Public Comment
California Ocean Plan SWQPA Amendment
Deadline: 8/31/12 by 12 noon

WATER RECLAMATION
SOLID WASTE MANAGEMENT

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

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GRACE ROBINSON CHAN
Chief Engineer and General Manager

August 31, 2012

RECEIVED
8-31-12
SWRCB Clerk

Via electronic mail & Federal Express

Charles R. Hoppin, Chair, and Members of the Board
State Water Resources Control Board
1001 I Street, 24th Floor
Sacramento, CA 95814

Attn: Jeanine Townsend, Clerk to the Board

Dear Chair Hoppin and Members of the Board:

Comments on the July 25, 2012 Revised Proposed California Ocean Plan Amendment Addressing Implementation of State Water Board Resolutions 2010-0057 and 2011-0013 Designating State Water Quality Protection Areas to Protect State Marine Protected Areas

The Sanitation Districts of Los Angeles (Sanitation Districts) thank you for the opportunity to submit comments regarding the July 25, 2012 revised draft Substitute Environmental Documentation (revised draft SED), including the staff report and proposed amendment (Revised Draft Amendment) to the California Ocean Plan (Ocean Plan), regarding designation of State Water Quality Protection Areas (SWQPAs) to protect Marine Protected Areas (MPAs). Our comments focus on the newly proposed provisions of the Revised Draft Amendment related to municipal wastewater outfalls, and are consistent with comments previously submitted.

Background

The Sanitation Districts are a confederation of 23 independent special districts located throughout Los Angeles County serving the wastewater and solid waste management needs for approximately 5.4 people. For over 87 years, the Sanitation Districts have operated one of the largest regional wastewater collection and treatment systems in the nation, with a service area that covers approximately 820 square miles and encompasses 78 cities and the unincorporated territories of Los Angeles County. Within the greater Los Angeles metropolitan area, the Sanitation Districts operate an interconnected system of sewers and wastewater treatment plants called the Joint Outfall System (JOS), which serves 17 districts, 73 cities, and a population of over 5 million people. The terminal treatment plant in the JOS is the Joint Water Pollution Control Plant (JWPCP), which discharges to an ocean outfall system offshore of White Point on the southern side of the Palos Verdes Peninsula, represents a multi-billion dollar public infrastructure investment. To ensure our operations are protective of public and environmental health, we have conducted over 40 years of comprehensive coastal environmental monitoring along Palos Verdes including the area off South Palos Verdes associated with two recently designated MPAs, the Point Vicente and Abalone Cove State Marine Conservation Areas (SMCAs).

The Sanitation Districts advocated against placement of MPAs off South Palos Verdes for multiple reasons:

- intrinsically low quality habitat,
- presence of a Superfund site as a result of legacy DDT and PCB sediment contamination,
- ongoing sedimentation from the Portugese Bend landslide, and
- new water quality regulation that might be triggered by or as a result of MPA designation, or as a result of SWQPA designation to protect water quality in MPAs, which could negatively impact the Sanitation Districts' JWPCP treatment facility discharge.

The potential that the inappropriate designation of the Point Vicente and Abalone Cove SMCAs over unsuitable, contaminated, sediment-impacted habitat could potentially drive the imposition of new requirements on the JWPCP discharge and result in substantial socioeconomic impacts to the Sanitation Districts' ratepayers is unacceptable to the Sanitation Districts. The Sanitation Districts, in the performance of their fiduciary duties to their ratepayers, wrote a total of 14 comment letters during the Marine Life Protection Act implementation process in the South Coast Study Region and made clear to the California Fish and Game Commission their willingness to challenge the designation of the Point Vicente and Abalone Cove SMCAs on multiple grounds in an effort to mitigate this unacceptable exposure to the Sanitation Districts' ratepayers. Indeed, in August and September 2010, the boards of directors of each of the Districts in the Joint Outfall System adopted the attached Resolution opposing designation of MPAs in areas surrounding the Palos Verdes Peninsula. However, as a result of the State Water Board's adoption of Resolution 2010-0057, the Sanitation Districts placed their opposition to the designations in abeyance in anticipation of adoption of Ocean Plan Amendments consistent with State Water Board Resolution 2010-0057. *See attached December 9, 2010 letter to the Fish and Game Commission.*

The Resolution directed State Water Board staff to prepare an amendment to the Ocean Plan consistent with the Resolution's terms, which included: (a) explicit recognition that State Water Quality Protection Areas (SWQPAs) should not be established over existing wastewater outfalls or the zone of initial dilution of existing wastewater outfalls; and (b) where SWQPAs are established in the vicinity of existing municipal wastewater outfalls, no new or modified limiting conditions or prohibitions can be imposed upon those outfalls based on the SWQPA designation. *See* Resolution No. 2010-0057 at Provision No. 3. The Resolution also very clearly states that it is the State Water Board's intent that "*no new or modified limitations, substantive conditions, or prohibitions will be imposed upon existing municipal wastewater discharge outfalls based on the designation of MPAs other than State Marine Reserves*." *Id.* at Provision No. 4 (emphasis added).

Comments on Revised Draft Amendment

The Sanitation Districts greatly appreciate State Water Board staff's efforts to date to develop the revised draft SED and Revised Draft Amendment consistent with State Board Resolution No. 2010-0057. While the revised documents have generally improved in this respect, newly proposed language in Section E.2. of the Revised Draft Amendment is in direct contravention of Provision No. 4 of the Resolution, which we respectfully request that the Board rectify prior to the State Water Board's adoption of the revised draft SED and Revised Draft Amendment in October 2012.

Section E of the Revised Draft Amendment addresses "Implementation Provisions for Marine Managed Areas," and includes Section E.2., which states, "*The designation of State Marine Parks and State Marine Conservation Areas may not serve as the **sole** basis for* ~~No~~ new or modified limitations, substantive conditions, or prohibitions ~~(beyond those in existing law, regulations and water quality control plans) will be imposed~~ upon existing municipal point source wastewater discharge outfalls ~~based on any MPAs designated as State Marine Parks and State Marine Conservation Areas~~." (emphasis added) By including the word "sole" in the revised version of this sentence, the State Water Board staff has entirely changed the meaning of the language that appears in Provision 4 of the Resolution, which meant to exclude from *any* consideration the designation or presence of MPAs (other than State Marine Reserves) as a basis for "new or modified limitations, substantive conditions, or prohibitions" upon existing municipal wastewater discharge outfalls. Section E.2. now appears to affirmatively support the concept that MPA designations, such as State Marine Parks and State Marine Conservation Areas, may not serve as the sole basis, but could be used in combination with other unspecified factors, to impose "new or modified limitations, substantive conditions, or prohibitions" upon existing municipal wastewater discharge outfalls. This outcome, and the regulatory uncertainty associated with it, is exactly the circumstance the Resolution sought to avoid. For this reason, this provision should be returned to the language of the February 23, 2012 version of the Draft Amendment, or else the word "sole" should be removed from Section E.2. of the Revised Draft Amendment.

Additionally, Section E.2. and Section 5(a)(3) could now be considered in conflict, as the Revised Draft Amendment adheres to the language of the Resolution noted above (Provision 3) for SWQPAs designated in the vicinity of an existing municipal wastewater outfall, confirming that "no new or modified limiting condition or prohibitions" can be imposed based on the SWQPA designation itself. For example, a SWQPA designation overlying a MPA for the purpose of protecting water quality could not result in "new or modified limiting conditions or prohibitions," but the underlying MPA designation could be used in some future action to justify the imposition of "new or modified limitations, substantive conditions, or prohibitions." *Id.* At Sections E.2. and 5(a)(3). This is an illogical outcome.

Inclusion of the "sole" language in Section E.2. is also inconsistent with the findings made in the staff report supporting the Revised Draft Amendment. In Sections 5.6.3. and 5.7.4.1., the staff report describes the significant environmental and socioeconomic impacts of imposing additional restrictions or prohibitions upon existing municipal wastewater outfalls as a result of MPA designations, and concludes that "Because the potential benefit of such actions is limited and the costs associated with additional controls or prohibitions are significant, staff proposed language that excludes the presence or proximity of an MPA as justification to reopen and amend a municipal wastewater treatment plant permit to better protect water quality within the MPA." *See* revised draft SED at pages 38-39 and 41-42. The staff report also notes the substantial investments in existing municipal infrastructure, the disruption of which is discouraged, the low risk that POTW discharges, which are already required to comply with the requirements of the Ocean Plan, present to MPAs, and the fact that the "design and designation of MPAs [by the Fish & Game Commission] was not intended to affect existing, permitted actions granted by other agencies including the State and Regional Water Boards and U.S. EPA." *Id.* No findings were made to justify inclusion of the "sole" language in Section E.2.

Given the express language of the Resolution, inclusion of the word "sole" in Section E.2. is unreasonable under Water Code section 13000. The inclusion of "sole" in Section E.2. is also not supported by findings. This constitutes an abuse of discretion. *See Topanga Association for a Scenic Community v. County of Los Angeles,* 11 Cal.3d 506, 515; *California Edison v. SWRCB,* 116 Cal. App.3d 751, 761 (4th Dt. 1981); *see also In the Matter of the Petition of City and County of San Francisco, et al.,* State Board Order No. WQ-95-4 at 10 (Sept. 21, 1995).

Comments on CEQA Checklist

The CEQA Checklist concludes that the proposed amendment to the Ocean Plan will have no significant impact on the environment nor are cumulative impacts expected. *See* revised draft SED, p. A67. However, the SWRCB failed to reflect the potential environmental impacts of the proposed modifications to the draft Amendment in the CEQA Checklist. In fact, the issue related to Section E.2 raises significant CEQA issues, because allowing the designation of State Marine Parks and State Marine Conservation Areas to serve as the partial basis for new or modified effluent limitations, substantive conditions, or prohibitions means that it would be the SWRCB's Policy that the presence of these designations could trigger new water quality regulation of existing municipal point source wastewater discharge outfalls. New water quality regulation (through new or modified effluent limitations, substantive conditions or prohibitions) would potentially result in the need for upgraded treatment facilities, reduced volume of discharge or other facility modifications.

The Sanitation Districts pointed out the potential environmental impacts that should be assessed in a comment letter dated July 15, 2011 on the Scoping Document for this amendment (attached). The reasonably foreseeable potential environmental impacts that are associated with the Revised Draft Amendment would be extensive, and include but are not limited to:

- Air quality impacts associated with construction due to construction equipment and possibly ongoing operation due to use of emergency generators, turbines, and other facility equipment,
- Biological resource impacts associated with construction, depending on the location of the new facilities.
- Greenhouse gas impacts associated with construction and operation.
- Hydrology and water quality impacts associated with construction due to earth-moving efforts and the generation of sedimentation and erosion.
- Land use and planning impacts associated with operation due to land use and zoning conflicts, depending on facility location.
- Noise impacts associated with construction and operation due to equipment and machinery.
- Transportation impacts associated with construction due to construction worker trips and equipment, and possibly operation due to new employee trips or relocating employees.
- Utilities and Service System impacts associated with new wastewater treatment requirements that exceed those that would otherwise be imposed by the applicable Regional Water Quality Control Board and that would result in the construction of new or upgraded wastewater treatment facilities.

In conclusion, should the proposed modification to the Revised Draft Amendment not be incorporated into the final version that is adopted by the State Water Board, at a minimum, the sections on Air Quality, Biological Resources, Greenhouse Gas Emissions, Hydrology and Water Quality, Land Use and Planning, Noise, Transportation/Traffic, Utilities and Service Systems, and Mandatory Findings of Significance all must be revised to reflect the potential for significant environmental impacts as a result of the Draft Amendment.

The Sanitation Districts thank you for the opportunity to comment on the revised draft SED and Revised Draft Amendment, and request that the proposed modification to the Revised Draft Amendment be incorporated into the final version that is proposed for adoption by the State Water Board.

Very truly yours,

Grace R. Chan

Grace Robinson Chan

GRC:PLF:djm
Enclosures

cc: Assemblymember Mike Eng

SAMPLE (also adopted by Districts 1, 3, 4, 5, 8, 15, 16, 17, 18, 19, 21, 22, 23, 28, 29. 34 & South Bay Cities)

AMENDED
RESOLUTION OF THE BOARD OF DIRECTORS OF COUNTY SANITATION DISTRICT NO. 2 OF LOS ANGELES COUNTY REQUESTING THAT CALIFORNIA FISH AND GAME COMMISSION AND DEPARTMENT OF FISH AND GAME NOT DESIGNATE MARINE PROTECTED AREAS IN ANY AREAS SURROUNDING THE PALOS VERDES PENINSULA

WHEREAS, the County Sanitation Districts of Los Angeles County are 23 separate Sanitation Districts that collectively provide wastewater and solid waste management services to 78 cities and unincorporated areas within Los Angeles County, and serve a population of approximately 5.7 million residents; and

WHEREAS, 17 contiguous Sanitation Districts within the Greater Los Angeles metropolitan area comprise the Joint Outfall Districts and collectively operate the Joint Outfall System, a regional, interconnected system of sewerage facilities that includes an ocean outfall system located off Whites Point on the south Palos Verdes Peninsula; and

WHEREAS, the state Legislature enacted the Marine Life Protection Act (MLPA) in 1999 and determined there was a need to re-examine and redesign California's system of marine protected areas (MPAs) to increase its coherence and its effectiveness in protecting the state's marine life, habitat, and ecosystems; and

WHEREAS, in 2004, the California Resources Agency, the Department of Fish and Game, and the Resources Legacy Fund Foundation created a public-private partnership to implement the MLPA, and set a goal of completing MPA designation by 2011 in each of five separate regions covering the entire coast of California; and

WHEREAS, in 2009, a Blue Ribbon Task Force (BRTF), appointed by the Secretary of Resources to oversee a stakeholder-based process in the South Coast region, submitted an Integrated Preferred Alternative network of MPAs to the Fish and Game Commission that includes two proposed MPAs south of the Palos Verdes Peninsula within two miles of the Districts' ocean outfall system; and

WHEREAS, the proposed MPAs include a portion of the Palos Verdes Shelf Superfund Study Area, which contains sediments highly contaminated with DDT and PCBs; and

WHEREAS, the Portuguese Bend Landslide is located in the vicinity of the proposed MPAs, and, as a result of this natural feature, the marginal intrinsic habitat within the proposed MPAs is further impaired; and

WHEREAS, the State Water Resources Control Board (State Board) is responsible for designation of Water Quality Protection Areas (WQPAs) and the State Board and Regional Water Quality Control Board are responsible for implementation of water quality requirements to protect such areas; and

WHEREAS, the State Board has indicated that WQPAs, with more stringent water quality regulations than are currently in place, will be imposed wherever MPAs are designated; and

WHEREAS, the cost of complying with stricter water quality regulations at the Joint Water Pollution Control Plant will cost from hundreds of millions of dollars to several billion dollars for users of the Joint Outfall System; and

WHEREAS, such costs are not justified for the protection of MPAs containing poor habitat and within a Superfund site with high levels of sediment contamination; and

WHEREAS, placement of MPAs off the West Palos Verdes Peninsula would cause unacceptable socioeconomic impacts to the local and regional communities as determined by the BRTF; and

WHEREAS, the Fish and Game Commission has stated that it intends to adopt a regulation designating a network of MPAs for the South Coast Region by the end of 2010;

NOW, THEREFORE, BE IT RESOLVED, that the Board of Directors of County Sanitation District No. 2 of Los Angeles County opposes the designation of MPAs in any areas surrounding the Palos Verdes Peninsula.

