perimeter road of the recently graded basins of the Upper Ramer Lank unit of the State Wildlife Management Area. A 4-foot drop structure is located at the point where the drain passes under the Southern Pacific Railroad tracks. The banks are either barren or have a saltgrass and bermuda grass cover along most of the channel. The banks' slopes are either steeply cut or shallow. Scattered stands of common reed are found on the banks. Further upstream, salt and bermuda grass form the dominant cover along the narrow channel.
Narcissus	Near the State Imperial Wildlife Management Area headquarters, the operational discharge of the Narcissus lateral enters the drain. The banks of this drain are densely vegetated with common reed, saltgrass, and several date and fan palms near the refuge buildings. The Narcissus Drain parallels the access road around the perimeter of Lower Ramer Lake. The drain is mostly a shallow cut, less than 3 feet deep and is adjacent to remnants stands of creosote bush scrub. Near the drain are scattered stands of iodine bush. The lower portion of the drain has a thin strand of curly dock mixed with the saltgrass along the channel. Two drop structures are located near the confluence with the Alamo River. On the Alamo River floodplain, the drain passes through a thick stand of salt cedar that forms the riparian zone.
Nettle	Near the confluence with the Alamo River, the banks of the Nettle Drain are generally covered by stands of common reed and saltgrass. The drain cuts deeply to the river, with the upper slopes largely barren and the lower half of the slope covered by salt and bermuda grasses. There are scattered stands of salt bush and common reed along the banks. The lateral operational discharge enters the drain near the railroad tracks.

TABLE 2.3-2
Habitat Along Drains in the Imperial Valley

Drain	Habitat Description
Nutmeg	A thin stand of saltgrass and scattered stands of common reed are found along most of this drainage channel. The common reed stands have been sprayed with herbicide.
Nectarine	Nectarine Drain is characterized by largely barren bank slopes or patches of salt or bermuda grass for most of its length. Along the lower reach near the Alamo River, the drain has scattered common reed stands and enters the river in a shallow trough. In the Alamo River floodplain, the drain passes through salt cedar thickets, but is largely an open channel.
B Drain	B Drain is lined with stand of common reed and saltgrass along the reach from the proposed interceptor to the junction of B Drain and C Drain. The drain is generally narrow and steeply cut.
C Drain	Vegetation along C Drain is mostly saltgrass and stands of common reed. Some sections appear to be dead from herbicide spray. The extent of the saltgrass on the bank slopes along most of this drain has been controlled by herbicide.
D Drain	The drainage channel has recently been dredged in the section along State Highway 115 (Eddins Road) west of Calipatria. Dredge spoil along the canal embankment contains common reed and saltgrass. The D Drain flows parallel to Highway 115 to the confluence with the Alamo River; west of Brandt Road, D Drain is a pipeline to the Alamo River. The drain passes through a thin stand of salt cedar near the highway bridge.
Spruce No. 4	Spruce No. 4 is characterized by broad and gently sloped banks with patches of bermuda grass. Drain banks are largely devoid of vegetation along the reach upstream from the drop structure near the new River. A drop structure is located about 150 feet upstream from the confluence with the New River in an area of barren cliff banks. The drain drops more than 20 feet to the river level where there are stands of salt cedar forming the New River riparian corridor. Erosion and bank slumping contribute to the barren banks.
Spruce No. 5	Spruce No. 5 is dominated by common reed stands in the lower reach near the New River. Although it is deeply cut near the end of the drain, the upper stream reaches are broad and open and dominated by a salt and bermuda grass cover with a few salt bushes near the top of the slope.
Pinner	Saltgrass is the dominant cover along the banks upstream from the drop structure. Between the drop structure and the New River, the banks of Piner Drain have debris and rubble piles or are largely barren. No common reed is present, but new stands of salt cedar are becoming established.
Tamarack	A cover of salt and bermuda grasses forms the dominant cover along the bank of this drain near the New River. There are only a few stand of common reed or salt cedar and even fewer salt bush clumps. The channel is only about 3 feet wide along most of the drain.
Timothy	Upstream from the New River, this drain forms a narrow channel. A drop structure is located 200 feet upstream from the confluence. The banks are either barren or have a saltgrass bermuda grass cover along most of the channel. The banks are steep with stands of common reed and some salt bush. Farther upstream, salt and bermuda grasses form a dominant cover on the slope.
Trifolium No. 2	The banks of this drain have been denuded of most vegetation in lower reaches near the river. There is bank slumping and disturbance along the channel, and considerable rubble and debris on both bank slopes. Near the river is a thin stand of salt cedar and mostly barren riparian zone.

TABLE 2.3-2
Habitat Along Drains in the Imperial Valley

Drain	Habitat Description
Trifolium No. 3	Near the New River, the banks of the drain are generally covered by stands of common reed and saltgrass. The drain cuts deeply to the river, with the upper slopes largely barren and the lower half of the slope covered by salt and bermuda grasses. There are scattered stands of salt bush and common reed along the banks.
Trifolium No. 4	There are lines with stands of common reed and saltgrass along most of channel. It is fairly open as there is a wide bench between the channel and the slope. The bench and slopes are mostly covered by saltgrass or bermuda grass and few stands of common reed. Near the end of the drain at the New River, the drain is deeper with a n arrow 2- to 4-foot-wide channel at the bottom. The vegetation in the lower reach appears to have been sprayed with a herbicide.
Trifolium No. 5	This broad drainage channel has salt cedar and common reed along the banks. Near the New River, the drain passes through salt cedar thickets.
Trifolium No. 6	This deep drain channel is covered by common reed from the point downstream from the lateral spill to the confluence with the New River. Upstream from the lateral spill, additional stands of common reed occur.
Trifolium No. 7	Vegetation along Trifolium No. 7 is mostly saltgrass and stands of common reed; some vegetation appears to be dead from herbicide spray. The extent of the saltgrass cover on the bank slopes may also be limited by herbicide application.
Trifolium No. 8	The drainage channel is lined with salt cedar or is barren as a result of herbicide use. Near the channel alignment bend at the junction of Foulds Road and Lack Road, common reed and saltgrass line the banks of the 4- to 6-foot-wide ditch. Flow in the lower reach of the drain is augmented by spillage from the lateral at Gate 180E.
Trifolium No. 9	The upper reach is the broad channel about 6- to 8-feet-wide lined with saltgrass or common reed, although extensive portions appear to have been sprayed with herbicide. Spillage from the lateral mixes with the drain about 200 yards upstream of the New River. Portions of the lower channel are barren.
Trifolium No. 10	The channel width of Trifolium No. 10 is about 2 to 3 feet near Foulds Road and is lined with saltgrass, bermuda grass, and scattered stands of common reed. Near the end of the drain are trunks of dead salt cedar and stands of common reed that appear to have been killed by herbicides.
Trifolium No. 11	The drainage channel is about 7-feet wide near the confluence with the New River. The banks along the drain are lined with saltgrass and stands of common reed.
Trifolium No. 12	Along the lower reach of Trifolium No. 12, north of Foulds Road, the drain is lined with thick stands of common reed and salt cedar. To the west are thick stands of salt cedar bordering ponds of the NWR and private duck clubs. Before reaching the New River, the drain bends toward the Salton Sea and flows parallel to the New River and passes through cattail stands.
Barbara Worth	Predominantly barren channel with small patches of salt cedar and salt bush. A dense thicket of salt bush and salt cedar borders the top of the drain.
Ash Lat. 18	Typical vegetation found in this drain consists of saltgrass, bermuda grass, salt bush, and salt cedar.
Ash No. 34	Saltgrass and bermuda grass are the dominant vegetative features of this drain, carpeting the lower edges of the banks.
Ash No. 30	The banks of the drain are barren except for the lower edges, where a band of saltgrass and bermuda grass lines the channel to the water line.

TABLE 2.3-2
Habitat Along Drains in the Imperial Valley

Drain	Habitat Description
Ash Lat. 37	Saltgrass and bermuda grass are the dominant vegetation features of this drain, covering the lower edges of the channel banks.
Schenk No. 6	Typical vegetation found in this drain consists of saltgrass, bermuda grass, and salt bush.
Ash No. 25	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, salt bush, common reed, and mallow.
South Central No. 2-B	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, salt bush, common reed, and mallow.
EHL No. 1	This contains vegetation common to drains and ditches in this area, such as common reed, saltgrass, bermuda grass, salt bush, and mallow.
EHL No. 6	This contains vegetation common to drains and ditches in this area, such as common reed, saltgrass, bermuda grass, salt bush, and mallow.
EHL No. 7	This contains vegetation common to drains and ditches in this area, such as common reed, saltgrass, bermuda grass, salt bush, and mallow
Bonds Corner	At the proposed interceptor location, common reed is the dominant vegetative type in this drain. Saltgrass is found at the lower edges of the banks along the water line.
Verde No. 1	This contains vegetation common to drains and ditches in this area, such as common reed, saltgrass, bermuda grass, salt bush, and mallow.
Verde No. 2	This contains vegetation common to drains and ditches in this area, such as common reed, saltgrass, bermuda grass, salt bush, and mallow.
Whitcomb No. 3	Typical vegetation found in this drain includes common reed, saltgrass, bassia, salt bush, and juncus. Common reed is found in thick stands at scattered locations along this drain.
Hemlock Lat. 4	This contains vegetation common to drains and ditches in this area, such as common reed, saltgrass, bermuda grass, salt bush, and mallow.
Peach	Typical vegetation found in the drain includes saltgrass, salt bush, bermuda grass, and mallow.
Pampas	Salt cedar and common reed are found intermittently along the banks. Saltgrass and bermuda grass form a carpet along the lower edges.
Palmetto	Saltgrass and bermuda grass are the dominant plant species found in this drain. Salt cedar, salt bush, and common reed can be found interspersed along the banks.
Pear No. 2	The banks of this drain are predominantly bare, except for the lower edges, which are covered with a thick layer of saltgrass and bermuda grass. Salt bush is found occasionally along the top of the banks.
Warren	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
EHL No. 8	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
EHL No. 10	Saltgrass and bermuda grass form a dense cover along the bottom and lower edges of this drain, obscuring the water level. Mexican sprangletop and salt bush are found occasionally mixed within this stand.

TABLE 2.3-2
Habitat Along Drains in the Imperial Valley

Drain	Habitat Description
EHL No. 11	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
EHL No. 12	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
EHL No. 13	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
EHL No. 14	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
EHL No. 15	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
Orita	Vegetation cover in this drain is predominantly saltgrass and bermuda grass.
Ohmar	The banks of this drain are mostly covered by saltgrass and bermuda grass, with patches of heliotrope, salt bush, and bassia growing along the upper reaches of the bank.
Orange	Dominant plant species along this drain are saltgrass and bermuda grass, forming a dense carpet along the lower edges. Small stands of salt bush and five-hook bassia are interspersed along the drain.
Oxalis	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
Olive	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
Orchid	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
Holtville	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
Occident	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
Orient	This contains sparsely vegetated with salt cedar and salt bush. Past herbicide use is evident by the dead vegetation along the upper reaches of the bank.
Munyon	Dominant plant species along this drain are common reed, salt bush, and saltgrass. Saltgrass and bermuda grass form a dense carpet along the lower edges of the bank in spots. In the Alamo River floodplain, a section of this drain has extensive debris piles along the tops of its banks.
Myrtle	Typical vegetation found in this drain are salt cedar, salt bush, saltgrass, and bermuda grass. The saltgrass and bermuda grass inhabit the lower edges of the drain towards the water line, forming a thick layer.
Mullen	Saltgrass and bermuda grass cover the lower edges of this drain, with salt bush and curly dock interspersed among the sloping banks.
Maple	This is vegetated primarily with saltgrass and salt bush, with some juncus growing along the water's edge.
Mesquite	Common reed is the dominant cover type in this drain, forming dense stands in some areas. Salt cedar and saltgrass are also found interspersed among the common reed.

TABLE 2.3-2
Habitat Along Drains in the Imperial Valley

Drain	Habitat Description
Magnolia	Dominant plant species along this drain are common reed and salt bushy. In some sections of the drain, common reed was growing so densely as to obscure the bottom.
Moss	A light covering of saltgrass covers the lower half of this drain along the steep banks. Common reed has also established itself along this drain, occasionally growing in thick patches.
Oak	At the proposed interceptor location, the banks of this drain are predominantly bare with scattered patches of saltgrass and bermuda grass.
Osage	This contains vegetation common to drain sand ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
Lewis	This contains vegetation common to drains and ditches in this area, such as saltgrass, bermuda grass, common reed, salt bush, and mallow.
Orita	Vegetation cover is predominantly saltgrass and bermuda grass.
North Central	The banks of this drain were typically vegetated only at the bottom with saltgrass and bermuda grass. Some sections of the drain contained a thick stand of common reed, while other sections were bare banks with plant species such as mallow and heliotrope interspersed along the top.
Rice	The dominant plant cover in this drain was a mat of saltgrass and bermuda grass. Other plant species include heliotrope, salt bush, and mexican sprangletop.
Rice No. 3	At this proposed interceptor location, the banks of this drain were predominantly bare, with only scattered occurrence of established plants such as mallow or salt bush.
Rice No. 4	Saltgrass and bermuda grass are the dominant vegetative feature of this drain, covering the lower edges of the banks.
Rice No. 14	Saltgrass and bermuda grass are the dominant vegetative feature of this drain, covering the lower edges of the banks.
Wildcat	Dominated by saltgrass and bermuda grass on the lower edges of its banks, with a few sparse patches of salt bush and baccharis growing along the slopes.
Cook	Common plant species found along this drain include common reed, mexican sprangletop, and saltgrass, which form a dense cover on the lower edges.
Sumac	At the proposed interceptor location, the western portion of the canal is heavily vegetated, primarily with salt bush and salt cedar.
Fillaree	At the proposed interceptor location, this drain is heavily vegetated with salt bush as the dominant cover type. Saltgrass, bermuda grass, and some salt cedar are interspersed along the lower edges of the banks.
Dixie	Common reed and salt bush are the dominant vegetation types in this drain. Sparse patches of cattail and sedge also grow along the water line and bottom of this drain.
Dixie No. 1	This is primarily vegetated with salt cedar and salt bush. Cattail, saltgrass, and bermuda grass also grow along the banks. Farther east, the banks along Dixie Drain No. 1 became deeply cut with steep slopes. Most of the vegetation occurs in the bottom of the drain channel, forming a dense thicket of salt cedar and salt bush.
Dixie No. 5	Vegetation along Dixie No. 5 is mostly saltgrass and bermuda grass; however, some sections of this drain are heavily vegetated with cattail and sedge. Salt bush, salt cedar, bassia, and mexican sprangletop also occur along this drain.

TABLE 2.3-2
Habitat Along Drains in the Imperial Valley

Drain	Habitat Description
Fern Canal	The banks of this drain are primarily vegetated with dead and live bassia, salt bush, and saltgrass.
Fig	Plan species common to this drain include salt cedar, common reed, saltgrass, and sedge. Small, intermittent patches of saltgrass and sedge occur close to the water line.
Wormwood	Light coverings of saltgrass and bermuda grass occur on the predominantly barren banks. Salt bush, mexican sprangletop, common reed, and salt cedar are also found in varying densities along the length of this drain.
Greeson	Dominant vegetation in this drain include saltgrass, bermuda grass, and mexican sprangletop. These species grow toward the lower edges of the banks, creating a dense cover at the water line.
Greeson No. 2	Saltgrass and bermuda grass grow in a thick layer along the lower edges of this drain. Sparse patches of cattail and sedge occur intermittently.
Martin	Thick stands of cattail occur in this drain, while salt bush forms a border near the tops of the banks. In section of this drain, the emergent vegetation obscures the drain channel.
Brockman	Vegetation consists of predominantly saltgrass and bermuda grass growing at the lower edges of the bank slopes.
Brockman No. 2	Vegetation consists of predominantly saltgrass and bermuda grass growing at the lower edges of the bank slopes.
Carr	The banks slopes are largely barren, with patches of mexican sprangletop and saltgrass growing along the water's edge. Mallow and salt bush occur sparsely on the tops of the banks.
All American No. 11	The dominant plant species in this drain is saltgrass, which occurs in thick mats along the water line. Small clumps of salt bush and mexican sprangletop also occur along the banks.

Survey locations with 37.5 percent vegetation cover or greater were classified according to the dominant vegetation species (Table 2.3-4). Values reported in Tables 2.3-3 and 2.3-4 are the average of winter and spring surveys.

Hurlbert's (1997) quantitative data are consistent with the qualitative descriptions of the drains reported in the 1994 EIR (IID 1994). The first method used to characterize vegetation showed that herbaceous cover and bare ground comprised the majority of the drains (median equals 82.7 percent, range 43.6 to 94 percent). With the exception of Holtville Main Drain, herbaceous cover and bare ground comprised about 75 to 95 percent of the drains. The second method used to characterize drain habitat showed a similar pattern. Bare ground/herbaceous cover and sparse cover comprised 72 to 96 percent of the drains, except for the Holtville Main Drain where these habitats covered only 35 percent of the drain.

TABLE 2.3-3
Percentage of Drain Area Comprised of Each Major Plant Species or Other Habitat Type for the 10 Drains Surveyed by Hurlbert (1997)

Vegetation Cover	Drains									
	Vail Cut-off	Trifolium No. 2	Elder Nos. 14/14A	Rice No. 5	Nettle	Holtville Main	Warren	South Central	Mesquite	P[a]
Herbaceous	70.7	44.9	32.2	29.2	55.5	22.9	46.3	40.7	34.9	*34.9*
Bare ground	18.9	31.7	58.9	64.8	31.3	20.7	33.0	41.9	45.8	*45.8*
Atriplex		0.6				2		1.1	3.2	*3.2*
Phragmites	7.5	3.5	2.1	3.3	10.6	7.7	12.9	3.5	0.9	*0.9*
Pluchea		8.7		0.9	0.7	6.8		4.6	5.2	*5.2*
Tamarix		7.6	0.5			29.6	1.0	0.5	3.0	*3.0*
Typha						6.3	1.5	3.8	1.1	*1.1*
Other	2.7	2.9	6.3	1.7	1.7	3.8	5.1	3.7	6.1	*6.1*

[a] Numeric values reported of percent vegetation for P Drain are identical to Mesquite Drain and are inconsistent with other information presented for P Drain. Thus, these values are believed to be incorrect.
Source: Hurlbert 1997.

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TABLE 2.3-4
Percent of Different Habitat Types Occurring at Survey Points Along Drains Surveyed by Hurlbert (1997)

	Drains									
Habitat	**Vail Cut-off**	**Trifolium No. 2**	**Elder Nos. 14/14A**	**Rice No. 5**	**Nettle**	**Holtville Main**	**Warren**	**South Central**	**Mesquite**	**P**
Bare Ground/ Herbaceous	79.2	41.0	88.0	89.2	58.2	13.5	59.1	61.9	48.8	64.3
Sparse cover	6.3	31.4	8.0	4.9	19.8	22.2	17.2	20.0	36.0	17.1
Phragmites	14.6	2.9	4.0	3.6	19.6	9.4	19.8	3.5	1.2	7.1
Pluchea	0	13.3	0	0	1.5	6.4	0	6.2	6.0	5.5
Tamarix	0	10.5	0	0	0	35.1	0	0.5	0	0
Phragmites/Pluchea	0	0	0	2.5	0.5	0	0	0.5	0	5.5
Atriplex	0	0	0	0	0.5	0	0	0.5	0.4	0
Typha	0	0	0	0	0	7.6	0	0	0.8	0
Tamarix, Pluchea	0	0	0	0	0	3.2	0	6.7	0	0
Phragmites, Tamarix	0	1.0	0	0	0	0	3.9	0	0	0
Tamarix, Typha	0	0	0	0	0	1.8	0	0	0	0
Tamarix, Other	0	0	0	0	0	0.8	0	0	0	0
Pluchea, Atriplex	0	0	0	0	0	0	0	0	0	0.7
Other	0	0	0	0	0	0.4	0	0.5	6.8	0

Source: Hurlbert 1997.

19863

The qualitative descriptions from the 1994 EIR and Hurlbert (1997) data show that vegetation typically is very limited along the drains.

Both studies also indicate that common reed (*Phragmites* sp.) is the most prevalent plant species. Cattails are uncommon and occur in small, localized areas. With the exception of small, localized areas of cattails and occasionally bulrushes, the drains do not support emergent vegetation. As such, habitat availability and quality for marsh-associated species are poor.

The data reported by Hurlbert (1997) were used to estimate the acreage of vegetation supported by IID's drainage network. Hurlbert (1997) only characterized vegetation between the drain banks. A standard lateral drain (excluding the water surface) is about 14 feet wide at the top of the drain embankment (Figure 2.3-4). Assuming all drains are 14 feet wide, the 1,456 miles (cited from IID Memorandum, dated October 4, 2000) of drains in the Imperial Valley cover 2,471 acres. However, as described above, potential habitat includes only a small proportion of the drains. The average percent cover of bare ground and herbaceous cover[2] was calculated for each of nine drains from data in Hurlbert (1997).[3] The remaining portion of the drain was assumed to be vegetated. It was then assumed that the drains surveyed were a representative sample of all drains in the Imperial Valley. Acres of vegetation supported by the entire drainage system were calculated based on the percentage vegetation supported by the drains surveyed weighted by the drain's length. With this method, an estimated 652 acres of vegetation are supported in the drains.

As noted above, the nine drains surveyed were assumed to be a representative sample of the entire drainage system. This assumption may not be accurate but is necessary in the absence of more complete information. In particular, the Holtville Main Drain is an unusual drain. Good water quality combined with the drain's large size results in Holtville Main Drain supporting substantially more vegetation than is typical for drains. As shown by Hurlbert's data, Holtville Main Drain is 56 percent vegetated while the next most vegetated drain (Trifolium 2) is only 23 percent vegetated. The remaining drains surveyed have less vegetation. Holtville Main Drain was also the longest drain surveyed at 17.8 miles followed by South Central Drain at 12.2 miles. Because the estimate of the amount of vegetation in the drainage system was derived from the percentage of vegetation in each of the drains surveyed weighted by their lengths, inclusion of Holtville Main Drain (the longest drain with an atypical amount of vegetation) may have resulted in an overestimation of the amount of vegetation in the entire drainage system.

Only a small proportion of the vegetated acreage consists of cattails which are favored by wildlife species associated with drain habitats. The Holtville Main Drain had the greatest percentage of cattails at 6.3 percent followed by the South Central, Warren, and Mesquite Drains at 3.8, 1.5, and 1.1 percents, respectively. The remaining five drains did not support cattails. For the nine drains, the average percent cover of cattails weighted by drain length was 2.5 percent. Based on this average, the entire IID drainage system supports about 63 acres of cattail vegetation.

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2 Herbaceous cover consists of annual weedy vegetation that provides little or no habitat value to wildlife.

3 As noted in Table 2.3-4, data presented for P Drain in Hurlbert (1997) are believed to be incorrectly reported. As such, data from P Drain were not used in this analysis.

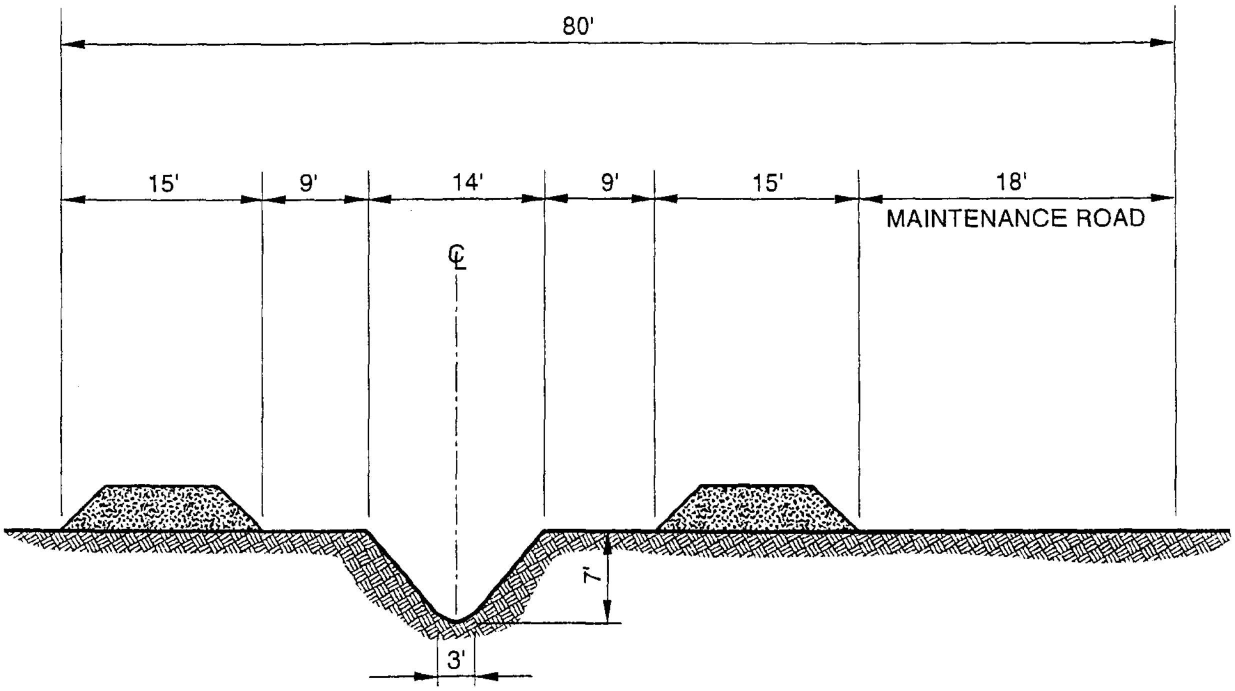

Figure 2.3-4
Typical Lateral Drain Profile
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Conveyance System

Canals that convey water from the Lower Colorado River to customers within the IID service area support little vegetation. Approximately 70 percent of the 1,667 miles (cited from IID Memorandum, dated October 4, 2000) of canals in Imperial Valley are concrete-lined or in pipes, and therefore do not support rooted vegetation. Embankment slopes of the lined canals also are maintained free of vegetation. About 537 miles (cited from IID Memorandum, dated October 4, 2000) of the delivery system consist of earthen channels (Figure 2.3-5). The canal slopes can support vegetation that typically consists of bands of vegetation at the water surface. The bands of vegetation consist of common reed, saltgrass, Bermuda grass, and seedling salt cedar. Tree and shrub cover are rare or nonexistent on most canals and laterals (IID 1994). Along the AAC, an almost continuous thick stand of common reed, 3- to 15-feet wide) grows along both sides of the canal for the majority of its length. The 30-mile long section of the AAC between Pilot Knob and Drop 4 supports about 30 acres of common reed (Reclamation and IID 1994). Vegetation along the canals is of minimal value to wildlife because it has little emergent vegetation and water velocity and depth in the canals are too great for most species.

Water seepage has induced phreatophytic vegetation[4] to develop along the AAC in a landscape previously dominated by dry, desert scrub. Between Drops 2 and 3, about 100 acres of scattered phreatophytic vegetation is supported by seepage. Only about 1 acre is emergent wetland vegetation. The remaining vegetation consists of screwbean and honey mesquite (22.6 acres), salt cedar (28.7 acres), and arrowweed (47.2 acres). However, under the AAC lining project this portion of the AAC will be abandoned and this vegetation will be lost. Effects of loss of this habitat on listed species have been evaluated in a previous Section 7 consultation. For this HCP, the lining project is assumed to be in place. A larger (1,422 acres) marsh complex that will not be affected by the AAC lining project is located between Drops 3 and 4. Marsh vegetation comprises about 111 acres of the complex. The other vegetation present within the complex includes salt cedar (755 acres), arrowweed (233 acres), screwbean mesquite (251 acres), cottonwood and willow (39 acres).

In addition to these areas, phreatophytic vegetation supported by seepage from the AAC exists between Drop 4 and the East Highline Canal. This area is about 100 to 150 acres in size. Closer to the Lower Colorado River in the vicinity of Mission Wash, seepage from the AAC probably contributes to supporting several areas of phreatophytic vegetation totaling about 100 acres. The vegetation composition of these areas has not been determined, but would be expected to exhibit a plant species composition similar to that found in other seepage areas along the AAC.

Seepage communities along Imperial Valley canals are rare and are generally limited to areas adjacent to the East Highline Canal. As part of the system-based water conservation activities, IID may install seepage recovery systems along portions of the west side of the East Highline Canal (see Section 1.7.2.2). Seepage communities in the vicinity of proposed seepage recovery systems were digitized from Digital Orthophoto Quarter Quadrangles (DOQQ) and visited during May 2001 to assess general vegetation characteristics. Seepage communities also occur on the east side of the East Highline Canal but these areas would not be affected by covered activities. The location of seepage communities in the vicinity of proposed seepage recovery systems is shown in Figure 2.3-6 and the sizes of the seepage areas are listed in Table 2.3-5.

[4] Phreatophytic vegetation is vegetation associated with wet areas. In the HCP area, phreatophytic plant species include tamarisk, common reed, willows, and cattails.

The plant species composition of the seepage communities is diverse and varies substantially among the seepage areas. Arrowweed, common reed, and tamarisk are the most common species in the seepage communities, with mesquite, cattails and a few cottonwoods present in some areas. About 412 acres of vegetation supported by seepage from the East Highline Canal occurs in areas where seepage recovery systems are under consideration.

TABLE 2.3-5
Seepage Communities Along the East Highline Canal. Area ID refers to Figure 2.3-6.

Area ID	Acres	Area ID	Acres
1	3.2	17	10.2
2	6.8	18	7.9
3	3.1	19	6.1
4	3.3	20	43.3
5	2.0	21	24.8
6	0.9	22	26.6
7	11.9	23	3.8
8	16.1	24	56.6
9	18.1	25	54.9
10	13.5	26	3.6
11	6.8	27	5.7
12	13.4	28	7.0
13	12.3	29	11.0
14	8.3	30	3.5
15	6.5	31	5.6
16	9.4	32	6.0
Grand Total		**412.2**	

Unmanaged Vegetation Adjacent to the Salton Sea

Vegetation has naturally developed in some locations along the margins of the Salton Sea. This phreatophytic vegetation occurs above the shoreline and shoreline strand community (see the following discussion of tamarisk scrub habitat). Unmanaged vegetation includes diked wetlands that are below the water surface elevation of the Salton Sea. The Salton Sea database (University of Redlands 1999) refers to these unmanaged areas of phreatophytic vegetation as "adjacent wetlands".

The Salton Sea database (University of Redlands 1999) classifies 6,485 acres along the Salton Sea as adjacent wetlands, and 64 acres as mudflat. Tamarisk and iodine bush are the most common species of adjacent wetlands (Table 2.3-6; Figure 2.3-7). Cattails and bulrushes are identified as the primary vegetation on 217 acres of adjacent wetlands. In the HCP area, the

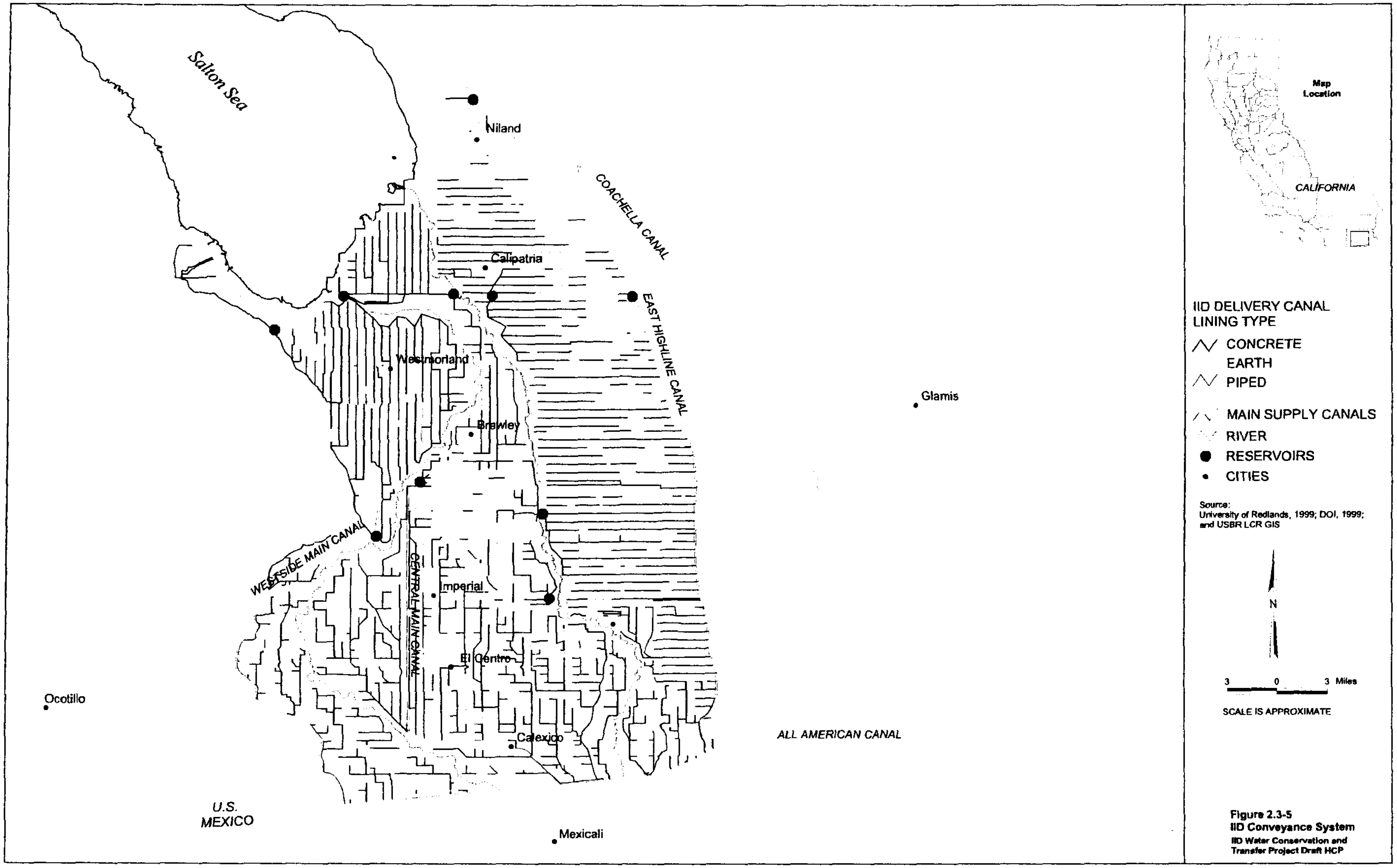

Figure 2.3-5
IID Conveyance System
IID Water Conservation and Transfer Project Draft HCP

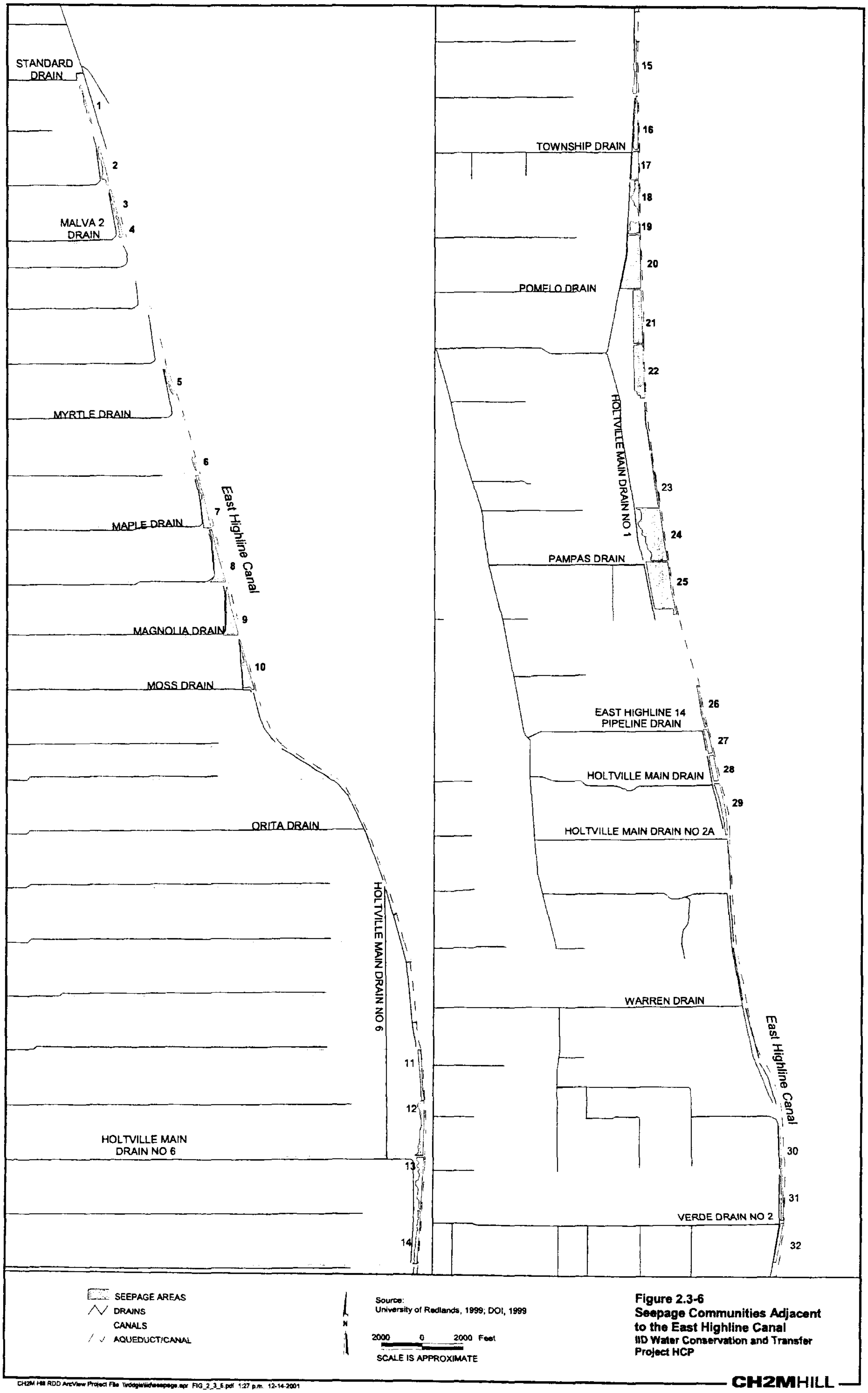

Figure 2.3-6
Seepage Communities Adjacent to the East Highline Canal
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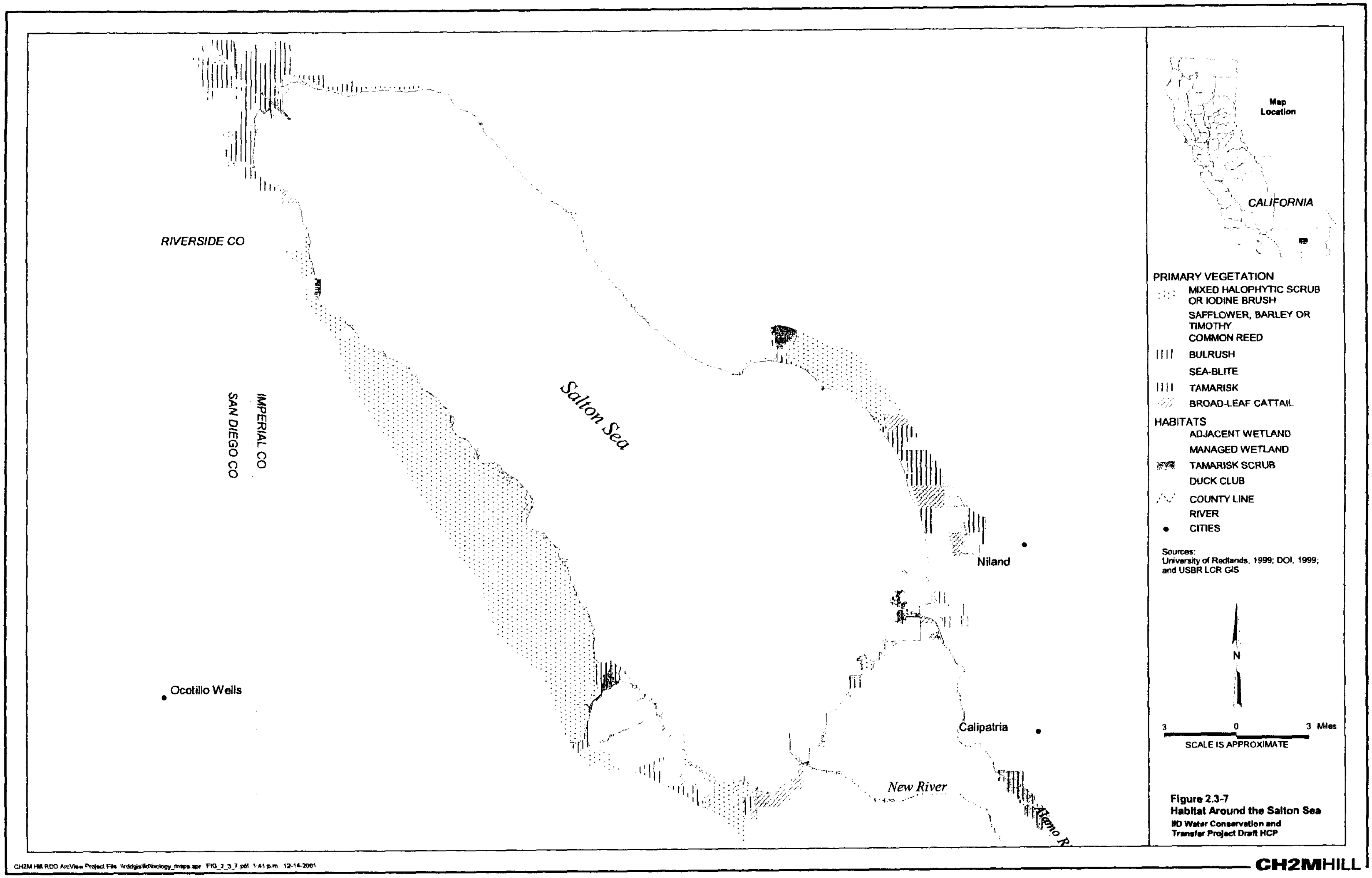

Figure 2.3-7
Habitat Around the Salton Sea
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Salton Sea database identifies three parcels as being dominated by cattails: one on the southwestern edge of the Salton Sea (35 acres), and two on the southern edge (32 acres). A fourth parcel on the eastern edge of the Salton Sea is dominated by bulrushes (17 acres). However, three of these areas are misclassified in the Salton Sea database. The first parcel of 35 acres is a managed duck club and therefore does not meet the definition of an "adjacent wetland" (i.e., unmanaged areas). Of the two parcels totaling 32 acres, one is an IID drain and the other is a marsh managed by the USFWS. The drain parcel is managed by IID as part of its drainage system. Habitat in this drain was accounted for in the quantification of habitat in the drainage system above. The other parcel managed by USFWS does not meet the definition of an adjacent wetland (i.e., unmanaged areas). The last parcel encompassing 17 acres is sustained by runoff from CDFG's managed marsh area in the Wister Unit. The remaining 133 acres identified as adjacent wetland dominated by cattail or bulrush occur adjacent to the northwestern portion of the Salton Sea. This area is outside of the HCP area.

TABLE 2.3-6
Primary Vegetation of Areas Classified as Adjacent Wetlands in the Salton Sea Database

Primary Vegetation	Total Acres at Salton Sea	Percentage of Adjacent Wetlands	Acres in HCP Area
Iodine bush	1,577	24	1,509
Mixed halophytic shrubs	65	1	-
Arrowweed	597	9	-
Bulrush	17[a]	<1	17
Sea-blite	86	1	86
Tamarisk	2,349	36	437
Cattail	200[a]	3	67
No primary wetland vegetation	1,595	25	1,305
Total	**6,485**		**3,421**

[a]See text for further description of these areas.
Source: Salton Sea Database (University of Redlands 1999)

Managed Marsh

Managed marsh consists of areas that are actively managed for one or more marsh habitat values and functions. In the HCP area, managed marsh occurs primarily on the state and federal refuges. Private duck clubs also support managed marsh.

The Imperial Wildlife Area (WA), managed by the CDFG, and the Sonny Bono - Salton Sea National Wildlife Refuge (NWR), managed by the USFWS lie within the HCP area (Figure 2.3-8). Both of these refuges were established to provide winter habitat for migratory waterfowl. However, in addition to providing habitat for migratory waterfowl, both refuges are managed to provide habitat for a wide diversity of resident and migratory waterfowl. The refuges are also managed to provide marsh habitat and offer the highest quality, year-round marsh habitat value in the HCP area. Both Imperial WA and the Sonny Bono Salton Sea NWR receive irrigation delivery water from IID. Agricultural drainage water is not used on the refuges.

The HCP area also contains 17 private duck clubs, covering about 5,582 acres. Most of the duck clubs are near the Salton Sea. These clubs are managed exclusively to attract wintering waterfowl, although other wildlife will use these marsh areas when available. Managed marsh units on the duck clubs are flooded in fall and winter when wintering waterfowl are present in the valley. They are not flooded during other times of the year; therefore they do not provide habitat for year-round resident wildlife that are associated with marsh habitat. Generally duck clubs receive irrigation delivery water from the IID.

2.3.2.2 Tamarisk Scrub Habitat

Native riparian plant communities in the southwestern desert are dominated by cottonwoods and willows, but palo verde and mesquite also occur. Much of the native riparian plant communities in the desert southwest has been replaced by nonnative plant species, particularly tamarisk. Tamarisk scrub communities supplant native vegetation following major disturbance, including alterations in stream and river hydrology, and can form extensive stands in some places. Characteristic species include salt cedar (*Tamarix chinensis, T. ramosissima*), big saltbrush (*Atriplex lentiformis*), *Coldenia palmeri*, and saltgrass (*Distichlis spicata*); associate species can include common reed (*Phragmites communis* var. *berlandieri*) and giant reed (*Arundo donax*).

In the HCP area, tamarisk scrub is found along the New and Alamo Rivers. Areas along the New River are composed of a virtual monoculture of tamarisk, with only a few areas of native vegetation. Vegetation along the Alamo River is similarly dominated by tamarisk. Dredging has extended the river channels of both the New and Alamo Rivers into the Salton Sea. The banks of the extended river channels support a thick strand of tamarisk and common reed.

The width of tamarisk scrub stands adjacent to the New and Alamo Rivers varies substantially along their lengths. Based on a review of DOQQs, much of the length of the rivers supports only a narrow band of tamarisk of less than 50 feet on both sides of the channels. In more limited portions of the rivers, larger stands of tamarisk have developed that may extend 500 feet or more from the river channel. To estimate the amount of tamarisk scrub habitat occurring along the floodplains of the New and Alamo Rivers, vegetation along the rivers was digitized from the DOQQs. Vegetation along the rivers was assumed to consist of tamarisk scrub. Based on this work, the New and Alamo Rivers support about 2,568 acres and 962 acres of tamarisk scrub habitat respectively, for a total of 3,530 acres.

Tamarisk scrub occurs in other portions of the HCP area, wherever water is available, including the margins of the Salton Sea (Table 2.3-7). Tamarisk scrub is also one of the major plant species comprising vegetation along the drains and is found in seepage areas adjacent to canals. The HCP area contains about 438 acres of the tamarisk-dominated areas adjacent to the Salton Sea (University of Redlands 1999). The source of the water that supports tamarisk adjacent to the Salton Sea is uncertain, but is likely the result of shallow groundwater and seepage rising to the surface at its interface with the sea. In addition to the adjacent wetlands, tamarisk is a primary component of areas designated as shoreline strand community in the Salton Sea database. The shoreline strand community occupies about 293 acres (University of Redlands 1999) immediately adjacent to the Salton Sea and consists of tamarisk and iodine bush. As with the tamarisk-dominated areas adjacent to the Salton Sea described above, the source of water supporting this community is undetermined, but is likely the result of shallow groundwater and seepage rising to the surface at its interface with the sea.

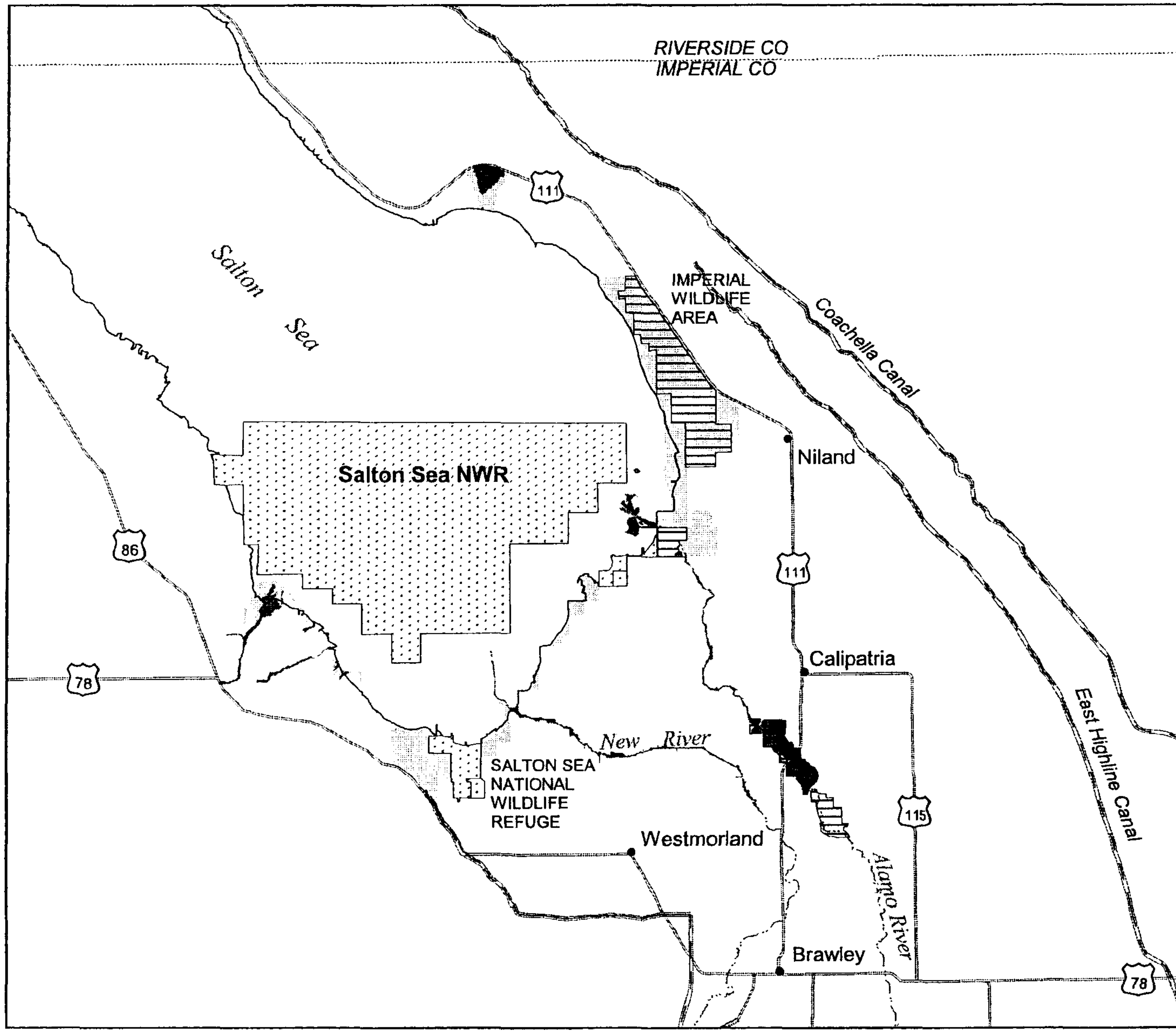

Figure 2.3-8
Location of State and Federal Refuges and Existing Wildlife Habitat
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Along IID's drainage system, Hurlbert (1997) can be used to estimate the acreage of tamarisk scrub supported by the drains. Of the drains surveyed by Hurlbert (1997), the percentage of drain area comprised of tamarisk varied from 0 to 29.6 percent (Table 2.3-3), yielding a weighted average percentage of 8.7. Assuming that tamarisk covers 8.7 percent of the drains, the drainage network in the HCP supports about 215 acres of tamarisk scrub habitat.

Cottonwood-willow habitat is largely absent from the HCP area. Cottonwoods and willows occur in seepage communities along the AAC. In addition, some remnant cottonwoods occur in Imperial Valley at distances of 20 to 60 feet from the East Highline Canal (IID 1994). A few patches of willow also persist along the Alamo River.

2.3.2.3 Agricultural Field Habitat

Irrigated agricultural land is the predominant land cover type in the Imperial Valley, and comprises most of the HCP area. Agricultural fields attract a variety of wildlife species. The crops grown, the methods used and the total acreage in production within IID's service area are based on the decisions of individual farmers. Current and anticipated market prices have an important role in the types of crops that are economically beneficial for farmers to grow. As a result, the total acreage in agricultural production and the types and amount of crops grown fluctuate from year-to-year. The different types of crops and the range of acreage of each of the major crops grown within the service area for 1999 are shown in Table 2.3-7. The cropping pattern is likely to be similar to Table 2.3-6 for the short term, but could change during the term of the permit as markets for various crops or other conditions change.

TABLE 2.3-7
Crops Produced (Greater Than 200 Acres) in IID Service Area During 1999

Crop Description	Acres	Percentage
Alfalfa (all)	192,633	35.56
Sudan grass (all)	62,881	11.61
Bermuda grass (all)	55,179	10.19
Wheat	42,464	7.84
Sugar beets	33,997	6.28
Lettuce (all)	22,558	4.16
Carrots	16,995	3.14
Melons, spring (all)	14,293	2.64
Broccoli	12,305	2.27
Onions	11,526	2.13
Duck ponds (feed)	9,105	1.68
Cotton	7,131	1.32
Ear corn	6,790	1.25
Citrus (all)	6,169	1.14
Asparagus	6,166	1.14
Cauliflower	3,960	0.73
Onions (seed)	3,541	0.65
Potatoes	3,159	0.58

TABLE 2.3-7
Crops Produced (Greater Than 200 Acres) in IID Service Area During 1999

Crop Description	Acres	Percentage
Klien grass	3,113	0.57
Rape	3,034	0.56
Rye grass	3,034	0.56
Vegetables, mixed	2,162	0.40
Watermelons	2,158	0.40
Tomatoes, spring	2,024	0.37
Melons, fall (all)	2,019	0.37
Rapini	1,323	0.24
Fish farms	1,293	0.24
Cabbage	1,284	0.24
Spinach	1,229	0.23
Garbanzo beans	1,057	0.20
Barley	868	0.16
Field corn	844	0.16
Pasture, permanent	701	0.13
Peppers, bell	429	0.08
Garlic	308	0.06
Flowers	279	0.05
Oats	212	0.04

2.3.2.4 Salton Sea Habitat

Wildlife habitats at the Salton Sea have been largely described previously in Section 2.3.2.1, Drain Habitat and Section 2.3.2.2, Tamarisk Scrub Habitat. However, for the species covered by the HCP, use of the Salton Sea is a function of the abundant food resources, availability of a large, open body of water, and the presence of unique habitat features, rather than vegetation composition. The following discussion focuses on the food resources and food chain relationships, and unique habitat features supported by the Salton Sea.

Food Chain Relationships

The Salton Sea is considered eutrophic with plentiful phytoplankton, a condition that often results in algal blooms (Hurlbert 1999a). The dominant primary producers are phytoplankton and phytobenthos; plant life in the Salton Sea predominantly is single-celled algae. Major groups of algae include diatoms (*Chrysophyta*), dinoflagellates (*Pyrrophyta*), and green algae (*Chlorophyta*) (Carpelan 1961). Blue-green algae (*Cyanophyta*) have also been found on the seafloor in shallow water and on buoys and pilings in the Salton Sea. During recent sampling, several new species of diatoms were observed (Hurlbert 1999b). Many of the previously observed species are still present in the Salton Sea. The phytoplankton composition changes may be caused by an increase in the salinity of the Salton Sea, as well as from the introduction of tilapia (Hurlbert 1999b).

Within the Salton Sea, five phyla of invertebrates are represented: Protozoa, Rotifera, Nematoda, Annelida, and Arthropoda. Some of the common invertebrates found in the Salton Sea include ciliate protozoans, foraminifera, rotifers, copepods, barnacle, pileworm, amphipod, and the water boatman (a corixid). The rotifer *Brachionus plicatilis* is the dominant rotifer species, is completely planktonic, and has great value as food for larval fishes. The pileworm *Neanthes* is a major food source for fish and some birds and is a significant species in the benthos of the Salton Sea. Pileworms have been abundant since their introduction to the Salton Sea during the 1930s and are the principal detritus-feeding benthic organisms in the Salton Sea.

The major zooplanktonic organisms in the Salton Sea include *Brachionus*, copepods (*Apocyclops dengizicus, Cletocamptus dietersi*), the egg and larval stages of the pileworm, and the larval stages of the barnacle (*Balanus amphitrite saltonensis*). Other zooplanktonic species that occur in the Salton Sea include brine shrimp, brinefly larva, and some surface-dwelling insects. The remaining invertebrate species or life stages are primarily benthic. Organisms that need to attach permanently to a hard surface are limited to the few rocky areas, docks, debris, or inundated brush along the shore.

Fish species inhabiting the Salton Sea are adapted to living in high-salinity waters. Most of the fish are nonnative species (Walker 1961; Dritschilo and Pluym 1984; and Setmire et al. 1993) that have been introduced from the Gulf of California by CDFG. Fish found in the Salton Sea include the sport fish sargo (*Anisotremus davidsoni*), orangemouth corvina (*Cynoscion xanthulus*), Gulf croaker (*Bairdiella icistia*), and other fish species listed in Table 2.3-8. Gulf croaker, sargo, and corvina are marine species, while the remaining species are estuarine or freshwater fish with extreme salinity tolerances. Tilapia are the most abundant fish in the Salton Sea. Tilapia were introduced into drainage ditches to control aquatic weeds in the late 1960s and early 1970s. They were also produced on fish farms close to the Salton Sea. The Salton Sea was colonized by tilapia that escaped from the fish farm and from those stocked in the drainage system. Anglers first reported catching tilapia in the Salton Sea in 1967 (Costa-Pierce and Riedel 2000a). The highest densities reported from areas around the New and Alamo rivers and nearshore areas extending about 6,458 feet (600 m) from the shoreline (Costa-Pierce and Riedel 2000a; Costa-Pierce, pers, comm.). Tilapia productivity of the nearshore area has been estimated at 3,600 kg/ha/yr, far exceeding productivity of tilapia in tropical lakes (Costa-Pierce and Riedel 2000a). The abundant fish population attracts and supports large numbers of piscivorous birds, particularly during winter.

TABLE 2.3-8
Fish Species Present in the Salton Sea

Species Name	
Sargo (Anisotremus davidsoni)	Mosquitofish (Gambusia affinis)
Gulf croaker (Bairdiella icistia)	Longjaw mudsucker (Gillichthys mirabilis)
Orangemouth corvina (Cynoscion xanthulus)	Sailfin molly (Poecilia latapinna)
Desert pupfish (Cyprinodon macularis)	Mozambique mouthbrooder (Tilapia mossambica)
Common carp (Cyprinus carpio)	Zill's tilapia (Tilapia zilli)

TABLE 2.3-8
Fish Species Present in the Salton Sea

Threadfin shad (Dorosoma petenense)

Source: Black 1988

The Salton Sea represents one of the centers for avian biodiversity in the American Southwest, with occurrence records for more than 400 species and an annual average abundance of waterbirds of 1.5 to 2 million (Reclamation and SSA 2000; Hart et al. 1998; and Shuford et al. 1999). Numbers of birds can exceed this average by several million during certain years; (e.g., the maximum number of wintering eared grebes alone has exceeded 3.5 million individuals [Jehl 1988], representing the majority of the population of eared grebes in western North America). Populations of some species that use the Salton Sea are similarly of regional, continental, or worldwide importance, representing significant portions of the total populations for those species. The Salton Sea is an integral part of the Pacific Flyway, providing an important migratory stopover for fall and spring shorebirds, and supporting large populations of wintering waterfowl. In surveys from 1978 to 1987, midwinter waterfowl numbers averaged more than 75,000 (Heitmeyer et al. 1989); species typically present in large numbers include snow and Ross's geese, ruddy ducks, pintail, white-faced ibis (*Plegadis chihi*), and others. The Salton Sea represents one of only four remaining interior sites along the Pacific Flyway that supports more than 100,000 shorebirds during migration (Page et al. 1992), with as many as 44 species represented (McCaskie 1970; and Shuford et al. 1999). The Salton Sea also supports large breeding populations of waterbirds.

The overall high productivity of the Salton Sea can be attributed to a number of factors, including relatively mild-warm year-round temperatures, ample nutrient input through agricultural runoff and wastewater discharges to the tributary rivers, and a generally high morpho-edaphic index in the Salton Sea. A high morpho-edaphic index reflects the high surface-to-volume ratio of the Salton Sea (i.e., it has a large area, but is relatively shallow), which results in a number of conditions that can generate higher productivity (e.g., with more of the water column within the zone of light penetration, there is greater production of phytoplankton and other photosynthetic organisms relative to the overall quantity of water). The higher productivity transfers steadily up the food chain, resulting in higher densities of prey species for birds.

Aquatic invertebrates are important as food resources for species of birds in the Salton Sea include brine shrimp (*Artemia salina*), brine fly larvae (*Ephydra sp.*), adult pileworm (*Neanthes succinea*), and the nauplia and cypris of the barnacle (*Balanus amphitrite saltonensis;* Reclamation and SSA 2000). These species are forage for a wide variety of species including diving ducks, grebes, phalaropes (*Phalaropus* spp.), and a number of piscivorous fish that supplement their diet with invertebrates. Dabbling ducks also may forage on aquatic invertebrates in shallow areas, and many shorebirds will forage for invertebrates in shallow flooded areas and mudflats. Other bird species forage on fish including cormorants, diving ducks, pelicans, black skimmer, terns, egrets, and herons. Species of fish in Salton Sea used as prey include tilapia, bairdiella, sargo, mosquito fish, and larval orange-mouthed corvina (Reclamation and SSA 2000).

Since the early 1990s, there has been an unprecedented series of fish and bird die-offs at the Salton Sea (USFWS 2000; and Kuperman and Matey 1999). Fish kills often are massive, averaging between 10,000 and 100,000 fish, but sometimes several million fish. Fish die-offs produce substantial amounts of carrion for piscivorous birds, but can have adverse effects on bird populations by contributing to disease outbreaks. Causes of the fish die-offs are not always clear, but a number of potential pathogens have been identified; low oxygen levels also could be responsible for some fish kills. Pathogens implicated in fish kills include infestations with a lethal parasitic dinoflagellate (*Amyloodinium ocellatum*) and acute bacterial infections from bacteria of the genus *Vibrio* (USFWS 2000).

Large fish kills have been associated with avian botulism die-offs. It is likely that septicemia in fish produces the conditions in the intestinal tract of sick fish that allow botulism spores to germinate and produce the toxin. Birds foraging on sick fish may ingest fatal doses of the botulism toxin (USFWS 2000). A large botulism die-off in birds occurred in 1996, when 8,538 white pelicans and 1,129 brown pelicans died along with large numbers of great egret, snowy egret, eared grebe, black-crowned night heron, and numerous other birds (Jehl 1996). The total bird mortality in this event was more than 14,000 birds (USFWS 1996b).

Since 1987, significant avian die-offs have been recorded on an almost annual basis. While avian disease has been present at the Salton Sea for many years, the recent increase of disease occurrence, the magnitude of losses, and the variety of diseases has increased concern for birds using the Salton Sea (Reclamation and SSA 2000). Significant events have included a die-off of 4,515 cattle egrets in 1989 from salmonellosis; a die-off of an estimated 150,000 eared grebes in 1992 from unknown causes; a loss of more than 14,000 birds, including nearly 10,000 pelicans, in 1996 from avian botulism; a die-off of 6,845 birds in 1997; and a loss of 18,140 birds in 1998 from various agents, including avian cholera, botulism, Newcastle disease, and salmonella (USFWS 1996b).

Habitat Features

Most of the bird activity at the Salton Sea is concentrated at three primary locations. These locations include along the north and south shores (particularly at the New and Alamo river deltas), and near the mouth of Salt Creek on the eastern shore (Reclamation and SSA 2000). In these areas, concentrations of breeding colonies for colonial breeding birds occur. Suitable habitat conditions for colonial birds include an easily accessible and abundant food source and nest and roost sites that are generally protected from predators, such as trees or islands.

Some natural islands are available for nesting at the Salton Sea; however, a number of sites consists of old levees now inundated in sections and separated from the mainland, or other man-made islands. With the exception of Mullet Island at the south end of the Salton Sea, most sites are less than 10,750 square feet in area. Fluctuations in the level of the Salton Sea can increase or decrease the available habitat for island nesting birds.

Nesting islands in the Salton Sea are described in Molina (1996). Mullet Island is located 1.6 miles from the Alamo River mouth and has relatively high relief and ample nesting areas. It has historically supported nesting black skimmers, double-crested cormorants, gull-billed terns, and Caspian terns; since 1992 gulls have also nested there. The site is subjected to some human disturbance, with the Red Hill Marina only 1.9 miles from the island. Other nesting sites in the south portion of the sea include Morton Bay, which consists of an eroded impoundment east of the mouth of the Alamo River. It has two low-lying nesting islets, protected from wave inundation by a nearly continuous perimeter levee. Near Rock Hill, a series of small flat earthen islets within a freshwater impoundment have been suitable for nesting since 1995; this site is located within Sonny Bono-Salton Sea NWR and is under active management, including water-level control and protection from disturbance. Adjacent to Obsidian Butte, a nesting site is located on a small, low islet, consisting of a rocky perimeter and an interior beach composed of crushed barnacle. At Ramer Lake, located along the Alamo River 3.1 miles southeast of the Salton Sea, small, man-made, compacted earth islets provide nesting habitat. However, heavy recreational use in this area results in a high potential for colony disturbance. A small nesting site is present at Elmore Ranch on the southwest shore of the Salton Sea; it lies on a single, earthen levee remnant and is susceptible to wave action, erosion, and inundation. On the north end of the Salton Sea, one site is present at Johnson Street near the mouth of the Whitewater River. This site consists of remnants of earthen levees isolated from the Salton Sea by rising water levels.

2.3.2.5 Desert Habitat

The HCP area supports little native desert habitat. The primary occurrence of native desert habitat in the HCP area is along the AAC within IID's right-of-way (Figure 2.3-9). The 82-mile AAC traverses desert habitat for 60 miles; the remaining 22 miles of the canal lie within agricultural areas of the Imperial Valley. Desert habitat also occurs adjacent to rights-of-ways of the East Highline, Thistle, Trifolium, and Westside Main canals, but not within the rights-of-way. Within Imperial Valley, desert plant species have colonized small areas that have not been under agricultural production for many years. These areas occur as inclusions within the predominantly agricultural landscape. Two principal desert habitats are supported in the HCP area: creosote bush scrub and dunes. The characteristics and distribution of each of these habitats are described below.

Creosote Bush Scrub

Creosote bush scrub is characterized by widely spaced shrubs, approximately 1.6 to 9.8 feet tall, usually with largely bare ground between. It is the basic creosote scrub community of the Colorado Desert, typically occurring on well-drained secondary soils of slopes, fans, and valleys. Characteristic species include creosote bush (*Larrea divaricata*), burro weed (*Ambrosia dumosa*), brittle brush (*Encelia farinosa*), and ocotilla (*Fouquieria splendens*). Succulents are common, and ephemeral annual herbs are present and generally bloom during late February and March. Mesquite thickets, an important wildlife habitat component, are present in creosote bush scrub habitat.

Creosote bush scrub is the predominant desert habitat in the HCP area and occurs along much of the AAC. It is also present adjacent to the HCP area along the East Highline and Westside Main Canals. Plant species comprising this habitat may occur in the Imperial Valley in areas that have been fallowed.

Desert Dunes

AAC traverses the Algodones Dunes. The dunes consist of both active desert dunes and stabilized or partially stabilized dunes. Active desert dune communities are characterized as essentially barren expanses of actively moving wind-deposited sand with little or no stabilizing vegetation. Dune size and shape are determined by abiotic site factors, including wind patterns, site topography, and source of sand deposits. Characteristic plant species

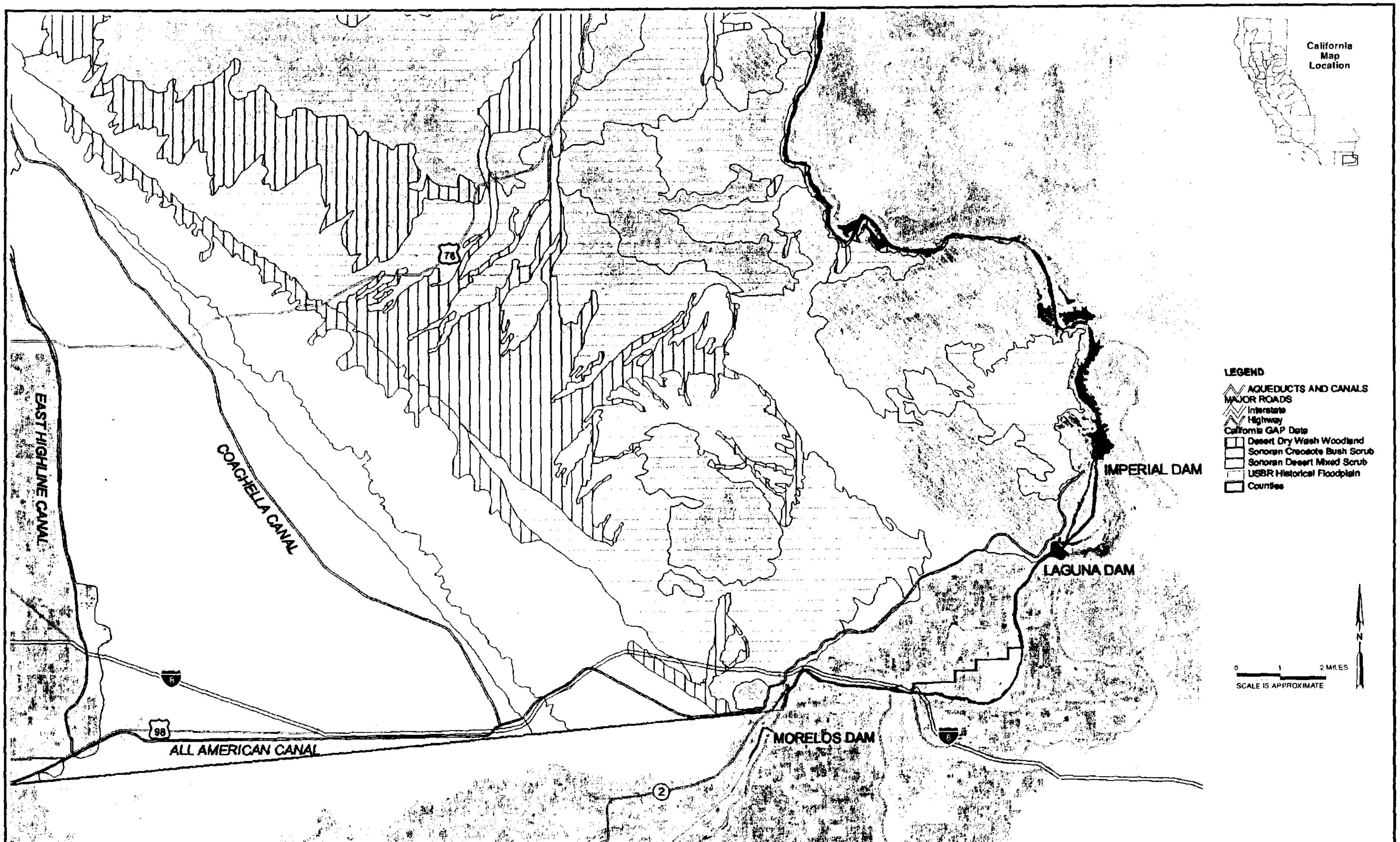

Figure 2.3-9
Desert Habitats in/and Adjacent to the HCP Area
IID Water Conservation and Transfer Project Draft HCP
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may include bee plant (*Cleome sparsifolia*), *Dicoria canescens*, evening primrose (*Oenothera avita*), and *Tiquilia plicata*.

Some desert dunes have been stabilized or partially stabilized by shrubs, scattered low annuals, and perennial grasses in areas with less wind or higher water availability. These dunes typically occupy sites that are lower and more sheltered than active dunes, with soil moisture retained just below the sand surface, allowing perennial vegetation to survive long drought periods. Mesquite (*Prosopis glandulosa, P. pubescens*) scrub is often associated with this community. Other characteristic plant species include sand verbena (*Abronia villosa*), burro weed, ankle grass (*Astragalus* spp.), salt cedar (*Tamarix* spp.), saltbrush (*Atriplex canescens*), croton (*Croton californicus* var. *mojavensis*), dalea grass, wild buckwheat (*Eriogonum deserticola*), desert sunflower (*Geraea canescens*), and others. Plant cover increases as dunes are progressively stabilized. This community intergrades with sandier phases of creosote bush scrub.

2.3.2.6 Aquatic Habitat

Aquatic habitat occurs in the HCP area within IID's conveyance and drainage infrastructure as well as in the New and Alamo Rivers. Aquatic habitat conditions associated with these features are described in the following section. The Salton Sea also provides aquatic habitat, but was discussed previously (Section 2.3.2.4).

The IID diverts water from the Colorado River into the AAC at Imperial Dam. The AAC conveys water to three main canals in Imperial Valley: the East Highline Canal, Westside Main Canal, and Central Main Canal (Figure 2.3-5). Customers take water from the main canals or lateral canals that branch off of the main canals. To service customers in Imperial Valley, IID maintains 1,667 miles of canals (cited from IID Memorandum, dated October 4, 2000). Most of the canals (1,114 miles) are concrete lined. About 16 miles of the conveyance are pipelines, while the remaining 537 miles are earthen canals (cited from IID Memorandum, dated October 4, 2000). IID also operates the 82-mile AAC, which conveys water from Imperial Dam on the Colorado River to IID's conveyance system in the valley. The AAC is currently unlined, but 24 miles are planned to be concrete lined in the future (Reclamation and IID 1994).

Water levels in the AAC are maintained as high as possible to maximize power generation from the hydropower facilities. Although other canals do not contain hydroelectric power generation facilities, water levels also are tightly controlled. Lowest flows in the canal system occur in January and February when irrigation demand is lowest. Water velocity in the AAC ranges from about 0.5 to 1 foot per second (ft/s) during these months. The highest flows occur during March through August, which is the main irrigation season. During this period, water velocities in the AAC increase to about 2.5 to 3.5 ft/s (USACOE 1996).

Within the AAC and main canals in the Imperial Valley, aquatic habitat in the center of the canals is characterized by high water velocities and a lack of aquatic vegetation and aquatic invertebrates. This portion of the main canals provides poor conditions for fish and other aquatic organisms. Along the canal edges, lower water velocities and deposition of sediment allow limited development of submerged and emergent vegetation. The lower water velocities and cover provided by aquatic vegetation, in combination with vegetation on the canal banks (primarily the common reed), provide better habitat conditions for aquatic invertebrates and fish. Submerged vegetation consists primarily of Eurasian water-milfoil with some sago pondweed (*Potamogetou pectinatus;* Reclamation and IID 1994). The noxious aquatic weed hydrilla (*Hydrilla verticillata*) is common in the canal system within the Imperial Valley, but is rare in the AAC (Reclamation and IID 1994). The canals are routinely cleaned of vegetation, thus limiting aquatic habitat quality.

As a result of high water velocities, concrete substrates in many canals, and the lack of submerged and aquatic vegetation, the canals (with the exception of the AAC) support few invertebrates. In the AAC, mollusks, particularly the exotic Asiatic clam and aquatic snail, are common along the shoreline where sediment deposits and submerged and emergent vegetation develops (USACOE 1996). Crayfish are present in small numbers (USACOE 1996).

Drainage Network

A system of subsurface tile drains, surface drainage ditches, and river channels collect and convey agricultural drainwater in the IID service area. Currently, IID operates and maintains 1,456 miles of drains (cited from IID Memorandum, dated October 4, 2000). These drains are primarily unlined earthen channels.

Aquatic habitat in the drains is of poor quality as a result of silty substrates, poor water quality, and shallow depth. Portions of the drains support rooted vegetation, such as cattails, common reed, or filamentous and mat-forming algae. These areas are more frequently found where canal (operational) discharge provides better water quality. However, vegetation is regularly cleared from the drains.

The availability of aquatic habitat in drains depends on drainwater from agricultural fields. This water comes from both surface and subsurface (tile) sources. As a result, the amount of water in the drains varies throughout the year in response to the level of irrigation. When the agricultural fields discharging into a drain are not being irrigated (i.e., little surface runoff), the drainwater flows are dominated by the highly saline subsurface (tile) water. In the upper portions of the drain watersheds, a lack of irrigation activity can result in drains experiencing a dry out condition and might not support aquatic habitat.

The drainage network supports abundant aquatic invertebrates, especially waterboatmen (*Corixa* sp.; Radke 1994). Analysis of benthic invertebrate communities in several of the irrigation drains indicates that the communities are composed of relatively few species and are dominated by one or two taxa. Of the 10 drains sampled, the mollusk family Thiaridae was the most abundant taxa in 8 of the drains, comprising between 50 and 95 percent of the sample (Setmire et al. 1996). Another taxon observed frequently, but with lesser abundance than Thiaridae, was the mollusk family Physidae. The pollution-sensitive mayflies, stoneflies, and caddisflies (Ephemeroptera, Plecoptera, and Trichoptera) were poorly represented. A single caddisfly larvae of the family Philopotamidae was the only pollution-sensitive taxon documented in the benthic samples (Setmire et al. 1996).

Invertebrate densities were found to be much lower in the water column than in the benthic samples (Setmire et al. 1996). The number of taxa ranged from a low of 4 to a high of 10. Chironomid larvae were the most abundant invertebrates found in 6 of the 10 drainwater column samples (Setmire et al. 1996). Other frequently observed taxa included mosquito larvae (*Culicidae*) and oligochaete worms. Larval chironomids are a food source for other invertebrates and fish, and adults are eaten by many kinds of birds.

New and Alamo Rivers

The New River was enlarged in the early 1900s when the Colorado River overflowed its banks and formed a new channel to the Salton Sea. When it crosses into the U.S., the New River is primarily composed of agricultural drainage water and wastewater from the Mexicali Valley in Mexico. In the Imperial Valley, agricultural drains discharge into the river. The Alamo River also enters the U.S. from Mexico and receives agricultural drainage water in the Imperial Valley. Aquatic habitat quality in the New and Alamo Rivers is poor because of poor water quality, as well as high turbidity and unstable substrates that inhibit production of benthic invertebrates and rooted vegetation.

2.3.3 Water Quality and Biological Resources

Water quality is a concern for biological resources in Imperial Valley and the Salton Sea. In the Imperial Valley, wildlife can be exposed to poor water quality conditions in the drains that carry agricultural drainage water. Much of the drain water empties into the Salton Sea where wildlife species also can be exposed to poor water quality conditions. The quality of water in drains and the Salton Sea can affect wildlife in a number of ways. Some contaminants (e.g., selenium) can bioaccumulate and have direct or indirect toxic effects. The concentrations of other constituents (e.g., salts) can affect survival or reproductive success of aquatic species inhabiting the Salton Sea. Finally, water quality can influence plant species composition of habitats supported along the Salton Sea or in agricultural drains, and thereby alter habitat suitability for species using these habitats. The constituents of greatest concern in the Imperial Valley and Salton Sea and potentially affected by the water conservation and transfer programs are salinity and selenium. These constituents are the focus of the following discussion. The IID Water Conservation and Transfer Project EIR/EIS provides information on other water quality constituents.

2.3.3.1 Salinity

The salinity of the Salton Sea has been increasing because of high evaporative water loss and continued input of salts from irrigation drainage water. The sea is currently hypersaline with a salinity greater than the ocean. The present salinity levels in the Salton Sea are 44 grams per liter (g/L; equivalent to parts per thousand). Tilapia are the most abundant fish in the Salton Sea and are the primary prey of piscivorous birds. Therefore, the salinity tolerance of tilapia is key to predicting the effects of the water conservation and transfer programs on covered species of piscivorous birds. The salinity tolerances of other fish species inhabiting the Salton Sea is provided in the IID Water Conservation and Transfer Project EIR/EIS.

Tilapia have been collected at a salinity level of 120 ppt, but reproduction has not been reported at this salinity level (Whitfield and Blaber 1979). Costa-Pierce and Riedel (2000) provide a review of reported salinity tolerances of tilapia. Highest growth rates were reported at 14 ppt, but growth was still good and tilapia reproduced at 30 ppt. At 69 ppt, tilapia grew poorly, but reproduced well. In the Salton Sea at about 44 ppt, tilapia also grew poorly, but reproduced well. Based on these studies, Costa-Pierce and Riedel (2000a) suggested that tilapia in the Salton Sea could successfully acclimate to and continue to reproduce at a salinity level of 60 ppt. In areas with higher salinity, growth, survival, and reproduction would be expected to decline (Costa-Pierce, pers. comm. January 12, 2001).

2.3.3.2 Selenium

Soil derived from parent rocks containing high amounts of selenium is found throughout much of the West (Seiler et al. 1999; Skorupa 1994). Selenium enters soils, groundwater, and surface waters through irrigation of selenium-bearing soils, through selenium-bearing sediments brought in through local drainages, or through water imported for irrigation. Selenium enters the Imperial Valley through Colorado River water brought in for irrigation; its ultimate source is upstream from Parker Dam (Engberg 1992). Selenium is concentrated in irrigated soils through evapotranspiration and flushed into water sources through irrigation practices (Ohlendorf and Skorupa 1989; and Seiler et al. 1999). The primary source of selenium in surface drains is from subsurface drainage discharges from sumps and tile drains (Setmire et al. 1996); subsequently it is discharged into rivers and the Salton Sea.

Selenium is essential in trace amounts for both plants and animals but toxic at higher concentrations (Rosenfeld and Beath 1946). At excessive levels, selenium can cause adverse effects in mammalian reproduction, but it is especially toxic to egg-laying organisms including birds and fish. Reproductive impairment is generally a more sensitive response variable than adult mortality. Selenium bioaccumulates readily in invertebrates (typically 1,000 times the waterborne concentration) and fish; hence, fish and birds that feed on aquatic organisms are most at risk for showing adverse effects (Ohlendorf 1989; and Eisler 2000).

Selenium concentrations were measured from Imperial Valley and Salton Sea in a number of different studies. These include broad-based studies of selenium in water, sediment, and biotic samples a (Setmire et al. 1990; Setmire et al. 1993; and Rasmussen 1997) to more focused surveys looking at concentrations in tissues of specific fish or bird species (Ohlendorf and Marois 1990; Bruehler and de Peyster 1999; and Audet et al. 1997). These studies are reviewed below.

Early sampling (Rasmussen 1988; and Rasmussen and Starrett 1988) identified levels of selenium higher in Salton Sea fish than those occurring in the New and Alamo Rivers, reflecting the primary source of bioaccumulation of selenium from benthic food sources of the Salton Sea. More recent data show a similar pattern (Table 2.3-9).

TABLE 2.3-9
Selenium Concentrations in Freshwater and Marine Fish from Imperial Valley Rivers and the Salton Sea

Station No.	Station Name	Species	Tissue	Sample Date	Selenium (mg/kg ww)
719.47.00	Coachella Valley Stormwater Channel	Tilapia *Tilapia sp.*	Fillet	11/17/97	1.020
723.10.01	Alamo River / Calipatria	Channel Catfish *Ictalurus punctatus*	Fillet	11/20/97	1.060
723.10.02	New River / Westmorland	Channel Catfish *Ictalurus punctatus*	Fillet	11/20/97	0.360
723.10.02	New River / Westmorland	Channel Catfish *Ictalurus punctatus*	Liver	11/20/97	3.230
723.10.58	New River / Interboundary	Carp *Cyprinus carpio*	Fillet	12/10/97	0.460
728.00.90	Salton Sea / South	Tilapia *Tilapia sp.*	Fillet	11/20/97	1.310

TABLE 2.3-9
Selenium Concentrations in Freshwater and Marine Fish from Imperial Valley Rivers and the Salton Sea

Station No.	Station Name	Species	Tissue	Sample Date	Selenium (mg/kg ww)
728.00.90	Salton Sea / South	Tilapia *Tilapia sp.*	Liver	11/20/97	6.650
728.00.92	Salton Sea / North	Orangemouth Corvina *Cynoscion xanthulus*	Fillet	11/18/97	1.360
728.00.92	Salton Sea / North	Orangemouth Corvina *Cynoscion xanthulus*	Liver	11/18/97	2.040

Source: Rassmussen 1997
Notes: Concentrations in wet weight; mg/kg – milligrams per kilogram

Other early studies on selenium in tissues include the Selenium Verification Study (White et al. 1987), the reconnaissance investigation by the DOI in 1986 and 1987 (Setmire et al. 1990), and a follow-on detailed study by DOI from 1988 to 1990 (Setmire et al. 1993; and Schroeder et al. 1993). The Selenium Verification Study also identified higher selenium concentrations in samples from the Salton Sea fish than those reported in freshwater fish from the Alamo and New Rivers. In the reconnaissance investigation by DOI (Setmire et al. 1990), samples were taken of water, sediment, and biota in the Imperial Valley. Levels in fish and waterfowl in this study indicated bioaccumulation of selenium. Selenium concentrations in mollies and mosquitofish and in invertebrates are shown in Tables 2.3-10 and 2.3-11, respectively.

TABLE 2.3-10
Selenium Concentrations in Mosquitofish and Sailfin Molly from the New and Alamo Rivers and Irrigation Drains and San Felipe and Salt Creeks, Salton Sea, 1988-1990

	New and Alamo Rivers and Irrigation Drains			San Felipe and Salt Creeks		
Fish Species	N/DV	GM (µg/g dw)	Range (µg/g dw)	N/DV	GM (µg/g dw)	Range (µg/g dw)
Mosquitofish	3/3	3.5	2.6-4.7	2/2	6.9	6.4-7.4
Sailfin molly	4/4	3.9	2.5-5.8	2/2	6.4	5.5-7.4

Source: Setmire et al. 1993
Notes: Concentrations in dry weight; N/DV: number of samples collected per number of samples with detectable values; Geometric mean (GM): calculated using one-half detection limit when data set has more than 50 percent detectable values.

TABLE 2.3-11
Selenium Concentrations in Pelagic Invertebrates from the New and Alamo Rivers and Irrigation Drains and San Felipe and Salt Creeks, Salton Sea, 1988-1990

Pelagic Invertebrate Species	New and Alamo Rivers and Irrigation Drains			San Felipe and Salt Creeks		
	N/DV	GM (µg/g dw)	Range (µg/g dw)	N/DV	GM (µg/g dw)	Range (µg/g dw)
Amphipod, pileworm, waterboatman composite	-	-	-	2/2	2.8	2.6-3.1

TABLE 2.3-11
Selenium Concentrations in Pelagic Invertebrates from the New and Alamo Rivers and Irrigation Drains and San Felipe and Salt Creeks, Salton Sea, 1988-1990

Pelagic Invertebrate Species	New and Alamo Rivers and Irrigation Drains			San Felipe and Salt Creeks		
	N/DV	GM (µg/g dw)	Range (µg/g dw)	N/DV	GM (µg/g dw)	Range (µg/g dw)
Asiatic river clam	5/5	4.4	2.6-6.4	-	-	-
Crayfish	-	-	-	2/2	3.1	2.4-3.3
Pileworm	8/8	3.1	0.8-12.1	-	-	-
Waterboatman	3/3	2.1	1.4-3.3	-	-	-

Source: Setmire et al. 1993
Notes: *Concentrations in dry weight; –: no data;* N/DV: number of samples collected per number of samples with detectable values; Geometric mean (GM): calculated using one-half detection limit when data set has more than 50 percent detectable values.

Selenium concentrations found in most invertebrates were generally below 5 µg/g DW, which has been recommended as a dietary threshold to avoid adverse effects in fish and birds that prey on invertebrates (Setmire et al. 1993). This finding indicates that selenium in invertebrates at the Salton Sea are unlikely to cause toxicity to predators feeding on invertebrates. However, some of the pileworms analyzed did exceed 5 µg/g DW with concentrations ranging from 0.8 to 12.1 µg/g DW.

Several species of aquatic birds or eggs were also sampled (Table 2.3-12) (Setmire et al. 1993). Selenium exposure and potential effects in birds can be assessed most directly through the selenium concentrations in eggs (Skorupa and Ohlendorf 1991; and DOI 1998). In the detailed study, black-necked stilts were the only species for which eggs were sampled. Stilt eggs had geometric mean concentrations of 6.2 µg/g or less at all locations. Based on Lemly (1996), the geometric mean indicates that risks are low to none for reproductive impairment in black-necked stilts though the range of concentrations likely exceeds 6.2 and could result in some reproductive impairment. In fact, Bennett (1998) conducted a study that evaluated nesting proficiency in comparison to egg selenium concentrations, and the results indicated that the species is likely experiencing a low level of selenium-induced reproductive depression at the Salton Sea.

TABLE 2.3-12
Selenium Concentrations in Migratory Birds and Estimated Egg Concentrations from the New and Alamo Rivers, Agricultural Drains, San Felipe Creek, Salt Creek and the Salton Sea Collected During 1988-1990

Bird species	Salton Sea				New and Alamo Rivers and IID Drains			
	N/DV	GM (µg/g dw)	Range (µg/g/dw)	Estimated egg Concentration (µg/g dw)[1]	N/DV	GM (µg/g dw)	Range (µg/g dw)	Estimated Egg Concentration (µg/g dw)[1]
Migratory Birds								
Eared grebe	5/5	12.7	2.7-35.1	-	-	-	-	-

19886

TABLE 2.3-12
Selenium Concentrations in Migratory Birds and Estimated Egg Concentrations from the New and Alamo Rivers, Agricultural Drains, San Felipe Creek, Salt Creek and the Salton Sea Collected During 1988-1990

	Salton Sea				New and Alamo Rivers and IID Drains			
Bird species	N/DV	GM (μg/g dw)	Range (μg/g/dw)	Estimated egg Concentration (μg/g dw)[1]	N/DV	GM (μg/g dw)	Range (μg/g dw)	Estimated Egg Concentration (μg/g dw)[1]
(muscle)								
Northern shoveler (liver)	-	-	-	-	19/19	19.1	9.1-47.0	6.3
Northern shoveler (muscle)	-	-	-	-	6/6	5.2	3.8-12.0	-
Ruddy duck (liver)	57/57	11.7	5.2-41.5	3.86	-	-	-	-
Ruddy duck (muscle)	17/17	4.8	2.7-7.2	-	-	-	-	-
White-faced ibis (carcass)	-	-	-	-	9/9	5.3	3.9-6.6	-
White faced ibis (liver)	-	-	-	-	9/9	7.4	5.0-13.2	2.44
Resident Birds								
American coot (liver)	-	-	-	-	3/3	10.3	7.9-16.3	3.4
Black-necked stilt (egg)	127//127	4.3	1.6-35.0	-	-	-	-	-
Black-necked stilt (carcass)	19/19	5.4	3.2-11.3	-	-	-	-	-
Listed Birds								
Yuma clapper rail (whole body)	-	-	-	-	1/1	-	4.8	-

Source Setmire et al. 1993
Notes Concentrations in dry weight; - No data; N.DV: number of samples collected per number of samples with detectable values
[a] Estimated from geometric mean using conversion factor from Lemly (1996)

A focused survey was conducted on selenium concentrations in subsurface drainwater, surface drainwater, bottom sediments, and transplanted Asiatic river clams at 48 irrigation drain sites in the Imperial Valley (Setmire et al. 1996; Roberts 1996; and Hurlbert 1997). Tilewater had the highest concentrations of selenium (median 28 μg/L). Drain samples

19887

showed considerable dilution of tilewater selenium (median 6 µg/L). Selenium in bottom sediments was correlated (r^2=0.55) with the percent material finer than 0.062 mm (median 0.5 µg/g).

In an attempt to evaluate concentrations of various compounds in colonial waterbirds, Audet et al. (1997) sampled eggs, bird livers, and fish from waterbird nesting colonies or adjacent areas at the Salton Sea. The results for selenium concentrations for bird egg and liver samples are presented in Table 2.3-13. Selenium concentrations found in eggs at the Salton Sea were below all teratogenesis thresholds indicating that selenium levels are below those found to cause teratogenesis. However, selenium concentrations in eggs were within the range at which reproductive performance could be affected. Fish samples were within the range of earlier studies (Saiki 1990; and Setmire et al. 1993).

TABLE 2.3-13
Selenium Concentrations in Bird Eggs and Livers Collected at the Salton Sea, 1991

	Egg Samples			Liver Samples		
Species	N	GM (µg/g dw)	Range (µg/g dw)	N	GM (µg/g dw)	Range (µg/g dw)
Double-crested cormorant	–	–	–	6	21.96	17-29
Great-blue heron	4	3.86	2.8-5	10	9.57	3.5-17
Black-crowned night-heron	3	5.27	4.6-6.5	4	12.24	4.8-20
White pelican	–	–	–	6	14.79	11-22
Black skimmer	12	4.65	2.2-8.2	–	–	–
Cattle egret	3	3.6	2.7-5.4	–	–	–
Great egret	9	4.77	3.5-7.1	–	–	–
Gull-billed tern	6	4.1	3.4-5.3	–	–	–

Source: Audet et al. 1997.
Notes: concentrations in dry weight; –: no data

Studies conducted on Yuma clapper rails (Roberts 1996; and USFWS 1994) involved analyses of sediment, crayfish, bird egg, kidney, liver, and whole body samples from salvaged birds for selenium and organochlorines. Egg and bird tissue samples were taken in the CDFG Wister Wildlife Management Unit when drainwater was being used as a water source for managed marshes. Concentrations of selenium from the study are presented in Table 2.3-14. The other samples (sediment and crayfish) were collected when most of the Wister Unit had been converted to the use of Colorado River water.

TABLE 2.3-14
Detection Frequency and Summary Statistics for Selenium in Yuma Clapper Rail Diet and Tissue Samples

Matrix	N/DV	Geometric Mean (µg/g dw)	Range (µg/g dw)
Sediments	19/19	1.43	0.55-9.57
Crayfish	19/19	2.16	0.92-4.67
Rail eggs	2/2	–	4.98-7.75

TABLE 2.3-14
Detection Frequency and Summary Statistics for Selenium in Yuma Clapper Rail Diet and Tissue Samples

Matrix	N/DV	Geometric Mean (μg/g dw)	Range (μg/g dw)
Rail liver	2/2	–	3.09-11.78
Rail kidney	1/1	–	3.69

Source: Roberts 1996
Notes: concentrations in dry weight; –: no data; N/DV: number of samples collected per number of samples with detected value

2.3.4 Covered Species and Habitat Associations

This HCP covers 96 species (Table 1.5-1). The covered species use one or more of the six general habitat types described below:

- Salton Sea
- Tamarisk scrub habitat
- Drain habitat
- Desert habitat
- Freshwater aquatic habitats
- Agricultural fields

The covered species can be grouped based on their habitat association and how they use the habitat. The following identifies the covered species associated with each of the habitat types in the HCP area, and describes how the habitat is used and the relative quality of the habitat for the covered species. Some species use more than one habitat in the HCP area and could be exposed to impacts in each of the habitats that they use. Such species are assigned to multiple habitats. More specific information on each of covered species' habitat requirements, status and distribution and life history traits is provided in Appendix A.

2.3.4.1 Salton Sea Habitat Associates

The Salton Sea is a large inland sea that attracts many species associated with large waterbodies as well as species that are more typically associated with coastal areas. Since its formation in the early 1900s the diversity and number of species using the Salton Sea has increased. The sea has become an important breeding location for several species. For example, the Salton Sea supports the largest inland breeding population of western snowy plovers. However, the Salton Sea is most well-known for the large populations of wintering birds. Located on the Pacific Flyway, many birds also pass through the Salton Sea area on migrations to and from Central and South America.

Table 2.3-15 identifies the covered species that are primarily associated with the Salton Sea. In the HCP area, some species (e.g., pelicans) only occur at the Salton Sea, while others use the Salton Sea in addition to other habitats within the HCP (e.g., western snowy plover).

19889

TABLE 2.3-15
Covered Species Associated with the Salton Sea in the HCP Area

Resident Breeders[a]	Migratory Breeders[a]	Short-Term Residents[a]	Transient Species[a]
Desert pupfish	Van Rossem's gull-billed tern	Osprey	California least tern
Double-crested cormorant	Black skimmer	Black tern	Elegant tern
Western snowy plover		Laughing gull	Merlin
		American white pelican	Black swift
		Wood stork	Vaux's swift
		Long-billed curlew	Purple martin
		California brown pelican	Bank swallow
			Reddish egret
			Bald eagle
			Prairie falcon
			Peregrine falcon

[a]Resident breeders are species that occur at the Salton Sea year-round and breed in this habitat in the HCP area.
Migratory breeders are species that breed at the Salton Sea but migrate out of the HCP area or into other habitats for the non-breeding season.
Short-term residents are species that do not breed in the HCP area, but migrate into the HCP area and use the Salton Sea for several months (e.g., during winter).
Transient species are species that do not breed in the HCP area, but use the Salton Sea in the HCP area for very short periods of time, typically during migration.

2.3.4.2 Tamarisk Scrub

The species associated with tamarisk scrub habitat are primarily riparian species that find optimal habitat in native riparian habitats consisting of cottonwoods, willows, and other native riparian plant species. As previously described, tamarisk invaded many areas and supplanted native riparian vegetation in the HCP area in most locations. Tamarisk also colonized non-riparian areas along drains or seepage areas. Tamarisk scrub habitat does not represent optimal habitat for the species that use this habitat in the HCP area. Rather, it constitutes the only available tree-dominated habitat in the HCP area. As such, it is used although not preferred. Table 2.3-16 identifies the covered species that use tamarisk scrub habitat in the HCP area.

TABLE 2.3-16
Covered Species Associated with Tamarisk Scrub Habitat in the HCP Area

Resident Breeders	Migratory Breeders	Short-Term Residents	Transient Species
White-tailed kite	Elf owl	Large-billed savannah sparrow	Merlin
Summer tanager	Brown-crested flycatcher	Sharp-shinned hawk	Black swift
Vermilion flycatcher	Yellow-breasted chat	Cooper's hawk	Vaux's swift
Gila woodpecker	Yellow warbler		Long-eared owl

TABLE 2.3-16
Covered Species Associated with Tamarisk Scrub Habitat in the HCP Area

Resident Breeders	Migratory Breeders	Short-Term Residents	Transient Species
Gilded flicker			Least Bell's vireo
Harris hawk			Purple martin
Crissal thrasher			Western yellow-billed cuckoo
			Bank swallow
			Willow flycatcher
			Arizona Bell's vireo

2.3.4.3 Drain Habitat Associates

Covered species using drain habitat in the HCP area include species that use it exclusively (e.g., Yuma clapper rail) as well as species that will exploit the resources of the habitat, but are not dependent upon it (e.g., northern harrier; Table 2.3-17). The highest quality drain habitat within the HCP area occurs on the state and federal refuges where active management promotes development of emergent aquatic vegetation such as cattails and bulrushes. The drains themselves also provide habitat; however, much of the vegetation in the drains consists of common reed or salt cedar, and only a small proportion of the drains supports cattails or bulrushes. Thus, for species with an affinity for emergent vegetation, habitat quality and availability is limited outside of the state and federal refuges.

TABLE 2.3-17
Covered Species Associated with Drain Habitats in the HCP Area

Resident Breeders	Migratory Breeders	Short-Term Residents	Transient Species
Yuma clapper rail	Fulvous whistling-duck	Aleutian Canada goose	Golden eagle
California black rail		Short-eared owl	Merlin
Desert pupfish		Northern harrier	Black swift
White-faced ibis		Greater sandhill crane	Vaux's swift
Least bittern			Purple martin
Lowland leopard frog[a]			Bank swallow
			Tricolored blackbird
			Bald eagle
			Peregrine falcon

[a] These species are addressed separately from the other species in this habitat group.

2.3.4.4 Desert Habitat Associates

Native desert habitat primarily occurs in the HCP area along the AAC. This portion of the HCP area consists of creosote bush scrub and desert dune habitats. This habitat has not been converted to another use, but is subject to disturbance from maintenance and recreational activities. Most of the covered species associated with desert habitat are limited to this habitat type (e.g., desert tortoise) and would not occur in other habitats in the HCP area. A few (e.g., loggerhead shrike) use desert habitats in addition to other habitats in the HCP area. Table 2.3-18 identifies the covered species associated with desert habitats.

TABLE 2.3-18
Covered Species Associated with Desert Habitat in the HCP Area

Resident Breeders	Migratory Breeders	Short-Term Residents	Transient Species
Cheeseweed moth lacewing[a]	Elf owl		Golden eagle
Andrew's scarab beetle[a]			Prairie falcon
Desert tortoise			
Colorado desert fringe-toed lizard			
Western chuckwalla			
Couch's spadefoot toad			
Colorado River toad[a]			
Flat-tailed horned lizard			
Banded gila monster[a]			
Harris' hawk			
Loggerhead shrike			
Le Conte's thrasher			
Crissal thrasher			
Jacumba little pocket mouse[a]			
Nelson's bighorn sheep			
Peirson's milk-vetch			
Algodones Dunes sunflower			
Wiggin's croton			
Flat-seeded spurge[a]			
Foxtail cactus[a]			
Munz's cactus[a]			
Giant Spanish needle			
Sand food			
Orocopia sage[a]			
Orcutt's aster[a]			

[a] These species are addressed separately from the other species in this habitat group.

2.3.4.5 Aquatic Habitat Associates

The conveyance and drainage systems provide aquatic habitat. Most of the fish species present in these systems are foreign species. Razorback suckers are the only covered species that are residents in the canal system. Desert pupfish are the only covered species that are residents in drains.

2.3.4.6 Agricultural Field Habitat Associates

Agricultural fields comprise most of the habitat in the Imperial Valley. While not a native habitat, many of the covered species have adapted to using agricultural fields in fulfilling one or more life requisites (Table 2.3-19). Often species show an association with certain crop types. Most of the covered species associated with agricultural fields use this habitat for foraging; only a few actually breed in agricultural habitats. Loggerhead shrike and Yuma cotton rat are the only species expected to breed in agricultural habitats. Actual nest locations of these species are on the margins of the fields. The remaining resident and migratory breeders breed in other habitats of the HCP area, but forage in agricultural fields during the breeding season. Agricultural habitats in the HCP area also provide foraging opportunities for wintering birds (i.e., short-term residents) and transient species.

TABLE 2.3-19
Covered Species Associated with Agricultural Fields in the HCP Area

Resident Breeders	Migratory Breeders	Short-Term Residents	Transient Species
Loggerhead shrike	Fulvous whistling-duck	Black tern	Prairie falcon
White-tailed kite		Mountain plover	Golden eagle
White-faced ibis		Ferruginous hawk	Swainson's hawk
Western snowy plover		Aleutian Canada goose	Merlin
Greater sandhill crane		Short-eared owl	Black swift
Yuma hispid cotton rat[a]		Northern harrier	Vaux's swift
Colorado River hispid cotton rat[a]		Long-billed curlew	Purple martin
			Bank swallow

[a]These species are addressed separately from the other species in this habitat group.

2.3.4.7 Other Species

Most of the covered species can be grouped according to their habitat associations. However, the occurrence of burrowing owls and the 12 bat species covered by the HCP are more a function of the occurrence of unique habitat features than the presence and quality of a general habitat type. Burrowing owls occur at high densities in the Imperial Valley and are associated with the general agricultural landscape. They are however, strongly associated with canals and drains where they inhabit burrows in the unlined banks of these structures. While the surrounding agricultural fields provide foraging opportunities, it is the presence of suitable burrows created by burrowing rodents that largely determine the occurrence of burrowing owls.

The HCP covers 12 bat species (Table 2.3-20). For foraging, it is likely that they use a wide range of habitats, exploiting localized areas of insect abundance. Habitats in the HCP area could be used for foraging. Whether any of the covered bat species roost in the HCP area and the types of structures that they use are unknown. Some bats probably roost outside of the HCP area but come into the HCP area to forage, while others can probably find suitable roosts within the HCP area in buildings, trees, bridges, or other structures. The location of suitable roosting sites is probably an important factor in the extent to which these species occur in the HCP area.

TABLE 2.3-20
Covered Bat Species in the HCP Area[a]

Species Name	
Spotted bat	Pale western big-eared bat
Western mastiff bat	Big free-tailed bat
California leaf-nosed bat	Mexican long-tongued bat
Occult little brown bat	Southwestern cave myotis
Western small-footed myotis	Pocketed free-tailed bat
Pallid bat	Yuma myotis

[a]The process for ensuring ESA and CESA coverage for these species is being developed.

CHAPTER 3

Habitat Conservation Plan Components and Effects on Covered Species

3.1 Approach to and Framework for the Conservation Strategy

The draft HCP employs both habitat-based and species-specific approaches. The habitat-based component of the conservation strategy of the draft HCP focuses on mitigating the potential loss of habitat values (quality and quantity) of each habitat type within the HCP area. This is accomplished primarily by creating or acquiring replacement habitat. The overall conservation strategy for the IID HCP is to maintain or increase the value (amount and/or quality) of each habitat in the HCP area in addition to implementing measures to minimize direct effects to covered species from operation and maintenance (O&M) and construction activities. The habitat-based conservation approach of the HCP is augmented by a species-specific treatment individual species (i.e., burrowing owls, desert pupfish, razorback sucker) that are not easily accommodated by habitat approach. Consistent with the guidance provided by the USFWS, all HCP effects are evaluated on a species-by-species basis. In addition to the habitat-based and species-specific strategies, the draft HCP contains general commitments that guide and facilitate the implementation of the plan.

The area for which IID seeks coverage supports six general habitats as follows:

- Salton Sea
- Tamarisk scrub
- Drain vegetation
- Desert
- Aquatic
- Agricultural fields

Covered species are assigned to one or more habitat groups based on the habitats that they use in the HCP area. The overall conservation strategy for the IID HCP is to maintain or increase the value (amount and/or quality) of each habitat in the HCP area. Species for which the ecology is best understood are used to develop the appropriate level of mitigation for each of the habitats occurring in the HCP area. By ensuring the habitat representation and quality in the HCP area, the persistence of covered species using these habitats can be reasonably assumed.

Although the HCP predominantly follows a habitat-based approach, the effect of the covered activities and implementation of the HCP measures on each covered species are evaluated as required under the USFWS's 5-Point Policy. Life history, habitat requirements, occurrence and distribution in the HCP area, and overall population status of each species are used to predict the potential effects of implementing the HCP. By considering each species individually within the habitat-based framework, the adequacy of the HCP measures in meeting the issuance criteria for each covered species is demonstrated.

The occurrence and distribution of burrowing owls in the HCP area is determined more by the availability of unique features (e.g., burrows) than the occurrence and distribution of a particular habitat type. A species-specific conservation strategy was developed for burrowing owls to ensure adequate coverage by the HCP measures. Further, the Aquatic Habitat group contains desert pupfish and razorback suckers. However, these species occupy two different aquatic habitats, the IID drainage system, and the IID conveyance system, respectively, and the effects of covered activities on these species are distinctly different. Therefore, desert pupfish and razorback suckers are also addressed individually.

IID's HCP consists of five habitat conservation strategies and three species-specific strategies. The habitat conservation strategies are as follows:

- Salton Sea habitat
- Tamarisk scrub habitat
- Drain habitat
- Desert habitat
- Agricultural field habitat

The three species-specific strategies are as follows:

- Burrowing owl
- Desert pupfish
- Razorback sucker

Each of these conservation strategies, described in the following sections, were developed based on the potential for and magnitude of the effects the covered activities could have on covered species using each habitat. The following description of the specific strategies and habitat conservation measures is presented to help facilitate an understanding of the details of the commitments made by IID. The italicized language presented within text boxes represents the specifics of the measure; the text that follows each measure provides a justification for the measure and additional clarification. This format is intended to improve the readers' ability to understand and distinguish the key elements and commitments of the plan. However, the document as a whole, not just the language contained in the text boxes, forms the basis of IID's HCP and its commitments.

The elements of this HCP that address the effects related to changes at the Salton Sea were not developed in anticipation of a project to restore the Salton Sea nor are they dependent upon implementation of a future restoration project. However, because a future project could influence the appropriateness or need for certain mitigation measures, several of the measures contain alternative direction in the event that a restoration project is implemented.

3.2 General HCP Commitments

To ensure proper implementation of the HCP measures presented in the following sections and the Monitoring and Adaptive Management Program (Chapter 4), IID will hire a full-time biologist to oversee implementation of the HCP measures and convene an HCP Implementation Team (HCP IT) to guide implementation of and adjustments to the HCP. These commitments are described in more detail below.

General – 1. *Within 1 year of issuance of the ITP, IID will appoint a full-time equivalent biologist/project manager (HCP Implementation Biologist) to manage the proper implementation of the HCP. Responsibilities will include ensuring adequate staffing and resources. Prior to securing a full-time equivalent biologist/project manager, IID's existing environmental compliance staff will ensure compliance with the HCP requirements.*

The HCP contains a suite of measures covering a variety of habitats and species and requires a comprehensive monitoring program. To ensure that the terms of the HCP are carried out, IID will hire a full-time biologist. The HCP Implementation Biologist will be responsible for ensuring that IID is complying with the HCP conditions.

General – 2. *Within 3 months of issuance of the ITP, IID will convene an HCP Implementation Team consisting of representatives from IID, USFWS, and CDFG.*

IID will convene an HCP Implementation Team consisting of representatives from IID, USFWS, and CDFG to guide execution of the HCP over the term of the HCP. The purpose of the IT is to collaboratively guide and coordinate execution of the HCP over the term of the permit. The HCP IT will be responsible for the following:

- Guiding implementation of the HCP measures (e.g., identifying the location and characteristics for managed marsh habitat to be created under the DHCS)
- Developing specific methodologies for survey programs and studies, and
- Adjusting the HCP measures under the Adaptive Management Program.

Specific responsibilities of the HCP IT are identified in the HCP measures presented in the following sections, in Chapter 4 Monitoring and Adaptive Management and Chapter 5 Plan Implementation.

3.3 Salton Sea Habitat Conservation Strategy

3.3.1 Amount and Quality of Salton Sea Habitat

For the species covered by the HCP, use of the Salton Sea is a function of the abundant food resources, availability of a large, open body of water, and the presence of unique habitat features. The attractiveness of the Salton Sea to piscivorous birds stems from the very high abundance of fish at the Salton Sea. The availability of protected nesting and roosting locations adds to the attractiveness of the Salton Sea to these birds and other colonial-nesting birds. For non-piscivorous bird species, abundant aquatic invertebrates are an important food resource. Aquatic invertebrates include brine shrimp, brine fly larvae, adult pileworm, and barnacle nauplia and cypris. In addition to the food resources and nesting/roosting areas for birds, the Salton Sea provides habitat for desert pupfish and could play a role in supporting shoreline strand and adjacent wetland vegetation. Potential impacts of the covered activities to covered species using these resources relate to changes in salinity and the water surface elevation of the Salton Sea.

3.3.1.1 Fish Abundance

The tilapia, *Tilapia mozambicus,* is the primary prey for covered species of piscivorous birds at the Salton Sea. Changes in the abundance of tilapia could alter the level of use of the Salton Sea by covered species of piscivorous birds. Thus, it is important to consider the ecology of tilapia at the Salton Sea in assessing the potential effects of the water conservation and transfer programs on covered piscivorous birds.

The Salton Sea supports the highest density of tilapia reported. Costa-Pierce and Riedel (2000a) estimated the standing crop of tilapia as 3,200 pounds per acre (lb/acre), 3.6 to 14.4 times greater than some tropical lakes in Southeast Asia. Within the Salton Sea, the highest densities of tilapia occur at the New and Alamo River deltas and in nearshore areas (Costa-Pierce and Riedel 2000a; Costa-Pierce pers. comm. 2000). The nearshore area of high tilapia density extends about 1,970 feet from the shoreline and at the deltas areas about 0.39 mi^2 (square miles) in size around each river mouth support high tilapia density. The catches per unit effort of tilapia in the deltas and nearshore areas were more than 10 to 30 times greater than in pelagic areas of the sea and in the rivers (Table 3.3-1).

A food habit study of tilapia in the Salton Sea showed that in pelagic areas tilapia feed on zooplankton, particularly copepods and rotifers, whereas in the nearshore and deltaic areas, the diet was much more diverse and included a substantial amount of sediment and detrital matter (Costa-Pierce and Riedel 2000b). The high concentration of tilapia in the river deltas and nearshore areas may be related to the high levels of organic m atter in the river and drain discharges to the sea at these locations. The nearshore and delta areas also support breeding by tilapia. In addition to nearshore and delta areas, tilapia spawn in drains.

TABLE 3.3-1
Catch Per Unit Effort for Tilapia in the Salton Sea

Area	Catch Per Unit Effort (kg/hr)
Pelagic	0.22
Nearshore	2.37
River deltas	3.29
River channels	0.1

Source: Costa-Pierce and Riedel (2000a)

Tilapia have a high salinity tolerance. They are able to adapt to very high salinity levels, particularly if the increase in salinity is gradual (Phillipart and Ruwet 1982 cited in Costa-Pierce and Riedel 2000a). Tilapia have been collected at a salinity level of 120 ppt, but reproduction has not been reported at this salinity level (Whitfield and Blaber 1979). Costa-Pierce and Riedel (2000a) provide a review of reported salinity tolerances of tilapia. Highest growth rates were reported at 14 ppt, but growth was still good and tilapia reproduced at 30 ppt. At 69 ppt, tilapia grew poorly, but reproduced well. In the Salton Sea at about 44 ppt, tilapia also grew poorly, but reproduced well. Based on these studies, Costa-Pierce and Riedel (2000a) suggested that tilapia in the Salton Sea could successfully acclimate to and continue to reproduce at a salinity level of 60 ppt. Above a salinity level of 60 to 70 ppt, growth, survival, and reproduction would decline (Costa-Pierce, pers. comm. January 12, 2001). While evidence suggests that reproduction of tilapia will begin to decline at a salinity level above 60 ppt, the actual salinity thresholds for reproduction and survival in the Salton Sea could be higher.

3.3.1.2 Nesting and Roosting Sites

Nesting and roosting sites used by covered species (i.e., black skimmers, gull-billed terns, white pelicans, brown pelicans, and double-crested cormorants) are presently available at several locations around the Salton Sea. Most sites are small, generally less than 0.25 acres, and with low relief, sometimes only a few inches above the level of wind-driven wave inundation. Water depth between islands and the mainland is only a few feet. Mullet Island is the largest island and used heavily as a nesting and roosting site. Other smaller islands consisting of old earthen levees are also available. Fewer islands are present in the northern portion of the sea; remnants of earthen levees near the mouth of the Whitewater River provide some nesting and roosting sites.

3.3.1.3 Desert Pupfish

Desert pupfish inhabit pools formed by barnacle bars located in near-shore and shoreline areas of the Salton Sea and at Salt and San Felipe creeks. Barnacle bars are deposits of barnacle shells on beaches, near-shore, and at the mouths of drains that discharge to the Salton Sea. Pools form behind the barnacle bars. These pools provide habitat for pupfish and also are believed to be important for allowing pupfish movement among drains, shoreline pools and smaller tributaries such as Salt and San Felipe creeks.

3.3.1.4 Shoreline Strand and Adjacent Wetland Habitat

The Salton Sea database identifies 293 acres of shoreline strand habitat along the Salton Sea. Shoreline strand habitat consists of tamarisk and iodine bush. In addition to the shoreline strand, the Salton Sea database identifies 2,349 acres of adjacent wetlands dominated by tamarisk. The source of the water that supports the shoreline strand community is uncertain but could consist of a combination of shallow groundwater and seepage from the Salton Sea. These areas potentially provide habitat for covered species associated with tamarisk scrub habitat.

3.3.2 Effects of the Covered Activities

The primary potential effects of the covered activities on covered species using the Salton Sea relate to changes in the rate of salinization of the sea and changes in the water surface elevation. The salinity level influences the abundance and persistence of fish that support foraging by piscivorous birds and also could influence the ability for pupfish to use the sea to move among drains and to move from Salton Sea to San Felipe Creek and mouth of Salt Creek. Reductions in the water surface elevation could influence the availability and suitability of nesting and roosting areas for colonial nesting birds and also the extent of tamarisk along the sea's margins. The projected changes in salinity and water surface elevation with and without implementation of the water conservation and transfer programs and the potential responses of covered species to these changes are described below.

3.3.2.1 Increased Salinity

Since its formation, the salinity of the Salton Sea has been increasing because of high evaporative water loss and continued input of salts from irrigation drainage water. Increasing salinity of Colorado River water delivered at Imperial Dam, which is the sole source for irrigation water in Imperial Valley, also is a factor. The Salton Sea is currently hypersaline, with salinity greater than the ocean.

The Mozambique tilapia is the most abundant fish species in the Salton Sea (Costa-Pierce and Riedel 2000a; Black 1988) and is the primary forage species for piscivorous birds at the Salton Sea (Molina 1996; S. Johnson, pers. comm. 2000). Because of the importance of tilapia in the diet of piscivorous birds at the Salton Sea, the potential change in the tilapia population of the Salton Sea is the focus of assessing the impact of the covered activities on covered piscivorous bird species.

Modeling by Reclamation (2001) indicates that the salinity of the Salton Sea would continue to gradually increase over the next 75 years in the absence of the water conservation and transfer programs. The mean of the salinity projections show the salinity of the Salton Sea surpassing 60 ppt in 2023 (Figure 3.3-1). Costa-Pierce and Riedel (2000a) stated that survival, growth and reproduction would decline at a salinity above 60 ppt. Thus, once the salinity of the Salton Sea surpassed 60 ppt, tilapia abundance would be expected to decline as the increasing salinity impaired reproduction. However, relatively freshwater inflow from the New and Alamo Rivers creates an estuarine environment in the river deltas where salinity levels are lower than in the main body of the Salton Sea. Under current conditions, Costa-Pierce and Riedel (2000c) reported salinity levels ranging from 10 to 30 ppt in the river deltas. Tilapia could persist at the Salton Sea if the deltas continued to provide lower salinity environments.

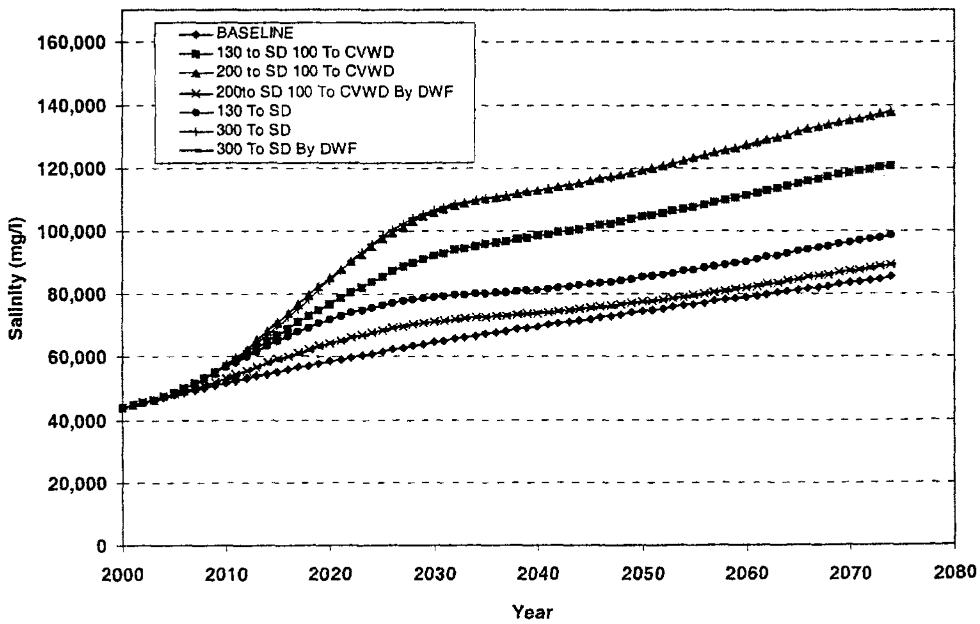

FIGURE 3.3.-1
Projected Salinity Levels With and Without Implementation of the Water Conservation and Transfer Programs

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Water conserved through IID's water conservation programs would result in a reduction in inflows to the Salton Sea. This inflow reduction would increase the rate of salinization of the sea. IID could achieve water conservation through a combination of on-farm and system-based measures, and fallowing. The degree to which water conservation would accelerate salinization would depend on the method of water conservation, the amount of water conserved, and the amount of water transferred out of the Salton Sea basin. The potential effects of the water conservation and transfer programs on the rate of salinization are bounded by projections of 1) using all on-farm and system-based measures to achieve 300 KAFY of conservation and 2) using all fallowing to achieve 300 KAFY of conservation (Figure 3.3-1). With conservation and transfer of 300 KAF using on-farm and system-based measures the mean salinity of the Salton Sea is predicted to surpass 60 ppt in 2012 (Figure 3.3-2), 11 years earlier than under the baseline projections. Using all fallowing to achieve the same level of conservation, the mean salinity of the Salton Sea is predicted to exceed 60 ppt in 2017 or 2016, six to seven years earlier than under the baseline condition, depending on where the water is transferred.

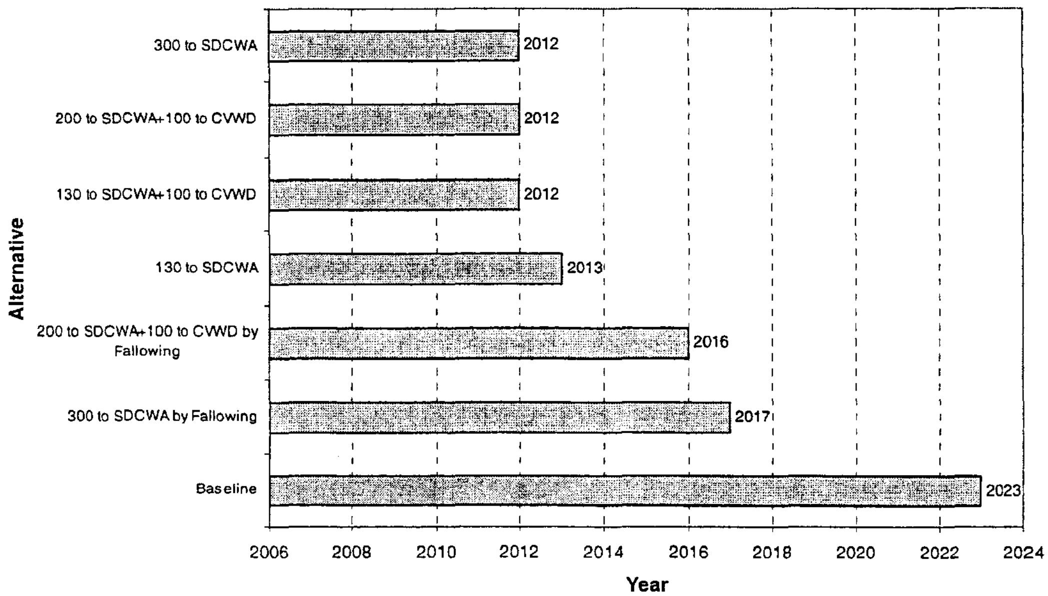


FIGURE 3.3-2
Year That Mean Salinity of the Salton Sea is Projected to Exceed 60 ppt Under the Baseline Condition and the Potential Range of Water Conservation Amounts and Transfer Locations

The preceding discussion could be interpreted as suggesting that the rate and magnitude future changes in salinity and the response of tilapia are certain and determinant. The modeling conducted by Reclamation constitutes the best available information on the rate and magnitude of salinity increases at the Salton Sea. However, models are necessarily simplified representations of complex systems that can and do react unpredictably. Myriad factors will influence the actual salinity trajectory of the sea. Factors potentially influencing the salinity trajectory include but are not limited to future weather conditions; unknown chemical dynamics; variations in inflows from Mexico; implementation of a Salton Sea Restoration Project; variations in IID diversion levels because of legal or political changes, drought in the upper basins states, or others factors. These unknowns could accelerate or decelerate the salinization of the Sea relative to the current projections. However, these factors would be expected to equally affect the projections with and without implementation of the water conservation and transfer programs. As such, the differences between the salinity projections with implementation of the water conservation and transfer programs and the baseline would not be expected to change substantially.

In the preceding discussion, tilapia were assumed to no longer be able to reproduce once the salinity of the sea reached 60 ppt and at that point their abundance at the sea would decline. The actual response of tilapia to increased salinity at the Salton Sea likely will be much less definitive for several reasons. First, relatively freshwater will continue to flow into the Salton Sea at the New, Alamo and Whitewater rivers and from the drains. Some tilapia could persist at the Salton Sea if low salinity areas persisted around the deltas and potentially near drain outlets. Second, given tilapia's ability to tolerate very high salinity levels as juveniles and adults, the deltas and drains could serve as a breeding population from which individuals could disperse to populate other areas of the sea until the salinity of the main body became intolerable to adults and juveniles. Third, tilapia at the Salton Sea could evolve to tolerate higher salinities. These three factors could act to extend the persistence and abundance of tilapia at the Salton Sea. Alternatively, increased stress associated with higher salinity could increase the susceptibility of tilapia to disease and lead to increased incidences of massive die-offs. Although the exact response of tilapia to increased salinity cannot be predicted with certainty, it is reasonable to expect that the total tilapia population supported in the Salton Sea would be reduced relative to existing conditions. This reduction would occur with or without implementation of the water conservation and transfer programs. The potential effects of a reduction in tilapia at the Salton Sea on the four major piscivorous birds covered by the HCP are described below.

American White Pelican

White pelicans use the Salton Sea as a migratory stopover and wintering area. As a migratory stopover, individual pelicans appear to use the Salton Sea for a few weeks to a few months before continuing on their migration to Mexico (Shuford et al. 1999). Some birds probably remain at the Salton Sea throughout the winter rather than continuing on to Mexico.

The number of pelicans using the Salton Sea at any time varies substantially. According to counts reported by USFWS and aerial surveys conducted by Point Reyes Bird Observatory (Shuford et al. 2000), the Salton Sea at times supports one of the largest concentrations of white pelicans in the Pacific Flyway. McKay reported maximum counts of white pelicans at the Salton Sea during 1984 to 1990. The maximum counts ranged from 2,000 to 17,000 and usually occurred in February. The average of maximum counts for these years was 6,500 white pelicans. Based on a sharp decline in counts between 1985 and 1990, the population of pelicans using the Salton Sea was believed to be declining. However, the aerial surveys conducted in 1999 found 16,697 pelicans using the Salton Sea in January and February, a similar number as reported by McKay in 1985 (17,000; Shuford et al. 2000). The following November, Shuford et al. (2000) reported 19,197 pelicans at the Salton Sea.

Christmas Bird count data show white pelicans at the Salton Sea in every year since 1979 (Figure 3.3-3). The number of birds observed in Christmas Bird Counts at the Salton Sea from 1979 to 2000 averages about 2,195.

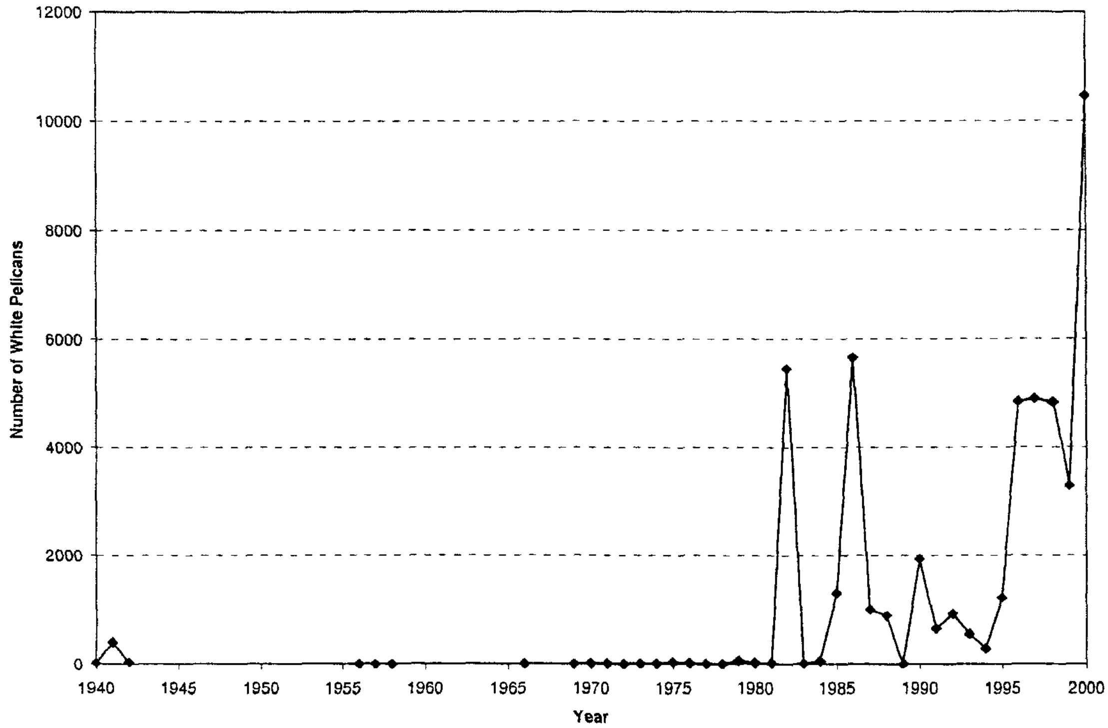


FIGURE 3.3-3
Number of White Pelicans Reported in Christmas Bird Counts at the Salton Sea from 1940 to 2000

The USFWS recorded numbers of white pelicans at the Salton Sea for a 21-month period between December 1999 and August 2001. White pelican numbers were highest (24,110) in February 2000 and lowest (770) June 2001 (Table 3.3-2).

TABLE 3.3-2
American White Pelicans Reported at the Salton Sea, California.

Date	Number Counted
December 1999	5,000
January 2000	8,875
February 2000	24,110
March 2000	15,408
April 2000	7,255
May 2000	3,510
June 2000	3,459
July 2000	1,147

TABLE 3.3-2
American White Pelicans Reported at the Salton Sea, California.

Date	Number Counted
August 2000	994
September 2000	13,997
October 2000	5,075
November 2000	3,000
December 2000	7,380
January 2001	8,736
February 2001	18,705
March 2001	15,036
April 2001	3,200
May 2001	1,245
June 2001	770
July 2001	1,320
August 2001	7,430
Average	**7,412**

Source: Salton Sea Authority, Wildlife Disease Program

These data indicate that winter and migratory use of the Salton Sea is highly variable within and among years. While large numbers of white pelicans stop at the Salton Sea for brief periods of time on migration or exploit food resources at the sea sporadically during the winter, the average wintering population is much lower. Pelicans that overwinter at the Salton Sea usually are present in greatest numbers at the Salton Sea from November to April (Shuford et al. 2000). In addition to the Salton Sea, pelicans using the Pacific Flyway also overwinter along the California coast south of San Francisco, the San Joaquin Valley, throughout Baja California, and in the Gulf of California (Johnsgard 1993).

Pelicans are highly opportunistic and mobile in selecting foraging sites, and have been reported to travel long distances to forage even during breeding, an energetically stressful time (Knopf and Kennedy 1980). At Pyramid Lake, Nevada, pelicans have been reported foraging at seven different lakes during the breeding season. With the exception of Pyramid Lake where the breeding colony is located, all of the foraging sites were more than 37 miles from Pyramid Lake, with the farthest foraging site (Stillwater NWR), nearly 62 miles away (Knopf and Kennedy 1980). Knopf and Kennedy (1980) found that pelicans nesting at Pyramid Lake switched foraging locations frequently during the nesting season. Changes in foraging location appeared to be linked to the availability of fish. For example, pelicans used Pyramid Lake, the closest foraging location to the breeding colony, at relatively low levels except for June when tui chub became available in shoreline areas. Knopf and Kennedy (1980) characterized pelicans as "opportunistic in selecting foraging sites where fish are most readily available." Johnsgard (1993) also notes the great distances that pelicans will travel to forage. Summarizing data from other studies, Johnsgard (1993) reports one-way foraging flights of up to 100 miles (Great Salt Lake), round trips of 60 to 380 miles (Chase Lake, ND), and one-way distances of 90 miles (Harvey and Warner basins).

The reported foraging behavior of white pelicans indicates that they seek the most favorable foraging area within a wide area. The availability of an abundant source of fish, tilapia in particular, makes the Salton Sea attractive to pelicans. With increased salinity of the Salton Sea, the abundance of tilapia would likely decline as described above. However, tilapia could persist at the Salton Sea, particularly in the New and Alamo River deltas. Pelicans currently concentrate foraging in the deltas (Shuford et al. 2000). With the continued persistence of tilapia at the Salton Sea, pelicans would likely continue to use the Salton Sea as a migratory stopover and wintering area. However, if salinity increases result in a substantial decline in the abundance of tilapia, it is reasonable to expect that the level of use of the Salton Sea by white pelicans would decline. A decline in the level of use of the Salton Sea by pelicans could be manifested as a shorter stopover time for birds that continue to wintering grounds farther south, lower numbers of birds, or shorter residence periods of overwintering birds. Given their opportunistic foraging strategy and ability to travel long distances, it is likely that pelicans would switch to other wintering areas if fish at the Salton Sea became less abundant and if the energetic costs of foraging there became greater than at other locations in California and Mexico. As such, the actual level of take resulting from changes in fish abundance is uncertain. However, it is reasonably likely that the level of use of the Salton Sea by white pelicans would decline as tilapia abundance declined. This effect would occur with and without implementation of the water conservation programs. The effect of the water conservation programs would be to accelerate the rate at which this effect would be manifested.

Adult pelicans are capable of moving long distances to find food. As such, with a decline in the abundance of fish at the Salton Sea, at least some of the adult pelicans, albeit possibly not all, should be able to find alternate food resources. The segment of the population most at risk to adverse effects of reduced fish abundance at the Salton Sea likely would be first year birds. First year birds are not as experienced as older birds at locating food and exploiting food resources. For brown pelicans, Johnsgard (1993) suggested that the high mortality rate of first year birds and substantially lower mortality rate of birds older than 1 year reflected an improved foraging efficiency of older birds. Similarly, first year white pelicans could be the least adept segment of the population at finding and exploiting alternate foraging habitat with a decline in the abundance of fish at the Salton Sea. A portion of the birds using the Salton Sea, possibly disproportionately first year birds, could be injured or killed if they could not find alternate foraging habitat or forage efficiently.

California Brown Pelican

Brown pelicans probably had little historical use of the Salton Sea (Anderson pers. comm.). Some postbreeding pelicans were documented at the sea in the late 1970s. Use of the Salton Sea by brown pelicans subsequently increased, with the maximum summer usage estimated at 5,000 birds. Nearly 2,000 were recorded in 1999, but a maximum of only 1,000 were recorded in 2000 (Shuford et al. 2000). The USFWS recorded numbers of brown pelicans at the Salton Sea for a 21-month period between December 1999 and August 2001. Brown pelican numbers were highest (3,990) in July 2001 and lowest (5) March 2000 (Table 3.3-3).

TABLE 3.3-3
California Brown Pelicans Reported at the Salton Sea, California.

Date	Number Counted
December 1999	100
January 2000	50
February 2000	40
March 2000	5
April 2000	10
May 2000	82
June 2000	2,563
July 2000	1,948
August 2000	1,354
September 2000	918
October 2000	300
November 2000	319
December 2000	96
January 2001	38
February 2001	65
March 2001	6
April 2001	16
May 2001	530
June 2001	2,650
July 2001	3,990
August 2001	3,280
Average	**874**

Source: Salton Sea Authority, Wildlife Disease Program

The post-breeding visitors are mostly young birds that disperse northward from breeding areas in the Gulf of California (Hazard, pers. comm.). Most use of the Salton Sea is by post-breeding visitors, with more limited use for wintering. Shuford et al. (2000) reported that brown pelicans occur at the Salton Sea primarily from mid-June to early October. They observed the highest numbers in August. The primary wintering area in the U.S. is along the California coast (Johnsgard 1993).

Brown pelicans only recently, in 1996, started nesting at the Salton Sea (Shuford et al. 1999). The number of breeding birds has been low with 6 pairs nesting in 1996 and several pairs attempting to nest in most years since then (Shuford et al. 1999). Brown pelicans did not nest at the Salton Sea in 1999 (Shuford et al. 2000). Nesting birds have used tamarisk at the Alamo River delta and also attempted to nest at Obsidian Butte (S. Johnson, pers. comm.).

Compared to the nearest breeding colonies of brown pelicans located in the Gulf of California on San Luis Island (4,000 to 12,000 pairs), Puerto Refugio (1,000 to 4,000 breeding pairs) and Salsipuedes/Animas/San Lorenzo area (3,000 to 18,000 pairs), the population nesting at the Salton Sea makes a small contribution to the overall population. Other breeding populations occur off the southern California Coast and the western coast of Baja California (Johnsgard 1993).

Dispersing juveniles wander considerably from nesting locations and can travel long distances (Johnsgard 1993). Young eastern brown pelicans can move more than 310 miles from breeding areas (Johnsgard 1993). Similarly in California, most banded birds were recovered within 310 miles of the breeding site but one was found in Mexico, 1,375 miles away from the banding location (Johnsgard 1993). Adults also appear to become wanderers after breeding and have been reported to move 280 to 360 miles from nesting areas (Johnsgard 1993).

As previously described, the abundance of tilapia is expected to decline as the salinity of the sea increases. However, tilapia could persist at the Salton Sea, particularly in the New and Alamo River deltas. Pelicans currently concentrate foraging in the deltas (Shuford et al. 2000). With the continued persistence of tilapia at the Salton Sea, brown pelicans would likely continue to visit the Salton Sea as post-breeders. Because post-breeding pelicans are known to wander over large areas, it is likely that the pelicans would remain at the Salton Sea for a shorter period of time and/or seek out more favorable foraging areas in the Gulf of California or along the Pacific Coast, if foraging becomes energetically unfavorable at the Salton Sea. These areas are within the distances that brown pelicans can travel. As such, the actual level of take of post-breeding visitors resulting from changes in fish abundance is uncertain. However, it is reasonably likely that the level of use of the Salton Sea by brown pelicans would decline as tilapia abundance declined. This effect would occur with and without implementation of the water conservation programs. The water conservation programs would only act to accelerate the rate at which this effect would be manifested.

Breeding only recently was initiated at the Salton Sea and only in small numbers of birds (6 pairs or fewer). Brown pelicans did not nest at the sea in 1999 (Shuford et al. 2000). Brown pelicans that have nested at the Salton Sea represent less than 1 percent of the California breeding population (Johnsgard 1993) and a far smaller percentage of the subspecies' entire population. Depending on the degree to which the tilapia population declines, brown pelicans might not nest at the Salton Sea again in the future Because of the small number of birds that have nested at the sea and the infrequency of nesting, the impact associated with the potential loss of future breeding opportunities for brown pelicans at the Salton Sea would be minor.

Black Skimmer

Black skimmers first appeared in California in 1962. Six years later five skimmers were sighted at the Salton Sea (Collins and Garrett 1996). The first nesting by black skimmers in California occurred in 1972 at the Salton Sea (Collins and Garrett 1996). Since black skimmers were first observed in California, their numbers have been steadily increasing. New breeding locations have been reported at several locations along the California Coast from San Diego to San Francisco Bay and the number of birds using these various locations has generally been increasing (Table 3.3-4). In addition to the California nesting sites, black skimmers nest at Montague Island in the Gulf of California (Collins and Garret 1996).

At the Salton Sea, nesting colonies of black skimmers have ranged in size from 10 to several hundred pairs; most colonies consist of 50 to 200 pairs (Molina 1996). As many as 777 black skimmers have been reported in summer (Shuford et al. 2000). The Salton Sea is unique in being the only inland breeding site of this species and currently supports about 30 percent of the known breeding population in California. Skimmers nest on bare earthen slopes, terraces, and levees adjacent to the Sea. Specific nesting locations include Mullet Island, the Whitewater River delta, Morton Bay, Rock Hill, and Obsidian Butte.

TABLE 3.3-4
Number of Pairs or Nest Initiations* by Black Skimmers at Various Locations in California, 1972-1995.

Year	Salton Sea	San Diego Bay	Bolsa Chica	Upper Newport Bay	San Francisco Bay	Batiquitos Lagoon
1972	5					
1973	3					
1974	10					
1975	9					
1976	25	1				
1977	100	3				
1978	100	6				
1979	ND	14				
1980	0	30				
1981	0	25				
1982	0	35				
1983	0	50				
1984	0	++				
1985	47	150	10*			
1986	300	130	60*	2		
1987	500	++	106*	ND		
1988	100	200	150*	15		
1989	0	++	112*	45		
1990	100	++	338*	14		
1991	80	>157	398*	40		
1992	100	++	278*	++		
1993	300	326 (473*)	284*	++		
1994	450	310 (420*)	353*	++	2*	
1995	487	>200	201*	451*	2*	14*

Source: Collins and Garrett (1996)
ND: no data available
++ birds seen, possibly in large numbers, but no nest census data available.

After breeding, skimmers appear to be very mobile, moving among a number of wintering locations. Gazzaniga (1996) showed wide month-to-month fluctuations in the number of skimmers using five locations on the California coast. The reasons for the fluctuations were unclear, but she suggested that weather and food resources could play a role. Long distance movements by black skimmers also have been reported. Palacios and Alfaro (1992) captured birds banded at Bolsa Chica along the coast of Baja California and Gazzaniga (1996) observed a bird banded at Bolsa Chica at Princeton Harbor, 160 miles north of Bolsa Chica. Skimmers banded as chicks at Bolsa Chica have also been found breeding at Montague Island in the Gulf of California (Collins and Garret 1996). In combination with the observed colonization of several locations on the California coast since the 1970s, these observations suggest that skimmers regularly travel long distances during the winter and will establish breeding colonies where suitable nesting conditions exist.

Black skimmers could be adversely affected by the changes predicted at the Salton Sea in two ways. First, the water surface elevation of the Salton Sea is projected to decline and to create a land bridge to Mullet Island (see section 3.3.2.2). The suitability of this nesting location for black skimmers could decline if predation or disturbance increased as a result of formation of the land bridge. In addition, other nesting and roosting locations could become less suitable for black skimmers as the sea elevation declines. Second, the increased salinity is expected to result in reduced abundance of tilapia. These effects would occur with or without implementation of the water conservation and transfer programs. However, the projected salinity change and decline in tilapia abundance could be accelerated by the water conservation programs

Skimmers are believed to feed on young tilapia to a large extent at the Salton Sea (Molina 1996). While tilapia could persist at the Salton Sea, their abundance and reproductive rate is expected to decline. As a result, prey availability for skimmers could decline, and nesting might not be sustained or could occur at a lower level than currently is supported at the Salton Sea.

Double-Crested Cormorant

At the Salton Sea, cormorants nest on rocky ledges on Mullet Island or on dead vegetation at the deltas of the New and Alamo rivers. Snags in the Salton Sea are important for providing protected roost sites for double-crested cormorants. Cormorants regularly move between the Salton Sea and the lakes at the Finney-Ramer Unit of the Imperial Wildlife Area where they forage. Lakes at the Finney-Ramer Unit of Imperial WA also support double-crested cormorant nesting and roosting.

Double-crested cormorants are a common and abundant species at Salton Sea, with counts of up to 10,000 individuals (USFWS 1993; IID 1994). Small nesting colonies were documented at the north end of the sea in 1995 (USFWS 1996), but recently (1999) more than 7,000 double-crested cormorants and 4,500 nests were counted on Mullet Island. Mullet Island now represents the largest breeding colony of double-crested cormorants in California (Shuford et al. 1999). The year-round resident population is about 3,000 birds (Shuford et al. 2000).

With increased salinity of the Salton Sea, the abundance of cormorants at the Salton Sea could decline with reduced prey availability (i.e., tilapia). Increased salinity and reduced fish abundance at the Salton Sea would occur irrespective of the water conservation programs. However, the implementation of the water conservation programs could accelerate the occurrence of these changes. Changes in the suitability of nest and roost sites as the sea's elevation recedes also could occur. As described below, the sea's elevation is projected to decline under the baseline condition and with the water conservation and transfer programs. As a result, Mullet Island would become connected to the mainland potentially leading to increased disturbance or predation at the cormorant colony. Cormorants could abandon the colony on Mullet Island as a result of changes in the suitability of the site and/or changes in prey availability.

Even with changes in the suitability of foraging, roosting, and nesting habitat quality at the Salton Sea, cormorants would still inhabit the HCP area. They currently nest and roost on the Finney-Ramer Unit of the Imperial WA and forage at lakes on this unit as well as in agricultural drains, reservoirs, and Fig Lagoon. The New and Alamo River deltas also would continue to provide nesting, roosting, and foraging opportunities. However, the large colony on Mullet Island would probably not persist.

Desert Pupfish

Desert pupfish have a high salinity tolerance. They have been collected at a salinity as high as 90 ppt (Kinne and Kinne 1962). Under baseline conditions, the projections show that the mean salinity of the Salton Sea would not exceed 90 ppt in 75 years. Similarly, the mean salinity would not be expected to exceed 90 ppt in 75 years with use of all fallowing to conserve water. (Table 3.3-5). Thus, under both of these conditions (baseline and conservation of 300 KAF with all fallowing), pupfish would be expected to be able to continue to use the sea to move among drains.

With conservation using on-farm and system-based measures to conserve 300 KAFY, the mean projections show the salinity of the Salton Sea exceeding 90 ppt in 2022 (Table 3.3-5). At this salinity, the sea could become intolerable to pupfish and prevent them from moving among drains. If the sea becomes a barrier to pupfish, pupfish could be isolated in individual drains. Small, isolated populations are at risk of extinction because of environmental and genetic stochasticity. Ultimately, this condition also would occur under the baseline and with water conservation achieved with all fallowing, but at a later time.

TABLE 3.3-5
Mean Year that Salinity of the Salton Sea is Projected to Exceed 90 ppt Under the Baseline Condition and Various Water Conservation and Transfer Scenarios

Scenario	Year
Baseline	>2074[a]
300 KAFY to SDCWA by Fallowing	>2074[a]
200 KAFY to SDCWA + 100 KAFY to CVWD by Fallowing	>2074[a]
130 KAFY to SDCWA	2060
130 KAFY to SDCWA + 100 KAFY to CVWD	2029
200 KAFY to SDCWA + 100 KAFY to CVWD	2022
300 KAFY to SDCWA	2022

[a]The model projections stopped in 2074.
Source: Reclamation (2001)

3.3.2.2 Water Surface Elevation

The water surface elevation of the Salton Sea is projected to decline under both the baseline condition and with implementation of the water conservation and transfer programs. Under the baseline condition, the water surface elevation is projected to decline until a new equilibrium (evaporation equals inflows) is reached at about –235 ft msl in the years 2070 to 2075 (Figure 3.3-4). The projected baseline is based on changes in current inflows as a result of the following:

- Continued and full implementation of the existing IID/MWD transfer
- Higher salinity in the Colorado River at Imperial Dam
- Reduced surplus flows available from the Colorado River
- Reduced contributions from the Coachella Aquifer.

The IID/MWD transfer began producing water in about 1990, ramping up to full implementation in 1999. The projected baseline continues this transfer for the 75 year period at full implementation of 100 to 110 KAFY. The continued and full implementation of the IID/MWD transfer for the 75 year period as projected in the IID/MWD Transfer EIR. will on average reduce flows to the Salton Sea approximately 100 KAFY.

Higher salinity in the Colorado River will require that IID and CVWD divert more water from the Colorado River to leach salt from the agricultural fields for crop production. This however will be offset by California's Colorado River agriculture entitlement of 3.85 MAFY which will limit additional diversions from the Colorado River for this required additional salt leaching. As a result, crop yields and eventually crop production could decline resulting in less need for water and less return flows to the Salton Sea. In addition, some farmers may choose to idle some of their agriculture ground to allow for additional leaching of other more productive ground. The baseline modeling assumptions include this combination of a limit on agriculture diversions and the potential of idle ground for salt leaching. The net result to the baseline will be reduced flows to the Salton Sea over time.

Based on long range forecasts of snowmelt runoff in the Colorado River Basin and the fact that all lower basin states are using their full entitlements leads to the conclusion of less surplus flows available from the Colorado River. As a result, the California agriculture water users will be limited to their entitlement of 3.85 MAFY. Currently CVWD requires surplus Colorado River water to meet its full demand. The projected baseline assumes that CVWD and IID would be limited to a maximum diversion of 3.43 MAFY (Palo Verde Irrigation District will continue to use 420 KAFY) in order to maintain the California agriculture entitlement of 3.85 MAFY. This is included in the baseline and combined with the salt leaching projection results in less diversions of Colorado River water by IID and CVWD which reduces flows to the Salton Sea.

CVWD derives a portion of its water supply from groundwater. Based on population and agricultural growth within the CVWD and the limited water supply entitlement from the Colorado River, groundwater usage within the CVWD is required to continue into the future. Without additional recharge to this aquifer, the water table will continue to decline causing less inflows to the Salton Sea and CVWD projects that the Salton Sea water will eventually intrude into the CVWD aquifer. This assumption was included in the baseline projection which resulted in less flows to the Salton Sea over the modeling period.

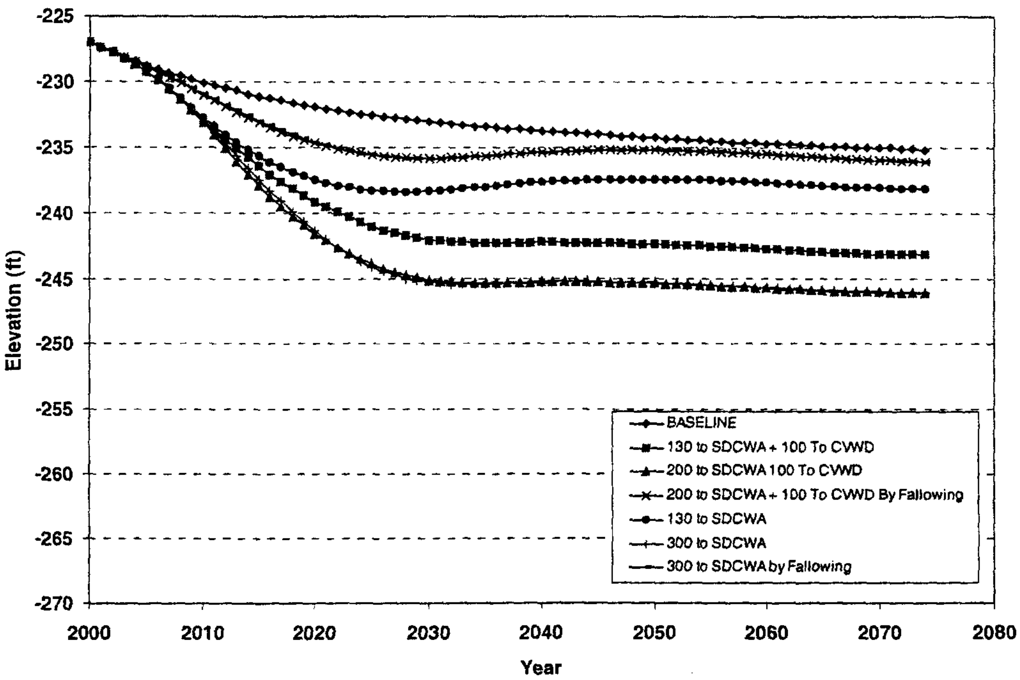
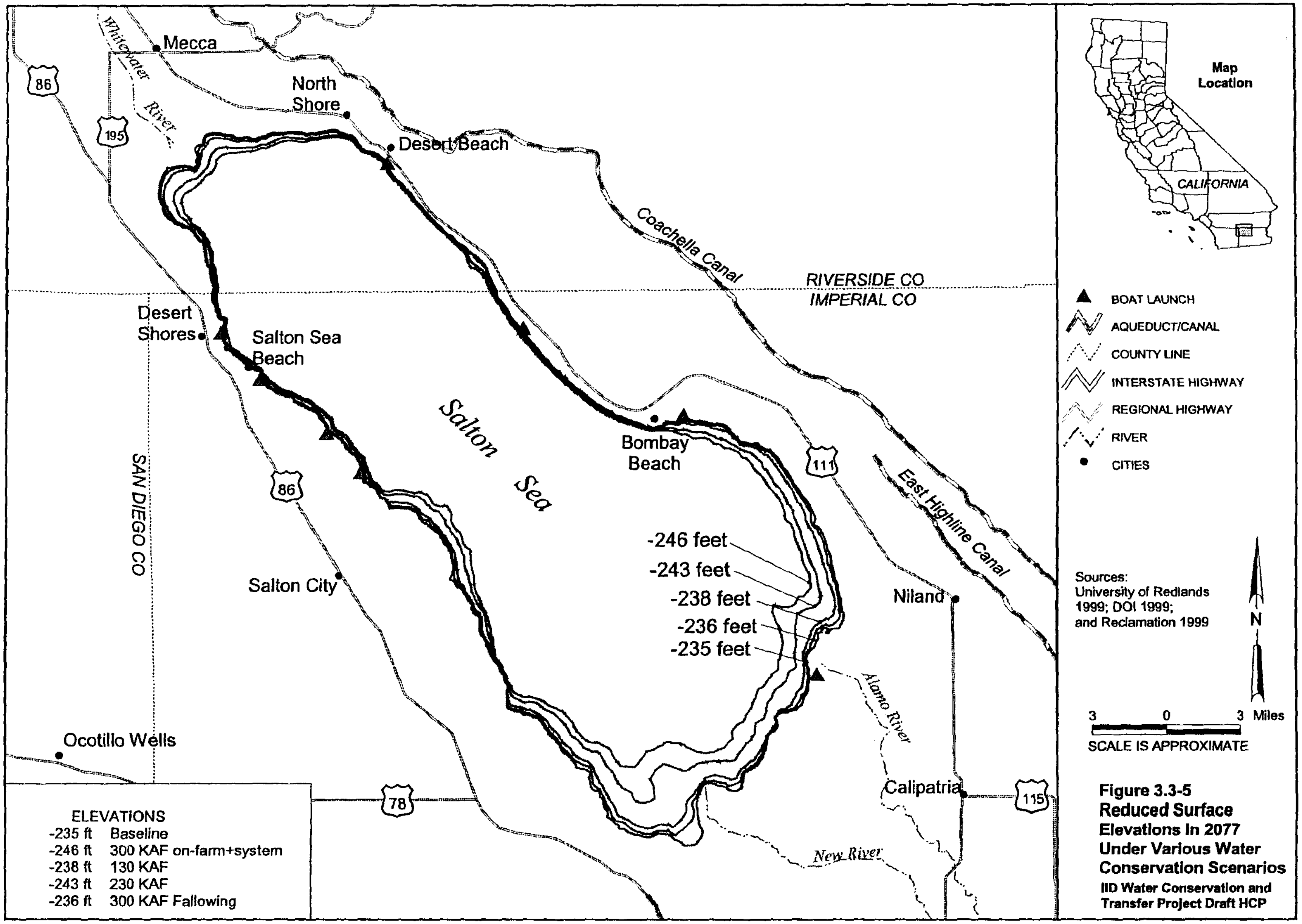


FIGURE 3.3-4
Projected Water Surface Elevation with and Without Implementation of the Water Conservation and Transfer Programs

Implementation of the water conservation and transfer programs would result in less inflow to the sea and would result in a more rapid decline in water surface elevation than under the baseline. With conservation of 300 KAFY through on-farm and system-based measures, the water surface elevation would decline rapidly for the first 35 years. After this period, the water surface elevation would stabilize at about –246 ft msl (Figure 3.3-4). With conservation of 300 KAFY through fallowing, the water surface elevation would decline at a slightly faster rate than under the baseline condition (Figure 3.3-4), but would approach the baseline projections after about 35 years when the water surface elevation would stabilize at about –236 ft msl. Figure 3.3-5 shows the location of the shoreline at various surface elevations.

Nesting and Roosting Sites

Colonial nesting birds, including several covered species nest and roost on a number of small islands (islets) around the Salton Sea and a large island, Mullet Island. Bathymetry data of the Salton Sea indicates that the elevation of the land between the mainland and Mullet Island is less than –231 feet, or less than 4 feet below the existing surface water elevation (University of Redlands 1999). Thus, Mullet Island would be connected to the mainland with a decline in sea level of about 4 feet. Other islands used for nesting in addition to Mullet Island that could be connected to the mainland include a small barren islet at Johnson Street that supports gull-billed terns and black skimmers, and a single levee remnant at Elmore Ranch that has supported several species of ground-nesting birds. These sites are separated from the mainland by water that is about 2 to 3 feet deep.



ELEVATIONS	
-235 ft	Baseline
-246 ft	300 KAF on-farm+system
-238 ft	130 KAF
-243 ft	230 KAF
-236 ft	300 KAF Fallowing

Figure 3.3-5
Reduced Surface Elevations in 2077 Under Various Water Conservation Scenarios
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The declines in water surface elevations projected for the baseline and the water conservation scenarios would result in these islands becoming connected to the mainland. Under the baseline condition and with implementation of water conservation through all fallowing, the water surface elevation would decline by about 8 to 9 feet. With conservation of 300 KAFY through on-farm and system-based measures, the water surface elevation is projected to decline about 19 feet. Although the islands would become connected to the mainland under all levels of conservation including the baseline condition, the timing would vary by a few years depending on the methods used to conserve water, the amount of conservation and where the water is transferred (Table 3.3-6). With water conservation through on-farm and system-based measures, nesting islands could become connected to the mainland from 1 to 7 years earlier than under the baseline. Use of all fallowing to conserve water would decrease this difference to 0 to 4 years.

TABLE 3.3-6
Year When the Water surface Elevation of the Salton Sea is Projected to Decline 2, 3 and 4 Feet Under the Baseline Condition and Various Water Conservation and Transfer Scenarios.

	Elevation Decline		
	2 Feet	**3 Feet**	**4 Feet**
Baseline	2006	2010	2015
300 to SDCWA by Fallowing	2006	2008	2011
200 to SDCWA + 100 to CVWD by Fallowing	2006	2008	2010
130 to SDCWA	2005	2007	2008
130 to SDCWA + 100 to CVWD	2005	2007	2008
300 to SDCWA + 100 to CVWD	2005	2007	2008
300 to SDCWA	2005	2007	2008

Tamarisk Scrub Shoreline Strand

Depending on the relationship between the water surface elevation of the Salton Sea and maintenance of the shoreline strand and adjacent wetlands, the water conservation program could cause changes in the amount of tamarisk scrub habitat in shoreline strand and adjacent wetland areas. There is, however, considerable uncertainty about the extent of these possible changes. As the sea recedes, tamarisk could establish at lower elevations, replacing vegetation lost at high elevations. Alternatively, it has been suggested that tamarisk will not establish in areas exposed by a receding sea level because of excessive soil salinity (Reclamation and SSA 2000). In areas where drain water or shallow groundwater is the predominant water source, no change in tamarisk-dominated adjacent wetlands is expected. It is currently not possible to predict the magnitude of changes in tamarisk in shoreline strand and adjacent wetland areas.

3.3.2.3 Other Covered Activities

Through their effect on the rate of salinization and surface elevation decline, water conservation and transfer activities are the primary covered activities anticipated to impact covered species associated with the Salton Sea. Table 3.3-7 summarizes the relationships of other covered activities to covered species associated with the Salton Sea.

TABLE 3.3.7
Potential Effects of Covered Activities on Covered Species Associated with the Salton Sea

Activity	Potential Effects (Positive and Negative)
Water Use and Conservation	
Combined effects of on-farm and system-based water conservation	Water conservation could reduce the amount of water flowing to the Salton Sea and accelerate declines in sea elevation and accelerate the rate of salinization.
Installation of on-farm water conservation features	On-farm water conservation practices would be constructed within agricultural fields or their margins, removed from portions of the Salton Sea used by covered species.
Installation of system-based water conservation features	System-based water conservation practices would be constructed within the Imperial Valley in association with IID's conveyance system and in agricultural fields and their margins. System-based conservation activities would not be conducted at the Salton Sea.
Operation and Maintenance	
Conveyance system operation	Conveyance system operation is limited to moving water through the canals to meet customer needs and to address maintenance requirements. Other than the filling, draining and moving water through the canals, no physical effects are encompassed by conveyance system operation. No effects to covered species associated with the Salton Sea would be expected.
Drainage System Operation	
Rerouting or constructing new drains	IID reroutes or constructs about 2 miles of drains every 10 years. During the term of the permit IID could reroute drains near the Salton Sea. However, given the infrequent, transient and localized nature of the activities, no effects to covered species associated with the Salton Sea would not be expected.
Piping drains	IID does not anticipated piping drains at the Salton Sea.
Inspection activities	Potential effects of inspection activities would be limited to a minor potential for disturbance of covered species if they occur in the vicinity of structures at the time of inspection.
Canal lining maintenance	Canal lining maintenance consists of repairing the concrete lining of canals only. Lined canals do not occur in portions of the Salton Sea used by covered species.
Right-of-way maintenance Embankment maintenance Erosion maintenance	Along drains, right-of-way maintenance, embankment maintenance and erosion maintenance is conducted in association with vegetation control/sediment removal along drains. Given the infrequent, transient and localized nature of the activities, no effects to covered species associated with the Salton Sea would be expected.
Seepage maintenance	Seepage maintenance is conducted only along the canal system and consists of repairing leaks. Few canals occur near the Salton Sea in areas used by covered species associated with the Salton Sea. Given the infrequent, transient and localized nature of the activities, no effects to covered species associated with the Salton Sea would be expected.

TABLE 3.3.7
Potential Effects of Covered Activities on Covered Species Associated with the Salton Sea

Activity	Potential Effects (Positive and Negative)
Structure maintenance	Few structures requiring replacement occur at the Salton Sea in areas used by covered species. With the infrequent, transient and localized nature of the activities, no effects to covered species associated with the Salton Sea would be expected.
Pipeline maintenance	No piped drains occur at the Salton Sea.
Reservoir maintenance	No reservoirs occur at the Salton Sea.
Sediment removal Vegetation control	IID controls vegetation and removes sediment from drains that discharge directly to the sea. Because these activities are localized (within and immediately adjacent to the drain channels) and conducted relatively infrequently on drains discharging directly to the Sea (about once every 5 years), they have a minor potential to affect species associated with the Salton Sea. Effects to desert pupfish are addressed separately in Section 3.7.
New and Alamo River maintenance	IID dredges the deltas of the New and Alamo rivers about once every four years. In conducting this dredging, IID retains the vegetation on the banks. Thus, habitat is not removed by these dredging operations, but the dredging could temporarily disturb covered species using the deltas. IID coordinates with USFWS at the refuge prior to conducting these activities.
Salton Sea dike maintenance	Salton Sea dike maintenance activities consist of replacing riprap, grooming embankments and repairing damaged sections of the dikes. With the infrequent, transient and localized nature of the activities, no effects to covered species associated with the Salton Sea would be expected.
Gravel and rock quarrying	IID quarries gravel and rock from two quarries adjacent to the Salton Sea (Red Hill and Pumice Island).The quarries are barren and do not support vegetation. Covered species associated with the Salton Sea are not known to occur at either of these quarries.
Fish hatchery operation and maintenance	The fish hatchery is located in the Imperial Valley, removed from the Salton Sea.
Recreational facilities	IID conducts dredging at Salton Sea Beach, Corvina Beach and Bombay Beach about every 60 days. IID also dredges at Red Hill Marina on request. This dredging presents a minor potential to displace birds that are foraging or resting on the water in the vicinity. The HCP does not cover take of covered species by recreationists.
HCP/EIS/EIR mitigation	IID would have the flexibility in locating specific HCP and EIR/EIS mitigation measures away from sensitive areas for covered species (e.g., nesting or roosting sites.