SAMPLE (also adopted by Districts 1, 3, 4, 5, 8, 15, 16, 17, 18, 19, 21, 22, 23, 28, 29. 34 & South Bay Cities)

PASSED AND ADOPTED by the Board of Directors of County Sanitation District No. 2 of Los Angeles County on September 8, 2010.

ATTEST:

Secretary to the Boards

COUNTY SANITATION DISTRICT NO. 2
OF LOS ANGELES

Barbara Calhoun

Barbara Calhoun

Chairperson pro tem

Cities of Alhambra, Artesia, Bell, Bellflower, Bell Gardens, Cerritos, Commerce, Compton, Downey, Long Beach, Los Angeles City, Montebello, Monterey Park, Norwalk, Paramount, Pico Rivera, San Gabriel, South Gate, Vernon, Whittier, and portions of unincorporated Los Angeles County

APPROVED AS TO FORM:

LEWIS, BRISBOIS, BISGAARD & SMITH, LLP

Daniel V. Hyde

District Counsel

WATER RECLAMATION
SOLID WASTE MANAGEMENT

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STEPHEN R. MAGUIN
Chief Engineer and General Manager

July 15, 2011

Ms. Emily Siegel
State Water Resources Control Board
1001 I Street, 15th Floor
P.O. Box 100
Sacramento, CA 95814-0100

Dear Ms. Siegel:

Comments on the Scoping Document for Amendment of the Water Quality Control Plan for Ocean Waters of California to Address State Water Quality Protection Areas and Marine Protected Areas Implementing State Water Board Resolutions 2010-0057 and 2011-0013

The Sanitation Districts of Los Angeles County (Sanitation Districts) would like to express their support and appreciation for the very high priority assigned to the proposal to amend the California Ocean Plan (Ocean Plan) to address State Water Quality Protection Areas (SWQPAs) and Marine Protected Areas (MPAs) and the State Water Board staff's preparation of a Scoping Document that is consistent with State Board Resolutions 2010-0057 and 2011-0013.

The Sanitation Districts operate a major wastewater treatment facility (known as the Joint Water Pollution Control Plant, or JWPCP) that discharges treated effluent through an ocean outfall system off the south coast of the Palos Verdes Peninsula. It serves about 5 million people, represents a multibillion-dollar public infrastructure investment, and is one of the two largest wastewater treatment facilities on the west coast of the United States. The Sanitation Districts have actively participated in the Marine Life Protection Act (MLPA) process in the California South Coast Study Region (SCSR), not only because of their duty to protect the essential public health infrastructure that the Sanitation Districts operate off shore of the Palos Verdes Peninsula, but also because of the decades of comprehensive monitoring that the Sanitation Districts have conducted to ensure the protection of the marine environment. The comments below focus on the portion of the Scoping Document pertaining to Ocean Plan amendments that will be developed in relation to regulation of existing wastewater outfalls that are in the proximity of Marine Protected Areas and State Water Quality Protection Areas.

As stated in the Scoping Document, existing wastewater infrastructure serving much of California's coastal population provides an important public service and represents a substantial public investment in infrastructure that cannot easily be replaced or relocated. It is vitally important that the regulatory policies of the Water Boards be articulated clearly in the Ocean Plan because it will provide local public agencies such as ours with the regulatory certainty necessary to efficiently serve coastal Californians into the future. This amendment also is necessary because of the complexities involved in interpreting the various relevant provisions of the MLPA, the Marine Managed Areas Improvement Act,

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and the Porter-Cologne Act, and the need for clarity about how these statutes will be applied in the future, now that MPAs have been established along much of the State's coastline.

The Sanitation Districts supported adoption of Resolution 2010-0057, which directed staff to prepare an Ocean Plan amendment as described in the Scoping Document, due to our concerns related to potential regulation of our ocean outfall system off the south coast of the Palos Verdes Peninsula triggered by designation of new Palos Verdes MPAs in close proximity to our infrastructure. *(See attached December 9, 2010 letter from the Sanitation Districts to the Fish and Game Commission.)* The same potential exists for impacts to wastewater treatment facilities along the entire California coast.

Without an Ocean Plan amendment to articulate a statewide approach, Regional Water Quality Control Boards (RWQCBs) would be free to impose additional inconsistent discharge requirements on wastewater treatment facilities as a result of an MPA or SWQPA being established in proximity to their discharges. It is reasonably foreseeable that in the absence of an Ocean Plan amendment, additional discharge requirements would in fact be imposed. A no-action alternative to the proposed Ocean Plan amendment could therefore lead to significant environmental impacts as a result of required construction and operation of additional or replacement wastewater treatment facilities needed to comply with new or modified discharge requirements. These significant environmental impacts must be identified and analyzed by the State Water Board in a Substitute Environmental Document (SED) for the proposed Ocean Plan amendments. Similar impacts may occur under some other alternative amendment scenarios that may be developed and analyzed, if additional regulation of existing municipal wastewater outfalls by the State and/or Regional Water Boards is authorized or allowed under those alternatives.

The potential environmental impacts associated with these additional or replacement wastewater facilities would be extensive and would include, but not be limited to:

- Air quality impacts associated with construction due to construction equipment and possibly ongoing operation due to use of emergency generators, turbines, and other facility equipment.
- Biological resource impacts associated with construction, depending on the location of the new facilities.
- Greenhouse gas impacts associated with construction and operation.
- Hydrology and water quality impacts associated with construction due to earth-moving efforts and the generation of sedimentation and erosion, and possibly operation due to relocation of infrastructure (i.e. outfalls and ancillary structures and equipment) for the release of treated wastewater.
- Land use and planning impacts associated with operation due to land use and zoning conflicts, depending on facility location.
- Noise impacts associated with construction and operation due to equipment and machinery.
- Transportation impacts associated with construction due to construction worker trips and equipment, and possibly operation due to new employee trips or relocating employees.

Therefore, the SED must assess, at a minimum, the reasonably foreseeable environmental impacts for the no-action alternative, and potentially other alternatives, to an Ocean Plan amendment as described in the Scoping Document. Further information on these issues is presented in the attached October 15, 2010 letter from the Sanitation Districts to the California Fish and Game Commission. The Sanitation Districts also would be pleased to provide the State Water Board with additional data and information related to the potential environmental impacts upon request.

Thank you for the opportunity to comment on the Scoping Document for the development of this important Ocean Plan amendment.

Very truly yours,
Stephen R. Maguin

Philip L Friess

Philip L. Friess
Department Head
Technical Services

PLF:SMW:cv

Attachments

WATER RECLAMATION
SOLID WASTE MANAGEMENT

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

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STEPHEN R. MAGUIN
Chief Engineer and General Manager

October 15, 2010

Mr. Thomas Napoli
Marine Life Protection Act / South Coast Study Region
Draft Environmental Impact Report
Department of Fish and Game
South Coast MLPA Office
4665 Lampson, Suite C
Los Alamitos, CA 90720

Dear Mr. Napoli:

MLPA CEQA Comments

Thank you for the opportunity to submit comments on the draft environmental impact report ("DEIR") regarding the Integrated Preferred Alternative ("IPA") and other alternatives for the South Coast Study Region ("SCSR"). The County Sanitation Districts of Los Angeles County ("Sanitation Districts") have actively participated in the Marine Life Protection Act ("MLPA") process for the SCSR, not only because of our duty to protect the essential public health infrastructure that the Sanitation Districts operate offshore of the Palos Verdes Peninsula, but also because of the decades of comprehensive monitoring that the Sanitation Districts have conducted to ensure the protection of the marine environment. As a result, the Sanitation Districts have expert knowledge of the marine environment near the Palos Verdes Peninsula.

The Sanitation Districts are a confederation of 23 independent special districts located throughout Los Angeles County serving the wastewater and solid waste management needs for over 5.7 million people. For over 87 years, the Sanitation Districts have operated one of the largest regional wastewater collection and treatment systems in the nation, with a service area that covers approximately 820 square miles and encompasses 78 cities and the unincorporated areas of Los Angeles County. Within the greater Los Angeles metropolitan area, the Sanitation Districts operate an interconnected system of sewers and wastewater treatment plants called the Joint Outfall System ("JOS") that serves 17 districts, 73 cities, and a population of over 5 million people. The terminal treatment plant in the JOS is the Joint Water Pollution Control Plant ("JWPCP"), which discharges to an ocean outfall system offshore of White Point on the southern side of the Palos Verdes Peninsula.

Throughout the MLPA process, the Sanitation Districts have stated our concerns relating to the proposed marine protected areas ("MPAs") offshore of the Palos Verdes Peninsula. The Sanitation Districts also submitted a comment letter dated August 3, 2010, regarding the Notice of Preparation ("NOP") ("NOP comment letter") that provided recommendation about the scope and type of analysis that should be included in the DEIR. Attachment A contains a list of all of the letters we have submitted during the MLPA and CEQA processes, and Attachment B includes copies of our most recent comment letters dated August 3, 2010, February 19, 2010, and March 26, 2010.

None of the Sanitation Districts' comments in the NOP comment letter regarding the scope and type of analysis necessary were reflected in the DEIR. The DEIR failed to analyze or even mention several of the environmental impact issues identified by the Sanitation Districts. In the absence of evidence to support the impact analysis and significance determinations related to air quality, water quality, biology, and hazardous and hazardous materials provided in the DEIR, the Sanitation Districts question whether the California Department of Fish and Game ("DFG") has prepared an adequate DEIR and whether the administrative record contains substantial evidence to support any approval of the proposed action by the Fish and Game Commission.

On September 10, 2010, the Sanitation Districts sent a letter to DFG requesting all letters and scoping comments received in response to the NOP be posted on its website as it had done for the Central Coast and North Central Coast Study Areas. This information is important for the Sanitation Districts and other stakeholders to consider when reviewing the DEIR. DFG staff did not respond to this written request or make these letters and comments available during the review.

This comment letter contains the following sections, which are generally organized according to the sections of the DEIR:

- NOP Comments Not Considered in Preparing the DEIR
- Baseline Conditions and General Analysis (All DEIR Chapters and Sections)
- Chapter 3.0, Project Description
- Section 6.1, Air Quality, and Section 6.2, Global Climate Change and Greenhouse Gas Emissions
- Section 6.3, Water Quality and Oceanography
- Chapter 7.0, Biological Resources
- Section 8.2, Public Services and Utilities
- Section 8.3, Land Use and Recreational Resources
- Section 8.4, Recreational Vessels
- Section 8.5, Hazards and Hazardous Materials
- Chapter 9.0, Cumulative
- Chapter 10.0, Alternatives

Each section identifies information that was requested in the NOP comment letter but not addressed in the DEIR and includes a discussion of statements made in the DEIR that require clarification or additional analysis. The DEIR statements requiring clarification are also summarized in Attachment C. In addition, the Sanitation Districts recently commissioned two technical reports prepared by leading experts to discuss the performance of the proposed Point Vicente State Marine Conservation Area ("Point Vicente SMCA") and Abalone Cove State Marine Conservation Area ("Abalone Cove SMCA") and the effect of the existing Palos Verdes Superfund Site ("PVSS") on the proposed SMCAs. These technical reports are included as Attachment D, An Analysis of the Proposed Point Vicente and Abalone Cove Marine Protected Areas and Attachment E, An Evaluation of the Impacts of the Palos Verdes Shelf Superfund Site on Proposed Marine Protected Areas off the Palos Verdes Peninsula, and are referenced throughout the various sections of this letter.

NOP Comments Not Considered in Preparing the DEIR

Section 15375 of the CEQA Guidelines states that the purpose of the NOP is to solicit guidance from Responsible Agencies, Trustee Agencies, the Office of Planning and Research, and involved federal agencies as to the scope and content of the environmental information to be included in the EIR. The NOP scoping period for the SCSR started June 29, 2010, and ended August 3, 2010. Fifteen days later, on August 18, 2010, the 500-plus page DEIR was released to the public.

Although CEQA does not specify a minimum time for the lead agency to consider and address comments raised during the NOP comment period, release of the DEIR within approximately 2 weeks after the close of the NOP comment period strongly suggests that, contrary to the policy underlying CEQA, DFG made no significant attempt to consider the scoping issues comments (see CEQA Guidelines Sections 15002(j), 15003, 15044, 15082, 15083). Because of the time required to prepare a DEIR of this magnitude, it is obvious that the analyses in the DEIR were completed prior to the end of the scoping period. The DEIR could not adequately address any of the issues raised by the Sanitation Districts or others during the NOP scoping period because there was insufficient time for DFG to consider the issues raised and prepare the appropriate analyses. The specific issues raised by the Sanitation Districts' comments will be addressed separately in this letter.

Since the NOP scoping comments were not considered in the DEIR, and many substantive issues raised by the Sanitation Districts and others identifying potentially significant impacts were not addressed in the DEIR, we believe that the EIR should be revised to include a full discussion of all the substantive issues identified during the NOP scoping period. The revised EIR must provide analyses supported by substantial evidence regarding the significance of the potential impacts identified and, where appropriate, must address any feasible mitigation measures or alternatives that may avoid or substantially reduce the potentially significant impacts.

Baseline Conditions and General Analysis (All DEIR Chapters and Sections)

The CEQA Guidelines require that an EIR include a description of the physical environmental conditions in the vicinity of the project as they exist at the time the NOP is published (CEQA Guidelines Section 15125). The environmental setting normally constitutes the baseline physical environmental conditions by which a lead agency determines whether an impact is significant. Characterization of the baseline is crucial to appropriately disclosing the actual environmental impacts of a project. (*Communities for a Better Environment v. South Coast Air Quality Management District* (2010), 48 Cal.4th 310, 321-322)

As stated in the Sanitation Districts NOP comment letter, the DEIR should have included information characterizing the existing setting to provide a baseline for determining the environmental impacts of MPAs identified in the IPA. Specifically, the existing setting should have been characterized at the proposed Point Vicente and Abalone Cove SMCAs on the Palos Verdes Shelf. This information is important not only for creating a DEIR with a complete and appropriate administrative record demonstrating full disclosure, but also it is fundamental to the impact analysis. The following information should have been included in the water quality and oceanography, biological resources, public services and utilities, and hazards and hazardous materials sections of the DEIR:

- Characteristics of the Portuguese Bend Landslide, Klondike Canyon Landslide, and Abalone Cove Landslide ("PBL").
- Nature (thickness and type) of the sediment within the proposed Abalone Cove and Point Vicente SMCAs due to the PBL.

- Existing turbidity due to the PBL.
- Existing PVSS and the levels of both dicholorodiphenyltricholoroethane ("DDT") and polychlorinated biphenyls ("PCB") within the proposed Abalone Cove and Point Vicente SMCAs.
- Existing levels of DDT and PCB contamination in the bodies of invertebrates, fishes, mammals, and birds within the proposed Abalone Cove and Point Vicente SMCAs.
- Existing fish, mammal, and bird species present (including type and quantity) and their use (e.g., feeding, reproduction, and roosting) of the proposed Abalone Cove and Point Vicente SMCAs, and the Palos Verdes Shelf.
- Existing health risk to invertebrates, fish, mammals, birds, and humans due to DDT and PCB contamination from the PVSS.
- Proximity of the existing ocean outfall system to the proposed Abalone Cove and Point Vicente SMCAs and the volume, direction, duration, concentrations, and other water quality characteristics associated with the release of treated effluent into the Pacific Ocean up-current from these SMCAs.
- Regulatory requirements for operation of the existing ocean outfall system and the existing monitoring and maintenance performed by the Sanitation Districts for the existing ocean outfall system in the proposed Abalone Cove and Point Vicente SMCAs and at the existing outfalls.

An appropriate description of the existing setting or baseline at the proposed Abalone Cove and Point Vicente SMCAs and at the Palos Verdes Shelf would provide a more appropriate impact analysis for the DEIR. This information is not included in the project description of the DEIR, or in any other section of the DEIR. The DEIR failed to establish baseline conditions necessary to analyze the potential environmental impact of the IPA.

Also, DFG failed to collect and analyze the most up-to-date and detailed data available regarding the existing setting. The Sanitation Districts offered in the NOP comment letter to work with DFG and provide the extensive data that the Sanitation Districts regularly collect on the Palos Verdes Shelf. In fact, more than 1½ years ago the Sanitation Districts provided DFG with information to help characterize the baseline for the analysis, which should have been included in the DEIR (e-mail to Brian Owens, May 15, 2009). These reports and scientific publications were again submitted via compact disk in the Districts' February 19, 2010 comment letter to the Fish and Game Commission (Attachment B). None of this data was used in the DEIR, and the Sanitation Districts are not even listed as a reference in the document. This demonstrates that DFG failed to use any of this relevant information to analyze the potential impacts of its IPA.

Chapter 3.0, Project Description

The PVSS is listed on the Cortese List prepared by the Department of Toxic Substances Control;[1] however, DEIR Section 3.1, "Project Location," (Page 3-2) describes the entire Palos Verdes Peninsula

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[1] As identified in the Sanitation Districts NOP comment letter dated August 3, 2010: the NOP should have clearly identified this listing, as required by CEQA Statute Section 21092.6. The Sanitation Districts and the U.S. Environmental Protection Agency (EPA) have previously informed the California Department of Fish and Game (DFG) in comment letters submitted during the MPA designation process that Abalone Cove and Point Vicente are located in a listed Superfund Site. DFG did not disclose this information in the NOP and, therefore, many parties commenting on the NOP were unaware of the fact that DFG was planning to designate the MPA within an area designated as a Superfund Site on the Cortese List. Therefore, DFG should correct this inadequacy and withdraw the DEIR, comply with Section 21092.6 and re-issue the NOP so responsible and trustee agencies and the public can provide appropriate NOP scoping comments regarding the superfund site and the MPA locations. After receiving

and fails to mention the PVSS or the contaminants that currently exist there. Because these existing conditions are omitted from the DEIR, its project description is inadequate.

The project description also inexplicably omits mention of any continuing operation of the White Point ocean outfall system from discussions of the Point Vicente SMCA (Section 3.5.10) and Abalone Cove State Marine Park ("SMP") and SMCA (Section 3.5.11) while mentioning the PVSS remediation program. This omission makes the project description incomplete, in part, because the DEIR does not fully describe the regulations applicable to the project area. As requested by the Sanitation Districts in their November 4, 2009 letter, the following language for both of these SMCAs should be included under "Proposed Modifications of Other Regulated Activities":

> The intent of the MPA is to allow ongoing and future operations associated with the Sanitation Districts of Los Angeles County's White Point Outfall system to continue without restriction. It would be inappropriate to redesignate the Abalone Cove SMCA and the Point Vicente SMCA as a state marine reserve and/or state water quality protection areas (e.g., ASBS) due to the proximity of these locations to the White Point ocean outfall system and the critical need for ongoing operations of this infrastructure to protect the public health of the residents of Los Angeles County.

The language from the November 4, 2009 letter needs to be added to the project description of the DEIR. Also, the project description needs to be modified to accurately reflect baseline conditions including the PVSS and Outfall, and the regulatory setting for the project area.

Section 6.1, Air Quality, and Section 6.2, Global Climate Change and Greenhouse Gas Emissions

The assessment of recreational vessel effects contained in Section 6.1.3.1.1, "Commercial Fishing Vessels and Commercial Passenger Fishing Vessels – All Areas" (Page 6.1-14) identifies a number of speculative assumptions made by DFG in connection with its analysis. These assumptions, while possibly applicable to the North Coast and Central Coast where recreational vessel traffic is more fragmented, are not appropriate for the SCSR. Recreational fishing is the dominant type of vessel traffic in the SCSR, and emissions from recreational fishing vessels should be modeled to provide a more accurate analysis. Data from recreational fishing groups, DFG fishing license and catch statistics, game warden observations, and Ecotrust fishing displacement analysis, should be included in this analysis to provide a realistic description of typical recreational users and a quantitative assessment of impacts associated with these vessels. This requires correction and revision of the analysis of air quality impacts associated with the project's effect of increasing recreational vessel travel as well as its conclusions regarding the significance of this impact.

The analysis of Criterion GHG-1 (Page 6.2-8) does not accurately quantify the increase in greenhouse gas emissions arising from increased recreational vessel traffic. These impacts of inclusion of the proposed Point Vicente and Abalone Cove SMCAs in the IPA must be disclosed and considered.

Attachment C identifies DEIR statements requiring clarification in Section 6.1. DFG's failure to substantiate or clarify these statements makes its analysis of the IPA inadequate pursuant to CEQA Guidelines Sections 15064, 15126.2, and 15151.

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comments to the revised NOP, DFG should modify the DEIR to correct this deficiency and the other deficiencies identified in this letter and in conjunction with the scoping and other comments received in response to that NOP.

Section 6.3, Water Quality and Oceanography

The Sanitation Districts NOP comment letter proposed several additions to the scope of analysis for the DEIR that were based on information we submitted to the Blue Ribbon Task Force ("BRTF") in previous comment letters in February and March 2010. These letters documented that the existing conditions at the Palos Verdes Shelf area are degraded due to the PBL and the PVSS. Based upon these conditions, the analysis was required to include an evaluation of the suitability of the Palos Verdes Shelf for MPA designation, including the effects of DDT and PCB and the PLB on habitat quality and potential MPA performance. No such analysis was included in the DEIR, and it must be revised to address these issues. Specifically, this analysis must include:

- A description of the PBL and water quality characteristics generated by the PBL (e.g., turbidity, sedimentation, etc.) and the impact of these water quality characteristics on the proposed Abalone Cove and Point Vicente SMCAs.
- A description of the existing levels of DDT/PCB in the sediment and water column at the proposed Abalone Cove and Point Vicente SMCAs and at the Palos Verdes Shelf, as well as a quantitative analysis of the impact of these levels on the biological communities of the habitats of these proposed SMCAs (e.g., degraded habitat, only species tolerant of contaminated sediment are supported, reproductive impairment, etc.).

The PVSS is not mentioned in Section 6.3.2.1.4, "Contaminated Sediment," and the reference to a Regional Profile (DFG 2009) does not adequately disclose information on the sediment that has an adverse biological impact in the SCSR. The description of existing conditions in Section 6.3.2.2.3, "Point Dume to Newport Beach (Subregion 3)," of the soft bottom areas adjacent to White's Point and other location at the Palos Verdes Peninsula as "among the most severely impacted" by DDT and PCB sediment contamination neglects to mention that the proposed the Point Vicente and Abalone Cove SMCAs are in this 'severely impacted' area. Neither of these sections contains information regarding the levels of DDT/PCB that currently exist at the PVSS or any description of the location of the PVSS. These omissions make the impact analyses in these sections, as well as the significance conclusions based upon them, inadequate. The DEIR water quality analysis should be redone.

Section 6.3.2.2.3, "Point Dume to Newport Beach (Subregion 3)," also fails to acknowledge that many of the nearshore/offshore areas of Palos Verdes (including both Santa Monica and San Pedro bays) are listed as impaired waterbodies pursuant to Section 303(d) of the Clean Water Act due to DDT and PCB contamination of sediment and/or fish tissue. Specific impaired areas within the IPA proposal include Point Vicente, Abalone Cove, Long Point, and Inspiration Point (SWRCB 2006), none of which are mentioned as "main impaired water bodies of the subregion."

There is no information regarding the PBL in the DEIR discussion of oceanography and water quality. As discussed in Attachment D, the turbidity plume associated with the PBL transports sediment towards Point Fermin to the east and Rocky Point to the northwest following the longshore current and associated longshore transport on the Palos Verdes Peninsula (Hickey 1993). As a result, rocky reefs continue to be buried by sediment in this area. (Pondella D. J., II 2009; Pondella D. J., et al. 2010; USACE 2000) Further, chronic reduced water clarity along the southern face of the Palos Verdes Peninsula due to turbidity from the PBL has been well documented in monthly surveys performed by the Sanitation Districts since 1982. As a result, kelp forest growth and the associated biological communities dependent upon this habitat are impaired relative to similar coastal water habitats without chronic turbidity (Attachment D). The omission of descriptions of the PVSS and the PBL inadequately characterizes the existing environmental setting, and therefore the EIR provides an inadequate and incomplete water quality analysis regarding inclusion of the proposed Point Vicente and Abalone Cove SMCAs in the IPA.

Section 6.3.4, "Water Quality and Oceanography," discusses the PVSS remediation program in the description for the proposed Point Vicente and Abalone Cove SMCAs and concludes there would be no conflict between the designation of the MPAs and the U.S. Environmental Protection Agency's ("USEPA's") remediation program. The analysis also states that since existing discharges or activities "would continue under the proposed Project IPA pursuant to any required federal, state, and local permits, or activities pursuant to Section 630, Title 14, CCR, or as otherwise authorized by the Fish and Game Commission (Commission)," mitigation would not be required. We presume impacts would either not occur or would be less than significant because the impact determination was omitted or excluded from the discussion of Criterion WQ-1. Clarifying language in the Initial Statement of Reasons ("ISOR") was included in the MPA regulations for sites where possible conflicts could occur with activities such as the remediation program. However, as noted on Page 4 of this letter regarding Sections 3.5.10 and 3.5.11, the operation and maintenance of the White Point ocean outfall system (including sampling of biomass and sediment along the Palos Verdes Shelf) was not included in the "Other Regulated Actions" sections of either the proposed Point Vicente SMCA or Abalone Cove SMCA. These existing activities should have been discussed and analyzed for conflicts with the proposed MPA designation, including, without limitation:

- A description of the frequency, duration, and timing of current water quality monitoring by the Sanitation Districts
- A description of the existing effluent discharge characteristics
- An analysis of the impact of existing effluent discharge on the proposed Abalone Cove and Point Vicente SMCAs

Attachment C identifies DEIR statements requiring clarification in Section 6.3. DFG's failure to substantiate these statements makes its analysis of the IPA inadequate pursuant to CEQA Guidelines Sections 15064, 15126.2, and 15151.