3.3.3 Approaches for Mitigating Impacts of Reduced Fish Abundance

As previously described, with or without implementation of the water conservation and transfer project, the salinity of the Salton Sea is expected to increase to a level that would no longer support fish. The effect of implementation of the water conservation and transfer programs is temporal (up to 11 years earlier), causing a condition (i.e., reduced fish abundance) to occur sooner but one that is expected to occur regardless of implementation of the project. Thus, effects on covered piscivorous bird species would occur earlier with implementation of the water conservation and transfer project but also is expected to occur without the project.

In identifying potential mitigation approaches to address the earlier reduction in fish availability at the Salton Sea, the IID recognized and considered the following:

- The salinity of the Salton Sea will continue to increase in the absence of the proposed water conservation and transfer programs and reduce the suitability of the Salton Sea for fish-eating birds
- It is unreasonable and impractical for the water conservation and transfer programs to bear the burden of restoring the Salton Sea and
- The level of mitigation should be scaled to the impact attributable to the water conservation and transfer programs.

In accordance with these considerations, IID and others have developed and are considering various approaches for minimizing and mitigating the impact of the anticipated take of piscivorous birds. These mitigation approaches include creating replacement habitat (ponds), constructing and operating of hatcheries to augment food supplies for piscivorous birds, and allowing conserved water to flow to the Sea.

IID has not identified a preferred approach for addressing piscivorous birds and presents the various approaches under consideration in this draft HCP as means to seek input on which approach or combination of approaches is most appropriate. These approaches are described below.

3.3.3.1. Approach 1: Hatchery and Habitat Replacement

Under this approach proposed by USFWS and CDFG, IID would implement a phased program for maintaining fish to provide foraging opportunities for piscivorous birds at the Salton Sea. In the first phase, IID would construct a hatchery to ensure continued availability of tilapia as forage base for piscivorous birds. It is expected that as salinity in the Salton Sea increases, tilapia reproduction would be affected before adult survival is threatened. IID would stock tilapia in the Salton Sea when the CDFG determines that natural reproduction of tilapia has ceased in the Salton Sea based on annual young-of-year abundance surveys conducted by CDFG. IID would continue stocking tilapia in the Salton Sea for as long as tilapia could continue to survive and grow or until a Salton Sea restoration project were to be funded and its implementation initiated.

The hatchery element would be intended to extend the period of time when fish would be present in the Salton Sea. Juvenile and adult tilapia are capable of withstanding high salinity levels; tilapia have been collected at a salinity as high as 120 ppt. However, the ability of tilapia to reproduce is more sensitive to salinity. At salinity above 60 ppt, tilapia reproduction has been predicted to decline. Fish produced by the hatchery under this approach would be used to replace reproduction of tilapia lost in the Sea because of high salinity. Because juvenile and adult tilapia can tolerate higher salinity levels, the hatchery would extend the time that the Sea supports fish. This extension would have the dual benefit of continuing to support fish as prey for fish-eating birds and providing additional time for implementation of a long-term restoration project.

Hatchery operations likely would be located near the Salton Sea on land not currently under cultivation. The acreage could vary depending on the level of production needed to augment natural reproduction. For the purpose of planning, it is anticipated that up to 50 acres would be needed to accommodate the hatchery operation. The facility would be designed to ensure that any discharged hatchery effluent to the Salton Sea would be adequately treated to avoid adverse water quality impacts. Water requirements would vary depending on the level of production needed.

The second component of the approach would be initiated if a long-term restoration Project were not implemented before the Sea could no longer support fish. Under this component of the approach, IID would create 5,000 acres of ponds at the Salton Sea that would support fish and provide a forage base for piscivorous birds. The purpose of these ponds would be to maintain some foraging opportunities at the Salton Sea for piscivorous birds for the remainder of the permit term. The objective of creating ponds would be to maintain a level of foraging habitat that would help ensure that piscivorous birds would continue to be represented at the Salton Sea. IID would stock the ponds with tilapia (from continued hatchery operations) and manage the ponds to provide foraging opportunities for covered piscivorous bird species for remainder of the 75-year permit term. If a project to restore the Salton Sea were implemented at any time during the term of the permit, IID would contribute the remaining funding committed to the creation and operation of a hatchery and for creation and management of ponds to the restoration project.

The ponds would be about 5 feet deep and constructed using berms. To obtain the soil characteristics necessary for berm construction, the ponds would be constructed on farmland. The construction cut and fill would be balanced such that transport of soil to or from the construction site would not be required. The ponds likely would be constructed along the southern edge of the Salton Sea in land blocks 160 and 640 acres in size. The water supply for the mitigation ponds would be of the same quality as that delivered to farmers. Based on preliminary calculations performed by CDFG, close to 30 KAFY would be required to maintain the ponds. The water associated with the 5,000 acres of farmland removed from production to construct the ponds would be sufficient to support the ET losses in the ponds if the historic water use on those acres was equivalent to about 6 AFY. If historic water use were less, additional conservation could be required to generate water necessary to maintain the ponds. In addition to the water necessary to support the ponds, additional water could be necessary to provide adequate water circulation in the ponds. The requirements for water circulation would not be defined until the specific pond locations were identified and the characteristics of the pond system design developed. Any impacts associated with obtaining water to maintain circulation in the ponds would be addressed in subsequent environmental documentation.

3.3.3.2. Approach 2: Use of Conserved Water as Mitigation

Approach 1 outlines a strategy for mitigating the potential incidental take of piscivorous birds by using hatchery production and creating replacement habitat. In lieu of this approach, IID could reduce or avoid the effects of water conservation on salinity and mitigate impacts on piscivorous birds by conserving additional water and allowing it to flow to the Salton Sea. This approach, which could be used in combination with other approaches or used to avoid impacts entirely, would make up for conservation-related reductions in flow to the Sea. Under this approach, water conserved for mitigation purposes could be generated through system improvements, on-farm conservation, fallowing, or any combination.

To avoid or mitigate the temporal impacts of reducing flows to the Sea, IID could fallow or otherwise conserve an amount of water equivalent to the project-related inflow reduction and allow the conserved water to flow to the Sea. (This amount would be in addition to the amount of water conserved for transfer.) For example, if all water conservation was achieved through fallowing, approximately 50,000 acres of fallowed land would be required to generate the water necessary for transfer and approximately an additional 25,000 acres of fallowing would be required to generate the water necessary to offset changes in inflow to the Sea. An additional 9,800 acres of fallowing would be required to provide water necessary for the IOP. This mitigation would maintain salinity and elevation changes on the baseline trajectory, thereby avoiding salinity increases and elevation decreases related to the water conservation.

3.3.3.3. Other Approaches Considered

In addition to the two approaches outlined above, IID considered several other approaches for mitigating salinity impacts in the Salton Sea. Each of these approaches contributed to mitigating the impacts at the Salton Sea, but was removed from consideration for various reasons. These approaches are briefly described in the following.

Habitat Replacement Approach

This approach entailed creation of over 65,000 acres of deepwater ponds to provide foraging opportunities sufficient to support the current level of use of the Salton Sea by piscivorous birds. The ponds would be operated for a period of about 11 years to correspond to the number of years that water conservation would accelerate the point at which salinity in the Sea would be too high to support fish. This approach was removed from consideration because the estimated cost of implementing the mitigation exceeded $8 billion.

Tri-Delta Wetland Project

This approach, developed by CVWD, would entail construction of vinyl sheet pile walls in the Salton Sea to capture drain flow from the Whitewater, Alamo, and New rivers. The vinyl sheet pile walls would create low salinity areas in the river deltas to support fish production and to provide a forage base for piscivorous birds. These areas also could increase habitat values for migrating shorebirds and waterfowl. This approach was not considered because of insufficient project detail to determine feasibility and address agency concerns.

Pacific Institute Approach

This approach, which is similar to the Tri-Delta Wetland Project, would expand the area of low salinity water by constructing earthen dikes in the Salton Sea to impound flows from the Whitewater, Alamo, and New rivers. This approach also was not considered because of insufficient detail to determine feasibility and address agency concerns.

Shared Risk Approach

This approach outlines a process for sharing the mitigation cost and risks associated with the Salton Sea impacts with the state and federal governments. The approach does not identify a specific mitigation program; instead it caps IID's and the other water agencies' obligation at $60 million and places the responsibility for any further mitigation on the government. Consideration of this approach as mitigation was discontinued, but consideration as a means to share costs and risks associated with the mitigation will continue.

3.3.4 Other Salton Sea Mitigation Measures

Although no specific approach for mitigating the impacts to covered piscivorous bird species from reduced fish availability is currently proposed, mitigation was developed for other impacts to covered species using the Salton Sea.

3.3.4.1 Increased Salinity

The acceleration in the salinization of the Salton Sea with implementation of the water conservation and transfer programs has the potential to affect desert pupfish as explained above.

> **Salton Sea – 1.** *IID will ensure that an appropriate level of connectivity between pupfish populations within individual drains that are connected to the Salton Sea either directly or indirectly and that are below the first check will be maintained in the event that conditions in the Salton Sea become unsuitable for pupfish during the term of the HCP. When the salinity of the Salton Sea reaches 90 ppt (or lower as determined by the HCP IT), IID will work with the IT to prepare and implement a detailed plan for ensuring genetic interchange among the pupfish populations in the drains. IID will continue to maintain created pupfish habitats for the duration of the term of the permits. IID also will construct and maintain one pupfish refugium pond consistent with the Desert Pupfish Recovery Plan. This pond will maintained for that purpose of assisting in the recovery efforts for that species. IID will work with the HCP IT to determine the location, timing, and technique in implementing this measure.*

As previously described, desert pupfish occupy many of IID's drains that discharge directly to the sea. Individual pupfish are believed to use shoreline pools and the Salton Sea to move among the various drains. As the sea becomes more saline and nears the limit of pupfish tolerance, movement among the drains could cease and isolate populations. Small, isolated populations are more susceptible to problems associated with reduced genetic variability and the effects of random environmental events. To avoid the potential for isolating pupfish populations in the drains, IID will work with the HCP IT to restore a connection between populations or otherwise ensure continued genetic exchange among populations.

Pupfish have a high salinity tolerance, and have been recorded at a salinity of 90 ppt. Model results suggest that under a water conservation project using only on-farm and system improvements as the means for conservation, the 90 ppt level would not be reached for at least 20 years. Given the time period between project initiation and when mitigation would be required, IID will defer the specifics of the mechanism by which connectivity will be achieved in order to take advantage of additional information that might be available at the time mitigation is necessary. When the salinity of the Salton Sea reaches 90 ppt (or lower as determined by the HCP IT), IID will work with the IT to prepare a detailed plan for ensuring genetic interchange among the pupfish populations in the drains. The plan will be submitted to USFWS and CDFG for approval before implementation. The plan will include construction details, the schedule for completion, and a monitoring program to demonstrate effectiveness (including adaptive management elements if appropriate). The budget allocated for ensuring genetic interchange among populations in the drains will be based on the assumption that physical connections (channels) will be constructed and maintained. However, this should not preclude IID or the HCP IT from developing more suitable alternatives which would need to be approved by the USFWS and CDFG.

In addition to ensuring connectivity among pupfish populations, IID will take a positive step to contribute to the recovery of desert pupfish by constructing and managing a refugium pond to support a population of pupfish consistent with the goals of the *Desert Pupfish Recovery Plan* (Marsh and Sada 1993). The pond will be designed and located in consultation with the HCP IT, USFWS, and CDFG. IID will develop a detailed plan in coordination with the HCP IT, and the USFWS and CDFG will have approval of the plan. The USFWS and CDFG will be responsible for identifying the source population. A person qualified to capture and handle pupfish and that meets the approval of CDFG and USFWS will make the introductions. Management of the pond will be carried out by IID, although IID may choose to transfer management to another entity (e.g., USFWS or CDFG). Any transfer of management responsibility would be accompanied by a management endowment to ensure continued management until the end of the term of the HCP.

3.3.4.2 Water Surface Elevation

Future declines in the water surface elevation of the sea are expected to result in nesting and roosting islands becoming connected to the mainland and could cause a reduction in the amount of tamarisk scrub habitat in areas immediately adjacent to the sea. As described in Section 3.3.2.2, nesting and roosting islands used by covered species would become connected to the mainland with or without implementation of the water conservation and transfer project. Thus, any impacts to covered species from changes in the suitability of nesting and roosting islands would not be attributable to the water conservation and transfer programs. Nevertheless, IID has agreed to implement measures to ensure that nesting and roosting islands are available. In addition, measures to address the effects of reductions in water surface elevation on potential changes in the extent of tamarisk scrub in areas adjacent to the Salton Sea are identified.

These measures are only applicable if IID implements a Salton Sea option under which the surface water elevation of the Sea would decline to a greater degree than under the baseline condition.

Salton Sea – 2. *If the water conservation and transfer program results in the water surface elevation declining at a faster rate or greater magnitude than would occur under the baseline condition, IID will construct nesting islands suitable for gull-billed terns and black skimmers. Nesting islands will be located so they are not connected to the mainland or otherwise accessible to predators and in areas with minimal levels of human activity. IID will develop the design and configuration of the islands in coordination with the HCP IT.*

The Salton Sea represents one of only two nesting locations for gull-billed terns in the United States and one of about 6 nesting locations for black skimmers. As the water surface elevation of the Salton Sea declines, islands at the Salton Sea currently used by these species would become connected to the mainland such that they would be accessible to terrestrial predators and could be subject to human disturbance. To offset the potential reduced suitability of nesting and roosting areas that could occur with a lowered Sea elevation, IID will create islands and/or berms to provide nesting and roosting opportunities for gull-billed terns and black skimmers. These features would be located so they are not connected to the mainland or otherwise accessible to predators and in areas with minimal levels of human activity. Black skimmers and gull-billed terns currently use berms and dikes at the Salton Sea (Molina 1996) and are known to use dredge spoils for nesting (Layne et al. 1996). Thus, it is reasonable to expect that they would exploit additional created features.

Salton Sea – 3. *If the water conservation and transfer program results in the water surface elevation declining at a faster rate or greater magnitude than would occur under the baseline condition, IID will conduct the following to address potential changes in tamarisk scrub habitat adjacent to the Salton Sea. Within 3 years of initiating the water conservation and transfer program, IID will conduct a baseline survey of the areas designated as 1) "shoreline strand" and 2) "adjacent wetland" with tamarisk as the primary vegetation as shown in the Salton Sea Digital Atlas (University of Redlands 1999).The general approach to the baseline survey is described in Chapter 4. Following issuance of the incidental take permit, IID, in consultation with the HCP IT will develop the specific survey protocol necessary to verify and quantify net changes in the total amount of tamarisk in shoreline strand and adjacent wetland areas and submit a study plan for approval by the USFWS and CDFG. IID will repeat the survey at least every five years for 35 years but may choose to conduct the surveys more frequently.*

If the surveys show a net loss in the acreage of tamarisk related to the water conservation and transfer project, IID will create or acquire native tree habitat consisting of mesquite bosque or cottonwood-willow habitat. The amount of habitat to acquire or create will be calculated based on the following ratios.

- *If IID creates habitat prior to the surveys showing a net loss in the amount of tamarisk, the mitigation ratio for the acreage of created habitat to net lost acreage of tamarisk will be 0.25:1 as long as the created habitat meets the success criteria.*
- *If IID creates habitat after the surveys show a net loss or IID acquires existing habitat, the mitigation ratio for the acreage of the created or acquired habitat to lost acreage of tamarisk will be 0.75:1. The habitat will be created or acquired within 1 year of documenting a net reduction in tamarisk scrub unless otherwise agreed to by IID, USFWS, and CDFG.*
- *If IID elects to acquire habitat, IID will work with the HCP IT to identify a property for acquisition. Habitat to be acquired must support mesquite bosque or cottonwood-willow habitat and occur within the Salton Sea Basin. If the only available properties that meet these requirements are larger than required to compensate for the lost acreage, IID will acquire the least expensive property. IID can use the additional acreage of the acquired habitat to fulfill future mitigation obligations of Tree Habitat –1 or Tree Habitat 2. IID will place a conservation easement on acquired lands and provide for the property to be managed for covered species for the term of the permit. With the approval of USFWS and CDFG, which approval shall not be unreasonably withheld, IID may transfer the land to a third party who agrees to and is authorized to manage the land for habitat conservation purposes. If IID transfers the land to a third party, IID will establish an endowment fund adequate to provide for the management of the lands for the term of the permit. If IID retains ownership of the land, IID will prepare and submit to USFWS and CDFG for approval a management plan for the property that describes how the property will be managed. The management plan will describe the actions that IID will take to maintain the*

ecological functions of the acquired habitat. While the specific management needs will vary depending on the property acquired, considerations for the management plan include:

- *Measures to control human access (e.g., fencing, signage)*
- *Frequency at which land will be visited to assess maintenance/management needs*
- *Types of maintenance action (e.g., removing garbage, repairing fences)*
- *Vegetation management practices (e.g., prescribed burning, removal of exotic plants)*

If IID elects to create habitat, IID will develop a habitat creation plan. The habitat creation plan will include the following information:

- *location*
- *planting plan (including species composition and layout)*
- *grading and other construction activities*
- *long-term management practices*
- *vegetation and species use monitoring*
- *success criteria for the plantings and the actions that IID will take if the success criteria are not met*

If a Salton Sea Restoration Project is implemented that affects the water surface elevation of the sea, IID will discontinue monitoring the shoreline strand and adjacent wetlands and will not be responsible for mitigating any additional reductions in the amount of tamarisk in these areas over the term of the permit.

The Salton Sea database identifies 293 acres of shoreline strand habitat along the Salton Sea. Shoreline strand habitat consists of tamarisk and iodine bush. In addition to the shoreline strand, the Salton Sea database identifies 2,349 acres of adjacent wetlands dominated by tamarisk. The source of the water that supports the shoreline strand community is uncertain but could consist of a combination of shallow groundwater and seepage from the Salton Sea. The extent to which the water surface elevation of the Salton Sea contributes to supporting this community is uncertain.

Depending on the relationship between the water surface elevation of the Salton Sea and maintenance of the shoreline strand and adjacent wetlands, the water conservation program could cause changes in the amount of tamarisk scrub habitat in shoreline strand and adjacent wetland areas. There is however, considerable uncertainty about the extent of these possible changes. As the sea recedes, tamarisk could establish at lower elevations, replacing habitat lost at high elevations. Alternatively, it has been suggested that tamarisk will not establish in areas exposed by a receding sea level because of excessive soil salinity (Reclamation and SSA 2000). In areas where drain water or shallow groundwater is the predominant water source, no change in tamarisk-dominated adjacent wetlands is expected. It is currently not possible to predict the magnitude of changes in tamarisk in shoreline strand and adjacent wetland areas.

Because of the uncertainty about the potential changes in the amount of tamarisk scrub adjacent to the Salton Sea, IID will monitor changes in this community and compensate for measured net losses in the amount of tamarisk. Within three years of issuance of the ITP, IID will conduct a field survey of the areas typed as shoreline strand or adjacent wetland with tamarisk as the primary vegetation as shown in the Salton Sea Digital Atlas (University of Redlands 1999). The habitat boundaries will be determined, and the percent coverage by live tamarisk and dead tamarisk will be estimated. This information will provide the basis for determining the extent of future changes in tamarisk scrub.

Potential impacts to the tamarisk scrub adjacent to the Salton Sea as a result of the covered activities would be associated with implementation of water conservation and transfer and the resulting projected decline in the water surface elevation of the Salton Sea. Hydrologic modeling of the water conservation and transfer programs indicates that the water surface elevation would decline over about 30 years and then stabilize. As shown in figure 3.3-4, this stabilization at about 30 years is predicted with conservation through on-farm measures, system-based measures, and/or fallowing.

IID will monitor the tamarisk scrub for 35 years to capture the period over which the sea elevation would decline and several years after the sea has stabilized to identify reductions that occur as the plants adjust to the new sea elevation. It is important to note that the water surface elevation is projected to decline in the absence of the proposed water conservation and transfer programs as well. However, it will not be possible to differentiate changes in the adjacent wetland/shoreline strand community attributable to the conservation and transfer relative to the changes that would have occurred in the absence of the transfer. Nevertheless, IID has agreed to compensate for measured changes in the amount of tamarisk scrub in the delineated shoreline strand and adjacent wetland areas.

IID will continue to survey the adjacent wetland and shoreline strand areas at least every five years after completion of the baseline survey. These data will be compared with the previous survey data to determine if there was a decline in the amount of tamarisk scrub habitat. In addition to evaluating changes in the shoreline strand and adjacent wetlands demarcated in the Salton Sea Digital Atlas (University of Redlands 1999), IID will review aerial photographs and conduct ground-truthing to determine if tamarisk scrub has colonized new areas in response to changes in sea elevation. The acreage of any new areas of tamarisk scrub will be determined. If the data show a net loss of tamarisk scrub, IID will create or acquire and preserve native tree habitat to compensate for any take of covered species resulting from net loss of tamarisk scrub.

IID may compensate for a net loss of tamarisk scrub in two ways: 1) acquire native tree habitat or 2) create native tree habitat. IID may elect to create native tree habitat prior to a reduction in tamarisk occurring. In this case, IID would be able establish functioning native tree habitat prior to any loss in tamarisk scrub. Native tree habitat has a higher value than tamarisk scrub. Based on the relative habitat values developed by Anderson and Ohmart (1984), the habitat value of native tree habitat is about four times greater than tamarisk. Thus, IID would replace tamarisk at a 0.25:1 ratio (native tree to tamarisk), if it creates native tree habitat prior to measuring a reduction in tamarisk in the shoreline strand or adjacent wetlands.

If IID acquires native tree habitat or creates native tree habitat after measuring a net loss, a higher mitigation ratio (0.75:1) will be used to determine the acreage of native tree habitat to acquire or create. In the case of acquiring habitat, a higher mitigation ratio is used because there would be a net loss of vegetation. A higher mitigation ratio also is used if habitat is created after the reduction has been measured to account for the delay between when the habitat is created and when it starts functioning as habitat.

3.3.5 Effects on Covered Species

Covered species potentially using the Salton Sea in the HCP area include resident breeding species, migratory breeding species, short-term residents during winter or migration, and transient species that occur in the HCP area irregularly during migration or other wanderings. Under the SSCS, IID would implement one of two approaches to address potential changes in fish resources. In addition, IID would implement specified measures to address potential effects to desert pupfish from increases in salinity, potential effects to species associated with tamarisk scrub from changes in tamarisk scrub habitat adjacent to the Salton Sea, potential effects to black skimmers and gull-billed terns from changes in the suitability of nesting/roosting islands. The effects of implementing the HCP on listed species (state and/or federal) associated with the Salton Sea and on other species that regularly use for Salton Sea are evaluated for each individual species below. The effects of implementing the HCP on the remaining covered species which are transient at the Salton Sea are summarized in Table 3.3-8

3.3.5.1 White Pelican

Approach 1

This approach would benefit white pelicans by maintaining foraging opportunities over the entire 75 year permit term. Under Approach 1, IID would construct and operate a hatchery to maintain tilapia in the Salton Sea as long as the salinity was within the tolerance level of juvenile and adult fish. After this point, IID would create and maintain ponds to produce fish through the end of the permit term. Stocking fish produced at the hatchery would extend the period of time that fish are supported at the Salton Sea beyond that which would occur under the baseline condition.

Under the baseline condition, reproduction of tilapia could be substantially reduced in about 2023 when the salinity of the Salton Sea is projected to exceed 60 ppt. Adults can tolerate higher salinities and could survive beyond this year. However, as these older fish died, the abundance of fish would decline. Use of the Salton Sea by white pelicans would be expected to decline as the abundance of fish declined.

With Approach 1, IID would continue to stock fish as long as the salinity was tolerable. Tilapia have been collected at a salinity as high as 120 ppt. This salinity is predicted to occur in 2052 with implementation of the water conservation and transfer programs. Thus, relative to the baseline condition, this measure could extend the period of time that the full population of white pelicans could be supported at the Salton Sea by 30 years. After this period, creation of ponds would continue to provide foraging opportunities that could support a smaller number of white pelicans until the end of the 75 year permit.

projected to exceed 60 ppt. The potential response of white pelicans to reduced fish availability at the Salton Sea after this salinity is exceeded was described in section 3.3.2.1.

TABLE 3.3-8
Potential Effects of Salton Sea Habitat Conservation Strategy on Transient Species Covered by the HCP Potentially Using the Salton Sea

Species	Occurrence in HCP Area	Habitat Use in the HCP Area	Potential Effects of HCP
Elegant tern	Accidental during spring	Probably concentrates foraging in shallow, shoreline areas of the Salton Sea.	Approach 1. Construction and operation of a hatchery and creation of ponds would maintain fish at the Salton Sea as prey for elegant terns for a longer period of time than would occur under the baseline condition. Approach 2. Mitigation water would avoid the temporal reduction in prey availability predicted with implementation of the water conservation transfer project.
Reddish egret	Very rare visitor in summer and fall	Probably concentrates foraging in shallow, shoreline areas and mudflats of the Salton Sea and adjacent marshes	Approach 1. Construction and operation of a hatchery and creation of ponds would maintain fish at the Salton Sea as prey for reddish egrets for a longer period of time than under baseline conditions. Approach 2. Mitigation water would avoid the potential temporal reduction in prey availability predicted with on-farm or system-based conservation. Other Strategies. Managed marsh habitat created under the DHCS could provide additional foraging opportunities.
Merlin	Rare visitor during fall and winter.	Probably concentrates foraging at Salton Sea where shorebirds are abundant. May also prey on shorebirds and songbirds using managed and unmanaged marshes, tamarisk scrub habitat, and agricultural fields.	Both Approaches. Shorebirds would continue to occur at Salton Sea as mudflat habitat and insects would persist. Merlins would continue to forage for shorebirds at the Salton Sea and elsewhere in the HCP area.
Black swift	Accidental during spring.	Could use a wide variety of habitats in the HCP area.	Both Approaches. Insects would continue to be available at the Salton Sea and in other habitats throughout the HCP area, continuing to provide foraging opportunities for black swifts.

TABLE 3.3-8
Potential Effects of Salton Sea Habitat Conservation Strategy on Transient Species Covered by the HCP Potentially Using the Salton Sea

Species	Occurrence in HCP Area	Habitat Use in the HCP Area	Potential Effects of HCP
Vaux's swift	Common spring migrant; uncommon fall migrant	Known to congregate at north end of the Salton Sea; could use wide variety of habitats in the HCP area	<u>Both Approaches.</u> Insects would continue to be available at the Salton Sea, and in other habitats throughout the HCP area, continuing to provide foraging opportunities for Vaux's swift.
Purple martin	Occasional spring and fall migrant	Could use a wide variety of habitat is the HCP area.	<u>Both Approaches.</u> Insects would continue to be available at the Salton Sea, and in other habitats throughout the HCP area, continuing to provide foraging opportunities for purple martins.

Approach 2

With implementation of Approach 2, IID would avoid changes in inflow to the Salton Sea as a result of the water conservation and transfer programs. This approach would avoid impacts to white pelicans resulting from the acceleration of salinity increases and reduced fish abundance attributable to the water conservation and transfer programs. Under this approach, fish would be expected to persist until about 2023 when the salinity of the sea is

3.3.5.2 California Brown Pelican

Approach 1

The effects of implementing Approach 2 on brown pelicans would be similar to those described for white pelicans. By operating a hatchery and creating ponds if necessary, IID would extend the period of time that fish would be available at the Salton Sea. This longer period of fish availability would benefit brown pelicans relative to the baseline condition.

Approach 2

Under Approach 2, IID would maintain the prey resource for brown pelicans until that resource would be lost without implementation of the water conservation and transfer program. By maintaining the same inflow level as would have occurred without implementation of the water conservation and transfer programs, IID would avoid impacts to brown pelicans attributable to the water conservation and transfer programs. The potential response of brown pelicans to reduced fish availability at the Salton Sea after this point was described in section 3.3.2.1.

3.3.5.3 Black Skimmer

Approach 1

As described for white pelicans, implementation of Approach 1 would benefit fish-eating birds by extending the period of time that fish are available at the Salton Sea. Black skimmers would further benefit if IID implemented Approach 1 because IID would also implement Salton Sea – 2. Under this measure, IID would create nesting islands for black skimmers to replace islands exposed by a reduction in the surface water elevation. These islands would be available for a longer period time than currently used islands would remain under the baseline. The provision of nesting/roosting islands for a longer period than under the baseline condition constitutes a benefit of this approach to black skimmers by potentially supporting nesting at the Salton Sea for a longer period.

Approach 2

With implementation of Approach 2, IID would avoid changes in inflow to the Salton Sea as a result of the water conservation and transfer programs. This approach would avoid impacts to black skimmers resulting from the acceleration of salinity increases and reduced fish abundance attributable to the water conservation and transfer programs. Under this approach, fish would be expected to persist until about 2023 when the salinity of the sea is projected to exceed 60 ppt. This approach also would avoid the acceleration of surface elevation declines attributable to the water conservation and transfer programs. As a result, nesting and roosting islands would become connected to the mainland at the same time as under the baseline after which nesting might not continue. The potential response of black skimmers to reduced fish availability at the Salton Sea after this salinity is exceeded was described in section 3.3.2.1.

3.3.5.4 Van Rossem's Gull-billed Tern

Gull-billed terns typically are associated with salt marshes and coastal bays, but also frequent open habitats such as pastures and farmlands for foraging. They primarily feed on insects, such as grasshoppers and beetles, but also will prey on earthworms, fish, frogs, lizards, small mammals, eggs, and young of other birds (CDFG 1999). Foraging likely occurs at the mudflats along the Sea as well as in adjacent agricultural fields and marshes. As a result of these food habits, the potential reduction in tilapia abundance at the Salton Sea would not be expected to affect gull-billed terns.

The Salton Sea is one of only two breeding locations for gull-billed terns in the United States, the other being in San Diego. About 160 pairs nest at the Sea each year (USFWS 1997b; Shuford et al. 1999). Numbers of nesting birds at the Salton Sea have declined from earlier estimates of about 500 as the rising sea has flooded nests (CDFG 1999). They nest on sandy flats amidst shells and debris (CDFG 1999) around the south end of the Sea (Shuford et al. 1999). The largest breeding colonies are at the southeast corner of the Sea and to the south of Salton City (CDFG 1999) on Mullet Island and a small barren islet at Johnson Street. The islets at Rock Creek also support nesting gull-billed terns. The islets are in an impoundment of the Salton Sea NWR.

As explained in section 3.3.2.2, nesting/roosting islands would become connected to the mainland with the reduction in the water surface elevation with and without implementation of the water conservation and transfer programs. Gull-billed terns could abandon some or all of their current nesting areas. Under Approach 1, IID would create nesting island which would benefit gull-billed terns by maintaining nesting opportunities for a longer period of time than under the baseline. Under Approach 2, the nesting/roosting islands would become connected to the mainland at the same time as under the baseline condition.

3.3.5.5 Double-Crested Cormorant

At the Salton Sea, cormorants nest on rocky ledges on Mullet Island or on dead vegetation at the deltas of the New and Alamo rivers. Snags in the Salton Sea are important for providing protected roost sites for double-crested cormorants. Cormorants regularly move between the Salton Sea and the lakes at the Finney-Ramer Unit of the Imperial Wildlife Area where they forage. The Finney-Ramer Unit of Imperial WA also supports nesting and roosting double-crested cormorants at the lakes on this unit.

Double crested cormorants are a common and abundant species at Salton Sea, with counts of up to 10,000 individuals (IID 1994). Small nesting colonies were documented at the north end of the Sea in 1995 (USFWS 1996), but recently (1999) over 7,000 double-crested cormorants and 4,500 nests were counted on Mullet Island. Mullet Island currently supports the largest breeding colony of double-crested cormorants in California (Shuford et al. 1999).

The population of double-crested cormorants in the United States declined considerably during the 1960s and early 1970s. This decline was attributed to pesticide residues in the marine food chain, principally DDT (Small 1994). The population began recovering in the late 1970s and 1980s, and is currently estimated to number 1 to 2 million birds in the United States and Canada with the U.S. population increasing at a rate of about 6 percent (64 FR 60826). In some locations, cormorant populations have increased to levels that some consider them a significant competitor with recreational fishing. In response, the USFWS is developing a national double-crested cormorant management plan (64 FR 608266).

Double crested cormorants are abundant throughout California and the United States. With the large and increasing population throughout the U.S. and Canada, even complete loss of cormorants breeding at the Salton Sea would not jeopardize or substantially reduce the U.S. population cormorants despite the Sea harboring the largest breeding colony in California. Thus, even if some individuals were lost as a result of the covered activities, the effects on the entire cormorant population would be minor.

Approach 1

Under Approach 1, IID would construct and operate a hatchery to maintain tilapia in the Salton Sea as long as the salinity was within the tolerance level of juvenile and adult fish. After this point, IID would create and maintain ponds to produce fish through the end of the permit term. This approach would be beneficial to cormorants relative to the baseline condition. Stocking fish produced at the hatchery could extend the period of time that fish are supported at the Salton Sea beyond that which would occur under the baseline condition. Under the baseline condition, reproduction of tilapia is expected to decline in about 2023 when the salinity of the Salton Sea is projected to exceed 60 ppt. Adults can tolerate higher salinities and could survive beyond this year. However, as these older fish died, the abundance of fish would decline. Use of the Salton Sea by cormorants would be expected to decline as the abundance of fish declined.

Under Approach 1, IID would also continue to stock fish as long as the salinity was tolerable. Tilapia have been collected at a salinity as high as 120 ppt. This salinity is predicted to occur in 2052 with implementation of the water conservation and transfer programs. Thus, relative to the baseline condition, this measure could extend the period of time that the full population of double-crested cormorants could be supported at the Salton Sea by 30 years. After this period, creation of ponds would continue to provide foraging opportunities that could support a smaller number of cormorants until the end of the 75 year permit.

Approach 2

Under Approach 2, IID would avoid impacts to fish-eating birds, including double-crested cormorants by avoiding changes in inflow to the Salton Sea. Under this approach, IID would conserve sufficient water and allow this conserved water to flow to the sea to offset the reduction in inflow attributable to water conservation and transfer. By maintaining the same inflow level as would have occurred without implementation of the water conservation and transfer programs, IID would avoid accelerating salinization of the sea and the earlier occurrence of expected declines in fish abundance. Salinity increases would follow the trajectory predicted for the baseline condition. Under the baseline condition, the salinity of the Salton Sea is projected to exceed 60 ppt, the threshold above which reproduction of tilapia is expected to decline, in 2023. The potential response of double-crested cormorants to reduced fish availability at the Salton Sea was described in section 3.3.2.1.

3.3.5.6 Western Snowy Plover

Western snowy plovers are year-round breeding residents and summer migrants at the Salton Sea. The Salton Sea supports the largest wintering population of snowy plovers in the interior western United States and one of only a few key breeding populations in interior California (Shuford et al. 1999). The summer breeding population typically consists of over 200 individuals (IID 1994).

Nesting habitat for the western snowy plover in the project area is limited to the shoreline of the Salton Sea where they are known to nest on undisturbed, flat, sandy or gravelly beaches (Reclamation and SSA 2000). For foraging, snowy plovers use the shoreline of the Salton Sea, primarily concentrated on sandy beaches or alkali flats along the western and southern shorelines. They could also forage in agricultural fields in the valley.

Use of the Salton Sea by western snowy plovers is not expected to change as a result of the covered activities, including implementation of the water conservation and transfer project. This species forages for insect prey on mudflats, and nests in similar habitats. Mudflat habitats would continue to exist with a decline in Sea elevation, thus, continuing to provide nesting and foraging opportunities for western snowy plover. None of the alternative approaches to addressing changes in fish abundance would not affect snowy plovers positively or negatively.

3.3.5.7 Osprey

Ospreys occur at the Salton Sea in small numbers as a nonbreeding visitor throughout the year (IID 1994). They prey almost exclusively on fish. Large trees and snags near the water are used for roosting and nesting. In the HCP area, suitable habitat conditions exist for the osprey at the Salton Sea and other water bodies in the HCP area including Fig Lagoon, the New and Alamo rivers, and Finney and Ramer lakes. Under the SSCS, IID would implement measures to maintain fish at the Salton Sea on which osprey could prey 1) until that resource would be lost without implementation of the water conservation and transfer program (Approach 2) or for the entire 75 year permit term (Approach 1). Regardless of the approach implemented, foraging opportunities would continue to be available at other locations in the HCP area. As only a small number of osprey currently use the HCP area, these other foraging locations would be adequate to support the existing level of use of the HCP area by osprey.

3.3.5.8 Black Tern

Black terns are common at the Salton Sea during the spring, summer and fall; they rarely occur at the Sea during the winter (USFWS 1997b). The Salton Sea watershed is thought to be the most important staging area for black terns in the Pacific Flyway (Shuford et al. 1999). In addition to the Salton Sea, black terns are common summer residents and migrants in Imperial Valley with up to about 10,000 individuals foraging over agricultural fields at some times (Shuford et al. (1999). There is no evidence that nesting occurs in the HCP area (CDFG 1999).

Black terns forage primarily on insects and fish, but tadpoles, frogs, spiders, earthworms, and crustaceans are also taken. While black terns foraging in agricultural fields are assumed to be foraging on insects, those at the Salton Sea could forage on insect prey as well as fish.

The relative importance of these different prey types to black terns at the Salton Sea has not been determined.

Under the Salton Sea Conservation Strategy (SSCS), IID would implement measures to maintain fish at the Salton Sea 1) until that resource would be lost without implementation of the water conservation and transfer program (Approach 2) or for the entire 75 year permit term (Approach 1). Regardless of the approach implemented, because black terns eat a wide variety of prey, foraging opportunities would continue to be available in agricultural fields and managed marsh on the state and federal refuges. Creation of managed marsh habitat under the Drain Habitat Conservation Strategy (DHCS) would increase foraging opportunities for black terns. Thus, black terns would not be expected to be affected under the various approaches under consideration.

3.3.5.9 Laughing Gull

Laughing gulls are a common post-breeding visitor (up to 1,000 individuals) at the Salton Sea and nested in the area up until the 1950s (USFWS 1997b; IID 1994; Shuford et al. 1999). They previously nested on sandy islets along the southwestern shore of the Salton Sea. Nesting habitat on the islets was lost to erosion as the Sea elevation increase and could have caused laughing gulls to abandon nesting at the Salton Sea. Currently, most laughing gulls occur at the south end of the Sea and in adjacent marsh habitats on the state and federal refuges.

Use of the HCP area by laughing gulls would probably not change substantially from the pre-HCP condition. Laughing gulls exploit a variety of food resources (e.g., garbage dumps), although their diet primarily consists of crustaceans, insects and fish. Insects would remain abundant at the Salton Sea and in marsh habitats and agricultural fields near the Sea. Creation of marsh habitat under the DHCS would further increase foraging opportunities. These food resources would remain available to laughing gulls and continue to support use of the area. To the extent that laughing gulls prey on fish, the SSCS would maintain this prey resource for laughing gulls until that resource would be lost without implementation of the water conservation and transfer program (Approach 2) or for the entire 75 year permit term (Approach 1).

3.3.5.10 Wood Stork

Wood storks have a limited distribution in the United States, breeding only in Florida. After breeding, wood storks wander within their breeding range but also outside the breeding range to areas in Texas, Louisiana, and the Salton Sea. They can arrive at the Salton Sea as early as May after the breeding season and remain as late as October (Small 1994). At the Salton Sea, as many as 1,500 wood storks were counted in the 1950s (Shuford et al. 1999), but more recently counts of only 275 have been reported (IID 1994). The decline in the level of use of the Salton Sea by wood storks has coincided with an overall decline in the breeding population in Florida. Loss of habitat in Florida is believed responsible for the declines in this species.

Wood storks forage in shallow water for small fish, small vertebrates and aquatic invertebrates. At the Salton Sea, shallow shoreline areas and pools formed by barnacle bars provide appropriate foraging conditions for wood storks. Most wood storks at the Salton Sea occur at the southern end (CDFG 1999).

The effects of the water conservation and transfer project on wood storks would be similar to that described for laughing gulls, black terns and gull-billed terns with respect to changes in food resources. Under the SSCS, IID would implement measures to maintain fish at the Salton Sea 1) until that resource would be lost without implementation of the water conservation and transfer program (Approach 2) or for the entire 75 year permit term (Approach 1). Managed marsh created under the DHCS would increase foraging opportunities for wood storks by supporting a variety of vertebrate and invertebrate prey species. As food resources would persist in the HCP area, wood storks would be expected to continue to use the sea as a post-breeding visitor as long as breeding populations were supported in Florida.

3.3.5.11 Long-billed Curlew

The long billed curlew is a common, year round resident at the Salton Sea with large flocks of as many as 1,000 birds observed during the winter. Summer numbers are lower. Recent counts found 2,100 long-billed curlews at the Salton Sea in August, with smaller numbers in the winter (December- 250 birds) and spring (April – 50 birds). The highest count of long-billed curlews in the HCP area was 7,500 birds in August 1995 (Shuford et al. 1999). It is not known to breed in the HCP area (Shuford et al. 1999).

Long-billed curlews primarily forage on a variety of insect prey, including beetles, grasshoppers, and spiders. In coastal areas, it also feeds on crabs, crayfish, mollusks, and other large invertebrates. With these food habitats, long-billed curlews could forage along the shoreline of the Salton Sea but also commonly forage in agricultural fields.

The covered activities, including implementation of the water conservation and transfer project are not expected to affect use of the HCP area by long-billed curlew. Mudflats at the Salton Sea that long-billed curlews could use for foraging would continue to be available and abundant even at reduced Sea elevations. Agricultural fields that long-billed curlews frequent for foraging also would remain abundant. No change in the level of use of the HCP area by long-billed curlews would be expected because of implementation of the SSCS.

3.3.5.12 California Least Tern

The California least tern occurs at the Salton Sea only accidentally. Less than 10 records of this species exist at the Salton Sea NWR (USFWS 1997b). Nesting has not been reported. Given the very low level of use of the HCP area, it is very unlikely that the covered activities would result in take of any California least terns. Similarly, implementation of the Salton Sea Habitat Conservation Strategy would not be expected to affect California least tern positively or negatively.

3.3.5.13 Bald Eagle

Bald eagles are a rare and occasional winter visitor to the Salton Sea with one to three individuals typically observed during winter. When visiting the Salton Sea, bald eagles probably prey on the abundant fish but probably also pursue waterfowl at the Sea or managed marshes in the Imperial Valley. Under the SSCS, IID would implement measures to maintain fish at the Salton Sea 1) until that resource would be lost without implementation of the water conservation and transfer program (Approach 2) or for the entire 75 year permit term (Approach 1). With the abundance of alternate prey (i.e., waterfowl) and low level of use of the HCP area by bald eagles, changes in fish abundance occurring under the three approaches would have little effect on use of the HCP area by bald eagles.

3.3.5.14 Peregrine Falcon

Peregrine falcons are rare visitors to the HCP area. No cliffs or tall buildings that could provide nesting sites for peregrine falcons occur in the project area; thus, use of the project area by peregrine falcons is limited to foraging. They have been observed foraging at managed marsh habitats of the Salton Sea NWR where they prey on wintering and migrating waterfowl. Both the Imperial Valley and Salton Sea are heavily used by wintering and migrating waterfowl. Use of the Salton Sea by waterfowl would continue under the HCP and peregrine falcons would be expected to continue to exploit this resource at the Salton Sea and managed marsh habitat adjacent to the Salton Sea and within the Imperial Valley. While not target species of the HCP, the created marsh habitat would attract migrating and wintering waterfowl and provide additional foraging opportunities for peregrine falcons, thereby benefiting the species.

3.3.5.15 Bank Swallow

Bank swallows are casual visitors to the HCP area, potentially occurring in the HCP area as migrants during the spring and fall. For foraging, they are not strongly associated with any particular habitat type, although they often forage near water where insects are abundant. Insects would continue to be available at the Salton Sea and adjacent marsh habitats. To the extent that bank swallows currently forage along the Salton Sea, foraging opportunities would persist.

3.4 Tamarisk Scrub Habitat Conservation Strategy

3.4.1 Amount and Quality of Habitat in the HCP Area

In the HCP area, tamarisk scrub is found along the New and Alamo Rivers, sporadically along some drains, in seepage areas adjacent to the East Highline Canal and All American Canal, adjacent to the Salton Sea, and in other scattered and isolated patches throughout the HCP area wherever water is available. The covered species associated with tamarisk scrub habitat (Table 2.3-16) primarily are riparian species that find optimal habitat in riparian vegetation consisting of mesquite, cottonwoods, willows, and other native riparian plant species. Tamarisk has invaded most areas within the HCP area where water supplied from the Colorado River provides sufficient soil moisture. Native riparian or mesquite bosque habitat is largely absent from the HCP area. Tamarisk also has colonized non-riparian areas along drains or seepage areas. Tamarisk scrub habitat is not optimal habitat for the species that use this habitat in the HCP area. Rather, it constitutes the only available tree-dominated habitat in the HCP area. While covered species will use tamarisk scrub, it is poor-quality habitat and is not preferred.

The New and Alamo Rivers support about 2,568 acres and 962 acres of tamarisk scrub habitat respectively, for a total of 3,530 acres. About 31 acres occur in the deltas of these rivers. With its tolerance for high salt concentrations, tamarisk has colonized the margins of the Salton Sea. Tamarisk is a primary component of areas designated as shoreline strand community in the Salton Sea database. The shoreline strand community occurs immediately adjacent to the sea and consists of tamarisk and iodine bush and encompasses about 293 acres (University of Redlands 1999). The source of the water that supports the shoreline strand community is uncertain, but is likely the result of shallow groundwater and seepage rising to the surface at its interface with the Salton Sea. In addition to the shoreline strand community, tamarisk scrub occupies about 2,349 acres of adjacent wetland areas of the Salton Sea as designated in the Salton Sea database. Section 2.3.2 provides additional information on the location and characteristics of the shoreline strand and adjacent wetland areas. Tamarisk is a common species in the drains. Drains support an estimated 215 acres of tamarisk scrub habitat. About 412 acres and 755 acres of tamarisk scrub habitat also are supported in seepage areas adjacent to the East Highline Canal and AAC, respectively. Table 3.4-1 summarizes the location and acreage of tamarisk scrub in the HCP area.

TABLE 3.4-1
Location and Acreage of Tamarisk Scrub Habitat in the IID HCP Area

Location	Acreage
New River	2,568
Alamo River	962
Shoreline strand	293
Adjacent to Salton Sea	2,349
Drains	215
AAC Seepage area	755
East Highline Canal seepage areas	412
Other patches	Unquantified
Total Quantified	**7,554**

3.4.2 Effects of the Covered Activities

The mechanisms through which the covered activities could take a covered species associated with tamarisk scrub are changes in habitat (permanent or temporary changes), disturbance, or mortality/injury. The potential effects of each of the covered activities on tamarisk scrub vegetation and covered species using tamarisk scrub habitat are described in Table 3.4-2. Activities with the potential to affect habitat are described in more detail following the table. Activities that are not expected to affect habitat have a very limited potential to affect covered species, with potential effects limited to disturbance in the event that the activity was conducted in close proximity to tamarisk scrub inhabited by covered species.

TABLE 3.4-2
Potential Effects of Covered Activities on Covered Species Associated with Tamarisk Scrub Habitat

Activity	Potential Effects (Positive and Negative)
Water Use and Conservation	

TABLE 3.4-2
Potential Effects of Covered Activities on Covered Species Associated with Tamarisk Scrub Habitat

Activity	Potential Effects (Positive and Negative)
Combined effects of on-farm and system-based water conservation	Water conservation could reduce the amount of water flowing to the Salton Sea and contribute to a reduced sea elevation. The acreage of tamarisk scrub in areas adjacent to the Salton Sea could be reduced. This potential effect is addressed as part of the Salton Sea Habitat Conservation Strategy.
Installation of on-farm water conservation features	On-farm water conservation practices would be constructed within agricultural fields or their margins and therefore would not likely affect tamarisk scrub habitat or covered species using tamarisk scrub habitat. Tamarisk could colonize the margins of constructed tailwater return ponds and delivery ponds and thereby increase the availability of this habitat to covered species.
Installation of System-Based Water Conservation Features	
Canal lining and piping	Canal lining is proposed along 1.74 miles of canal to reduce seepage. Canals proposed for lining (see Section 1.7) are surrounded by *agricultural fields. Tamarisk does not occur along the canals proposed* for lining because IID tightly controls vegetation within the canal right-of-way and farming adjacent to the canals prevent the development of tamarisk outside of IID's right-of-way.
Construction of new canals	New canals would be constructed through agricultural fields and would tie into the existing canal system. Only if a new canal crossed a drain in an area supporting tamarisk scrub would there be the potential for impacts to species-associated with tamarisk scrub. It is anticipated that construction of new canals would not affect tamarisk scrub habitat or covered species using this habitat to any meaningful level because little additional canal would be constructed over the term of the permit and effects to tamarisk scrub habitat would only occur if the new canal crossed a drain in an area supporting tamarisk.
Lateral interceptors	Lateral interceptors would be constructed in agricultural fields but would cross some drains where there could be tamarisk scrub. As described under Structure Maintenance below, IID anticipates constructing up to six drain crossings each year. Drain crossings for lateral interceptors are encompassed by those described under Structure Maintenance. A lateral interceptor system includes a small reservoir (see Section 1.7). Construction of the reservoirs could remove up to 15 acres of tamarisk scrub vegetation.
Reservoirs	IID could construct up to 100 reservoirs 1 to 10 acres in size, and encompassing up to 1,000 acres. These reservoirs would be on agricultural lands or barren lands and would not impact tamarisk scrub habitat. Farmers are expected to construct 1 to 2 acre reservoirs to better regulate irrigation water. These reservoirs would be installed in agricultural fields and would not impact tamarisk scrub habitat.
Seepage Recovery Systems	Seepage recovery systems are proposed along the East Highline Canal. About 43 acres of tamarisk scrub habitat could be permanently lost because of installation of subsurface seepage recovery systems. Effects of surface seepage recovery systems on vegetation are addressed under the DHCS.
Operation and Maintenance	
Conveyance system operation	Conveyance system operation is limited to moving water through the canals to meet customer needs and to address maintenance

19936

TABLE 3.4-2
Potential Effects of Covered Activities on Covered Species Associated with Tamarisk Scrub Habitat

Activity	Potential Effects (Positive and Negative)
	requirements. Other than the filling, draining and moving water through the canals, no physical effects are encompassed by conveyance system operation. No effects to tamarisk or covered species using tamarisk scrub habitat would be expected.
Drainage System Operation	
Rerouting or constructing new drains	IID reroutes or constructs about 2 miles of drains every 10 years. Newly constructed drains could increase habitat for covered species associated with tamarisk scrub habitat. If IID constructed 2 miles of drains every 10 years, 15 miles of new drains would be created over the 75-year permit term, which could increase habitat for species associated with tamarisk scrub habitat as tamarisk colonized the new drain. Rerouting drains could result in the temporary reduction in vegetation in the drains during the period between abandonment of the old drain and when vegetation develops in the rerouted drain. No net loss of vegetation would occur because the rerouted portion would replace the abandoned section.
Piping drains	Over the 75-year term IID anticipates that about 50 miles of open drains would be pipelined, with an annual average of 0.67 miles of drain pipelining. About 22 acres of vegetation in the drains could be lost over the term of the permit of which an estimated 7 acres could be tamarisk.
Inspection activities	Potential effects of inspection activities would be limited to a minor potential for disturbance of covered species if they occur in the vicinity of structures at the time of inspection.
Canal lining maintenance	Canal lining maintenance consists of repairing the concrete lining of canals only. Activities required for canal lining maintenance are limited to the canal prism and adjacent roadway. Tamarisk does not grow in these areas. Therefore, canal lining maintenance would not likely affect tamarisk scrub habitat or covered species using this habitat.
Right-of-way maintenance Embankment maintenance Erosion maintenance	Along drains, right-of-way maintenance, embankment maintenance and erosion maintenance is conducted in association with vegetation control/sediment removal along drains. Potential impacts to covered species from these activities are encompassed by those under vegetation control. Along canals, these activities consist of grading and grooming canal embankments and maintaining the right-of-way free of vegetation. Vegetation typically consists of *Atriplex* and arrowweed but can include tamarisk. All canals are treated annually. Because of this annual treatment, tamarisk cannot become established and develop enough to provide habitat for covered species. Occasionally, storm events will cause bank sloughing or wash outs along drains and require immediate repair. The bank sloughing or wash outs remove vegetation (e.g., tamarisk) such that IID's actions to correct the erosion problem require minimal additional vegetation removal, including removal of tamarisk.
Seepage maintenance	Seepage maintenance is conducted only along the canal system and consists of repairing leaks. Because seepage maintenance is done regularly and routinely, tamarisk does not become established. Therefore, seepage maintenance would not likely affect tamarisk habitat or covered species using this habitat.
Structure maintenance	IID estimates that about 300 structures will be replaced each year. About 100 of these structures would be drainage structures with the remaining

TABLE 3.4-2
Potential Effects of Covered Activities on Covered Species Associated with Tamarisk Scrub Habitat

Activity	Potential Effects (Positive and Negative)
	200 canal structures. Replacement of canal structures would not be expected to affect tamarisk scrub habitat. All construction activity would be conducted with the canal's right-of-way that is maintained free of vegetation. Along lateral drains, replacing each structure temporarily disturbs an area about 75 feet long. Thus, each year about 7,500 feet (1.4 miles) of the drains would be disturbed, potentially and temporarily removing 0.6 acres of vegetation, a portion of which could be tamarisk. (7500 ft X 14 ft / 43560)*26 percent vegetated). This potential loss of vegetation is addressed in the DHCS. Installation of new drain crossings could result in the permanent loss of drain vegetation. IID estimates that six 40-feet-wide crossings will be constructed each year. Based on this estimate, 18,000 feet (3.4 miles) of drain would be affected by drain crossings over the term of the permit, potentially resulting in the loss of 1.5 acres of drain vegetation a portion of which could be tamarisk. ((18,000 ft X 14 ft / 43560)*26 percent vegetated) This potential loss of vegetation is addressed in the DHCS. New structures that would be constructed on the drainage system would consist of control structures. Control structures are installed in steep drains that are eroding. Because of the erosion, drains needing control structures support little vegetation. Thus, construction of new control structures has a limited potential to affect tamarisk scrub habitat or associated covered species
Pipeline maintenance	Drain pipelines primarily occur in farm fields while conveyance system pipelines occur through developed areas. Neither of these areas support tamarisk scrub habitat. As such, the potential for pipeline maintenance to affect covered species is very low.
Reservoir maintenance	Reservoirs are located on the conveyance system. Vegetation is tightly controlled around the reservoir such that tamarisk scrub habitat does not develop. As such, continued reservoir maintenance would not likely affect species associated with tamarisk scrub habitat.
Sediment removal Vegetation control	IID removes sediment from about 300 miles of drains annually. Mechanical and chemical control of vegetation is conducted in association with sediment removal as necessary. While IID strives to maintain vegetation on drain banks, vegetation within the channel bottom is removed with sediment, potentially including tamarisk. These activities can temporarily reduce the amount of vegetation in the drains. An estimated 130 acres of vegetated drain is affected by sediment removal and vegetation control each year of which about 43 acres are tamarisk. Vegetation impacts in the drains are addressed and mitigated by the Drain Strategy. Vegetation control along canals focuses on removing moss and algae. Thus, no effects to tamarisk scrub habitat would occur.
New and Alamo River maintenance	IID dredges the deltas of the New and Alamo rivers about once every four years. In conducting this dredging, IID retains the vegetation on the banks. Thus, tamarisk scrub habitat is not removed by these dredging operations, but the dredging could temporarily disturb covered species using tamarisk along the river channels. IID coordinates with USFWS at the refuge prior to conducting these activities. Mechanical and chemical control is used to treat the banks around the 20 drop structures on the New and Alamo rivers. About 10 acres are treated annually. Because of this annual treatment, tamarisk cannot

TABLE 3.4-2
Potential Effects of Covered Activities on Covered Species Associated with Tamarisk Scrub Habitat

Activity	Potential Effects (Positive and Negative)
	become established and develop enough to provide habitat for covered species.
Salton Sea dike maintenance	Salton Sea dike maintenance activities consist of replacing riprap, grooming embankments and repairing damaged sections of the dikes. Because tamarisk does not occur on or immediately adjacent to the dikes, no change in habitat would occur with these activities and no disturbance of covered species would be expected.
Gravel and rock quarrying	Tamarisk scrub habitat is not found at the gravel and rock quarries. Thus, quarrying is not likely to affect covered species associated with tamarisk scrub habitat.
Fish hatchery operation and maintenance	The fish hatchery is a developed facility and does not support habitat for covered species associated with tamarisk scrub habitat.
Recreational facilities	New recreational facilities could be constructed in association with IID's drain and canals. As described in Section 1.7, potential recreational facilities may include bikepaths, footpaths, picnic tables, and similar facilities. Because recreational facilities would not be constructed in the drain prism where tamarisk scrub habitat could occur, construction of recreational facilities would not be expected to affect habitat for species associated with this habitat. If recreational facilities were constructed adjacent to drains, there would be a minor potential for disturbance of covered species during construction. Vegetation along canals is tightly controlled such that it is unlikely that any tamarisk would be removed to develop recreational facilities along canals. Further, IID would not locate new recreational facilities in areas with extensive tamarisk due to the increased construction cost associated with removal of tamarisk. The HCP does not cover take of covered species by recreationists.
HCP/EIS/EIR mitigation	HCP measures consisting of habitat construction could eliminate some tamarisk scrub habitat depending on its specific location. However, IID would not locate habitat creation areas in areas with extensive tamarisk if possible due to the increased construction cost associated with removal of tamarisk.

3.4.2.1 Habitat Changes at the Salton Sea

Covered species using tamarisk scrub also could be adversely affected by the water conservation and transfer programs if reductions in the sea elevation resulted in the loss of tamarisk scrub in shoreline strand and adjacent wetland areas around the Salton Sea. Impacts to covered species potentially resulting from changes in tamarisk scrub adjacent to the Salton Sea as a result of a reduced sea elevation are addressed as part of the Salton Sea Habitat Conservation Strategy. The following provides a general description of the nature and extent of potential changes in tamarisk scrub habitat adjacent to the Salton Sea. Mitigation for impacts to covered species using tamarisk scrub adjacent to the Salton Sea is covered under the Salton Sea Habitat Conservation Strategy.

The Salton Sea database identifies 293 acres of shoreline strand habitat along the Salton Sea. Shoreline strand habitat consists of tamarisk and iodine bush. In addition to the shoreline strand, the Salton Sea database identifies 2,349 acres of adjacent wetlands dominated by tamarisk. The source of the water that supports the shoreline strand community is uncertain but likely is the result of shallow groundwater rising to the surface at its interface to the Salton Sea. Depending on the extent to which seepage from the Salton Sea contributes to supporting the shoreline strand community and adjacent wetlands dominated by tamarisk, the water conservation program could result in a reduction in the amount of tamarisk scrub habitat. There is however, considerable uncertainty about the extent of these possible changes. As the sea recedes, tamarisk could establish at lower elevations, replacing habitat lost at higher elevations. Alternatively, it has been suggested that tamarisk will not establish in areas exposed by a receding sea level because of excessive soil salinity (Reclamation and SSA 2000). In areas where relatively good quality drain water or shallow groundwater is the predominant water source, no change in tamarisk-dominated adjacent wetlands is expected. It is currently not possible to predict the magnitude of changes in tamarisk in shoreline strand and adjacent wetland areas as a result of the water conservation and transfer programs.

3.4.2.2 Permanent Habitat Loss in the Imperial Valley

Covered activities potentially resulting in the permanent loss of tamarisk scrub habitat in the Imperial Valley are installation of lateral interceptors, installation of seepage recovery systems, piping drains, structure maintenance and wetland creation projects. The potential effects of each of these activities on habitat are described below. In total, an estimated 65.5 acres of tamarisk scrub could be lost because of the covered activities over the term of the permit.

As part of the water conservation and transfer project, IID could install 16 lateral interceptor systems (see Section 1.7). These systems consist of a canal and a reservoir about 40-surface acres in size. Some of the reservoirs could be located close to the New or Alamo rivers and their construction could result in removal of some tamarisk scrub adjacent to these rivers. IID anticipates that up to 15 acres of tamarisk scrub could be removed to construct reservoirs associated with lateral interceptor systems.

Seepage recovery systems are proposed along the East Highline Canal. Subsurface recovery systems are proposed where there is not an existing drain. These systems consist of an underground, perforated pipeline that collects the water and directs it to a sump. Along the East Highline Canal, the pipelines would be installed in close proximity to the outside toe of the canal embankment. Vegetation supported by seepage generally occurs on the embankment where it intercepts seepage water. Because the recovery system would be at the base of the embankment, vegetation would not be lost as a consequence of removing seepage water. However, construction would likely require removal of some of the seepage-supported vegetation. Construction to install these systems disturbs an area about 70 feet wide along the pipeline installation route. About 13.2 miles of pipeline are anticipated to be installed for the seepage recovery systems resulting in the removal of about 43 acres of tamarisk scrub habitat. This amount constitutes about 10 percent of the estimated 412 acres of tamarisk scrub habitat supported in seepage areas adjacent to the East Highline Canal in the HCP area.

Over the 75-year term, IID anticipates that about 50 miles of open drains (an annual average of 0.67 miles) would be pipelined. The entire drainage system encompasses an estimated 2,471 acres of which an estimated 26 percent (652 acres) is vegetated. Tamarisk comprises about 33 percent of the vegetation in the drains. Assuming that 26 percent of the 50 miles of drains piped is vegetated, 22 acres of drain vegetation could be lost over the term of the permit from piping drains. On average, about 7 acres could be tamarisk. This potential loss of vegetation in the drains is addressed through the DHCS.

Structure maintenance with the potential to eliminate drain vegetation consists of installation of new drain crossings. IID estimates that six 40-foot-wide crossings will be constructed each year. Based on this estimate, 18,000 feet (3.4 miles) of drain would be affected by drain crossings over the term of the permit. Assuming the impacted area is 26 percent vegetated, about 1.5 acres of drain vegetation could be lost of which an estimated 0.5 acres could be tamarisk. This potential loss of vegetation in the drains is addressed through the DHCS.

3.4.2.3 Temporary Habitat Disturbance in the Imperial Valley

Covered activities potentially resulting in the temporary loss of tamarisk scrub habitat are sediment removal/vegetation control and structure maintenance. The potential effects of these activities are described below. In total, an estimated 43.2 acres of tamarisk could be temporarily disturbed by the covered activities each year. However, all of this tamarisk is in the drains and is addressed through the DHCS.

The amount of vegetation in the drains was conservatively estimated at 652 acres; about 215 acres are tamarisk IID anticipates that it will clear vegetation/sediment from approximately one-fifth (about 130 acres) of the vegetated acreage in the drains each year. Thus, about 43 acres of tamarisk scrub and species associated with tamarisk scrub could be exposed to drain cleaning each year. Drain cleaning could displace individuals, temporarily reduce habitat in the localized area of the cleaning, or destroy nests if covered species breed in the drains. These potential impacts are addressed through the DHCS.

Structure replacement could temporarily remove drain vegetation, some of which could be tamarisk. IID estimates that about 100 structures on drains will need to be replaced each year. Along lateral drains, replacing each structure temporarily disturbs an area about 75 feet long. Thus, each year about 7,500 feet (1.4 miles) of the drains would be disturbed, potentially resulting in the temporary removal of 0.6 acres of vegetation of which about 0.2 acres could be tamarisk. This potential impact is addressed through the DHCS.

3.4.2.4 Summary of Habitat Effects in the Imperial Valley

Within the Imperial Valley, the covered activities have the potential to permanently remove 65.5 acres of tamarisk and temporarily disturb 43.2 acres (Table 3.4-3). All of the tamarisk potentially temporarily affected is in the drains and is addressed under the DHCS. Of the 65.6 acres potentially permanently lost, 15 acres would be located along the New and/or Alamo rivers, 43 would be along the East Highline Canal, and 7.5 acres would be in the drainage system. The potential loss of 7.5 acres of tamarisk in the drains is addressed under the DHCS. Th 65.5 acres of potential permanent loss of tamarisk constitutes less than one percent of the quantified acreage of tamarisk scrub (Table 3.4-1).

TABLE 3.4-3
Potential Impacts to Tamarisk Scrub Habitat in the Imperial Valley

Covered Activity	Acreage	Comments
Permanent Loss		
Lateral interceptors	15	
Subsurface recovery systems	43	
Piping drains	7	Covered by DHCS
Structure maintenance	0.5	Covered by DHCS
Total permanent loss	65.5	7.5 acres are covered by the DHCS
Temporary Loss		
Vegetation control/sediment removal	43	Covered by DHCS
Structure maintenance	0.2	Covered by DHCS
Total temporary loss	43.2	Covered by DHCS

3.4.3 Approach and Biological Goals

The biological goal of the Tamarisk Scrub Habitat Conservation Strategy is to maintain the species composition, relative abundance, and life history functions of covered species using tamarisk scrub habitat within the HCP area. This overall goal is to be accomplished through implementing measures to meet two specific objectives:

- Avoid and minimize take of covered species associated with tamarisk scrub habitat, and
- Create or acquire and preserve native tree habitat to mitigate any take of covered species caused by removal of tamarisk.

3.4.4 Tamarisk Scrub Habitat Mitigation and Management Measures

The mitigation and management measures described below are the specific actions that IID will undertake to fulfill the goals of the Tamarisk Scrub Habitat Conservation Strategy. The key elements of the conservation strategy are as follows:

- Minimize take, including disturbance, of covered species as a result of construction activities
- Acquire or create, and preserve native tree habitat to mitigate for the take of covered species resulting from the loss of tamarisk scrub or native tree/shrub habitat permanently removed as a result of construction activities

***Tree Habitat* – 1.** *For scheduled construction activities (except for the installation of subsurface seepage recovery systems), the site will be surveyed before initiation of construction activities. If tamarisk scrub habitat occurs on the project site and would be affected by the construction activities or operation of the constructed facilities, the acreage and plant species composition of the affected vegetation will be determined.*

- *After completion of the construction activities, IID will restore native tree vegetation temporarily impacted by the construction. IID will submit to USFWS and CDFG a vegetation restoration plan for approval. The vegetation restoration plan will describe 1) the amount and species composition of the vegetation that would be impacted, 2) the actions that IID will take to restore the area to pre-disturbance conditions, 3) the criteria for assessing the success of the restoration, 4) monitoring and reporting requirements, and 5) the actions that will be undertaken if the success criteria are not achieved. Restoration is not required for temporarily impacted areas consisting of tamarisk.*

For tamarisk that would be permanently lost, IID will create or acquire native tree habitat consisting of mesquite bosque or cottonwood-willow habitat. The amount of habitat to acquire or create will be calculated based on the following ratios.

- *If IID creates habitat prior to conducting the construction activities, the mitigation ratio for the acreage of created habitat to lost acreage of tamarisk will be 0.25:1 as long as the created habitat meets the success criteria.*

- *If IID creates habitat after conducting the construction activities or if IID acquires existing habitat, the mitigation ratio for the acreage of the created or acquired habitat to lost acreage of tamarisk will be 0.75:1. The habitat will be created or acquired within 1 year of initiation of the construction activities unless otherwise agreed to by IID, USFWS, and CDFG.*

- *If IID elects to acquire habitat, IID will work with the HCP IT to identify a property for acquisition. Habitat to be acquired must support mesquite bosque or cottonwood-willow habitat, occur within the Salton Sea Basin and meet with the approval of the USFWS and CDFG. If the only available properties that meet these requirements are larger than required to compensate for the lost acreage, IID will acquire the least expensive property. IID can use the additional acreage of the acquired habitat to fulfill the mitigation obligations of Tree Habitat – 1 or Tree Habitat - 2 for future projects, or Salton Sea - 3. IID will place a conservation easement on acquired lands and provide for the property to be managed for covered species for the term of the permit. With the approval of USFWS and CDFG, which approval shall not be unreasonably withheld, IID may transfer the land to a third party who agrees to and is authorized to manage the land for habitat conservation purposes. If IID transfers the land to a third party, IID will establish an endowment fund adequate to provide for the management of the lands for the term of the permit. If IID retains ownership of the land, IID will prepare and submit to USFWS and CDFG for approval a management plan for the property that describes how the property will be managed. The management plan will describe the actions that IID will take to maintain the ecological functions of the* acquired habitat. While the specific management needs will vary depending on the property acquired, considerations for the management plan include:

- *Measures to control human access (e.g., fencing, signage)*
- *Frequency at which land will be visited to assess maintenance/management needs*
- *Types of maintenance action (e.g., removing garbage, repairing fences)*
- *Vegetation management practices (e.g., prescribed burning, removal of exotic plants)*
- *If IID elects to create habitat, IID will work with the HCP IT to develop a habitat creation plan. The habitat creation plan will include the following information:*
- *location*
- *planting plan (including species composition and layout)*
- *grading and other construction activities*
- *long-term management practices*

- *vegetation and species use monitoring*
- *success criteria for the plantings and the actions that IID will take if the success criteria are not met.*

IID will undertake a variety of construction activities in the future, primarily as part of the water conservation and transfer project and to modernize and rehabilitate its facilities. As described above, these construction activities have the potential to remove a small amount of tamarisk scrub vegetation which has a small potential to result in take of a covered species. This mitigation measure addresses this potential take by requiring site-specific surveys for every scheduled construction activity to determine if the construction would impact tamarisk scrub habitat and subsequently taking actions to compensate for the loss if habitat would be permanently lost because of the construction. By conducting site-specific surveys, IID will determine if any tamarisk scrub habitat will be affected and create native tree habitat to replace lost habitat values. If areas of tamarisk scrub habitat will be affected, IID will create or acquire and preserve native tree habitat at a 0.25:1 or 0.75:1 mitigation ratio.

The 0.25:1 mitigation ratio for tamarisk was derived based on the relative value of the habitat affected (i.e., tamarisk scrub) and the habitat that would be created (i.e., cottonwood-willow or mesquite bosque). Anderson and Ohmart (1984) developed a classification system for riparian plant communities along the LCR based on the plant species composition and structural characteristics. Their plant species composition categories are cottonwood/willow, tamarisk, screwbean mesquite, honey mesquite, tamarisk/honey mesquite, and arrowweed. The structural classes and their characteristics are described in Table 3.4-4. Anderson and Ohmart (1984) further assigned a habitat value rating to each plant community/structural class that ranged from 1 (lowest value) to 26 (highest value). Based on this rating system, tamarisk scrub habitats have low habitat value ratings for all structural classes, ranging from 3 to 8 units (Table 3.4-5). Tamarisk is considered to be a relatively unimportant plant community for most bird species along the LCR (Rice et al. 1980). In contrast, the habitat value ratings for cottonwood/willow communities range from 17 to 26 for communities that contained trees greater than 15 feet tall. Cottonwood/willow stands with few cottonwood trees greater than 15 feet tall, have a similar habitat value rating as tamarisk communities. Similarly, honey mesquite communities have high habitat value ratings.

TABLE 3.4-4
Structural Characteristics of Riparian Vegetation According to Anderson and Ohmart (1984) Classification System

Structure Type	Characteristics
I	Mature stand with distinctive overstory greater than 15 feet in height, intermediate class from 2 to 15 feet, tall, and understory from 0 to 2 feet tall.
II	Overstory is greater than 15 feet tall and constitutes greater than 50 percent of the trees with little or no intermediate class present.
III	Largest proportion of trees is between 10 and 20 feet in height with few trees above 20 feet or below 5 feet in height.
IV	Few trees above 15 feet present. 50 percent of the vegetation is 5 to 15 feet tall with the

19944

TABLE 3.4-4
Structural Characteristics of Riparian Vegetation According to Anderson and Ohmart (1984) Classification System

Structure Type	Characteristics
	other 50 percent between 1 to 2 feet in height.
V	60 to 70 percent of the vegetation present is between 0 to 2 feet tall, with the remainder in the 5- to 15-foot class.
VI	75 to 100 percent of the vegetation from 0 to 2 feet in height.

The structural characteristics of the tamarisk scrub in the HCP area has not been determined with the exception of the tamarisk present in seepage areas along the AAC between Drops 2 and 3 and between Drops 3 and 4. The tamarisk scrub in these areas is structural types III and V (Reclamation and IID 1994). These structural types are likely to be the predominant types within the HCP area as well. Thus, the tamarisk scrub in the HCP area provides a relative habitat value of 5. The cottonwood/willow community between Drops 3 and 4 was structural type IV with a relative habitat value of 19 (Reclamation and IID 1994) suggesting that at least a structural type IV community can be created in the native tree habitats. This seepage community also supports a honey mesquite community of structural type IV with a relative habitat value rating of 21. Thus, it is reasonable to expect that created or acquired native tree habitat would provide at least a relative habitat value of 19. As compared to tamarisk scrub with a relative habitat value of 5, the created native tree habitat with a relative habitat value of 19, would provide a habitat value about 4 times greater than the value of the tamarisk scrub currently available. As such, using a 0.25:1 mitigation ratio would result in a similar habitat value in the created native tree habitat as the tamarisk scrub habitat.

TABLE 3.4-5
Wildlife Habitat Value Rating for Tamarisk and Cottonwood/Willow Habitats

Community/Structure	Value
Cottonwood/Willow	
Type I	17
Type II	23
Type III	26
Type IV	19
Type V	5
Type VI	6
Honey Mesquite	
Type III	20
Type IV	21
Type V	10
Type VI	9

TABLE 3.4-5
Wildlife Habitat Value Rating for Tamarisk and Cottonwood/Willow Habitats

Community/Structure	Value
Tamarisk	
Type I	4
Type II	8
Type III	5
Type IV	3
Type V	5
Type VI	7
Mixed Communities[a]	
Saltcedar/palms V	10
Saltcedar/honey mesquite IV	8
Saltcedar/honey mesquite V	7.5
Saltcedar/honey mesquite/palms V	12.5
Screwbean mesquite/palms IV	14
Screwbean mesquite/palms V	14

Source: Anderson and Ohmart (1984, presented in Reclamation and IID 1994) unless noted
[a]USFWS (1993)

If native tree habitat is created prior to removal of tamarisk by construction activities, the habitat will be available to covered species at the time the tamarisk is removed. As described above, native tree habitat is four times more valuable to wildlife than tamarisk and creating native tree habitat at a 0.25:1 ratio prior to removal of tamarisk would ensure that there would be not net loss of habitat value for covered species. If native tree habitat is created after tamarisk is removed, there would be slight reduction in habitat value between when the tamarisk is removed and the created habitat is installed and develops into functional habitat. A higher mitigation ratio (0.75:1) is used to account for this delay. If IID elects to acquire existing habitat, there could still be a slight reduction in habitat value because of an overall net loss in acreage. A higher mitigation ratio (0.75:1) is used to account for the net loss.

- **Tree Habitat – 2.** If IID installs subsurface seepage recovery systems on the East Highline Canal, prior to the initiation of construction, IID will determine the acreage of seepage community vegetation that will be removed and permanently lost because of the construction. For seepage community vegetation that would be permanently lost, IID will create or acquire native tree habitat consisting of mesquite bosque or cottonwood-willow habitat. The amount of habitat to acquire or create will be calculated based on the following ratios.

- *If IID creates habitat prior to installing the subsurface recovery systems, the mitigation ratio for the acreage of created habitat to lost acreage of tamarisk will be 0.5:1 as long as the created habitat meets the success criteria.*
- *If IID creates habitat after installing the subsurface recovery systems, the mitigation ratio for the acreage of the created or acquired habitat to lost acreage of tamarisk will be 1.5:1. The habitat will be created or acquired within 1 year of initiation of construction activities unless otherwise agreed to by IID, USFWS, and CDFG.*
- *If IID elects to acquire habitat, IID will work with the HCP IT to identify a property for acquisition. Habitat to be acquired must support mesquite bosque or cottonwood-willow habitat, occur within the Salton Sea Basin and meet with the approval of the USFWS and CDFG. If the only available properties that meet these requirements are larger than required to compensate for the lost acreage, IID will acquire the least expensive property. IID can use the additional acreage of the acquired habitat to fulfill the mitigation obligations of Tree Habitat – 1 or Tree Habitat - 2 for future projects, or Salton Sea - 3. IID will place a conservation easement on acquired lands and provide for the property to be managed for covered species for the term of the permit. With the approval of USFWS and CDFG, which approval shall not be unreasonably withheld, IID may transfer the land to a third party who agrees to and is authorized to manage the land for habitat conservation purposes. If IID transfers the land to a third party, IID will establish an endowment fund adequate to provide for the management of the lands for the term of the permit. If IID retains ownership of the land, IID will prepare and submit to USFWS and CDFG for approval a management plan for the property that describes how the property will be managed. The management plan will describe the actions that IID will take to maintain the ecological functions of the acquired habitat. While the specific management needs will vary depending on the property acquired, considerations for the management plan include:*
- *Measures to control human access (e.g., fencing, signage)*
- *Frequency at which land will be visited to assess maintenance/management needs*
- *Types of maintenance action (e.g., removing garbage, repairing fences)*
- *Vegetation management practices (e.g., prescribed burning, removal of exotic plants)*
- *If IID elects to create habitat, IID will develop a habitat creation plan. The habitat creation plan will include the following information:*
- *location*
- *planting plan (including species composition and layout)*
- *grading and other construction activities*
- *long-term management practices*
- *vegetation and species use monitoring*
- *success criteria for the plantings and the actions that IID will take if the success criteria are not met.*

IID may install subsurface seepage recovery systems along the East Highline Canal as part of the water conservation and transfer program. The plant communities adjacent to the East Highline Canal that are supported by seepage from the canal consist of a wide variety of plants, including tamarisk, mesquite, arrowweed, common reed, and a few cottonwoods. Covered species associated with tamarisk scrub habitats could use these plant communities. Installation of subsurface seepage recovery systems would result in the loss of some vegetation and the USFWS and CDFG identified potential take of covered species from removal of a portion of the seepage community vegetation. This measure will mitigate potential impacts of the take of covered species that could result from construction of subsurface seepage recovery systems by acquiring or creating native tree vegetation sufficient to offset lost habitat value.

The 0.5:1 mitigation ratio was derived from relative habitat value ratings for mixed communities (Table 3.4-5). The vegetation of the seepage communities consists of a mix of species, including but not limited to tamarisk, mesquite, *Atriplex*, non-native palms, cottonwoods, and *Phragmites*. Depending on the species composition and structural conditions, the habitat value ratings for mixed communities range from 7.5 to 14. The habitat value of seepage communities is probably on the lower end of this range because of the preponderance of non-native species. As described above, the created or acquired habitat would be expected to have a habitat value of at least 19, about twice the value of the seepage communities. Thus, a 0.5:1 mitigation ratio would be adequate to offset any loss in habitat value from removal of seepage communities along the East Highline Canal.

For the same reason as described under Tree Habitat –1, a higher mitigation ration (1.5:1) is used if the habitat is created after the subsurface seepage recovery systems are installed or if habitat is acquired.

Tree Habitat – 3. *For scheduled construction activities, including installation of subsurface seepage recovery systems, that will remove tamarisk, cottonwoods, willows or mesquite, the site will be surveyed to determine whether any covered species are potentially breeding at the site. If covered species are found to be potentially breeding on the project site, IID will schedule the construction activities that directly affect habitat to occur outside of the breeding season.*

In addition to potentially reducing the amount of tamarisk scrub habitat available to covered species, construction activities could disturb or injure covered species using the habitat. The effect of disturbance and the potential for injury would be greatest on covered species if covered species were nesting in the habitat to be removed by construction. To minimize the potential for take of covered species from construction activities, IID will survey tamarisk, cottonwood, willow or mesquite vegetation to determine if any covered species are breeding in the habitat that would be affected by the construction activities. If the surveys indicate that covered species are likely to be breeding in the habitat that would be affected, IID will schedule activities that would affect the habitat to occur outside of the breeding season. Outside of the breeding season, IID could remove the habitat. By scheduling construction activities that would affect habitat to occur outside of the breeding season, IID will minimize the potential to injure or disturb a covered species.

3.4.5 Effects on Habitat

Tamarisk is a non-native species that has invaded riparian areas of the southwest and readily colonizes non-riparian areas with adequate soil moisture. Tamarisk is considered poor quality habitat for native wildlife species although some wildlife species have adapted to using tamarisk where it has displaced native vegetation. Tamarisk can form dense monocultures with little structural diversity. Bird species diversity and abundance have been found to be lower in tamarisk than in stands of native riparian vegetation. Thirty-two riparian-dependent bird species have been identified in the Southwestern U.S. (Anderson and Ohmart 1984, Kelly and Finch 1999). Twenty-six of these species require broadleaf trees for nesting and breeding along the Lower Color River and cannot fulfill these life requisites in tamarisk (Anderson and Ohmart 1984, Kelly and Finch 1999). Two groups, large raptors, and cavity nesting species, are not known to occur in tamarisk. Tamarisk's growth form is generally as a large shrub that does not possess the structural characteristics required by species such as raptors or woodpeckers that rely on trees as perch and/or nest sites. Some birds have been found to use tamarisk for nesting along the Rio Grande and Pecos Rivers in New Mexico, but are broadleaf obligates at lower elevations along the Colorado River. The discrepancy in use of tamarisk between these two areas is believed to be caused by a difference in temperature extremes between the higher elevation eastern watersheds and the low elevation rivers of southwest Arizona and California. Most tamarisk habitat along the LCR lacks the species diversity and canopy structure necessary to ameliorate extreme climate conditions and as a result does not provide suitable habitat for many of the species known to successfully breed in tamarisk farther east (Hunter et al. 1985, 1987, and 1988). These studies indicate the poor quality of tamarisk as wildlife habitat.

Tamarisk currently is common and abundant in the HCP area, having colonized areas adjacent to the New and Alamo Rivers, agricultural drains, areas adjacent to the Salton Sea and areas receiving seepage or agricultural runoff (Table 3.4-1). Construction of lateral interceptors and subsurface recovery systems could result in the removal of 58 acres of tamarisk scrub which constitutes less than one percent of the quantified acreage of tamarisk scrub in the HCP area (Table 3.4-3). These acres are addressed through Tamarisk Scrub Habitat Conservation Strategy (Tree Habitat - 1 and 2). Thus, tamarisk would be expected to remain locally and regionally abundant. Furthermore, because of its poor quality and high abundance, the distribution and amount of tamarisk is not likely to limit the abundance or distribution of any covered species. Nonetheless, because tamarisk is known to be used by several covered species, the Tamarisk Scrub Habitat Conservation Strategy includes habitat creation or acquisition to offset any take of covered species resulting from a local reduction in the distribution or abundance of tamarisk. Created or acquired native tree habitat would provide higher quality habitat, increase habitat diversity in the HCP area, and provide true tree habitat for covered species.

3.4.6 Effects on Covered Species

Tamarisk is not a preferred habitat for any of the covered species. Most of the covered species potentially using this habitat are considered riparian species associated with native riparian plant communities such as cottonwoods, willows, palo verde, and mesquite. Covered species associated with tamarisk scrub fall into this category because tamarisk scrub represents the only tree-dominated habitat in the HCP area. Covered species potentially using tamarisk scrub habitats in the HCP area include resident breeding species, migratory breeding species, winter visitors, and transient species that may visit tamarisk scrub habitat during migration or other wanderings.

The effects of the Tamarisk Scrub Habitat Conservation Strategy on listed species (state and/or federal) are evaluated for each individual species below. In addition, the effects on unlisted species that regularly occur in the HCP area are individually evaluated. The effects of implementing the HCP on the covered species potentially using tamarisk that are transient in the HCP area are summarized in Table 3.4-6.

3.4.6.1 Willow Flycatcher

Willow flycatchers consistently occur in the HCP area during migration. They are not known to breed in the HCP area, but recent observations of willow flycatchers during the breeding season along the Whitewater River suggest that this species could breed in the HCP area in the future. Willow flycatchers typically are associated with willow thickets. Willow thickets do not exist in the HCP area, but willow flycatchers have been reported using tamarisk and common reed along the Salton Sea and agricultural drains, and in seepage communities adjacent to the East Highline Canal during migration. Because they only occur in the HCP area during migration, the potential for take of willow flycatchers as a result of covered activities such as drain maintenance is low.

The minor reduction in the amount of tamarisk scrub habitat in the HCP area as a result of the covered activities in the Imperial Valley probably would have negligible effects on willow flycatchers. Tamarisk is generally considered poor quality habitat, even though willow flycatchers are known to use tamarisk for nesting in other portions of its range. Further, tamarisk is abundant in the HCP area as well as regionally. As such, it is unlikely that a reduction in the amount of tamarisk scrub would substantially affect or result in take of willow flycatchers.

Implementation of the Tamarisk Scrub Habitat Conservation Strategy would be expected to maintain or improve habitat conditions for willow flycatchers. Native tree habitat would be created or acquired, and preserved to replace any tamarisk scrub habitat that would be permanently lost as a result of the construction activities. As part of the Salton Sea Habitat Conservation Strategy, native tree habitat also could be created or acquired, and preserved if a net loss of tamarisk scrub habitat occurs within the shoreline strand or adjacent wetlands as a result of the water conservation and transfer programs. Consisting of native plant species, the created or acquired habitat would be expected to provide better habitat for willow flycatchers than tamarisk.

TABLE 3.4-6
Potential Effects of Tamarisk Scrub Habitat Conservation Strategy on Covered Species Associated with Tamarisk Scrub Habitat

Species	Occurrence in HCP Area	Habitat Use in the HCP Area	Potential Effects of HCP
Large-billed savannah sparrow	Rare to uncommon post breeding and winter visitor.	Known to use tamarisk scrub habitat on river deltas. Could use tamarisk scrub habitat throughout the HCP area.	The HCP not expected to affect this species positively or negatively because of abundance of tamarisk scrub habitat in the HCP area.
Sharp-shinned hawk	Regular migrant and winter visitor.	Known to use drain habitat; potentially visits tamarisk scrub throughout the HCP area.	To the extent that sharp-shinned hawks use tamarisk scrub, created or acquired native tree habitat would at least offset any loss of habitat value resulting from removal of tamarisk. Native tree habitat could provide higher quality foraging habitat than tamarisk by attracting songbirds.
Merlin	Rare visitor during fall and winter.	Probably concentrates foraging at Salton Sea where shorebirds are abundant. Could also prey on shorebirds and songbirds using managed and unmanaged marshes, tamarisk scrub habitat, and agricultural fields.	To the extent that merlin use tamarisk scrub, created or acquired native tree habitat would at least offset any loss of habitat value resulting from removal of tamarisk. Native tree habitat could provide higher quality foraging habitat than tamarisk by attracting songbirds.
Black swift	Accidental during spring.	Could use a wide variety of habitats in the HCP area.	To the extent that black swifts use tamarisk scrub, created or acquired native tree habitat would at least offset any loss of habitat value resulting from removal of tamarisk. Native tree habitat could provide higher quality foraging habitat by supporting a more diverse and abundant insect community.
Vaux's swift	Common spring migrant; uncommon fall migrant.	Known to congregate at north end of the Salton Sea during migration; could use wide variety of habitats in the HCP area.	To the extent that Vaux's swift use tamarisk scrub, created or acquired native tree habitat would at least offset any loss of habitat value resulting from removal of tamarisk. Native tree habitat could increase the availability and quality of foraging habitat and potentially enhance survival of migrating birds by supporting a more diverse and abundance insect community.
Cooper's hawk	Regular migrant and winter visitor.	Known to use drain habitat; potentially uses tamarisk scrub throughout the HCP area.	To the extent that Cooper's hawks use tamarisk scrub, created or acquired native tree habitat would at least offset any loss of habitat value resulting from removal of tamarisk. Native tree habitat could provide higher quality foraging habitat than tamarisk by attracting songbirds and providing perch sites for roosting and foraging.

TABLE 3.4-6
Potential Effects of Tamarisk Scrub Habitat Conservation Strategy on Covered Species Associated with Tamarisk Scrub Habitat

Species	Occurrence in HCP Area	Habitat Use in the HCP Area	Potential Effects of HCP
Long-eared owl	Occasional winter visitor.	Could use tamarisk scrub habitat throughout the HCP area	To the extent that long-eared owls use tamarisk scrub, created or acquired native tree habitat would at least offset any loss of habitat value resulting from removal of tamarisk.
Purple martin	Occasional spring and fall migrant.	Could use a wide variety of habitat is the HCP area.	To the extent that purple martin use tamarisk scrub, created or acquired native tree habitat would offset any loss of habitat value resulting from removal of tamarisk. Native tree habitat could increase the availability and quality of foraging habitat and potentially enhance survival of migrating birds by supporting a more diverse and abundant insect community

19952

3.4.6.2 Least Bell's Vireo

Least Bell's vireo occurs accidentally in the HCP area during migration. This low level of use is reflected by only two observations of this species at the Salton Sea NWR. On the rare occasion that it does occur in the HCP area, it could use tamarisk as the only available tree or shrub habitat. Because of the very low level of use, it is very unlikely that any least Bell's vireo would be taken as a result of the covered activities. The minor potential changes in the amount of tamarisk as a result the covered activities would not be expected to influence future use of the HCP area or reduce survival of vireos migrating through the HCP area. Implementation of the HCP would not have any adverse effects on least Bell's vireo and could have a minor beneficial effect through the creation or acquisition of higher quality native tree habitat for migratory stopovers.

3.4.6.3 Arizona Bell's Vireo

Historically and currently, the distribution of Arizona Bell's vireo is limited to areas along the LCR. The nearest known occurrence of this species to the HCP area is from eastern Imperial County near the Colorado River. Given the low level of use of the HCP area, it is unlikely that the covered activities would result in take of any Arizona Bell's vireo. Similarly, implementation of the Tamarisk Scrub Habitat Conservation Strategy would not be expected to affect Arizona Bell's vireo positively or negatively in the short term. Over the term of the permit, the vireo's range could expand to include the Imperial Valley. In this event, the creation or acquisition of native tree habitats could be beneficial in providing habitat for this species.

3.4.6.4 Swainson's Hawk

Swainson's hawks are occasional visitors to the Salton Sea area during their spring and fall migrations. They are not known to breed in the HCP area. For foraging, Swainson's hawk frequent agricultural fields. Trees and utility poles are used as perch and roost sites. Agricultural fields that Swainson's hawks can use for foraging are abundant in the HCP area. The extent to which the hawks use individual fields could be related to the availability of perch sites in the vicinity of the fields. Although tamarisk is abundant in the HCP area, tamarisk probably provides few perching opportunities for Swainson's hawk because it typically remains a large shrub, lacking the more robust and open structure required by Swainson's hawk for perching and roosting. As such, Swainson's hawks probably would not be affected by the projected minor reduction in tamarisk.

Under the Tamarisk Scrub Habitat Conservation Strategy, native tree habitat would be created or acquired, and preserved to replace tamarisk scrub habitat that would be permanently lost as a result of the construction activities. This created or acquired habitat would provide better habitat for Swainson's hawk because of the presence of trees that the hawks could use for roosting or perching while foraging. Additional benefits could be realized if native tree habitat is created as part of the Salton Sea Habitat Conservation Strategy.

3.4.6.5 Gila Woodpecker

Gila woodpeckers have been observed at a number of locations in the Imperial Valley in areas that support large trees, such as near towns and houses. They are also known to occur along the AAC in areas with trees supported by seepage, or in association with telephone poles that may also be used to create nesting cavities. The species may breed in these locations. The Gila woodpecker has declined dramatically in California. Loss and degradation of mature riparian habitat and saguaros have been implicated as the primary reason for this decline.

Tamarisk is very poor habitat for Gila woodpeckers. The few birds that have been observed using tamarisk along the LCR are believed to be dispersing juveniles rather than territorial adults (Larsen 1987). Gila woodpeckers have not been found to nest in tamarisk (Larsen 1987). Based on this low level of use and lack of use by breeding birds, the potential for the covered activities to result in take of Gila woodpeckers is low. In Imperial Valley, Gila woodpeckers only are known to occur in association with trees in urban areas or agricultural operations (e.g., ranch yards). They not known to use tamarisk. Therefore, Gila woodpeckers are unlikely to be affected by the minor reduction in tamarisk expected in the Imperial Valley.

The potential for Gila woodpeckers to be disturbed or injured as a result of the covered activities is also low because this species is typically found in association with trees in urban areas or agricultural fields. Few, if any, of the covered activities would be conducted near areas supporting trees. The Tamarisk Scrub Habitat Conservation Strategy includes measures to minimize injury or disturbance to Gila woodpeckers if construction activities would affect trees. Under the Tamarisk Scrub Habitat Conservation Strategy, IID will survey areas that would be disturbed during construction to determine if any covered species, including Gila woodpeckers, are breeding in habitat that would be disturbed. Removal of habitat will be avoided until after the breeding season and native tree habitat created to compensate for tamarisk scrub or cottonwood-willow habitat that is permanently lost. These measures will minimize and mitigate any take of Gila woodpeckers as a result of construction activities.

Implementation of the tamarisk scrub conservation strategy could benefit Gila woodpeckers. The availability of trees suitable for excavating nesting cavities has been identified as a limiting factor for Gila woodpeckers (Larsen 1987). Under the Tamarisk Scrub Habitat Conservation Strategy, native tree habitat would be created/acquired, and preserved. Trees such as cottonwoods or mesquite would be an important component of this habitat. Given the limited availability of trees of suitable size and wood characteristics in the HCP area, the creation or long-term preservation of native tree habitat would contribute to maintaining or increasing the availability of suitable nest trees over the term of the permit. With their apparent tolerance for human activity and willingness to exploit suitably sized trees, regardless of species, Gila woodpeckers would likely rapidly exploit the trees provided under Tamarisk Scrub Habitat Conservation Strategy. Gila woodpeckers would further benefit if native tree habitat was created or acquired, and preserved as part of the Salton Sea Habitat Conservation Strategy.

3.4.6.6 Gilded Flicker

Gilded flickers have habitat requirements similar to those of the Gila woodpecker described above and similarly are believed to have declined in California because of loss of mature riparian habitat and saguaros. Unlike Gila woodpeckers, they appear intolerant of human activity and have not been reported in the Imperial Valley. Their occurrence along the AAC is unknown.

Little potential habitat for gilded flickers exists in the HCP area. The few trees available in the Imperial Valley are generally located near human activity, such as in parks, residential areas, or on ranches. Because they have a low tolerance for human activity and are not known to use tamarisk, gilded flickers are unlikely to occur in the Imperial Valley.

The Tamarisk Scrub Habitat Conservation Strategy would mitigate impacts to gilded flickers in the event that they occur in the HCP area. Under the Tamarisk Scrub Habitat Conservation Strategy, IID will survey areas that would be disturbed during construction to determine if any covered species, including gilded flickers, are breeding in habitat that would be disturbed. Removal of habitat will be avoided until after the breeding season and native tree habitat created or acquired, and preserved to compensate for tamarisk scrub habitat that is permanently lost. These measures will minimize and mitigate any take of gilded flickers as a result of construction activities. The creation or long-term preservation of native tree habitat also would contribute to maintaining or increasing the availability of suitable nesting conditions for gilded flickers if located in areas of limited human activity. Additional nesting habitat could be gained if native tree habitat is created or acquired, and preserved as part of the Salton Sea Habitat Conservation Strategy. However, overall, gilded flickers are unlikely to be positively or negatively affected by implementation of the HCP because of their low level of use of the HCP area.

3.4.6.7 Western Yellow-billed Cuckoo

Yellow-billed cuckoos are rare in the HCP area and occur only as accidentals. The species has been observed on two occasions at the Salton Sea NWR, but has not been reported in the Imperial Valley. On one occasion, a single individual was observed along the AAC. The absence of yellow-billed cuckoos from the HCP area is expected because riparian cottonwood-willow habitat that yellow-billed cuckoos require does not exist in the HCP area. Riparian areas have been invaded by tamarisk, which yellow-billed cuckoos are not known to use in the western portion of their distribution. Because of the low level of use of the HCP area by yellow-billed cuckoos, the potential for take is very low.

Because the level of use of the HCP area by cuckoos is very low, implementation of the Tamarisk Scrub Habitat Conservation Strategy would probably have little effect on yellow-billed cuckoos at least in the short term. The creation or long-term protection of higher quality native tree habitat could enhance survival of cuckoos that accidentally stray into the HCP area. Implementation of the HCP would not have any adverse effects on yellow-billed cuckoos and could have minor beneficial effects.

3.4.6.8 White-tailed Kite

White-tailed kites can occur in the HCP area throughout the year. Their current breeding status in the HCP area is uncertain. They have bred in the HCP area previously, but have not been verified to breed there recently. White-tailed kites typically forage in agricultural fields and are known to roost in Bermuda grass fields. Nests are located in trees. If white-tailed kites currently nest in the HCP area, they are most likely to use landscape trees or eucalyptus trees bordering agricultural fields as there are few other trees available in the Imperial Valley. Use of tamarisk is probably minimal because it does not provide a structure conducive to perching or nesting by raptors. As such, the minor potential reduction in the amount of tamarisk scrub in the Imperial Valley, would not be expected to adversely affect white-tailed kites. However, the Tamarisk Scrub Habitat Conservation Strategy could benefit white-tailed kites.

however, benefit from the Tamarisk Scrub Habitat Conservation Strategy and potentially the Salton Sea Habitat Conservation Strategy under which native tree habitat would be created or acquired, and preserved. The native habitat would include native tree species such as cottonwoods and mesquite, that Harris' hawks are known to use for nesting. Harris hawks could use these trees for nesting in the future.

Harris' hawks are probably most likely to occur in the HCP area in the seepage community between Drops 3 and 4 on the AAC. This community contains cottonwoods and mesquite that could be used for nesting with adjacent desert scrub, a commonly used habitat for foraging. O&M activities would not affect this community and no construction activities affecting that seepage area are anticipated under this HCP. In addition, under the Tamarisk Scrub Habitat Conservation Strategy, construction in habitat potentially used by Harris' hawks for breeding would be avoided during the breeding season and any loss of breeding habitat caused by construction activities would be mitigated through creation of native tree habitat. This component of the Tamarisk Scrub Habitat Conservation Strategy would minimize the potential for take of Harris' hawk.

3.4.6.12 Crissal Thrasher

The crissal thrasher occupies dense thickets of shrubs or low trees in desert habitats. Mesquite, ironwood, catclaw acacia, and arrowweed willow are preferred vegetation. Crissal thrashers are resident, breeding species in the HCP area and have been reported along the Alamo River and near the towns of Niland and Brawley. Tamarisk represents the primary shrub vegetation available in the HCP area. The extent to which crissal thrasher use tamarisk is uncertain, but invasion of mesquite scrub habitats by tamarisk has been implicated as contributing to declines of this species, suggesting that tamarisk scrub is poor quality habitat, if it is used at all.

Changes in the amount of tamarisk are not likely to adversely affect crissal thrasher because of the abundance of this vegetation locally and regionally as well as its relatively poor quality as habitat. IID has and will continue to conduct O&M activities of the drains. Tamarisk is currently supported in the drains despite maintenance activities and a similar amount of tamarisk would be expected to persist in drains under the HCP. Thus, the drains would continue to support habitat for crissal thrashers at a level similar to existing conditions. In addition to the persistence of tamarisk expected in the drains, IID would create or acquire, and preserve native tree habitat under the Tamarisk Scrub Habitat Conservation Strategy and potentially the Salton Sea Habitat Conservation Strategy to offset lost habitat value resulting from construction activities. Created habitat would increase the amount of habitat for crissal thrashers while habitat acquisition would provide greater certainty that the habitat would be available over the term of the permit.

The Imperial Valley is composed of highly modified habitats. Crissal thrashers apparently have adapted to this highly modified environment as evidenced by their persistence and continued breeding in the Imperial Valley. Little change in the extent or availability of tamarisk is expected with implementation of the HCP and the habitat conditions of the Imperial Valley would remain largely the same as existing conditions. As such, crissal thrasher would be expected to persist at levels similar to existing levels.

Crissal thrasher also could occur in seepage communities adjacent to the East Highline Canal. O&M activities would have little affect on the availability of tamarisk in seepage areas, but construction activities could impact tamarisk in these areas and affect crissal thrashers. The Tamarisk Scrub Habitat Conservation Strategy requires surveys and avoidance of occupied habitat during the breeding season and also compensation for any affected habitat. With this measure, the potential for take of individuals would be minimized and any effects related to a reduction in habitat would be offset.

3.4.6.13 Elf Owl

The elf owl population in California has declined to low levels, such that it currently is only known from a few locations along the LCR and some isolated locations in Riverside County. Given the low population size and limited distribution, it is very unlikely that elf owls would occur in the HCP area. Thus, the potential for take of elf owls is very low.

The seepage community along the AAC between Drops 3 and 4 is the most likely place where elf owls would occur in the HCP area given its closer proximity to the LCR than the Imperial Valley and the presence of adjacent desert scrub habitat. For nesting, elf owls appear to prefer forest habitat bordering desert habitat, conditions that exist in this seepage community. No construction activities affecting that seepage area are anticipated under this HCP.

Under the Tamarisk Scrub Habitat Conservation Strategy, any habitat affected by construction would be replaced by creation of additional native tree habitat. Construction during the breeding season also would be avoided thereby minimizing the potential for take of elf owls. Overall, implementation of the HCP is not likely to affect elf owls.

3.4.6.14 Brown-crested Flycatcher

Brown-crested flycatchers are most numerous in riparian groves of cottonwood, mesquite, and willow, which afford suitable nest sites, but often forage in adjacent desert scrub or tamarisk (Garrett and Dunn 1981). In the HCP area, brown-crested flycatchers have been observed along the AAC in seepage communities and the northern shoreline of the Salton Sea. Given its apparent ability to use tamarisk for foraging, brown-crested flycatchers could occur throughout much of the HCP area. Brown-crested flycatchers are secondary cavity nesters. As such, breeding by this species in the HCP area is limited to the few areas supporting trees that are suitable for woodpeckers. Tamarisk is not suitable for woodpeckers and potentially suitable trees are principally landscape trees.

Brown-crested flycatchers do not breed in tamarisk; thus their potential to be adversely affected by drain O&M activities is relatively low. In addition, because of the abundance of tamarisk, potential reductions in the amount of tamarisk in the HCP area as a result of the project is not likely to adversely affect brown-crested flycatchers. Rather, the occurrence of this flycatcher in the HCP area is probably limited by the limited number of trees suitable for woodpeckers. Under the Tamarisk Scrub Habitat Conservation Strategy and potentially the Salton Sea Habitat Conservation Strategy, native tree habitat will be created or acquired, and preserved. This native habitat would include native trees such as cottonwoods or mesquite that woodpeckers can use for nesting. This habitat could contribute to maintaining or potentially increase the abundance and distribution of this species. In addition, before construction activities, IID will survey to determine if breeding habitat for brown-crested flycatchers would be affected by construction activities. Construction would be avoided during the breeding season if flycatchers are found to be breeding in the affected habitat. This component of the Tamarisk Scrub Habitat Conservation Strategy constitutes a minimization aspect of the strategy.

3.4.6.15 Yellow-breasted Chat

Yellow-breasted chats are occasional migrants and summer residents in the HCP area. Preferred habitat for the chat consists of cottonwood-willow riparian habitats, in which they primarily use the willow scrub component. This type of habitat is rare in the HCP area. However, yellow-breasted chats have been reported to use tamarisk scrub habitat and to breed in tamarisk scrub habitats around the Salton Sea. Because they will use tamarisk scrub, they are vulnerable to drain O&M activities, but a potential reduction in the amount of tamarisk scrub habitat is not likely to adversely affect this species, because it is poor quality habitat and is abundant in the HCP area.

The drains would continue to support tamarisk that could be used by yellow-breasted chats. The tamarisk currently in the drains persists under IID's drain maintenance activities. As these activities would continue, tamarisk would remain available in the drains as potential habitat for yellow-breasted chats. Although water conservation activities could reduce the amount and quality of water in the drains, this potential reduction is not expected to result in a substantial change in the extent and characteristics of vegetation in the drains. Thus, the drains would continue to support habitat for yellow-breasted chats at a level similar to existing conditions.

Under the Tamarisk Scrub Habitat Conservation Strategy and potentially the Salton Sea Habitat Conservation Strategy, native tree habitat would be created or acquired, and preserved. Consisting of cottonwoods, willows, mesquite, and other native riparian plant species, this habitat would provide greater habitat quality than tamarisk for yellow-breasted chats. Use of the HCP area by yellow-breasted chats is expected to remain at existing levels or increase with implementation of the HCP. In addition, before construction activities, IID will survey to determine if breeding habitat for yellow-breasted chats would be affected by construction activities. Construction would be avoided during the breeding season if chats are found to be breeding in the affected habitat. This component of the Tamarisk Scrub Habitat Conservation Strategy constitutes a minimization aspect of the strategy.

3.4.6.16 Yellow Warbler

The yellow warbler is a common spring and fall migrant and a rare winter visitor to the Salton Sea area. Small numbers regularly winter in the Imperial Valley, and have been observed near the towns of Niland and Calexico. The species is not known to breed in the HCP area. Yellow warblers are typically associated with riparian shrub habitats, consisting of willows and young cottonwoods. This type of habitat is largely absent in the HCP area. Agricultural drains support tamarisk as well as dense stands of common reed and yellow warblers have been observed to use these habitats. Thus, they are vulnerable to drain O&M activities.

IID has and will continue to conduct O&M activities of the drains. The vegetation currently supported in the drains is a product of these maintenance activities and current use of this habitat by yellow warblers occurs in light of these activities. Although water conservation activities could reduce the amount and quality of water in the drains, this potential reduction is not expected to result in a substantial change in the extent and characteristics of vegetation in the drains. Thus, the drains would continue to support habitat for yellow warblers at a level similar to existing conditions.

Under the Tamarisk Scrub Habitat Conservation Strategy and potentially the Salton Sea Habitat Conservation Strategy, native tree habitat would be created or acquired, and preserved. This habitat would have a similar species composition and structure as the native riparian habitat typically used by yellow warblers. The created native tree habitat would provide higher quality habitat that could be used instead of or in addition to the vegetation supported by the drains. Habitat also would persist in the drains and yellow warblers would be expected to continue to use this habitat. Use of the HCP area by yellow warblers is expected to remain at existing levels or increase with implementation of the HCP.

3.5 DHCS

3.5.1 Amount and Quality of Habitat in the HCP Area

Habitat in the HCP area potentially used by species associated with drain habitat occurs in association with the drainage system, in managed marsh on the state and federal refuges, and on private duck clubs. Species associated with drain habitat also could use seepage areas adjacent to the AAC or East Highline Canal. Seepage areas adjacent to the AAC would not be affected by the covered activities. Potential effects to seepage areas adjacent to the East Highline Canal are addressed under the Tamarisk Scrub Conservation Strategy. The quality and quantity of habitat on the state and federal refuges and on private duck clubs will not be affected by the covered activities. Thus, potential effects to covered species are restricted to habitat in the drains.

For drain-associated species, cattail/bulrush vegetation is preferred and provides the highest quality habitat in the HCP area. Although potentially used, non-native plants provide poor quality habitat for covered species. Additional information on the habitat preferences of the covered species associated with drain habitat is provided in Appendix A, Species Covered by the HCP.

Drains support an estimated 63 acres of cattail vegetation and 589 acres of other vegetation consisting of tamarisk, common reed, and other plant species (see discussion of drain habitat in Chapter 2). This vegetation has developed and coexists with IID's drain cleaning activities and other maintenance activities. During the HCP term, IID would continue its current drain maintenance practices; thus, the existing type and amount of vegetation supported in the drains would be expected to remain similar to existing conditions. In conducting drain maintenance, IID only cleans drains when necessary to maintain gravity flow of tilewater from the farm fields into the drains. About one-fifth of the drain system is cleaned annually. Drain cleaning is focused on removing sediment that accumulates in the bottom of the drain. Flow-obstructing vegetation is removed during this process as well but bank vegetation is often retained to maintain bank stability and to control erosion. These practices moderate fluctuations in habitat availability in the drains and reduce the exposure of covered species to disturbance as a result of drain cleaning activities.

In addition to vegetation in the drains, cattail/bulrush vegetation also occurs in the seepage area between Drops 3 and 4 along the AAC and in small patches in some of the seepage areas adjacent to the East Highline Canal. Table 3.5-1 summarizes the amount and location of drain habitat and areas of emergent vegetation in the HCP area.

TABLE 3.5-1
Estimated Acreage and Characteristics of Drain Habitat in Drains and Seepage Areas in the IID HCP Area

Location	Acreage	Characteristics
Drains	652	63 acres of cattail vegetation
		589 acres of tamarisk, common reed and other plant species
AAC Seepage Areas	111	Primarily cattails

3.5.2 Effects of the Covered Activities

The covered activities have the potential to take a covered species via changes in water quality or through changes in the amount of habitat, disturbance, injury or mortality. The following describes the potential effects to covered species from changes in water quality. Habitat changes, disturbance, injury or mortality potentially resulting from the covered activities are addressed collectively following the water quality evaluation.

3.5.2.1 Water Quality Effects

System-based and on-farm water conservation activities, in combination, could contribute to increased selenium concentrations in drain water and affect reproductive success of some covered species associated with drain habitat. The potential effect of the water conservation activities on selenium concentrations in drain water and the subsequent potential effects on reproductive success were predicted using the IID Water Conservation Model and mathematical equations that relate selenium concentrations in water to egg concentrations and hatchability as described below.

Prediction of Selenium Concentrations

The IID Water Conservation Model was used to predict selenium concentrations (ppb) in drain water at specific locations (nodes)[1] in the drainage system over a 12-year time period for the following scenarios:

- Conservation of 130 KAFY of on-farm conservation (130 KAFY on-farm)
- Conservation of 230 KAFY of on-farm conservation (230 KAFY on-farm)
- Conservation of 230 KAFY consisting of 130 KAFY from on-farm measures and 100 KAFY from system improvements (130 KAFY on-farm + 100 KAFY system-based)

[1] In the IID Water Conservation Model, nodes were located at the end of each drain where the drain empties into the New or Alamo River or the Salton Sea.

- Conservation of 300 KAFY consisting of 230 KAFY from on-farm measures and 70 KAFY from system improvements (230 KAFY on-farm + 70 KAFY system-based).

On-farm conservation of 130 KAFY is the lowest level of conservation under the IID/SDCWA water conservation and transfer project. Under the QSA, a minimum of 230 KAFY is to be conserved. The maximum amount of conservation and transfer is 300 KAFY under both agreements. The maximum amount of water conservation that can be achieved using system-based measures is 100 KAFY. Thus, the scenarios reflect the range of water conservation levels (130KAFY to 300 KAFY) and techniques (up to 100 KAFY system-based measures).

Implementation of various on-farm conservation methods would vary from year to year and cannot be predicted with certainty for each node. Therefore, a number of model runs for each level of conservation were completed and the average selenium concentration at each node over the various runs was computed for use in the analysis of potential toxic effects. The number of miles of drain associated with each node was used to compute summary statistics that express the overall number of miles of drain with waterborne selenium concentrations in the following categories:

0-5 ppb	5-6 ppb	6-7 ppb	7-8 ppb	8-9 ppb
9-10 ppb	10-11 ppb	11-12 ppb	12-13 ppb	>13 ppb

For both the conversion from waterborne selenium to egg selenium concentrations and the probability of effects on hatchability (described below), the upper end of each concentration category was used (e.g., 5, 6, 7... ppb). For the category representing greater than 13 ppb of waterborne selenium, the maximum selenium concentration predicted by the model under each conservation level was used. The number of miles associated with each node was converted to number of acres by assuming that the vegetated area along drains averaged 14 feet in width.

$$\#acres = (\#miles \times 5{,}280 \times 14)/43{,}560$$

Conversion of Waterborne Selenium to Egg Selenium Concentration

Based on samples of eggs from 18 different pond systems and 3 non-drainwater reference sites in the San Joaquin Valley (Skorupa et al. unpub. data), there is a very strong correlation between mean waterborne selenium and mean egg concentrations ($r=0.901$, $N=36$, $P<0.01$) with the following regression equation for the relationship as reported by Ohlendorf et al. (1993):

$$\log \text{egg Se } (\mu g/g) = 0.44 + 0.434 \log \text{water Se } (\mu g/l)$$

Based on this relationship, the predicted selenium concentrations in drainwater were converted to selenium concentrations in eggs for black-necked stilt. Black-necked stilt was used because of the extensive data available on this species and because it displays an intermediate level of sensitivity to selenium (Skorupa 1998). The "stilt standard" is considered the appropriate standard for generalized assessments of toxic impacts (Skorupa 1998).

Probability of Toxic Effects

The probability of effects on the hatchability of eggs was computed from the following logistic equation reported in Skorupa (1998).

$$P(>1\ \text{inviable egg}) = EXP(-2.327 + 0.0503[\text{selenium conc.}]) / \{1 + EXP(-2.327 + 0.0503[\text{selenium conc.}])\}$$

Although the probability of teratogenic effects (e.g., embryonic deformities) could have been used as a measure of potential impact, egg hatchability was chosen as the response variable for assessing the potential impact of selenium toxicity because of the relative insensitivity of teratogenesis as a response variable. Egg hatchability effects were expressed as the probability of a hen producing a clutch in which at least one egg was inviable (did not hatch). Hatchability effects were corrected for background rates of inviability as described in Skorupa (1998).

Computation of Affected Acreage

The number of miles (acres) at each selenium concentration and the probability of hatchability effects at that concentration were used to predict the level of potential effect at each level of water conservation. The probability of hatchability effects in each category of waterborne selenium concentration was multiplied by the number of miles (acres) in each category as predicted by the water quality model and summed over all categories to produce an estimate of the overall number of miles (acres) of drain habitat that would be necessary to offset potential selenium effects.

Only a portion of the drainage system is vegetated and covered species associated with drain habitat primarily use vegetated areas. Some of the covered species (e.g., white-faced ibis and long-billed curlew) forage occasionally in unvegetated portions of the drains. However, these species primarily forage in other habitats (e.g., agricultural fields or on the state and federal refuges) such that their exposure to selenium in the drains is sporadic. Selenium is metabolized by birds when exposed through their diet, and losses from tissue begin within a few weeks following exposure if not continuously resupplied through elevated dietary concentrations of selenium. As a result, occasional use of unvegetated portions of the drains would not be expected to result in accumulation of selenium to levels that would compromise the reproductive success of the covered species. Therefore, the analysis of the potential effects of increased selenium on covered species was restricted to vegetated portions of the drains, and the maximum effects value was adjusted by the proportion of the drainage system that is vegetated. Currently, this proportion is estimated to be 0.26. This conversion was used to determine the number of acres of additional vegetated drain habitat needed to offset potential selenium effects attributable to the water conservation and transfer program.

The estimated number of additional vegetated drain acres necessary to offset the potential effects (reduced hatchability) of increased selenium concentrations in the drains under each alternative are presented in Table 3.5-2. Hatchability effects are presented at the level of the clutch (or hen) rather than at the level of an individual egg. Hens that are affected may still produce viable eggs, but this analysis assumes that the entire clutch is lost, making the estimate of overall effect a conservative measure of potential impacts.

TABLE 3.5-2
Estimated Number of Additional Vegetated Acres Necessary to Offset Potential Selenium Effects on Hatchability Associated with Varying Water Conservation Amounts and Techniques

			Acres of Additional Drain Habitat Needed to Offset Effect			
Maximum Water Se conc.	Egg Se conc. (µg/g)	Probability of >1 inviable eggs in clutch	130 KAFY on-farm	230 KAFY on-farm	130 KAFY on-farm + 100 KAFY system-	200 KAFY on-farm + 100 KAFY system-

(µg/L)		(Corrected)			based	based
5	5.538	0.02767	1.48	1.14	1.00	0.83
6	5.994012	0.03024	3.55	1.79	1.75	1.04
7	6.408738	0.03261	5.84	4.75	4.40	3.54
8	6.791115	0.03484	4.94	5.49	5.92	4.99
9	7.147287	0.036946	2.87	3.98	4.40	5.05
10	7.481695	0.03894	1.49	2.69	2.46	3.68
11	7.797662	0.04085	0.64	1.38	1.24	1.89
12	8.097756	0.04269	0.37	0.65	0.63	0.96
13	8.384003	0.0444	0.3	0.36	0.38	0.58
>13	Variable	Variable	1.15[a]	1.31[a]	14.88[b]	19.76[b]
		Total	22.64	23.53	37.06	42.32

[a] Maximum water concentration = 46.5; egg concentration = 14.6; probability of hatchability effects = 0.0876714813
[b] Maximum water concentration = 2658; egg concentration = 84.4; probability of hatchability effects = 0.8594

Results of the analysis indicate that conservation of 130 KAFY using on-farm methods would require the addition of up to 23 acres as indicated by predicted decreases in hatchability. Increasing the conservation level to 230 KAFY using only on-farm methods would increase the level of impact only slightly to 24 acres. A maximum of about 42 acres of drain vegetation would be necessary under a water conservation program using both on-farm and system-based conservation methods at the 300 KAFY level of conservation (Table 3.5-2).

Other Water Quality Effects

Water conservation activities would reduce tailwater entering the drains. This reduction in tailwater would result in less sediment reaching the drains with an associated reduction in DDT and metabolite levels and other organochlorides attached to sediments. Likewise, reductions in organophosphate pesticides and phosphate and nitrogen fertilizers would be achieved. Exposure of covered species to these compounds therefore would be reduced.

3.5.2.2 Habitat and Direct Effects

The mechanisms through which the covered activities could take a covered species are changes in habitat (permanent or temporary changes), disturbance, or mortality/injury. The potential effects of each of the covered activities on drain vegetation and covered species using drain habitat are described in Table 3.5-3. Activities with the potential to affect habitat are described in more detail below. Activities that are not expected to affect habitat have a very limited potential to affect covered species, with potential effects limited to disturbance.

TABLE 3.5-3
Potential Effects of Covered Activities on Covered Species Associated with Drain Habitat

Activity	Potential Effects (Positive and Negative)
Water Use and Conservation	

TABLE 3.5-3
Potential Effects of Covered Activities on Covered Species Associated with Drain Habitat

Activity	Potential Effects (Positive and Negative)
Combined effects of on-farm and system-based water conservation	Water conservation will reduce the flow in the drains. However, the small reduction in the flow in the drains is not expected to result in changes in the amount of vegetation supported in the drains.
Installation of on-farm water conservation features	On-farm water conservation practices would be constructed within agricultural fields or their margins and therefore would not likely affect drain habitat or covered species using drain habitat. Constructed tailwater return ponds and delivery ponds could serve as added freshwater foraging areas to aquatic species in drains.
Installation of System-Based Water Conservation Features	
Canal lining and piping	Canal lining or piping results in modifications to canals with no physical changes to drains. Therefore, canal lining or piping would not likely affect drain habitat or covered species using drain habitat.
Construction of new canals	New canals would be constructed through agricultural fields and would tie into the existing canal system. Modifications, if any, to drains would occur where a crossing was necessary for the canal and one did not already exist. It is anticipated that construction of new canals would not likely affect drain habitat or covered species using drain habitat to any meaningful level. However, although drain crossings can remove vegetation when installed, they provide refugia for small fish and invertebrates that provide prey for foraging birds.
Lateral interceptors	Lateral interceptors would be constructed in agricultural fields but would cross some drains. As described under Structure Maintenance below, IID anticipates constructing up to six drain crossings each year. Drain crossings for lateral interceptors are encompassed by those described under Structure Maintenance.
Reservoirs	IID could construct up to 100 reservoirs 1 to 10 acres in size, and encompassing up to 1,000 acres. These reservoirs would be on agricultural lands or barren lands and would not impact drain habitat. Farmers are expected to construct 1 to 2 acre reservoirs to better regulate irrigation water. These reservoirs would be installed in *agricultural fields and would not impact drain habitat.*
Seepage Recovery Systems	Seepage recovery systems are proposed along the East Highline Canal. Potential effects to covered species using plant communities supported by seepage from the East Highline Canal are addressed under the Tamarisk Scrub Conservation Strategy. For covered species using drain habitat, potential effects of construction of seepage recovery systems are limited to construction of check structures for the surface recovery systems. Approximately 1.6 acres of drain vegetation could be permanently lost because of installation of surface seepage recovery systems.
Operation and Maintenance	
Conveyance system operation	Conveyance system operation is limited to moving water through the canals to meet maintenance and customer needs. Other than the filling, draining and moving water through the canals, no physical effects are encompassed by conveyance system operation. No effects to drain habitat or covered species using drain habitat would be expected.

TABLE 3.5-3
Potential Effects of Covered Activities on Covered Species Associated with Drain Habitat

Activity	Potential Effects (Positive and Negative)
Drainage System Operation	
Rerouting or constructing new drains	IID reroutes or constructs about 2 miles of drains every 10 years. Newly constructed drains would increase habitat for covered species associated with drain habitat. If IID constructed 2 miles of drains every 10 years, 15 miles of new drains would be created over the 75-year permit term, which could increase habitat for species associated with drain habitat. Rerouting drains could result in the temporary reduction in vegetation in the drains during the period between abandonment of the old drain and when vegetation develops in the rerouted drain. No net loss of vegetation would occur because the rerouted portion would replace the abandoned section.
Piping drains	Over the 75-year term IID anticipates that about 50 miles of open drains would be pipelined, with an annual average of 0.67 miles of drain piping. About 22 acres of drain vegetation could be lost over the term of the permit from piping drains.
Inspection activities	Potential effects of inspection activities would be limited to a minor potential for disturbance of covered species if they occur in the vicinity of structures at the time of inspection.
Canal lining maintenance	Canal lining maintenance consists of repairing the concrete lining of canals only with no physical changes to drains. Therefore, canal lining maintenance would not likely affect drain habitat or covered species using drain habitat.
Right-of-way maintenance Embankment maintenance Erosion maintenance	Along drains, right-of-way maintenance, including embankment and erosion maintenance is conducted in association with vegetation control/sediment removal along drains. Potential impacts to covered species from these activities are encompassed by those under vegetation control.
Seepage maintenance	Seepage maintenance is conducted only along the canal system. Therefore, seepage maintenance would not likely affect drain habitat or covered species using drain habitat.
Structure maintenance	IID estimates that about 300 structures will be replaced each year. About 100 of these structures would be drainage structures. Along lateral drains, replacing each structure temporarily disturbs an area about 75 feet long. Thus, each year about 7,500 feet (1.4 miles) of the drains would be disturbed, temporarily removing 0.6 acres of vegetation. (7500 ft X 14 ft / 43560)*26 percent vegetated) Installation of new drain crossings could result in the permanent loss of drain vegetation. IID estimates that six 40-feet-wide crossings will be constructed each year. Based on this estimate, 18,000 feet (3.4 miles) of drain would be affected by drain crossings over the term of the permit, potentially resulting in the loss of 1.5 acres of drain vegetation. (18,000 ft X 14 ft / 43560)*26 percent vegetated) New structures that would be constructed on the drainage system would consist of control structures. Control structures are installed in steep drains that are eroding. Because of the erosion, drains needing control structures support little vegetation. Thus, construction of new control

19965

TABLE 3.5-3
Potential Effects of Covered Activities on Covered Species Associated with Drain Habitat

Activity	Potential Effects (Positive and Negative)
	structures has a limited potential to affect drain habitat or associated covered species
Pipeline maintenance	Drain pipelines primarily occur in farm fields while conveyance system pipelines occur through developed areas. Neither of these areas support vegetation used by species associated with drain habitat. As such, the potential for pipeline maintenance to affect covered species is very low.
Reservoir maintenance	Reservoirs are located on the conveyance system. The reservoir embankments are relatively steep and vegetation is tightly controlled. These features make the reservoirs unattractive to covered species such that the potential for reservoir maintenance to affect covered species associated with drain habitat is very low.
Sediment removal	IID removes sediment from about 300 miles of drains annually. While IID strives to maintain vegetation on drain banks, vegetation within the channel is removed with sediment. Sediment removal temporarily reduces vegetation in the drains. An estimated 130 acres of vegetated drain is affected by sediment removal each year.
Vegetation control	Vegetation control along canals focuses on removing moss and algae, and has little potential to affected covered species associated with drain habitat. Covered species associated with drain habitat are not expected to use canals because of the lack of vegetation, deep water, and high water velocity.
	Along drains, mechanical and chemical methods are used to control vegetation. Mechanical and chemical control of vegetation is conducted in association with sediment removal described above. Thus, an estimated 130 acres of vegetation are temporarily affected each year.
New and Alamo River Maintenance	IID dredges the deltas of the New and Alamo rivers about once every four years. In conducting this dredging, IID retains the vegetation on the banks. Thus, habitat is not affected by these dredging operations, but the dredging could temporarily disturb covered species using vegetation along the river channels. IID coordinates with USFWS at the refuge prior to conducting these activities.
Salton Sea dike maintenance	Salton Sea dike maintenance activities consist of replacing riprap, grooming embankments and repairing damaged sections of the dikes. Because the dikes do not support vegetation that covered species associated with drain habitat use, no change in habitat would occur with these activities. Potential effects are limited to a minor potential for disturbance.
Gravel and Rock Quarrying	Gravel and rock quarries do not occur in drains or immediately adjacent to marsh habitats. Thus, the potential for quarrying to affect covered species associated with drain habitat is minor.
Fish Hatchery Operation and Maintenance	The fish hatchery is a developed facility and does not support habitat for covered species associated with drain habitat.
Recreational facilities	Because new recreational facilities would not be constructed in the drain prism, construction of recreational facilities would not be expected to affect habitat for species associated with drain habitat. If recreational facilities were constructed adjacent to drains, there would be a minor potential for disturbance of covered species during construction. The

TABLE 3.5-3
Potential Effects of Covered Activities on Covered Species Associated with Drain Habitat

Activity	Potential Effects (Positive and Negative)
	HCP does not cover take of covered species by recreationists.

Permanent Habitat Loss

Covered activities potentially resulting in the permanent loss of drain habitat are installation of seepage recovery systems, piping drains, and structure maintenance. The potential habitat effects of each of these activities is described below. In total, an estimated 25.1 acres of drain vegetation could be lost because of the covered activities over the term of the permit.

Seepage recovery systems are proposed along the East Highline Canal. Surface recovery systems are proposed where there is an existing drain that currently collects seepage from the East Highline Canal. Construction in the drain for these systems is minimal consisting of installation of a small check structure. Conservatively assuming 0.1 acre is impacted by each check structure, a maximum of 1.6 acres of drain vegetation could be permanently lost because of installation of surface seepage recovery systems.

Over the 75-year term IID anticipates that about 50 miles of open drains (an annual average of 0.67 miles) would be pipelined. The entire drainage system encompasses an estimated 2,471 acres of which an estimated 26 percent (652 acres) is vegetated. Assuming that 26 percent of the 50 miles of drains piped is vegetated, 22 acres of drain vegetation could be lost over the term of the permit from piping drains.

Structure maintenance with the potential to eliminate drain vegetation consists of installation of new drain crossings. IID estimates that six, 40-foot-wide crossings will be constructed each year. Based on this estimate, 18,000 feet (3.4 miles) of drain would be affected by drain crossings over the term of the permit. Assuming the impacted area is 26 percent vegetated, about 1.5 acres of drain vegetation could be lost.

Temporary Habitat Disturbance

Covered activities potentially resulting in the temporary loss of drain habitat are sediment removal/vegetation control and structure maintenance. The potential effects of these activities are described below. In total, an estimated 130 acres of drain vegetation could be temporarily disturbed by the covered activities each year.

The amount of vegetation in the drains was conservatively estimated at 652 acres; about 63 acres are cattail/bulrush and about 589 acres support other vegetation. IID anticipates that it will clear vegetation/sediment from approximately one-fifth (about 130 acres) of the vegetated acreage in the drains each year. Thus, on average, covered species in one fifth of the habitat in the drains are exposed to drain cleaning each year. Drain cleaning could displace individuals, temporarily reduce habitat in the localized area of the cleaning, or destroy nests if covered species breed in the drains at the time of cleaning.

Structure replacement could temporarily remove drain vegetation. IID estimates that about 100 structures on drains will need to be replaced each year. Along lateral drains, replacing each structure temporarily disturbs an area about 75 feet long. Thus, each year about 7,500 feet (1.4 miles) of the drains would be disturbed, potentially resulting in the temporary removal of 0.6 acres of vegetation.

Drain cleaning and structure replacement does not permanently eliminate habitat. Rather, it results in a temporary reduction of vegetation in portions of the drains. Vegetation remains undisturbed in the remainder of the drainage system. In conducting drain cleaning activities, IID focuses sediment and vegetation removal on the center of the drain and strives to maintain vegetation on the drain banks. These aspects of IID's drain cleaning activities minimize impacts to covered species potentially resulting from fluctuations in the amount or type of vegetation. Furthermore, the existing habitat conditions in the drains are the product of IID's drain cleaning regime in which about one-fifth of the drainage system is cleaned each year. Thus, habitat would be expected to persist in the drains at a level and species composition similar to existing conditions.

Drain cleaning and other activities occurring near the drains is ongoing. Covered species use drain habitats in the HCP area and persist in the HCP area coincident with these activities. Yuma clapper rails have been reported in Holtville Main Drain annually since 1995 and in Trifolium No. 1 drain in all but one year since 1994 (USFWS unpublished data). In addition to Yuma clapper rails, the following covered species were reported in surveys of drains in the Imperial Valley: Cooper's hawk, loggerhead shrike, long-billed curlew, northern harrier, peregrine falcon, sharp-shinned hawk, short-eared owl, tricolored blackbird, white-faced ibis, white-tailed kite, willow flycatcher, and yellow warbler (Hurlbert 1997). The observed use of the drains by American bitterns also suggests that least bitterns could use the drains. Because these species currently coexist with drain cleaning and other maintenance activities and habitat conditions in the drains are expected to remain similar to existing conditions, use of drain habitat by covered species is expected to remain similar to existing levels.

3.5.3 Approach and Biological Goals

- The biological goal of the DHCS is to maintain the species composition, relative abundance, and life history functions of covered species using drain habitat within the HCP area. This goal is to be achieved through focusing on the Yuma clapper rail as a "flagship" species for Drain Habitat. Thus, the specific objective of the strategy is to create managed marsh habitat with characteristics (e.g., plant species composition, plant density, water depth) that support Yuma clapper rails.

The DHCS is composed of minimization and mitigation measures. Under the water conservation and transfer programs, the amount of water conservation will gradually increase. Thus, changes in water quality caused by the water conservation and transfer programs will occur gradually. This gradual increase in water conservation constitutes a minimization aspect of the HCP. Additional HCP measures that would minimize effects on covered species using drain habitats include:

- Avoiding dredging of the river deltas during the period when covered species could be breeding at the deltas (Drain Habitat – 2)

- Seasonal restrictions on construction activities in areas inhabited by burrowing owls (Owl – 4, 5, and 8)
- Seasonal restrictions on activities in pupfish drains (Pupfish – 1)

These measures will reduce the potential for covered activities to result in take of covered species. In addition to these minimization aspects of the HCP, impacts to covered species potentially resulting from increased selenium concentration in the drains or from operation and maintenance activities associated with the drains will be mitigated by creating managed marsh habitat.

Creating additional habitat directly addresses actual effects of the covered activities that relate to changes in the amount or quality of habitat by providing alternative habitat. It also addresses disturbance and other risks to covered species using drain habitats by creating a safe haven where they are not exposed to the covered activities. By creating habitat that provides equal or greater habitat value than that currently supported in the HCP area, a similar or greater number of individuals of the covered species can be supported, particularly because the amount of habitat in the drains is not expected to change substantially over the term of the permit. Thus, the impact of the take of any individuals using impacted habitats in the HCP area (e.g., drains) is minimized and mitigated by increasing the overall quality and quantity of available habitat in the HCP area and thereby creating conditions capable of supporting larger populations of the covered species than currently inhabit the HCP area.

3.5.4 Habitat Mitigation and Management Measures

The mitigation and management measures presented below are the specific actions that IID will undertake to fulfill the goals of the DHCS. These measures serve as the basis for the contractual commitments described in the Implementation Agreement. The text following each measure provides additional clarification and describes the rationale for the measure. The key elements of the DHCS are as follows:

- Create at least 190 acres of managed marsh habitat and up to a total of 652 acres of managed marsh habitat
- Reduce disturbance and mortality/injury of covered species from covered activities

Drain Habitat – 1. *IID will create at least 190 acres of managed marsh habitat. Within 1 year of the issuance of the incidental take permit, IID will conduct a vegetation survey of the drainage system following the protocol in Appendix B. Based on this vegetation survey, the HCP Implementation Team will determine the amount of habitat for covered species supported in the drains. The acreage required to compensate for selenium effects will be recalculated based on the results of the vegetation survey following the same methodology described in Section 3.5.2, "Effects of the Covered Activities." If the acreage of habitat for covered species found in the drains through the vegetation survey plus the acreage required to compensate for selenium effects exceeds 190 acres, IID will create managed marsh habitat in an amount equal to the greater acreage up to a maximum of 652 acres. Creation of the managed marsh habitat will be phased over 15 years, with at least one-third of the total amount created within 5 years, two-thirds within 10 years, and the total amount created within 15 years of issuance of the incidental take permit.*

IID will ensure that the water used to support the managed marsh habitat is irrigation water from the LCR or is other water with the same selenium concentration as water from the LCR or that meets an EPA selenium standard for protection of aquatic life that has received a "No Jeopardy" determination from the USFWS, whichever is greatest.

The managed marsh habitat will be created on lands owned by IID. IID will work with the HCP IT to determine the location and characteristics of the managed marsh habitat. IID will manage the created marsh habitat in the same manner as the USFWS manages emergent freshwater marsh units of the Sonny Bono Salton Sea NWR. IID will coordinate with refuge staff to ensure that the managed marsh habitat is managed similarly to refuge.

Under Drain Habitat -1, IID will create at least 190 acres of managed marsh habitat and up to 652 acres. The specific amount of managed marsh that IID will create will be determined through a vegetation survey completed within 1 year of issuance of the incidental take permit. Based on this survey, the HCP IT will determine the total amount of habitat for covered species in the drains and the amount of managed marsh habitat necessary to offset selenium impacts. IID will create managed marsh habitat equal to the total amount of habitat in the drains plus additional habitat based on predicted toxicity effects from increases in selenium under the water conservation and transfer program.

The quality of the created managed marsh habitat is expected to be much higher than the habitat quality of the vegetation supported in the drains. The managed marsh habitat will be created and managed in the same manner as the USFWS manages emergent freshwater marsh units on the Sonny Bono Salton Sea NWR. Based on the USFWS current management practices, the created managed marsh habitat is expected to consist of cattail/ bulrush vegetation. Cattail/bulrush vegetation provides higher quality habitat conditions for the covered species than the vegetation in the drains. Most of the vegetation in the drains is tamarisk or common reed; only a small amount of cattail/bulrush vegetation (about 63 acres) is estimated to be in the drains. Although current information indicates that covered species could use areas dominated by common reed and tamarisk, the level of use is low relative to cattail/bulrush areas. Further, habitat in the drains occurs as a narrow strip from about 3 to 15 feet wide and therefore, consists entirely of edge habitat. While cattail/bulrush in the drains is used by some covered species, the created marsh habitat is expected to support greater use (both in number of species and number of individuals) because the habitat will be in larger blocks with less edge habitat. Species diversity increases with the size of habitat patches (Harris and Silva-Lopez 1992; Brown and Dinsmore 1986) and reproductive success can be greater in larger patches than in narrow, linear habitats. Linear habitats have a high degree of edge habitat, and predation pressure is typically greater in edge-dominated habitats than more insular habitats (Harris and Silva-Lopez 1992).

The managed marsh habitat will be created on land owned by IID. The HCP IT will determine where to locate the created managed marsh habitat. In making this determination, the HCP IT will consider factors such as:

- Location relative to other wildlife habitat and populations of covered species (e.g., refuges)
- Potential conflicts with restoration projects for the Salton Sea
- Availability of facilities to deliver water to the managed marsh habitat, and

19970

- Soils
- Land value

The HCP IT will ensure that the habitat is created in the best location to maximize the long-term benefits to covered species.

IID will support the created marsh habitat with better quality water than currently occurs in the drainage system. Under this measure, IID has committed to using irrigation water from the Colorado River or water of equivalent quality with respect to selenium or water that meets the EPA selenium standard with a "No Jeopardy" opinion. Irrigation water from the Colorado River is the best quality water available in the Imperial Valley. The selenium concentration in the LCR has averaged about 2.1 ppb in recent years (Table 2.2.1). For comparison, the average concentration of selenium in the New and Alamo rivers and selected drains emptying into these rivers has ranged from about 4 ppb to near 10 ppb (Table 2.2.1). Thus, in addition to the better habitat quality resulting from the plant species composition and physical characteristics, the managed marsh habitat will have better water quality than the drains.

Drain Habitat – 2. *IID will not dredge the river deltas between February 15 and August 31, except as necessary to prevent flooding during storm events.*

IID dredges portions of the deltas of the New and Alamo rivers every year to maintain flow to the sea. In conducting this dredging, IID retains the vegetation on the banks of the river channels to maintain the stability of channels. Because vegetation is retained, habitat is not affected by these dredging operations and the principal concern for covered species that may be using the deltas is disturbance or injury. By not conducting these activities between February 15 and August 31, except in emergency situations, IID will avoid the breeding periods of covered species that could be using the river deltas for nesting. This commitment will minimize the potential for take of covered species breeding in the deltas.

3.5.5 Effects on Habitat

The approach to the DHCS is to create managed marsh habitat of greater value than habitats actually affected by the covered activities. Under the DHCS, an amount of managed marsh habitat equal to the total amount of habitat in the drains plus an additional amount of habitat based on predicted toxicity effects from increases in selenium under the water conservation and transfer program would be created. At least 190 acres of high-quality marsh habitat and up to 652 acres would be created within 15 years of issuance of the ITP. This habitat would be created in large blocks, and would be expected to consist of cattails, bulrush, sedges, and other emergent wetland plants, depending on the USFWS management of habitat for Yuma clapper rails on the Salton Sea NWR.

The DHCS would more than double the acreage of habitat for drain-associated species. Comprised of cattails and bulrush, the created habitat also would provide substantially greater habitat value than the existing vegetation in the drains. The larger blocks of created habitat also would increase its attractiveness and value to wildlife as compared to the narrow, linear habitat of the drains.

The drains would continue to support vegetation similar in character and quantity to existing vegetation. IID has been conducting O&M activities along the drainage system for many decades and would continue these O&M activities over the term of the permit. The vegetation currently supported in the drains is a product of these maintenance activities. Although the water conservation activities could reduce the quantity and quality of water in the drains, this potential reduction is not expected to result in a substantial change in the extent and characteristics of vegetation in the drains (see Section 4.7 of the EIS/EIR). Thus, the drains would continue to support habitat and species composition at a level similar as currently exists in the drains, and covered species could continue to use this habitat.

IID would use water with selenium concentration low enough to avoid adverse reproductive effects to support the managed marsh habitat. The selenium concentration of water used to support the managed marsh is expected to be close to 2 ppb. This selenium concentration is considerably lower than the selenium concentration in most of the drains in the HCP area. Adverse effects from selenium toxicity would be avoided in the managed marsh and the quality of the managed marsh habitat would be further enhanced beyond that in the drains.

3.5.6 Effects on Covered Species

Covered species associated with marsh habitats known to use or potentially using habitats in the HCP area include resident breeding species, migratory breeding species, winter visitors, and transient species that may use marsh habitat during migration or other wanderings. Many of the covered species associated with marsh habitat are not likely to use vegetation within the confines of a drain to a great degree (e.g., short-eared owls, greater sandhill cranes), but would likely use the larger, more open configuration of the created marsh habitat. As such, these species would be largely unaffected by the covered activities, but would benefit from creation of high-quality marsh habitat. Even though individuals of some of the covered species could be taken as a result of the covered activities, the DHCS is expected to maintain or increase the level of use of the HCP area by covered species because conditions in the drains are not expected to change substantially while the DHCS will approximately double the amount of habitat.

The effects of the DHCS on listed species (state and/or federal) are evaluated for each individual species below. In addition, the effects on species that breed in the HCP area are individually evaluated. The effects of implementing the HCP on the remaining species are summarized in Table 3.5-4. These species are transients or occur in the HCP area for short periods of time (e.g., overwintering) but do not breed in the HCP area.

3.5.6.1 Yuma Clapper Rail

In the HCP area, Yuma clapper rails predominantly occur on the state and federal refuges. Since 1990, the number of clapper rails counted on the Imperial WA has varied between 90 and 331, and on the Salton Sea NWR, clapper rail numbers have fluctuated between 13 and 102. Combined, the refuges in the HCP area have supported 106 to 411 clapper rails each year. Although comprehensive surveys have not been completed in areas off of the refuges, habitat availability is limited off of the refuges. Consistent with the limited habitat availability off of the refuges, the number of clapper rails reported off of the refuges has been low, ranging from 3 to 43 in surveys conducted between 1990 and 1999. Few of these sightings were in the drains and clapper rails have only been reported in two drains (Holtville Main and Trifolium No. 1).

19972

High quality habitat for Yuma clapper rails consists of mature stands of dense or moderately dense cattails intersected by water channels. Rails breed, forage and find cover in this type of habitat. Rails have also been reported using areas of common reed although nesting is uncertain and the density is lower than in cattail marshes. The IID drainage system is estimated to contain about 63 acres of cattails. Common reed, tamarisk, and arrowweed are the predominant species of the remaining 589 acres of vegetation estimated in the drainage system. The vegetation characteristics of the drains suggest that the drains provide poor quality habitat for rails. Further, Anderson and Ohmart (1985) found the home ranges of rails to average about 18.5 acres/pair. The drains are unlikely to support a block of vegetation of this size, which further suggests that habitat in the drains is of limited quality to rails. A maximum of nine rails have been reported in two drains; breeding has not been verified. In combination, these factors suggest limited use of the drains by clapper rails.

TABLE 3.5-4
Potential Effects of DHCS on Drain –Associated Species Covered by the HCP

Species	Occurrence in HCP Area	Habitat Use in the HCP Area	Potential Effects of HCP
Short-eared owl	Rare winter visitors; more common in fall.	Primarily agricultural fields and marshes on state and federal refuges; occasional use of drain habitat. Also observed along Alamo River.	Created marsh habitat would increase suitable habitat availability and potentially benefit the species.
Northern harrier	Common fall and winter residents. Could breed in area, but breeding has not been confirmed.	Primarily agricultural fields and marshes on state and federal refuges; some use of drain habitat.	Created marsh habitat would increase availability of high-quality habitat and potentially benefit the species.
Golden eagle	Accidental during spring and winter.	Probably visits agricultural fields and managed marshes on the state and federal refuges to prey on wintering and migrating waterfowl.	Created marsh habitat could increase foraging opportunities by attracting migrating and wintering waterfowl.
Merlin	Rare visitor during fall and winter.	Probably concentrates foraging at Salton Sea where shorebirds are abundant. May also prey on shorebirds and songbirds using managed and unmanaged wetlands and tamarisk scrub habitat.	Created marsh habitat could increase foraging opportunities by attracting shorebirds and songbirds.
Black swift	Accidental during spring.	Could use a wide variety of habitats in the HCP area.	Created marsh habitat would increase the availability and quality of foraging habitat.
Vaux's swift	Common spring migrant; uncommon fall migrant.	Known to congregate at north end of the Salton Sea; could use wide variety of habitats in the HCP area.	Created marsh habitat would increase the availability and quality of foraging habitat and potentially enhance survival of migrating birds.
Purple martin	Occasional spring and fall migrant.	Could use a wide variety of habitat in the HCP area.	Created marsh habitat would increase the availability and quality of foraging habitat.
Tricolored blackbird	Rare in spring and winter. Not known to breed in HCP area.	Drain habitat and marshes on the state and federal refuges provide potential habitat.	Created marsh habitat would increase availability and quality of foraging habitat.

Potential effects of the covered activities on clapper rails consist of disturbance, temporary loss of habitat, destruction of nests, and exposure to increased selenium concentrations. IID cleans about one-fifth of the drainage system each year. Thus, about 12.6 acres of cattails could subject to drain cleaning each year. Rails inhabiting these areas could be displaced as a result of drain cleaning and if they breed in the drains, there is some potential for a nest to be lost because of the drain cleaning. To the extent that rails use common reed, a few individuals could be displaced by drain cleaning activities. Considering the poor quality of common reed habitat and availability of this vegetation in areas unaffected by covered activities (e.g., along the New or Alamo Rivers), displaced individuals would likely quickly find alternate habitat. Rails could be exposed to slightly higher concentrations of selenium in the drains. Based on the evaluation of the effects of increased selenium concentrations, using the stilt standard, the reproductive success of rails foraging in the drains could be reduced slightly relative to existing conditions.

Under the HCP, IID will create at least 190 acres and up to 652 acres of managed marsh habitat. Based on the vegetation survey, IID will create at least an equivalent amount of habitat as is supported in the entire drainage system. The created habitat also will be of substantially better quality for Yuma clapper rails than the habitat in the drains because it will contain preferred plant species (i.e. cattails and bulrush), have better water quality than the drains, and be configured to provide a mix of dense vegetation interspersed with open water. The created habitat will be managed in the same manner as clapper rail units are managed on the refuge. The units on the refuges support the majority of the clapper rail population in the Imperial Valley. Thus, the created marsh habitat is expected to support a larger population of Yuma clapper rails than currently is supported in the drains.

Estimates of rail densities vary widely, ranging from 0.06 to 1.26 rails/acre (Table 3.5-5). Based on these estimates, the number of rails supported by 190 acres of created marsh could range from 11 to 239 rails if all of the habitat was designed for Yuma clapper rails. Probably, a smaller number of clapper rails would be supported because a portion of the managed marsh would be managed for other covered species (e.g., black rails). Habitat for Yuma clapper rails would continue to be available in the drains and clapper rails would be expected to persist in the drains at existing levels. Therefore, the created marsh would act to increase the amount of habitat and overall population of clapper rails in the HCP area and thereby benefit the species.

TABLE 3.5-5
Reported Densities of Yuma Clapper Rails

Location	Density Rails/Acre[a]	Source
LCR	0.10	Anderson and Ohmart (1985)
Cienega de Santa Clara	0.36	Piest and Campoy (1998)
Cienega de Santa Clara	0.60[b]	Piest and Campoy (1998)
Topock Marsh	0.06	Smith (1975, reported in Piest and Campoy [1998])
Mittry Lake Wildlife Area	0.39	Todd (1980, reported in Piest and Campoy [1998])
Hall Island	1.26	Todd (1980, reported in Piest and Campoy [1998])

[a]acres of cattail habitat
[b]Estimated density taking into account non-responding birds

Clapper rails establish territories as early as February with nesting and incubation beginning in mid-March. IID will avoid potential impacts to birds that could be using the deltas during the breeding season by not dredging the deltas of the New or Alamo rivers after mid-February.

3.5.6.2 California Black Rail

California black rails occur in the HCP area in small numbers. In the only systematic survey for the species at the Salton Sea and surrounding areas in 1989, 23 birds were recorded. Thirteen were located at the mouth of the New River, eight were in seepage communities along the Coachella Canal, and one was found at Finney Lake. Up to 50 black rails have been reported in the wetland complex supported by seepage from the AAC between Drops 3 and 4. Black rails have not been reported to occur in the drains. Black rails are most closely associated with bulrush vegetation although they will use areas dominated by cattails. Their apparent low occurrence in the HCP area may reflect this preference for bulrush, which is not as common in the HCP area as are cattails. Because of the limited occurrence and distribution of black rails in the HCP area, particularly in the drains, the potential for black rails to be adversely affected by the covered activities and the number of rails potentially affected is low.

By creating at least 190 acres of high-quality marsh habitat and up to 652 acres, IID will increase habitat availability for California black rails. This habitat will be of better quality for black rails than the habitat affected in the drains because it would:

- Consist of one or more large blocks
- Contain preferred vegetation (bulrush)
- Have better water quality

Flores and Eddleman (1991) have suggested that California black rails are capable of rapidly colonizing new habitat. Thus, black rails could take advantage of the newly created habitat within a short period of time. Given the current low level of use of the HCP area by black rails, the high-quality habitat created under the HCP, and the rail's ability to rapidly colonize new habitats, the HCP could contribute to increasing the population and distribution of California black rails.

Few estimates are available on the naturally occurring density of California black rails in marsh habitats. Repking and Ohmart (1977) estimated the density of black rails in spring along the LCR as 0.4 to 0.6 rails/acre. At this density, the 190 acres of marsh habitat created under the HCP could support up to 114 black rails depending on the design and management of the managed marsh. Considering that current estimates of black rails in the HCP area are less than 100, the created habitat could benefit black rails considerably.

The few records of black rails in the HCP area include areas adjacent to the Salton Sea and the New River deltas among others. Like clapper rails, black rails breed in the early spring. Black rails have been reported using the New River delta. IID will avoid potential impacts to birds that could be nesting in this area by not dredging the deltas of the New or Alamo rivers after mid-February.

3.5.6.3 Greater Sandhill Crane

Small numbers (about 200 to 300) of greater sandhill cranes regularly winter in the Imperial Valley. The origin of these birds has not been determined, but they likely are part of the LCR Valley population, as the Central Valley population of sandhill cranes is reported to overwinter only as far south as Tulare County. The LCR Valley population numbers is about 1,500 birds and is believed to be increasing. The entire population of greater sandhill cranes totals more than 30,000 birds and regional populations are stable or increasing.

Throughout their range, sandhill cranes commonly exploit agricultural fields for foraging, particularly grain fields. To a lesser degree, marshes are used for foraging, but are required for breeding. Wetlands and areas of open shallow water are preferred habitats for night roosts. The primary attraction for wintering sandhill cranes in the Imperial Valley is probably the abundance of agricultural fields, particularly wheat and Sudan grass fields, that provide abundant foraging opportunities. However, the availability of habitat suitable for night roosting is also important for maintaining use of the HCP area by greater sandhill cranes.

Under the DHCS at least 190 acres and up to 652 acres of marsh habitat will be created. Cranes are not known to use the drains, and therefore, are unlikely to be affected by activities occurring in the drains. They would, however, benefit from creation of marsh habitat that would increase roosting opportunities. They currently are known to use shallow ponds on duck clubs in the Imperial Valley as roost sites, and therefore could be expected to use the created managed marsh habitats as well. Cranes also could use the created marsh habitat for foraging, although with the abundance of grain fields in the HCP area and their preference for foraging in this habitat type, their use of the created marsh habitat for foraging would likely be limited.

3.5.6.4 Aleutian Canada Goose

Aleutian Canada geese occur in the HCP area in small numbers as fall migrants and winter residents where they forage in the wetland areas around the Salton Sea and in the agricultural fields throughout the Imperial Valley. Aleutian Canada geese use open habitats such as marshes and agricultural fields and are not known to use vegetation in the confines of a drain. As such, their use of marsh habitats in the HCP area is restricted to the state and federal refuges and private duck clubs. The habitat quality of these areas would not change under the HCP. Because they are not known or expected to use drains, Aleutian Canada Geese are not likely to be adversely affected by the covered activities.

Implementation of the DHCS would benefit Aleutian Canada geese. Under this strategy, at least 190 acres and up to 652 acres of high-quality marsh habitat would be created. This habitat would consist of one or more large blocks of marsh vegetation interspersed with open water areas. Aleutian Canada geese would be expected to exploit this habitat because similar habitats are used on the state and federal refuges. Thus, implementation of the HCP would increase habitat availability for Aleutian Canada geese.

3.5.6.5 Bald Eagle

A few bald eagles (3 or fewer) are regularly observed at the Salton Sea during winter. The principal potential effects of the covered activities on bald eagles are a potential decline in the availability of fish in the Salton Sea. Thus, potential effects of implementing the HCP on bald eagles are also addressed under the Salton Sea Habitat Conservation Strategy. Bald eagles are not known to use the drains and because of the abundance of fish and waterfowl at the Salton Sea and adjacent refuges, the drains do not provide essential foraging habitat for bald eagles. Thus, no adverse effects to bald eagles would be expected from covered activities operating in the drainage system.

Bald eagles could benefit from the DHCS. Although fish are the primary prey of bald eagles, they also prey on waterfowl. Under the DHCS, at least 190 acres and up to 652 acres of marsh habitat would be created. The Imperial Valley and Salton Sea areas are heavily used by wintering and migrating waterfowl. While not target species of the HCP, the created marsh habitat would attract migrating and wintering waterfowl. As such, it would provide additional foraging opportunities for bald eagles, overall benefiting the species.

3.5.6.6 Peregrine Falcon

Peregrine falcons are rare visitors to the HCP area. No cliffs or tall buildings that could provide nesting sites for peregrine falcons occur in the project area, thus use of the project area by peregrine falcons is limited to foraging. They have been observed foraging at managed marsh habitats of the Salton Sea NWR where they prey on wintering and migrating waterfowl. With the abundance of waterfowl at the Salton Sea and adjacent refuges, the drains do not constitute essential foraging habitat for peregrine falcons. Thus, no adverse effects to these falcons would be expected from covered activities operating in the drainage system.

Peregrine falcons could benefit from the DHCS. Under the DHCS, at least 190 acres and up to 652 acres of marsh habitat would be created. The Imperial Valley and Salton Sea areas are heavily used by wintering and migrating waterfowl. While waterfowl are not target species of the HCP, the created marsh habitat would attract migrating and wintering waterfowl and provide additional foraging opportunities for peregrine falcons, thereby benefiting the species.

3.5.6.7 Bank Swallow

Bank swallows are casual visitors to the HCP area, potentially occurring in the HCP area as migrants during the spring and fall. For foraging, they are not strongly associated with any particular habitat type, although they often forage near water where insects are abundant. The covered activities are unlikely to adversely affect bank swallows because of the swallow's rare occurrence in the HCP area and broad habitat use for foraging. Under the DHCS, at least 190 acres and up to 652 acres of marsh habitat would be created. The created marsh habitat could benefit bank swallows by increasing foraging opportunities.

3.5.6.8 White-faced Ibis

White-faced ibis typically nest in extensive marshes, constructing nests in tall marsh plants such as cattails and bulrushes over water. In the HCP area, white-faced ibis use tamarisk and mesquite snags in the Salton Sea for nesting in addition to marshes on the state and federal refuges and other areas adjacent to the Salton Sea. They roost at these locations as well as on private duck clubs. Habitat quality and quantity on the state and federal refuges and private duck clubs would not be affected under the HCP. It is unlikely that any ibis nest or roost in vegetation in the drains because of the species' association with extensive marshes or other isolated and protected locations for nesting. Thus, temporary or permanent loss of vegetation in the drains from the covered activities would not likely affect white-faced ibis, nor would covered activities occurring in the drains be expected to disturb or injure an ibis. White-faced ibis are known to forage in the drains (Hurlbert et al. 1997) and some could be exposed to increased selenium levels. However, white-faced ibis appear to predominantly forage in agricultural fields. With prey from the drains comprising only a portion of the diet, the potential for ibis to experience reduced reproductive output because of increased selenium concentrations in the drains is limited.

Some nesting sites could be lost if a reduction in the elevation of the Salton Sea, exposes snags currently used by white-faced ibis. However, tamarisk stands over water would continue to be available along the New and Alamo River deltas although the deltas are disturbed every few years for channel dredging. A minimization aspect of the DHCS is that dredging would not occur between February 15 and August 31, except as necessary to prevent flooding during storm events. This restriction will avoid disturbance of white-faced ibis during their breeding season.

Under the HCP, IID would create at least 190 acres and up to 652 acres of marsh habitat. White-faced ibis would be expected to benefit from the creation of marsh habitat under the HCP. The new habitat would be created in large blocks, creating extensive, undisturbed marsh habitat preferred by white-faced ibis. Riparian trees and shrubs could be integrated with the created marsh habitat as mitigation for tamarisk scrub habitat. These features, as well as the cattail and bulrush vegetation supported in the marsh, would provide preferred nesting and roosting habitats for white-faced ibis. Considering the poor quality of habitat in the drains, and expected persistence of currently used habitat in the HCP area, the habitat created under the HCP would increase the overall amount and quality of habitat in the HCP area for this species.

3.5.6.9 Least Bittern

Least bitterns typically are associated with extensive cattail and bulrush marshes. In the HCP area, least bitterns nest in managed and unmanaged marsh habitats adjacent to the Salton Sea, principally on the state and federal refuges. The extent to which least bitterns use vegetation in the drains is uncertain. Least bitterns probably forage in the drains, but are not likely to nest in drain vegetation. Least bitterns typically nest in large marsh areas and the drains provide only scattered patches of emergent vegetation. Least bitterns have not been reported in the drains, and the drains probably provide poor habitat for bitterns such that the potential for least bitterns to be adversely affected by covered activities is low.

Under the HCP, IID would create at least 190 acres and up to 652 acres of marsh habitat. The new habitat could be created in large blocks, creating the extensive, undisturbed marsh habitat preferred by least bitterns. Riparian trees and shrubs would be integrated with the created marsh habitat as mitigation for tamarisk scrub habitat. These features as well as the cattail and bulrush vegetation supported in the marsh would provide preferred nesting and roosting habitats for least bitterns. Considering the poor quality of habitat in the drains, and expected persistence of currently used habitat in the HCP area, the habitat created under the HCP would increase the overall amount and quality of habitat in the HCP area for this species.

The created marsh habitat would be concentrated in one or more large blocks of marsh vegetation interspersed with open water areas. This habitat would be expected to be used by least bitterns to a greater degree and would likely support nesting by these birds. Rosenberg et al. (1991) estimated the breeding density of least bitterns in marshes of the LCR as 0.4 birds/acre. At this density, the 190 acres of created marsh habitat could support 76 least bitterns while 652 acres could support 260 bitterns. The least bittern population at the Salton Sea has been estimated at 550 birds. Thus, the managed marsh habitat created under the HCP could increase the population by 14 percent and possibly up to 47 percent if 652 acres of habitat is created. Considering that the potential for the covered activities to adversely affect bitterns is low, this increase in habitat constitutes a substantial benefit.

3.5.6.11 Fulvous Whistling-Duck

The Salton Sea area has supported up to about 200 whistling ducks during the spring and summer, with a much smaller breeding population. In recent decades, the fulvous whistling-duck has declined in the southwestern U.S., while increasing in numbers in the Southeast. Primary factors contributing to the decline of fulvous whistling-ducks in California are draining and development of marsh habitats and hunting.

Fulvous whistling-ducks nest in areas of dense cattails near the south end of the Salton Sea and forage on wetland plants and submerged aquatic vegetation in freshwater habitats that occur on the state and federal refuges and private duck clubs. Drains could provide a limited amount of foraging habitat for fulvous whistling-ducks, but are unlikely to be used for nesting because of their small size. The covered activities are not likely to substantially affect fulvous whistling-ducks because the ducks are not expected to use drain habitat for nesting.

IID will also create at least 190 and up to 652 acres of high-quality marsh habitat. Fulvous whistling ducks are not likely to use drain habitat but would benefit from the creation of managed marsh habitat. The managed marsh habitat would increase the availability of suitable habitat for fulvous whistling-ducks and could contribute to increasing the number of breeding pairs in the Imperial Valley/Salton Sea area. Such an increase would benefit the species.

3.6 Desert Habitat Conservation Strategy

3.6.1 Amount and Quality of Habitat in the HCP Area

Desert habitat in the HCP area occurs in the rights-of-way of the AAC, East Highline and portions of the Westside Main, Thistle, and Trifolium Extension canals (see Figure 2.3-9). Table 3.6-1 shows the miles of each canal adjacent to desert habitat. IID's right-of-way along the AAC varies from about 750 to 2,000 feet wide. IID's rights-of-way on the East Highline, Westside Main, Thistle and Trifolium Extension canals are highly variable ranging from about 80 feet to 300 feet. The canal, canal embankments, and maintenance roads take up much of the rights-of-way of these canals, such that the amount of desert habitat actually within IID's rights-of-way is limited.

The desert habitat consists predominantly of creosote bush scrub; dune habitat occurs along the AAC where it traverses the Algodones Dunes. Some of the covered species (e.g., Algodones Dunes sunflower) could only occur in the HCP area where the AAC passes through the dunes, but most of the covered species are associated with creosote bush habitat. Habitat quality varies along the AAC and the other canals. However, O&M activities have been ongoing within the rights-of-way since the canals were constructed. As a result, much of the area within IID's right-of-way is disturbed. In addition, off-road vehicle use is common in the vicinity of the AAC and has contributed to habitat degradation.

TABLE 3.6-1
Miles of Canals Adjacent to Desert Habitat

Canal	Miles
All American	60
Westside Main	6
East Highline	40
Thistle	5
Trifolium Extension	10
Total	**121**

3.6.2 Effects of the Covered Activities

Many of the covered activities have no potential to take or adversely affect covered species associated with desert habitat. These covered activities and an explanation of why species associated with desert habitat would not be impacted are listed in Table 3.6-2. The remaining covered activities have a limited potential to take a covered species as discussed below.

TABLE 3.6-2
Covered activities that Would Not Affect Covered Species Associated with Desert Habitat

Activity	Reason for No Effect
On-farm water use and conservation	On-farm water use and conservation activities would be only conducted on lands used for agricultural production. No on-farm conservation measures would be implemented on desert habitat.
System-based water conservation	System-based water conservation measures include canal lining, installation of lateral interceptors, installation of reservoirs, and seepage recovery systems. No canal lining is proposed as part of the water conservation and transfer programs for the AAC, East Highline, Westside Main, Thistle, or Trifolium extension canals. Canal sections proposed for lining are in agricultural areas of the Imperial Valley removed from desert habitat (Figure 1.7-3). Proposed locations for lateral interceptors are within agricultural areas, removed from areas supporting desert habitat (Figure 1.7-4). Reservoirs would be constructed in agricultural areas, removed from areas supporting desert habitat. Seepage recovery systems are proposed along the East Highline Canal. However, all construction required to install these systems would be conducted on the west side of the canal, and desert habitat is limited to the east side of the canal.

TABLE 3.6-2
Covered activities that Would Not Affect Covered Species Associated with Desert Habitat

Activity	Reason for No Effect
Drainage system operation	Drainage system operation is limited to moving water through the drains. No physical effects are encompassed by drainage system operation.
Seepage maintenance	Any actions to correct seepage problems that would occur along the AAC, East Highline, Westside Main, Thistle or Trifolium Extension canals would be conducted on the agricultural side of the canal and therefore, would not affect covered species associated with desert habitat.
Pipeline maintenance	Because no pipelines occur on the desert side of canals, pipeline maintenance would not affect covered species associated with desert habitat.
Reservoir maintenance	No reservoirs occur along the AAC or adjacent to desert habitat on the other canals. Therefore, reservoir maintenance would not affect covered species associated with desert habitat.
New and Alamo River maintenance	The AAC, East Highline, Westside Main, Thistle and Trifolium Extension canals and their rights-of-way do not intersect the New or Alamo rivers in areas supporting desert habitat.
Salton Sea dike maintenance	The AAC, East Highline, Westside Main, Thistle and Trifolium Extension canals and their rights-of-way do not intersect the dikes at the Salton Sea.
Gravel and Rock Quarrying	No gravel or rock quarries occur in the rights-of-way of the AAC, East Highline, Westside Main, Thistle or Trifolium Extension canals.
Fish Hatchery Operation and Maintenance	The fish hatchery is not located in the rights-of-way of the AAC, East Highline, Westside Main, Thistle or Trifolium Extension canals.
Recreational facilities	Although IID permits fishing in the AAC, East Highline and Westside Main canals, IID has not developed nor anticipates developing recreational facilities along any of these facilities. The HCP does not cover take of covered species by recreationists.