Chapter 7.0, Biological Resources

The Sanitation Districts' comment letters dated August 3, February 19, and March 26, 2010 identified existing environmental concerns in the proposed Point Vicente and Abalone Cove SMCAs including the PBL, the PVSS, and their proximity to the existing White Point ocean outfall system. The MLPA EIRs for the other study areas essentially assumed that an MPA designation results in either less than significant impacts or beneficial impacts to the environment because the MPA designation protects an area from environmental impacts that could occur without the designation. This standard approach is not appropriate for impact analysis of the SCSR IPA and, specifically, for the proposed Point Vicente and Abalone Cove SMCAs. The protections afforded by the MPA designation for these areas could attract species to an area of known environmental problems and, therefore, may not result in less than significant impacts or beneficial impacts. Further, a more incisive analysis is required for considering potential impacts for these proposed MPAs. USEPA's Palos Verdes Shelf Interim Record of Decision ("IROD") states that the response action to be taken in the PVSS is necessary "to protect the public health or welfare, or the environment, from actual or threatened releases of pollutants or contaminants into the environment, which may present an imminent and substantial endangerment to public health, welfare, or the environment" (USEPA 2009). The USEPA Montrose Resettlement Program ("MRSP") was established to protect the public from consuming contaminated fish from this area and to reduce contamination intake. The DEIR does not analyze these issues and this omission makes both its impact analysis and significance conclusions insufficient. Specifically, the DEIR conclusion that the IPA will create less than significant environmental impacts to biological resources is not only inadequate and erroneous but potentially endangers public health. This analysis must be redone to address these significant potential impacts.

The Sanitation Districts NOP comment letter identified further studies necessary for a DEIR including the expected changes in populations of the fish species known to bioaccumulate DDT and PCBs and the effects on wildlife species and humans consuming increased amounts of contaminated fish. Analysis of these potential impacts would fully disclose the potential negative effects of the proposed Point Vicente and Abalone Cove SMCAs in the IPA including but not limited to generating more contaminated biomass, biomagnification up the food chain, and increased exposure of wildlife and humans to DDT and PCBs. These potential impacts need to be identified and analyzed to provide full disclosure of potential environmental effects resulting from the IPA and alternatives under CEQA. Specifically, the DEIR should have included the following:

- A description of the existing quantity, variation, and type of invertebrate, fish, bird, and mammal species located in the proposed Point Vicente and Abalone Cove SMCAs and the greater Palos Verdes Shelf in the existing setting
- A description of the existing levels of DDT/PCB in these various species in the existing setting
- A description of the bioaccumulation of DDT/PCB through each species and through the food chain in the existing setting
- A quantitative analysis of the changes in the existing species populations as a result of locating the proposed Abalone Cove and Point Vicente SMCAs in the PVSS (i.e., analyze the relationship between an increase in the population of species [due to the protection offered by Abalone Cove and Point Vicente] and the increased total contaminant load of DDT/PCBs within these increased populations due to bioaccumulation in each species and in the food chain)
- A quantitative assessment of the change in health risk to wildlife and humans from locating the proposed Abalone Cove and Point Vicente SMCAs in the PVSS

Like other sections described above, Section 7 does not include an adequate description of the existing conditions. Section 7.1.2.1.10, "Sandy/Soft Bottom Habitats," (Page 7-28) states that anthropogenic discharge has been associated with the degraded health and quality of soft-bottom habitat, and discloses that studies have found that demersal fish are negatively affected by outfall discharge. Yet no analysis was conducted to assess the significance of the SMCA designations in this area.

In addition, this section does not identify the PVSS or explain its existing conditions and current impacts. Section 7.1.2.1.11, "Hard bottom/Rocky Reef Habitats," does not identify the PBL, which is of anthropogenic origin, or its current impacts on hard bottom/rock reef habitats. Finally, Section 7.1.2.2, "Habitat Restoration Activities," (Pages 7-36 and 7-37) does not discuss the current studies and work conducted by the USEPA to restore the PVSS. Therefore, the existing setting is incomplete.

The DEIR must include a detailed quantitative analysis that will set forth the actual impacts of the designating the Abalone Cove and Point Vicente SMCAs based upon existing environmental conditions at these locations. The DEIR should have analyzed the indirect adverse effects on species that would otherwise benefit from the MPA designation and the impacts associated with re-building fish populations and other species populations in the PVSS. According to the Master List of Species Likely to Benefit from MPAs from the Master Plan for Marine Protected Areas (approved February 2008): "A reduction in removal of a species within MPAs has been shown worldwide to increase abundance, mean size, and reproductive potential of certain fished species." While an increase in fish numbers and sizes is generally regarded as a beneficial effect in most areas, unintended negative effects to the fish, birds, and marine mammals in the Palos Verdes Peninsula area may result from bioaccumulation of DDT and PCBs from existing conditions in that environment. Heal the Bay (2010) advises the public not to consume nine fish species in the proposed MPA areas that are also listed by DFG as likely to benefit from creation of an MPA:

- Top smelt
- Rockfish
- Surf perch
- Black croaker
- Sculpin (scorpion fish)
- Queenfish
- Kelp bass
- Corbina
- White croaker

The DFG website, "Public Advisories on Fish Consumption," also warns against human consumption of species likely to bioaccumulate DDT and PCBs, species that are also listed as benefiting (increasing) from MPAs in the SCSR (DFG 2010). While much attention regarding DDT's impacts has been about human consumption, DDT was originally banned by the federal government because of the near-catastrophic effect of DDT on some bird species, including falcons, eagles, and brown pelicans. All of these species are present within the proposed Point Vicente and Abalone Cove SMCAs. The Science Advisory Team ("SAT") found in its ecological risk assessment of the Palos Verdes Shelf that intermediate risk exists south to southwest of the outfalls as well as northwest of Point Vicente. Specifically, the aquatic water quality criterion is not met for DDT in these areas. White croaker, kelp bass, and sanddabs on the Palos Verdes Shelf generally exceed the DDT no observable effects concentration ("NOEC").[2] DFG has found that white croaker and kelp bass benefit from the MPA designations.

Attachment D summarizes the results of the models used for analysis of the IPA that were performed by the UC Davis ("UCD") and UC Santa Barbara ("UCSB") modeling research groups. These models utilized spatial data on habitat, fishery effort, and proposed MPA locations (in the IPA) to simulate population dynamics of fished species (n = 8) and to generate predicted spatial distributions of species abundance and fishery yield. These analyses resulted in a calculation of long-term equilibrium estimates of conservation value (i.e., biomass) and economic value (i.e., fishery yield and profit). Results are averaged across all 8 species used for analysis, which are ocean whitefish, black surfperch, opaleye, kelp bass, kelp rockfish, sheephead, red urchin, and halibut. Appendix B3 in the MLPA master plan contains additional detailed parameter values and literature sources for each estimate (life history information in model). A closer evaluation of the model and research indentifies two potential issues with the analysis: (1) the assumptions used for modeling may not be accurate or appropriate for the Point Vicente and Abalone Cove SMCAs, and (2) further analysis of the effects of locating these two proposed MPAs within the DDT/PCB PVSS is necessary if the results of the model are correct. Details regarding these two potential issues are discussed below.

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[2] The NOEC for fish is 1,900 microgram/kilogram whole body tissue for DDT.

(1) As discussed in Attachment D, the modeling did not account for deleterious impacts on growth and reproduction due to contamination with DDT and PCBs or the effects of the PBL on the habitat at the Point Vicente and Abalone Cove SMCAs. The modeling treats all rocky reef habitats as equal and does not account for variations in habitat quality due to turbidity or reef burial (associated with the PBL). As discussed above in connection with DEIR Section 6.3, empirical evidence exists that the sedimentation of PBL has an impact on the water column and water quality off the coast of the Palos Verdes Peninsula. This sedimentation results in the degradation of reef habitat and has had significant biological consequences. Furthermore, modeling assumed that the Abalone Cove SMCA biological metrics (i.e., biomass) were the same as those for the proposed Point Vicente SMCA. This over-emphasizes the value of this PBL-degraded habitat. Finally, there is a disconnect between the model inputs and realistic empirical data. The biomass estimates are dated and not fine-scaled enough to make realistic assumptions of relative biomass estimates. Therefore, the models may be over estimating the effect of the two MPAs when compared to the other MPAs, thus presenting an inflated benefit to the overall IPA.

(2) The effect of these two locations on total biomass compared to the overall array of MPAs in the IPA is very small (Attachment D). However, when modeling the efficiency of the two MPAs (a measure of the efficiency of the MPA at increasing biomass), the results indicated the two areas would greatly increase the overall biomass (assuming no deleterious impacts on growth and reproduction due to contamination with DDT and PCBs). If this model is correct, these two areas would be efficient at generating fish that are susceptible to the uptake of DDT/PCB (surfperch, rockfish, kelp bass). These fish would propagate and then spread to other non-contaminated areas where humans could catch them. Further, the protected areas may become a magnet for picivorous birds and mammals that would consume these more highly contaminated fish and increase the potential risk to humans and wildlife. The DEIR failed to evaluate these potential impacts, resulting from the models used in the analysis, from the establishment of MPAs off the Palos Verdes Shelf.

Attachment C identifies DEIR statements requiring clarification in Section 7.0. For example, the analysis and findings under "Potential Impact BIO-4: Impacts on Special-status Marine Species Resulting from Removal or Modification of Existing MPAs" are incomplete and unsubstantiated. Specifically, the analyses of the bald eagle, golden eagle, American peregrine falcon, and brown pelican (Section 7.1.3.3, Pages 7-75 and 7-77) do not mention the potential indirect or direct effects of bioaccumulation of DDT in the food chain that would result from the designation of the proposed Point Vicente and Abalone Cove SMCAs. All of these birds have been affected in the past by legacy DDT contamination. Although the MSRP is enhancing their status by restricting further access to DDT, the opposite result is likely under the IPA. Protection of the species in areas with large legacy DDT deposits would facilitate further dispersal of the DDT. Fish would eventually be forced to leave the proposed MPAs (as discussed above) and would take the body burden of the DDT they acquired with them. The net result would be a wider dissemination of increased DDT body burden through contaminated fish. The biomagnification of this contamination would increase the chances for additional DDT exposure in marine mammals and birds feeding on the contaminated fish and ultimately increased DDT exposure for raptors scavenging carcasses found on beaches. Tests of such food sources and the predators that feed on them have shown high body burdens of DDT and its metabolites in tissues (Blasius and Goodmanlowe 2008; NOAA/EPA 2007). Therefore, the analysis in the DEIR of these special-status species is incomplete, and the findings are unsubstantiated.

Section 8.2, Public Services and Utilities

Sanitation Districts' NOP comment letter indicated that the DEIR should have discussed the reasonably foreseeable future need for new public service facilities in the service area. Although the DFG proposed project "protects" existing activities such as the Sanitation Districts' Publicly Owned Treatment Works (POTW) discharges by allowing all permitted related activities, the DFG action would not limit the State Water Resources Control Board's (SWRCB's) authority to impose additional water quality standards on the Sanitation Districts' discharge as a result of an MPA being placed in proximity to that discharge. In Table 3.3 of the DEIR, the SAT level of protection specified for the Point Vicente and Abalone Cove SMCAs is very high and high respectively. For the Point Vicente MPA this is the highest level of protection the same as specified for a State Marine Reserve. Because the SWRCB has specifically stated that it would revise all existing ocean discharge permits pursuant to DFG's MPA designation (see below), the DEIR should have analyzed the indirect effect of the MPA designation upon the need for and impacts on new sanitation facilities. Since these indirect impacts have less to do with water quality and more to do with impacts associated with relocating existing facilities and building new facilities, it is appropriate to discuss them in the public services and utilities section of the DEIR. As stated in Appendix G of the State CEQA Guidelines, the lead agency should address how the proposed project would:

> Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

As discussed in the Sanitation Districts' February 19, 2010, and March 26, 2010 comment letters, a reasonably foreseeable indirect effect of including the proposed Point Vicente and Abalone Cove SMCAs as part of the IPA is the restriction of the discharge from the Sanitation Districts' White's Point ocean outfall system. Specifically, the SWRCB has stated that the designation of new state water quality protection areas (SWQPAs) to protect water quality in MPAs will occur sometime in the near future as a result of the completion of the updated statewide MLPA network (SWRCB pers. comm.; SAT 2009). Therefore, the DEIR should have included a detailed analysis of the extent of the MPA restrictions on the Sanitation Districts' White's Point ocean outfall system and the potential for the MPA designation to ultimately cause the requirement to construct new facilities to increase the level of treatment and/or a reduction in volume of discharge to the ocean. If this analysis leads to a conclusion that the Sanitation Districts would need to increase or change treatment streams or reduce the volume of discharge, the DEIR needs to include at least at a qualitative level analysis of the potentially significant impacts associated with construction and operation of the new facilities. The new facilities could include modifications or additions to the facilities at the Sanitation Districts' JWPCP or new upstream water reclamation plants. Impacts associated with these new facilities would be extensive and would include, but not be limited to:

- Air quality impacts associated with construction due to construction equipment and possibly operation due to emergency generators, turbines, and other facility equipment.
- Biological resource impacts associated with construction depending on the location of the new facilities.
- Greenhouse gas impacts associated with construction and operation.
- Hydrology and water quality impacts associated with construction due to earth-moving efforts and the generation of sedimentation and erosion, and possibly operation due to new locations for the releases of discharge.
- Land use and planning impacts associated with operation due to land use and zoning conflicts, depending on facility location.
- Noise impacts associated with construction and operation due to equipment and machinery.

- Transportation impacts associated with construction due to construction worker trips and equipment, and possibly operation due to new employee trips or relocating employees.

DFG did not accept the Sanitation Districts offer in the NOP comment letter to assist with the analysis of these reasonably foreseeable impacts. Section 8.2.2, "Environmental Setting," (Page 8.2-7) states that establishment of MPAs within the SCSR would not have an impact on existing utilities and discharge locations within the proposed MPAs, and these facilities would continue to operate based on existing permit conditions. However, it is reasonably foreseeable that, as a result of the MPA, the SWRCB/regional water quality control board (RWQCB) will alter the discharge requirements applicable to the Sanitation Districts' facilities and thereby impact the public services they provide. The public services and utilities section does not discuss these potentially significant impacts. Because it lacked any analysis of these impacts, that section also did not include any mitigation measures to reduce significant public service impacts.

Attachment C identifies statements requiring clarification in Section 8.2. DFG's failure to substantiate these statements makes its analysis of the IPA inadequate pursuant to CEQA Guidelines Sections 15064, 15126.2, and 15151.

Section 8.3, Land Use and Recreational Resources

Appendix G of the State CEQA Guidelines states that, in addressing land use in environmental documentation, the lead agency should address how the proposed project would:

> Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction of the project (including but not limited to the general plan, specific plan, local coastal program, or zoning ordinance adopted for the purpose of avoiding or mitigating and environmental effect).

The DEIR, in order to meet this requirement, should have included an analysis in its DEIR land use section of the potential inconsistency between the MLPA's regional goals and objectives and whether they would be achieved by locating the proposed Abalone Cove and Point Vicente SMCAs within the PVSS. The purpose underlying the MLPA was to reduce the removal of species within MPAs through over-fishing and other anthropogenic activites (i.e., avoiding or mitigating an environmental effect). However, the MPA designation could conflict with USEPA's response action as documented in the IROD, along with the policies, plans, and regulations of other agencies , because of the potential release of additional toxins into the food chain and environment and other issues discussed in the Sanitation Districts' comments to Sections 6.3 and 7.0, above. Under CEQA, the analysis of land use consistency is always linked to physical environmental effects resulting either directly or indirectly from the proposed action and alternatives (CEQA Guidelines Sections 15002(g), 15126.2, 15358, 15382). Disclosure of the inherent conflict between the MLPA goals and objectives and the proposed designation of Point Vicente and Abalone Cove as MPAs should have been included in the DEIR and should have been studied in connection with the environmental impacts disclosed in the other sections of the DEIR (e.g., water quality and oceanography, and biological resources) to determine if the inherent conflict presents a significant physical environmental effect. If so, the conflict must be deemed significant and alternatives or mitigation must be sought to avoid or substantially reduce this impact.

Attachment C identifies statements requiring clarification in Section 8.3. For example, in Section 8.3.3.3, the DEIR states, "The proposed Project IPA is consistent with the policies contained in the California Coastal Act." The significance conclusion is not supported by substantial evidence because it is an assumption made on only a portion of the facts. There are policies that are relevant to the proposed project that were omitted in the analysis and are detailed in Attachment C. DFG's failure to substantiate these statements makes its analysis of the IPA inadequate pursuant to CEQA Guidelines Sections 15064, 15126.2, and 15151.

Section 8.4, Recreational Vessels

Attachment C identifies statements requiring clarification in Section 8.4. For example, the analysis of Criterion VT-1 seems to be contradictory to the analysis of VT-2 and seems to lack specific evidence. Details related to these two criteria are discussed in Attachment C. DFG's failure to substantiate these statements makes its analysis of the IPA inadequate pursuant to CEQA Guidelines Sections 15064, 15126.2, and 15151.

Section 8.5, Hazards and Hazardous Materials

The DEIR states that while there are areas within the Southern California Bight that have been identified as having contaminated sediments the designation process of the MPAs has avoided known contaminated sediment areas. This statement is not correct. The proposed designations of the Point Vicente and Abalone Cove SMCAs are located in the PVSS where DDT and PCB impacts currently create a hazard to the public, wildlife and the environment (USEPA 2009). The possibility of toxic biomass migration of fish gestating in larger numbers within these proposed SMCAs entirely contradicts the assumption that the designations would not create hazards to the public or the environment. These potentially significant impacts have not been analyzed in the DEIR.

The NOP comment letter indicated the designation of Abalone Cove and Point Vicente SMCAs within the PVSS should have been analyzed for impacts on both marine life and humans. In addition, the letter recommended that the existing setting and analysis discussions in other relevant sections such as Chapter 7.0, "Biology," and Section 6.3, "Water Quality and Oceanography," be cross-referenced with the hazard and hazardous materials section, as this would provide appropriate context and an interdisciplinary approach to the analysis. However, Section 8.5, "Hazards and Hazardous Materials," does not adequately address the hazardous issues of the PVSS or cross-reference analysis in any other chapters. It fails to adequately describe the existing setting, and it fails to reach impact determinations based on correct, factual, substantial evidence.

Section 8.5.2.1.1, "Sediment Contamination within the Regional Water Quality Control Board Los Angeles Region," (Page 8.5-8) describes a health advisory warning only for ingestion of the white croaker. The most recent consumption guidance includes restricted consumption for more than a dozen species. The existing setting must be updated to include this information.

Section 8.5.2.2, "Superfund Sites," confuses the effluent affected sediment deposit (a clearly identifiable feature composed of JWPCP discharge solids buried by cleaner sediment) with the extent of the sediment contamination. The DEIR incorrectly states that the site is located over one (1) mile offshore in 150 feet (45 meters) or more of water. The USEPA has identified the zone of sediment contamination much more broadly than the area of the effluent-affected sediment deposit. Studies in 1992 for the Natural Resource Damage Assessment ("NRDA") (Lee 1994) indicated that a 5-cm to 60-cm-thick elliptical shaped, deposit of effluent-affected sediment extended over most of the shelf and slope from White Point to Point Vicente. As described in the USEPA IROD, the shore side of the deposit ends relatively sharply at the 30-m depth contour, while the ocean side extends over the Palos Verdes Shelf break to the mid- to lower slope. Cross-shore, the thickest part of the EA deposit extends along the 60-m isobath. Along-shore, the deposit is thickest (60+ cm) near the 90-inch outfall. It thins rapidly toward the southeast, just exceeding 15 cm a kilometer from the outfall. It tapers much more gradually toward the northwest. About 12 km northwest from the outfalls, the effluent-affected deposit is still 25 cm thick. The contamination levels in 2002/2004 are shown throughout the Palos Verdes Shelf in Figures 1-8 and

1-9 (DDT and PCB respectively) of the USEPA Palos Verdes Shelf Feasibility Study (May 2009). The PVSS extends from shore to 200 meters deep with the areas with contamination levels of the most concern beginning in about 30 meters of water. The existing setting discussion of the PVSS inaccurately characterizes the extent of sediment contamination and does not discuss the levels of contamination within the site at all.

The analysis contained in Section 8.5 does not consider the potential hazards associated with locating the proposed Point Vicente and Abalone Cove SMCAs within the PVSS. Specifically, "Criterion HAZ-9: Have environmental effects which will result in substantial adverse effects on human beings," is focused solely on the displacement of commercial and recreational vessels from areas where it is safe to eat the fish to areas where it is unsafe and/or not advised to eat the fish (e.g., the Palos Verdes Peninsula). While this impact may occur under Criterion HAZ-9 as a result of the proposed project, the analysis completely ignores the possibility that designation of the Point Vicente and Abalone Cove SMCAs would result in a hazard to human beings, directly or indirectly, through the movement of contaminated biomass (e.g., fish) from these MPAs to other locations. DDT present in the PVSS contaminated layer of sediment still exchanges with the ocean water, as demonstrated by DDT concentrations in the water and in the tissues of local marine animals (Attachment E). Numerous studies over the last several decades have documented the accumulation of DDT and PCB in marine animals of the Palos Verdes Shelf, particularly with fish (Attachment E). Fish frequenting the area of legacy deposits have elevated body burdens of toxicants as a function of their location, and that the level of toxic body burden for fish decreases the farther they get from "hot spots" (CSDLAC 2010). As discussed above, the proposed Abalone Cove and Point Vicente SMCAs have the potential for relatively high biomass production efficiency when compared to other MPAs. Therefore, they will, in theory, likely generate numerous fish of larger size. However, due to the bioaccumulative nature of DDT and PCBs, these fish would also carry a larger contaminant load from the PVSS than the same population of fish without MPA protection. These fish would then migrate outside the MPA boundaries to adjacent nontoxic areas. This result is inconsistent with the MSRP's goal of limiting public exposure to elevated tissue burdens of toxic materials through not-take and limited take zones and public education. This result is also inconsistent with the policies underlying the USEPA IROD. The USEPA's evaluation of human health and ecological risks determined that existing conditions exceed ambient water quality objectives and pose a threat to human health and the ecosystem. Consequently, the USEPA decided that simply allowing natural processes to remedy the threat of DDT and PCB to the local marine ecosystem and human health was insufficient. Finally, none of this information is addressed or analyzed under Criterion HAZ-9.

The mitigation measure included in the DEIR (Page 8.5-20) does not address the issue of fish behavior and the migration of contaminated fish. The mitigation measure reads as follows:

> The state has issued Safe Eating Guidelines for Fish from Coastal Waters of Southern California: Ventura Harbor to San Mateo Point (OEHHA 2009). The public has been notified through the Department website and in the written regulations books distributed to fisherman of these known risks. Should OEHHA notify the Department of further health advisories, the Department will amend the information in the regulatory booklets and the website to reflect these changes.

The location of the proposed MPAs would increase the average tissue concentration in individual fish and the overall contaminated biomass in these areas. This biomass would be expected to spillover from the MPAs, thus altering the geographic distribution of contaminated fish into areas that are not currently contaminated. Further, current fish consumption advisories are based upon fish tissue contaminant concentrations prior to MPA protection and may be rendered ineffective at protecting public health when MPA protection increases the average tissue concentration of these species. MPAs over the PVSS would, therefore, potentially increase exposure to the public of the contaminated food source and actually compromise the proposed mitigation measure. Although Criterion HAZ-9 would have been an appropriate location to discuss the migration of toxic biomass, no discussion of this potential impact is contained in that criterion. The conclusion that this potential impact is less than significant with mitigation is not supported by a complete analysis and is therefore unsubstantiated.

DEIR statements requiring clarification are identified in Attachment C. The most egregious unsubstantiated statement in the DEIR occurs in this section on Page 8.5-17:

> Criterion HAZ-4: Be located on a site, which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create significant hazard to the public or the environment.
>
> There are areas within the Southern California Bight that have been identified on lists compiled pursuant to Government Code Section 65962.5 as having contaminated sediments. Many of these sites are currently undergoing assessment, monitoring and remediation. The designation process of the MPAs has avoided known contaminated sediment areas. MPAs could be located in areas where contaminated sediments exist, but have not been identified. However, the designations of the MPAs would not create a hazard to the public or the environment. Therefore, there would be no impact.

This "no impact" statement is incorrect. The proposed Point Vicente and Abalone Cove SMCAs are located in the PVSS, which is designated as a superfund site. Furthermore, the PVSS is listed on the Cortese List, which is one of the lists compiled pursuant to Government Code Section 65962.5. The MPAs are located in areas where DDT has been recorded between 0 and 10 mg/kg, and PCB has been recorded between 0 and 1.5 mg/kg in up to 2 centimeters of sediment (USEPA 2009). Furthermore, at least the upper layers of contaminated material will likely remain within 5–10 centimeters of the surface of the seabed for the foreseeable future, due to the shift of fully secondary treatment at the JWPCP in 2002 and the lack of particulate matter currently deposited (Attachment E). The possibility of toxic biomass migration of fish gestating in larger numbers within MPAs, as described above, entirely contradicts the assumption that the designations would not create hazards to the public or the environment. Therefore, that conclusion is entirely unsubstantiated. Unsubstantiated statements result in inadequate analysis and are not appropriate in a DEIR per CEQA Guidelines Sections 15064, 15126.2, and 15151.

Chapter 9.0, Cumulative

CEQA Guidelines Section 15130 discusses the type and scope of cumulative analysis required in an EIR. A "cumulative impact" is an impact created as a result of the combination of the project evaluated in the EIR together with other projects causing related impacts. (CEQA Guidelines Section 15355.) The discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence, and that discussion should be guided by the standards of practicality and reasonableness and should focus on the cumulative impact to which the identified other projects contributed.

One reasonably foreseeable cumulative project in the bight is USEPA actions associated with the IROD. In Section 9.3.6.2 Montrose Settlements Restoration Program the discussion ends with:

> In 2005 the resource trustee agencies identified above prepared a joint programmatic Environmental Impact Statement (EIS)/EIR for the proposed restoration effort. In 2006, the Department issued a Notice of Determination stating that the restoration program

would not have a significant impact on the environment, and approving the project (Department 2006).

It is unclear from this description whether this is referring to the USEPA signed IROD discussed in the USEPA letter to the California Fish and Game Commission dated February 18, 2010. The IROD specifically identifies the type of future activities USEPA will conduct to remediate the superfund site. Some of these activities involve capping contaminated sediments on the Palos Verdes Shelf, which may result in temporary resuspension of some of the contaminated sediments, disruption of the benthic community and increased turbidity (Attachment E). These impacts would likely have an effect on the function of the MPAs and could result in significant cumulative effects (Attachment E). None of this is discussed in the cumulative impact chapter. While the area is expected to recover from the disturbance in less than ten years, the estimated dates of achieving the objectives under the USEPA preferred alternative are 2023 for the water and 2039 for the sediment. The IROD and these activities should be described in the cumulative section for a complete identification of the future actions that may have a cumulative effect when combined with the proposed project.