Covered activities with some potential to affect covered species associated with desert habitat are:

- Conveyance system operation
- Inspection activities
- Canal maintenance
- Right-of-way maintenance
- Sediment removal
- Structure maintenance
- Vegetation control
- Hydroelectric power plant maintenance

The potential for these activities to impact covered species associated with desert habitat is low and generally are limited to direct injury or mortality from being struck by motor vehicles and disturbance of covered species inhabiting desert habitat adjacent to the rights-of-way. Potential effects of each these activities on covered species associated with desert habitat are described below. Burrowing owls also can inhabit desert areas and be impacted by these activities but they are addressed individually as described in Section 3.7.1.

Conveyance system operation consists of moving water through the canals to meet customer and maintenance needs. These activities consists of filling, draining and moving water through the canals and therefore does not entail activities that could impact desert habitat. Potential effects to covered species from conveyance system operation are limited to the potential for individuals to be struck by vehicles as workers travel along the conveyance system. To ensure proper water deliveries, workers travel portions of the canal system on a daily and repetitive basis. Along all of the canals, vehicular travel is on the established road adjacent to the canal and along the East Highline, Westside Main, Thistle and Trifolium Extension, most travel is on the agricultural side of the canals. As a result, the potential for a covered species to be struck by a vehicle while conducting conveyance system operations is low.

Inspection activities consist of workers visiting structures to ensure they are working properly and make minor repairs or adjustments. Potential effects of this activity on covered species is limited to individuals being struck by a vehicle as the worker travels to structures. Inspections activities are conducted about once a month. As explained for conveyance system operations, vehicle travel occurs on established roads. Further, along the East Highline, Westside Main, Thistle, and Trifolium Extension canals, most travel is on the agricultural side of the canals the delivery and drainage are structures. Thus, the potential for a covered species to be struck by a vehicle while conducting inspection activities is low.

Canal maintenance consists of maintaining the seepage recovery systems adjacent to the AAC, managing the abandoned section of the AAC as an emergency channel, and maintaining the canal lining of the future AAC parallel canal. IID operates three seepage recovery systems along the AAC (one at Drop 3 and two at Drop 4). These systems are open seepage recovery systems. About once every 5 years IID removes vegetation from these systems. Because vegetation consists of plant species typical of drain habitat and not desert plants, desert habitat would not be affected. Potential impacts consist of a minor potential for disturbance if covered species occur in adjacent areas. Because excavators move very slowly when removing vegetation (stop and go cycle), active individuals of the covered species likely would be able to avoid being struck by the excavator. However, some of the covered species (e.g., flat-tailed horned lizards, Colorado Desert fringed toed lizards) could be vulnerable during inactive periods or because they become motionless when threatened (e.g., flat-tailed horned lizards). While tracking to the job site, excavators move at a very low speed (<5 mph).

After completion of the AAC Lining Project, IID anticipates managing abandoned canal section as an emergency channel. Management is expected to consist of mechanical and chemical vegetation control and sediment removal. These actions would be conducted at least annually. Vegetation control of the abandoned section would not result in a loss of habitat because desert habitat does not currently exist as the canal is still in use. Vegetation control and sediment removal would maintain the canal free of vegetation discouraging colonization by covered species. Even if some covered species ventured into the abandoned section, the potential for take of a covered species is minor because sediment removal and vegetation control activities would be conducted infrequently (about once a year) and the equipment used to conduct these activities is very slow moving.

The future parallel canal along the AAC will be a concrete-lined channel whereas the existing canal is earthen. Future canal maintenance activities will include repairing and replacing concrete lining. These activities are conducted in and immediately adjacent to the canal and are entirely within disturbed areas of IID's right-of-way. No effects to habitat would occur and potential effects to covered species would be limited to a minor potential for disturbance if covered species occurred in areas adjacent to the construction work.

Right-of-way maintenance along canals adjacent to desert habitat is focused on the roads along the canals and the canal embankments. Roadways are regularly graded and watered. One grader and water truck is assigned full time to the AAC. Grading is continual along the portion of the AAC within the Imperial Valley with all of the valley portion of the AAC covered in three months. With the exception of the portion of the AAC that traverses the Algodones Dunes, for the portions of the AAC outside of the Imperial Valley, the roadway is graded about once a year. Occasionally, IID must recreate a portion of the road because of blowing sand. Roadways of the East Highline, Westside Main, Thistle, and Trifolium are graded and watered several times a year.

Along the portion of the AAC that traverses the Algodones Dunes, IID annually knocks down portions of the sand dunes, creating a flatter slope that allows sand to blow across the canal. In conducting this flattening, a dozer drags and I-beam back and forth across the peaks of the dunes to level them. The area where this activity is conducted begins at the Coachella Turnout (Sta. 1907+20) and extends to about Sidewinder Road at Pilot Knob (Sta. 1243+65), a distance of 12.56 miles. The area actually disturbed is about 50 to 75 feet wide yielding a total acreage disturbed of 76 to 114 acres. This operation begins in July every year and lasts about 6 weeks. In conjunction with flattening the dunes, the roadways along the AAC are cleared of accumulated sand. After the roads are opened up, they are immediately treated with herbicides for vegetation control. IID has been conducting these activities since the construction of the AAC in about 1945.

Grading and watering roads does not remove any habitat for covered species such that potential effects to covered species are limited to being struck by moving vehicles. However, because the equipment (graders, water trucks, dozers) used to conduct right-of-way maintenance is slow moving, the potential for a covered species to be struck is low. Along the East Highline, Westside Main, thistle, and Trifolium the likelihood of this impact is less because the roads along these canals are on the agricultural field side. Reconstructing and clearing the road, and flattening the dunes along the Algodones Dunes portion of the AAC could result in the removal of a covered plant species, if any covered plants colonized the area.

Right-of-way maintenance also includes embankment maintenance. At times material from the canal embankment washes down the embankment. A dozer is used to reshape the outside of the canal embankments. The East Highline, Westside Main, Thistle and Trifolium Extension canals do not have embankments such that the activity is limited to the AAC. Along the AAC, the need for embankment maintenance is very spotty and irregular. About once every 10 years, an area requires reshaping.

Structure maintenance on canals consists of servicing, repairing and replacing structures required to deliver water to customers as well as controlling vegetation around the structures to maintain access. Table 3.6-3 summarizes the type and number of structures on the AAC, East Highline, Westside Main, Thistle, and Trifolium Extensions. Because only a portion of the Westside Main, Thistle, and Trifolium Extension canals are adjacent to desert habitat, only a portion of the structures listed in Table 3.6-3 occur in areas where the canal is adjacent to desert.

TABLE 3.6-3
Structures on the AAC, East Highline, Westside Main, Thistle and Trifolium Extension canals.

	Canals[a]				
Structure	**AAC**	**EHL**	**WSM**	**Thistle**	**TriExt**
Bridges	0	15	12	0	1
Check	7	25	49	60	29
Control structure	0	2	4	0	0
Crossing (road, rail, drain, delivery)	11	2	49	39	31
Drop structure	5	0	0	0	0
Flume	0	1	2	0	0
Gate	28	68	148	101	57
Heading	28	76	55	0	0
Hydropower facility	5	0	0	0	0
Overpass	1	0	0	0	0
Pump	4	14	4	2	2
Reservoir inlet	0	1	1	0	0
Siphon	1	0	5	0	6
Spill gate	3	0	4	5	6
Total	**93**	**204**	**333**	**207**	**132**

[a]AAC = All American Canal; EHL = East Highline Canal; WSM = Westside Main Canal; TriExt = Trifolium Extension

Routine activities associated with structure maintenance consist of making minor repairs and adjustments and maintaining the area around the structure free of vegetation. Vegetation is tightly controlled around structures such that habitat never develops for covered species. The routine maintenance activities are conducted in close proximity to the structures and within the area maintained clear of vegetation such covered species are very unlikely to occur in the area. Traveling to the structure to conduct maintenance activities has a minor potential to take a covered species as explained for conveyance system operations and inspection activities.

Over the 75-year permit term, IID anticipates replacing all of the structures along the canals at least once. For major structures such as hydropower generation facilities, an area up to 20 acres in size can be disturbed by the construction. However, the area disturbed in replacing a facility would be the same as when the facility was originally installed and all construction would be within IID's right-of-way. Thus, removal of previously undisturbed desert vegetation is not anticipated. Replacement of large facilities could disturb covered species if they inhabit areas adjacent to the construction area or covered species could be injured if they entered the construction area.

Vegetation control along these canals consists of chaining within the prism of the canal. In chaining, a tractor traveling along the road adjacent to the canal drags a chain on the inside of the canal prism. Because the tractor remains on an established road and all work is conducted within the canal prism, there are no effects to desert vegetation. Potential effects to covered species associated with desert habitat are limited to being struck by the vehicle. However, the potential for this effect is low because the tractor moves very slowly such that individuals would be able to avoid the vehicle. The outer embankments of the AAC are maintained free of vegetation through regular grading as described under right-of-way maintenance. No vegetation control is conducted on the desert side of the East Highline, Westside Main, Thistle, or Trifolium Extension canals.

Hydroelectric power plant maintenance consists of controlling vegetation around the hydroelectric facility. Potential effects of this activity are the same as described for structure maintenance.

3.6.3 Approach and Biological Goals

In the HCP area, desert habitat only occurs in the right-of-way of the AAC, adjacent to the East Highline Canal and adjacent to sections of the Westside Main Canal, Thistle and Trifolium Extension. The primary covered activities with the potential to affect species associated with desert habitat are the O&M activities associated with the canals and to a more limited degree the hydroelectric facilities on the AAC. As briefly summarized above, covered activities have the potential to affect covered species by directly killing or injuring an individual (primarily resulting from motor vehicles) or from disturbance. IID also could conduct construction activities to replace or rehabilitate facilities or install new facilities. Construction could kill, injure, or disturb individuals of covered species, or indirectly affect covered species through changes in habitat quality or quantity.

The approach to the Desert Habitat Conservation Strategy is to implement a program to minimize the potential for take of covered species during O&M activities. If construction activities are required within the rights-of-way during the term of the permit, additional measures would be implemented to minimize the potential for take and to compensate for any decrease in habitat quality or availability. The biological goal of the Desert Habitat Conservation Strategy is to maintain viable populations of covered species that occupy desert habitats in the HCP area. This goal will be achieved by avoiding and minimizing the potential for death or physical injury of individuals of the covered species, and improving habitat contiguity and persistence to compensate for changes in habitat quality or quantity caused by construction activities.

3.6.4 Desert Habitat Mitigation and Management Measures

The mitigation and management measures described below are the specific actions that IID will undertake to fulfill the goals of the Desert Habitat Conservation Strategy. The key elements of the conservation strategy are as follows:

- Implement a worker education program

- Implement interim measures to avoid and minimize the potential for take of covered species during O&M and construction activities
- Refine avoidance and minimization measures based on species surveys and adaptive management program
- Conduct surveys to determine the occurrence of covered species in the right-of-way
- Protect habitat outside of the right-of-way when construction activities reduce the quality or availability of habitat

Desert Habitat– 1. *IID will implement a worker education program. Workers conducting O&M activities along the AAC, East Highline, Westside Main, Thistle or Trifolium Extension canals will be required to attend a worker education program to ensure proper implementation of the HCP measures addressing desert habitat. Workers will be instructed on the requirements of the HCP within six months of issuance of the incidental take permit. The worker education program will be conducted at least annually to ensure instruction of new employees and as a refresher. For new workers, IID will ensure that they are informed of and understand the requirements of the HCP prior to conducting O&M activities either individually or through the annual education program.*

The worker education program will instruct workers on the identification and habitat association of covered species using desert habitat. Pictures of the different habitat types will be included in the manual with a list of covered species potentially occurring in each habitat type. Activities with the potential to affect covered species inhabiting desert habitat and the practices to follow to minimize potential adverse effects to these species will be explained (see Desert Habitat – 2). Workers will be instructed on procedures approved by the HCP IT for moving covered species in the event that a covered species is found during O&M activities and is in imminent danger from covered activities. Workers will be required to report any observations of dead or injured individuals of the covered species or when they relocate an individual (see Desert Habitat – 2 and 3).

A worker education manual will be prepared by IID with the concurrence of USFWS and CDFG. The manual will be distributed to each person conducting O&M activities along the AAC, East Highline, Westside Main, Thistle or Trifolium canals. The manual will include a photograph/drawing of each covered species associated with desert habitat and brief information on its identification. As information of the occurrence and distribution of covered species along the AAC, East Highline, Westside Main, Thistle and Trifolium Extension canals becomes available through the survey program (see Desert Habitat – 4), it will be added to the manual. The manual will also summarize the HCP's requirements for O&M activities for easy reference. The HCP IT will review the manual annually and update it as appropriate.

The primary concern for covered species using desert habitat relates to O&M activities. The effectiveness of avoidance and minimization measures (Desert Habitat – 2) will depend on workers being familiar with the covered species and understanding the requirements of the HCP with respect to these species. A worker education program is critical to ensuring that measures are implemented properly.

Desert Habitat – 2. *IID will conduct O&M activities in accordance with the following measures.*

- *Workers will be instructed to be alert to the occurrence of covered species in roadways while driving and to avoid hitting individuals at all times.*
- *Prior to moving a parked vehicle, workers will check around and underneath the vehicle for covered species. If a covered species is found in harm's way and is moving, it will be allowed to move away from the vehicle on its own accord before the vehicle is moved. If the individual is not moving, the worker will relocate the individual to a nearby safe location following procedures outlined in the worker education program.*
- *Workers will be familiarized with covered plants species and instructed to avoid injuring or uprooting plants.*
- *Workers will properly dispose of garbage in closed containers to minimize raven attraction.*
- *Workers will not be permitted to bring pets to the work site.*
- *IID will restrict O&M activities to previously disturbed areas within the right-of-way along the existing AAC, the future parallel canal, East Highline and portions of the Westside Main, Thistle and Trifolium Extension canals where the canals are adjacent to native desert habitat.*
- *O&M will include periodic removal of vegetation from the maintenance roads and canal embankments to prevent establishment of vegetation that could attract covered species.*

These practices are interim measures and may be modified over the term of the permit based on survey results and through the adaptive management and monitoring program (see Desert Habitat – 4 and Chapter 4). The HCP IT will review these measures at least every 5 years and may adjust the measures as long as the adjustments do not increase the total cost of implementing the HCP.

For covered species of reptiles, a primary concern for O&M activities is the potential for motor vehicle traffic to strike individuals as they are crossing the road or basking on the road surface. Reptiles also will seek out the shade created by parked vehicles. Because of these behaviors, reptiles are vulnerable to being killed or injured from motor vehicles. Covered mammalian and amphibian species also are at risk of being struck by motor vehicles. Through the first two measures, the potential for covered species to be impacted by motor vehicles will be reduced.

Garbage that is not properly disposed of can attract avian and mammalian predators (e.g., ravens and coyotes) and increase the local abundance of predators. These predators could prey on covered species and could become a substantial mortality agent for some species. For example, predation by ravens on eggs and young is a considerable concern for desert tortoise populations. By properly disposing of garbage, IID will avoid attracting predators and increasing predator populations that could result in detrimental levels of predation on covered species along and adjacent to the AAC, East Highline and Westside Main canals.

Previously disturbed areas in the rights-of-way along the AAC, East Highline, Westside Main Canal, Thistle, and Trifolium Extension canals provide poor habitat quality for the covered species. Plants are not likely to become established in areas continuously disturbed. Covered plants would not be expected to occur in these routinely disturbed areas and covered animals would not be expected to occur because habitat would not develop. By restricting activities to disturbed areas, IID will further reduce the potential to directly injure a covered species. In addition, impacts to desert habitat would be avoided and no changes in habitat availability or quality for the covered species would occur.

Desert Habitat – 3. *IID will implement the following measures while conducting scheduled construction activities within its rights-of-way along the AAC, East Highline, and portions of the Westside Main, Thistle, and Trifolium Extension canals containing native desert habitat. Examples of scheduled construction activities are canal lining, installation of new major canal structures, canal relocations, canal additions, and embankment rehabilitations.*

- *Where practicable, IID will limit construction activities, including vehicle travel, in the rights-of-way of the AAC and future parallel canal, the East Highline Canal, and the Westside Main Canal to previously disturbed areas.*
- *Staging areas will be situated on the agricultural side of the canal except where the canal is not bordered by agricultural areas.*
- *Prior to initiating construction activities, the HCP Implementation Biologist will conduct a habitat survey of the construction area and adjacent areas. Based on the habitat conditions and species survey information, the biologist will determine which covered species are likely to occur in or immediately adjacent to the construction area. IID will implement the species-specific minimization and avoidance measures contained in Appendix C for the species identified by the biologist.*
- *A biological monitor will be on-site during construction activities or exclusion fencing will be erected to keep covered species out of the construction area.*
- *If a covered animal species occur on the project site during construction, construction activities adjacent to the individual's location will be halted and the individual allowed to move away from the construction area on its own accord. If the individual is not moving, the biological monitor or other trained worker will relocate it to a nearby safe location outside of the construction area.*
- *The construction area will be clearly flagged prior to the start of construction activities and all construction activities will be confined to the demarcated area. To the extent practicable, the construction area will be situated and demarcated to avoid habitat for covered species.*
- *After completion of the construction activities, IID will restore any native vegetation temporarily impacted by the construction. If native desert vegetation would be temporarily impacted by construction, prior to the start of construction activities, IID will develop a vegetation restoration plan in conference with the HCP IT. The vegetation restoration plan will (1) describe the amount and species composition of the vegetation that would be impacted, (2) the actions that IID will take to restore the disturbed area, (3) the criteria for assessing the success of the restoration, and (4) the actions that will be undertaken if the success criteria are not achieved. For native desert vegetation permanently lost, IID will mitigate in accordance with Desert Habitat – 5.*
- *A speed limit of 20 miles/hour will be maintained on the construction site, staging areas, and storage areas.*
- *No pets will be permitted on the construction site.*
- *Prior to moving a parked vehicle, the ground around and under the vehicle will be inspected for covered species. If an individual of a covered species is found and is moving, it will be allowed to move away from the vehicle on its own accord. If it is not moving, it may be removed and*

relocated to a nearby safe location following the procedures outlined in the worker education program.

For a particular construction project, IID may implement alternative measures or modify the standard or species-specific avoidance and minimization practices if agreed to by the USFWS and CDFG. In addition, the standard and species-specific avoidance and minimization practices may be modified over the term of the permit based on survey results and through the adaptive management and monitoring program (see Desert Habitat – 4, Desert Habitat – 5, and Chapter 4). The HCP IT will review these measures at least every 5 years and may adjust the measures as long as the adjustments do not increase the cost of implementation.

IID may undertake various construction activities along the AAC, East Highline Canal, and portions of the Westside Main, Thistle and Trifolium Extension canals adjacent to native desert habitat during the term of permit. The specific location of this construction is not currently known and the specific effects on species associated with desert habitat cannot be determined. With this measure, IID commits to determine the effects of a construction project on habitat for covered species and to take actions to avoid and/or mitigate potential effects to covered species as a result of construction activities.

Covered species could be injured or disturbed by construction activities. The actions that IID will implement under Desert Habitat – 3 are typical practices required by CDFG and USFWS to avoid and minimize impacts to listed species during construction projects. The measures are designed to minimize the potential for death or injury of covered species during construction and to compensate for any reduction in the quality or quantity of habitat for covered species.

Desert Habitat – 4. *Within 1 year of the issuance of the incidental take permit, IID will initiate a baseline survey its rights-of-way on the AAC, the East Highline Canal and the portions of the Westside Main, Thistle and Trifolium Extension canals adjacent to desert habitat to determine the occurrence and location of covered species. The baseline surveys will be conducted for three consecutive years. The worker education manual (see Desert Habitat – 1) will be revised to include a habitat map and map(s) of known locations of each of the covered species within the rights-of-way of these canals. The surveys will be repeated at least every 5 years and the worker education manual updated as necessary to accurately portray the occurrence and distribution of covered species within IID's right-of-way. The interval for repeating the surveys and updating the manual may be lengthened if agreed to by IID, USFWS, and CDFG. The HCP IT will develop the specific survey protocols.*

Most of the covered activities that will occur in the rights-of-way of the AAC, East Highline, Westside Main, Thistle and Trifolium Extension canals are O&M activities. These O&M activities are focused on maintaining access roads to the canal and associated facilities clear of vegetation and accessible by equipment, and maintaining the structural integrity and capacity of canals and reservoirs. O&M activities generally do not involve disturbance of native desert habitat and are concentrated in previously disturbed areas. Because most of the covered activities occurring in the right-of-way would not affect habitat quality or quantity, the primary concern for covered species is the potential for covered species to be injured by equipment operation.

By knowing where covered species occur along the canals adjacent to native desert habitat, IID can better educate its workforce to avoid and minimize the potential to injure a covered animal species during O&M activities. Further, IID will be able to design and schedule construction activities to avoid and minimize impacts to covered animal species.

The greatest threat to covered plant species is the potential for the plants to be injured or uprooted by equipment. By surveying the rights-of-way and educating the workforce on procedures to follow in areas supporting covered plants, the potential for covered plants to be impacted will be minimized or avoided. Information on the location of covered plant species will also be used to design and carry out construction activities in a manner that avoids or minimizes direct impacts to covered plant species. By repeating the surveys over the term of the permit and educating workers to recognize covered plant species, plants that colonize new locations will be similarly protected.

The baseline surveys described in Chapter 4 will fulfill the obligation to survey for covered species within three years. The same survey protocol and methods will be followed in conducting the subsequent recurring surveys.

Desert Habitat – 5. *If desert habitat used by covered species would be permanently lost as a result of O&M or construction activities, IID will determine the amount of habitat lost and acquire, or grant a conservation easement on land at a 1:1 ratio for the acreage impacted within 1 year of the removal of the habitat. IID will not permanently remove more than 100 acres of native desert habitat over the term of the permit.*

- *Land to be acquired or subject to the conservation easement will have (1) known use by covered species that use the impacted areas or (2) be situated adjacent to areas of occupied habitat and support suitable habitat for the covered species that use the impacted habitat, and (3) is deemed to have long term viability as habitat for covered species based on its patch size, connectivity or location to other conserved habitat. IID will work with the HCP IT to identify a property to acquire or cover with a conservation easement. IID will place a conservation easement on this acquired land or otherwise provide for the protection of the property for the term of the permit. With the approval of USFWS and CDFG, which approval shall not be unreasonably withheld, IID may transfer the land to a third party who agrees to and is authorized to manage the land for habitat conservation purposes. If IID transfers the land to a third party, IID will establish an endowment fund adequate to provide for the management of the land for the term of the permit.*
- *If IID retains ownership of the land, IID will prepare and submit to the USFWS and CDFG a management plan for the property that describes how the property will be managed to maintain its suitability for the covered species. The management plan will describe the actions that IID will take to maintain the ecological functions of the acquired habitat. While the specific management needs will vary depending on the property acquired, considerations for the management plan include:*
- *Measures to control human access (e.g., fencing, signage)*
- *Frequency at which land will be visited to assess maintenance/management needs*
- *Types of maintenance action (e.g., removing garbage, repairing fences)*
- *Vegetation management practices (e.g., prescribed burning, removal of exotic plants)*

If habitat used by covered species will be permanently lost, IID will acquire and preserve other desert habitat and ensure that it is managed for desert habitat values for the term of the permit. This measure is derived from the Biological Opinion for the AAC Lining Project in which desert habitat is to be acquired and transferred to Bureau of Land Management if habitat for the flat-tailed horned lizard is affected (USFWS 1996). The Biological Opinion specified a 1:1 ratio because desert habitat quality along the AAC is low. Only minor amounts of desert habitat if any occurs in the rights-of-way of the East Highline and Westside Main canals and what habitat does occur is disturbed, providing only low quality habitat. IID would employ a similar measure to mitigate impacts to covered species associated with desert habitat potentially resulting from construction projects in the rights-of-way of the AAC, East Highline Canal or portions of the Westside Main Canal adjacent to desert habitat.

3.6.5 Effects on Habitat

Desert habitat only occurs in the HCP area adjacent to the AAC, along the eastern edge of the East Highline Canal and along the western edge of portions of the Westside Main, Thistle and Trifolium Extension canals. The covered activities that would occur in the rights-of-way of these canals primarily consist of O&M activities. Under the Desert Habitat Conservation Strategy, IID would limit these activities to previously disturbed areas. Thus, the amount and quality of desert habitat in the HCP area would not be expected to change. The Desert Habitat Conservation Strategy also includes provisions to preserve desert habitat off site in the event that covered activities do result in the loss or degradation of desert habitat. Off-site compensation areas would be identified in coordination with the USFWS and CDFG, ensuring that any acquired areas would benefit the covered species.

3.6.6 Effects on Covered Species

Most of the covered activities occurring in the right-of-way would not affect habitat quality or quantity, and the primary concern is the potential for covered species to be injured by equipment used for O&M activities. As a result, the Desert Habitat Conservation Strategy focuses on minimizing the potential for covered species to be injured by activities along canals adjacent to desert habitat. However, the strategy also includes provisions to protect habitat if IID's activities remove native desert vegetation. Because little or no change in the quality or availability of habitat, and few incidences of take of covered species are expected as a result of the covered activities, no adverse effects to covered species associated with desert habitat would be expected. Rather, by minimizing the potential for take of covered species and ensuring that any habitat lost or degraded by the covered activities is compensated for, implementation of the Desert Habitat Conservation Strategy would provide an overall benefit to the covered species associated with desert habitat. The effects of implementing the Desert Habitat Conservation Strategy on each of the covered species associated with desert habitat is provided below. The effects of implementing the HCP on transient species are summarized in Table 3.6-4.

3.6.6.1 Desert tortoise

Potential habitat for the desert tortoise within the HCP area occurs in creosote bush scrub within the rights-of-way of several of IID's canals. However, this habitat is marginal for the species because it is below the optimal elevation, the diversity and abundance of perennial and annual grasses upon which it feeds is relatively low, and the area is subject to ongoing disturbance associated with canal maintenance activities and off-road recreational vehicle use. While it is unlikely that desert tortoise use the HCP area, specific measures have been developed to avoid and minimize the potential for take resulting from construction and maintenance activities within the canal rights-of-way that contain desert habitat. For several of the covered reptiles, a primary concern for O&M activities is the potential for vehicle traffic to strike individuals as they are moving or basking on the road surface, or seeking shade created by parked vehicles. In addition to standard avoidance measures, species-specific measures would be implemented for tortoise, including conducting pre-construction surveys for occupied burrows, fencing excavation areas, relocating tortoises from burrows that cannot be avoided, halting construction if the species is present, and relocating individual's outside of the construction area if necessary.

Through implementation of these measures, the potential for take of desert tortoise through direct injury would be minimized. Permanent loss of creosote bush scrub will be compensated through the acquisition or granting of easement of in-kind habitat at a 1:1 replacement ratio.

3.6.6.2 Colorado Desert Fringe-toed Lizard

Suitable habitat for the species in the HCP area occurs where the AAC traverses the Sand Hills and Algodones Dunes. About 100 Colorado desert fringe-toed lizards were found during surveys in the Sand Hills along a 600-foot-wide transect immediately adjacent to the north side of the AAC (Reclamation and IID 1994; 1996b). However, the likelihood of encountering the species within portions of the right-of-way where IID conducts activities is low given the marginal quality of habitat due to substrate compaction from vehicular use and ongoing disturbances related to canal maintenance. Nevertheless, IID will implement measures to further reduce the potential for take of this species. These measures include implementing a worker education program, requiring practices to avoid or minimize striking individuals with vehicles (e.g., checking under parked vehicles) and practices to avoid degrading habitat (e.g., restricting activities to previously disturbed areas) during O&M and construction activities. In addition to these general avoidance measures, species-specific measures would be implemented, including conducting pre-construction surveys, hourly biological monitoring of the construction area when surface temperatures exceed 30 degrees Celsius, cessation of work if lizards are observed, and re-location of individuals if necessary.

3.6.6.3 Western Chuckwalla

Western chuckwallas are associated with the Sonoran Creosote Bush Scrub plant community, but within this community it is restricted to areas with large rocks, boulders, or rocky outcrops, usually on slopes. Within the HCP area, creosote bush scrub is found within the rights-of-way of the AAC and several other canals in the Imperial Valley. However, the habitat is of marginal quality for western chuckwallas because it consists of mostly sandy substrates and generally lacks rocky features. Thus, the likelihood of encountering the species within IID's canal rights-of-way is low with a concomitant low likelihood of impacts to this species.

TABLE 3.6-4
Potential Effects to Transient Covered Species Associated with Desert Habitat

Species	Occurrence in HCP Area	Habitat Use in the HCP Area	Potential Effects of HCP
Prairie falcon	Rare migrants throughout the year	Probably visits agricultural field and Salton Sea shoreline to prey on shorebirds; also could occur in desert habitat	No effects expected because of 1) small number of birds and limited time period that prairie falcons occur in the HCP area, 2) the minimal effects expected to occur to desert habitat, and 3) implementation of compensation measures compensate if habitat is impacted.
Golden eagle	Accidental during spring and winter.	Probably visits agricultural fields and managed marshes on the state and federal refuges to prey on wintering and migrating waterfowl. Also could occur in desert areas.	No effects expected because of 1) small number of birds and limited time period that golden eagles occur in the HCP area, 2) the minimal effects on expected to occur to desert habitat, and 3) implementation of compensation measures compensate if habitat is impacted.

Although the potential for impacts to western chuckwallas is low, IID will implement measures to further avoid and minimize the potential impacts. These measures include implementing a worker education program, requiring practices to avoid or minimize striking individuals with vehicles (e.g., checking under parked vehicles) and practices to avoid degrading habitat (e.g., restricting activities to previously disturbed areas) during O&M and construction activities. In addition to these standard avoidance measures, IID will implement species-specific measures to minimize the potential for take of chuckwallas, including conducting pre-construction surveys, hourly biological monitoring of the construction area when surface temperatures exceed 30 degrees Celsius, cessation of work if chuckwallas are observed, and re-location of individuals if necessary.

3.6.6.4 Couch's Spadefoot Toad

No records of Couch's spadefoot toad exist for the HCP area, but it is within the species' range. It is uncertain if suitable habitat conditions are present in the HCP area. Couch's spadefoot toads could use native desert habitats within the right-of-way of the AAC and use seepage communities associated with the AAC or East Highline Canal for breeding. Surveys conducted under the Desert Habitat Conservation Strategy will provide information on the presence of suitable habitat and this species in the HCP area.

This species rarely occurs above ground. Up to 10 month out of the year it remains within burrows located in friable soil associated with desert plants. Because the ground is compacted and plant cover is minimal, these toads are not likely to burrow in portions of the rights-of-way where IID conducts its activities. Thus, potential impacts of IID's activities consist of striking toads with vehicles during the brief periods when it rains and the toads are above ground, and if construction activities eliminated breeding ponds. Installation of seepage recovery systems on the East Highline Canal are not expected to impact Couch's spadefoot toads because the recovery systems are proposed for the west side of the canal and desert habitat occurs on the east side of the canal. Seepage communities on the east side of the East Highline Canal which are adjacent to desert habitat would not be affected by the proposed seepage recovery systems.

IID would implement a suite of measures to minimize direct injury and mortality to covered species associated with desert habitat. The worker education program and implementation of these measures would act to further reduce the potential for take of Couch's spadefoot toads. Potential breeding ponds would be identified as part of the baseline habitat surveys. If IID conducts construction activities in the vicinity of breeding ponds, actions would be taken to avoid impacts or compensate for impacts to this important habitat.

3.6.6.5 Flat-tailed Horned Lizard

Flat-tailed horned lizards are known to occur within the HCP area and suitable habitat for the species exists along the AAC and along the western side of the Westside Main Canal in the West Mesa. Extensive habitat for this species also occurs to the east of the East Highline Canal (BLM 1990). The species is well distributed along the AAC, although this area has not been identified as a key area for the species. Flat-tailed horned lizards typically occupy sandy, desert flatlands with sparse vegetation and low plant diversity. Optimal habitat is found in the desert scrub community which is also occupied by the fringe-toed lizard. The O&M activities of primary concern for this species are associated with motor vehicle traffic striking individuals as they are crossing roads or basking on road surfaces. Individuals that have sought cover and shade under parked vehicles also could be harmed when the vehicle is moved.

This species is likely to occur within the AAC right-of-way. Under the Desert Habitat Conservation Strategy, IID will implement specific measures to avoid and minimize the potential for take of the flat-tailed horned lizard. These measures include implementing a worker education program, requiring practices to avoid or minimize striking individuals with vehicles (e.g., checking under parked vehicles) and practices to avoid degrading habitat (e.g., restricting activities to previously disturbed areas) during O&M and construction activities. In addition to these general avoidance measures, species-specific measures include conducting pre-construction surveys, hourly biological monitoring of the construction area when surface temperatures exceed 30 degrees Celsius, cessation of work if lizards are observed, and re-location of individuals if necessary.

3.6.6.6 Harris' hawk

Cottonwood and mesquite trees that could provide potential nesting habitat for Harris' hawks occur in a few isolated seepage areas along the AAC, principally between Drops 3 and 4. Because of the limited amount of potential habitat for this species in the HCP area, its occurrence in the HCP area is very low. As such, the potential for IID's activities to impact this species is very low.

To further reduce the potential for its activities to impact Harris' hawk, IID will implement measures to identify and protect active nest sites from potential impacts of O&M and construction activities. Measures include restricting activities to previously disturbed areas such that vegetation that could be used for nesting is avoided, surveying for the species in potential nesting habitat in and near construction sites, establishing a buffer around nests, and prohibiting construction during the breeding season until after young have fledged. Any permanent removal of vegetation that could be used as habitat for the species will be compensated through the acquisition or granting of easement of in-kind habitat.

3.6.6.7 Loggerhead shrike

In the HCP area, habitat for loggerhead shrikes consists mainly of agricultural fields, although the species could also use desert habitats within rights-of-way of several canals for nesting and foraging. Under the Desert Habitat Conservation Strategy, IID will limit activities to previously disturbed areas. With this restriction, IID will avoid reducing habitat for loggerhead shrikes and minimize the potential for disturbance or injury of individuals. In addition to these measures, IID will implement species-specific measures to further minimize potential impacts to loggerhead shrike such as surveying for potential nesting habitat in and near the construction site, establishing buffers around nests, and prohibiting construction between February 1 through July 31, or until young have fledged (see Appendix C for a full listing of measures). Any permanent loss of vegetation that could be used as habitat for the species will be done outside of the breeding season and compensated through the acquisition or granting of easement of in-kind habitat at a 1:1 replacement ratio.

3.6.6.8 Le Conte's thrasher

The creosote bush scrub community in the AAC right-of-way and adjacent to the East Highline, Westside Main, Thistle and Trifolium Extension canals provides potential habitat for the LeConte's thrasher. The species is reported as an extirpated breeder at the Salton Sea Nation Wildlife Refuge (USFWS 1997), but breeding pairs have been observed in desert scrub habitat east of the Coachella Canal, suggesting the potential for it to occur in desert scrub habitat within the AAC right-of-way. The primary reason for species decline is habitat loss attributable to degradation, fragmentation, agricultural conversion, irrigation, urbanization, oil and gas development, fire, and over-grazing.

Under the Desert Habitat Conservation Strategy, IID would implement measures to avoid and minimize adverse effects to Le Conte's thrasher, including a implementing a worker education program and requiring practices to avoid degrading habitat (e.g., restricting activities to previously disturbed areas) during O&M and construction activities. In addition to general avoidance measures, specific measures have been developed to avoid impacts to this species, such as surveys for potential nesting habitat in and near the construction site, establishing buffers around nests, and prohibiting construction between January 15 through June 15, or until young have fledged (see Appendix C for a full listing of measures). Any unavoidable and permanent removal of vegetation that could be used as habitat for the species will be done outside of the breeding season and compensated through the acquisition or granting of easement of in-kind habitat at a 1:1 replacement ratio.

3.6.6.9 Crissal Thrasher

The crissal thrasher occupies dense thickets of shrubs or low trees in desert riparian and desert wash habitats. Limited stands of mesquite, willow, and cottonwoods found in seepage areas of the AAC or adjacent to the East Highline could provide habitat for the species. The species is resident to Imperial, Coachella, and Borrego Valleys. Breeding pairs have been observed along the Alamo River and near the towns of Niland and Brawley (USGS Breeding Bird Surveys), and across from the mission wash flume 3 miles north-northeast of Bard and in areas around the Laguna Dam. Removal of mesquite brushland for agricultural production and introduction of tamarisk are the primary causes of population reductions, followed by habitat degradation and disturbance from off-road vehicle activity.

Under the Desert Habitat Conservation Strategy, IID would implement measures to avoid and minimize adverse effects to crissal thrasher, including implementing a worker education program and requiring practices to avoid degrading habitat (e.g., restricting activities to previously disturbed areas) during O&M and construction activities. In addition to general avoidance measures, specific measures have been developed to avoid impacts to this species, such as surveys for potential nesting habitat in and near the construction site, establishing buffers around nests, and prohibiting construction between January 15 through June 15, or until young have fledged (see Appendix C for a full listing of measures). Any unavoidable and permanent removal of vegetation that could be used as habitat for the species will be done outside of the breeding season and compensated through the acquisition or granting of easement of in-kind habitat at a 1:1 replacement ratio.

3.6.6.10 Nelson's bighorn sheep

Bighorn sheep are known to use desert scrub habitat, however, their occurrence in the HCP area is unlikely given the lack of adjacent mountainous regions for use as escape and breeding habitat, and high level of human activity in the project area. The closest known population of Nelson's bighorn sheep are in the Chocolate Mountains, where 120 individuals have been observed (CDFG 1999b).

Impacts to the species would be avoided through implementation of the Desert Habitat Conservation Strategy, and any unavoidable impacts to desert vegetation would be compensated through the acquisition or granting of easement of in-kind habitat at a 1:1 replacement ratio. By removing the potential for injury to the species from the covered activities, and by replacing lost habitat through the protection of higher quality desert habitat if necessary, the Nelson's bighorn sheep would not be adversely affected by the HCP. Under the HCP, implementation of the Desert Habitat Conservation Strategy is expected to have no effect on this population.

3.6.6.11 Peirson's Milk-vetch

Potential habitat for this species occurs within the creosote scrub and dune habitats within the AAC right-of-way. About 25 percent of the known populations are within the North Algodones Dunes Wilderness. Results of a 1993 survey by IID and Reclamation documented more than 1,300 individuals within a 1-mile reach of the proposed AAC parallel canal in the high dunes area (USFWS 1996b).

Under the Desert Habitat Conservation Strategy, avoidance measures, both general and plant-specific, have been developed in order to avoid and minimize impacts from O&M and construction activities. Specific measures include pre-construction surveys, prohibiting surface disturbance within a prescribed radius of the species if it is found within the project area, and transplanting individuals if impacts are unavoidable and transplanting is deemed appropriate by USFWS and CDFG (see Appendix C for a full listing of measures). General measures include familiarizing workers with covered plant species they are likely to encounter within the right-of-way and instructing them to avoid injuring or uprooting plants. IID also will restore any native vegetation temporarily impacted by construction and compensate for unavoidable and permanent impacts to vegetation by acquiring or granting a conservation easement on land at a 1:1 ratio for the acreage impacted.

3.6.6.12 Algodones Dunes Sunflower

Potential habitat for this subspecies occurs where the AAC traverses the Sand Hills and Algodones Dunes. This subspecies is naturally limited throughout its range by the availability of suitable dune habitat and is considered to be rare throughout its range. The main distribution of populations is within the Algodones Dunes system and, secondarily, in the Yuma dunes in Arizona. These stands are not large in numbers of individuals, but they are significant in maintaining genetic flow between populations in California and Arizona. During 1984 surveys, 885 plants were found evenly distributed along the survey area between Interstate 8 and Drop 1 along the north side of the AAC.

Under the Desert Habitat Conservation Strategy, avoidance measures, both general and plant-specific, have been developed in order to avoid and minimize impacts from O&M and construction activities. Plant-specific measures include pre-construction surveys, prohibiting surface disturbance within a prescribed radius of the subspecies if it is found within the project area, and transplanting individuals if impacts are unavoidable and transplanting is deemed appropriate by USFWS and CDFG (see Appendix C for a full listing of measures). General measures include familiarizing workers on covered plant species likely to be encountered within the right-of-way and instructing them to avoid injuring or uprooting plants. IID also will restore any native vegetation temporarily impacted by construction and compensate for unavoidable and permanent impacts to vegetation by acquiring or granting a conservation easement on land at a 1:1 ratio for the acreage impacted.

3.6.6.13 Wiggin's Croton

Potential habitat for Wiggin's croton occurs in the creosote scrub and dune habitats in the Algodones Dunes within the AAC right-of-way. Several populations of the species have been found in and near the AAC right-of-way; and results of a 1993 survey by IID and Reclamation indicated occurrences of this species within the high dunes system as well as isolated populations in the smaller dunes. During surveys of the dunes system, 338 individuals were observed within the canal right-of-way.

Avoidance measures, general and plant-specific, have been developed in order to avoid and minimize impacts from O&M activities. Plant-specific measures include pre-construction surveys, prohibiting surface disturbance within a prescribed radius of the species if it is found within the project area, and transplanting individuals if impacts are unavoidable and transplanting is deemed appropriate by USFWS and CDFG (see Appendix C for a full listing of measures). General measures include familiarizing workers on covered plant species likely to be encountered within the right-of-way and instructing them to avoid injuring or uprooting plants. IID also will restore any native vegetation temporarily impacted by construction and compensate for unavoidable and permanent impacts to vegetation by acquiring or granting a conservation easement on land at a 1:1 ratio for the acreage impacted.

3.6.6.14 Giant Spanish Needle

In California, this species is restricted to southeastern Imperial County, where it is primarily found in the Algodones Dunes System. Potential habitat for the species occurs where the AAC traverses the Sand Hills and the Algodones Dunes. In 1994, Reclamation and IID conducted special-status plant surveys, and identified 2,908 individuals in the corridor to the west of Interstate 8, and 787 individuals in the area east of Interstate 8. The giant Spanish needle is not considered to be endangered, but the species is under potential threat from military activities; off-road vehicle use; habitat degradation; and direct impacts resulting from infrastructure improvements (highways and utilities), and quarry and stockpile operations.

As with the other plant species covered under the Desert Habitat Conservation Strategy, avoidance measures, both general and plant -specific, have been developed in order to avoid and minimize impacts from O&M activities (see Appendix C for a full listing of measures). Under the HCP, the giant Spanish needle would be protected through a combination of measures. Plant-specific measures include pre-construction surveys, prohibiting surface disturbance within a prescribed radius of the species if it is found within the project area, and transplanting individuals if impacts are unavoidable and transplanting is deemed appropriate by USFWS and CDFG (see Appendix C for a full listing of measures). General measures include familiarizing workers on covered plant species likely to be encountered within the right-of-way and instructing them to avoid injuring or uprooting plants. IID also will restore any native vegetation temporarily impacted by construction and compensate for unavoidable and permanent impacts to vegetation by acquiring or granting a conservation easement on land at a 1:1 ratio for the acreage impacted.

3.6.6.15 Sand Food

The sand food is a perennial root parasite that occurs on sand dunes or in sandy areas in association with creosote scrub below 650 feet. Potential habitat for the species occurs in the creosote scrub and dune habitats along the AAC right-of-way, and populations of the sand food are found within the Algodones Dunes system. The species was observed near the proposed AAC parallel canal during 1994 surveys; 208 individuals were found in the corridor to the west of Interstate 8, and 363 individuals were found east of Interstate 8. This species is considered rare throughout its range, and is limited by the availability of suitable habitat and host plants, both of which have been reduced in extent or degraded by various land uses, including military and recreational vehicular activities, bulldozing and clearing of native dune vegetation, agriculture, and invasion of dunes by nondune species.

Under the HCP, the sand food would be protected through a combination of general and plant-specific avoidance measures. Plant-specific measures include pre-construction surveys, prohibiting surface disturbance within a prescribed radius of the species if it is found within the project area, and transplanting individuals if impacts are unavoidable and transplanting is deemed appropriate by USFWS and CDFG (see Appendix C for a full listing of measures). General measures include familiarizing workers on covered plant species likely to be encountered within the right-of-way and instructing them to avoid injuring or uprooting plants. IID also will restore any native vegetation temporarily impacted by construction and compensate for unavoidable and permanent impacts to vegetation by acquiring or granting a conservation easement on land at a 1:1 ratio for the acreage impacted.

3.7 Species-specific Conservation Strategies

3.7.1 Burrowing Owls

Burrowing owls commonly inhabit the earthen banks of agricultural canals and drains in the HCP area. Drain and canal maintenance activities have the potential to affect burrowing owls. These routine activities can trap owls in their burrows or injure individuals. Construction activities such as reservoir construction and canal structure projects can adversely affect burrowing owls in similar ways. If concentrated near an occupied burrow, construction activities also can disturb owls and potentially lead to nest abandonment.

Although individual owls can be at risk to injury or disturbance, maintenance activities are ultimately beneficial to owls. Burrowing owls require sparsely vegetated areas with friable soil suitable for burrowing by burrowing mammals. Drain and canal maintenance activities create these conditions as vegetation is removed and friable soils are maintained. The high availability of suitable burrow locations provided by the drains and canals, adjacent to foraging habitat provided by the agricultural fields contributes to the maintenance of a high population of owls in the Imperial Valley. As such, the BOCS focuses on continuing the activities that provide suitable habitat conditions for burrowing owls, while minimizing the potential to take individuals. The overall biological goal of the BOCS is to maintain a self-sustaining population of burrowing owls across the current range of the owl encompassed by the HCP area. The specific objective is to maintain adequate burrow availability and community parameters (e.g., burrowing mammals, foraging habitat), to the extent that IID can influence these parameters, at levels to support the initial distribution and relative abundance of owls on lands covered by the HCP and affected by the covered activities. The specific actions that IID will undertake to achieve this objective are detailed below. These measures apply throughout the HCP area, including the rights-of-way of the AAC, East Highline and Westside Main Canals.

Owl – 1. *IID will implement a worker education program. Workers responsible for drain cleaning or conveyance system maintenance will be required to attend a worker education program to ensure proper implementation of the HCP measures addressing burrowing owls. Workers will be instructed on the requirements of the HCP within six months of issuance of the incidental take permit. The worker education program will be conducted at least annually to ensure instruction of new employees and as a refresher. For new workers, IID will ensure that they are informed of and understand the HCP requirements prior to conducting drain cleaning or conveyance system maintenance activities either individually or through the annual education program.*

- *The worker education program will instruct workers on the identification and habitat use of burrowing owls. Workers will be instructed to exercise care when operating in areas inhabited by burrowing owls so as to avoid injuring owls. Workers will be required to report any observations of dead or injured burrowing owls.*
- *The worker education program also will provide instruction on drain cleaning procedures required by the HCP (see Owl – 2 and Owl - 3) and procedures for conducting conveyance system maintenance (see Owl – 4 and Owl – 5). A worker education manual will be prepared and distributed to each person conducting drain cleaning or conveyance system maintenance activities. The manual will include a photograph/drawing of a burrowing owl and brief information on its identification. The manual also will summarize the HCP's requirements for drain cleaning and conveyance system maintenance for easy reference. Concurrence of the manual will be gained from the USFWS and CDFG. The manual will be reviewed annually and updated as appropriate.*

The primary concern for burrowing owls relates to O&M activities. The effectiveness of avoidance and minimization measures (Owl –2, Owl – 3, Owl – 4, and Owl – 5) will depend on workers being able to recognize burrowing owls and understand the requirements of the HCP with respect to burrowing owls. A worker education program is critical to ensuring that measures are implemented properly and the benefits to burrowing owls are realized.

Owl – 2. *Immediately prior to initiating drain or canal cleaning operations, the equipment operator will make a visual inspection of banks to identify burrows in the section to be cleaned. The equipment operator will look for burrows from the side of the drain/canal opposite the side where the equipment will be operated. The location of burrows will be indicated with paint or other temporary method for reference*

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during drain cleaning. All burrows of suitable size for burrowing owls will be identified and avoidance measures followed regardless of use by burrowing owls. In conducting drain/canal cleaning,

- *The operator will avoid collapsing or filling burrows.*
- *The operator will exercise care in removing sediment from the drain/canal and depositing spoils on the bank so as to avoid moving the excavator bucket directly over a burrow.*

The HCP Implementation Biologist and maintenance workers will work together to develop standard operating procedures for drain and canal cleaning. The standard operating procedures will be developed within one year of issuance of the incidental take permit and refined and updated based on monitoring results (see Chapter 4). Workers will be instructed in the standard operating procedures through the worker education program (Owl – 1).

To minimize the potential for drain and canal cleaning activities to impact individual owls, the workers conducting this maintenance will inspect areas to be cleaned and avoid burrows during their cleaning operations. The primary concern for drain and canal cleaning activities is the potential for an occupied burrow to be filled or collapsed resulting in entrapment of owls in the burrow. Drain and canal cleaning activities have the potential to fill or collapse burrows if vegetation and soil are removed in the immediate vicinity of the burrow or if sediment falls from the bucket as the excavator operator swings the bucket from the drain bottom to the drain bank. Under this measure, these potential effects will be avoided or minimized. All burrows, regardless of occupancy by owls, will be treated in this manner, thus avoiding impacts to owls inhabiting the burrows at the time of drain or canal cleaning and maintaining the availability of burrows for future use.

As part of the worker education program (Owl – 1), workers will be instructed on the identification of owls and their burrows as well as standard operating procedures for drain and canal cleaning developed under Owl - 2. The worker education program will ensure that workers can identify burrows suitable for burrowing owls, understand the requirements under Owl-2, and know the proper techniques for cleaning drains and canals in areas supporting burrowing owls.

Owl – 3. *When grading spoils from drain or canal cleaning, the soil to be graded will first be rolled away from the channel and broken up into small clods and slowly rolled back towards the channel. Care will be taken to not roll the soil back down the slope.*

When drains and canals are cleaned, the spoils are deposited on the roadway adjacent to the drain or canal. After the spoils have dried, they are graded to a level surface. Owls inhabiting burrows in the drain bank can be trapped in their burrow if the spoils are allowed to roll down the drain bank and block the burrow entrances. This measure reduces the potential for this impact to occur. Workers conducting the drain or canal cleaning will be instructed (Owl – 1) in the appropriate techniques for grading spoils as part of the worker education program.

Owl – 4. *Burrows in drain and canal banks will be left undisturbed where they do not compromise the integrity of the channel embankment or channel lining. When burrows must be filled to maintain the integrity of the channel, the corrective actions will be conducted during October through February. Prior to filling a burrow, the HCP Implementation Biologist will ensure that owls are not present in the burrow by using one of the techniques detailed in Appendix D.*

In the HCP area, burrowing owls often inhabit burrows in canal banks behind concrete lining on the canals. If burrows become large, they can weaken the concrete lining or the canal embankment and ultimately cause lining failures and leaks in the canal. Similarly, drain embankments can be weakened by burrows. IID fills in burrows to prevent the development of leaks and more costly repairs as part of its O&M activities on the conveyance and drainage system. Under this measure, IID will allow burrows to persist in canal and drain banks as long as they do not jeopardize the integrity of the lining or embankment. As part of the worker education program (Owl – 1), workers will be instructed on the conditions under which a burrow poses a threat to a channel's integrity and when burrows do not pose a threat and, therefore, are to be left undisturbed. Through this measure, IID will reduce impacts of conveyance and drainage system maintenance activities on owls and burrow availability, and promote persistence of burrowing owls in the HCP area.

Owl – 5. *Prior to replacing facilities or constructing new facilities, workers will coordinate with the HCP Implementation Biologist. Replacement and construction of facilities consists of installing system-based water conservation measures, rerouting drains and canals, replacing concrete lining on canals, conducting seepage maintenance, and replacing structures. The workers will inform the biologist of the location and type of work required and work with the biologist to schedule the work. The biologist will determine if burrows occupied by burrowing owls would be filled or collapsed by the required work. If occupied burrows would be affected, the work will be scheduled to occur during October through February. Prior to conducting the work, the HCP Implementation Biologist will ensure that owls are not present in the burrow by using one of the techniques detailed in Appendix D. If no occupied burrows are found, the burrows will be made inaccessible to owls and work can proceed at any time.*

In the HCP area, burrowing owls often inhabit burrows in canal embankments or in association with structures required to convey irrigation and drainage water. Sections of concrete lining need to be replaced to prevent or repair leaks and to maintain the smooth flow of water. When leaks occur, embankments need to be cored and new material added to repair the embankment. Structures need to be replaced periodically to maintain proper functioning of the conveyance and drainage systems. Burrows can be filled in conducting these actions and owls occupying burrows in these areas can be killed or injured.

Other covered activities that could fill or collapse burrows and impact owls are:

- Installation of canal lining
- Installation of lateral interceptors and reservoirs
- Installation of seepage recovery systems
- Canal rerouting
- Drain rerouting

As explained below, these activities are expected to have only minor effects on burrowing owls.

About 537 miles of IID's canal system are currently unlined. IID could pursue lining the unlined portions of the conveyance system during the permit term. Although lining the remaining unlined portions of the canal system could displace many owls, only 1.74 miles of canals currently have been identified for lining under the water conservation and transfer program. Rosenberg and Haley (2001) estimated the density of burrowing owls in Imperial Valley at 4.7 pairs/mile. Based on this estimate, lining 1.74 miles of canal could displace 16 owls (8 pairs) and temporarily reduce burrow availability. After the lining is completed, burrowing mammals would be expected to create new burrows along the newly lined canal and replace any burrows impacted during the lining process.

Lateral interceptors and reservoirs would be installed in agricultural fields (see Figure 1.7-5). Burrows used by burrowing owls are located along drains and canals, rather than within an agricultural field. Because the new interceptors and canals would be located in agricultural fields, the potential for impacts to burrowing owls is low. Construction of these new features could increase nesting opportunities for burrowing owls because additional canals (i.e., the lateral interceptors) would be constructed. Construction of the entire lateral interceptor system identified (see Table 1.7-3) would result in about 72 additional miles of canals. As burrows are created by burrowing mammals in the new canals, burrow availability for owls would increase.

Seepage recovery systems are contemplated along the East Highline Canal. Areas where seepage recovery systems would be installed probably provide poor habitat conditions for burrowing owls. The areas proposed for seepage recovery systems contain moist soils because of the seepage and most support dense vegetation (see Figure 2.3-6). These characteristics are not conducive to burrowing owls and no owls were observed in May 2001 when the proposed locations where visited. Thus, impacts to burrowing owls from installation of seepage recovery systems are expected to be low.

On average, IID reroutes about 0.25 miles of canal and about 0.2 miles of drains every year. In rerouting a canal or drain, the existing drain or canal is abandoned and a new drain or canal constructed. Abandonment of a canal or drain could result in the loss of burrows for owls. Assuming a density of 4.7 pairs/miles (Rosenberg and Haley 2001), about four owls (2 pairs) could be displaced by drain and canal rerouting each year. Drain and canal rerouting would not result in a permanent loss of habitat for owls. The newly constructed drain or canal sections would replace the habitat lost from abandoning canal or drain sections.

Under this measure, the HCP Implementation Biologist and workers will work closely to ensure that owls are removed from the work area prior to the start of activities and repairs are scheduled to avoid the owl's breeding period. Thus, through this measure, IID will minimize the potential for take of owls by these activities.

Owl – 6. *IID will not change its current drain and canal maintenance techniques to techniques that are not compatible with burrowing owls. IID will not implement any drain and canal maintenance techniques that may affect burrowing owl habitat beyond those currently employed without receiving concurrence from USFWS and CDFG that the new techniques are compatible with the maintenance of burrowing owl habitat.*

Currently, IID's drain and canal maintenance activities create suitable habitat conditions for burrowing owls. Burrowing owls require sparsely vegetated areas with friable soil suitable for burrowing. Drain and canal maintenance activities create ideal locations for burrows because vegetation is removed and friable soils are maintained through embankment maintenance. As long as IID continues to follow existing practices for maintaining the drains and canals, these features will continue to provide suitable habitat conditions for burrowing mammals that create burrows for owls. However, during the 75-year permit term, new technologies or practices for drain and canal maintenance could be developed that are not compatible with burrowing mammals or burrowing owls. Incompatible practices include those that would eliminate friable soil or sparsely vegetated conditions along the canals or drains. By committing not to employ techniques that would reduce the availability or suitability of drains and canals for burrowing mammals, IID will perpetuate the conditions that make the HCP area favorable for burrowing owls. In the event that alternative drain and canal maintenance techniques or technologies become available during the term of the permit, IID will seek concurrence from USFWS and CDFG that the new techniques are compatible with maintaining habitat for burrowing mammals and burrowing owls. This will give IID the opportunity to take advantage of more efficient techniques and technologies in the future and provide USFWS and CDFG with the ability to ensure that maintenance techniques remain compatible with the biological objectives for burrowing owls.

Owl – 7. *IID will conduct a demographic study of burrowing owls in the HCP area. The demographic study will be initiated after relative abundance and distribution surveys have been completed for the entire HCP area (see Chapter 4) and will continue for 12 to 15 years. The HCP Implementation Team will develop the study design and duration for the demographic study in consultation with a statistician.*

IID has been delivering water to farmers in the Imperial Valley and maintaining its drainage and conveyance system for over 75 years. The Imperial Valley supports one of the highest densities of burrowing owls and supports much higher densities than in nearby native desert habitat (Rosenberg and Haley 2001). These observations suggest that the high density of burrowing owls is a consequence of agriculture in combination with IID's drainage and conveyance system operation and maintenance. The burrowing owl population has persisted in the Imperial Valley for many years. Agriculture and IID's activities have made positive contributions to this persistence.

With this measure, IID will conduct a demographic study to assess the status of the burrowing owl population in the HCP area. Under the demographic study, several areas within the HCP area will be intensively studied. The specific areas will be identified following results of the first complete relative abundance and distribution survey (see Chapter 4). The HCP Implementation Team will develop the final study design to develop a life table and annual growth rate (λ). The results of the demographic study will be used in the monitoring and adaptive management program (see Chapter 4).

Owl – 8. *For activities that would permanently eliminate burrows suitable for burrowing owls as determined by the HCP Implementation Biologist, IID will determine if owls are currently using burrows that would be impacted. If owls are not using burrows that would be impacted, the burrows will be made inaccessible to owls and the activity may proceed at any time. If owls are using burrows that would be impacted, IID will conduct the activity during October through February and prior to the start of the activity, the HCP Implementation Biologist will ensure that owls are not present in the burrows using one of the methods described in Appendix D. For every impacted burrow regardless of whether owls are currently using the burrows, IID will install two replacement burrows in areas deemed appropriate by the HCP IT.*

Covered activities with the potential to permanently eliminate burrows include:

- Converting an open drain into a pipeline drain
- Constructing control houses as part of facility automation
- Developing facilities to support fishing, wildlife viewing, picnicking, and related activities at IID facilities

Most of IID's drainage system consists of open drains. Burrowing owls commonly inhabit the inside banks of the drain. At a farmer's request, IID will install a pipeline to carry drain water thereby allowing the farmer to use the land occupied by the drain. Installing a pipeline to carry drain water eliminates existing burrows in the drain banks and prohibits the development of burrows in the future. Very little of the drainage system is in pipes, and minimal additional piping of drains is anticipated over the term of the permit.

As part of its system improvements, IID will automate operation of various structures. Automation includes construction of a control house and a surrounding gravel access and parking area. Less than a 1-acre area is disturbed for construction of these facilities. If burrows occur in the footprint of the control house and access/parking areas, they would be permanently lost as burrowing mammals could not recreate burrows within the footprint. In this event, the loss of burrows would be mitigated according to Owl – 8. However, construction of control houses is not anticipated to eliminate burrows or to impact burrowing owls because 1) IID will have flexibility in the exact location of the facilities and therefore will be able to avoid areas inhabited by owls, and 2) the facilities will be located outside of the embankments of the canals and drains and thereby avoid where most of the owl burrows occur.

Construction of recreational facilities also could result in the permanent loss of burrows. IID does not currently plan to construct additional recreational facilities but could do so over the term of the HCP. Potential new recreational facilities would be associated with IID's facilities and would consist of very small structures such as picnic tables, information kiosks, and restroom facilities. Furthermore, IID would have flexibility in locating new facilities or projects and would locate and design recreational facilities so as to avoid impacts to owls. If new recreational facilities cannot be situated to avoid owl burrows, the loss of burrows would be mitigated according to Owl – 8.

Under this measure, IID commits to taking actions to avoid, minimize and compensate the potential effects to burrowing owls from activities that could reduce the availability of burrows. If occupied burrows will be impacted, IID will conduct the activities outside of the breeding season and remove owls from the burrows that would be impacted prior to initiating the activities. IID also will create two replacement burrows for every impacted burrow as recommended in the CDFG Staff Report on Burrowing Owl Mitigation (CDFG 1995). The availability of suitable burrows is generally believed to be a limiting factor for burrowing owls although burrow availability as a limiting factor has not been investigated in the Imperial Valley. By replacing burrows that would be impacted, IID will provide alternate habitat for displaced owls. Burrowing owls are known to use artificial nest burrows at the Salton Sea NWR (Gervais et al. 2000), and therefore owls would be expected to colonize replacement burrows created by IID.

Owl – 9. *IID will implement a farmer and public education program on burrowing owls. Periodically, IID will include information on burrowing owls in water bills to farmers. The materials will provide information on the ecology and habitat use of burrowing owls, the benefits to farmers of burrowing owls in controlling agricultural pests, and farm management practices that are beneficial and detrimental to burrowing owls. IID also will make materials on burrowing owls available to the public and will take advantage of opportunities to conduct public outreach programs on burrowing owls. These materials will be prepared and distribution initiated within 1 year of issuance of the incidental take permit.*

In addition to the canals and drains maintained by IID, burrowing owls inhabit burrows along delivery ditches on private agricultural lands and use agricultural fields for foraging. By educating farmers on the benefits of burrowing owls in controlling agricultural pests and of farm management practices that are beneficial to owls, IID will contribute to the overall maintenance of burrowing owls in the HCP area. Educating the public also will contribute to maintenance of burrowing owls. For example, in Florida, Milsap and Bear (2000) found a decrease in nest failures due to harassment following implementation of a burrowing owl education program in the public schools.

3.7.1.1 Effects on Burrowing Owls

Haug et al. (1993) reported that burrowing owls have declined in abundance throughout most of their range. In the western states, 54 percent of 24 jurisdictions reported burrowing owl populations decreasing, and there were no reported increases. More recent analyses suggest that burrowing owl populations in western and midwestern portions of North America have been increasing (Sheffield 1997). Based on breeding bird survey data, the burrowing owl population in the midwestern and western portion of the U.S. has increased about 2 percent during 1980 to 1994. During the same period, the western states showed a 4.2 percent increase, with the population in California increasing by 6.3 percent.

The trend in burrowing owl populations in California estimated from breeding bird surveys contrasts with findings of DeSante and Ruhlen (1995). They reported the results of surveys for burrowing owls conducted throughout California except for the Great Basin and desert areas during 1991 to 1993. The surveys indicated a 37 to 60 percent decrease in the number of breeding groups since the early 1980s with the burrowing owl being extirpated from several counties (i.e., Marin, San Francisco, Santa Cruz, Napa Ventura, and coastal San Luis Obispo) and nearly extirpated from several additional counties (i.e., Sonoma, Orange, and coastal Monterey). Development is believed to have been the primary cause of the extirpation and decline of burrowing owls in these counties. However, they also found a non-significant increase in the number of pairs of burrowing owls of 3.1 percent between 1991 and 1992 and a significant increase in the number of pairs of 19 percent between 1992 and 1993. DeSante and Ruhlen (1995) attributed their results to losses of small breeding groups, but increases in the size of large breeding groups.

Burrowing owls occur at a very high density in the Imperial Valley. The density of burrowing owls in Imperial County surpasses that of any other single county (Reclamation and SSA 2000). A high density of burrowing owls also was noted in the late 1960s (Coulombe 1971). An estimated 6,429 pairs of burrowing owls inhabit the Imperial Valley representing 69 percent of the estimated total population in California (Shuford et al. 1999). This population level translates into a density of about 236 pairs per 60 square miles (DeSante and Ruhlen 1995). For comparison, the average density of burrowing owls in other lowland areas in California was estimated at 11.9 pairs per 60 square miles (DeSante and Ruhlen 1995).

The reasons for the very high density of burrowing owls in the Imperial Valley have not been determined. In the Imperial Valley, insects are the primary prey of burrowing owls (Coulombe 1971; Rosenberg et al. 2000) and Rosenberg et al. (2000) suggested that the year-round agriculture in Imperial Valley could result in the area providing a consistently high biomass of insects. IID's extensive drain and canal system also could play a role in maintaining a high burrowing owl density in the Imperial Valley. Burrowing owls are dependent on burrows created by other agents. Rosenberg and Haley (2001) identified water seepage, muskrats and gophers as the primary agents creating burrows used by burrowing owls in the Imperial Valley. Some burrows used by burrowing owls were formed by round-tailed ground squirrels. The banks of the canals and drains are maintained clear of vegetation, creating suitable conditions for burrow construction by burrowing mammals and owls commonly inhabit canal and drain banks. Hurlbert (1997) found the greatest number of burrowing owls along drains with the least amount of vegetation, although burrowing owls were present along all of the drains surveyed.

Drain and canal maintenance activities can pose a risk to burrowing owls, such as trapping owls in their burrows. In conducting mechanical vegetation control in drains, an excavator, operated from the drain bank, is used to scrape vegetation from the side and bottom of the drain in the channel bottom. Canal embankments are maintained free of vegetation by chaining, discing, side scraping, and use of Roundup®, Rodeo®, and Direx®.

Under the HCP, IID will implement a worker education program and commit to precautions to reduce the potential for owls to be injured during maintenance operations. Although individuals could be affected by drain and canal embankment maintenance activities, the population in the Imperial Valley is expected to remain at its currently high density for several reasons. First, burrowing owls occur at high densities in the Imperial Valley concurrently with drain and canal maintenance activities and the Imperial Valley has supported a high density of burrowing owls for several decades (Coulombe 1971; DeSante and Ruhlen 1995). Second, Hurlbert (1997) found a greater number of owls along drains with little vegetation suggesting that drain maintenance activities that clear vegetation could overall be beneficial to burrowing owls. Drain banks and canal embankments free of vegetation are favorable to burrowing owls because they provide suitable burrowing locations as well as potentially reduce predation risk by eliminating cover for predators and edges where predators often concentrated foraging activities (Warnock and James 1997). Third, IID only cleans about one-fifth of its drain system a year and drain maintenance is focused in areas with accumulations of vegetation or sediment, areas less likely to support large numbers of burrowing owls than bare banks. Thus, in any given year, most burrowing owls would be unaffected by drain maintenance activities. All of these factors suggest that existing drain maintenance practices are consistent with the persistence of burrowing owls in the Imperial Valley.

IID currently maintains canal and drain embankments free of vegetation through a combination of mechanical and chemical methods. These methods create barren banks that attract burrowing mammals that subsequently create burrows that burrowing owls use. While it is currently anticipated that IID will continue to use these methods for drain and canal maintenance, new technology or techniques could be developed in the future. Under the HCP, IID will commit to not changing drain and canal maintenance practices in a manner that would render canal and drain embankments unsuitable for burrowing mammals and burrowing owls. By not employing drain or canal maintenance practices that are incompatible with burrowing owls, IID will ensure that suitable conditions for burrows persist in the HCP area for the term of the permit.

3.7.2 Desert Pupfish

Desert pupfish have become established in many of the drains constructed and maintained by IID that discharge directly via gravity into the Salton Sea. Although IID routinely maintains adequate drainage in these channels by removing vegetation and sediment, these drains provide the habitat conditions (e.g., water quality, food source, and aquatic vegetation) necessary to support pupfish. IID's maintenance activities, while likely necessary to maintain the habitat characteristics necessary to support pupfish, have the potential to result in the incidental take of pupfish. In addition, implementation of water conservation projects has the potential to change water quality in the drains occupied by pupfish and to adversely affect pupfish.

The biological goals of the desert pupfish conservation strategy are to maintain viable populations of desert pupfish in the HCP area. This will be accomplished by maintaining or increasing pupfish habitat in IID's drains relative to the current levels (i.e., no net loss) and to minimizing the potential for IID's drain maintenance and construction activities, and the water conservation program to result in the incidental take of desert pupfish. As previously described, these goals are augmented and supported by the Salton Sea measures designed to maintain connectivity among drain populations of pupfish and to promote recovery by establishing additional population refugia. The specific goals of the desert pupfish strategy will be achieved by implementing measures that:

- Ensure that IID will operate and maintain its drainage system in a manner that will maintain current levels of pupfish drain habitat
- Minimize the effects of potential increases in the concentration of selenium and possible other contaminants in the drainage system resulting from water conservation
- Enhance the potential for increasing the amount of pupfish habitat in areas exposed as the Salton Sea recedes
- Examine the efficacy of modifying drain maintenance activities to reduce the potential for take of pupfish and adjust maintenance activities based on the findings
- Avoid or minimize the potential for take of pupfish by IID construction activities

Pupfish – 1. *IID will operate and maintain its existing drainage system in a manner that will maintain the amount of pupfish drain habitat currently available (i.e., no net loss of pupfish drain habitat). Currently available pupfish habitat will be defined as the portion of all IID drains and their tributaries that discharge directly to the sea from downstream from the first check. IID will continue to maintain at least that amount of pupfish habitat for the duration of the term of the ITPs. IID's obligation for maintaining current levels of pupfish habitat may be reduced if the HCP IT determines that portions of the defined drain sections do not contain suitable pupfish habitat.*

Various surveys conducted by CDFG and others have recorded the presence of desert pupfish in many of IID's drains that discharge directly to the Salton Sea and their tributaries (Sutton 1999). Although not native habitat, the drains provide aquatic habitat that supports pupfish and contributes to the persistence of pupfish populations in the Imperial Valley. Desert pupfish use of habitat within the drains that discharge into the Salton Sea likely is influenced by flow, water quality, vegetation, and possibly the disturbance regime established by IID's drain maintenance activities. Pupfish populations also are influenced by interactions with exotic species. Implementation of the water conservation program has the potential to influence these factors and to adversely affect the quality of pupfish habitat in the drains.

Under this measure, IID will help ensure that the amount of drain habitat currently available to pupfish will remain unchanged relative to current conditions. IID will accomplish this by operating and maintaining its drainage system in a manner that will encourage continued use of the drains by pupfish. Although the presence of pupfish in and among these drains is sporadic and variable, all drain segments extending upstream from their direct connection with Salton Sea to the first check (Figure 3.7-1) were considered potential habitat for the purpose of this measure. Based on this definition, IID's drainage system supports 13.8 miles of drain potentially used by desert pupfish.

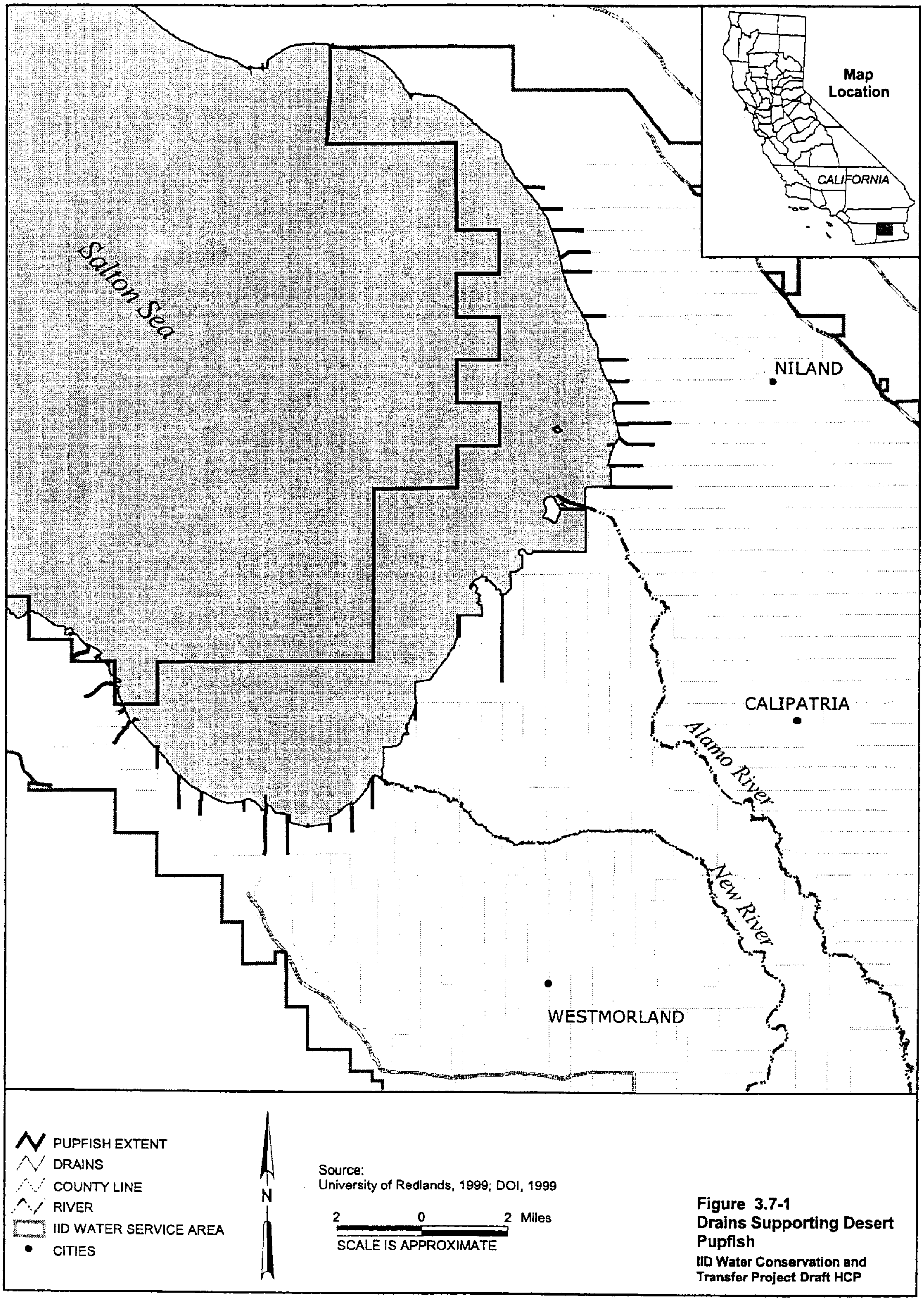

Figure 3.7-1
Drains Supporting Desert Pupfish
IID Water Conservation and Transfer Project Draft HCP

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Foraging and roosting habitat is abundant in the HCP area, but few trees are available for nesting. The native tree habitat that would be created or acquired, and preserved under the Tamarisk Scrub Habitat Conservation Strategy could provide suitable nest and perch locations for white-tailed kites. White-tailed kites will readily use lone trees adjacent to agricultural fields for nesting. Although they have not been reported to nest in the HCP area in recent years, white-tailed kites previously nested in the area. The native tree habitat created or acquired, and preserved under Tamarisk Scrub Habitat Conservation Strategy and potentially the Salton Sea Habitat Conservation Strategy could increase the likelihood that this species would breed in the HCP area again.

In addition, the Tamarisk Scrub Habitat Conservation Strategy includes measures to minimize injury or disturbance to white-tailed kites if construction activities would affect trees that kites could use for nesting. Under the Tamarisk Scrub Habitat Conservation Strategy, IID will survey areas that would be disturbed during construction to determine if any covered species, including white-tailed kites, are breeding in habitat that would be disturbed. Removal of habitat will be avoided until after the breeding season and native tree habitat created to compensate for tamarisk scrub or cottonwood-willow habitat that is permanently lost. These measures will minimize and mitigate any take of white-tailed kites as a result of construction activities.

3.4.6.9 Summer Tanager

Summer tanagers are rare in the HCP area, but have been reported in the HCP area in summer and winter. Although they have not been reported to breed in the HCP area, reports of summer tanagers in the HCP area during the summer suggest that the species could become a breeding species in the future. Summer tanagers are typically associated with mature cottonwood-willow riparian forest habitat; however, they are known to use areas supporting large tamarisk.

Tamarisk is considered poor quality habitat for summer tanagers, even though they have been reported to use it in some areas. Tamarisk is abundant in the HCP area as well as regionally. Because of the poor quality of tamarisk as habitat for summer tanagers, the abundance of tamarisk, and the apparent low level of use of the HCP area by summer tanagers, it is unlikely that the minor reduction in the amount of tamarisk scrub expected in the Imperial Valley would substantially affect or result in take of summer tanagers.

Summer tanagers could benefit from the creation or long-term protection of native tree habitat under the Tamarisk Scrub Habitat Conservation Strategy and potentially the Salton Sea Habitat Conservation Strategy. The native tree habitat would consist of cottonwoods, willows, mesquite, and other plant species typical of southwestern riparian areas. Native riparian habitat is preferred by summer tanagers and the decline in this habitat type is believed to have been the primary cause of declines in this species. The current level of use of the HCP area by summer tanagers would be expected to continue and potentially increase, particularly if breeding pairs were attracted to native tree habitat created or acquired and preserved under the Tamarisk Scrub Habitat Conservation Strategy.

In addition, the Tamarisk Scrub Habitat Conservation Strategy includes measures to minimize injury or disturbance to summer tanagers if construction activities would affect habitat that summer tanagers use for nesting. Under the Tamarisk Scrub Habitat Conservation Strategy, IID will survey areas that would be disturbed during construction to determine if any covered species, including summer tanagers, are breeding in habitat that would be disturbed. If summer tanagers are found likely to be breeding in affected habitat, removal of habitat will be avoided until after the breeding season. Native tree habitat also will be created to compensate for tamarisk scrub or cottonwood-willow habitat that is permanently lost. These measures will minimize and mitigate any take of summer tanagers as a result of construction activities.

3.4.6.10 Vermilion Flycatcher

Vermilion flycatchers are known to occur within the HCP area, but are considered rare (Shuford et al. 1999). Although, the species is thought to have bred in the HCP area at one time, no nesting populations are currently known. Historically, vermilion flycatchers were associated with native riparian plant communities. However, unlike some other riparian habitat associates, vermilion flycatchers have come to exploit non-native habitats such as common reed and tamarisk supported in agricultural drains. Thus, they could be disturbed by drain O&M activities. The minor potential loss of tamarisk scrub habitat in the Imperial Valley is unlikely to adversely affect vermilion flycatcher because of its low quality and abundance in the HCP area.

IID has and will continue to conduct O&M activities of the drains. The vegetation currently supported in the drains is a product of these maintenance activities. Although conservation activities could reduce the amount and quality of water in the drains, this potential reduction is not expected to result in a substantial change in the extent and characteristics of vegetation in the drain. Thus, the drains would continue to support habitat for vermilion flycatchers at a level similar to existing conditions.

The Tamarisk Scrub Habitat Conservation Strategy and potentially the Salton Sea Habitat Conservation Strategy include creation or acquisition of native tree habitat. This created habitat would have a similar species composition and structure as the native riparian habitat historically used by vermilion flycatchers. The created native tree habitat would provide higher quality habitat that could be used instead of or in addition to the vegetation supported by the drains.

Under the Tamarisk Scrub Habitat Conservation Strategy, construction in potential breeding areas would be avoided during the breeding season and any loss of breeding habitat caused by construction activities would be mitigated through creation of native tree habitat. This component of the Tamarisk Scrub Habitat Conservation Strategy would minimize the potential for take of vermilion flycatchers. Overall, implementation of the HCP would not have adverse effects on vermilion flycatchers and could have beneficial effects.

3.4.6.11 Harris' Hawk

Historically Harris' hawks bred at the south end of the Salton Sea, but have not been reported in the HCP area in recent years. Harris' hawks occur in desert scrub dominated by saguaro, palo verde, and ironwood (*Olneya tesota*); cottonwood-mesquite forests; and semi-desert prairies. Saguaro cacti, palo verde, mesquite, and riparian trees, especially cottonwoods, are used as nest sites. Harris hawks are somewhat tolerant of human activity and will use trees in urban settings as well as utility poles. They are not known to use tamarisk.

Harris' hawks are not known to use tamarisk, thus they would not be affected by changes in the amount of tamarisk scrub potentially resulting from the covered activities. They could,

Pupfish – 2. *IID will operate and maintain its drain channels in a manner that minimizes the effects of water conservation on water quality. Based on the findings of studies to determine the effects of selenium on pupfish conducted by the USFWS or others, IID will work with the HCP Implementation Team to determine the best means for managing its drain channels to minimize potential selenium effects on pupfish. Measures to be adopted by IID may include: splitting combined drain channels (drain/operational water) to improve water quality, providing limited biological treatment, including use of discharge from managed marsh mitigation habitat, and consolidating channels and blending flows.*

Selenium is a naturally occurring constituent of Colorado River water that is concentrated in drain water by evaporation and transpiration in the Imperial Valley prior to discharge into the Salton Sea. Implementation of the water conservation project has the potential to influence the concentration of selenium and other contaminants in the drains occupied by desert pupfish. Under an option where fallowing is used as the mechanism for conserving water, selenium concentrations are projected to decrease on average in the pupfish drains from a baseline concentration of 4.8 ppb to 4.61 ppb (see *Water Quality* section of the IID Water Conservation and Transfer Project Draft EIR/EIS). However, water conservation options that incorporate only on-farm conservation and system improvements are projected to increase the annual average concentration of selenium from 4.8 ppb up to 6.69 ppb.

- The effects of elevated selenium concentrations on pupfish reproduction and survival have not been directly assessed, and the USFWS currently is funding a study to evaluate the effects of selenium on desert pupfish. Other future studies might also evaluate the potential effects of selenium on pupfish and identify important concentration thresholds. This measure is intended to avoid or minimize the potential for increased selenium concentrations in the drains induced by water conservation to result in the incidental take of desert pupfish.

Upon determination (as a result of the USFWS selenium study or other studies) of the effects of selenium on desert pupfish reproduction and survival, IID will work with the HCP IT to develop and implement practices to minimize the potential for incidental take of pupfish. IID has several options for reducing the selenium concentration in the drains. These practices could include splitting combined drain channels (drain/operational water) to improve water quality (Figure 3.7-2), providing limited biological treatment, including use of discharge from managed marsh mitigation habitat, and consolidating channels and blending flows. Fallowing also could be used to minimize potential increases in selenium resulting from water conservation measures.

Pupfish – 3. *IID will increase the amount of pupfish drain habitat (expressed as linear channel distance) over the term of the HCP. This will be accomplished as the Sea recedes by extending or modifying existing IID drains, creating additional drain channels, connecting pumped drains directly to the Sea, or by maintaining the suitability of naturally created drain channels. IID's financial obligation for creating and managing additional pupfish habitat will be based on the anticipated costs necessary to double the amount of pupfish habitat in the IID drains. The design, configuration, and management of these areas will be developed jointly by the HCP Implementation Team and IID, and will be developed in consideration of the specific physical characteristics of pupfish habitat (e.g., water depth and velocity, and channel width) and water quality (e.g., turbidity and selenium concentration). IID will continue to maintain created pupfish habitats for the duration of the term of the ITPs, except where maintenance is in conflict with the* *objectives of the Salton Sea Restoration Project. IID will work with the HCP IT to implement this measure.*

IID's commitment to maintain (no net loss) pupfish drain habitat in the Imperial Valley (Pupfish—1) is intended to help ensure the persistence of pupfish populations in the Imperial Valley over the term of the HCP. The requirements of Pupfish—3 focus on maintaining current habitat in those drains that discharge directly to the Salton Sea. Under various water conservation scenarios, including no action, the surface elevation of the Salton Sea is expected to decline. As the Sea recedes, land that is currently inundated will become exposed. IID's drainage system is dependent upon gravity flow to the sea, and as the sea recedes, additional channels will be created or developed to convey drain water to the sea.

IID will take advantage of the opportunity to augment the availability of pupfish habitat as the Salton Sea recedes and drains are extended. As presently projected, reductions in water surface elevation at the Sea will expose areas over which drain water will flow to the sea. Under this measure, IID will work with the HCP IT to determine the best means for facilitating and managing these drain extensions. Options for managing these channel extensions could include allowing drain water flowing from the current discharge locations to create natural channels to the sea or designing and actively creating channels. Channels allowed to extend naturally likely would meander over the exposed seabed, and should support conditions favorable for occupation by pupfish. However, some level of maintenance (e.g., vegetation control) likely would be required to retain the suitability of the habitat. Designed and constructed channels might be preferred or used in combination with unmanaged created channels.

In addition to the extension of drains that currently discharge to the Sea via gravity flow, a reduction of Sea elevation will allow IID to link directly to the Sea several large drains that are currently pumped (e.g., Vail Cut-Off and Pumice drains). These drains currently do not allow for movement of pupfish into the drain from the Sea. Connecting these drains directly to the Sea would provide pupfish with access to those pumped drains.. Since gravity drains require less cleaning than pumped drains, more vegetative re-growth would be allowed to occur in these drains after they are opened to the Salton Sea. In addition, connection to the Sea would help prevent isolation of population segments.

IID's commitment to work with the HCP IT to actively increase pupfish habitat in areas exposed by a receding Sea will be limited by the total HCP budget. IID's financial obligation for creating and managing additional pupfish habitat will be based on the anticipated costs necessary to double the amount of pupfish habitat that currently exists in the IID drains. The HCP IT will have discretion over how the creation of additional pupfish habitat will be designed and managed. The HCP IT also will be allowed to allocate portions of the pupfish habitat budget to conducting studies to better define appropriate means for creating and managing pupfish habitat.

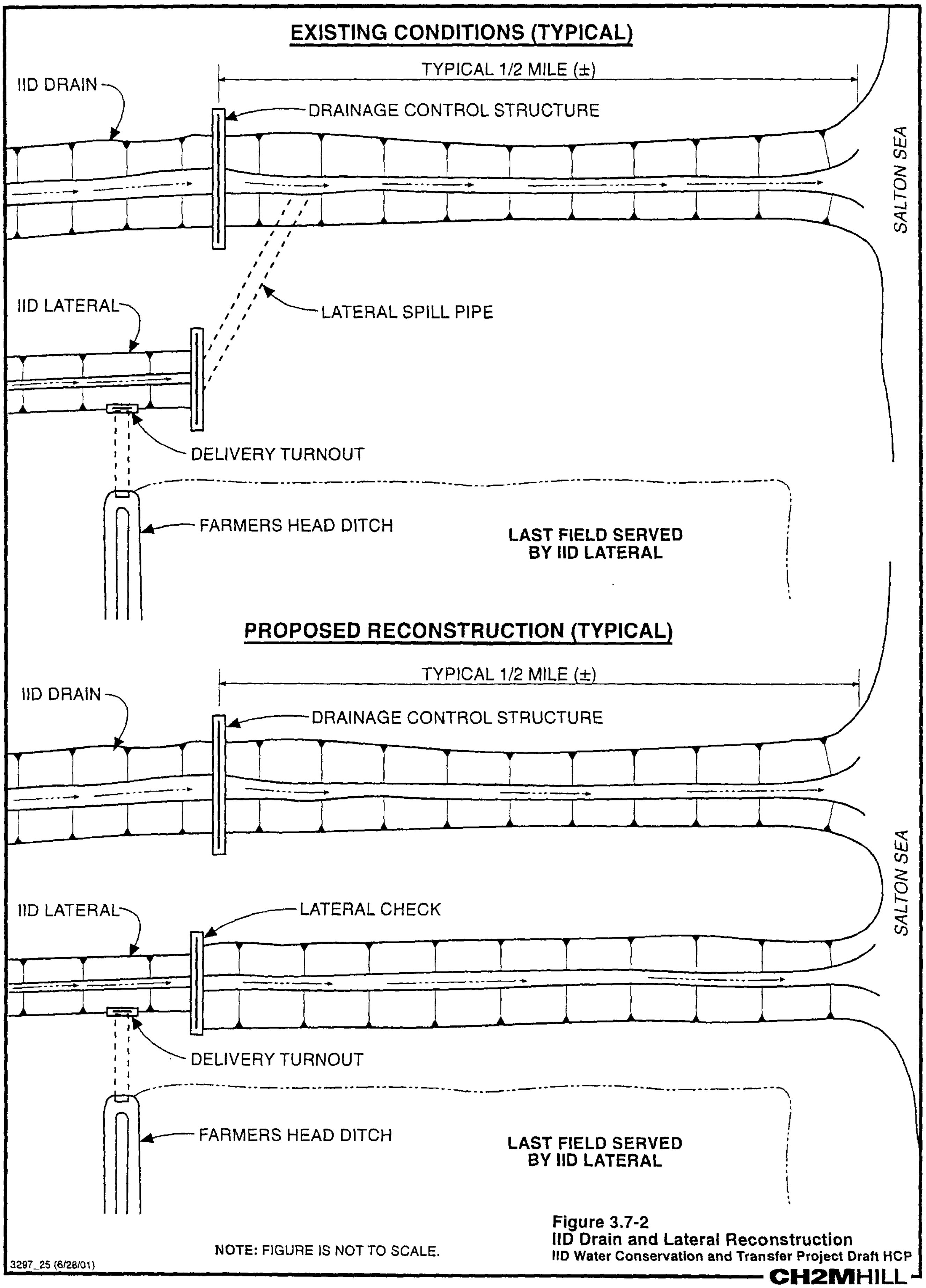

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Figure 3.7-2
IID Drain and Lateral Reconstruction
IID Water Conservation and Transfer Project Draft HCP

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Pupfish – 4. *IID will implement a study to evaluate the potential effect of routine drain maintenance on pupfish occupying the drains and to determine the efficacy of modifying maintenance practices to avoid or minimize potential take. The specific requirements of the studies will be developed by the HCP Implementation Team. In the event that the HCP Implementation Team can determine, based on the findings of the evaluation, that modification of the maintenance practices would minimize impacts to pupfish, IID will modify its maintenance practices, if practicable. Modifications in drain maintenance practices could include the timing of sediment and vegetation removal, the direction in which the drains are cleaned (i.e., upstream or downstream), and the manner in which sediment is removed from the channel (e.g., one side only).*

Desert pupfish use of habitat within the drains that discharge into the Salton Sea is influenced by flow, water quality, vegetation, and possibly the disturbance regime established by IID's drain maintenance activities. Pupfish populations also are influenced by interactions with exotic species. IID's ongoing maintenance activities and implementation of the water conservation program have the potential to influence these factors and to adversely affect the quality of pupfish habitat in the drains. While the continued long-term persistence of pupfish in IID's drains suggests that IID's drain maintenance practices (see Chapter 1 description of covered activities) are compatible with pupfish, it is possible that modification of these practices could reduce the potential for maintenance activities to take pupfish. Under this measure, IID will initiate a program to examine the effects of current drain maintenance practices on pupfish and adjust its practices based on the results of the study and the recommendations of the HCP IT. Potential modifications in drain maintenance practices could include the timing of sediment and vegetation removal, the direction in which the drains are cleaned (i.e., upstream or downstream), and the manner in which sediment is removed from the channel (e.g., one side only).

Pupfish – 5. *For construction activities (i.e., in-channel modifications) that directly affect pupfish drains, IID will gradually dewater the affected drain segment in a manner that will encourage the downstream movement of pupfish out of the affected area before construction. IID will ensure that a person qualified to capture and handle pupfish and that meets the approval of the USFWS and CDFG will be present during the dewatering process to salvage and transport any pupfish stranded in the affected portion of the drain. Prior to conducting construction activities that could result in the stranding of pupfish, IID will work with the HCP IT to develop guidelines for relocating fish. Salvaged fish will be transported to a safe location downstream of the construction site or to a location determined by the HCP Implementation Team.*

Over the term of the HCP, IID anticipates that various construction activities (e.g., reservoir construction, wetland project construction, and mitigation habitat creation) might be located in areas adjacent to drains that support desert pupfish. Although it is likely that IID will have sufficient flexibility in the siting of these construction projects to avoid impacts to desert pupfish in most situations, it is reasonable to assume that it may become necessary for IID to engage in construction activities that could affect pupfish during the term of the HCP. This measure provides a process to help ensure that potential take of desert pupfish associated with these activities is minimized.

Construction activities that require the dewatering and/or removal of drain sections have the potential to strand pupfish if access to downstream habitat is blocked or if pupfish are not given adequate time to move out of the affected site. To avoid this potential, IID will dewater the affected portion of the drain channel in a manner that allows for the downstream movement of fish out of the construction site. IID will have a person qualified to capture and handle pupfish at the construction site during the dewatering of the drain to salvage any pupfish that do not move downstream. Salvaged pupfish will be transported and released immediately downstream of the construction site or to an alternative location specified by the HCP Implementation Team.

3.7.2.1 Effects on Desert Pupfish

Implementation of the desert pupfish conservation strategy would provide an overall benefit to desert pupfish occupying drains in the HCP area. Under the conservation strategy, the amount of habitat relative to current conditions would be maintained (Pupfish—1) or increased (Pupfish—3), and the potential for adverse effects on desert pupfish resulting from the water conservation project would be avoided or minimized (Pupfish – 2). The results of the studies that will be carried out under measure Pupfish-4 are expected to further benefit pupfish by providing the information necessary for IID to manage its drainage system in a manner that reduces the potential for incidental take and that encourages the continued persistence of pupfish in the Imperial Valley. Moreover, the possible reconfiguration of existing drains and creation of additional habitat is expected to significantly augment existing pupfish habitat in the Imperial Valley.

3.7.3 Razorback Sucker

Razorback suckers are known to occur in the All American and East Highline Canal systems. This species has also been found in an IID reservoir near Niland. The population in Imperial County is believed to be comprised of old members of a dwindling, non-reproductive, remnant stock (Tyus 1991; Minckley et al. 1991). No recruitment of wild-spawned fish occurs.

Razorback suckers in the HCP area are isolated from the main razorback sucker population in the Colorado River and its tributaries. Because they are isolated from the main population and are not known to be reproducing, razorback suckers in the HCP area are not contributing to the overall razorback sucker population. As a result, loss of these individuals would have no effect on the razorback sucker population. Although take of individual razorback suckers in the IID canals system would not impact the species' population, IID will implement measures to minimize mortality of suckers as a result of canal dewatering.

Razorback Suckers – 1. *IID will ensure that a person qualified to capture and handle razorback suckers and that meets the approval of the USFWS and CDFG will be present during the dewatering of canals to salvage and transport any razorback suckers stranded in the affected portion of the canal. Salvaged fish will be transported to the Colorado River. The HCP IT will develop a procedure for salvaging and returning fish to the Colorado River consistent with other procedures for handling razorback suckers.*

This measure was derived from measures for razorback suckers required by the USFWS in the Biological Opinion for the AAC Lining Project (USFWS 1996). By salvaging any razorback suckers found in the canal system when canals are dewatered and returning these fish to the LCR, loss of these could be avoided. If left in the canal system when the canal is dewatered, any

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suckers in the canal would certainly be lost. Under this measure, fish will be salvaged and returned to the LCR where they could contribute to the overall population.

3.8 Agricultural Field Habitat

3.8.1 Amount and Quality of Habitat in the HCP Area

Irrigated agricultural land is the dominant land cover type in the Imperial Valley, and comprises most of the HCP area. Foraging is the predominant use of agricultural fields by covered species although they are also used as resting habitats (Shuford et al. 2000). IID's Service Area encompasses approximately 500,000 acres of irrigated agriculture. The amount and types of crops grown in the HCP area varies from year-to-year and different species use different crop types. Despite this variability, a few crop types appear to be preferred by the covered species. These crops are

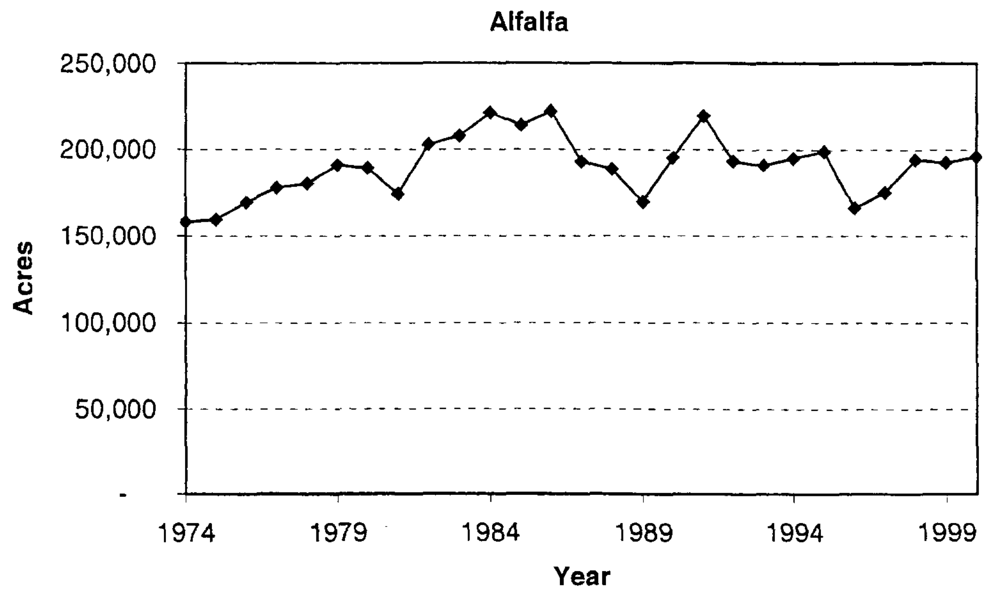
- Alfalfa
- Sudan grass
- Bermuda grass, and
- Wheat

Historically, alfalfa has been a predominant crop in the Imperial Valley, comprising about 27 to 43 percent of the agricultural acreage (Figure 3.8-1). In contrast, the amount of Sudan grass and Bermuda grass only recently has become a significant crop in the HCP area (Figures 3.8-1 and 3.8-2). In the 1970s both of these crops comprised less than 1 percent of the agricultural acreage in the Imperial Valley, but in recent years, both have exceeded 10 percent of the agricultural acreage in the valley.

3.8.2 Effects of the Covered Activities

Over the term of the permit, covered species using agricultural fields in the Imperial Valley could be directly affected by some of the covered activities. Many of the activities covered by the HCP consist of activities conducted by IID to maintain and operate its conveyance and drainage systems. These O&M activities are limited to IID's rights-of-way that are adjacent to but not within agricultural fields. As such they have very limited potential to impact a covered species. The primary activities covered by the HCP with a potential to affect species using agricultural fields are:

- Conversion of land owned by IID that is currently in agricultural production to other covered activities (e.g., creation of managed marsh habitat).



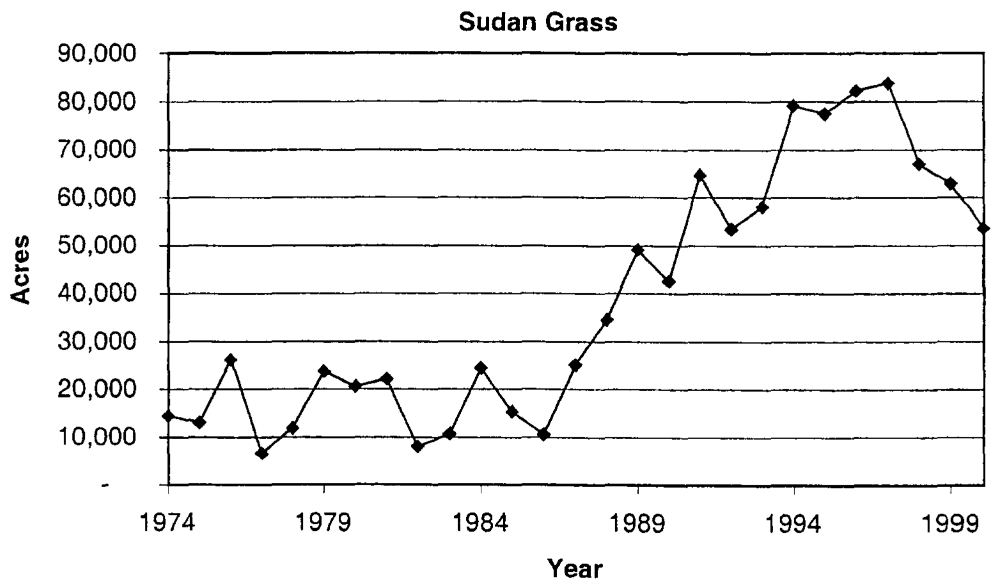
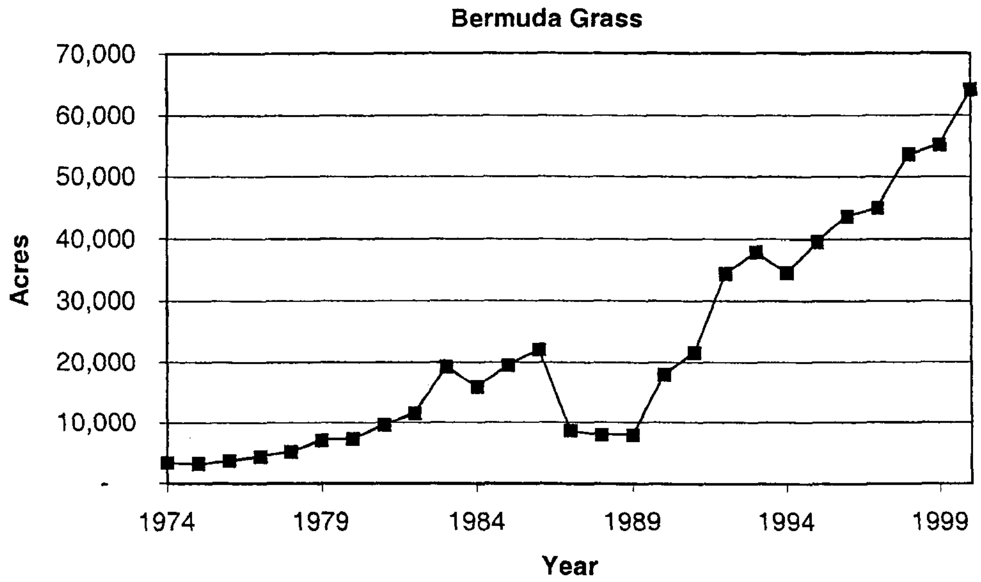


FIGURE 3.8-1
Historic Acreages of Alfalfa and Bermuda Grass in the Imperial Valley



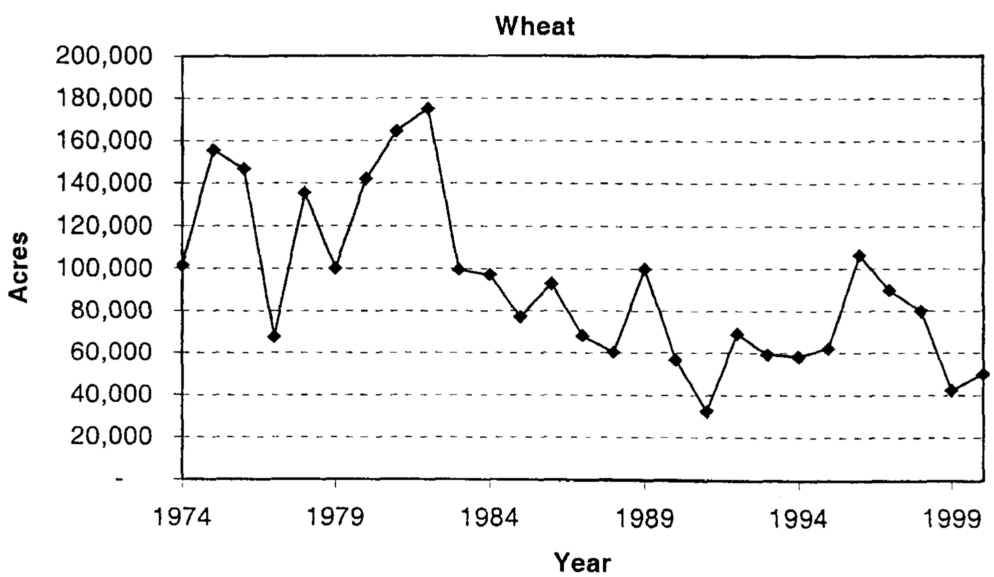


FIGURE 3.8-2
Historic Acreages of Sudan Grass and Wheat in the Imperial Valley.

- Various construction activities that could occur in or adjacent to agricultural fields.
- Water conservation measures implemented on farms, including fallowing.

In addition to these activities, depending on the Salton Sea approach followed, changes in the amount of agricultural field habitat could result from implementation of the HCP as well. Table 3.8-1 summarizes the potential effects of the covered activities on species associated with agricultural field habitat. Additional discussion of those activities with the potential to affect covered species using agricultural fields is provided in the following table.

TABLE 3.8-1
Potential Effects of Covered Activities on Covered Species Associated with Agricultural Field Habitat

Activity	Potential Effects (Positive and Negative)
Water Use and Conservation	
Combined effects of on-farm and system-based water conservation	Combined effects relate to changes in the water quantity and quality in the drains, changes in salinity in the Salton Sea and changes in the water surface elevation at the Salton Sea. Agricultural fields would not be affected by these changes.
Installation of on-farm water conservation features	Installation and operation of on-farm water conservation features could affect covered species using agricultural field habitat through disturbance as features are installed, and reduction in the amount of agricultural field habitat. Installation of tailwater return systems could result in up to 12,500 acres of agricultural land being converted to tailwater ponds. No effects to covered species from long-term changes in irrigation techniques are expected.
Fallowing	If used for water conservation, fallowing would reduce the amount of land in agricultural production and could change the availability of foraging habitat for covered species.
Installation of System-Based Water Conservation Features	
Canal lining and piping	Because canal lining activities would be performed within IID's right-of-way, no changes in the amount of agricultural field habitat would occur. Disturbance to most covered species using field adjacent to canals during the lining process would not be expected because lining would be conducted when the adjacent fields are not being irrigated. Thus, covered species would not be expected to be in areas adjacent to the construction.
Construction of new canals	IID anticipates constructing about 0.25 miles of canal each year. Because new canals would likely cross agricultural fields, about 2 acres of agricultural field habitat could be removed each year.
Lateral interceptors	IID could install 16 lateral interceptor systems. The canal and reservoirs comprising these systems predominantly would be located in agricultural fields. About 1,480 acres of agricultural field habitat could be lost if all of the systems were constructed.

20023

TABLE 3.8-1
Potential Effects of Covered Activities on Covered Species Associated with Agricultural Field Habitat

Activity	Potential Effects (Positive and Negative)
Reservoirs	IID currently does not have any reservoirs in design, but anticipates constructing up to 100 reservoirs during the 75-year permit term. These reservoirs would be 1 to 10 acres in size, with a capacity ranging from about 5 to 30 AF. It is anticipated that most of these reservoirs would be located in agricultural fields. Up to 1,000 acres of agricultural field habitat could be lost from reservoir construction. In addition to reservoirs constructed and operated by IID, farmers could construct small regulating reservoirs to facilitate the conservation of water. These 1 to 2-acre reservoirs would be constructed to better regulate irrigation water applied to fields and to settle suspended solids prior to introduction into drip irrigation systems. IID anticipates that these reservoirs could be used on up to 50 percent of the agricultural land in its service area. A single reservoir services about 80 acres of land. About 3,000 of these reservoirs could be constructed, potentially resulting in the loss of about 6,000 acres of agricultural land.
Seepage Recovery Systems	Seepage recovery systems would be installed adjacent to but not within agricultural fields. Thus, no change in the amount of agricultural field habitat would occur. There would be a minor potential for disturbance of covered species using adjacent agricultural fields during construction activities.
Operation and Maintenance	
Conveyance system operation	Conveyance system operation is limited to moving water through the canals to meet maintenance and customer needs. Other than the filling, draining and moving water through the canals, no physical effects are encompassed by conveyance system operation.
Drainage System Operation	
Rerouting or constructing new drains	IID reroutes or constructs about 2 miles of drains every 10 years. With a standard drain right-of-way, of about 80 feet, about 19 acres of agricultural field habitat could be impacted every 10 years.
Piping drains	Over the 75-year term IID anticipates that about 50 miles of open drains would be pipelined. If the land formerly occupied by the open drain is farmed, an additional 485 acres of agricultural habitat could be supported as drains are piped.
Inspection activities	Potential effects of inspection activities would be limited to a minor potential for disturbance of covered species if they occur in the vicinity of structures at the time of inspection.
Canal lining maintenance Right-of-way maintenance Embankment maintenance Erosion maintenance Seepage maintenance Structure maintenance Pipeline maintenance Reservoir maintenance Sediment removal Vegetation control	These activities are limited to IID's rights-of-way along the canals and drains and around reservoirs. Because they do not extend into adjacent agricultural fields, they would not result in changes in the amount of agricultural field habitat. Effects are limited to a minor potential to disturb covered species using agricultural fields adjacent to the drain, canal or reservoir where the maintenance is being conducted.
New and Alamo River Maintenance	River maintenance activities occur in and immediately adjacent to the river channels. Because river maintenance activities do not extend into adjacent agricultural fields, they would not result in changes in the

TABLE 3.8-1
Potential Effects of Covered Activities on Covered Species Associated with Agricultural Field Habitat

Activity	Potential Effects (Positive and Negative)
	amount of agricultural field habitat. No disturbance to agricultural field habitat species would be expected.
Salton Sea dike maintenance	Salton Sea dike maintenance activities consist of replacing riprap, grooming embankments and repairing damaged sections of the dikes. Because the maintenance activities would occur on the sea side of the dikes, no change in habitat would occur with these activities and no disturbance of covered species would be expected.
Gravel and Rock Quarrying	Quarries are not located in or immediately adjacent to agricultural fields. Therefore, no impacts to covered species using agricultural fields would occur from quarrying.
Fish Hatchery Operation and Maintenance	The fish hatchery is a developed facility and does not contain habitat for covered species associated with agricultural fields.
Recreational facilities	New recreational facilities would be developed within IID's rights-of-way and therefore would not affect agricultural field habitat. Effects to covered species are limited to a minor potential to disturb covered species using agricultural fields adjacent to the rights-of-way. The HCP does not cover take of covered species by recreationists.
HCP/EIS/EIR Mitigation	Th DHCS includes construction of managed marsh. If located on agricultural lands, up to 652 acres of agricultural fields would be converted to managed marsh.
	Approach 1 of the SSCS consists of constructing and operating a hatchery and constructing 5,000 acres of ponds. Construction of the habitat would require about 50 acres and would probably be located on agricultural land. The 5,000 acres of ponds also would be constructed on agricultural fields.
	Approach 2 of the SSCS includes the option of conserving additional water (beyond that required for the water conservation and transfer program) to use to avoid changes in inflow to the sea. Fallowing could be used to generate this additional water which would reduce the amount of agricultural field habitat.
Land use changes	IID leases out about 1,169 acres of land for agricultural production. IID could convert this land to another use (e.g., managed marsh) resulting in a reduction in the amount of agricultural land.

The HCP covers conversion of land owned by IID from agricultural production to other covered uses (e.g., creation of managed marsh habitat). It does not cover other landowners that convert their lands to non-agricultural uses. Fallowing is considered an agricultural land use and fallowing by landowners in the IID service area is covered by this HCP. IID owns about 6,600 acres of land in the irrigated portion of the Imperial Valley and about 6,100 acres of land adjacent to the Salton Sea. About 1,167 acres of land leased from IID is in agricultural production (see Table 1.7-5). This land represents about 0.2 percent of the irrigated lands in the HCP area. Thus, even if all of IID land in agricultural production was converted to another use, agricultural field habitat would remain abundant in the HCP area.

System improvements that could eliminate some agricultural field habitat are construction of new canals, installation of lateral interceptors, and construction of new reservoirs. These activities could remove about 8,630 acres of agricultural field habitat over the term of the permit. Relative to the entire irrigated area of Imperial Valley that covers about 500,000 acres, this potential loss constitutes about 1.7 percent of the agricultural land. Because construction would not occur in agricultural fields under active production, the potential for disturbance of covered species using this habitat would be minor.

Farmers in the IID service area could implement a variety of measures to conserve water, including the following:

- Installing tailwater return systems
- Dividing fields into level basins
- Installing drip irrigation systems
- Shortening furrows/border strips
- Narrowing border strips
- Implementing cutback irrigation
- Laser leveling fields
- Changing field slopes to improve water distribution uniformity
- Employing cascading tailwater systems

Installation of tailwater return systems could result in a small amount of land being taken out of production to accommodate a tailwater pond. Tailwater ponds typically have about a 3-4 AF-capacity and cover 1 to 2 acres. Assuming an average farm size of 80 acres, a 2 acre tailwater return pond could eliminate about 2.5 percent of the area from agricultural production. If all farms installed tailwater systems, a 2.5 percent reduction in farmed area throughout the Imperial Valley would amount to about 12,500 acres. Farmers typically locate tailwater return ponds in the least productive portions of their fields particularly areas that are farmed irregularly such that the actual loss in agricultural field habitat likely would be less than 12,500 acres in the extreme case that all farms installed tailwater return systems. Tailwater return systems are installed when no crops are being produced, typically during the summer. Because they would be installed when no crops were being grown on the field, the potential for disturbance to covered species would be limited.

Operation of a tailwater return system requires pumping water from the tailwater pond back up to the field head. In the Imperial Valley, farmers usually use diesel-powered pumps because they are less expensive to operate. However, some farmers could use electric pumps, requiring IID to erect additional power lines to provide power to the pumps. Although the additional power lines would be short, up to 0.5 mile, and distributed throughout the valley, they could result in take, if covered bird species fly into the power lines.

Installing drip irrigation systems would require a minor amount of temporary ground disturbance, resulting in a minor potential for disturbance of covered species. Installations of drip systems would occur between crops, therefore, no temporary or permanent changes in the amount of agricultural field habitat would occur.

The remaining water conservation techniques require reconstruction/recontouring of an agricultural field. Covered species using agricultural field habitat could be disturbed during the reconstruction/recontouring. However, because reconstruction/recontouring would be conducted when no crops are being grown on the field, the potential for disturbance to covered species is limited. No change in the amount of agricultural field habitat would occur as a result of reconstruction/recontouring of agricultural fields to achieve water conservation.

While farmers would implement various water conservation practices, these practices are not expected to change irrigation practices in a manner that would reduce habitat suitability for covered species. A given crop consumes a certain amount of water. This consumptive use would not change with water conservation and a given crop would need to be irrigated at the same frequency as under existing irrigation practices. The water conservation techniques would reduce the amount of tailwater (i.e., surface water that runs off the field), not the amount of water consumed by the crops. Also, with the exception of drip irrigation systems, the water conservation techniques improve the efficiency of a surface irrigation practice, rather than change how the crop is irrigated. For example, tailwater return systems collect and store water from a flood irrigated field for use in subsequent flood irrigations. The improved efficiencies would be manifested as a reduction in the amount of water leaving the field as tailwater.

In addition to the water conservation measures discussed above, fallowing could be used to conserve water for transfer and in complying with the Inadvertent Overrun Policy. Fallowing could reduce the acreage of irrigated agriculture available in the HCP area at any one time. If only fallowing was used to generate 300 KAF of conserved water, about 50,000 acres of land would be needed. To comply with the IOP, an average of 9,800 acres of land would need to be fallowed. Combined, these acreages represents about 12 percent of the irrigated area within the IID Service Area. Even with this reduction, agricultural field habitat would remain abundant in the IID Service Area, consisting of about 440,000 acres remaining in agricultural production.

The HCP measures for the Salton Sea also could reduce the acreage of agricultural fields in active production depending on the approach selected. Approach 1 of the SSCS includes constructing and operating a hatchery to stock fish in the Salton Sea until the fish can no longer survive and grow. At that point, IID would construct 5,000 acres of ponds to continue to support fish for piscivorous birds. These ponds would be constructed on agricultural land and therefore, this approach would reduce the amount of agricultural land by a small amount.

Approach 2 of the SSCS entails generating mitigation water such there would be no change in inflow to the Salton Sea with implementation of the water conservation and transfer programs. Fallowing could be used for this water conservation. The amount of land that would need to be fallowed would depend on how water for transfer was conserved. If fallowing was used to generate all of the 300 KAFY of water for transfer, then about 25,000 acres of land would need to be fallowed for mitigation water. Under this scenario, a total of 75,000 acres of land would be fallowed. If on-farm and system-based measures were used to conserve 300 KAFY of water for transfer, then about 75,000 acres of lands would be needed for mitigation water.

The acreages presented above of agricultural field habitat potentially affected under the water conservation and transfer programs represent worst-case estimates for each of the covered activities and are not additive. For example, farms that fallowed land to achieve water conservation would not install tailwater return systems. The ultimate amount of agricultural land that could be taken out of production to implement the water conservation and transfer programs is uncertain because it would be influenced by the mix of water conservation measures that are implemented. Nonetheless, any change in the amount of agricultural land would be within the ranges presented above.

3.8.3 Approach and Biological Goals

The biological goal of the agricultural field conservation strategy is to maintain agriculture as the primary economic enterprise in IID's Service Area to continue to provide foraging habitat for covered species associated with agricultural field habitat. This goal is to be achieved by implementing the water conservation and transfer programs for the IID/SDCWA Water Transfer Agreement and the QSA, and this HCP. Species that exploit agricultural habitats would continue to be supported with implementation of water conservation and transfer programs and HCP because successful implementation of these programs would encourage continued agricultural production.

3.8.4 Agricultural Field Habitat Strategy

Agriculture is the primary economic enterprise within IID's service area. Agriculture in the Imperial Valley is dependent upon a secure right to divert and use Colorado River water for irrigation purposes and an efficient system of drainage. IID holds very senior water rights under priorities 3, 6, and 7 of the Seven Party Agreement, which allocates California's share of Colorado River water among California entitlement holders. For years, however, other California water agencies, including the QSA parties, have challenged the amount and use of Colorado River water diverted by IID under its senior water rights. IID also has been required to develop a conservation program, and specifically to consider water transfers, as a result of SWRCB regulatory proceedings in the 1980s, as set forth in Decision 1600 (1984) and Order 88-20 (1988).

A couple key objectives of the IID/SDCWA Transfer Agreement include (1) implementation of a water conservation and transfer program without impairing IID's historic senior-priority water rights, in a manner consistent with state and federal law; and (2) to provide a means of financing conservation measures, including environmental and other implementation costs. Thus, the water transfer program is intended to protect and preserve IID's water rights and the feasibility and economic viability of agriculture production within IID's service area. In addition, the QSA will settle, by consensual agreement, longstanding disputes among the QSA parties regarding the priority and use of Colorado River water by IID, and it will confirm IID's right to implement the water transfers specified in the QSA. Thus, the QSA will enhance the certainty and reliability of Colorado River water supplies available to IID and will assist IID in meeting demands for water for agricultural use, thus facilitating continued agricultural production.

As explained in Chapter 1, the purpose and need for the HCP stems from IID's requirement for long-term regulatory certainty in committing to the IID/SDCWA Transfer Agreement and QSA. Long-term no-surprises assurances regarding ESA compliance measures and costs are needed by IID to commit to the long-term investment obligations of the IID/SDCWA Transfer Agreement and QSA. Thus, incidental take authorization and unlisted species assurances is integral to implementing the water transfer programs, which in turn are critical to ensuring that agriculture will continue to be the primary land use in the Imperial Valley.

With a few exceptions, the covered species that use agricultural fields in the Imperial Valley would probably not occur in the Imperial Valley in the absence of agriculture. Before the cultivation of the Imperial Valley, desert habitat predominated and supported wildlife species associated with this habitat. With agricultural production, the Imperial Valley attracted wildlife capable of exploiting this new resource and with a tolerance for regular human activity. The continued use of the Imperial Valley by these species depends primarily upon the perpetuation of agricultural production. The regulatory certainty provided by the incidental take authorization and assurances obtained with implementation of the HCP combined with implementation of the water transfer programs would increase the likelihood that agricultural production will remain the predominant land use in the HCP area.

Although the primary concern for covered species associated with agricultural field habitat is the persistence of agriculture in the Imperial Valley, a potential for covered bird species to be killed or injured by powerlines associated with pumps for tailwater return systems was identified. Under the HCP, IID will implement the following measure to minimize this potential impact.

Agriculture – 1. *If IID builds additional power lines to provide power to pumps to run tailwater return systems, IID will install markers (e.g., flagging, balls, discs) on the new power lines to alert birds to the presence of the power lines.*

3.8.5 Effects on Habitat

3.8.5.1 Direct Effects of the Covered Activities

Implementation of the water conservation and transfer programs could result in a reduction in the amount of land in agricultural production at any one time. The amount of agricultural land affected would depend on the mix of water conservation techniques. To conserve water for transfer, fallowing could result in up to 50,000 acres of agricultural land being taken out of active production for one or more seasons. Other conservation techniques would result in a substantially smaller reduction in the acreage of agricultural land. With the exception of the HCP measures for the Salton Sea, other covered activities would have only minor effects on the amount of agricultural land. As described previously, depending on the approach selected for the Salton Sea, up to 75,000 acres of agricultural land could be taken out of production for fallowing for mitigation water or for 5,000 acres of ponds.

3.8.5.2 Changes in Cropping Patterns

The crops grown in the Imperial Valley are based on the decisions of individual farmers. Current and anticipated market prices are an important consideration for the farmers in deciding which crops to grow. As a result, the types and amount of crops grown fluctuate from year-to-year as is illustrated by the types and acreages of crops grown in the IID during 1974 to 2000 (Appendix E).

Historically, IID's water deliveries to farmers have ranged from about 2.4 MAFY to 3.4 MAFY, a range of 1 MAFY. Under the water conservation and transfer programs, up to 300 KAFY would be conserved. This level of water conservation is within the range of historic variability in IID's annual deliveries to farmers. Because of weather (hot), soil types (high clay content) and irrigation water quality (salinity), certain crops grow better than others in this environment and

20029

as a result, it is expected that the same crop mix will continue to be grown into the future. Thus, cropping patterns in the future would be expected to be within the range of historic variability.

3.8.6 Effects on Covered Species

Covered species potentially using agricultural field habitats in the HCP area include resident breeding species, migratory breeding species, short-term residents during winter or migration, and transient species that occur in the HCP area irregularly during migration or other wanderings. The effects of implementing the HCP on listed species (state and/or federal) associated with agricultural field habitat are evaluated for each individual species below. In addition, the effects on other species that regularly use agricultural fields in the Imperial Valley are individually evaluated. The effects of implementing the HCP on transient species are summarized in Table 3.8-2.

3.8.6.1 Mountain Plover

Mountain plover is a common winter visitor to the Salton Sea Basin. The Imperial Valley has one of the mountain plover's largest wintering populations in the Pacific Flyway. During February 1999 surveys, 2,486 individuals were counted in the valley. This number represents about half of the California population and about one quarter of the North American population.

Installation of water conservation measures in agricultural fields would not be expected to affect mountain plovers. On-farm conservation measures would be installed when crops were not being grown, primarily in the summer. Mountain plovers only occur in the HCP area during the winter and therefore, would not be in the area when this work was being conducted. Construction in agricultural fields required for other covered activities such as creation of managed marsh habitat or system-based conservation measures could occur during the winter when plovers are in the HCP area. These activities could flush birds if the construction occurred in areas used by mountain plovers for foraging.

In the Imperial Valley, mountain plovers are strongly associated with agricultural fields. Recent studies have found mountain plovers to most frequently use grazed alfalfa, and burned Bermuda grass fields. They have also been reported to forage in plowed fields and sprouting grain fields during the winter.

TABLE 3.8-2
Potential Effects to Transient Covered Species Associated with Agricultural Field Habitat

Species	Occurrence in HCP Area	Habitat Use in the HCP Area	Potential Effects of HCP
Prairie falcon	Rare migrants throughout the year	Probably visits agricultural fields and the Salton Sea shoreline to prey on shorebirds; also could occur in desert habitat	No effect expected from installation of conservation measures. Potential reduction in agricultural field habitat would not affect prairie falcons because of the small numbers of birds, the limited time period that they occur in the HCP area, and the abundance of agriculture fields and other habitats that can be used for foraging.
Golden eagle	Accidental during spring and winter	Probably visits agricultural fields and managed marshes on the state and federal refuges to prey on wintering and migrating waterfowl.	No effect expected from installation of conservation measures. Potential reduction in agricultural field habitat would not affect golden eagles because of the small numbers of birds, the limited time period that they occur in the HCP area, and the abundance of agriculture fields and other habitats that can be used for foraging.
Merlin	Rare visitor during fall and winter	Probably concentrates foraging at Salton Sea where shorebirds are abundant. Could also prey on shorebirds and songbirds using managed and unmanaged marshes, tamarisk scrub habitat, and agricultural fields.	No effect expected from installation of conservation measures. Potential reduction in agricultural field habitat would not affect merlins because of the small numbers of birds, the limited time period that they occur in the HCP area, and the abundance of agriculture fields and other habitats that can be used for foraging.
Black swift	Accidental during spring	Could use a wide variety of habitats in the HCP area.	No effect expected from installation of conservation measures. Potential reduction in agricultural field habitat would not affect swifts because of the small numbers of birds, the limited time period that they occur in the HCP area, and the abundance of agriculture fields and other habitats that can be used for foraging.
Vaux's swift	Common spring migrant; uncommon fall migrant	Known to congregate at north end of the Salton Sea during migration; could use wide variety of habitats in the HCP area.	No effect expected from installation of conservation measures. Potential reduction in agricultural field habitat would not affect swifts because of limited time period that they occur in the HCP area, and the abundance of agriculture fields and other habitats that can be used for foraging.
Purple martin	Occasional spring and fall migrant	Could use a wide variety of habitat is the HCP area.	No effect expected from installation of conservation measures. Potential reduction in agricultural field habitat would not affect purple martins because of the small numbers of birds, the limited time period that they occur in the HCP area, and the abundance of agriculture fields and other habitats that can be used for foraging.

Depending on the water conservation measures and Salton Sea approach implemented the amount of agricultural land in production could be reduced by about 15 percent. This potential reduction is not expected to adversely affect mountain plovers for several reasons. Plover abundance in the Imperial Valley does not appear to be related to the availability of preferred crop types. Bermuda grass currently is one of the most commonly used crop types by plovers. The acreage of Bermuda grass was very low in the 1970s but is currently abundant (Figure 3.8-1). During this same period, the relative abundance of mountain plovers showed no discernable trend (Figure 3.8-3). These data suggest that foraging habitat availability is not limiting and that a potential reduction in agricultural acreage would not have any effect on mountain plovers.

Plovers also show an affinity for grazed alfalfa. Sheep graze alfalfa in the Imperial Valley from October through March, approximately the period when mountain plovers are in the valley. As with crops, the number of sheep grazed in the valley (Figure 3.8-4) and hence the acreage of alfalfa grazed varies from year to year. Like Bermuda grass, mountain plover relative abundance appears unrelated to the level of sheep grazing, and hence the acreage of grazed alfalfa. Further, the amount of grazed alfalfa is not expected to change as a result of the water conservation and transfer programs. The Imperial Valley provides important winter range for sheep. As long as there is a demand for winter pasture, sheep grazing will continue in the Imperial Valley. Implementation of the water conservation programs would not change the demand for winter range. Therefore, the current availability of grazed alfalfa would not change because of the water transfer project and no adverse effects to mountain plovers would occur.

Preliminary research also suggests that plovers avoid fields being irrigated with sprinklers; the reasons for this pattern is uncertain. Implementation of the water conservation and transfer programs would not change the level of use of sprinklers for irrigation in the Imperial Valley. Sprinkler systems are primarily used to germinate seed and for cooling of young crops planted in late summer; use of sprinklers for irrigation is limited. The need to use sprinklers for germination and cooling would continue with implementation of the water conservation and transfer programs. Use of sprinklers would not increase because it is not a favorable irrigation method in desert environments due to high evaporative losses.

3.8.6.2 Swainson's Hawk

Swainson's hawks are occasional visitors to the Salton Sea area during their spring and fall migrations. They are not known to breed in the HCP area. For foraging, Swainson's hawk frequent agricultural fields. In other parts of its range, the Swainson's hawk frequents alfalfa fields and lightly grazed pasture. Similar types of agricultural fields likely are used in the Imperial Valley.

Installation of water conservation measures in agricultural fields would not be expected to affect Swainson's hawks. On-farm conservation measures would be installed when crops were not being grown, primarily in the summer. Swainson's hawks only occur in the HCP area during the spring and fall and therefore, would not be in the area when this work would be conducted. Construction in agricultural fields required for other covered activities such as creation of managed marsh habitat or system-based conservation measures could occur during periods when Swainson's hawks are in the HCP area. The occurrence of these

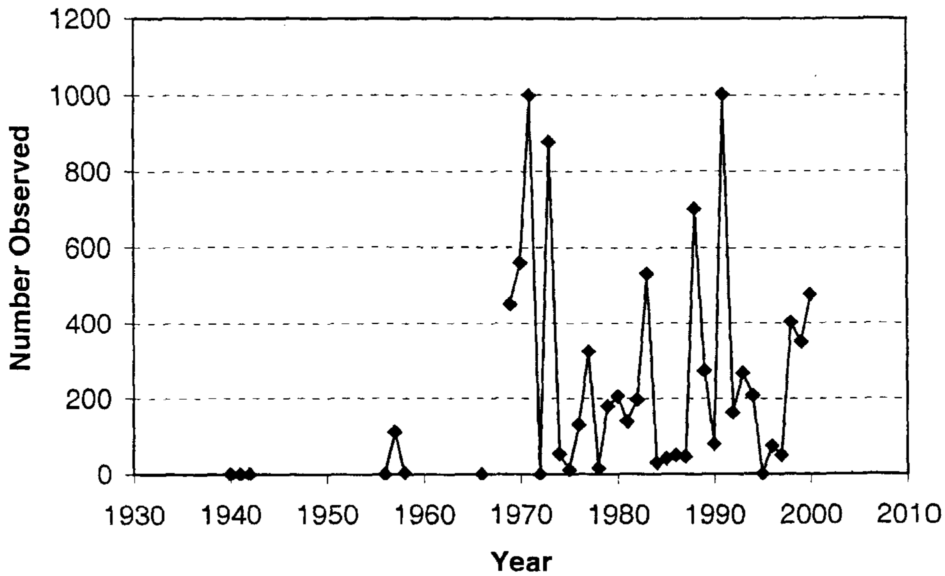


FIGURE 3.8-3
Christmas Bird Count Results for the Salton Sea (South end) for Mountain Plover.

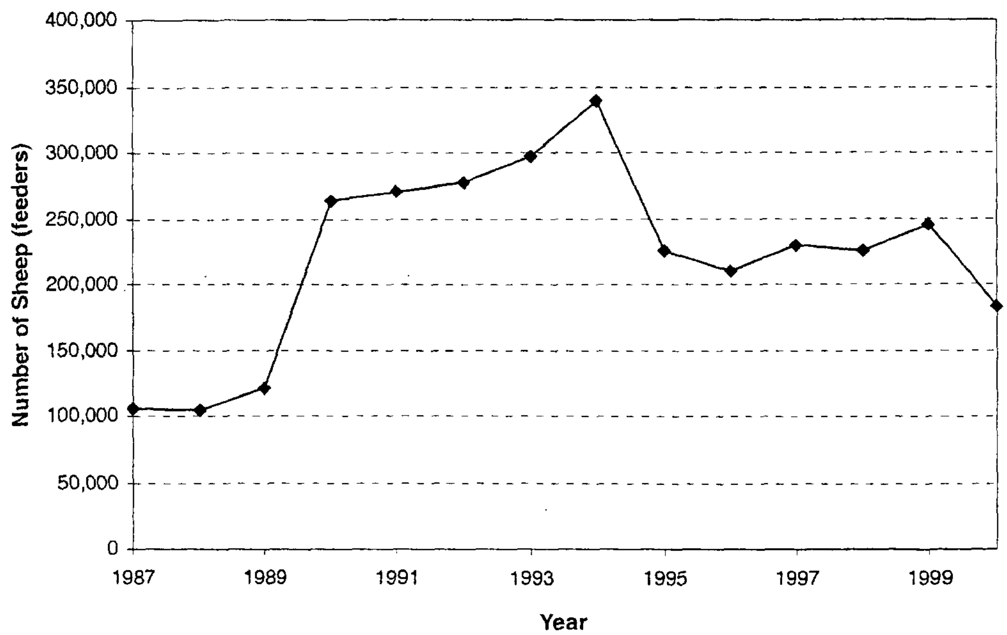


FIGURE 3.8-4
Number of Sheep Grazed in the Imperial Valley

20033

activities in agricultural fields would not affect foraging by Swainson's hawks. These hawks typically forage by spotting prey while flying and then diving to capture the prey. Because they often forage in association with operating farm equipment, they would not be disturbed by construction activities.

Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15percent. Few Swainson's hawks occur in the HCP area and those that do are there for only brief periods during their spring or fall migrations. The USFWS (1997) characterizes them as occasional visitors with normally fewer than five individuals each season (spring and fall) at the Salton Sea NWR. Swainson's hawks commonly use alfalfa fields. In the Imperial Valley, the acreage of alfalfa has varied from about 158,000 to 222,000 (i.e., 27 to 43 percent of the agricultural land in the Imperial Valley) Because of the small numbers of hawks, the limited time period that they occur in the HCP area and the abundance of agriculture fields, Swainson's hawks would not be expected to be affected by the changes in the amount of agricultural land anticipated under this HCP.

3.8.6.3 Greater Sandhill Crane

Installation of on-farm water conservation measures in agricultural fields would not be expected to affect greater sandhill cranes. On-farm conservation measures would be installed when crops were not being grown, primarily in the summer. Sandhill cranes only occur in the HCP area during the winter and therefore, would not be in the area when this work was being conducted. Construction in agricultural fields required for other covered activities such as creation of managed marsh habitat or system-based conservation measures could occur during periods when sandhill cranes are in the HCP area. Construction activities has a potential to flush birds if the construction occurred in or adjacent to areas used by sandhill cranes for foraging.

Small numbers (up to 300 individuals) of greater sandhill cranes winter in the Imperial Valley. Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15 percent. Wintering birds feed in irrigated croplands and pastures. Grains such as wheat, sorghum, barley, oats are important winter foods. The acreage of wheat in the Imperial Valley has fluctuated from 32,500 to about 175,000 acres. Sorghum, barley and oats are minor commercial crops in the Imperial Valley. Cranes have continued to winter in the Imperial Valley through this wide fluctuation in the amount of wheat. The magnitude of the potential change in the total amount of agricultural land is within the range of variability in wheat and only a portion of fallowed agricultural land, if any, would consist of crops used by cranes. Further, the state and federal refuges plant cereal grains such as wheat, rye and barley that provide foraging opportunities for cranes. Because of the small numbers of cranes, the abundance of agriculture fields, and management of lands on the refuges for grain, greater sandhill cranes would not be expected to be affected by the changes in the amount of agricultural land anticipated under this HCP.

3.8.6.4 Bank Swallow

Bank swallows are casual visitors to the HCP area, potentially occurring in the HCP area as migrants during the spring and fall. For foraging, they are not strongly associated with any particular habitat type, although they often forage near water where insects are abundant. The covered activities are unlikely to adversely affect bank swallows because of the swallow's rare occurrence in the HCP area and broad habitat use for foraging.

3.8.6.5 Short-eared Owl

Short-eared owls are rare winter visitors to the Salton Sea area, but are more common in the fall. Still, the number of owls occurring in the HCP area is small. The USFWS (1997) characterizes them as occasional visitors with normally fewer than five individuals at the Salton Sea NWR.

Short-eared owls are not expected to be affected by installation of water conservation measures in agricultural fields. On-farm conservation measures would be installed when crops were not being grown, primarily in the summer. Short-eared owls only occur in the HCP area during the fall and winter, and therefore, would not be in the area when this work was being conducted. Construction in agricultural fields required for other covered activities such as creation of managed marsh habitat or system-based conservation measures could occur during fall or winter. The occurrence of these activities in agricultural fields are unlikely to affect foraging by short-eared owls because owls primarily hunt at night when construction activities would be occurring.

Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15 percent. Only a few short-eared owls use the HCP area as wintering habitat and migrants would only occur in the HCP area for brief periods of time. Short-eared owls commonly forage in alfalfa fields but also use pasture, and marshes, and probably other grass-type crops such as wheat, Sudan grass, and Bermuda grass. In the Imperial Valley, the acreage of alfalfa has varied from about 158,000 to 222,000 (i.e., 27 to 43 percent of the agricultural land in the Imperial Valley). Because of the small numbers of owls and the abundance of agriculture fields, short-eared owls would not be expected to be affected by the changes in the amount of agricultural land anticipated under this HCP.

3.8.6.7 Aleutian Canada Goose

Aleutian Canada geese occur in the HCP area as fall migrants and winter residents where they forage in the wetland areas around the Salton Sea and in the agricultural fields throughout the Imperial Valley. The primary overwintering area for this subspecies is in the San Joaquin Valley of California and use of the HCP area is limited.

Installation of on-farm water conservation measures in agricultural fields would not be expected to affect Aleutian Canada geese. On-farm conservation measures would be installed when crops were not being grown, primarily in the summer. Canada geese only occur in the HCP area during the fall and winter and therefore, would not be in the area when this work was being conducted. Construction in agricultural fields required for other covered activities such as creation of managed marsh habitat or system-based conservation measures could occur during periods when geese are in the HCP area. Construction activities could flush birds if the construction occurred in or adjacent to areas used by Aleutian Canada geese for foraging.

Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15 percent. Wintering birds are attracted to grain fields. In the Imperial Valley, grains are commercially produced but also are grown on the refuges specifically to provide forage for wintering geese. With management of the refuges for geese and the overall abundance of agricultural fields in the Imperial Valley, Aleutian Canada geese would not be expected to be affected by the changes in the amount of agricultural land anticipated under this HCP.

3.8.6.8 Ferruginous Hawk

Ferruginous hawks regularly occur in the Imperial Valley in small numbers during the winter. This species forages in agricultural fields for small mammals such as rabbits, ground squirrels and mice. Ferruginous hawks would be expected to forage in a wide variety of crop types as long as prey were abundant and were accessible.

Installation of water conservation measures in agricultural fields would not be expected to affect ferruginous hawks. On-farm conservation measures would be installed when crops were not being grown, primarily in the summer. Ferruginous hawks only occur in the HCP area during winter and therefore, would not be in the area when this work would be conducted. Construction in agricultural fields required for other covered activities such as creation of managed marsh habitat or system-based conservation measures could occur when ferruginous hawks are in the HCP area. However, the occurrence of these activities in agricultural fields would not affect foraging by ferruginous hawks. In foraging, these hawks soar and then dive from great heights to capture prey and likely would not be disturbed by construction activities.

Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15 percent. This potential reduction in agricultural fields is not likely to affect ferruginous hawks. Even with a 15 percent reduction, the Imperial Valley would support about 425,000 acres of agricultural field habitat. Much of this acreage is expected to consist of crops favorable to foraging by ferruginous hawks (e.g., alfalfa). Given the small number of hawks and large amount of potential habitat, the few ferruginous hawks using the HCP area would have ample foraging opportunities.

3.8.6.9 Western Snowy Plover

Western snowy plovers are year-round breeding residents and winter migrants at the Salton Sea. The Salton Sea supports the largest wintering population of snowy plovers in the interior western United States and one of only a few key breeding populations in interior California (Shuford et al. 1999). For foraging, snowy plovers use the shoreline of the Salton Sea, primarily concentrated on sandy beaches or alkali flats along the western and southern shorelines. They also could forage in agricultural fields in the valley.

Because snowy plovers predominantly use mudflats and beaches adjacent to the Salton Sea, there is very little potential for activities occurring in agricultural fields to affect them. In the LCR Valley, snowy plovers have been reported to forage in plowed agricultural fields and could do so in the Imperial Valley as well. Even if they do forage in agricultural fields, the potential for the covered activities to affect this species is minimal. Foraging birds could be displaced if construction activities to install on-farm or system-based conservation measures or create managed marsh were conducted in fields where the birds were foraging. Because of their apparent preference for foraging at the Salton Sea, a potential reduction in the amount of agricultural field habitat would not be expected to reduce foraging opportunities for snowy plovers.

3.8.6.10 Black Tern

Black terns are common at the Salton Sea during the spring, summer and fall; they rarely occur at the Sea during the winter (USFWS 1997b). The Salton Sea watershed is thought to be the most important staging area for black terns in the Pacific Flyway (Shuford et al. 1999). In addition to the Salton Sea, black terns are common summer residents and migrants in Imperial Valley with up to about 10,000 individuals foraging over irrigated agricultural fields at some times (Shuford et al. (1999).

Installation of water conservation measures in agricultural fields and construction of system-based conservation measures or managed marsh would not be expected to affect black terns. Black terns are attracted to agricultural fields during irrigations when insects are displaced and are easy to capture. Construction activities would not be conducted while the fields were being irrigated and therefore would not affect black terns.

Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15 percent. Even with a 15 percent reduction, the Imperial Valley would support about 425,000 acres of agricultural field habitat. Because of the abundance of agricultural field habitat, it is unlikely that the amount of agricultural fields limits the population of black terns in the Imperial Valley. The availability and quality of marshes for breeding both in the Imperial Valley and elsewhere probably is the primary factor affecting the population size (USFWS 1999). Given that it is unlikely that agricultural fields are limiting the level of use of the HCP area, the potential reduction in agriculture would not be expected to affect black terns.

3.8.6.11 Northern Harrier

Northern harriers are common fall and winter residents in the HCP area, but occur only occasionally during the spring and summer. Throughout California, harriers commonly use agricultural fields, particularly alfalfa and pasture, in addition to native habitats such as native grasslands and marshes.

Installation of water conservation measures in agricultural fields would not be expected to affect northern harriers. On-farm conservation measures would be installed when crops were not being grown, primarily in the summer. Harriers predominantly occur in the HCP area during fall and winter and therefore, their occurrence in the area when this work would be conducted would be minimal. Construction in agricultural fields required for other covered activities such as creation of managed marsh habitat or system-based conservation measures could occur when northern harriers are in the HCP area. However, the occurrence of these activities in agricultural fields also would not be expected to affect foraging by northern harriers. In foraging, harriers fly low over vegetation in search of prey and then swoop down to capture prey and likely would not be disturbed by construction activities.

Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15 percent. Even with a 15 percent reduction, the Imperial Valley would support about 425,000 acres of agricultural field habitat. The abundance of agricultural field habitat is probably not a limiting factor for northern harriers in the Imperial Valley. Rather, the availability of breeding areas and habitat conditions at breeding areas probably have a much greater influence on the number of harriers wintering in the Imperial Valley (see e.g., Remsen 1978). Given that it is unlikely that agricultural fields limit the level of use of the HCP area by northern harriers, the potential reduction in agriculture would not be expected to affect this species.

3.8.6.12 Fulvous Whistling-duck

The Salton Sea area has supported a population as high as about 200 whistling ducks during the spring and summer, with a much smaller breeding population. They forage in marshes and irrigated agricultural field. In the Imperial Valley, alfalfa, corn and grain fields could be used by whistling-ducks for foraging.

Installation of water conservation measures in agricultural fields and construction of system-based conservation measures or managed marsh have a minor potential to disturb fulvous whistling-ducks. These ducks could forage on grain remaining on fields after harvest. If construction occurred in or adjacent to fields where whistling-ducks were foraging, some individuals could be disturbed. The potential for this to occur is considered remote because a relatively small population of whistling ducks inhabits the HCP area and they predominantly occur at the state and federal refuges.

Fulvous whistling-ducks are not expected to be affected by the potential reduction in agricultural field habitat with implementation of the water conservation and transfer programs. As noted above, the HCP area supports a small population. The ducks predominantly use marshes and agricultural fields on the state and federal refuges. Thus, the reduction in agricultural fields potentially occurring with implementation of the water conservation and transfer programs and HCP would not be expected to affect the whistling-duck population. The DHCS actually would increase the amount of managed marsh habitat (see section 3.5).

3.8.6.13 White-tailed Kite

White-tailed kites can occur in the HCP area throughout the year but in small numbers. The highest number of kites reported in one year in the Christmas Bird Count (1940 to 2000) was 10. The USFWS (1997) characterizes them as occasional visitors with normally fewer than five individuals each season (spring, fall, and winter) at the Salton Sea NWR. Their current breeding status in the HCP area is uncertain. They have bred in the HCP area previously, but have not been verified to breed there recently. White-tailed kites typically forage in agricultural fields and are known to roost in Bermuda grass fields.

Installation of water conservation measures in agricultural fields and construction of system-based conservation measures or managed marsh are unlikely to disturb white-tailed kites. In foraging, white-tailed kites hover in search of prey and then drop down to capture prey. Because they do not forage on the ground, they would not be disturbed by construction activities. While white-tailed kites roost in Bermuda grass fields, construction activities would not be expected to affect roosting kites. Construction would not be conducted in fields in active agricultural production and therefore kites would not be expected to roost in areas subject to construction.

Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15 percent. A small number of white-tailed kites occur in the HCP area. White-tailed kites forage in alfalfa, Sudan grass and Bermuda grass fields in the Imperial Valley. In the Imperial Valley, the acreage of alfalfa has varied from about 158,000 to 222,000 (i.e., 27 to 43 percent of the agricultural land in the Imperial Valley). Sudan grass and Bermuda grass currently collectively comprise about 25 percent of agricultural land in the valley. Thus, greater than 50 percent of the agricultural area provides potential foraging habitat. Because of the small numbers of kites and the abundance of agriculture fields, white-tailed kites would not be expected to be affected by the changes in the amount of agricultural land anticipated under this HCP.

3.8.6.17 Loggerhead Shrike

In the HCP area, loggerhead shrikes are associated with agricultural fields as well as desert habitat. Shrikes use agricultural fields for foraging. Vegetation along agricultural drains, fence posts, and other natural and manmade structures along the margins of fields provide perch sites from which loggerhead shrikes forage. Drain vegetation could support nesting.

Construction activities to install on-farm or system-based water conservation techniques or managed marsh have a minor potential to affect shrikes. These activities could result in disturbance if shrikes are nesting in vegetation adjacent to construction activities. The potential for this effect is considered very low. The type of equipment used to install the systems (e.g., excavators, graders, dozers) is the same type of equipment that IID uses in conducting its O&M activities. Also, workers are routinely working in and adjacent to the fields. Thus, shrikes nesting adjacent to agricultural fields are probably accustomed to construction equipment and human activity.

Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15 percent. Shrikes forage on a wide variety of prey, including insects, small birds, mice, reptiles, and spiders. With this broad diet, food availability is probably not limiting such that the potential loss of some agricultural field habitat would not likely adversely affect loggerhead shrikes.

3.8.6.18 Long-billed Curlew

The long-billed curlew is a common, year-round resident in the HCP area. It is not known to breed in the HCP area (Shuford et al. 1999). The highest count of long-billed curlews in the HCP area was 7,500 birds in August 1995 (Shuford et al. 1999). In the Imperial Valley, long-billed curlews predominantly forage in agricultural fields during irrigations that increase the availability of insects. Curlews also forage on mudflats at the Salton Sea.

Installation of water conservation measures in agricultural fields and construction of system-based conservation measures or managed marsh would not be expected to affect long-billed curlews. Curlews are attracted to agricultural fields during irrigations when insects are displaced and are easy to capture. Construction activities would not be conducted while the fields were being irrigated and therefore would not affect long-billed curlews.

Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15 percent. Even with a 15 percent reduction, the Imperial Valley would still support about 425,000 acres of agricultural field habitat. Because of the abundance of agricultural field habitat, it is unlikely that the amount of agricultural fields limits the population of long-billed curlews in the Imperial Valley. The availability of and quality of breeding habitat in the species' breeding range is believed to have been a primary cause of the species decline and is still a primary concern for this species. Given that it is unlikely that agricultural fields are limiting the level of use of the HCP area by long-billed curlews, the potential reduction in agriculture would not be expected to affect this species.

3.8.6.19 White-faced Ibis

White-faced ibis occur in the HCP area throughout the year but are most abundant in the winter. The HCP area supports a large wintering population of white-faced ibis. More than 24,000 ibis were recorded at the Salton Sea in 1999, representing about 50 percent of the California population. Agricultural fields are used extensively by ibis for foraging. Alfalfa appears to be the most commonly used crop type, although others such as wheat also are visited.

Installation of on-farm water conservation measures in agricultural fields would not be expected to affect white-faced ibis. On-farm conservation measures would be installed when crops were not being grown, primarily in the summer. The majority of the white-faced ibis using the HCP area occur in the area in the winter, with only a small breeding population. Thus, most of the birds would not be in the area when this work was being conducted. Impacts to ibis present during the summer also would not be expected because ibis forage in agricultural fields during irrigations and on-farm systems would not be installed when fields were being irrigated. For the same reason, construction in agricultural fields required for other covered activities such as creation of managed marsh habitat or system-based conservation measures would not affect ibis.

Depending on the water conservation measures implemented the amount of agricultural land in production could be reduced by about 15 percent. Even with a 15 percent reduction, the Imperial Valley would still support about 425,000 acres of agricultural field habitat. This reduction in agriculture field habitat is not likely to affect white-faced ibis. Loss of marsh habitat and pesticides in breeding areas are believed to be the primary factors contributing to earlier declines in white-faced ibis, rather than conditions on wintering areas (Remsen 1987).

The number of white-faced ibis wintering in the Imperial Valley has increased substantially in the 1990s (Figure 3.8-5). Over the same period, the acreage of alfalfa showed no trend, but rather fluctuated within its historic range (Figure 3.8-1). These findings suggest that the population of white-faced ibis wintering in the Imperial Valley is 1) not limited by the amount of foraging habitat (i.e., alfalfa), and 2) is determined by conditions in the species' breeding range. Given that the amount of agricultural land is not likely determining the size of the ibis population using the Imperial Valley, the potential reduction in agricultural land would not be expected to affect this species.

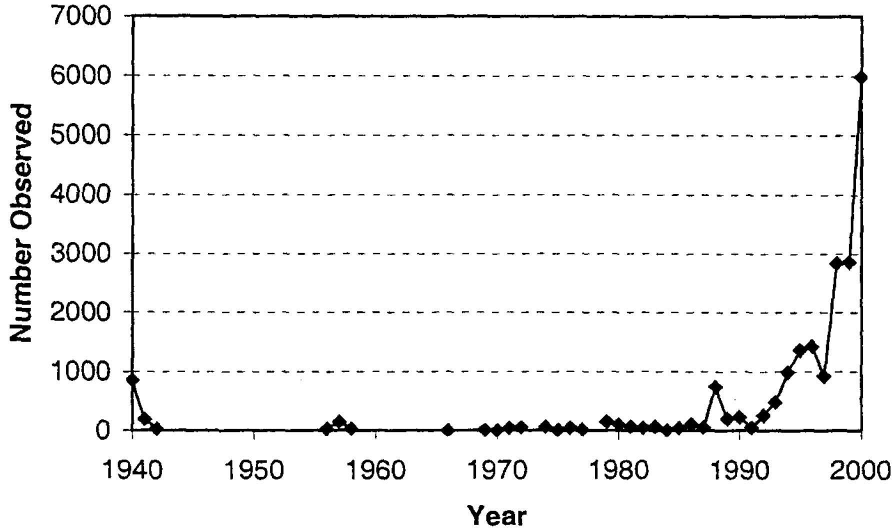


FIGURE 3.8-5
Christmas Bird Count results for the Salton Sea (South end) for White-Faced Ibis.

3.9 Other Covered Species

Of the 96 species covered by this HCP, the USFWS and CDFG identified 25 species for which existing information on the ecology and distribution in the HCP area is limited or that might not occur in the HCP area. These species are listed in Table 3.9-1. The approach to covering these species is to implement a research program to better understand the presence, distribution, and ecological requirements of these species in the HCP area. Based on the results of the research program, IID will implement measures to avoid, minimize, and mitigate the impacts of any take of these activities resulting from the covered activities.

TABLE 3.9-1
Covered Species Addressed Separately from the Habitat – Based and Species-Specific Conservation Strategies

Cheeseweed moth lacewing	Western small-footed myotis	Yuma hispid cotton rat
Andrew's dune scarab beetle	Occult little brown bat	Flat-seeded spurge
Colorado River toad	Southwestern cave myotis	Banded gila monster
Lowland leopard frog	Yuma myotis	Jacumba little pocket mouse
Mexican long-tongued bat	Western mastiff bat	Orcutt's aster
California leaf-nosed bat	Pocketed free-tailed bat	Foxtail cactus
Pallid bat	Big free-tailed bat	Munz's cactus

20041

TABLE 3.9-1
Covered Species Addressed Separately from the Habitat – Based and Species-Specific Conservation Strategies

Pale western big-eared bat	Colorado River hispid cotton rat	Orocopia sage
Spotted bat		

3.9.1 Measures for the Other Covered Species

Other Species – 1. *IID will implement a study program for the species listed in Table 3.9-1 in the HCP area. The program will focus on determining the occurrence and distribution of these species in the HCP area and determining their habitat requirements to the degree necessary to develop avoidance, minimization and mitigation measures that meet the issuance criteria for federal and state incidental take permits. IID will commit $625,000 to fund the study program IID will -define the specific surveys and studies to be conducted. Before initiating the studies, IID will submit a detailed description of the study program to the USFWS and CDFG for approval.*

To ensure that appropriate and effective conservation measures are implemented for these species, IID will implement a study program designed by the HCP IT to determine the specific occurrence and habitat requirements of these species in the HCP area. The study program will determine the distribution of the covered species listed in Table 3.9-1 in the HCP area. For those species determined to occur in the HCP area, the study program also will provide information on their specific habitat requirements in the HCP. This information will be used in developing appropriate avoidance, minimization and mitigation measures (See Other Species – 2).

Other Species – 2. *Following completion of the study program or discrete species-specific components of the study program, the HCP IT will meet to review the results. Based on the results of the study program, the HCP IT will*

- *assess the potential effects of the covered activities on each of the species listed in Table 3.9-1*
- *recommend measures to avoid, minimize, and mitigate the impacts of the covered activities as necessary to meet the issuance criteria for state and federal incidental take permits*
- *develop compliance and effectiveness monitoring programs*
- *identify additional studies necessary to develop measures meet the issuance criteria.*

IID will prepare a report of the results of the studies, describes the impacts of the covered activities on the covered species, and proposes avoidance, minimization and mitigation measures for those impacts. IID will submit the report to the USFWS and CDFG for approval of the measures.

IID will reserve $625,000 to fund the minimization and mitigation program. IID will initiate the study program at the time of issuance of the permits and implement appropriate measures within one year of receiving recommendations from the HCP IT.

Prior to completion of the study program or species-specific components of the study program, the HCP IT will annually review the results of the study program. Based on this review the HCP IT will develop interim measures to avoid, minimize and mitigate the impacts of the covered activities on the *covered species. IID will submit an annual report of the study results and the proposed interim measures to the USFWS and CDFG for approval.*

With the information gained through Other Species - 1, the HCP IT will be able to better define the potential impacts to these species from IID's covered activities. This information also will be important to developing measures to avoid, minimize, and mitigate potential effects of the covered activities on the covered species listed in Table 3.9-1. The final measures to be implemented will be developed in coordination with the USFWS and CDFG as part of the HCP IT and will be subject to their approval. ` 3.9-1 illustrates the process for implementing the study program, using the information obtained in the study program to develop avoidance and mitigation measures, and obtaining approval from the USFWS and CDFG for the measures. By delaying development of minimization and mitigation measures until additional information is available, better decisions can be made on the minimization and mitigation measures that are necessary and appropriate for compliance with the issuance criteria for incidental take permits under federal and state ESAs.

3.9.2 Effects to the Other Covered Species

Implementation of Other Species–1 and Other Species-2 will provide an overall benefit to these covered species for two principle reasons. First, the habitat requirements and distribution of these species are poorly understood. The information gained through the study program will make a substantial contribution to understanding these species. This information will be valuable in developing management strategies for these species in other portions of their ranges and thereby contribute to the conservation of these species beyond the limits of the HCP area.

Second, under the HCP, IID is committing to implementing measures to avoid, minimize, and mitigate potential effects of covered activities on these species as identified through the study program. In the absence of these measures, any adverse effects of the covered activities to these species would continue. Because none of the covered species in Table 3.9-1 are currently listed, they are afforded minimal to no protection under state or federal law. An individual species could receive protection in the future if it was listed. However, it is uncertain whether any of these covered species would be listed in the future. Also, protection afforded by listing of one of the covered species would only extend to the species actually listed. The remaining covered species would remain vulnerable. The certainty that protective measures would be implemented over an extended period of time (75 years) would provide a long-term benefit to these species in the HCP area, contribute to improved management elsewhere, and possibly prevent the need to list them in the future.

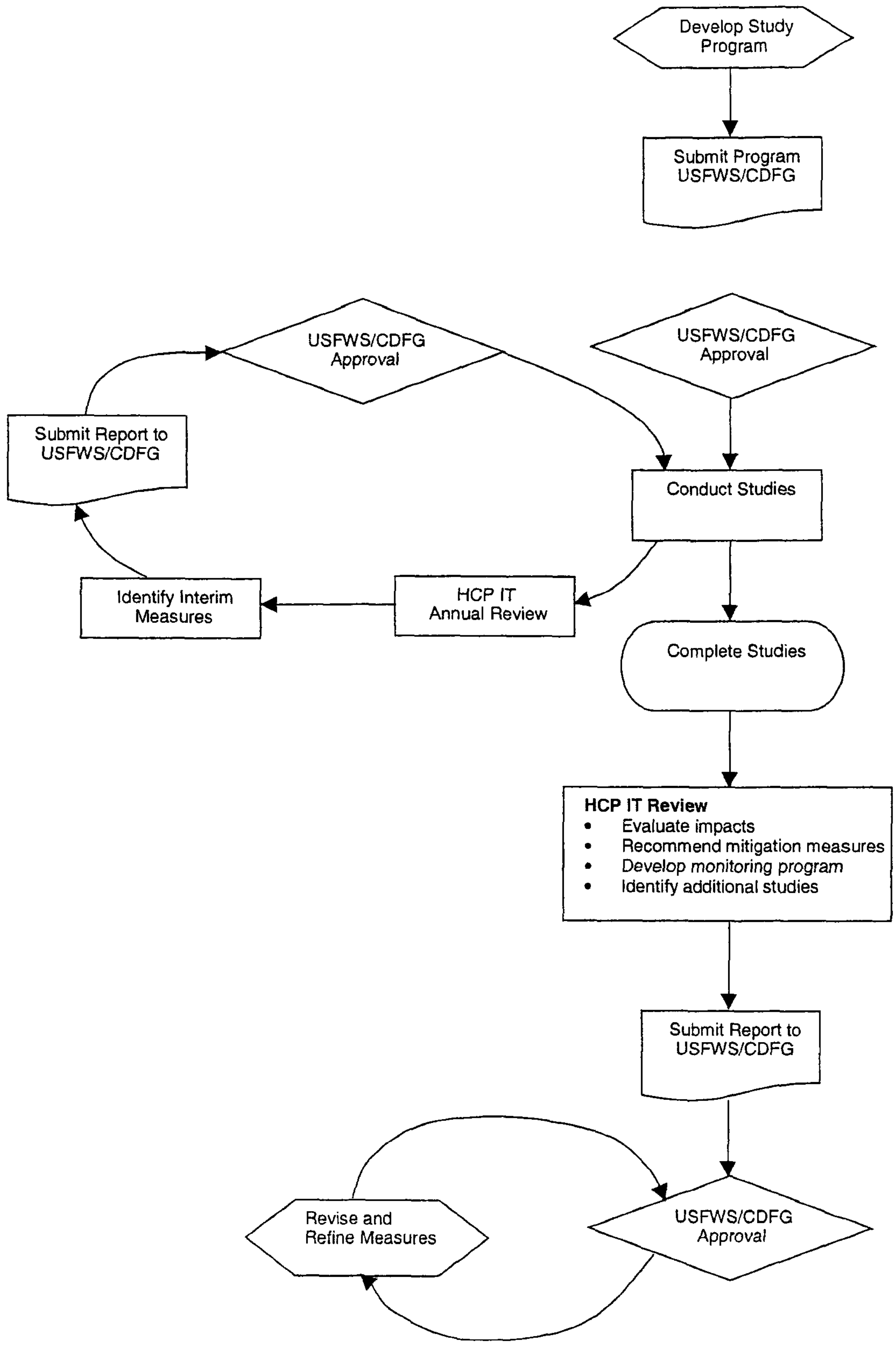


FIGURE 3.9-1
Process for Addressing Other Covered Species

CHAPTER 4

Monitoring and Adaptive Management

Monitoring the effectiveness of the conservation measures and ensuring compliance with the terms of the conservation program are mandatory elements of an HCP. The Service elaborated on monitoring and adaptive management requirements for HCPs in its 5-Point Policy Guidance (64 FR 11485). The Service identifies two types of monitoring required for HCPs: (1) Effects and Effectiveness Monitoring; and (2) Compliance Monitoring. Effectiveness monitoring entails collecting data that can be used to determine the effects of permitted actions on covered species and evaluating the effectiveness of the conservation program in achieving the biological goals and objectives. Key information to be obtained through monitoring includes the level of incidental take (IT) resulting from the permitted activities, and the biological conditions generated through the conservation program. Compliance monitoring verifies that the permittee is carrying out the terms and conditions of the HCP, and the accompanying permit and Implementation Agreement.

In its 5-Point Policy Guidance, the Service clarifies the need for and role of adaptive management in HCPs. An adaptive management strategy is not required for all HCPs. However, it is considered essential for HCPs that cover species for which there are significant biological data or information gaps. To be effective, an adaptive management strategy should:

- Identify the areas of uncertainty and the specific questions to be answered to resolve the uncertainty
- Identify alternative conservation strategies
- Integrate a monitoring program that is able to detect changes or provide information necessary to evaluate the operating conservation program
- Specify feedback loops for adjusting the conservation program if necessary

The following outlines IID's strategy for demonstrating compliance with the terms of the HCP, monitoring the effectiveness of the HCP, and adaptively modifying the conservation program.

4.1 Salton Sea

4.1.1 Compliance Monitoring

4.1.1.1 Piscivorous Birds

Compliance monitoring for the component of the Salton Sea Conservation Strategy that addresses impacts to piscivorous birds from changes in fish abundance will depend on the approach selected. The following describes compliance monitoring requirements for each of the approaches.

Approach 1: Hatchery and Habitat Replacement

Under Approach 1, IID would construct a hatchery to produce fish (tilapia or other appropriate species) to stock in the Salton Sea until the salinity reaches a level at which the fish cannot survive and grow. At that point IID would construct 5,000 acres of ponds to continue to support fish at the Salton Sea until the end of the permit. IID would work through the HCP IT to develop the design and operating procedures for the hatchery and IID would notify the USFWS and CDFG when the hatchery was constructed and operating. IID would submit annual reports to the USFWS and CDFG on the species and numbers of fish stocked each year in the Salton Sea. Through the involvement of the HCP IT and the annual stocking reports, compliance with the commitment to construction and operation of a hatchery would be monitored.

If IID constructs ponds, IID will submit site-specific plans for creation of the ponds to the USFWS and CDFG prior to construction and inform these agencies when the construction is completed (see section 4.1.4). The HCP IT also will be actively involved in locating and designing the ponds. Through the reporting requirements and involvement of the HCP IT, the USFWS and CDFG will be able to monitor IID's compliance with the measures for this approach.