The DEIR should also have analyzed two additional reasonably foreseeable projects within Southern California that may have cumulative impacts in the cumulative project chapter. The first project is the reasonably foreseeable circumstance of the RWQCB establishing SWQPAs in these coast areas as described in the Ocean Plan. The likelihood of this action is shown not only through communications between the Sanitation Districts and the SWRCB but also by the record of the MPA process. SAT's Draft Recommendations for Considering Water Quality and Marine Protected Areas in the MLP South Coast Study Region (SAT 2009) states that one potential MPA designation implementation strategy to protect and restore water quality is to inform the water boards of potential water quality concerns for MPAs, since the SWRCB and the RWQCB have the primary responsibility for regulating water quality. For example, the regional water boards may recommend to the State Water Resources Control Board the designation of additional state water quality protection areas ("SWQPAs"), or work on priority total maximum daily loads that could restore water quality in MPAs" (SAT 2009). The analysis needed to include the associated potential cumulative environmental effects resulting from the placement of MPAs in and around the White's Point ocean outfall system. The second project is the Long Beach Terminal Island Rail Project, which would create efficiencies in the rail system and remove an at-grade crossing by filling sections of the harbor. This project was omitted from the cumulative projects list and needs to be included in the analysis.

Chapter 10.0, Alternatives

A DEIR should describe the rationale for selecting the alternatives analyzed in the DEIR, identify any alternatives that were considered by the lead agency but were rejected as infeasible during the scoping process, and explain the reasons underlying the lead agency's decision. (CEQA Guidelines Section 15126.6.) Among the factors that may be taken into account when addressing the feasibility of an alternative are: site suitability, economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, and jurisdictional boundaries. (*Id.*) The Sanitation Districts' comment letters provided the BRTF and DFG with evidence of the infeasibility of creating MPAs on the Palos Verdes Shelf. The Palos Verdes Shelf is not suitable location for MPAs because of the PBL, the PVSS, and its proximity to the existing White's Point ocean outfall system. Further, the two proposed locations on that shelf are not suitable because they do not satisfy the scientific guidelines identified in the MLPA Master Plan for Marine Protected Areas. For these reasons, the Sanitation Districts' NOP comment letter requested that the DEIR alternatives analysis chapter must fully describe a scientific basis for including the proposed Abalone Cove and Point Vicente SMCAs in the IPA. However, the DEIR alternatives analysis section does not provide any information regarding the feasibility of the alternatives or the scientific rationale for including either of these proposed MPAs in the IPA. Although Section 2.0

of the DEIR describes the process regarding how the IPA was developed and Section 3 lists the objectives and detailed project description, the DEIR does not provide either a discussion of the feasibility of or scientific rationale for including either the proposed Abalone Cove SMCA or Point Vicente SMCA.

While CEQA requires the lead agency to assess the potential significant impacts of a proposed action and not necessarily the underlying value of the action itself, the failure of the proposed action to meet the goals or objectives specified by the lead agency suggests that it has failed to properly screen alternatives to the proposed project. The goals and objectives of the MLPA relate to the protection of marine life populations and ecosystems. The goals and objectives of the MLPA are inconsistent with the inclusion of the proposed Abalone Cove and Point Vicente SMCAs in the IPA. Attachments D and E, and Table 1 present substantial factual and scientific evidence showing that the effects of designating these two areas as MPAs will be inconsistent with the stated goals and objectives of the MLPA. Inclusion of these proposed MPAs in the IPA subverts these goals and objectives because of: (1) the existing site conditions at the PVSS and PBL; (2) deficiencies in the type, size, and level of protection of desirable habitats within these MPAs; and (3) the ongoing discharge of treated wastewater adjacent to these sites.

Table 1. Analysis of Goals and Objectives Relative to Point Vicente and Abalone Cove

Goal	Objective	Analysis
Goal 1: To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems ***Goal 2: To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.***	Objective 1: Protect and maintain species diversity and abundance consistent with natural fluctuations, including areas of high native species diversity and representative habitats. Objective 1: Help protect or rebuild populations of rare, threatened, endangered, depressed, depleted, or over-fished species, and the habitats and ecosystem functions upon which they rely.	The proposed Point Vicente and Abalone Cove SMCAs are predominantly deep sand habitat, which does not support high native species diversity. Several depleted and overfished species of interest in the Palos Verdes Shelf region (black sea bass, kelp bass, barred sand bass, white sea bass, red urchin, sheephead, spiny lobster, etc.) occur within shallow rocky habitats; however, little of this habitat occurs within the proposed Point Vicente and Abalone Cove SMCAs. In addition, the persistent kelp beds in these MPAs do not satisfy SAT habitat guidelines. Persistent kelp beds provide key habitat for a large percentage of the depressed and depleted species along Palos Verdes and in the Southern California Bight. Locating these MPAs within a superfund site puts achievement of these goals and objectives at risk. In practical terms reduced abundances of marine organisms will result in lower productivity in the ecosystem and reduced species diversity will result in reduced ecosystem function. The capping operations proposed for remediation of the PVSS increase the chances of further reductions in diversity in the next decades.
Goal 2: See text above.	Objective 2: Sustain or increase reproduction by species likely to benefit from MPAs, with emphasis on those species identified as more likely to benefit from MPAs, and promote retention of large, mature individuals.	Species more likely to benefit from MPAs include bocaccio, giant sea bass, broomtail grouper, canary rockfish, pink/green/white/black abalone, and purple hydrocoral, all of which occur on or near shallow rock habitat within this region. The proposed Point Vicente and Abalone Cove SMCAs protect mostly deep sand habitat and, therefore, are unlikely to increase or sustain

		these species. In addition, these MPAs have less reef habitats than recommended and so provide less opportunity to protect these species, which have an adult home range greater than the MPA boundaries. These MPAs are proposed in areas with reproductive toxins exceeding screening levels established by the USEPA that biomagnify up the food web which compromises this goal and supporting objectives. Rebuilding populations, especially large, mature individuals, would have an adverse affect due to likely bioaccumulated and biomagnified DDT/PCB.
Goal 1: See text above.	Objective 2: Protect areas with diverse habitat types in close proximity to each other.	The proposed Point Vicente and Abalone Cove SMCAs would not protect deep rock or hard bottom habitat, which is a key habitat that supports the greatest biodiversity. In addition, these MPAs do not capture the persistent kelp habitat, which has become increasingly rare in the SCSR over the past 50 years. Therefore, there is no replication of these key habitats within these two MPAs or the IPA. In addition, the soft bottom habitat, which encompasses the majority of this SMCA cluster, is much less diverse than shallow rock habitat.
	Objective 4: Protect biodiversity, natural trophic structure and food webs in representative habitats.	
Goal 4: Protect marine natural heritage, including protection of representative and unique marine life habitats in CA waters for their intrinsic values.	Objective 1: Include within MPAs key and unique habitats identifies by the MLPA Master Plan Science Advisory Team for this study region.	
	Objective 2: Include and replicate to the extent possible [practicable], representatives of all marine habitats identified in the MLPA or California Marine Life Protection Act Master Plan for Marine Protected Areas across a range of depths.	

Goal 3:Improve opportunities provided by marine ecosystems that are subject to minimal human disturbance.	All three objectives.	The Palos Verdes Shelf has been highly disturbed by the presence of DDT/PCB at the superfund site, and will continue to experience disturbance during remediation activities over the coming decade, or longer. In addition, the PBL continues to have an adverse impact on the habitat proposed for the Abalone Cove SMCA.
Goal 5: To ensure that south coast California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines.	Objective 3: Effectively use scientific guidelines in the California Marine Life Protection Act Master Plan for Marine Protected areas.	None of the spacing guidelines are met for the proposed Point Vicente and Abalone Cove SMCAs or for key habitat types in the region. In addition, these MPAs barely meet the size guideline for MPAs as identified by the SAT. These SMCAs are also located near outfalls, planned EPA remediation activities and the turbidity and sedimentation of the PBL. All three of these conditions are not consistent with the SAT guidance for this area.
	Objective 5: Include simple, clear, and focused site-specific objectives/rationales for each MPA and ensure that site-level rationales for each MPA are linked to one or more regional objectives.	

The Sanitation Districts request that the Fish and Game Commission and staff carefully consider the issues raised in this letter. The Sanitation Districts are responsible to more than 5 million people to protect essential public health infrastructure from unintended impacts resulting from the MLPA process. We strongly recommend that the DFG complete its obligations under CEQA to address the issues raised in this letter and the NOP scoping letter, to fully disclose the significant impacts associated with including the proposed Abalone Cove and Point Vicente SMCAs as part of the IPA or any other recommended project.

Thank you for consideration of our comments. We look forward to providing further assistance and information in connection with the preparation of the environmental documentation for this project.

Very truly yours,

Stephen R. Maguin

Philip L. Friess

Philip L. Friess
Department Head
Technical Services

PLF:TDD:mh

Attachment A	List of Comment Letters Submitted by the Sanitation Districts During the SCSR MPA Process and CEQA Process
Attachment B	Letters Submitted by the Sanitation Districts on August 3, 2010 (NOP comment letter), March 26, 2010, and February 19, 2010
Attachment C	DEIR Statements Requiring Clarification
Attachment D	An Analysis of the Proposed Point Vicente and Abalone Cove Marine Protected Areas
Attachment E	An Evaluation of the Impacts of the Palos Verdes Shelf Superfund Site on Proposed Marine Protected Areas off the Palos Verdes Peninsula

cc: Fish and Game Commissioners

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Attachment A

List of Comment Letters Submitted by the Sanitation Districts During the SCSR MPA Process and CEQA Process

- Avoid Areas of Wastewater Impact, March 3, 2009
- Methods to Evaluate MPA Proposals: Water and Sediment Quality, April 4, 2009
- Analysis and Proposal of MPAs, April 23, 2009
- Alternative Proposal for MPAs, April 24, 2009
- SAT Special Evaluation of MPA Placement, April 24, 2009
- Comments to the Master Plan Science Advisory Team, August 26, 2009
- Comments Opposing the Abalone Cove SMCA, October 9, 2009
- Opposition to Abalone Cove SMCA, November 4, 2009
- Opposition to Adoption of Abalone Cove SMCA, November 30, 2009
- Opposition to Proposed MPAs – Integrated Preferred Alternative, February 19, 2010
- Opposition to Proposed MPAs in South Palos Verdes, March 26, 2010
- Comments at NOP Scoping Meeting, July 23, 2010
- NOP Comment Letter, August 3, 2010
- Request for Extension of Review Period, August 24, 2010
- Request for Comment Letters Submitted in Response to NOP, September 10, 2010

Attachment B

Letters Submitted by the Sanitation Districts on
August 3, 2010, March 26, 2010, and February 19, 2010

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STEPHEN R. MAGUIN
Chief Engineer and General Manager

August 3, 2010

Mr. Thomas Napoli
Marine Life Protection Act / South Coast Study Region
Draft Environmental Impact Report
Department of Fish and Game
South Coast MLPA Office
4665 Lampson, Suite C
Los Alamitos, CA 90720

Dear Mr. Napoli:

Comments on the June 29, 2010 Notice of Preparation of Draft Environmental Impact Report Regarding Marine Protected Areas in the California South Coast Study Region Pursuant to the Marine Life Protection Act

Thank you for the opportunity to submit comments regarding the Notice of Preparation (NOP) of the draft environmental impact report (EIR), which will study the environmental impacts of the Integrated Preferred Alternative (IPA) and the other alternatives.

The Sanitation Districts are a confederation of 23 independent special districts located throughout Los Angeles County servicing the wastewater and solid waste management needs for over 5.7 million people. For over 87 years, the Sanitation Districts have operated one of the largest regional wastewater collection and treatment systems in the nation, with a service area that covers approximately 820 square miles and encompasses 78 cities and the unincorporated territories of Los Angeles County. Within the greater Los Angeles metropolitan area, the Sanitation Districts operate an interconnected system of sewers and wastewater treatment plants called the Joint Outfall System (JOS), which serves 17 districts, 73 cities and a population of over 5 million people. The terminal treatment plant in the JOS is the Joint Water Pollution Control Plant (JWPCP), which discharges to an ocean outfall system offshore of White Point on the southern side of the Palos Verdes Peninsula. The Sanitation Districts have actively participated in the Marine Life Protection Act (MLPA) process in the California South Coast Study Region (SCSR), not only because of our duty to protect the essential public health infrastructure that the Sanitation Districts operate off shore of the Palos Verdes Peninsula, but also because of the decades of comprehensive monitoring that the Sanitation Districts have conducted to ensure the protection of the marine environment.

Throughout the MLPA process, the Sanitation Districts have stated our concerns relating to the proposed marine protected areas (MPAs) offshore of South Palos Verdes. Attachment A includes a list of all the letters we have submitted during the MLPA process, and Attachment B includes copies of our most recent letters dated February 19, 2010, and March 26, 2010. Unfortunately, the Sanitation Districts' input was not reflected in the recommendations of the Blue Ribbon Task Force (BRTF), whose IPA includes low-value MPAs offshore of South Palos Verdes that would overlie the Palos Verdes Shelf Superfund site, would protect very low quality habitats impacted by the Portuguese Bend Landslide

(PBL), would add very little biological productivity to the SCSR, and are in the immediate vicinity of the Sanitation Districts' ocean outfall system.

The Palos Verdes Shelf Superfund Site is listed on the Cortese List prepared by the Department of Toxic Substances Control. The NOP should have clearly identified this listing as required by CEQA Statute Section 21092.6. The Sanitation Districts and the U.S. Environmental Protection Agency (EPA) have previously informed the California Department of Fish and Game (DFG) in comment letters submitted during the MPA designation process that Abalone Cove and Point Vicente are located in a listed superfund site. DFG did not disclose this information in the NOP. Therefore, DFG should comply with Section 21092.6 and re-issue the NOP so that responsible and trustee agencies can provide appropriate NOP scoping comments regarding the superfund site and the MPA locations.

The Sanitation Districts have prepared a detailed response to the NOP regarding DFG's approach to preparing the draft EIR. To be consistent with Section 15082 of CEQA regarding NOP comments, the Sanitation Districts have included the following information in this comment letter:

- Significant environmental issues and mitigation measures to be studied in the draft EIR
- Reasonable alternatives to be included and analyzed in the draft EIR

Additionally, we have provided comments regarding the goals and objectives of the MLPA as they relate to the selection of the IPA and the inclusion of Abalone Cove State Marine Conservation Area (Abalone Cove) and Point Vicente State Marine Conservation Area (Point Vicente) in the IPA.

Significant Environmental Issues and Mitigation Measures

The NOP proposed a quantitative analysis of many environmental resources. Comment letters prepared by the Sanitation Districts to the Fish and Game Commission on February 19, 2010, and March 26, 2010, identified the existing environmental concerns in these two areas including the PBL, the Palos Verdes Shelf Superfund Site, and the proximity to the existing White Point ocean outfall system. When DFG prepared the EIRs for the other MPA designations within the state, they took the basic analytical approach that an MPA designation results in beneficial effects to the environment because the MPA designation protects an area from environmental impacts that could occur without the designation. The standard approach used by DFG for other MPA EIRs will be inadequate for the impact analysis of Abalone Cove and Point Vicente. The protections afforded by the MPA designation could attract species to an area of known environmental concerns and problems; consequently, this may not result in beneficial effects. Therefore, DFG's draft EIR cannot simply conclude that designating Abalone Cove and Point Vicente would result in a beneficial impact on the environment because an existing unprotected area would be protected. The draft EIR must include a detailed quantitative analysis to determine the appropriate impacts of designating Abalone Cove and Point Vicente within the MPA, based on the existing environmental conditions associated with these two locations. Such analysis is required in order to provide full disclosure of potential environmental effects resulting from the IPA and alternatives under CEQA. The recommended additional analysis is outlined below by subject matter/resource.

Baseline Conditions

Section 15125 of the CEQA Guidelines states an EIR must include a description of the physical environmental conditions in the vicinity of the project as they exist at the time the NOP is published. According to CEQA, the environmental setting normally constitutes the baseline physical environmental conditions by which a lead agency determines whether an impact is significant. Therefore, as emphasized by the California Supreme Court in *Communities for a Better Environment v. South Coast Air Quality*

Management District (2010) 48 Cal.4th 310, the characterization of the baseline is imperative to making appropriate public disclosure of the "actual environmental impacts".

For the DFG MPA designation, the appropriate characterization of the baseline at Abalone Cove, Point Vicente, and the Palos Verdes Shelf will lead to the appropriate impact analysis in the draft EIR. Therefore, the draft EIR needs to include the following information to characterize the existing setting (and baseline for determining the environmental impacts of the IPA) at Abalone Cove, Point Vicente, and the Palos Verdes Shelf:

- Characteristics of the Portuguese Bend Landslide (PBL)
- Nature (thickness and type) of the sediment inundation within Abalone Cove and Point Vicente due to PBL
- Existing turbidity due to PBL
- Existing Palos Verdes Shelf Superfund Site and the levels of both DDT and PCB within Abalone Cove and Point Vicente
- Existing levels of DDT and PCB contamination in the bodies of invertebrates, fishes, mammals, and birds within Abalone Cove and Point Vicente
- Type and quality of inter-tidal and subtidal habitats
- Existing fish, mammal, and bird species present (including type and quantity) and their use of these areas (e.g., feeding, reproduction, roosting, etc)
- Existing health risk to invertebrates, fish, mammals, birds, and humans due to DDT and PCB contamination from the Palos Verdes Shelf Superfund Site
- Proximity of the existing outfall system to Abalone Cove and Point Vicente and the volume, direction, duration, concentrations, and other water quality characteristics associated with the release of treated effluent into the Pacific Ocean
- Regulatory requirements for operation of the existing outfall system and the existing monitoring and maintenance performed by the Sanitation Districts for the existing outfall system in Abalone Cove and Point Vicente and at the existing outfalls

This information should be included in the project description, hazards and hazardous materials, water quality and oceanography, biological resources, and public services and utilities sections of the draft EIR, where appropriate. For preparation of the draft EIR, DFG should be collecting the most up to date and detailed data of the characteristics listed above to establish the appropriate baseline from which to determine significant impacts. The Sanitation Districts would be willing to work with DFG to provide them with the extensive data we have collected on the Palos Verdes Shelf over the years.

Hazards and Hazardous Materials

The NOP identifies that the draft EIR will consider if the proposed IPA or alternatives would directly or indirectly increase the foreseeable risk of upset or accidental release of hazardous material to the environment from facilities or vessels operating within the SCSR. The NOP also states that the draft EIR will determine whether the proposed project IPA and alternatives will result in either direct or indirect emission of hazardous materials to the environment. Furthermore, the NOP states that the MPA location within the proposed project IPA and alternatives will be compared with a list of contaminated or polluted sites to determine if the proposed project IPA and alternatives will result in increased risk to the public or the environment.

A description of the Palos Verdes Shelf Superfund Site should also be included in the existing setting section of the hazards and hazardous materials section and text be incorporated stating that Abalone Cove and Point Vicente would be located within the Palos Verdes Shelf Superfund Site. Analysis and impacts associated with designating the MPA to include the Abalone Cove and Point Vicente locations should discuss the overlap with the Palos Verdes Shelf Superfund Site designation. This analysis in the hazards and hazardous materials section of the draft EIR should be cross referenced with the impact analysis in the water quality and oceanography section and/or the biological resources section for ease of reference to the readers.

Land Use

The NOP states the land use analysis will include a review and discussion of conflicts between land use and natural resource plans operating with the SCSR. As identified in Appendix G of the State CEQA Guidelines under the land use topic, the lead agency should address how the proposed project would:

> Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction of the project (including but not limited to the general plan, specific plan, local coastal program, or zoning ordinance adopted for the purpose of avoiding or mitigating and environmental effect).

Therefore, the Sanitation Districts recommend the land use section also analyze the consistency of the MLPA’s regional goals and objectives as they apply to Abalone Cove and Point Vicente. It is appropriate to discuss the policy of the MLPA and the goals under the land use threshold because the MLPA was adopted for the purposes of a reduction in removal of a species within MPAs due to over-fishing and other anthropogenic activites (i.e., avoiding or mitigating an environmental effect). Under CEQA, the analysis of land use consistency, as with all environmental impacts, is always linked to physical environmental effects occurring either directly or indirectly from the proposed action and alternatives (CEQA Guidelines Sections 15002(g), 15126.2, 15358, 15382). Therefore, the disclosure of the inherent conflict between the MLPA goals and objectives and the proposed designation of Abalone Cove and Point Vicente within the IPA should be connected to the environmental impacts disclosed in the other sections of the draft EIR (e.g., water quality and oceanography, and biological resources) to determine if the inherent conflict presents a significant physical environmental effect. If so, the conflict must be deemed significant and alternatives must be sought to avoid or substantially reduce this impact.

Water Quality and Oceanography

The NOP acknowledges the potential for conflicts between existing facilities operations and permitting and the proposed MPAs. The NOP identifies that such conflicts will be analyzed in the water quality and oceanography section of the draft EIR. However, the Sanitation Districts propose several additions to the scope of analysis below.

The previous comment letters dated February 19, 2010, and March 26, 2010 have documented the existing conditions of the Palos Verdes Shelf area as degraded due to the PBL and the Palos Verdes Shelf Superfund Site. The Clean Water Act requires the EPA to set ambient water quality criteria (AWQC) to serve as national water quality standards to protect aquatic life. Although the waters overlaying the Palos Verdes Shelf have met the AWQC for PCBs, they do not meet the AWQC for DDT. Therefore, based on the EPA standards for protecting wildlife, the EPA has determined that contaminants found within these areas in the water, sediment, and in the fish do not meet the protective requirements of aquatic life.

The analysis in the draft EIR needs to include an evaluation of the suitability of existing habitat and quality on the Palos Verdes Shelf for MPA designation, including the effects of DDT/PCB and the PLB on habitat quality and potential MPA performance. Specifically the analysis should include:

- A description of the existing quantity, variation, and type of habitat in Abalone Cove, Point Vicente, and on the greater Palos Verdes Shelf
- A description of the PBL and the water quality characteristics generated by the PBL (e.g., turbidity, sedimentation, etc.) and the impact of these water quality characteristics on Abalone Cove and Point Vicente
- A description of the existing levels of DDT/PCB in the sediment and water column at Abalone Cove, Point Vicente, and the Palos Verdes Shelf and a quantitative analysis of the impact of these levels on the biological communities of the Abalone Cove and Point Vicente habitats (e.g., degraded habitat; only species tolerant of contaminated sediment are supported; reproductive impairment; etc.).

As part of this analysis, the draft EIR should include a discussion and analysis of the conflict of operating the Abalone Cove and Point Vicente MPAs within the Palos Verdes Shelf Superfund Site. This analysis would include any conflicts between the interim Record of Decision (IROD) activities proposed and discussed in the Letter from Carmen White, Remedial Project Manager, to Jim Kellogg dated February 18, 2010, and the designation of the MPAs. It should discuss the impact of the designation on the efforts to remediate the Palos Verdes Shelf, including any restrictions DFG would place on the remediation process. Alternatively, it should discuss the exclusions prescribed for these activities as identified by Table 1 of the Draft Initial Statement of Reasons for Regulatory Action for South Coast MPAs dated March 29, 2010. The Sanitation Districts also request a discussion and analysis of conflicts with the existing and continued operation of the existing outfall system. Specifically the analysis should include:

- Description of the existing and likely future regulatory requirements with which the Sanitation Districts comply and how they comply (regular monitoring, reporting, etc.)
- Description of the frequency, duration, and timing of current water quality monitoring by the Sanitation Districts
- Description of the existing effluent discharge characteristics,
- Analysis of the impact of existing effluent discharge on Abalone Cove and Point Vicente

Biological Resources

The NOP states that the draft EIR analysis will consider whether the IPA or alternatives would otherwise affect the life history of native species. However, this impact does not encompass the entire effects analysis of the proposed MPA designation. The draft EIR should include an analysis of the indirect adverse effects on the species that would otherwise benefit from the MPA designation and analyze the impact associated with re-building fish populations and other species populations in the Palos Verdes Shelf Superfund Site. For example, one effect of establishing MPAs is to benefit certain species by creating attractive sanctuary areas with less external disturbances. According to the Master Plan for Marine Protected Areas (approved February 2008), Appendix G: Master List of Species Likely to Benefit from MPAs: “A reduction in removal of a species within MPAs has been shown worldwide to increase abundance, mean size, and reproductive potential of certain fished species.”

While an increase in fish numbers and size is generally regarded as a beneficial effect in most areas, there exists the potential for unintended negative effects on the fish, birds, and marine mammals in the Palos Verdes Peninsula area due to the effects of bioaccumulation of DDT and PCBs in the environment from existing conditions. Heal the Bay[1] advises the public not to consume nine fish species in the proposed MPA area that are also listed by DFG as likely to benefit from creation of an MPA (Appendix G):

- Top smelt
- Rockfishes
- Surf perches
- Black croaker
- Sculpin (scorpion fish)
- Queenfish
- Kelp bass
- Corbina
- White croaker

DFG's website, "Public Advisories on Fish Consumption,"[2] also warns about human consumption of species likely to bioaccumulate DDT and PCBs, species that are also listed as benefiting (increasing) from MPAs in the SCSR. While much of the focus has been on human consumption, the use of DDT was not originally banned by the federal government because of human health effects, but because of the near catastrophic effects on some bird species, including falcons, eagles, and brown pelicans, all of which occur in Abalone Cove and Point Vicente. The Science Advisory Team (SAT) identified that the ecological risk assessment conducted for the Palos Verdes Shelf indicated intermediate risk occurs south to southwest of the outfalls as well as northwest of Point Vicente. Specifically, the aquatic water quality criterion is not met for DDT in this area. White croaker, kelp bass, and sanddabs on the Palos Verdes Shelf generally exceed the DDT no observable effects concentration (NOEC).[3] White croaker and kelp bass are stated above to benefit from the MPA designation. Therefore, in order to fully analyze the potential negative effects of including Abalone Cove and Point Vicente in the IPA and to reach a science-based determination on the significance of the indirect effects of the MPA designation, DFG will need to study and disclose the expected changes in populations of the fish species listed above known to bioaccumulate DDT and PCBs, and analyze the effects on wildlife species and humans consuming increased amounts of contaminated fish. Specifically, the analysis should include:

- Description of the existing quantity, variation, and type of invertebrate, fish, bird, and mammal species located in Abalone Cove, Point Vicente, and the greater Palos Verdes Shelf
- Description of the existing levels of DDT/PCB in these various species
- Description of the bioaccumulation of DDT/PCB through each species and through the food chain

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[1] Available at: Hhttp://www.healthebay.org/enlargephoto/default.asp?photo=stayhealthy_consumptionguidelinesH. Accessed on: July 23, 2010.

[2] Available at: http://www.dfg.ca.gov/marine/fishcon1.asp. Accessed on: July 23, 2010.

[3] The NOEC for fish is 1,900 microgram/kilogram whole body tissue for DDT.