Approach 2:Use of Conserved Water as Mitigation

Under Approach 2, IID would conserve sufficient additional water to offset the inflow reduction to the sea occurring as a result of the water conservation and transfer program. If this approach is used, IID will submit annual reports to the USFWS and CDFG showing the total amount of water conserved and transferred and the total amount of mitigation water conserved for the preceding year.

4.1.1.2 Desert Pupfish Connectivity

In the event that salinity in the Salton Sea becomes too high to support pupfish, IID agreed under Salton Sea - 1 to actively provide connectivity among the populations of pupfish occupying drains. The appropriate methods for accomplishing this objective and the specific details of the program will be defined by the HCP IT, in consideration of the specific circumstances at the time the measure is implemented. Compliance with this measure will be accomplished through the reporting requirements outlined in the detailed plan developed by IID and the HCP IT (see Salton Sea-1; Chapter 3).

4.1.1.3 Nesting/Roosting Islands

Under Salton Sea - 2, IID will create nesting/roosting islands for gull-billed terns and black skimmers if the water conservation and transfer program including the HCP measures results in the water surface elevation declining at a faster rate or to a greater degree than in the absence of the water conservation and transfer programs. IID will work with the HCP IT to design and locate nesting/roosting islands and submit final designs to the USFWS and CDFG for approval prior to construction of the islands. IID will notify the USFWS and CDFG upon completion of the construction.

4.1.1.4 Tamarisk Scrub Shoreline Strand

Under Salton Sea - 3, IID will monitor tamarisk scrub adjacent to the Salton Sea and acquire land supporting existing native tree habitat or create native tree habitat to compensate for a net reduction in the amount of tamarisk scrub adjacent to the Salton Sea attributable to water conservation and transfer. Compliance with these commitments will be monitored through the reporting requirements (see section 4.1.4.3). The HCP IT also will be actively involved in developing restoration plans, habitat creation plans and identifying properties for acquisition. Through the reporting requirements and involvement of the HCP IT, the USFWS and CDFG will be able to monitor IID's compliance with Salton Sea - 3.

4.1.2 Effectiveness Monitoring

4.1.2.1 Piscivorous Bird Measures

Approach 1: Hatchery and Habitat Replacement

If this approach is pursued, CDFG would monitor fish populations in the Salton Sea to determine 1) when reproduction by tilapia has ceased and therefore stocking would begin and 2) when growth and survival of survival has been compromised and the ponds would need to be constructed. The data collected by CDFG would allow an assessment of the effectiveness of the stocking program in maintaining fish populations in the Salton Sea.

Once the ponds are constructed, IID would monitor the fish population in the ponds and bird use of the ponds. The number of piscivorous birds at the Salton Sea fluctuates dramatically within and among years. These fluctuations can be caused by myriad factors only some of which are related to conditions at the Salton Sea. As a result, the number of birds would not be a good measure of the effectiveness of the ponds. The acreage of ponds to create was based on an estimate of fish production in the ponds (500 pounds/acre). Therefore, to monitor the effectiveness of this approach, IID would determine the fish production in terms of pounds of fish per acre of the created ponds to determine if the assumption of 500 pounds/acre is achieved in the ponds.

Although monitoring bird numbers is not appropriate for determining the effectiveness of the ponds, an important determinant of the effectiveness of the ponds is use of the ponds by the covered piscivorous birds. IID will conduct annual bird survey of the ponds during the fall, winter and spring to determine if the covered piscivorous bird species are using the ponds.

Approach 2: Use of Conserved Water as Mitigation

The compliance monitoring and reporting would show whether conservation to generate mitigation water was effective at offsetting the inflow reduction to the sea attributable to water transfers.

4.1.2.2 Desert Pupfish Connectivity

The effectiveness of providing connectivity among pupfish populations in the drains will be incorporated into the detailed plan prepared by IID for accomplishing this objective (see measure Salton - 1 in Chapter 3).

4.1.2.3 Nesting/Roosting Islands

After the nesting/roosting islands are constructed, IID will monitor bird use of the nesting/roosting islands. Surveys will be conducted during the spring/summer when gull-billed terns and black skimmers are breeding to determine if these species use the

20047

created features. Surveys will be conducted annually for five years following completion of island construction.

4.1.2.4 Tamarisk Scrub Shoreline Strand

The objective of this component of the Salton Sea Conservation Strategy is to ensure no net loss of habitat value for species associated with tamarisk scrub. Under Salton Sea – 3, IID will conduct a baseline survey and periodic subsequent surveys (at least every 5 years for 35 years) to quantify net changes in the total amount of tamarisk in shoreline strand and adjacent wetland dominated by tamarisk. Areas adjacent to the Salton Sea that are dominated by tamarisk will be mapped by delineating patch boundaries on aerial photographs or Digital Orthophoto Quarter Quadrangles (DOQQ). For each area delineated, the total percent coverage by tamarisk, percent coverage by live tamarisk and the percent coverage by dead tamarisk will be categorized following the California Native Plant Society's cover classes (Table 4.1-1). Following completion of the habitat surveys, a geographic information system (GIS) of the habitat data will be developed. A map showing the areas and percent coverage of tamarisk scrub adjacent to the Salton Sea will be prepared.

TABLE 4.1-1
Vegetation Cover Classes of the California Native Plant Society

Cover Class	Canopy Closure (percent)
1	≤ 1
2	> 1 to 5
3	>5 to 25
4	> 25 to 50
5	>50 to 75
6	> 75 to 100

IID will follow the same process for conducting the subsequent surveys. IID will revisit areas that have been mapped and characterized and determine if there have been changes in the percent coverage and/or the boundaries of each area. IID will revise the patch boundaries and percent coverage categorizations as appropriate. In addition to revisiting mapped areas, IID will acquire recent (no greater than 1 year old) DOQQs or aerial photographs and review them to determine if tamarisk has colonized new areas. If the photographs indicate that tamarisk has colonized new areas, IID will delineate and characterize the areas using the same methods as for the baseline surveys. The GIS will be updated accordingly. IID will submit a report of the results of the baseline and subsequent surveys to the USFWS and CDFG within six months of completing the surveys Information to include in the report is described below in Section 4.1.4.3.

If the monitoring shows a net reduction the amount of live tamarisk, IID will compensate for net changes in the amount of tamarisk scrub habitat by either acquiring land that supports existing native tree habitat or creating native tree habitat. If IID acquires native tree habitat, IID will work with the HCP IT to identify properties and obtain approval from the USFWS and CDFG prior to acquisition.

If IID elects to create native tree habitat, IID will work with the HCP IT to develop a habitat creation plan (see Salton Sea - 3). The mitigation ratios specified in Salton Sea - 3 were derived from the relative habitat value of potentially impacted habitat (i.e., tamarisk scrub and mixed communities) relative to the habitat value expected in the created habitat. Specifically, the objective of the created habitat is to provide a relative habitat value of about 20 or greater. Cottonwood-willow habitat of types II, III, IV and honey mesquite habitat of types III and IV provide about this relative habitat value. The characteristics of these structural types are summarized in Table 3.4-4. The habitat creation plan will be designed to achieve the characteristics of these structural types. To ensure the desired structural characteristics are achieved, the habitat creation plan also will include specific vegetation monitoring requirements, criteria to assess success, and the actions that IID will take if the success criteria are not met. Typical success criteria for created habitats include the survival, species composition, size, and density of plants. The types of actions typically taken if the success criteria are not met include installing new plants to replace plants that have died, conducting weed control, and adjusting irrigation practices.

4.1.3 Adaptive Management Program

4.1.3.1 Piscivorous Bird Measures

Approach 1 Hatchery and Habitat Replacement

Under Approach 1, CDFG would monitor fish populations in the Salton Sea. IID will work closely with CDFG and the HCP IT to adjust stocking rates and stocking procedures as necessary to maintain fish in the sea as prey for piscivorous birds. If IID constructs ponds, IID would monitor fish production in the created ponds and submit annual reports. If fish production is less than 500 pounds per acre, the HCP IT will develop recommendations for increasing fish production (e.g., management changes, fish stocking). Based on these recommendations, IID will submit a description of the actions to be implemented to the USFWS and CDFG for approval.

Approach 2: Use of Conserved Water as Mitigation

No adaptive management program is necessary for implementing this approach.

4.1.3.2 Desert Pupfish Connectivity

A process for making adjustments to the measures ultimately adopted for ensuring connectivity among drain populations of pupfish will be incorporated into the detailed plan prepared by IID for accomplishing this objective (see measure Salton - 1 in Chapter 3).

4.1.3.3 Nesting/Roosting Islands

The surveys for gull-billed terns and black skimmers will indicate whether these species are attracted to the constructed islands. The HCP IT will annually review the results of the surveys. If gull-billed terns and black skimmers are using the islands IID will reduce the bird survey frequency to once every five years for the remainder of the permit term or until the HCP IT determines that additional surveys are not necessary. If these species are not found to be using the islands, the HCP IT will assess whether modifications to the islands would improve the likelihood of these species using the islands. The HCP IT will recommend physical modifications to the islands or changes in management of the islands likely to attract gull-billed terns and black skimmers. IID will submit a description of the changes to be implemented to the USFWS and CDFG for approval. IID will continue to monitor use of the island by skimmers and gull-billed terns annually for five years, repeating the review and adjustments until these species are found to use the features or the HCP IT determines that provision of nesting sites by IID for these species is no longer necessary.

4.1.3.4 Tamarisk Scrub Shoreline Strand

Adaptive management will be incorporated into the habitat creation plans for native tree habitat mitigation sites. In the habitat creation plan, success criteria and the corrective actions that IID will take in the event that the success criteria are not met will be specified. With this monitoring and adjustment based on the monitoring, IID will ensure that the native tree habitat is progressing toward the desired structural characteristics.

4.1.4 Reporting

4.1.4.1 Piscivorous Bird Measures

Approach 1 Hatchery and Habitat Replacement

Prior to constructing a hatchery, IID will submit a facility-specific design and management plan to the USDFWS and CDFG for approval. IID will notify the USFWS and CDFG when construction of the hatchery has been completed. Once the hatchery is operating, IID will submit annual reports that document the species and number of fish stocked annually.

If IID constructs ponds, before creating ponds, IID will submit to USFWS and CDFG, site-specific plans for the ponds to be created. The site-specific plan will

- Show the location of the ponds,
- Describe construction methods and schedule
- Describe and diagram the ponds, other earthwork and water control structures, and
- Describe how the habitat will be managed

IID will notify the USFWS and CDFG when the work has been completed.

IID will submit annual reports of the results of the bird surveys. The reports will include

- A list of all birds observed using the ponds
- The number of white pelicans, brown pelicans, black skimmers and double-created cormorants observed using the ponds

Approach 2 Use of Conserved Water as Mitigation

IID will submit annual reports to the USFWS and CDFG showing the total amount of water conserved and transferred and the total amount of mitigation water conserved during the previous year.

4.1.4.2 Desert Pupfish Connectivity

The reporting requirements for the measures ultimately adopted for ensuring connectivity among drain populations of pupfish will be incorporated into the detailed plan prepared by IID for accomplishing this objective (see measure Salton - 1 in Chapter 3).

4.1.4.3 Nesting/Roosting Islands

Before creating nesting/roosting islands, IID will submit to USFWS and CDFG, site-specific plans for the features to be created. The site-specific plan will

- Show the location of the nesting/roosting islands,
- Describe and diagram the islands,
- Describe the management actions IID will employ to maintain the islands.

IID will notify the USFWS and CDFG when the work has been completed.

IID will submit annual reports of the results of the surveys for gull-billed terns and black skimmers. The reports will include

- List of all birds observed using the created islands
- Number of gull-billed terns and black skimmers observed using the islands
- Information on these species using other islands at the Salton Sea for breeding obtained either during the field surveys or reported by other researches/surveyors

4.1.4.4 Tamarisk Scrub Shoreline Strand

Under Salton Sea -3, IID will conduct a baseline survey of tamarisk scrub in shoreline strand and adjacent wetlands dominated by tamarisk. IID will submit a report of the results of the baseline survey to the USFWS and CDFG within six months of completing the surveys. The report will include the following:

- A description of the survey methods
- Acreages and maps of tamarisk scrub adjacent to the Salton Sea.

The raw data sheets will be made available to the USFWS and CDFG for review.

IID will repeat the surveys of tamarisk scrub every five years for 35 years. IID will submit reports of the results of the periodic surveys to the USFWS and CDFG within six months of completing the surveys. The reports will include:

- A description of any deviations from the established survey protocol
- Acreages and maps of tamarisk scrub adjacent to the Salton Sea.
- Identification of areas where the extent of tamarisk changed (either increased or decreased)
- Quantification of any net change in the amount tamarisk scrub habitat.

The raw data sheets will be made available to the USFWS and CDFG for review.

If monitoring shows a net change in the amount of tamarisk scrub, IID will create or acquire native tree habitat to compensate for net changes in the amount of tamarisk scrub. IID will not be responsible for compensating for a net reduction in the amount of tamarisk scrub that is attributable to a cause other than the water conservation and transfer program (e.g., fire, federal or state tamarisk control program, installation of actions for restoration of the Salton Sea). IID will work with the HCP IT to develop a plan to create native tree habitat or identify properties supporting native tree habitat to acquire. For lands in which it retains ownership, IID will submit a management plan to the USFWS and CDFG. IID will obtain written approval from the USFWS and CDFG prior to purchasing a property to meet the commitments of Salton Sea - 3. The HCP IT may include additional reporting requirements as part of the habitat creation plans and habitat management plans.

4.2 Tamarisk Scrub Habitat

4.2.1 Compliance Monitoring

Under Tree Habitat - 1 IID will restore native tree vegetation temporarily impacted by construction activities. Under Tree Habitat - 1 and 2, IID will acquire land supporting existing native tree habitats or create native tree habitats to compensate for permanent loss of tamarisk scrub habitat. Compliance with these commitments will be monitored through the reporting requirements (see section 4.2.4.2). The HCP IT also will be actively involved in developing restoration plans, habitat creation plans and identifying properties for acquisition. Through the reporting requirements and involvement of the HCP IT, the USFWS and CDFG will be able to monitor IID's compliance with Tree Habitat - 1 and 2.

Tree Habitat 1, 2 and 3 specify that IID will conduct preconstruction surveys to determine the amount and characteristics of vegetation that would be impacted by construction and to determine if any covered species are breeding in vegetation that would be impacted. Within six months of the issuance of the ITP, IID will develop a standard checklist for the preconstruction surveys with input from the HCP IT. Information to be included on the preconstruction checklist will consist of

- Project Location
- Type of construction activity
- Approximate acreage affected during construction
- Acreage of vegetation temporarily impacted
- Acreage of vegetation permanently impacted
- Vegetation characteristics (species composition, height, density)
- Timing and methods used to survey for covered species
- List of covered species and number of individuals observed.

IID will submit completed preconstruction survey checklists to the USFWS and CDFG on an annual basis.

4.2.2 Effectiveness Monitoring

The overall goal of the Tamarisk Scrub Habitat Conservation Strategy is to maintain the species composition, relative abundance, and life history functions of covered species using tamarisk scrub habitat within the HCP area. This overall goal is predominantly to be accomplished by creating or acquiring native tree habitat that provides equal habitat value as the tamarisk removed by construction activities. IID may compensate for the removal of tamarisk scrub habitat by either acquiring land that supports existing native tree habitat or creating native tree habitat. If IID acquires native tree habitat, IID will work with the HCP IT to identify properties and obtain approval from the USFWS and CDFG prior to acquisition. The involvement of the HCP IT and approval requirements from USFWS and CDFG will ensure that any property acquired by IID will support useable habitat for the covered species associated with tamarisk scrub.

If IID elects to create native tree habitat, IID will work with the HCP IT to develop a habitat creation plan. The mitigation ratios specified in Tree Habitat - 1 and 2 were derived from the relative habitat value of potentially impacted habitat (i.e., tamarisk scrub and mixed communities) relative to the habitat value expected in the created habitat. Specifically, the objective of the created habitat is to provide a relative habitat value of about 20 or greater. Cottonwood-willow habitat of types II, III, IV and honey mesquite habitat of types III and IV provide about this relative habitat value. The characteristics of these structural types are summarized in Table 3.4-4. The habitat creation plan will be designed to achieve the characteristics of these structural types. The habitat creation plan also will include the specific vegetation monitoring requirements, criteria to assess success, and the specific actions that IID will take if the success criteria are not met as necessary to ensure the desired structural characteristics are achieved. Typical success criteria for created habitats include the survival, species composition, size, and density of plants. The types of actions typically taken if the success criteria are not met include installing new plants to replace plants that have died, conducting weed control, and adjusting irrigation practices.

IID also will monitor use of the created habitat by bird species in general. Many of the covered species associated with tamarisk scrub occur sporadically and in low numbers in the HCP. As a result, focusing only on covered species to determine whether the created habitat is functioning might not provide meaningful information. Thus, species use monitoring will focus on broad groups of birds (e.g. raptors, neotropical migrants) that encompass and include the covered species associated with tamarisk scrub, rather than attempting to demonstrate use by each covered species. The surveys will be designed to provide presence/absence data. Point counts or other appropriate survey methodology will be used. The HCP IT will develop the species requirements for monitoring the use of the created habitat by covered species (see Tree Habitat - 1 and 2), including the survey technique, timing of the surveys, and duration of the surveys following creation of the habitat.

4.2.3 Adaptive Management Program

Adaptive management will be incorporated into the plans that address creation of native tree habitat. In the habitat creation plan, success criteria and the corrective actions that IID will take in the event that the success criteria are not met will be specified. With this monitoring and adjustment based on the monitoring, IID will ensure that the created native tree habitat is progressing toward the desired structural characteristics. The results of species use monitoring will be considered in the design and management of subsequent created habitat sites.

4.2.4 Reporting

As required under Tree Habitat - 1, IID will develop a vegetation restoration plan for temporarily impacted native tree vegetation in consultation with the HCP IT. The vegetation restoration plan will describe 1) the amount and species composition of the vegetation that would be impacted, 2) the actions that IID will take to restore the area to pre-disturbance conditions, 3) the criteria for assessing the success of the restoration, 4) monitoring and reporting requirements, and 5) the actions that will be undertaken if the success criteria are not achieved. IID will submit restoration plans to the USFWS and CDFG for approval. IID will notify the USFWS and CDFG when the restoration work has been completed.

Where construction activities would permanently remove habitat, IID will work with the HCP IT to develop a plan to create native tree habitat or identify properties supporting native tree habitat to acquire. The habitat creation plan will include the following information:

- location
- planting plan (including species composition and layout)
- grading and other construction activities
- long-term management practices
- vegetation and species use monitoring success criteria for the plantings and the actions that IID will take if the success criteria are not met.

For lands it retains ownership of IID will submit a management plan to the USFWS and CDFG. While the specific management needs will vary depending on the property acquired, considerations for the management plan include:

- Measures to control human access (e.g., fencing, signage)
- Frequency at which land will be visited to assess maintenance/management needs
- Types of maintenance action (e.g., removing garbage, repairing fences)
- Vegetation management practices (e.g., prescribed burning, removal of exotic plants)

IID will obtain written approval from the USFWS and CDFG prior to purchasing a property to meet the commitments of Tree Habitat - 1 or 2. The HCP IT may include additional reporting requirements as part of the habitat creation plans and habitat management plans.

IID will submit completed preconstruction survey checklists to the USFWS and CDFG within 1 week of completing a preconstruction survey.

4.3 Drain Habitat

4.3.1 Baseline Covered Species Surveys

A baseline survey of the covered species will be conducted during a consecutive 3-year period to determine the presence or absence, distribution, relative abundance, and breeding status of covered species using drains in the HCP area. The covered species surveys will start within 6 months of completion of the drain vegetation survey described in Appendix B. A general survey protocol for the covered species surveys is provided in Appendix F. However, the number of sample points and location of sample points for the covered species surveys will be influenced by the results of the drain vegetation survey (see Drain Habitat - 1). Thus, the HCP IT will develop the final protocol for the covered species surveys following completion of the drain vegetation survey.

4.3.2 Compliance Monitoring

Under the Drain Habitat Conservation Strategy (DHCS), IID will create managed marsh habitat and manage the habitat in the same manner that emergent freshwater marsh units on the Sonny Bono Salton Sea NWR are managed. Compliance with this commitment will be monitored through the reporting requirements under which IID will submit site-specific plans for creation of the managed marsh to the USFWS and CDFG prior to construction and inform these agencies when the construction is completed (see section 4.3.5). The HCP IT also will be actively involved in locating and designing the managed marsh habitat. Through the reporting requirements and involvement of the HCP IT, the USFWS and CDFG will be able to monitor IID's compliance with the DHCS measures.

Under Drain Habitat - 1, IID has committed to use water with the same selenium concentration as water from the LCR or that meets an EPA selenium standard for protection of aquatic life that has received a "No Jeopardy" determination from the USFWS, whichever is greatest to support the managed marsh. If IID uses irrigation water from the LCR to maintain the managed marsh, it is not necessary monitor water quality. If IID uses water other than irrigation water from the LCR, then IID will monitor the quality of the water delivered to the managed marsh to demonstrate that the water meets the selenium concentrations specified in Drain Habitat - 1.

4.3.3 Effectiveness Monitoring

The biological goal of the DHCS is to maintain the species composition, relative abundance and life history functions of covered species using drain habitat within the HCP area. The specific objective is to create managed marsh habitat that is useable by Yuma clapper rails and other covered species. Yuma clapper rails are the focal species for the DHCS. As described under the DHCS in Chapter 3, the managed marsh habitat created by IID will be designed and managed in the same manner that emergent freshwater marsh units are managed on the state and federal wildlife refuges. IID will conduct species-specific surveys for Yuma clapper rails and California black rails and conduct general surveys for other covered species in the created managed marsh habitat.

Following creation of managed marsh habitat, IID will survey the created habitat for Yuma clapper rails and California black rails, and conduct general point count surveys annually for five years. After the initial five-year survey period, IID will continue to survey at the same frequency that clapper rail surveys are conducted on the federal wildlife refuge but no less frequently than once every five years. Currently, the federal wildlife refuge is surveyed annually for clapper rails. IID will survey for Yuma clapper rails and California black rail following the prevailing protocol (Appendix F). A general protocol for point count surveys also is provided in Appendix F. IID will work with the HCP IT to further define the specific number of points and exact timing of the point count surveys in the created managed marsh habitat.

4.3.4 Adaptive Management Program

Adaptive management is incorporated into the DHCS in two ways. First, IID has committed to managing created marsh habitat in the same manner as the federal wildlife refuge manages emergent freshwater marsh units. It is anticipated that habitat management for clapper rails on the refuge will be refined over time as the understanding of clapper rail ecology improves. IID will incorporate the refinements in management implemented on the refuges into management of its created habitat. Also, the HCP IT and HCP Implementation Biologist will work closely with refuge staff to develop and refine habitat management practices for clapper rails over the term of the permit.

The second opportunity for adjusting the DHCS is in the design of the managed marsh habitat. Under the DHCS, IID will phase creation of managed marsh habitat over a 15-year period. At least one-third of the habitat will be created within five years of issuance of the permit. This habitat will be designed based on management and design practices followed for emergent freshwater marsh units on the state and federal refuges. The design of the remaining two-thirds of the managed marsh habitat could be adjusted in response to the results of the covered species baseline surveys and other available information.

Current information indicates that the occurrence, relative abundance and level of use of drains by covered species other than Yuma clapper rails is low. If the baseline surveys and other available information reveal a high level of use of the drains by a covered species other than clapper rails, the HCP IT may adjust the design and management of the created habitat if necessary to ensure that the created habitat supports these species in addition to Yuma clapper rails.

4.3.5 Reporting

4.3.5.1 Baseline Covered Species Surveys

IID will conduct a drain vegetation survey within 1 year of issuance of the incidental take permit (see Drain Habitat - 1). IID will submit a report of the results of the drain vegetation survey to the USFWS and CDFG within six months of completing the surveys. The report will include the following:

- A description of the survey methods
- Total acreage of vegetation supported in the drainage system
- Plant species composition of the vegetation

The raw data sheets will be made available to the USFWS and CDFG for review.

For the covered species surveys, IID will submit a report to the USFWS and CDFG of the results within six months of completing the survey each year. The report will:

- Describe the survey methods used (as described in Appendix F and as modified by the HCP IT)
- List the species and number of individuals of each species observed
- Identify the location of covered species
- Present and discuss the relative abundance of covered species among the survey stations
- Indications of breeding activity

As additional surveys are conducted, the reports will present the cumulative information collected. The raw data sheets will be made available to USFWS and CDFG for review.

4.3.5.2 Habitat Creation

The DHCS specifies creation of managed marsh habitat within certain time periods. Before creating managed marsh habitat, IID will submit to USFWS and CDFG, site-specific plans of the habitat to be created. The site-specific plan will

- Show the location of the created habitat,
- Describe and diagram earthwork and water control structures,
- Describe the desired plant species composition and how the desired composition will be achieved,
- Describe how the habitat will be managed, and
- Success criteria and the actions that IID will take if the success criteria are not met.

IID will notify the USFWS and CDFG when the work has been completed.

4.3.5.3 Covered Species Surveys

IID will submit a report of the results of the rail and point count surveys to the USFWS and CDFG annually. For clapper rails and black rails, the report will show the number of each species that responded during the current year's survey and in each previous survey for the habitat area surveyed. Similarly for the point count data, the report will list the species and number of individuals recorded for the current year's survey and in each previous survey for the habitat area surveyed.

4.4 Desert Habitat

4.4.1 Baseline Surveys

4.4.1.1 Desert Habitat Survey

Desert habitat occurs in the HCP area in IID's right-of-way along the AAC and adjacent to the East Highline, Westside Main, Thistle and Trifolium Extension canals. Prior to conducting surveys for the covered species along these canals, IID will conduct a habitat survey to identify and map habitat and habitat features. The area covered by the survey will encompass IID's right-of-way along the AAC from its intersection with the East Highline Canal to the desilting basins at Imperial Dam, and IID's rights-of-way along the Westside Main, East Highline, Thistle, or Trifolium Extension canals where the right-of-way contains or is immediately adjacent to desert habitat.

Habitats will be mapped by delineating habitat patch boundaries on aerial photographs or DOQQ within IID's right-of-way. Habitats or unique habitat features adjacent to but outside of IID's right-of-ways also could influence the occurrence and distribution of covered species within the HCP area. Areas outside of the HCP area will not be comprehensively surveyed. Rather, the aerial photographs/DOQQs will be examined to identify habitats or habitat features within 0.5 miles that could support use by the covered species. Habitats or features identified on the aerial photographs/DOQQs will be visited to determine the specific habitat and feature type as long as access to the property is granted. The location and characteristics of the habitat or habitat feature will be mapped.

Habitats will be classified according to the California Wildlife Habitat Relationships (CWHR) habitat classification system (Mayer and Laudenslayer 1988). The CWHR system is commonly used in California to classify habitat. The CWHR classifies habitat in a standardized manner based on plant species composition and major structural attributes (e.g., canopy coverage, shrub, or tree size).

The CWHR habitat types potentially occurring in the HCP area are as follows:

- Desert scrub
- Desert succulent scrub
- Desert wash
- Desert riparian
- Alkali sink scrub
- Desert Dunes

For each habitat patch, the CWHR will be identified and a canopy closure class assigned. To better distinguish varying structural characteristics of desert habitats, the California Native Plant Society' cover classes (Table 4.1-1) will be used to describe canopy closure rather than the CWHR system's classes. For areas classified as Desert Riparian the dominant species will be identified and subareas delineated based on species composition where distinct differences in plant species composition occur. For example, between Drops 3 and 4 along the AAC, water seepage from the canal supports a 1,422-acre complex of tamarisk, mesquite, cottonwoods, willows and cattails. Under this habitat classification system, the 1,422-acre area would be classified as Desert Riparian. Within this area, the patches of tamarisk, mesquite, cottonwood/willows and cattails would be delineated and the dominant vegetation identified. Following completion of the habitat surveys, a geographic information system (GIS) of the habitat data will be developed.

The distribution of some of the covered species depends on the occurrence of unique habitat features in addition to general habitat types. Important features are burrows, rock outcrops/piles, and temporary pools. During the habitat surveys, the surveyors will note the presence of burrows for each habitat patch; however, the exact location of burrows will not be mapped. If temporary pools occur in the HCP area they would only be apparent following rain. Therefore, temporary pools will not be mapped as part of the general habitat survey. Rather, the location of temporary pools will be identified during surveys for Couch's spadefoot toad that will be conducted during and following periods of rain (Appendix F). Mapped features will be added to the GIS.

4.4.1.2 Covered Species Surveys

A baseline survey of the covered species will be initiated within 1 year of issuance of the incidental take permit and conducted during a consecutive 3-year period to determine the presence or absence, distribution, relative abundance, and breeding status of covered species along the AAC, East Highline, Westside Main, Thistle and Trifolium Extension canals in the HCP area. The covered species surveys will start within 6 months of completion of the desert habitat survey described above. A general survey protocol for the covered species surveys is provided in Appendix F. However, the number of sample points and location of sample points for the covered species surveys will be influenced by the results of the desert habitat survey. Thus, the HCP IT will develop the final protocol for the covered species surveys following completion of the desert habitat survey.

4.4.2 Compliance Monitoring

4.4.2.1 Avoidance and Minimization Measures

As part of the Desert Habitat Conservation Strategy, IID will implement a worker education program and implement measures to avoid and minimize impacts to covered species associated with desert habitat and their habitat resulting from covered activities. IID will provide copies of the worker education manual and updates of the manual to the USFWS and CDFG. The HCP Implementation Biologist will periodically conduct random checks (during their routine duties) of workers conducting O&M activities to assess whether workers are following the standard operating procedures. If during the periodic random checks of workers conducting O&M, the HCP Implementation Biologist finds that a worker is not following the standard operating procedures, the HCP Implementation Biologist will report the infraction to the workers' supervisor. Workers will be subject to retraining or disciplinary action through IID's Policies and Procedures.

4.4.2.2 Habitat Restoration/Acquisition

Under Desert Habitat - 3, IID will restore native desert vegetation temporarily impacted by construction activities. Under Desert Habitat - 5, IID will acquire land or protect land with a conservation easement to compensate for permanent loss of desert habitat. Compliance with these commitments will be monitored through the reporting requirements (see section 4.4.5.2). The HCP IT also will be actively involved in developing restoration plans and identifying properties for acquisition. Through the reporting requirements and involvement of the HCP IT, the USFWS and CDFG will be able to monitor IID's compliance with Desert Habitat - 3 and 5.

4.4.3 Effectiveness Monitoring

The primary goal of the Desert Habitat Conservation Strategy is to avoid killing or injuring covered species as a result of covered activities. Because of the low likelihood of observing an injured individual and subsequently being able attribute the injury to a specific action, it is not possible to specifically address the effectiveness of the measures in avoiding take. The best information on the effectiveness of the measures will come from the workers and HCP Implementation Biologist. First, workers will be instructed to report any incidences of mortality or injury of a covered species. Few or no reported incidences could suggest that the measures are effective while a large number of reports could suggest areas needing improvement. The HCP Implementation Biologist also will be a valuable source of information. The biologist will be regularly coordinating with workers, monitoring construction activities, and checking on the implementation of the measures. The biologist will include comments/recommendations and observations regarding the effectiveness of the measures to avoid take of covered species in required reports (see section 4.4.5.1). While none of this information would be conclusive with respect to the effectiveness of the measures, the HCP IT will consider this information in deciding whether to adjust the avoidance measures (see Section 4.4.4 Adaptive Management Program).

4.4.4 Adaptive Management Program

The HCP IT will review the measures of Desert Habitat - 2 and Desert Habitat - 3 annually for the first 3 years and every 3 years thereafter. The HCP IT may adjust the measures as long as the adjustments do not increase the cost of implementation. The HCP IT may adjust the measures based on results of the species and habitat surveys, prevailing practices for avoiding take, observations/recommendations of the HCP Implementation Biologist, among others.

4.4.5 Reporting

4.4.5.1 Habitat and Covered Species Surveys

IID will submit a report of the results of the desert habitat survey to the USFWS and CDFG within six months of completing the surveys. The report will include the following:

- A description of the survey methods
- Acreages and maps of the various habitat types

The raw data sheets will be made available to the USFWS and CDFG for review.

IID will submit reports to the USFWS and CDFG within six months of completing covered species surveys. The report will include the following information.

- Results of the relative abundance and distribution surveys,
- Description of any deviations from the standard methodology
- Maps of covered species locations
- Comments/observations and recommendations

The raw data sheets will be made available to the USFWS and CDFG for review.

IID will also submit an annual report of observations regarding the effectiveness of the measures to avoid take of covered species and comments/recommendations for modifications to the avoidance measures.

4.4.5.2 Habitat Restoration/Acquisition

The Desert Habitat Conservation Strategy specifies restoration of native desert vegetation if construction activities would temporarily disturb vegetation. As required under Desert Habitat - 3 IID will develop a vegetation restoration plan in consultation with the HCP IT. IID will submit restoration plans to the USFWS and CDFG and notify the USFWS and CDFG when the restoration work has been completed. Where construction activities would permanently remove habitat, IID will work with the HCP IT to identify properties to acquire or protect with a conservation easement as required in Desert Habitat - 3. IID will obtain written approval from the USFWS and CDFG prior to acquiring the property or recording the easement.

4.5 Burrowing Owls

4.5.1 Compliance Monitoring

As part of the BOCS, IID will implement a worker education program and implement measures to avoid and minimize impacts to burrowing owls and their habitat resulting from covered activities (Owl - 1). IID will provide copies of the worker education manual and updates of the manual to the USFWS and CDFG. Submission of the manual and updates will serve as compliance monitoring for Owl - 1.

The HCP Implementation Biologist will periodically conduct random checks (during their routine duties) of workers conducting O&M activities to asses whether workers are following the standard operating procedures for burrowing owls. If during the periodic random checks of workers conducting O&M, the HCP Implementation Biologist finds that a worker is not following the standard operating procedures, the HCP Implementation Biologist will report the infraction to the workers' supervisor. Workers will be subject to retraining or disciplinary action through IID's Policies and Procedures. These random checks will serve as compliance monitoring for Owl - 2, 3 and 4.

Under Owl - 5, workers are to coordinate with the HCP Implementation Biologist prior to conducting various construction activities. Owl - 8 also addresses construction-related effects on burrowing owls. To demonstrate compliance with these measures over the term of the permit, within six months of the issuance of the ITP, IID will develop a standard preconstruction checklist. Information to be included on the preconstruction checklist includes

- Location of activity
- Type of activity
- Whether owls are known to occur in the construction area
- Number of suitable burrows that would be permanently lost
- The actions taken to avoid and minimize impacts to burrowing owls, including timing of construction, removal of owls from the burrows, number of artificial burrows installed and location of artificial burrows.

IID will submit completed checklists to the USFWS and CDFG on an annual basis.

Under Owl - 8, IID has committed to conducting a demographic study on burrowing owls. Compliance with this measure will be ensured through the submittal of the demographic study plan to the USFWS and CDFG for approval and annual reporting requirements of the results (see Section 4.5.4).

4.5.2 Effectiveness Monitoring

4.5.2.1 Avoidance and Minimization Measures

To assess the effectiveness of the avoidance and minimization measures, the HCP Implementation Biologist will periodically conduct random checks (during their routine duties) of workers conducting O&M activities. During these checks the biologist will judge the effectiveness of the measures in avoiding the collapse or fill of burrows. A narrative description of the effectiveness in avoiding impacts to burrows will be included in the annual report.

4.5.2.2 Relative Abundance and Distribution

IID will determine the relative abundance and distribution of burrowing owls in the HCP area. IID will survey 20 percent of the drainage and conveyance system in such a manner as to provide a valley-wide perspective of the burrowing owl population each year for the term of the permit. The HCP IT will approve the final study design but the general survey protocol will be as follows. The survey will be conducted by driving along the drains and canals and counting the number of territorial male owls observed. If more than one owl is observed at a burrow, only one owl will be counted to reflect one territory. Because owls in burrows in drain banks are more reliably observed from the drain bank opposite the burrow, both sides of drains will be driven. Along canals, owls can be reliably observed from one side of the canal, thus driving both sides of the canals will not be necessary. The surveys will be conducted after territories have been established but prior to the chicks fledging, approximately late April to early May. The location of each territory will be recorded to within 30 meters. The surveyors also will note any observations of banded birds.

The locations of the observed burrowing owls will be incorporated into a geographic information system (GIS). The burrowing owl GIS will be linked to or combined with spatial information on IID's maintenance activities and crop types in the HCP area. The GIS will be updated annually.

4.5.2.3 Demographic Study

Under the BOCS, IID will conduct a study of the burrowing owl population to understand the status of the population and estimate key population parameters. The demographic study will be initiated once relative abundance and distribution data have been obtained for the entire HCP area (i.e., after 5 years). The relative abundance and distribution data will be used to select areas for the demographic study. In the selected areas, all owls will be captured and banded. The weight, wing cord, and sex (when it can be reliably determined) of each owl will be recorded. Clutch sizes (number of chicks at time of banding) will be recorded for each female. The location of active nest burrows will be identified and entered into a GIS. The demographic study will be conducted for 12 to 15 years, with banding conducted annually. The specific study term and number of nests will be determined by the

HCP IT following consultation with a statistician. The fate of banded birds will be tracked through the annual capture of birds for banding as well as through observations during the relative abundance and distribution survey. The data collected through the demographic study will be used to construct a life table and calculate annual growth rates (λ). IID will develop the final study plan for the demographic study with input from the HCP IT. The study plan will be submitted to the USFWS and CDFG for approval.

4.5.3 Adaptive Management Program

IID has been delivering water to farmers in the Imperial Valley and maintaining its drainage and conveyance system for over 75 years. The Imperial Valley supports one of the highest densities of burrowing owls and supports much higher densities than in nearby native desert habitat (Rosenberg and Haley 2001). These observations suggest the persistence of burrowing owls in the HCP area is compatible with IID's drainage and conveyance system O&M activities. The burrowing owl population has persisted in the Imperial Valley for many years. Agriculture and IID's activities have made positive contributions to this persistence.

The results of the demographic study will be used to determine the population trend of the burrowing owl population. An annual growth rate (λ) equal to 1 indicates a stable population. A $\lambda > 1$ indicates that a population is increasing, whereas a $\lambda < 1$ suggests a population that is decreasing. Once the demographic study is completed, a one-tailed statistical test will be used to determine if λ is significantly less than 1 at a significance level (α) equal to 0.1. If λ is not significantly less than 1, the burrowing owl population will be considered to be stable or increasing and the conservation strategy will be considered effective. No adjustments to the operating BOCS will be made.

If λ is significantly less than 1, the HCP IT will have the option to access the Owl Contingency Fund. The HCP IT will have the discretion in determining whether the fund should be accessed and how the funds will be directed; however, the Owl Contingency Fund must be used only for actions addressing burrowing owls. Actions that could be funded with the Owl Contingency Fund include, but are not limited to:

- Conducting focused studies to understand the factors influencing the burrowing owl population
- Implementing management actions to benefit the population (e.g., creating burrows)
- Continuing the demographic study.

The demographic study will be discontinued after 12 to 15 years unless supported through the Owl Contingency Fund as authorized by the HCP IT. However, the relative abundance and distribution will continue over the term of the permit and will be used to provide insight on the status and trend of the burrowing owl population. Following completion of the demographic study, the HCP IT will establish criteria for using the relative abundance data to signal a "substantial adverse change" in the burrowing owl population. During the remainder of the permit (i.e., the period following completion of the demographic study until the end of the permit), if the relative abundance indicates a substantial adverse change based on the established criteria, the HCP Implementation Team will have the discretion to

20063

use the Owl Contingency Fund as described above. The adaptive management program for burrowing owls is depicted in Figure 4.5-1.

4.5.4 Reporting

IID will submit an annual report to the USFWS and CDFG. The annual report will include the following information.

- A narrative description of the effectiveness of the avoidance and minimization measures.
- Results of the relative abundance and distribution surveys, including deviations from the standard methodology, map of owl locations, data tables of the survey results and summary statistics, comments/observations and recommendations.
- For those years when the demographic study is conducted results of the demographic study, including deviations from the standard methodology, data tables of study results, calculations of λ, comments/observations and recommendations.

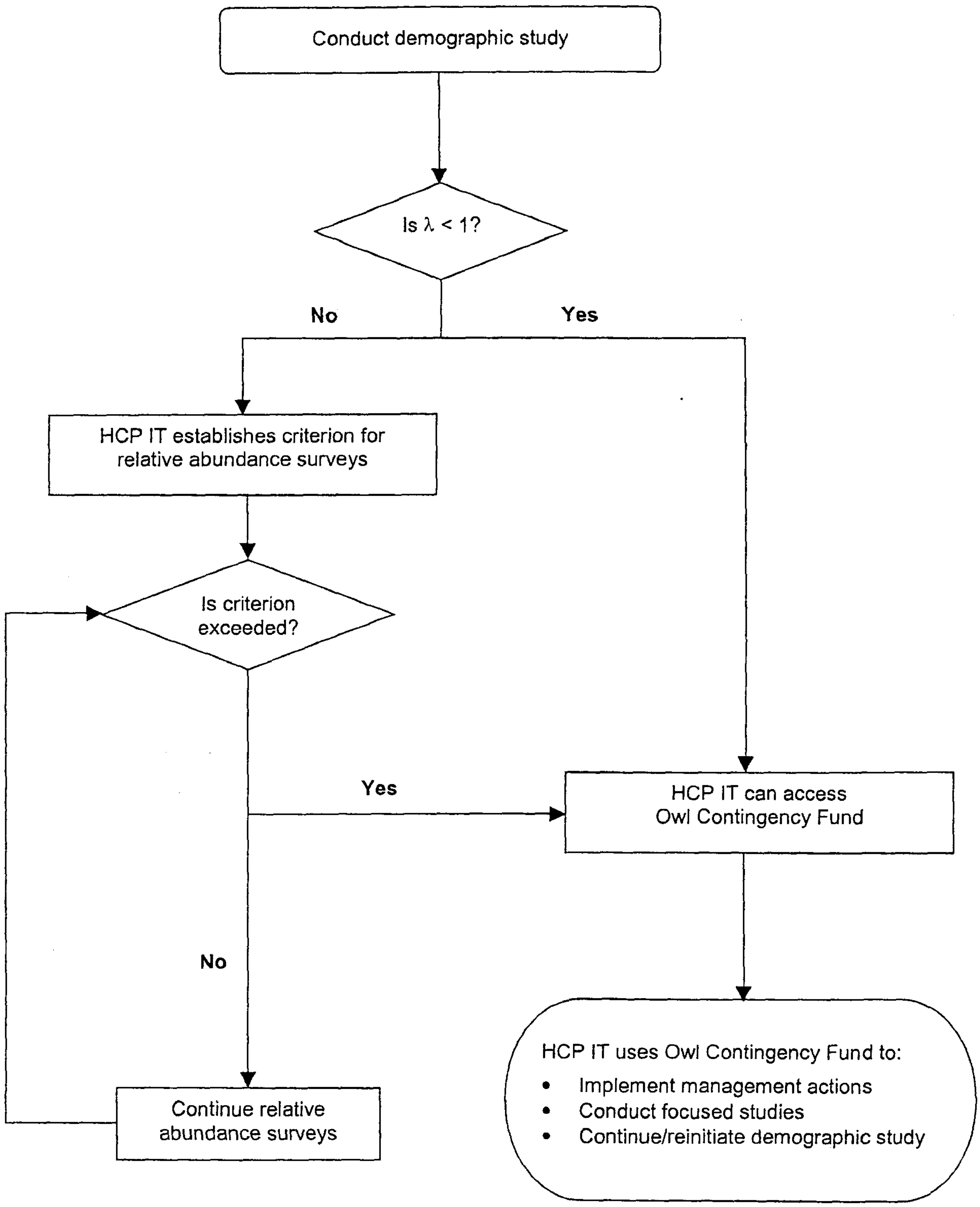


FIGURE 4.5-1
Burrowing Owl Adaptive Management Framework

4.6 Desert Pupfish

4.6.1 Compliance Monitoring

To achieve the biological goals of the desert pupfish strategy, IID has committed to implement several measures that will benefit pupfish and help ensure the persistence of pupfish in the drainage system. Each of these measures will be carried out in coordination with the HCP IT and will include various reporting requirements. These reports and routine interaction with the HCP IT will ensure compliance with the measures.

4.6.2 Effectiveness Monitoring

Several measures outlined in the pupfish strategy assume that maintaining potential habitat will ensure continued use by pupfish. Although factors beyond IID's control could influence the persistence of pupfish in the drains (e.g., competition with exotic species), routine monitoring of pupfish presence will be necessary to confirm continued use and to develop information useful in adaptively adjusting the creation and management of habitat in the future. To date, reliable techniques for capturing or monitoring pupfish populations have not been developed. Capture using baited minnow traps has been successful in demonstrating presence; however, trapping has proven to be unreliable in documenting absence. In consideration of the limitations of existing techniques, the HCP IT will develop an appropriate protocol for monitoring pupfish presence in drains maintained by IID and in drain channels constructed under Pupfish—3. In developing an appropriate protocol, the HCP IT may confer with outside scientists and/or contract with researchers to specifically study alternative monitoring approaches. The HCP IT and IID will prepare a detailed plan for monitoring pupfish presence within three years of issuance of the ITPs.

IID also has committed to modifying drains or drain flows to reduce the effects of potential increased selenium concentrations in the drains under certain circumstances (Pupfish—2). IID will monitor selenium concentrations in any drains modified under this measure to determine of the effectiveness of the action. The HCP IT will develop a specific monitoring plan that will include the frequency and extent of selenium sampling.

4.6.2 Adaptive Management

The detailed plans for pupfish and selenium monitoring developed by the HCP IT will contain an adaptive management element that outlines how information developed by the monitoring will be used to adjust future management and habitat creation activities.

4.6.3 Reporting

IID will submit an annual report to the USFWS and CDFG. The annual report will include the following information.

- All information specified in the reporting requirements identified in the detailed pupfish monitoring plan and selenium monitoring plan to be developed by the HCP IT.
- Results of pupfish salvage efforts at construction sites, including date, location, number of fish salvaged, and release location.

4.7 Razorback Suckers

4.7.1 Compliance Monitoring and Reporting

Under the Razorback Sucker Conservation Strategy, razorback suckers found when a canal is dewatered will be salvaged and released in the LCR. Whenever suckers are salvaged, IID will submit the following information to the USFWS and CDFG within one week of salvaging the fish:

- Canal where razorback suckers were salvaged
- Number and approximate age (i.e. adult or juvenile) of fish salvaged
- Number surviving transport and initial release.

4.7.2 Effectiveness Monitoring

The objective of the razorback sucker conservation strategy is to avoid killing any suckers that inhabit the canal system. The reports submitted to USFWS and CDFG of the number of fish salvaged and the number surviving until release will allow an assessment of the effectiveness of the measure in avoiding mortality of razorback suckers.

4.7.3 Adaptive Management

The HCP IT will develop the procedure for salvaging, transporting and releasing razorback suckers. Over the term of the permit, the HCP IT may adjust the procedures to improve survival of fish during capture, transport and release. The HCP IT may adjust the procedure if the compliance monitoring shows a high level of mortality or for consistency with standard practices developed by the USFWS or CDFG. With written approval from the USFWS and CDFG, IID can discontinue salvaging fish if 1) the long-term survival of salvaged razorback suckers is found to be poor, and/or 2) the USFWS and CDFG discontinue requiring salvage of razorback suckers for other projects.

4.8 Incidental Takings

At least once annually at a meeting of the HCP IT, IID will report any incidences of mortality or injury of covered species that occur as a result of the covered activities.

CHAPTER 5

Plan Implementation and Costs and Funding

5.1 Plan Participants and Covered Persons

IID only shall receive an ITP, under Section 10(a)(1)(B) of the FESA, from the USFWS pursuant to this HCP. Similarly, IID only shall receive an ITP under Section 2081(b) of the California Fish and Game Code from CDFG pursuant to this HCP. Coverage under the ITPs shall extend to others (e.g., farmers) engaged in activities related specifically to the water conservation program, as described below under Section 5.1.2 Other Covered Persons.

5.1.1 IID's Roles and Responsibilities

IID will have the sole responsibility for implementing the HCP. Specific duties include the following:

- Administer funds received from SDCWA pursuant to the Transfer Agreement
- Enter into water conservation agreements with willing farmers
- Implement the mitigation strategy, including the following:
  - Oversee habitat creation and management as described in Chapter 3
  - Conduct monitoring in the HCP area and of created habitats, as described in Chapter 4
  - Implement adaptive management strategies, as described in Chapter 4
  - Generate the periodic reports as described in Chapter 4
- Manage available funds to implement this HCP

5.1.2 Third-party Beneficiaries

The covered activities include installation and operation of on-farm water conservation activities and fallowing which is considered an on-farm water conservation technique. Under the water conservation and transfer programs, individual farmers would voluntarily participate in the conservation program. The method of achieving water conservation would be at the discretion of the individual farmer. Any take of covered species attributable to farmers resulting from installation or operation of water conservation measures is covered by the HCP. Furthermore, any take of covered species resulting from cessation of water conservation practices is covered. Farmers are not covered by this HCP for take of any covered species potentially resulting from other ordinary agricultural practices.

5.2 HCP Implementation Team

Under the HCP, IID will convene an HCP Implementation Team (HCP IT) consisting of representatives of the USFWS, CDFG, and IID to guide execution of the HCP over the term of the HCP. The HCP IT will be responsible for the following:

- Guiding implementation of the HCP measures (e.g., identifying the location and characteristics for managed marsh habitat to be created under the Drain Habitat Conservation Strategy)
- Developing specific methodologies for survey programs and studies, and
- Adjusting the HCP measures under the Adaptive Management Program.

Specific responsibilities of the HCP IT are identified in the HCP measures contained in Chapter 3 Habitat Conservation Plan Components and Effects on Covered Species and in Chapter 4 Monitoring and Adaptive Management.

Although IID will remain responsible for complying with the terms of the HCP, the HCP IT will play an important role in the implementation of specific aspects of the HCP. For example, the HCP IT may recommend revisions to the standard minimization and avoidance measures for O&M activities in desert habitat. While the HCP IT has the authority to recommend revisions, the HCP IT will not have the power to authorize IID to implement the revised measures and remain in compliance with the HCP. Only the USFWS and CDFG can approve that future adjustments are in compliance with the HCP requirements. Because the HCP IT will be composed of representatives from the USFWS and CDFG, conflicts between the recommendations of the HCP IT and authorizing individuals of these agencies are not expected. Nevertheless, in the event of such disagreements, both CDFG and the USFWS will have veto power over any recommendations/decisions made by the HCP IT. The CDFG and USFWS have 60 days from when the HCP IT makes a recommendation or decision to veto the decision. If an HCP IT decision is vetoed, the practices being implemented prior to the decision remain in effect unless or until the HCP IT issues a decision that is not vetoed by either resource agency.

5.3 Costs and Funding

The estimated cost of implementing the HCP ranges widely depending on the ultimate amount of habitat creation necessary under the Drain Habitat and Tamarisk Scrub Habitat Conservation Strategies, and for tamarisk adjacent to the Salton Sea under the Salton Sea Habitat Conservation Strategy. Per commitments identified in the IID/SDCWA Water Conservation and Transfer Agreement and the QSA, approximately $22.5 million has been allocated for the environmental mitigation required to mitigate project impacts and to minimize the impact of the potential take of covered species. Any mitigation costs in excess of the $22.5 million estimated to minimize and mitigate project impacts could be funded through one or a combination of the following: revenue generated through conservation and transfer of water, additional funds contributed by the water agencies, and grants or funding provided by the federal and state governments.

5.4 Response to Emergencies

Occasionally IID must respond to emergency situations. Emergency activities are actions that IID must take immediately and unpredictably to repair or prevent damage to its facilities in order to prevent property damage or protect human health and safety. Emergencies are situations under which IID cannot follow the normal procedures detailed under each of the conservation strategies (Chapter 3) to correct or prevent damage to property or risk to human health or safety. Emergency activities are most frequently required to respond to storm events or natural disaster (e.g., earthquakes) that result in damage to IID facilities (e.g. canal wash out, plugged siphon) and interrupt the distribution or collection of water.

Responding to an emergency requires IID to take immediate action. Because of the need to respond immediately in emergency situations, IID would not be able to follow the avoidance measures of HCP. These measures generally consist of surveying areas for covered species use prior to conducting construction activities and avoiding construction during sensitive time periods if covered species are present. In addition, Tree Habitat – 1 requires that construction areas be surveyed prior to construction to determine the acreage and plant species composition of vegetation that would be impacted. Similarly Desert Habitat – 5 requires a habitat survey if desert habitat would be impacted. In an emergency situation, IID would not be able to conduct the required species or habitat surveys nor schedule construction to avoid sensitive time periods. The measures IID would not be able to comply with are listed in Table 5.4-1. However, IID would be able to comply with HCP measures that specify restoration or creation of replacement habitat.

When an emergency occurs such that IID cannot comply with all of requirements of the HCP, IID will implement the following procedures.

- IID will notify the USFWS and CDFG within 24 hours of initiating emergency activities. In notifying the USFWS and CDFG, IID will describe the nature of the emergency and the actions necessary to correct the problem.
- The HCP Implementation Biologist will visit sites where emergency activities are being implemented as soon as possible. The biologist will take pictures of the damaged areas and note the general extent and species composition of any vegetation impacted by the emergency response activities. IID will use this information to restore or create replacement habitat in accordance with Tree Habitat – 1 and Desert Habitat – 3 and 5.
- For burrowing owls, the HCP Implementation Biologist will estimate the number of burrows impacted during the emergency activities based on the on-going surveys and the emergency action site visit. In accordance with Owl – 8, IID will install two burrows for every burrow permanently lost as a result of the emergency activities.
- Within one month of completing emergency actions, IID will meet with USFWS and CDFG to review the measures IID will implement to mitigate any impacts resulting from the emergency actions.

TABLE 5.4-1
Measures of the HCP that Contain Elements that IID Would not be Able to Follow When Responding to Emergencies.

Measure	Description
Tree Habitat - 1	For construction activities, the site will be surveyed before initiation of construction activities. If tamarisk scrub habitat occurs on the project site and would be affected by the construction activities, the acreage and plant species composition of the affected vegetation will be determined.
Tree Habitat – 3	For scheduled construction activities, the site will be surveyed to determine whether any covered species are potentially breeding at the site. If covered species are found, IID will schedule the construction activities that directly affect habitat to occur outside of the breeding season.
Drain Habitat – 2	IID will not dredge the river deltas between February 15 and August 31.
Desert Habitat – 3	Prior to initiating construction activities, the HCP Implementation Biologist will conduct a habitat survey of the construction area and adjacent areas. IID will implement the species-specific minimization and avoidance measures contained for the species identified by the biologist as potentially occurring at the construction site. A biological monitor will be on-site during construction activities or exclusion fencing will be erected to keep covered species out of the construction area. The construction area will be clearly flagged prior to the start of construction activities and all construction activities will be confined to the demarcated area.
Owl – 5	Prior to replacing facilities or constructing new facilities, workers will coordinate with the HCP Implementation Biologist. The biologist will determine if burrows occupied by burrowing owls would be filled or collapsed by the required work. If occupied burrows would be affected, the work will be scheduled to occur during October through February. Prior to conducting the work, the HCP Implementation Biologist will ensure that owls are not present in the burrows.
Owl – 8	For activities that would permanently eliminate burrows suitable for burrowing owls, IID will determine if owls are currently using burrows that would be impacted. If owls are using burrows that would be impacted, IID will conduct the activity during October through February and prior to the start of the activity, the HCP Implementation Biologist will ensure that owls are not present in the burrows.
Pupfish – 5	For construction activities (i.e., in-channel modifications) that directly affect pupfish drains, IID will gradually dewater the affected drain segment. IID will ensure that a person qualified to capture and handle pupfish and that meets the approval of the USFWS and CDFG will be present during the dewatering process to salvage and transport any pupfish stranded in the affected portion of the drain. Salvaged fish will be transported to a safe location downstream of the construction site or to a location determined by the HCP Implementation Team.
Sucker – 1	IID will salvage any razorback suckers found stranded in the dewatered portions of canals. Salvaged fish will be transported to the Colorado River.

5.5 Changed and Unforeseen Circumstances

5.5.1 The No Surprises Rule

The No Surprises Rule, published as a final rule on February 28, 1998 (63 FR 8859), generally provides that, as long as the HCP is properly implemented, the federal government will not require additional land, water, or money from the permittee in the event of unforeseen circumstances. Also, any additional measures to mitigate reasonably foreseeable changed circumstances will be limited to those changed circumstances specifically identified in the HCP and only to the extent of the mitigation specified in the HCP.

The No Surprises Rule has the following two major components:

- Changed Circumstances: USFWS regulations (50 CFR 17.32) state that "If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and were provided for in the plan's operating conservation program, the permittee will implement the measures specified in the plan. If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances and such measures were not provided for in the plan's operating conservation program, the Director will not require any conservation and mitigation measures in addition to those provided for in the plan without the consent of the permittee, provided the plan is being properly implemented."
- Unforeseen Circumstances: USFWS regulations (50 CFR 17.32) state, in part, that "In negotiating unforeseen circumstances, the Director will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the conservation plan without the consent of the permittee. If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, the Director may require additional measures of the permittee where the conservation plan is being properly implemented, but only if such measures are limited to modifications within conserved habitat areas, if any, or to the conservation plan's operating conservation program for the affected species, and maintain the original terms of the conservation plan to the maximum extent possible. Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the conservation plan without the consent of the permittee. The Director will have the burden of demonstrating that unforeseen circumstances exist, using the best scientific and commercial data available."

For the purposes of this HCP, changed circumstances are those changes affecting a species or geographic area covered by an HCP that can reasonably be anticipated and planned for by IID and the USFWS at the time of preparation of the HCP. Unforeseen circumstances refer to changes that could not reasonably have been anticipated by IID and the USFWS at the time the HCP was developed and negotiated, and that result in a substantial and adverse change in the status of a species covered by the HCP. The USFWS bears the burden of demonstrating that unforeseen circumstances exist, using the best available scientific and commercial data available, and considering certain specific factors.

Consistent with the No Surprises Rule and long-established agency practice, the HCP Implementation Agreement includes provisions restricting the authority of the USFWS and CDFG to require additional mitigation measures from IID to provide for the conservation of the covered species.

5.5.2 Changed Circumstances

In discussions with USFWS and CDFG, IID identified several circumstances under which changes could occur during the term of the ITP that would result in a substantial and adverse change in the status of a species covered by the HCP. These relate primarily to circumstances that influence IID's ability to carry out its obligations 1) on managed marsh and native tree habitats created and managed for mitigation, 2) in habitats supported by IID water (e.g., pupfish drains), and 3) in habitats acquired and managed for mitigation. These circumstances include:

- Seismic activity that affects IID's conveyance and drainage infrastructure and/or its ability to deliver or drain water
- Storm events that result in damage to IID infrastructure and substantial flooding
- Toxic spills that influence operations or directly affect species and habitat
- Introduction and invasion by exotic plant or animal species that affect covered species or their habitat
- Drought conditions in the Colorado River basin that influence the availability of water in the Imperial Valley

The potential for each of these circumstances is reasonably foreseeable. IID's strategy for addressing each of these is described below.

5.5.2.1 Earthquake

Because of its proximity to several faults, the Imperial Valley lies within a very seismically active area. The most recent surface ruptures in the valley occurred on October 15, 1979 (Mw 6.4) and on May 18, 1940 (Mw 6.9). During these events, IID sustained damage to the concrete lined portions of its system; however, IID's ability to deliver and drain water was not significantly affected. Earthquakes of the magnitude of the 1979 quake are anticipated to occur at a frequency of 30 to 40 years, whereas earthquakes of the magnitude of the 1940 event may occur only every 700 years. Because of the projected low frequency of a 6.9 magnitude earthquake in the valley, IID does not anticipate an event of greater magnitude during the term of the HCP.

The potential for an earthquake to cause a changed circumstance stems primarily from the possibility of a canal rupture or blockage that impairs IID's ability to deliver or drain water locally. This could potentially inhibit IID's ability to deliver water to the managed marsh and tree habitat mitigation sites over the short term or adversely influence conditions in the drains that support pupfish. In the event that an earthquake ruptures canals or drains, IID will implement the emergency measures described above in Section 5.4. These measures are intended to address repairs as quickly as possible and to mitigate potential habitat losses associated with those activities. Because IID's primary business is delivering irrigation water for agriculture in the Imperial Valley, it has a strong incentive to repair damage and restore deliveries as quickly as possible. IID will give managed marsh and tree habitat mitigation sites and pupfish drains the same priority as the most sensitive crops when restoring service to affected areas.

In addition to the potential consequences of earthquake on mitigation sites and pupfish, the repair of earthquake damage along canals (including concrete lining) and drains could affect burrowing owls. Actions taken by IID to repair damage to canals and drains will be carried out according to the emergency measures described in Chapter 3. In addition to these measures, which address the direct effects of emergency repair activities, the HCP Implementation Team will have access to a contingency fund allocated specifically to remedy adverse changes in the status of the burrowing owl population (for any reason) in the HCP area as evidenced by the population monitoring program for this species.

Since IID began operations, water conveyed through the AAC and its major canals has not been disrupted due to earthquake, and IID does not anticipate that earthquakes of the magnitude reasonably expected during the term of the HCP would significantly affect IID's ability to deliver water, nor would they cause damage that would result in the change of the status of a covered species. In addition, IID anticipates that any local disruptions in water delivery or damage to the system can be corrected and mitigated (if necessary) under the emergency measures of the HCP. Therefore, any changes in a species status resulting from long-term disruption of flow in the AAC or IID's major canals due to earthquake is considered an unforeseen circumstance.

5.5.2.2 Flood

On average, the Imperial Valley receives just over three inches of precipitation annually and the potential for major flooding is low. Nonetheless, intense storms occasionally result in local flooding and damage to IID canals and drains. These flood events typically are short in duration, and are not expected to result in a change in the status of a covered species. Flood damage to IID facilities (e.g., canals and drains) will be addressed and mitigated by the emergency measures described above in Section 5.4. A storm related flood event of sufficient magnitude to change the status of a covered species is not a reasonably foreseen event, and thus is considered an unforeseen circumstance.

5.5.2.3 Exotic Species

Invasive exotic plant species, such as tamarisk, are common in the agricultural areas of the Imperial Valley. These exotic species, as well as other unwanted vegetation, are routinely controlled by various means in the irrigated areas by farmers and IID. An invasion of exotic species could impair IID's ability to maintain its mitigation lands and habitats or reduce the suitability of these areas to covered species if left unmanaged. Weed control will be an integral element of the management plans developed with the HCP IT for each of the mitigation sites. Therefore, IID anticipates that the potential for exotic or competing plants to adversely affect habitat and covered species is very low and that reasonable outbreaks will be addressed by the current measures identified in the HCP. In the event that an exotic plant species is introduced that cannot be controlled by conventional means, IID will notify USFWS and CDFG, and work with the HCP IT to develop an appropriate corrective strategy. These activities will be coordinated with, comparable to, and conducted on a scale similar to the efforts conducted on similar habitats managed by area refuges.

In addition to the possibility of invasive plants affecting habitat and covered species, introduced animal species have the potential to influence the status of covered species over the term of the HCP. Introduced animals that prey upon or compete with covered species could influence the persistence and survival of covered species in the mitigation sites and the HCP area. If the introduction of an exotic species creates a circumstance that adversely affects a covered species, IID will work with the USFWS, CDFG, and HCP IT to develop a strategy for reducing the effects of that species' introduction. Actions could include modifying the management of mitigation lands to discourage the use by exotic species, implementing control measures, or developing educational materials for IID workers and farmers. Any activities conducted by IID in response to an exotic species must be conducted within the original operating budget for the HCP.

5.5.2.4 Drought

As previously described, agricultural production in the Imperial Valley is supported by irrigation and is not dependent on natural rainfall. Similarly, the managed marsh and native tree habitat mitigation sites, and flows in the pupfish drains are supported by water from the Colorado River. While drought in the conventional sense is not a foreseeable concern in the valley, long-term drought conditions in the Colorado River Basin could produce occasional reductions in water supplies that could affect IID's ability to fully deliver water to some or all of its customers. Such an event has not occurred since IID began operation.

In the unlikely event that water supplies from the Colorado River were reduced, IID would continue to give the mitigation sites and pupfish drains priority in water delivery. Given the amount of water necessary to support these mitigation and habitat areas relative to the agricultural needs in the valley, IID could easily continue to deliver water to the mitigation lands and the drains that support pupfish.

Over the history of IID's operation, agricultural users in the Imperial Valley have not lost crops nor changed cropping patterns due to the unavailability of irrigation water. This is due in large part to the storage capacity of water projects on the Colorado River, the reliability of IID's delivery infrastructure and the seniority of IID's water rights. Although local water deficiencies could occur, changes in water availability sufficient to change the status of a covered species are not expected. Therefore, circumstances where insufficient water availability precludes delivery of water to mitigation sites and existing habitat or substantially changes cropping patterns are not reasonably foreseeable and are considered unforeseen circumstances.

5.5.2.5 Disease

Various avian diseases (e.g., avian botulism) are common in the Imperial Valley, and USFWS and CDFG maintain ongoing programs to monitor and control disease outbreaks in the Salton Sea area. Managed marsh habitat created and managed by IID as mitigation associated with the HCP likely will attract waterfowl and other birds susceptible to these diseases. As part of its ongoing management of these sites, IID will monitor the open water areas for dead and sick birds, and coordinate the removal and disposal of dead and dying birds with the refuges and the Salton Sea Authority. During periods of severe outbreaks, IID will work with the HCP IT to modify its water management practices in the mitigation sites or implement other measures to reduce the potential for infection. The removal and disposal of dead birds and adjustments in water management were incorporated in the budgets allocated for the managed marsh mitigation. Additional activities to reduce disease outbreaks will be conducted to the extent the operating budget allows.

5.5.2.6 Toxic Spills

Toxic materials (e.g. anhydrous ammonia, diesel, and pesticides) are frequently transported or used in the Imperial Valley to support agriculture. Although the likelihood of a toxic spill changing the status of a covered species is remote, a spill occurring in a canal or drain could have broad effects on covered species and habitat. In the event of a spill in a canal that conveyed water to one of the mitigation sites, IID will take immediate action to minimize the migration of the material from the spill site and prevent movement of the material into the mitigation site (e.g., close delivery gates). IID will notify USFWS and CDFG, and work with the HCP IT to develop a plan for restoring water to the affected site. The timing and mechanism for restoring water will be determined by IID and the HCP IT in consideration of the characteristics of the spill and the type of material released.

The accidental release of a toxic material into a drain that supports pupfish will be treated in a manner similar to spills in canals. IID will take actions to minimize the downstream impact of the material in the drain and notify USFWS and CDFG immediately. These actions may include opening spill gates from laterals to the drain to dilute as much as practicable the concentration of the toxic substance within the drain flow. IID and the HCP IT will develop a course of action based on the specific circumstances of the event. Any activities conducted by IID in response to toxic spills must be conducted within the original operating budget for the HCP.

5.5.3 Unforeseen Circumstances

There are various, reasonably foreseen events that have the potential to affect the status of a covered species or influence IID's ability to meet its obligations under the HCP. A strategy for responding to potential changed circumstances associated with these events is outlined above. All circumstances not described above that would result in a change in the status of a covered species or additional impacts on the covered species not addressed by the HCP are considered unforeseen.

Based on its operation history, IID considers any event that disrupts delivery of water through the AAC, East Highline, Westside Main, or Central Main canals for a sufficient duration to cause a change in the status of a covered species to be an unforeseen circumstance. In addition, all projections of Salton Sea elevation indicate a reduction over the term of the HCP. These projections take into consideration a reasonable range of hydrologic conditions, and a change in hydrology that results in an increase in elevation of the Salton Sea is not anticipated. Therefore, impacts on habitat for covered species and created mitigation sites resulting from an increase in the elevation of the Salton Sea is an unforeseen circumstance.

CHAPTER 6

Alternatives

Section 10 of the ESA requires an applicant for an ITP to consider and describe "alternative actions to such takings" within the HCP. IID considered several alternatives in the process of developing the HCP that were determined to be inconsistent with its objectives and/or less likely to be successfully implemented. The alternatives to the HCP that were considered are listed below.

1. No Action Alternative
2. Conservation and Transfer of 130 KAF
3. Conservation and Transfer of 230 KAF

6.1 No Action Alternative

Under the No Action Alternative, IID would continue to meet the demands of farmers and other water users within its service area in the Imperial Valley using Colorado River water diverted in accordance with IID's existing water rights. IID would not engage in a program to conserve water for the purpose of transferring it outside the service area other than continued implementation of the 1988 IID/MWD Water Conservation and Transfer Agreement. System improvements and modernization programs would continue as needed, with listed species consultations (when necessary) conducted on an individual, project-specific basis. IID's ongoing O&M activities along the AAC and in the Imperial Valley would continue.

Under this alternative, diversion of water through the AAC would remain consistent with the range of flows currently diverted at Imperial Dam. In the Imperial Valley, the canal system would be operated and maintained in a manner consistent with current O&M activities, and the habitat values supported by the canal system would remain similar to the levels currently supported. Water quantity and quality in the drainage system also would be expected to be similar to existing conditions and trends.

Under the No Action, the salinity of the Salton Sea would continue to increase and the water surface elevation would decrease. The rate and magnitude of salinity and water surface elevation changes and the effects of these changes on covered species is described in Section 3.3.2. In addition, the EIR/EIS provides an evaluation of the trends in biological resources of the HCP area under the No Action.

The No Action Alternative is inconsistent with IID's primary goals and objectives. IID's primary objective is to continue to reliably deliver water and provide drainage to its agricultural and other water customers in the Imperial Valley. The No Action Alternative is also inconsistent with the objective of implementing the QSA which provides for a 75-year reallocation of Colorado River water among IID, MWD, and CVWD to address state and national issues concerning the Lower Colorado River. The Proposed Project and QSA provide IID with a means for protecting its water right and gaining additional future certainty in meeting the water demands of its customers. This provides considerable benefit to the agricultural community and economy in the Imperial Valley and also benefits the covered species by assisting in assuring the continued viability of agriculture in the Imperial Valley. The agricultural activities supported by water delivered by IID provide habitat that has attracted many species to the area. Species using habitats associated with agricultural production in the Imperial Valley also are dependent upon continued delivery of water to maintain existing levels of use. Future impairment of IID's ability to fully deliver water to its customers could also result in negative effects on the fish and wildlife resources that are dependent upon the habitats supported by agricultural irrigation water.

In consideration of these factors, IID determined that taking no action could lead to the impairment of its ability to deliver water in the future and result in negative impacts to its customers, the biological resources, and the agricultural economy that depends on water delivery. Therefore, the No Action Alternative is not considered to be a practicable or feasible alternative.

6.2 Modification of Water Conservation and Transfer Amounts

Two different levels of water conservation were examined as alternative actions to the level of take anticipated under the proposed water conservation programs and the HCP. The underlying premise for considering these alternatives was that the potential for impact and the level of take are related to the amount of water conserved and transferred out of the system. Each of these alternatives was anticipated to have incrementally less impact relative to the Proposed Project.

As described in Section 6.1, No Action Alternative, it is important for IID to meet the terms of the IID/SDCWA Water Conservation and Transfer Agreement and the QSA to protect its water right and its ability to fully serve its customers in the future. Modification of the water conservation and transfer amounts is inconsistent with meeting that objective. In addition, as described below, reduced conservation and transfer amounts would not substantially reduce the level of take or mitigation requirements. For these reasons, none of these alternatives were adopted.

6.2.1 Conservation and Transfer of 130 KAF Out of the Basin

Under this level of water conservation, IID would restrict the amount of water conserved and transferred out of the basin (i.e., to SDCWA) to 130 KAFY. Water would be conserved through a variety of on-farm methods. As with the proposed HCP, potential impacts along and within IID's canal and drainage system, and in and around the Salton Sea could occur. Habitat conditions along the AAC would remain relatively unchanged. IID's ongoing O&M activities would be the same as those outlined in the proposed HCP. The primary difference between this alternative and the proposed HCP relate to the amount and quality of water in the drains and entering the Salton Sea.

Results of the analysis conducted for the proposed HCP indicate that conservation of 130 KAFY annually using on-farm methods would result in a maximum of 23 acres of additional drain vegetation being needed to compensate for increased selenium toxicity as indicated by predicted hatchability effects (see Section 3.5). Using a mitigation ratio of 1:1 for take associated with selenium toxicity, a maximum of 23 acres of managed marsh habitat would be created to mitigate selenium toxicity impacts to covered species under this alternative. Under the proposed HCP, 23 to 42 acres of habitat would be needed to offset selenium toxicity. While the level of mitigation required specifically for selenium effects would be lower under this alternative, creation of managed marsh to address impacts of other covered activities would result in the overall amount of mitigation being similar to the Proposed HCP.

The rate of salinization of the Salton Sea and the expected effects on covered species using the Salton Sea would also not differ substantially from the proposed HCP. Conservation of 300 KAF through on-farm and system-based measures under the HCP would reduce inflow to the sea by about 300 KAF. At this level of reduced inflow, the modeling shows the salinity of Salton Sea exceeding 60 ppt in 2012 (Figure 3.3-1). Conservation and transfer of 130 KAF of water using on-farm measures would reduce inflow to the Salton Sea by 130 KAF. At this level of inflow reduction, the modeling shows that 60 ppt would be exceeded in 2013, one year later than under the Proposed HCP. Because the reduced level of conservation would not reduce the level of impact relative to the activities covered by the permit, it was not carried forward.

6.2.2 Conservation and Transfer of 230 KAF

This level of water conservation anticipates the conservation of a total of 230 KAFY and transfer of 130 KAFY to SDCWA and 100 KAFY to CVWD. Under this scenario, it is assumed that the impacts to the Imperial Valley (e.g., reduction of habitat quality in the drains) would be intermediate to the Proposed Project and the 130 KAF level of conservation. IID's ongoing O&M activities would be the same as those outlined in the proposed HCP.

Conservation of 230 KAF annually using a combination of on-farm methods (130 KAFY) and system improvements (100 KAFY) would result in a maximum of 37 acres of drain vegetation needed to offset selenium toxicity as indicated by predicted hatchability effects. If the total of 230 KAFY were conserved using only on-farm methods, a maximum of 24 acres of would be needed. Using a mitigation ratio of 1:1 for take associated with selenium toxicity, from 24 to 37 acres of managed marsh habitat would be created to mitigate selenium toxicity impacts to covered species under this alternative. This range of impacts is nearly identical to that predicted under the proposed HCP (23 to 42 acres). Thus, this alternative would not substantially change the level of take of covered species or mitigation requirements.

The rate of salinization of the Salton Sea and the expected effects on covered species using the Salton Sea would also not differ substantially from the proposed HCP. Conservation and transfer of 230 KAF would be achieved through conservation of 130 KAF through on-farm conservation measures and 100 KAF conserved through system-based measures, fallowing or additional on-farm measures. Inflow to the sea would be reduced by up to 230 KAF. At this level of inflow reduction, the salinity of the Salton Sea is projected to surpass 60 ppt in 2012, the same year as under the Proposed HCP. Thus, this lower level of conservation would not reduce the level of impact relative to the activities covered by the permit.

CHAPTER 7

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APPENDIX A

Species Covered by the HCP

APPENDIX A

Species Covered by the HCP

Invertebrates

Cheeseweed Moth Lacewing (*Oliarces clara*)

Range and Distribution

The cheeseweed moth lacewing has been documented from Yuma County in western Arizona; Imperial, Riverside, and San Bernardino Counties in Southern California; and Clark County, Nevada. Collections of the moth lacewing have been made from sea level in Imperial County to 100 meters (m) (328 feet) elevation in Riverside County (Faulkner, 1990; Faulkner personal communication). The range of the species may be much more extensive than its documented range, correlating to some extent with the range of its larval host plant, creosote bush (*Larrea tridentata*) (Faulkner personal communication).

Population Status

This species is rarely observed in the field. However, in 1964, a massive emergence occurred near Palm Springs, with hundreds of individuals present (Faulkner, 1990). The cheeseweed moth lacewing is a federal species of concern (former category 2 candidate for federal listing). Although infrequently observed, the moth lacewing may exist at many undocumented sites throughout the arid southwest region of the United States. The fleeting, localized nature of adult emergence complicates efforts to assess the population status of this species.

Habitat Requirements

The larval stage is associated with creosote bush, a desert shrub found throughout much of the southwestern United States and northwestern Mexico (Faulkner, 1990). All collections of mature larvae and egg cases have produced specimens that were found inhabiting the root mass of this plant (USBR, 1996). Adult emergence from soils near creosote bushes often follows winters of high precipitation, and is fleeting and localized, lasting no longer than 4 days (Faulkner personal communication). On the first day, adult males emerge early in the morning and form large aggregations at the highest natural or manmade landmark. This landmark may be a cliff, rock outcropping, or telephone pole. Flight is weak and many individuals are observed walking to the landmark rather than flying. Adult male activity on the first day ceases at noon with individuals taking shelter in the cracks of cliff walls, under rocks, and under vegetation. Females emerge on day two and mating occurs. Activity decreases throughout the third day with the increased occurrence of mortality, and ceases by the fourth day with nearly complete mortality (Faulkner, 1990).

Habitat in the Proposed Project Area

The creosote bush scrub community is widespread throughout the unirrigated areas of the Sonoran Desert. This habitat type surrounds the Salton Sea between the higher rock hillsides and the more saline desert saltbrush community. In the Habitat Conservation Plan (HCP) area, creosote scrub also occurs with the right-of-way of Imperial Irrigation District (IID) along the AAC.

Proposed Project Area Occurrence

The occurrence and distribution of the cheeseweed moth lacewing in the proposed project area are unknown. Suitable habitat likely exists in the HCP area in desert habitats adjacent to the AAC. A single moth lacewing was attracted to a light near Parker, California, in 1949 (Belkin, 1954); however, no emergence sites have been documented for this area (USBR, 1996).

Andrew's Dune Scarab Beetle (*Pseudocatalpa andrewsi*)

Range and Distribution

The Andrew's dune scarab beetle is endemic to the creosote bush scrub habitats of the Algodones Dunes and Sand Hills in Imperial County, California, and may occur in portions of the sand dune system in Baja California Norte, Mexico.

Population Status

Detailed population information is not available for this species. However, its limited distributional range and endemisim to the area make this beetle a federal species of concern. No current threats have been identified; however, offroad vehicle traffic on the dunes could potentially impact this species.

Habitat Requirements

Andrew's dune scarab beetle primarily occurs at elevations between 98 and 492 feet (30 and 150 meters) in desert dune and Sonoran desert scrub habitats. This species inhabits both surface and subsurface sand, utilizing the wet sand interface as protection from heat of the day. This beetle specifically inhabits troughs of loose drifting sand between the dunes. They have been observed buried 12 inches deep in the sand.

Habitat in the Proposed Project Area

Suitable habitat for Andrew's dune scarab beetle in the proposed project area occurs where the AAC traverses the Sand Hills and Algodones Dunes.

Proposed Project Area Occurrence

Andrew's dune scarab beetle is endemic to the Algodones Dunes and Sand Hills areas in Imperial County. Distribution of this species is apparently widespread across the main dune mass, and it could potentially occur within the right-of-way of IID along the AAC. There is no evidence that it inhabits desert areas other than the main dunes (Hardy and Andrews, 1980).

Fish

Razorback Sucker (*Xyrauchen texanus*)

Range and Distribution

Historically, the razorback sucker inhabited the Colorado River and its tributaries from Wyoming to the Gulf of California. Razorback suckers were found in the Gila, Salt, and Verde Rivers, which are all tributaries of the Lower Colorado River (LCR). Upper basin tributaries containing historic populations of razorback suckers included the Gunnison River upstream to Delta, Colorado; the Green River from its confluence with the Colorado River upstream to Green River, Wyoming (Vanicek et al., 1970); the Duchesne River (Tyus, 1987); the lower White River near Ouray, Utah (Sigler and Miller, 1963); the Little Snake River and lower Yampa River, Colorado (McAda and Wydoski, 1980); and the San Juan River, New Mexico. Most razorback suckers in the LCR basin are currently restricted to Lake Mohave with smaller populations occurring in the Colorado River below Davis Dam, Lake Mead, and Senator Wash Reservoir (Bradford and Vlach, 1995). Razorback suckers have also been captured sporadically from the mainstream Colorado River, impoundments, and canals (Marsh and Minckley, 1989). Valdez and Carothers (1998) indicate that a small population also exists in the Grand Canyon section of the Colorado River. The current distribution of razorback suckers in the Upper Colorado River basin is confined to small groups of fish in several widely distributed locations. Most fish occur in an area including the lower 6.4 kilometers (km) (4 miles) of the Yampa River and the Green River from the mouth of the Yampa River downstream to the confluence with the Duchesne River (USFWS, 1997a). Small populations may also occur in the Colorado River at Grand Valley and in the San Juan River upstream from Lake Powell.

Population Status

The largest extant population of razorback suckers in the LCR basin occurs in Lake Mohave; however, this population is declining rapidly. The Lake Mohave population was estimated to contain 60,000 individuals in 1988 (Minckley et al., 1991) but by 1995, only 25,000 razorback suckers were thought to exist there (Marsh, 1995). Although razorback sucker spawning has been successful and larval fish have been observed (more than 20,000 wild razorback sucker larvae were collected in 1995 from Lake Mohave [USBR, 1996b]), virtually no recruitment has been detected. Combined data from 1990 to 1997 suggest that the total population of razorback suckers in Lake Mead during 1997 was between 400 and 450 individuals (Holden et al., 1997). Recent population estimates from 1998 indicate that this population may have decreased to less than 300 fish (Holden et al., 1999). Successful spawning has been identified at two locations in Lake Mead. Thousands of larvae were collected during the spring of 1997, but no juveniles were found during May and June of the same year (Holden et al., 1997). The occurrence of some relatively young razorback suckers in recent surveys indicates there may be some recruitment in Lake Mead.

In the upper basin, razorback sucker populations are smaller and more widely distributed. The largest concentration occurs in the middle Green River, but Modde et al. (1996) report that the mean razorback sucker population from 1980 to 1992 in the middle Green River was only 524 individuals.

During the past few decades, the population dynamics of razorback suckers at different locations in the LCR basin have exhibited similar trends. Adult fish were observed in each population; however, juveniles were rare. Although wild populations of razorback suckers had been observed spawning in various locations in the lower basin, recruitment was never successful enough to replenish the adult populations. Eventually, the adult fish die of old age, and populations become reduced or extirpated. The lack of recruitment in these populations is thought to be primarily a result of predation by non-native fish on early life stages of razorback suckers.

Water resource development and interactions with non-native fish species currently threaten razorback suckers (Pacey and Marsh, 1998). The limiting factors resulting from these two major threats include altered temperature and flow regimes, habitat loss, habitat fragmentation, predation, competition, and an increased risk of disease and parasitism. The primary limiting factor for razorback suckers in the lower basin is probably the direct effect of predation by non-native fish on early life stages of razorback suckers (Johnson, 1997; Pacey and Marsh, 1998).

The presence of impoundments in the LCR represents another major threat to razorback suckers. The unnatural temperature and flow regimes created by impoundments may inhibit spawning and reduce growth of razorback suckers. Daily fluctuations in the river may result in mortality from fish stranded in flooded areas. Another limiting factor that is directly related to the flow regime is loss of habitat. The comparatively stable flows that occur downstream of impoundments during the spring and early summer do not allow the river to flood and maintain low-lying areas. Historically, high spring and summer flows created large backwater areas and off-channel habitat that may have been important habitat for early life-stages of razorback suckers. The dams and impoundments also act as barriers to larval drift, species expansion, and migration.

Habitat Requirements

Adult razorback sucker habitat utilization can vary depending on season and location. Adult razorback suckers are adapted for swimming in swift currents, but they may also be found in eddies and backwaters away from the main current (Allan and Roden, 1978). Ryden and Pfeifer (1995) observe that subadult razorback suckers use eddies, pools, backwaters, and other slow water habitats during spring runoff, and move into swifter habitats associated with the main channel during summer. Tyus and Karp (1990) report that during spring runoff, adults also use flooded lowlands and areas of low velocity. Tyus (1987) indicates that mid-channel sandbars represent a common summer habitat. Bradford et al. (1998) conclude that adult razorback suckers in the lower Imperial Division area of the Colorado River actively selected backwater habitats for use; however, many of these habitats had become unavailable to fish due to the effects of regulated flows. In clear reservoirs, adults of this species are considered pelagic, and can be found at various depths, except during the spawning period when they use more shallow shoreline areas. Little is known about juvenile habitat requirements because very few juveniles have been captured in the wild. Larval razorback suckers have been observed using nearshore areas in Lake Mohave (Marsh and Langhorst, 1988). In riverine environments, young razorback suckers use shorelines, embayments, and tributary mouths (Minckley et al., 1991).

During the spawning season, adult razorback sucker migrations have been documented in Lake Mohave (Marsh and Minckley, 1989), the Green River, and the lower Yampa River (Tyus, 1987). Razorback sucker adults have demonstrated fidelity for spawning locations (Tyus and Karp, 1990). Spawning in lakes and streams takes place over loosely packed gravel or cobble substrate, and always at velocities less than 1.5 m/second (4.9 feet/second) (Bradford and Vlach, 1995). In the lower basin reservoirs, spawning occurs from January through April/May (Langhorst and Marsh, 1986). In Lake Mead, spawning has been observed from mid-February until early May (Holden et al., 1997). In the upper basin, spawning occurs later in the year; but the temperature range is similar to lower basin spawning times (USFWS, 1997a). The final thermal preferendum for the adult razorback sucker is estimated to lie between 22.9 degrees Celsius (°C) and 24.8°C (73.2 and 76.6 degrees Fahrenheit [°F]) (Bulkley and Pimental, 1983).

The razorback sucker is an omnivorous bottom feeder. Its diet is dependent on location and life stage (Bradford and Vlach, 1995; Valdez and Carothers, 1998). Larval razorback suckers were reported to feed on diatoms, rotifers, algae, and detritus (Wydoski and Wick, 1998). Stomach contents of adult individuals collected in riverine habitat consist of algae and dipteran larvae, while adults examined from Lake Mohave were found to feed primarily on planktonic crustaceans (Minckley, 1973).

Habitat in the Proposed Project Area

Razorback suckers are associated with large river systems and, within those systems, prefer low-velocity backwater areas. The high-water velocities and sparse vegetation associated with the irrigation canals in Imperial Valley do not provide these conditions, and habitat quality is low for razorback suckers. While it is possible that adult razorback suckers entrained in the canal system persist for some time, they are not likely to establish a self-sustaining population.

Proposed Project Area Occurrence

Razorback suckers are known to occur in the All American and East Highline canal systems. The species has also been found in an IID reservoir near Niland. The population in Imperial County is believed to be composed of old members of a dwindling, nonreproductive, remnant stock (Tyus, 1991; Minckley et al., 1991). No recruitment of wild-spawned fish occurs, probably because of predation by introduced fishes and poor habitat conditions (Tyus, 1991).

Desert Pupfish *(Cyprinodon macularius)*

Range and Distribution

Desert pupfish historically occupied the Gila River basin below about 1,500 meters elevation in Arizona and Sonora, including the Gila, Santa Cruz, San Pedro, and Salt Rivers; the LCR in Arizona and California downstream from the vicinity of Needles to the Gulf of California and onto its delta in Sonora and Baja California; the Rio Sonoyta of Arizona and Sonora; Puerto Penasco, Sonora; and the Laguna Salada basin of Baja California. (Marsh and Sada, 1993). Suitable habitat was available, and the species probably occurred in the Agua Fria, Hassayampa, and Verde Rivers of Arizona as well. Distribution of desert pupfish was widespread but probably not continuous within its historic range.

There are currently two recognized subspecies of the desert pupfish, *Cyprinodon macularius macularius* and *C. m. eremus*. Both subspecies are included in the federal listing of the desert pupfish as endangered. Only the *macularis* subspecies occurs in the proposed project area. Historically, *C. m. macularius* occurred in the Gila River basin, mainstream Colorado River from Needles to the Gulf of California, Rio Sonoyta, Puerto Peñasco, and Laguna Salada (Minckley, 1973 and 1980; Miller and Fuiman, 1987). Currently, in California, the *macularius* subspecies is restricted to San Felipe Creek and the adjacent wetland, San Sebastian Marsh, upper Salt Creek, and a small portion of the Salton Sea (Miller and Fuiman, 1987). In California, the San Felipe Creek system, including San Sebastian Marsh and Salt Creek, provides natural habitat for the desert pupfish populations. *C. m. eremus* was historically found only in Quitobaquito Spring, Arizona. This species still contains a natural population. Reintroductions of *C. m. macularius* (15 populations) and *C. m. eremus* (6 populations) have occurred at many different locales in Arizona. Pupfish are also thought to inhabit the Rio Sonoyta and Santa Clara Slough in Sonora, Mexico (*Federal Register*, 1986).

Population Status

Although remarkably tolerant of extreme environmental conditions, the desert pupfish is threatened throughout its native range primarily because of habitat loss or modification, pollution, and introductions of exotic fishes (USFWS, 1986). The introduction of non-native species is the greatest future threat and current limiting factor affecting the desert pupfish. Introduced species, such as the mosquitofish (*Gambusia affinis*) and largemouth bass, supplant pupfish as a result of predation and aggression while cichlids (*Tilapia* spp.) and mollies interfere with reproductive behavior (USFWS, 1993a). The non-native bullfrog (*Rana catesbiana*) is also a predator of the desert pupfish (USFWS, 1993a).

Although desert pupfish have very high tolerances for adverse environmental conditions, severe conditions can reduce this species' ability to survive. Improper grazing can increase turbidity by increasing erosion and reducing riparian vegetation. Water pollution from the application of pesticides in proximity to desert pupfish habitat is also an important factor, contributing to the decline of the Quitobaquito subspecies (Miller and Fuiman, 1987).

Desert pupfish habitat quality can be a limiting factor. Droughts can cause the springs and headwaters that this species inhabits to dry up. Water development proposed projects can degrade desert pupfish habitat by removing water through groundwater pumping, diversion, and irrigation. The reduction of the amount of water in these habitats can create situations where the desert pupfish are at a competitive disadvantage with exotic fish species.

Habitat Requirements

Desert pupfish use a variety of different habitats, including cienagas, springs, headwater streams, and margins of large rivers. It prefers shallow, clear water, with either rooted or unattached aquatic plants, restricted surface flow, and sand-silt substrates (Black, 1980; Marsh and Sada, 1993; and Schoenherr, 1990). They have the ability to withstand extreme water temperatures up to 45°C (113°F), dissolved oxygen concentrations down to 0.1 to 0.4 parts per million (ppm) (USFWS, 1986), and salinity twice that of seawater (68 parts per trillion [ppt], Lowe et al., 1967). Barlow (1958) reported that adult desert pupfish survived salinity as high as 98,100 milligrams per liter (mg/L) in the laboratory. They can also survive 10 to 15 ppt changes in salinity as well as daily temperature fluctuations of 22 to 26° C (Kinne, 1960; Lowe and Heath, 1969). In less harsh environments where a greater diversity of fishes are found, pupfish tend to occupy water shallower than that inhabited by adults of most other species (Marsh and Sada, 1993).

Spawning at the Salton Sea takes place between late March and late September when water temperatures exceed 20° C (Moyle, 1976; UCLA, 1983). Pupfish can spawn several times during this period. Adult male desert pupfish are very territorial during the spawning season such that schools consist either entirely of adult females or entirely of juveniles. Desert pupfish usually set up territories in water less than 1 m (3 feet) deep and associated with structure (Barlow, 1961). Territoriality is highest in locations with large amounts of habitat, high productivity, high population densities, and limited spawning substrate (USFWS, 1993a). Desert pupfish prefer water 18 to 22 centimeters (cm) deep for egg deposition (Courtois and Hino, 1979). Depending on size, a female pupfish may lay 50 to 800 eggs or more during a season (Crear and Haydock, 1971). The eggs hatch in 10 days at 20° C, and the larvae start feeding on small invertebrates within a day after hatching (Crear and Haydock, 1971). Larvae are frequently found in shallow water where environmental conditions are severe.

Desert pupfish are omnivorous and consume a variety of algae, plants, insects, and crustaceans (USFWS, 1993a; Cox,1972; and Naiman, 1979). Walters and Legner (1980) found that pupfish foraged mostly on the bottom, consuming midge larvae, detritus, aquatic vegetation, and snails. Desert pupfish is an opportunistic feeder whose diet varies seasonally with food availability (Naiman, 1979). In general, when invertebrates are available, they are the preferred food of foraging pupfish. In the Salton Sea, ostracods, copepods, and occasionally insects and pile worms are taken (Moyle, 1976). As invertebrates become less available, pupfish adjust their feeding behavior and their gut usually contains large amounts of algae and detritus, as well as invertebrates (Cox, 1972). The desert pupfish is not considered an important food for wading birds and other fish because of its low numbers (Walker et al., 1961; Barlow, 1961).

Habitat in the Proposed Project Area

Desert pupfish prefer backwater areas, springs, streams, and pools along the shoreline of the Salton Sea. Desert pupfish habitat occurs in pools formed by barnacle bars located in near-shore and shoreline areas of the Salton Sea and in Salt Creek. Barnacle bars are deposits of barnacle shells on beaches, near-shore, and at the mouths of drains that discharge to the Salton Sea. The bars form pools that provide habitat for desert pupfish (IID, 1994). Habitat for desert pupfish also occurs in the mouths of drains discharging directly to the Salton Sea and in the desert washes at San Felipe Creek and Salt Creek.

Proposed Project Area Occurrence

Desert pupfish were abundant along the shore of the Salton Sea through the 1950s (Barlow, 1961). During the 1960s, the numbers declined; by 1978, they were noted as scarce and sporadic (Black, 1980). Declines are thought to have resulted from the introduction and establishment of several exotic tropical species into the Salton Sea (Bolster, 1990; Black, 1980). These introduced species prey on or compete with desert pupfish for food and space. The sailfin molly (*Poecilia latipinna*) was discovered in irrigation drains in the late 1950s

(Black, 1980) and has become established in the Salton Sea (Moyle, 1976). The Mozambique mouthbrooder (*Tilapia mossambicus*) and Zill's cichlid (*T. zillii*) were introduced into the Salton Sea in the late 1960s and early 1970s to control aquatic weed growth in the irrigation canals and drains (Black, 1980). Interactions with the introduced mosquitofish (*Gambusia affinis*) have contributed to the decline of pupfish (Evermann, 1930; Jennings, 1985). Other factors responsible for declines in desert pupfish populations around the Salton Sea include habitat modification due to water diversions and groundwater pumping for agriculture (Pister, 1974; Black, 1980). There is also concern that introduced saltceder (tamarisk) near pupfish habitat may cause a lack of water at critical times due to evapotranspiration (Marsh and Sada, 1993). Aerial pesticide application is a common practice around the Salton Sea that may also affect pupfish populations (Marsh and Sada, 1993).

Historical accounts indicate that desert pupfish was once widespread and abundant around the Salton Sea. Surveys conducted by the USFWS to determine their distribution around the Salton Sea indicated that desert pupfish were present in more than 50 localities in canals and shoreline pools on the southern and eastern margins of the Salton Sea (Lau and Boehm, 1991) and in small pools in San Felipe Creek, Carrizo Wash, and Fish Creek Wash near the Salton Sea. Localities also include agricultural drains in the Imperial and Coachella Valleys, shoreline pools around the Salton Sea, the mouth of Salt Creek in Riverside County, lower San Felipe Creek and its associated wetlands in Imperial County, and eight artificial refuge ponds (Bolster, 1990; USFWS, 1999). Designated critical habitat for desert pupfish includes San Felipe Creek, Carrizo Wash, and Fish Creek in Imperial County, California (USFWS, 1986). The distribution of pupfish around the Salton Sea and designated critical habitat are shown on Figure A-1.

In surveys conducted by the California Department of Fish and Game (CDFG) in 1978-1979, desert pupfish accounted for 3 percent of the total catch in irrigation drains, 5 percent of the catch in shoreline pools, and less than 1 percent of the catch from three natural permanent tributaries and the Salton Sea proper (Black, 1980). However, desert pupfish accounted for 70 percent of the total catch from San Felipe Creek.

Dunham and Minckley (1998) reported a rebound of pupfish populations in the Salton Sea paralleling recent declines in non-native fishes, presumably in response to increasing salinity. However, surveys in the various habitats around the Salton Sea indicate a general decline in desert pupfish abundance and distribution since 1991 (Table A-1). In 1991, 41 irrigation drains contained pupfish; this number was reduced to 33 in 1993 (Remington and Hess, 1993). Only 11 irrigation drains contained pupfish in 1998, and the numbers of desert pupfish also declined from the earlier surveys (Sutton, 1999).

Extreme annual variability in catch has occurred at individual sample sites (e.g., Trifolium 12 and County Line drains) (Table A-1). Variability in catch also occurs within a season and some drains that did not yield pupfish during one trap set often produced pupfish in subsequent trappings (Nicol et al., 1991). This suggests that desert pupfish may move among habitats for various reasons. A variety of other factors may also influence trapping results, including numbers of traps, trap location, bait types, timing, water level fluctuations, and vegetation removal (Nicol et al., 1991).

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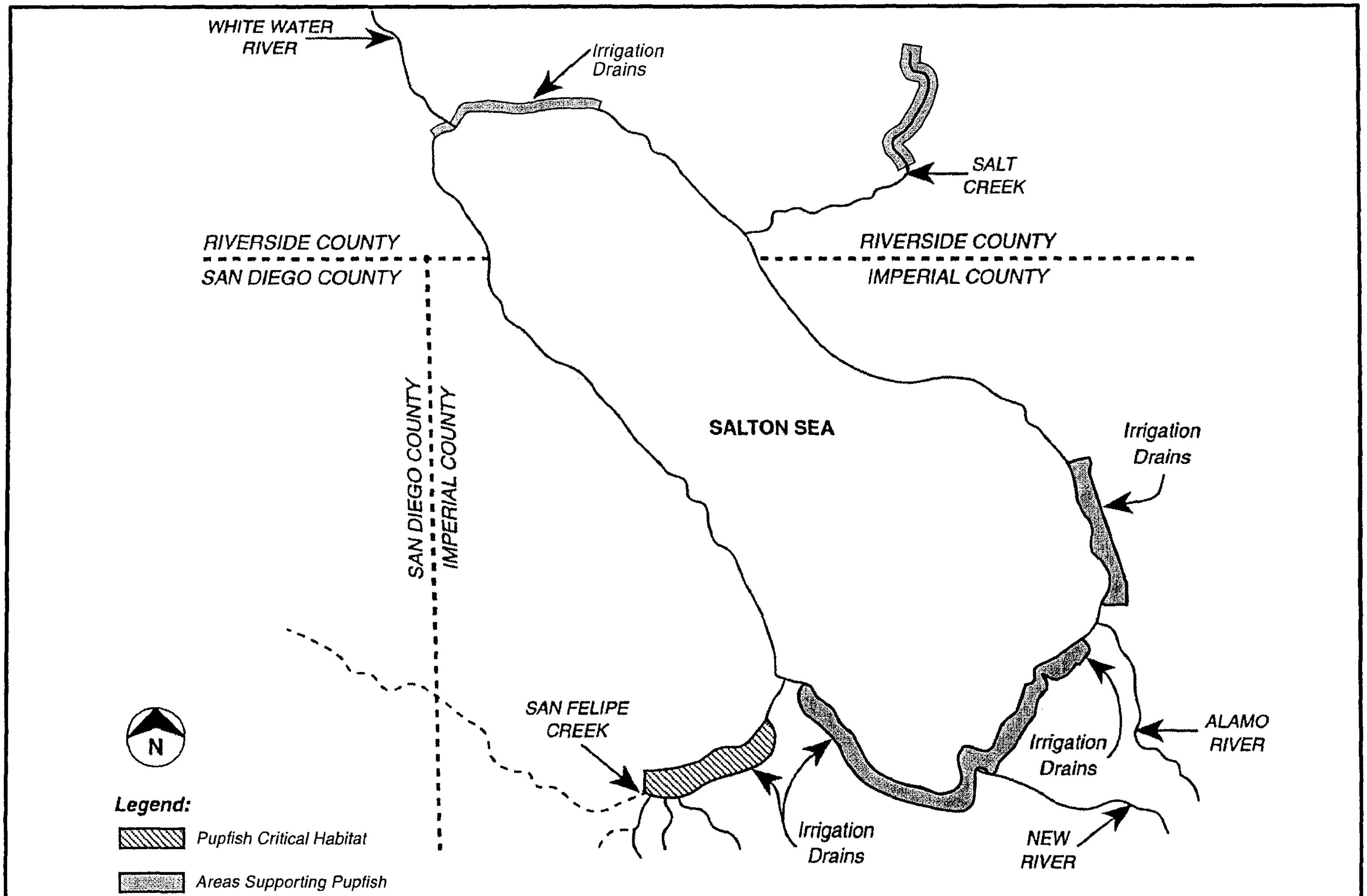

Figure A-1
Areas Sampled During 1993
CDFG/IID Desert Pupfish Survey
IID Water Conservation and Transfer Project Draft HCP

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TABLE A-1
Numbers of Desert Pupfish Collected During Various Surveys at the Salton Sea

Drains	Year						
	1991[1]	1993[2]	1994[3,4]	1995[1]	1996[4]	1997[4,5]	1998[4]
North End							
County Line	*				490	6	4
Oasis Grant	7						
Ave 84	38	27			*		1
Ave 83	5	1			27		1
Ave 82	*	4			*		1
Ave 81	3	5			6	6	8
Ave 80	80						
Ave 79	22	35	7				
Ave 78	155	84	1				
Ave 76	1	8	16		1		
Ave 74			1		3		
Ave 73			6				
Ave 68			2				
King Street	67		12		8	14	3
McKinley 0.5	*						
McKinley	17	51					
Cleveland 0.5	10	12					
Cleveland	18	29					
Arthur 0.5	18	6					
Arthur 4	4	8					
Garfield 0.5	2						
Garfield	*	1			1		
Hayes 0.5	9						
Hayes	2	79					
Grant 0.5	7						
Grant	92	5					
Johnson 0.5	37	17			1		
Lincoln		1					
Buchanon			*				

TABLE A-1
Numbers of Desert Pupfish Collected During Various Surveys at the Salton Sea

	Year						
Drains	**1991[1]**	**1993[2]**	**1994[3,4]**	**1995[1]**	**1996[4]**	**1997[4,5]**	**1998[4]**
South End							
Niland 4	19						
Niland 3		1					
Niland 2	2						
Niland 1		1	2				
Z		1	3				
W		11	356				1
T			2				
S		4	1				1
R		2	1			1	
Q			10				
P			10				
O			1				
Vail 4A	1						
Vail 56	44		53				
Vail 5A	26						
Vail 6	1						
Vail cut-off		1	2				
Vail 7		4	3				
Trifolium 12		261	3		1		
Trifolium 13		38	1				1
Trifolium 14A			1				1
Trifolium 1	9		1		1		
Tri Storm	1	2	3		16		2
Trifolium 18	2		2				
Poe	13	1	3		1		
Lone Tree Wash	8						
3W of Lone Tree	6						
Trifolium 19	8		3		1		
Trifolium 20		50	7				1
Trifolium 20A					13		

TABLE A-1
Numbers of Desert Pupfish Collected During Various Surveys at the Salton Sea

	Year						
Drains	**1991[1]**	**1993[2]**	**1994[3,4]**	**1995[1]**	**1996[4]**	**1997[4,5]**	**1998[4]**
Trifolium 22		34	47				
Trifolium 23	13	64	22		1		
Trifolium 23N	2						
WP-10 SS-11	1						
S. Felipe Wash	5	3	1		31		
Pools							
S. of Bombay	23						
N. of Niland 4	30						
N. of Niland 3	9						
N. of Niland 1	4						
"U" drain pool							1
W. of New River	7						
S. of New River	1						
E. of Tri 22	6						
By Tri 23	4						
By Tri 23N	*						
N. of Tri 20A							70
N. of Grant 0.5							2
N. of Hayes 0.5					2		
S. of Salt Creek				3			
Tributaries							
S. Felipe Creek	*	224	195	115	*	388	*
Upper Salt Creek		9	15	45	18	102	
Lower Salt Creek	1			12			
* - observed							

Source: Sutton (1999)
[1] Nicol, Lau, and Boehm (1991)
[2] Remington and Hess (1993)
[3] Schoenherr (1994) – Only surveyed north end drains
[4] CDFG, unpublished data
[5] No drain surveys in 1995; only north end drains surveyed in 1997

In a study of pupfish distribution and movement, Sutton (1999) found that physical habitat conditions appeared to influence the distribution and abundance of desert pupfish. While most irrigation drains were characterized by high densities of non-native fishes and low numbers of pupfish, one drain (Drain C) was unique because of a large, healthy population of desert pupfish coexisting with a high density of young tilapia. The habitat in Drain C was different from the other drains in having a high density of emergent vegetation (e.g., cattails) along both banks combined with a large portion of open, slow-moving water. The rooted aquatics acted to reduce the flow of water and provided cover and shelter for the pupfish (Sutton, 1999).

Sutton (1999) observed desert pupfish movement between the Salton Sea and nearby drains. Pupfish were observed moving from both irrigation drains and Salt Creek downstream into shoreline pools. The reverse movement from shoreline pools upstream into both drains and Salt Creek was also observed. The best evidence of movements was observed in the southwestern area between Drain C and a connected shoreline pool. Decreases in the size of shoreline pools during seasonal fluctuations in water levels may affect fish health and/or force pupfish to seek other habitat. Thus, the connectivity between habitat types may be necessary to prevent pupfish from becoming stranded in habitats that cannot sustain them for prolonged periods (Sutton, 1999). These observations indicate the importance of agricultural drains as pupfish habitat and the potential for pupfish to use shoreline aquatic habitats as corridors. This potential movement may be important in providing genetic mixing between various populations.

Based on the trapping studies conducted to date, desert pupfish populations are known from or expected in drains directly discharging to the Salton Sea, in shoreline pools of the Salton Sea, and in desert washes at San Felipe Wash and Salt Creek. Desert pupfish are not known to occur nor are they expected to occur in the New or Alamo Rivers because of the high sediment loads, excessive velocities, and presence of predators. Drains in the HCP area where pupfish have been found are shown on Figure A-2.

Amphibians

Couch's Spadefoot Toad (*Scaphiopus couchii*)

Range and Distribution

The Couch's spadefoot toad occurs from southeastern California eastward through Arizona, New Mexico, Texas, and Oklahoma, and southward into San Luis Potosí, Nayarit, and the southern tip of Baja California, Mexico. An isolated population of the species also occurs near the Petrified Forest National Monument in Colorado (Jennings et al., 1994).

Population Status

Despite an apparent tolerance for agricultural habitat modification and other disturbances, the Couch's spadefoot toad seems to be declining throughout its range (Jennings et al., 1994). Factors responsible for the decline of this species are not well known, but may include noise disturbances from offroad vehicles and disturbances that alter the percolation characteristics of temporary rain pools (Jennings et al., 1994).

Habitat Requirements

Couch's spadefoot toad frequents arid and semiarid habitats of the southwest, occurring along desert washes, in desert riparian, palm oasis, desert succulent shrub, and desert scrub habitats. It is also found in cultivated cropland areas. This toad requires friable soil for burrowing. Burrowing sites are often selected beneath desert plants to reduce exposure to lethal maximum temperatures during the hottest part of the summer (Dimmitt and Ruibal, 1980). Logs, and other debris, are also used as shelter from the heat.

Temporary pools and potholes with water lasting longer than 10 to 12 days are required as breeding sites. Runoff basins at the base of sand dunes are also sites of reproduction (Mayhew, 1965). The water temperature of these potential breeding sites must be above 17° C (63°F) for normal embryonic development to occur (Hubbs and Armstrong, 1961). Soil temperatures above 20° C (68°F) are also required to initiate breeding. Still, standing water is required for reproduction.

Habitat in the Proposed Project Area

In the proposed project area, native desert habitats are restricted to along the AAC. Spadefoot toads could use these desert areas, particularly in areas near the seepage communities where they may be able to breed. As spadefoot toads are also known to use agricultural areas, they may occur throughout the proposed project area in association with agricultural drains.

Proposed Project Area Occurrence

The proposed project area occurs within the range of this species; however, no populations have been reported from the Imperial Valley. The nearest known populations have been reported from the neighboring Conchise County in Arizona (AGFD, 1995), and Sonora, Mexico (Flores-Villela, 1993).

Colorado River Toad (*Bufo alvariu*)

Range and Distribution

The Colorado River toad ranges from southeast California across lowland Arizona to southwestern New Mexico, and southward through most of Sonora to northern Sinaloa, Mexico (Fouquette, 1970). Historically, the species likely extended northward along the bottomlands of the Colorado River to extreme southern Nevada near Fort Mohave (Jennings et al., 1994). In the main part of its range, it can be found from sea level to 1,600 m (5,300 feet).

Population Status

The overall status of the Colorado River toad is uncertain. The New Mexico Department of Game and Fish (NMDGF, 1997) describes the status of this species as probably fairly secure, while other investigators have suggested the species is imperiled throughout much of its range (Jennings et al., 1994). In California, the species is probably extirpated over most of its range due to habitat destruction and use of pesticides (Jennings et al., 1994). Although habitat alteration along the LCR has adversely affected this species, the specific factors responsible for declines in this region are uncertain. Isolation of small, vulnerable populations caused by channelization and damming of the Colorado River, and the introduction of the spiny softshell turtle and bullfrog in the early 1900s may also be partly responsible for the species' decline along the LCR (King and Robbins, 1991).

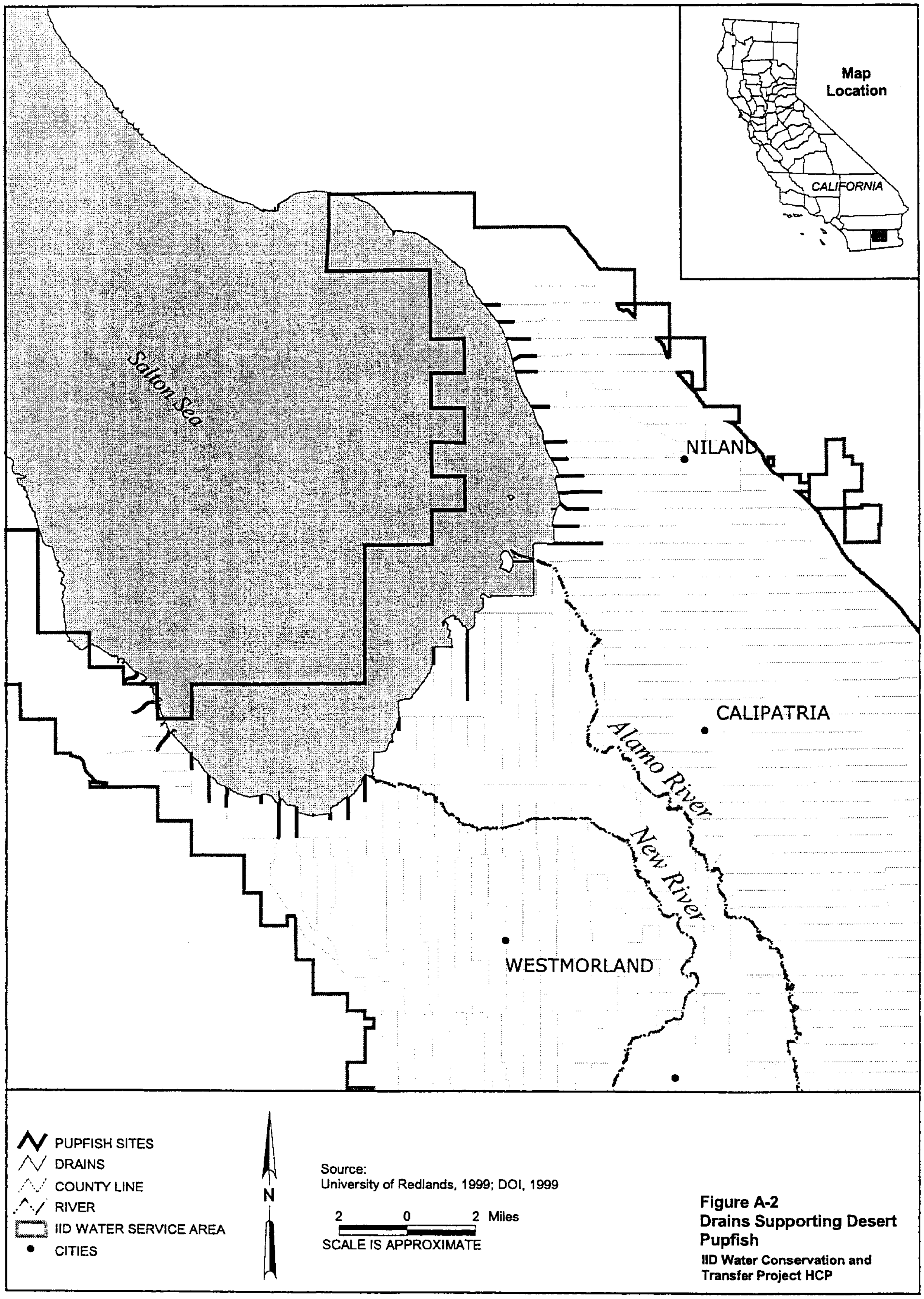

Figure A-2
Drains Supporting Desert Pupfish
IID Water Conservation and Transfer Project HCP

CH2M Hill RDD ArcView Project File \\Thor\Cart1\rddgis\iid\worst_case.apr 2:23 p.m. 03-8-2001

CH2MHILL

Habitat Requirements

Colorado River toads are found in a variety of desert and semiarid habitats including brushy desert with creosote bush and mesquite washes, semiarid grasslands, and woodlands. It is semiaquatic and usually associated with large, permanent, or semipermanent streams. It is occasionally found near small springs, temporary rain pools, human-made canals, and irrigation ditches. When not on the surface, this species uses the burrows of other animals as refugia. Colorado River toads have also been found underneath watering troughs (Wright and Wright, 1949; Stebbins, 1985). Primary breeding habitat for the Colorado River toad is moderately large streams, but it is also known to breed in temporary rain pools, and human-made watering holes and irrigation ditches (Blair and Pettus, 1954; Stebbins, 1954 and 1985; Savage and Schuierer, 1961). This species needs permanent or semipermanent water sources for breeding.

Habitat in the Proposed Project Area

In the proposed project area, native desert habitats are restricted to along the AAC. These toads could use these desert areas, particularly in areas near the seepage communities where they may be able to breed. Agricultural drains have the potential to be used by these toads, and the toads could use areas adjacent to the New and Alamo Rivers, although their use of tamarisk has not been determined.

Proposed Project Area Occurrence

The known extant populations in the U.S. have been reported from southeastern Arizona and southwestern New Mexico (Rosen et al., 1996). While populations have been reported to occur in Sonora, Mexico (Flores-Villela, 1998), this species is presumably extinct in California (Jennings et al., 1994). No populations have been reported from the HCP area.

Lowland Leopard Frog (*Rana yavapaiensis*)

Range and Distribution

The lowland leopard frog historically occurred from the Virgin River near Littlefield, Arizona, into northern Sonora, Mexico, and in southeastern California and western New Mexico (Platz and Frost, 1984; NMDGF, 1997). It now occurs mostly in central Arizona, below 1,676 m (5,500 feet), south and west of the Mogollon Rim (NMDGF, 1997). In California, the CDFG recently reintroduced lowland leopard frogs into San Felipe Creek, which empties into the Salton Sea north of the proposed project area on the west side of the Sea.

Population Status

With the exception of the population re-established in San Felipe Creek, the lowland leopard frog has been extirpated from southeastern California. It is also believed to have been extirpated from southwestern Arizona and New Mexico (AGFD, 1997). The species has not been found in surveys in California since 1965 (Clarkson and Rorabaugh, 1989; USFWS, 1999). The species is considered stable in central Arizona, but declining in southeast Arizona (AGFD, 1997).

Potential reasons for regional declines include water manipulations; water pollution (including human use of aquatic habitat); introduced species (e.g., fish, bullfrogs, and crayfish); heavy grazing; and habitat fragmentation (Clarkson and Rorabaugh, 1989; AGFD, 1996 and 1997). In addition, in Arizona where the species still occurs, it may face future threats from competition with the Rio Grande leopard frog, an introduced species that is expanding into the range of the lowland leopard frog (AGFD, 1996).

Habitat Requirements

The lowland leopard frog is generally restricted to permanent waters associated with small streams and rivers, springs, marshes, and shallow ponds. It is normally found at elevations below 1,500 m (4,921 feet) and is often concentrated near deep pools in association with the root masses of large riparian trees (NMDGF, 1997). In Arizona, lowland leopard frogs show a strong preference for lotic habitats, with 82 percent of known localities being natural lotic systems and 18 percent lentic habitats, primarily stock tanks (Sredl, 1997). Historic accounts from the Imperial Valley reported the species occurring in slack water habitats, such as canals and roadside ditches with abundant aquatic vegetation (Storer, 1925; Klauber, 1934). Emergent or submergent vegetation, such as bulrushes or cattails, is probably necessary for cover and as substrate for oviposition (Jennings et al., 1994). Both aquatic habitat and adjacent moist upland or wetland soils with a dense cover of grasses or forbs and a canopy of cottonwoods or willows are important components of leopard frog habitat. Large pools may be essential for adult survival and reproductive efforts, while smaller pools and marshy habitats probably enhance juvenile survival (NMDGF, 1997). Studies of microhabitat use by differing age classes of lowland leopard frogs suggest that management practices that create or maintain a variety of aquatic habitats may be important to this species. The primary food source for adults is small invertebrates, while larvae eat algae, plant tissue, organic debris, and probably small invertebrates (AGFD, 1997).

Leopard frogs may be especially vulnerable to catastrophic events, such as floods and drought. Tadpoles are susceptible to predation by introduced predators, such as catfish and bullfrogs. Removal of vegetation may result in increased predation by both aquatic and terrestrial predators (NMDGF, 1997). Because local populations of leopard frogs are prone to extinction, it is also important to facilitate recolonization through the maintenance of adequate dispersal corridors (Sredl, 1997).

Habitat in the Proposed Project Area

Lowland leopard frogs are generally associated with small streams and marshes that support emergent vegetation. In the HCP area, suitable habitat could occur in the wetlands on the state and federal refuges and wetlands adjacent to the Salton Sea. The New and Alamo Rivers probably do not provide suitable habitat conditions due to their large size. However, portions of the agricultural drainage system that support cattails could provide suitable conditions.

Proposed Project Area Occurrence

Lowland leopard frogs are not known to currently inhabit the proposed project area. However, as noted above, lowland leopard frogs were recently reintroduced into San Felipe Creek, a west side tributary to the Salton Sea just north of the proposed project area.

Lowland leopard frogs have the potential to occur in the proposed project area in the future as a result of additional introductions or migration from reintroduced populations.

Reptiles

Desert Tortoise (*Gopherus agassizi*)

Range and Distribution

The desert tortoise is found in many Mojave and Sonoran Desert habitats in a range that covers southeastern California, southern Nevada, and northern Mexico. Suitable tortoise habitat includes sandy washes, canyons, and gravel beds dominated by creosote bush scrub with ocotillo, cactus, and yucca, usually between elevations from 500 to 2,700 feet (Reclamation, 1993). In the Salton Trough, desert tortoise occur near San Gorgonio Pass and on the alluvial fans of Coachella Valley.

The Colorado River has been an effective geographic barrier, separating the Mojave and the Sonoran populations of desert tortoise for millions of years. The Mojave population is found to the west and north of the Colorado River, and the Sonoran population is found to the east and south. The Mojave population may be further divided into two subpopulations, western and eastern. A low sink that generally runs from Death Valley to the south may be used to separate the western and eastern subpopulations.

Population Status

Analysis of study plot data from sites in the western Mojave Desert indicates that subpopulations (both adults and especially juveniles) have declined over the last decade. Populations are threatened by a combination of human activities (i.e., urbanization, agricultural development, off-highway vehicle use, grazing, and mining) and from direct vandalism, collections, and raven predation of young. Luckenbach (1982) concluded that human activity is the most significant cause of desert tortoise mortality. In addition, a virus is spreading through the natural population.

Data recently collected on the Mojave population of the desert tortoise indicate that many local desert tortoise subpopulations have declined precipitously. The apparent distribution of Upper Respiratory Disease Syndrome, not identified before 1987 in wild desert tortoises, has suggested the possibility of an epizootic condition and thus may be a significant contributing factor to the current high level of desert tortoise losses documented for certain localities.

Habitat Requirements

The species inhabits desert scrub, desert wash habitats, and Joshua tree woodland (Zeiner et al., 1988). Optimal habitat has been characterized as creosote bush scrub in which precipitation ranges from 5 to 20 cm (2 to 8 inches), the diversity of perennial plants is relatively high, and production of ephemerals is prominent (Luckenback, 1982; Turner, 1982, Turner and Brown, 1982; Schamberger and Turner, 1986). Tortoises feed primarily on spring annual grasses and forbs, as well as perennial grasses. They are most active in the spring and fall months, and escape extreme temperatures of summer and winter by remaining in underground burrows, hibernating in the winter months. Soil conditions must be firm, but soft sandy loams are suitable for burrow construction. Desert tortoise burrows have been found in a variety of locations, such as along the banks of washes, at the base of shrubs, in the open on flat ground, under rocks, on steep hill sides, in caleche caves, and in berms along rail lines.

Habitat in the Proposed Project Area

In the HCP area, creosote bush scrub only occurs in the right-of-way of IID along the AAC. Outside the HCP area, creosote bush scrub surrounds the Salton Sea between the higher rock hillsides and the more saline desert saltbrush community. It also occurs adjacent to the irrigated portions of the valley.

Proposed Project Area Occurrence

Desert tortoise populations are known from areas northeast of the Imperial Valley, particularly in the Chocolate Mountains and the Chuckwalla Valley where high densities have been recorded. Areas adjacent to the Coachella Canal were surveyed in 1981, but no animals were found; and the area was considered poor habitat because of rocky soils and sparse vegetation (USBR, 1993). Populations have also been reported from the Pinto Drainage in the far southwestern part of Imperial County. It is unlikely that desert tortoise would be found in most of the HCP area because most of the HCP area is at or below sea level (IID, 1994).

Flat-Tailed Horned Lizard (*Phrynosoma mcalli*)

Range and Distribution

The flat-tailed horned lizard occurs only in sparsely vegetated, sandy areas of the deserts of extreme southwestern Arizona; southeastern California; northeastern Baja California; and extreme northwestern Sonora, Mexico. In Arizona, the species occurs in the Yuma Desert west of the Tinaja Altas and Gila Mountains, and south of the Gila River. In California, it is found in the Coachella Valley, then south toward the head of the Gulf of California (AGFD, 1997c). The original range of the species has diminished in recent years due to human activities (Turner et al., 1980).

Population Status

The flat-tailed horned lizard was proposed as threatened in November 1993 (FR 58 [227]: 62624-62629). The species was withdrawn from proposed status on July 15, 1997. Habitat loss and other impacts have fragmented this species' distribution. Agricultural and urban development in the Imperial Valley have isolated populations in East Mesa from those west of the Salton Sea, in the Yuma desert, and in the Superstition Mountain area. Flat-tailed horned lizards in the Coachella Valley may be geographically isolated from flat-tailed horned lizards in the Imperial Valley by the Salton Sea and conversion of habitat to croplands. The All American and Coachella Canals are likely barriers to movement, and major highways, such as Interstate 8 in Imperial County and Interstate 10 in Riverside County, further fragment populations. Habitat loss to development and recreation, such as off-highway vehicle use, are the principal threats to species persistence (Zeiner et al., 1988).

Human impacts have resulted in the loss of roughly 34 percent of the historic flat-tailed horned lizards habitat. In the Imperial and Coachella valleys, a large portion of the flat-tailed horned lizard's habitat has been converted to urban or agricultural use or was flooded by the filling of the Salton Sea from 1905 to 1907. The precise extent of this species' historic habitat cannot be quantified because filling of the Salton Sea and much of the agricultural development predates most collections of flat-tailed horned lizards.

Habitat Requirements

Flat-tailed horned lizard habitat is characterized by areas of low relief with surface soils of fine, packed sand, or pavement overlain with loose, fine, windblown sand (Turner et al., 1980). This species requires fine sand substrates that allow subsurface burrowing to avoid extreme temperatures. Shrubs and clumps of grass are also used for thermal cover when soil surface temperature is very high. Within its range, the flat-tailed horned lizard typically occupies sandy, desert flatlands with sparse vegetation and low plant species diversity, but is occasionally found in low hills or areas covered with small pebbles or desert pavement. Optimal habitat is found in the desert scrub community; however, the species is also known to occur at the edges of vegetated sand dunes, on barren clay soil, and in sparse saltbush communities. Flat-tailed horned lizards are occasionally found on blacktop roads. The flat-tailed horned lizard shares habitat with the fringe-toed lizard.

Habitat in the Proposed Project Area

Suitable habitat for flat-tailed horned lizards in the proposed project area occurs along the AAC and along the western side of the Westside Main Canal in the West Mesa. Extensive habitat for this lizard also occurs to the east of the East Highline Canal (BLM, 1990).

Proposed Project Area Occurrence

Flat-tailed horned lizards are known to occur in the HCP area. Lizards have been observed near Gorden Wells where the Coachella Canal branches off the AAC. Field surveys have detected lizards in the East Mesa south of Highway 78 east of the East Highline Canal (BLM, 1990). Surveys for the flat-tailed horned lizard were conducted in May 1984 and again in June 1993 (Reclamation and IID, 1994; 1996b). Results of the two surveys were similar. Flat-tailed horned lizards were observed along the AAC between Drops 1 and 3; however, scat was also observed east of the eastern Interstate 8 crossing of the Algodones Dunes. USFWS (1996b) surmised that the species is probably absent from the high dunes between Drop 1 to about the eastern Interstate 8 crossing. Although this species is well distributed along the AAC, this area has not been identified as a key area for the species (Turner and Medica, 1982). The area is isolated from other flat-tailed horned lizard habitat by the AAC, Interstate 8 on the north, and agricultural development in the Mexicali Valley to the south.

Western Chuckwalla *(Sauromalus obesus obesus)*

Range and Distribution

The chuckwalla is found throughout the deserts of the southwestern U.S. and northern Mexico (Stebbins, 1985). Chuckwallas are found in a variety of desert scrub and woodland habitats from sea level to 3,750 feet in the Mojave and Colorado deserts.

20110

Population Status

The chuckwalla is a widespread species, but is regionally limited by its requirement for rock outcrops. Under ideal conditions, it can be quite common locally. Urban expansion (e.g., construction of roads and utilities, inundation by reservoirs, and agriculture) has reduced the available habitat for this species. Overcollection by collectors or shooters can cause local declines in this long-lived species. Collection also leads to habitat destruction when collectors use tools to pry open crevices and break up rockpiles resulting in further declines in chuckwalla populations (NMDGF, 1997).

Habitat Requirements

Western chuckwallas are most abundant in the Sonoran Creosote Bush Scrub plant community, but only occur in areas with large rocks, boulders, or rocky outcrops, usually on slopes. Warm rock surfaces are used for basking and as lookout positions for predators. Typical habitat includes rocky hillsides and talus slopes, boulder piles, lava beds, or other clusters of rock, usually in association with desert scrub habitat. Burrows are dug between rocks for dwelling and breeding (NMDGF, 1997). Chuckwallas feed entirely on plant material, especially the flowers, leaves, and fruits of the creosote bush. Nests are dug in sandy, well-drained soils. Chuckwallas are generally active only from mid-spring to mid-summer, and occasionally in fall, though they can be active year-round in warm areas.

Habitat in the Proposed Project Area

The creosote bush scrub community is widespread throughout the nonirrigated areas of the Sonoran Desert. This habitat type surrounds the Salton Sea between the higher rock hillsides and the more saline desert saltbrush community. In the HCP area, creosote scrub only occurs within the right-of-way of IID along the AAC. However, most of the habitat along the AAC consists of sandy soils, lacking significant amounts of rocky habitat. IID operates two quarries adjacent to the Salton Sea. These quarries could provide suitable habitat conditions for chuckwallas, but chuckwallas are unlikely to inhabit these quarries because they are surrounded by agriculturals and wetlands and are isolated from desert habitats.

Proposed Project Area Occurrence

This species is known to occur on lava flows and craters of the LCR Valley, but has not been observed in the HCP area. Lack of suitable habitat makes the occurrence of this species unlikely. The right-of-way of IID along the AAC is the only location where chuckwallas might occur.

Colorado Desert Fringe-toed Lizard (*Uma notata notata*)

Range and Distribution

The range of this species is extreme southeastern California west to extreme eastern San Diego County, and northeastern Baja California. In California, this species is found south of the Salton Sea in the Colorado Desert Region in northeast San Diego County and the majority of Imperial County. It is restricted to areas containing fine, loose sand.

Population Status

While the distribution of this species is limited, populations in areas without disturbance appear healthy and stable. The current primary threat to this species is off-road vehicle use.

Habitat Requirements

The Colorado desert fringe-toed lizard is highly adapted to living in areas of windblown sand and is not known to occur elsewhere (Smith, 1971). Distribution is restricted to fine, loose, windblown sand of dunes, flats, riverbank, and washes (Stebbins, 1985). It is most abundant on well-developed dunes, but does occur on level or undulating sand with very low vegetation. The species is a habitat specialist and is restricted to the distribution of sand particles no coarser than 0.375 millimeters (mm).

Colorado desert fringe-toed lizards often seek cover under shrubs at the foot of dunes. They burrow in sand during hot or cold weather and go into torpor in winter. The lizards usually hibernate on the lee side of the dunes and can tolerate being buried by up to 12 feet of wind-deposited sand. Fringe-toed lizards often burrow 5 to 6 cm below the sand surface, using rodent burrows or the bases of shrubs for cover and thermoregulation.

Habitat in the Proposed Project Area

Suitable habitat for the Colorado desert fringe-toed lizard occurs in the proposed project area, specifically, where the AAC traverses the Sand Hills and Algodones Dunes.

Proposed Project Area Occurrence

The Colorado desert fringe-toed lizard is found in areas with fine, loose, windblown sand in habitats such as desert wash or sparse desert scrub south of the Salton Sea in San Diego and Imperial Counties. It could potentially occur throughout the study area wherever aeolian sand is found (Norris, 1958). During Reclamation surveys for the flat-tailed horned lizard, approximately 100 Colorado desert fringe-toed lizards were sighted in the Sand Hills along a 600-foot-wide transect immediately adjacent to the north side of the AAC.

Banded Gila Monster *(Heloderma sespectum cinctum)*

Range and Distribution

The Gila monster is distributed from southwestern Utah and Southern Nevada south to Southern Sonora, Mexico, and from the Colorado River east to extreme southwestern New Mexico (AGFD, 1998b). The banded Gila monster, which is the subspecies potentially occurring in the study area, ranges from the Vermilion Cliffs, Utah, south through the LCR basin, including extreme Southern Nevada, southeastern California, and Arizona west of the Central Plateau to Yuma (Jennings et al., 1994).

Population Status

The Gila monster has declined in heavily urbanized and agricultural areas throughout its range, but remains locally common elsewhere. Because the Gila monster is only one of two poisonous lizards in the entire world, the species is highly prized as a pet. Demand as a collectors item may have created a black market for this species and contributed to its decline (Jennings et al., 1994; Zeiner et al., 1988).

Habitat Requirements

The banded Gila monster is uncommon in a variety of desert woodland and scrub habitats, principally in desert mountain ranges. This lizard prefers the lower slopes of rocky canyons and arroyos but is also found on desert flats among scrub and succulents. It seems to prefer slightly moist habitats in canyons, arroyos, and washes. The Gila monster utilizes the burrows of other animals and may construct its own. Rock crevices and boulder piles are also used for shelter (Shaw, 1950; Stebbins, 1954; Bogert and Del Campo, 1956). Little is known about reproductive requirements. Eggs are laid in the soil in excavated nests, so the soil must be sandy or friable. Gila monsters may also require areas with exposure to the sun and moisture (Stebbins, 1954; Bogert and Del Campo, 1956). This species seems to occur in areas that are moister than surrounding areas.

Habitat in the Proposed Project Area

Most of the proposed project area is agricultural land or urban area and offers no habitat for the banded Gila monster. Desert scrub occurs along the AAC. However, this area is near major highways and areas heavily utilized for off-highway recreation and are unlikely to support this species. There are no desert mountain ranges in the proposed project area. The nearest suitable habitat likely occurs in the Chocolate Mountains to the northeast of the proposed project site and in the rocky areas along the LCR.

Proposed Project Area Occurrence

The banded Gila monster is not known to occur in the proposed project area, and lack of suitable habitat makes the presence of this species unlikely.

Birds

American White Pelican (*Pelecanus erythrorhynchos*)

Range and Distribution

American white pelicans once nested throughout inland North America on isolated islands in rivers, lakes, and bays that were free of mammalian predators. Breeding colonies were distributed from British Columbia and the prairie provinces of Canada south across the southern U.S. from California to Florida. This species now breeds in scattered locations in the prairie provinces and in the western U.S. (Washington to Texas). Most white pelicans winter in central California, along the Pacific Coastal lowlands south to Guatemala and Nicaragua, along the Gulf Coast, and throughout most of Florida (Terres, 1980; Ehrlich et al., 1988).

Population Status

The American white pelican has declined in numbers since presettlement times due primarily to the loss and degradation of breeding and foraging habitats and from human persecution, especially by fishermen who mistakenly believed that the pelican competed for game fishes. Eggshell thinning caused by the use of insecticides may also have played a significant role in the decline of this species (Terres, 1980).

Nesting American white pelicans have declined in California in the last century because of degradation and loss of nesting habitat; the only remaining nesting colonies are at large lakes in the Klamath Basin. The white pelican population is vulnerable to decline because of its low annual reproductive output, colonial nesting, and dependence on isolated nesting sites. Drought, water diversion proposed projects, and disruptive human activities at nesting colonies have adversely affected this species. Lowering water levels in lakes allows predators to destroy nesting colonies as nesting islands become connected to mainland shorelines. American white pelicans also are susceptible to persistent pesticides that pollute the watershed. An estimated 10 percent of the white pelican western population died from avian botulism in 1996 (Rocke, 1999).

Habitat Requirements

White pelicans are usually associated with large freshwater marshes and shallow lakes at lower elevations 853 to 1,676 m [2,800 to 5,500 feet]) that support a rich supply of fish. They are also frequently found in coastal estuaries (Garrett and Dunn, 1981; Terres, 1980). Large expanses of open water appear to be a major stimulus in attracting these birds to an area, with the nearby vegetation seemingly an unimportant factor (NMDGF, 1997). Fish are the primary diet of the white pelican, but salamanders, frogs, crayfish, and a variety of aquatic invertebrates are also consumed. This species can catch prey only in shallow water or within about 1 m (3 feet) of the surface of the water. The white pelican has the ability to disperse widely and locate new food supplies.

The white pelican is a colonial species that is often found nesting and foraging in association with several species of waterbirds, particularly the double-crested cormorant. White pelicans breed synchronously and due to brood reduction (i.e., starvation of smaller chicks because of harassment by the larger sibling), only one juvenile is usually raised per successful nesting attempt. Sexual maturity is reached at age three (NMDGF, 1997).

Habitat in the Proposed Project Area

Suitable habitat for white pelicans in the proposed project area occurs mainly at the Salton Sea. Pelicans congregate at the mouths of the New and Alamo Rivers, where prey items are generally abundant (IID, 1994). Lakes in the valley (e.g., Fig, Lagoon, and Finney Lakes) also provide suitable habitat for white pelicans.

Proposed Project Area Occurrence

The Salton Sea is an important migratory stopover for American white pelicans. The pelicans appear to use the Salton Sea for a few weeks to a few months before continuing on their migration to Mexico (Shuford et al., 1999). As many as 33,000 American white pelicans have been counted at the Salton Sea during migration and during the winter (USFWS, 1999). From the early 1900s to the late 1950s, this species also nested at the Salton Sea. Currently, it is unlikely that there is sufficient undisturbed habitat at the Salton Sea to support nesting colonies of American white pelicans.

In radio-telemetry studies during 1991, individual pelicans migrating south from northern California (e.g., Clear Lake National Wildlife Refuge) were documented as using the Salton Sea (Anderson, 1993). The large populations of white pelicans at the Salton Sea in the early- to mid-1980s were likely associated initially with extensive flooding in the LCR Delta area

20114

from the late 1970s through the mid-1980s, when many white pelicans came to reside in the region for a substantial portion of the wintering period, using Salton Sea/Laguna Salada/Rio Hardy wetlands as wintering habitat. Most recent censuses of the Salton Sea white pelicans (Anderson, 1993) indicate that use may be declining in recent years, but that the area still supports several thousand white pelicans for significant periods during the winter (Anderson, 1993; Setmire et al., 1993). Although accurate data are not available to compare relative numbers of white pelicans at the Salton Sea with those found at other typical habitats in the region, the population at the sea is probably much larger than at the other areas (Anderson, 1993). Data collected by the USFWS (USFWS, 1993d) also indicate that smaller numbers of white pelicans have used the Salton Sea and adjacent wetlands in recent years as compared to the peak numbers reported in 1985. Overall, the USFWS counts in combination with data summarized above indicate that 2,000 to 17,000 white pelicans use the Salton Sea as overwintering habitat for up to about 6 months.

California Brown Pelican *(Pelecanus occidentalis californicus)*

Range and Distribution

Brown pelicans occur in marine habitats along the Pacific, Atlantic, and Gulf Coasts in North America and range southward through the Gulf and Caribbean areas to Central and South America. The California subspecies nests on islands off the coast of Southern California, south along the coast of Baja California and the Gulf of California, to Guerrero, Mexico (CDFG, 1992). After the breeding season, California brown pelicans disperse from breeding areas and can be found as far north as British Columbia, Canada, and as far south as South America.

Population Status

Brown pelican populations declined greatly in the mid-20th century because of human persecution, disturbance of nesting colonies, and reproductive failure caused by eggshell thinning and the adverse behavioral effects of pesticides (Palmer, 1962; Terres, 1980). Most North American populations of this species were extirpated by 1970. Since the banning of dichlorodiphenyl-trichloroethane (DDT) and other organochlorine use in the early 1970s, brown pelicans have made a strong recovery and are now fairly common and perhaps still increasing on the southeast and west coasts (Kaufmann, 1996). The endangered Southern California Bight population of the brown pelican grew to 7,200 breeding pairs by 1987, but has experienced considerable population fluctuations in recent years and has not, as yet, been considered sufficiently stable for delisting (CDFG, 1992). In 1992, there were an estimated 6,000 pairs in Southern California and about 45,000 pairs on Mexico's west coast (Ehrlich et al., 1992).

Habitat Requirements

Brown pelicans are found primarily in warm estuarine, marine subtidal, and marine pelagic waters (Zeiner et al., 1990; NMDGF, 1997). They occur mostly over shallow waters along the immediate coast, especially near beaches and on salt bays (Kaufmann, 1996). Brown pelicans roost on water, rocks, rocky cliffs, jetties, piers, sandy beaches, and mudflats, and forage in open water. Brown pelicans are plunge divers, often locating fish from the air and diving into the water to catch them. They feed almost exclusively on fish. The brown pelican is a colonial nester. It nests on islands in trees, bushes, and on the ground. This species first breeds at 2 or 3 years of age with only one brood raised per year (Kaufmann, 1996; Terres, 1980; Zeiner et al., 1990). For roosting, brown pelicans congregate at selected roosting locations that are isolated from human activity.

Habitat in the Proposed Project Area

Because brown pelicans are associated with large open waterbodies, habitat for brown pelicans in the proposed project area principally occurs at the Salton Sea where abundant fish populations provide foraging opportunities for brown pelicans. Nesting habitat is present at the Alamo River Delta, where brown pelicans have nested since 1996 (Shuford et al., 1999). In addition to the Salton Sea, brown pelicans are known to use Finney Lake in the Imperial Wildlife Area (Corps, 1996).

Proposed Project Area Occurrence

Brown pelicans probably had little historical use of the Salton Sea (Anderson, 1993). Some visiting postbreeding pelicans were documented at the Salton Sea in the late 1970s, but overwintering was not confirmed until 1987. Use of the Salton Sea by brown pelicans subsequently increased. The Salton Sea currently supports a year-round population of California brown pelicans, sometimes reaching 5,000 birds, although more typically numbering 1,000 to 2,000 birds. In 1996, the brown pelican was first found to nest successfully at the Salton Sea and several pairs have attempted to nest annually since then (Shuford et al., 1999).

Other than the small number of breeding birds at the Salton Sea, the closest breeding colonies of brown pelicans are located in the Gulf of California on San Luis Island (about 220 miles southeast of the Salton Sea). On San Luis Island, breeding populations vary between 4,000 and 12,000 pairs. The Puerto Refugio area contains about 1,000 to 4,000 breeding pairs, and the Salsipuedes/Animas/San Lorenco area supports 3,000 to 18,000 pairs. Birds from these breeding areas may visit the Salton Sea after the breeding period.

Double-crested Cormorant (*Phalacrocorax auritus*)

Range and Distribution

The double-crested cormorant is a year-round resident along the Pacific Coast of Canada and the U.S. During the summer, it may occur in the north-central U.S. and central provinces of Canada. Wintering birds are found in coastal states along the Gulf of Mexico (Kaufman, 1996). Double-crested cormorants are found year-round along the California coast. About 7,500 individuals nest in Northern California, with lesser numbers in Southern California, Oregon, and Washington (Tyler et al., 1993).

Population Status

The population of double-crested cormorants declined considerably during the 1960s and early 1970s. This decline was attributed to pesticide residues in the marine food chain, principally DDT (Small, 1994). The population began recovering in the late 1970s and 1980s, but has not yet achieved historic levels. Kaufman (1996) reports that the population is currently increasing and expanding its range. In some locations, cormorant populations have increased to levels that some consider them a competition with recreational fishing. The USFWS is considering implementing control measures in some locations.

Habitat Requirements

The double-crested cormorant is a year-round resident along the entire coast of California and on inland lakes and rivers of fresh, salt, or brackish quality (Zeiner et al., 1990). They feed mainly by diving for fish in water less than 30 feet deep, but will also prey on crustaceans and amphibians. The species requires undisturbed nest sites beside water on islands or on the mainland, including offshore rocks, cliffs, rugged slopes, and live and dead trees. In the midwest, they typically nest in flooded dead timber (snags) and on rocky islands, often in mixed colonies with great blue herons and black-crowned night herons (Meier, 1981).

Habitat in the Proposed Project Area

Suitable habitat for double-crested cormorants in the proposed project area occurs at the Salton Sea and at lakes in the valley, such as Finney and Ramer Lakes on the Imperial Wildlife Area. At the Salton Sea, cormorants nest on rocky ledges such as occur on Mullet Island or on accumulations of dead vegetation that occur at the deltas of the New and Alamo Rivers. Snags in the Salton Sea are important for providing protected roost sites for double-crested cormorants. Cormorants regularly move between the Salton Sea and the lakes at the Finney-Ramer Unit of the Imperial Wildlife Area where they forage. In addition to suitable habitat found at the Salton Sea and on the refuges, double-crested cormorants occasionally forage in open water areas of the New and Alamo Rivers. They may also use larger agricultural drains for foraging on occasion.

Proposed Project Area Occurrence

Double-crested cormorants occur as a common year-round resident at the Salton Sea, with counts of up to 10,000 individuals (IID, 1994). Small numbers of cormorants have nested at the Salton Sea in the past, and small nesting colonies were documented at the north end of the Salton Sea in 1995 (USFWS, 1996a), the first time since 1989 (USFWS, 1993d). Over 7,000 double-crested cormorants and 4,500 nests were counted on Mullet Island in 1999. This represents the largest breeding colony on the West Coast (Point Reyes Bird Observatory, 1999).

Least Bittern *(Ixobrychus exilis hesperis)*

Range and Distribution

Least bitterns nest throughout much of the U.S. and southeast Canada south to most of tropical and subtropical South America east of the Andes. The northern populations of this species winter in California, south Texas, and central Florida (Terres, 1980). Most of the California population winters in Mexico and migrates in the spring and the summer to scattered locations in the western U.S., including the Colorado River, Salton Sea, Central Valley, and coastal lowlands of Southern California.

Population Status

This species is believed to have declined in many locales, but it is still abundant in parts of North America (Kaufman, 1996). Although no trend data are available for western populations of the least bittern, population trends probably reflect the availability of suitable freshwater marsh habitats (Sauer et al., 1997). Marsh habitats been declined throughout the 20th century due to channelization, dredging, flood control, grazing, stream diversion, recreational activities, and wildfires (NMDGF, 1997). Pesticides are also considered a threat to least bitterns (Zeiner et al., 1990a).

Habitat Requirements

Least bitterns inhabit fresh and brackish water marshes, and desert riparian habitats (Zeiner et al., 1990a). It is a secretive bird usually found in densely vegetated marshes. This long-distance migrant can also inhabit saltwater and brackish marshes near the coast in the southern portion of its range (Kaufmann, 1996; Terres, 1980). In the LCR Valley, the largest breeding populations of least bitterns are found in extensive cattail and bulrush marshes like those found near Topock and Imperial Dam. Smaller populations of least bitterns are found throughout the LCR Valley at a variety of marshy areas, including ponds and agricultural canals (Rosenberg et al., 1991). Rosenberg et al. (1991) estimated the breeding density of this species to be 40 birds per 40 hectares (ha) (100 acres [ac]) in some marshy areas along the LCR. The least bittern builds its nest in tall marsh vegetation, usually cattails. It occasionally nests in loose colonies, but nests are generally scattered throughout the appropriate marsh vegetation.

The least bittern is a carnivorous species that primarily eats small fish, such as catfish, minnows, eels, sunfish, killifish, and perch. Other food items consumed by this species include frogs, tadpoles, salamanders, leeches, slugs, crayfish, small snakes, aquatic insects, and, occasionally, shrews, and mice (Terres, 1980; Kaufmann, 1996).

Habitat in the Proposed Project Area

Least bitterns nest in wetlands adjacent to the Salton Sea that provide dense emergent vegetation, such as cattails or tules. They forage for fish, aquatic and terrestrial invertebrates, and small vertebrates in shallow waters and mudflats along the Salton Sea shoreline or in adjacent freshwater marshes. Dense salt cedar stands adjacent to marshes are often used as roost sites (Garrett and Dunn, 1981). Agricultural drains with emergent vegetation and areas of the New and Alamo Rivers are likely to also provide foraging habitat for least bitterns. Portions of the drains support cattail stands that could be used by least bitterns for nesting. Whether least bitterns nest in the drain vegetation is unknown. In addition, marsh communities supported by seepage from the AAC and the main canals in Imperial Valley are also expected to provide suitable habitat.

Proposed Project Area Occurrence

Least bitterns occur in the proposed project area throughout the year although they are more common in the summer. At the Salton Sea, the least bittern population has been estimated at about 550 individuals (IID, 1994).

Reddish Egret *(Egretta rufescens)*

Range and Distribution

In the U.S., reddish egrets breed along the Gulf Coast and Florida coast. Outside the U.S., breeding occurs in Baja California and along the Pacific and Atlantic coasts of Mexico and south to Guatemala. The species also breeds in the Caribbean. It overwinters from southern Florida to Colombia and Venezuela (DeGraaf and Rappole, 1995).

Population Status

The population of reddish egrets was substantially reduced in the late 1800s by feather collectors. Since then, the population has increased. Currently, the U.S. population is estimated at about 2,000 pairs (Kaufman, 1996).

Habitat Requirements

Reddish egrets are associated with coastal tidal flats, salt marshes, ocean shores, and lagoons. For foraging, it prefers calm shallow waters close to shore such as in marshes or protected bays and lagoons. Small fish comprise most of the reddish egret's diet; but frogs, tadpoles, and crustaceans are also taken. Occasionally, reddish egrets will feed on aquatic invertebrates (Kaufman, 1996).

Habitat in the Proposed Project Area

In the proposed project area, reddish egrets are mainly expected to occur at the Salton Sea where suitable foraging habitat exists along the margins of the Salton Sea. Mudflats and marsh habitats adjacent to the Salton Sea may provide suitable foraging conditions for this species. Reddish egrets could also find suitable foraging conditions at the wetlands and lakes of the state and federal refuges and duck clubs. Reddish egrets could forage in agricultural drains like other wading birds (e.g., great blue herons) in the proposed project area.

Proposed Project Area Occurrence

The reddish egret is a rare visitor to the proposed project area in the summer and fall. Only seven records of this species exist at the Salton Sea NWR (USFWS, 1997b). It is not known to breed in the area.

White-faced Ibis (*Plegadis chihi*)

Range and Distribution

The white-faced ibis formerly nested from Minnesota west to Oregon and south into California, Utah, and Colorado, and locally down to the Gulf Coast and Mexico (Terres, 1980). Breeding colonies are now isolated, with the greatest abundance of breeding birds occurring in Utah, Texas, and Louisiana. The winter range extends from California and along the Gulf Coast south into Mexico, Central America, and Costa Rica.

Population Status

Breeding white-faced ibis populations declined in distribution and abundance during the 1960s and 1970s, especially in the western U.S. (Ryder and Manry, 1994; Shuford et al., 1996). Since the 1980s, however, there has been an increase in western white-faced ibis populations due to improved nesting habitat management, increased planting of alfalfa, and a ban on DDT and other pesticide use in the early 1970s. Unlike some other western states, however, the breeding population in California has decreased substantially, and the species is no longer a regular breeder in the state (Remsen, 1978; Zeiner et al. 1990).

The winter population in California appears to have increased especially since the 1970s (Shuford et al., 1996). This may be due to changes in agricultural practices that provide more ibis winter habitat or because the species was overlooked and not surveyed adequately in the early part of the century. During the winter of 1994 to 1995, the California population of the white-faced ibis was estimated at 27,800 to 28,800 individuals.

The primary reason for the decline of the white-faced ibis as a nesting species in California is the loss of extensive marsh habitats (Remsen, 1978; Shuford et al., 1996). Allowing wetlands to dry up in the spring and summer for mosquito and cattail control adversely impacts this species (Remsen, 1978). White-faced ibis populations also declined dramatically during the 1960s and 1970s, due to the impacts of pesticides on reproductive success, and loss of habitat due to drought and flood control proposed projects (Ryder and Manry, 1994). Pesticides (e.g., dieldrin) were documented in the 1970s as causing large-scale nesting failures at breeding colonies in Utah, Texas, and Nevada and may be an additional cause of the decline of this species in California (Remsen, 1978; Terres, 1980). Decreasing reproductive success of ibis nesting at Carson Lake, Nevada, in the mid-1980s (Henny and Herron, 1989) and at Colusa, California, from 1989 to 1991 (Dileanis et al., 1992) was attributed to DDT. These birds appear to have been exposed to pesticides on their wintering grounds (Henny and Herron, 1989). However, limited testing for persistent organochlorine pesticides in ibises from several locations in Mexico indicated that concentrations of DDE, a metabolite of DDT, are the same for Mexican birds as for those in the southwestern U.S. (Mora, 1997). Although there are some areas in Mexico from which birds were not tested that have the potential for higher DDT accumulation, there is also the possibility that ibises are acquiring DDE during migration stopovers and winter residency in the southwestern U.S.

Habitat Requirements

The white-faced ibis is gregarious throughout the year, foraging in flocks in perennial marshes, wet fields and croplands, and shallow open water (Grinnell and Miller, 1944; Palmer, 1962; Cogswell, 1977; Burger and Miller, 1977). Most wintering ibises in the Salton Sea/Imperial Valley area foraged in irrigated agricultural lands, especially alfalfa and wheat (Shuford et al., 1996). Along the Colorado River, the ibis also forages primarily in alfalfa fields, but uses other flooded agricultural fields, marshes, and along lake shores (Rosenberg et al., 1991; Shuford et al., 1996). White-faced ibis probe for invertebrates and small vertebrates in freshwater marshes, in shallow waters along lakeshores, in wet agricultural fields and meadows, and occasionally in salt marshes.

The white-faced ibis nests near the ground or over water in colonies located in extensive, undisturbed marshes with large stands of tall marsh plants such as bulrushes (Palmer, 1962; Burger and Miller, 1977; Terres, 1980). Egg laying is from April to July, with incubation lasting 3 weeks and young remaining at the nest for about 5 weeks after hatching (Cogswell, 1977; Terres, 1980). It can establish new colonies in areas with extensive marshes and other conditions that are suitable for breeding. Several factors may affect establishment of new breeding colonies, including population age structure and breeding site fidelity. In addition, the white-faced ibis is able to shift nesting areas in response to changing availability of marsh habitat (Ryder, 1967). However, this species may need other ibises and other waders, such as herons, gulls, and ducks, present to initiate a new colony (Palmer, 1962; Burger and Miller, 1977).

Habitat in the Proposed Project Area

For nesting, white-faced ibis typically use areas of extensive marsh. However, in the proposed project area, they nest predominantly in tamarisk and mesquite snags that are over water. In the proposed project area, the state and federal wildlife refuges and naturally occurring marshes along the Salton Sea are the only areas known to support nesting white-faced ibis. Agricultural drains support limited amounts of cattails and bulrushes in small patches within the confines of the drain. These patches are not likely to provide suitable nesting habitat for white-faced ibis.

Nighttime roosts in the Imperial Valley are found in managed wetlands, such as Ramer Lake and local duck club wetlands, where birds roost in open ponds or in marsh vegetation. The Salton Sea also supports roosting birds (Salton Sea Authority and Reclamation, 2000).

Agricultural fields are used extensively by white-faced ibis for foraging. Alfala is one of the primary crops of the Imperial Valley, and white-faced ibis typically congregate in these fields foraging on insects displaced as the field is flood irrigated. Wheat fields are also commonly used for foraging.

Proposed Project Area Occurrence

White-faced ibis occur year-round in the proposed project area although the greatest numbers occur during winter. The Salton Sea provides habitat for the second largest wintering population of this species in California (USFWS, 1999) and more than 24,000 were recorded at the Salton Sea in 1999 (Point Reyes Bird Observatory, 1999). These numbers represent more than 50 percent of the white-faced ibis in California (Shuford et al., 1999). Small numbers of white-faced ibis nest at the Salton Sea (USFWS, 1996a). At Finney Lake on the Imperial Wildlife Area, recent breeding estimates indicate 370 breeding pairs using this lake (Shuford et al., 1999).

Wood Stork *(Mycteria americana)*

Range and Distribution

Wood storks have a limited distribution in the U.S. They occur as year-round residents in Florida, Mexico, and parts of South America where they breed (Kaufman, 1996; DeGraaf and Rappole, 1995). They also breed at scattered locations elsewhere in the southeastern U.S. (DeGraaf and Rappole, 1995). After the breeding season, wood storks occur throughout their breeding range as postbreeding visitors but also wander outside their breeding range to locations in Texas, Louisiana, and Southern California (DeGraaf and Rappole, 1995).

Population Status

The population of wood storks in the southeastern U.S. was reportedly greater than 150,000 at one time. By the early 1990s, the population declined to about 10,000 (Kaufman, 1996). Numbers in California appear to have declined since the 1950s (CDFG, 1999a). The decline of this species is attributed to loss of breeding and foraging habitat in Florida.

Habitat Requirements

Wood storks are associated with marshes, lagoons, and ponds. The species primarily feeds on fish, small vertebrates, and aquatic invertebrates. They forage while wading by moving their open bill in the water until contacting a prey item, and then quickly snapping the bill closed (CDFG, 1999a). Thus, foraging is restricted to shallow water areas. Wood storks appear in California as early as May after the breeding season and remain as late as October (Small, 1994).

Habitat in the Proposed Project Area

Suitable habitat for wood storks in the proposed project area principally occurs at the Salton Sea and adjacent wetland areas. Shallow shoreline areas and pools formed by barnacle bars provide appropriate foraging conditions for wood storks. Most wood storks at the Salton Sea occur at the southern end (CDFG, 1999a).

Proposed Project Area Occurrence

The wood stork is a common postbreeding visitor to the Salton Sea, generally occurring at the Salton Sea between July and September (IID, 1994). It is also known to occur at the Salton Sea during the spring, fall, and winter although less frequently and in fewer numbers (USFWS, 1997b). In the 1950s, as many as 1,500 wood storks occurred at the Salton Sea (Shuford et al., 1999). In recent years, up to 275 individuals have been counted at the Salton Sea (IID, 1994).

Aleutian Canada Goose *(Branta canadensis leucopareia)*

Range and Distribution

The Aleutian Canada goose once nested in the outer two-thirds of the Aleutian Islands in Alaska and in the Commander and Kuril Islands of the former Soviet Union. Currently, they nest on six islands of the Aleutian archipelago and on one island of the Semidi Island group, southward of the Alaska peninsula. Most Aleutian Canada geese migrate from breeding grounds in Alaska during September, arriving at wintering grounds in California in mid-October. Most Aleutian Canada geese winter in the Central Valley from Los Banos to just north of Sacramento.

Population Status

The Aleutian Canada goose is a federally listed endangered species. Predation by arctic foxes introduced during 1920 to 1936 to many of the Aleutian Islands was primarily responsible for reducing the population to about 800 birds. Aleutian Canada geese were also hunted recreationally and for food until 1975. Chronic outbreaks of avian cholera and avian botulism are present threats to wintering Aleutian Canada geese. The Aleutian Canada goose population has increased in recent years to more than 5,000 (Small, 1994), and the USFWS is considering delisting this species.

Habitat Requirements

In winter, Aleutian Canada geese are associated with lakes, fresh emergent wetlands, moist grasslands, croplands, pastures, and meadows (CDFG, 1990). Geese feed on a wide variety of marsh vegetation, including algae, seeds of grasses and sedges, grain (especially in winter), and berries.

Habitat in the Proposed Project Area

Aleutian Canada geese do not breed in the proposed project area, and their use of the proposed project area is restricted to over wintering. Habitat for Aleutian Canada geese consists of wetlands adjacent to the Salton Sea, managed wetlands on the state and federal refuges, and wetlands on private duck clubs. In addition, Aleutian Canada geese often forage in agricultural fields during the winter.

Proposed Project Area Occurrence

Aleutian Canada geese occur only as rare fall migrants and winter residents in the proposed project area where they forage in the wetland areas around the Salton Sea in the agricultural fields throughout the Imperial Valley (Small, 1994; USFWS, 1997b). The 1998 Christmas Bird count reported two Canada Geese (Small Races) in the south Salton Sea area.

Fulvous Whistling-Duck (*Dendrocygna bicolor*)

Range and Distribution

The fulvous whistling-duck is a tropical/subtropical species that breeds in widely separated populations in all hemispheres. This goose-like duck is found in the southern U.S. and Mexico, northeast and southeast South America, east Africa, and India. In the Western Hemisphere, it ranges from Mexico north into the Gulf States and California and along the Atlantic and Pacific Coasts to New Brunswick and British Colombia, respectively (Terres, 1980). Breeding birds in the southern U.S. winter in southern Mexico (Ehrlich et al., 1988).

Population Status

In recent decades, the fulvous whistling-duck has declined in the southwestern U.S. while increasing in numbers in the Southeast. At the Lake Okeechobee area in southern Florida the population was estimated at 6,000 ducks in the late 1980s (Turnbull et al., 1989). The decline of this species in the Southwest has been primarily attributed to the draining of permanent marshes for agricultural use and the diversion of lakes and rivers for irrigation. The destruction of nests by farmers in other parts of North America, susceptibility to hunting due to its unwary behavior, and poisoning by crop pesticides have also contributed to this species' decline (Kaufmann, 1996; Ehrlich et al., 1988; Zeiner et al., 1990).

Fulvous whistling-duck historically occurred as a regular summer visitor in small numbers along the Southern California coast north to Los Angeles and in greater numbers in the Central Valley (Garrett and Dunn, 1981). In California, the range and population size of fulvous whistling-ducks have declined, particularly on the coastal slope and in the San Joaquin Valley. By the 1970s, the fulvous whistling-duck was thought to breed only in the

Imperial Valley (Shuford et al., 1999). It also has declined along the Colorado River and at the Salton Sea and is now considered a rare summer visitor that may sporadically breed at the Salton Sea (USFWS, 1997b). Reasons for decline of the fulvous whistling-duck are draining and development of marsh habitats and hunting. Pesticides have been shown to cause declines in fulvous whistling-duck populations in other states and also may have adversely affected the California population (Zwank et al., 1988).

Habitat Requirements

The fulvous whistling-duck inhabits shallow wetlands, preferring freshwater and brackish marshes on the coastal plain. Although marshy shallows are preferred, roving flocks of whistling-ducks wander widely and occasionally occur at most wetland habitats. Ponds, lakes, and irrigated agricultural fields, particularly flooded rice fields, are commonly used by this species (Terres, 1980; Kaufmann, 1996; and Ehrlich et al., 1988). The fulvous whistling-duck usually builds its nest in freshwater marshes among dense stands of cattails or bulrushes. The nest is frequently built on a marsh hummock or on the ground at the water edge. Occasionally, nests are placed among tall grasses in wet meadows and rarely in tree cavities (Terres, 1980; Kaufmann, 1996; and Ehrlich et al., 1988). They form long-term pair bonds and raise one brood per year (Ehrlich et al., 1988).

The diet of the fulvous whistling-duck consists mostly of plant material, including a wide variety of greens and seeds. It often forages in agricultural fields for alfalfa, rice, and corn. A few aquatic insects are also eaten (Terres, 1980; Kaufmann, 1996; and Ehrlich et al., 1988).

Habitat in the Proposed Project Area

Habitat for fulvous whistling-ducks primarily occurs on the state and federal wildlife refuges at Finney and Ramer Lakes, which support dense stands of cattails and bulrushes as well as the freshwater impoundments above the mouth of the Alamo River (Garrett and Dunn, 1981). Freshwater marshes at the Salton Sea National Wildlife Refuge also potentially provide habitat for this species. Fulvous whistling-ducks nest in dense freshwater wetlands consisting of cattails near the south end of the Salton Sea and forage on wetland plants and submerged aquatic vegetation in freshwater habitats (Salton Sea Authority and Reclamation, 2000). Agricultural drains and seepage communities along the water delivery canals may provide foraging habitat for fulvous whistling-ducks but are unlikely to be used for nesting due to their small size. Agricultural fields of alfalfa and wheat are used for foraging in addition to marsh habitats.

Proposed Project Area Occurrence

The Salton Sea has supported a population of up to about 200 individuals during the spring and summer (IID, 1994). Most of these birds are postbreeders arriving in June and July (Small, 1994). The species rarely occurs in the HCP area during the winter (USFWS, 1997b). Christmas bird surveys in 1999 reported only 5 birds in the south Salton Sea area and 17 birds from the Martinez Lake area near Yuma Arizona. The 1999 breeding bird surveys for the Southern California population reported an average of less than 1 where in other parts of its range average counts ranged between 3 and 30.

Cooper's Hawk *(Accipter cooperii)*

Range and Distribution

The Cooper's hawk breeds from Southern Canada south throughout much of the U.S. and into northern Baja California, Mexico, and northern mainland Mexico (Johnsgard 1990). It breeds throughout most of California (Zeiner et al., 1990). Outside of the breeding season, it disperses widely from southern Canada south into Central America. Cooper's hawks are usually year-round residents in the Southwest, with some migrants from more northern areas arriving in winter (Zeiner et al., 1990).

Population Status

Cooper's hawk populations have declined historically with an estimated decrease of 13.5 percent between 1941 and 1945 and with rates as high as 25 percent a year after 1948 with the widespread use of DDT (Henny and Wright, 1972). Since the late 1960s, however, there has been an increase in some populations, especially in the northeast (Evans, 1982). A conservative estimate based on Christmas Bird Count data is that there were 19,400 individuals in the U.S. and Canada (Johnsgard, 1990). The largest populations were in Arizona and California. An additional but unknown number of individuals that breed in the U.S. but winter south to Central America were not included in this estimate.

Historically, Cooper's hawks nested in lowland riparian woodlands in the Central Valley and coastal valleys. Cooper's hawks declined as a breeding species in California in the 1950s and 1960s (Remsen, 1978). Major factors in the decline of Cooper's hawk populations include pesticide-induced reproductive failures, especially in the eastern U.S., and loss of riparian nesting habitat, especially in the Southwest (Remsen, 1978). Other threats include human disturbance at the nest and illegal taking of nestlings.

Habitat Requirements

Cooper's hawks are associated with open and patchy deciduous and mixed forests, riparian woodlands, and semiarid woodlands in the Southwest (Johnsgard, 1990; Zeiner et al., 1990). The Cooper's hawk most often nests in deciduous riparian forest, oak woodland, or young- to mid-seral stage, even-aged conifer forest (30 to 70 years old), usually near streams or other open water (Reynolds, 1983). Eucalyptus woodlands may also be used. These forests range from extensive wilderness to smaller forest fragments, woodlots, deciduous riparian groves, small conifer plantations, and suburban habitats (Reynolds, 1983; Bosakowski et al., 1992; and Rosenfield and Bielefeldt, 1993). In central California oak woodlands, Asay (1987) found the majority of nests to be in closed canopy forests, but noted two nests that occurred in lone trees. Cooper's hawks appear to be tolerant of fragmented forest conditions, and forest edge is generally included within their home range (Rosenfield and Bielefeldt, 1993). Even in heavily wooded areas, Cooper's hawk nests were found significantly closer to forest openings than random sites (Bosakowski et al., 1992).

In the western U.S., Cooper's hawks' diet includes about 50 percent birds, with the remainder consisting of mammals, amphibians, and reptiles. They hunt from perches with short flight attacks or extended searching flights, often relying on stealth to capture their prey. These hawks prefer hunting in broken woodland and along habitat edges, catching prey on the ground, in the air, or on vegetation (Zeiner et al., 1990).

Habitat in the Proposed Project Area

Cooper's hawks primarily forage on small birds and often hunt along woodland edges. In the proposed project area, Cooper's hawks can find suitable foraging conditions in and adjacent to tamarisk stands that occur along the New and Alamo Rivers and agricultural drains. Wetlands and tamarisk scrub along the Salton Sea are known to be used by Cooper's hawks (Salton Sea Authority and Reclamation, 2000). Similarly, wetland and riparian habitats on the state and federal refuges provide suitable foraging habitat, as do habitats supported by seepage from the AAC.

Proposed Project Area Occurrence

Cooper's hawks are winter visitors to the proposed project area (USFWS, 1997b). About 300 migrants occur in Imperial Valley during winter (IID, 1994). Several Cooper's hawks were observed along the Holtville Main Drain during surveys of selected drains in Imperial Valley (Hurlbert et al., 1997). This drain had the greatest amount of vegetation, predominantly tamarisk, of all of the drains surveyed.

Sharp-shinned Hawk (*Accipiter striatus*)

Range and Distribution

Sharp-shinned hawks nest in north-central North America and in Central and South America. Their breeding range extends from west and central Alaska south through much of Canada and into the upper Great Plains. Breeding populations also extend south along the Pacific Coast to central California and along the northern Atlantic Coast southwest to South Carolina. There is a large disjunct breeding area that includes Arizona, Utah, New Mexico, and Colorado. The winter range is south of the breeding range and includes most of the U.S. except Alaska, where it is found only along the southwest coast.

Population Status

The Canadian and U.S. wintering populations of sharp-shinned hawks were conservatively estimated to be more than 30,100 individuals (Johnsgard, 1990). Highest densities were from Massachusetts to Virginia on the Atlantic Coast and in California and Arizona in the west. The size of the population that breeds in the U.S. and winters to the south is unknown, but is expected to be substantial.

Earlier declines in sharp-shinned hawk populations were likely the result of decreased reproductive success due to pesticides introduced following World War II (Johnsgard, 1990). Populations increased after DDT was banned in the U.S. in the early 1970s; however, there has been a decline recently in the number of sharp-shinned hawks passing through traditional migratory paths in the eastern U.S. (Viverette et al., 1996). The continued use of pesticides in Central and South America, the wintering grounds for many sharp-shinned hawks that breed in North America and for many of their avian prey species, is also a concern (Johnsgard, 1990). Forest management practices in the western U.S. that produce monoculture forest habitats may be detrimental to this hawk species as well. This species was historically shot in large numbers during migration, which also contributed to its historic decline in abundance.

Habitat Requirements

Sharp-shinned hawks' breeding habitat is typically boreal forest, where up to 80 percent of the North American breeding population is found (Johnsgard, 1990). In winter, sharp-shinned hawks use a wider variety of habitats. While it is typically associated with woodland habitats, the sharp-shinned hawk will use open or young forests with a variety of plant life supporting abundant avian prey. Along the Colorado River, sharp-shinned hawks forage in mesquite and willow groves and along the brushy borders of agricultural fields and canals. They forage by darting out from a perch or by hunting in low gliding flights to capture unwary avian prey (Zeiner et al., 1990).

Habitat in the Proposed Project Area

Sharp-shinned hawks typically use woodland habitats. In the proposed project area, woodland habitats are relatively rare and consist mainly of tamarisk scrub along the Salton Sea, the New and Alamo Rivers, and agricultural drains. Tamarisk, as well as some cottonwoods, willows, and mesquite, are supported by seepage from the AAC between Drops 3 and 4 and may provide habitat for sharp-shinned hawks. Tamarsik and eucalyptus trees bordering agricultural fields may also be used as perch sites for foraging.

Proposed Project Area Occurrence

Sharp-shinned hawks occur in the proposed project area as migrants and winter visitors (USFWS, 1997b). About 250 sharp-shinned hawks occur in Imperial Valley during migration or winter (IID, 1994). Ten drains were surveyed in the Imperial Valley during 1994 to 1995. Two sharp-shinned hawks were observed along the Trifolium 2 Drain, and one was observed along the Holtville Main Drain (Hurlbert et al., 1997). These two drains had the greatest vegetation coverage of the 10 drains surveyed.

Golden Eagle *(Aquila chrysaetos)*

Range and Distribution

The golden eagle is found throughout the U.S. and Canada, ranging from Southern Alaska to central Mexico. It is a widely distributed resident throughout western North America, except for the recent extirpation in the Central Valley of California (Harlow and Bloom, 1989).

Population Status

Approximately 500 breeding pairs of golden eagles nest in California (CDFG, 1985). Golden eagle populations declined in Southern California primarily because of the loss of large, unfragmented habitat areas as well as lead toxicosis (Harlow and Bloom, 1989). Human disturbance of nest areas may have also contributed to earlier statewide declines (Thelander, 1974).

Habitat Requirements

Golden eagles occupy primarily mountain, desert, and canyon habitats, usually avoiding dense forested areas where hunting is difficult due to their large wingspan (Johnsgard, 1990). Golden eagles construct their nests on cliff ledges and high rocky outcrops, in large trees, on top of telephone poles, and on the ground (Bruce et al., 1982; and Knight et al., 1982). Golden eagles hunt over open country for hares, marmots, rodents, snakes, birds, and sometimes newborn ungulates and carrion. In California, golden eagles forage on wintering waterfowl. Grassland, oak savannah, alpine tundra, meadows, open woodland, chaparral, and wetland habitats provide foraging habitat.

Habitat in the Proposed Project Area

Much of the proposed project area could potentially be used by golden eagles for foraging; however, golden eagles are most likely to concentrate foraging activities in areas of high prey concentrations. In the proposed project area, the Salton Sea and managed wetlands at the state and federal wildlife refuges, as well as private duck clubs, attract abundant waterfowl populations during winter. Agricultural fields also attract waterfowl. Golden eagles may exploit the seasonally abundant prey of these areas.

Proposed Project Area Occurrence

Golden eagles occur at the Salton Sea only as accidentals during the winter and spring (USFWS, 1997b).

Ferruginous Hawk (*Buteo regalis*)

Range and Distribution

Ferruginous hawks breed from southeastern Washington; southern Alberta and Saskatchewan, Canada; and western North Dakota south to Texas, northern New Mexico, and Arizona (Johnsgard, 1990). They winter primarily from the central part of their breeding range in Nevada, Colorado, and Kansas south to northern Mexico (Johnsgard, 1990). There are no breeding records from California, but they are a fairly common winter resident in the southwestern part of the state (Zeiner et al., 1990). Important wintering locales for ferruginous hawks in California include Fish Lake Valley, Owens Valley, Carrizo Plain, Cuyama Valley, Antelope Valley, Lucerne Valley, Lakeview-Perris area (Riverside), and Lake Henshaw (Garrett and Dunn, 1981).

Population Status

The ferruginous hawk has declined as a breeding resident in parts of its range, including Oregon, Arizona, and Kansas. It is now considered a sparse breeder in northern Arizona and no longer nests in southeastern Arizona (AGFD, 1996). The estimated breeding population of ferruginous hawks in the U.S. and Canada in the early 1980s was 3,000 to 4,000 breeding pairs (Schmutz, 1984). In 1986, the estimated wintering population of ferruginous hawks north of Mexico was about 5,500 individuals based on Christmas Bird Count data (Johnsgard, 1990). Most wintering birds were concentrated in Arizona and Colorado. From 1973 to 1984, there was a substantial increase in the abundance of wintering ferruginous hawks in the U.S. based on Christmas Bird Count data (Warkentin and James, 1988). The largest regional increases in wintering populations were in California and the eastern portion of the range.

The decline of the ferruginous hawk is attributed to the loss of large, open tracts of grasslands and desert scrub habitats used for nesting to agriculture and urban development (Schmutz, 1984 and 1987; AGFD, 1996). This species is also vulnerable to prairie dog control programs, illegal hunting, and human disturbance at nesting sites (Schmutz, 1984; AGFD, 1996). Habitat loss and illegal hunting may threaten populations of this species in the study area (Schmutz, 1984; AGFD, 1996).

Habitat Requirements

Ferruginous hawks are adapted to breeding and wintering in large expanses of semiarid grasslands of the Great Plains with scattered trees, rock outcrops, and tall trees along streams and rivers (Johnsgard, 1990). They also use agricultural lands in winter for foraging in both California (Zeiner et al., 1990) and the LCR Valley (Rosenberg et al., 1991). Ferruginous hawks forage on rabbits, jackrabbits, and grassland rodents, such as ground squirrels and prairie dogs (Johnsgard, 1990; Plumpton and Andersen, 1997). They forage mostly from perches and the ground but also capture prey via long, low, overhead flights. They may steal prey from other raptors and scavenge for food.

Habitat in the Proposed Project Area

Ferruginous hawks are associated with arid open habitats. In the HCP area, they could use agricultural fields or desert habitats adjacent to the AAC.

Proposed Project Area Occurrence

Ferruginous hawks regularly occur in the Imperial Valley in small numbers during the winter. In the Colorado River Valley, most winter migrants and residents are observed from mid-October to mid-March, although they can occur in the valley from late September to early April (Rosenberg et al., 1991). Similar periods of occurrence are assumed for the Imperial Valley. They are not known to breed in the HCP area.

Swainson's Hawk (*Buteo swainsoni*)

Range and Distribution

Swainson's hawks nest in disjunct areas of central Alaska and from western Canada, east as far as Minnesota and south through Texas to Baja California, Mexico, and north-central Mexico (Johnsgard, 1990). This species migrates in large flocks between breeding areas in North America and wintering areas in South America (Terres, 1980). In California, this formerly widespread hawk is now restricted to portions of the Central Valley and the Great Basin region of the state (CDFG, 1991).

Population Status

The geographic range and abundance of the Swainson's hawk have decreased in the western U.S. (Zeiner et al., 1990). Swainson's hawks have declined in parts of their range (e.g., southeastern Oregon and California) since the 1940s, whereas in the Great Plains, there was no evidence of decline by the mid-1980s except in peripheral populations (Johnsgard, 1990). As of the mid-1980s, an estimated 500,000 birds were in North America; however, more recently, there is thought to have been a nationwide decline (AGFD, 1996). Detailed information is lacking on the historical and current abundance of breeding Swainson's hawks in Arizona (AGFD, 1996). In California, it is estimated that the breeding population around 1900 may have exceeded 17,000 pairs (CDFG, 1991). As of the early 1990s, the statewide population was estimated to be only about 550 pairs. The population is still declining, and the species has disappeared from Southern California, except as a spring and fall transient during migration.

The major reason for the substantial decline of this species in the western U.S. is the loss of nesting and foraging habitat due to urban expansion into rural areas (Zeiner et al., 1990; CDFG, 1991). There has also been considerable foraging habitat loss due to the trend in planting agricultural crops unsuitable for foraging (e.g., vineyards, orchards, and rice); grassland losses due to grazing practices; fire control; and shrub invasion (CDFG, 1991; AGFD, 1996). Another major threat to Swainson's hawks has been pesticide use in South America, with an estimated 20,000 to 30,000 individuals killed in 1996 (AGFD, 1996). Additional threats to Swainson's hawks include nesting habitat loss due to flood control proposed projects, shooting, pesticide poisoning of prey animals, competition with other raptors, and human disturbance at nest sites (CDFG, 1991).

Habitat Requirements

Swainson's hawks nest in mature riparian forests; oak groves; or in lone trees adjacent to foraging areas, such as agricultural fields (Johnsgard, 1990; Zeiner et al., 1990; and CDFG, 1991). Nests are built from 1.2 to 30.5 m (4 to 100 feet) high with an average nest tree height of nearly 18 m (58 feet) in the Central Valley of California (Zeiner et al., 1990; CDFG, 1991). Swainson's hawks nest from late March to late August. Spring migration occurs from March through May, and fall migration occurs from September through October.

Swainson's hawks are unusual among most large birds of prey in that they feed largely on insects during the nonbreeding season (e.g., dragonflies, grasshoppers, and crickets) and often congregate in large flocks to forage (Jaramillo, 1993; Rudolph and Fisher, 1993). Because they depend on insect prey in the winter, they are highly migratory (Johnsgard, 1990). During the breeding season, they feed on small mammals and, to a lesser degree, on birds, lizards, and amphibians (Terres, 1980; Johnsgard, 1990). These hawks often soar in search of prey, catching insects and bats in flight, and will also walk on the ground to capture prey (Zeiner et al., 1990). Swainson's hawks forage during migration in grasslands, agricultural fields (including alfalfa and other hay crops), and lightly grazed pastures (CDFG, 1991). Unsuitable foraging areas are crops in which prey is scarce or inaccessible, such as vineyards, orchards, rice, corn, and cotton.

Habitat in the Proposed Project Area

Agricultural fields provide the primary foraging habitat for Swainson's hawks in the proposed project area. Swainson's hawks often visit alfalfa fields for foraging in other parts of its range and would be expected to forage in alfalfa, wheat, and sudangrass fields in the Imperial Valley. Trees, such as tamarisk or eucalyptus that occur adjacent to agricultural fields, provide perch and roost sites.

Proposed Project Area Occurrence

Swainson's hawks are occasional visitors to the Salton Sea area during the spring and fall (USFWS, 1997b). No breeding occurs in the proposed project area.

Northern Harrier (*Circus cyaneus*)

Range and Distribution

The northern harrier is a widespread species that can be found distributed from Alaska in the spring and summer as far south as South America. It is distributed across the U.S. with populations that exist year-round throughout the central states to the west coast (Kaufman, 1996). In California, the harrier is a year-round resident that is commonly found throughout the state in low-lying areas of agricultural lands, estuaries, and marshes (Zeiner et al., 1990).

Population Status

Northern harriers are generally declining throughout their range, and southern breeding limits are retracting northward (Johnsgard, 1990). Breeding populations have been reduced in most parts of the harrier's range due to the loss and degradation of wetland, meadow, and grassland habitats and burning and plowing of nesting areas during early stages of the breeding cycle (Remsen, 1978; Johnsgard, 1990). Habitat destruction and exposure to pesticides are the primary threats to northern harriers (Ehrlich et al., 1992). In addition, northern harriers nest on the ground and are vulnerable to nest destruction from agricultural and other human activities; nest predation; and heavy grazing, which reduces nesting cover and also can result in trampling of nests (Zeiner et al., 1990a).

Based on CBC data, there was an estimated population of 111,500 northern harriers in North America (MacWhirter and Bildstein, 1996). Highest densities in the U.S. were reported from the Chesapeake Bay Area, Texas, California, and Arizona.

Habitat Requirements

The northern harrier is an open country species, nesting at low elevations up to about 900 feet (Johnsgard, 1990). They feed mostly on voles and other small mammals; birds; frogs; reptiles; and insects that inhabit low-lying wetland marshes, swamps, bogs, fields, pastures, cropland, and meadows (Johnsgard, 1990). In the LCR Valley, harriers forage primarily in alfalfa or grass fields and over sparse riparian vegetation or marshes and occasionally over open desert. The harrier usually hunts with low, coursing flights over the ground (3 to 30 feet), making quick plunges onto prey. Harriers use tall grasses and wetland forbs as cover. The harrier nests on the ground in tall grasses, sedges, reeds, rushes, cattails, willows, or shrubby vegetation, usually on marsh edges (Brown and Amadon, 1968; Johnsgard, 1990). Grasslands, cultivated fields, and pastures are used for nesting in addition to native habitats. Harriers breed from April to September, with most egg laying between mid-April and July (Johnsgard, 1990; Zeiner et al., 1990).

Habitat in the Proposed Project Area

Throughout California, northern harriers commonly use agricultural fields. In the proposed project area, habitat for northern harriers is abundant. Alfalfa, wheat, and sudangrass are currently the principal crops in the valley, all of which provide suitable forage for harriers. Additional foraging and roosting habitat are available in the managed wetlands of the state and federal wildlife refuges and private duck clubs and wetlands in the vicinity of the Salton Sea.

Proposed Project Area Occurrence

Northern harriers are common fall and winter residents in the proposed project area, but only occasionally occur in the area during the spring and summer (USFWS, 1997b). Small (1994) states that nesting of harriers has been significantly reduced in the southern part of California. No recent breeding pairs have been confirmed in Imperial Valley, but, given the occasional occurrence of northern harriers in the project area during summer, breeding is possible. Ten drains were surveyed in the Imperial Valley during 1994 to 1995 (Hurlbert et al., 1997). One to nine individuals were observed along eight of the drains. Surveys conducted in 1999 reported 33 northern harriers at the Salton Sea (Salton Sea Authority, 2000).

White-tailed Kite (*Elanus leucurus*)

Range and Distribution

The white-tailed kite's range extends from coastal zones in western Oregon south to Baja California, Mexico. The white-tailed kite is a common to uncommon, year-long resident in coastal and valley lowlands and rarely found away from agricultural areas. It inhabits herbaceous and open stages of most habitats, primarily in cismontane California.

Population Status

Population declines were noted nationwide during the 1980s and 1990s (Dunk, 1995). However, Small (1994) reports a general population increase in California in recent years following declines in several portions of the state (e.g., southern and west-central areas) during the 1980s.

Habitat Requirements

The white-tailed kite uses herbaceous lowlands with variable tree growth and dense populations of voles (Waian and Stendell, 1970). The preferred foraging habitat of the white-tailed kite consists of farmlands, open grasslands, meadows, emergent wetlands, clearcuts, and lightly wooded areas (Johnsgard, 1990). Lightly grazed or ungrazed fields provide the best foraging habitat (Dunk, 1995). Specific associations with plant species for foraging or nesting seem unimportant; rather vegetation structure and prey base are thought to be the primary determinants of foraging and nesting habitat quality. Substantial groves of dense, broad-leafed deciduous trees are used for nesting and roosting. This species uses trees with dense canopies for cover. In Southern California, it also roosts in saltgrass and Bermudagrass.

The white-tailed kite makes a nest of loosely piled sticks and twigs and lined with grass, straw, or rootlets. Nests are placed near top of dense oak, willow, or other tree stand; usually 6 to 20 m (20 to 100 feet) above ground (Dixon et al., 1957). Nest trees range from 10 to 170 feet tall and can occur as single, isolated trees or in large stands greater than 250 acres. Most nests are placed near forest/grass edges in the upper one-third of the tree (Dunk, 1995).

Habitat in the Proposed Project Area

Agricultural fields and managed wetlands associated with the state and federal wildlife refuges provide foraging areas for the white-tailed kite. Tamarisk and eucalyptus bordering agricultural fields provide potential roosting and nesting sites.

Proposed Project Area Occurrence

White-tailed kites may occur in the proposed project area throughout the year. Although not common, they are regularly observed (USFWS, 1997b). Breeding status is uncertain. They have bred in the HCP area previously, but have not been verified to breed there recently (USFWS, 1997b). White-tailed kites were observed during general avian surveys of several drains in the Imperial Valley (Hurlbert et al., 1997).

Bald Eagle *(Haliaeetus leucocephalus)*

Range and Distribution

Bald eagles occur in North America from central Alaska and Canada south to northern Mexico (USFWS, 1995b). They are found primarily along coasts, inland lakes, and large rivers, but may also be found along mountain ranges during migration. Although the bald eagle is greatly reduced in abundance from historical levels, the current distribution is essentially the same (USFWS, 1976). Many bald eagles withdraw in winter from northern areas, migrating north again in spring and summer to breed (Terres, 1980).

Population Status

Historically, bald eagles are believed to have nested throughout North America on both coasts and along major rivers and large lakes (Gerrard and Bortolotti, 1988). By the mid-1800s, bald eagle populations had declined radically throughout most of the U.S. because of widespread shooting, reductions in the species' prey base, and secondary poisoning as a result of predator control programs. The introduction of DDT for agricultural purposes in the 1940s furthered the decline of this species, resulting in widespread reproductive failure due to eggshell thinning. Efforts to save the bald eagle, including passing of the Bald Eagle Protection Act in 1940, listing the bald eagle as a federally endangered species in 1967, and banning DDT in the U.S. and Canada in the early 1970s, have resulted in a slow recovery of the species. Between 1982 and 1990, the number of occupied bald eagle territories in the lower 48 U.S. doubled from 1,482 to 3,014. Reintroduction programs have also contributed to the species' recovery (Hunt et al., 1992). Due to population increases, the USFWS has proposed to delist the bald eagle (FR 64 36454-36464).

Habitat Requirements

Bald eagles are associated with aquatic ecosystems, including large rivers, major lakes, reservoirs, estuaries, and seacoasts. They require open water habitats that support an adequate food base. Bald eagles forage on fish and waterfowl from perch sites adjacent to foraging areas. Thus, perch sites near open water or marshes are an essential habitat feature. Bald eagles acquire food in a diversity of ways. They catch live prey, steal prey from other predators, and find carrion. Fish, small mammals, and waterfowl make up the majority of eagles' diet (Terres, 1980).

Habitat in the Proposed Project Area

Suitable foraging habitat occurs at the Salton Sea and adjacent wetlands where eagles may prey on fish and waterfowl. The state and federal wildlife refuges as well as private duck clubs that support abundant waterfowl populations during the winter may also attract bald eagles. In addition, some waterfowl species forage in agricultural fields of the valley, and bald eagles probably exploit this food source where trees are present to provide roost sites.

Proposed Project Area Occurrence

Bald eagles are a rare and occasional winter visitor to the proposed project area. A few winter migrants (one to three birds) have been regularly observed at the Salton Sea, but are rarely observed during the fall (IID, 1994). They are not known to breed in the proposed project area.

Osprey *(Pandion haliaetus)*

Range and Distribution

The osprey is a cosmopolitan species, found on every continent except Antarctica (Terres, 1980). In North America, ospreys breed from northwest Alaska and Canada south to Baja California, Mexico, and Florida (Johnsgard, 1990). In the U.S., it occurs close to coastal waters on the east and west coasts and inhabits inland areas around the Great Lakes, Utah, Arizona, and Nevada. Ospreys winter on the Gulf Coast and Southern California south into Central and South America (Terres, 1980). This species breeds throughout Northern California from the Cascade Range south to Marin County and throughout the Sierra Nevada (Zeiner et al., 1990).

Population Status

Ospreys have declined in abundance, especially since the 1960s (Terres, 1980). There were an estimated 8,000 pairs in the contiguous U.S. in the early 1980s with Florida having the largest numbers, followed by Chesapeake Bay and Maine (Johnsgard, 1990). Based on Christmas Bird Count data, the U.S. winter population was estimated at 7,080 individuals in 1986, with over half in Florida. Since DDT was banned in the U.S., osprey populations have increased considerably in many parts of the country (Kaufman, 1996). The North American breeding population has been estimated at 17,000 to 20,000 individuals (Poole, 1989).

The decline in osprey numbers is largely attributed to the adverse effects of DDT and other pesticides on reproduction (Johnsgard, 1990). Some areas still have greatly reduced osprey populations that may be due to residual effects of these now banned pesticides. Over half of the North American population may winter in Latin America and the West Indies where pesticide use is not as controlled as in the U.S. and Canada. Human encroachments on breeding areas and shooting have also adversely affected osprey populations.

Habitat Requirements

Ospreys are found only in association with lakes, reservoirs, coastal bays, or large rivers. They feed predominantly on fish, although some mammals, birds, reptiles, and amphibians are also eaten. Ospreys require open, clear water for foraging and swoop down while in flight or from a perch to catch fish at the water's surface. Large trees and snags near the water are used for roosting and nesting. During the breeding season, ospreys generally restrict their movements to activities in and around the nest site, and between the nest and foraging sites.

Habitat in the Proposed Project Area

Habitat for ospreys in the proposed project area principally occurs at the Salton Sea, where abundant fish populations provide foraging opportunities. Snags and trees along the margins of the Salton Sea provide important perch sites that osprey use for foraging and eating captured prey. Ospreys may also forage along the New and Alamo Rivers and lakes in the Imperial Valley, such as Finney Lake and Fig Lagoon.

Proposed Project Area Occurrence

At the Salton Sea, ospreys occur in small numbers as a nonbreeding visitor throughout the year (IID, 1994).

Harris' Hawk *(Parabuteo unicinctus)*

Range and Distribution

Historically, Harris' hawks were residents of semiopen habitats from northern Baja California, Mexico, east through central and southern Arizona, southern New Mexico, and southern Texas; and south through Central America and South America. This species has also occurred infrequently in Kansas, Louisiana, Colorado, Utah, and Nevada (Johnsgard, 1990). Historically, Harris hawk occurred year-round in the LCR Valley from near Needles to the Imperial National Wildlife Refuge, with a small disjunct breeding population at the south end of the Salton Sea (Small, 1994; Bednarz, 1995).

Population Status

Although Harris' hawks are still located throughout most of its historic range, they were believed to be extirpated from southeastern California and southwestern Arizona by the early 1970s. Small numbers of Harris' hawks are once again present in California due to accidental releases and recent attempts at reestablishing a breeding population along the LCR. Attempts to reintroduce the Harris' hawk occurred in the 1980s, when nearly 200 birds were released along the LCR (Walton et al., 1988). A few nests have been found incidentally since (Bednarz, 1995).

Habitat Requirements

Harris' hawks occur in desert scrub dominated by saguaro, paloverde (*Cercidium spp.*), and ironwood (*Olneya tesota*); cottonwood-mesquite forests; and semidesert prairies. Saguaro cacti, paloverde, mesquite, and riparian trees, especially cottonwoods, are used as nest sites. This species also occurs in some urban environments where it takes advantage of washes, vacant lots, and areas of undeveloped desert (Rosenberg et al., 1991; Johnsgard, 1990). In urban situations, nests have been placed in pine trees, palm trees, and transmission towers. The diet of the Harris' hawk consists mainly of small- to medium-sized rodents, but it is also known to take birds, lizards, and mammals up to the size of rabbit.

Habitat in the Proposed Project Area

Little potential habitat for Harris' hawk exists in the HCP area. Cottonwood and mesquite trees that Harris' hawks could use for nesting occur only in a few isolated seepage areas along the AAC, principally between Drops 3 and 4. In the remainder of the HCP area, Harris' hawks could use landscape trees and trees on the state and federal refuges. Agricultural fields throughout the HCP area could be used for foraging.

Proposed Project Area Occurrence

Harris' hawks have been observed at the Imperial National Wildlife Refuge and are known to forage in mesquite and willow groves along the LCR (Bednarz and Ligon, 1988). Although they apparently bred at the Salton Sea, historically, they have not been observed recently.

Merlin *(Falco columbarius)*

Range and Distribution

Merlins breed in summer in the northern forests of Europe, Asia, and North America. In North America, their breeding range extends from northwestern Alaska and northern Canada to the southern limits of the boreal coniferous zone. In winter, most merlins migrate south of their breeding range to the western U.S., the Gulf Coast, and south to northern South America (Johnsgard, 1990; Terres, 1980).

Population Status

The status of this species is somewhat uncertain. Some merlin populations apparently declined significantly during the 1960s as a result of pesticide contamination and the loss of native grassland habitats. More recent analyses suggest population increases on the northern prairies of the U.S. and southern Canada, possibly resulting from banning DDT. In other areas, merlin numbers are now probably stable.

Habitat Requirements

Wintering habitats of the merlin are extremely diverse, ranging from deserts to tropical forests and including prairies, open farmland, and even urban areas. Along the California coast, they often concentrate their foraging in areas supporting abundant shorebird populations. The merlin is a predator that catches and eats a wide variety of avian prey, often consuming locally abundant species like doves and house sparrows. Although birds often comprise over 90 percent of the merlins' diet, they occasionally feed on large insects, rodents, bats, and reptiles (Ehrlich et al., 1988; Kaufmann, 1996; and Johnsgard, 1990).

Habitat in the Proposed Project Area

Much of the proposed project area could be used by merlins. Along the Salton Sea, merlin may forage on shorebirds that congregate along the mudflats and shallows. Wetlands and riparian habitats on the state and federal wildlife refuges also support abundant bird populations that would be attractive to foraging merlins. In the LCR Valley, the merlin prefers open habitats, such as agricultural lands and wetlands with scattered trees or shrubs such as along canals and drains (Rosenberg et al., 1991). Similar habitats are probably used in the Imperial Valley as well.

Proposed Project Area Occurrence

Merlins are rare visitors to the Salton Sea area in the fall and winter (USFWS, 1997b). They are not known to breed in the area.

Prairie Falcon (*Falco mexicanus*)

Range and Distribution

Prairie falcons breed from southeastern British Columbia, southern Alberta, and southern Saskatchewan south through the western U.S. to southern Arizona, southern New Mexico, and Baja California, Mexico. It winters from its breeding range in southern Canada south to central Mexico, expanding its range eastward after the nesting season onto the Great Plains and westward to the California coast (Johnsgard, 1990; Terres, 1980; and Kaufmann, 1996). In California, the prairie falcon can be found year-round in the southern half of the state and in the Klamath Basin in Northern California (Zeiner et al., 1990).

Population Status

The North American population of prairie falcons has been estimated at 7,800 birds (Johnsgard 1990). The species is believed to be declining in Utah, western Canada, and agricultural areas of California. In California, local problems, such as the effects of agricultural chemicals on reproduction and the conversion of grassland to cropland, are thought to be responsible for the species' decline.

Habitat Requirements

Prairie falcons typically inhabit open and treeless terrain, such as arid plains, hills, mountains, and deserts. Throughout their range, they prefer habitats with nearby cliffs and escarpments that provide suitable nesting sites. Wintering prairie falcons in the desert Southwest are commonly found in low and moderate elevation habitats, including agricultural fields, lakes, and reservoirs. In summer, higher elevation communities, such as desert grassland and chaparral, are frequently occupied. Breeding prairie falcons nest on sheer cliffs overlooking vast foraging areas. Most nests are built in "potholes" on cliff ledges, but old stick nests that other raptors built are also commonly used. Less frequently, nests are placed in caves, holes, and other rocky crevices (Johnsgard, 1990; Ehrlich et al., 1988).

The prairie falcon's diet consists mostly of small birds and mammals. Seasonal shifts in diet tend to reflect changes in the abundance of easily caught prey species. Mourning doves, western meadowlarks, ground squirrels, horned larks, black-tailed, and Gambel's quail may all be seasonally important prey animals for the prairie falcon in the study area. Other species, including various lizards and insects, are also eaten regularly (Johnsgard, 1990; Kaufmann, 1996).

Habitat in the Proposed Project Area

Habitat for prairie falcons in the proposed project area consists mainly of agricultural fields and the shoreline of the Salton Sea. Prairie falcons may also forage in desert areas adjacent to the irrigated portions of the valley. In addition, small areas that have not been cultivated in many years occur within the valley and support more natural vegetation. Prairie falcons may also exploit these areas for foraging.

Proposed Project Area Occurrence

Prairie falcons are rare migrants at the Salton Sea and in the Imperial Valley. About 30 migrants occur in the valley each year (IID, 1994). Prairie falcons may also occur along the AAC.

Peregrine Falcon (*Falco peregrinus*)

Range and Distribution

Peregrine falcons breed throughout much of North America, as well as South America, Eurasia, Australia, Africa, and Oceania. The American peregrine falcon, which is the most southerly subspecies of peregrine falcon in North America, breeds south of the arctic tundra of Canada and Alaska to Mexico. In winter and during migration, the American peregrine falcon extends its range southward to the Caribbean and parts of South America.

Population Status

The American peregrine falcon began its decline in North America in the late 1940s, when DDT and other chlorinated hydrocarbon pesticides were being used in large quantities (Johnsgard, 1990; NMDGF, 1997). Approximately 600 to 800 pairs nested in the western U.S. before 1940 (NMDGF, 1997). By 1965, the species was extirpated from east of the Mississippi, and fewer than 20 breeding pairs still occurred west of the Great Plains (Johnsgard, 1990; NMDGF, 1997). In the early 1970s, the U.S. and Canada banned DDT; subsequently, the nesting success of wild peregrine falcons began to rise. At the same time, captive breeding and reintroduction programs were being implemented, with the known number of pairs in the West estimated at nearly 200 by 1987 (NMDGF, 1997). The peregrine falcon was previously listed as a federal endangered species. However, with the known number of territorial pairs at approximately 1,400 and a total population of more than 3,000 pairs, the USFWS has recently delisted the species.

Habitat Requirements

Peregrine falcons occur in a wide range of open country habitats from desert mountains to seacoasts (Kaufman, 1996). The presence of tall cliffs is the most characteristic feature of the peregrine's habitat and is considered a limiting factor for this species. Cliffs provide the peregrine with both nesting and perching sites and an unobstructed view of the surrounding area. Where cliffs are lacking, manmade structures, such as tall buildings and bridges, can be used as substitutes.

Nearby waterbodies or wetlands that support abundant prey of small- to medium-sized birds, particularly waterfowl, are another common feature of peregrine habitat that influences their distribution and abundance (Johnsgard, 1990). Highly mobile, flocking, and colonial-nesting birds, such as pigeons, shorebirds, and waterfowl, are the peregrine falcon's primary prey. River canyons that offer a large number of potential nest sites, abundant prey, and ideal hunting conditions are frequently inhabited by this species (Skaggs et al. 1988).

Habitat in the Proposed Project Area

No cliffs or tall buildings that could provide nesting sites for peregrine falcons occur in the proposed project area; thus, use of the proposed project area by peregrine falcons is limited to foraging. Much of the proposed project area could provide foraging opportunities for peregrine falcons, given this species' association with open habitats. Peregrine falcons are most likely to concentrate foraging activities in areas with high concentrations of shorebirds and waterfowl. In the proposed project area, managed wetlands on the state and federal wildlife refuges as well as private duck clubs attract large numbers of wintering waterfowl and may also attract peregrine falcons. The Salton Sea also provides suitable foraging habitat as large numbers of waterfowl and shorebirds inhabit this area. In addition, some waterfowl and shorebirds forage in agricultural fields and peregrine falcons may also exploit this foraging opportunity.

Proposed Project Area Occurrence

Peregrine falcons are rare visitors to the Salton Sea area although they may occur at any time during the year (USFWS, 1997b). Small numbers of migrant peregrine falcons (one to three birds) are regularly observed over Salton Sea marsh areas, particularly at the Salton Sea National Wildlife Refuge (IID, 1994). One peregrine falcon was observed during surveys of selected drains in Imperial Valley (Hurlbert et al., 1997).

California Black Rail *(Laterallus jamaicensis coturniculus)*

Range and Distribution

The California subspecies of the black rail occurs in western North America from San Francisco Bay and the Sacramento/San Joaquin Delta south along the California coast into northern Baja California, Mexico. In California, it also occurs in the San Bernardino/ Riverside area and at the Salton Sea (CDFG, 1991). Along the LCR, the California black rail is a permanent resident in the vicinity of Imperial Dam and Bill Williams Delta (Snider, 1969; Repking and Ohmart, 1977). Black rails are also thought to breed in the Cienega de Santa Clara, one of only three breeding localities for this species in Mexico and one of the few for the subspecies anywhere (Piest and Campoy, 1998).

Population Status

California black rail populations declined substantially between the 1920s and 1970s due to the loss and degradation of coastal salt marsh and inland freshwater marsh habitats (Eddleman et al., 1994; CDFG, 1991). Along the LCR, black rail populations declined an estimated 30 percent between 1973 and 1989, with the majority of birds shifting from north of Imperial Dam to Mittry Lake during the same period (Eddleman et al., 1994). Currently, black rails appear to be stable along the LCR, with approximately 100 to 200 individuals estimated to occur from Imperial National Wildlife Refuge south to Mittry Lake (Rosenberg et al., 1991). This population and the small population at the Salton Sea represent the only stable inland population of this subspecies (Eddleman et al., 1994; Rosenberg et al., 1991).

The California black rail's decline throughout its range is attributed to the loss of saltwater and freshwater wetlands to urban and agricultural development (Wilbur, 1974). The effect of selenium on black rails remains unknown, but toxic levels of this heavy metal may also threaten black rail populations in the study area (AGFD, 1996; Eddleman et al., 1994; and Flores and Eddleman, 1991). These factors continue to threaten the California black rail.

Habitat Requirements

Preferred habitat of the California black rail is characterized by minimal water fluctuations that provide moist surfaces or very shallow water, gently sloping shorelines, and dense stands of marsh vegetation (Repking and Ohmart, 1977). Studies conducted along the LCR suggest that habitat structure and water depths are more important factors than plant composition in determining black rail use of wetland habitats. Unsuitable water and structural conditions appear to restrict the California black rail to only a fraction of the emergent vegetation available within an entire wetland (Flores and Eddleman, 1995). In general, Flores and Eddleman (1995) found that black rails used marsh habitats with high stem densities and overhead coverage that were drier and closer to upland vegetation than randomly selected sites. Marsh edges with water less than 1 inch deep dominated by California bulrush and three-square bulrush are used most frequently. Areas dominated by cattail are also used regularly, but only in a small proportion to their availability and generally within 165 feet of upland vegetation where water depth is 1.2 inches. Telemetry studies at Mittry Lake found black rails to be sedentary, with home ranges averaging 1.2 acres or less (Flores and Eddleman, 1991). The erratic movements recorded for some juvenile and unmated birds during this research were consistent with the "wandering" behavior attributed to this subspecies and supports the idea that black rails may be capable of quickly occupying newly created habitats (Flores and Eddleman, 1991).

Flores and Eddleman (1991) also studied black rail diets and food availability at Mittry Lake and found that black rails consume a wide variety of invertebrates throughout the year, including beetles, earwigs, ants, grasshoppers, and snails. When invertebrate availability drops during the winter months, a larger portion of cattail and bulrush seeds is consumed. Lower resource availability in winter causes black rails to experience a significant weight loss, indicating they are more vulnerable to stress during this time.

Nesting biology of the California black rail is poorly understood. Double clutching and renesting may be fairly common in this subspecies. These behaviors, combined with a relatively large clutch size, long breeding season, apparently low predation rates, and aggressive nest defense, suggest that the black rail has a high reproductive potential that is likely limited by the availability of shallow water environments (Eddleman et al., 1994; Flores and Eddleman, 1991).

Habitat in the Proposed Project Area

California black rails are associated with dense wetland vegetation consisting of cattails and bulrushes in shallow water. In the proposed project area, these characteristics are found primarily in the managed wetlands on the state and federal wildlife refuges, in wetland areas adjacent to the Salton Sea, and in marsh habitats supported by seepage from the AAC between Drops 3 and 4 and adjacent to the East Highline Canal. Black rails may use agricultural drains in the valley, although they have not been found to make extensive use of agricultural drains in previous surveys. Vegetation along agricultural drains mainly consists of common reed and tamarisk, species that are not generally used by black rails. Areas of cattails and bulrushes do exist along the drains. However, these areas are small and narrow and often interspersed with other vegetation, such as common reed. The habitat value of marsh vegetation supported by agricultural drains is probably limited and may only support foraging by black rails.

Proposed Project Area Occurrence

The species is known to use marsh habitats at Finney Lake on the Imperial Wildlife Area, seepage communities along the All-American, Coachella, and East Highline Canals; and wetland areas adjacent to the Salton Sea, including the New River Delta (Evans et al., 1991; Jurek, 1975; Garrett and Dunn, 1981; and Jackson, 1988).

Few surveys for the California black rail have been conducted in the proposed project area. A study by Jurek (1975) and other investigators in 1974 and 1975 identified eight marsh areas with black rails between the Coachella and East Highline Canals south of Niland. The Coachella Canal south of Niland was concrete-lined in 1981, and all black rail habitat supported by canal seepage was dessicated (Evans et al., 1991). Subsequent surveys of seepage communities along unlined portions of the Coachella Canal north of Niland detected rails at another eight sites (Jackson, 1988; Evans et al., 1991).

Along the AAC, Kasprzyk et al. (1987) recorded 30 to 50 California black rails in the marsh located between Drops 3 and 4 during surveys in April and May 1984. More recently, California black rails were censused along the AAC during April and May 1988, in conjunction with surveys for Yuma clapper rails. A minimum population of three black rails was recorded for the area between Drops 3 and 4.

In the only systematic survey for the species at the Salton Sea and surrounding areas in 1989, 23 birds were recorded. Thirteen were located at the mouth of the New River, 8 were in seepage communities along the Coachella Canal, and 1 was found at Finney Lake. Up to seven rails have been observed at Finney Lake on other occasions (Shuford et al., 1999). The reproductive status of these birds is uncertain, although some locations have had numerous calling birds over periods of several weeks in the spring, suggesting a breeding population (Salton Sea Authority and Reclamation, 2000).

Yuma Clapper Rail *(Rallus longirostris yumanensis)*

Range and Distribution

The Yuma clapper rail is one of seven North American subspecies of clapper rails. It occurs primarily in the LCR Valley in California, Arizona, and Mexico and is a fairly common summer resident from Topock south to Yuma in the U.S., and at the Colorado River Delta in Mexico. There are also populations of this subspecies at the Salton Sea in California, and along the Gila and Salt Rivers to Picacho Reservoir and Blue Point in central Arizona (Rosenberg et al., 1991). In recent years, individual clapper rails have been heard at Laughlin Bay and Las Vegas Wash in southern Nevada (NDOW, 1998). Population centers for this subspecies include Imperial Wildlife Management Area (Wister Unit), Salton Sea National Wildlife Refuge, Imperial Division, Imperial National Wildlife Refuge, Cibola National Wildlife Refuge, Mittry Lake, West Pond, Bill Williams Delta, Topock Gorge, and Topock Marsh.

Population Status

In 1985, Anderson and Ohmart (1985) estimated a population size of 750 birds along the Colorado River north of the international boundary. The USFWS (1983) estimated a total of 1,700 to 2,000 individuals throughout the range of the subspecies. Between 1990 and 1999, call counts conducted throughout the species range in the U.S. have recorded 600 to

1,000 individuals. These counts are only estimates of the minimum number of birds present. The population is probably higher than these counts show, since up to 40 percent of the birds may not respond in call surveys (Piest and Campoy, 1998). Based on the call count surveys, the population of Yuma clapper rail in the U.S. appears stable (USFWS, unpublished data). The range of the Yuma clapper rail has been expanding over the past 25 years, and the population may increase (Ohmart and Smith, 1973; Monson and Phillips, 1981; Rosenberg et al., 1991; and McKernan and Brandon, 1999).

A substantial population of Yuma clapper rail exists in the Colorado River Delta in Mexico. Eddleman (1989) estimated that 450 to 970 rails inhabited this area in 1987. Piest and Campoy (1998) reported a total of 240 birds responding to taped calls in the Cienega. Accounting for nonresponding birds, they estimated a total population of about 5,000 birds in cattail habitat in the Cienega.

The Yuma clapper rail is threatened by river management activities that are detrimental to marsh formation, such as dredging, channelization, bank stabilization, and other flood control measures. Another threat is environmental contamination due to selenium. High selenium levels have been documented in crayfish, a primary prey of clapper rails, and some adult birds and eggs. Other threats to the Yuma clapper rail include mosquito abatement activities, agricultural activities, development, and the displacement of native habitats by exotic vegetation (CDFG, 1991). The large population of Yuma clapper rails at the Cienega de Santa Clara is threatened by the loss of the source of water that maintains the wetland habitat. This threat is significant, given that the recent population estimate of approximately 5,000 individuals suggests the majority of Yuma clapper rails found in North America inhabit this area.

Habitat Requirements

The Yuma clapper rail is associated primarily with freshwater marshes with the highest densities of this subspecies occurring in mature stands of dense to moderately dense cattails and bulrushes. Dense common reed and sparse cattail-bulrush marshes may support the rail at lower densities (Rosenberg et al., 1991). A mosaic of uneven-aged marsh vegetation and open water areas of variable depths appear to provide optimal habitat for Yuma clapper rails (Conway et al., 1993). Similarly, Anderson (1983) found the highest densities of clapper rails in stands of cattails dissected by narrow channels of flowing water.

Anderson and Ohmart (1985) found home ranges of single or paired birds in the LCR Valley encompassed up to 100 acres, with an average home range of 18.5 acres. Home ranges were found to overlap extensively. Estimates of rail densities vary widely, ranging from 0.06-rail/acre to 1.26 rails/acre (Table A-2).

TABLE A-2
Reported Densities of Yuma Clapper Rails

Location	Density rails/acre[a]	Source
Lower Colorado River	0.1	Anderson and Ohmart (1985)
Cienega de Santa Clara	0.36	Piest and Campoy (1998)
Cienega de Santa Clara	0.60[b]	Piest and Campoy (1998)

TABLE A-2
Reported Densities of Yuma Clapper Rails

Location	Density rails/acre[a]	Source
Topock Marsh	0.06	Smith (1975, reported in Piest and Campoy [1998])
Mittry Lake Wildlife Area	0.39	Todd (1980, reported in Piest and Campoy [1998])
Hall Island	1.26	Todd (1980, reported in Piest and Campoy [1998])

[a] acres of cattail habitat
[b] estimated density, taking into account nonresponding birds

Food primarily consists of crayfish, but they will also feed on small fish, isopods, insects, spiders, freshwater shrimp, clams, and seeds when available (Ohmart and Tomlinson, 1977; CDFG, 1991; and Rosenberg et al., 1991). Crayfish have been found to constitute up to 95 percent of the diet of Yuma clapper rails in some locations (Ohmart and Tomlinson, 1977). The availability of crayfish has been suggested as a factor limiting clapper rail populations (Rosenberg et al., 1991).

Yuma clapper rails begin courtship and pairing behavior as early as February, with nesting and incubation beginning as early as mid-March. Most nesting starts between late April and late May (Eddleman, 1989; Conway et al., 1993). Young hatch in the first week of June and suffer high mortality from predators in their first month of life (Rosenberg et al., 1991). The majority of rail chicks fledge by August.

Nests are constructed on dry hummock or under dead emergent vegetation and at the bases of cattail/bulrush vegetation. Nests may be located throughout a marsh over shallow or deep water, near the marsh edge, or in the interior of the marsh (Eddleman, 1989). Usually, nests have no overhead canopy because the dense marsh vegetation surrounding the nest provides protective cover. Occasionally, nests are located in small shrubs over shallow water areas.

Habitat in the Proposed Project Area

In the proposed project area, habitat for Yuma clapper rails consists mainly of managed wetlands on the state and federal wildlife refuges. Yuma clapper rails will use agricultural drains dominated by common reed for foraging, but these areas do not provide suitable nesting habitat. Clapper rails are strongly associated with cattail stands for nesting, and few areas of cattails exist along the agricultural drains and the New and Alamo Rivers. Areas of cattails that do exist along these waterways are small and narrow and often interspersed with vegetation, such as common reed and offer suboptimal habitat conditions. Seepage from the AAC supports a wetland community between Drops 3 and 4, where clapper rails have been reported.

Proposed Project Area Occurrence

In the proposed project area, the principal concentrations of Yuma clapper rails are at the south end of the Salton Sea near the New and Alamo River mouths, at the Salton Sea Wildlife Refuge, at the Wister Waterfowl Management Area, and at Finney Lake in the Imperial Wildlife Area. Since 1990, an average of 365 ± 106 rails have been counted around the Salton Sea, which represents an estimated 40 percent of the entire U.S. population of this species (Point Reyes Bird Observatory, 1999; USFWS, 1999). Results of surveys conducted at the Salton Sea since 1994 are summarized in Table A-3.

TABLE A-3
Number of Yuma Clapper Rails Found at Traditional Survey Locations at the Salton Sea and Surrounding Areas from 1994 to 2000

Location	1994	1995	1996	1997	1998	1999	2000
Salton Sea NWR Unit 1							
Trifollium 1 Drain	4	3	1	1	1	0	1
A-1 Pond	2	N/S	6	4	3	6	6
B-1 Pond	N/S	N/S	4	9	11	10	10
Reidman 3	7	8	17	N/S	N/S	2	1
Reidman 4	9	8	N/S	N/S	1	3	7
Bruchard Bay	7	6	3	5	3	0	0
New River Delta	7	0	1	0	0	0	N/S
Salton Sea NWR Unit 2 and Hazard							
HQ 'B' Pond	5	3	4	2	2	2	3
Union Pond	9	9	12	15	15	9	6
Barnacle Bar Marsh	N/S	0	0	2	0	2	1
McKindry Pond	N/S	N/S	N/S	0	0	2	N/S
Hazard 5	3	N/S	N/S	N/S	N/S	N/S	N/S
Hazard 6	23	22	18	11	11	12	10
Hazard 7	6	3	10	7	5	6	10
Hazard 8 (east) (south)	2	N/S	N/S	N/S	N/S	2	1
Hazard 9 and Ditch	3	4	3	3	3	2	4
Hazard 10	7	7	N/S	N/S	2	6	6
Alamo River (east and delta)	5	4	4	4	4	3	4
Imperial Wildlife Area Wister Unit	309	307	239	211	185	191	N/A
Off-Refuge Areas							
Lack and Grumble	2	3	3	2	2	2	0
'T' Drain Marsh	N/S	N/S	10	15	10	6	6
Walt's Club (McDonald Rd.)	N/S	N/S	N/S	N/S	N/S	2	N/S
Barnacle Beach	N/S	20	20	7	8	3	N/S
Holtville Main Drain	N/S	12	10	5	6	5	1
Boyle and Martin Road	1	N/S	N/S	N/S	N/S	N/S	N/S

TABLE A-3
Number of Yuma Clapper Rails Found at Traditional Survey Locations at the Salton Sea and Surrounding Areas from 1994 to 2000

Location	1994	1995	1996	1997	1998	1999	2000
Total On-Refuge	408	384	322	274	246	258	N/A
Total Off-Refuge	3	35	43	29	26	18	7

Source: USFWS unpublished data
N/S: No surveys
N/A: Not available

Rails are also known to occur in the seepage community along the AAC between Drops 3 and 4 and in other seepage areas associated with the Coachella and East Highline Canals (Gould, 1975; Jurek, 1975; Bennett and Ohmart, 1978; Kasprzyk et al., 1987). Surveys conducted between Drops 3 and 4 on April 30 and May 1, 1981, detected 17 clapper rails (Reclamation and IID, 1994). Ten birds were detected during a May 20, 1982, survey. Additional surveys along the AAC were conducted in spring 1984. The area surveyed was the same as was surveyed in 1981. These surveys indicated a population of at least three clapper rails. The area was surveyed again in 1988, again indicating a population of three clapper rails in the marsh habitat between Drops 3 and 4 (Reclamation and IID, 1994).

Yuma clapper rails have also been found using agricultural drains and the Alamo River. Surveys conducted by the USFWS (Steve Johnson, pers. comm.) found Yuma clapper rails in the Trifolium 1 drain and the Alamo River. Hurlbert et al. (1997) surveyed 10 drains in the Imperial Valley and found 1 clapper rail along the Holtville Main Drain in the southeastern part of the valley. Previous surveys by the USFWS of the Holtville Main Drain reported as many as 12 Yuma clapper rails (5 pairs and 2 individuals) using this drain.

Greater Sandhill Crane (*Grus canadensis tabida*)

Range and Distribution

With the exception of those that nest in Siberia or Cuba, sandhill cranes are restricted to North America. Six subspecies are currently known. The lesser (*G. c. canadensis*), Florida (*G. c. pratensis*), and greater (*G. c. tabida*) are migratory. Historically, the migratory subspecies nested in wetland habitats over much of eastern Siberia, Alaska, Canada, and the northern U.S. as far south as northern Arizona, Utah, western Colorado, central Nebraska, northern and eastern Iowa, southern Illinois, central Indiana and Ohio, and the southern borders of Lake St. Claire and Lake Erie (Sanderson, 1977; Drewien and Lewis, 1987).

Several populations of greater sandhill cranes (*G. c. tabida*) are now recognized in North America. The eastern population nests in Minnesota, Michigan, and Wisconsin and migrates through Illinois, Indiana, Ohio, Tennesee, Kentucky, and Georgia. The Rocky Mountain population nests from northwestern Colorado and northeastern Utah northward through eastern Idaho, western Wyoming, and southwestern Montana, wintering in New Mexico. The Central Valley population nests in eastern and central Oregon and northeastern California and winter in the Central Valley of California south to Tulare County. The LCR Valley population nests in northeastern Nevada and northwestern Utah and southwestern

Idaho. This population winters along the Colorado River with a major wintering site near Poston, Arizona.

Population Status

The eastern population of greater sandhill cranes contains some 15,000 birds and is increasing (Lovvorn and Kirkpatrick, 1982). The Rocky Mountain population consists of about 16,500 birds (Drewien and Lewis, 1987), and its future seems secure because considerable portions of the nesting grounds are in publicly owned national forests, parks, and wildlife refuges. The Central Valley population is estimated at more than 3,000 birds and has been static for some time (Drewien and Lewis, 1987). The LCR Valley population is small at about 1,500 birds and appears to be increasing (Drewien and Lewis, 1987).

Habitat Requirements

Greater sandhill cranes breed in open, isolated wetlands surrounded by shrubs or forestland. Diverse structural and compositional vegetation, including species such as bulrush, cattails, and burreed, are used for nesting sites (Tacha et al., 1992). Habitats such as meadows, irrigated pastures and fields, bogs, fens, and marshes are used as foraging areas. Wintering populations roost in shallow open water, marshes, rivers, and lakes where they flock together at night for safety (Johnsgard, 1975a; Eckert and Karalus, 1981). Wintering populations feed primarily in irrigated croplands and pastures (Walker and Schemnitz, 1987). Moist sites are commonly used, but this species also feeds on dry plains far from water. Food items include crops such as wheat, sorghum, barley, oats, corn, and rice as well as insects, snails, reptiles, small mammals, seeds, and berries (Tacha et al., 1992).

Habitat in the Proposed Project Area

In the proposed project area, sandhill cranes find suitable roosting habitat in the managed wetlands of the state and federal wildlife refuges and private duck clubs. Sandhill cranes are known to winter at roost sites located in shallow flooded ponds of a private duck club near Imperial (Radke, 1992). Sandhill cranes have also been observed at other private ponds in the Imperial Valley, sometimes in association with white-faced ibis. Wheat and sudangrass fields as well as other agricultural crops may be used for foraging.

Proposed Project Area Occurrence

Both the greater and lesser subspecies have been detected in Imperial Valley, with most observations being of the greater subspecies. Greater sandhill cranes regularly winter in the Imperial Valley although in small numbers of 200 to 300 individuals (IID, 1994). A flock of about 100 to 200 birds regularly winters in the area between Brawley and El Centro, primarily in the area east of Highway 86 (IID and BLM, 1987).

Western Snowy Plover *(Charadrius alexandrinus nivosus)*

Range and Distribution

The western snowy plover is one of two subspecies of snowy plover recognized in North America. It breeds on the Pacific Coast from southern Washington to southern Baja California, Mexico, and the interior areas of Oregon, California, Nevada, Utah, New Mexico, Colorado, Kansas, Oklahoma, north-central Texas, coastal areas of extreme southern Texas,

20146

and possibly, extreme northeastern Mexico (USFWS 1993c). The western snowy plover is a resident throughout most of its range, except populations on the northern Pacific Coast that withdraw south in winter (Terres, 1980). In California, the inland wintering populations are concentrated in the San Joaquin Valley and at the Salton Sea, with small numbers of birds occurring at alkali lakes and sewage ponds in the Great Basin, Mojave, and Colorado Deserts (Shuford et al., 1995).

Population Status

The Pacific Coast population of the western snowy plover is considered demographically isolated from populations of the western snowy plover breeding in interior regions (USFWS, 1993c). The Pacific Coast population of western snowy plovers has declined precipitously and is listed as federally threatened. The decline of this population is attributed to the loss of suitable breeding habitat and by disturbance and destruction of nests in the species' remaining habitat (USFWS, 1993c; Ehrlich et al., 1992). The coastal population in the U.S. is estimated at 1,900 birds (Shuford et al., 1995). The coastal population in Mexico was determined to be 1,344 birds occurring along barrier beaches and salt flats along the peninsula in Baja California (Palacious et al., 1994). The interior population of western snowy plovers has also declined, but not as severely as the coastal populations. It is estimated that the interior populations in Washington, Oregon, and California is 7,900 birds (Page et al 1991). The inland snowy plover population in California is estimated at between 300 and 500 birds (Shuford et al., 1995).

Habitat Requirements

Western snowy plovers are found on beaches; open mudflats; salt pans and alkaline flats; and sandy margins of rivers, lakes, and ponds. Interior populations favor shores of salt or alkaline lakes, evaporation ponds, and sewage ponds (Shuford et al., 1995; Terres, 1980; Kaufmann, 1996; and Ehrlich et al., 1988). Western snowy plovers forage in plowed agricultural fields and on exposed mudflats and shorelines (Rosenberg et al., 1991). At inland sites, snowy plovers forage on the ground primarily for insects, including various flies and beetles (Ehrlich et al., 1988; Kaufmann, 1996). Western snowy plovers nest on undisturbed flat, sandy, or gravelly beaches. Snowy plovers tend to be site faithful, with the majority of birds returning to the same breeding locations in subsequent years (USFWS, 1993c).

Habitat in the Proposed Project Area

- Nesting habitat for the western snowy plover in the proposed project area is limited to the shoreline of the Salton Sea where they are known to nest on undisturbed, flat, sandy, or gravelly beaches (Salton Sea Authority and Reclamation, 2000). For foraging, snowy plovers use the shoreline of the Salton Sea but may also forage in agricultural fields in the valley.

Proposed Project Area Occurrence

Western snowy plover are year-round breeding residents and winter migrants at the Salton Sea. The Salton Sea supports the largest wintering population of snowy plovers in the interior western U.S. and is one of only a few key breeding populations in interior California

(Shuford et al., 1999). The summer breeding population typically consists of more than 200 individuals (IID, 1994 and Shuford et al., 1995).

Mountain Plover *(Charadrius montanus)*

Range and Distribution

Mountain plovers breed from the high plains and plateaus of the central U.S., south through eastern New Mexico and western Oklahoma to western Texas. They winter from central California, western and southern Arizona, and southern Texas south to Baja California, Mexico, and central Mexico. Currently, northeast Colorado is the breeding stronghold of this species with only small breeding populations remaining in Montana, Wyoming, Oklahoma, and New Mexico (Knopf, 1996; Terres, 1980; and Kaufmann, 1996).

In California, they are fairly common but very local winter visitors, with the largest numbers occurring in grasslands and agricultural areas of the interior California. Winter flocks regularly occur on the Carrizo Plain in San Luis Obispo County, the western San Joaquin Valley, Antelope Valley, and Imperial Valley. This species also occurs along the Colorado River mainly near Blythe (Garrett and Dunn, 1981).

Population Status

Although once abundant throughout its range, the mountain plover is believed to have suffered a 61 percent population decrease between 1966 and 1987. Mountain plovers have disappeared from much of their former breeding range because of agricultural conversion of former shortgrass prairie. Populations of this species now appear to be relatively small and highly restricted in a patchy distribution. In 1995, the North American population of this species was estimated at 8,000 to 10,000 birds (Knopf, 1996). The decline of the mountain plover is primarily attributed to human-related disturbances on breeding grounds, including the loss of native habitat to agriculture and urbanization, hunting, range management, gas and oil development, mining, prairie dog control, environmental contamination, and vehicle disturbance (Leachman and Osmundson, 1990; Knopf, 1996).

Habitat Requirements

Mountain plovers are associated with dry, open plains. They nest primarily on shortgrass prairie and grazed grassland. In winter, they occur in flocks of 15 to several hundred individuals, feeding on desert flats, alkaline flats, grazed pastures, plowed ground, and sprouting grain fields (Knopf, 1996; Hayman et al., 1986; Kaufmann, 1996; and Terres, 1980). Mountain plovers eat mostly insects, including grasshoppers, beetles, flies, and crickets (Kaufmann, 1996). A sample of six plover stomachs contained beetles and larva, weevils, earwigs, and maggots (Rosenberg et al., 1991). On their wintering grounds, mountain plovers have been successfully attracted to burned grasslands for use as night roost sites (Knopf, 1996).

Habitat in the Proposed Project Area

In the Imperial Valley, wintering flocks of mountain plovers frequent bare plowed agricultural fields that have not been irrigated. Bermuda grass crops are also used (Reclamation and IID, 1994).

Proposed Project Area Occurrence

Mountain plover is a common winter visitor to the Salton Sea Basin. The Imperial Valley has one of the mountain plover's largest wintering populations in the Pacific Flyway, with between 700 and 1,000 individuals (USFWS, 1999). During February 1999 surveys, 2,486 individuals were counted in the valley. This number represents about half of the California population and about one-quarter of the North American population (Point Reyes Bird Observatory, 1999).

Long-billed Curlew (*Numenius americanus*)

Range and Distribution

The long-billed curlew nests from southern Canada south to Utah, New Mexico, and Texas, and formerly in Kansas, Iowa, Minnesota, Wisconsin, and Illinois. The species winters in California, western Nevada, Arizona, Texas, and Louisiana south to Baja California and Guatemala, returning north in March to April. In California, the long-billed curlew is an uncommon to fairly common breeder from April to September in wet meadow habitat in Siskiyou, Modoc, and Lassen Counties. There is one recent nesting record for Owens Valley, Inyo County (CDFG, 1999a). This species is uncommon to locally very common as a winter visitor along most of the California coast and in the Central and Imperial Valleys, where the largest flocks occur. Small numbers of nonbreeders remain on the coast in summer, and larger numbers remain in some years in the Central Valley (Cogswell, 1977; Page et al., 1979; and Garrett and Dunn, 1981).

Population Status

The long-billed curlew is currently on the Audubon Society's Blue List because of declining numbers, probably caused by agricultural practices (Tate, 1981). This species once nested throughout the grasslands of the west, east to the prairies of southern Wisconsin and Illinois, but disappeared from many places with the plowing of plains and prairies for agriculture in the 1930s. The species was also decimated by hunters along the Atlantic coast in the fall. The long-billed curlew is a proposed candidate for federal endangered status. Breeding range has retracted considerably in the last 80 years, but western populations have not decreased as much as those in the eastern U.S.

Habitat Requirements

The long-billed curlew breeds on grazed, mixed-grass, and shortgrass prairies. Habitats on gravelly soils and gently rolling terrain are favored over others (Stewart, 1975). Nests are usually located in relatively flat areas with grass cover 4 to 8 inches high. The nest is a sparsely lined depression, often remote from water (Palmer, 1967). Nests are often placed close to cover such as a grass clump, rock, or soil mound (Johnsgard, 1981). In California, the long-billed curlew nests on elevated interior grasslands and wet meadows, usually adjacent to lakes or marshes (Grinnell and Miller, 1944). Upland shortgrass prairies and wet meadows are used for nesting; coastal estuaries, open grasslands, and croplands are used in winter. When migrating, the curlew frequents shores of lakes, rivers, salt marshes, and sandy beaches.

Habitat in the Proposed Project Area

The Salton Sea and adjacent wetlands, state and federal wildlife refuges, private duck clubs, and areas along the New and Alamo Rivers may provide suitable habitat for this species. Agricultural fields of alfalfa, wheat, and sudangrass may also provide habitat and foraging areas for the long-billed curlew.

Proposed Project Area Occurrence

The long billed curlew is a common, year-round resident at the Salton Sea with large flocks of as many as 1,000 birds observed during the winter. Summer numbers are lower, with flocks of around 150 birds (CDFG, 1970).

Black Tern *(Childonias Niger)*

Range and Distribution

In Canada, the black tern breeds from southwestern and east-central British Columbia and the southwestern portion of the Northwest Territories southward to Southern Quebec and New Brunswick (DeGraaf and Rappole, 1995). Its breeding range extends to California, Utah, Nebraska, Illinois, and Maine in the U.S. (DeGraaf and Rappole, 1995). Nonbreeding birds may occur along the Pacific Coast and in eastern North America to the Gulf Coast. In winter, black terns migrate to Central and South America. In California, nesting populations occur only in the northeastern part of the state (Ehrlich et al., 1992).

Population Status

Black terns were once a very common spring and summer visitor to fresh emergent wetlands of California (Grinnell and Miller, 1944). Numbers have declined throughout its range, especially in the Central Valley (Cogswell, 1977). Currently, it is a fairly common migrant and breeder on wetlands of the northeastern plateau area but is absent from some historic nesting localities, such as Lake Tahoe (Cogswell, 1977). Despite the presence of apparently suitable habitat in rice farming areas, breeding is questionable in the Central Valley (Gaines, 1974). It remains fairly common in spring and summer at the Salton Sea, but evidence of nesting there is lacking (Garrett and Dunn, 1981).

Populations in North America have declined sharply since the 1960s. Contributing factors are believed to include loss of wetland habitat, runoff of farm chemicals into wetlands resulting in reduced hatching success, and loss of food supply on wintering grounds due to overfishing (Kaufman, 1996). Campgrounds and marinas on the shorelines of large lakes and wetlands also may be partially responsible for population declines (Marcot, 1979).

Habitat Requirements

For breeding, black terns are associated with freshwater marshes and lakes, but favor coastal waters during migration. They prefer freshwater marshes with extensive marsh vegetation intermixed with open water. Black terns typically nest in small, scattered colonies (CDFG, 1999a). The nest site is situated low in the marsh on a floating mat of vegetation or debris, or on the ground close to the water (Kaufman, 1996). The terns may also take over coot and grebe nests for nesting.

Black terns forage primarily on insects and fish, but tadpoles, frogs, spiders, earthworms, and crustaceans are also taken. Their diet shifts seasonally with insects forming a greater portion of the diet during the breeding season, and small fish become the predominant prey during migration and in winter (Kaufman, 1996). Black terns forage by hovering above wet meadows and fresh emergent wetlands. Insects are captured in the air or are plucked from the water surface or vegetation (CDFG, 1999a). They also frequent agricultural fields for foraging.

Habitat in the Proposed Project Area

Potential nesting habitat occurs in the proposed project area in the wetlands along the Salton Sea and in the managed wetlands of the state and federal wildlife refuges such that nesting could be supported in the future. Beaches or mudflats of the Salton Sea and agricultural fields in the valley are known foraging areas in the proposed project area.

Proposed Project Area Occurrence

Black terns are common at the Salton Sea during the spring, summer, and fall; they rarely occur at the sea during the winter (USFWS, 1997b). In the Imperial Valley, black terns are common residents and migrants with up to about 10,000 individuals inhabiting the valley at some times (IID, 1994). Although they occur at the Sea throughout the summer, there is no evidence that nesting takes place (CDFG, 1999a). The Salton Sea watershed is thought to be the most important staging area for black terns in the Pacific Flyway (Shuford et al., 1999).

Laughing Gull (*Larus atricilla*)

Range and Distribution

In the U.S., laughing gulls range along the Atlantic coast from Nova Scotia south to Florida and along the Gulf Coast. In the western U.S., the species generally occurs along the coast in the extreme southwest, with its range extending southward into Baja California and Mexico through Central America and the northern coast of South America. Laughing gulls also inhabit the West Indies (DeGraaf and Rappole, 1995).

Population Status

The National Biological Survey shows laughing gulls to be increasing in most locations along the Gulf and Atlantic Coasts. Kaufman (1996) considers the current population of laughing gulls in North America to be stable. DeGraaf and Rappole (1995) consider the species common and showing a long-term increase.

Habitat Requirements

Laughing gulls are typically associated with coastal areas, frequenting salt marshes, coastal bays, beaches, and piers. They may also move farther inland and use rivers, fields, dumps, and lakes. The species nests in colonies on beaches in areas supporting grasses or shrubs. Nests are on the ground and consist of a scrape with a sparse lining or a shallow cup lined with grasses, sticks, and debris. Migration is primarily along the coast where birds roost on inland lakes, bays, estuaries as well as the open ocean. Optimal habitat is sparse to dense vegetation that provides protection from predators as well as some protection from

20151

inclement weather (Burger, 1996). Laughing gulls exploit a variety of food resources, but their diet primarily consists of crustaceans, insects, and fish.

Habitat in the Proposed Project Area

In the HCP area, laughing gulls are expected to principally occur at the Salton Sea. The shoreline of the Salton Sea provides suitable habitat for roosting and foraging. Nesting opportunities for laughing gulls have largely been eliminated due to rising water levels of the Salton Sea, resulting in the loss of islets used as nesting sites (Small, 1994). Laughing gulls concentrate feeding along the water edge of the Salton Sea but may also use agricultural fields and managed wetlands in the valley as additional foraging areas (Burger 1996).

Proposed Project Area Occurrence

Laughing gulls are a common postbreeding visitor (up to 1,000 individuals) at the Salton Sea and previously nested in the area (USFWS, 1997b; IID, 1994). Most laughing gulls occur along the shoreline at the south end of the Salton Sea and occasionally in adjacent wetland habitats. The average seasonal population at the Salton Sea is around 400 to 500 birds (Small, 1994).

Black Skimmer (*Rhynchops niger*)

Range and Distribution

Black skimmers range from about Massachusetts on the Atlantic Coast south through the Gulf Coast and Central and South America to Argentina (DeGraaf and Rappole, 1995). On the Pacific Coast, skimmers occur as far north as the Los Angeles, with breeding documented at the Salton Sea and in San Diego (Kaufman, 1996). Its range in the west is currently expanding (Kaufman, 1996).

Population Status

The population of black skimmers declined on the Atlantic Coast in the late 19th century as eggs were harvested and adults were killed for their feathers. Their numbers subsequently have recovered. Black skimmers have been expanding in the west, but nesting colonies are still sensitive to disturbance (Kaufman, 1996). In California, nesting distribution is limited. Nesting colonies are located only at the Salton Sea, San Diego Bay, and the Bolsa Chica Refuge in Orange County (Salton Sea Authority and Reclamation, 2000).

Habitat Requirements

Skimmers typically occur in coastal areas protected from open surf, such as lagoons, estuaries, inlets, and sheltered bays (Kaufman, 1996). They nest in single-species colonies, often near nesting gulls or terns. This is evident at the Salton Sea where nesting colonies are almost always near nesting gull-billed terns or Caspian terns (Molina, 1996). Nest sites are on gravel bars, low islands, or sandy beaches. Dredge spoils and dikes are also used for nesting. Skimmers use similar habitats for roosting. Because skimmers are sensitive to human disturbance, suitable nesting areas must be free from human disturbance (CDFG, 1999a). The nest itself is simple scrape located above high water (Terres, 1980).

Black skimmers begin arriving from wintering grounds in Mexico in April with numbers increasing through June. Upon arrival, skimmers form loose aggregations and often roost in areas that are subsequently used for nesting (Molina, 1996). Nesting at the Salton Sea generally starts in June or later; rarely it has continued into October. Nesting dates are probably a function of the level of the sea since this determines the availability of nest sites (Garrett and Dunn, 1981).

Skimmers forage on small fish, crustacean, and aquatic insects. Prey are captured by skimming low over the surface of the water, scooping up fish and aquatic invertebrates. As skimmers never dive for fish, only prey that occurs in surface waters are accessible. Skimmers concentrate foraging activities in calm shallow waters and commonly forage in groups.

Habitat in the Proposed Project Area

In the proposed project area, habitat for the black skimmer is restricted to the Salton Sea and Ramer Lake. At the Salton Sea, black skimmers forage over open water and along beaches and mudflats (Salton Sea Authority and Reclamation, 2000). Often, they concentrate foraging where the New and Alamo Rivers as well as agricultural drains empty into the Salton Sea (Garrett and Dunn, 1981). Skimmers nest on bare earthen slopes, terraces, and levees along the Salton Sea. Often nests are placed upslope of barnacle bars, 3 to 4 meters from the edge of the water to avoid inundation by wave action (Molina, 1996).

Proposed Project Area Occurrence

Black skimmer is a breeding resident at the Salton Sea, with a population of 600 individuals (IID 1994). In some years, the breeding population of skimmers at the Salton Sea may constitute 40 percent of the breeding population in California (Shuford et al., 1999). Skimmer colonies form at the north and south end of the Salton Sea in most years (Shuford et al., 1999). Molina (1996) monitored nesting success of skimmers at the Salton Sea during 1993 and 1995. Hatch rate was found to vary substantially among these years. Nesting success was lowest in 1994 when only 27 percent of the nests were successful as compared to 1993 when 71 percent of the nests were successful.

Between 1991 and 1995, skimmers nested at seven sites. Locations of nesting colonies are Mullet Island, the Whitewater River delta, Morton Bay, Rock Hill, Obsidian Butte, Ramer Lake, and Elmore Ranch (Molina, 1996). The Rock Hill site occurs on the Salton Sea National Wildlife Refuge and is the only nesting site under active management. However, the suitability of nesting habitat at Rock Hill may be compromised by the heavy recreational use this area receives (Molina, 1996). Many of the nesting sites are susceptible to wave action, erosion, and inundation; the past and continuing increase in the elevation of the Salton Sea may have inundated suitable nesting areas (Molina, 1996).

California Least Tern (*Sterna antillarum browni*)

Range and Distribution

The discontinuous breeding range of the California least tern extends from Baja California, Mexico, to San Francisco Bay. The majority of the population apparently nests in coastal Southern California. Two nesting colonies are also known in the San Francisco Bay area.

Population Status

The California least tern was formerly widespread and "common to abundant" (Grinnell and Miller, 1944) along the central and Southern California coast. Human use of beaches for recreational, residential, and industrial development has severely diminished the availability of suitable nesting areas in California (Grinnell and Miller, 1944; Garrett and Dunn, 1981; and Ehrlich et al., 1992) and has led to isolated, small colony sites that artificially concentrate breeding terns. Episodic losses in least terns have occurred due to cold, wet weather; extreme heat; dehydration and starvation; unusually high surf or tides; the El Niño warm sea current; and human disturbance of least tern colonies (Massey, 1988). California least terns may also be susceptible to pesticide contamination and bioaccumulation (Boardman, 1987a and 1987b).

The California least tern population declined to a known low of between 623 and 763 breeding pairs in the early 1970s (Bender, 1974). Because of a variety of management efforts, the California least tern population has increased to an estimated California breeding population of about 2,160 pairs in 1992.

Habitat Requirements

California least terns nest in open sand, salt pans, or dried mudflats near lagoons or estuaries. They feed almost exclusively on small fish captured in shallow, nearshore areas, particularly at or near estuaries and river mouths (Massey, 1974; Collins et al., 1979; Massey, and Atwood, 1981; Atwood and Minsky, 1983; Atwood and Kelly, 1984; Minsky, 1984; and Bailey, 1984). California least terns are opportunistic in their foraging strategy and known to take many different species of fish. They also take crustaceans and insects (Ehrlich et al., 1988).

Habitat in the Proposed Project Area

In the proposed project area, California least terns are known to occur only at the Salton Sea. Use of the sea is likely limited to foraging in the open water and resting on the shore (USFWS 1999). Mudflats along the shore of the Salton Sea may provide suitable resting areas and could be suitable for nesting, although nesting by California least terns is unknown at the Salton Sea. Shallow nearshore areas as well as shoreline pools formed by barnacle bars may be used for foraging.

Proposed Project Area Occurrence

The California least tern occurs at the Salton Sea only accidentally. Less than 10 records of this species exist at the Salton Sea NWR (USFWS, 1997b). Nesting has not been, reported, and based on the low level of use of the Salton Sea by California least terns, nesting is not currently expected.

Elegant Tern (*Sterna elegans*)

Range and Distribution

The elegant tern breeds along both coasts of Baja California, Mexico, and intermittently in northwestern Mexico and extreme southwestern California (DeGraaf and Rappole, 1995). The elegant tern's range in North America is extremely limited; it occurs only in a few places in California, including the Salton Sea and San Diego Bay. In winter, it migrates to the west coast of South America (DeGraaf and Rappole, 1995).

Population Status

Formerly, elegant terns were a rare and irregular postnesting visitor to coastal California (Grinnell and Miller, 1944). During the 1950s, numbers increased; large flocks now can be seen in most years off the southern coast (Cogswell, 1977). Elegant terns breed primarily in Mexico, but a nesting colony was established at San Diego Bay in 1959 (Cogswell, 1977). This colony persisted and may have facilitated the recent range extension of nonbreeders northward to the coast of central California (Cogswell, 1977). More recently, in 1987, another breeding colony became established in Orange County (Kaufman, 1996). However, the elegant tern is considered vulnerable in the U.S. due to the limited number of breeding sites (Kaufman, 1996).

Habitat Requirements

The elegant tern typically inhabits inshore coastal water, bays, estuaries, and harbors. It forages for fish in shallow water areas (CDFG, 1999a). Fish are captured by diving into the water (Ehrlich et al., 1988; Scott, 1987). When not foraging, elegant terns often congregate on beaches and mudflats (CDFG, 1999a). Roosting occurs on high beaches.

The elegant tern nests in colonies often in association with other terns. In California, nesting colonies are often near Caspian tern colonies that may help deter predators (Kaufman, 1996). Nest sites are a simple scrape typically located on upper beaches (about 60 feet from the water line), although the San Diego colony nests on dikes between salt ponds (CDFG, 1999a). Elegant tern colonies are sensitive to disturbance, and nesting locations need to be free from human intrusion.

Habitat in the Proposed Project Area

In the proposed project area, elegant terns would be expected to occur only at the Salton Sea. Elegant terns are rarely found at inland locations, but the Salton Sea and adjacent mudflats provide potentially suitable foraging and roosting areas for elegant terns. Breeding has not been reported at the Salton Sea, but potentially suitable conditions exist along the Salton Sea.

Proposed Project Area Occurrence

Elegant terns occur only accidentally at the Salton Sea during spring. Only three records of the species exist at the Salton Sea National Wildlife Refuge (USFWS, 1997b).

Van Rossem's Gull-billed Tern (*Sterna nilotica vanrossemi*)

Range and Distribution

The breeding range of Van Rossem's gull-billed tern extends from the extreme southwestern U.S. to Sonora, and Baja California, Mexico. During winter, it migrates to coastal areas of Central and South America (DeGraaf and Rappole, 1995). The species colonized Southern California, apparently from Mexico, and began nesting at the Salton Sea in the 1920s (Kaufman, 1996). Breeding occurred in San Diego in the 1980s (Kaufman, 1996). These two locations are the only known breeding areas of Van Rossem's gull-billed tern in the U.S.

Population Status

This species as a whole was once common in the eastern U.S. and Gulf States but was nearly exterminated in the early 1900s because of egg and feather collection (DeGraaf and Rappole, 1995; Zeiner et al., 1990a), and the populations have not recovered. The status of the Van Rossem subspecies is uncertain, but its limited breeding locations and requirement for undisturbed nesting sites suggest the population may be vulnerable.

Habitat Requirements

Gull-billed terns are typically associated with salt marshes and coastal bays but also frequent open habitats such as pastures and farmlands for foraging. They primarily feed on insects, such as grasshoppers and beetles but will also prey earthworms, fish, frogs, lizards, small mammals, eggs, and young of other birds (CDFG, 1999a). Prey are captured on the ground, in the air, or off the surface of water. Foraging is typically concentrated over marshes (Kaufman, 1996). Rarely, gull-billed terns will dive for fish.

This species breeds in small colonies on open sandy flats, often near nesting colonies of other terns (CDFG, 1999a). Dredge spoils, shell mounds, and mudflats may also be used for nesting. Nests are a shallow depression in soft sand, soil, or dry mud (CDFG, 1999a).

Habitat in the Proposed Project Area

At the Salton Sea, gull-billed terns nest on sandy flats amid shells and debris around the south end (CDFG, 1999a; Shuford et al., 1999). Foraging likely occurs at the mudflats along the sea as well as in adjacent wetland areas and agricultural fields.

Proposed Project Area Occurrence

Van Rossem's gull-billed tern is an uncommon summer breeding resident at the Salton Sea, with up to 160 pairs nesting at the Salton Sea each year (USFWS, 1997b; Shuford et al., 1999). The largest breeding colonies are at the southeast corner of the Salton Sea and to the south of Salton City (CDFG, 1999a). Numbers of nesting birds at the Salton Sea have declined from earlier estimates of about 500 as the rising sea has flooded nests (CDFG, 1999a).

Western Yellow-billed Cuckoo *(Coccyzus americanus occidentalis)*

Range and Distribution

Historically, the western yellow-billed cuckoo was a fairly common breeding species throughout the river bottoms of the western U.S. and southern British Columbia (Gaines and Laymon, 1984). Because of the loss of riparian woodland habitat, particularly cottonwood-willow habitat, the cuckoo has become an uncommon to rare summer resident in scattered locations throughout its former range. In California, remnant populations breed along sections of seven rivers, including the Colorado River in the southern part of the state.

Population Status

Yellow-billed cuckoos were fairly common and widespread in riparian systems throughout the western U.S. until the early 1900s. Since then, this species has decreased substantially in abundance. Surveys conducted in California during 1986 and 1987 found 31 to 42 breeding pairs along the Upper Sacramento River, the Feather River, the south fork of the Kern River, and along the Santa Ana, Amargosa, and LCRs (CDFG, 1991). This represents a 66 to 81 percent decline from 1977 surveys when there were an estimated 122 to 163 pairs. Along the LCR, there was a 93 percent decline in cuckoos between the 1976 surveys, which documented 242 individuals, and the 1986 survey in which only 18 individuals were found (Rosenberg et al., 1991). At Bill Williams Delta, cuckoos decreased about 75 percent during the same surveys, with only 50 to 60 cuckoos remaining in 1986.

The population trend for the western yellow-billed cuckoo is considered to be declining primarily due to the continued loss of cottonwood-willow riparian habitats (CDFG, 1991; Rosenberg et al., 1991). Major threats to this habitat type include reclamation, flood control, and irrigation proposed projects; habitat loss due to urbanization and agricultural activities; and the continued invasion of non-native salt cedar into riparian areas. Exposure to pesticides and other contaminants on wintering and breeding grounds, as well as livestock grazing and offroad vehicle use in riparian habitats, also continue to threaten this species' survival (Rosenberg et al., 1991; CDFG 1991; and Gaines and Laymon, 1984).

Habitat Requirements

Mature stands of cottonwood-willow provide the primary habitat for this species. Willows or isolated cottonwoods mixed with tall mesquites are used to a lesser extent (Rosenberg et al., 1991). Monotypic stands of salt cedar are generally uninhabited by cuckoos. The cuckoo arrives on its breeding grounds in mid- to late-June and departs by the end of August, spending only about one-quarter of its annual cycle on its breeding territory. As a midsummer breeder, the cuckoo faces extremely high temperatures that could easily kill eggs not protected by behavioral or physiological cooling mechanisms. To counter these midsummer temperatures, the cuckoo is a nest-site specialist, choosing stands of mature cottonwoods that have a subcanopy layer of willows that provide thermal refuge for the nest. Cuckoos maintain larger territories than many birds of comparable size (Platt, 1975). Gaines (1974) found very few cuckoos where suitable habitat was less than 330 feet wide and patch size was less than 25 acres. Galli et al. (1976) found cuckoos were rarely present in patches of suitable habitat less than 60 acres.

The restriction of this species' breeding to the midsummer period is thought to be in response to a seasonal peak in large insect abundance (e.g., cicadas, which dominate the cuckoo's diet). Mantids, grasshoppers, and caterpillars are also important food resources for the cuckoo. Cuckoos will occasionally consume lizards and tree frogs (Rosenberg et al., 1991).

Habitat in the Proposed Project Area

The cottonwood-willow habitat that yellow-billed cuckoos require is largely absent from the proposed project area. Riparian areas in the proposed project area are dominated by tamarisk, which yellow-billed cuckoos are not known to use. Seepage areas along the AAC supports localized areas of cottonwoods and willows; however, these areas are limited in size and distribution. While these areas provide potential habitat, the small size of these patches and fragmented distribution are unlikely to support any breeding population of yellow-billed cookoos.

Proposed Project Area Occurrence

Most occurrences are from eastern Imperial County near the LCR near Laguna Dam, Winterhaven, and Bard. Yellow-billed cuckoos have been observed along the AAC across from the mission wash flume, 3 miles north-northeast (NNE) of Bard in stands of mature cottonwoods with a dense understory of cattails and introduced palm trees. Two records of yellow-billed cuckoos exist for the Salton Sea National Wildlife Refuge (USFWS, 1997b).

Short-eared Owl (*Asio flammeus*)

Range and Distribution

The short-eared owl breeds from northern Alaska south through most of Canada and the central U.S., and from northern Ohio west to central California. It also breeds in Eurasia, South America, and Cuba. In North America, northern populations of the short-eared owl are strongly migratory, wintering in the Southern U.S. and south to Guatemala (Johnsgard, 1988; Terres, 1980). In California, the short-eared owl is a year-round resident commonly found in low-lying areas of agricultural lands, estuaries, emergent wetlands, and marshes (Zeiner et al., 1990).

Population Status

The short eared-owl is currently thought to be declining in most portions of its range, especially in the prairie provinces of Canada, along the Pacific Coast, and in parts of the Southeast (Ehrlich et al., 1988). The range of short-eared owls has decreased over the recent decades. It has disappeared from many locations in the southern U.S. where it previously nested (Kaufman, 1996). The loss and fragmentation of grassland and wetland habitats due to agricultural expansion, increased grazing, and urbanization have been implicated as contributors to this range reduction (Remsen, 1978). Pesticides may have contributed to declines as well (Marti and Marks, 1989). Small (1994) reports the breeding population has declined in California and attributes this decline to a combination of shooting and habitat loss due to marsh drainage, agriculture, recreational development, and expansion of urban development.

Habitat Requirements

Short-eared owls breed in open habitats, such as prairies, marshes, grassy plains, and tundra, that support high numbers of small mammals and provide opportunities to roost, nest, and forage. In winter, stubble fields, coastal dunes, meadows, marshes, and pastures are commonly occupied (Johnsgard, 1988; Terres, 1980; Ehrlich et al., 1988; and Kaufmann, 1996). Dense nonwoody vegetation (grasses, reeds, sedges, rushes), brush, and open wetlands are required for roosting and nesting.

Short-eared owls eat mostly rodents, preferring voles over smaller mice. A variety of open-country and marsh-associated birds, such as western meadowlarks, horned larks, and red-winged blackbirds, are also commonly eaten by this species. Other prey includes rabbits, gophers, rats, shrews, insects, and bats (Johnsgard, 1988; Terres, 1980; Ehrlich et al., 1988; and Kaufmann, 1996). It searches by flying low (3 to 20 feet) over the ground, hovering, and swooping down on prey. They use large mounds and fence posts as perches. Where prey is abundant, large aggregations of short-eared owls often roost and hunt communally.

Habitat in the Proposed Project Area

In the LCR Valley, the short-eared owl is most often associated with agricultural fields (primarily, tall alfalfa); marshes; and grassy edge habitats (Rosenberg et al., 1991). They most likely use similar habitats in the Imperial Valley, such as the managed wetlands of the state and federal wildlife refuges, wetlands adjacent to the Salton Sea, and agricultural fields throughout the valley.

Proposed Project Area Occurrence

Short-eared owls are rare winter visitors to the Salton Sea area (USFWS, 1997b; Garrett and Dunn, 1981) but are more common in the fall (USFWS, 1997b). Short-eared owl have been observed along the Alamo River, and Hurlbert et al. (1997) observed one owl during surveys of selected drains in the Imperial Valley. Short-eared owls have also been observed near the towns of Calipatra and Westmorland.

Long-eared Owl (*Asio otus*)

Range and Distribution

Long-eared owls are widely distributed throughout Eurasia, North Africa, and North America. In North America, the species breeds from central Canada south to northern Baja California, Mexico. Although it is a resident species in most of its breeding range, some populations of long-eared owls withdraw from northern areas and winter from Southern Canada south to southern Mexico (Johnsgard, 1988; Terres, 1980; and Kaufmann, 1996).

Population Status

Although the status of this species is not well known, there is evidence that the overall population of long-eared owls in North America is declining, probably as a result of forest cutting and the destruction of grovelands and riparian habitats, especially in the western states (Kaufmann, 1996; Johnsgard, 1988).

Habitat Requirements

Long-eared owls live in a variety of habitats that contain dense trees for nesting and roosting, and open areas for foraging. Coniferous and mixed coniferous forests containing extensive meadows, prairies supporting groves of trees, and streamside woodlands in desert areas are some of this species' preferred habitats (Kaufmann, 1996; Ehrlich et al., 1988; Terres, 1980; and Johnsgard, 1988). In the southwest, long-eared owls can be found in dense stands of tall cottonwood or tamarisk and in densely vegetated desert washes (Rosenberg et al., 1991). During the breeding season, long-eared owls are territorial and widely dispersed throughout the landscape. The normal breeding density of this species is 10 to 50 pairs per 60 square miles (Johnsgard, 1988). Long-eared owls nest in trees, usually in the abandoned nests of corvids. The nests of other large birds, such as herons and hawks, are also commonly used. When nest sites are scarce, long-eared owls occasionally nest in tree cavities or on the ground in heavy cover (Ehrlich et al., 1988; Kaufmann, 1996; Johnsgard, 1988; and Terres, 1980). During the nonbreeding season, aggregations of long-eared owls will often cluster at favored roosting sites (Bent, 1938).

The diet of the long-eared owl overwhelmingly consists of rodents, but they will also eat small birds, bats, insects, snakes, and other small animals, with prey size being the most important factor in food selection (Ehrlich et al., 1988; Kaufmann, 1996; Johnsgard, 1988; and Terres, 1980).

Habitat in the Proposed Project Area

Long-eared owls are associated with forested habitats, particularly adjacent to a stream or meadow. In the proposed project area, tamarisk scrub is the only potential habitat. Long-eared owls are known to use tamarisk in the southwest. Potential habitat for long-eared owls in the proposed project area consists mainly of tamarisk scrub habitat along the New and Alamo Rivers, Salton Sea, agricultural drains, and in areas receiving seepage from water delivery canals. Long-eared owls could use the agricultural fields throughout the Imperial Valley for foraging.

Proposed Project Area Occurrence

Long-eared owls are occasional winter visitors to the Salton Sea area (USFWS, 1997b). They are not known to breed in the area.

Western Burrowing Owl (*Athene cunicularia*)

Range and Distribution

The breeding range of the western burrowing owl extends south from southern Canada into the western half of the U.S. and down into Baja California, and central Mexico. The winter range is similar to the breeding range, except most owls from the northern areas of the Great Plains and Great Basin migrate south (Haug et al. 1993).

Population Status

Burrowing owls have declined in abundance throughout most of their range (Haug et al., 1993). In the western states, 54 percent of 24 jurisdictions reported burrowing-owl populations decreasing; there were no reported increases. Local populations are especially prone to extinction in this species (Haug et al., 1993). The species is listed as endangered or sensitive in 14 states in the U.S. and as threatened or endangered in four provinces in Canada. In California, the burrowing owl is currently considered a federal sensitive and a state species of special concern.

Burrowing owls were once a common, locally abundant species throughout much of California, although a decline in abundance was noticed by the 1940s (Grinnell and Miller, 1944). This decline has rapidly continued throughout most of California (Remsen, 1978). However, breeding bird surveys between 1980 and 1989 indicate the burrowing owl is increasing in southeastern California, the lower Sonoran deserts, and LCR Valley of western Arizona (Haug et al., 1993).

DeSante and Ruhlen (1995) reported the results of surveys for burrowing owls conducted throughout California, except for the Great Basin and desert areas during 1991 to 1993. During the 3-year census period, 9,450 breeding pairs of burrowing owls were estimated to occur in the area surveyed (95 percent confidence limits for this estimate are 7,206 and 11,695 pairs). This survey also found a 37 to 60 percent decrease in the number of breeding groups since the early 1980s, with the burrowing owl being extirpated from several counties (Marin, San Francisco, Santa Cruz, Napa Ventura, and coastal San Luis Obispo) and nearly extirpated from several additional counties (Sonoma, Orange, and coastal Monterey). Development is believed to have been the primary cause of the extirpation and decline of burrowing owls in these counties. In agricultural regions, removal of ground squirrels, use of chemical herbicides on levees and irrigation canals, and use of chemical insecticides and rodenticides on agricultural fields may have contributed to declines in burrowing owls (DeSante and Ruhlen, 1995). Gervais et al. (2000) found low but detectable levels of DDE (n = 7; range = 0.20 - 3.4; mean = 0.62 milligrams per kilogram [mg/kg] DDE, fresh weight) and no eggshell thinning in eggs collected from areas around the Salton Sea. In this same study, selenium concentrations in burrowing owl eggs (n = 7; range = 1.6 - 2.4; mean = 1.8 mg/kg Se, dry weight) were below background levels (less than 3 mg/kg Se, dry weight; Skorupa et al., 1996).

Burrowing owls have declined through much of their range because of habitat loss associated with urbanization, agricultural conversion, and rodent control programs (Remsen, 1978; Johnsgard, 1988). Pesticides, predators, and vehicle collisions have also contributed to their decline (Haug et al., 1993; James and Espie, 1997). Survival and reproductive success are adversely affected by spraying insecticides over nesting colonies (James and Fox, 1987). Burrowing owls also have been incidentally poisoned and their burrows destroyed during eradication programs aimed at rodent colonies (Collins, 1979; Remsen, 1978; and Zarn, 1974). Although burrowing owls are relatively tolerant of lower levels of human activity, there are human-related impacts, such as shooting, burrow destruction, and the introduction of non-native predators, that adversely affect the owls (Zarn, 1974; Haug et al., 1993). Populations of native predators (e.g., gray foxes and coyotes) artificially enhanced by development (i.e., availability of artificial food sources and shelter) and introduced predators (e.g., red foxes, cats, and dogs) near burrowing owl colonies adversely impact this species (Zeiner et al., 1990).

Habitat Requirements

Burrowing owls inhabit open areas, such as grasslands, pastures, coastal dunes, desert scrub, and the edges of agricultural fields. They also inhabit golf courses, airports, cemeteries, vacant lots, and road embankments or wherever there is sufficient friable soil for a nesting burrow (Haug et al., 1993). In the Imperial Valley, burrowing owls typically inhabit agricultural fields with extensive dirt embankments. Burrowing owls eat a variety of different prey items, including rodents, frogs, small birds, terrestrial and aquatic invertebrates, and carrion (Zarn, 1974; Johnsgard, 1988; and Gervais et al., 2000).

Burrowing owls use burrows created by other animals for nesting and shelter. The most commonly used rodent burrow in California is that of the California ground squirrel (Collins, 1979). In other locations, burrows of badgers, prairie dogs, tortoises, and other animals may be used (Haug et al., 1993).

Burrowing owl nesting is strongly dependent on local burrow distribution. Nesting densities in the LCR Valley vary from eight pairs per 0.6-square mile in optimal habitat to one pair per 36 square miles in poor quality habitat (Johnsgard, 1988). Home range and foraging area may overlap between different pairs, with only the burrow being actively defended (Coulombe, 1971; Johnsgard, 1988). Telemetry studies of foraging ranges of nesting burrowing owls conducted at three California sites (including Salton Sea) showed a mean range of 300 acres around the burrow (Gervais et al., 2000). Not all individuals capable of breeding do so every year. Breeding is initiated in early March (Coulombe, 1971). Eggs are laid from late March to July (Terres, 1980). Young fledge in the late summer to fall (Coulombe, 1971).

DeSante and Ruhlen (1995) investigated the relationship between various habitat characteristics and the probability that a burrowing owl population at a particular locale significantly increased or decreased over surveys conducted during 1991 to 1993. No habitat characteristics were associated with the probability of the population decreasing. However, the probability that a population would increase was significantly related to several habitat characteristics. Populations with a high probability of increasing were generally associated with undisturbed habitat types, particularly pastures, large distances to the nearest irrigation canal, and the occurrence of a large number of ground squirrels. Populations with a low probability of increasing were associated with linear habitat types (e.g., roadsides and ditches), areas subject to soil disturbance, proximity to irrigation canals, and low numbers of ground squirrels. Crop type was not related to the probability that a population would increase.

Habitat in the Proposed Project Area

In the proposed project area, burrowing owls commonly inhabit the earthen banks of agricultural canals and drains. They concentrate along the edges of agricultural fields, especially where the banks of irrigation ditches provide suitable nesting burrows. Canal embankments are more commonly used for nesting than drains because vegetation is maintained at lower levels in the canals. Burrowing owls at the Salton Sea National Wildlife Refuge also use artificial nest burrows placed along roadsides and forage in the surrounding agricultural fields both on and off the refuge (Gervais et al., 2000).

Proposed Project Area Occurrence

Burrowing owls are a common year-round resident adjacent to the Salton Sea and in the Imperial Valley (Garrett and Dunn, 1981; USFWS, 1997b). Burrowing owls occur at a very high density in the Imperial Valley, and the density of burrowing owls in Imperial County surpasses that of any other single county (Sturm, 1999). The Institute of Bird Populations estimated that 6,429 pairs of burrowing owls inhabit the Imperial Valley representing 69 percent of the estimated total population in California (Shuford et al., 1999). This population level translates into a density of about 236 pairs per 60 square miles (DeSante and Ruhlen, 1995). For comparison, the average density of burrowing owls in other lowland areas in California was estimated at 11.9 pairs per 60 square miles (DeSante and Ruhlen, 1995).

Elf Owl *(Micrathene whitneyi)*

Range and Distribution

The elf owl breeds in the southwestern U.S.; Baja California, Mexico; and northern mainland Mexico (Terres, 1980). In the U.S., it is found in extreme southern Nevada, central Arizona, southwestern New Mexico, western Texas, and the southeastern corner of California (Johnsgard, 1988). In winter, it migrates south to Baja California, Mexico; mainland Mexico; and the Rio Grande Valley in Texas. In California, it is a very rare and local summer resident in riparian habitats along the LCR, which lies at the western edge of its range (Rosenberg et

20162

al. 1991). Small numbers of elf owls can be found at Bill William's Delta, near Needles, near Blythe, the Fort Mohave area, and at Cibola National Wildlife Refuge. It used to be present south of Yuma. West of the Colorado River, there are records at the oases of Cottonwood Springs and Corn Springs, in Riverside County.

Population Status

Once more numerous along the length of Colorado River, elf owls have been nearly extirpated from loss of habitat. The population status of the elf owl is directly dependent on available nesting holes made by woodpeckers and on sufficient insects during the breeding season (Johnsgard, 1988). In California, at the extreme northwest edge of its range, the elf owl is likely declining in the few desert riparian habitats that it occupies (Johnsgard, 1988). There may also be a general decline in Arizona, although it may be increasing its range in north-central Arizona and western New Mexico. It is difficult to determine the species' overall status in the southwest. The elf owl was never a common or widespread species along the LCR, where 1987 surveys of riparian habitats reported between 17 and 24 owls at 10 different sites (CDFG, 1991). Population estimates in California for the early 1990s were 17 to 25 breeding pairs (CDFG, 1991; Rosenberg et al., 1991).

Although the elf owl has probably never been common, it has declined due to the loss of mature riparian and saguaro habitats (CDFG, 1991; Rosenberg et al., 1991). The habitat loss is attributed to agricultural development, river channeling, and flooding (CDFG, 1991). The elf owl is a California state endangered species.

Habitat Requirements

The elf owl occupies desert riparian habitat of moderate to open canopy, often with a moderate to sparse shrub understory, and typically bordering desert wash, desert scrub, or grassland habitats. Taller trees with a shrub understory seem to be required (Grinnell and Miller, 1944). This owl uses perches overlooking open ground or grassland (Marshall, 1956). Foraging perches are typically in moderately tall cottonwood, sycamore, willow, mesquite, and saguaro cactus. Moderately tall trees and snags, such as cottonwood, sycamore, willow, mesquite, and saguaro cactus, afford perches and woodpecker-excavated or other cavities. Elf owls are dependent on woodpecker-excavated holes for nest sites, usually 15 to 20 feet from the ground (Bent, 1938). In California, elf owls have nested in cottonwood (Miller, 1946) and saguaro (Brown, 1903); this owl is also known to nest in willow, sycamore, and mesquite trees or snags of moderate height.

Habitat in the Proposed Project Area

Little potential habitat for elf owls occurs in the HCP area. Most riparian habitats are dominated by dense stands of tamarisk that are not suitable for elf owls. Cottonwood/willow habitat and mesquite habitats are primarily restricted to a scattered and isolated seepage areas adjacent to the AAC.

Proposed Project Area Occurrence

Since 1970, elf owls have been reported only north of Needles, San Bernardino County, 22 miles north of Blythe, Riverside County, and at Corn Springs (Gaines, 1977a; Garrett and Dunn, 1981). They have not been reported in the HCP area. The general lack of habitat makes it unlikely that elf owls would occur in any portion of the HCP area.

Vaux's swift (*Chaetura vauxi*)

Range and Distribution

The Vaux's swift breeds in western North America and winters in Mexico and Central America. In California, they primarily nest in the Coast Ranges south to Monterey County but are also likely breed in low densities in Lake, Butte, Tehama, Plumas, and other interior California counties.

Population Status

Significant population declines of the Vaux's swift have been documented in Oregon and Washington (Sharp, 1992), and most populations are believed to be declining throughout the species' range (Bull and Collins, 1993). The removal of large, broken-top trees and large, hollow snags, most of which are found in late-seral stage forests, has been suggested as contributing to population declines (Sharp, 1992).

Habitat Requirements

The Vaux's swift nests in coniferous forests along the central and northern California coast, and mixed oaks and conifers in the interior mountain ranges. Natural cavities and burned-out hollow trees are preferred nest sites (Small, 1994). Nests are typically built on the inner wall of a large, hollow tree or snag, especially those charred by fire (Bent, 1940). Large-diameter, hollow trees or snags are also important for roosting nonbreeders, recently fledged young, and postbreeding adults. Vaux's swifts feed primarily on insects and spiders (Bull and Collins, 1993). Foraging occurs above the forest canopy and at lower levels in meadows, over lakes, rivers and ponds, and above burned areas (Grinnell and Miller, 1944; Bull and Collins, 1993; and Small, 1994).

Habitat in the Proposed Project Area

There is no suitable nesting habitat in the proposed project area. Migrating birds may forage over the Salton Sea, wetlands, streams, agricultural fields, and in residential areas. While less desirable, the desert scrub habitat may also provide some foraging habitat for this species (Sanders and Edge, 1998; Zeiner, et al., 1990).

Proposed Project Area Occurrence

Vaux's swifts occur in the HCP area as a migrant during the spring and fall. It is relatively common at the Salton Sea during the spring but considered uncommon in the fall (USFWS 1997b). Thousands of migrating birds have been reported at the north end of the Salton Sea during the spring but are relatively uncommon elsewhere in the Salton Basin during spring migration (Garrett and Dunn, 1981).

Black Swift (*Cypseloides niger*)

Range and Distribution

The black swift occurs in western North America, breeding from southeastern Alaska, through western Canada and the U.S. and into Mexico (DeGraaf and Rappole, 1995). It ranges as far east as Colorado (Kaufman, 1996). The black swift's winter range is poorly known, but it may be found in northern South America and in the West Indies (DeGraaf and

Rappole, 1995). In California, black swifts breed very locally in the Sierra Nevada and Cascade Range, the San Gabriel, San Bernardino, and San Jacinto Mountains and in coastal bluffs and mountains from San Mateo County south probably to San Luis Obispo County (CDFG, 1999a).

Population Status

The current status of black swifts is uncertain. Kaufman (1996) characterized the population as probably stable, but DeGraaf and Rappole (1995) consider the species to be experiencing a long-term decline.

Habitat Requirements

Black swifts are associated with mountainous country and coastal cliffs. This association reflects their use of cliffs, often behind waterfalls, for nesting (Kaufman, 1996). Foraging, however, occurs over a wide variety of habitats (CDFG, 1999a). Like other swifts, black swifts are insectivores that capture insects in flight and foraging locations reflect the occurrence and availability of insect prey. Common prey items include wasps, flies, mayflies, caddisflies, beetles, leafhoppers, and beetles. When available, black swifts will also feed on emerging swarms of winged adult ants and termites (Kaufman 1996).

Habitat in the Proposed Project Area

The proposed project area does not support nesting habitat for black swifts. However, much of the proposed project area could be used by black swifts for foraging, given this species' preference for open habitats. The Salton Sea—as well as—other waterbodies, such as managed wetlands, the New and Alamo Rivers, and major canals are likely to provide abundant insect prey for foraging black swifts. Agricultural fields may also provide suitable foraging habitat depending on the abundance of flying insects.

Proposed Project Area Occurrence

Black swifts occur accidentally in the proposed project area during the spring. Only two records of this species exist for the Salton Sea National Wildlife Refuge (USFWS, 1997b).

Gilded Flicker *(Colaptes chrysoides)*

Range and Distribution

The gilded flicker occurs along the LCR Valley in southern Arizona and southeastern California (Rosenberg et al., 1991). In California, the gilded flicker is an uncommon resident along the Colorado River north of Blythe (Garrett and Dunn, 1981; CDFG, 1991). It was historically widespread in riparian habitat all along the Colorado River Valley. It also used to inhabit saguaro deserts near Laguna Dam, above Yuma (CDFG, 1991). Until the late 1970s, a small number of gilded flickers were resident in Joshua Tree woodlands of the eastern Mojave Desert near Cima Dome in California (Garrett and Dunn, 1981; CDFG, 1991).

Population Status

The gilded flicker was historically common throughout the LCR Valley. In 1983, however, the entire population along the LCR Valley in Arizona and California was estimated to be about 270 individuals. In the Arizona Sonoran desert east of the Colorado River, the gilded flicker is still common. In California, there were an estimated 40 individuals along the LCR in 1984 (Hunter, 1984; CDFG, 1991); however, during 1986 surveys, there were no gilded flickers observed in this area. Rosenberg et al. (1991) reported "scattered pairs" between Imperial and Laguna Dams. Gilded flickers were last observed in the eastern Mojave Desert at Cima Dome in 1978.

The decline of the gilded flicker in the LCR Valley is attributed to the loss of upland saguaro habitats and mature riparian forests (CDFG, 1991). Other threats to the flicker include water and flood control proposed projects, agricultural operations, livestock grazing, the introduction of exotic plants into native systems, and offroad vehicle activity.

Habitat Requirements

The desert-dwelling gilded flicker is found in saguaro habitats, mature cottonwood-willow riparian forests, and occasionally in mesquite habitats with tall snags during the breeding season (CDFG, 1991; Rosenberg et al., 1991). They forage primarily on the ground for ants and termites (Rosenberg et al., 1991). They will also eat mistletoe berries, cactus fruits, and other wild berries but seldom forage in trees for insects as other woodpecker species often do (Terres, 1980; Rosenberg et al., 1991). Breeding begins in February, and two broods are usually raised in a year, with fledglings in late May and in July (Rosenberg et al., 1991). Cavities for nesting are usually excavated in saguaros, cottonwoods, and willows. Saguaros are preferred nesting sites, and riparian trees are usually used only when saguaros are unavailable. Gilded flickers rarely nest near human dwellings.

Habitat in the Proposed Project Area

The proposed project area does not contain areas supporting saguaros, the preferred nesting substrate of gilded flickers. Suitable habitat for gilded flickers is generally lacking in the Imperial Valley because most of the riparian habitat is dominated by tamarisk. Large trees potentially suitable for nesting principally occur in urban areas that gilded flickers generally avoid for nesting. The scattered patches of cottonwoods and willows supported by seepage adjacent to the AAC are likely to provide only minimal habit value because of their small size and limited distribution.

Proposed Project Area Occurrence

In California, gilded flickers are generally restricted to rare occurrences along the LCR (CDFG, 1999a) and are not known to occur in the Imperial Valley.

Gila Woodpecker *(Melanerpes uropygialis)*

Range and Distribution

Gila woodpeckers occur in the extreme southwestern U.S. and south into Baja California and central Mexico (Terres, 1980). In the U.S., they occur in Arizona, southeastern California, southwestern Nevada, and southwestern New Mexico. In California, Gila woodpeckers are a common year-round resident in mature riparian forest in the LCR Valley (Rosenberg et al., 1991). They also occur in groves and ranch yards having tall trees south of the Salton Sea and near Brawley, Imperial County (Garrett and Dunn, 1981). Along the LCR, they are now limited to several localities between Needles and Yuma (CDFG, 1991).

Population Status

The Gila woodpecker was formerly widespread and abundant but now is primarily found in remnant native riparian habitats with tall trees in the LCR Valley (Rosenberg et al., 1991). In 1984, an estimated 200 individuals occurred in California along the LCR (CDFG, 1991). Relatively low reproductive success was documented for 27 monitored pairs during this time. The total population along the LCR is estimated at about 1,000 individuals (Rosenberg et al., 1991).

The Gila woodpecker is declining in California due to the loss and degradation of mature riparian habitats and saguaro habitats in the LCR Valley (Garrett and Dunn, 1981; CDFG, 1991; and Rosenberg et al., 1991). Other potential threats faced by this species include water and flood control proposed projects, agricultural operations, introduced predators, livestock grazing, and the introduction of exotic plants into riparian systems (CDFG, 1991).

Habitat Requirements

Gila woodpeckers are closely associated with saguaros or large trees that they use for nesting (Rosenberg et al., 1991). They are most common in the desert mesas of Arizona (Terres, 1980). In California, they are found primarily in mature riparian habitats, although they also use mesquite stands, orchards, and tall cultivated trees and utility poles for nesting (Garrett and Dunn, 1981; Rosenberg et al., 1991; and Tierra Madre Consultants, 1998). Gila woodpeckers appear to need large blocks of riparian habitat for nesting; isolated patches of riparian habitat less than 50 acres do not support this species (Rosenberg et al., 1991). Although a number of the woodpeckers may occur in residential and park areas with tall trees, they have low reproductive success in these areas because of competition for nesting cavities with the introduced European starling.

Nesting cavities are excavated high in trees or saguaros and may be used for more than one season unless taken over by owls or European starlings. Breeding begins in February with pairing and territorial chasing. Young are dependent on parents for an extended period of time after fledging, although two to three broods can be raised in a season (Rosenberg et al., 1991). Pairs in riparian areas tend to successfully raise more than one brood, each with three to four young. In other habitats, Gila woodpeckers tend to have high rates of nest failure because of the eviction of adults and eggs from nesting cavities by aggressive starlings.

The Gila woodpecker forages by using its sharp bill to search for and chisel prey items from tree trunks and branches. Gila woodpeckers eat mostly insects, such as grasshoppers, beetles, ants, and grubs (Terres 1980). They also eat bird eggs, fruit from orchards, mistletoe berries, cactus pulp, saguaro fruits, and corn (Ehrlich et al., 1988; Scott, 1987; and CDFG, 1991).

Habitat in the Proposed Project Area

The proposed project area does not contain areas supporting saguaros, a commonly used nesting substrate of Gila woodpeckers. Cottonwoods and willows supported by seepage adjacent to the AAC are limited in size and distribution but may provide suitable habitat for Gila woodpeckers. Gila woodpeckers may use telephone poles as nesting substrates (Tierra Madre Consultants, Inc., 1998); these occur throughout the proposed project area. Garrett and Dunn (1981) reported Gila woodpeckers also using groves and ranch yards having tall trees south of the Salton Sea and near Brawley, Imperial County. Although Gila woodpeckers use these areas for nesting, reproductive success may be poor due to competition with European starlings.

Proposed Project Area Occurrence

Gila woodpeckers may breed locally but are listed as rare to very uncommon on the Salton Sea Wildlife Refuge, occupying habitats near houses and towns where larger trees are found (USFWS, 1997b). They have also been observed in areas near Brawley and along the Alamo River. Gila woodpeckers are also known to occur between the Laguna and Imperial Dams along the LCR. Gila woodpeckers have been observed at two locations along the AAC; across from the mission wash flume in a mature stand of cottonwoods and 6.5 miles to the northeast of Yuma in an area dominated by salt cedar, mesquite, and palo verde. A biological survey that Tierra Madre Consultants, Inc., conducted along the south side of the AAC in 1998 noted several Gila woodpeckers, including one pair nesting in a cottonwood (Tierra Madre Consultants, Inc., 1998). None of the Gila woodpeckers were seen using holes in powerline poles, rather they appeared to use poles as song perches and foraging sites (Tierra Madre Consultants, Inc., 1998).

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

Range and Distribution

The southwestern willow flycatcher is recognized as one of five subspecies of the willow flycatcher. Willow flycatchers were once widespread and locally common throughout the southwest, and were distributed across southern California, southern Nevada, southern Utah, Arizona, New Mexico, and western Texas (Hubbard, 1987; Unitt, 1987; and Browning, 1993). At present, the willow flycatcher is believed to be extirpated as a breeding species along the lower reaches of most southwestern riverine systems. The largest breeding populations of southwestern willow flycatcher in California occur along the San Luis Rey and Santa Margarita Rivers in San Diego County and along the south fork of the Kern River at the southwest end of the Sierra Nevada Mountains (Salton Sea Authority and Reclamation, 2000). Although historical records indicate this species was once abundant along the LCR, recent surveys have found breeding willow flycatchers persisting very locally in small, widely scattered locations, including Grand Canyon National Park, Lake Mead Delta, Adobe Lake, Topock Marsh, the Virgin River Delta, and Mormon Mesa (USFWS, 1995a; Sogge et al., 1997; McKernan, 1997; McKernan and Braden, 1999; and AGFD, 1997e). Large numbers of willow flycatcher pass through Southern California deserts during spring and fall migration (Garrett and Dunn, 1981).

Population Status

Since the 1800s, the willow flycatcher has experienced extensive population reductions throughout its range (USFWS, 1995a; AGFD, 1997e). Based on recent censuses and population estimates throughout the range of the southwestern willow flycatcher, the USFWS (1995a) estimated the total number of remaining flycatchers at approximately 300 to 500 pairs. The population of southwestern willow flycatcher in Southern California was estimated at fewer than 80 pairs in the early 1980s (Unitt, 1984). Declines are continuing in most populations that have been monitored since that time (USFWS, 1995a). The primary factors responsible for the decline of the southwestern willow flycatcher are the loss and degradation of native riparian habitats, particularly cottonwood-willow associations (USFWS, 1995a; AGFD, 1997e). Related factors contributing to the decline of this species include brood parasitism by brown-headed cowbirds, increased predation, salt cedar invasion, urban and agricultural development, livestock grazing, water diversion and impoundment, channelization, offroad vehicle use and recreation, floods, pesticides, forest practices, and possible gene pool limitations (USFWS, 1995a; AGFD, 1997e). The small size of remaining flycatcher populations (most populations contain fewer than five pairs) suggests that environmental stochasticity, demographic stochasticity, and genetic deterioration may also be playing an increasing role in the species' decline. Recent observations of physical deformities, including crossed bills and missing eyes, in conjunction with the discovery of high levels of several toxic chemicals (e.g., lead, arsenic, and selenium) in or near breeding sites, suggest that environmental contamination may also be threatening this species (Paxton et al., 1997). The willow flycatcher is a California state endangered species.

Habitat Requirements

The southwestern willow flycatcher is a neotropical migrant that is strongly associated with riparian habitats. It is considered a partial obligate on cottonwood-willow riparian systems throughout southwestern riverine systems. Its association with cottonwood-willow habitats is strongest at low elevations (Hunter et al., 1987). Invasion of cottonwood-willow habitats by exotic species, principally tamarisk, may reduce habitat value for southwestern willow flycatchers. In particular, tamarisk may not provide the thermal cover necessary for the southwestern willow flycatcher to nest successfully. At higher elevations, willow flycatchers often use tamarisk stands (Hunter et al., 1987), suggesting that under some circumstances, these altered riparian habitats may support this species.

Breeding habitat consists of dense stands of intermediate-size shrubs or trees, such as willow, Coyote bush, ash, boxelder, and alder, with an overstory of larger trees, such as cottonwood. Exotic species, such as Russian olive and tamarisk, may also be present in composition. Both even- and uneven-aged sites are utilized by this subspecies for nesting habitat. Typically, nesting habitat for the willow flycatcher has extensive canopy coverage and is structurally homogenous (USFWS, 1995a). Occupied habitat is generally associated with surface water or saturated soil (Sogge et al. 1997) and dominated by shrubs and trees 10 to 30 feet tall that provide dense lower and mid-story vegetation, with small twigs and branches for nesting. Apparently, habitat structure and the presence of surface water or saturated soils may be more important than plant species composition in defining suitable flycatcher habitat (USFWS, 1995a).

The willow flycatcher is present and singing on its breeding territory by mid-May, and young are fledged by early to mid-July (USFWS, 1995a). Territory sizes for the willow flycatcher are not well known due to the subspecies' rarity and variable habitat utilization. However, habitat patches as small as 1.2 acres have been found to support one or two nesting pairs (USFWS, 1995a). Nesting success rates for the willow flycatcher appear to be affected by habitat fragmentation, resulting in increased rates of predation and high levels of brood parasitism by the brown-headed cowbird (USFWS, 1995a; AGFD, 1997e).

This species is insectivorous and forages for insects both within and above dense riparian vegetation. Prey items are taken on the wing and gleaned from foliage. This species also forages along water edges, backwaters, and sandbars adjacent to nest sites.

Habitat in the Proposed Project Area

Cottonwood-willow habitat is largely absent from the proposed project area. Between Drops 3 and 4, seepage from the AAC supports a localized area of cottonwood/willow habitat. Tamarisk also occurs in areas receiving seepage from the AAC and is dominant along the New and Alamo Rivers. Because of the lower structural diversity of tamarisk stands and poor thermal cover, these low-elevation riparian areas are likely to provide marginal nesting habitat at best for willow flycatchers. Tamarisk and common reed supported along the agricultural drains may be used by migrating willow flycatchers.

Proposed Project Area Occurrence

The occurrence and distribution of southwestern willow flycatchers in the proposed project area is poorly known. Willow flycatchers of an undetermined subspecies have been reported at the Salton Sea National Wildlife Refuge and are considered an uncommon spring migrant and common fall migrant (USFWS, 1997b). These birds may include other subspecies of willow flycatchers that migrate through the area between northern breeding areas and wintering grounds in South America. Willow flycatchers have been reported in the Imperial Valley in residential areas near Niland, in riparian and desert scrub habitats, and along agricultural drains. In addition, 10 agricultural drains were surveyed in the Imperial Valley during 1994 to 1995. Single willow flycatchers were observed along the Holtville Main, Trifolium 2, and Nettle Drains (Hurlbert et al., 1997). Willow flycatchers are also known to use seepage communities along the AAC near the mission wash flume 3 miles NNE of Bard.

These observations show a low but consistent use of the area by willow flycatchers during migration. Nesting has not been reported in the proposed project. However, recent surveys have found willow flycatchers along on the Whitewater River (a tributary to the Salton Sea) during the breeding season, suggesting that nesting could occur in the proposed project area in the future (B. McKernan, pers. comm).

Brown-Crested Flycatcher (*Myiarchus tyrannulus*)

Range and Distribution

The brown-crested flycatcher is a fairly common summer resident (May to July) in desert riparian habitat along the Colorado River. A few nest at Morongo Valley, San Bernardino County; birds may nest very locally at other desert oases and riparian habitats northwest to Mojave River near Victorville, San Bernardino County. Vagrants have been recorded west to the South Fork Kern River near Weldon, Kern County, north to Furnace Creek Ranch, Death Valley, Inyo County, and on the Farallon Islands (Gaines, 1977a; Garrett and Dunn, 1981; and McCaskie et al., 1988).

Population Status

Numbers have declined in recent decades, apparently in response to destruction of desert riparian habitat and to competition for nest cavities from European starlings (Remsen, 1978).

However, DeGraaf and Rappole (1995) still consider the species common throughout its range.

Habitat Requirements

Brown-crested flycatchers are most numerous in riparian groves of cottonwood, mesquite, and willow, which afford suitable nest sites, but often forage in adjacent desert scrub or tamarisk (Garrett and Dunn, 1981). This species requires riparian thickets, trees, snags, and shrubs for foraging perches, cavities, and other cover. Brown-crested flycatchers also require woodpecker-excavated cavities for nesting and are thus secondarily dependent on snags; trees with rotten heart-wood; utility poles; and fence posts, in which ladder-backed and Gila woodpeckers, and other primary excavators, dig nesting cavities.

Habitat in the Proposed Project Area

Nesting habitat is minimal in the proposed project area, because cottonwood/willow habitat is rare, occurring only in small isolated patches along the AAC. Where nest sites are present, saltcedar and creosote shrubs provide suitable foraging habitat. Wetland areas on the state and federal refuges and agricultural drains may provide suitable foraging habitat for migrating brown-crested flycatchers.

Proposed Project Area Occurrence

The brown-crested flycatcher is known to occur in riparian areas along the LCR between the Laguna and Imperial Dams and has been observed along the AAC in scattered mature cottonwoods across from the mission flume 3 miles NNE of Bard. Birds have also been observed along the northern shoreline of the Salton Sea.

Vermilion Flycatcher (*Pyrocephalus rubinus*)

Range and Distribution

Vermilion flycatchers occur in the southwestern U.S., southern portions of New Mexico, Arizona, and western Texas (Kaufman, 1996). In California, the vermilion flycatcher is a rare, local, year-long resident along the Colorado River, especially in the vicinity of Blythe in Riverside County. A few still breed sporadically in desert oases west and north to Morongo Valley and the Mojave Narrows in San Bernardino County (CDFG, 1999a). Outside the U.S., they occur throughout much of Central and South America (DeGraaf and Rappole, 1995).

Population Status

Surveys have shown declines in the population in Texas (Kaufman, 1996), although the species remains common throughout most of its range (DeGraaf and Rappole, 1995). In California, it was formerly much more common and widespread and is now rare in the Imperial and Coachella Valleys. Numbers have declined drastically along the Colorado River, primarily the result of habitat loss; the species faces extirpation in California if the present trend continues (Grinnell and Miller, 1944; Gaines, 1977b; Remsen, 1978; and Garrett and Dunn, 1981).

Habitat Requirements

Vermilion flycatchers are closely associated with water and inhabit streamside habitats in arid regions. Breeding birds use riparian habitats consisting of cottonwood, willow, mesquite, and other riparian plant species. The use of tamarisk is restricted to high-elevation riparian systems only (Hunter et al., 1987). Often nest sites are adjacent to irrigated fields, irrigation ditches, pastures, or other open and mesic areas (CDFG, 1999a). Nests are located in large trees or shrubs, generally 8 to 20 feet above the ground (CDFG, 1999a).

Vermilion flycatchers forage on insects, particularly beetles, flies, wasps, bees, and grasshoppers. They forage by sallying from perch sites. Foraging is concentrated over water in other mesic habitats.

Habitat in the Proposed Project Area

The proposed project area supports little cottonwood/willow/mesquite habitat. Seepage from the AAC supports a small amount of this habitat between Drops 3 and 4. Tamarisk scrub habitat is widespread in the proposed project area and may provide suitable habitat for vermilion flycatchers. Tamarisk scrub occurs along the New and Alamo Rivers, Salton Sea, agricultural drainage canals, and in areas receiving seepage from water delivery canals. Wetland areas on the state and federal refuges and agricultural drains could be used for foraging and nesting.

Proposed Project Area Occurrence

Vermilion flycatchers are known to occur in the proposed project area but are considered rare (Shuford et al., 1999). While breeding populations presumably occurred in the proposed project area at one time, no nesting populations are currently known (USFWS, 1997b).

Purple Martin (*Progne subis*)

Range and Distribution

The purple martin nests west of the Cascade Range and Sierra Nevada from southwestern British Columbia south to Baja California, Sonora, and Arizona. Nesting occurs east of the Rocky Mountains from northeastern British Columbia and central Alberta east through northern Minnesota, Wisconsin, southern Ontario to central Nova Scotia and south to the Gulf coast and central Florida. In fall, it migrates to and winters in South America.

Population Status

Purple martins began to decline in California in the late 1950s (Small, 1994). Observed declines have been attributed to nest site competition, with the introduced European starling and the loss of suitable nest and roost trees (Remsen, 1978). Currently, the purple martin is a California state species of special concern.

Habitat Requirements

Purple martins are not strongly associated with a particular habitat type. Factors influencing their occurrence and distribution appear to be insect abundance and diversity, presence of open water, humidity, wind speed, and visibility around nest sites. Only the nest substrate itself appears to strongly affect where they occur during the breeding season (Williams, 1996). Purple martins typically nest along rivers, estuaries, and other large water bodies and sometimes in old burns or urban situations (Marshall, 1992). This species usually nests in old woodpecker cavities, often in tall, large-diameter trees and snags but also uses nest boxes, cornices of old buildings, and occasionally rock cavities (Marshall, 1992). In some locations (e.g., Sacramento), hollow box bridges are used for nesting (Williams, 1996).

Purple martins forage by capturing insects in flight. Foraging can occur over any habitat type where insects are abundant.

Habitat in the Proposed Project Area

Purple martins could use most of the proposed project area for foraging. Purple martins will forage in most areas with abundant flying insects. In the proposed project area, the Salton Sea as well as other waterbodies, such as managed wetlands, the New and Alamo Rivers, and major canals, may provide these conditions. Agricultural fields may also provide suitable foraging habitat, depending on the abundance of flying insects.

Proposed Project Area Occurrence

Purple martins are occasional visitors to the Salton Sea area as spring and fall migrants (USFWS, 1997b). No published records exist of purple martins nesting in the southeastern portion of California (Williams, 1996), and purple martins are not expected to nest in the proposed project area.

Bank Swallow (*Riparia riparia*)

Range and Distribution

Bank swallows are a migratory species that range throughout much of the U.S. and Canada during the spring and summer. In California, the majority of its habitat is concentrated along the Upper Sacramento River and several tributaries (CDFG, 1990). Some small, isolated populations occur at a few sites in northwestern California (CDFG, 1990). In winter, it migrates to South America.

Population Status

In California, the bank swallow's population and range have been declining (Small, 1994). Historically, the bank swallow was found throughout the state, but the current distribution is primarily limited to areas along the Upper Sacramento River and several tributaries (CDFG, 1990). Garrison et al. (1987) reported a total breeding population in California of about 16,000 pairs in 1987. In 1990, the estimated breeding population was 4,500 pairs (Small, 1994). Erosion and flood control measures are considered the primary causes of observed declines (Garrison et al., 1987). In other portions of the species' range, population numbers are high and appear stable (Kaufman, 1996).

Habitat Requirements

The bank swallow is usually found foraging over or near open water and open land areas. While considered a riparian species, the bank swallow does not have specific associations with riparian plant communities (Garrison et al., 1987). Foraging takes place during coursing flights over grasslands, along rivers, and other open areas (Sharp, 1992).

Habitat in the Proposed Project Area

Bank swallows do not breed in the proposed project area, and their use of habitats in the proposed project area is restricted to foraging. Bank swallows could use most of the proposed project area for foraging since they will forage in any habitat with abundant flying insects. In the proposed project areas, the Salton Sea—as well as—other waterbodies, such as managed wetlands, the New and Alamo Rivers, and major canals, may provide these conditions. Agricultural fields may also provide suitable foraging habitat, depending on the abundance of flying insects.

Proposed Project Area Occurrence

The bank swallow migrates through the Salton Sea area in April and again in September on its way between wintering areas in South America and its nesting areas in Northern California. It is considered a casual visitor to the proposed project area with only a few records (Garrett and Dunn, 1981).

Crissal Thrasher (*Toxostoma crissale*)

Range and Distribution

The crissal thrasher is a resident of southeastern deserts. It is found from southeastern California to southern Nevada, southwestern Utah to west-central Texas, and Baja California south to central Mexico. In California, it occurs in the eastern Mojave Desert of San Bernardino and southeastern Inyo counties up to 5,900 feet in elevation. It is also a resident in Imperial, Coachella, and Borrego Valleys.

Population Status

The crissal thrasher appears to be localized and uncommon throughout much of its range. While it is still fairly common in Colorado River Valley, population numbers have declined markedly in recent decades (Grinnell and Miller, 1944; Remsen, 1978; and Garrett and Dunn, 1981). Removal of mesquite brushland for agricultural development and introduction of tamarisk are the primary causes of the population reductions (Remsen, 1978). Offroad vehicle activity also may degrade habitat and disturb these thrashers.

Habitat Requirements

The crissal thrasher occupies dense thickets of shrubs or low trees in desert riparian and desert wash habitats. It also occurs in dense sagebrush and other shrubs in washes in juniper and pinyon-juniper habitats. Cover for this species is provided by thickets of dense, shrubby vegetation along streams and in washes and frequently, mesquite, screwbean mesquite, ironwood, catclaw acacia, and arrowweed willow. Crissal thrashers forage mostly on the ground, especially between and under shrubs. The crissal thrasher nests in thickets of desert shrubs or on forked branches of a small trees.

Habitat in the Proposed Project Area

Dense thickets of tamarisk along canals, drainages, agricultural fields and rivers in the proposed project area may provide suitable nesting and foraging habitat for this species. Limited stands of mesquite, willow, and cottonwoods found in seepage areas of the AAC may also provide suitable habitat for the crissal thrasher.

Proposed Project Area Occurrence

The crissal thrasher is a resident of the Imperial, Coachella, and Borrego Valleys. Breeding pairs have been observed along the Alamo River and near the towns of Niland and Brawley. Birds have also been observed across from the mission wash flume 3 miles NNE of Bard and in areas around the Laguna Dam.

Le Conte's Thrasher (*Toxostoma lecontei*)

Range and Distribution

The Le Conte's thrasher is a year-round resident throughout its range (Sheppard, 1996). The species can be found from central California to southwestern Utah, south to western Arizona, and Baja California and northwestern Mexico (Terres, 1980). Specifically, it is found in the San Joaquin Valley and Mojave and Colorado Deserts of California and Nevada southward into northeast Baja California, Mexico, and farther south into central and coastal Baja California. It is found in the Sonoran Desert from extreme southwest Utah and western Arizona south into west Sonora, Mexico. Within its range, its distribution is patchy with the southernmost occurrence in Mexico at about 26 N and northernmost in northwestern Sonora, Colorado (Sheppard, 1970). In California, the species occurs in southern California deserts and in western and southern San Joaquin Valley (Garret and Dunn, 1981). The species may have historically extended north to Fresno and Mono Counties (Ziener et al., 1990).

Population Status

Numbers of Le Conte's thrasher have declined in recent decades. The species is vulnerable to offroad vehicle activity and other mechanical disturbances, including agriculture and development (Ziener et al., 1990). Shooting may be a factor in human-related deaths (Sheppard, 1996). Habitat loss due to degradation, fragmentation, agricultural conversion, irrigation, urbanization, oil and gas development, fire, and over-grazing are the primary reasons for the decline of the species (Brown, 1996).

Habitat Requirements

Le Conte's thrasher occurs in open desert wash, desert scrub, alkali desert scrub, and desert succulent shrub habitats on sandy and often alkaline soils (Ziener et al., 1990; Unitt 1984; and Sheppard 1970). Desert shrubs and cacti are frequently used for cover (Sheppard, 1970). This species often inhabits areas where soil is fine alluvium or sandy and topography is flat and open, including dunes and gently rolling hills (Sheppard, 1996; Miller and Stebbins 1964). Le Conte's thrasher requires areas with an accumulated leaf litter under most plants as diurnal cover for its mostly arthropod prey. Surface water rarely exists anywhere within several miles of most of its territories except temporarily following infrequent rains. Le Conte's thrashers nest in dense, spiny shrubs or densely branched cactus. Typical nest sites are characterized by shade above the nest and may be located in an arroyo in relatively deep shade from overhanging branches and roots (Sheppard, 1996). Nests are known to persist for several years and are often easier to find than the birds (Miller and Stebbins, 1964).

Habitat in the Proposed Project Area

The creosote bush scrub community is widespread throughout the nonirrigated areas of the Sonoran Desert. In the HCP area, the occurrence of this community is limited to the right-of-way of IID along the AAC.

Proposed Project Area Occurrence

The USFWS (1997) reports LeConte's thrasher as an extirpated breeder at the Salton Sea National Wildlife Refuge with no recent breeding records. Breeding pairs have been observed in desert scrub habitat east of the Coachella Canal, suggesting the potential for them to occur in desert scrub habitat adjacent to the AAC as well.

Loggerhead Shrike (*Lanius ludovicianus*)

Range and Distribution

Loggerhead shrikes formerly nested throughout much of North America, from Canada south through the Great Basin, along the Gulf Coast, and south to Florida and Mexico (Terres, 1980; Cade and Woods, 1997). Their range is currently more restricted, encompassing mainly the southern portions of the historic range.

Population Status

The loggerhead shrike underwent northeastern and north-central range expansions in the late 1800s and early 1900s that were attributed to deforestation and expansion of agriculture (Cade and Woods, 1997). Since the 1940s, there has been a contraction of the range, especially in the north, and an overall decrease in abundance that is associated with reforestation, loss of pasture lands, and expansion of intensive row crop agriculture. Christmas Bird Count and breeding bird survey data show that since 1966, there has been an overall decreasing trend in the abundance of loggerhead shrikes across North America, although some locations have stable or increasing populations. Loggerhead shrikes have always been most abundant in the southern and western parts of their range. They appear to be increasing, especially as a winter resident, in the LCR Valley (Rosenberg et al., 1991). The increase in abundance during the winter is attributed to the expansion of agriculture in the valley, which provides suitable wintering habitat.

The primary reasons loggerhead shrikes are thought to have declined are loss and degradation of breeding habitat (Cade and Woods, 1997). The pattern of historical range expansion and contraction indicates that natural successional changes in vegetation and human-caused landscape changes have made habitat suitable or unsuitable and that loggerhead shrike populations have tracked these habitat suitability changes. With the decreasing availability of farmland in the Northeast, there has been a decline in the range and abundance of breeding loggerhead shrike. Pasture lands, which have declined even more than other types of farmlands, are especially important to shrikes. Certain types of agriculture do not produce suitable loggerhead shrike habitat, such as intensive, chemically treated row crop monocultures. In the West, localized declines are usually attributed to habitat loss from urbanization and intensive modern agriculture practices.

Other causes of decline that have been suggested include possible adverse effects from pesticides, especially organochlorines that can cause eggshell thinning and reduced reproductive success (Cade and Woods, 1997). However, at this time, there is no evidence for a direct impact from pesticides; rather, it may be that pesticides have a stronger indirect effect by reducing insect prey abundance. Other factors contributing to the decline of loggerhead shrike populations include collisions with automobiles and predation by domestic and feral cats.

Habitat Requirements

Loggerhead shrikes prefer open country, such as grasslands, meadows, scrublands, deserts, pastures, and certain ruderal or agricultural lands (Terres, 1980; Cade and Woods, 1997). For nesting, they require suitable nesting shrubs or small trees and hunting perches in an open area with grassy or herbaceous ground cover and bare areas where food is often found (Cade and Woods, 1997). Loggerhead shrikes breed in sparse riparian woodland and desert washes in the Colorado River area. Loggerhead shrikes nest in shrubs or trees, and eggs are laid from February to July.

Shrikes are carnivorous, eating a variety of prey including mice, small birds, reptiles, insects (e.g., grasshoppers, crickets, and beetles), and spiders (Terres, 1980; Rosenberg et al., 1991). Prey is hunted from perches, the ground, or in aerial pursuit. Thorny trees and bushes or barbed wire are used to impale and store prey.

Recommended management strategies for the loggerhead shrike include providing a mosaic of disturbed grassland patches or pasture lands the size of typical territories within monocultures of row crops (Gawlik and Bildstein, 1993; Cade and Woods, 1997). Habitat should be managed away from major roads, given the propensity for shrikes to be killed by automobiles (Cade and Woods, 1997). Other recommendations include fencing shrub patches from livestock to provide nesting sites and increasing the number of hunting perches where they are scarce (Yosef, 1996).

Habitat in the Proposed Project Area

In the proposed project area, habitat for loggerhead shrikes consists mainly of agricultural fields. Vegetation along agricultural drains may be used as perch sites from which loggerhead shrikes forage in adjacent agricultural fields. Nesting may also occur in these habitats. Loggerhead shrikes use urban areas with trees in the Imperial Valley.

Proposed Project Area Occurrence

The loggerhead shrike is a year-round resident at the Salton Sea and Imperial Valley known to occur near the town of Clipatria and areas south of the Salton Sea. The species is known to breed in the vicinity (USFWS, 1997b). Ten drains were surveyed in the Imperial Valley during 1994 to 1995. Loggerhead shrikes were detected along 7 of the 10 drains. Numbers recorded ranged from 1 to 11 individuals.

Arizona Bell's Vireo (*Vireo bellii arizonae*)

Range and Distribution

The Arizona Bell's vireo is distributed throughout the river systems of the desert Southwest from the Colorado River in southeastern California to the Grand Canyon. It is a summer resident along the LCR.

Population Status

Since 1900, populations of this subspecies of Bell's vireo have declined along the lower reaches of the Colorado River where it is now a rarity to locally uncommon summer resident from Needles south to Blythe (Brown et al., 1983; Zeiner et al., 1990; and Rosenberg et al., 1991). This subspecies has also declined along the lower reaches of the Gila, Santa Cruz, and Salt Rivers. At higher elevations, it has remained common throughout its range (Hunter et al., 1987). Since the completion of Glen Canyon Dam in 1963, the Arizona Bell's vireo has been expanding its range eastward along the Colorado River into Grand Canyon National Park (Brown et al., 1983). Construction of Glen Canyon Dam has prevented seasonal flooding that formerly scoured the banks of the river and has allowed an extensive riparian scrub to develop in the old high-water zone. This newly created habitat is largely composed of salt cedar and willow species and supports significant populations of Arizona Bell's vireo (Brown et al., 1983). Grand Canyon populations of the Arizona Bell's vireo are regionally significant due to the substantial decline of this subspecies at lower elevations. Elsewhere along the LCR, the Arizona Bell's vireo is now a rare to locally uncommon summer resident from Needles south to Blythe (Zeiner et al., 1990; Rosenberg et al., 1991).

The decline of this subspecies is primarily due to extensive habitat loss and degradation and heavy nest parasitism by brown-headed cowbirds (Rosenberg et al., 1991; CDFG, 1992). Current threats to this subspecies include the continued loss and degradation of habitat due to urbanization, water and flood control proposed projects, agriculture, livestock grazing, introduced competitors, exotic invasive plants, offroad vehicles, and nest parasitism by brown-headed cowbirds (Brown, 1993; CDFG, 1992; and Rosenberg et al., 1991). Populations of the Arizona Bell's vireo appear to be regulated primarily by the availability of suitable nesting habitat and secondarily by the rate of cowbird parasitism (Brown, 1993). The Arizona Bell's vireo is a California state endangered species.

Habitat Requirements

The Arizona Bell's vireo is an insectivorous, neotropical migrant that breeds in summer in riparian scrub habitats (Brown, 1993; Rosenberg et al., 1991; and CDFG, 1992). Bell's vireos are insectivorous, gleaning insects from foliage and branches close to the ground (CDFG, 1999a). At low elevations, this subspecies is largely associated with early successional cottonwood-willow. Serena (1986) found that Goodding willow was the most important plant contributing to cover around vireo nest sites in the LCR Valley. The near dependence of this subspecies on cottonwood-willow habitats at low elevations may be due to the extremely high mid-summer temperatures that exist outside these habitats (Walsberg and Voss-Roberts, 1983; Hunter et al., 1987). At higher elevations (above 427 m [1,400 feet]), the Arizona Bell's vireo utilizes tamarisk and honey mesquite, as well as cottonwood-willow habitats (CDFG, 1992; Hunter et al., 1987; and Rosenberg et al., 1991). The elevational differences this subspecies exhibits in its breadth of habitat use is typical of many southwestern riparian birds and appears to be related to the availability of appropriate nest-site environments that may be constrained by restricted thermal tolerances (Hunter et al., 1987). Most nests are located 1.5 to 4.5 feet above ground and are generally suspended from small, lateral, or terminal forks of low branches in dense bushes; small trees; and, occasionally, herbaceous vegetation. In the Grand Canyon, 77 (64 percent) of 121 vireo nests were located in shrub salt cedar and 29 (24 percent) in honey mesquite (Brown, 1993).

The Arizona Bell's vireo is a frequent host of the brown-headed cowbird. Although the percentage of cowbird eggs hatched relative to the number laid in vireo nests is low, cowbird parasitism significantly reduces vireo productivity through nest abandonment, the destruction or removal of both eggs and young, and nestling competition (Brown, 1993; CDFG, 1992; and Rosenberg et al., 1991).

Habitat in the Proposed Project Area

Cottonwood-willow habitat is largely absent from the proposed project area. Seepage from the AAC supports a small area of this habitat between Drops 3 and 4. Tamarisk is also common in this area and other areas receiving seepage from the AAC and along the New and Alamo Rivers. In addition to these areas, tamarisk stands develop along agricultural drains and in areas receiving seepage from unlined canals in the Imperial Valley. While tamarisk provides habitat in parts of the Arizona Bell's vireo range, the extreme temperatures that occur in summer months in the proposed project areas likely preclude extensive utilization of this habitat.

Proposed Project Area Occurrence

Arizona Bell's vireo are not known to occur in the Imperial Valley, and the potential for this species to occur in the Imperial Valley in the future is low (IID, 1994). Arizona Bell's vireos have been observed in eastern Imperial County near Bard Lake and Laguna Dam. In the proposed project area, Arizona Bell's vireo is most likely to occur in habitats supported by seepage from the AAC.

Least Bell's Vireo (*Vireo bellii pusillus*)

Range and Distribution

Least Bell's vireo migrate from their wintering ground in Southern Baja California to Southern California between mid-March and early April to Southern California, where they remain until July or August.

Population Status

The breeding populations north of the U.S.-Mexico border now numbers only about 400 pairs. Least Bell's vireo currently breeds in only a few scattered areas of riparian habitat in Southern California along the coast and western edge of the Mojave Desert. The decline in least Bell's vireo is related to the loss of riparian habitat. As much as 90 percent of the original extent of riparian woodlands in California has been eliminated, and most of the remaining 10 percent is in a degraded condition. Additionally, widespread habitat losses have fragmented most remaining populations into small, disjunct, widely dispersed subpopulations (Franzreb, 1980). The spread of agriculture, excessive livestock grazing, recreational activities, and brown-headed cowbirds continue to put pressure on the remaining population.

Habitat Requirements

For breeding, least Bell's vireos are associated with riparian woodlands consisting of willows, cottonwoods, and wild blackberry, and, in desert locations, mesquite. Dense thickets of willow and other low shrubs are used for nesting and roosting sites (CDFG, 1999a). Areas containing a high proportion of degraded habitat result in lower reproductive success than areas with high quality riparian woodlands (Pike and Hays, 1992). Least Bell's vireos glean insects from foliage and branches, and usually forage close to the ground (CDFG, 1999a). Least Bell's vireos are highly territorial and sensitive to many forms of human disturbance including noise, night lighting, and consistent human presence in an area. Excessive noise can cause least Bell's vireo to abandon an area.

Habitat in the Proposed Project Area

High quality breeding habitat for Least Bell's vireo does not occur in the proposed project area. Tamarisk thickets along the New and Alamo Rivers and irrigation canals and drains could be used by least Bell's vireo during migration. Habitats used while migrating are not well known, but least Bell's vireos are assumed to use riparian habitats similar to those used for breeding during migration, if such habitats are available. In addition, small wetland areas that support some willows and cottonwoods along the AAC could also be used temporarily by least Bell's vireo but are not expected to support breeding pairs.

Proposed Project Area Occurrence

The least Bell's vireo is a rare and local summer resident in lowland riparian woodlands along the LCR (Garrett and Dunn, 1981). In the proposed project area, the subspecies is known to occur accidentally only during migration. Only two records of the least Bell's vireo exist at the Salton Sea National Wildlife Refuge (USFWS, 1997b). Breeding has not been reported at the Salton Sea or elsewhere in the proposed project area.

Tricolored Blackbird (*Agelaius tricolor*)

Range and Distribution

The tricolored blackbird occurs primarily in California's Central Valley in coastal districts from Sonoma County south. In this portion of its range, it is a year-round resident. In northeastern California, where the species is present only during summer, it occurs regularly only at Tule Lake; but breeding pairs have been observed in some years as far south as Honey Lake. In southern deserts, tricolored blackbirds are found regularly only in Antelope Valley, Los Angeles County (CDFG, 1999a). In winter, tricolored blackbirds become more widespread along the central coast and San Francisco Bay area (Grinnell and Miller, 1944; McCaskie et al., 1979; and Garrett and Dunn, 1981).

Population Status

Tricolored blackbird populations have declined in recent decades, probably due to habitat loss (Kaufman, 1996; DeHaven et al., 1975). Because tricolored blackbirds nest in large, dense colonies, they are vulnerable to nest destruction by mammalian and avian predators (Bent, 1958). Currently, the tricolored black bird is a federal sensitive species and a California state species of special concern.

Habitat Requirements

Tricolored blackbirds roost in large flocks in areas with emergent wetland vegetation, especially cattails and tules, and in trees and shrubs adjacent to wetland areas (Terres, 1980). Tricolored blackbirds forage on the ground in croplands, grassy fields, flooded lands, and along edges of ponds (CDFG, 1999a). In California, insects and spiders composed 86 to 91 percent of the nestling and fledgling diet, and 28 to 96 percent of adult diet in spring and summer (Skorupa et al., 1980). The fall and winter diet is composed primarily of seeds and cultivated grains, such as rice and oats.

Tricolored blackbirds nest near fresh water, preferably in emergent wetland with tall, dense cattails or tules, but also in thickets of willow, blackberry, wild rose, and tall herbs. The nest is usually located a few feet over, or near, fresh water or may be hidden on the ground among low vegetation (CDFG, 1999a). This species is highly colonial often nesting in a minimum colony of about 50 pairs (Grinnell and Miller, 1944).

Habitat in the Proposed Project Area

Potentially suitable habitat for tricolored blackbirds occurs in the managed wetlands of the state and federal wildlife refuges, in other wetlands adjacent to the Salton Sea, along agricultural drains, and in marsh communities supported by seepage from the main water delivery canals. The wetlands on the state and federal refuges probably provide the greatest habitat value since these areas support more cattails and bulrushes in larger patches than other areas of marsh vegetation in the proposed project area. The agricultural drains support only limited amounts of cattails and bulrushes in small patches. More commonly, vegetation along the agricultural canals consists of common reed and tamarisk. Red-winged blackbirds and yellow-headed blackbirds are common and abundant in common reeds along drains in Imperial Valley (Hurlbert et al., 1997), and tricolored blackbirds may similarly find suitable habitat conditions in these areas. Agricultural fields in the area provide suitable foraging habitat.

Proposed Project Area Occurrence

Tricolored blackbirds are rare in the proposed project area. They are not known to breed in the proposed project area, but may occur during spring and winter (USFWS, 1997b; Garrett and Dunn, 1981). Two records for this species exist for the Salton Sea National Wildlife Refuge (USFWS, 1997b; Reclamation and IID, 1994), and one tricolored blackbird was observed along the Holtville Main Drain during surveys of selected drains in the Imperial Valley in the mid-1990s (Hurlbert et al., 1997).

Yellow Warbler *(Dendroica petechia)*

Range and Distribution

During its summer breeding season, the yellow warbler can be found throughout the U.S., into Canada and Alaska (Kaufman, 1996). Yellow warblers migrate to Central and South America where they winter. Their current breeding range in California includes the Great Basin, Sierra Nevada, Cascade Ranges, Klamath Mountains, Coast Ranges, and northern Sacramento Valley (Zeiner et al., 1990). The yellow warbler is locally common in the central and northern Coast Ranges (Remsen, 1978).

Population Status

Small (1994) reports that the breeding population of yellow warblers in California has been declining since the 1930s. The two primary reasons for declines in yellow warbler populations are the loss of riparian forests, particularly in the Sacramento and San Joaquin

Valleys, and nest parasitism by the introduced brown-headed cowbird (Remsen, 1978). Along the north coast and Cascade region, populations are thought to be relatively stable, not having experienced similar declines as those in the interior lowlands. A negative trend (nonsignificant) in abundance was noted in the western states by Robbins et al. (1986). The yellow warbler has declined considerably in the coastal lowlands and may be extirpated as a breeder from the Colorado River (Garrett and Dunn, 1981). Pesticide use and habitat loss on wintering grounds in South America may have also played a role in the observed declines of this species.

Habitat Requirements

Yellow warblers nest in riparian scrub and riparian forest habitats from lowland riparian areas up to the mixed north-slope forest zone. Breeding birds are closely associated with alder-cottonwood-willow stands (Harris, 1991), but they will apparently also nest in the shrub-sapling stage of Douglas-fir forest (Meslow and Wight, 1975). Nests are typically placed low (3 to 6 feet) in shrubs and trees in deciduous riparian habitat (Beedy and Granholm, 1985; Zeiner et al., 1990). The species forages mainly in deciduous riparian habitat, but also in adjacent stands of woodlands and conifer forests (Marcot, 1979). On the Colorado River, transients are found in any dense riparian vegetation including salt-cedar, as well as other exotic trees (Rosenberg et al., 1991). Insects are the primary food item, but yellow warblers will occasionally eat berries.

Habitat in the Proposed Project Area

Cottonwood/willow habitat is largely absent in the proposed project area. It is primarily limited to a seepage area between Drops 3 and 4 along the AAC. Agricultural drains support tamarisk as well as dense stands of common reed that potentially provide suitable habitat for yellow warblers. Tamarisk scrub habitat along the Salton Sea and the New and Alamo Rivers could similarly support yellow warblers. In addition to these areas, chats may use tamarisk and common reed thickets that have invaded areas of the state and federal refuges.

Proposed Project Area Occurrence

The yellow warbler is a common spring and fall migrant and a rare winter visitor to the Salton Sea area (USFWS, 1997b). Small numbers regularly winter in the Imperial Valley (Garrett and Dunn, 1981) and have been observed near the towns of Niland and Calexico. Yellow warblers were detected along 6 of the 10 drains surveyed in the Imperial Valley during 1994 to 1995, where numbers recorded ranged from 1 to 20 individuals (Hurlbert et al., 1997).

Yellow-breasted Chat (*Icteria virens*)

Range and Distribution

The yellow-breasted chat's range extends throughout most of the western U.S. and into Mexico (Kaufman, 1996). The winter range of this migratory species extends south into Central and South America. This species is a summer resident in Imperial County.

Population Status

Small (1994) reports that the species has declined throughout California. The loss of riparian forests and nest parasitism by the introduced brown-headed cowbird have been implicated as the primary contributors to this decline (Small, 1994). Both these factors have affected populations in the interior lowlands and southern coast of California. Along the north coast, populations are thought to be relatively stable, not having suffered from similar declines (Remsen, 1978). Habitat loss on wintering grounds in South America may have also played a role in the observed decline of this species.

Habitat Requirements

In Northern California, the yellow-breasted chat occurs in well-developed riparian habitats (Harris, 1991). Nesting habitat consists of very dense scrub; brushy thickets; and briery tangles (usually willows, blackberry, and grapevines), which are generally adjacent to streams, ponds, or swamps (Zeiner et al., 1990; Kaufman, 1996). This species prefers various types of edge habitat, including grass-shrub, shrub-forest, and water-shrub. Occasionally, they will nest in dry overgrown pastures and in upland thickets along the margins of wooded areas (Kaufman, 1996). Hunter et al. (1988) found that chats will use the exotic saltcedar; however; they do not report the frequency of nest placement in saltcedar. Brown and Trosset (1989) report that chats nest in tamarisk and native shrubs in proportion to the occurrence of the different types of vegetation. Territory size is up to 4 acres (Brown, 1985). Dennis (1958) noted that nesting chats never occupied habitat patches less than 3 acres. Up to half of their diet may be berries and fruit, which explains their preference for shrubby thickets in nonforested areas (Kaufman, 1996).

Habitat in the Proposed Project Area

Well developed riparian habitat is largely absent from the proposed project area. Willows and mesquite occur in seepage areas adjacent to the AAC and in a few areas adjacent to the Salton Sea. Agricultural drains and areas along the New and Alamo Rivers support tamarisk as well as dense stands of common reed that potentially provide suitable habitat for yellow-breasted chats. In addition to these areas, chats may use tamarisk and common reed thickets that have invaded areas of the state and federal refuges.

Proposed Project Area Occurrence

Yellow-breasted chats are occasional migrants and summer residents in the proposed project area. They are known to breed in riparian and wetland areas around the Salton Sea (Salton Sea Authority and Reclamation, 2000). The species also occurs in Eastern Imperial County near Bard and the Laguna Dam. The species has been observed along the AAC across from the mission wash flume, 3 miles NNE of Bard in scattered mature cottonwoods with a dense understory of cattails and introduced palm trees, surrounded by salt cedar and agricultural fields (CNDDB).

Large-billed Savannah Sparrow *(Passerculus sandwichensis rostratus)*

Range and Distribution

The large-billed savannah sparrow is a Mexican subspecies of savannah sparrow that breeds in marshes around the head of the Gulf of California, particularly in the delta of the

Colorado River (Unitt, 1984). It was formerly common in winter along the California coast, primarily from Santa Barbara south, and was recorded as far north as San Luis Obispo County. Its winter range also included the Channel Islands. In California, this subspecies is now a rare to uncommon postbreeding visitor to the Salton Sea and Southern California coast from mid-July through March or April, when it returns to the Colorado River Delta to breed (Garrett and Dunn, 1981).

Population Status

The large-billed savannah sparrow was once widespread in salt marshes and on beaches along the coast of Southern California. The decline of the large-billed Savannah sparrow is attributed to breeding habitat alterations in the Gulf of California and the lower reaches of the Colorado River (Unitt, 1984; Garrett and Dunn, 1981). The status of the large-billed Savannah sparrow in California is uncertain. It has been stated that "many" of these birds migrate to Southern California marshes (Zink et al., 1991), but also that the migrating portion of that population is "reduced or extinct" (Wheelwright and Rising, 1993). Its decline may be partially caused by the drying up of marshes at the mouth of the Colorado River.

Habitat Requirements

In winter, large-billed Savannah sparrows are generally associated with saltmarsh, mudflats, and low coastal strand vegetation. At the Salton Sea, they are found primarily in tamarisk scrub (Garrett and Dunn, 1981). Like other Savannah sparrows, the large-billed Savannah sparrow is omnivorous and probably eats mostly insects, seeds, tiny crustaceans, and mollusks. Grasses and other weeds are also likely consumed (Kaufmann 1996; Rosenberg et al., 1991).

Habitat in the Proposed Project Area

In the proposed project area, large-billed savannah sparrows are known to use only tamarisk scrub near mouths of the New and Alamo Rivers at the Salton Sea (Garrett and Dunn, 1981). However, given this association with tamarisk at the Salton Sea, large-billed Savannah sparrows may also use tamarisk scrub throughout the proposed project area.

Proposed Project Area Occurrence

This subspecies of Savannah sparrow is a rare to uncommon postbreeding and winter visitor to the Salton Sea area. It occurs in the proposed project area from mid-July through the winter, migrating to the Colorado River Delta and Mexico to breed (Garrett and Dunn, 1981).

Summer Tanager (*Piranga rubra*)

Range and Distribution

The summer tanager is a neotropical migrant that breeds throughout most of the southeastern and southwestern U.S., including New Mexico, Arizona, southern Nevada, and southeast California. This species winters from Southern Baja California and central Mexico south to South America (Terres, 1980; Robinson, 1996).

Population Status

Although summer tanagers are still common and widespread in many areas, their range may be contracting in the eastern U.S.; they have experienced sharp declines along the LCR (Ehrlich et al., 1988; Kaufmann, 1996; and Robinson, 1996). Elsewhere in the Southwest, summer tanagers are believed to have been extirpated from the lower Gila, Santa Cruz, and Salt Rivers (Hunter et al., 1987). Along the LCR, the severe decline of this species since the 1970s is attributed to the continuing loss of mature cottonwood-willow habitat. Summer tanagers were still fairly abundant in the area until the early 1980s, when severe flooding at Bill Williams Delta and along the Colorado River mainstream resulted in a 36 percent population decrease. After the flooding, only 138 individuals were estimated to occur in the entire valley, while population densities at Bill Williams Delta dropped from 16 to 24 birds per 100 acres to 6 to 10 birds per 100 acres (Rosenberg et al., 1991). Based on these trends, it appears that the summer tanager may become extirpated as a breeding species along the LCR (Rosenberg et al., 1991). The continuing loss of structurally well developed stands of cottonwood-willow riparian forest is the primary threat to this species in the Southwest (Rosenberg et al., 1991; Hunter et al., 1987). However, the summer tanager is still common and abundant elsewhere within its range (Kaufman, 1996). The summer tanager is a California state species of special concern.

Habitat Requirements

In the southwestern U.S., summer tanagers occur primarily in cottonwood-willow forests along rivers and streams but can also occur in tamarisk stands along the Colorado River. The species is generally found in association with tall riparian trees, suggesting that canopy height may be a more important factor than species composition in the tanager's selection of foraging and nesting habitats (Rosenberg et al., 1991). Summer tanagers forage mainly in the tops of tall riparian trees for insects. In the Southwest, this species feeds heavily on cicadas, bees, and wasps. They also eat a variety of other insects (e.g., caterpillars, beetles, spiders, and flies) and berries and small fruits (Kaufmann, 1996; Terres, 1980; and Rosenberg et al., 1991).

Habitat in the Proposed Project Area

Cottonwood/willow habitat is of limited size and distribution in the proposed project area, occurring primarily in the seepage areas along the AAC between Drops 3 and 4. Most riparian areas in the proposed project area are dominated by tamarisk, which may provide suitable habitat along the New and Alamo Rivers, adjacent to the Salton Sea, and along agricultural drains.

Proposed Project Area Occurrence

Summer tanagers are rare in the proposed project area during summer and winter. They are more common in winter but are still considered only occasional visitors (USFWS, 1997b). The summer tanager breeds along the Colorado River and has been observed between the Laguna and Imperial Dams in areas with willow, mesquite, and salt cedar (CDFG, 1999b). Known or suspected nesting localities outside the Colorado River are Brock Ranch (Imperial County), Borrego Springs (San Diego), Thousand Palms Oasis (Riverside), Palm Springs (Riverside), Whitewater Canyon (Riverside), Morongo Valley (San Benito), Tecopa (Inyo), Mohave River, and Valyermo (Lassen) (Garrett and Dunn, 1981). These reports of breeding in arid regions outside the Colorado River indicate that summer tanagers could breed in the proposed project area.

Mammals

Mexican Long-tongued Bat (*Choeronycteris mexicana*)

Range and Distribution

The Mexican long-tongued bat reaches the northern limit of its range in southeastern U.S. In New Mexico and Arizona, long-tongued bats have been found at elevations ranging from sea level to 6,000 feet, occupying desert and montane riparian, desert succulent shrub, desert scrub, and pinyon-juniper habitats. In California, the long-tongued bat is known only from San Diego County. An invasion in 1946 provided most of the California records for long-tongued bats (Olson, 1947). California records largely have been in urban habitat in San Diego (Olson, 1947).

Population Status

Mexican long-tongued bats are considered rare in Mexico, and fewer than 400 individuals have been observed in the U.S. since 1906. Threats include recreational caving; natural and intentional mine closures; renewed mining activity; mine reclamation; and loss of food plants as a result of development, agriculture, and grazing (Noel, 1998).

Habitat Requirements

The Mexican long-tongued bat occurs in a variety of habitats, ranging from arid scrub habitats to mixed oak-conifer forests (Arroyo-Cabrales et al., 1987). It favors desert canyons with riparian vegetation. In Mexico, New Mexico, and Arizona, this bat occupies deep canyons of desert mountain ranges. A variety of roost sites is used, including caves, mines, buildings, and trees. Caves, mines, and probably buildings are used as nursery sites. This species forages in desert and montane riparian, desert scrub, desert succulent shrub, and pinyon-juniper habitats. The long-tongued bat feeds mainly on nectar, fruit, and pollen.

Habitat in the Proposed Project Area

Desert scrub is widespread throughout the nonirrigated areas of the Sonoran Desert. This habitat type surrounds the Salton Sea between the higher rock hillsides and the more saline desert saltbrush community. Succulent shrubs comprise a minor component of the vegetation community and foraging habitat may be limited. The only portion of the HCP area that supports desert scrub habitat is in the right-of-way of IID on the AAC.

While mining activity has occurred throughout Imperial County, the nearest abandoned mine shafts are located near Hedges at the southwestern tip of the Cargo Muchacho Mountains, well outside of the proposed project area. Areas along the AAC supporting cottonwoods, landscape trees, and buildings may provide roosting sites.

Proposed Project Area Occurrence

This species has not been reported to occur in Imperial County; however, the area is within the distributional range of the species. The limited availability of roosting sites and potentially sparse forage makes the occurrence of this species unlikely in the proposed project area.

California Leaf-nosed Bat (*Macrotus californicus*)

Range and Distribution

California leaf-nosed bats range from coastal and eastern California to western New Mexico, and from southeastern Nevada south into Baja California and northwestern mainland Mexico (Hall, 1981).

Population Status

The status of this bat remains unknown (USFWS, 1994). In Southern California, this species has disappeared from most coastal basins and declined in many other areas. In Nevada, no recent sightings of this species have been reported (NNHP, 1997). Like many cave dwelling bats, loss of foraging habitat and disturbances at roost sites are thought to be responsible for the declines (Williams, 1986). Filling or plugging of cave and abandoned mine entrances, intrusion by explorers, and renewal of historic mining sites may also be contributing factors.

This species is particularly susceptible to human disturbance that may cause abandonment of roosts during the breeding season. The impact of human disturbance on roost sites may be significant due to the specific thermal regime required for maternity roosts. Closing of mines and caves or improper gating of entrances can also affect colonies (AGFD, 1996). The AGFD (1997b) describes modification of cave conditions, including changes in air movement, humidity, and temperature, as potentially serious concerns for this species. In some situations, roosting sites remain intact, but nearby foraging habitat is lost due to development, agriculture, or grazing.

Habitat Requirements

California leaf-nosed bats occur in arid regions, using habitats such as desert scrub, alkali scrub, desert washes, riparian associations, and palm oases (Zeiner et al., 1990). Like most bats, this species often forages near open water where greater quantities of insects are available. The species uses separate daytime and nighttime roosts. During winter months, the California leaf-nosed bat forms large colonies in only a few geothermally heated mines in the deserts of the Southwest (Brown and Berry, 1991). Day roosts are often in deeper caves or mines and occasionally in abandoned structures (Zeiner et al., 1990). This species requires warm roosts with temperatures of 80.6°F or more due to its inability to lower its body temperature and become torpid (Bell, 1985). Maternity colonies are generally located in mines with temperatures that reach 80.6 to 89.6°F. California leaf-nosed bat roost sites typically have high ceilings and room for flight. Roosting takes place far enough from the entrance (30 to 80 feet) to take advantage of the humidity and moderate temperatures of the cave (Vaughan, 1959). Night roosts are in bridges, mines, buildings, overhangs, or other structures with overhead protection (Zeiner et al., 1990). The species may form colonies of up to 500 individuals (Zeiner et al., 1990).

California leaf-nosed bats forage for insects within 3 feet of the ground by hovering and picking prey off vegetation or the ground. This species feeds on large flying insects, such as grasshoppers, moths, and beetles (AGFD, 1997b). Foraging ranges are small, with most activity within a mile of day roosts in winter months and up to 5 miles during summer months (Brown, pers. comm.). The presence of woody riparian vegetation, such as mesquite, ironwood, and palo verde, is required in foraging areas. California leaf-nosed bats do not hibernate, and some populations migrate south for the winter.

Habitat in the Proposed Project Area

California leaf-nosed bats use caves and mines as day roosts. The only mine shafts in the area occur near Hedges, at the southwestern tip of Cargo Muchacho Mountains. Plant species preferred for foraging (mesquite, palo verde, ironwood) are rare in the proposed project area and restricted to scattered patches along the AAC. It is unknown whether they forage in riparian areas dominated by tamarisk.

Proposed Project Area Occurrence

Leaf-nosed bats are known to feed on grasshoppers, beetles, cicadas, and moths in various places along the Colorado River (Hoffmeister, 1986). Roost sites have been reported several abandoned mines in the Chocolate and Carago Muchacho Mountains. However, the lack of daytime roost sites along with the scarcity of suitable foraging habitat makes the occurrence of this species in the proposed project area unlikely.

Pallid Bat *(Antrozous pallidus)*

Range and Distribution

The pallid bat has a wide range extending from southern British Columbia and Montana into Central Mexico and east to Texas, Oklahoma, and Kansas (Sherwin, 1998). It is a year-round resident of grassland and desert habitats in the southwestern U.S. (Hermanson and O'Shea, 1983). The pallid bat is a locally common species of low elevations in California where it occurs throughout most of the state, except the high Sierra Nevada from Shasta to Kern Counties and the northwestern corner of the state from Del Norte and western Siskiyou Counties to northern Mendocino County.

Population Status

The pallid bat is a California state species of concern due to limited population numbers. Current threats include mine closure proposed projects; human disturbance of roost sites; extermination in buildings; pesticides; and loss of foraging areas due to urban development, logging activities, and vineyard development (Sherwin, 1998).

Habitat

The pallid bat typically roosts in rock crevices but will also use caves, mines, buildings, and trees. It primarily forages on ground-dwelling arthropods, such as scorpions, crickets, and grasshoppers (Hermanson and O'Shea, 1983).

The pallid bat is most often found in arid, low-elevation habitats, including grasslands, shrublands, woodlands, and forests. These bats are nocturnal and emerge up to an hour after sunset. Day roosts include caves, crevices, mines, trees, and buildings. Night roosts are generally in more open sites and are near day roosts. Horizontal crevices with stable temperatures are preferred day roosts in summer; vertical crevices with fluctuating temperatures are preferred during cooler periods. Palled bats are relatively inactive during the winter and may hibernate. Migrational patterns include local movements to hibernacula and a postbreeding season dispersal.

Habitat in the Proposed Project Area

Pallid bats are well adapted to human environments and frequently use buildings, bridges, and trees as roosts. Thus, they could roost throughout the proposed project area. Foraging may also occur throughout the proposed project area in any habitat where insect prey is abundant, including agricultural areas, wetlands, riparian areas, canals drains, and desert scrub.

Proposed Project Area Occurrence

While specific populations have not been identified in the proposed project area, roosts have been identified in the general proposed project vicinity at the Mary Lode Mine in the Chocolate Mountains and in the Queen Incline and the Mesquite Adit near the Tumco wash in the Carago Muchacho Mountains.

Pale Western Big-eared Bat *(Corynorhinus townsendii pallescens)*

Range and Distribution

The big-eared bat occurs throughout the western U.S., from southern British Columbia southward to southern Mexico. Isolated, relict populations of this species are found in the southern Great Plains and Ozark and Appalachian Mountains (AGFD, 1998a). The pale western subspecies (*C. t. pallescens*) occurs in Washington, Oregon, California, Nevada, Idaho, Arizona, Colorado, New Mexico, Texas, and Wyoming (Handley, 1959).

Population Status

The results of a survey performed by Pierson and Rainey (1994) suggest that drastic population declines for the pale western big-eared bat have occurred in California throughout the last 40 to 60 years. Among these declines are a 52 percent loss in the number of maternity colonies, a 44 percent decline in the number of roosts, a 55 percent decline in the number of animals, and a 32 percent decrease in the average size of remaining colonies in the state. The lower Colorado desert along the Colorado River, an area that experiences heavy recreational use, is one of three areas in California in which marked declines in the numbers of pale western big-eared bat colonies have taken place. The overall population trend appears to be declining in Arizona, as well. Currently, there are only 13 verified maternity roosts in the state, representing 10 separate colonies, with a total population of about 1,000 adult females (Pierson and Rainey, 1994). More than half of the known maternity roosts are in mines, and only 4 of these roosts contain 200 or more individuals. There may be losses or reductions of maternity colonies, which are easily disturbed; these disturbances often result in abandonment (AGFD, 1996). In the absence of human disturbance, maternity colonies tend to remain stable over time (Pierson and Rainey, 1994).

This species is threatened by human disturbance at major maternity roosts; renewed mining; closure and sealing of abandoned mines naturally or for hazard abatement; and, possibly, the use of nontarget pesticides (AGFD, 1996). Pale western big-eared bats are extremely sensitive to human disturbance, and simple entry into a maternity roost can result in the abandonment of the site (Pierson et al., 1991). This bat feeds heavily on noctid moths, which require wetland habitats. The significant loss of wetlands has resulted in a decrease in prey base for the pale western big-eared bat (ISCE, 1995).

Habitat Requirements

Pale western big-eared bats can be found in a variety of habitats but are most commonly associated with Mohave mixed scrub (e.g., sagebrush, sagebrush-grassland, blackbrush, and creosote-bursage) and lowland riparian communities. Separate day and night roosts are used. Day roosts are in caves, mines, or tunnels. Hibernation roosts are cold, but stay above freezing (Zeiner et al., 1990) and must be quiet and undisturbed. Pale western big-eared bats usually hibernate singly or in small groups and are almost always found in ceiling pockets (Pierson et al., 1991). In climatically moderate areas, this species appears to arouse from torpor frequently on warm nights to feed and changes roost locations often. In these areas, roosts are often L-shaped, with both a vertical and a horizontal entrance that creates a cold sink and generates a strong airflow (Pierson et al., 1991). Maternity roosts are generally located in mines and caves, with the favored roost for clusters of mothers and young often in a ceiling pocket or along the walls just inside the roost entrance, well within the twilight zone (Pierson et al., 1991). The determining factor for maternity roost site selection may be temperature related. In California, maternity roosts are generally warm; the species appears to select the warmest available sites, some of which reach 30°C (86°F) (Pierson et al., 1991). Night roosts may be in buildings or other structures. Separate hibernation and maternity roosts are often used.

Foraging takes place over desert scrub, riparian habitats, or open water with 15 miles of the roost sites. Small moths are the primary food of this species, but other insects are also sometimes eaten (AGFD, 1998a). This species has poor urine concentrating abilities compared to other bats of the region and, therefore, requires access to a nearby water supply (Zeiner et al., 1990).

Habitat in the Proposed Project Area

Pale western big-eared bats use caves and mines for roosting. The only mine shafts in the area occur near Hedges, at the southern extent of the Cargo Muchacho Mountains, which are well outside the proposed project area. Pale western big-eared bats could forage throughout the proposed project area, although they probably would concentrate foraging activities along the LCR, Salton Sea, New and Alamo Rivers, agricultural drains, and water conveyance canals, given this species' association with water. Tall tress, bridges, and buildings could be used as night roosting sites.

Proposed Project Area Occurrence

The species has been observed in eastern Imperial County near Bard. It has been reported to roost in the Senator Mine and Picacho Mine in the Chocolate Mountains. This species is known to occur in the project area.

Spotted Bat *(Euderma maculatum)*

Range and Distribution

The spotted bat has been reported from scattered locations from southern British Columbia to Montana and from coastal California, Texas, and northern Mexico (Hall, 1981). In

California, it is found primarily in foothills, mountains, and deserts in the southern part of the state (Zeiner et al., 1990a and 1990b). It is generally considered widespread, but rare.

Population Status

The population status of the spotted bat is not well known because of the low number of sightings reported. The spotted bat is considered one of the rarest North American mammals. The species appears linked to riparian habitats in many areas, which are generally declining throughout the species' range. The spotted bat is a federal and California state species of special concern.

Habitat Requirements

The habitat requirements and preferences of this species are varied and not well understood. It is known to occur in the openings of conifer forests in montane habitats, riparian woodlands, and desert scrub (Hoffmeister, 1986; NMDGF, 1997; and AGFD, 1998b). Roost site localities are poorly known. This species is thought to use crevices and cracks in cliff faces, and occasionally caves and buildings for roost sites. Roots are often in the vicinity of open water (AGFD, 1998b). Moths seem to be the primary food item of this species, although other insects may be consumed (AGFD, 1998b).

Habitat in the Proposed Project Area

The types of habitats potentially used by spotted bats in the proposed project area are uncertain because this species' ecology is poorly known. Spotted bats could use much of the proposed project area since this species appears to be associated generally with open habitats. Foraging may be concentrated along waterways, such as the Salton Sea, New and Alamo Rivers, large canals, and agricultural drains. Potentially, spotted bats could roost at gravel quarries, highway bridges, or in buildings.

Proposed Project Area Occurrence

No information is available on the occurrence of spotted bats specifically in the proposed project area. Male spotted bats are often observed foraging near the Colorado River in and near the Grand Canyon; however, females are usually observed at higher elevations (Herder, pers. comm.). Occurrences have also been reported from the Yuma area (Hoffmeister, 1986).

Western Small-footed Myotis (*Myotis ciliolabrum*)

Range and Distribution

The small-footed myotis ranges from southern Canada south to central Mexico and from California eastward to west Texas. It is a year-round resident in California, occurring in a variety of habitat types.

Population Status

In 1996, this species was delisted as threatened by the U.S. Fish and Wildlife Department. It remains a federal species of concern. Threats to this species include loss of suitable roosting sites habitat, including destruction and disturbance, and pesticide use.

Habitat Requirements

The small-footed myotis is a common bat of arid uplands in the upper Sonoran Desert. It occurs in a wide variety of habitats, primarily in relatively arid, open stands in forests, woodlands, and brushy uplands near water. The small-footed myotis feeds on a variety of small flying insects, including moths, flies, and beetles, while flying over water and among trees. It requires more water than most other bats and can be found drinking shortly after night emergence. The small-footed bat can be found roosting in caves, buildings, crevices, and under loose bark. Occasionally, it will also roost under bridges (Zeiner, 1990).

Hibernation takes place in caves and mines. Summer roosts are in crevices, cracks, holes, under rocks, and in buildings (AGFD, 1997k). Colonies can be as large as 50 or more individuals (Zeiner et al., 1990).

Habitat in the Proposed Project Area

Areas adjacent to the Salton Sea and along the New and Alamo Rivers, agricultural drains, and possibly the water conveyance canals may be used for foraging. Because this species uses a wide variety of natural and man-made structures for roosts, suitable roost sites could occur throughout the proposed project area.

Proposed Project Area Occurrence

Historic records indicate this species has been present in the Salton Sea area (SSA and Reclamation, 2000). However, the only known roost in the vicinity of the proposed project area is the Mary Lode Mine, located in the Chocolate Mountains to the northeast of the Algodones Dunes (CDFG, 1999b). Still, because this bat will use buildings for roosts and forages in a diversity of habitats, it may occur throughout the HCP area.

Occult Little Brown Bat (*Myotis lucifugus occultus*)

Range and Distribution

The occult little brown bat occurs locally throughout most of the U.S. and Canada, as far north as Alaska and as far south as central Mexico. The subspecies *M. l. occultus* (identified as a separate species, *M. occultus*, by Hoffmeister [1986]) occurs throughout Arizona and into eastern California, western New Mexico, and central Mexico.

Population Status

This species is declining due to using pesticides, destructing nesting colonies, collecting by researchers, humans disturbing hibernating individuals, and harvesting timber that removes mature or dead trees and snags (Williams, 1986; Fenton and Barclay, 1980). Disturbance of hibernating colonies can cause mortality due to use of remaining fat reserves; disturbance to maternity roosts may cause abandonment. Increased exploration of caves and mines has probably caused a decrease in population numbers. Pesticide use has also caused drastic declines in some areas (Kunz et al., 1977; Clark et al., 1978). One and possibly two of the three or four known maternity roosts of this species in Arizona have been eliminated. The status of a third colony on the Verde River is unknown (AGFD, 1997g). The occult little brown bat is a federal and California state species of special concern.

Habitat Requirements

In the southwest, the occult little brown bat occurs in a variety of habitats, including ponderosa pine forests, oak-pine woodlands (near water), and along permanent water or in riparian forests in some desert areas (AGFD, 1997g). It is usually closely associated with open water sources, such as rivers, ponds, or reservoirs, and it flies low along shorelines while foraging (Hoffmeister, 1986). It often feeds over open water habitats (Zeiner et al., 1990). This species generally hunts low over water for flying insects, including mosquitoes and midges (AGFD, 1997g). It roosts in hollows in living or dead trees, under rocks or wood, or sometimes in buildings or mines (NMDGF, 1997). This species seems to prefer human structures to natural ones for maternity roosts, and may use mines or caves for hibernation (AGFD, 1997g). Separate day, night, hibernation, and nursery roosts are used. Seasonal movement of several hundred miles between summer roosts and winter hibernacula have been recorded (NMDGF, 1997). Site fidelity is correlated to the permanence of the roost (e.g., cave verses foliage roosts). Colonies can be very large with up to 300,000 individuals (Cockrum, 1956).

Habitat in the Proposed Project Area

The Salton Sea, lakes, wetlands, rivers, canals, and agricultural drains may provide suitable foraging habitat for this species. Because this species uses a wide variety of natural and man-made structures for roosts, suitable roost sites could occur throughout the proposed project area.

Proposed Project Area Occurrence

The occult little brown bat has been known to use riparian areas along the LCR (Reclamation and IID, 1994); however, no recent records exist for this species in this area, and it may be extirpated in this portion of its range (Brown, pers. comm.).

Southwestern Cave Myotis (*Myotis velifer brevis*)

Range and Distribution

In the U.S., the cave myotis is found in the southwestern half of Arizona and immediately adjacent areas of California, Nevada, and New Mexico (AGFD, 1997c). It is also found in west and south Texas and Oklahoma, then southward through Mexico to Guatemala. In California, the southwestern subspecies is restricted to lowlands of Colorado River and adjacent mountain ranges and in San Bernardino, Riverside, and Imperial Counties, although it is more common farther east.

Population Status

Population trends for this species are not well understood, but populations of cave myotis appear to be declining. Large colonies, each containing approximately 1,000 individuals, have been observed in the past in the Riverside Mountains of Riverside and San Bernardino Counties; however, more recent examinations in this area suggest a significant decline in population size (Williams, 1986). Like many other cave-dwelling bats, declines in populations of this species are probably due to pesticide use, mining, and loss of riparian habitats, as well as disturbances to roost sites by humans exploring caves or mines or by the filling or plugging of cave and abandoned mine entrances (Williams, 1986). The species is particularly vulnerable at maternity roosts, where they congregate in large numbers (AGFD, 1997c). The southwestern cave myotis is a federal and California state species of special concern.

Habitat Requirements

This species prefers arid habitats dominated by creosote bush, palo verde, brittlebrush, cactus, and desert riparian. Roosts are typically in caves or mines, but buildings and bridges have also been used. The diet of the southwestern cave myotis consists primarily of moths and beetles that are taken over open washes and near vegetational boundaries. Dense, linear stands of mesquite, salt cedar, and catclaw acacia bordering the still water of oxbow ponds are considered optimal foraging areas (Vaughan, 1959; Hoffmeister, 1986). The southwestern cave myotis is a colonial cave-dweller, occurring in colonies of several thousand individuals in most of its range. Mines, buildings, and bridges may also be used as roosting sites. Hibernation caves have high humidity, often with standing or running water and little air movement. Hibernating cave myotis may form clusters. This species uses temporary night roosts. Nursery colonies are in the hibernation cave or another cave. Occasionally, other sites, such as bridges, are used. Optimal sites are relatively warm, with little human disturbance.

Habitat in the Proposed Project Area

The extensive stands of salt cedar bordering the Alamo and New Rivers could provide foraging habitat for this species. Some agricultural drains that support dense tamarisk and common reed could also provide suitable foraging habitat. Bridges and buildings throughout the area could be used as temporary roosting sites.

Proposed Project Area Occurrence

This species may have been extirpated from the proposed project area by agricultural practices and habitat conversion (USFWS, 1999). No recent surveys have been conducted in the area to determine the occurrence of this species.

Yuma Myotis *(Myotis yumanensis)*

Range and Distribution

The range of the Yuma myotis extends across western North America from British Columbia to central Mexico, and from the West Coast to as far east as Idaho and west Texas. It is thought to migrate seasonally throughout much of its range. The Yuma myotis is known to roost in caves, abandoned buildings, and other structures. The Yuma myotis is uncommon in Mojave and Colorado Desert regions, except for the mountain ranges bordering the Colorado River Valley. Found in a wide variety of habitats ranging from sea level to 11,000 feet, it is uncommon to rare above 8,000 feet. It is not known where the Yuma bat goes for winter, but it has been captured in Arizona in February.

Population Status

Breeding has not been studied, except for a couple of isolated sites in Colorado. At that site, the colony was estimated to number around 100 adult individuals and is the first western record of a breeding site for this species. Elsewhere throughout its range, this species is known to form maternity colonies upwards of several thousand individuals in caves or attics (Hoffmeister, 1986; Hall, 1981; Findley et al., 1975). Threats include mine closure, human disturbance to roost sites, and pesticides.

Habitat Requirements

The Yuma myotis prefers cliffs and rocky walls near desert scrub, pinyon-juniper woodlands, and other open woodlands and forests. Like many bat species, it is closely tied to an open water source for foraging and drinking (Zeiner et al., 1990) and tends to be found near permanent watercourses (AGFD, 1997j). Small moths, midges, termites, and other insects that fly over water are preferred food items of this species. Insects are caught while foraging low over rivers, irrigation canals, permanent ponds, streams, or creeks (AGFD, 1997j). The Yuma myotis roosts in narrow crevices in rock; bridges; buildings; and, occasionally, mines (Hoffmeister, 1986). Preferred roosting habitats, however, are buildings and abandoned cliff swallows' mud nests (AGFD, 1997j). This species is somewhat tolerant of human activity, as evidenced by roosts in attics of inhabited houses or other human-occupied structures (Hoffmeister, 1986). Colonies can be as large as several thousand individuals (Zeiner et al., 1990). Separate daytime and night roosts are used.

Habitat in the Proposed Project Area

The canals, rivers, lakes, and streams throughout the proposed project area offer suitable foraging habitat for the Yuma myotis. This species is relatively tolerant of human activity and may roost in houses, under bridges, or in other natural and manmade structures throughout the proposed project area.

Proposed Project Area Occurrence

This species is known to occur in Imperial County and has historically been reported to occur in the proposed project area (Hall, 1981). No recent surveys have been conducted for this species in the proposed project area, but suitable roosting and foraging habitats are present.

Western Mastiff Bat *(Eumops perotis californicus)*

Range and Distribution

The greater western mastiff bat ranges from San Francisco Bay east to Arizona and Texas, then south to northwestern and central Mexico (AGFD, 1997e). The majority of the western mastiff bats in California are year-round residents; however, some are believed to migrate in the winter to warmer, lowland climates (Williams, 1986).

Population Status

Threats to this species reportedly include human disturbances at roost sites, limited numbers of adequate watering sites, cultivation of major foraging areas, and poisoning and reduction of insects by insecticide use (AGFD, 1996; Williams, 1986). Populations in California are believed to have undergone significant declines in recent years, primarily due to extensive loss of habitat and the widespread use of insecticides (Williams, 1986). Populations in Arizona may also be declining, and some roost sites are no longer occupied (AGFD, 1996 and 1997e). In other areas, greater western mastiff bat populations appear fairly stable (NMDGF, 1997). This western mastiff bat is a federal and California state species of special concern.

Habitat Requirements

Mastiff bats favor rugged, rocky areas in Sonoran Desert scrub habitats, where suitable crevices are available for day roosts (AGFD, 1996). They inhabit crevices in cliff faces, high buildings, trees, and tunnels (Zeiner et al., 1990). Colonies prefer deep crevices up to 10 feet or more (AGFD, 1997e). Because of their large size and long wings, these bats require considerable space to launch themselves into flight, so roosting sites are usually situated to permit a free downward fall for at least 6.5 to 10 feet.

Western mastiff bats forage in open areas, generally over mesquite as far as 25 miles from roost sites (Vaughan, 1959; Jameson and Peeters, 1988). They require long or unobstructed waterways for drinking and feed on moths, bees, wasps, and flying ants that get caught in thermal currents (AGFD, 1996). Mastiff bats roost singly or in small colonies, sometimes with other bat species; several alternate day roosts may be used (Zeiner et al., 1990). Movement among different roost sites is thought to be influenced by temperature, as well as human disturbance (AGFD, 1996). Colonies often support 2 to several dozen individuals but typically number fewer than 100 individuals (AGFD, 1996).

Habitat in the Proposed Project Area

Western mastiff bats are generally associated with open desert habitats near unobstructed waterways. In the proposed project area, these types of habitats occur adjacent to the Salton Sea and along the All American, East Highline, and Westside Main Canals. The availability of suitable roost sites in the proposed project area is unknown. Gravel quarries near the Salton Sea could provide roost sites. Other types of potential roost sites in the proposed project area include bridges, buildings, and trees.

Proposed Project Area Occurrence

Western mastiff bats are known to occur in Imperial County, and roost sites have been found in several abandoned mine sites in the Carago Muchacho Mountains; occurrences in the proposed project have not been reported. Because of the extensive foraging range and availability of habitat in the proposed project area, the western mastiff bat could potentially occur there.

Pocketed Free-Tailed Bat (*Nyctinomops femorosacca*)

Range and Distribution

The pocketed free-tailed bat occurs in western North America, from Southern California, central Arizona, southern New Mexico, and western Texas south into Mexico, including Baja California (Navo, 1998). The pocketed free-tailed bat is found in Riverside, San Diego, and Imperial Counties. This species is rare in California, but is more common in Mexico.

Population Status

The pocketed free-tailed bat is currently a California state species of special concern due to limited population size and rarity of occurrences. No known threats have been identified for this species; however, human disturbance to roosting sites, loss of foraging habitat, and pesticides could pose potential threats to this species (Navo, 1998).

Habitat Requirements

The pocketed free-tailed bat prefers arid lowlands, especially desert canyons, dominated by creosote bush or chaparral vegetation. Habitats used include pinyon-juniper woodlands, desert scrub, desert succulent shrub, desert riparian, desert wash, alkali desert scrub, Joshua tree, and palm oasis. This species prefers rock crevices in cliffs as roosting sites. It must drop from the roost to gain flight speed. The pocketed free-tailed bat reproduces in rock crevices, caverns, or buildings and primarily feeds on moths and beetles.

Habitat in the Proposed Project Area

Creosote scrub habitat is found in areas adjacent to the Salton Sea and along the All American, Coachella, and Westside Main Canals. Areas along the New and Alamo Rivers and along larger drainages and canals may also provide foraging habitat. The availability of suitable roost sites in the proposed project area is unknown. Gravel quarries near the Salton Sea may provide suitable roost sites.

Proposed Project Area Occurrence

The pocketed free-tailed bat is known to occur in Imperial County, but this species has not been reported in the proposed project area. Foraging habitat occurs in the proposed project area, but roosting sites may limit the occurrence of this species.

Big Free-tailed Bat (*Nyctinomops macrotis*)

Range and Distribution

The big free-tailed bat is a migratory species. It ranges from most of South America northward to include Mexico, Arizona, New Mexico, southern and western Texas, Southern California, southeastern Nevada, northeastern Utah, and as far north as central Colorado (Navo, 1998; Hall, 1981).

Population Status

This species is a California state species of special concern due to its rarityhere. While the big free-tailed bat is common in parts of its range and does not appear to be threatened, impacts such as human disturbance to roosting sites, loss of forage habitat, and pesticides are likely to have negative impacts on this species (Navo, 1998).

Habitat Requirements

Big free-tailed bats generally inhabit rugged rocky habitats, although a wide range of habitats—including desert scrub, woodlands, and evergreen forests—are visited during foraging and migration (Navo, 1998). Roosts are usually in buildings, caves, and rock crevices. This bat feeds almost exclusively on moths, but crickets, grasshoppers, flying ants, and stinkbugs are occasionally taken (Easterla, 1973; Easterla and Whitaker, 1972).

Habitat in the Proposed Project Area

The preferred rocky habitat of the big free-tailed bat does not occur in the proposed project area. Desert scrub, agricultural fields, wetlands, lakes, rivers, canals, and drainages where insects are abundant could provide suitable foraging habitat for migrating bats.

Proposed Project Area Occurrence

Big free-tailed bats are known to migrate through the proposed project area during the spring and fall (USFWS, 1997). No roost sites are known to occur in the proposed project area.

Jacumba Little Pocket Mouse *(Perognathus longimembris internationalis)*

Range and Distribution

The range of the Jacumba little pocket mouse is restricted to the deserts of extreme Southern California and northern Mexico. Its range extends from Jacumba, California, approximately 62 miles south of the U.S.-Mexican border.

Population Status

This subspecies has an extremely limited range and is endemic to Southern California. The population status of this subspecies is unknown at this time. Current threats have not been identified but may include habitat and offroad vehicle activities and predation by introduce species.

Habitat Requirements

Habitat requirements are not well understood, but it is known to occupy sandy habitats on the desert floor. Preferred habitats include desert riparian, desert scrub, desert wash, and sagebrush. Little pocket mice generally dwell in burrows and may stay underground for up to 5 months in winter. Burrow systems are rarely occupied by more than one mouse, and some animals may use more than one burrow (Kenagy, 1973). Sandy soils are preferred for burrowing (Hall, 1946), but burrows are also found on gravel washes and on stony soils (Beatley, 1976b; Miller and Stebbins, 1964).

Habitat in the Proposed Project Area

Desert scrub habitats occur in the proposed project area only within the right-of-way of IID on the AAC. No native desert riparian habitat occurs in the HCP area because tamarisk has invaded riparian areas of the New and Alamo Rivers. It is uncertain whether Jacumba little pocket mice would use these areas.

Proposed Project Area Occurrence

While potential habitat does occur in the area, the known range of the Jacumba little pocket mouse does not extend into the proposed project area.

20198

Colorado River Hispid Cotton Rat (*Sigmodon arizonae plenus*)

Range and Distribution

The Colorado River hispid cotton rat occurs in the vicinity of the Colorado River and its tributaries in southeastern California. In Arizona, it occurs along the Colorado River from Parker to Ehrenberg (Hoffmeister, 1986). One additional locality has been reported in Nevada, along the Nevada-California border (Hall, 1946); however, populations once occurring in Nevada are now thought to be extinct (Hall, 1946; Bradley 1966). The distributional limits of the Colorado River cotton rat have not been established, and the southern limits of its range are not known (Hafner et al., in press). McKernan (unpublished data) has provided records for this species at Topock Marsh, Parker Dam, near Parker, Arizona; on the Colorado River Indian Tribe (CRIT) Reservation north of the Palo Verde Division Dam, near Blythe, California; and on and near Cibola National Wildlife Refuge. The dates of these observations range from 1974 to 1998.

Population Status

The population status and reasons for decline of this species are not well understood. The Colorado River hispid cotton rat has a limited range and occurs along an area of the river that is subject to a number of human disturbances. Agricultural and urban development, draining of wetlands, livestock grazing, and water diversion proposed projects have probably all contributed to the species' decline. The Colorado River hispid cotton rat is a federal and California state species of concern.

Habitat Requirements

This species primarily occurs in grassland and mixed grassland/scrub habitats but may also occur in agricultural fields. It is most common in grassland and cropland habitats near water (Fleharty and Mares, 1973; Kaufman and Fleharty, 1974), including grass-forb understories in early successional stages of other habitats (McClenaghan and Gaines, 1978). Tall, dense grass is preferred. The species also occurs in overgrown clearings and herbaceous borders of fields and brushy areas (Hall and Dalquest, 1963). Trapping success for this subspecies occurs most often in areas dominated by common reed (Zimmerman, pers. comm.). Runways are made through dense herbaceous growth and are similar in appearance to vole runways but much larger. The hispid cotton rat sometimes feeds on sugar beets, citrus, and other crops. Nests of woven grass are constructed either in burrows or on the surface (Baar et al., 1974).

Habitat in the Proposed Project Area

Habitat for this species is widespread throughout the proposed project area. Irrigated agricultural fields of alfalfa, wheat, sudangrass, and sugar beets provide suitable habitat for the cotton rat. Many drainages and ditches adjacent to agricultural fields include dense patches of common reed, a habitat known to be used by this species.

Proposed Project Area Occurrence

Habitat and historical records for this species occur in the proposed project area (SSA and Reclamation, 2000). Populations have also been reported near the Colorado River, a few miles above the Laguna Dam and near Bard. Establishment of cotton rats in the Imperial Valley was apparently in response to agricultural irrigation practices (Dixon, 1922).

Yuma Hispid Cotton Rat *(Sigmodon hispidus eremicus)*

Range and Distribution

The Yuma hispid cotton rat is known from Yuma County, Arizona; Imperial County, California; and northern Baja California, Mexico (Hall, 1981; Hoffmeister, 1986). The distributional range of the Yuma hispid cotton rat has increased as agricultural development has expanded along the LCR (Hafner et al., in press).

Population Status

The status of Yuma hispid cotton rat populations is unknown. It is believed this species has adapted to agricultural conditions along the LCR and expanded its range. The Yuma hispid cotton rat is a federal and California state species of special concern.

Habitat Requirements

Hispid cotton rats occupy moist, grassy habitats where they cut runways through the grass. Hoffmeister (1986) indicates that cotton rats in Yuma County have been found mostly along the Colorado River and adjacent sloughs in brushy areas. Cotton rats have been reported from habitats vegetated with common reed, arrowweed, and cattails. Agricultural fields, especially Bermuda grass farms, also provide habitat (Hoffmeister, 1986). Hispid cotton rats eat many grasses and forbs and are more vegetarian than most native mice (Jameson and Peeters, 1988). The Yuma hispid cotton rat has benefited from the expansion of irrigated fields and shown success in utilizing agricultural areas. (Zimmerman, pers. comm.). Yuma hispid cotton rats prefer tall, dense grasses close to water. The AAC may serve as a dispersal corridor for cotton rats to move from the LCR into the Imperial Valley.

Habitat in the Proposed Project Area

Potentially suitable habitat for the Yuma hispid cotton rat is abundant throughout the proposed project area. Irrigated agricultural fields of Bermuda grass, alfalfa, wheat, sudangrass, and sugar beets provide suitable habitat for the cotton rat. Many drainages and ditches adjacent to agricultural fields include dense patches of cattails, arrowweed, and common reeds.

Proposed Project Area Occurrence

Dixon (1922) reported this species in the Imperial Valley earlier this century, and the subspecies is commonly found along roadsides adjacent to alfalfa and clover fields (Zimmerman, pers. comm.).

Nelson's Bighorn sheep (*Ovis canadensis nelsoni*)

Range and Distribution

Bighorn sheep are well distributed in the mountainous regions of North America from Canada to Mexico. The desert subspecies (*O. c. nelsoni*) is found in the mountainous desert regions of Utah, Nevada, Arizona, and California south into Mexico.

Population Status

Historic hunting, disease introduced from domestic sheep, and competition from domestic livestock resulted in dramatic declines in big horn sheep populations throughout the 1800s. While hunting was banned in the early 1900s, poaching continues to threaten the survival of this species. It is estimated that 90 percent of the historic population has been eliminated, and recovery has been slow (Banfield, 1974; Darymple, 1985; Geist, 1979; and Nowak and Paradiso, 1983). The Nelson's big horn sheep is a federal species of concern.

Habitat Requirements

Habitats used by bighorn sheep include alpine dwarf-shrub, low sage, sagebrush, bitterbrush, pinyon-juniper, palm oasis, desert riparian, desert succulent shrub, desert scrub, subalpine conifer, perennial grassland, montane chaparral, and montane riparian (DeForge, 1980; Monson and Sumner, 1980; Wehausen, 1980). Bighorn sheep graze and browse on a wide variety of plant species; green, succulent grasses and forbs are preferred; and browse is important all year, especially for populations in arid habitats. Some populations use mineral licks, and some may be limited by phosphorus. Bighorn sheep feed in open habitats, such as rocky barrens, meadows, and low, sparse brushlands (Dunaway, 1972; Monson and Sumner, 1980; Wehausen, 1980; Ginnett and Douglas, 1982; and Lawson and Johnson, 1982); they use rocky, steep terrain for escape and bedding. Steep, rugged slopes and canyons are used for lambing areas (Wehausen, 1980). Water is critical in arid regions.

Habitat in the Proposed Project Area

No suitable habitat occurs in the proposed project area. While desert scrub habitat does occur, there are no adjacent mountainous regions to offer escape and breeding habitat. In addition, the desert scrub habitat in the proposed project areas occurs in proximity to significant human activity, such as offroad vehicle recreation sites and major highways.

Proposed Project Area Occurrence

Approximately 120 Nelson's bighorn sheep are known to inhabit area the Chocolate Mountains (CDFG, 1999b). There is, however, no suitable habitat in the proposed project area for bighorn sheep, and, given the sensitivity of this species to human disturbance, their occurrence is unlikely.

Plants

Algodones Dunes Sunflower (*Helianthus niveus* ssp. *tephrodes*)

Range and Distribution

The Algodones Dunes sunflower occurs in southwestern Arizona, the Southern Sonoran Desert of Imperial County, California, and northern Mexico. In California, it is restricted to the Algodones Dunes. The main distribution of this species is in the Algodones Dunes system in California and, secondarily, in the Yuma dunes in Arizona. Although these stands may not be large in terms of numbers of individuals, they are potentially significant in maintaining genetic flow between populations of this subspecies in California and Arizona.

Population Status

This subspecies is naturally limited throughout its range by the availability of suitable dune habitat and is considered rare throughout its range. It occurs on the Barry M. Goldwater Air Force Range in Arizona (USFWS, 1992), where it may be threatened by military activities. In California, this species is threatened primarily by offroad vehicles (Skinner and Pavlik, 1994).

Habitat Requirements

The Algodones Dunes sunflower is restricted to active sand dunes or sandy desert areas, typically below 700 feet in elevation, and is also found in association with creosote bush scrub.

Habitat in the Proposed Project Area

Potential habitat occurs where the AAC traverses the Sand Hills and Algodones Dunes.

Proposed Project Area Occurrence

On the Sand Hills, it is generally found only on the central axis of the dunes. During the 1984 surveys, a total of 885 plants was found evenly distributed along the survey area between Interstate 8 and Drop 1 along the north side of the AAC (Reclamation and IID, 1994). No plants were observed along the AAC corridor to the east of Interstate 8.

Giant Spanish Needle (*Palafoxia arida* var. *gigantea*)

Range and Distribution

The giant Spanish needle occurs in southwestern Arizona, southeastern California, and northeastern Baja California, Mexico. In Arizona, this variety is currently known only in the vicinity of Yuma. In California, it is restricted to southeastern Imperial County, where it is found primarily in the Algodones Dunes system. In Baja California, it has been noted in sand dunes along or near the international border with California.

Population Status

The giant Spanish needle is naturally limited throughout its range by the availability of suitable dune or sandy habitat. While it is not considered endangered, potential threats to the populations include military activities; offroad vehicle use; habitat degradation; and direct impacts resulting from highway improvements, utility corridors, and quarry and stockpile operations.

Habitat Requirements

The giant Spanish needle is restricted to active or stable sand dunes or sandy desert areas, typically below 350 feet, and is also found in association with creosote bush scrub.

Habitat in the Proposed Project Area

Potential habitat occurs where the AAC traverses the Sand Hills and the Algodones Dunes.

Proposed Project Area Occurrence

The giant Spanish needle occurs primarily in the Algodones Dunes system. As part of the AAC Lining Proposed Project, a 600-foot-wide corridor along the portion of the AAC that passes through the Algodones Dunes was surveyed for special-status plant species (Reclamation and IID, 1994). These surveys identified 2,908 individuals in the corridor to the west of Interstate 8, and 787 individuals were found east of Interstate 8.

Orcutt's Aster *(Xylorhiza orcuttii)*

Range and Distribution

Orcutt's aster occurs in Imperial, Riverside, and San Diego Counties in California and Baja California, Mexico.

Population Status

Orcutt's woody aster is considered extremely rare because of limited populations. The plant is considered endangered in parts of its range; however, many of the known populations lie within Anza-Borrego State Park boundaries and are well protected. Populations are presumed stable on the southern deserts.

Habitat Requirements

Orcutt's aster occurs primarily in Sonoran creosote scrub habitats in rocky canyons and sandy washes at elevations between 65 and 1,200 feet. Generally, this species has been observed in areas with little shrub cover.

Habitat in the Proposed Project Area

This species is associated with creosote scrub. The only portion of the HCP area that supports this plant community is the right-of-way of IID along the AAC.

Proposed Project Area Occurrence

No plants have been observed in the proposed project area, although potential habitat exists. The nearest known populations are in Anza-Borrego Desert State Park to the west of the HCP area.

Foxtail Cactus *(Escobaria vivipara var. alversonii)*

Range and Distribution

The foxtail cactus occurs in the Sonoran and southern Mojave deserts of Arizona and California. In California, it occurs along the border between the Mojave and Colorado Deserts in Riverside, San Bernardino, and Imperial Counties.

Population Status

The current population status of the foxtail cactus is not definitively known, although it has been reported as occurring in "large, healthy populations" throughout much of its range (Warren and Laurenzi, 1987). It appears to have a relatively restricted geographic distribution, and populations have been affected primarily by horticultural collecting.

Habitat Requirements

The foxtail cactus occurs in both sandy and rocky areas but seems to prefer heavy, rocky soils with decomposing granite or basalt and is often found on basalt between 250 and 5,000 feet in elevation. It may also occur in association with creosote bush scrub.

Habitat in the Proposed Project Area

Potential habitat occurs in the creosote scrub habitat along the AAC and Coachella Canal and potentially in scrub habitat adjacent to the Salton Sea between the higher rock hillsides and the more saline desert saltbrush community.

Proposed Project Area Occurrence

While no plants have been observed in the proposed project area, this variety is known from upland habitats primarily west of the LCR. At least one population occurs in the vicinity of the Palo Verde Dam quarry site.

Munz's Cactus (*Opuntia munzii*)

Range and Distribution

Munz's cactus occurs in the Sonoran Desert where the species occurrences are primarily from the Chocolate and Chukwalla Mountains in Riverside and Imperial Counties.

Population Status

This species is endemic to California and considered extremely rare, with only a few known small populations. Due to the general inaccessibility of the habitats, the plant is not considered endangered, and no current threats have been identified.

Habitat Requirements

Munz's cactus grows at elevations between 500 and 2,000 feet in sandy or gravelly soils found in washes and along canyon walls associated with creosote scrub.

Habitat in the Proposed Project Area

This species is associated with creosote scrub. The only portion of the HCP area that supports this plant community is the right-of-way of IID along the AAC.

Proposed Project Area Occurrence

No plants have been reported to occur in the proposed project area. Known locations for this species are primarily washes below the Chocolate Mountains along the eastern edge of the Imperial Valley.

Flat-Seeded Spurge (*Chamaesyce platysperma*)

Range and Distribution

The flat-seeded spurge is generally restricted to Southern California occurring in Imperial, San Diego, Riverside, and San Bernardino Counties. Rare occurrences outside California have been reported from Arizona and Sonora, Mexico.

Population Status

The present status of this species is poorly known. Population occurrences are typically highly restricted, but presumably stable. The Coachella Valley has been heavily impacted in recent years; however, lack of sufficient collection data precludes determination of the effects on this species (Reiser, 1994).

Habitat Requirements

The flat-seeded spurge is an annual herb found on sandy flats, dunes, and in creosote bush scrub. It flowers from February to September and is undetectable during other times of the year or in years when environmental conditions are less than optimum.

Habitat in the Proposed Project Area

This species is associated with creosote scrub. The only portion of the HCP area that supports this plant community is the right-of-way of IID along the AAC.

Proposed Project Area Occurrence

While potential habitat is present in the proposed project area, no plants have been observed.

Wiggin's Croton (*Croton wigginsii*)

Range and Distribution

Wiggin's croton occurs in the southwest portion of Imperial County, Arizona, and Baja California and Sonora, Mexico.

Population Status

Occurrences of Wiggin's croton in California are confined to several populations, some of which may be endangered. Outside California, the plant is more common and widespread.

Habitat Requirements

Wiggin's croton is a woody shrub that occurs primarily in stable and active dunes, and sandy washes at elevations ranging from 160 to 350 feet. Although less common, it also occurs on sandy sites in the Sonoran Desert creosote scrub habitat. Like all croton species, Wiggin's croton prefers areas with sandy and/or loose soils.

Habitat in the Proposed Project Area

Potential habitat for Wiggin's croton in the HCP area occurs in the creosote scrub and dune habitats along the AAC.

Proposed Project Area Occurrence

In California, Wiggin's croton occurs in the Algodones Dunes in the Sand Hills system. As part of the AAC Lining Proposed Project, a 600-foot-wide corridor along the portion of the AAC that passes through the Algodones Dunes was surveyed for special-status plant species (Reclamation and IID, 1994). These surveys identified 1,447 individuals in the corridor to the west of Interstate 8, and 43 individuals were found east of Interstate 8.

Results of the 1993 surveys indicated occurrences of this species in the high dune system as well as isolated populations in the smaller dunes. A total of 338 individuals was observed in the proposed canal right-of-way. Wiggin's croton was also observed south of Power Drop Station No. 1 between transmission poles 8191 and 8178 (Reclamation and IID, 1994).

Peirson's Milk-Vetch *(Astragalus magdalenae var. peirsonii)*

Range and Distribution

The current distribution of Peirson's milk vetch is thought to be restricted to the Algodones Dunes in Imperial County, California; northeastern Baja California; and the Gran Desierto in Sonora, Mexico. The historic occurrence reported from the Borrego Valley in San Diego County, California, has not been observed for several decades and is presumed to have been extirpated (USFWS, 1998).

Population Status

Peirson's milk-vetch is currently state and federally listed as endangered. The species' population is believed to be declining (CDFG, 2000). Approximately 25 percent of the known populations are in the North Algodones Dunes Wilderness, managed by the Bureau of Land Management. The remaining populations continue to be threatened by offroad vehicles, grazing and trampling by livestock and feral burros, trampling by recreational users, competition from non-native plants, urban development, construction related to fisheries development, and alteration of soil hydrology.

Habitat Requirements

Peirson's milk-vetch is a short-lived perennial that occurs on the slopes and hollows of well developed dune systems at elevations between 150 and 800 feet. It is adapted to habitats with specific substrate or hydrologic conditions that occur as inclusions within creosote bush scrub or sagebrush dominated communities.

Habitat in the Proposed Project Area

Potential habitat occurs in the creosote scrub and dune habitats along the AAC.

Proposed Project Area Occurrence

In the Algodones Dunes area, Peirson's milk-vetch tends to grow in the west and central portions of the dunes. During the 1984 surveys, 1,422 plants were found in the sand dune habitat between Interstate 8 and Drop 1 of the AAC (Reclamation and IID, 1994). Results of the 1993 surveys found more than 1,300 individuals within a 1-mile reach of the proposed canal right-of-way in the high dunes area (USFWS, 1996b).

Sand Food *(Pholisma sonorae)*

Range and Distribution

The sand food occurs scattered in a roughly 3,900-square-mile area that includes habitat surrounding the Gulf of Mexico in southwestern Arizona, the Sonoran Desert of California, northeastern Baja California, and northwestern Mexico. In Arizona, the species occurs in Southern Yuma County along the U.S.-Mexico boundary. In California, it occurs in southeastern Imperial County, in or near the Algodones Dunes. Its southernmost extent is Bahia Adair on the Sea of Cortez coast of Sonora, Mexico.

Population Status

Considered rare throughout its range, this species is naturally limited by the availability of suitable habitat and host plants. Both habitat and host plants have been reduced in extent or degraded by a variety of land uses, including military maneuvers, recreational vehicles, agriculture, bulldozing and clearing of native dune vegetation, litter, and invasion of dunes by nondune species, (AGFD, 1998d; CDFG, 1999b; Yatskievych, 1994; and Nabhan, 1980).

Habitat Requirements

The sand food is a perennial root parasite that lacks chlorophyll and occurs on sand dunes or in sandy areas in association with creosote bush scrub below 650 feet. It is parasitic on dune buckwheat, Palmer coldenia, plicate coldenia, white bursage, and arrowweed (Yatskievych, 1994; Hickman, 1993; and Yatskievych and Mason, 1986).

Habitat in the Proposed Project Area

Potential habitat occurs in the creosote scrub and dune habitats along the AAC.

Proposed Project Area Occurrence

Major populations of this species are found in the Algodones Dunes system. As part of the AAC Lining Proposed Project, a 600-foot-wide corridor along the portion of the AAC that passes through the Algodones Dunes was surveyed for special-status plant species (Reclamation and IID, 1994). These surveys identified 208 individuals in the corridor to the west of Interstate 8, and 363 individuals were found east of Interstate 8.

Orocopia Sage (*Salvia greatae*)

Range and Distribution

Endemic to southeastern California, orocopia sage occurs in San Bernardo, Riverside, and Imperial Counties. The largest known populations occur in the Orocopia Mountains to the Chocolate Mountains, in Riverside County.

Population Status

Orocopia sage is a federal species of concern and is considered extremely rare throughout its range but not endangered. Threats to this species have not been identified.

Habitat Requirements

Orocopia sage occurs in creosote bush scrub, in desert dry washes, on alluvial fans, and woodlands below 590 feet.

Habitat in the Proposed Project Area

Potential habitat occurs only in the creosote scrub and dune habitats along the AAC.

Proposed Project Area Occurrence

There are no known occurrences of this species in the proposed project area. Most of the suitable habitat is found north and east of the proposed project area.

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20228

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APPENDIX B

Methodology for Characterizing Vegetation in the IID Drainage System

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Methodology for Characterizing Vegetation in the IID Drainage System

A comprehensive survey of vegetation in the IID drainage system will be conducted. The survey will collect data necessary to quantify the amount and type of vegetation supported in the drainage system. The survey will be conducted by teams of two people. Prior to initiating the surveys, field personnel will be instructed in field techniques and data collection to ensure consistent characterization among crews.

Standard Methodology

The entire drainage system will be surveyed. For each drain, vegetation will be characterized starting at the upstream end of the drain and moving downstream. Crossings occur at regular intervals of about 0.5 miles along every drain (Figure B-1). Vegetation will be characterized by drain segment, with a segment defined as that portion of the drain between two crossings.

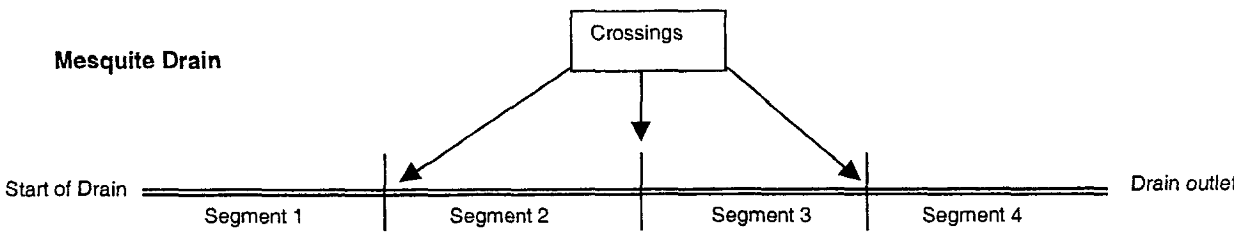


FIGURE B-1
Schematic of Drain Showing Crossings and Designations of Segments for Vegetation Characterization

In each segment, the following measurements, indicated on Figure B-2, will be taken:

- The top width of the drain, including overburden
- The projected (i.e., horizontal) width of the vegetation in the drain, including the width of the water surface
- The width of the water surface

The actual width of the vegetation will be developed from these measurements after field data collection. Because the width of the vegetation can vary along the length of the drain segment, the vegetation width measurement will reflect where the vegetation is concentrated and will not include small "pockets" of vegetation that occur sporadically on the banks of the drain. In addition, the height of the overburden will be estimated.

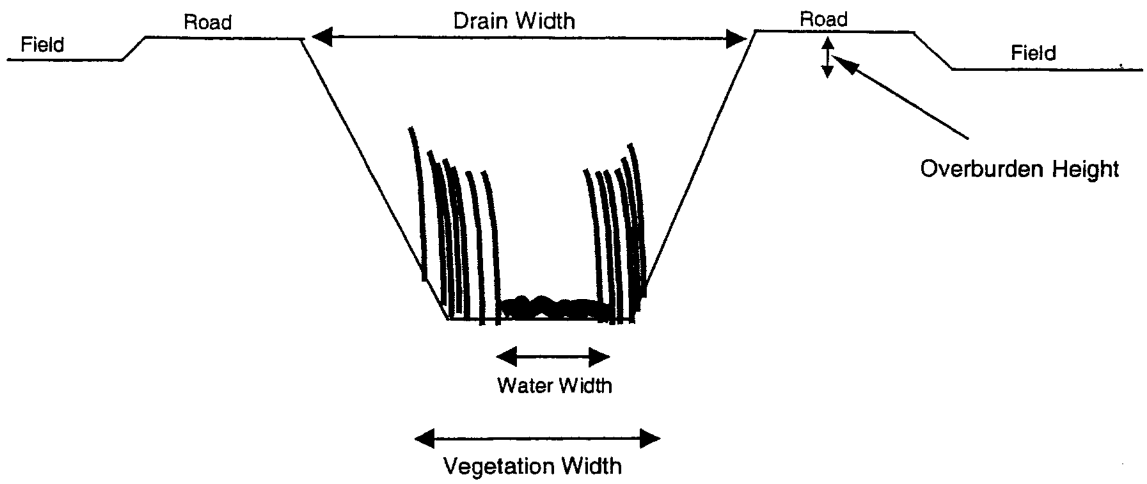


FIGURE B-2
Schematic of Drain Showing Data to be Collected

Vegetation can occur on the drain banks, in addition to the bottom of the drain. The vegetation width will be measured as the horizontal distance or projection rather than the slope distance covered by vegetation. Measuring vegetation width as the slope distance covered by vegetation was considered but not pursued for the following reasons. First, habitat created under the HCP would be higher quality than the habitat in the drains, thus, compensating for any underestimation in the amount of vegetation resulting from using the horizontal distance rather than the slope distance to estimate the amount of habitat. Second, some portions of the drains could be inaccessible and may require using aerial photography to determine the amount of vegetation. If aerial photography is used, the acreages generated would reflect a horizontal distance rather than a slope distance. To ensure consistency in the event that aerial photography is necessary to delimit certain areas of vegetation for this survey (or future surveys), vegetation width will be measured as the horizontal distance.

The total percent coverage of vegetation will be classified, according to the California Native Plant Society system (Table B-1). In estimating the percent coverage, the area covered by water will be excluded so the estimate reflects the density of the vegetation along the banks. Within the vegetated area (i.e., that portion of the drain covered by vegetation [vegetation width – water width]), the plant species composition will be characterized by identifying the plant species present and assigning a vegetation cover class, according to Table B-1. Plant species likely to occur in the drains that will be individually identified are listed in Table B-2. The percent coverage of herbaceous plants not listed in Table B-2 will be addressed collectively as "Herbaceous." Additional plant species of importance to wildlife could be encountered during the field surveys; such species will be individually identified and added to Table B-2. Dead or senescent vegetation will be included in estimating the total percent coverage and species composition.

TABLE B-1
Vegetation Cover Classes

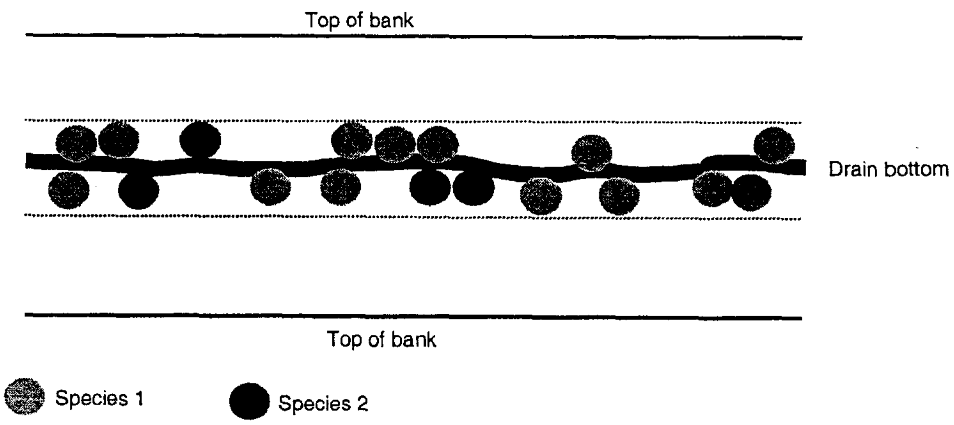
Class	Percent Coverage
1	≤ 1
2	> 1 – 5
3	> 5 – 25
4	> 25 – 50
5	> 50 – 75
6	> 75 – 100

TABLE B-2
Plant Species for Which Percent Coverage Will Be Individually Classified

Atriplex spp. (saltbush)	*Prosopis* spp. (mesquite)
Carex spp. (sedge)	*Rumex crispus* (curly dock)
Juncus spp. (rush)	*Salix* spp. (willow)
Larrea tridentata (creosote bush	*Scirpus* spp. (bulrush)
Phragmites communis (common reed)	*Suaeda torreyana ramosissima* (iodine bush)
Pluchea sericea (arrowweed)	*Tamarix* spp. (salt cedar)
Polygonum spp. (smartweed)	*Typha* spp. (cattail)

EXAMPLE

Total percent coverage: Class 5 (>50 – 75%)
Plant Species 1: Class 6 (>75–100%)
Plant Species 2: Class 3 (>5-25%)



In addition to the quantitative information on vegetation, the field crew will note the following information:

- Presence of aquatic vegetation
- Dead vegetation
- Indication of recent maintenance activities (e.g., herbicide application, mechanical cleaning)

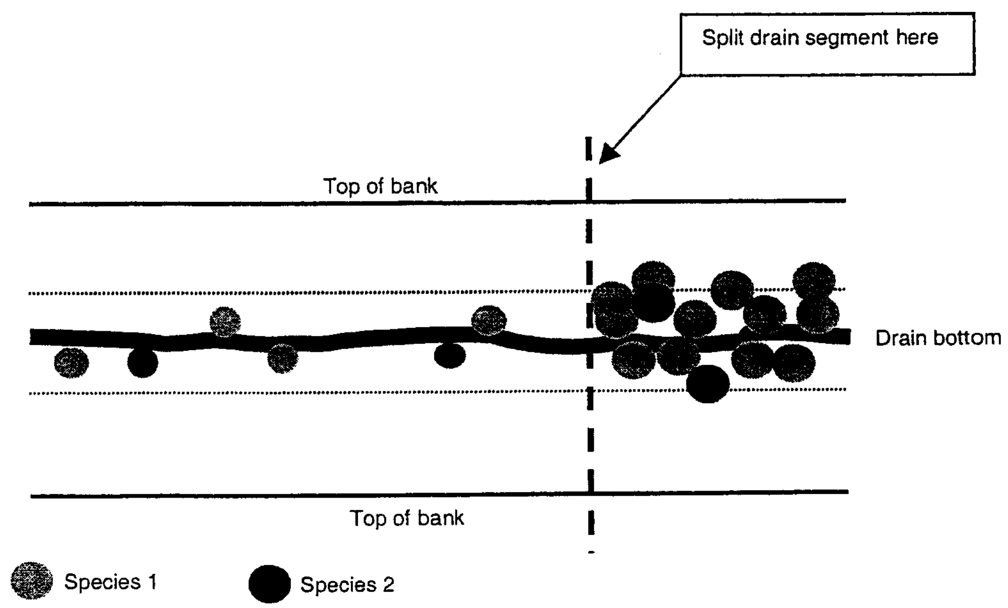
Although the focus of the survey is to characterize the vegetation, the field crews also will note covered species in or along the drains.

Special Conditions Methodologies

Most of the drains have vegetation consisting of one or two plant species in a narrow band along the water's edge for most of the length of the segment. However, some drains have a more complex vegetation pattern. Two special conditions were identified during a field visit to develop the survey protocol. First, along some drains, the type and extent of vegetation can vary substantially along the segment length. Second, vegetation in the drain can exist as two distinct bands, with dense emergent vegetation on the bottom of the drain and more xeric species on the drain banks. The following describes the approach to characterizing vegetation in these two circumstances. These techniques will be used only where there are clear, distinct, and large differences in plant species composition or percent coverage.

Condition 1: Variable Vegetation Along Segment Length

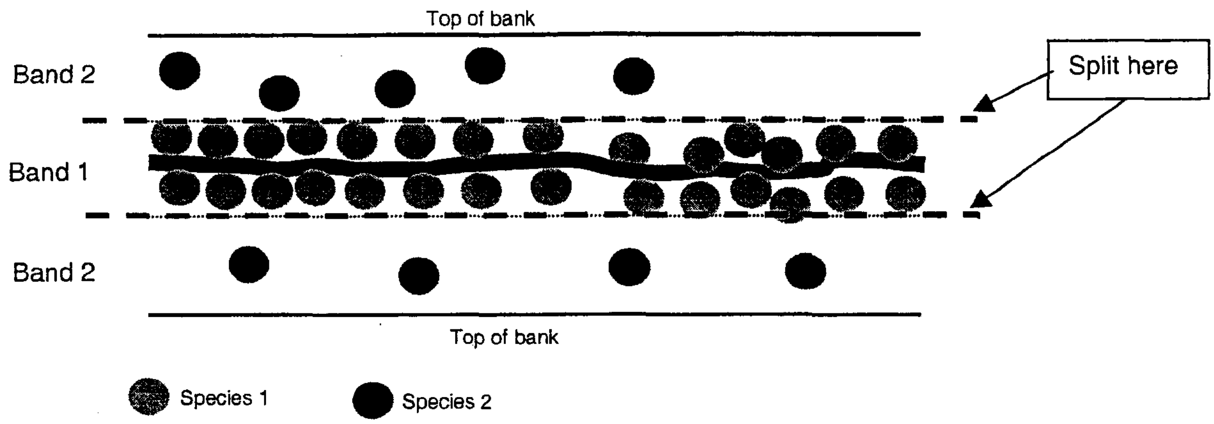
Along some drains, the density or width of the vegetation can change abruptly, as shown schematically. In this case, the drain segment will be split into two subsegments and the vegetation characteristics quantified individually for each subsegment. The subsegments will be distinguished with a letter (e.g., Mesquite Drain Segment 1a and 1b). The location of the split will be designated through Global Positioning System coordinates or as a distance from the nearest crossing.



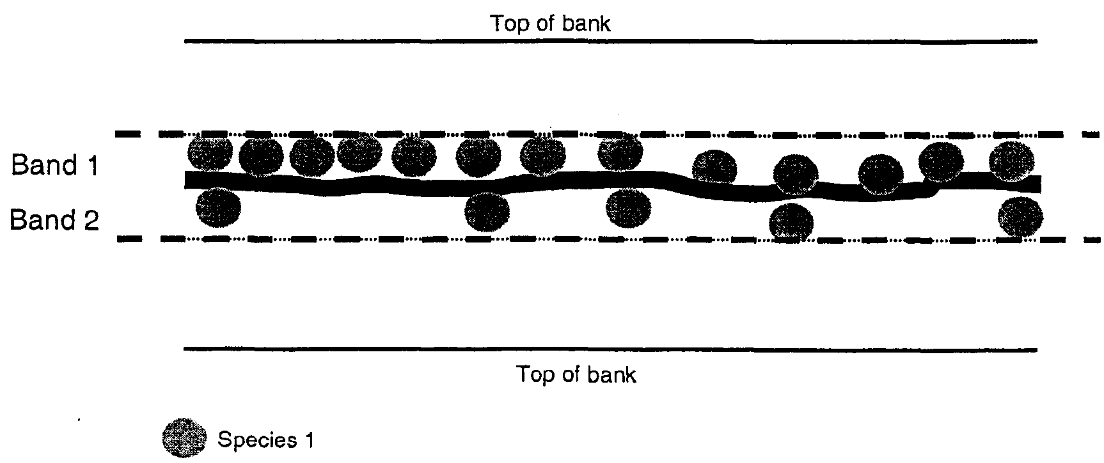
20235

Condition 2: Two or More Distinct Vegetation Bands

Along some drains, two distinct bands of vegetation with different species composition and percent coverage occur. This condition is illustrated subsequently. In this case, the vegetation will be split into two bands and the vegetation characteristics quantified. The band flanking the water will be referred to as Band 1, with the band occurring higher on the drain bank referred to as Band 2. Typically, the vegetation characteristics of Band 2 will be the same on both sides of the drain and; therefore, will be combined in estimating the width and percent coverage.



Vegetation flanking the water, but on opposite sides of the water, could substantially differ in terms of percent coverage as illustrated below. If the percent coverage of the vegetation differs by more than 50 percent between the two sides, the vegetation flanking the water will be split into two bands as shown. The side with the highest percent coverage will be designated Band 1, and vegetation width will be measured as the width of the vegetation in Band 1 plus the water width. The vegetation on the opposite bank will be designated Band 2, and its width and percent coverage estimated as described previously.



20236

APPENDIX C

Species-Specific Avoidance and Minimization Measures for Construction Activities in Desert Habitat

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Species-Specific Avoidance and Minimization Measures for Construction Activities in Desert Habitat

Desert Tortoise

- If a tortoise occurs on the project site during construction, construction activities adjacent to the tortoise's location will be halted and the tortoise allowed to move away from the construction site. If the tortoise is not moving, the biological monitor will relocate it to nearby suitable habitat outside the construction area. The tortoise will be placed in the shade of a shrub.
- Prior to construction, the construction area and adjacent areas within 100 feet of the construction site will be searched for burrows that could be used by desert tortoise. When burrows are found, they will be checked for desert tortoise. Both occupied and unoccupied burrows will be flagged and avoided (employing a 50-foot buffer) during construction. If an occupied burrow cannot be avoided, it will be excavated and the tortoise relocated to an unoccupied burrow outside the construction area that is approximately the same size as the one from which it was removed. If an existing burrow is unavailable, the biologist will construct or direct the construction of a burrow of similar shape, size, depth, and orientation as the original burrow. Desert tortoises moved during inactive periods will be monitored for at least two days after placement in the new burrows to ensure their safety. All desert tortoise handling and burrow excavation will be in accordance with handling procedures developed by the USFWS and conducted by an authorized biologist.
- Any construction pipe, culverts, or similar structures with a diameter of 3 to 12 inches that are stored on the construction site for one or more nights will be inspected for tortoises before the material is moved, buried, or capped. Alternatively, all such structures may be capped before being stored on the construction site.
- Trench segments or other excavations will be fenced with temporary tortoise-proof fencing, covered at the close of each working day, or provided with tortoise escape ramps. All excavations will be inspected for tortoises prior to filling.
- Construction activities will be conducted only between dawn and dusk.
- A clearance survey will be conducted within 48 hours prior to the start of construction activities. Desert tortoise found on the construction site will be relocated to nearby suitable habitat outside the construction area.

Colorado Desert Fringe-toed Lizard and Flat-tailed Horned Lizard

- A clearance survey will be conducted within 48 hours prior to the start of construction activities. Colorado Desert Fringe-Toed Lizards (CDFLs) and Flat-Tailed Horned Lizards (FTHL) found on the construction site will be relocated to nearby suitable habitat outside the construction area.
- Construction areas will be examined hourly for the presence of CDFLs and FTHLs when surface temperatures exceed 30 degrees Celsius and construction activities are occurring.
- If a CDFL or FTHL occurs on the project site during construction, construction activities immediately adjacent to the lizard's location will be halted and the lizard allowed to move away from the construction site. If the lizard is not moving, the biological monitor will capture and relocate the lizard. Relocated lizards will be placed in the shade of a shrub. If the surface temperature in the sun is less than 30 degrees Celsius or greater than 50 degrees Celsius, the lizard will be held for later release. Initially captured CDFLs or FTHLs will be held in a cloth bag, cooler, or other appropriate clean dry container. Lizards will be maintained at temperatures between 25 and 35 degrees Celsius and will not be exposed to direct sunlight. Release will occur as soon as possible after capture and during daylight hours when the surface temperatures range from 32 to 40 degrees Celsius.
- Trenches, holes, or other excavations will be examined for these two lizards prior to filling. If lizards are found, they will be relocated by the biological monitor to nearby suitable habitat.

Western Chuckwalla

- A clearance survey will be conducted within 48 hours prior to the start of construction activities. Western Chuckwallas found on the construction site will be relocated to nearby suitable habitat outside the construction area.
- If a chuckwalla occurs on the project site during construction, construction activities adjacent to the individual's location will be halted and the individual allowed to move away from the construction site. If the individual is not moving, the biological monitor will relocate it to nearby suitable habitat outside the construction area. It will be placed in the shade of a shrub.
- Prior to construction, the construction area and adjacent areas within 100 feet of the construction site will be searched for burrows that could be used by western chuckwalla. If potentially suitable burrows are found, they will be checked for occupancy. Occupied burrows will be flagged and avoided (employing a 50-foot buffer) during construction. If the burrow cannot be avoided, it will be excavated and the occupant relocated to an unoccupied burrow outside the construction area and of approximately the same size as the one from which it was removed. If an existing burrow is unavailable, the biologist will construct or direct the construction of a burrow of similar shape, size, depth, and orientation as the original.

- Trenches, holes, or other excavations will be examined for these species prior to filling. If individuals are found, the biological monitor will relocate them to nearby suitable habitat.

Couch's Spadefoot Toad

- Based on the baseline habitat and species surveys and the preconstruction surveys, water sources used by Couch's Spadefoot Toad will be identified. If construction activities occur within 0.6 miles of water sources used by Couch's Spadefoot Toads, construction activities will be conducted only between dawn and dusk.
- If water sources used by Couch's Spadefoot Toads occur on or within 500 feet of the construction site, a 500-foot buffer will be established around the water source. The buffer will be staked and flagged. No construction activities will be permitted within the buffer.
- If the water source cannot be avoided and would be permanently lost as a result of construction, IID will mitigate in accordance with Desert Habitat – 5.

Harris Hawk

- Prior to the start of construction activities, potential nesting habitat on the construction site and within 0.25 mile of the construction site will be surveyed to determine if Harris Hawks are nesting. If nesting Harris Hawks are found, a 0.25-mile buffer will be established around the nest site. The buffer will be staked and flagged. No construction activities will be permitted within the 0.25-mile buffer during February 1 to October 15 or until young have fledged. Vegetation within the 0.25-mile buffer may be removed after the young have fledged.

Elf Owl

- Prior to the start of construction activities, potential nesting habitat on the construction site and within 0.25 miles of the construction site will be surveyed to determine if Elf Owls are nesting. If nesting Elf Owls are found, a 0.25-mile buffer will be established around the nest site. The buffer will be staked and flagged. No construction activities will be permitted within the 0.25-mile buffer during April 1 to July 31 or until young have fledged. Vegetation within the 0.25-mile buffer may be removed after the young have fledged.

Loggerhead Shrike, Le Conte's Thrasher, and Crissal Thrasher

- Prior to the start of construction activities, potential nesting habitat for these species on the construction site and within 500 feet of the construction site will be surveyed to determine if any are nesting. If nesting shrikes or thrashers are found, a 500-foot buffer will be established around the nest site. The buffer will be staked and flagged. No construction activities will be permitted within the buffer during the species-specific breeding periods as follows:

- Loggerhead shrike: February 1 through July 31 or until young have fledged
- Crissal thrasher: February 1 through June 30 or until young have fledged
- Le Conte's thrasher: January 15 through June 15 or until young have fledged

Vegetation within the 500-foot buffer may be removed after the young have fledged.

Pierson's Milk-vetch, Algodones Dunes Sunflower, Wiggin's Croton, Giant Spanish Needle, and Sand food

- Prior to the start of construction activities, the construction area will be surveyed for the presence of covered plant species. Surveys will be conducted during the time period necessary to identify these species but will be conducted within one year of initiating construction activities.

If covered plant species occur on the construction area, an activity exclusion zone, 25 feet in radius, will be established around each individual. Exclusion zones will be flagged and staked in the field prior to the start of the construction. No surface disturbing activity will occur within the exclusion zones. If a 25-foot-radius exclusion zone cannot be established, IID will confer with the USFWS and CDFG regarding the best configuration of the exclusion zone, given the location of the plants and construction area requirements. If the plants cannot be avoided, IID will confer with USFWS and CDFG. The USFWS and CDFG will determine if the plants can be transplanted. If the plants can be transplanted, IID will work with USFWS and CDFG to identify a location and the appropriate procedures for transplanting those plants that cannot be avoided. If USFWS and CDFG determine that the plants would not survive transplanting, IID will acquire land that is occupied by the impacted plant species at a 1:1 ratio for the acreage impacted.

APPENDIX D

Procedures for Removing Burrowing Owls

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Procedures for Removing Burrowing Owls

Part of the Burrowing Owl Conservation Strategy includes ensuring that burrowing owls are absent from burrows prior to conducting specific activities that would fill or collapse the burrow. The HCP Implementation Biologist will follow one of the following four procedures to ensure that owls are absent from burrows that will be impacted.

Option 1

Prior to conducting the activities, the biologist will use a scope to determine if an owl is present in a burrow.

- If the burrow is unoccupied, the burrows will be made inaccessible to owls, and the activities may proceed.
- If the burrow is occupied, the biologist will install a one-way door to remove the owl from the burrow. The biologist will scope the burrow to confirm that the owl has vacated. After confirming that the owl has vacated the burrow, the burrow will be made inaccessible to owls.

Option 2

Prior to conducting the activities, the biologist will install a one-way door with a trap in burrows that would be impacted. The biologist will check the trap approximately every 4 hours until the owl is trapped. The owl will be relocated to suitable habitat; the burrows will be made inaccessible to owls.

Option 3

At least 3 days before conducting the activities, the biologist will install a one-way door in burrows that would be impacted. Prior to conducting the activities, the biologist will use a scope to verify that burrows are vacant. After confirming that the owl has vacated the burrow, the burrow will be made inaccessible to owls.

Option 4

The HCP Implementation Biologist may use any other procedure approved by the HCP Implementation Team for ensuring that owls are not present in burrows.

APPENDIX E

Cropping Patterns in the Imperial Valley 1974-2000

Table E-1

Acreages of Crops in the Imperial Irrigation District During 1974 - 2000

Crops with Less than 1,000 Acres Not Shown

Crop	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Broccoli	710	773	1,302	1,860	2,359	2,756	2,368	2,466	2,306	4,427	5,050	5,560	3,409	9,020	9,106	11,343	10,484
Cabbage	1,429	319	198	230	405	754	938	510	444	63	359	653	392	802	867	866	1,225
Carrots	6,385	5,988	7,572	4,394	6,489	9,211	7,666	6,755	8,917	7,402	10,053	13,361	8,736	12,976	11,678	11,874	12,682
Cauliflower	-	5	94	-	-	152	211	179	84	151	942	1,506	1,886	3,928	5,964	6,673	7,334
Ear Corn	273	4	273	297	1,052	620	127	2	658	510	809	1,238	364	1,639	3,006	1,724	1,822
Garbanzo Be	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Garlic	708	1,395	499	380	658	584	840	159	306	376	523	411	339	-	-	42	353
Lettuce	48,376	44,912	44,420	39,230	41,499	43,629	43,728	36,772	31,086	26,086	26,807	28,063	30,964	24,842	28,477	32,628	38,929
Cantaloupes	8,888	7,559	9,169	10,446	13,196	10,427	11,047	14,587	14,020	13,263	15,326	23,213	21,211	32,407	30,104	28,858	33,335
Honeydews	148	842	655	985	1,470	1,362	755	1,804	2,917	1,434	2,325	1,160	920	2,562	1,430	2,150	2,948
Watermelon:	1,573	2,472	1,964	3,146	1,022	3,136	3,215	3,917	5,354	4,972	4,656	5,057	2,757	4,786	4,113	3,830	3,234
Onions	6,273	7,509	4,539	4,605	6,917	6,970	5,498	5,739	10,013	7,248	7,887	6,802	8,192	9,133	10,217	8,903	10,125
Onions (See	1,469	1,248	1,701	1,769	1,866	2,449	2,440	3,232	2,371	2,886	1,715	1,382	1,853	1,736	1,483	2,261	3,339
Potatoes	-	-	-	-	-	-	-	-	-	-	-	-	-	20	80	152	177
Rapini	280	259	189	110	149	170	90	305	156	184	123	46	46	146	191	505	479
Spinach	-	-	-	-	-	-	-	30	-	16	48	55	55	-	-	85	191
Squash	970	1,287	1,272	971	1,105	1,112	1,358	1,471	1,286	797	1,009	549	391	694	467	206	216
Tomatoes	2,909	5,736	3,621	4,355	3,281	3,215	1,713	3,433	3,071	2,822	4,604	4,441	3,194	3,482	5,128	13,208	11,416
Vegetables,	122	212	232	41	26	10	18	121	4	402	687	813	266	911	1,463	1,350	1,382
Alfalfa	155,608	158,784	168,637	176,328	178,120	187,609	187,205	171,745	202,180	205,138	216,687	208,498	218,890	190,250	183,462	166,732	190,808
Alfalfa (Seed	2,383	627	738	1,524	2,356	3,362	2,082	2,515	833	2,685	4,516	5,394	3,069	2,594	5,030	3,070	4,523
Alicia Grass	2,797	2,900	1,961	821	965	325	168	62	52	50	14	14	13	-	71	-	-
Barley	5,358	3,481	3,585	6,761	7,735	4,098	1,895	382	232	259	259	311	464	325	-	-	203
Bermuda Gr.	2,403	2,158	2,344	3,047	2,351	2,215	2,315	3,745	3,684	2,816	2,786	2,077	1,763	5,680	4,083	4,249	4,498
Bermuda Gr.	964	1,046	1,362	1,349	2,837	4,939	5,019	5,929	7,849	16,428	13,175	17,402	20,238	2,966	3,926	3,778	13,410
Cotton	78,808	43,000	66,792	138,118	61,740	82,757	83,376	80,076	42,217	18,079	27,316	20,744	18,977	22,791	20,760	9,568	11,014
Field Corn	-	-	-	-	484	-	-	-	-	294	388	1,232	471	223	272	142	210
Kleingrass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oats	1,002	275	148	780	182	511	271	39	717	274	464	372	533	1,046	472	4,806	2,602
Rape	46	-	-	-	-	-	-	-	-	267	-	-	-	-	-	-	-
Rye Grass	8,875	8,766	6,978	5,571	8,294	2,438	1,065	2,332	4,892	2,540	6,717	3,306	3,172	5,727	7,369	8,205	8,876
Sorghum Gr.	31,610	24,271	16,961	7,164	15,060	8,497	3,807	2,300	2,335	1,616	1,572	598	485	3	70	50	-
Soy Beans	-	-	-	87	3,338	3,092	38	91	181	-	5	-	78	120	-	144	-
Sudan Grass	14,450	13,047	26,155	6,566	11,761	23,732	20,587	22,122	8,013	10,410	24,311	15,202	10,527	24,914	34,509	48,792	41,482
Sudan Grass	-	-	-	-	75	-	-	-	-	228	115	76	-	153	-	342	1,055
Sugar Beets	69,108	71,425	73,813	59,789	36,459	47,784	36,861	43,929	37,607	39,525	38,102	37,340	34,048	41,504	41,099	29,163	41,508
Wheat	101,499	155,575	146,744	67,503	135,488	99,952	142,073	164,463	175,047	99,507	97,043	77,057	92,831	68,199	60,290	99,891	56,833
Asparagus	5,066	4,426	4,423	3,719	3,565	3,473	3,308	2,568	2,459	2,992	3,541	5,049	3,928	4,478	5,039	5,376	6,145
Citrus - Grap	657	600	546	442	368	295	295	294	444	464	353	520	329	417	690	688	688
Citrus - Lem	967	968	697	660	765	777	776	776	671	710	1,045	870	575	563	580	580	580
Citrus - Mixe	285	292	287	219	220	220	176	191	191	390	203	299	108	104	30	33	33
Citrus - Oran	444	409	401	380	354	334	334	369	353	356	355	355	335	325	402	402	472
Duck Ponds	7,020	6,809	7,106	7,635	7,213	7,178	7,768	8,064	8,169	12,908	8,866	8,904	9,157	7,940	7,763	7,819	7,863
Fish Farms	465	425	448	537	529	529	624	684	754	1,196	784	724	664	671	771	721	908
Guar Beans	-	-	-	-	-	-	-	299	1,892	-	-	18	-	-	-	-	-
Jojoba	-	-	-	2	2	2	2	508	3,062	3,005	3,005	3,005	2,844	2,119	2,117	2,117	2,117
Pasture, Per	556	997	1,802	729	277	457	300	312	386	449	473	550	545	527	498	501	599

Table E-1

Acreages o

Crops with

Crop	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Broccoli	9,543	8,889	64,069	6,406	5,926	6,311	6,480	9,589	12,305	10,916
Cabbage	1,431	1,077	1,511	1,483	757	710	966	1,126	1,441	877
Carrots	14,635	15,557	16,312	16,312	14,959	16,469	16,014	16,416	16,995	18,167
Cauliflower	6,087	6,237	3,755	3,755	2,762	2,776	2,553	3,313	3,960	3,642
Ear Corn	2,973	3,830	2,879	4,491	3,896	4,372	5,500	6,088	6,790	5,921
Garbanzo Be	-	-	-	-	75	1,211	1,034	51	1,057	108
Garlic	464	414	85	457	335	437	165	104	308	76
Lettuce	31,292	22,959	21,847	22,143	20,516	19,299	20,172	19,046	22,558	18,089
Cantaloupes	21,236	12,304	13,582	14,339	14,931	13,337	13,535	14,087	14,030	11,270
Honeydews	792	232	335	782	550	998	868	863	1,459	1,421
Watermelons	2,326	2,485	2,596	3,498	2,619	2,822	2,419	1,635	2,158	1,143
Onions	11,862	10,126	10,767	12,004	11,258	13,324	10,176	9,757	11,526	12,377
Onions (See	2,540	2,790	2,315	1,929	1,317	1,882	3,573	2,256	3,541	3,812
Potatoes	621	604	970	1,304	1,923	2,538	2,784	2,622	3,159	2,775
Rapini	520	520	589	546	744	704	722	1,150	1,323	1,505
Spinach	222	169	451	366	345	372	646	950	1,229	485
Squash	201	187	102	220	223	59	150	114	191	108
Tomatoes	6,385	3,483	2,850	3,486	1,985	2,022	862	655	2,024	798
Vegetables,	1,635	1,178	2,059	2,134	1,663	803	1,761	1,711	2,162	1,961
Alfalfa	202,145	186,205	182,910	188,309	185,512	152,834	160,982	174,363	168,271	177,854
Alfalfa (Seec	17,397	7,099	7,949	6,675	13,423	13,238	14,248	19,781	24,362	18,223
Alicia Grass	1	71	1	1	1	1	1	1	1	1
Barley	145	92	182	239	606	58	91	337	868	109
Bermuda Gr.	5,776	15,359	17,367	17,056	21,704	20,952	24,301	31,774	31,731	41,918
Bermuda Gr.	15,890	19,098	20,494	17,535	17,854	22,636	20,613	21,865	23,448	22,185
Cotton	9,401	4,227	7,255	6,891	6,881	4,601	3,970	4,640	7,131	5,641
Field Corn	35	178	477	405	734	453	1,683	579	844	824
Kleingrass	-	-	-	135	135	452	567	1,623	3,113	6,998
Oats	3,750	1,981	1,262	1,539	2,063	1,267	1,753	2,411	212	850
Rape	-	-	45	558	919	773	778	5,098	3,034	621
Rye Grass	9,091	9,591	6,227	5,867	4,685	2,978	4,600	4,968	3,034	2,860
Sorghum Gr.	-	68	98	113	20	2,536	255	40	82	205
Soy Beans	-	-	-	80	-	-	-	-	-	-
Sudan Grass	64,513	53,352	57,850	78,878	77,383	81,896	83,562	66,568	62,286	53,446
Sudan Grass	167	72	273	266	151	300	310	391	595	148
Sugar Beets	41,591	39,703	41,492	34,802	31,612	33,980	39,327	34,258	33,997	31,475
Wheat	32,552	69,180	59,283	58,247	62,117	106,513	90,005	80,184	42,464	49,868
Asparagus	6,445	6,466	6,111	6,136	5,265	4,919	5,337	5,574	6,166	5,922
Citrus - Grap	864	920	1,036	1,078	1,157	1,200	1,194	1,337	1,412	1,384
Citrus - Lem	660	691	789	799	811	1,161	1,834	1,914	2,094	2,357
Citrus - Mixe	33	33	29	29	29	78	278	944	1,004	872
Citrus - Orar	1,060	525	632	632	667	667	780	840	947	927
Duck Ponds	8,099	8,244	8,243	8,070	7,994	8,798	8,837	8,979	9,105	10,025
Fish Farms	908	903	1,175	1,173	1,173	1,173	1,263	1,293	1,293	1,293
Guar Beans	-	-	-	-	20	276	104	153	-	-
Jojoba	2,117	2,117	2,017	2,017	1,943	400	202	2	2	2
Pasture, Per	607	610	695	798	728	696	722	684	701	546

20246

APPENDIX F

General Survey Methods for Covered Species

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General Survey Methods for Covered Species

As described in Chapter 4, IID will conduct baseline surveys for covered species and periodic ongoing surveys. This appendix describes the general methods that IID will use to survey for covered species. Because the number of sample points and location of sample points for the covered species surveys will be influenced by results of the drain and desert habitat surveys, the HCP IT will finalize procedures for the covered species surveys following completion of the habitat surveys.

Covered Species Surveys

Drain Habitat

Covered species potentially using drain habitat includes birds and amphibians. However, the amphibians associated with drain habitat are the lowland leopard frog and Colorado River toad. These two species are addressed separately and individually under Other Species – 1 and 2. Therefore, the covered species surveys for drain habitat focus on birds. Two different survey methods will be used for birds in drain habitat: (1) call surveys and (2) point counts. These two survey methods are described below.

Call Surveys

Call surveys will be used to survey for Yuma clapper rails, California black rails, and least bitterns. Standard survey protocols have been developed for Yuma clapper rails and California black rails. The protocols are similar and combined here into one protocol. The HCP IT may modify the survey protocol for local conditions or in response to new information.

For surveys of the drains, survey points will be randomly distributed in vegetated areas of the drains. Within the created managed marsh, survey points will be distributed on a 100 m (328 ft) grid system (Conway et al. 2001). In drains, survey points will be distributed linearly. Survey points will be spaced about 100 m [328 ft] apart (Conway et al. 2001). The number of survey points will depend on the acreage of drain vegetation and the created managed marsh. Conway et al. (2001) recommend one point per one hectare of habitat (i.e., 1 point per 2.47 acres). This recommended density will be used to determine the number of survey points with modification as necessary to maintain adequate spacing among points. The location of the survey points will be recorded so they can be incorporated into a GIS and plotted on a map.

Surveys will be initiated 30 minutes before sunrise and completed no later than 3 hours after sunrise. Surveys will not be conducted if the wind speed is greater than 10 mph. Three surveys will be conducted in a year, one each during March, April, and May. For black rails, Conway et al. (2001) recommend conducting the first survey during March 21 – 30, the second survey during April 21 – 30, and the third survey during May 21 – 30. These timings are also appropriate for Yuma clapper rails and will be used unless the HCP IT identifies a more appropriate site-specific survey schedule.

Following the protocol developed by Conway et al. (2001), at each survey point, the observers will first wait quietly for 3 minutes, recording all birds seen or heard. Following this quiet period, observers will broadcast recorded calls of rails and bitterns over a 3-minute period. The tape used to broadcast calls will include 30 seconds of calls interspersed with 30 seconds of silence. The 30 seconds of calls will consist of calls interspersed with 5 seconds of silence. Conway et al. (2001) provide additional information on the broadcast call period of the surveys. Observers will record each individual detected and indicate when each individual is detected during the initial 3-minute passive period and/or during any of the 1-minute broadcast periods. Observers also will estimate whether the response is within or beyond 50 m of the survey point.

Point Counts

Point counts will be used to detect the remaining covered bird species associated with drain habitat. The point counts will be conducted following the protocol of Ralph et al. (1993, 1995) with modifications based on Guers and Flannery (2000). Based on these protocols, counts at each point will last 5 minutes. The species and number of individuals of all birds seen or heard during this period will be recorded. Birds detected within a 50-m radius of the point will be recorded separately from those that are detected farther away and those that are observed flying overhead. In addition to recording birds observed, the surveyors will indicate whether a bird was observed using the drain vegetation. The survey points established for the call surveys will be used for the point counts with the additional constraint that points must be at least 250 m apart (Guers and Flannery 2000). Counts will be conducted three times during each of the three seasons (spring: March – June; fall: October – November; and winter: December – February). Counts will be separated by at least 2 weeks.

Desert Habitat

Covered species potentially occurring in desert habitat in the HCP area include birds, amphibians, reptiles, mammals, and insects. However, nine of the species potentially occurring in desert habitat are addressed separately and individually under Other Species— 1 and 2. These species are:

- Cheeseweed moth lacewing
- Andrew's scarab beetle
- Banded gila monster
- Jacumba little pocket mouse
- Flat-seeded spurge
- Foxtail cactus
- Munz's cactus
- Orocopia sage
- Orcutt's aster

Because these species are addressed separately, they were not considered in developing the survey methods. The survey protocols that will be used to detect covered birds, amphibians, and mammals associated with desert habitat are described subsequently.

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- Jacumba little pocket mouse
- Flat-seeded spurge
- Foxtail cactus
- Munz's cactus
- Orocopia sage
- Orcutt's aster

Because these species are addressed separately, they were not considered in developing the survey methods. The survey protocols that will be used to detect covered birds, amphibians, and mammals associated with desert habitat are described subsequently.

20252

Birds

Point counts will be used to detect birds in desert habitat following the same protocol as described for drain habitat. The location and number of points will be determined based on the desert habitat survey. A stratified random sampling approach will be used to distribute points among the various habitats identified during the habitat surveys. Points will be located at least 250 m apart (Guers and Flannery, 2000).

The point counts will be conducted three times during each of the three seasons (spring: March – June; fall: October – November; and winter: December – February). Counts will be separated by at least 2 weeks.

Amphibians

The only amphibian covered by this HCP with the potential to occur in desert habitat is the Couch's spadefoot toad. Surveys for Couch's spadefoot toad will be conducted following rainstorms when these toads breed in pools formed by rain. Following heavy rainstorms, IID will survey the rights-of-way of the AAC and East Highline Canal. Pools that could be used by Couch's spadefoot toads will be identified and mapped. The presence/absence of Couch's spadefoot toads also will be noted for each pool.

Reptiles

Four different survey methods will be used to survey for reptiles in desert habitat: (1) pitfall traps, (2) area searches, (3) desert tortoise protocols, and (4) flat-tailed horned lizard protocols. The HCP IT may modify survey methods as appropriate to most effectively and efficiently survey for the covered reptile species.

Pitfall Traps

Pitfall traps will be used to survey for western chuckwalla and Colorado Desert fringe-toed lizards. Used with drift fences, pitfall traps are a preferred method for detecting many reptiles. Drift fences intercept animals moving along the ground and direct them into the pitfall trap. Pitfall trap and fences will be established at each of the points used for point count surveys of birds. Traps will be run for 3 consecutive nights at each location. The traps will be checked and closed soon after sunrise each day. Pitfall trapping will be conducted once each month during March, April, May, June, October, and November.

Area Searches

Some reptile species are not sampled effectively with pitfall trapping. Thus, area searches will be used to increase the likelihood of detecting covered reptile species. Area searches consist of systematically searching a specified area for animals (Heyer et al., 1994). Area searches will be conducted in areas of suitable habitat for western chuckwalla and Colorado Desert fringe-toed lizards as determined by HCP IT. Plots 25 m by 25 m will be established in areas considered most likely to contain covered reptiles (Heyer et al., 1994). This area will be intensively searched for covered reptile species or their sign. Area search surveys will be conducted each month during March, April, May, June, October, and November.

Desert Tortoise

Surveys for desert tortoise will be conducted following the standard protocols for this species. The survey protocol for desert tortoise consists of searching specified transects for signs of desert tortoise. Surveys will be conducted between March 25 and May 31. Transects for desert tortoise surveys will be established in areas of suitable habitat for desert tortoise as determined by the HCP IT.

Flat-tailed Horned Lizard

Surveys for flat-tailed horned lizards will be conducted following the standard protocols for this species with any modifications deemed appropriate by the HCP IT. The current survey protocol for flat-tailed horned lizards is as follows. Transects consisting of parallel, linear routes will be evenly spaced in areas of suitable habitat for flat-tailed horned lizards as determined by the HCP IT. The number and distribution of transects will be such that a minimum of 10 hours of survey effort will be expended per 640 acres surveyed. Each transect will be traversed by a single worker. On each transect, either scat or lizards will be surveyed. The location of transects and each flat-tailed horned lizard and scat will be recorded. However, all observations of horned lizards or scat will be noted regardless of whether the transect is a scat or lizard transect. Scat and lizard survey routes will be alternated or randomly assigned to the transects at the HCP IT's discretion. Three surveys will be conducted, spaced at least 2 weeks apart during April through September. Lizard surveys will be conducted when surface temperatures in the sun range from 35 to 50°C. Scat surveys will not be conducted for at least 12 days after heavy rains, hailstorms, or strong winds of an intensity sufficient to move considerable amounts of sand across roads or that damage signs and trees.

In addition, road surveys will be conducted consisting of driving all roads in or near the areas where transects are situated and recording observations of horned lizards. Surveyors will drive very slowly (no faster than 10 mph). Three road survey will be conducted during April through September. Roads will be driven in the morning when substrate temperatures adjacent to the roads and in the sun range from 25 to 50°C. The location of each flat-tailed horned lizard observed will be recorded.

Mammals

Nelson's bighorn sheep is the only covered mammal species potentially occurring in desert habitat in the HCP area. Surveys for Nelson's bighorn sheep will be conducted in conjunction with the desert tortoise and/or flat-tailed horned lizard surveys. During the desert tortoise and flat-tailed horned lizard surveys, the surveyors also will search for and record signs of bighorn sheep presence. Because bighorn sheep could occur near the AAC at times other than March 25 through May 31, when desert tortoise surveys are conducted, surveys for bighorn sheep also will be conducted during the summer (July – September), fall (October – November), and winter (December – February).

References

Conway, C.J., C. Sulzman, and B.E. Raulston. 2001. *Population trends, distribution, and monitoring protocols for California Black Rails.* Draft Final Report. AGFD Heritage Program IIPAM Grant #I99010. Submitted to Arizona Game and Fish Department, California Department of Fish and Game and U.S. Bureau of Reclamation. July 1.

Guers, S. L. and M. E. Flannery. 2000. *Landbird migration and monitoring at the Salton Sea: 1999 field season.* In Avifauna of the Salton Sea: abundance, distribution, and annual phenology. USEPA.

Heyer, W. R., M. A. Donnelly, R. W. McDiarmid, L. C. Hayek, and M. S. Foster. 1994. *Measuring and monitoring biological diversity: standard methods for amphibians.* Smithsonian Institution Press, Washington, D.C.

APPENDIX G

California Endangered Species Act, Application for an Incidental Take Permit Under Section 2081 of the Fish and Game Code for Incidental Take of State-Listed Species Along the Lower Colorado River

APPENDIX G

California Endangered Species Act, Application for an Incidental Take Permit Under Section 2081 of the Fish and Game Code for Incidental Take of State-Listed Species Along the Lower Colorado River

This permit application was prepared to support the Imperial Irrigation District's (IID's) application for an Incidental Take Permit (ITP) in conformance with Section 2081 (b) of the California Endangered Species Act (CESA). This permit application describes management actions that will be implemented to mitigate the impacts of any take of state-listed species associated with IID's implementation of the IID/San Diego County Water Authority (SDCWA) Transfer Agreement and Quantification Settlement Agreement (QSA).

Applicant's Name, Mailing Address, and Telephone Number:

Imperial Irrigation District
Operating Headquarters
333 E. Barioni Blvd.
P.O. Box 937
Imperial, CA 92251
Telephone: (760) 339-9831
Fax: (760) 339-9896

Principal Officer:
Registered Agent for the Service of Process:
Point of Contact:

List of Species for Which Coverage Is Requested

IID is seeking authorization under Section 2081 (b) of the CESA for incidental take of state-listed species that could occur along the Lower Colorado River (LCR) (Table G-1).

TABLE G-1
Species to be Covered by the ITP

Common Name	Scientific Name	Federal Status	State Status
Bonytail	*Gila elegans*	Endangered	Endangered
Razorback sucker	*Xyrauchen texanus*	Endangered	Endangered
Arizona Bell's vireo	*Vireo bellii arizonae*		Endangered

TABLE G-1
Species to be Covered by the ITP

Common Name	Scientific Name	Federal Status	State Status
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Endangered
Brown pelican	*Pelecanus occidentalis*	Endangered	Endangered
California black rail	*Laterallus jamaicensis*		Threatened
Elf owl	*Micrathene whitneyi*		Endangered
Gilded flicker	*Colaptes chrysoides*		Endangered
Gila woodpecker	*Melanerpes uropygialis*		Endangered
Peregrine falcon	*Falco peregrinus*		Endangered
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Endangered
Western yellow-billed cuckoo	*Coccyzus americanus*		Endangered
Yuma clapper rail	*Rallus longirostris yumanesis*	Endangered	Threatened

Description of the Project

The IID/SDCWA Transfer Agreement is a long-term transaction between IID and SDCWA involving the voluntary conservation by IID of up to 300,000 acre-feet/year (300 KAFY) and the subsequent transfer of all or a portion of the conserved water to SDCWA. The transferred, conserved water is intended for use in SDCWA's service area in San Diego County, California. Under certain circumstances, up to 100 KAFY of the water conserved by IID may be transferred to Coachella Valley Water District (CVWD) and/or Metropolitan Water District (MWD). Key aspects of the project are summarized subsequently. A more detailed description of the proposed project is located in Chapter 1 of the Habitat Conservation Plan, and Chapter 1 of the Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the IID Water Conservation and Transfer Project.

Subsequent to execution of the IID/SDCWA Transfer Agreement, a settlement agreement was negotiated by and among IID, CVWD, and MWD, with the participation of the State of California and the Department of the Interior (DOI). The proposed terms of the settlement agreement were incorporated in the QSA. The QSA facilitates a number of component agreements and actions, which, when implemented, will enhance the certainty and reliability of Colorado River water supplies available to the signatory agencies and will assist these agencies in meeting their water demands within California's normal-year apportionment of Colorado River water. The QSA establishes water budgets for IID, MWD, and CVWD and sets forth approved parameters of various water transfers and exchanges, including the conservation by IID of up to 300 KAFY for transfer to SDCWA, CVWD, and/or MWD.

The Secretary of DOI, in the role as water master for the LCR, must implement the terms of the QSA by delivering Colorado River water in accord with its terms. The actions required of the Secretary are set forth in a proposed Implementation Agreement (SIA), which is intended to be effective concurrently with the QSA. As a condition precedent to implementation of the QSA, certain other federal actions are required, including the adoption of Interim Surplus Criteria and the adoption of an Inadvertent Overrun Program to facilitate the payback of inadvertent exceedances by IID or CVWD of their respective Priority 3 diversion caps.

If the QSA is approved and implemented, it would change the project described in the IID/SDCWA Transfer Agreement in certain respects. The QSA would limit the amount of conserved water transferable to SDCWA to a maximum of 200 KAFY and would provide for CVWD's option to acquire up to 100 KAFY of water conserved by IID, in lieu of transfer of this increment of conserved water to SDCWA. The QSA also provides for MWD's option to acquire any portion of the 100 KAFY of conserved water available to, but not acquired by, CVWD.

The EIR/EIS for the IID Water Conservation and Transfer Project addresses the environmental impacts of IID's consensual limit on its Priority 3 diversions and the conservation by IID of up to 300 KAFY for transfer pursuant to the IID/SDCWA Water Transfer Agreement and/or the QSA. The accompanying HCP supports the issuance of ITPs under the federal Endangered Species and CESA for this project in Imperial Valley, the Salton Sea, and along the All American Canal. This permit application supports issuance of an ITP under 2081(b) of CESA for take of state-listed species that could occur along the LCR between Imperial Dam and Parker Dam as a result of the conservation by IID of up to 300 KAFY for transfer pursuant to the IID/SDCWA Water Transfer Agreement and/or the QSA. Incidental take of federally listed species was covered in the Biological Opinion issued to the U.S. Bureau of Reclamation (Reclamation) on the *Interim Surplus Criteria (ISC), Secretarial Implementation Agreements (SIAs) for change in point of diversion of up to 400,000 acre-feet of California apportionment waters within California, and implementation of certain conservation measures on the LCR, Lake Mead to the Southerly International Boundary in Arizona, California and Nevada* (USFWS 2001). The EIR/EIS for the IID Water Conservation and Transfer Project will satisfy CEQA requirements for issuance of the Section 2081 permit.

Project Area Location and Affected Environment

The portion of the LCR affected by the proposed project is defined as the mainstem and the 100-year floodplain of the Colorado River from Parker Dam downstream to Imperial Dam. This geographic subregion includes approximately 140 miles. IID currently diverts water from the Colorado River at Imperial Dam, located about 18 miles northeast of Yuma, Arizona.

Habitats supported along the LCR and potentially affected by the proposed project include:

- Riparian communities (e.g., cottonwood-willow, mesquite, salt-cedar)
- Backwaters and marshes
- Mainstem riverine

Table G-2 shows the acreage of the various plant communities comprising riparian communities along the LCR. Table G-3 summarizes the acreage of riparian communities (all plant communities combined), backwaters, and marshes along the LCR between Parker and Imperial Dams. Additional information on habitats along the LCR is provided in Section 3.2.3.1 of the EIR/EIS.

TABLE G-2
Plant Communities in the LCR 100-Year Floodplain

Structure Type	Acres	Percent of Total Vegetation[a]
Cottonwood-willow	1,502	3
Salt cedar-honey mesquite	14,200	24
Salt cedar-screwbean mesquite	5,025	9
Salt cedar	30,840	53
Honey mesquite	3,128	5
Arrowweed	2,773	5
Atriplex	511	<1
Creosote	317	<1
Total	**58,296**	

[a] Excluding 1,723 acres of agriculture
Source: CH2M HILL 1999

TABLE G-3
Acreage of Habitats Along the LCR Between Parker and Imperial Dams

Habitat	Acreage
Riparian communities	58,296
Backwater (open water portions)	3,955
Marsh	6,710

Source: CH2M HILL, 1999
Source: Ogden Environmental and Energy Services Geographic Information System

Project Effects and Proposed Conservation Measures

Effects to Habitats

The conserved water consists of Colorado River water that otherwise would be diverted by IID for use within IID's service area in Imperial County, California. For conserved water transferred to SDCWA or MWD, IID's annual diversions of Colorado River water at Imperial Dam would be reduced by the amount of the conserved water, and this amount would be diverted at MWD's Whitsett Intake at Parker Dam on the Colorado River for delivery through MWD's Colorado River Aqueduct. For conserved water transferred to

CVWD, IID's annual diversions of Colorado River water at Imperial Dam also would be reduced by the amount of the conserved water, and this amount will be diverted into the Coachella Canal from the All American Canal (AAC). The effect of the change in the point of diversion would be to reduce flows in the LCR between Parker and Imperial Dams.

The USFWS (2001) evaluated the impact on federally listed species of changes in points of diversion for 400 KAFY of California allocation water in its Biological Opinion on the *Interim Surplus Criteria (ISC), Secretarial Implementation Agreements (SIAs) for change in point of diversion of up to 400,000 acre-feet of California apportionment waters within California, and implementation of certain conservation measures on the LCR, Lake Mead to the Southerly International Boundary in Arizona, California and Nevada*. Reclamation also is currently preparing a Programmatic EIS addressing these actions. The 300 KAFY of water that IID would conserve and transfer under the IID/SDCWA Transfer Agreement and QSA is encompassed by the 400 KAFY contained in Reclamation's project. Therefore, the analyses conducted for the Biological Opinion and PEIS are used for the analysis of effects of this project on state-listed species.

The change in the points of diversion would reduce flows in the LCR between Parker and Imperial Dams. This flow reduction would decrease the amount of open water habitat and/or change the characteristics (e.g., depth, velocity) of open water habitat in the mainstem and in backwaters. Lower water levels in marsh habitat in backwater areas would be expected to reduce the extent of marsh vegetation or change the plant species composition. Riparian communities in some locales would experience reduced groundwater and surface water levels, which could alter the amount and characteristics of the affected communities. Table 4 summarizes the acreage and potential effects to these habitats as a result of the proposed project, based on analyses conducted for the Biological Opinion and the PEIS. As explained in more detail in the Section 3.2 of the EIR/EIS, the acreages in Table G-4 were derived from the Biological Opinion by assuming the acreage affected was proportional to the amount of water transferred from IID and diverted at Parker Dam.

TABLE G-4
Acreage of Each Habitat Potentially Affected by the Proposed Project

Habitat	Acreage	Comments
Riparian (occupied by Southwestern Willow Flycatcher)	279	Acreage predicted to experience reduced groundwater and surface water levels. Actual changes in acreage, plant species composition, and structure cannot be predicted and are uncertain.
Backwater (open water)	12	
Marsh	21	Acreage predicted to experience reduced groundwater and surface water levels. Actual changes in acreage, plant species composition, and structure cannot be predicted and are uncertain.
Mainstem riverine	26	

Under the Biological Opinion, Reclamation committed to certain actions to mitigate impacts to federally listed species as a result of the change in the points of diversion of 400 KAFY. These conservation measures are as follows.

- Monitor 372 acres of occupied habitat that could be affected by the change in the point of diversion for 400 KAFY of water.
- Restore and maintain 372 acres of new replacement willow flycatcher habitat along the LCR within 5 years of execution of the SIA that provides federal approval for the water transfer actions.
- Restore and maintain additional habitat (up to 744 acres) if monitored habitat is found to be affected.
- Restore 44 acres of backwater habitat (marsh and open water combined) along the LCR between Parker and Imperial Dams.
- Re-introduce and monitor 20,000 sub-adult razorback suckers below Parker Dam.
- Continue the ongoing study on Lake Mead for an additional 4 years to determine reasons for persistence of adult razorback suckers in the reservoir.
- Fund the capture of wild-born or F1 generation bonytail chubs from Lake Mohave to be incorporated into the broodstock for this species.

The first four measures compensate for potential impacts to marsh, backwater (open water), and riparian habitat, while the last three measures address the net reduction in open water in the mainstem. These measures address the impacts associated with the change in the points of diversion for 400 KAFY of water and encompass the impacts associated with IID's proposed project. The following analysis considers impacts to state-listed species in the context of the conservation measures to be implemented by Reclamation.

Effects to Listed Species

Razorback Sucker

Razorback suckers inhabit the mainstem and backwater habitats along the LCR. Detailed information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP, the Biological Assessment for the ISC/SIA (Reclamation 2000), and associated Biological Opinion (USFWS 2001).

Potential effects to razorback suckers attributable to the proposed project consist of projected reductions in backwater habitat (33 acres) and mainstem riverine habitat (26 acres). These reductions have the potential to take a razorback sucker. The construction of 44 acres of backwater habitat by Reclamation would offset the projected reduction in this habitat. Further, Reclamation would reintroduce razorback suckers below Parker Dam and continue funding an ongoing study of this species at Lake Mead. These measures would mitigate potential effects to razorback suckers from the small change in the amount of mainstem riverine habitat. With the conservation measures to be implemented by Reclamation, any take of razorback suckers resulting from a change in the point of diversion of the 300 KAFY of water conserved by IID would be fully mitigated. No additional mitigation is necessary.

Bonytail

Bonytail are presently found in Lakes Mohave and Havasu. Detailed information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP, the Biological Assessment for the ISC/SIA (Reclamation, 2000), and associated Biological Opinion (USFWS, 2001).

The change in the point of diversion for 300 KAFY of water conserved and transferred by IID would not affect the operation of those lakes (Reclamation 2000). Because bonytail do not currently inhabit the LCR between Parker and Imperial Dams, no take of this species is expected over the short-term with implementation of the proposed project. However, efforts are underway to reintroduce bonytail to the LCR below Parker Dam. Depending on when bonytail are reintroduced relative to the ramp up for water conservation by IID, reintroduced fish could experience a small decline in backwater habitat and mainstem riverine habitat. The conservation measures implemented by Reclamation to construct replacement backwater habitat and contribute to maintenance of broodstock for this species would fully mitigate any take caused by a change in the point of diversion. Therefore, no additional mitigation is necessary.

Arizona Bell's Vireo

The Arizona Bell's vireo is a summer breeding resident along the LCR. This species uses riparian habitats similar to the southwestern willow flycatcher. Additional information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP.

A change in point of diversion of 300 KAFY of water under the proposed project could impact 279 acres of riparian habitat occupied by southwestern willow flycatchers. Given their similar habitat associations, this acreage also represents habitat potentially occupied by Arizona Bell's vireo. Thus, impacts to the Arizona Bell's vireo would be generally similar to those described for the southwestern willow flycatcher in the Biological Opinion. No information is available on the number of occupied territories that may be affected by the loss of 372 habitat acres. However, a reduction in riparian habitat could cause take of Arizona Bell's vireo through displacement of adults, reduced productivity, or reduced survivorship of adults and/or young.

Conservation measures implemented by Reclamation for the change in the points of diversion for 400 KAFY of water would consist of restoring 372 acres of riparian habitat and monitoring and restoring up to an additional 744 acres, if monitoring shows an impact to riparian habitat. With these measures, Reclamation would at least replace any impacted riparian habitat. Thus, these measures would encompass and fully mitigate any take of Arizona Bell's vireo potentially resulting from the change in the point of diversion of 300 KAFY under IID's proposed project. No additional mitigation measures are necessary.

Bald Eagle

Information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP and the Biological Assessment for the ISC/SIA (Reclamation 2000). In its Biological Assessment, Reclamation concluded that implementation of the ISC/SIA (including the change in the points of diversion of 400 KAFY) would not likely adversely affect the food resources, foraging opportunities, or nesting habitat of the bald eagle. The USFWS concurred with Reclamation's determination that Reclamation's proposed action is not likely to adversely affect bald eagles (USFWS 2001).

Based on Reclamation's and USFWS' evaluations, no take of bald eagles is expected. Any take that did occur as a result of a change in the point of diversion for the 300 KAFY of water conserved by IID would be fully mitigated by the Reclamation's conservation measures. No additional mitigation measures are necessary.

California Brown Pelican

Along the Colorado River, the brown pelican is a rare but annual post-breeding wanderer from Mexico in late summer and early fall (Reclamation 2000). It is most frequently seen around Imperial Dam, but individuals have occurred north to Davis Dam and Lake Mead. Virtually all records are of lone immature birds, likely dispersing from breeding colonies in the Gulf of California or perhaps via the Salton Sea (Reclamation 2000). Along the river, they prefer large open-water areas near dams. Additional information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP and the Biological Assessment for the ISC/SIA (Reclamation 2000).

In its Biological Assessment for the ISC/SIA project, 4.4. Plan, Reclamation made a finding of no effect for the brown pelican because the action would not change the character of aquatic habitat potentially utilized by this species (Reclamation 2000). The USFWS concurred with this determination. Based on Reclamation's and USFWS' evaluations, no take of brown pelicans is expected. Any take that did occur as a result of a change in the point of diversion for the 300 KAFY of water conserved by IID would be fully mitigated by the Reclamation's conservation measures. No additional mitigation measures are necessary.

California Black Rail

The California black rail is associated with marsh habitats along the LCR. Information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP and the Biological Assessment for the ISC/SIA (Reclamation 2000).

A change in point of diversion of 300 KAFY of water under the proposed project could impact an estimated 21 acres of marsh habitat in backwater areas. Given their similar habitat associations, impacts to the California black rail would be generally similar to those described for the Yuma clapper rail in the Biological Opinion. A reduction in marsh habitat could cause take of California black rails through displacement of adults, reduced productivity, or reduced survivorship of adults and/or young.

Conservation measures implemented by Reclamation for the change in the points of diversion for 400 KAFY of water would consist of restoring 44 acres of backwater habitat (open water and marsh combined). With this measure, Reclamation would replace any impacted marsh habitat. Thus, these measures would encompass and fully mitigate any take of California black rail resulting from the change in the point of diversion of 300 KAFY under IID's proposed project. No additional mitigation measures are necessary.

Elf Owl

The elf owl is a very rare and local summer resident in riparian habitats along the LCR, which lies at the western edge of its range (Rosenberg et al. 1991). Historically, it occurred south of Yuma. Elf owls are not known to use riparian habitats along the LCR for breeding. Additional information on the range, distribution, abundance, and habitat requirements of the elf owl is presented in Appendix A of the HCP.

A change in point of diversion of 300 KAFY of water under the proposed project could impact 279 acres of riparian habitat. Because elf owls are very rare and not known to breed along the LCR, the potential for take of elf owls because of these potential habitat effects is very low. Nonetheless, conservation measures implemented by Reclamation for the change in the points of diversion for 400 KAFY of water would consist of restoring 372 acres of riparian habitat and monitoring and restoring up to an additional 744 acres, if monitoring shows an impact to riparian habitat. With these measures, Reclamation would at least replace any impacted riparian habitat. Thus, these measures would encompass and fully mitigate any take of elf owls resulting from the change in the point of diversion of 300 KAFY under IID's proposed project. No additional mitigation measures are necessary.

Gilded Flicker

The gilded flicker occurs along the LCR Valley in southern Arizona and southeastern California (Rosenberg et al., 1991). In California, there were an estimated 40 individuals along the LCR in 1984 (Hunter, 1984; CDFG, 1991); but during 1986 surveys, there were no gilded flickers observed in this area. Rosenberg, et al. (1991) reported "scattered pairs" between Imperial and Laguna Dams. The preferred nesting substrate for this species is saguaros; however, they also use mature cottonwood-willow riparian forests to a more limited degree Additional information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP.

A change in point of diversion of 300 KAFY of water under the proposed project could impact 279 acres of riparian habitat occupied by southwestern willow flycatchers. This acreage also represents habitat potentially occupied by gilded flicker. Thus, impacts to the gilded flicker would be generally similar to those described for the southwestern willow flycatcher in the Biological Opinion. No information is available on the number of occupied territories that could be affected by changes in the amount or characteristics of 279 acres of riparian habitat. However, a reduction in riparian habitat could cause take of a gilded flicker through displacement of adults, reduced productivity, or reduced survivorship of adults and/or young.

Conservation measures implemented by Reclamation for the change in the points of diversion for 400 KAFY of water would consist of restoring 372 acres of riparian habitat and monitoring and restoring up to an additional 744 acres, if monitoring shows an impact to riparian habitat. With these measures, Reclamation would at least replace any impacted riparian habitat. Thus, these measures would encompass and fully mitigate any take of gilded flicker resulting from the change in the point of diversion of 300 KAFY under IID's proposed project. No additional mitigation measures are necessary.

Gila Woodpecker

Gila woodpeckers are known to occur between the Laguna and Imperial Dams along the LCR. In 1984, an estimated 200 individuals occurred in California along the LCR (CDFG 1991). The total population along the LCR is estimated at about 1,000 individuals (Rosenberg et al. 1991). While saguaros are a commonly used nesting substrate for the species, in California, they primarily use mature riparian habitat. Gila woodpeckers appear to need large blocks of riparian habitat for nesting; isolated patches of riparian habitat less than 50 acres in size do not support the species (Rosenberg, et al. 1991). Additional information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP.

A change in point of diversion of 300 KAFY of water under the proposed project could impact 279 acres of riparian habitat occupied by southwestern willow flycatchers. This acreage also represents habitat potentially occupied by Gila woodpecker. Thus, impacts to the Gila woodpecker would be generally similar to those described for the southwestern willow flycatcher in the Biological Opinion. No information is available on the number of occupied territories that could be affected by changes in the amount or characteristics of 279 acres of riparian habitat. However, a reduction in riparian habitat could cause take of a Gila woodpecker through displacement of adults, reduced productivity, or reduced survivorship of adults and/or young.

Conservation measures implemented by Reclamation for the change in the points of diversion for 400 KAFY of water would consist of restoring 372 acres of riparian habitat and monitoring and restoring up to an additional 744 acres, if monitoring shows an impact to riparian habitat. With these measures, Reclamation would at least replace any impacted riparian habitat. Thus, these measures would encompass and fully mitigate any take of Gila woodpecker resulting from the change in the point of diversion of 300 KAFY under IID's proposed project. No additional mitigation measures are necessary.

Peregrine Falcon

Peregrine falcons occur in a wide range of open country habitats. The presence of tall cliffs is the most characteristic feature of the peregrine's habitat and is considered a limiting factor for the species. Nearby waterbodies or wetlands that support abundant prey of small to medium-size birds are another common habitat feature and influence the species distribution and abundance (Johnsgard, 1990). These habitat features are present in the project area, and the species may use areas affected by the water diversion for both foraging and nesting. Information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP.

Nesting habitat for this species would not be affected by the proposed project. Potential impacts to 279 acres of riparian habitat and 21 acres of marsh habitat could affect the abundance and distribution of prey species of the peregrine falcon. However, given this species' mobility and the abundant prey base in the river corridor, it is unlikely that any take of peregrine falcons would occur. In the unlikely event that take of peregrine falcons did occur from these habitat changes, the conservation measures implemented by Reclamation would fully mitigate the take.

Southwestern Willow Flycatcher

The southwestern willow flycatcher is associated with riparian habitats. The majority of southwestern willow flycatchers found during the past 5 years of surveys on the LCR have been in saltcedar, or a mixture of saltcedar and native cottonwood and willow, especially Goodings willow, coyote willow, and Fremont cottonwood (Reclamation, 2000). Sixty-four nesting attempts were documented on the LCR from southern Nevada to Needles, California, in 1998 (Reclamation, 2000). Additional information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP, the Biological Assessment for the ISC/SIA (Reclamation, 2000), and the associated Biological Opinion (USFWS, 2001).

A change in point of diversion of the 300 KAFY of water conserved and transferred by IID could degrade or reduce the amount of willow flycatcher habitat by lowering river and groundwater elevations (USFWS, 2001; Reclamation, 2000). An estimated 279 acres of occupied southwestern willow flycatcher habitat could be affected. A reduction in occupied habitat could cause take of a southwestern willow flycatcher through displacement of adults, reduced productivity, or reduced survivorship of adults and/or young.

Conservation measures implemented by Reclamation for the change in the points of diversion for 400 KAFY of water would consist of restoring 372 acres of riparian habitat and monitoring and restoring up to an additional 744 acres, if monitoring shows an impact to riparian habitat. With these measures, Reclamation would at least replace any impacted riparian habitat. These measures would encompass and fully mitigate any take of southwestern willow flycatchers resulting from the change in the point of diversion of 300 KAFY under IID's proposed project. Therefore, no additional mitigation measures are necessary.

Western Yellow-billed Cuckoo

Mature stands of cottonwood-willow provide the primary habitat for western yellow-billed cuckoos. In the LCR area, cuckoos have been detected as far south as Gadsden and Imperial National Wildlife Refuge (Reclamation, 2000). Additional information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP and the Biological Assessment for the ISC/SIA (Reclamation, 2000).

A change in point of diversion of 300 KAFY of water under the proposed project could impact 279 acres of riparian habitat occupied by southwestern willow flycatchers. This acreage also represents habitat potentially occupied by western yellow-billed cuckoos. Thus, impacts to the western yellow-billed cuckoo would be generally similar to those described for the southwestern willow flycatcher in the Biological Opinion. No information is available on the number of occupied territories that could be affected by changes in the amount or characteristics of 372 habitat acres. However, a reduction in riparian habitat could cause take of a western yellow-billed cuckoo through displacement of adults, reduced productivity, or reduced survivorship of adults and/or young.

Conservation measures implemented by Reclamation for the change in the points of diversion for 400 KAFY of water would consist of restoring 372 acres of riparian habitat and monitoring and restoring up to an additional 744 acres, if monitoring shows an impact to riparian habitat. With these measures, Reclamation would at least replace any impacted riparian habitat. These measures would encompass and fully mitigate any take of western yellow-billed cuckoos potentially resulting from the change in the point of diversion of 300 KAFY under IID's proposed project. Therefore, no additional mitigation measures are necessary.

Yuma Clapper Rail

The Yuma clapper rail is associated with marsh habitats along the LCR. Information on the range, distribution, abundance, and habitat requirements of this species is presented in Appendix A of the HCP, the Biological Assessment for the ISC/SIA (Reclamation, 2000), and associated Biological Opinion (USFWS, 2001).

A change in point of diversion of 300 KAFY of water under the proposed project could impact an estimated 21 acres of marsh habitat in backwater areas. A reduction in marsh habitat could cause take of Yuma clapper rails through displacement of adults, reduced productivity, or reduced survivorship of adults and/or young. Conservation measures implemented by Reclamation for the change in the points of diversion for 400 KAFY of water would consist of restoring 44 acres of backwater habitat (open water and marsh combined). With this measure, Reclamation would replace any impacted marsh habitat. These measures would encompass and fully mitigate any take of Yuma clapper rail potentially resulting from the change in the point of diversion of 300 KAFY under IID's proposed project. Therefore, no additional mitigation measures are necessary.

Incidental Take Determinations and Jeopardy Analysis

Razorback Sucker

The USFWS determined that all razorback suckers inhabiting the 44 acres of backwater habitat affected by the change in the points of diversion for 400 KAFY could be taken, but determined that this level of take would not jeopardize the species. IID's proposed project is encompassed by the USFWS' determination and therefore would have a lower level of take and would not jeopardize the species.

Bonytail

No bonytail are present in reach of the LCR from Parker to Imperial Dams. Take of bonytail is not expected in the short term but could occur if bonytail are re-introduced in the LCR in the future. The USFWS determined that implementation of Reclamation's ISC/SIA project, 4.4 Plan would not result in jeopardy to bonytail. IID's proposed project is encompassed by the USFWS' determination on this project and therefore would have a lower level of take if any and would not jeopardize the species.

Arizona Bell's Vireo

This species is not federally listed and was not covered in the Biological Assessment or Biological Opinion for the ISC/SIA. Consistent with the USFWS determination for the southwestern willow flycatcher, all Arizona Bell's vireos inhabiting the 279 acres of riparian habitat potential affected by the proposed project could be taken. With implementation of the conservation measures, this level of take is not likely to result in jeopardy to the species.

Bald Eagle

No take of bald eagles is expected. With implementation of the conservation measures, any take of bald eagles that did occur would not result in jeopardy to the species.

California Brown Pelican

No take of California brown pelicans is expected. With implementation of the conservation measures, any take of brown pelicans that did occur would not result in jeopardy to the species.

California Black Rail

The California black rail is not a federally listed species and was not addressed in the USFWS Biological Opinion. However, Reclamation addressed the species in their Biological Assessment and concluded the project effects on this species would be the same as for the Yuma clapper rail (Reclamation, 2000). Impacts to 21 acres of marsh habitat under the proposed project could result in take of the California black rail inhabiting these areas. However, with implementation of the conservation measures, this potential take is not likely to result in jeopardy to the species.

Elf Owl

Because this species is not federally listed, it was not covered in the Biological Opinion for the ISC/SIA. Take of this species is not expected. Nonetheless, a very low level of take could occur as a result of the potential effects of the proposed project on riparian habitat. With implementation of the conservation measures, the very low level of take potentially occurring is not likely to result in jeopardy to the species.

Gilded Flicker

The gilded flicker is not federally listed and was not covered in the Biological Assessment or Biological Opinion for the ISC/SIA. Consistent with the USFWS determination for the southwestern willow flycatcher, all gilded flickers inhabiting the 279 acres of riparian habitat potentially affected by the IID's proposed project could be taken. With implementation of the conservation measures, this level of take is not likely to result in jeopardy to the species.

Gila Woodpecker

The gila woodpecker is not federally listed and was not covered in the Biological Assessment or Biological Opinion for the ISC/SIA. Consistent with the USFWS determination for the southwestern willow flycatcher, all gila woodpeckers inhabiting the 279 acres of riparian habitat potentially affected by the IID's proposed project could be taken. With implementation of the conservation measures, this level of take is not likely to result in jeopardy to the species.

Peregrine Falcon

No take of peregrine falcons is expected. With implementation of the conservation measures, any take of peregrine falcons that did occur would not result in jeopardy to the species.

Western Yellow-Billed Cuckoo

This species is not federally listed and was not covered in the Biological Opinion for the ISC/SIA. Consistent with the USFWS determination for the southwestern willow flycatcher, all western yellow-billed cuckoos inhabiting the 279 acres of riparian habitat affected by IID's proposed project could be taken. With implementation of the conservation measures, this potential take of yellow-billed cuckoos is not likely to result in jeopardy to the species.

Yuma Clapper Rail

The USFWS determined that impacts to 28 acres of marsh habitat with the change in the points of diversion for 400 KAFY could harm Yuma clapper rails (USFWS, 2001) and could adversely affect the habitat use of approximately 100 clapper rails in the Parker Dam to Imperial Dam reach of the LCR. The level of take that would occur is uncertain. However, with implementation of the conservation measures by Reclamation, the USFWS determined that the potential take was not likely to result in jeopardy to the species (USFWS, 2001). IID's proposed project is encompassed by the USFWS' determination and therefore would have a lower level of take and would not jeopardize the species.

Southwestern Willow Flycatcher

The USFWS determined that all southwestern willow flycatchers inhabiting the 372 acres of riparian habitat affected by the change in the points of diversion for 400 KAFY could be taken, but this take would not jeopardize the species. IID's proposed project is encompassed by the USFWS' determination and therefore would have a lower level of take and would not jeopardize the species.

Compliance Monitoring and Funding Assurances

Responsibility for funding and implementing the conservation measures associated with the ISC/SIA project, 4.4 Plan was assumed by Reclamation and five designated applicants through their consultation with the USFWS under section 7 of the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). No additional mitigation is necessary to meet the permit requirements for incidental take authorization of state-listed species on the LCR for IID's proposed project.

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20272

Appendix D
Imperial Irrigation District Water Conservation and Transfer Project

EIR/EIS Alternatives Analysis Report

Lead Agencies

Imperial Irrigation District

US Bureau of Reclamation

November 25, 2001

Table of Contents

1. Introduction

1.1 Purpose of Alternatives Analysis

The purpose of this alternatives analysis (alternatives report) is to identify a reasonable range of feasible alternatives to be evaluated in the Draft Environmental Impact Report/Environmental Impact Statement (Draft EIR/EIS) for the Proposed Project, as required by the California Environmental Quality Act (CEQA) guidelines (Section 15126.6) and the National Environmental Policy Act (NEPA).

CEQA Guidelines. The CEQA guidelines, Section 15126.6, Consideration and Discussion of Alternatives to the Proposed Project, provides:

"(a) Alternatives to the Proposed Project. An EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives. An EIR need not consider every conceivable alternative to a project. Rather it must consider a reasonable range of potentially feasible alternatives that will foster informed decisionmaking and public participation. An EIR is not required to consider alternatives which are infeasible. The lead agency is responsible for selecting a range of project alternatives for examination and must publicly disclose its reasoning for selecting those alternatives. There is no ironclad rule governing the nature or scope of the alternatives to be discussed other than the rule of reason. (*Citizens of Goleta Valley v. Board of Supervisors* (1990) 52 Cal.3d 553 and *Laurel Heights Improvement Association v. Regents of the University of California* (1988) 47 Cal.3d 376)."

NEPA Regulations. The Council on Environmental Quality Regulations for Implementing NEPA, Section 1502.14, Alternatives Including the Proposed Action, provides:

"This section is the heart of the environmental impact statement. Based on the information and analysis presented in the sections on the affected environment (Sec. 1502.15) and the Environmental Consequences (Sec. 1502.16), it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public. In this section agencies shall:

> (a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives that were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.

(b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.

(c) Include reasonable alternatives not within the jurisdiction of the lead agency.

(d) Include the alternative of no action.

(e) Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.

(f) Include appropriate mitigation measures not already included in the proposed action or alternatives."

1.2 Alternatives Analysis Process

The focus of the alternatives analysis under CEQA and NEPA is to identify alternatives which have the potential to reduce the potential significant impacts of the Proposed Project.

The potentially significant impacts, based on preliminary environmental analysis, are primarily impacts associated with the Salton Sea. The water conservation and transfer included in the Proposed Project would reduce flows to the Salton Sea, which would result in a decline in elevation, surface area and an increase in salinity. These effects would cause significant impacts to water quality, air quality biological resources including fish and birds, recreation resources and aesthetics of the Salton Sea. However, depending on the HCP option selected as part of the Proposed Project, these impacts may be either reduced or avoided. Additionally, impacts to agricultural resources may be significant in the IID water service area as a result of fallowing for conservation.

On the Lower Colorado River, there may be some biological and hydrological impacts due to the change in the point of diversion from Imperial Dam to Parker Dam. The change in the point of diversion will have the effect of reducing the flow between the points by 300 AF/year. Biological conservation measures proposed for the LCR would likely mitigate these potential impacts.

To prepare the alternatives analysis, a comprehensive list of all potential alternatives was compiled. Potential alternatives for this project were identified from comments received during the scoping process; the environmental review process for the Program EIR, which was being prepared for the Quantification Settlement Agreement (QSA); and through discussions with Imperial Irrigation District (IID) and San Diego County Water Authority (SDCWA) engineers and other water resource professionals familiar with the IID system and the region.

To the extent possible, available information about each alternative was gathered to allow a comparison of alternatives. Potential alternatives were then subjected to screening criteria to identify the alternatives recommended for full evaluation in the Draft EIR/EIS. Alternatives that do not survive the screening criteria will be described in the Draft EIR/EIS as "alternatives that were considered but eliminated" and the reasons for their elimination will be documented. Surviving alternatives will be included for analysis in the Draft EIR/EIS.

Screening criteria were developed based on CEQA and NEPA requirements and the Proposed Project objectives (below). The criteria were designed to eliminate alternatives considered to be infeasible, and to identify alternatives that could reasonably meet most of the Proposed Project objectives while minimizing the environmental impacts.

1.3 Project Objectives and Purpose and Need

Under the CEQA guidelines, § 15124(b), an EIR must include a "statement of objectives sought by the proposed project." These objectives are used to develop the range of alternatives to be considered in the EIR. Under the CEQA guidelines, § 15126.6(a), quoted above, alternatives analyzed in the EIR must be able to "feasibly attain most of the basic objectives of the project." IID's Proposed Project objectives and the purpose and need for the Proposed Project as determined by Reclamation are further described below.

1.3.1 IID's Objectives

IID's underlying objective for the Proposed Project is to meet the terms of, and implement, the IID/SDCWA Transfer Agreement, the QSA, and the Habitat Conservation Plan (HCP). The IID/SDCWA Transfer Agreement and the QSA state contractually acceptable terms for the conservation and transfer of a substantial amount of Colorado River water from IID's water service area to more urban areas of Southern California, which are in need of more reliable water supplies.

IID has determined that a water conservation and transfer project would provide a means of developing a conservation program within the IID water service area, while benefiting the recipients of the conserved water. IID has also determined that a water conservation and transfer project will implement directives from the State Water Resources Control Board (SWRCB) to develop a conservation program, and will protect IID's historic Colorado River water rights. Under California laws designed to encourage water conservation and voluntary transfers, title to conserved water remains with the transferor. On this basis, IID can allow conserved water to be used by another entity while retaining its historic water rights, which have been, and continue to be, the basis for economic activity in the Imperial Valley. In addition to funding implementation costs of conservation measures, environmental mitigation costs, and the costs of mitigating third-party impacts, IID anticipates that proceeds from the sale of conserved water would provide economic benefits to IID, and to cooperating landowners and tenants in the Imperial Valley.

Both the IID/SDCWA Transfer Agreement and the QSA are contractual agreements that are intended to facilitate the varied goals of the contracting parties. Thus, the Proposed Project objectives are to meet the proponents' goals for each agreement. These goals are listed below, under the applicable agreement.

1.3.1.1 IID/SDCWA Transfer Agreement

The goals of the IID/SDCWA Transfer Agreement for IID are to:

- Conserve water and convey it in a market-based transaction that provides payment to IID sufficient to fund a water conservation program, including the cost of on-farm and system improvements, environmental mitigation costs, and other implementation costs.
- Develop a water conservation program that includes the participation of Imperial Valley landowners and tenants so that on-farm and system-based conservation measures could be implemented.
- Implement a water conservation and transfer program without impairing IID's historic senior-priority water rights, in a manner consistent with state and federal law.
- Provide an economic stimulus to Imperial Valley's agricultural economy and the surrounding community.

The goals of the IID/SDCWA Transfer Agreement for SDCWA are to

- Acquire an independent, alternate, long-term water supply to provide drought protection and increased reliability for planned growth in municipal, domestic, and agricultural uses.
- Diversify its sources of water supply and reduce its current dependence on a single source for imported water to enhance the reliability of its water supply.
- Establish a stable, competitive price for a significant portion of its water supply.

1.3.1.2 QSA

The following goals of the QSA are the collective goals of its proponents –(IID, SDCWA, Coachella Valley Water District [CVWD], and the Metropolitan Water District of Southern California [MWD]):

- Settle, by consensus agreement, longstanding disputes regarding the quantity, priority, use, and transferability of Colorado River water.
- Agree on a plan for the future distribution of Colorado River water among IID, CVWD, MWD, and SDCWA for up to 75 years, based on Colorado River water budgets for IID, CVWD, MWD, and SDCWA.
- Facilitate agreements and actions which, when implemented, will enhance the certainty and reliability of Colorado River water supplies available to IID, CVWD, MWD, and SDCWA, and will assist these agencies in meeting their water demands within California's apportionment of Colorado River water.

- Identify agreed-on terms and conditions for the conservation and transfer of specific amounts of Colorado River water within California.
- Provide incentives to promote conservation of Colorado River water.

1.3.1.3 HCP

For IID, the goal of the HCP is to minimize and mitigate the impacts of any take of covered species that might occur as a result of its implementation of the IID/SDCWA Transfer Agreement, the QSA, and continuation of its routine Operation and Maintenance (O&M) activities.

1.3.2 Reclamation's Purpose and Need

The Secretary exercises functions similar to a water master to fulfill the BCPA, adopted regulations, and the Decree. Reclamation delivers water to users in the Lower Basin states of Arizona, California, and Nevada, which have legal rights through entitlements to Colorado River water. Reclamation maintains that before water could be released from federal reservoirs, federal requirements of reasonable and beneficial use must be met. Reclamation is responsible for implementing these regulations. Reclamation is also responsible for accounting for its delivery and consumptive use of Colorado River water by each diverter and each state on an annual basis, as well as for approving annual water orders and administering the delivery of water from storage to each point of diversion. For Reclamation, the underlying purpose and need of the Proposed Project is to facilitate implementation of the IID/SDCWA Transfer Agreement and the QSA.

1.4 Screening Criteria

According to CEQA guidelines, an alternative can be eliminated if it fails to meet "most" of the Proposed Project objectives, if it does not avoid the significant impacts of the Proposed Project, or if it is "infeasible"--§ 15126.6(c).

Screening criteria have been developed to evaluate potential alternatives and eliminate those that do not qualify for detailed assessment as an alternative in the Draft EIR/EIS, in accordance with CEQA guidelines.

Project Objectives Criteria:

There are several very specific project objectives defined by the terms of both the IID/SDCWA Transfer Agreement and the QSA as enumerated above. The project objectives criteria below (C1 and C2) represent the most essential aspects of those objectives.

C1. Will the alternative provide SDCWA with a reliable source of water to assist in diversifying its water supply sources and meeting projected demands in average and dry years. A core objective of the Proposed Project is to reduce SDCWA's reliance on water from MWD, and to protect it from severe shortages during drought periods. *An alternative that does not aid* in achieving that objective *would be eliminated from further consideration.*

C2. Will the alternative implement a meaningful and substantial conservation program consistent with SWRCB directives without impairing IID's historic water rights. In both Decision 1600 (SWRCB 1984) and Order 88-20 (SWRCB 1988), SWRCB instructed IID to develop and implement a meaningful water conservation plan and noted that conservation in excess of 300,000 KAFY is a reasonable long-term goal of the plan. To pass this criterion, alternatives must provide a substantial conservation plan and preserve IID's historic water rights.

Reduction of Impact Criteria:

C3. Will the alternative reduce the environmental impacts of the Proposed Project? The purpose of the alternatives analysis is to identify alternatives that minimize the impacts of the Proposed Project; therefore, when applying this criteria, the following should be considered:

1) Does the alternative reduce or avoid the potential significant impacts of the Proposed Project (water quality, biological, recreation and aesthetic impacts to the Salton Sea)? (If not, it can be ruled out), and (2) Does the alternative result in new, potentially significant impacts that were not associated with the Proposed Project (this is a factor in determining feasibility). Overall, an alternative should have "substantial environmental advantages."

Feasibility Criteria:

CEQA guidelines define feasible as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social and technological factors" (§ 15364).

Also, § 15126.6(f) states that the following factors might be taken into account when addressing the feasibility of alternatives: site suitability, economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, jurisdictional boundaries (projects with a regionally significant impact should consider the regional context), and whether the proponent can reasonably acquire, control, or otherwise have access to the alternative site.

C4. Is the alternative technically feasible and reliable? To pass this criterion, an alternative must utilize proven technology and be designed to ensure reliability of operation.

C5. Is the alternative institutionally and legally feasible? To pass this criterion, an alternative must not face major obstacles from governmental agencies to obtaining discretionary permits and approvals that are necessary to implement the alternative.

C6. Can the alternative be implemented within a timeframe that fulfills SDCWA reliability requirements? SDCWA currently needs to enhance its reliability to protect its customers from drought; therefore, an alternative that could take up to 10 years to develop and construct would not meet this criteria. Additionally, timing is a critical element of the SDCWA/IID Water Transfer Agreement, the QSA and the California 4.4 Plan.

Other Criteria

C7: Does the alternative meet the transfer objectives of the QSA? To meet this criterion, an alternative must include transfer of up to 100KAF to CVWD and/or MWD.

1.5 Alternative Analysis Results

Fourteen alternatives (including sub-alternatives) were initially identified for evaluation. Screening criteria were then applied to those 14 alternatives. The performance of each of these alternatives, evaluated against the screening criteria, is documented in this alternatives report. Of the 14 alternatives, 5, including the Proposed Project and the No Project alternative, are recommended for further evaluation in the Draft EIR/EIS, based on the screening analysis.

Table 1: Alternative Analysis Summary shows how each alternative performed against each of the screening criteria. The table indicates which alternatives would be carried forward for analysis in the Draft EIR/EIS, and which have been eliminated from further consideration. The table also summarizes the rationale for inclusion or exclusion of each of the considered alternatives. Table 2: Alternatives Summary provides a summary of relevant available information for each alternative.

TABLE D-1
Alternative Analysis Summary

Type of Criteria	Screening Criteria: Project Objectives — C1: Provide SDCWA with reliable source	Project Objectives — C2: Support cons. and protect IID's water rights	Reduce Impacts — C3 : Minimize Env. Impacts compared to the Proposed Project	Feasibility — C4: Technically Feasible and Reliable	Feasibility — C5: Institutionally and Politically feasible	Feasibility — C6: Implementable within reasonable schedule	C7: Meets QSA transfer objectives	Project Specific — Evaluate in EIR/EIS?	Rationale for Evaluation in EIR/EIS
Alternative									
Proposed Project	Pass	Pass	N/A1	Pass	Pass	Pass	Pass	Yes	N/A – This is the Proposed Project and impacts of alternatives will be compared to impacts of the Proposed Project.
1. No Project	Required for Evaluation by CEQA and NEPA							Yes	Required by CEQA and NEPA
2. 130 KAFY Water Conservation and Transfer (Meet Minimum of IID/SDCWA Transfer Agreement Only)	Pass	Pass	Pass	Pass	Maybe	Pass	Fail	Yes	Meets primary objectives and potentially reduces impacts when compared to the Proposed Project - reduced conservation and transfer reduces impacts to Salton Sea and LCR.
3. 230 KAFY Water Conservation and Transfer (Meet Minimum of QSA and IID/SDCWA Transfer Agreement)	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Yes	See rationale for Alternative 2 above.
4. 300 KAFY Water Conservation and Transfer (Meet Minimum of QSA and IID/SDCWA Transfer Agreement) - Fallowing Only	Pass	Maybe	Pass	Pass	Maybe	Pass	Pass	Yes	Meets primary objectives and potentially reduces impacts when compared to the Proposed Project - fallowing reduces impacts to the Salton Sea.
5. Water Treatment and Reuse	Pass	Pass	Fail	Fail	Maybe	Unknown	Pass	No	Does not reduce impacts compared to the proposed project, may include additional impacts associated with construction of facilities and disposal of treatment byproducts.
6. Alternative Conveyances									
6a. Connect Coachella Canal to CRA	Pass	Pass	Fail	Pass	Maybe	ST-F; LT - P2	Pass	No	Reduces impacts to LCR because does not require change in diversion point on LCR, however impacts to LCR with Proposed Project can be fully mitigated. Significant construction and potentially operation impacts associated with constructing 10 miles of conveyance facilities for this alternative prevent this alternative from reducing impacts compared with the Proposed Project, which does not require construction of facilities other than for conservation measures.
6b. Extend the AAC to SDCWA system	Pass	Pass	Fail	Pass	Pass	ST-N LT-Y	Pass	No	Reduces impacts to LCR because does not require change in diversion point on LCR for 200 or 250 out of 300K (transfers to MWD would be diverted at Parker, however impacts to LCR with Proposed Project can be fully mitigated. Significant construction and potentially operation impacts associated with constructing 150 miles of conveyance facilities for this alternative prevent this alternative from reducing impacts compared with the Proposed Project, which does not require construction of facilities other than for conservation measures.
6c. New conveyance from LCR	Pass	Pass	Fail	Pass	Maybe	ST-F LT-P	Pass	No	Reduces impacts to LCR because does not require change in diversion point on LCR for 200 or 250 out of 300K (transfers to

20282

TABLE D-1
Alternative Analysis Summary

Type of Criteria	Screening Criteria: Project Objectives — C1: Provide SDCWA with reliable source	C2: Support cons. and protect IID's water rights	Reduce Impacts — C3 : Minimize Env. Impacts compared to the Proposed Project	Feasibility — C4: Technically Feasible and Reliable	C5: Institutionally and Politically feasible	C6: Implementable within reasonable schedule	C7: Meets QSA transfer objectives	Project Specific — Evaluate in EIR/EIS?	Rationale for Evaluation in EIR/EIS
to SDCWA in Mexico									MWD would be diverted at Parker, however impacts to LCR with Proposed Project can be fully mitigated. Significant construction and potentially operation impacts associated with constructing 150 miles of conveyance facilities for this alternative prevent this alternative from reducing impacts compared with the Proposed Project, which does not require construction of facilities other than for conservation measures.
6d. Expand capacity of the CRA	Pass	Pass	Fail	Unknown	Unknown	Fail	Pass	No	Does not reduce impacts compared to the Proposed Project, since diversion would also be at Parker Dam. In addition this alternative has significant additional impacts associated with >100 miles of construction required to expand existing CRA. Additionally this alternative may not be politically feasible.
6e. Construct a New Aqueduct Parallel to the CRA	Pass	Pass	Fail	Pass	Pass	ST-F LT-P	Pass	No	Does not reduce impacts compared to the Proposed Project, since diversion would also be at Parker Dam. In addition this alternative has significant additional impacts associated with >100 miles of construction required to construct a new aqueduct parallel to the CRA. Additionally this alternative may not be politically feasible.
7. Other Conservation/Transfer	Fail	Fail	Unknown	N/A	Fail	Unknown	Unknown	No	Cannot guarantee reliable supply, particularly during drought periods when it is most needed and could compromise IID's water rights because it does not implement a water conservation program in IID as required by the SWRCB. Also, may not reduce impacts when compared to the Proposed Project, depending on origin of water and method of conveyance.
8. Maximize Local Supplies in SDCWA-Desalination	Maybe	Fail	Unknown	Pass	Unknown	ST-F LT-P	Fail	No	Impacts, such as energy use, disposal of byproducts, encroachment onto sensitive marine habitats, associated with development of this alternative may be greater than the Proposed Project. Also the project may not be economically feasible.
9. CVP and SWP Supplies	Fail	Fail	Unknown	Unknown	Pass	Pass	Fail	No	Cannot guarantee reliable supply, particularly during drought periods when it is most needed and could compromise IID's water rights because it does not implement a water conservation program in IID as required by the SWRCB. Also, may not reduce impacts when compared to the Proposed Project, depending on origin of water to be purchased and method of conveyance.
10. Water Banking	Unknown	Fail	Pass	Pass	Pass	Pass	Fail	No	Cannot guarantee reliable supply, particularly during drought periods when it is most needed and could compromise IID's water rights because it does not implement a water conservation program in IID as required by the SWRCB. Also, may not reduce impacts when compared to the Proposed Project, depending on origin of water banked and methods of conveyance.

TABLE D-1
Alternative Analysis Summary

	Screening Criteria								
	Project Objectives		Reduce Impacts	Feasibility				Project Specific	
Type of Criteria	C1: Provide SDCWA with reliable source	C2: Support cons. and protect IID's water rights	C3 : Minimize Env. Impacts compared to the Proposed Project	C4: Technically Feasible and Reliable	C5: Institutionally and Politically feasible	C6: Implementable within reasonable schedule	C7: Meets QSA transfer objectives	Evaluate in EIR/EIS?	Rationale for Evaluation in EIR/EIS

Notes:
1 F6 is not rated for this alternative because this criteria is intended to identify alternatives which have the potential to minimize environmental impacts when compared to the proposed project.
2 ST-F LT-P means that the project does not meet the criteria in the Short Term but does in the Long Term.

20284

TABLE D-1
Alternative Analysis Summary

	Screening Criteria								
	Project Objectives		Reduce Impacts	Feasibility			Project Specific		
Type of Criteria	C1: Provide SDCWA with reliable source	C2: Support cons. and protect IID's water rights	C3 : Minimize Env. Impacts compared to the Proposed Project	C4: Technically Feasible and Reliable	C5: Institutionally and Politically feasible	C6: Implementable within reasonable schedule	C7: Meets QSA transfer objectives	Evaluate in EIR/EIS?	Rationale for Evaluation in EIR/EIS

Notes:
1 F6 is not rated for this alternative because this criteria is intended to identify alternatives which have the potential to minimize environmental impacts when compared to the proposed project.
2 ST-F LT-P means that the project does not meet the criteria in the Short Term but does in the Long Term.

20285

TABLE D-2
Alternatives Summary

	Water Conserved by IID	Point of Diversion on LCR	Salton Sea Elevation (2077)[1]	Salton Sea Salinity (2077)	Construction Required
Proposed Project: All Conservation Measures	Up to 300 KAFY	Parker Dam (for transfers to SDCWA or MWD) Imperial Dam (for transfers to CVWD)	-246 feet msl	138 g/l	As needed to install conservation measures
1. No Project	None	Imperial Dam	-235 feet msl	85 g/l	None
2. 130 KAFY Water Conservation and Transfer (On-farm Irrigation System Improvements Only)	Up to 130 KAFY	Parker Dam	-238 feet msl	98 g/l	As needed to install conservation measures
3. 230 KAFY Water Conservation and Transfer (Any combination of conservation measures)	Up to 230 KAFY	Parker Dam (for transfers to SDCWA or MWD) Imperial Dam (for transfers to CVWD)	-243 feet msl	121 g/l	As needed to install conservation measures
4. 300 KAFY Water Conservation and Transfer - Fallowing Only	Up to 300 KAFY	Parker Dam (for transfers to SDCWA or MWD) Imperial Dam (for transfers to CVWD)	-236 feet msl	89 g/l	None
5. Water Treatment and Reuse	Up to 300 KAFY	Parker Dam (for transfers to SDCWA or MWD) Imperial Dam (for transfers to CVWD)	No modeling available, however impacts to the Salton Sea would be much greater since 2x the drainage is required to create the same amount of conservation as the Proposed Project.	TBD	60 acres
6. Alternative Conveyances					
6a. Connect Coachella Canal to CRA	Up to 300 KAFY	Imperial Dam	-246 feet msl	138 g/l	Approximately 10 miles

TABLE D-2
Alternatives Summary

	Water Conserved by IID	Point of Diversion on LCR	Salton Sea Elevation (2077)[1]	Salton Sea Salinity (2077)	Construction Required
6b. Extend the AAC to SDCWA system	Up to 300 KAFY	Up to 200 KAFY at Imperial Dam; up to 100 KAFY at Parker Dam (to MWD)	-246 feet msl	138 g/l	Approximately 150 miles
6c. New conveyance from LCR to SDCWA in Mexico	Up to 300 KAFY	Up to 200 KAFY at Imperial Dam; up to 100 KAFY at Parker Dam (to MWD)	-246 feet msl	138 g/l	Approximately 100 miles
6d. Expand capacity of the CRA	Up to 300 KAFY	Parker Dam (for transfers to SDCWA or MWD) Imperial Dam (for transfers to CVWD)	-246 feet msl	138 g/l	Approximately 240 miles
6e. Construct a New Aqueduct Parallel to the CRA	Up to 300 KAFY	Parker Dam (for transfers to SDCWA or MWD) Imperial Dam (for transfers to CVWD)	-246 feet msl	138 g/l	Approximately 240 miles x140 ft. width
7. Other Conservation/Transfer	None – water conserved in other District	Unknown – Potentially upstream of Parker Dam?	-235 feet msl	85 g/l	Depends on availability of existing conveyance
8. Maximize Local Supplies in SDCWA-Desalination	None	N/A	-235 feet msl	85 g/l	Depends on facilities
9. CVP and SWP Supplies	None	N/A	-235 feet msl	85 g/l	None
10. Water Banking					

1 Based on Salton Sea Model developed by Reclamation (Reclamation 2001). Values shown assume highest level of conservation achieved for each alternative.

2. Screening Criteria Analysis

This section includes a summary description of the Proposed Project and potential project alternatives, and an explanation of how each measures up against the screening criteria. Additionally, for each alternative, a conclusion is drawn regarding whether or not the alternative would be carried forward for additional analysis in the Draft EIR/EIS, or eliminated from further consideration.

Proposed Project – 300 KAFY Water Conservation and Transfer Meets Maximum Transfer Amounts under IID-SDCWA Transfer Agreement and QSA).

The Proposed Project includes the implementation of the water conservation and transfer project described in the IID/SDCWA Transfer Agreement. If the QSA is finalized and implemented. the Proposed Project would also include the modified IID/SDCWA transfer, and the additional water transfer to CVWD and/or MWD described in the QSA.

The IID/SDCWA Transfer Agreement is a long-term transaction between IID and SDCWA involving the conservation by IID of a primary amount between 130 KAFY and 200 KAFY, and the subsequent transfer of all or a portion of the conserved water to SDCWA. The IID/SDCWA Transfer Agreement also provides for the transfer of an additional "discretionary amount" of up to 100 KAFY. The conserved water would consist of Colorado River water that otherwise would be diverted by IID for use within IID's water service area in Imperial County, California. The water is intended for use within SDCWA's service area in San Diego County, California. Water would be diverted from the Lower Colorado River (LCR) at Parker Dam and conveyed via the Colorado River Aqueduct (CRA) to the SDCWA service area, pursuant to an exchange agreement between SDCWA and MWD. Fallowing by individual landowners and farmers is not permitted under the terms of the IID/SDCWA Water Transfer Agreement for the conservation of the first 200 KAFY.

Under the terms of the QSA, SDCWA would be limited to the primary amount of conserved water (130-200 KAFY). An additional amount of 100 KAFY would be transferred to either the Coachella Valley Water District (CVWD) or the Metropolitan Water District (MWD). Fallowing is not prohibited by the QSA.

For the purposes of the environmental assessment of the Proposed Project, it is assumed that water conservation would occur through the implementation of a broad range of conservation measures, which may vary from year to year, or even from season to season, depending on farmer participation, weather and other physical conditions, agricultural market conditions, and other variable factors. The conservation measures might include the following:

- On-farm irrigation system improvements, including on-farm irrigation management techniques
- Water delivery system improvements
- Water treatment and reuse measures
- Fallowing

Details of various conservation measures are included in Chapter 2 Project Description of the IID Water Conservation and Transfer EIR/EIS.

Water conservation within the IID water service area would result in a decrease in the amount of agricultural drainage reaching the Salton Sea, which would affect salinity levels and Sea elevations.

Proposed Project Screening Criteria	
C1: Provide SDCWA with reliable source	Pass
C2: Protect IID's water rights	Pass
C3: Reduce environmental impacts	N/A*
C4: Technically feasible and reliable	Pass
C5: Institutionally and politically feasible	Pass
C6: Implementable within reasonable time period	Pass
C7: Meets QSA transfer objectives	Pass

EXPLANATION: This alternative is the Proposed Project, and it meets the Proposed Project objectives. It is designed to provide SDCWA with an alternative and reliable water source. It uses proven conservation technologies and is cost effective. The Proposed Project does not appear to pose any insurmountable permitting issues. Because it does not require any large-scale construction prior to implementation, the Proposed Project would be implementable within a reasonable time period. C2 is given a rating of Pass with the assumption that IID will not implement fallowing if there is any uncertainty that fallowing would be considered a reasonable and beneficial use of IID's water rights. Also, the IID/SDCWA Transfer Agreement prohibits the use of fallowing as a conservation measure under IID's contracts with participating landowners. Unless this is changed, the amount of conserved water that landowners could generate by fallowing would be limited by contractual restrictions.

*C3 is not rated for the Proposed Project because this criterion is intended to identify alternatives that could minimize environmental impacts when compared to the Proposed Project.

CONCLUSION: This alternative will be assessed in the Draft EIR/EIS as the Proposed Project.

Alternative 1: No Project (As Required by CEQA and NEPA)

The No Project alternative is the scenario under which the Proposed Project is not constructed, permitted, or implemented. The No Project alternative is not the environmental status quo. Rather, it is defined as "existing environmental conditions" as well as what would reasonably be expected to occur in the foreseeable future if the Proposed Project were not approved, based on current plans and consistent with available infrastructure (CEQA Guidelines, §15126.6[e][2]). Under the No Project alternative, the IID/SDCWA Transfer Agreement would not be implemented, the QSA would not be finalized and implemented, and the HCP would not be finalized and implemented.

The No Project Alternative is not evaluated in this analysis because it is required by CEQA and NEPA and will be carried forward into the Draft EIR/EIS.

Alternative 2: 130 KAFY Water Conservation and Transfer (Meets Minimum Requirements of IID-SDCWA Water Transfer Agreement Only)

This alternative is a scaled back version of the Proposed Project and includes only the minimum amount of water transfer allowable under the terms of the IID-SDCWA Transfer Agreement (130 KAFY). This alternative would not implement the QSA provisions for transfer of up to 100 KAFY to CVWD and/or MWD. The 130 KAFY would be conserved using on-farm irrigation system improvements only. Other terms would be the same as for the transfer to SDCWA under the Proposed Project.

Alternative 2 Screening Criteria	
C1: Provide SDCWA with reliable source	Pass
C2: Protect IID's water rights	Maybe
C3: Reduce environmental impacts	Pass
C4: Technically feasible and reliable	Pass
C5: Institutionally and politically feasible	Maybe
C6: Implementable within reasonable time period	Pass
C7: Meets QSA transfer objectives	Fail

EXPLANATION: This alternative meets most of the Proposed Project objectives, albeit to a lesser extent than the Proposed Project. It does provide SDCWA with an alternative and reliable water source; however, the water source would be a smaller supply than the Proposed Project. This alternative uses proven conservation technologies and is cost effective. It does not appear to pose any insurmountable permitting issues; however, because this alternative only includes transfer of 130 KAFY, CVWD and MWD could raise objections because they would not receive water from this reduced level of transfer (compared to the Proposed Project, from which they would receive up to 100KAF) and, as a result, it may impede implementation of the QSA. Because this alternative does not require any large-scale construction prior to implementation, it could be implemented within a reasonable time period. C2 and C5 are given a rating of Maybe because failure to implement the QSA means that longstanding disputes among IID, CVWD, and MWD regarding the allocation of Colorado River water will not be resolved. This alternative fails C7.

Because this alternative results in a significantly smaller reduction in drainage to the Salton Sea, it has the potential to substantially reduce the significant environmental impacts associated with increased salinity when compared to the Proposed Project.

CONCLUSION: This alternative will be carried forward for evaluation in the Draft EIR/EIS.

Alternative 3: 230 KAFY Water Conservation and Transfer – All Conservation Measures (Meets Minimum Transfer Amounts under IID-SDCWA Transfer Agreement and QSA)

This alternative is similar to Alternative 1, the Proposed Project, except that the minimum primary transfer amount is transferred to SDCWA under the IID/SDCWA Transfer Agreement (130 KAFY), and 100 KAFY is transferred to CVWD and/or MWD pursuant to the QSA. Thus, the total amount of water conserved and transferred is reduced to 230 KAFY rather than to 300 KAFY, as provided for under the Proposed Project. Conservation could be accomplished using any combination of conservation measures.

All other terms of the Proposed Project remain the same.

Alternative 3 Screening Criteria	
C1: Provide SDCWA with reliable source	Pass
C2: Reduce environmental impacts	Pass
C3: Protect IID's water rights	Pass
C4: Technically feasible and reliable	Pass
C5: Institutionally and politically feasible	Pass
C6: Implementable within reasonable time period	Pass
C7: Meets QSA transfer objectives	Pass

EXPLANATION: This alternative meets most of the Proposed Project objectives. It would provide SDCWA with an alternative and reliable water source. It does not impair IID's water rights, it utilizes proven conservation technologies, and it is cost effective. This alternative does not appear to pose any insurmountable permitting issues. This alternative is implementable within a reasonable time period because it does not require any large-scale construction prior to implementation.. Because this alternative results in a significantly smaller reduction in drainage to the Salton Sea, it has the potential to substantially reduce the significant environmental impacts associated with increased salinity and reduced elevation when compared to the Proposed Project.

CONCLUSION: This alternative will be carried forward for evaluation in the Draft EIR/EIS.

Alternative 4: 300 KAFY - Fallowing as Exclusive Conservation Method:

This alternative is similar to the Proposed Project, except that fallowing lands within the IID water service area is the exclusive means of conserving up to 300 KAFY for transfer.

For purposes of analyzing the impacts of fallowing, it is assumed that lands would be taken out of production, and that the total amount of water historically delivered to the fallowed land would be treated as conserved water. To conserve 300 KAFY by land retirement, about 50,000 acres would be required to be fallowed. (These predicted acreages were developed using the IID Conservation Model.) To predict the amount of land required for a target conservation quantity, the model randomly selected farm locations and sizes. The actual historical water usage of those parcels would be used to calculate the amount of conserved water that could be generated, and the total amount of fallowed land that would be required. Because participation by landowners in the fallowing program would be voluntary, actual acreage might vary depending on the actual historical water usage of the land fallowed. This alternative would assess implementation of fallowing in various ways, including short-term and long-term land retirement, and rotational fallowing.

Alternative 4 Screening Criteria	
C1: Provide SDCWA with reliable source	Pass
C2: Protect IID's water rights	Maybe
C3: Reduce environmental impacts	Pass
C4: Technically feasible and reliable	Pass
C5: Institutionally and politically feasible	Maybe
C6: Implementable within reasonable time period	Pass
C7: Meets QSA transfer objectives	Pass

EXPLANATION: The fallowing of lands to develop conserved water for transfer is a controversial issue within the Imperial Valley, and has been opposed by members of the community based on potential socio-economic impacts to third parties. The IID Board has adopted a policy that landowners participating in the conservation plan should not be compensated for fallowing as a means of conserving water for transfer. In addition, the IID/SDCWA Transfer Agreement currently prohibits fallowing as a means of conservation under IID's contracts with participating landowners for the first 200 KAFY. The QSA does not prohibit fallowing.

This alternative would commit IID to a single conservation method over the term of the Proposed Project. It does not provide flexibility to IID to vary the components of the conservation program. Also, it does not further IID's objective of using the conservation program to encourage and finance on-farm and system facilities and improvements, nor does it respond directly to SWRCB directives. Therefore, this alternative receives a Maybe for C2.

As a condition to implementation of this alternative, IID may require assurances from state and federal regulators that use of water conserved by fallowing is a reasonable and beneficial use in compliance with IID's water rights. Nevertheless, this alternative may provide a means for meeting some of the basic Proposed Project objectives, and for potentially reducing the environmental impacts of the Proposed Project (because impacts to the Sea would be less, and because no construction is involved).

Modeling over the project period of 75 years shows that fallowing would substantially reduce environmental impacts compared to the Proposed Project. Alternative 4 would result in lower salinity (93 g/L compared to 144 g/L) and reduced elevation decline (-236 MSL compared to –246 MSL) because it would allow more drain water to continue to flow to the Salton Sea. Therefore, it receives a Pass for C3.

CONCLUSION: This alternative will be carried forward for further analysis in the Draft EIR/EIS.

Alternative 5: Treatment/Reuse

Treatment/Reuse technology conserves water by collecting agricultural drainage, treating it, and reusing it for irrigation.

Each year an estimated 1,000,000 AF of water flows from the IID drainage system into the Salton Sea. This drainage water comprises canal operational discharge, tile and tailwater from farms, subsurface seepage, stormwater, municipal and industrial effluent, and other miscellaneous drainages. This alternative would reclaim drainage water to produce irrigation-quality water while meeting all applicable discharge and waste disposal requirements.

To achieve a capacity of up to 300KAF (to fulfill the requirements of the IID/SDCWA transfer agreement and the QSA), the alternative could either construct a small number of centrally located, large-scale plants or several decentralized smaller capacity water reclamation plants, to collect and treat drain water. Most likely, an initial project phase to demonstrate feasibility would treat 100 KAFY, producing 50 KAFY of water to be reused for irrigation. At full-scale, as much as 5-600KAF would be required for processing to produce 300 KAFY of reclaimed water for reuse in IID, and thus conserved in IID.

Treatment would require silt removal, salt removal, and nitrate and selenium removal. The percentage of treated water that can be reclaimed for reuse is dependent on the quality of the source drainage water and the quality limitations imposed on the process effluent stream. At present, it is estimated that two-thirds to one-half of the processed volume can be reclaimed based on the anticipated water quality.

Disposal of waste streams from the treatment process is a potential obstacle to implementation of this alternative. Anticipated waste streams from the treatment process and potential disposal options are shown below:

Waste Product Quantities and Disposal Options		
Waste Product	**Estimated Quantity**	**Anticipated Disposal Method**
Sediment	1,000 lbs per AF of processed water	Make available as fill dirt for agricultural and road construction projects
Fluidized bed sludge	5-40 lbs biological floc per AF of processed water	Landfill disposal or application as fertilizer
Selenium adsorption media	Quantity unknown	Media recycled for base material recovery
Wastewater effluent stream	25-50% of processed water	Return to drainage system under permit requirements to be established by the RWQCB

Screening Criteria	
C1: Provide SDCWA with reliable source	Pass
C2: Protect IID's water rights	Pass
C3: Reduce environmental impacts	Fail
C4: Technically feasible and reliable	Fail
C5: Institutionally and politically feasible	M– Depends on ability to meet permitting requirements.
C6: Implementable within reasonable time period	Unknown
C7: Meets QSA transfer objectives	Pass

EXPLANATION: This alternative might provide SDCWA with an alternate and reliable water source, and would protect IID's water rights. However, this alternative would not reduce environmental impacts to the Salton Sea when compared to the Proposed Project; therefore, and fails C3. In addition to an increased reduction in flows to the sea, this alternative would also have impacts associated with the construction of treatment plants and disposal of treatment byproducts. The technology proposed with this alternative is proven; however, because the large-scale quantities of water proposed to be reclaimed in a series of plants is unprecedented, and disposal issues are unresolved, this alternative fails C4.

Similarly, it is unknown how long it may take to site, design, permit, and construct 10 water reclamation treatment plants. Therefore, it is unknown if this alternative could meet C6.

CONCLUSION: This alternative has been eliminated from further consideration.

Alternative 6: Alternative Conveyances:

This series of five sub-alternatives (6a-6e) considers alternative conveyances for transferring water from the Lower Colorado River to the SDCWA service area. Alternative 1, the Proposed Project, includes conveying water to SDCWA via MWD's Colorado River Aqueduct (CRA) and an exchange agreement between SDCWA and MWD. For the purposes of this analysis, it is assumed that the transfer quantities and conservation measures would be the same as for the Proposed Project; only the conveyance would differ (i.e., up to 300 KAF would be transferred, as described in the terms of the IID/SDCWA Transfer Agreement and in the QSA).

6a. Connect Coachella Canal to the CRA: This alternative would connect the Coachella Canal to the CRA by adding a new pipeline and associated facilities between these two canals west of the city of Coachella. This option would retain the current diversion point on the Lower Colorado River at Imperial Dam, and water would be conveyed via the AAC and the Coachella Canal to the CRA (for use in the MWD, CVWD or SDCWA service areas). (The Proposed Project requires a change in the diversion point from Imperial Dam to Parker Dam for conserved water transferred to SDCWA or MWD.)

Alternative 6a **Screening Criteria**	
C1: Provide SDCWA with reliable source	Pass
C2: Protect IID's water rights	Pass
C3: Reduce Environmental Impacts	Fail
C4: Technically feasible and reliable	Pass
C5: Institutionally and politically feasible	Maybe
C6: Implementable within reasonable time period	Short-Term – Fail Long-Term - Pass
C7: Meets QSA transfer objectives	Pass

EXPLANATION: This alternative might reduce potential environmental impacts on the Lower Colorado River when compared to the Proposed Project because water would be diverted at Imperial Dam, downstream of Parker Dam. The diversion would avoid the impacts associated with the reduction of flows in the Lower Colorado River caused by the change in the diversion point required under the Proposed Project.

However, this alternative would result in new, potentially significant impacts associated with the construction of the new pipeline facilities. Without an investigation of the pipeline corridor, it is unknown if these impacts would be greater than the Proposed Project. However, construction of a 10-mile pipeline in an area known to contain habitat for the endangered and special-status species is likely to have significant impacts. Considering that the impacts to the LCR with the Proposed Project can be fully mitigated, it is likely that this alternative would not substantially reduce environmental impacts when compared to the proposed project. Additionally, impacts to the Salton Sea would not be reduced with this alternative. Therefore, this alternative fails C3.

Although it would not be possible to construct the project in the short-term, it could be constructed and available for a significant portion of the 75-year life of the IID/SDCWA Transfer Agreement. Since IID and Reclamation do not own or control the site of the new facilities, this alternative may be legally or technically difficult to implement.

CONCLUSION: Because this alternative would not reduce impacts when compared to the Proposed Project, this alternative has been eliminated from further consideration.

Alternative 6b. Extend the AAC to SDCWA System:

This alternative would connect the All American Canal (AAC) to the SDCWA system via a new pipeline between the western end of the AAC and the San Vicente Reservoir within Imperial and San Diego Counties. Like Alternative 6a, this alternative would retain the current diversion point, at Imperial Dam, on the Colorado River for water transferred to San Diego, and would avoid the environmental impacts of the change in the diversion point required under the Proposed Project. However, water transferred to MWD under the terms of the QSA would require a change in the point of diversion to convey water via the CRA to the MWD service area. This alternative may also require a canal parallel to the AAC, from the eastern portion of the extension, east to Imperial Dam because the AAC may not have sufficient capacity to carry the transfer water.

This alternative would require pump stations to deliver water from the LCR to the SDCWA service area with significant energy requirements.

This alternative is currently undergoing feasibility evaluation by SDCWA as a separate project in the Regional Water Facilities Master Plan scheduled for completion in April 2002.

Alternative 6b Screening Criteria	
C1: Provide SDCWA with reliable source	Pass
C2: Protect IID's water rights	Pass
C3: Reduce environmental impacts	Fail
C4: Technically feasible and reliable	Maybe
C5: Institutionally and politically feasible	Pass
C6:Implementable within reasonable time period	Short Term – Fail Long Term - Pass
C7: Meets QSA transfer objectives	Pass

EXPLANATION: The environmental impacts of 150 miles of construction are likely to be significantly greater than the LCR impacts of the Proposed Project, which would be reduced by this alternative (but not eliminated; up to 100 KAF would be diverted at Parker for MWD, as per QSA conditions). Depending on the final route selection, the construction corridor would likely intersect habitat for endangered species along the border, particularly bighorn sheep, and compliance with the ESA would be required. Additionally, lining of the AAC, which might be required for this alternative, would potentially impact groundwater, particularly under federal lands. Also, pump stations would be required to deliver water from the LCR to SDCWA via this new conveyance, resulting in additional environmental impacts related to energy generation and consumption.

The impacts to the Salton Sea would not be reduced with this alternative, but would remain the same as the Proposed Project. Because impacts to the LCR can be mitigated with the Proposed Project, and because the impacts of constructing 150 miles of pipeline are likely to be significant, this alternative fails C3 for not reducing the impacts of the Proposed Project.

This alternative is currently undergoing feasibility evaluation by SDCWA as a separate project in the Regional Water Facilities Master Plan scheduled for completion in April 2002.

CONCLUSION: Because this alternative does not reduce environmental impacts when compared to the Proposed Project, it has been eliminated from further consideration.

Alternative 6c. New conveyance from LCR to SDCWA in Mexico:

This alternative assumes that water conserved by IID would be transferred to SDCWA via a new conveyance that would be constructed in Mexico. The Regional Colorado River Conveyance Feasibility Study, a privately funded project, is currently evaluating several conveyance alignments wholly in the US, wholly in Mexico, and combinations of these alignments, to distribute water to both countries. Three alignments have been identified in Mexico.

Several obstacles to the construction of a conveyance in Mexico that would transfer water from the LCR to SDCWA have been identified. These obstacles include costs, endangered species impacts, and international legal issues. Conceptual design, geology explorations, and cost estimates for the Mexican alignments are expected in early 2002.

Alternative 6c Screening Criteria	
C1: Provide SDCWA with reliable source	Pass
C2: Protect IID's water rights	Pass
C3: Reduce environmental impacts	Fail
C4: Technically feasible and reliable	Pass
C5: Institutionally and politically feasible	Maybe
C6: Implementable within reasonable time period	Short Term- Fail Long Term- Pass
C7: Meets QSA transfer objectives	Pass

EXPLANATION: The environmental impacts of more than 100 miles of construction are likely to be significantly greater than the LCR impacts of the Proposed Project, which would be reduced (but not eliminated, because water delivered to MWD would be diverted at Parker Dam) by this alternative. Depending on the final route selection, it is likely that the construction corridor would intersect habitat for endangered species, particularly bighorn sheep along the border. Also, a pump station would be required to deliver water from the LCR to SDCWA via this new conveyance, resulting in additional environmental impacts related to energy generation and consumption.

The impacts to the Salton Sea would not be reduced with this alternative, but would remain the same as the Proposed Project. Because impacts to the LCR can be mitigated with the Proposed Project, and because the impacts of constructing 150 miles of pipeline are likely to be significant, this alternative fails C3 for not reducing the impacts of the Proposed Project.

This alternative is currently undergoing feasibility evaluation by SDCWA as a separate project in the Regional Water Facilities Master Plan scheduled for completion in April 2002.

CONCLUSION: Because this alternative does not reduce environmental impacts when compared to the Proposed Project, it has been eliminated from further consideration.

Alternative 6d. Expand capacity of the CRA:

SDCWA conducted an engineering study in 1996 to evaluate conveyance options to transfer water from IID to the SDCWA service area (Black & Veatch 1996). That report included an option of expanding the capacity of the Colorado River aqueduct by 200 KAFY.

Alternative 6d Screening Criteria	
C1: Provide SDCWA with reliable source	Pass
C2: Protect IID's water rights	Pass
C3: Reduce environmental impacts	Fail
C4: Technically feasible and reliable	Unknown
C5: Institutionally and politically feasible	Unknown
C6: Implementable within reasonable time period	Fail
C7: Meets QSA transfer objectives	Pass

EXPLANATION: This alternative would not reduce any environmental impacts associated with the Proposed Project because it would also require a change in the diversion point from Imperial Dam to Parker Dam, and it would introduce new, potentially significant impacts associated with the construction required to expand the CRA.

It is not known if it would be feasible to expand the CRA, or if that proposal would be institutionally acceptable to MWD, the owner of the CRA. The cost of this alternative was reported to be more than the cost of constructing an entirely new conveyance from Parker Dam to the SDCWA service area (SDCWA 2001).

CONCLUSION: Because this alternative does not reduce impacts when compared to the Proposed Project, this alternative has been eliminated from further consideration

Alternative 6e. Construct a new aqueduct parallel to the CRA:

The same engineering report described in the discussion of Alternative 6d (Black & Veatch 1996), included an option of building a new pipeline parallel to the existing CRA.

Alternative 6e Screening Criteria	
C1: Provide SDCWA with reliable source	Pass
C2: Protect IID's water rights	Pass
C3: Reduce environmental impacts	Fail
C4: Technically feasible and reliable	Pass
C5: Institutionally and politically feasible	Pass
C6: Implementable within reasonable time period	Short-Term – Fail Long-Term – Pass
C7: Meets QSA transfer objectives	Pass

EXPLANATION: This alternative would not reduce any environmental impacts associated with the Proposed Project because it would also require a change in the diversion point, from Imperial Dam to Parker Dam. In addition, it would introduce new, potentially significant impacts associated with the construction required to construct a new pipeline parallel CRA. The pipeline would also have operational impacts if the pipeline required any aboveground facilities that would prevent migration of wildlife.

CONCLUSION: Because this alternative does not reduce impacts when compared to the Proposed Project, this alternative has been eliminated from further consideration

Alternative 7 – Alternative Transfers:

This alternative considers the possibility of agricultural water districts, other than IID, conserving and transferring water to SDCWA.

Opportunities may exist to transfer Colorado River water to SDCWA, CVWD, and/or MWD from other agricultural water districts with Colorado River water entitlements in the Upper Basin states. Transferring water from Upper Basin states may be less reliable than water from IID, depending on each state's laws regarding required approvals for out-of-state transfers. In-state users may have priority for "surplus" water supplies.

Transferring water from districts other than IID would avoid the impacts to the Salton Sea resulting from conservation within the IID service area, and would avoid any other impacts resulting from conservation activities within IID.

There is also the possibility of a water transfer from the Palo Verde Irrigation District, in which PVID would fallow its land and the conserved water would be diverted to the CRA. (This transfer alternative is included in the No Project Alternative 1b of the QSA PEIR).

Alternative 7 Screening Criteria	
C1: Provide SDCWA with reliable source	Fail
C2: Protect IID's water rights	Fail
C3: Reduce environmental impacts	Unknown
C4: Technically feasible and reliable	N/A
C5: Institutional and politically feasible	Fail
C6: Implementable within reasonable time periods	Unknown
C7: Meet QSA transfer objectives	Unknown

EXPLANATION: This alternative might not provide SDCWA with a reliable supply of water because users within the Upper Basin states would likely be unable to transfer water out of state without first making it available to other in-state users. For this reason, this alternative fails C1. This alternative could adversely impact IID's water rights, because it would not serve IID's objective to develop an on-farm and system conservation program to increase irrigation efficiency, and does not implement SWRCB directives to IID, thereby increasing the potential for challenges to its water use, when compared to the Proposed Project.

Environmental impacts to the LCR could be more severe than for the Proposed Project because water could be diverted upstream of Parker Dam, depending on the conveyance facilities used to deliver water. However, this alternative would eliminate impacts associated with conservation in the IID service area, including impacts to the Salton Sea. Because impacts to LCR have not been defined for this alternative, it receives an Unknown for C3.

Additionally, the economics of this alternative are unknown. Given the growing demand for water in the upper basin states, the institutional and political feasibility of transferring water out of that area into California is uncertain.

CONCLUSION: Because this alternative fails to meet the project objectives and may not reduce environmental impacts when compared to the proposed project, it has been eliminated from further consideration.

Alternative 8. Maximize Local Supplies in SDCWA Service Areas and Develop 200 KAFY Desalination Facility:

Under this alternative, SDCWA would maximize the development of all potential local water supplies and develop 200 KAFY of seawater desalination capacity. No water would be transferred from IID. The increase in local water supplies would diversify SDCWA sources and increase their overall reliability. SDCWA's 2000 Urban Water Management Plan projects the local water supplies that would be developed and the amount of additional water that could potentially become available, as shown on the table below.

It is assumed that CVWD cannot increase its local groundwater supply because it is currently operating in overdraft conditions and is seeking to increase recharge to its aquifer, as described in the Coachella Valley Groundwater Management Plan EIR (CVWD 2000).

Potential Local Water Supply Sources

Source	Potential 2020 Quantity (AFY)
Conservation	93,200
Surface water	85,600
Groundwater	59,500
Water recycling	53,400
Desalination	25,000
TOTAL	**316,700**

Source: SDCWA, Urban Water Management Plan, 2000

Although SDCWA only projects 25,000 AFY of water from desalination in its Urban Water Management Plan, this alternative proposes 200 KAFY of desalination capacity. Desalination was selected as the only local water source that has significant potential to be expanded beyond what is already planned by SDCWA.

Currently, the largest membrane-based seawater desalination plant now under construction in the U.S. is in Tampa, Florida, where the Poseidon Resources Corporation and the Covanta Energy Corporation will be producing 25 million gallons (17,885 AFY) of water per day for about $1.75 per thousand gallons, the lowest rate in the world. But the estuarine waters of Tampa Bay are far less salty than the ocean, cutting desalting costs.

In Trinidad, Ionics is building what will be the biggest ocean-desalination plant in the Western Hemisphere, with an output of 29 million gallons per day (32,120 AFY) at about $2.50 per thousand gallons. IDE's plant in Cyprus provides 16 million gallons of drinkable water a day for a similar price. But with improving technology and economies of scale, contractors for planned Israeli projects are expected to keep the cost close to $2 per thousand gallons. (NY Times, June 2001).

For this alternative, it is assumed that either one or more desalination facilities would be constructed with a total capacity of 200,000 AFY in the SDCWA service area. Specific details about this conceptual alternative have not been developed. However, the two major obstacles for this alternative would be siting issues and the provision of an energy supply. Ideally, a desalination facility could be co-located with a power plant to obtain a reliable power supply and utilize existing power plant cooling water facilities for seawater intake and discharge of blended concentrate (brine). Securing a reliable and cost-effective energy supply for such a large capacity of desalination would be a determining factor in assessing the feasibility of this alternative.

Alternative 8 Screening Criteria	
C1: Provide SDCWA with reliable source	Maybe
C2: Protect IID's water rights	Fail
C3: Reduce environmental impacts	Unknown
C4: Technically feasible and reliable	Pass
C5: Institutionally and politically feasible	Unknown
C6: Implementable within reasonable time period	Short-Term – Fail Long-Term - Pass
C7: Meets QSA transfer objectives	Fail

EXPLANATION: This alternative might adversely impact IID's water rights because it would not serve IID's objective to develop an on-farm and system conservation program to increase irrigation efficiency. In addition, it would not implement SWRCB directives to IID, thereby increasing the potential for challenges to its water use when compared to the Proposed Project. Therefore, this alternative fails C2.

Additionally, the two biggest obstacles to implementation of this alternative are facility siting and securing an energy supply that can be guaranteed as economically feasible for the long-term. Siting constraints along the coast of California cannot be underestimated; the "Unknown" rating for C5 reflects the uncertainty of finding a suitable site and successfully gaining the required approvals. Similarly, without knowing where a plant may be located, the possibility of reducing environmental impacts when compared to the Proposed Project is Unknown (C3).

However, it is reasonable to assume that significant impacts would result from construction and operation of a large desalination facility that would require withdrawal of significant amount of water (potentially from an area of environmental sensitivity), disposal of brine concentrate, and generation and use of a significant amount of energy. Poseidon Resources

Corporation prepared a feasibility study in July 2001 to evaluate the potential of a seawater desalination project at the Encina Power Plant in the City of Carlsbad. The study showed that the potential costs for a 50 mgd (56,000 AFY) project were competitive with development of other local water supplies. This is currently considered the maximum amount potentially feasible at this site because it can be supported by the existing power plant and nearby water distribution facilities. Additional studies will need to be conducted to determine feasibility for amount beyond 50 mgd at this site. Another potential location for a seawater desalination facility is at the South Bay Power Plant, where additional studies are still required to determine feasibility for any desalination to occur. The South Bay site does not possess ready access to the ocean for concentrate (brine) discharge from the desalination process. Therefore, brine disposal is the primary constraint to developing a project at this location. The feasibility of seawater desalination in the required volumes remains extremely speculative. Because of these challenges, if implemented, this alternative would require several years before water would be available for consumers in the SDCWA service area. Therefore, it fails C6 for the short-term, but passes for the possibility of providing a supply for the long-term.

CONCLUSION: Because this alternative fails to meet the primary Proposed Project objectives of providing SDCWA with a reliable supply, and protecting IID's water rights, and because this alternative, depending on site location, might not reduce environmental impacts when compared to the Proposed Project, it has been eliminated from further consideration.

Alternative 9 - CVP and SWP Supplies:

This alternative considers other potential supplies within California that could be purchased and delivered to SDCWA. The two main sources of additional supplies in California include the transfers from the State Water Project's Water Bank, and transfers from the Central Valley Project.

SWP Water Bank: The state water project may have capacity that could be used for wheeling supplies transferred from Northern or Central California. The State Water Bank already exists to facilitate water transfers from willing sellers to water-short districts. Created in 1991 as a drought emergency measure, the Department of Water Resources (DWR) created the bank, purchased water from sellers for $125/AF, and sold the water for $175/AF. SDCWA purchased 21,600 AF in 1991. The bank has recently facilitated transfers ranging from 10,000 AF to 127,000 AF.

CVP Transfers: Transfers among CVP contractors or users have been ongoing informally for several years. Between 1981 and 1989, more than 1,200 such transfers were made to meet agricultural needs. Because these transfers do not require a change in Reclamation's water rights permits or the CVP, they are not subject to SWRCB jurisdiction.

In addition to transfers between individual contractors, two groups of contractors have set up permanent transfer pooling systems. The pools establish banks where participants can deposit water when they have excess, and can withdraw water when they need it.

Passage of the Central Valley Project Improvement Act (CVPIA) has provided the opportunity for CVP water to be considered a major potential resource for Southern California. The CVPIA allows not only districts, but individual farmers to transfer water. Districts only have veto rights if the transfer is more than 20 percent of their contracted CVP supply. These requirements have simplified the transfer of CVP water to other areas of the state.

The major obstacle to securing these supplies is that the water would require use of MWD conveyance facilities to reach SDCWA, and these facilities do not have enough capacity under existing operations, and might not be available to wheel additional supplies to SDCWA.

Alternative 9 Screening Criteria	
C1: Provide SDCWA with reliable source	Fail
C2: Protect IID's water rights	Fail
C3: Reduce environmental impacts	Unknown
C4: Technically feasible and reliable	Unknown
C5: Institutionally and politically feasible	Pass
C6: Implementable within reasonable time period	Pass

C7: Meets QSA transfer objectives	Fail

EXPLANATION: Water transfers from other sources in California to SDCWA might supplement their existing supply; however, it is unlikely that they could provide SDCWA with a reliable source in the event of a drought period. – Therefore, F1 is rated Fail.

This alternative may adversely impact IID's water rights because it would not serve IID's objective to develop an on-farm and system conservation program to increase irrigation efficiency, and it would not implement SWRCB directives, thereby allowing the potential for challenges to its water use. Therefore, this alternative fails C2. Without specific transfer terms, it is speculative to state whether this alternative could minimize environmental impacts when compared to the Proposed Project.

Additionally, due to conveyance capacity constraints, C4 is rated Unknown. This alternative would not meet the QSA transfer objectives.

CONCLUSION: Because this alternative does not meet the Proposed Project objectives to supply SDCWA with a reliable alternative water supply and protect IID's water rights, it has been eliminated from further consideration. Additionally, it is uncertain if this project could reduce environmental impacts when compared to the Proposed Project. However, it should be noted that SDCWA might pursue some transfers from these sources as a supplement to its overall supply.

Alternative 10: Water Banking

This alternative is modeled after the water banking concept currently under development between the Central Arizona Project and the Southern Nevada Water Authority (SNWA). The Arizona Water Banking Agreement will allow Nevada and other states to store unused and surplus Colorado River water in Arizona's groundwater aquifer for future use.

Nevada will pay to have any unused portion of Colorado River water diverted to Arizona, which will store the water in an underground aquifer. When Nevada needs the water— for example, 10,000 AF —it will use its "credits" from the groundwater bank and pump an additional 10,000 AF from the Colorado River. Arizona will then use the 10,000 AF of stored groundwater that had been deposited, and pump less from the Colorado River.

The Arizona Water Banking Agreement allows Nevada to store as much as 1.2 MAF of water in Arizona—about four years' worth of its annual allocation. Nevada plans to participate in the banking process over the next 15 years, and to use the supply when needed, probably after 2015.

Arizona created the Arizona Groundwater Banking Authority in 1996 after initial discussions of the concept. In creating the Banking Authority the state legislation also allowed the creation of an interstate bank to give Nevada and California the opportunity to bank water in Arizona.

In November 1999, Reclamation released regulations governing interstate water banking. These regulations create a framework under which contracts among appropriate parties may be negotiated. (Source: www.snwa.com)

In this alternative, a similar water banking concept would be developed and implemented. SDWCA would pay to have surplus water, if available from the LCR, banked in the depleted aquifer of CVWD. When water is needed, SDCWA would then pay CVWD to use groundwater in exchange for CVWD's LCR water supply. SDCWA would divert CVWD's LCR supply at Parker Dam.

Alternative 10 Screening Criteria	
C1: Provide SDCWA with reliable source	Unknown
C2: Protect IID's water rights	Fail
C3: Reduce environmental impacts	Pass
C4: Technically feasible and reliable	Pass
C5: Institutionally and politically feasible	Pass
C6: Implementable within reasonable time period	Pass
C7: Meets QSA transfer objectives	Fail

EXPLANATION: It is unlikely, or at least unknown, if this alternative could provide SDCWA with a reliable water source because the quantity of surplus water available for banking in CVWD aquifers is unknown. The available amount of water would fluctuate yearly based on supply and demand of other higher priority water users. Further analysis is necessary to evaluate whether this alternative could provide SDCWA with a reliable source and become a viable project.

Additionally, this alternative might adversely impact IID's water rights because it would not serve IID's objective to develop an on-farm and system conservation program to increase irrigation efficiency. Also it would not implement SWRCB directives to IID, thereby increasing the potential for challenges to its water use, when compared to the Proposed Project. Therefore, this alternative fails C2.

This alternative does have the potential to reduce impacts when compared to the Proposed Project. It would reduce impacts to the Salton Sea, and it could improve groundwater conditions in CVWD.

CONCLUSION: Because this alternative would not meet the primary project objectives of providing SDCWA with a reliable water supply and protecting IID's water rights, it has been eliminated from further consideration.

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Imperial Irrigation Decision Support System Summary Report

Prepared for

Imperial Irrigation District

December 2001

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Contents

Tables

Figures

SECTION 1

Introduction

Imperial Irrigation District (IID or District) is considering a temporary transfer of Colorado River water that IID is entitled to divert under its Colorado River entitlement. The Proposed Project will implement two agreements: the first agreement is exclusively with the San Diego County Water Authority (SDCWA); the second agreement includes partial transfer to SDCWA, Coachella Valley Water District (CVWD), and possibly the Metropolitan Water District of Southern California (MWD). For either agreement, the transfer will result from water conservation within the IID water service area[1].

The Imperial Irrigation Decision Support System (IIDSS) was developed to support the understanding of how the irrigation and drainage network in IID would respond to a variety of water conservation programs. Specifically, the IIDSS simulates water conservation measures and the associated changes to water quality and quantity in the agricultural canals and drains.

The primary purpose of this summary report is to provide an overview of the logic, design, and operation of the IIDSS, and some key findings.

This Summary Report is organized into the following sections:

- Section 1—Introduction
- Section 2—Design of the Imperial Irrigation Decision Support System
- Section 3—Alternative Conservation Program Assessments

IID Irrigation and Drainage Systems

IID diverts their entire water supply from the Colorado River through the All American Canal. Service is provided 12 months per year to some 5,300 farm gates to irrigate over 460,000 acres of crops. Since 1988, IID annual diversions at Pilot Knob on the All American Canal has varied from 2.62 to 3.25 million acre-feet per year (ac-ft/yr). Figure 1-1 shows the location of IID. (Figure 2-2 illustrates key IID delivery facilities.)

IID's water supply is regulated by the Colorado River Water Storage and Supply System. Water is diverted from the Colorado River at Imperial Dam, 18 miles northeast of Yuma, Arizona. However, the water supply above Imperial Dam is controlled by major federal water works upstream of the diversion point. The storage and control facilities that provide a constant year-round supply to match IID demands include Hoover Dam and Lake Mead (32.5 million ac-ft capacity when constructed), Glenn Canyon Dam and Lake Powell (active capacity of 20.9 million ac-ft when constructed), Davis Dam, Parker Dam, and Imperial Dam. These facilities, with the exception of Imperial Dam, are operated by the

[1] For this report, the term IID is meant to be the IID water service area.

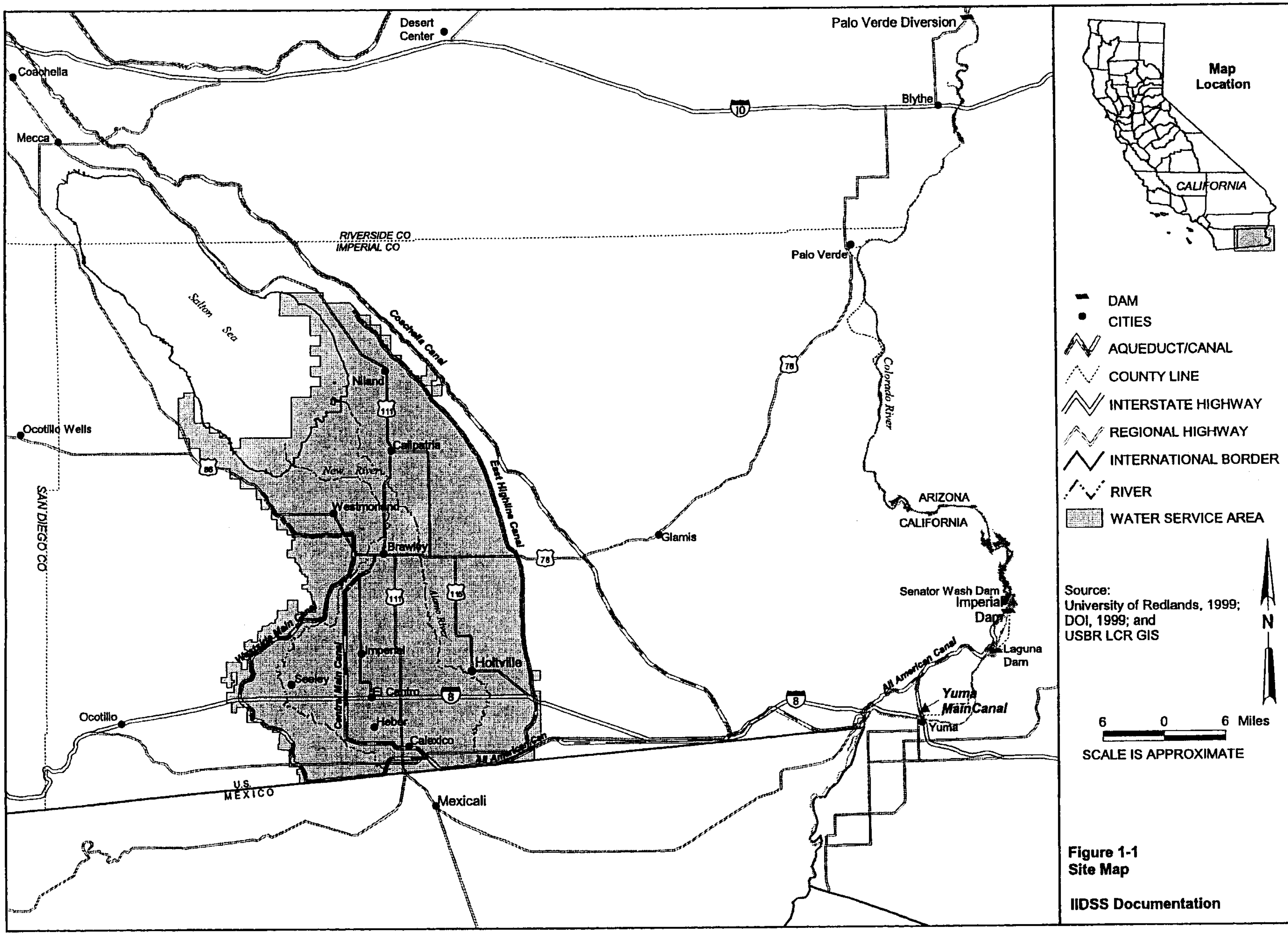

Figure 1-1
Site Map

IIDSS Documentation

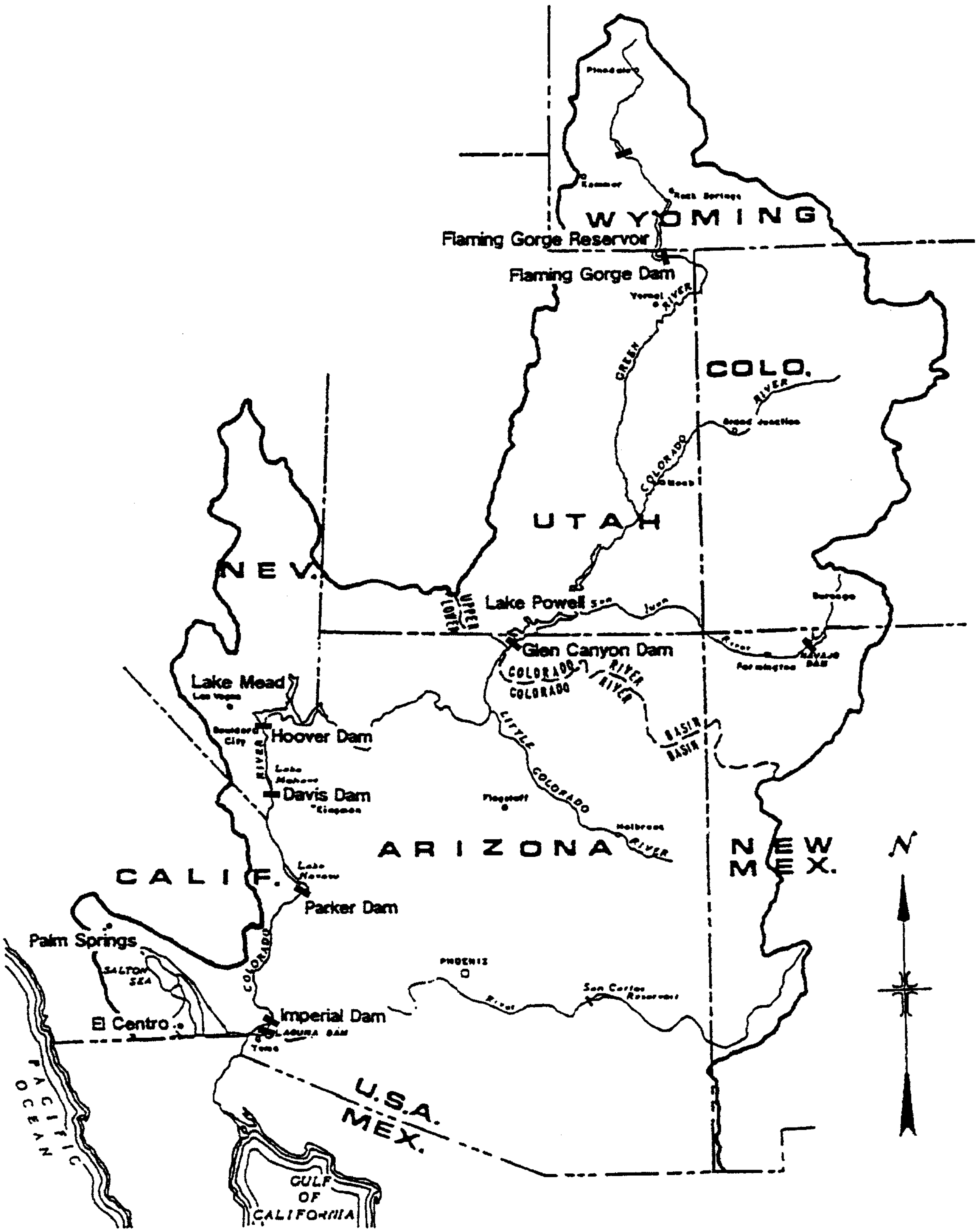

Figure 1-2
Selected Colorado River Water Projects
IIDSS Documentation

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U.S. Department of the Interior, Bureau of Reclamation (USBR). Figure 1-2 shows key hydrologic elements and water projects for the Colorado River Basin. IID orders water 1 week in advance to allow for travel time from Lake Mead. The USBR delivers these orders to Imperial Dam for diversion into the All American Canal and related IID facilities, which are operated by IID. The maximum canal capacity at the headworks is 15,150 cubic feet per second (cfs). This capacity decreases below the delivery points and is about 7,000 cfs below Drop 1, the delivery turnout for the Coachella Canal. The All American Canal provides flow to the Pilot Knob power plant and passes through five drop structures and hydroelectric power plants. Check structures and power plants provide control for water flow rates and elevations along the canal length. The canal is mostly unlined (earth section), has a typical depth of 21 feet, and is 160 feet wide at water level.

The All American Canal runs in a westerly direction and delivers water to three main canal systems within IID. These three canals, East Highline, Central Main, and Westside Main, generally run north and deliver water to the District's lateral canal system. There are about 1,672 miles of canals and laterals, 1,102 miles of which are concrete lined. All of these canal systems provide gravity service. Farm turnouts/delivery points are from the lateral canals. The turnout facilities are owned and operated by the District, with each turnout having a control gate and flow measurement device.

To improve water delivery service and water use, the District has constructed seven regulating reservoirs with a total capacity of 2,256 ac-ft. These reservoirs level out the variability in supply (ordered 1 week earlier), providing delivery more consistent with farmer needs. In addition, three lateral interceptor systems capture operational water discharges for reuse within the irrigation system. Like the regulating reservoirs, these systems are planned to conserve water and provide improved service to the farmers.

The District drainage system (Figure 2-3) consists mainly of surface drains and the Salton Sea. Approximately 1,500 miles of surface drains are maintained by the District to collect field operational (tailwater) and system operational discharge and subsurface tile drain (tilewater) flows. These drains flow either to the Salton Sea via the Alamo and New River systems or directly into the Salton Sea itself. The 33,000 miles of tile drainage systems under irrigated fields are owned by the individual farmers and discharge into the surface drains.

The Colorado River at Imperial Dam is high in salinity and selenium. Historically, salinity has varied from about 600 milligrams per liter (mg/L) to nearly 1,100 mg/L, with an average salinity during the IIDSS study period of 747 mg/L. Selenium during this same period was slightly greater than 2 micrograms per liter (μg/L) (0.002 mg/L). Although there is a time lag, farmers eventually increase water diversions for leaching of salts that accumulate in their soils.

The Salton Sea serves as a drainage basin for irrigation and storm runoff in the Imperial, Coachella, and Mexicali valleys. The Salton Sea has officially been designated as a repository for agricultural drainage by the federal government.

Water Transfer Basics

Both transfer agreements stipulate that any water transferred will be the result of water conservation. The duration of transfer will be from 45 to 75 years. The minimum annual volume transferable is 130,000 ac-ft, with a maximum potential of 300,000 ac-ft/yr. This is in addition to the present 106,500 ac-ft now being conserved and transferred to MWD.

Conservation projects are categorized as on-farm and system. On-farm conservation is a voluntary program and farmers will choose their own conservation methods that may include fallowing. The farmers will also decide how much water they will conserve with a possible maximum annual amount per acre set by IID. On-farm conservation is measured by the reduction in historical water deliveries (1987 to 1998) at farm turnouts. In addition, the length of time a farmer participates in the program will likely vary, meaning participants may be moving into and out of the conservation program. In summary, the variables associated with defining an on-farm conservation program are nearly endless, and include spatial distribution, voluntary participation over given time frames, the volume and efficiency of any conservation method, and the total variability of irrigation demand and performance in space and time. System conservation projects include lateral interceptor systems, seepage collector systems, mid-lateral and operational reservoirs, canal lining projects, and the possibility of fallowing by IID.

Imperial Irrigation Decision Support System

From the above discussion, the conclusions are: (1) The IID system is extremely large and hydrologically complex, (2) the conservation programs will include conservation projects that will be dynamic and changing over time, and (3) the potential impacts to drainwater quality will vary in both space and time. In addition, verification of conserved water will be difficult in the complex IID canal and drainage system. Conservation will change the water quality in the IID drainage system according to the conservation amounts, methods, and spatial density. As a result, it was determined that more than an analytical or numerical model would be required to simulate and predict the effects of water conservation within the IID water service area. It was concluded that decision support system technology would be used to develop a predictive tool for analyzing the effects of conservation within the IID.

IID System Representation

The IIDSS simulates the physical input and output processes that occur in delivering water to a farm, irrigating a crop, and predicting the resultant drainage outflow. The IIDSS includes three modules: a Delivery System Module, an On-farm System Module, and a Drainage System Module. Working together, these modules will provide the needed results to identify "wet water" conservation savings and changes in quality and quantity of drainage waters.

IIDSS Purpose

For conservation projects that are implemented, or planned, the IIDSS will do two things: (1) determine the amount of *net* conserved water resulting from all conservation measures within a conservation program, and (2) predict the change in water quality and quantity in drains and rivers flowing through IID. Obviously, the power of the IIDSS is its ability to track multiple conservation measures and to account for temporal changes and spatial movement of those measures around the irrigated service area. Having that ability will facilitate analysis of the relative impacts of different conservation programs and the comparison of those impacts to other conservation programs or a projected future with no conservation programs. In essence, the IIDSS allows "what if" analysis.

The water quality parameters to be tracked in the IIDSS include salinity, selenium, sediment, nitrogen, phosphorus, boron, and organochlorine and organophosphorus insecticides.

Peer Review

To validate the IIDSS and provide additional quality control, a Peer Review Team was assembled for review of the IIDSS and its documentation. A detailed presentation was made to this team on the development and operations of the IIDSS. This same Team reviewed several versions of the documentation and commented on the IIDSS concepts, structure, science, and logic. This Team found the IIDSS to be a valid representation of conditions at IID. Clarification was added to the documentation as a result of this review.

SECTION 2

Design of the Imperial Irrigation Decision Support System

Irrigation System Overview

IID's irrigation system diverts water from the Colorado River to over 5,000 tenants that are distributed throughout the 1,000 square miles of the district. As shown on Figure 2-1, water for irrigation is diverted from the Colorado River and distributed to farms, municipal and industrial (M&I), and other users via the delivery system. The drainage system collects the return flows from these users and discharges to the Alamo and New rivers and the Salton Sea. Figure 2-1 provides a conceptual overview of all the external and internal IID water flow paths described in this chapter.

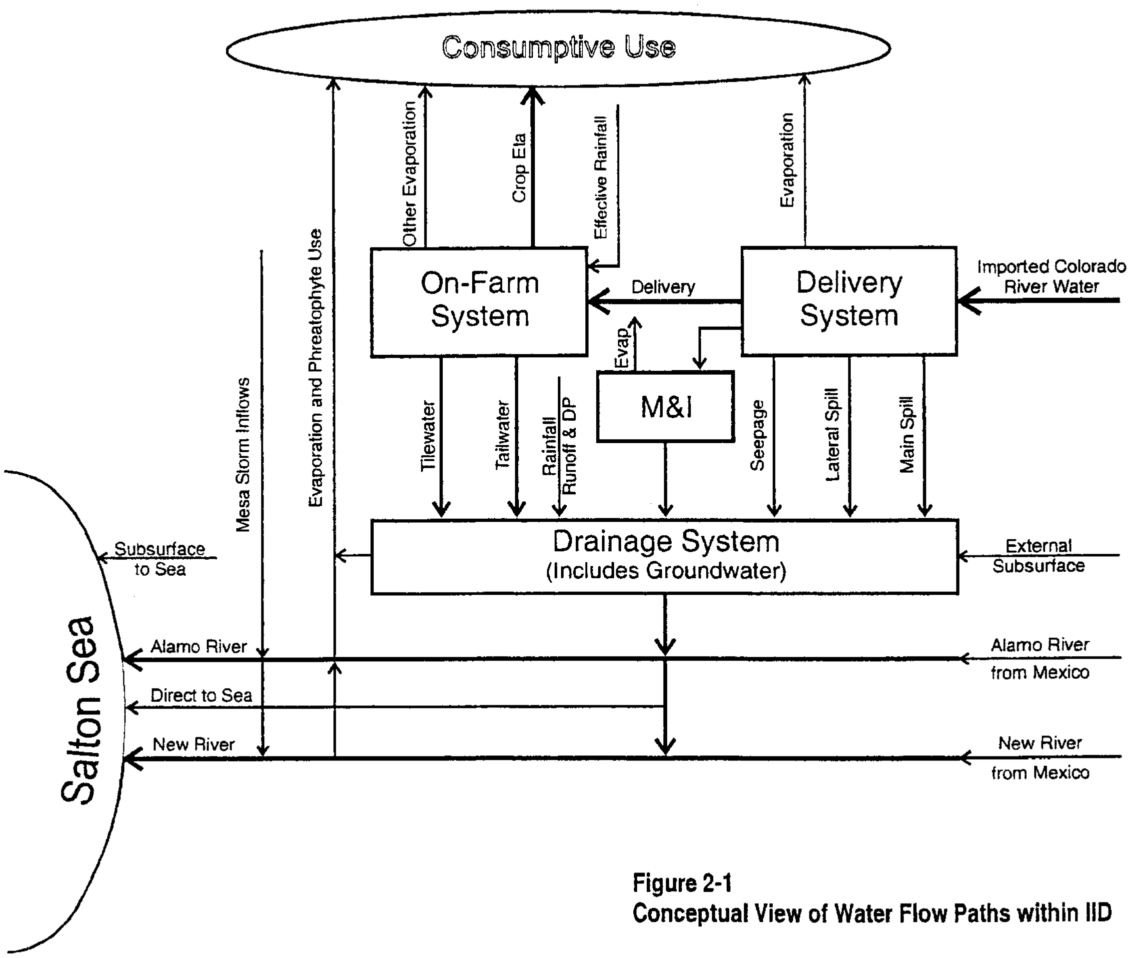

Figure 2-1
Conceptual View of Water Flow Paths within IID

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Rectangular boxes on Figure 2-1 represent the delivery, on-farm, municipal and industrial (M&I), and drainage systems that define water demands, canal and drain flows, and water quality throughout the delivery canals and drains. The oval at the top of the figure, labeled consumptive use, represents the discharge of water to the atmosphere via evapotranspiration (ETa) from farm fields, evaporation from water surfaces, and transpiration by phreatophytes growing along canals, drains, and rivers. Approximately two-thirds of the water diverted from the Colorado River to the IID water service area is consumptively used. The remaining third of imported water discharges to the Salton Sea, which is represented by the open oval on the left-hand side of Figure 2-1. Arrows connecting the system boxes and discharge ovals represent the modeled water flow paths throughout IID.

The weight of the arrows on Figure 2-1 indicates the relative volume of flow along the associated flow paths. Table 2-1 gives the measured and simulated mean annual flows for these flow paths for the 12-year (1987 to 1998) calibration and validation period.

TABLE 2-1
Measured and Simulated Mean (1987 to 1998) Annual Flows (ac-ft) along Major Flow Paths within IID

Description	Recorded	Modeled
Imported Colorado River Water	2,865,700[a]	2,857,000
Canal and Reservoir Evaporation		20,800
Canal Seepage		122,700
Main Canal Spills		6,700
Lateral Spills		116,900
Sum of Delivery System Losses	271,600[b]	267,100
Delivery to Farms	2,489,600	2,489,700
Crop Eta		1,806,200
Other Evaporation		-
Effective Rainfall		100,700
Tailwater		390,000
Tilewater		394,200
Delivery to M&I + Stock + Misc.	104,500[c]	104,500
Consumptive Use from M&I + Stock + Misc.		76,300
Return Flow from M&I + Stock + Misc.		28,200
Change in Soil Water and Groundwater Storage		-
Recovered Return Flow from Mesa Lateral 5		4,400
Rainfall Runoff and Deep Percolation		36,800
Evaporation and Phreatophyte Use		125,100
Mesa Storm Inflows		7,900
Subsurface Inflow (Estimated)	20,000	20,000
Alamo River from Mexico	1,700	1,700
New River from Mexico	164,700	164,700
Alamo River to the Salton Sea	604,500	605,100
New River to the Salton Sea	453,500	453,000
Direct to Sea	100,200	101,200
Subsurface to Sea (Estimated)	1,000	1,000

[a]All American Canal at Mesa Lateral 5 by water balance from recapitulation data.
[b]Sum of delivery system losses is calculated from the difference in recorded diversions less deliveries.
[c]Includes estimates of deliveries to rural pipes and community greens.

A water balance is kept for each system (rectangle) shown on Figure 2-1, so that the sum of the inflows is equal to the sum of the outflows plus the change in storage within each system. The storage capacity within IID's delivery system is very small relative to the annual flow so the annual change in storage within the delivery system is always near zero. The soil water storage capacity of IID's farm fields and the drainable shallow groundwater storage are relatively large. However, over the course of several years the change in stored water within the on-farm and drainage systems is small and assumed to be zero. Thus, the data in Table 2-1 show that the summation of mean annual flows into each system is exactly equal to the summation of the flows out of each system. Likewise, a water balance can be computed for the IID water service area as a whole showing that the sum of inflows equals the sum of outflows.

Delivery System

Figure 2-2 shows the Geographic Information System (GIS) representation of the extent and configuration of IID's delivery system. Using the 12-year (1987 to 1998 calibration period) modeled mean values presented in Table 2-1, the delivery system imports 2,857,000 ac-ft/yr from the Colorado River via the All American Canal[2]. From this, 2,489,700 ac-ft are delivered to IID farms and 104,500 ac-ft are delivered to M&I users, stock, rural pipes, and community greens, leaving a net delivery system loss of 267,100 ac-ft/yr (accounting for return flows to the delivery system). Of this net delivery system loss, approximately 8 percent is canal and reservoir evaporation, 46 percent is canal seepage, 2 percent is main canal spills, and 44 percent is lateral spills.

On-farm System

Water flows through the delivery system and is delivered to a farm or farms, group of fields, or another type of user through a turnout. There are approximately 5,300 turnouts in IID. Of these, roughly 35 percent are solely for agricultural irrigation, 3 percent are for other uses, and the remaining 62 percent of the turnouts serve a combination of agricultural and other uses. Agricultural irrigation accounts for 96 percent of the total water use within the IID[3] water service area.

Water delivered through a farm turnout is either consumed or discharged to the drainage system. Crop uptake and evapotranspiration are the water consumption mechanisms; tailwater and tilewater are the methods of discharge. This partitioning of on-farm water into consumptive use and tailwater and tilewater return flow components is a complex process within the on-farm system.

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[2] The upstream boundary of the study area is the All American Canal at Mesa Lateral 5, which is just upstream of the East Highline Canal heading. Relatively small amounts of water are delivered to IID users off the All American Canal upstream of the Mesa Lateral 5 heading (3,400 ac-ft per year) and along the Coachella Canal (4,100 ac-ft per year) and are excluded from this analysis. Additionally, there are approximately 99,400 ac-ft per year of seepage and evaporation loss along the All American Canal between Pilot Knob and the East Highline Canal charged to IID's total Colorado River diversion. Thus, the modeled mean (1987-1998) IID annual diversion of Colorado River water is 2,857,000 + 3,400 + 4,100 + 99,400 = 2,963,900 ac-ft.

[3] Other uses are composed mainly of M&I demands, but also include stock, rural pipe deliveries, and water for irrigating community greens (e.g., parks, school grounds). Other uses are not modeled in detail. Deliveries to M&I (72,600 ac-ft per year) and stock (10,300 ac-ft per year) uses are recorded. Rural pipe deliveries and deliveries to community greens are estimated to be 11,600 ac-ft per year and 10,000 ac-ft per year, respectively. The total of all other uses is 104,500 ac-ft per year. Consumptive use by all other uses is assumed to be 70 percent of deliveries except for stock, which is assumed to be

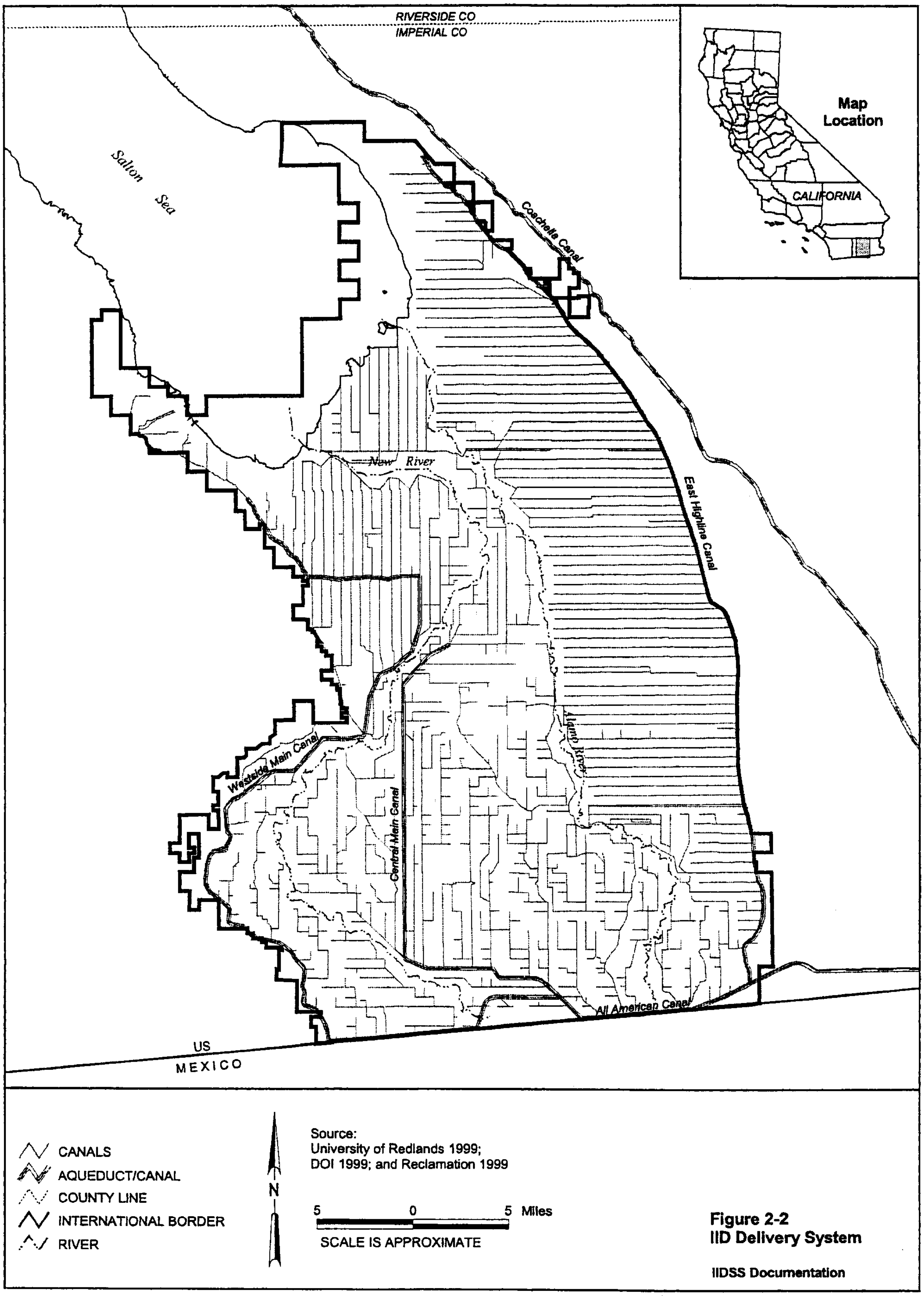

Figure 2-2
IID Delivery System

IIDSS Documentation

Using the 12-year modeled mean values presented in Table 2-1, the average annual deliveries to IID farms are 2,489,700 ac-ft. Of this, approximately 390,000 ac-ft returns to the drainage system as tailwater and 394,200 ac-ft as tilewater. The balance, 1,705,500 ac-ft, makes up the consumptive irrigation volume. The estimated average annual effective[4] precipitation is 100,700 ac-ft. Thus, the estimated total average annual crop consumptive use is 1,806,200 ac-ft (1,705,500 + 100,700).

Drainage System

The third major component of the IID irrigation system is the drainage system that consists of approximately 1,500 miles of surface drains. The drains collect tilewater and tailwater flows from the farms, and pass them either directly to the Salton Sea or discharge them to the New or Alamo rivers. Figure 2-3 illustrates the extent and configuration of IID's drainage system.

Using the 12-year modeled mean values presented in Table 2-1, the average annual discharge to the Salton Sea is 1,160,300 ac-ft (605,100 ac-ft via the Alamo River + 453,000 ac-ft via the New River + 101,200 ac-ft via drains discharging directly to the Salton Sea + an estimated 1,000 ac-ft of subsurface flow). Of this total drainage system discharge to the Salton Sea, 186,400 ac-ft/yr on average comes from Mexico (1,700 ac-ft via the Alamo River + 164,700 ac-ft via the New River + an estimated 20,000 via subsurface inflows) and an estimated 44,700 ac-ft comes from rainfall runoff and deep percolation and mesa storm inflows (36,800 ac-ft and 7,900 ac-ft, respectively).

An estimated 125,100 ac-ft evaporates annually from the drainage system via phreatophyte use and direct evaporation from water surfaces. A water balance on the drainage system (inflows – outflows = change in storage) shows that the average annual change in storage is zero (390,000 ac-ft of tailwater + 394,200 ac-ft of tilewater + 28,200 ac-ft of M&I and miscellaneous return flow + 122,700 ac-ft of canal seepage + 6,700 ac-ft of main canal spill + 116,900 ac-ft of lateral canal spill + 186,400 ac-ft from Mexico + 44,700 ac-ft from rainfall and mesa storm inflows – 1,160,300 ac-ft of total discharge to the Salton Sea – 125,100 ac-ft of evaporation and phreatophyte consumptive use – 4,400 ac-ft of recovered return flow from Mesa Lateral 5 = 1,289,800 ac-ft of drainage system inflows – 1,289,800 ac-ft of drainage system outflows = 0).

Data Review

The IIDSS determines the effectiveness of water conservation measures and the associated impacts to water quality and quantity in the drains. The basis for these determinations are water and water constituent mass balances. These balances track the flow of water and associated water quality constituents into and through IID to the atmosphere and Salton Sea as shown on Figure 2-1. To model each of the processes illustrated on Figure 2-1, large amounts of data were required, though they were not always readily available. This section briefly describes the data review process and data issues that were identified.

[4] Effective precipitation is the portion of precipitation that contributes to the total consumptive use of irrigated crops.

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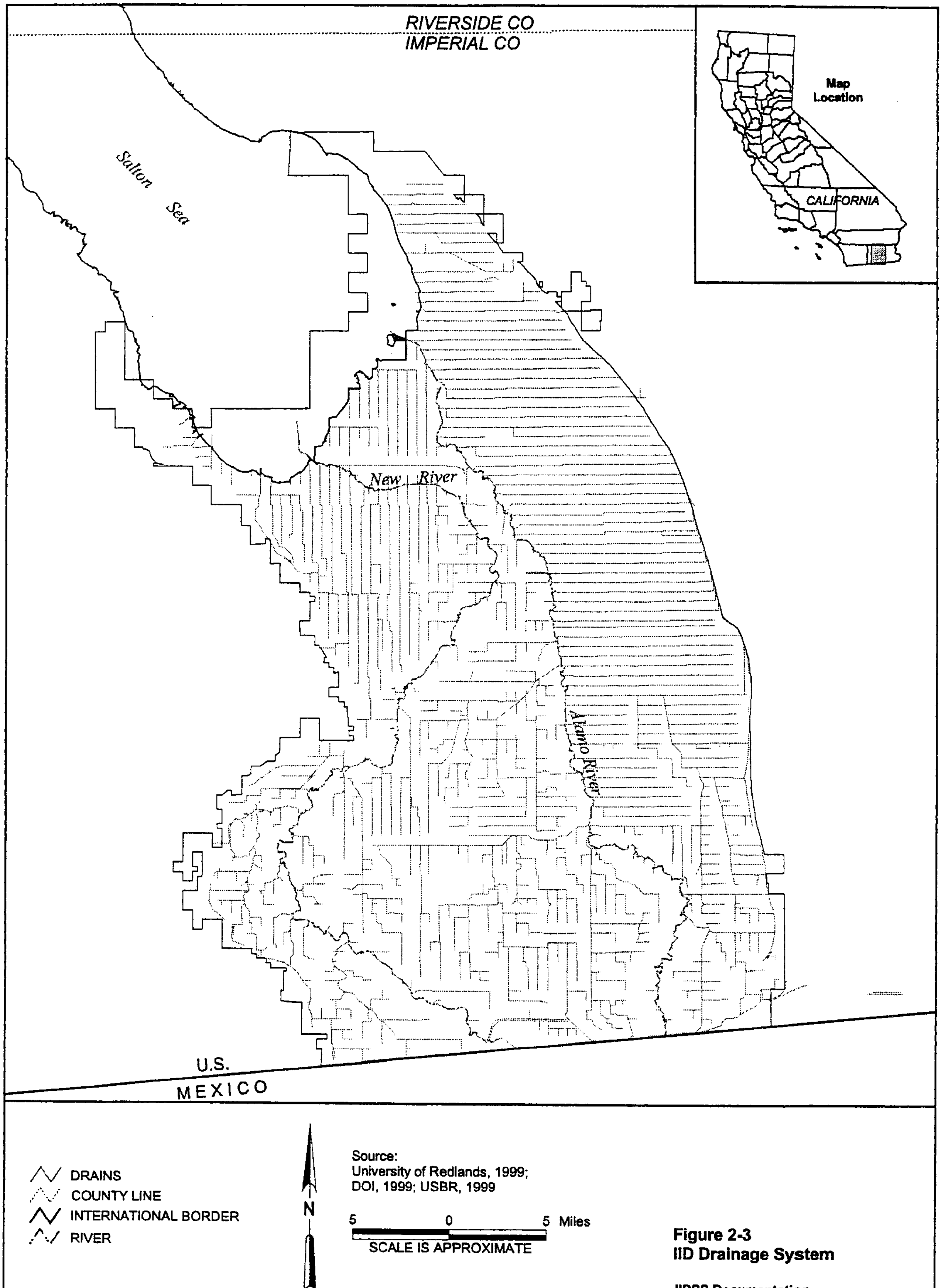

Figure 2-3
IID Drainage System

IIDSS Documentation

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Data Collection and Analysis

Historical flow data were retrieved from IID's database through a series of queries. These data represented the measured amounts of water that were delivered to each of the 5,287 turnouts during the 12-year span from 1987 to 1998. This 12-year period from 1987 through 1998 was selected for model development, calibration, validation, and verification since this was the only period of full monthly water deliveries and cropping information available in electronic form[5]. Data gaps were identified and assumptions were made to fill them.

Because the amount of data was large, an IIDSS database, written in Microsoft Access, was used to store this information. Data from this database were included in the IIDSS Configuration Manager that was used to prepare input data sets for simulation of various alternatives by the MODSIM hydrologic model.

Delivery System Issues

Using the historical record of deliveries, a water balance was constructed to determine system losses between the All American Canal at Mesa Lateral 5 Heading and the sum of all deliveries. This water balance identified the sum of evaporation and seepage loss volumes plus spill volumes. Because main canal spillage was the only recorded delivery system loss, models of canal seepage and evaporation and lateral spillage as functions of flow in each canal reach had to be developed.

The delivery system is represented in the MODSIM link-node model using approximately 7,800 links and 7,800 nodes. Links correspond to the canal reaches and nodes represent canal branch points, turnouts, and termini. A GIS with a networking algorithm was used to populate the model with the link-node data necessary to simulate the delivery network. Link-node model time variant data included turnout demands and spills, delivery system information, and lateral interceptor systems and canal capacities.

Analysis of the system configuration identified multiple paths (canals) that water deliveries could follow to a particular turnout. Because MODSIM computes the optimum flow paths, a method of assigning a "delivery cost" was employed and calibrated to simulate the actual flow paths observed at IID.

Modifications were required to account for the time-varying system modifications, such as lining of canals and construction of lateral interceptor systems, under the conservation program developed pursuant to the 1988 IID/MWD Agreement. Synthetic demands were developed to represent water that was lost to canal seepage and evaporation prior to lining.

On-farm Issues

Available on-farm data consisted of time series of crop acreage, crop type, and irrigation method; soil type; and name of delivery turnout. To simulate on-farm processes, more data than were readily available were required. Reviewing literature and performing a series of analyses were used to develop crop evapotranspiration, tailwater, tilewater, and irrigation

[5] Electronic data on IID water orders, deliveries, and charges began May 1986 and, at the time of IIDSS model development, ran until mid-November 1999. Coincident with executing and logging water deliveries the zanjeros (ditch riders) also noted crops and planting and harvest dates. These crop history data were also stored in an electronic database covering the same time period as the delivery history database.

performance data. Methods to simulate the effectiveness of water conservation were also developed. Each farm turnout was simulated using two nodes: a delivery node and a drainage node.

Drainage System Issues

Because only limited flow measurements in the drainage system were available, professional judgment was used to determine the fractions of water deliveries that returned to the drainage system. In particular, return flow fractions needed to be determined for on-farm agricultural practices, M&I, other uses, and recovered water that was previously lost through canal seepage and spillage.

The drainage system is represented in MODSIM using approximately 1,500 links and 1,500 nodes. As with the delivery system, GIS software (a networking algorithm) was used to spatially connect the drainage nodes and links.

Boundary Inflow Issues

The drainage systems in the IID water service area ultimately discharge to one of three locations: directly to the Salton Sea, the New River, or the Alamo River. As a result of the drainage flows commingling with flows in the rivers, it was necessary to determine the volume of water that entered the IID service area via the rivers at the boundary.

Water Quality Issues

Water quality data were obtained and reviewed for nine chemicals of concern: salinity, sediment, boron, nitrogen, phosphorus, selenium, organochlorine insecticides (DDT, also used to represent its metabolites, and toxaphene), and organophosphorus insecticides (diazinon and chlorpyrifos).

Water quality data were compiled from various data sources to describe concentration and flow data from the Colorado River, the All American Canal, IID open drains, and for the Alamo River and the New River at the international border and their outlets to Salton Sea. Individual measurements were averaged into monthly values for the period from 1970 to 1999, and a subset of these monthly values for the 1987 to 1998 model calibration period was used in the model runs. Out of a possible 144 monthly water values for the 12-year modeling period, the number of data points for the non-pesticide constituents varied generally between 12 and 114; the number of organochlorine pesticide measurements was less than 5 values in this period.

In general, salinity, boron, and selenium are imported into the system from the Colorado River with the irrigation water. Small amounts of nitrogen and phosphorus, and sediment are also introduced through the irrigation water, but the primary source of these constituents is irrigated fields. In addition, pesticides come exclusively from farm runoff and pass through the drain system. Once in the drainage system, TDS and boron behave as conservative constituents, and selenium, nitrogen, and phosphorus appear to be influenced by chemical and biological activity. The coarse sediment largely settles in the drains and the finest suspended sediment continues through the rivers to the Sea. The measured concentrations for the constituents in the irrigation water, drains, and rivers to the Salton Sea are summarized in Table 2-2.

TABLE 2-2
Mean Flows and Concentrations for Water Quality Parameters

Parameter	Irrigation Delivery	New River			Alamo River		
		Border	Drains	Outlet	Border	Drains	Outlet
Daily mean flow (cfs)	3,934	250		622			843
Instantaneous flow (cfs)		193			2		
Total dissolved solids (TDS) (mg/L)	771	3,894	2,116	2,997	3,191	2,375	2,458
Total suspended solids TSS (mg/L)	86	117	193	313	360	318	479
Selenium (Se) (µg/L)	2.5	3.0	7.4	7.1	5.9	7.9	7.7
Nitrate (NO_3) (mg/L)	0.28	0.84	7.49	4.37	1.87	8.14	7.81
Total phosphorus (mg/L)	0.05	1.42	0.78	0.81	0.47	0.84	0.63
Total Phosphorus (Total P) in sediment (mg/kg)		535	1,300	1,600			1,100
DDT (µg/L)	0.001	0.088	0.013	0.016	0.011	0.020	0.016
DDT in sediment (µg/kg)		0.1	2.6	11.0	0.1	14.6	0.1
Diazinon (µg/L)			0.025				0.025
Chlorpyrifos (µg/L)			0.025				0.025
Boron (ug/L)	170	1,600	804	1,172	1,798	683	695

Baseline

Utilization of the IIDSS to determine water conservation resulting from various on-farm and system measures and the impact of such conservation on water supply and quality in the drainage courses of the IID water service area over the 75-year term of the Proposed Project requires establishment of a Baseline against which to measure change. To be meaningful, the baseline must represent the expected variability in drain flow and quality that could reasonably be expected in the future, based on the present state of irrigation within the District, but without implementing any new water conservation measures. It must also represent a sufficiently long record to allow assessment of long-term variability. Once the Baseline conditions are established, impacts can be assessed by applying the expected range of conservation measures to the Baseline condition.

The Baseline hydrology and water quality represents the physical conditions at a point in time (NOI and NOP for the Transfer EIR/EIS) and reasonable anticipated future variability in these conditions. Hydrology and water quality are resources that change over time and cannot be properly represented at a point in time. Therefore, a 75-year predicted Baseline was developed using the IIDSS, and based on 12 years (1987 to 1998 model calibration period) of available data representing river diversions, canal flows, farm turnout flows, climatic information, crops irrigated, drain flows, and water quality in the canals and drains. These data were adjusted according to reasonable anticipated future changes such as an increase in Colorado River salinity and for the effects of the 1988 IID/MWD Agreement. Finally, the data were projected to 75 years using a correlation based on 75 years of historical weather data compared to the 12-year data period. The Baseline prediction included an adjustment to limit the diversion of Priorities 1, 2, and 3 for normal year hydrology in the Colorado River to 3.85 maf/y.

The basic assumptions listed below represent reasonable anticipated future conditions and were used to develop the Baseline:

- The crop-mix represented during the 12-year period is a reasonable representation of what is likely to be grown in the future.
- Climatic variability is a reasonable proxy for the variability in diversion and delivery from year-to-year that is independent of farming practices.
- Salinity of supply water from the Colorado River will be maintained by Reclamation at an average 879 mg/L pursuant to the Salinity Control Act.
- Flow and water quality from Mexico over the past 12 years is the best reflection of future conditions.
- Changes in diversion and delivery as a result of conservation measures employed to date (pursuant to the 1988 IID/MWD Agreement) are best represented by the conservation verification estimates reported each year by the IID/MWD Conservation Verification Consultant Committee.

Structure of Imperial Irrigation Decision Support System

Overview

The general goal of the IIDSS was to support the understanding of how the irrigation and drainage network in the IID water service area would respond to a variety of water conservation alternatives. Specifically, the IIDSS is concerned with the effectiveness of water conservation measures and the associated impacts to water quality and quantity in the drains. This was accomplished by creating mathematical and numerical representations of each process and system presented on Figure 2-1. Collectively, these mathematical and numerical representations are integrated into a decision support system framework consisting of user interfaces, databases, analysis tools, and models collectively referred to as the IIDSS.

IIDSS was designed to simulate irrigation and drainage within IID for a 75-year period using a 12-year calibration and verification period. As explained above, the 12-year calibration period from 1987 through 1998 was selected because it covered the full availability of electronic data on IID gate deliveries and crop acreages, data that are key to the conceptual design of the IIDSS. The 75-year simulation capability was developed to analyze how the IID irrigation and drainage networks would respond over 75 years of water conservation[6], which is the full operations term of the Proposed Project.

[6] On April 29, 1998, IID and SDCWA executed the IID/SDCWA Water Conservation and Transfer Agreement, which defines the negotiated, contractual terms of the proposed water conservation and transfer to SDCWA. One of those terms is the length of the transfer. The agreement has an initial term of 45 years after the transfers commence. IID and SDCWA each have an option to extend the term for an additional 30 years. Thus the water transfers between IID and SDCWA could continue for up to 75 years. The proposed Quantification Settlement Agreement (yet to be executed) provides for a comparable term.

Components

As shown on Figure 2-4, the IIDSS uses three major components that are linked together to perform each simulation. These components are the IIDSS Database, the Configuration Manager, and the MODSIM hydrologic model[7].

Geographic Information System

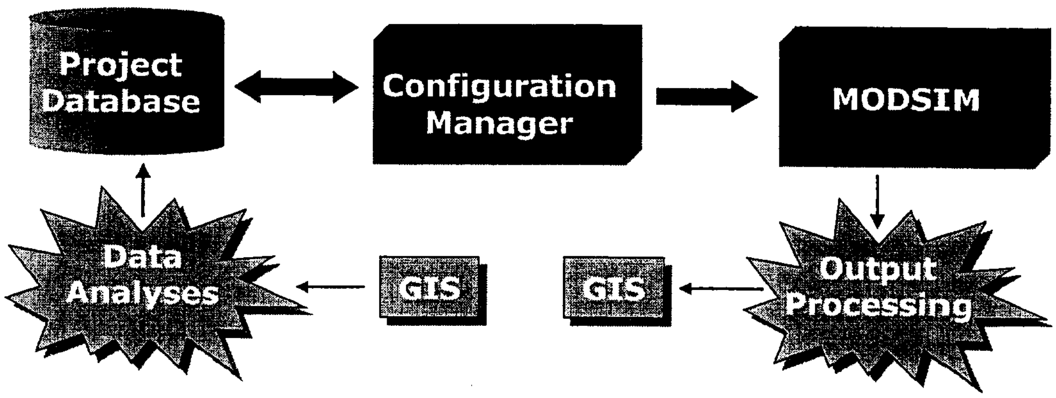


Figure 2-4
Components of the Imperial Irrigation Decision Support System

The GIS is an electronic spatial database that contains physical descriptions of the canal and drainage networks. The GIS exploits the spatial relationships of the data it contains. For example, a spatial query was performed to determine discharge points in the model, as in *"Show me the closest node in the drainage system that is downstream of this turnout in the supply system."* The spatial relationships and physical data were exported from the GIS and stored in the IIDSS Database so that they were available to other IIDSS components.

Because the hydrologic model MODSIM and GIS share common names for canals, drains, and turnouts, simulation data can be extracted from the modeling environment and displayed and queried in the GIS environment. Linking MODSIM results to the GIS helps the understanding of differences among simulations.

Data Analyses

Analyses were performed on multiple forms and sources of data to gain an understanding of the processes shown on Figure 2-1. Many of these analyses addressed the data issues presented above:

[7] Labadie, J. 1995. MODSIM River Basin Network Flow Model for Conjunctive Stream—Aquifer Management, Program Users Manual and Documentation, Department of Civil Engineering, Colorado State University, Ft. Collins, CO.

- Delivery System: Seepage and evaporation rates as fractions of canal flow were determined and stored in the IIDSS Database with the GIS data. Correlation parameters between flow volumes, delivery frequency, and spill volumes were determined and incorporated into the Configuration Manager and passed to MODSIM.
- On-farm: Flow paths and water quality analyses resulted in irrigation schedules that were stored in the IIDSS Database. Tailwater and tilewater algorithms and water quality relationships were developed and applied within the Configuration Manager.
- Drainage System: Parameters relating phreatophyte uptake to canal size were determined and incorporated into the Configuration Manager. Fate and transport parameters of water quality constituents were determined and incorporated into the Configuration Manager and passed to MODSIM.

The findings of these analyses were either incorporated into the IIDSS Database as a series of lookup tables or incorporated directly into the Configuration Manager as algorithms and procedures.

IIDSS Database

The IIDSS Database consists of several tables stored in a Microsoft Access database. The data sources included historical data obtained from IID, physical data obtained from the GIS, and computed ET data that correspond to the historical data on deliveries, crops, and irrigation methods. This single repository served to consolidate all of the historical data used to develop the IIDSS. The elements of the database are described in each of the relevant sections of this report.

Configuration Manager

The Configuration Manager is a standalone computer application written in Visual Basic that performs two main tasks: (1) conducts and manages simulations, and (2) prepares input files for MODSIM.

The Configuration Manager simulates on-farm processes (computes the tailwater and tilewater flow to drainage and shifts in water delivery requirements resulting from voluntary on-farm water conservation programs), subsurface (tilewater) flow lagging, and water quality transformations resulting from on-farm irrigation practices. The results of these simulations are added to the tables in the IIDSS Database.

To configure the MODSIM simulations, the Configuration Manager converts data stored in the database into several tab-delimited text files. One set of files is prepared for each simulation.

The water quality modeling consists of calculating loads – imports from the Colorado River and from Mexico, constituents added at the field level, and subsequent transport through drains and rivers to the Salton Sea. Constituents moving through the groundwater were modeled using tanks with lagged tile flow. Non-agricultural sources were included in the water quality calculations based on data from National Pollutant Discharge Elimination System (NPDES) permitted sites. Because this part of the water quality model was intertwined with the on-farm hydrology, the Configuration Manager calculates these components of the overall model before passing the water quality loads and tile flows by drain node to MODSIM.

MODSIM

The MODSIM link-node hydrology model was employed to simulate the monthly operation of the IID system for a 12- and 75-year time period. MODSIM simulates the routing of water through the delivery system to delivery points throughout the IID water service area and computes the overall water demand in the All American Canal at Mesa Lateral 5. System constraints, including maximum canal and drain flows, system spills, maximum and minimum reservoir capacities, and conveyance losses are included in the simulation.

MODSIM also routes mass and flows through the IID drainage network and through the New River and the Alamo River. MODSIM adds loads from canal seepage and spills to the network. Loss functions were used to simulate physical, chemical, or biological decay or losses of constituents in the drainage/river system. From the MODSIM output of flows and loads, concentrations can be calculated at any drain or river node throughout the drainage/river network. The constituent concentrations measured at the outlets of the New River and of the Alamo River to the Salton Sea are used for model calibration.

Output Processing

Voluminous MODSIM output is summarized and placed into comma-delimited (*.csv) text files that are imported into spreadsheets, databases, GIS, and other programming environments for further processing and reporting. Drainage flows predicted by MODSIM are adjusted for storm runoff and phreatophyte depletions. For water quality analyses, concentration calculations are carried out using the predicted water quality loads and dividing by these adjusted drain flows.

SECTION 3

Alternative Conservation Program Assessments

Overview

The primary purpose for IIDSS is the detailed estimation of conservation programs and resulting changes in water quantity and quality in the drains, rivers, and discharge to the Salton Sea. Under the Proposed Project and alternatives, conservation will be achieved through a variety of methods, including on-farm projects, improved water management, fallowing, and system conservation projects. Each of these conservation projects impacts water quality in the drains differently for each of the water quality constituents of concern. The volume of conservation has a significant impact on changes to these water qualities. IIDSS will track conservation volumes individually and cumulatively anywhere within the IID system. Estimates of water quantity and quality changes can also be developed at the end of any surface drain, at any drain junction on a river system, and at all discharge locations to the Salton Sea.

This section of the report describes the conservation projects and programs evaluated by IIDSS, the water quality parameters evaluated, the criteria used in IIDSS for development of alternative program runs, and key findings developed from the alternative programs.

Conservation Projects and Programs

Under the Proposed Project and alternatives, conservation will be achieved through a variety of methods. These methods are categorized as on-farm, including fallowing, and irrigation delivery system methods. The conservation program consists of a combination of methods that achieves a target conservation volume, and the combination of methods is expected to vary over the 75-year term to respond to varying conditions and farm ownership participation.

On-Farm Conservation Projects

On-farm conservation can be achieved through a combination of on-farm irrigation system improvements, fallowing, and improved water management. Farmer participation in the conservation and transfer program is voluntary. It is anticipated that farmer participation will be dynamic in location, annual conservation volumes, length of participation, methods used to achieve conservation, and the efficiency in water management necessary to achieve on-farm conservation. Hence, the expected methods of on-farm conservation can only be estimated at this time and will likely vary over time. Unless previously arranged, selection of on-farm participants is done randomly by the Configuration Manager.

Numerous on-farm irrigation methodologies exist for reducing on-farm water use. To compute conservation at the farm level, IIDSS uses the change in On-farm Irrigation

Performance Index (PI), which is computed for each participating farm. The change in the PI to compute conservation is not dependent on the on-farm improvement method. Hence, the hardware and management improvements used to achieve on-farm conservation are not described in the IIDSS and are not required model inputs.

For the EIR/EIS, an assessment of potential on-farm conservation methods was made to support the socio-economic evaluations and intent of the water transfer program. All reasonable on-farm improvement methodologies were assessed for potential use in the IID water service area, considering ongoing practices, soils, and crops. In consultation with IID staff and knowledgeable local farmers, the following on-farm methods were selected as the most likely for potential use:

- Level basins
- Shortened furrows/border strips
- Tailwater return systems
- Narrowed border strips
- Cutback
- Laser leveling
- Multi-slope
- Cascading tailwater
- Drip irrigation
- Water management

In addition, fallowing is considered an on-farm conservation method. Fallowing is defined as non-use of farmland for crop production to conserve water. The average per-acre savings from fallowing is 5.63 ac-ft/ac. This value is based on the 12-year IIDSS database of annual turnout deliveries and average irrigated acreage. Fallowing can be rotated from field to field. For purposes of alternative simulation runs, fallowed land was randomly selected, with no annual rotation assumed. A series of alternative simulations indicated that spatial changes in water quality were very minor for this assumption.

Irrigation Delivery System Projects

Five types of irrigation delivery system conservation projects have been identified as potentially feasible within IID. Detailed descriptions, potential conservation volumes, and cost for each type of project are shown in a report by Imperial Valley Engineering Services (as modified). The projects include:

- Lateral interceptor systems
- Canal lining
- Mid-lateral reservoirs
- Seepage collector systems
- Drainwater treatment and reuse

Conservation Programs for IIDSS Simulation

For purposes of simulations, a conservation program is a combination of projects/methods that will achieve an annual target conservation volume. The program can include a combination of on-farm projects, delivery system projects, and fallowing that will achieve the desired annual conservation volume. Table 3-1 lists the conservation programs to be assessed in the EIR/EIS.

Table 3-1 also illustrates the interaction between the two potential agreements, the IID/SDCWA Transfer Agreement and/or the proposed Quantification Settlement Agreement (QSA). One or both of these agreements requires that:

1. At least a 130,000 ac-ft of annual conservation will be by on-farm methods (the minimum program). Fallowing is included as an on-farm method.
2. Farmer participation in the transfer program is voluntary. The conservation method(s) and length of participation in the on-farm water conservation program is the farmers' choice. IIDSS computes the on-farm conservation volume as the reduction in delivered water from a quantified amount defined from turnout delivery records for the years 1987 through 1998.
3. The potential maximum annual transfer is 300,000 ac-ft.
4. For annual transfers greater than 130,000 ac-ft, achieved under the IID/SDCWA Agreement, the additional conservation volumes can be achieved by a mix of on-farm, system, and fallowing conservation methods. Potentially, 300,000 ac-ft can be transferred out of the Salton Sea basin (for transfer to SDCWA alone or SDCWA and MWD).
5. If the QSA is implemented, annual conservation can be achieved by a mix of on-farm, system, and/or fallowing projects. It is assumed that water transferred to CVWD remains in the basin and can eventually contribute to runoff that reaches the Salton Sea. If CVWD exercises their options to acquire 100,000 ac-ft per year, the minimum transfer under the QSA is 230,000 ac-ft per year.
6. The transfer will last a minimum of 45 years and can be extended to 75 years.
7. The ramp-up schedule for conservation and transfer is shown in Table 3-2 for the QSA. Ramp-up to volumes required by the IID/SDCWA Agreement occurs in 20,000-ac-ft increments for the first 10 years, then 10,000-ac-ft increments for the next 10 years.

The conditions sited above define the broad setting for alternative conservation programs necessary to satisfy the Proposed Project for water transfer and associated conservation programs.

TABLE 3-1
Simulated Water Conservation Programs

Proposed Project and Alternatives	IID/SDCWA Transfer Agreement Implementation Only	With QSA Implementation	Corresponding Model Runs: IIDSS	Corresponding Model Runs: Salton Sea Model[a]
Proposed Project	a) At least 130 KAFY via On-farm to SDCWA b) Additional 70 KAFY via On-farm and/or WDS[c] to SDCWA. Total of 200 KAFY to SDCWA. c) Remaining 100 KAFY via On-farm and/or WDS to SDCWA[b] Total of 300 KAFY to SDCWA	a) 100 KAFY via On-farm, WDS, and/or fallowing to CVWD or MWD b) 100 KAFY via On-farm, WDS, and/or fallowing to CVWD or MWD c) N/A	Model Run: 12-year (200 + 100); in-basin Model Run: 75-year (200 + 100); in-basin	200KAF to SDCWA and 100KAF to CVWD via On-farm and System Conservation 300 KAF to SDCWA (out of basin)
Simulation 1: No Project	N/A	N/A	Model Run: 12-year capped Baseline Model Run: 75-year capped Baseline	Baseline Conditions
Simulation 2: 130 KAFY	130 KAFY via On-farm to SDCWA	N/A	Model Run: 12-year 130 On-farm Model Run: 75-year 130 On-farm	130 KAF to SDCWA
Simulation 3: 230 KAFY	a) At least 130 KAFY via On-farm to SDCWA b) Additional 100 KAFY via on-farm and/or WDS to SDCWA[b] Total of 230 KAFY to SDCWA	a) 100 KAFY via On-farm, WDS, and/or fallowing to CVWD or MWD b) N/A	Model Run: 12-year 230 On-farm Model Run: 75-year 230 On-farm	130K to SDCWA and 100K to CVWD via On-farm Conservation
Simulation 4: 300 KAFY*	300 KAFY via fallowing to SDCWA	300 KAFY via fallowing to SDCWA, CVWD or MWD	Model Run: 12-year 300 DW Fallow Model Run: 75-year 300 DW Fallow	200K to SDCWA and 100K to CVWD via Fallowing

Notes:
[a] Salton Sea analysis for water surface elevation, surface area, and salinity.
[b] Up to 100 KAFY can be conserved via WDS and a maximum of 230 KAFY can be conserved via On-farm.
[c] WDS – water delivery system
*This alternative would require waiver or modification of existing IID/SDCWA Transfer Agreement.

TABLE 3-2
IID Water Conservation - Ramp-up Schedule (Assuming Implementation of QSA)

Year	SDCWA AT 130 KAF	CVWD/MWD (KAF)	Total KAF with QSA (SDCWA at 130 KAF)	SDCWA AT 200 KAF	Total KAF with QSA (SDCWA at 200 KAF)
2002	20.0		20.0	20.0	20.0
2003	40.0		40.0	40.0	40.0
2004	60.0		60.0	60.0	60.0
2005	82.5	2.5	85.0	82.5	85.0
2006	105.0	5.0	110.0	105.0	110.0
2007	122.5	7.5	130.0	122.5	130.0
2008	130.0	10.0	140.0	140.0	150.0
2009	130.0	15.0	145.0	160.0	175.0
2010	130.0	20.0	150.0	180.0	200.0
2011	130.0	25.0	155.0	200.0	225.0
2012	130.0	30.0	160.0	200.0	230.0
2013	130.0	35.0	165.0	200.0	235.0
2014	130.0	40.0	170.0	200.0	240.0
2015	130.0	45.0	175.0	200.0	245.0
2016	130.0	50.0	180.0	200.0	250.0
2017	130.0	55.0	185.0	200.0	255.0
2018	130.0	60.0	190.0	200.0	260.0
2019	130.0	65.0	195.0	200.0	265.0
2020	130.0	70.0	200.0	200.0	270.0
2021	130.0	75.0	205.0	200.0	275.0
2022	130.0	80.0	210.0	200.0	280.0
2023	130.0	85.0	215.0	200.0	285.0
2024	130.0	90.0	220.0	200.0	290.0
2025	130.0	95.0	225.0	200.0	295.0
2026	130.0	100.0	230.0	200.0	300.0

Strategy and Criteria for Selection of Alternative Conservation Programs

IIDSS simulation runs illustrated in Table 3-1 were established to produce the reasonable best and worst case (bookend) impacts to changes in water quality (selenium and salinity) in the IID drains and rivers. In addition, alternative simulations to establish bookend impacts on salinity to the Salton Sea were developed[8] and are listed in Table 3-1. The strategy and method for selection of the alternative programs is discussed below.

Proposed Project

The Proposed Project is one that meets the intent of the IID/SDWCA Transfer Agreement or the IID/SDCWA Agreement as modified and supplemented by the QSA. These two agreements and required transfer volumes that will be achieved by conservation and/or fallowing are discussed above. The IIDSS conservation program simulations for the EIR/EIS analysis were developed to bookend the changes in water quality in the drains, rivers, and discharge to the Salton Sea.

[8] Output from IIDSS for IID salinity loading was provided to the USBR for modeling of Salton Sea surface elevations, surface area, and changes in salinity.

The key water quality impacts are those from increased selenium and salinity concentrations. For selenium, the significant increases in concentration occurs in the IID drains and in the rivers. The major concern for the Salton Sea is the increased concentration and loading of salinity and the reduction in water elevations resulting from reduced inflows. There is also concern for increased salinity concentrations in the IID drain system. The conservation program will improve concentrations associated with other water quality parameters that originate from on-farm cultural practices. Boron concentration is well below environmental and crop use standards. The greatest increase to selenium and salinity concentrations occurs at maximum conservation (for transfer purposes) of 300,000 ac-ft/yr when fallowing is not part of the alternative program. Minimum increases to these concentrations occur at the minimum program of 130,000 ac-ft of on-farm conservation.

Evaluations for impacts other than water quality are not part of the IIDSS simulations. However, information from the IIDSS output and database is of value to the socio-economic assessment.

No Project

For this project, the "no project" scenario is the same as the project Baseline over the next 75 years. As stated, the significant changes from recent historical conditions that formulate the project Baseline are the changes in salinity of source water and an annual entitlement of 3.43 million ac-ft shared between IID and CVWD. Crop mixes and water diversions remain as in the historical database except as identified below.

An increase in the Colorado River salinity from the historical (1987 – 1998) average of 747 mg/L to 879 mg/L is reflected in the Baseline and will increase required water delivery needs in the IID water service area to satisfy crop leaching requirements. The increase in on-farm diversion for leaching is modeled as taking place only on fields where analysis of simulated ET demand together with historical delivery and cropping data indicate that additional leaching would be necessary to respond to the increased salinity of the delivered water.

The California agricultural Colorado River entitlements (Priorities 1, 2, and 3) are limited to 3.85 maf per year. If Priorities 1 and 2 are assumed to average 420 kaf per year, the remaining 3.43 maf per year is available for Priority 3, IID and CVWD. Therefore, the combined IID and CVWD diversions cannot exceed this 3.42 maf in a normal Colorado River water year. As a result, the Baseline assumes that this annual volume of 3.43 maf will be enforced.

Fallowing as an On-Farm Project

For a given conservation target, fallowing creates the least change in salinity and selenium concentrations in the IID drain and river systems. As a result, the least change to these concentrations is attributed to fallowing for 300,000 ac-ft of transfer.

IIDSS Conservation Programs Simulation Criteria

To capture a reasonable maximum and minimum change to water quality (selenium and TDS) created by the Proposed Project and alternatives, the following criteria were used:

- Minimum change in water quality occurs when fallowing is the conservation method. This was simulated using a fallowed conservation volume of 300,000 ac-ft/year.
- If fallowing is not used for conservation, the minimum changes to water quality in the drains occur for an on-farm conservation program of 130,000 ac-ft/yr.
- The maximum impact program is 300,000 ac-ft of conservation for transfer purposes. To ensure maximum water quality changes, 300,000 ac-ft of on-farm and a combination 300,000 ac-ft (200,000 ac-ft on-farm and 100,000 ac-ft system, which is near the maximum achievable level of system conservation) programs are simulated. Analysis shows that for a given conservation volume, delivery system conservation results in slightly higher concentrations of selenium and salinity in the drains and rivers.
- 75-year IIDSS simulations are made for each conservation program.
- Within the IID water service area, the evaluations are for the worst-case water quality impacts/changes. IIDSS simulation runs assume a "steady state" and start with full implementation (no ramp-up).
- Water demands in IID can be met at all times, that is, supply is not limited, subject to enforcement of entitlements.
- For simulation purposes, the number of farms/participants was varied to achieve the on-farm conservation target.
- The Salton Sea is a "declining" resource, with salinity and water surface elevation sensitive to timing of implementation. The conservation ramp-up schedule shown in Table 3-2 was used to prepare the 75-year flow and salt loading inputs for analysis of the Salton Sea salinity, elevation, and surface area changes for transfers assuming full QSA implementation. For the IID/SDCWA Agreement, the conservation ramp-up schedule occurs in increments of 20,000 ac-ft/year.
- Participation in on-farm conservation is accomplished by random selection. The improvement in on-farm irrigation performance is simulated using the Irrigation Performance Index for the various cropping families. Potential improvements in this index are based on existing on-farm performances within IID.
- Simulated programs use historical cropping patterns (1987 through 1998) and evapotranspiration along with historical delivered water to estimate conservation volumes.
- The maximum average annual system conservation is estimated to be approximately 104,000 ac-ft. The least cost ($/per ac-ft) projects are used in the simulation runs.
- Mid-lateral reservoirs and lateral interceptor systems create duplication for given service areas. Lateral interceptors are considered the most cost-efficient method and were used

for simulation analysis. Except for very site-specific conditions, there is no change in water quality impacts between the two system conservation methods.

- The maximum combined IID/CVWD entitlement at Pilot Knob is 3.43 maf per year. The modeling assumption is that the IID's diversion cap pursuant to the QSA is in force (3.1 maf to IID) and IID is conserving the necessary payback volume in addition to the transfer volume to achieve compliance. For the 75-year runs, the payback amounts to an average of an extra 59,210 ac-ft of conservation every year. Actual payback is to occur in the year(s) following the year entitlement is exceeded.
- Once established, the random selection for on-farm conservation and on-farm fallowing participants was fixed. Simulation of annual rotations was not necessary. The sensitivity of this assumption was tested by making several simulation runs with conservation at 130,000 ac-ft, with each simulation having random farm participation. This analysis showed very little difference in spatial impacts and changes in water quality concentrations for selenium and TDS in any given drain, and hence along the river reaches.

Ramp-up Simulation Criteria

For most water quality constituents, the concern for changes in water quality occur at full transfer and are simulated as a steady-state condition. However, the impacts of salinity on the Salton Sea depend on the implementation schedule. When salinity in the Salton Sea reaches a certain threshold value, wildlife and aquatic impacts become significant. To assist the USBR in determination of when salinity thresholds would be reached, annual salt loading to the Salton Sea were determined from IIDSS output for use in USBR modeling efforts using the ramp-up schedules shown in Table 3-2.

Figure 3-1 demonstrates that reductions in drainage flow are almost linear to the reductions in IID diversions that result from conservation. Figure 3-2 illustrates that the reduction in salinity loading in the IID drainage system is also a linear function of diversion salt loading. For a salinity concentration of 879 mg/L, this simply means that a 1-ac-ft reduction in diversion reduces salt loading in the IID drainage system by 1.1954 tons. This factor was used to determine salt loading to the Salton Sea during the ramp-up phase of a water transfer.

Salt loading to the Salton Sea during fallowing is also a linear function of the diversion volume. However, the drain water salinity and selenium concentrations for the fallowing alternative are less, as 31.1 percent more water remains in the drains for each acre-foot of transferable water.

Key Findings

Operation of the IIDSS provided considerable information regarding implementation of a water conservation and transfer program for IID. IIDSS was designed to spatially estimate changes in IID hydrology and in drain water quality. Those changes, along with other miscellaneous findings, are reported herein.

IID Hydrology

Simulated water balance data from IIDSS are shown in Table 3-3. Historical data, IIDSS calibration data, and Baseline information are shown for reference. Note that the IIDSS water balance is computed in the All American Canal, just upstream of the East Highline Canal at Mesa Lateral 5. The IID diversion point is considered to be at Pilot Knob on the All American Canal nearly 40 miles upstream. IID's share of the All American Canal losses between Mesa Lateral 5 and Pilot Knob are added to the water balance data to determine IID's actual diversion.

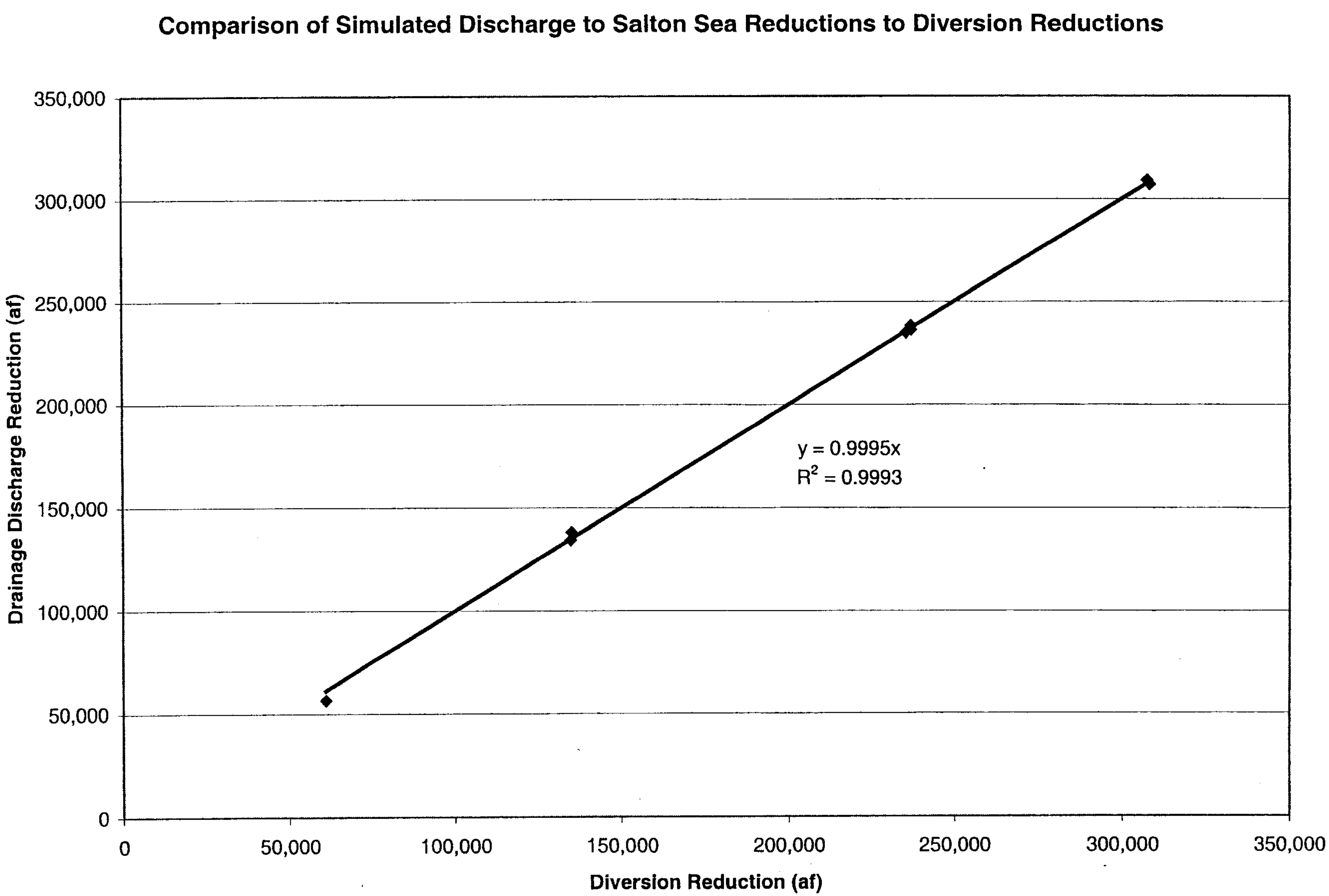


Figure 3-1
Diversion and Drainage Flow Relationships

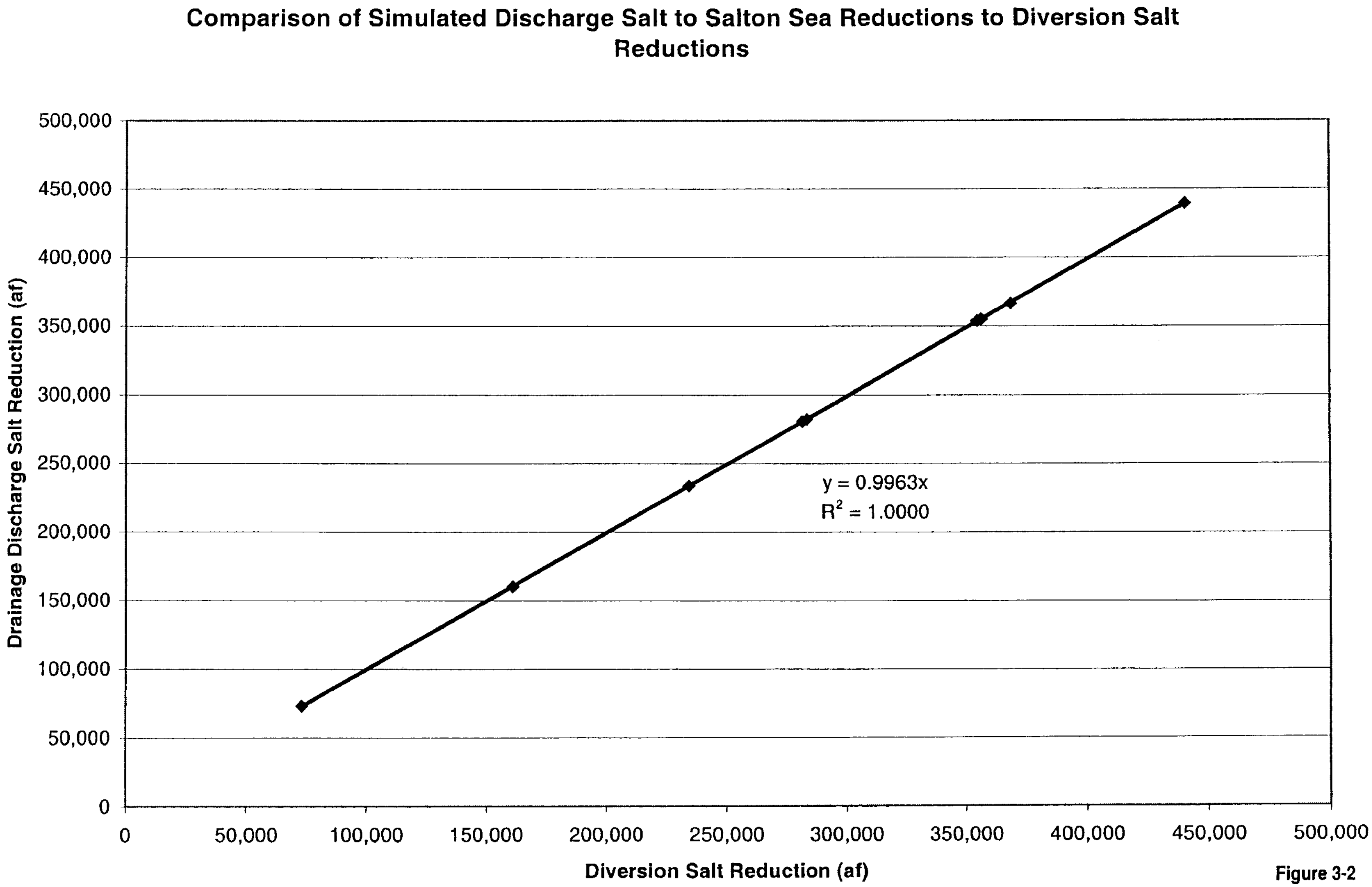


Figure 3-2
Relationship of IID Salinity Diversions to Salinity and Discharge to Drainage

TABLE 3-3
IIDSS Simulated Water Balance

Description	Recorded	Calibration	Baseline	200 kaf on-farm plus 100 kaf system	230 kaf on-farm	130 kaf on-farm	300 kaf DW fallowing
Imported Colorado River Water [a]	2,866,000	2,857,000	2,803,000	2,495,000	2,566,000	2,668,000	2,490,000
Canal and Reservoir Evaporation	-	21,000	19,000	17,000	17,000	18,000	17,000
Canal seepage	-	123,000	111,000	89,000	104,000	107,000	100,000
Main canal spills	-	7,000	-	-	-	-	-
Lateral spills	-	117,000	99,000	15,000	99,000	99,000	99,000
Sum of Delivery System Losses [b]	272,000	268,000	229,000	121,000	220,000	224,000	216,000
Delivery to Farms	2,490,000	2,490,000	2,458,000	2,258,000	2,229,000	2,328,000	2,158,000
Crop Eta	-	1,807,000	1,807,000	1,806,000	1,806,000	1,806,000	1,593,000
Other Evaporation	-	-	-	-	-	-	-
Effective Rainfall	-	101,000	101,000	101,000	101,000	101,000	101,000
Tailwater	-	390,000	344,000	197,000	178,000	252,000	305,000
Tilewater	-	394,000	408,000	356,000	346,000	371,000	361,000
Delivery to M&I + Stock + Misc [3]	105,000	105,000	120,000	120,000	120,000	120,000	120,000
Consumptive Use from M&I + Stock + Misc	-	76,000	86,000	86,000	86,000	86,000	86,000
Return Flow from M&I + Stock + Misc	-	29,000	34,000	34,000	34,000	34,000	34,000
Change in Soil Water and Groundwater Storage	-	-	-	-	-	-	-
Recovered return flow from Mesa Lateral 5	-	4,000	4,000	4,000	3,000	4,000	4,000
Rainfall Runoff and Deep Perc	-	34,000	38,000	36,000	37,000	37,000	38,000
Evaporation and Phreatophyte Use	-	125,000	125,000	125,000	125,000	125,000	125,000
Mesa Storm Inflows	-	8,000	8,000	8,000	8,000	8,000	8,000
Subsurface Inflow (Estimated)	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Alamo River from Mexico	2,000	2,000	2,000	2,000	2,000	2,000	2,000
New River from Mexico	165,000	165,000	165,000	165,000	165,000	165,000	165,000

TABLE 3-3
IIDSS Simulated Water Balance

Description	Recorded	Calibration	Baseline	200 kaf on-farm plus 100 kaf system	230 kaf on-farm	130 kaf on-farm	300 kaf DW fallowing
Alamo River to the Salton Sea	604,000	605,000	576,000	401,000	448,000	503,000	517,000
New River to the Salton Sea	454,000	453,000	431,000	335,000	346,000	382,000	399,000
Direct to Sea	100,000	101,000	92,000	56,000	70,000	80,000	86,000
Subsurface to Sea (Estimated)	1,000	1,000	1,000	1,000	1,000	1,000	1,000

Notes:

1) AAC at Mesa Lateral 5 by water balance from recapitulation data.
2) Sum of delivery system losses is calculated from the difference in recorded diversions less deliveries.
3) Includes estimates of deliveries to rural pipes and community greens.

Table 3-3 shows a water balance for four conservation programs. Slight differences between target and actual conservation (Baseline diversion less program diversion) are noted. This difference is attributed to two things. First, actual acreage needed for on-farm or fallowed conservation is slightly exceeded (the last randomly selected participatory farm will create a conservation volume in excess of the target), and second an additional 4 percent conservation above on-farm and fallowing transfer volumes is associated with reduced system losses due to lower delivery volumes.

Water Quality in the IID Drainage System

Water quality changes are computed at the ends of all IID drains and along the Alamo and New rivers at drain intersections for all IIDSS simulations. Table 3-4 presents a general overview of water quality changes for three constituents (TDS, selenium, and TSS) at key locations within the IID water service area for a 300,000-ac-ft per year transfer program that includes 200,000 ac-ft of on-farm conservation and 100,000 ac-ft of water delivery system (WDS) conservation. The percentages shown are for the predicted change from Baseline conditions. Table 3-5 demonstrates changes in water quality for 300,000 ac-ft per year of transfer developed by fallowing. For all water quality parameters, there is a slight improvement in water quality using fallowing to achieve the water transfer.

The data shown in Tables 3-4 and 3-5 are average annual concentrations for the 12-year simulations. Output from IIDSS is monthly and shows all water quality constituent concentrations varying on a monthly basis.

General observations are:

- The percent change associated with selenium and TDS concentrations is always an increase, and nearly identical. The changes in the Alamo River Basin are greater than changes in the New River Basin.
- New River inflows from Mexico buffer changes in the three constituents whose primary source is Colorado River water. This tends to minimize the increase in concentration when compared to the drains and the Alamo River.
- TSS concentrations are reduced. This is directly related to on-farm conservation and a resulting decrease in tailwater discharge.
- TSS concentrations are decreased only slightly in the direct-to-sea drains. This is related to farming methods and cropping patterns, as well as soil types. Most of the soils are very sandy (heavy) along these drains.
- Fallowing results in minor reductions in salinity and selenium concentrations in the IID drains and rivers.

Miscellaneous Findings and Conclusions

The following findings are considered significant for implementation of the water transfer:

- For a fixed level of farm participation and selected performance index, the annual conservation volume can vary by plus or minus 35 percent.

TABLE 3-4
IIDSS Simulations of Water Quality - General Overview
On-farm Conservation = 200,000 ac-ft and System Conservation = 100,000 ac-ft

	New River Basin						Alamo River Basin					
	Baseline			Proposed Project			Baseline		Proposed Project		Direct to Sea Drains	
Parameter	Mexico Inflows	Surface Drains	River at Sea	Mexico Inflows	Surface Drains	River at Sea	Surface Drains	River at Sea	Surface Drains	River at Sea	Baseline	Proposed Project
TDS (mg/L)	2,719	2,585	2,617	2,719	3,294 (+27.4 percent)	3,075 (+17.5 percent)	2,492	2,465	3,559 (+42.8 percent)	3,101 (+25.8 percent)	1,892	2,637 (+39.4 percent)
Se (µg/L)	2.25	6.51	3.30	2.25	8.30 (+27.5 percent)	3.77 (+14.2 percent)	6.32	6.25	9.03 (+42.8 percent)	7.86 (+25.8 percent)	4.80	6.69 (+39.4 percent)
TSS (mg/L)	50	294	238	50	232 (-21.2 percent)	175 (-26.7 percent)	252	264	193 (-23.4 percent)	209 (-20.8 percent)	136	132 (-3.0 percent)

TABLE 3-5
IIDSS Simulations of Water Quality - General Overview
Fallowing for 300,000 ac-ft per year

	New River Basin						Alamo River Basin					
	Baseline			Proposed Project			Baseline		Proposed Project		Direct to Sea Drains	
Parameter	Mexico Inflows	Surface Drains	River at Sea	Mexico Inflows	Surface Drains	River at Sea	Surface Drains	River at Sea	Surface Drains	River at Sea	Baseline	Proposed Project
TDS (mg/L)	2,719	2,585	2,617	2,719	2,585 (0 percent)	2,606 (-0.4 percent)	2,492	2,465	2,403 (-3.6 percent)	2,418 (-1.9 percent)	1,892	1,815 (-4.1 percent)
Se (µg/L)	2.25	6.51	3.30	2.25	6.51 (0 percent)	3.18 (-3.6 percent)	6.32	6.25	6.10 (-3.5 percent)	6.13 (-1.3 percent)	4.80	4.61 (-4.0 percent)
TSS (mg/L)	50	294	238	50	285 (-3.1 percent)	226 (-5.0 percent)	252	264	247 (-2.0 percent)	259 (-1.9 percent)	136	136 (0.0 percent)

- The maximum average annual system conservation is estimated at 104,340 ac-ft. This conservation is attributed to:
  - Lateral interceptors 89,069 ac-ft
  - Seepage collectors 15,051 ac-ft
  - Canal lining 224 ac-ft
- The 5.63-ac-ft per-acre fallow transfer was computed from the average annual turnout delivery divided by the average annual acreage considered in production. Monthly delivery data were used to establish the average annual acreage.
- On-farm conservation reduces the contribution of TSS in the drains and rivers. This reduction varies as a result of soil type and cropping mix, as well as farm practices (families).
- The average IID/CVWD overrun volume (diversions above 3.43 maf at Pilot Knob) from the 12-year historical database is 59,210 ac-ft. This overrun volume was assumed to be repaid during each year for all 75-year simulations.
- The spatial impacts to water quality based on random selection of on-farm participation were assessed. For a 130,000 ac-ft/yr program, 10 random simulations using 12-year runs were planned. Five simulation runs showed that for any given drain, random placement of on-farm projects caused little change in water quality. In addition, no measurable water quality differences were found in the rivers among the five runs.
- Using on-farm conservation and fallowing to create transferred water reduces flows in the delivery system. On the basis of several simulations, system seepage and evaporation losses were reduced by about 4 percent. This additional conservation was not reported in any of the alternative conservation programs. Hence, the reduction in drain water quality is overstated.

Salton Sea Accounting Model

SALTON SEA ACCOUNTING MODEL

DRAFT

Prepared by
Paul A. Weghorst, PE

U.S. Bureau of Reclamation
Lower Colorado Region

December 18, 2001

TABLE OF CONTENTS

1.0—Introduction

Assessment of the future of the Salton Sea (Sea) is dependent on the ability to predict the hydrologic response of the Sea to changing conditions. Foreseeable changes include a range of water conservation programs within the Salton Basin as well as possible restoration activities. The term "restoration" is used here to describe salinity reduction and control projects that might be developed. Conservation programs would likely change inflows of both water and dissolved solids into the Sea. Predicting hydrologic response to these possible changes requires a predictive computer model of the Salton Sea. The Salton Sea Accounting Model (Model) was developed for this purpose. This model is described in this document. A major aspect of the Model is the data contained within it. Therefore, salt and water budgets are also presented. Budgets are provided for historic and present level development conditions. In addition, forecasts of future changes in salt and water budgets are presented.

The development of the Salton Sea Accounting Model was a joint effort of the Bureau of Reclamation (Reclamation), Imperial Irrigation District (IID), and Coachella Valley water District (CVWD). The districts developed the historic and present level water budgets as well as future projections. Reclamation developed the model application.

2.0—Historic Inflows and Salt Loads

There are eight major sources of inflow to the Salton Sea. Table 2.1 lists each inflow source as well as the agency responsible for developing historic data attributed to each source.

Table 2.1
Salton Sea
Historic Water and Salt Budget
Inflow Sources and Agencies Contributing Data

Inflow Source	Contributing Agency
Mexico discharges into the New River	IID
Mexico discharges into the Alamo River	IID
IID discharges into the New River	IID
IID discharges into the Alamo River	IID
IID discharges direct to the Sea	IID
CVWD surface discharges	CVWD
Coachella aquifer discharges	CVWD
Unmeasured inflows	Reclamation

Details about developing each component, except the unmeasured inflows, are not provided here. Inquiries about details of the other components should be directed to either IID or CVWD. The development of the unmeasured inflows is discussed later in this document in discussions of Model calibration and net evaporation.

2.1 – Historic Water Budget

Table 2.2 presents a compilation of historic water inflow records for budget components listed in Table 2.1. This compilation represents a comprehensive historic water budget to the Salton Sea. This budget was used in the calibration and verification of the Model which is described later in this document. Figure 2.1 depicts each of the historic water budget components in hydrograph format. In the early 1980s, inflows from CVWD began declining. During this same period, inflows from Mexico increased.

2.2 – Historic Salt Budget

Table 2.3 presents a compilation of historic salt load records for budget components listed in Table 2.1. This compilation represents a comprehensive historic salt budget to the Salton Sea. Estimates of salt dissolved as the Sea inundated new areas (from 1950) is also provided in Table 2.3, These estimates assume that a half inch of salt was contained in the top layer of newly inundated sediments and that the salts were dissolved completely within each year. Exact estimates of salts dissolved as the Sea inundated new areas is not possible. However, not taking this into consideration in some fashion would have made the historic salt budget incomplete. This budget was used in the verification of the Model which is described later in this document. Figure 2.2 shows the salt budget in hydrograph form. In the early 1980s, salt loads from both IID and CVWD decreased. Loadings from Mexico increased substantially during the 1980s.

Table 2.2
Salton Sea
Historic Water Budget

Col. 1 Year	Col.. 2 Col. 3+4 Historic [1/] Alamo R. Inflow (af)	Col. 3 Historic [1/] Alamo R. Inflow frm Mexico (af)	Col. 4 Historic [1/] Alamo R. Inflow frm IID (af)	Col. 5 Col. 6+7 Historic [1/] New R. Inflow (af)	Col. 6 Historic [1/] New R. Inflow frm Mexico (af)	Col. 7 Historic [1/] New R. Inflow frm IID (af)	Col. 8 Historic [1/] IID Direct to Sea (af)	Col. 9 Col. 4+7+8 Total [1/] Historic IID to Sea (af)	Col. 10 Col.3+6 Total [1/] Historic Mexico to Sea (af)	Col. 11 Historic [2/] Surface Flows to Sea frm CVWD (af)	Col. 12 Historic [2/] Aquifer Flows frm CVWD (af)	Col. 13 Col 11+12 Total [2/] Historic frm CVWD (af)	Col. 14` Total Historic Reported Inflow (af)	Col. 15 Total [3/] Unmeasured Inflow (af)	Col. 16 Col 14+15 Total Historic Inflow (af)
1950	606862	1393	605469	460665	36992	423673	75658	1104800	38385	65811	2710	68521	1211706	68400	1280106
1951	642031	1385	640646	489668	35508	454160	74621	1169427	36893	108765	2632	111397	1317717	68400	1386117
1952	697247	1250	695997	524461	35917	488544	76032	1260573	37167	87139	2341	89480	1387220	68400	1455620
1953	756663	1308	755355	540547	31116	509431	81212	1345998	32424	62607	2396	65003	1443425	68400	1511825
1954	732821	1431	731390	492737	29505	463232	78588	1273210	30936	72467	2064	74531	1378677	68400	1447077
1955	654455	1915	652540	395860	46985	348875	68394	1069809	48900	85367	2016	87383	1206092	68400	1274492
1956	684155	2042	682113	429655	42713	386942	52333	1121388	44755	70602	2067	72669	1238812	68400	1307212
1957	622850	1762	621088	402516	70845	331671	58620	1011379	72607	53368	2205	55573	1139559	68400	1207959
1958	614481	1991	612490	405194	103983	301211	60344	974045	105974	56358	2243	58601	1138620	68400	1207020
1959	651750	1819	649931	434219	121824	312395	58637	1020963	123643	57105	2345	59450	1204056	68400	1272456
1960	682450	1921	680529	445059	121312	323747	55528	1059804	123233	70431	2336	72767	1255804	68400	1324204
1961	675576	1795	673781	436967	115031	321936	54983	1050700	116826	83894	2290	86184	1253710	68400	1322110
1962	681100	1705	679395	455330	132179	323151	86419	1088965	133884	112692	2241	114933	1337782	68400	1406182
1963	723765	2158	721607	477479	138936	338543	93647	1153797	141094	133333	2062	135395	1430286	68400	1498686
1964	563557	1834	561723	365857	105087	260770	82660	905153	106921	123248	1991	125239	1137313	68400	1205713
1965	535096	1798	533298	357747	111339	246408	103256	882962	113137	138788	2172	140960	1137059	68400	1205459
1966	610745	1545	609200	383469	102958	280511	114974	1004685	104503	128071	2220	130291	1239479	68400	1307879
1967	621091	1556	619535	383211	96899	286312	122123	1027970	98455	133784	2244	136028	1262453	68400	1330853
1968	611089	1469	609620	384078	106019	278059	113348	1001027	107488	133097	2262	135359	1243874	68400	1312274
1969	592664	1595	591069	375449	103312	272137	99433	962639	104907	130583	2319	132902	1200448	68400	1268848
1970	619018	1645	617373	390487	99671	290816	112314	1020503	101316	131253	2390	133643	1255462	68400	1323862
1971	671770	1510	670260	422995	107281	315714	106597	1092571	108791	142977	2403	145380	1346742	68400	1415142
1972	638743	1435	637308	418063	111165	306898	119331	1063537	112600	155126	2387	157513	1333650	68400	1402050
1973	638902	1370	637532	428639	117160	311479	116403	1065414	118530	163211	2372	165583	1349527	68400	1417927
1974	682320	1227	681093	436575	111839	324736	117663	1123492	113066	157208	2342	159550	1396108	68400	1464508
1975	682345	1568	680777	434507	99791	334716	112775	1128268	101359	173502	2229	175731	1405358	68400	1473758
1976	638917	1071	637846	435111	102588	332523	114924	1085293	103659	174684	2002	176686	1365638	68400	1434038
1977	615009	1419	613590	412978	107713	305265	101942	1020797	109132	156787	1784	158571	1288500	68400	1356900

20360

Col. 1 Year	Col.. 2 Col. 3+4 Historic [1/] Alamo R. Inflow (af)	Col. 3 Historic [1/] Alamo R. Inflow frm Mexico (af)	Col. 4 Historic [1/] Alamo R. Inflow frm IID (af)	Col. 5 Col. 6+7 Historic [1/] New R. Inflow (af)	Col. 6 Historic [1/] New R. Inflow frm Mexico (af)	Col. 7 Historic [1/] New R. Inflow frm IID (af)	Col. 8 Historic [1/] IID Direct to Sea (af)	Col. 9 Col. 4+7+8 Total [1/] Historic IID to Sea (af)	Col. 10 Col.3+6 Total [1/] Historic Mexico to Sea (af)	Col. 11 Historic [2/] Surface Flows to Sea frm CVWD (af)	Col. 12 Historic [2/] Aquifer Flows frm CVWD (af)	Col. 13 Col 11+12 Total [2/] Historic frm CVWD (af)	Col. 14` Total Historic Reported Inflow (af)	Col. 1 Year	Col.. 2 Col. 3+4 Historic [1/] Alamo R. Inflow (af)
1978	603073	1296	601777	393045	98408	294637	99260	995674	99704	144098	1727	145825	1241203	68400	1309603
1979	635126	1416	633710	457720	144905	312815	110127	1056652	146321	151002	1595	152597	1355570	68400	1423970
1980	641581	1655	639926	454544	156320	298224	105091	1043241	157975	143958	1453	145411	1346627	68400	1415027
1981	591591	2274	589317	433241	155443	277798	95810	962925	157717	156788	1402	158190	1278832	68400	1347232
1982	543453	1990	541463	416302	157009	259293	87919	888675	158999	152282	1415	153697	1201371	68400	1269771
1983	551971	1909	550062	477433	242606	234827	82946	867835	244515	150956	1186	152142	1264492	68400	1332892
1984	563917	1831	562086	512260	267904	244356	88592	895034	269735	140985	1053	142038	1306807	68400	1375207
1985	509547	1867	507680	489532	260238	229294	93867	830841	262105	123855	983	124838	1217784	68400	1286184
1986	498992	1890	497102	512348	264837	247511	89354	833967	266727	122959	836	123795	1224489	68400	1292889
1987	512200	2058	510142	493152	250862	242290	99262	851694	252920	117032	757	117789	1222403	68400	1290803
1988	558687	2152	556535	488940	226802	262138	100053	918726	228954	117188	603	117791	1265471	68400	1333871
1989	593664	1883	591781	431428	153439	277989	96109	965879	155322	110816	572	111388	1232589	68400	1300989
1990	617866	1993	615873	430510	133088	297422	91088	1004383	135081	109613	526	110139	1249603	68400	1318003
1991	594126	1951	592175	410629	130775	279854	88341	960370	132726	103866	415	104281	1197377	68400	1265777
1992	546043	1709	544334	396595	143178	253417	80734	878485	144887	100817	255	101072	1124444	68400	1192844
1993	617025	1642	615383	460296	190457	269839	88589	973811	192099	93504.76	169	93674	1259584	68400	1327984
1994	641071	1744	639327	443064	145260	297804	108805	1045936	147004	100277.45	51	100328	1293268	68400	1361668
1995	646167	1223	644944	472686	148762	323924	115134	1084002	149985	98062.57	-149	97913	1331900	68400	1400300
1996	640974	1077	639897	436589	118678	317911	118746	1076554	119755	94146.55	-197	93949	1290258	68400	1358658
1997	636810	1653	635157	487223	160762	326461	107093	1068711	162415	90685.64	-108	90578	1321704	68400	1390104
1998	649120	1446	647674	490930	174870	316060	108387	1072121	176316	85722.84	-287	85435	1333872	68400	1402272
1999	643426	1668	641758	465779	176447	289332	94414	1025504	178115	81765.22	-366	81400	1285019	68400	1353419
Average	623678	1665	622013	441475	128934	312541	93250	1027804	130599	115053	1539	116592	1274995	68400	1343395

1/ Provided by Imperial Irrigation District
2/ Provided by Coachella Valley Water District
3/ Computed during Model Calibration

20361

Table 2.3
Salton Sea
Historic Salt Budget

Year	Total [1/] Historic IID Salt Load to Sea (tons/yr)	Total [1/] Historic Mexico Salt Load to Sea (tons/yr)	Historic Salt Dissolved As Sea Inundated New Areas (tons/yr)	Historic [2/] Surface Flow Salt Load to Sea frm CVWD (tons/yr)	Historic [2/] Aquifer Salt Load frm CVWD (tons/yr)	Total Salt Load frm CVWD (tons/yr)	Total Historic Salt Load (tons/yr)
1950	2855378	84823	0	62200	7600	69800	3010001
1951	3139970	92572	416234	107100	7300	114400	3763176
1952	3364335	75842	584085	80900	6400	87300	4111562
1953	3684315	74128	717842	63800	5800	69600	4545885
1954	3648649	84301	528700	95100	4600	99700	4361350
1955	3577562	244785	419165	142000	2200	144200	4385712
1956	3713208	436841	159520	148100	1500	149600	4459169
1957	3603489	389519	0	141300	1500	142800	4135808
1958	3341376	530475	0	136900	2000	138900	4010751
1959	3401652	569705	0	145600	2000	147600	4118957
1960	3558534	603009	40266	190600	2200	192800	4394609
1961	3572808	576148	238972	237100	1300	238400	4626328
1962	3806946	612071	120026	328200	100	328300	4867343
1963	4050087	639664	372266	364200	-1500	362700	5424717
1964	3635121	678175	772455	355600	-4700	350900	5436651
1965	3819255	786501	0	418900	-6400	412500	5018256
1966	4148874	704090	0	386500	-3800	382700	5235664
1967	4139477	635787	0	374700	-3900	370800	5146064
1968	4012009	740074	0	372700	-4100	368600	5120683
1969	3754477	733842	0	362200	-4300	357900	4846219
1970	3780732	630950	0	369500	-4000	365500	4777182
1971	3900990	635685	0	397200	-3500	393700	4930375
1972	3876592	684430	0	421700	-3900	417800	4978822
1973	3980338	693063	0	437100	-4800	432300	5105701
1974	4204158	664649	0	444400	-5700	438700	5307507
1975	4196407	618895	211357	474600	-7000	467600	5494259
1976	4361658	669954	264736	486400	-10200	476200	5772548
1977	4187227	681825	780323	442000	-14500	427500	6076875
1978	3824323	684077	135762	419000	-18000	401000	5045162
1979	3998131	830984	0	421900	-19300	402600	5231715
1980	3988611	886112	270290	391700	-21400	370300	5515313
1981	3825050	983071	270598	453400	-24600	428800	5507519
1982	3608490	951238	0	454000	-25200	428800	4988528
1983	3333260	1269999	0	407500	-24300	383200	4986459
1984	3360246	1245141	0	360400	-28700	331700	4937087
1985	3296231	1094768	0	300600	-30700	269900	4660899
1986	2837518	1156095	0	291500	-30900	260600	4254213
1987	2753625	902813	0	282900	-32600	250300	3906738
1988	2854307	867612	0	281100	-32500	248600	3970519
1989	3139003	558769	0	271900	-34400	237500	3935272

Year	Total [1/] Historic IID Salt Load to Sea (tons/yr)	Total [1/] Historic Mexico Salt Load to Sea (tons/yr)	Historic Salt Dissolved As Sea Inundated New Areas (tons/yr)	Historic [2/] Surface Flow Salt Load to Sea frm CVWD (tons/yr)	Historic [2/] Aquifer Salt Load frm CVWD (tons/yr)	Total Salt Load frm CVWD (tons/yr)	Total Historic Salt Load (tons/yr)
1990	3328850	516591	0	273800	-33700	240100	4085541
1991	3033473	533884	0	263500	-33700	229800	3797157
1992	3247280	574283	0	248300	-35500	212800	4034363
1993	3476144	585887	0	225000	-39600	185400	4247431
1994	3371582	529953	0	196400	-41000	155400	4056935
1995	3293672	528697	0	174300	-45100	129200	3951569
1996	3445080	456753	32999	177800	-53700	124100	4058932
1997	3444677	643617	0	177300	-54700	122600	4210894
1998	3229808	601958	0	186900	-63900	123000	3954766
1999	3066967	594727	0	179200	-68900	110300	3771994
Average	3581439	631376	126711	288500	-16604	271896	4611423

1/ Provided by Imperial Irrigation District
2/ Provided by Coachella Valley Water District

Figure 2.1
Salton Sea
Historic Inflows

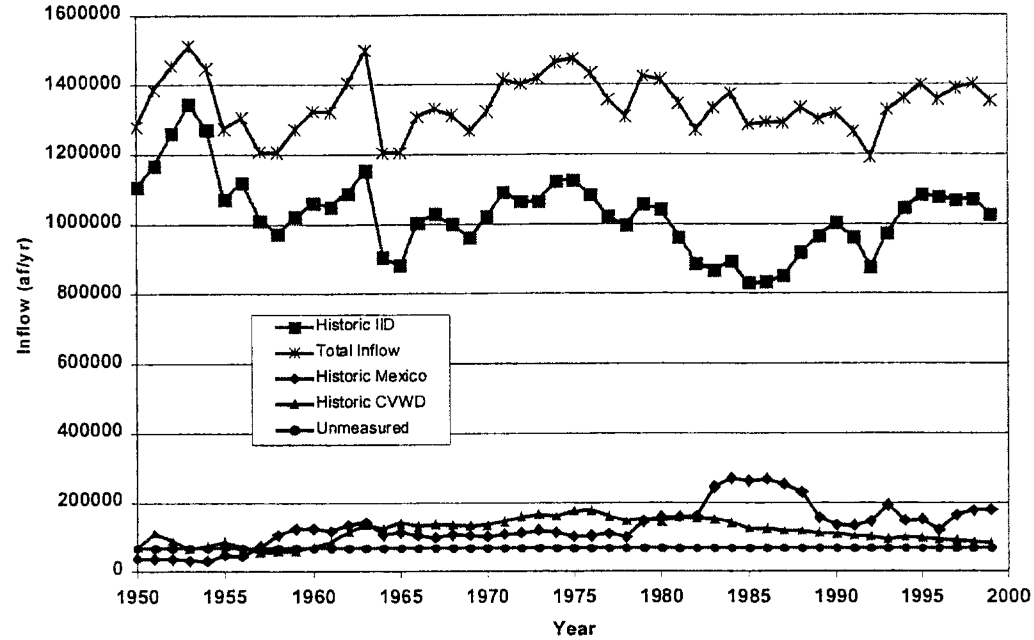
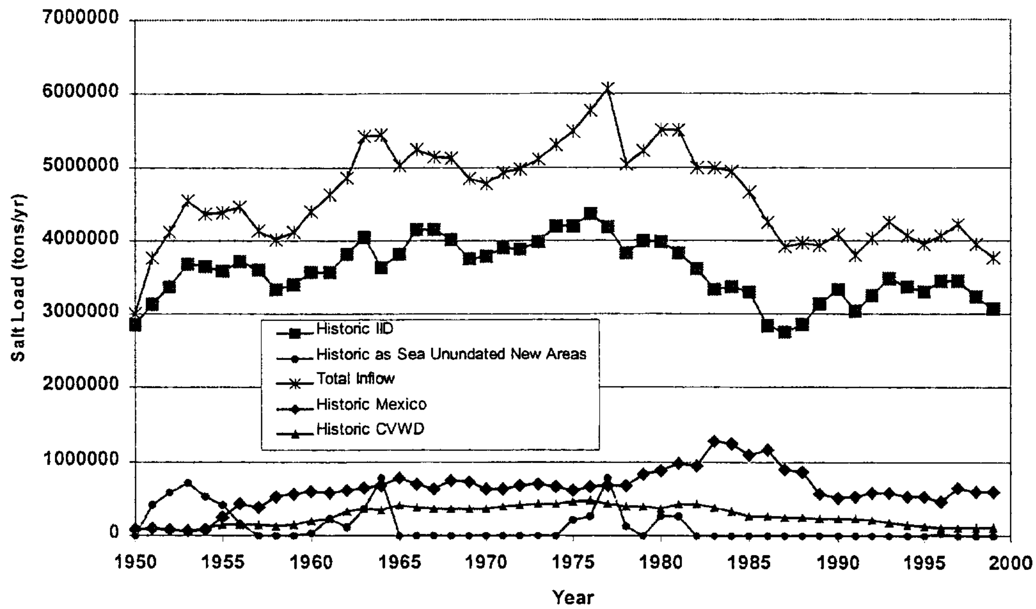


Figure 2.2
Salton Sea
Historic Salt Load



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3.0 — Historic Net Evaporation

3.1- Historic Pan Data

Using historic pan evaporation data in developing a computer model is a major source of errors and uncertainty. Problems associated with such data are, for the most part, due to measurement error. Such errors can be due to poor maintenance of water levels, bird/animal water consumption and bathing, stage recorder, and/or manual measurement errors. The result is that very little correlation exists between pan stations located even relatively close together. An assessment was performed of pan evaporation data from multiple stations maintained and operated by IID around the Salton Sea. Data from these surrounding stations were observed to have no correlation to each other, bringing into question the application of such data in predicting historic evaporation from the Salton Sea. As a result, pan evaporation data were not used in the development of the Model.

3.2 - Historic Precipitation Data

Historic precipitation data can also be a major source of error and uncertainty in developing a computer model. Problems associated with such data can be attributable to spatial variability in the tracking storms across a basin and stage recorder and/or manual measurement errors. Spatial variability problems make it impossible to assume that precipitation over a large body of water, such as the Salton Sea, can be represented by a few rain gauges located nearby. Point measurements of precipitation data cannot be used to represent rainfall over a large surface area. As a result, historic precipitation records from nearby climate stations were not used.

3.2 - Net Term Evaporation

To minimize errors in the Model from estimating evaporation and precipitation on the Salton Sea a unique approach was taken. The use of a "net term evaporation" was applied. This net term was computed during the calibration of the Model such that net term evaporation (being defined as Sea evaporation less Sea precipitation) was back calculated as a resultant term in the process of developing the historic water budget presented in Table 2.2. This was accomplished by simultaneously solving for average annual unmeasured inflows and net term evaporation. An iterative technique was applied such that unmeasured inflows were adjusted until a back calculated net term evaporation term equaled 68 inches on an average annual basis. A value of 68 inches for evaporation was derived as a target from a previous study of Salton Sea evaporation (Hughes 1967) and estimates of average annual precipitation in the Salton Basin. The USGS estimated evaporation from the Salton Sea to be 70.5 inches using a water budget approach. Average annual precipitation over the basin was estimated at 2.5 inches. Subtracting this average annual precipitation value from the 70.5 inches of evaporation resulted in a target of 68 inches for net evaporation. Table 3.1 presents a listing of the net evaporation computed in this process. This data is the basis for net evaporation calculations within the Model.

Table 3.1
Calculated Salton Sea Net Term Evaporation

Year	Net Term Evaporation (inches)
1950	67.6
1951	67.9
1952	66.6
1953	74.2
1954	69.4
1955	66.2
1956	73.9
1957	66.0
1958	67.1
1959	68.3
1960	66.0
1961	69.1
1962	67.2
1963	63.8
1964	71.6
1965	67.2
1966	69.2
1967	69.1
1968	70.3
1969	68.0
1970	71.0
1971	71.6
1972	71.8
1973	70.4
1974	73.7
1975	71.3
1976	56.1
1977	65.6
1978	66.7
1979	66.3
1980	64.2
1981	70.2
1982	66.4
1983	56.1
1984	69.9

Year	Net Term Evaporation (inches)
1985	67.8
1986	69.2
1987	68.0
1988	70.3
1989	72.3
1990	71.0
1991	64.7
1992	62.1
1993	60.5
1994	68.0
1995	68.6
1996	77.4
1997	72.0
1998	71.4
1999	72.5
Average	68.0

4.0 – Present Level Inflows and Salt Loads

Using historic water and salt budget data in the simulation of the Model to predict the future under existing conditions is not possible. The development of present level inflow budgets for both water and salt were required. There are eight major sources of future inflow to the Salton Sea. Table 2.1 lists each inflow source as well as the agency responsible for developing historic water and salt load inflows. This table also applies to the development of present level data attributed to each source. Present level inflows were provided by IID and CVWD based on their respective modeling efforts. Therefore, details about the development of present level flow components are not provided here. In summary these inflows represent effects due to a pre-existing conservation program between IID and MWD, effects of priority 3 entitlement enforcement of Colorado River water, the need for increased leaching within IID due to forecasted increases in salinity at Imperial Dam, changes in water use patterns in CVWD, and changes in Coachella Aquifer interactions with the Salton Sea. Inquiries of the details behind these inflows should be directed to either IID or CVWD. Present level unmeasured inflows cannot be predicted and are assumed to be the same as historic.

4.1 – Present Level Water Budget

Table 4.1 presents a compilation of present level water inflow records for components listed in Table 2.1. This compilation represents a comprehensive present level water budget to the Salton Sea. The model has the ability to simulate future conditions based on the assumption that present level conditions will continue. This water budget can be used as a starting point from which future changes to the Sea can be measured. Figure 4.1 depicts hydrographs of each present level development inflow component. It is difficult to predict present level flows from Mexico and there are no known published studies of such. Therefore it was assumed that future flows from Mexico would be equal to historic average annual flows for the years 1989 to 1999 plus 3 percent for increased future salinity in the Colorado River. Data provided by CVWD indicates that inflows from CVWD will decrease through time as a result of aquifer over drafting.

4.2 – Present Level Salt Budget

Table 4.2 presents a compilation of present level salt inflow records for components listed in Table 2.1. This compilation represents a comprehensive present level salt budget to the Salton Sea. This salt budget does not include a component for dissolving materials on newly inundated since the Sea is not expected to rise in elevation under present level conditions. This salt budget can be used as a starting point from which future changes to the Sea can be measured. The model has the ability to simulate future conditions based on the assumption that present level conditions will continue. Figure 4.2 is a hydrograph of present level salt loads from all sources. Salt loads from CVWD will eventually become negative as the Coachella Aquifer water levels decline and the Salton Sea recharges the aquifer in the future. This recharge will be minor in degree and will not involve large quantities of water. Mexico values are constant due to the assumption they will not change and are equal to average annual historic values for the period 1989 to 1999.

Table 4.1
Salton Sea
Present Level Water Budget

Year	Mexico 4/ Baseline Inflow (af)	IID 1/ Baseline Discharge to Sea (af)	Baseline 2/ Drain Flows/CVSC to Sea frm CVWD (af)	Baseline 2/ Aquifer Flows frm CVWD (af)	CVWD 2/ Baseline Discharge to Sea (af)	Inflow 1/ Reduction Due to Entitlement Enforcement (af)	Total 3/ Unmeasured Inflow (af)	Total Baseline Inflow to Sea (af)
2000	158592	952178	77534	-455	77080	-56856	68400	1199394
2001	158592	1053354	76222	-524	75698	-56856	68400	1299188
2002	158592	1019665	75836	-581	75255	-56856	68400	1265056
2003	158592	980000	75682	-633	75049	-56856	68400	1225185
2004	158592	949340	76429	-686	75743	-56856	68400	1195219
2005	158592	940522	76967	-742	76225	-56856	68400	1186883
2006	158592	934397	77174	-801	76373	-56856	68400	1180906
2007	158592	1027601	77176	-862	76315	-56856	68400	1274052
2008	158592	938780	76678	-928	75751	-56856	68400	1184667
2009	158592	976357	76220	-993	75227	-56856	68400	1221720
2010	158592	940652	75824	-1057	74767	-56856	68400	1185555
2011	158592	1096364	75437	-1119	74319	-56856	68400	1340819
2012	158592	1102122	75106	-1178	73928	-56856	68400	1346186
2013	158592	1035992	74774	-1236	73538	-56856	68400	1279666
2014	158592	1015039	74463	-1292	73171	-56856	68400	1258346
2015	158592	1057841	74172	-1345	72827	-56856	68400	1300804
2016	158592	958137	73958	-1396	72562	-56856	68400	1200835
2017	158592	1097408	73780	-1441	72338	-56856	68400	1339882
2018	158592	970489	73616	-1485	72131	-56856	68400	1212756
2019	158592	1102483	73448	-1529	71919	-56856	68400	1344538
2020	158592	933630	73291	-1569	71721	-56856	68400	1175487
2021	158592	1018457	73135	-1606	71529	-56856	68400	1260122
2022	158592	984430	72988	-1646	71342	-56856	68400	1225908
2023	158592	1105981	72834	-1686	71148	-56856	68400	1347265
2024	158592	1041634	72665	-1728	70937	-56856	68400	1282707
2025	158592	987664	72479	-1769	70710	-56856	68400	1228510
2026	158592	1009093	72319	-1812	70507	-56856	68400	1249736
2027	158592	1028147	72163	-1858	70305	-56856	68400	1268588
2028	158592	988991	72011	-1905	70106	-56856	68400	1229233
2029	158592	991076	71857	-1953	69904	-56856	68400	1231116
2030	158592	1106342	71709	-2000	69709	-56856	68400	1346187
2031	158592	997398	71562	-2048	69514	-56856	68400	1237048
2032	158592	947379	71414	-2097	69317	-56856	68400	1186832
2033	158592	1035849	71292	-2146	69146	-56856	68400	1275131
2034	158592	1029275	71184	-2196	68988	-56856	68400	1268399
2035	158592	945364	71059	-2246	68813	-56856	68400	1184313
2036	158592	1022577	70513	-2297	68215	-56856	68400	1260928
2037	158592	1021389	69968	-2349	67619	-56856	68400	1259144

Year	Mexico 4/ Baseline Inflow (af)	IID 1/ Baseline Discharge to Sea (af)	Baseline 2/ Drain Flows/CVSC to Sea frm CVWD (af)	Baseline 2/ Aquifer Flows frm CVWD (af)	CVWD 2/ Baseline Discharge to Sea (af)	Inflow 1/ Reduction Due to Entitlement Enforcement (af)	Total 3/ Unmeasured Inflow (af)	Total Baseline Inflow to Sea (af)
2038	158592	1091373	69427	-2401	67026	-56856	68400	1328535
2039	158592	1002077	68889	-2454	66435	-56856	68400	1238648
2040	158592	938756	68354	-2508	65846	-56856	68400	1174738
2041	158592	884449	67822	-2562	65261	-56856	68400	1119846
2042	158592	937873	67295	-2617	64678	-56856	68400	1172687
2043	158592	987754	66770	-2672	64099	-56856	68400	1221989
2044	158592	927646	66250	-2728	63523	-56856	68400	1161305
2045	158592	982748	65734	-2784	62950	-56856	68400	1215834
2046	158592	992067	65222	-2841	62381	-56856	68400	1224584
2047	158592	1005793	64715	-2899	61816	-56856	68400	1237745
2048	158592	1016584	64212	-2957	61255	-56856	68400	1247975
2049	158592	1022530	63713	-3016	60697	-56856	68400	1253363
2050	158592	879393	63219	-3075	60144	-56856	68400	1109673
2051	158592	944597	62730	-3135	59595	-56856	68400	1174328
2052	158592	1114332	62247	-3196	59051	-56856	68400	1343519
2053	158592	923277	61768	-3257	58511	-56856	68400	1151924
2054	158592	996533	61294	-3319	57975	-56856	68400	1224644
2055	158592	939315	60826	-3381	57445	-56856	68400	1166896
2056	158592	1017618	60362	-3444	56919	-56856	68400	1244673
2057	158592	942368	59905	-3507	56397	-56856	68400	1168901
2058	158592	946206	59453	-3572	55881	-56856	68400	1172223
2059	158592	918281	59006	-3636	55369	-56856	68400	1143786
2060	158592	1090278	58565	-3702	54863	-56856	68400	1315277
2061	158592	1018620	58130	-3768	54362	-56856	68400	1243118
2062	158592	886105	57700	-3835	53865	-56856	68400	1110106
2063	158592	936635	57276	-3902	53374	-56856	68400	1160145
2064	158592	971767	56858	-3970	52888	-56856	68400	1194791
2065	158592	984432	56446	-4039	52407	-56856	68400	1206975
2066	158592	937504	56040	-4108	51932	-56856	68400	1159572
2067	158592	850081	55639	-4178	51461	-56856	68400	1071678
2068	158592	942359	55245	-4249	50996	-56856	68400	1163491
2069	158592	983336	54857	-4321	50536	-56856	68400	1204008
2070	158592	1016119	54474	-4393	50081	-56856	68400	1236336
2071	158592	1084471	54098	-4466	49631	-56856	68400	1304238
2072	158592	1103947	53727	-4540	49187	-56856	68400	1323270
2073	158592	1094724	53362	-4615	48747	-56856	68400	1313607
2074	158592	1000653	53004	-4690	48313	-56856	68400	1219102
Average	158592	995413	67328	-2452	64875	-56856	68400	1230425

1/ Provided by Imperial Irrigation District
2/ Provided by Coachella Valley Water District
3/ No future change from historic is expected
4/ Average historic for years 1989 to 1999 plus 3 percent for increased salinity in Colorado River

Table 4.2
Salton Sea
Present Level Salt Budget

Year	Mexico 1/ Baseline Salt Load (tons/yr)	IID 1/ Baseline Salt Load (tons/yr)	CVWD 2/ Baseline Salt Load (tons/yr)	Reduction 1/ in Salt Due to Entitlement Enforcement (tons/yr)	Total Baseline Salt Load (tons/yr)
2000	556829	3322499	94401	-71052	3902677
2001	556829	3366696	87554	-71052	3940027
2002	556829	3396683	93703	-71052	3976163
2003	556829	3424603	90448	-71052	4000828
2004	556829	3323010	89370	-71052	3898157
2005	556829	3299450	77070	-71052	3862297
2006	556829	3227023	74420	-71052	3787220
2007	556829	3349659	71225	-71052	3906661
2008	556829	3288365	66743	-71052	3840885
2009	556829	3381829	72688	-71052	3940294
2010	556829	3232189	68575	-71052	3786541
2011	556829	3551068	64484	-71052	4101329
2012	556829	3576103	60719	-71052	4122599
2013	556829	3445681	57054	-71052	3988512
2014	556829	3264394	53636	-71052	3803807
2015	556829	3427082	50366	-71052	3963225
2016	556829	3248941	47372	-71052	3782090
2017	556829	3565121	34851	-71052	4085749
2018	556829	3331390	32395	-71052	3849562
2019	556829	3546706	30031	-71052	4062514
2020	556829	3301865	27889	-71052	3815531
2021	556829	3407048	25852	-71052	3918677
2022	556829	3445370	23734	-71052	3954881
2023	556829	3594752	21599	-71052	4102128
2024	556829	3458898	19331	-71052	3964006
2025	556829	3447560	17128	-71052	3950465
2026	556829	3434276	14780	-71052	3934833
2027	556829	3452860	2451	-71052	3941088
2028	556829	3440297	-157	-71052	3925917
2029	556829	3436980	-2671	-71052	3920086
2030	556829	3567579	-5172	-71052	4048184
2031	556829	3475968	-7671	-71052	3954074
2032	556829	3305266	-10373	-71052	3780670
2033	556829	3448445	-12921	-71052	3921301
2034	556829	3434391	-25098	-71052	3895070
2035	556829	3322073	-27734	-71052	3780116
2036	556829	3404727	-31173	-71052	3859331
2037	556829	3399918	-34707	-71052	3850988
2038	556829	3527938	-38235	-71052	3975480
2039	556829	3412273	-41757	-71052	3856293
2040	556829	3278980	-45373	-71052	3719384

Year	Mexico 1/ Baseline Salt Load (tons/yr)	IID 1/ Baseline Salt Load (tons/yr)	CVWD 2/ Baseline Salt Load (tons/yr)	Reduction 1/ in Salt Due to Entitlement Enforcement (tons/yr)	Total Baseline Salt Load (tons/yr)
2041	556829	3215236	-48982	-71052	3652031
2042	556829	3226817	-52685	-71052	3659909
2043	556829	3381318	-56380	-71052	3810715
2044	556829	3242971	-60068	-71052	3668680
2045	556829	3384930	-63749	-71052	3806958
2046	556829	3372211	-76370	-71052	3781618
2047	556829	3370741	-80165	-71052	3776353
2048	556829	3412826	-83952	-71052	3814651
2049	556829	3408825	-87731	-71052	3806871
2050	556829	3195655	-91602	-71052	3589830
2051	556829	3213389	-95464	-71052	3603702
2052	556829	3488604	-99318	-71052	3875063
2053	556829	3263426	-103262	-71052	3645941
2054	556829	3374209	-107298	-71052	3752688
2055	556829	3245841	-111224	-71052	3620394
2056	556829	3402452	-115341	-71052	3772888
2057	556829	3231338	-127475	-71052	3589640
2058	556829	3224846	-131611	-71052	3579012
2059	556829	3223631	-135638	-71052	3573770
2060	556829	3518586	-139856	-71052	3864507
2061	556829	3432582	-143965	-71052	3774394
2062	556829	3236172	-148164	-71052	3573785
2063	556829	3314338	-152454	-71052	3647661
2064	556829	3405320	-156735	-71052	3734362
2065	556829	3395959	-168764	-71052	3712972
2066	556829	3246003	-173070	-71052	3558710
2067	556829	3050843	-177467	-71052	3359153
2068	556829	3183190	-181856	-71052	3487111
2069	556829	3315452	-186336	-71052	3614893
2070	556829	3373925	-190906	-71052	3668796
2071	556829	3535882	-195468	-71052	3826191
2072	556829	3540304	-200021	-71052	3826060
2073	556829	3558742	-211905	-71052	3832614
2074	556829	3469929	-216592	-71052	3739114
Average	556829	3373633	-42467	-71052	3816942

1/ Provided by Imperial Irrigation District

2/ Provided by Coachella Valley Water District

3/ Average historic for years 1989 to 1999

Figure 4.1
Salton Sea
Present Level Inflows

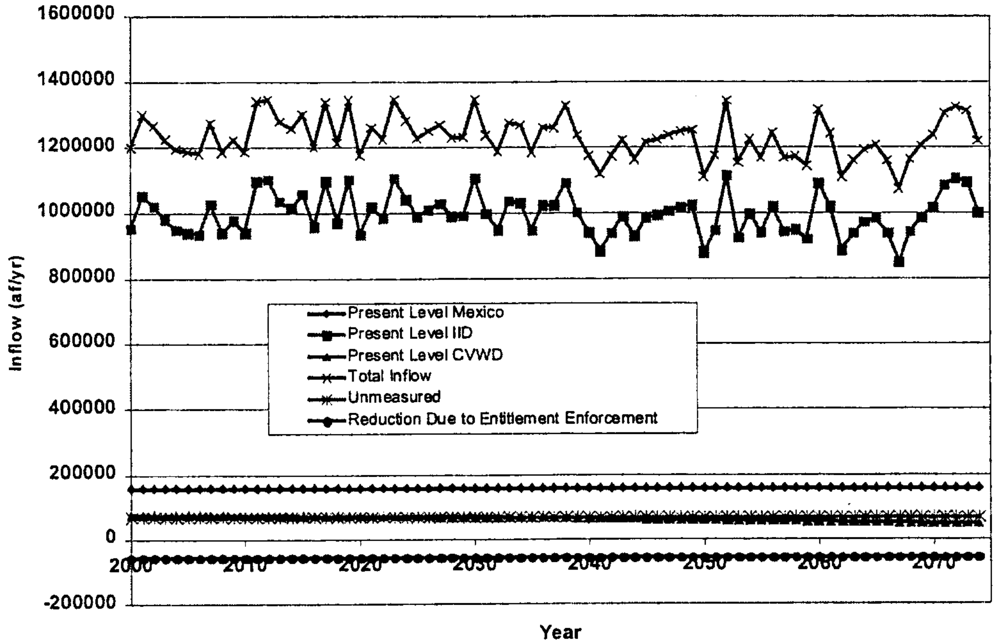
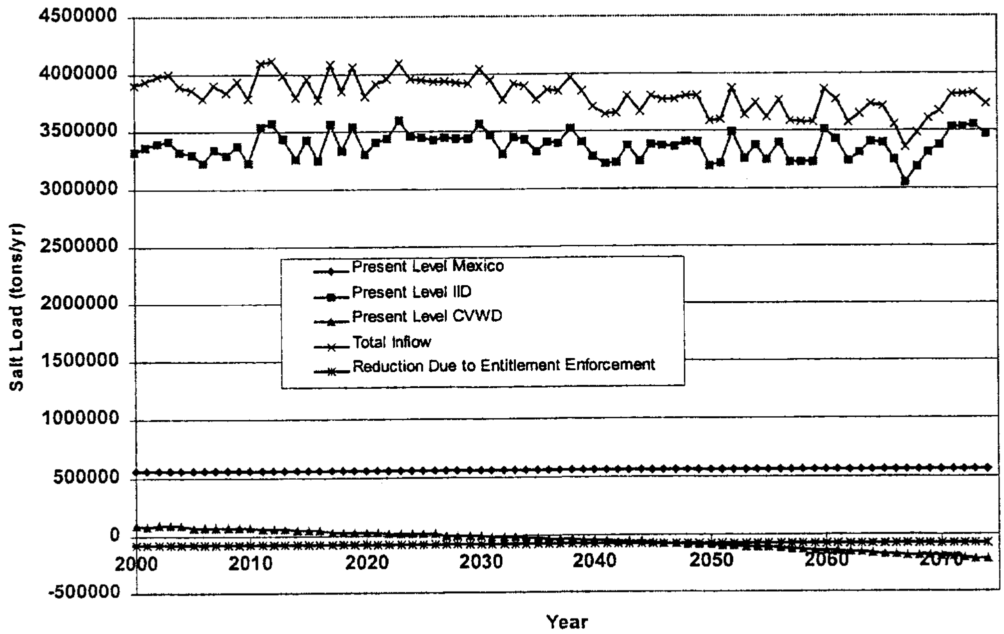


Figure 4.2
Salton Sea
Present Level Salt Load



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5.0 — Salton Sea Accounting Model

5.1 – Overview

This model is a spreadsheet model that resides inside of Microsoft Excel 2000 and utilizes a risk and uncertainty package produced by Palisades called @Risk. The Salton Sea Accounting Model incorporates the ability to perform stochastic and deterministic simulations of Salton Sea conditions. These stochastic capabilities provide for analysis of the variability of hydrologic parameters such as Sea inflow. The model operates on an annual time step.

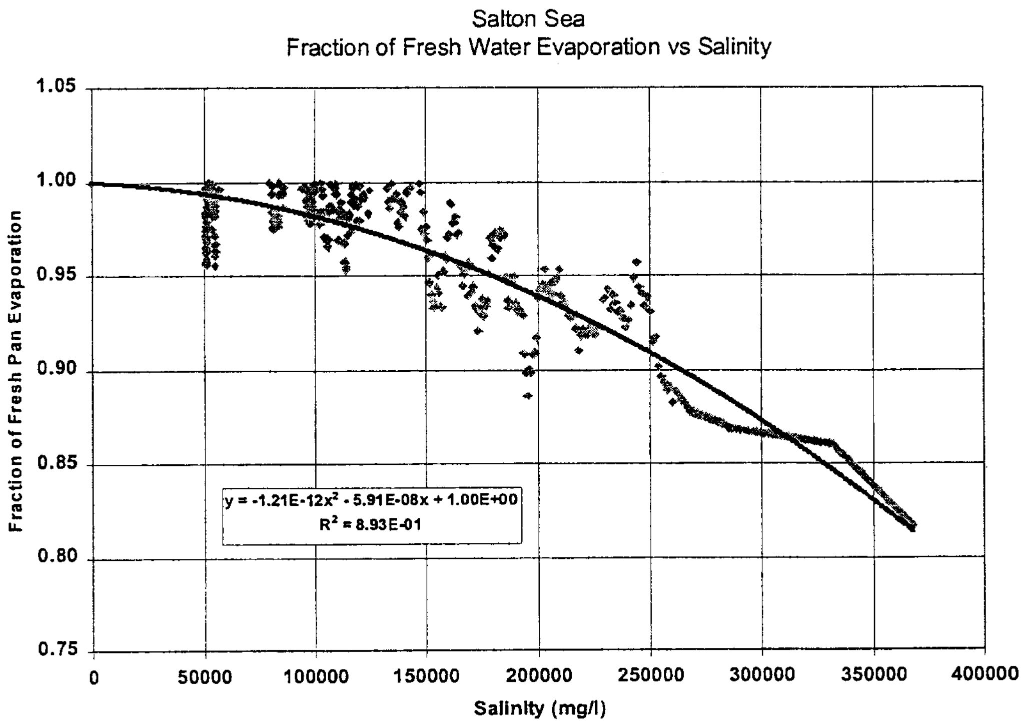
The objectives behind the development of the Salton Sea Accounting Model were to provide a tool that would allow the effective evaluation of historic, present, and future conditions within the Salton Sea. Specifically, the model was developed to provide predictions of changes in elevation, surface area, and salinity based on changes in inflow. Special operating requirements included the need to simulate:

Future changes in elevation
Future changes in salt loads into the Sea
Imports of water
Exports of water
In-Sea ponds

5.2 - Evaporation as a Function of Salinity

As salinity increases in the Salton Sea it is expected that evaporation rate reductions will occur. Reclamation in Denver, Colorado, conducted a research project that resulted in developing a relationship that depicts how evaporation will decrease as a function of salinity. Figure 5.1 presents this relationship whereby the effect of salinity is expressed as a fraction of fresh water pan evaporation. Given a specific salinity, the presented curve and equation can by used to calculate a fractional adjustment to the net term evaporation data. This relationship is built into the model whereby the adjustments to net term evaporation are made on annual basis. At 50,000 mg/L salinity levels, the adjustment to salinity is about 0.99. At 100,000 mg/L, the adjustment to net evaporation is about 0.975. At 325,000 mg/L, the adjustment would be 0.85. The adjustments, therefore, are not significant in the salinity ranges expected in the Salton Sea in the near future.

Figure 5.1

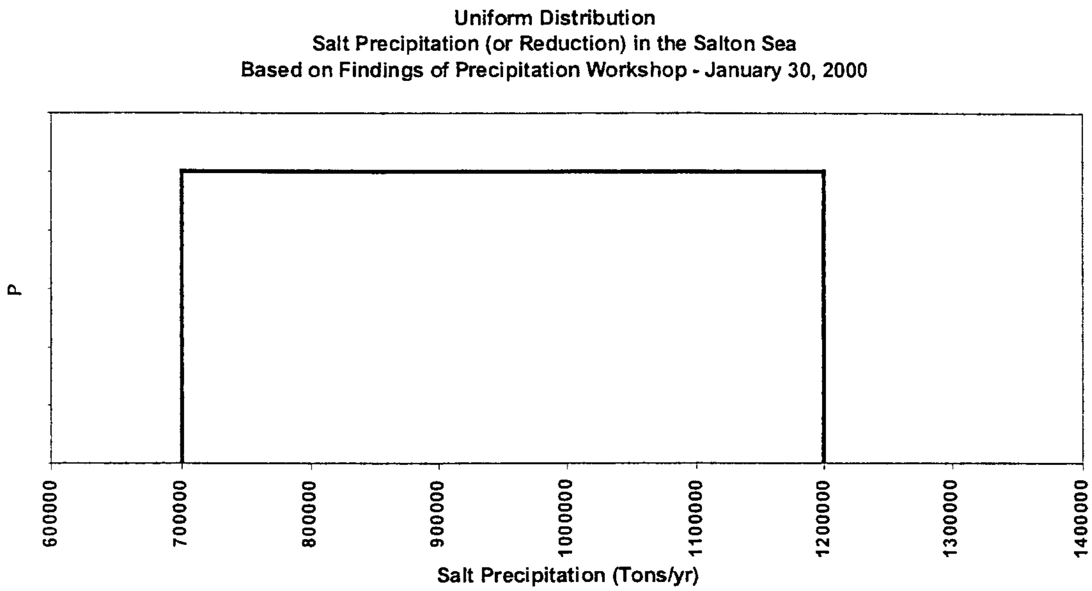


5.3 - Precipitation of Dissolved Solids

In December 2000, a Science Workshop was held in Riverside, California, to develop a joint opinion of scientists with knowledge in the field of salinity, salt precipitation, and biological reduction of sulfates within natural waters. It was concluded, and presented, in a yet to be published paper that dissolved solids are either being precipitated or biologically reduced within the Salton Sea as dissolved salts are added to Sea waters on an annual basis. It was concluded that, at a minimum, 0.7 million tons per year of salts dissolved in inflow waters are being precipitated upon mixing in the Sea. It was also concluded that, at a maximum, 1.2 million tons per year are either being precipitated and/or biologically reduced. If biologic reductions are occurring, then they could be, for example, through actions of sulfate reducing bacteria.

Given the wide range of possibilities that exist between 700,000 and 1.2 million tons per year, the Salton Sea Accounting Model was developed such that this issue was handled as an uncertainty term. When the model is operated in a stochastic mode, a different value for precipitation of dissolved solids is sampled from a uniform probability distribution (figure 5.2) defined by the limits of 700,000 and 1.2 million tons per year. The model then reduces the salt load to the Sea on an annual basis by a corresponding amount to that which is sampled from the distribution. This results in model simulations that account for the uncertainty of how dissolved solids are precipitated or reduced within the Salton Sea.

Figure 5.2



5.4 - Modes of Operation

The Salton Sea Accounting Model incorporates the ability to perform stochastic and deterministic simulations of the Salton Sea. Deterministic simulations of the model assume that the hydrologic and salt load variability of the Sea will repeat in the future exactly in the same pattern as in the present level water budget. During stochastic simulations of the Salton Sea, random samples are taken from IID water inflow and salt load data for present level conditions as well as from the dissolved solid precipitation distribution presented above. In addition, net term evaporation is sampled in paired fashion to corresponding present level inflow data from IID. In this mode, the model is typically executed 1,000 times and statistics related to model results are compiled. These statistics include for each year: mean values, mean values plus one standard deviation, mean values minus one standard deviation, 5 percentiles, and 95 percentiles. The data are to be interpreted as follows:

> *95 Percentile*: 95 percent of all model traces resulted in values less than or equal to the indicated values
>
> *5 Percentile*: 5 percent of all model traces resulted in values less than or equal to the indicated values
>
> *Mean*: Mean of all traces

-1 Standard Deviation: Values representing one standard deviation below the mean

+1 Standard Deviation: Values representing one standard deviation above the mean

5.5 - Area/Elevation/Capacity

In 1995, the Bureau of Reclamation conducted an extensive survey of the Salton Sea (Reclamation, 1997). The survey was to develop underwater topography and to compute area/elevation/capacity relationships for the Sea. This survey did not incorporate existing levees around the shoreline of the Salton Sea. As a result, the area/elevation/capacity data that was developed was not accurate at higher elevations. In the summer of 1999, Reclamation updated this survey data to reflect the influences of the existing levees on the area/elevation/capacity relationships. This was accomplished through the digitization of the Salton Sea shoreline from digital orthophoto quadrangles. Levees were identified along this shoreline and assigned an elevation of -220 feet. The two resulting elevation data (shoreline and levees) were merged into the 1995 survey data. New area/elevation/capacity data were then computed using Reclamation's reservoir survey software. Table 5.1 contains this data. This information was incorporated into the Salton Sea Accounting Model to interpolate elevations and surface areas for each year of model operation. The Model keeps a running accounting of water in storage and, using the data contained in Table 5.1, the model can interpolate elevations and water surface areas.

Figures 5.3 through 5.5 contain Area / Capacity, Elevation / Capacity, and Elevation / Area curves respectively. These charts give an overview of how area, elevation, and storage capacity within the Salton Sea vary.

TABLE 5.1
Salton Sea Elevation / Area / Capacity Data
Based on Revised 1995 Hydrographic GPS Survey Data
Includes Influences Due to Shoreline Levees Not Included in 1995 Survey
(September 1999)

Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)
-278.6	0	0	-275.5	17626	20016	-272.4	52416	127310	-269.3	88765	346460	-266.2	108550	654946
-278.5	1	0	-275.4	18573	21826	-272.3	53527	132607	-269.2	89598	355378	-266.1	109068	665826
-278.4	9	1	-275.3	19508	23730	-272.2	54652	138016	-269.1	90441	364380	-266	109576	676759
-278.3	27	2	-275.2	20479	25729	-272.1	55837	143541	-269	91260	373465	-265.9	110072	687741
-278.2	70	7	-275.1	21439	27825	-272	57012	149183	-268.9	92038	382630	-265.8	110574	698773
-278.1	193	20	-275	22315	30013	-271.9	58201	154944	-268.8	92798	391872	-265.7	111075	709856
-278	441	52	-274.9	23193	32288	-271.8	59399	160824	-268.7	93524	401188	-265.6	111580	720989
-277.9	789	114	-274.8	24086	34652	-271.7	60602	166824	-268.6	94241	410576	-265.5	112096	732172
-277.8	1209	214	-274.7	25087	37111	-271.6	61814	172945	-268.5	94916	420034	-265.4	112590	743407
-277.7	1681	358	-274.6	26113	39671	-271.5	63089	179190	-268.4	95608	429560	-265.3	113076	754690
-277.6	2145	549	-274.5	27254	42339	-271.4	64343	185562	-268.3	96313	439156	-265.2	113563	766022
-277.5	2619	787	-274.4	28712	45138	-271.3	65495	192053	-268.2	97003	448822	-265.1	114034	777402
-277.4	3168	1077	-274.3	30247	48086	-271.2	66672	198662	-268.1	97668	458555	-265	114510	788829
-277.3	3734	1422	-274.2	31717	51184	-271.1	67870	205389	-268	98332	468355	-264.9	114981	800304
-277.2	4341	1826	-274.1	33113	54425	-271	69137	212239	-267.9	98966	478220	-264.8	115453	811825
-277.1	5001	2293	-274	34430	57803	-270.9	70342	219213	-267.8	99580	488148	-264.7	115925	823394
-277	5705	2828	-273.9	35638	61306	-270.8	71507	226305	-267.7	100199	498137	-264.6	116398	835010
-276.9	6439	3435	-273.8	36765	64926	-270.7	72618	233512	-267.6	100834	508188	-264.5	116872	846674
-276.8	7273	4121	-273.7	37864	68658	-270.6	73722	240829	-267.5	101448	518302	-264.4	117345	858385
-276.7	8088	4889	-273.6	38998	72501	-270.5	74768	248253	-267.4	102038	528477	-264.3	117818	870143
-276.6	8897	5738	-273.5	40144	76458	-270.4	75837	255783	-267.3	102632	538710	-264.2	118300	881949
-276.5	9666	6666	-273.4	41296	80530	-270.3	76913	263421	-267.2	103206	549002	-264.1	118772	893802
-276.4	10409	7670	-273.3	42395	84714	-270.2	78140	271174	-267.1	103780	559351	-264	119248	905703
-276.3	11130	8747	-273.2	43498	89009	-270.1	79448	279053	-267	104350	569758	-263.9	119723	917652
-276.2	11793	9893	-273.1	44578	93413	-270	80635	287057	-266.9	104909	580221	-263.8	120187	929647
-276.1	12438	11105	-273	45669	97925	-269.9	81786	295178	-266.8	105448	590739	-263.7	120653	941689
-276	13115	12382	-272.9	46712	102544	-269.8	82977	303416	-266.7	105977	601310	-263.6	121108	953777
-275.9	13858	13731	-272.8	47797	107270	-269.7	84276	311779	-266.6	106513	611934	-263.5	121580	965912
-275.8	14718	15160	-272.7	48941	112107	-269.6	85610	320273	-266.5	107020	622611	-263.4	122042	978093
-275.7	15699	16681	-272.6	50094	117058	-269.5	86826	328895	-266.4	107527	633339	-263.3	122494	990320
-275.6	16692	18300	-272.5	51265	122126	-269.4	87852	337629	-266.3	108031	644116	-263.2	122931	1002591

Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)
-263.1	123362	1014905	-260	135199	1416184	-256.9	145399	1851301	-253.8	155220	2317466	-250.7	164257	2812727
-263	123787	1027263	-259.9	135553	1429722	-256.8	145739	1865858	-253.7	155523	2333003	-250.6	164553	2829167
-262.9	124200	1039662	-259.8	135899	1443294	-256.7	146069	1880448	-253.6	155830	2348571	-250.5	164850	2845638
-262.8	124619	1052103	-259.7	136244	1456902	-256.6	146395	1895071	-253.5	156139	2364169	-250.4	165147	2862137
-262.7	125031	1064586	-259.6	136583	1470543	-256.5	146718	1909727	-253.4	156445	2379798	-250.3	165436	2878667
-262.6	125439	1077109	-259.5	136920	1484218	-256.4	147036	1924415	-253.3	156748	2395458	-250.2	165723	2895225
-262.5	125840	1089673	-259.4	137259	1497927	-256.3	147360	1939134	-253.2	157046	2411148	-250.1	166013	2911811
-262.4	126235	1102277	-259.3	137597	1511670	-256.2	147681	1953886	-253.1	157337	2426867	-250	166300	2928427
-262.3	126618	1114920	-259.2	137936	1525446	-256.1	148009	1968671	-253	157631	2442615	-249.9	166588	2945071
-262.2	127008	1127601	-259.1	138268	1539257	-256	148330	1983488	-252.9	157923	2458393	-249.8	166876	2961745
-262.1	127401	1140321	-259	138598	1553100	-255.9	148655	1998337	-252.8	158211	2474200	-249.7	167174	2978447
-262	127796	1153081	-258.9	138926	1566976	-255.8	148975	2013219	-252.7	158497	2490035	-249.6	167476	2995180
-261.9	128191	1165880	-258.8	139254	1580885	-255.7	149289	2028132	-252.6	158782	2505899	-249.5	167785	3011943
-261.8	128576	1178719	-258.7	139580	1594827	-255.6	149601	2043076	-252.5	159067	2521791	-249.4	168090	3028736
-261.7	128959	1191596	-258.6	139902	1608801	-255.5	149918	2058052	-252.4	159351	2537712	-249.3	168397	3045561
-261.6	129340	1204511	-258.5	140221	1622807	-255.4	150233	2073060	-252.3	159634	2553662	-249.2	168702	3062416
-261.5	129715	1217463	-258.4	140547	1636845	-255.3	150543	2088099	-252.2	159918	2569639	-249.1	169008	3079301
-261.4	130089	1230453	-258.3	140874	1650916	-255.2	150853	2103168	-252.1	160200	2585645	-249	169311	3096217
-261.3	130464	1243481	-258.2	141196	1665020	-255.1	151172	2118270	-252	160481	2601679	-248.9	169621	3113164
-261.2	130837	1256546	-258.1	141520	1679156	-255	151497	2133403	-251.9	160764	2617741	-248.8	169932	3130141
-261.1	131214	1269649	-258	141849	1693324	-254.9	151832	2148570	-251.8	161045	2633832	-248.7	170249	3147150
-261	131581	1282788	-257.9	142171	1707525	-254.8	152158	2163769	-251.7	161326	2649950	-248.6	170567	3164191
-260.9	131946	1295965	-257.8	142492	1721758	-254.7	152476	2179001	-251.6	161613	2666097	-248.5	170892	3181264
-260.8	132311	1309178	-257.7	142813	1736024	-254.6	152786	2194264	-251.5	161901	2682273	-248.4	171222	3198370
-260.7	132672	1322427	-257.6	143132	1750321	-254.5	153092	2209558	-251.4	162185	2698477	-248.3	171553	3215509
-260.6	133034	1335712	-257.5	143449	1764650	-254.4	153397	2224882	-251.3	162471	2714710	-248.2	171889	3232681
-260.5	133398	1349034	-257.4	143773	1779011	-254.3	153697	2240237	-251.2	162763	2730972	-248.1	172225	3249886
-260.4	133759	1362391	-257.3	144092	1793404	-254.2	154000	2255622	-251.1	163059	2747263	-248	172565	3267126
-260.3	134123	1375785	-257.2	144415	1807830	-254.1	154305	2271037	-251	163361	2763584	-247.9	172911	3284400
-260.2	134483	1389216	-257.1	144739	1822287	-254	154611	2286483	-250.9	163662	2779935	-247.8	173266	3301708
-260.1	134843	1402682	-257	145065	1836777	-253.9	154915	2301959	-250.8	163961	2796316	-247.7	173639	3319054

Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)
-247.6	174005	3336436	-244.5	185646	3893530	-241.4	197570	4488430	-238.3	207554	5116905	-235.2	216669	5775237
-247.5	174361	3353854	-244.4	186042	3912115	-241.3	197924	4508204	-238.2	207865	5137676	-235.1	216929	5796917
-247.4	174720	3371308	-244.3	186450	3930739	-241.2	198281	4528015	-238.1	208175	5158478	-235	217196	5818624
-247.3	175073	3388798	-244.2	186860	3949405	-241.1	198638	4547860	-238	208485	5179311	-234.9	217466	5840357
-247.2	175423	3406323	-244.1	187288	3968112	-241	198993	4567742	-237.9	208793	5200175	-234.8	217731	5862116
-247.1	175775	3423883	-244	187726	3986863	-240.9	199349	4587659	-237.8	209112	5221070	-234.7	217987	5883902
-247	176129	3441478	-243.9	188174	4005658	-240.8	199707	4607612	-237.7	209438	5241998	-234.6	218238	5905714
-246.9	176484	3459108	-243.8	188619	4024497	-240.7	200058	4627600	-237.6	209765	5262958	-234.5	218483	5927550
-246.8	176844	3476775	-243.7	189073	4043382	-240.6	200411	4647624	-237.5	210098	5283951	-234.4	218722	5949410
-246.7	177212	3494478	-243.6	189532	4062312	-240.5	200747	4667682	-237.4	210427	5304977	-234.3	218956	5971294
-246.6	177591	3512218	-243.5	189966	4081287	-240.4	201075	4687773	-237.3	210759	5326036	-234.2	219188	5993201
-246.5	177968	3529996	-243.4	190376	4100304	-240.3	201402	4707896	-237.2	211106	5347130	-234.1	219416	6015131
-246.4	178350	3547812	-243.3	190767	4119361	-240.2	201726	4728053	-237.1	211467	5368258	-234	219640	6037084
-246.3	178738	3565666	-243.2	191145	4138457	-240.1	202043	4748241	-237	211809	5389422	-233.9	219861	6059059
-246.2	179109	3583558	-243.1	191516	4157590	-240	202360	4768461	-236.9	212136	5410619	-233.8	220082	6081056
-246.1	179483	3601488	-243	191887	4176760	-239.9	202678	4788713	-236.8	212449	5431849	-233.7	220299	6103075
-246	179860	3619455	-242.9	192255	4195967	-239.8	202992	4808997	-236.7	212743	5453108	-233.6	220515	6125116
-245.9	180242	3637460	-242.8	192632	4215212	-239.7	203297	4829311	-236.6	213028	5474397	-233.5	220729	6147178
-245.8	180621	3655503	-242.7	192994	4234493	-239.6	203608	4849657	-236.5	213309	5495714	-233.4	220943	6169262
-245.7	181000	3673584	-242.6	193364	4253811	-239.5	203916	4870033	-236.4	213582	5517058	-233.3	221149	6191366
-245.6	181378	3691703	-242.5	193735	4273166	-239.4	204218	4890439	-236.3	213852	5538430	-233.2	221354	6213491
-245.5	181754	3709860	-242.4	194105	4292558	-239.3	204518	4910876	-236.2	214120	5559829	-233.1	221553	6235637
-245.4	182127	3728054	-242.3	194469	4311986	-239.2	204819	4931343	-236.1	214385	5581254	-233	221752	6257802
-245.3	182499	3746285	-242.2	194841	4331452	-239.1	205123	4951840	-236	214646	5602705	-232.9	221952	6279987
-245.2	182868	3764554	-242.1	195204	4350954	-239	205426	4972368	-235.9	214910	5624183	-232.8	222151	6302192
-245.1	183245	3782859	-242	195554	4370492	-238.9	205725	4992925	-235.8	215165	5645687	-232.7	222350	6324417
-245	183640	3801204	-241.9	195894	4390064	-238.8	206027	5013513	-235.7	215417	5667216	-232.6	222547	6346662
-244.9	184040	3819588	-241.8	196229	4409671	-238.7	206331	5034131	-235.6	215668	5688770	-232.5	222744	6368927
-244.8	184454	3838012	-241.7	196560	4429310	-238.6	206630	5054779	-235.5	215917	5710349	-232.4	222941	6391211
-244.7	184868	3856478	-241.6	196899	4448983	-238.5	206932	5075457	-235.4	216168	5731954	-232.3	223138	6413515
-244.6	185261	3874985	-241.5	197231	4468690	-238.4	207238	5096165	-235.3	216419	5753583	-232.2	223336	6435839

20380

Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)	Salton Sea Elevation (ft)	Salton Sea Area (acres)	Salton Sea Capacity (af)
-232.1	223535	6458182	-229	229868	7160886	-225.9	236510	7883682	-222.8	243497	8627612			
-232	223734	6480546	-228.9	230077	7183883	-225.8	236730	7907344	-222.7	243727	8651974			
-231.9	223934	6502929	-228.8	230286	7206902	-225.7	236950	7931028	-222.6	243958	8676358			
-231.8	224134	6525333	-228.7	230496	7229941	-225.6	237171	7954734	-222.5	244190	8700765			
-231.7	224335	6547756	-228.6	230705	7253001	-225.5	237392	7978462	-222.4	244421	8725196			
-231.6	224536	6570200	-228.5	230916	7276082	-225.4	237613	8002212	-222.3	244653	8749650			
-231.5	224737	6592663	-228.4	231126	7299184	-225.3	237835	8025985	-222.2	244885	8774126			
-231.4	224939	6615147	-228.3	231337	7322307	-225.2	238057	8049779	-222.1	245118	8798627			
-231.3	225141	6637651	-228.2	231549	7345451	-225.1	238280	8073596	-222	245351	8823150			
-231.2	225344	6660175	-228.1	231761	7368617	-225	238502	8097435	-221.9	245584	8847697			
-231.1	225547	6682720	-228	231973	7391803	-224.9	238733	8121297	-221.8	245818	8872267			
-231	225750	6705285	-227.9	232185	7415011	-224.8	238957	8145182	-221.7	246052	8896860			
-230.9	225953	6727870	-227.8	232398	7438240	-224.7	239180	8169088	-221.6	246286	8921477			
-230.8	226157	6750475	-227.7	232611	7461491	-224.6	239404	8193018	-221.5	246521	8946118			
-230.7	226361	6773101	-227.6	232825	7484763	-224.5	239629	8216969	-221.4	246756	8970782			
-230.6	226565	6795748	-227.5	233038	7508056	-224.4	239854	8240943	-221.3	246991	8995469			
-230.5	226769	6818414	-227.4	233253	7531370	-224.3	240079	8264940	-221.2	247227	9020180			
-230.4	226974	6841101	-227.3	233467	7554706	-224.2	240304	8288959	-221.1	247463	9044914			
-230.3	227180	6863809	-227.2	233682	7578064	-224.1	240530	8313001	-221	247699	9069672			
-230.2	227385	6886537	-227.1	233898	7601443	-224	240756	8337065	-220.9	247936	9094454			
-230.1	227592	6909286	-227	234113	7624843	-223.9	240983	8361152	-220.8	248173	9119260			
-230	227798	6932056	-226.9	234329	7648266	-223.8	241210	8385262	-220.7	248410	9144089			
-229.9	228004	6954846	-226.8	234546	7671709	-223.7	241437	8409394	-220.6	248648	9168942			
-229.8	228210	6977657	-226.7	234763	7695175	-223.6	241664	8433549	-220.5	248886	9193818			
-229.7	228416	7000488	-226.6	234980	7718662	-223.5	241892	8457727	-220.4	249125	9218719			
-229.6	228622	7023340	-226.5	235197	7742171	-223.4	242121	8481928	-220.3	249363	9243643			
-229.5	228829	7046212	-226.4	235415	7765701	-223.3	242349	8506151	-220.2	249602	9268592			
-229.4	229036	7069106	-226.3	235633	7789254	-223.2	242578	8530398	-220.1	249842	9293564			
-229.3	229243	7092020	-226.2	235852	7812828	-223.1	242807	8554667	-220	250082	9318560			
-229.2	229451	7114954	-226.1	236071	7836424	-223	243037	8578959						
-229.1	229659	7137910	-226	236290	7860042	-222.9	243267	8603274						

Figure 5.3

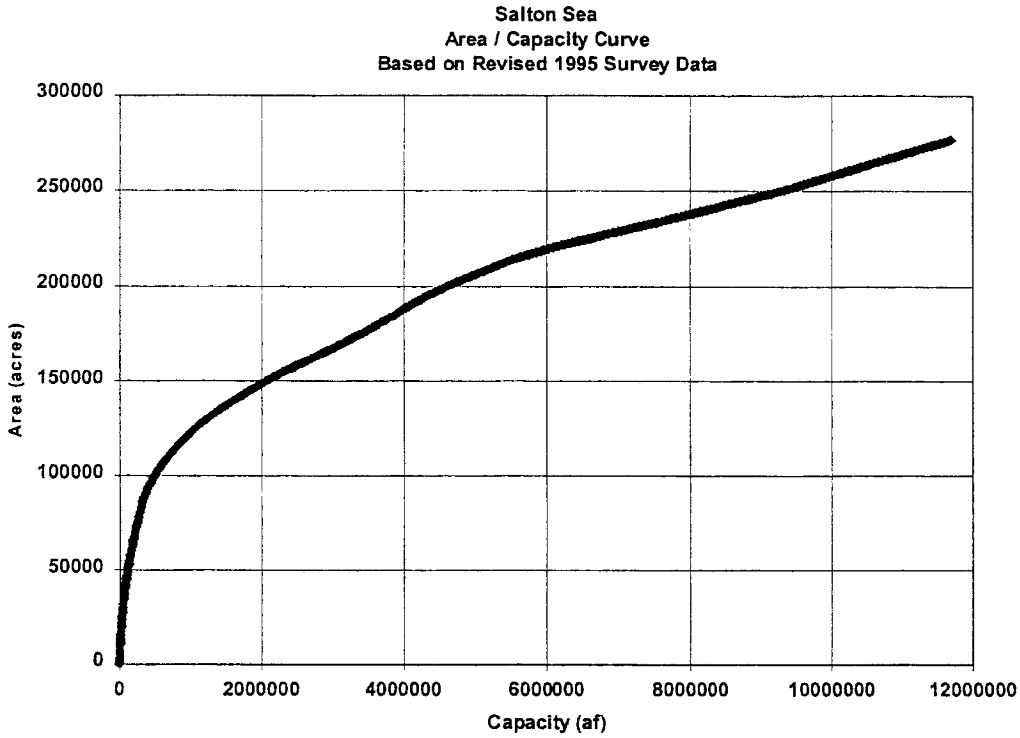
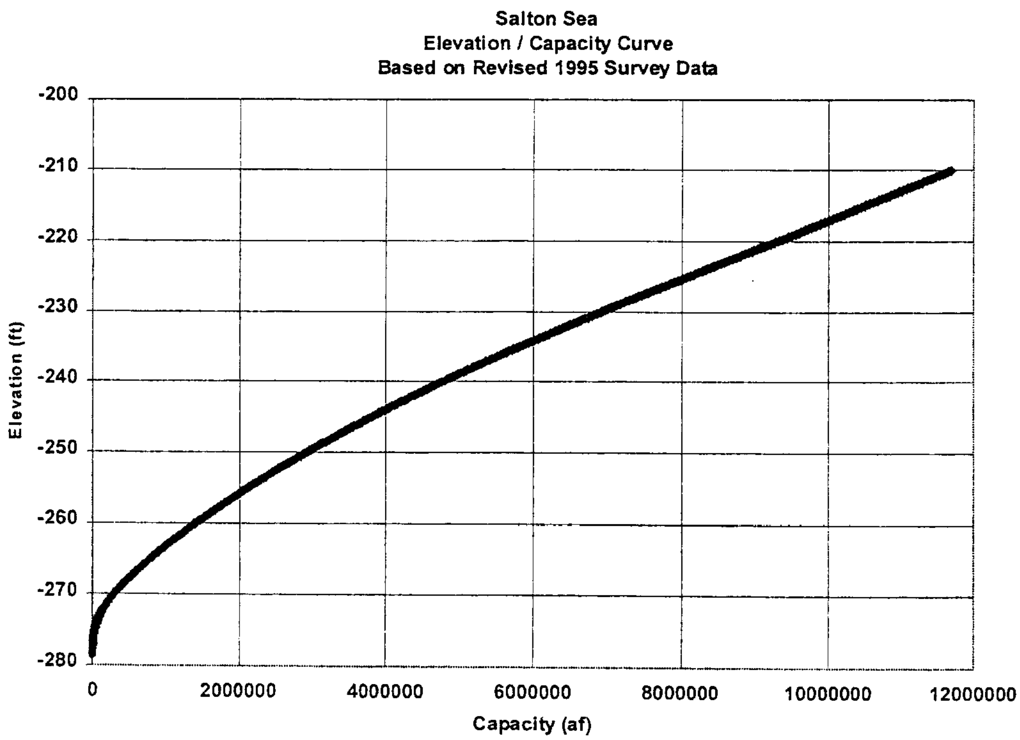
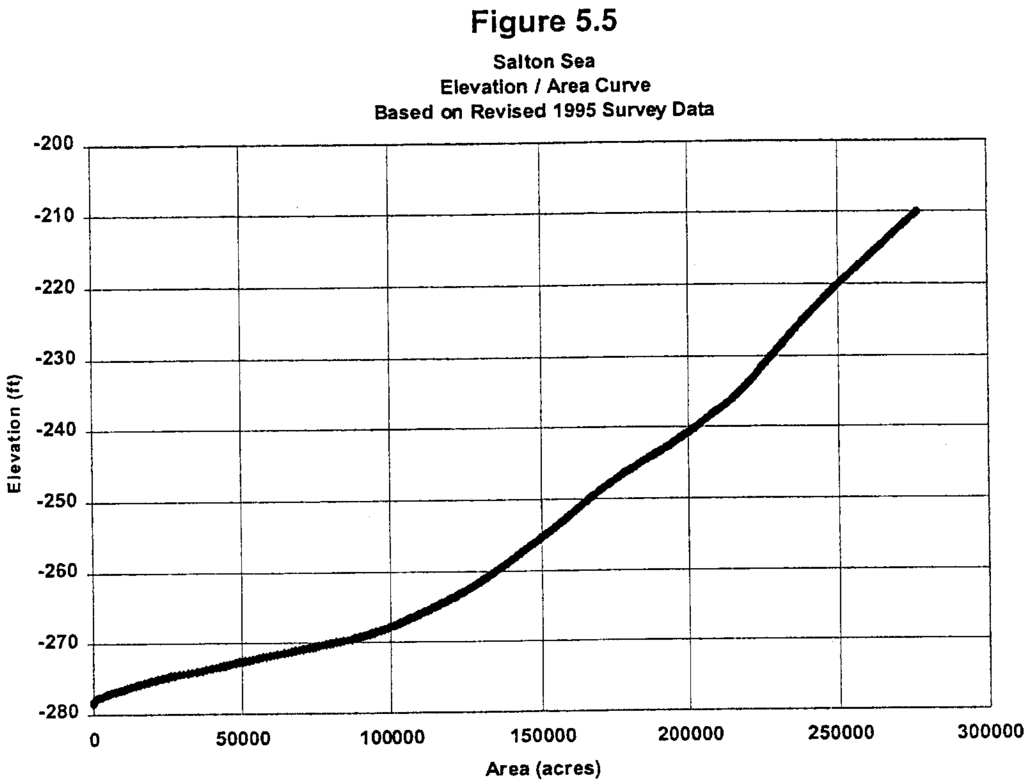


Figure5.4





6.0 - Future Inflows and Salt Loads

6.1 - Conservation Ramp-up Schedules

Future inflows to the Salton Sea are expected to decline. The most likely program that will have an effect on inflows is a transfer of water from IID to the San Diego County Water Authority (SDCWA), CVWD and/or MWD. The amount of water that could be transferred to San Diego is between 130,000 af per year and 200,000 af per yr. The amount of water to be transferred to CVWD and/or MWD is 100,000 af per year. Implementation of these transfers are to be based upon conservation efforts within the IID service area. The possible transfer scenarios are expected to follow ramp-up schedules as presented in Table 6.1. The information provided in Table 6.1 was provided by IID based on the IID/SDCWA transfer and Quantification Settlement Agreement modeling effort.

Table 6.1
Ramp-up Schedules for Reductions in Inflow 1/
Due to Conservation Measures

Year	Conservation Ramp up 130 KAF to SDCWA (af)	Conservation Ramp up 300 KAF to SDCWA (af)	Fallowing Conservation Ramp up 300 KAF to SDCWA (af)	Conservation Ramp up 130 KAF to SDCWA & 100 KAF to CVWD (af)	Conservation Ramp up 200 KAF to SDCWA & 100 KAF to CVWD (af)	Fallowing Conservation Ramp up 200 KAF to SDCWA & 100 KAF to CVWD (af)
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
2002	-20000	-20000	-6220	-20000	-20000	-6220
2003	-40000	-40000	-12440	-40000	-40000	-12440
2004	-60000	-60000	-18660	-60000	-60000	-18660
2005	-80000	-80000	-24880	-85000	-85000	-26435
2006	-100000	-100000	-31100	-110000	-110000	-34210
2007	-120000	-120000	-37320	-130000	-130000	-40430
2008	-130000	-140000	-43540	-140000	-150000	-46650
2009	-130000	-160000	-49760	-145000	-175000	-54425
2010	-130000	-180000	-55980	-150000	-200000	-62200
2011	-130000	-200000	-62200	-155000	-225000	-69975
2012	-130000	-210000	-65310	-160000	-230000	-71530
2013	-130000	-220000	-68420	-165000	-235000	-73085
2014	-130000	-230000	-71530	-170000	-240000	-74640
2015	-130000	-240000	-74640	-175000	-245000	-76195
2016	-130000	-250000	-77750	-180000	-250000	-77750
2017	-130000	-260000	-80860	-185000	-255000	-79305
2018	-130000	-270000	-83970	-190000	-260000	-80860
2019	-130000	-280000	-87080	-195000	-265000	-82415
2020	-130000	-290000	-90190	-200000	-270000	-83970
2021	-130000	-300000	-93300	-205000	-275000	-85525
2022	-130000	-300000	-93300	-210000	-280000	-87080
2023	-130000	-300000	-93300	-215000	-285000	-88635
2024	-130000	-300000	-93300	-220000	-290000	-90190
2025	-130000	-300000	-93300	-225000	-295000	-91745
2026	-130000	-300000	-93300	-230000	-300000	-93300
2027	-130000	-300000	-93300	-230000	-300000	-93300
2028	-130000	-300000	-93300	-230000	-300000	-93300
2029	-130000	-300000	-93300	-230000	-300000	-93300
2030	-130000	-300000	-93300	-230000	-300000	-93300
2031	-130000	-300000	-93300	-230000	-300000	-93300
2032	-130000	-300000	-93300	-230000	-300000	-93300
2033	-130000	-300000	-93300	-230000	-300000	-93300
2034	-130000	-300000	-93300	-230000	-300000	-93300
2035	-130000	-300000	-93300	-230000	-300000	-93300
2036	-130000	-300000	-93300	-230000	-300000	-93300
2037	-130000	-300000	-93300	-230000	-300000	-93300
2038	-130000	-300000	-93300	-230000	-300000	-93300

Year	Conservation Ramp up 130 KAF to SDCWA (af)	Conservation Ramp up 300 KAF to SDCWA (af)	Fallowing Conservation Ramp up 300 KAF to SDCWA (af)	Conservation Ramp up 130 KAF to SDCWA & 100 KAF to CVWD (af)	Conservation Ramp up 200 KAF to SDCWA & 100 KAF to CVWD (af)	Fallowing Conservation Ramp up 200 KAF to SDCWA & 100 KAF to CVWD (af)
2039	-130000	-300000	-93300	-230000	-300000	-93300
2040	-130000	-300000	-93300	-230000	-300000	-93300
2041	-130000	-300000	-93300	-230000	-300000	-93300
2042	-130000	-300000	-93300	-230000	-300000	-93300
2043	-130000	-300000	-93300	-230000	-300000	-93300
2044	-130000	-300000	-93300	-230000	-300000	-93300
2045	-130000	-300000	-93300	-230000	-300000	-93300
2046	-130000	-300000	-93300	-230000	-300000	-93300
2047	-130000	-300000	-93300	-230000	-300000	-93300
2048	-130000	-300000	-93300	-230000	-300000	-93300
2049	-130000	-300000	-93300	-230000	-300000	-93300
2050	-130000	-300000	-93300	-230000	-300000	-93300
2051	-130000	-300000	-93300	-230000	-300000	-93300
2052	-130000	-300000	-93300	-230000	-300000	-93300
2053	-130000	-300000	-93300	-230000	-300000	-93300
2054	-130000	-300000	-93300	-230000	-300000	-93300
2055	-130000	-300000	-93300	-230000	-300000	-93300
2056	-130000	-300000	-93300	-230000	-300000	-93300
2057	-130000	-300000	-93300	-230000	-300000	-93300
2058	-130000	-300000	-93300	-230000	-300000	-93300
2059	-130000	-300000	-93300	-230000	-300000	-93300
2060	-130000	-300000	-93300	-230000	-300000	-93300
2061	-130000	-300000	-93300	-230000	-300000	-93300
2062	-130000	-300000	-93300	-230000	-300000	-93300
2063	-130000	-300000	-93300	-230000	-300000	-93300
2064	-130000	-300000	-93300	-230000	-300000	-93300
2065	-130000	-300000	-93300	-230000	-300000	-93300
2066	-130000	-300000	-93300	-230000	-300000	-93300
2067	-130000	-300000	-93300	-230000	-300000	-93300
2068	-130000	-300000	-93300	-230000	-300000	-93300
2069	-130000	-300000	-93300	-230000	-300000	-93300
2070	-130000	-300000	-93300	-230000	-300000	-93300
2071	-130000	-300000	-93300	-230000	-300000	-93300
2072	-130000	-300000	-93300	-230000	-300000	-93300
2073	-130000	-300000	-93300	-230000	-300000	-93300
2074	-130000	-300000	-93300	-230000	-300000	-93300

1/ Provided by Imperial Irrigation District

6.2 - Salt Load Changes with Conservation

Table 6.2 presents a summary of forecasted changes in salt load under each of the conservation scenarios presented in Table 6.1. Information to develop table 6.2 was provided by IID. This data comes from other computer models and is representative of diversions by IID of water at Imperial Dam with salinity levels at 879 mg/L.

Table 6.2
Salt Load Reductions 1/
To The Salton Sea
Due to Conservation

Year	Salt Load Reductions from IID 130 KAF To SDCWA (tons)	Salt Load Reductions from IID 300 KAF to SDCWA (tons)	Fallowing Salt Load Reductions from IID 300 KAF to SDCWA (tons)	Salt Load Reductions from IID 130 KAF to SDCWA & 100 KAF to CVWD (tons)	Salt Load Reductions from IID Ramp up 200 KAF to SDCWA & 100 KAF to CVWD (tons)	Fallowing Salt Load Reductions from IID 200 KAF to SDCWA & 100 KAF to CVWD (tons)
2000	0	0	0	0	0	0
2001	0	0	0	0	0	0
2002	-24000	-24000	-24000	-24000	-24000	-24000
2003	-48000	-48000	-48000	-48000	-48000	-48000
2004	-72000	-72000	-72000	-72000	-72000	-72000
2005	-96000	-96000	-96000	-102000	-102000	-102000
2006	-120000	-120000	-120000	-132000	-132000	-132000
2007	-144000	-144000	-144000	-156000	-156000	-156000
2008	-156000	-168000	-168000	-168000	-180000	-180000
2009	-156000	-192000	-192000	-174000	-210000	-210000
2010	-156000	-216000	-216000	-180000	-240000	-240000
2011	-156000	-240000	-240000	-186000	-270000	-270000
2012	-156000	-252000	-252000	-192000	-276000	-276000
2013	-156000	-264000	-264000	-198000	-282000	-282000
2014	-156000	-276000	-276000	-204000	-288000	-288000
2015	-156000	-288000	-288000	-210000	-294000	-294000
2016	-156000	-300000	-300000	-216000	-300000	-300000
2017	-156000	-312000	-312000	-222000	-306000	-306000
2018	-156000	-324000	-324000	-228000	-312000	-312000
2019	-156000	-336000	-336000	-234000	-318000	-318000
2020	-156000	-348000	-348000	-240000	-324000	-324000
2021	-156000	-360000	-360000	-246000	-330000	-330000
2022	-156000	-360000	-360000	-252000	-336000	-336000
2023	-156000	-360000	-360000	-258000	-342000	-342000
2024	-156000	-360000	-360000	-264000	-348000	-348000

Year	Salt Load Reductions from IID 130 KAF To SDCWA (tons)	Salt Load Reductions from IID 300 KAF to SDCWA (tons)	Fallowing Salt Load Reductions from IID 300 KAF to SDCWA (tons)	Salt Load Reductions from IID 130 KAF to SDCWA & 100 KAF to CVWD (tons)	Salt Load Reductions from IID Ramp up 200 KAF to SDCWA & 100 KAF to CVWD (tons)	Fallowing Salt Load Reductions from IID 200 KAF to SDCWA & 100 KAF to CVWD (tons)
2025	-156000	-360000	-360000	-270000	-354000	-354000
2026	-156000	-360000	-360000	-276000	-360000	-360000
2027	-156000	-360000	-360000	-276000	-360000	-360000
2028	-156000	-360000	-360000	-276000	-360000	-360000
2029	-156000	-360000	-360000	-276000	-360000	-360000
2030	-156000	-360000	-360000	-276000	-360000	-360000
2031	-156000	-360000	-360000	-276000	-360000	-360000
2032	-156000	-360000	-360000	-276000	-360000	-360000
2033	-156000	-360000	-360000	-276000	-360000	-360000
2034	-156000	-360000	-360000	-276000	-360000	-360000
2035	-156000	-360000	-360000	-276000	-360000	-360000
2036	-156000	-360000	-360000	-276000	-360000	-360000
2037	-156000	-360000	-360000	-276000	-360000	-360000
2038	-156000	-360000	-360000	-276000	-360000	-360000
2039	-156000	-360000	-360000	-276000	-360000	-360000
2040	-156000	-360000	-360000	-276000	-360000	-360000
2041	-156000	-360000	-360000	-276000	-360000	-360000
2042	-156000	-360000	-360000	-276000	-360000	-360000
2043	-156000	-360000	-360000	-276000	-360000	-360000
2044	-156000	-360000	-360000	-276000	-360000	-360000
2045	-156000	-360000	-360000	-276000	-360000	-360000
2046	-156000	-360000	-360000	-276000	-360000	-360000
2047	-156000	-360000	-360000	-276000	-360000	-360000
2048	-156000	-360000	-360000	-276000	-360000	-360000
2049	-156000	-360000	-360000	-276000	-360000	-360000
2050	-156000	-360000	-360000	-276000	-360000	-360000
2051	-156000	-360000	-360000	-276000	-360000	-360000
2052	-156000	-360000	-360000	-276000	-360000	-360000
2053	-156000	-360000	-360000	-276000	-360000	-360000
2054	-156000	-360000	-360000	-276000	-360000	-360000
2055	-156000	-360000	-360000	-276000	-360000	-360000
2056	-156000	-360000	-360000	-276000	-360000	-360000
2057	-156000	-360000	-360000	-276000	-360000	-360000
2058	-156000	-360000	-360000	-276000	-360000	-360000
2059	-156000	-360000	-360000	-276000	-360000	-360000
2060	-156000	-360000	-360000	-276000	-360000	-360000
2061	-156000	-360000	-360000	-276000	-360000	-360000
2062	-156000	-360000	-360000	-276000	-360000	-360000
2063	-156000	-360000	-360000	-276000	-360000	-360000
2064	-156000	-360000	-360000	-276000	-360000	-360000
2065	-156000	-360000	-360000	-276000	-360000	-360000
2066	-156000	-360000	-360000	-276000	-360000	-360000
2067	-156000	-360000	-360000	-276000	-360000	-360000

Year	Salt Load Reductions from IID 130 KAF To SDCWA (tons)	Salt Load Reductions from IID 300 KAF to SDCWA (tons)	Fallowing Salt Load Reductions from IID 300 KAF to SDCWA (tons)	Salt Load Reductions from IID 130 KAF to SDCWA & 100 KAF to CVWD (tons)	Salt Load Reductions from IID Ramp up 200 KAF to SDCWA & 100 KAF to CVWD (tons)	Fallowing Salt Load Reductions from IID 200 KAF to SDCWA & 100 KAF to CVWD (tons)
2068	-156000	-360000	-360000	-276000	-360000	-360000
2069	-156000	-360000	-360000	-276000	-360000	-360000
2070	-156000	-360000	-360000	-276000	-360000	-360000
2071	-156000	-360000	-360000	-276000	-360000	-360000
2072	-156000	-360000	-360000	-276000	-360000	-360000
2073	-156000	-360000	-360000	-276000	-360000	-360000
2074	-156000	-360000	-360000	-276000	-360000	-360000

1/ Provided by Imperial Irrigation District

6.3 – CVWD With Project Flows

Under each of the IID scenarios for conservation and transfer to SDCWA, 100,000 af per year of water is also made available to CVWD. Once the transfer to CVWD begins, there will be changes in both the future water and salt inflows to the Salton Sea from CVWD. Table 6.3 presents future with project flows from CVWD. Table 6.4 shows future with project salt loads from CVWD. Data from both Table 6.3 and 6.4 are presented in chart form in Figure 6.1. As the 100,000 af per year of transferred water is used by CVWD, the Coachella Aquifer will be slowly recharged and both water and salt inflows will increase. CVWD provided this information.

Table 6.3
Future With Project
Inflows to the Salton Sea
From CVWD

Year	Project 1/ Surface Flows to Sea frm CVWD (af)	Project 1/ Aquifer Flows frm CVWD (af)	CVWD 1/ Project Discharge to Sea (af)
2000	77445	-462	76983
2001	75936	-531	75405
2002	75861	-585	75276
2003	76208	-630	75578
2004	78079	-671	77408
2005	79792	-709	79082
2006	76887	-745	76142
2007	77722	-779	76943
2008	73239	-808	72431
2009	74029	-828	73201
2010	75206	-843	74363

Year	Project 1/ Surface Flows to Sea frm CVWD (af)	Project 1/ Aquifer Flows frm CVWD (af)	CVWD 1/ Project Discharge to Sea (af)
2011	77161	-852	76309
2012	79778	-853	78924
2013	78865	-847	78018
2014	82637	-833	81804
2015	86148	-809	85339
2016	89607	-782	88825
2017	93125	-745	92379
2018	96730	-696	96034
2019	100524	-636	99888
2020	104437	-567	103870
2021	108631	-501	108131
2022	112931	-417	112514
2023	112695	-280	112415
2024	117841	-107	117734
2025	122994	82	123076
2026	127939	240	128179
2027	132635	398	133033
2028	136973	540	137513
2029	140812	658	141470
2030	144267	757	145024
2031	147428	838	148266
2032	150349	904	151253
2033	153106	957	154063
2034	155411	999	156410
2035	157304	1032	158335
2036	157377	1059	158436
2037	157256	1081	158337
2038	156965	1098	158062
2039	156522	1111	157633
2040	155948	1122	157070
2041	155260	1130	156390
2042	154472	1136	155608
2043	153598	1141	154739
2044	152650	1145	153794
2045	151637	1148	152785
2046	150570	1150	151720
2047	149455	1152	150607
2048	148300	1153	149453
2049	147110	1154	148264
2050	145890	1155	147045
2051	144645	1156	145801
2052	143378	1156	144534
2053	142092	1157	143249
2054	140791	1157	141948
2055	139476	1157	140633

Year	Project 1/ Surface Flows to Sea frm CVWD (af)	Project 1/ Aquifer Flows frm CVWD (af)	CVWD 1/ Project Discharge to Sea (af)
2056	138150	1157	139307
2057	136813	1157	137971
2058	135469	1158	136626
2059	134117	1158	135275
2060	132759	1158	133917
2061	131396	1158	132554
2062	130029	1158	131186
2063	128657	1158	129815
2064	128676	1158	129834
2065	128691	1158	129849
2066	128705	1158	129863
2067	128716	1158	129874
2068	128726	1158	129884
2069	128734	1158	129892
2070	128741	1158	129899
2071	128747	1158	129905
2072	128752	1158	129910
2073	128756	1158	129914
2074	128760	1158	129918
Average	123167	475	123642

1/ Provided by Coachella Valley Water District

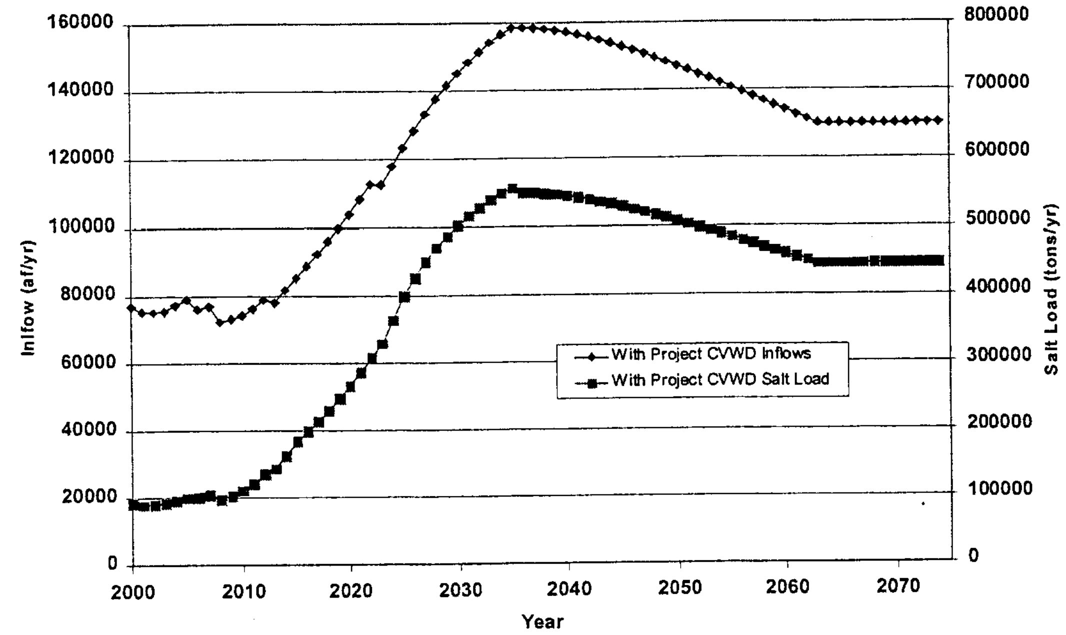
Table 6.4
Future With Project
Salt Load to the Salton Sea
From CVWD

Year	Project 1/ Surface Salt Load to Sea frm CVWD (tons/yr)	Project 1/ Aquifer Salt Load frm CVWD (tons/yr)	CVWD 1/ Project Salt Load to Sea (tons/yr)
2000	166500	-74300	92200
2001	168200	-78300	89900
2002	172100	-81300	90800
2003	176300	-83900	92400
2004	182400	-86100	96300
2005	188700	-88200	100500
2006	191500	-90200	101300
2007	196500	-92000	104500
2008	191800	-93500	98300
2009	198000	-94600	103400
2010	206500	-95300	111200
2011	217200	-95800	121400
2012	231400	-95900	135500
2013	239200	-95500	143700
2014	258200	-94800	163400
2015	278300	-93500	184800
2016	291200	-92000	199200
2017	304400	-90100	214300
2018	317900	-87400	230500
2019	332300	-84100	248200
2020	347100	-80300	266800
2021	363000	-76700	286300
2022	380000	-72100	307900
2023	393500	-64200	329300
2024	418100	-54400	363700
2025	443200	-44100	399100
2026	464500	-38500	426000
2027	485600	-35500	450100
2028	503900	-33400	470500
2029	518900	-31800	487100
2030	533100	-30500	502600
2031	545600	-29500	516100
2032	557000	-28700	528300
2033	567800	-28100	539700
2034	576400	-27600	548800
2035	583300	-27300	556000
2036	576472	-27000	549472
2037	576031	-26800	549231
2038	574962	-26600	548362
2039	573341	-26400	546941

Year	Project 1/ Surface Salt Load to Sea frm CVWD (tons/yr)	Project 1/ Aquifer Salt Load frm CVWD (tons/yr)	CVWD 1/ Project Salt Load to Sea (tons/yr)
2040	571239	-26300	544939
2041	568717	-26300	542417
2042	565831	-26200	539631
2043	562630	-26100	536530
2044	559156	-26100	533056
2045	555448	-26100	529348
2046	551538	-26000	525538
2047	547454	-26000	521454
2048	543223	-26000	517223
2049	538864	-26000	512864
2050	534396	-26000	508396
2051	529834	-26000	503834
2052	525194	-26000	499194
2053	520485	-26000	494485
2054	515718	-26000	489718
2055	510902	-26000	484902
2056	506043	-26000	480043
2057	501148	-26000	475148
2058	496223	-26000	470223
2059	491271	-26000	465271
2060	486297	-25900	460397
2061	481304	-25900	455404
2062	476295	-25900	450395
2063	471272	-25900	445372
2064	471340	-25900	445440
2065	471397	-25900	445497
2066	471446	-25900	445546
2067	471487	-25900	445587
2068	471523	-25900	445623
2069	471553	-25900	445653
2070	471579	-25900	445679
2071	471601	-25900	445701
2072	471619	-25900	445719
2073	471635	-25900	445735
2074	471648	-25900	445748
Average	430503	-46745	383758

1/ Provided by Coachella Valley Water District

Figure 6.1
Future With Project CVWD
Salt Load and Inflows
to the Salton Sea



7.0 — Historic Simulations

7.1 - Model Calibration

To minimize errors introduced into the Model from the estimation of evaporation and precipitation on the Salton Sea, a unique approach was taken. The use of a net term evaporation was applied. This net term was computed during the calibration of the Model such that net evaporation (being defined as Sea evaporation less Sea precipitation) was back calculated as a resultant term in the process of developing the historic water budget presented in Table 2.2. This was accomplished by simultaneously solving for average annual unmeasured inflows and net evaporation. An iterative technique was applied such that unmeasured inflows were adjusted until a back calculated net evaporation term equaled 68 inches on an average annual basis. A value of 68 inches for evaporation was derived as a target from a previous study of Salton Sea evaporation (Hughes 1967) and estimates of average annual precipitation in the Salton Basin. The USGS estimated evaporation from the Salton Sea to be 70.5 inches using a water budget approach. Average annual precipitation over the basin was estimated at 2.5 inches. Subtracting this average annual precipitation value from the 70.5 inches of evaporation resulted in a target of 68 inches for net evaporation. Table 3.1 presents a listing of the net evaporation computed in this process.

The resulting unmeasured inflows derived from the calibration process equals 68,400 af/yr. These unmeasured inflows include tributary inflows not accounted for in IID and CVWD historic data as well as other unaccounted for unmeasured inflows and/or errors resulting for the quantification of historic water budget components. Unmeasured inflows not accounted for in IID and CVWD historic data would include some annual variability not taken into consideration in the adoption of the use of a constant 68,400 af/yr unmeasured inflow to the Sea. However, the inclusion of such variability would have negligible effect on the ability of the model to forecast historic and/or future conditions.

To check calibration, the Salton Sea Accounting Model was applied to simulate historic conditions. The model was run with a starting elevation and salinity equal to –241.3 feet and 38,453 mg/L, respectively. This starting salinity value corresponds to that reported by the USGS and IID, respectively, for the year 1950. The model was executed for the period 1950 to 1999. Figures 7.1 and 7.2 present a comparison of simulated historic and historic measured end-of-year elevation and salinity, respectively. The charts clearly depict that the Salton Sea Accounting Model can adequately simulate historic conditions. This historic simulation was performed using mass balance salt loads to the Salton Sea rather than the historic water budget salt loads provided by IID and CVWD and presented in Table 2.3 above. These mass balance loads were computed based on historic salinity and changes in water storage within the Sea. Use of the mass balance salt load calculations were required for model calibration. However for predicting future conditions they are not accurate. The mass balance computations of salt load include influences of errors in the measurement of salinity and elevation within the Sea. While similar to the water budget salt loads provided in Table 2.3 on an average annual basis they do not agree year to year. Use of the mass balance numbers in the historic calibrations verifies that the model preserves conservation of mass for both water and salt. The mass balance salt loads were computed from historic salinity records. If there were a problem with mass balance in either water or salt accounting then the model would be unable to replicate historic salinity and elevation values. The small differences in elevation and salinity between historic and simulated historic in Figures 7.1 and 7.2 are due to errors introduced in the interpolation of elevations and surface areas within the model using the above presented area / capacity / elevation data as well as during the calculation of mass balance salt loads.

7.2 – Model Verification

Another set of historic simulations of the Model were performed to verify that the historic salt budget data provided in Table 2.3 accurately represents a history of salt discharges to the sea. Figures 7.3 and 7.4 present comparisons of historic elevation and salinity against simulated historic values based on the use of the historic salt budget data. Again the model is shown to perform very well in the simulation of historic conditions. The comparisons in Figures 7.3 and 7.4, serve to demonstrate that the historic salt load inflows put together by IID and CVWD are indeed accurate.

Based on these favorable results of comparisons of simulated historic and historic conditions as presented in Figures 7.1 through 7.4 the model is calibrated and verified for use in simulating future conditions within the Salton Sea.

Figure 7.1
Model Calibration - Elevation

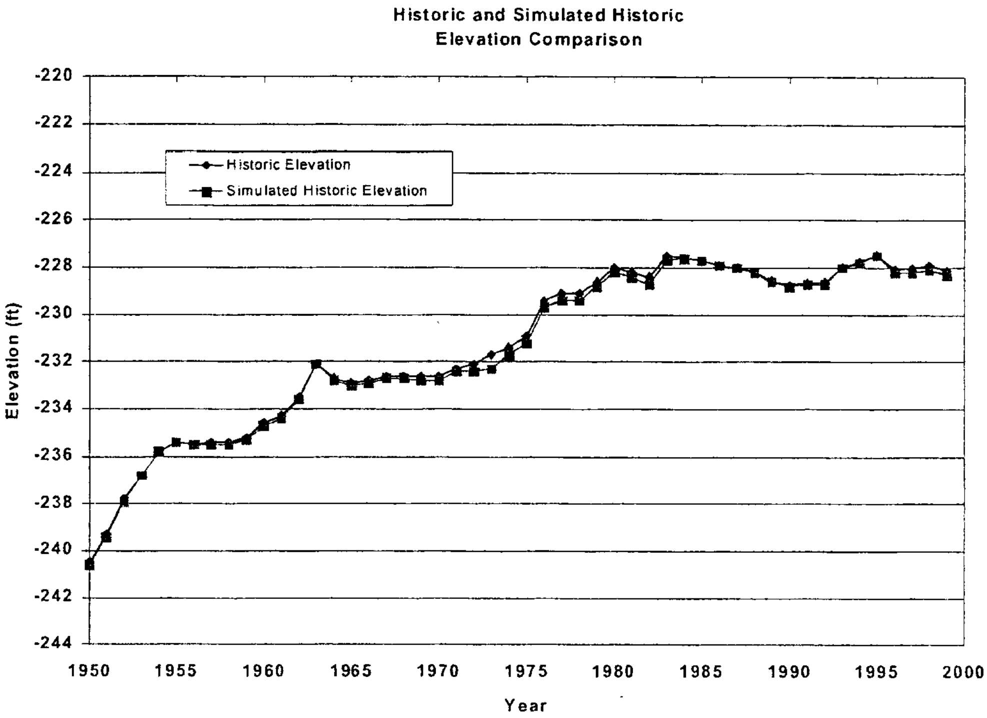


Figure 7.2
Model Calibration - Salinity

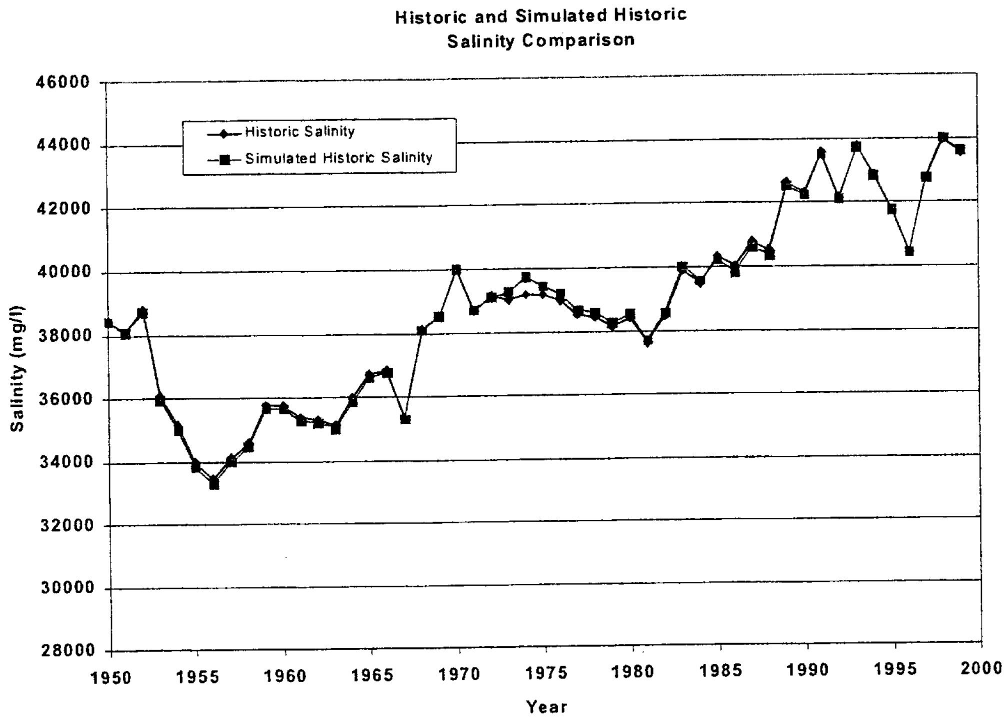


Figure 7.3
Model Verification - Elevation

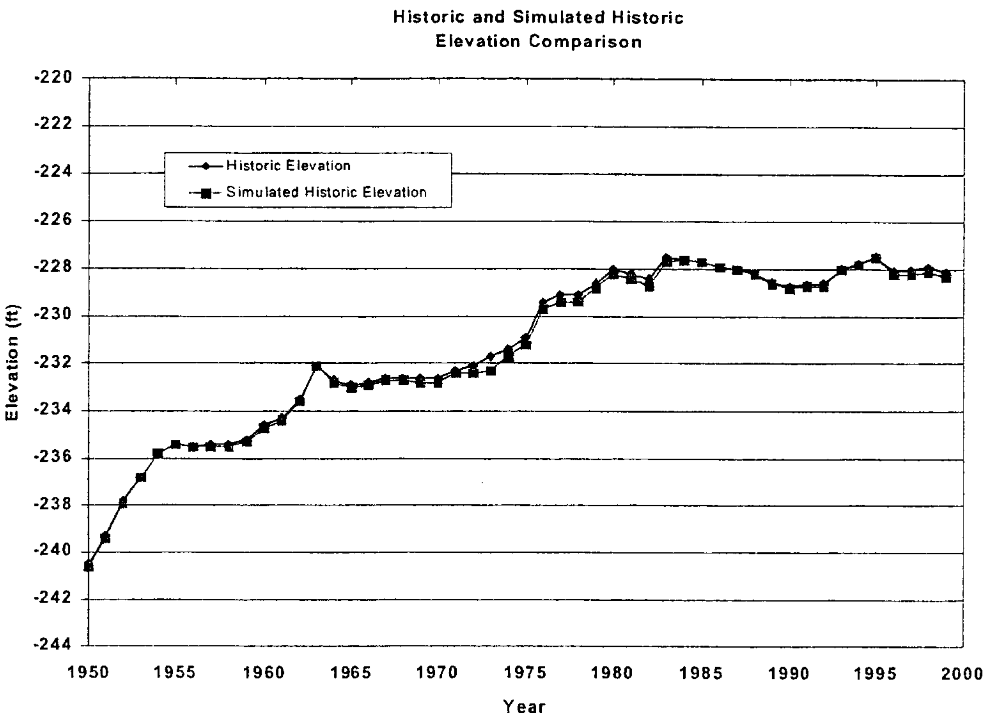
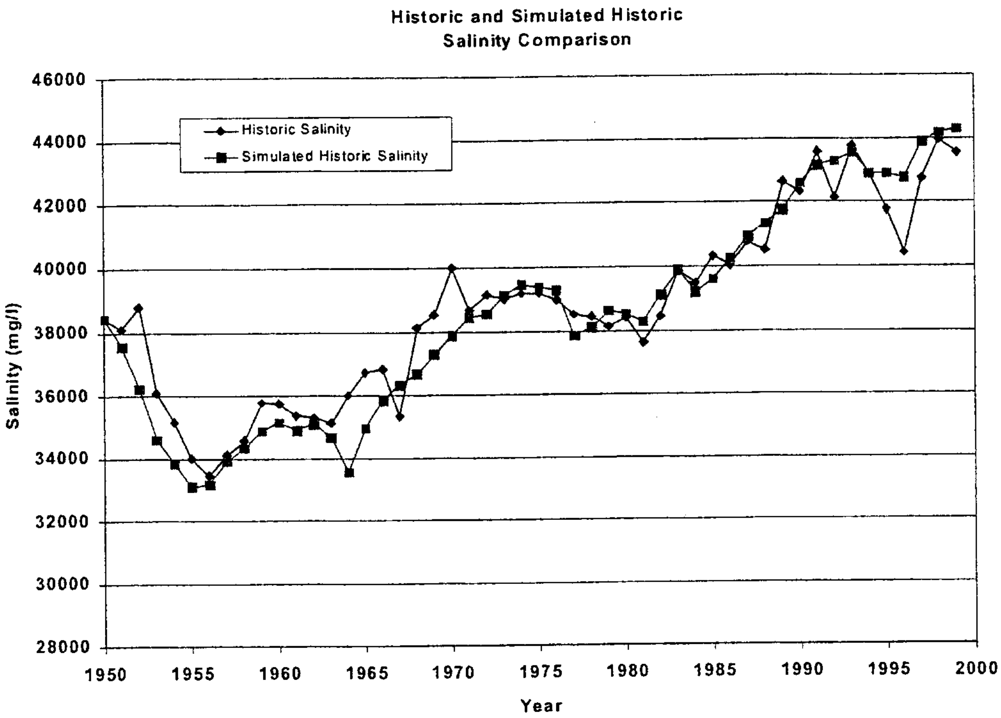


Figure 7.4
Model Verification - Salinity



8.0 — REFERENCES

Hughes, G. H.. 1967. USGS, Analysis of Techniques Used to Measure Evaporation From Salton Sea, California, Geological Survey Professional Paper 272-H.

USGS Sediment Data

RDB file created by NWIS qwflatout program

USGS Station ID	USGS Station Name	Sample Collection Dates	Sample Collection Times	Sediment Analysis in mg/L
STAID	SNAME	DATES	TIMES	P80154
15S	49S	8S	4S	9S
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19870204	1330	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19870408	1430	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19870610	1345	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19871027	1345	2.7
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19871215	1145	1.5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19880224	1145	2.1
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19880427	1145	1.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19880614	1115	1.6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19880809	1400	2.3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19881025	1245	3.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19881115	1300	4.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19881220	1145	2.3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890124	1300	2.3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890216	1530	0.9
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890313	1300	1.5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890411	1300	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890516	1300	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890614	1200	1.6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890718	1230	2.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890822	1200	3.3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19890919	1200	3.2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19891024	1330	3.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19891114	1245	7.7
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19891219	1115	6.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900123	1300	3.9
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900221	1230	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900327	1200	11
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900424	1300	1.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900522	1245	1.7
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900612	1245	1.7
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900724	1230	3.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900814	1300	11
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19900905	1300	7.2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19901030	1230	4.9
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19901128	1230	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19901218	1315	3.1
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19910115	1230	1.6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19910212	1230	1.5
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19960819	1000	20
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19961113	1030	12
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19961212	1100	5
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19970212	1015	45
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19970514	1030	24
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19970626	930	50
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19970820	915	125
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19971112	915	28
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19971217	915	32
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19980225	930	559

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USGS Station ID	USGS Station Name	Sample Collection Dates	Sample Collection Times	Sediment Analysis in mg/L
STAID 15S	SNAME 49S	DATES 8S	TIMES 4S	P80154 9S
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19781016	1230	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19781113	1305	5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790111	830	37
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790215	1100	12
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790312	1130	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790409	1245	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790507	1230	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790611	1215	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790709	1235	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790809	1045	7
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19790910	1135	8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19791015	1230	5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19791113	1230	5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19800107	1200	5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19821020	1100	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19821117	900	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19821214	1035	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830119	1200	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830209	1330	3
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830316	1300	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830419	1400	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830518	1100	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830615	1100	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830721	1210	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830824	830	8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19830913	1245	6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19841128	1300	3.5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19841219	1100	3.1
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850115	1430	5.1
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850220	1100	2.9
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850417	1100	2.1
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850514	1415	3.5
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850611	1355	2.9
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850716	1315	2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850821	1300	1.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19850905	1030	3.2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19851002	1245	2.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19851119	1400	5.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19851203	1430	1.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860109	1330	2.2
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860205	1400	2.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860318	1330	2.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860514	1330	1.6
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860626	1230	8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860715	1200	7.8
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19860812	1200	6.4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19861008	1400	4
9427520	COLORADO RIVER BELOW PARKER DAM, CA-AZ.	19861210	1430	4

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USGS Station ID	USGS Station Name	Sample Collection Dates	Sample Collection Times	Sediment Analysis in mg/L
STAID	SNAME	DATES	TIMES	P80154
15S	49S	8S	4S	9S
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19980429	930	41
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19980624	930	56
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19980819	930	18
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19981216	900	358
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19990324	1000	37
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19990428	930	62
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19990526	930	26
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19990630	930	19
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	19990825	930	13
9429490	COLORADO RIVER ABOVE IMPERIAL DAM, CA-AZ.	20000126	1015	9

IID Water Balance Data

Description	Recorded	Calibration	Capped Baseline	200 kaf on-farm plus 100 kaf system	230 kaf on-farm	130 kaf on-farm	300 kaf DW fallowing
Imported Colorado River Water [1]	2,866,000	2,857,000	2,803,000	2,495,000	2,566,000	2,668,000	2,490,000
Canal and Reservoir Evaporation	-	21,000	19,000	17,000	17,000	18,000	17,000
Canal seepage	-	123,000	111,000	89,000	104,000	107,000	100,000
Main canal spills	-	7,000	-	-	-	-	-
Lateral spills	-	117,000	99,000	15,000	99,000	99,000	99,000
Sum of Delivery System Losses [2]	272,000	268,000	229,000	121,000	220,000	224,000	216,000
Delivery to Farms	2,490,000	2,490,000	2,458,000	2,258,000	2,229,000	2,328,000	2,158,000
Crop Eta	-	1,807,000	1,807,000	1,806,000	1,806,000	1,806,000	1,593,000
Other Evaporation	-	-	-	-	-	-	-
Effective Rainfall	-	101,000	101,000	101,000	101,000	101,000	101,000
Tailwater	-	390,000	344,000	197,000	178,000	252,000	305,000
Tilewater	-	394,000	408,000	356,000	346,000	371,000	361,000
Delivery to M&I + Stock + Misc [3]	105,000	105,000	120,000	120,000	120,000	120,000	120,000
Consumptive Use from M&I + Stock + Misc	-	76,000	86,000	86,000	86,000	86,000	86,000
Return Flow from M&I + Stock + Misc	-	29,000	34,000	34,000	34,000	34,000	34,000
Change in Soil Water and Groundwater Storage	-	-	-	-	-	-	-
Recovered return flow from Mesa Lateral 5	-	4,000	4,000	4,000	3,000	4,000	4,000
Rainfall Runoff and Deep Perc	-	34,000	38,000	36,000	37,000	37,000	38,000
Evaporation and Phreatophyte Use	-	125,000	125,000	125,000	125,000	125,000	125,000
Mesa Storm Inflows	-	8,000	8,000	8,000	8,000	8,000	8,000
Subsurface Inflow (Estimated)	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Alamo River from Mexico	2,000	2,000	2,000	2,000	2,000	2,000	2,000
New River from Mexico	165,000	165,000	165,000	165,000	165,000	165,000	165,000
	-	-	-	-	-	-	-
Alamo River to the Salton Sea	604,000	605,000	576,000	401,000	448,000	503,000	517,000
New River to the Salton Sea	454,000	453,000	431,000	335,000	346,000	382,000	399,000
Direct to Sea	100,000	101,000	92,000	56,000	70,000	80,000	86,000
Subsurface to Sea (Estimated)	1,000	1,000	1,000	1,000	1,000	1,000	1,000

Notes:
1) AAC at Mesa Lateral 5 by water balance from recapitulation data.
2) Sum of delivery system losses is calculated from the difference in recorded diversions less deliveries.
3) Includes estimates of deliveries to rural pipes and community greens.

Not Rounded

	Recorded	Calibration	Capped Baseline	200 kaf on-farm plus 100 kaf system	230 kaf on-farm	130 kaf on-farm	300 kaf DW fallowing
	2,865,680	2,856,960	2,802,992	2,494,696	2,565,842	2,668,274	2,489,799
Seepage+evap		143,574	130,115	105,921	121,271	124,994	117,177
		20,849	18,857	17,109	17,406	18,033	16,885
		122,725	111,258	88,812	103,865	106,961	100,292
		6,741	-	-	-	-	-
		116,936	98,980	14,668	99,128	99,333	98,799
	271,531	267,251	229,095	120,589	220,399	224,327	215,976
Total deliveries			2,578,130	2,378,043	2,348,778	2,448,071	2,277,877
	2,489,615	2,489,718	2,458,130	2,258,043	2,228,778	2,328,071	2,157,877
Crop Eta should be constant across runs		1,806,283	1,806,553	1,805,718	1,805,526	1,806,019	1,592,414
		-	-	-	-	-	-
		100,680	100,680	100,680	100,680	100,680	100,680
		389,951	344,230	197,358	178,085	251,882	304,704
		394,165	408,028	355,647	345,847	370,849	361,440
	104,534	104,534	120,000	120,000	120,000	120,000	120,000
		76,262	86,010	86,010	86,010	86,010	86,010
		28,272	33,990	33,990	33,990	33,990	33,990
		-	-	-	-	-	-
		4,436	4,233	3,936	3,335	4,124	4,054
Rainfall RO&DP should be constant across runs		36,723	39,556	38,274	38,079	38,697	39,102
		125,141	125,141	125,141	125,141	125,141	125,141
		7,856	7,856	7,856	7,856	7,856	7,856
	20,000	20,000	20,000	20,000	20,000	20,000	20,000
	1,712	1,712	1,712	1,712	1,712	1,712	1,712
	164,744	164,744	164,744	164,744	164,744	164,744	164,744
	604,479	605,088	576,320	401,417	447,842	503,361	517,146
	453,504	452,980	431,398	335,330	346,222	382,026	399,146
	100,195	101,182	92,282	56,238	69,766	80,373	86,153
	1,000	1,000	1,000	1,000	1,000	1,000	1,000

Appendix G - Socioeconomics

Modeling Methodology

Input-Output

This Appendix provides a detailed discussion of the modeling used to estimate the Socioeconomic Impacts of the Proposed Project and alternatives. The impact analysis is based on a regional economic analysis using an Input-Output (I-O) model. I-O models are static models that predict future equilibrium conditions of a regional economy, based on estimated "changes" to the economy. The I-O analysis method recognizes the interdependence of different sectors within an economy. Each sector not only produces some good or service, but also purchases goods and services used in the production process. I-O models use mathematical equations to describe these relationships among different sectors of the economy to predict how dollars flow through sectors within the region or exit the region as exports and leakages.

Implan

The Implan Pro (Implan) I-O modeling system is used to evaluate the impacts of the Proposed Project and alternatives. The Implan system consists of a data set that contains the base economic data and the mathematical relationships for the different sectors of the economy, and computer software that implements the calculations of the I-O analysis. Data are available at the county level; the model can incorporate information from one or more counties.

Three separate categories of effects can be derived from an I-O analysis: direct effects, indirect effects, and induced effects. Direct effects are derived from changes in the final demand for a good or service. Indirect effects are the changes in economic activity that result from changes in inter-industry transactions. Induced effects represent the changes in economic activity that would occur as the regions' residents increase or decrease their disposable income expenditures. The change in disposable income can be internally driven by the direct and indirect effects of the initial economic changes, or the change in disposable income expenditures can be entered as an economic change.

The steps in conducting a I-O analysis using the Implan software include identifying the region of influence; generating the predictive model; estimating the initial changes to the economy; and finally, using the predictive model multipliers and the initial changes to estimate the total impacts on the region of influence.

Region of Influence

When deciding on the appropriate region of influence, a balance must be reached between creating a region large enough to capture the majority of the economic interactions involved and focusing on the specific area that will experience the greatest impact. If a small region of influence is defined, then much of the resulting economic activity will "leak" out of the region through outside trade. Creating a larger region of influence will result in less leakage through outside trade; however, the resulting impacts can become diluted relative to the size of the region. The Implan data sets are available at county and state levels, and models can be created that combine multiple states or counties. For the impact analysis of the conservation and transfer program, Imperial County in California is used as the region of influence. This single county is used because the majority of the economic activity associated with the program will occur within Imperial County.

The Implan software generates a set of predictive multipliers based on the economic data and the mathematical relationships of the modeled economy. These data and relationships are provided by the makers of the Implan system and are drawn from a number of secondary data sources, including but not limited to the US Department of Commerce Bureau of Economic Analysis and Labor Statistics. The Implan system is flexible enough that modelers can modify the data to better represent the local conditions of their region of influence. In the analysis of the IID Water Conservation and Transfer Project, the levels of output for selected agricultural sectors were modified using data reported by the Imperial County Agricultural Commissioner for the years 1987 to 1999 to better represent the average historic conditions of Imperial County agriculture. The county agricultural commissioner reports annual harvested acreage and value of production data for all crops grown in Imperial County. Each of these crops is allocated to one of the 13 agricultural production sectors within Implan. Using these data, acreage-weighted average total value of production estimates are calculated and used to replace the industry output data for the following sectors in the Implan data set: cotton, food grains, hay and pasture, grass seed, vegetables and sugar. Other portions of the Implan data set were modified for these agricultural industries to maintain constant relationships between output and the other value-added components of the model. Based on this modified data set, the predictive multiplier model is generated for use in the regional impact analysis.

Year-Blocks

The term of the program being analyzed is up to 75 years. Over this time period a number of project components will change that are relevant to the regional economic impact analysis. Each of the agreements that pertain to the conservation and transfer program have different rates at which water is conserved for transfer as well as variations in the price IID receives and differences in how that price will change over time. Additionally, as described below in the economic change category section, the measures used to conserve water will have different impacts, and those impacts will vary over time. To capture all of these potential variations, more than one impact analysis is necessary. During each year of the 75 years the annual economic change levels will be slightly different. Evaluating each of the 75 years with an I-O modeling run is neither practical nor appropriate. Recall that the results of an I-O analysis represent an equilibrium. If shocks to the economy were to change every year, the equilibrium point would never be achieved. During the early years of the program there will be more annual variation in economic change levels attributed to the program. To identify the magnitude and direction of the interim economic impacts during the early years as well as what would be anticipated later in the program once an equilibrium has been reached, impacts for a number of periods are estimated. During the first 30 years of the program, the annual changes are grouped into six year-blocks, each containing five program years. An average change to the economy is calculated for each of these six year-blocks, and the impacts are estimated using the predictive multiplier model. These year-block results represent interim impacts that could be anticipated if the conditions represented by the 5-year average impact were continued, unchanged, into the future. The final year-block represents the average annual impacts that are anticipated during years 31-75. Over this time period, the maximum quantity of water that is going to be conserved will have been reached, and the major initial capital expenditures on conservation equipment will have been made. Therefore, this final 45-year year-block represents an average annual economic change that could be expected to result in long-term equilibrium impacts attributable to the conservation and transfer program. For this reason, the results of this year-block are presented in the Draft EIR/EIS as the impact of the program.

The effects of price changes over time and the time value of money are important concepts in economic analyses that span multiple years. For this analysis one of the primary economic indicators that was identified in the public scoping process was the impact of the program on employment. The concepts of inflation and discounting of future streams of income or costs are not relevant for employment. Therefore the entire analysis is conducting in constant 2001 dollars.

Three impact categories are estimated that are used as shocks to the economy, and the full impact to the regional economy is modeled using the predictive multiplier model for each year-block. The economic change categories represent changes to the Imperial County economy that are directly related to different components of the conservation and transfer program. Two general types of shocks are investigated in the analysis; increases in expenditures resulting from the infusion of money into the economy in the form of transfer revenues and decreases in agricultural production resulting from the fallowing of land to conserve water. In the I-O modeling, economic changes are applied to multiple economic sectors over the 75-year term of the program and will vary depending on how the conservation program is implemented.

Applicable Contractual Agreements

The conservation and transfer program of the Proposed Project and alternatives is a voluntary program that is subject to the terms and conditions of the IID/SDCWA transfer agreement as well as in some instances the terms and conditions of the QSA. The IID/SDCWA transfer agreement outlines a timetable for the conservation and transfer of water from IID to SDCWA of up to 300 KAFY as well as outlining a formula that will determine the price SDCWA will pay IID for the transferred water. The transfer quantity is separated into a primary transfer of up to 200 KAFY and a discretionary transfer of up to 100 KAFY that would begin after the initial 200 KAFY is conserved and transferred. This agreement also stipulates that at least 130 KAFY of water must be conserved via on-farm irrigation system improvements. The parties of the agreement are considering the suspension of this requirement; therefore, the Socioeconomic impact analysis includes Proposed Project and alternatives implementations that do not conform to this portion of the agreement. If this requirement were imposed, the IID/SDCWA transfer agreement would have to be modified.

The terms and conditions of the QSA modify the IID/SDCWA transfer agreement such that the secondary transfer of up to 100 KAFY could be to either CVWD or MWD at a different price than stipulated by the IID/SDCWA transfer agreement. When the secondary transfer would begin is also modified by the terms and conditions of the QSA. Table G-1 shows the various conservation ramp-up schedules that are investigated in the analysis.

TABLE G-1
Conservation and Transfer Ramp-up Schedules

	SDCWA/IID Transfer Agreement Only		SDCWA/IID Transfer Agreement and QSA Terms and Conditions	
Program Year	**130 KAFY Maximum Transfer Quantity**	**300 KAFY Maximum Transfer Quantity**	**230 KAFY Total Transfer Quantity**	**300 KAFY Total Transfer Quantity**
2002	20	20	20	20
2003	40	40	40	40
2004	60	60	60	60
2005	80	80	85	85
2006	100	100	110	110
2007	120	120	130	130
2008	130	140	140	150
2009	130	160	145	175
2010	130	180	150	200
2011	130	200	155	225
2012	130	210	160	230
2013	130	220	165	235
2014	130	230	170	240
2015	130	240	175	245
2016	130	250	180	250
2017	130	260	185	255
2018	130	270	190	260
2019	130	280	195	265
2020	130	290	200	270
2021	130	300	205	275
2022	130	300	210	280
2023	130	300	215	285
2024	130	300	220	290
2025	130	300	225	295
2026	130	300	230	300
2027-2076	130	300	230	300

The timing of water conservation, the price paid to IID for the transferred water, and the conservation measures used will all affect the total impacts of the program on the regional economy. Therefore, to fully capture the potential impacts of the conservation and transfer program, multiple implementations of the Proposed Project and Alternatives 3 and 4 are analyzed. Alternative 1 (No Project alternative) does not have any impacts that are analyzed with the I-O model, and a single implementation is analyzed for Alternative 2.

Of the potential changes to the Imperial County economy that are predicted to result from the conservation and transfer program, only the reduction in agricultural production associated with fallowing will have an adverse effect. All other effects of the program will be beneficial because they represent an infusion of money into the economy that otherwise would not take place. How the transfer revenue is spent within the regional economy is discussed in detail in the economic change category sections. The different conservation program implementations are developed to bracket the beneficial and adverse impacts of the program for the Proposed Project and alternatives, assuming the terms and conditions of the QSA are or are not in effect. Table G-2 summarizes the conservation methods used and the destination of transferred water for each of the Proposed Project and alternative implementations investigated in the analysis.

TABLE G-2
Summary of Conservation Source Categories and Destinations for Proposed Project and Alternatives Implementations

		Conservation Program			Destination		
	Quantity Conserved (KAFY)	On-farm Irrigation System Improvements	Water Delivery System Improvements	Fallowing	SDCWA	CVWD (1)	CVWD/ MWD (2)
Proposed Project A–Beneficial effect without QSA	300	230	70		300		
Proposed Project B–Beneficial effect with QSA	300	230	70		200		100
Proposed Project C–Adverse effect without QSA	300			300	300		
Proposed Project D–Adverse effect with QSA	300			300	200	50	50
Alternative 1 No Project	0	0	0	0			
Alternative 2	130	130			130		
Alternative 3A–Beneficial effect	230	230			130		100
Alternative 3B–Adverse effect	230			230	130	50	50
Alternative 4A–Adverse effect without QSA	300			300	300		
Alternative 4B–Adverse effect with QSA	300			300	200	50	50

(1) IID is paid a price of $50 (in 1999$ escalated at 2.5%) for the first 50 KAFY
(2) IID is paid a price of $125 (in 1999$ escalated at 2.5%) for the second 50 KAFY

Economic Change Categories

For each of the Proposed Project and alternatives implementations summarized in Table G-2, there is an infusion of money into the Imperial County economy from outside sources. That money is collected by IID and either spent by the district or passed on to farmers for them to spend on irrigation system improvements or as household income. For this analysis, the expenditure of transfer income is separated into two economic change categories that are modeled separately: 1) conservation measure expenditures and 2) household disposable income expenditures. A third activity that is analyzed as a change to the economy is the reduction in agricultural production resulting from the fallowing of agricultural lands. Each of these three categories is discussed below.

Conservation Measure Expenditures

Water to be transferred by IID for payment must be conserved by changing some IID or farm activity so that less water is used within the water service area. For water delivery system improvements, two project types have been identified that could economically conserve substantial quantities of water. These include installing up to 14 lateral interceptor systems in specific locations throughout the IID water service area and constructing up to 26 surface or subsurface seepage recovery systems along the AAC.

On-farm conservation could result from any number of activities, including but not limited to changing irrigation technologies, improving on-farm irrigation management, or fallowing. Participation in the conservation program is voluntary, and, when this analysis was conducted, the IID Board of Directors had not identified the rules governing what if any restrictions would be placed on farmers regarding how water could be conserved for transfer, other than what was outlined in the contractual agreements. The IID/SDCWA transfer agreement outlines many different irrigation system improvements and irrigation management techniques that could be implemented to conserve water on farms. This impact analysis assumes that on-farm conservation will be implemented through the installation and operation of tailwater recovery system (TRS) irrigation systems. This assumption is made because TRSs are a proven technology in the IID water service area that can be applied to almost all crops and soil and field configurations found in the region.

On-farm Irrigation System Improvements

To estimate the annual impact to the local economy of installing and operating a TRS, a spreadsheet model is used that calculated the annual change in local expenditures associated with constructing, operating, and maintaining a tailwater recovery system to irrigate crops relative to a standard furrow irrigation system. Only the changes from the existing irrigation system are included in the analysis because they are the only new costs associated with the conservation and transfer program. The TRS cost assumes an 80-acre field that encompasses 75 irrigated acres. The initial cost to install the system is $83,720. Of this amount, $25,000 is for a diesel pump that is assumed to be replaced every 10 years, $27,270 is for permanent underground piping that is replaced every 30 years, and $31,000 is for pond excavation and components that are assumed to last for the entire term of the project. Relative to the assumed existing method of furrow irrigation, the use of the TRS would increase labor and maintenance costs by $1,885 per year, and the total annual energy cost is assumed to be $1,980. It is assumed that farmers would obtain private financing at a

20414

rate of 8 percent. The assumed terms of loans are 10 years for the pumps and 15 years for other components of the system. The analysis assumes that cropping patterns and other non-irrigation cultural practices remain constant. The hydrologic model developed by IID estimates that, on average, a typical TRS system would conserve 0.71 acre-feet per irrigated acre. Therefore each TRS system installed on a typical 80-acre field would conserve about 53 acre-feet per year.

Based on these assumptions the annual transfer revenue generated from a single 80-acre TRS system is calculated, along with annual expenditures for the purchase of TRS system components, operational expenses including fuel and labor, and financing costs for the loans assumed to be required to install the TRS system. An after-tax level of transfer revenues is also calculated that accounts for depreciation of equipment as well as for financing costs. The regional effects of the expenditure of after-tax transfer revenue are discussed below in the section on transfer revenue expenditures. All other expenditures are allocated to Implan sectors to estimate the total effect on the regional economy. The matching of actual expenditures for goods and services to economic industry sectors is an art that is open to interpretation. In the economic change spreadsheet model, all expenditures on the initial installation and major component replacements for TRS systems are allocated to Implan sector 50: new utility structures. In addition to the pump, motor, and pipelines, the conversion of a field from furrow irrigation to TRS irrigation requires some earth moving and grading. The "new utility structures" sector was determined to provide a reasonable approximation of the expenditure patterns associated with installing and replacing TRS components. The estimated increase in expenditures on operational labor and materials (other than major component replacements) are allocated to Implan sector 56: maintenance and repair other facilities. This sector was chosen because the expenditure patterns of the sector were determined to be the closest match for the expenditure patterns associated with the operation and maintenance of the TRS system. The cost of diesel fuel to operate the TRS irrigation systems is allocated to sector 447: wholesale trade. The analysis assumes that individual farmers will require private financing to install the TRS. In modeling this impact, only the interest cost is used because the impact of the expenditure of principal is already captured by the installation of system components. The annual interest expenditures are allocated to Implan sector 456: banking.

The economic change spreadsheet model allows various numbers of typical TRS systems to be installed in any year of the program's ramp-up period and tracks the combined annual level of initial construction expenditures as well as annual operations, maintenance, and finance expenditures that will accrue to each of the above-mentioned economic sectors. The sum of these expenditures represents the total annual impact to each sector resulting from the operation of multiple TRS systems of various ages. It is assumed that once a TRS system is installed, it is used for the remainder of the 75-year program period.

The number of systems required is determined by the assumptions of the program implementation schedule and the assumed conservation rate of 0.71 acre-feet per irrigated acre. Take, for example, the situation in which a particular program implementation calls for 20,000 acre-feet of conservation from on-farm irrigation system improvements during year one of the program. This requirement would mean installation of 376 TRS system in the IID water service area.

Water Delivery System Improvements

This same procedure is applied to the two IID water delivery system improvements: lateral interceptors and two types of seepage recovery systems—surface and subsurface. It is assumed that IID would use bond financing to obtain the capital funds necessary to construct the water delivery system improvements.

Seepage Recovery Systems

Cost and conservation estimates were calculated for both surface and subsurface seepage recovery systems. IID has identified 10 subsurface system sites and 16 surface system sites. It was estimated that an average subsurface system would have a capital cost of $271,500 and conserve 511 acre-feet per year. The 16 surface systems are assumed to have average initial capital costs of $180,000 per system and are estimated to conserve 622 acre-feet per year. Pump and motor combinations account for 19,000 of the initial capital costs for both system types. The analysis assumes that the pump and motor combinations would be replaced every 10 years. The surface systems would have annual energy costs of $1,715, and the subsurface systems would have an energy cost of 1,691. Both system types would have labor and other non-energy operations and maintenance costs of $3,000 per system per year.

Lateral Interceptors

A total of 14 different sites for lateral interceptor systems have been identified throughout the IID water service area. Engineering construction and operations costs estimates were generated for each potential lateral interceptor system. The different systems serve varying numbers of acres of farming area and would conserve different total quantities of water per system. To provide a level of flexibility in modeling the impacts of constructing and operating the lateral interceptor systems, all costs were translated into average cost per acre-foot conserved. This allows any lateral interceptors be brought on line in any year to conserve any quantity of water. The total quantity of water is limited to the total estimated conservation of all 14 systems. This amount is assumed to be 85,000 acre-feet per year. The average initial capital cost per acre-foot conserved is $495. Energy costs are assumed to be $5 per acre-foot, and other non-energy operations and maintenance costs are $6 per acre-foot.

IID indicated that the socioeconomic analysis should assume that IID would install all of the seepage recovery systems prior to constructing any lateral interceptor systems. According to the specific implementation schedules, various numbers of seepage recovery systems and lateral interceptor systems could be installed and operated in a given year. Based on the implementation schedules, the economic change spreadsheet model identifies the annual level of expenditures, on initial capital or replacement costs, energy expenditures and labor and other operations and maintenance expenditures. In the I-O modeling the capital expenditures are allocated to Implan sector 50: new utility structures, the energy costs to sector 443: electrical services, and the non-energy O&M costs to sector 56: maintenance and repair, other facilities. Although in reality these activities would probably be conducted by IID personnel, the spending patterns associated with these activities are assumed to be better replicated by these Implan sectors. The annual expenditures for each of these Implan sectors are averaged into the 7 program year-blocks as described earlier.

Transfer Revenue Expenditures

Transfer revenues are collected by IID from SDCWA, CVWD, and/or MWD according to the terms of the applicable contractual agreements. Table G-3 shows the transfer price series that are used for the analysis in 2001 dollars. A real-dollar price series for the SDCWA Agreement was provided by IID and discounted to 2001 dollars using a discount rate of 3.2 percent. This is the long-term real discount rate recommended for use in long-term projects by the United States Office of Management and Budget. The price series for water transferred under the terms and conditions of the QSA are calculated according to the base prices outlined in the QSA ($50 and $125 in 1999 dollars) and an assumed escalation rate of 2.5 percent. This escalation rate was provided by IID. These prices are also discounted back to 2001 dollars using the same long-term real discount rate of 3.2 percent. These transfer revenues will be used to pay for the costs of IID administering the program and to pay any costs IID incurs associated with the conservation of water for transfer. The remainder of the transfer revenue is passed on to farmers who participate in the conservation program based on the quantity of water they conserve. In estimating the level of compensation to farmers per acre-foot conserved, it is assumed that all transfer revenue in excess of IID costs are passed on to farmers.

TABLE G-3
Assumed Price Series for Transferred Water, 2001 Dollars

Program Year	SDCWA Agreement Prices	QSA Price for 1st 50 KAFY transferred to CVWD	QSA Price for 2nd 50 KAFY transferred to CVWD	QSA Price for any Water transferred to MWD
2002	241	52	130	130
2003	251	52	130	130
2004	261	51	129	129
2005	272	51	128	128
2006	282	51	127	127
2007	293	50	126	126
2008	304	50	125	125
2009	315	50	124	124
2010	327	49	124	124
2011	339	49	123	123
2012	353	49	122	122
2013	357	48	121	121
2014	360	48	120	120
2015	364	48	119	119
2016	368	47	119	119
2017	370	47	118	118
2018	373	47	117	117
2019	370	46	116	116
2020	368	46	115	115
2021	366	46	115	115
2022	372	46	114	114
2023	370	45	113	113
2024	368	45	112	112

TABLE G-3
Assumed Price Series for Transferred Water, 2001 Dollars

Program Year	SDCWA Agreement Prices	QSA Price for 1st 50 KAFY transferred to CVWD	QSA Price for 2nd 50 KAFY transferred to CVWD	QSA Price for any Water transferred to MWD
2025	366	45	112	112
2026	364	44	111	111
2027	362	44	110	110
2028	360	44	109	109
2029	358	43	109	109
2030	356	43	108	108
2031	354	43	107	107
2032	349	43	106	106
2033	347	42	106	106
2034	345	42	105	105
2035	344	42	104	104
2036	342	41	103	103
2037	340	41	103	103
2038	338	41	102	102
2039	336	41	101	101
2040	334	40	101	101
2041	333	40	100	100
2042	331	40	99	99
2043	329	39	99	99
2044	327	39	98	98
2045	325	39	97	97
2046	324	39	97	97
2047	322	38	96	96
2048	320	38	95	95
2049	318	38	95	95
2050	317	38	94	94
2051	315	37	93	93
2052	313	37	93	93
2053	311	37	92	92
2054	309	37	92	92
2055	308	36	91	91
2056	306	36	90	90
2057	304	36	90	90
2058	303	36	89	89
2059	301	35	88	88
2060	299	35	88	88
2061	297	35	87	87
2062	296	35	87	87
2063	294	34	86	86
2064	292	34	86	86

TABLE G-3
Assumed Price Series for Transferred Water, 2001 Dollars

Program Year	SDCWA Agreement Prices	QSA Price for 1st 50 KAFY transferred to CVWD	QSA Price for 2nd 50 KAFY transferred to CVWD	QSA Price for any Water transferred to MWD
2065	291	34	85	85
2066	289	34	84	84
2067	287	34	84	84
2068	286	33	83	83
2069	284	33	83	83
2070	282	33	82	82
2071	281	33	82	82
2072	279	32	81	81
2073	277	32	80	80
2074	276	32	80	80
2075	274	32	79	79
2076	272	32	79	79

To calculate compensation to farmers, the total costs that the district incurs during the first 45 years of each program's implementation are summed and capitalized to account for the cost of financing water delivery system improvements. The IID costs are capitalized assuming a rate of 8 percent over a period of 45 years. This total amount is subtracted from the total transfer revenue that the district anticipates it will collect over the first 45 years of the program implementation. This results in a total after-cost level of transfer revenue, which is then divided by the total quantity of water conserved on farm during the 45-year period, resulting in the per acre-foot farmer compensation level for that program implementation. Each program implementation will have a different compensation level.

The per-acre-foot farmer compensation level is used to calculate the total annual transfer revenue a farmer will receive based on the quantity of water conserved. Farm-level after-tax transfer revenue is calculated based on the total annual transfer revenue as well as the annual levels of depreciation and interest costs during each year of the program and the assumed effective combined state and federal tax burden of 40.3 percent.

To estimate the regional economic impact from the expenditures of this portion of the transfer revenue, the after-tax farm income must be converted into an in-county level of disposable income. To estimate in-county disposable income, the effect of savings or paying down of previously existing debt must be considered along with the leakage of money through out-of-county spending. This last component is somewhat difficult to predict.

Leakage of transfer revenue out of the county economy is anticipated to be caused by two factors. First, there are a number of out-of-county residents that own, in part or in whole, farmland in the IID water service area; this land is leased to others and farmed. It is believed that these landowners would end up getting a portion of the after-cost transfer revenues from the conservation program. For example, in the past, IID has estimated that out-of-county owners hold 37 percent of the farmland in the Imperial Valley and that a total of

56 percent of the valley's land is tenant farmed. In addition to the issue of out-of-county land ownership, there is the potential that county residents who participate in the program will spend the transfer revenue outside of the county, resulting in leakage of the beneficial impacts of transfer revenue spending out of the county economy.

This out-of-county leakage is included in the relationships that create the Implan predictive model. However, because of the somewhat limited opportunities for residents to purchase goods and services within the county relative to what is available in the surrounding economies of San Diego, Riverside County, and portions of Mexico, it is believed there may be more leakage from the county than assumed in the Implan relationships. In order to account for the potential of additional out-of-county spending by county residents and the movement of transfer revenues to out-of-county landowners, the after-tax level of transfer revenue is reduced by one half. This relatively large reduction in after-tax revenue to derive the in-county disposable income expenditures is used to provide a conservative estimate of the beneficial impacts of the spending of the transfer revenue on the Imperial County economy.

The economic impact of the disposable income spending associated with the conservation and transfer program is estimated by spreading the total disposable income expenditures out over all sectors of the economy using the household expenditures patterns provided in the Implan software. Because this impact is driven completely by increases in household expenditures, the entire impact is considered to be an induced impact in I-O modeling terms and is reported that way in the results.

Change in Agricultural Production

The majority of the crops grown in the IID water service area are sold to markets that are strongly influenced if not dominated by regional and world markets. The conditions of these markets will often have a greater impact on the decision-making of farmers than the economic incentives generated by the conservation and transfer program. Therefore the analysis assumes that future agricultural conditions—crops grown, expected prices and yields—will remain constant into the future, when farmers conserve water on-farm through the installation and operation of TRS irrigation, in the economic impact analysis, no other changes are made to agricultural production. Historic cropping patterns are also maintained in the evaluation of fallowing. When fallowing is used to conserve water, it is assumed that all non-permanent crops grown in the water service area will be reduced in proportion to the percentage of total cropped lands. The reduction in agricultural output is calculated based on the assumed number of acres fallowed and the estimated per-acre value of production for the agricultural sectors. Table G-4 shows the Implan agricultural production sectors that are used to estimate fallowing impacts as well as the estimated per-acre value of production and each sector's percentage of total non-permanent harvested acreage.

TABLE G-4
Assumed Percentage of Total Non-Permanent Crop Acreage and Gross Value of Production for Implan Crop Production Sectors

Crop Group	Percent of Total Non-Permanent Crops (a)	Estimated Gross Value Per Acre (b)
Cotton	2%	1,003
Food Grains	14%	425
Hay and Pasture	51%	444
Grass seed	5%	638
Vegetables	22%	3,400
Sugar	7%	1,227

Source:

(a) IID 1987 - 1999 and CH2M HILL calculations (Imperial Irrigation District (IID). *Annual Inventory of Areas Receiving Water.*

(b) CASS and CH2M HILL calculations (California Agricultural Statistics Service (CASS). 1999. "Summary of County Agricultural Commissioners' Report, Gross Values of Agricultural Production--California." August.

The percentage of total non-permanent crops for each Implan category is based on IID crop data from the years 1987 to 1999. The estimates of gross value per acre are based on Imperial County Agricultural Commissioner's data from the years 1987 to 1999. In both the IID crop data and the Agricultural Commissioner's data, there are many more individual crops reported than there are Implan agricultural production categories. Therefore, individual crops were all allocated to one of the Implan agricultural production sectors. For the percentage of total non-permanent crops, the annual individual crop acreage data was summed, and a 12-year annual average was used. The permanent crops that are excluded from fallowing are primarily tree crops that have production cycles measured in decades. For the estimated gross value of production, annual acreage-weighted average value of production estimates are calculated for each Implan production sector; the 12-year average of these values is used in the impact analysis.

To calculate the total reduction in the value of agricultural output, the information in Table G-4 is used along with an estimate of the quantity of water conserved per acre fallowed and assumptions regarding the average number of harvested acres per net acre of land farmed. Based on information from the IIDSS hydrologic model, it is assumed that the average water use on an acre of land in the IID water service area is 5.63 acre-feet per acre. This represents the average annual quantity of water delivered to an acre of agricultural land within the IID water service area during the period 1987 to 1999. In many instances, lands are multi-cropped, meaning that during the calendar year a single acre of land produces more than one acre of harvested crop. To account for this multi-cropping, the IID crops survey data for the years 1987-1999 are used to calculate a ratio of net-to-harvested acreage of 1.17 to 1. Based on the assumed conservation rate of 5.63 acre-feet per acre, a total of 3,552 acres of land must taken out of production every year to conserve 20,000 acre-feet per year. This decrease will result in a reduction of 4,156 acres of harvested crops. The analysis makes no assumptions regarding what acre of land is fallowed or how long it is kept out of production. This was also a supporting reason for assuming a reduction in the full non-permanent crop rotation when implementing fallowing.

Economic Change Value Estimates Used In Analysis

Based on the assumptions noted above, the annual economic change levels are averaged into the 7 program year-blocks for each economic change category for each Proposed Project and alternative implementation. Table G-5 shows the program year-block economic change levels used in the impact estimation for the Proposed Project, and Table G-6 shows the modeled economic change levels for Alternative 2 and Alternative 3. Alternative 4 results in the same economic change levels as Proposed Projects C and D and are not modeled again separately.

Impact Analysis Results

Each of these three economic change categories is estimated annually for all program implementation options, and the annual effects are averaged into the seven year-block effects that are used as inputs for the Implan model. To provide flexibility in the presentation of the impact results, each economic change category for each year-block is modeled separately. Because the relationships of I-O are linear, the impacts from all three economic change categories can be summed over a single year-block to provide the total impact for that year-block. Because the Implan results represent individual equilibrium outcomes, the results of different year-blocks cannot be summed to identify a total impact for a particular program implementation. The best representations of the final impact of a program implementation are the year-block 7 impacts that are presented in the main text of the Draft EIR/EIS. The following series of tables shows all year-block results at the greatest level of dissaggregation. For each Proposed Project and Alternative's implementation option discussed in the Draft EIR/EIS and summarized in Table G-1 of this Appendix, the direct, indirect, induced, and total impact is shown broken down so that the reader can see for each year-block and for each economic change category how each of 10 major economic sectors would be impacted.

Included in this Appendix are the results at the same level of detail for employment, output, and employee compensation. The tables are organized so that for each program year-block, and each economic change category, the reader can identify the contribution of the direct, indirect and induced effects on each of 10 economic sectors, for employment, output, and employee compensation impacts. Within a single program year-block, the effects of all economic change categories are summed to identify the total employment, output, or employee compensation change the county could be expected to experience. Alternative 4's impacts are as described for Proposed Projects C and D and are not presented again.

Tables G-7 and G-8 show the employment impacts: Proposed Projects A – D are in Table G-7 and Alternatives 2 and 3 are in Table G-8. The employment impacts represent anticipated changes in the numbers of full-time equivalents for each sector. Tables G-9 and G-10 show the value of business output impacts: Proposed Projects A – D are in Table G-9 and Alternatives 2 and 3 are in Table G-10. The values reported as changes in business output represent the change in the value of production for a given economic sector and are reported in millions of dollars. Tables G-11 to G-12 show the employee compensation impacts: Proposed Projects A – D are in Table G-11 and Alternatives 2 and 3 are in Table G-12. The values reported as changes in employee compensation represent changes in total wages paid to the employees of an economic sector, reported in millions of dollars.

When evaluating this information it is important to recognize that the results presented in the tables use different measures or metrics to evaluate the same impact. Thus, it is not appropriate to add together, for example, the output impact and the employee compensation impact to get a total impact to the economy.

Table G-5 - Economic Change Levels for the Proposed Project, Millions of Dollars

	Conservation Measure Expenditures					Disposable Income Expenditure	Agricultural Production					
	50: New Utility Structures	52: Maint & Repair Other Facilities	56: Electric Services	443: Wholesale Trade (Diesel)	447: Financing	456: PCE event set	10: Cotton	11: Food Grains	13: Hay and Pasture	14: Grass Seed	18: Vegetables	19: Sugar Crops
Proposed Project A												
Year Block 1	29.973	1.062	0.323	1.115	2.757	1.439	-	-	-	-	-	-
Year Block 2	32.664	3.257	0.976	3.421	6.878	4.282	-	-	-	-	-	-
Year Block 3	20.611	5.665	1.011	5.949	9.849	7.315	-	-	-	-	-	-
Year Block 4	23.288	7.435	1.011	7.808	10.564	9.569	-	-	-	-	-	-
Year Block 5	9.584	8.143	1.011	8.552	8.606	11.367	-	-	-	-	-	-
Year Block 6	12.261	8.143	1.011	8.552	6.468	12.079	-	-	-	-	-	-
Year Block 7	10.774	8.143	1.011	8.552	5.324	14.045	-	-	-	-	-	-
Proposed Project B												
Year Block 1	33.422	1.115	0.349	1.171	2.923	0.659	-	-	-	-	-	-
Year Block 2	37.075	3.788	0.994	3.979	8.176	2.162	-	-	-	-	-	-
Year Block 3	16.377	6.231	1.011	6.544	10.480	3.363	-	-	-	-	-	-
Year Block 4	17.292	7.258	1.011	7.623	9.403	3.748	-	-	-	-	-	-
Year Block 5	16.519	8.143	1.011	8.552	8.519	5.481	-	-	-	-	-	-
Year Block 6	11.778	8.497	1.011	8.924	6.974	6.473	-	-	-	-	-	-
Year Block 7	11.349	8.497	1.011	8.924	5.616	8.233	-	-	-	-	-	-
Proposed Project C												
Year Block 1	-	-	-	-	-	5.712	(0.226)	(0.723)	(2.804)	(0.385)	(9.241)	(1.112)
Year Block 2	-	-	-	-	-	15.231	(0.603)	(1.928)	(7.477)	(1.026)	(24.641)	(2.965)
Year Block 3	-	-	-	-	-	21.895	(0.866)	(2.772)	(10.749)	(1.474)	(35.422)	(4.262)
Year Block 4	-	-	-	-	-	26.655	(1.054)	(3.374)	(13.086)	(1.795)	(43.123)	(5.188)
Year Block 5	-	-	-	-	-	28.559	(1.130)	(3.615)	(14.021)	(1.923)	(46.203)	(5.559)
Year Block 6	-	-	-	-	-	28.559	(1.130)	(3.615)	(14.021)	(1.923)	(46.203)	(5.559)
Year Block 7	-	-	-	-	-	28.559	(1.130)	(3.615)	(14.021)	(1.923)	(46.203)	(5.559)
Proposed Project D												
Year Block 1	-	-	-	-	-	4.563	(0.238)	(0.759)	(2.945)	(0.404)	(9.703)	(1.168)
Year Block 2	-	-	-	-	-	12.748	(0.663)	(2.121)	(8.225)	(1.128)	(27.105)	(3.261)
Year Block 3	-	-	-	-	-	17.383	(0.904)	(2.892)	(11.217)	(1.539)	(36.963)	(4.447)
Year Block 4	-	-	-	-	-	19.194	(0.998)	(3.193)	(12.384)	(1.699)	(40.813)	(4.910)
Year Block 5	-	-	-	-	-	21.005	(1.093)	(3.495)	(13.553)	(1.859)	(44.662)	(5.374)
Year Block 6	-	-	-	-	-	21.729	(1.130)	(3.615)	(14.021)	(1.923)	(46.203)	(5.559)
Year Block 7	-	-	-	-	-	21.729	(1.130)	(3.615)	(14.021)	(1.923)	(46.203)	(5.559)

Table G-6 Economic Change Levels for Alternative 2 and Alternative 3, Millions of Dollars

	Conservation Measure Expenditures					Disposable Income Expenditure	Agricultural Production					
	50: New Utility Structures	52: Maint & Repair Other Facilities	56: Electric Services	443: Wholesale Trade (Diesel)	447: Financing	456: PCE event set	10: Cotton	11: Food Grains	13: Hay and Pasture	14: Grass Seed	18: Vegetables	19: Sugar Crops
Alternative 2												
Year Block 1	31.444	2.124	-	2.231	5.515	2.500	-	-	-	-	-	-
Year Block 2	9.433	4.532	-	4.759	8.156	5.224	-	-	-	-	-	-
Year Block 3	12.534	4.815	-	5.057	6.528	4.724	-	-	-	-	-	-
Year Block 4	2.817	4.957	-	5.206	4.512	6.105	-	-	-	-	-	-
Year Block 5	10.329	4.957	-	5.206	3.354	6.886	-	-	-	-	-	-
Year Block 6	2.817	4.957	-	5.206	3.345	7.320	-	-	-	-	-	-
Year Block 7	6.990	4.957	-	5.206	3.212	7.775	-	-	-	-	-	-
Alternative 3 A												
Year Block 1	34.589	2.231	-	2.343	5.846	1.033	-	-	-	-	-	-
Year Block 2	14.150	5.098	-	5.354	9.438	2.336	-	-	-	-	-	-
Year Block 3	19.762	6.125	-	6.433	9.040	1.901	-	-	-	-	-	-
Year Block 4	12.086	7.081	-	7.437	8.074	3.489	-	-	-	-	-	-
Year Block 5	21.007	7.966	-	8.366	7.750	4.760	-	-	-	-	-	-
Year Block 6	6.573	8.320	-	8.738	7.024	5.543	-	-	-	-	-	-
Year Block 7	11.528	8.320	-	8.738	5.481	7.021	-	-	-	-	-	-
Alternative 3 B												
Year Block 1	-	-	-	-	-	4.105	(0.238)	(0.759)	(2.945)	(0.404)	(9.703)	(1.168)
Year Block 2	-	-	-	-	-	9.383	(0.543)	(1.735)	(6.730)	(0.923)	(22.177)	(2.669)
Year Block 3	-	-	-	-	-	11.077	(0.640)	(2.049)	(7.945)	(1.089)	(26.181)	(3.150)
Year Block 4	-	-	-	-	-	12.706	(0.735)	(2.349)	(9.113)	(1.250)	(30.032)	(3.613)
Year Block 5	-	-	-	-	-	14.335	(0.828)	(2.651)	(10.282)	(1.410)	(33.882)	(4.076)
Year Block 6	-	-	-	-	-	14.987	(0.866)	(2.772)	(10.749)	(1.474)	(35.422)	(4.262)
Year Block 7	-	-	-	-	-	14.987	(0.866)	(2.772)	(10.749)	(1.474)	(35.422)	(4.262)

20425

Table G-7 Proposed Project Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

Program Year Block	Economic Change Category	Sector	Proposed Project A Direct Effect	Proposed Project A Indirect Effect	Proposed Project A Induced Effect	Proposed Project A Total Effect	Proposed Project B Direct Effect	Proposed Project B Indirect Effect	Proposed Project B Induced Effect	Proposed Project B Total Effect	Proposed Project C Direct Effect	Proposed Project C Indirect Effect	Proposed Project C Induced Effect	Proposed Project C Total Effect	Proposed Project D Direct Effect	Proposed Project D Indirect Effect	Proposed Project D Induced Effect	Proposed Project D Total Effect
Program Year Block 1	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-130	-130	0	-260	-140	-130	0	-270
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	-10	0	0	0	-10
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-10	-10	-20	0	-10	-10	-20
		TCPU	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
		Trade	0	0	0	0	0	0	0	0	0	-10	-20	-20	0	-10	-20	-30
	Agricultural Production Total		0	0	0	0	0	0	0	0	-130	-160	-30	-320	-140	-160	-30	-340
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	20	20	0	0	10	10
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	10	10	0	0	0	0	0	0	30	30	0	0	20	20
	Transfer Revenue Expenditures Total		0	0	10	10	0	0	10	10	0	0	50	50	0	0	40	40
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	340	0	0	340	380	0	0	380	0	0	0	0	0	0	0	0
		FIRE	20	0	10	40	30	0	10	40	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	60	30	100	0	70	40	110	0	0	0	0	0	0	0	0
		TCPU	0	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0
		Trade	10	30	50	90	10	30	50	90	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		380	110	100	580	420	120	110	640	0	0	0	0	0	0	0	0
	Program Year Block 1 Total		380	110	110	590	420	120	110	650	-130	-160	20	-270	-140	-160	10	-290

Table G-7 Proposed Project Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

Program Year Block 2		Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
		Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-360	-340	0	-690	-390	-370	0	-760
	Construction	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
	FIRE	0	0	0	0	0	0	0	0	0	-10	-10	-20	0	-10	-10	-20
	Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	0	0	0	0	0	0	0	-20	-30	-50	0	-20	-30	-50
	TCPU	0	0	0	0	0	0	0	0	0	-10	0	-20	0	-10	0	-20
	Trade	0	0	0	0	0	0	0	0	0	-30	-40	-70	0	-30	-40	-70
Agricultural Production Total		0	0	0	0	0	0	0	0	-360	-420	-80	-850	-390	-460	-90	-940
Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	0	0	0	0	0	0	0	0	10	10	0	0	10	10
	Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	10	10	0	0	10	10	0	0	50	50	0	0	40	40
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	0	0	20	20	0	0	10	10	0	0	70	70	0	0	60	60
Transfer Revenue Expenditures Total		0	0	40	40	0	0	20	20	0	0	140	140	0	0	120	120
Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	410	0	0	410	470	0	0	470	0	0	0	0	0	0	0	0
	FIRE	60	10	10	80	70	10	10	90	0	0	0	0	0	0	0	0
	Government	0	0	0	10	0	0	0	10	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	80	40	120	0	90	50	140	0	0	0	0	0	0	0	0
	TCPU	0	10	0	10	0	10	10	20	0	0	0	0	0	0	0	0
	Trade	40	30	60	130	40	30	70	150	0	0	0	0	0	0	0	0
Conservation Measure Expenditures Total		510	130	130	770	580	150	150	880	0	0	0	0	0	0	0	0
Program Year Block 2 Total		510	130	170	810	580	150	170	900	-360	-420	60	-710	-390	-460	30	-820

20427

Table G-7 Proposed Project Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 3	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-510	-480	0	-1000	-530	-500	0	-1040
		Construction	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
		FIRE	0	0	0	0	0	0	0	0	0	-20	-10	-20	0	-20	-10	-30
		Government	0	0	0	0	0	0	0	0	0	0	0	-10	0	0	0	-10
		Manufacturing	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-20	-40	-70	0	-30	-40	-70
		TCPU	0	0	0	0	0	0	0	0	0	-20	0	-20	0	-20	0	-20
		Trade	0	0	0	0	0	0	0	0	0	-40	-60	-100	0	-40	-60	-100
	Agricultural Production Total		0	0	0	0	0	0	0	0	-510	-600	-120	-1230	-530	-620	-120	-1280
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	10	10	0	0	10	10
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	20	20	0	0	10	10	0	0	70	70	0	0	50	50
		TCPU	0	0	0	0	0	0	0	0	0	0	10	10	0	0	10	10
		Trade	0	0	30	30	0	0	20	20	0	0	100	100	0	0	80	80
	Transfer Revenue Expenditures Total		0	0	70	70	0	0	30	30	0	0	210	210	0	0	160	160
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	320	0	0	320	290	0	0	290	0	0	0	0	0	0	0	0
		FIRE	90	10	10	100	90	10	10	110	0	0	0	0	0	0	0	0
		Government	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	60	40	100	0	50	40	90	0	0	0	0	0	0	0	0
		TCPU	0	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0
		Trade	70	20	60	150	70	20	50	150	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		480	100	120	700	450	90	110	660	0	0	0	0	0	0	0	0
	Program Year Block 3 Total		480	100	180	770	450	90	140	690	-510	-600	90	-1020	-530	-620	40	-1120

Table G-7 Proposed Project Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

		Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
		Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 4 — Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-620	-590	0	-1210	-590	-560	0	-1150
	Construction	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
	FIRE	0	0	0	0	0	0	0	0	0	-20	-10	-30	0	-20	-10	-30
	Government	0	0	0	0	0	0	0	0	0	0	0	-10	0	0	0	-10
	Manufacturing	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	0	0	0	0	0	0	0	-30	-50	-80	0	-30	-50	-80
	TCPU	0	0	0	0	0	0	0	0	0	-20	-10	-30	0	-20	0	-30
	Trade	0	0	0	0	0	0	0	0	0	-50	-70	-120	0	-40	-70	-110
Agricultural Production Total		0	0	0	0	0	0	0	0	-620	-730	-140	-1500	-590	-690	-140	-1420
Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	10	10	0	0	0	0	0	0	20	20	0	0	10	10
	Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	30	30	0	0	10	10	0	0	80	80	0	0	60	60
	TCPU	0	0	0	0	0	0	0	0	0	0	10	10	0	0	10	10
	Trade	0	0	50	50	0	0	20	20	0	0	130	130	0	0	90	90
Transfer Revenue Expenditures Total		0	0	90	90	0	0	40	40	0	0	250	250	0	0	180	180
Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	380	0	0	380	310	0	0	320	0	0	0	0	0	0	0	0
	FIRE	90	10	10	110	80	10	10	100	0	0	0	0	0	0	0	0
	Government	0	0	0	10	0	0	0	10	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	70	50	120	0	60	40	100	0	0	0	0	0	0	0	0
	TCPU	0	10	0	20	0	10	0	10	0	0	0	0	0	0	0	0
	Trade	90	30	70	180	80	20	60	160	0	0	0	0	0	0	0	0
Conservation Measure Expenditures Total		560	120	140	820	480	100	120	700	0	0	0	0	0	0	0	0
Program Year Block 4 Total		560	120	230	910	480	100	150	730	-620	-730	110	-1240	-590	-690	40	-1230

20429

Table G-7 Proposed Project Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

		Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
		Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 5 — Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-670	-630	0	-1300	-640	-610	0	-1260
	Construction	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
	FIRE	0	0	0	0	0	0	0	0	0	-20	-10	-30	0	-20	-10	-30
	Government	0	0	0	0	0	0	0	0	0	0	0	-10	0	0	0	-10
	Manufacturing	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	0	0	0	0	0	0	0	-30	-50	-90	0	-30	-50	-80
	TCPU	0	0	0	0	0	0	0	0	0	-30	-10	-30	0	-20	-10	-30
	Trade	0	0	0	0	0	0	0	0	0	-50	-80	-120	0	-50	-70	-120
Agricultural Production Total		0	0	0	0	0	0	0	0	-670	-780	-160	-1600	-640	-760	-150	-1550
Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	10	10	0	0	0	0	0	0	20	20	0	0	10	10
	Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	40	40	0	0	20	20	0	0	90	90	0	0	70	70
	TCPU	0	0	0	0	0	0	0	0	0	0	10	10	0	0	10	10
	Trade	0	0	50	50	0	0	30	30	0	0	130	130	0	0	100	100
Transfer Revenue Expenditures Total		0	0	110	110	0	0	50	50	0	0	270	270	0	0	200	200
Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	250	0	0	250	320	0	0	320	0	0	0	0	0	0	0	0
	FIRE	80	10	10	90	80	10	10	90	0	0	0	0	0	0	0	0
	Government	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	40	30	80	0	60	40	100	0	0	0	0	0	0	0	0
	TCPU	0	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0
	Trade	90	20	50	160	90	20	60	170	0	0	0	0	0	0	0	0
Conservation Measure Expenditures Total		420	80	100	600	490	100	120	710	0	0	0	0	0	0	0	0
Program Year Block 5 Total		420	80	210	700	490	100	170	760	-670	-780	110	-1330	-640	-760	50	-1350

Table G-7 Proposed Project Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 6	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-670	-630	0	-1300	-670	-630	0	-1300
		Construction	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
		FIRE	0	0	0	0	0	0	0	0	0	-20	-10	-30	0	-20	-10	-30
		Government	0	0	0	0	0	0	0	0	0	0	0	-10	0	0	0	-10
		Manufacturing	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-30	-50	-90	0	-30	-50	-90
		TCPU	0	0	0	0	0	0	0	0	0	-30	-10	-30	0	-30	-10	-30
		Trade	0	0	0	0	0	0	0	0	0	-50	-80	-120	0	-50	-80	-120
	Agricultural Production Total		0	0	0	0	0	0	0	0	-670	-780	-160	-1600	-670	-780	-160	-1600
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	10	10	0	0	0	0	0	0	20	20	0	0	10	10
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	20	20	0	0	0	0	0	0	0	0
		Services	0	0	40	40	0	0	0	0	0	0	90	90	0	0	70	70
		TCPU	0	0	0	0	0	0	0	0	0	0	10	10	0	0	10	10
		Trade	0	0	60	60	0	0	30	30	0	0	130	130	0	0	100	100
	Transfer Revenue Expenditures Total		0	0	110	110	0	0	60	60	0	0	270	270	0	0	200	200
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	280	0	0	280	280	0	0	280	0	0	0	0	0	0	0	0
		FIRE	60	10	10	70	60	10	10	70	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	50	40	80	0	50	40	80	0	0	0	0	0	0	0	0
		TCPU	0	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0
		Trade	90	20	50	160	100	20	50	170	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		430	80	100	620	440	80	110	630	0	0	0	0	0	0	0	0
	Program Year Block 6 Total		430	80	220	730	440	80	170	690	-670	-780	110	-1330	-670	-780	50	-1400

Table G-7 Proposed Project Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

Program Year Block 7		Sector	Proposed Project A Direct Effect	Proposed Project A Indirect Effect	Proposed Project A Induced Effect	Proposed Project A Total Effect	Proposed Project B Direct Effect	Proposed Project B Indirect Effect	Proposed Project B Induced Effect	Proposed Project B Total Effect	Proposed Project C Direct Effect	Proposed Project C Indirect Effect	Proposed Project C Induced Effect	Proposed Project C Total Effect	Proposed Project D Direct Effect	Proposed Project D Indirect Effect	Proposed Project D Induced Effect	Proposed Project D Total Effect
Program Year Block 7	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-670	-630	0	-1300	-670	-630	0	-1300
		Construction	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
		FIRE	0	0	0	0	0	0	0	0	0	-20	-10	-30	0	-20	-10	-30
		Government	0	0	0	0	0	0	0	0	0	0	0	-10	0	0	0	-10
		Manufacturing	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-30	-50	-90	0	-30	-50	-90
		TCPU	0	0	0	0	0	0	0	0	0	-30	-10	-30	0	-30	-10	-30
		Trade	0	0	0	0	0	0	0	0	0	-50	-80	-120	0	-50	-80	-120
	Agricultural Production Total		0	0	0	0	0	0	0	0	-670	-780	-160	-1600	-670	-780	-160	-1600
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	10	10	0	0	10	10	0	0	20	20	0	0	10	10
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	40	40	0	0	30	30	0	0	90	90	0	0	70	70
		TCPU	0	0	0	0	0	0	0	0	0	0	10	10	0	0	10	10
		Trade	0	0	70	70	0	0	40	40	0	0	130	130	0	0	100	100
	Transfer Revenue Expenditures Total		0	0	130	130	0	0	80	80	0	0	270	270	0	0	200	200
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	260	0	0	260	270	0	0	270	0	0	0	0	0	0	0	0
		FIRE	50	0	10	60	50	0	10	60	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	40	30	80	0	40	40	80	0	0	0	0	0	0	0	0
		TCPU	0	10	0	10	0	10	0	10	0	0	0	0	0	0	0	0
		Trade	90	20	50	160	100	20	50	170	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		400	80	100	580	420	80	100	600	0	0	0	0	0	0	0	0
	Program Year Block 7 Total		400	80	230	710	420	80	180	680	-670	-780	110	-1330	-670	-780	50	-1400

Table G-8 Alternatives 2 and 3 Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 1	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-140	-130	0	-270
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	-10
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-10	-10	-20
		TCPU	0	0	0	0	0	0	0	0	0	-10	0	-10
		Trade	0	0	0	0	0	0	0	0	0	-10	-20	-30
	Agricultural Production Total		0	0	0	0	0	0	0	0	-140	-170	-30	-340
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	10	10	0	0	0	0	0	0	10	10
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	10	10	0	0	0	0	0	0	20	20
	Transfer Revenue Expenditures Total		0	0	20	20	0	0	10	10	0	0	40	40
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	380	0	0	380	410	0	0	410	0	0	0	0
		FIRE	50	10	10	60	50	10	10	70	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	70	40	110	0	80	40	120	0	0	0	0
		TCPU	0	10	0	10	0	10	0	10	0	0	0	0
		Trade	20	30	60	110	30	30	60	120	0	0	0	0
	Conservation Measure Expenditures Total		450	120	110	680	490	130	120	740	0	0	0	0
	Program Year Block 1 Total		450	120	140	700	490	130	130	750	-140	-170	10	-300

20433

Table G-8 Alternatives 2 and 3 Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 2	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-320	-300	0	-620
		Construction	0	0	0	0	0	0	0	0	0	0	0	-10
		FIRE	0	0	0	0	0	0	0	0	0	-10	0	-20
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	-10
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-20	-30	-40
		TCPU	0	0	0	0	0	0	0	0	0	-10	0	-10
		Trade	0	0	0	0	0	0	0	0	0	-20	-40	-60
	Agricultural Production Total		0	0	0	0	0	0	0	0	-320	-370	-70	-770
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	10	10
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	20	20	0	0	10	10	0	0	30	30
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	20	20	0	0	10	10	0	0	40	40
	Transfer Revenue Expenditures Total		0	0	50	50	0	0	20	20	0	0	90	90
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	180	0	0	180	240	0	0	240	0	0	0	0
		FIRE	70	0	0	80	80	10	10	100	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	30	30	60	0	50	30	80	0	0	0	0
		TCPU	0	0	0	10	0	10	0	10	0	0	0	0
		Trade	50	10	40	100	60	20	40	120	0	0	0	0
	Conservation Measure Expenditures Total		310	60	70	440	390	80	90	560	0	0	0	0
	Program Year Block 2 Total		310	60	120	490	390	80	110	580	-320	-370	10	-680

Table G-8 Alternatives 2 and 3 Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 3	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-380	-360	0	-740
		Construction	0	0	0	0	0	0	0	0	0	-10	0	-10
		FIRE	0	0	0	0	0	0	0	0	0	-10	-10	-20
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	-10
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-20	-30	-50
		TCPU	0	0	0	0	0	0	0	0	0	-10	0	-20
		Trade	0	0	0	0	0	0	0	0	0	-30	-40	-70
	Agricultural Production Total		0	0	0	0	0	0	0	0	-380	-440	-90	-910
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	10	10
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	10	10	0	0	10	10	0	0	30	30
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	20	20	0	0	10	10	0	0	50	50
	Transfer Revenue Expenditures Total		0	0	40	40	0	0	20	20	0	0	100	100
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	220	0	0	220	320	0	0	320	0	0	0	0
		FIRE	60	0	10	70	80	10	10	90	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	40	30	70	0	60	40	100	0	0	0	0
		TCPU	0	10	0	10	0	10	0	10	0	0	0	0
		Trade	60	20	40	110	70	20	60	150	0	0	0	0
	Conservation Measure Expenditures Total		330	70	80	480	470	100	110	690	0	0	0	0
	Program Year Block 3 Total		330	70	120	530	470	100	130	710	-380	-440	20	-800

Table G-8 Alternatives 2 and 3 Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 4	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-430	-410	0	-840
		Construction	0	0	0	0	0	0	0	0	0	-10	0	-10
		FIRE	0	0	0	0	0	0	0	0	0	-10	-10	-20
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	-10	0	-10
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-20	-40	-60
		TCPU	0	0	0	0	0	0	0	0	0	-20	0	-20
		Trade	0	0	0	0	0	0	0	0	0	-30	-50	-80
	Agricultural Production Total		0	0	0	0	0	0	0	0	-430	-510	-100	-1040
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	10	10
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	20	20	0	0	10	10	0	0	40	40
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	30	30	0	0	20	20	0	0	60	60
	Transfer Revenue Expenditures Total		0	0	60	60	0	0	30	30	0	0	120	120
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	120	0	0	120	260	0	0	260	0	0	0	0
		FIRE	40	0	0	50	70	10	10	80	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	20	20	40	0	40	30	80	0	0	0	0
		TCPU	0	0	0	0	0	10	0	10	0	0	0	0
		Trade	60	10	20	90	80	20	50	150	0	0	0	0
	Conservation Measure Expenditures Total		220	40	50	300	410	80	100	580	0	0	0	0
	Program Year Block 4 Total		220	40	110	360	410	80	130	620	-430	-510	20	-920

Table G-8 Alternatives 2 and 3 Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

		Alternative 2				Alternative 3 A				Alternative 3 B			
		Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 5 – Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-490	-460	0	-950
	Construction	0	0	0	0	0	0	0	0	0	-10	0	-10
	FIRE	0	0	0	0	0	0	0	0	0	-20	-10	-20
	Government	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	-10	0	-10
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	0	0	0	0	0	0	0	-20	-40	-60
	TCPU	0	0	0	0	0	0	0	0	0	-20	0	-20
	Trade	0	0	0	0	0	0	0	0	0	-40	-60	-90
Agricultural Production Total		0	0	0	0	0	0	0	0	-490	-570	-110	-1170
Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	0	0	0	0	0	0	0	0	10	10
	Government	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	20	20	0	0	10	10	0	0	50	50
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	0	0	30	30	0	0	20	20	0	0	70	70
Transfer Revenue Expenditures Total		0	0	60	60	0	0	40	40	0	0	130	130
Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	200	0	0	200	370	0	0	370	0	0	0	0
	FIRE	30	0	0	40	70	10	10	80	0	0	0	0
	Government	0	0	0	0	0	0	0	10	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	10	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	30	20	60	0	60	40	110	0	0	0	0
	TCPU	0	0	0	10	0	10	0	10	0	0	0	0
	Trade	60	10	30	100	90	30	60	180	0	0	0	0
Conservation Measure Expenditures Total		290	60	70	410	530	110	130	770	0	0	0	0
Program Year Block 5 Total		290	60	130	480	530	110	170	810	-490	-570	20	-1040

Table G-8 Alternatives 2 and 3 Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

		Alternative 2				Alternative 3 A				Alternative 3 B			
		Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 6 — Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-510	-480	0	-1000
	Construction	0	0	0	0	0	0	0	0	0	-10	0	-10
	FIRE	0	0	0	0	0	0	0	0	0	-20	-10	-20
	Government	0	0	0	0	0	0	0	0	0	0	0	-10
	Manufacturing	0	0	0	0	0	0	0	0	0	-10	0	-10
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	0	0	0	0	0	0	0	-20	-40	-70
	TCPU	0	0	0	0	0	0	0	0	0	-20	0	-20
	Trade	0	0	0	0	0	0	0	0	0	-40	-60	-100
Agricultural Production Total		0	0	0	0	0	0	0	0	-510	-600	-120	-1230
Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	0	0	0	0	0	0	0	0	10	10
	Government	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	20	20	0	0	20	20	0	0	50	50
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	0	0	30	30	0	0	30	30	0	0	70	70
Transfer Revenue Expenditures Total		0	0	70	70	0	0	50	50	0	0	140	140
Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	120	0	0	120	0	0	0	0	0	0	0	0
	FIRE	30	0	0	40	0	0	0	0	0	0	0	0
	Government	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	20	20	30	0	0	0	0	0	0	0	0
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	60	10	20	90	0	0	0	0	0	0	0	0
Conservation Measure Expenditures Total		210	30	50	290	0	0	0	0	0	0	0	0
Program Year Block 6 Total		210	30	120	360	0	0	50	50	-510	-600	20	-1090

20438

Table G-8 Alternatives 2 and 3 Employment Impacts by Program Year Block, Economic Change Category and Impacted Sector (number of jobs)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 7	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-510	-480	0	-1000
		Construction	0	0	0	0	0	0	0	0	0	-10	0	-10
		FIRE	0	0	0	0	0	0	0	0	0	-20	-10	-20
		Government	0	0	0	0	0	0	0	0	0	0	0	-10
		Manufacturing	0	0	0	0	0	0	0	0	0	-10	0	-10
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-20	-40	-70
		TCPU	0	0	0	0	0	0	0	0	0	-20	0	-20
		Trade	0	0	0	0	0	0	0	0	0	-40	-60	-100
	Agricultural Production Total		0	0	0	0	0	0	0	0	-510	-600	-120	-1230
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	10	10
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	20	20	0	0	20	20	0	0	50	50
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	40	40	0	0	30	30	0	0	70	70
	Transfer Revenue Expenditures Total		0	0	70	70	0	0	70	70	0	0	140	140
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	160	0	0	160	270	0	0	270	0	0	0	0
		FIRE	30	0	0	40	50	0	10	60	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	30	20	50	0	40	30	80	0	0	0	0
		TCPU	0	0	0	10	0	10	0	10	0	0	0	0
		Trade	60	10	30	100	100	20	50	160	0	0	0	0
	Conservation Measure Expenditures Total		250	50	60	360	420	80	100	590	0	0	0	0
	Program Year Block 7 Total		250	50	130	430	420	80	170	660	-510	-600	20	-1090

Table G-9 Proposed Project Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 1	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-14	-3	0	-17	-15	-3	0	-18
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	-1	-1	-1	0	-1	-1	-1
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	-1	-1	0	0	-1	-1
		TCPU	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1
		Trade	0	0	0	0	0	0	0	0	0	-1	-1	-1	0	-1	-1	-2
	Agricultural Production Total		0	0	0	0	0	0	0	0	-14	-6	-2	-22	-15	-6	-2	-23
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Transfer Revenue Expenditures Total		0	0	1	1	0	0	0	0	0	0	4	4	0	0	3	3
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	31	0	0	31	35	0	0	35	0	0	0	0	0	0	0	0
		FIRE	3	1	2	5	3	1	2	5	0	0	0	0	0	0	0	0
		Government	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	4	2	6	0	5	2	7	0	0	0	0	0	0	0	0
		TCPU	0	1	0	2	0	1	1	2	0	0	0	0	0	0	0	0
		Trade	1	1	2	5	1	2	2	5	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		35	8	7	50	39	9	7	55	0	0	0	0	0	0	0	0
	Program Year Block 1 Total		35	8	8	51	39	9	8	55	-14	-6	2	-19	-15	-6	1	-20

20440

Table G-9 Proposed Project Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 2	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-39	-7	0	-45	-43	-7	0	-50
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	-2	-1	-3	0	-2	-2	-4
		Government	0	0	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1
		Manufacturing	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-1	-1	-3	0	-1	-2	-3
		TCPU	0	0	0	0	0	0	0	0	0	-2	0	-2	0	-2	0	-2
		Trade	0	0	0	0	0	0	0	0	0	-2	-2	-4	0	-3	-2	-4
	Agricultural Production Total		0	0	0	0	0	0	0	0	-39	-15	-6	-59	-43	-17	-6	-65
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	1	1	0	0	0	0	0	0	3	3	0	0	2	2
		Government	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	0	0	0	0	2	2	0	0	2	2
		TCPU	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
		Trade	0	0	1	1	0	0	0	0	0	0	3	3	0	0	2	2
	Transfer Revenue Expenditures Total		0	0	3	3	0	0	1	1	0	0	10	10	0	0	8	8
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	36	0	0	36	41	0	0	41	0	0	0	0	0	0	0	0
		FIRE	7	1	2	10	8	1	3	12	0	0	0	0	0	0	0	0
		Government	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	5	2	8	0	6	3	9	0	0	0	0	0	0	0	0
		TCPU	1	1	1	3	1	1	1	3	0	0	0	0	0	0	0	0
		Trade	3	2	3	8	4	2	3	9	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		47	10	9	66	54	11	10	75	0	0	0	0	0	0	0	0
	Program Year Block 2 Total		47	10	11	68	54	11	11	76	-39	-15	4	-50	-43	-17	2	-57

Table G-9 Proposed Project Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 3	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-56	-10	0	-65	-58	-10	0	-68
		Construction	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1
		FIRE	0	0	0	0	0	0	0	0	0	-3	-2	-5	0	-3	-2	-5
		Government	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	-1	-1
		Manufacturing	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-2
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-2	-2	-4	0	-2	-2	-4
		TCPU	0	0	0	0	0	0	0	0	0	-2	-1	-3	0	-2	-1	-3
		Trade	0	0	0	0	0	0	0	0	0	-3	-2	-6	0	-3	-2	-6
	Agricultural Production Total		0	0	0	0	0	0	0	0	-56	-22	-8	-85	-58	-23	-8	-89
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	1	1	0	0	1	1	0	0	4	4	0	0	3	3
		Government	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	1	1	0	0	4	4	0	0	3	3
		TCPU	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
		Trade	0	0	1	1	0	0	1	1	0	0	4	4	0	0	3	3
	Transfer Revenue Expenditures Total		0	0	5	5	0	0	2	2	0	0	14	14	0	0	11	11
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	26	0	0	26	23	0	0	23	0	0	0	0	0	0	0	0
		FIRE	10	1	2	13	10	1	2	13	0	0	0	0	0	0	0	0
		Government	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	4	2	6	0	4	2	5	0	0	0	0	0	0	0	0
		TCPU	1	1	1	2	1	1	1	2	0	0	0	0	0	0	0	0
		Trade	6	1	2	10	7	1	2	10	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		43	8	8	59	41	7	7	55	0	0	0	0	0	0	0	0
	Program Year Block 3 Total		43	8	13	63	41	7	10	57	-56	-22	6	-71	-58	-23	3	-78

20442

Table G-9 Proposed Project Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

Program Year Block 4 — Proposed Project A

		Direct Effect	Indirect Effect	Induced Effect	Total Effect
Agricultural Production	Agriculture	0	0	0	0
	Construction	0	0	0	0
	FIRE	0	0	0	0
	Government	0	0	0	0
	Manufacturing	0	0	0	0
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	0	0	0
	TCPU	0	0	0	0
	Trade	0	0	0	0
Agricultural Production Total		0	0	0	0
Transfer Revenue Expenditures	Agriculture	0	0	0	0
	Construction	0	0	0	0
	FIRE	0	0	2	2
	Government	0	0	0	0
	Manufacturing	0	0	0	0
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	0	2	2
	TCPU	0	0	0	0
	Trade	0	0	2	2
Transfer Revenue Expenditures Total		0	0	6	6
Conservation Measure Expenditures	Agriculture	0	0	0	0
	Construction	31	0	0	31
	FIRE	11	1	2	14
	Government	0	0	1	1
	Manufacturing	0	0	0	1
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	5	2	7
	TCPU	1	1	1	3
	Trade	8	2	3	12
Conservation Measure Expenditures Total		50	9	9	68
Program Year Block 4 Total		50	9	15	75

Program Year Block 4 — Proposed Project B

		Direct Effect	Indirect Effect	Induced Effect	Total Effect
Agricultural Production	Agriculture	0	0	0	0
	Construction	0	0	0	0
	FIRE	0	0	0	0
	Government	0	0	0	0
	Manufacturing	0	0	0	0
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	0	0	0
	TCPU	0	0	0	0
	Trade	0	0	0	0
Agricultural Production Total		0	0	0	0
Transfer Revenue Expenditures	Agriculture	0	0	0	0
	Construction	0	0	0	0
	FIRE	0	0	1	1
	Government	0	0	0	0
	Manufacturing	0	0	0	0
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	0	1	1
	TCPU	0	0	0	0
	Trade	0	0	1	1
Transfer Revenue Expenditures Total		0	0	2	2
Conservation Measure Expenditures	Agriculture	0	0	0	0
	Construction	25	0	0	25
	FIRE	9	1	2	12
	Government	0	0	0	1
	Manufacturing	0	0	0	1
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	4	2	6
	TCPU	1	1	1	2
	Trade	8	1	2	11
Conservation Measure Expenditures Total		43	7	8	58
Program Year Block 4 Total		43	7	10	60

Program Year Block 4 — Proposed Project C

		Direct Effect	Indirect Effect	Induced Effect	Total Effect
Agricultural Production	Agriculture	-68	-12	0	-79
	Construction	0	-1	0	-1
	FIRE	0	-3	-3	-6
	Government	0	-1	-1	-1
	Manufacturing	0	-2	0	-2
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	-2	-3	-4
	TCPU	0	-3	-1	-4
	Trade	0	-4	-3	-7
Agricultural Production Total		-68	-27	-10	-104
Transfer Revenue Expenditures	Agriculture	0	0	0	0
	Construction	0	0	0	0
	FIRE	0	0	4	4
	Government	0	0	1	1
	Manufacturing	0	0	0	0
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	0	4	4
	TCPU	0	0	1	1
	Trade	0	0	5	5
Transfer Revenue Expenditures Total		0	0	17	17
Conservation Measure Expenditures	Agriculture	0	0	0	0
	Construction	0	0	0	0
	FIRE	0	0	0	0
	Government	0	0	0	0
	Manufacturing	0	0	0	0
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	0	0	0
	TCPU	0	0	0	0
	Trade	0	0	0	0
Conservation Measure Expenditures Total		0	0	0	0
Program Year Block 4 Total		-68	-27	7	-87

Program Year Block 4 — Proposed Project D

		Direct Effect	Indirect Effect	Induced Effect	Total Effect
Agricultural Production	Agriculture	-64	-11	0	-75
	Construction	0	-1	0	-1
	FIRE	0	-3	-2	-5
	Government	0	-1	-1	-1
	Manufacturing	0	-1	0	-2
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	-2	-2	-4
	TCPU	0	-3	-1	-3
	Trade	0	-4	-3	-7
Agricultural Production Total		-64	-25	-9	-98
Transfer Revenue Expenditures	Agriculture	0	0	0	0
	Construction	0	0	0	0
	FIRE	0	0	3	3
	Government	0	0	1	1
	Manufacturing	0	0	0	0
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	0	3	3
	TCPU	0	0	1	1
	Trade	0	0	4	4
Transfer Revenue Expenditures Total		0	0	12	12
Conservation Measure Expenditures	Agriculture	0	0	0	0
	Construction	0	0	0	0
	FIRE	0	0	0	0
	Government	0	0	0	0
	Manufacturing	0	0	0	0
	Mining	0	0	0	0
	Other	0	0	0	0
	Services	0	0	0	0
	TCPU	0	0	0	0
	Trade	0	0	0	0
Conservation Measure Expenditures Total		0	0	0	0
Program Year Block 4 Total		-64	-25	3	-86

Table G-9 Proposed Project Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

Program Year Block	Category	Sector	Proposed Project A Direct Effect	Proposed Project A Indirect Effect	Proposed Project A Induced Effect	Proposed Project A Total Effect	Proposed Project B Direct Effect	Proposed Project B Indirect Effect	Proposed Project B Induced Effect	Proposed Project B Total Effect	Proposed Project C Direct Effect	Proposed Project C Indirect Effect	Proposed Project C Induced Effect	Proposed Project C Total Effect	Proposed Project D Direct Effect	Proposed Project D Indirect Effect	Proposed Project D Induced Effect	Proposed Project D Total Effect
Program Year Block 5	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-72	-13	0	-85	-70	-12	0	-82
		Construction	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1
		FIRE	0	0	0	0	0	0	0	0	0	-3	-3	-6	0	-3	-3	-6
		Government	0	0	0	0	0	0	0	0	0	-1	-1	-2	0	-1	-1	-1
		Manufacturing	0	0	0	0	0	0	0	0	0	-2	0	-2	0	-2	0	-2
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-2	-3	-5	0	-2	-3	-5
		TCPU	0	0	0	0	0	0	0	0	0	-3	-1	-4	0	-3	-1	-4
		Trade	0	0	0	0	0	0	0	0	0	-4	-3	-7	0	-4	-3	-7
	Agricultural Production Total		0	0	0	0	0	0	0	0	-72	-28	-11	-111	-70	-27	-10	-108
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	2	2	0	0	1	1	0	0	5	5	0	0	3	3
		Government	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	2	2	0	0	1	1	0	0	5	5	0	0	3	3
		TCPU	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
		Trade	0	0	2	2	0	0	1	1	0	0	5	5	0	0	4	4
	Transfer Revenue Expenditures Total		0	0	7	7	0	0	3	3	0	0	18	18	0	0	13	13
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	18	0	0	18	25	0	0	25	0	0	0	0	0	0	0	0
		FIRE	9	1	2	11	9	1	2	11	0	0	0	0	0	0	0	0
		Government	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	3	2	4	0	4	2	6	0	0	0	0	0	0	0	0
		TCPU	1	1	0	2	1	1	1	2	0	0	0	0	0	0	0	0
		Trade	9	1	2	12	9	1	2	12	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		36	6	7	48	43	7	8	58	0	0	0	0	0	0	0	0
	Program Year Block 5 Total		36	6	14	56	43	7	12	62	-72	-28	8	-93	-70	-27	3	-94

20444

Table G-9 Proposed Project Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 6	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-72	-13	0	-85	-72	-13	0	-85
		Construction	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1
		FIRE	0	0	0	0	0	0	0	0	0	-3	-3	-6	0	-3	-3	-6
		Government	0	0	0	0	0	0	0	0	0	-1	-1	-2	0	-1	-1	-2
		Manufacturing	0	0	0	0	0	0	0	0	0	-2	0	-2	0	-2	0	-2
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-2	-3	-5	0	-2	-3	-5
		TCPU	0	0	0	0	0	0	0	0	0	-3	-1	-4	0	-3	-1	-4
		Trade	0	0	0	0	0	0	0	0	0	-4	-3	-7	0	-4	-3	-7
	Agricultural Production Total		0	0	0	0	0	0	0	0	-72	-28	-11	-111	-72	-28	-11	-111
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	2	2	0	0	1	1	0	0	5	5	0	0	4	4
		Government	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	2	2	0	0	1	1	0	0	5	5	0	0	4	4
		TCPU	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
		Trade	0	0	2	2	0	0	1	1	0	0	5	5	0	0	4	4
	Transfer Revenue Expenditures Total		0	0	8	8	0	0	4	4	0	0	18	18	0	0	14	14
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	20	0	0	21	20	0	0	20	0	0	0	0	0	0	0	0
		FIRE	6	1	2	9	7	1	2	9	0	0	0	0	0	0	0	0
		Government	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	3	2	5	0	3	2	5	0	0	0	0	0	0	0	0
		TCPU	1	1	1	2	1	1	1	2	0	0	0	0	0	0	0	0
		Trade	9	1	2	12	9	1	2	12	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		36	6	7	50	37	6	7	51	0	0	0	0	0	0	0	0
	Program Year Block 6 Total		36	6	15	57	37	6	11	55	-72	-28	8	-93	-72	-28	3	-97

20445

Table G-9 Proposed Project Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 7	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-72	-13	0	-85	-72	-13	0	-85
		Construction	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1
		FIRE	0	0	0	0	0	0	0	0	0	-3	-3	-6	0	-3	-3	-6
		Government	0	0	0	0	0	0	0	0	0	-1	-1	-2	0	-1	-1	-2
		Manufacturing	0	0	0	0	0	0	0	0	0	-2	0	-2	0	-2	0	-2
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-2	-3	-5	0	-2	-3	-5
		TCPU	0	0	0	0	0	0	0	0	0	-3	-1	-4	0	-3	-1	-4
		Trade	0	0	0	0	0	0	0	0	0	-4	-3	-7	0	-4	-3	-7
	Agricultural Production Total		0	0	0	0	0	0	0	0	-72	-28	-11	-111	-72	-28	-11	-111
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	2	2	0	0	1	1	0	0	5	5	0	0	4	4
		Government	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	2	2	0	0	1	1	0	0	5	5	0	0	4	4
		TCPU	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	1
		Trade	0	0	3	3	0	0	2	2	0	0	5	5	0	0	4	4
	Transfer Revenue Expenditures Total		0	0	9	9	0	0	5	5	0	0	18	18	0	0	14	14
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	19	0	0	19	20	0	0	20	0	0	0	0	0	0	0	0
		FIRE	5	1	2	8	6	1	2	8	0	0	0	0	0	0	0	0
		Government	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	3	2	4	0	3	2	5	0	0	0	0	0	0	0	0
		TCPU	1	1	0	2	1	1	1	2	0	0	0	0	0	0	0	0
		Trade	9	1	2	12	9	1	2	12	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		34	6	7	46	35	6	7	48	0	0	0	0	0	0	0	0
	Program Year Block 7 Total		34	6	16	55	35	6	12	54	-72	-28	8	-93	-72	-28	3	-97

20446

Table G-10 Alternatives 2 and 3 Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 1	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-15	-3	0	-18
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	-1	-1	-1
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	-1	-1
		TCPU	0	0	0	0	0	0	0	0	0	-1	0	-1
		Trade	0	0	0	0	0	0	0	0	0	-1	-1	-2
	Agricultural Production Total		0	0	0	0	0	0	0	0	-15	-6	-2	-23
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	1	1
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	0	1	1
	Transfer Revenue Expenditures Total		0	0	2	2	0	0	1	1	0	0	3	3
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	34	0	0	34	37	0	0	37	0	0	0	0
		FIRE	6	1	2	8	6	1	2	9	0	0	0	0
		Government	0	0	0	1	0	0	1	1	0	0	0	0
		Manufacturing	0	0	0	1	0	0	0	1	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	5	2	7	0	5	2	8	0	0	0	0
		TCPU	0	1	1	1	0	1	1	2	0	0	0	0
		Trade	2	2	2	6	2	2	2	7	0	0	0	0
	Conservation Measure Expenditures Total		41	9	8	58	45	10	8	63	0	0	0	0
	Program Year Block 1 Total		41	9	9	59	45	10	9	64	-15	-6	0	-21

20447

Table G-10 Alternatives 2 and 3 Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 2	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-35	-6	0	-41
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	-2	-1	-3
		Government	0	0	0	0	0	0	0	0	0	0	0	-1
		Manufacturing	0	0	0	0	0	0	0	0	0	-1	0	-1
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-1	-1	-2
		TCPU	0	0	0	0	0	0	0	0	0	-1	0	-2
		Trade	0	0	0	0	0	0	0	0	0	-2	-1	-4
	Agricultural Production Total		0	0	0	0	0	0	0	0	-35	-14	-5	-53
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	1	1	0	0	0	0	0	0	2	2
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	0	0	0	0	2	2
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	1	1	0	0	0	0	0	0	2	2
	Transfer Revenue Expenditures Total		0	0	3	3	0	0	1	1	0	0	6	6
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	14	0	0	14	19	0	0	19	0	0	0	0
		FIRE	8	0	1	10	9	1	2	12	0	0	0	0
		Government	0	0	0	1	0	0	0	1	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	2	1	4	0	3	2	5	0	0	0	0
		TCPU	0	1	0	1	0	1	0	1	0	0	0	0
		Trade	5	1	1	7	5	1	2	8	0	0	0	0
	Conservation Measure Expenditures Total		27	5	5	36	34	6	6	46	0	0	0	0
	Program Year Block 2 Total		27	5	8	40	34	6	8	48	-35	-14	1	-47

Table G-10 Alternatives 2 and 3 Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 3	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-41	-7	0	-48
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	-2	-2	-3
		Government	0	0	0	0	0	0	0	0	0	-1	0	-1
		Manufacturing	0	0	0	0	0	0	0	0	0	-1	0	-1
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-1	-2	-3
		TCPU	0	0	0	0	0	0	0	0	0	-2	0	-2
		Trade	0	0	0	0	0	0	0	0	0	-2	-2	-4
	Agricultural Production Total		0	0	0	0	0	0	0	0	-41	-16	-6	-63
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	1	1	0	0	0	0	0	0	2	2
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	0	0	0	0	2	2
		TCPU	0	0	0	0	0	0	0	0	0	0	1	1
		Trade	0	0	1	1	0	0	0	0	0	0	2	2
	Transfer Revenue Expenditures Total		0	0	3	3	0	0	1	1	0	0	7	7
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	17	0	0	17	26	0	0	26	0	0	0	0
		FIRE	7	0	1	8	9	1	2	12	0	0	0	0
		Government	0	0	0	1	0	0	0	1	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	1	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	3	1	4	0	4	2	6	0	0	0	0
		TCPU	0	1	0	1	0	1	1	1	0	0	0	0
		Trade	5	1	2	8	6	1	2	10	0	0	0	0
	Conservation Measure Expenditures Total		29	5	5	40	41	8	8	57	0	0	0	0
	Program Year Block 3 Total		29	5	8	43	41	8	9	58	-41	-16	1	-56

20449

Table G-10 Alternatives 2 and 3 Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 4	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-47	-8	0	-55
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	-2	-2	-4
		Government	0	0	0	0	0	0	0	0	0	-1	0	-1
		Manufacturing	0	0	0	0	0	0	0	0	0	-1	0	-1
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-1	-2	-3
		TCPU	0	0	0	0	0	0	0	0	0	-2	-1	-2
		Trade	0	0	0	0	0	0	0	0	0	-3	-2	-5
	Agricultural Production Total		0	0	0	0	0	0	0	0	-47	-18	-7	-72
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	1	1	0	0	1	1	0	0	2	2
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	1	1	0	0	2	2
		TCPU	0	0	0	0	0	0	0	0	0	0	1	1
		Trade	0	0	1	1	0	0	1	1	0	0	2	2
	Transfer Revenue Expenditures Total		0	0	4	4	0	0	2	2	0	0	8	8
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	8	0	0	8	19	0	0	19	0	0	0	0
		FIRE	5	0	1	6	8	1	2	10	0	0	0	0
		Government	0	0	0	0	0	0	0	1	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	1	1	2	0	3	2	5	0	0	0	0
		TCPU	0	0	0	1	0	1	0	1	0	0	0	0
		Trade	5	0	1	7	7	1	2	10	0	0	0	0
	Conservation Measure Expenditures Total		17	3	3	24	35	6	7	47	0	0	0	0
	Program Year Block 4 Total		17	3	7	27	35	6	9	49	-47	-18	1	-64

20450

Table G-10 Alternatives 2 and 3 Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 5	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-53	-9	0	-62
		Construction	0	0	0	0	0	0	0	0	0	0	0	-1
		FIRE	0	0	0	0	0	0	0	0	0	-2	-2	-4
		Government	0	0	0	0	0	0	0	0	0	-1	0	-1
		Manufacturing	0	0	0	0	0	0	0	0	0	-1	0	-1
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-2	-2	-4
		TCPU	0	0	0	0	0	0	0	0	0	-2	-1	-3
		Trade	0	0	0	0	0	0	0	0	0	-3	-2	-5
	Agricultural Production Total		0	0	0	0	0	0	0	0	-53	-21	-8	-82
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	1	1	0	0	1	1	0	0	2	2
		Government	0	0	0	0	0	0	0	0	0	0	1	1
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	1	1	0	0	2	2
		TCPU	0	0	0	0	0	0	0	0	0	0	1	1
		Trade	0	0	1	1	0	0	1	1	0	0	3	3
	Transfer Revenue Expenditures Total		0	0	4	4	0	0	3	3	0	0	9	9
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	15	0	0	15	29	0	0	29	0	0	0	0
		FIRE	3	0	1	5	8	1	2	11	0	0	0	0
		Government	0	0	0	0	0	0	1	1	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	1	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	2	1	3	0	4	2	7	0	0	0	0
		TCPU	0	1	0	1	0	1	1	2	0	0	0	0
		Trade	5	1	1	7	8	1	3	12	0	0	0	0
	Conservation Measure Expenditures Total		24	4	5	33	45	8	9	62	0	0	0	0
	Program Year Block 5 Total		24	4	9	37	45	8	12	65	-53	-21	1	-73

20451

Table G-10 Alternatives 2 and 3 Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 6	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-56	-10	0	-65
		Construction	0	0	0	0	0	0	0	0	0	0	0	-1
		FIRE	0	0	0	0	0	0	0	0	0	-3	-2	-5
		Government	0	0	0	0	0	0	0	0	0	-1	0	-1
		Manufacturing	0	0	0	0	0	0	0	0	0	-1	0	-1
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-2	-2	-4
		TCPU	0	0	0	0	0	0	0	0	0	-2	-1	-3
		Trade	0	0	0	0	0	0	0	0	0	-3	-2	-6
	Agricultural Production Total		0	0	0	0	0	0	0	0	-56	-22	-8	-85
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	1	1	0	0	1	1	0	0	2	2
		Government	0	0	0	0	0	0	0	0	0	0	1	1
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	1	1	0	0	2	2
		TCPU	0	0	0	0	0	0	0	0	0	0	1	1
		Trade	0	0	1	1	0	0	1	1	0	0	3	3
	Transfer Revenue Expenditures Total		0	0	5	5	0	0	4	4	0	0	10	10
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	8	0	0	8	0	0	0	0	0	0	0	0
		FIRE	3	0	1	4	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	1	1	2	0	0	0	0	0	0	0	0
		TCPU	0	0	0	1	0	0	0	0	0	0	0	0
		Trade	5	0	1	7	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		16	3	3	22	0	0	0	0	0	0	0	0
	Program Year Block 6 Total		16	3	8	27	0	0	4	4	-56	-22	2	-76

Table G-10 Alternatives 2 and 3 Value of Business Output Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 7	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-56	-10	0	-65
		Construction	0	0	0	0	0	0	0	0	0	0	0	-1
		FIRE	0	0	0	0	0	0	0	0	0	-3	-2	-5
		Government	0	0	0	0	0	0	0	0	0	-1	0	-1
		Manufacturing	0	0	0	0	0	0	0	0	0	-1	0	-1
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-2	-2	-4
		TCPU	0	0	0	0	0	0	0	0	0	-2	-1	-3
		Trade	0	0	0	0	0	0	0	0	0	-3	-2	-6
	Agricultural Production Total		0	0	0	0	0	0	0	0	-56	-22	-8	-85
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	1	1	0	0	1	1	0	0	2	2
		Government	0	0	0	0	0	0	0	0	0	0	1	1
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	1	1	0	0	2	2
		TCPU	0	0	0	0	0	0	0	0	0	0	1	1
		Trade	0	0	1	1	0	0	1	1	0	0	3	3
	Transfer Revenue Expenditures Total		0	0	5	5	0	0	4	4	0	0	10	10
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	12	0	0	12	20	0	0	20	0	0	0	0
		FIRE	3	0	1	5	5	1	2	8	0	0	0	0
		Government	0	0	0	0	0	0	0	1	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	1	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	2	1	3	0	3	2	5	0	0	0	0
		TCPU	0	0	0	1	0	1	0	1	0	0	0	0
		Trade	5	1	1	7	9	1	2	12	0	0	0	0
	Conservation Measure Expenditures Total		20	4	4	28	34	6	7	47	0	0	0	0
	Program Year Block 7 Total		20	4	9	33	34	6	11	51	-56	-22	2	-76

Table G-11 Proposed Project Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 1	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-1	-1	0	-2	-1	-1	0	-2
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1
	Agricultural Production Total		0	0	0	0	0	0	0	0	-1	-2	-1	-3	-1	-2	-1	-4
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Transfer Revenue Expenditures Total		0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	8	0	0	8	8	0	0	9	0	0	0	0	0	0	0	0
		FIRE	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	1	1	2	0	2	1	2	0	0	0	0	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	1	1	2	0	1	1	2	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		9	2	2	13	10	3	2	14	0	0	0	0	0	0	0	0
	Program Year Block 1 Total		9	2	2	13	10	3	2	14	-1	-2	0	-2	-1	-2	0	-3

Table G-11 Proposed Project Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

Program Year Block 2	Category	Sector	Proposed Project A Direct Effect	Proposed Project A Indirect Effect	Proposed Project A Induced Effect	Proposed Project A Total Effect	Proposed Project B Direct Effect	Proposed Project B Indirect Effect	Proposed Project B Induced Effect	Proposed Project B Total Effect	Proposed Project C Direct Effect	Proposed Project C Indirect Effect	Proposed Project C Induced Effect	Proposed Project C Total Effect	Proposed Project D Direct Effect	Proposed Project D Indirect Effect	Proposed Project D Induced Effect	Proposed Project D Total Effect
Program Year Block 2	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-3	-2	0	-6	-4	-2	0	-6
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	-1	-1	0	0	-1	-1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	-1	-1	-1	0	-1	-1	-2
	Agricultural Production Total		0	0	0	0	0	0	0	0	-3	-4	-2	-9	-4	-4	-2	-10
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
	Transfer Revenue Expenditures Total		0	0	1	1	0	0	0	0	0	0	3	3	0	0	2	2
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	9	0	0	9	10	0	0	10	0	0	0	0	0	0	0	0
		FIRE	2	0	0	2	2	0	0	2	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	2	1	3	0	2	1	3	0	0	0	0	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	1	1	1	3	1	1	1	3	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		12	3	2	17	14	3	3	20	0	0	0	0	0	0	0	0
	Program Year Block 2 Total		12	3	3	18	14	3	3	20	-3	-4	1	-6	-4	-4	1	-8

20455

Table G-11 Proposed Project Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 3	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-5	-3	0	-8	-5	-3	0	-8
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	-1	-1	0	0	-1	-1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	-1
		Trade	0	0	0	0	0	0	0	0	0	-1	-1	-2	0	-1	-1	-2
	Agricultural Production Total		0	0	0	0	0	0	0	0	-5	-6	-2	-13	-5	-6	-2	-14
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	1	1	0	0	0	0	0	0	2	2	0	0	1	1
	Transfer Revenue Expenditures Total		0	0	1	1	0	0	1	1	0	0	4	4	0	0	3	3
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	7	0	0	7	6	0	0	6	0	0	0	0	0	0	0	0
		FIRE	2	0	0	3	2	0	0	3	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	1	1	2	0	1	1	2	0	0	0	0	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	2	1	1	4	2	0	1	4	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		12	2	2	16	11	2	2	15	0	0	0	0	0	0	0	0
	Program Year Block 3 Total		12	2	3	18	11	2	3	16	-5	-6	2	-9	-5	-6	1	-10

20456

Table G-11 Proposed Project Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

Program Year Block 4		Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
		Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-6	-4	0	-10	-6	-3	0	-9
	Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	0	0	0	0	0	0	0	-1	-1	-2	0	-1	-1	-1
	TCPU	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1
	Trade	0	0	0	0	0	0	0	0	0	-1	-1	-3	0	-1	-1	-2
Agricultural Production Total		0	0	0	0	0	0	0	0	-6	-7	-3	-16	-6	-7	-3	-15
Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	1	1	0	0	0	0	0	0	2	2	0	0	1	1
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	0	0	1	1	0	0	0	0	0	0	2	2	0	0	1	1
Transfer Revenue Expenditures Total		0	0	2	2	0	0	1	1	0	0	5	5	0	0	3	3
Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	8	0	0	9	7	0	0	7	0	0	0	0	0	0	0	0
	FIRE	2	0	0	3	2	0	0	2	0	0	0	0	0	0	0	0
	Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	1	1	2	0	1	1	2	0	0	0	0	0	0	0	0
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	3	1	1	4	3	0	1	4	0	0	0	0	0	0	0	0
Conservation Measure Expenditures Total		14	3	3	19	12	2	2	16	0	0	0	0	0	0	0	0
Program Year Block 4 Total		14	3	4	21	12	2	3	17	-6	-7	2	-11	-6	-7	1	-12

20457

Table G-11 Proposed Project Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 5	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-6	-4	0	-10	-6	-4	0	-10
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-1	-1	-2	0	-1	-1	-2
		TCPU	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1
		Trade	0	0	0	0	0	0	0	0	0	-2	-1	-3	0	-1	-1	-3
	Agricultural Production Total		0	0	0	0	0	0	0	0	-6	-8	-3	-17	-6	-7	-3	-16
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	0	0	0	0	2	2	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	1	1	0	0	0	0	0	0	2	2	0	0	2	2
	Transfer Revenue Expenditures Total		0	0	2	2	0	0	1	1	0	0	5	5	0	0	4	4
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	5	0	0	5	7	0	0	7	0	0	0	0	0	0	0	0
		FIRE	2	0	0	2	2	0	0	2	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	1	1	2	0	1	1	2	0	0	0	0	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	3	0	1	4	3	0	1	5	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		11	2	2	14	12	2	2	17	0	0	0	0	0	0	0	0
	Program Year Block 5 Total		11	2	4	16	12	2	3	18	-6	-8	2	-12	-6	-7	1	-13

Table G-11 Proposed Project Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 6	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-6	-4	0	-10	-6	-4	0	-10
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-1	-1	-2	0	-1	-1	-2
		TCPU	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1
		Trade	0	0	0	0	0	0	0	0	0	-2	-1	-3	0	-2	-1	-3
	Agricultural Production Total		0	0	0	0	0	0	0	0	-6	-8	-3	-17	-6	-8	-3	-17
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	0	0	0	0	2	2	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	1	1	0	0	0	0	0	0	2	2	0	0	2	2
	Transfer Revenue Expenditures Total		0	0	2	2	0	0	1	1	0	0	5	5	0	0	4	4
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	6	0	0	6	6	0	0	6	0	0	0	0	0	0	0	0
		FIRE	1	0	0	2	2	0	0	2	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	1	1	2	0	1	1	2	0	0	0	0	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	3	0	1	4	3	0	1	4	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		11	2	2	15	11	2	2	15	0	0	0	0	0	0	0	0
	Program Year Block 6 Total		11	2	4	17	11	2	3	16	-6	-8	2	-12	-6	-8	1	-13

Table G-11 Proposed Project Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Proposed Project A				Proposed Project B				Proposed Project C				Proposed Project D			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 7	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-6	-4	0	-10	-6	-4	0	-10
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	-1	-1	-2	0	-1	-1	-2
		TCPU	0	0	0	0	0	0	0	0	0	-1	0	-1	0	-1	0	-1
		Trade	0	0	0	0	0	0	0	0	0	-2	-1	-3	0	-2	-1	-3
	Agricultural Production Total		0	0	0	0	0	0	0	0	-6	-8	-3	-17	-6	-8	-3	-17
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	1	1	0	0	1	1	0	0	2	2	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	1	1	0	0	1	1	0	0	2	2	0	0	2	2
	Transfer Revenue Expenditures Total		0	0	2	2	0	0	1	1	0	0	5	5	0	0	4	4
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	6	0	0	6	6	0	0	6	0	0	0	0	0	0	0	0
		FIRE	1	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	1	1	2	0	1	1	2	0	0	0	0	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	3	0	1	4	3	0	1	4	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		10	2	2	14	11	2	2	14	0	0	0	0	0	0	0	0
	Program Year Block 7 Total		10	2	4	16	11	2	3	16	-6	-8	2	-12	-6	-8	1	-13

20460

Table G-12 Alternatives 2 and 3 Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

		Alternative 2				Alternative 3 A				Alternative 3 B			
		Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 1 / Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-1	-1	0	-2
	Construction	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	0	0	0	0	0	0	0	0	0	0
	Government	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	0	0	0	0	0	0	0	0	0	0
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	0	0	0	0	0	0	0	0	0	0	0	-1
Agricultural Production Total		0	0	0	0	0	0	0	0	-1	-2	-1	-4
Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	0	0	0	0	0	0	0	0	0	0
	Government	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	0	0	0	0	0	0	0	0	0	0
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	0	0	0	0	0	0	0	0	0	0	0	0
Transfer Revenue Expenditures Total		0	0	0	0	0	0	0	0	0	0	1	1
Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	8	0	0	8	9	0	0	9	0	0	0	0
	FIRE	1	0	0	2	1	0	0	2	0	0	0	0
	Government	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	2	1	2	0	2	1	3	0	0	0	0
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	1	1	1	2	1	1	1	2	0	0	0	0
Conservation Measure Expenditures Total		10	3	2	15	11	3	2	17	0	0	0	0
Program Year Block 1 Total		10	3	3	16	11	3	2	17	-1	-2	0	-3

Table G-12 Alternatives 2 and 3 Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 2	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-3	-2	0	-5
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	-1	-1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	-1	-1	-1
	Agricultural Production Total		0	0	0	0	0	0	0	0	-3	-4	-1	-8
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	0	1	1
	Transfer Revenue Expenditures Total		0	0	1	1	0	0	0	0	0	0	2	2
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	4	0	0	4	5	0	0	5	0	0	0	0
		FIRE	2	0	0	2	2	0	0	2	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	1	0	1	0	1	1	2	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	2	0	1	3	2	0	1	3	0	0	0	0
	Conservation Measure Expenditures Total		8	1	1	10	9	2	2	13	0	0	0	0
	Program Year Block 2 Total		8	1	2	11	9	2	2	13	-3	-4	0	-6

20462

Table G-12 Alternatives 2 and 3 Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 3	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-4	-2	0	-6
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	-1	-1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	-1	-1	-2
	Agricultural Production Total		0	0	0	0	0	0	0	0	-4	-4	-2	-10
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	0	1	1
	Transfer Revenue Expenditures Total		0	0	1	1	0	0	0	0	0	0	2	2
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	5	0	0	5	7	0	0	7	0	0	0	0
		FIRE	2	0	0	2	2	0	0	2	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	1	1	1	0	1	1	2	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	2	0	1	3	2	0	1	4	0	0	0	0
	Conservation Measure Expenditures Total		8	2	1	11	12	2	2	16	0	0	0	0
	Program Year Block 3 Total		8	2	2	12	12	2	2	16	-4	-4	0	-8

Table G-12 Alternatives 2 and 3 Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 4	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-4	-3	0	-7
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	-1	-1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	-1	-1	-2
	Agricultural Production Total		0	0	0	0	0	0	0	0	-4	-5	-2	-11
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	0	0	0	0	0	0	0	0	1	1
	Transfer Revenue Expenditures Total		0	0	1	1	0	0	1	1	0	0	2	2
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	3	0	0	3	6	0	0	6	0	0	0	0
		FIRE	1	0	0	1	2	0	0	2	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	1	0	1	1	2	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	2	0	0	2	3	0	1	4	0	0	0	0
	Conservation Measure Expenditures Total		6	1	1	7	10	2	2	14	0	0	0	0
	Program Year Block 4 Total		6	1	2	8	10	2	2	14	-4	-5	0	-9

Table G-12 Alternatives 2 and 3 Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B		
		Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 5	Agricultural Production: Agriculture	0	0	0	0	0	0	0	0	-5	-3	0	-8
	Construction	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	0	0	0	0	0	0	0	0	0	0
	Government	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	0	0	0	0	0	0	0	0	-1	-1
	TCPU	0	0	0	0	0	0	0	0	0	0	0	-1
	Trade	0	0	0	0	0	0	0	0	0	-1	-1	-2
	Agricultural Production Total	0	0	0	0	0	0	0	0	-5	-6	-2	-12
	Transfer Revenue Expenditures: Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	0	0	0	0	0	0	0	0	0	0	0	0
	FIRE	0	0	0	0	0	0	0	0	0	0	0	0
	Government	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	0	0	0	0	0	0	0	0	0	1	1
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	0	0	1	1	0	0	0	0	0	0	1	1
	Transfer Revenue Expenditures Total	0	0	1	1	0	0	1	1	0	0	3	3
	Conservation Measure Expenditures: Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
	Construction	4	0	0	4	8	0	0	8	0	0	0	0
	FIRE	1	0	0	1	2	0	0	2	0	0	0	0
	Government	0	0	0	0	0	0	0	0	0	0	0	0
	Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
	Mining	0	0	0	0	0	0	0	0	0	0	0	0
	Other	0	0	0	0	0	0	0	0	0	0	0	0
	Services	0	1	0	1	0	1	1	2	0	0	0	0
	TCPU	0	0	0	0	0	0	0	0	0	0	0	0
	Trade	2	0	1	3	3	1	1	5	0	0	0	0
	Conservation Measure Expenditures Total	7	1	1	10	13	3	2	18	0	0	0	0
	Program Year Block 5 Total	7	1	3	11	13	3	3	19	-5	-6	0	-10

20465

Table G-12 Alternatives 2 and 3 Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 6	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-5	-3	0	-8
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	-1	-1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	-1
		Trade	0	0	0	0	0	0	0	0	0	-1	-1	-2
	Agricultural Production Total		0	0	0	0	0	0	0	0	-5	-6	-2	-13
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	1	1	0	0	0	0	0	0	1	1
	Transfer Revenue Expenditures Total		0	0	1	1	0	0	1	1	0	0	3	3
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	3	0	0	3	0	0	0	0	0	0	0	0
		FIRE	1	0	0	1	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	1	0	0	0	0	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	2	0	0	2	0	0	0	0	0	0	0	0
	Conservation Measure Expenditures Total		5	1	1	7	0	0	0	0	0	0	0	0
	Program Year Block 6 Total		5	1	2	8	0	0	1	1	-5	-6	0	-10

20466

Table G-12 Alternatives 2 and 3 Employee Compensation Impacts by Program Year Block, Economic Change Category and Impacted Sector (Millions of Dollars)

			Alternative 2				Alternative 3 A				Alternative 3 B			
			Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Program Year Block 7	Agricultural Production	Agriculture	0	0	0	0	0	0	0	0	-5	-3	0	-8
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	-1	-1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	-1
		Trade	0	0	0	0	0	0	0	0	0	-1	-1	-2
	Agricultural Production Total		0	0	0	0	0	0	0	0	-5	-6	-2	-13
	Transfer Revenue Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	0	0	0	0	0	0	0	0	0	0	0	0
		FIRE	0	0	0	0	0	0	0	0	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	0	0	0	0	0	0	0	0	0	1	1
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	0	0	1	1	0	0	1	1	0	0	1	1
	Transfer Revenue Expenditures Total		0	0	1	1	0	0	1	1	0	0	3	3
	Conservation Measure Expenditures	Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
		Construction	4	0	0	4	6	0	0	6	0	0	0	0
		FIRE	1	0	0	1	1	0	0	1	0	0	0	0
		Government	0	0	0	0	0	0	0	0	0	0	0	0
		Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
		Mining	0	0	0	0	0	0	0	0	0	0	0	0
		Other	0	0	0	0	0	0	0	0	0	0	0	0
		Services	0	1	0	1	0	1	1	2	0	0	0	0
		TCPU	0	0	0	0	0	0	0	0	0	0	0	0
		Trade	2	0	0	3	3	0	1	4	0	0	0	0
	Conservation Measure Expenditures Total		6	1	1	8	10	2	2	14	0	0	0	0
	Program Year Block 7 Total		6	1	2	10	10	2	3	15	-5	-6	0	-10

20467