- Quantitative analysis of the changes in the existing species populations as a result of locating Abalone Cove and Point Vicente in the Palos Verdes Shelf Superfund Site (i.e., analyze the relationship between an increase in the population of species [due to the protection offered by Abalone Cove and Pointe Vicente] and the increased number of species with DDT/PCB due to bioaccumulation in each species and in the food chain)
- Quantitative assessment of the change in health risk to wildlife and humans from locating Abalone Cove and Point Vicente in the Palos Verdes Shelf Superfund Site

Public Services and Utilities

The NOP states that the analysis will include a review of whether the IPA and alternatives would result in the need for new governmental facilities or services. The NOP notes issues related to impacts to Publicly Own Treatment Works, such as the outfall system, will be discussed in the water quality section of the draft EIR. However, the Sanitation Districts believe the draft EIR should include the need for new facilities in the service area in this section as well. DFG should analyze the indirect effect of the MPA designation related to the need for and impacts of new sanitation facilities due to the restrictions associated with the MPA designations. Since these indirect impacts have less to do with water quality and more to do with impacts associated with building new facilities, it is appropriate to include them in the public services and utilities section. As identified in Appendix G of the State CEQA Guidelines under the public services topic, the lead agency should address how the proposed project would:

> Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

As discussed in previously submitted comment letters dated February 19, 2010, and March 26, 2010, a reasonably foreseeable indirect effect of including Abalone Cove and Point Vicente as part of the IPA would be to restrict the discharge from the Sanitation Districts' outfall system. Specifically, the State Water Resources Control Board (SWRCB) has stated that the designation of new state water quality protection areas (SWQPAs) to protect water quality in MPAs will occur sometime in the near future following the completion of the updated statewide MLPA network (SWRCB pers. comm.). Therefore, the draft EIR should include a detailed analysis of the extent of the MPA restrictions on the Sanitation Districts' outfall system and if the MPA designation would lead to the construction of new facilities to increase the level of treatment and/or potentially force a reduction in volume of discharge to the ocean. Furthermore, if the DFG analysis concludes that the Sanitation Districts would need to increase or change their treatment streams or reduce the volume of discharge, the DFG would be required to include an analysis of the potentially significant impacts associated with construction and operation of the new facilities in the draft EIR. The new facilities could include modifications or additions to the facilities at the Sanitation Districts' JWPCP or new upstream water reclamation plants. Impacts associated with these new facilities would be extensive and would include, but certainly not be limited to, the following:

- Air quality impacts associated with construction due to construction equipment and possibly operation due to emergency generators, turbines, and other facility equipment
- Biological resource impacts associated with construction depending on the location of the new facilities
- Greenhouse gas impacts associated with construction and operation
- Hydrology and water quality impacts associated with construction due to earth-moving efforts and the generation of sedimentation and erosion, and possibly operation due to new locations for the releases of discharge

- Land use and planning impacts associated with operation due to land use and zoning conflicts, depending on facility location
- Noise impacts associated with construction and operation due to equipment and machinery
- Transportation impacts associated with construction due to construction worker trips and equipment, and possibly operation due to new employee trips or relocating employees

The Sanitation Districts recommend the draft EIR include a discussion of these possible impacts related to these effects in the public services and utilities section. Furthermore, the draft EIR should include mitigation measures to reduce significant public service impacts.

Cumulative

Section 15130 of the 2010 CEQA Guidelines discusses the type and scope of the cumulative analysis. As defined in Section 15355, a cumulative impact consists of an impact that is created as a result of the combination of the project evaluated in the EIR together with other projects causing related impacts. The discussion of cumulative impacts should reflect the severity of the impacts and their likelihood of occurrence. The discussion should be guided by the standards of practicality and reasonableness, and should focus on the cumulative impact to which the identified other projects contributed. Mitigation measures can be proposed to reduce cumulative impacts, and with some projects, the only feasible mitigation for cumulative impacts involves the adoption of ordinances or regulations rather than the imposition of conditions on a project-by-project basis. As discussed above under “Public Services and Utilities,” the cumulative analysis of the draft EIR also needs to consider the reasonably foreseeable condition of the Regional Water Quality Control Board establishing SWQPAs, since this is a future project. The analysis needs to include the associated potential cumulative environmental effects resulting from the placement of MPAs in and around the White Point outfall system.

Alternatives

The NOP identifies three alternatives in addition to the IPA that will be analyzed in the draft EIR. The Sanitation Districts request that the draft EIR identify and analyze project alternatives that would reduce or avoid the potentially significant environmental effects the Sanitation Districts believe will be evident once DFG completes the environmental analysis described above with respect to the Palos Verdes Shelf. The Sanitation Districts specifically request an alternative be analyzed that consists of the IPA without the inclusion of Abalone Cove and Point Vicente, per the previously submitted February 19, 2010, and March 26, 2010 letters. Such an alternative would, in the opinion of the Sanitation Districts, have the potential for attaining most of the objectives of the MLPA while mitigating or avoiding the potential for significant adverse environmental impacts on the marine environment and important public infrastructure (see below under “Goals and Objectives of the MLPA” for additional details).

Section 15126.6 of the 2010 CEQA Guidelines states the EIR should describe the rationale for selecting the alternative to be discussed. Furthermore, the EIR should identify any alternatives that were considered by the lead agency but were rejected as infeasible during the scoping process and explain the reasons underlying the lead agency’s decision. Among the factors that may be taken into account when addressing the feasibility of an alternative are: site suitability, economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, and jurisdictional boundaries.

The Sanitation Districts provided factual evidence regarding the infeasibility of including MPAs on the Palos Verdes Shelf in their previously submitted letters. The Palos Verdes Shelf is not suitable as an MPA because of the PBL, the Palos Verdes Shelf Superfund Site, and the close proximity to the existing White Point outfall system. Therefore, the Sanitation Districts request that the alternatives analysis chapter fully describe the scientific rationale for including Abalone Cove and Point Vicente in the IPA.

Furthermore, the Sanitation Districts expect the draft EIR to include sufficient information about each alternative to allow a meaningful evaluation, analysis, and comparison with the proposed project, as required by CEQA. This information should include a discussion of the following: the scientific, environmental, and socioeconomic criteria used to select the IPA and the other alternatives (e.g., contaminated sediment, turbidity, etc.); a discussion of the SAT guidelines and if they were used as criteria to select alternatives; a description of the expected functionality and value of the IPA, and Abalone Cove and Point Vicente, compared to the alternatives.

Goals and Objectives of the MLPA

As CEQA requires the lead agency to assess the potential significant impacts of a proposed action and not necessarily the underlying value of the action itself, the goals of the MLPA and the objectives of the regional MPA are technically outside the scope of the draft EIR and purposes of an NOP. However, per CEQA (CEQA Guidelines 15093) the lead agency generally uses the goals and objectives as part of its reasoning for adopting a statement of overriding considerations (if the draft EIR concludes that there are significant and unavoidable impacts of the project with no feasible mitigation or alternatives). Therefore, the administrative record needs to be supported by substantial evidence that the goals and objectives are actually met by the proposed project.

These goals and objectives speak specifically to the protection of marine life populations and ecosystems as cited below and in the *California MLPA South Coast Project Regional Goals and Objectives and Design and Implementation Considerations for the MLP South Coast Study Region* dated February 26, 2009.

Goal 1. To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.

1. Protect and maintain species diversity and abundance consistent with natural fluctuations, including areas of high native species diversity and representative habitats.
2. Protect areas with diverse habitat types in close proximity to each other.
3. Protect natural size and age structure and genetic diversity of populations in representative habitats.
4. Protect biodiversity, natural trophic structure and food webs in representative habitats.
5. Promote recovery of natural communities from disturbances, both natural and human induced, including water quality.

Goal 2. To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.

1. Help protect or rebuild populations of rare, threatened, endangered, depressed, depleted, or over-fished species, and the habitats and ecosystem functions upon which they rely.

2. Sustain or increase reproduction by species likely to benefit from MPAs, with emphasis on those species identified as more likely to benefit from MPAs, and promote retention of large, mature individuals.

3. Sustain or increase reproduction by species likely to benefit from MPAs with emphasis on those species identified as more likely to benefit from MPAs through protection of breeding, spawning, foraging, rearing or nursery areas or other areas where species congregate.

4. Protect selected species and the habitats on which they depend while allowing some commercial and/or recreational harvest of migratory, highly mobile, or other species; and other activities.

Goal 3. Improve recreational, educational and study opportunities provided by marine ecosystems that are subject to minimal human disturbance, and to manage these uses in a manner consistent with protecting biodiversity.

1. Sustain or enhance cultural, recreational, and educational experiences and uses (for example, by improving catch rates, maintaining high scenic value, lowering congestion, increasing size or abundance of species, and protection of submerged sites).

2. Provide opportunities for scientifically valid studies, including studies on MPA effectiveness and other research that benefits from areas with minimal or restricted human disturbance.

3. Provide opportunities for collaborative scientific monitoring and research projects that evaluate MPAs that promote adaptive management and link with fisheries management, seabird and mammals information needs, classroom science curricula, cooperative fisheries research and volunteer efforts, and identify participants.

Goal 4. Protect marine natural heritage, including protection of representative and unique marine life habitats in CA waters for their intrinsic values.

1. Include within MPAs key and unique habitats identifies by the MLPA Master Plan Science Advisory Team for this study region.

2. Include and replicate to the extent possible [practicable], representatives of all marine habitats identified in the MLPA or California Marine Life Protection Act Master Plan for Marine Protected Areas across a range of depths.

Goal 5. To ensure that south coast California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines.

1. Minimize negative socio-economic impacts and optimize positive socio-economic impacts for all users including coastal dependent entities, communities and interests, to the extent possible, and if consistent with the Marine Life Protection Act and its goals and guidelines.

2. Provide opportunities for interested parties to help develop objectives, a long-term monitoring plan that includes standardized biological and socioeconomic monitoring protocols, a long-term education and outreach plan, and a strategy for MPA evaluation.

3. Effectively use scientific guidelines in the California Marine Life Protection Act Master Plan for Marine Protected areas.

4. Ensure public understanding of, compliance with, and stakeholder support for MPA boundaries and regulations.

5. Include simple, clear, and focused site-specific objectives/rationales for each MPA and ensure that site-level rationales for each MPA are linked to one or more regional objectives.

The Sanitation Districts do not believe the goals and objectives of the MLPA are met by the inclusion of Abalone Cove and Point Vicente in the IPA or its alternatives. Furthermore, the inclusion of Abalone Cove and Point Vicente as part of the IPA or its alternatives is in direct conflict with the MLPA regional goals and objectives. The location of Abalone Cove and Point Vicente conflicts with the goals and objectives primarily because of (1) the presence of the Palos Verdes Shelf Superfund Site and legacy contaminants known to occur at concentrations that pose a threat to the health of both humans and wildlife, (2) the presence of PBL, and (3) the ongoing discharge of treated wastewater adjacent to these sites. Abalone Cove and Point Vicente have been subject to high levels of disturbance over the years; and they hold very little intrinsic value.

The location of Abalone Cove and Point Vicente conflicts with Goal 1. Abalone Cove and Point Vicente would not promote recovery from human-induced impacts since remediation of the Palos Verdes Shelf Superfund Site will continue for many decades.

The inclusion of Abalone Cove and Point Vincent in the IPA does not support Goal 2. It is illogical to rebuild fish populations that are depleted if those populations would be adversely affected by DDT/PCB. Furthermore, as discussed above under "Significant Environmental Issues and Mitigation Measures – Biological Resources," it is likely there would be significant environmental impacts if the designation of Abalone Cove and Point Vicente results in increased reproduction by species likely to benefit from MPAs and promotes the retention of large, mature individuals, since these species would likely have bioaccumulated DDT/PCB.

The inclusion of Abalone Cove and Point Vincent in the IPA does not support Goal 3. Abalone Cove and Point Vicente are not locations that have experienced "minimal human disturbance." The Palos Verdes Shelf has been highly disturbed by the presence of DDT/PCB at the superfund site.

Abalone Cove and Point Vicente do not have unique intrinsic value and, therefore, are in conflict with Goal 4. The south face of the Palos Verdes Peninsula (the area between Point Fermin and Point Vicente) lacks key habitats outlined by the SCSR SAT as being important in a functional MPA network and is impacted by the PBL.

The inclusion of Abalone Cove and Point Vicente in the IPA conflicts with Goal 5 because it does not follow SAT guidance on the Palos Verdes MPAs. For example, the SAT recommended the following design guidance regarding this portion of the Palos Verdes Shelf:

- Areas nearest the outfalls are less favorable for MPA placement due to legacy contaminants and the current effluent flow
- Areas of ongoing and planned EPA fieldwork and mitigation activities at White Point are more vulnerable to perturbation and, therefore, less favorable in the short term for proposed MPA placement
- The area from Portuguese Bend Cove to White Point would be subject to turbidity and sedimentation at levels that affect organisms and biological communities as addressed above, and also would be less favorable for MPA placement

The Sanitation Districts request that the Fish and Game Commission and staff carefully consider the many issues raised in this letter. The Sanitation Districts have a responsibility to more than 5 million people to protect essential public health infrastructure from unintended impacts resulting from the MLPA process. We strongly recommend the draft EIR use sound science and not adopt Abalone Cove and Point Vicente as part of the IPA or any other recommended project. Thank you for consideration of our comments. We look forward to providing further assistance and information in connection with the preparation of the draft EIR for this project.

Very truly yours,

Stephen R. Maguin

Philip L. Friess

Philip L. Friess
Department Head
Technical Services

PLF:TJL:CB:ddg

Attachment A	List of Comment Letters Submitted by the Sanitation Districts During the SCSR MPA Process
Attachment B	Letters Submitted by the Sanitation Districts on February 19, 2010, and March 26, 2010

cc: Fish and Game Commissioners

Attachment A

List of Comment Letters Submitted by the Sanitation Districts During the SCSR MPA Process

- Avoid Areas of Wastewater Impact, March 3, 2009
- Methods to Evaluate MPA Proposals: Water and Sediment Quality, April 4, 2009
- Analysis and Proposal of MPAs, April 23, 2009
- Alternative Proposal for MPAs, April 24, 2009
- SAT Special Evaluation of MPA Placement, April 24, 2009
- Comments to the Master Plan Science Advisory Team, August 26, 2009
- Comments Opposing the Abalone Cove SMCA, October 9, 2009
- Opposition to Abalone Cove SMCA, November 4, 2009
- Opposition to Adoption of Abalone Cove SMCA, November 30, 2009
- Opposition to Proposed MPAs – Integrated Preferred Alternative, February 19, 2010
- Opposition to Proposed MPAs in South Palos Verdes, March 26, 2010
- Comments at NOP Scoping Meeting, July 23, 2010

Attachment B

Letters Submitted by the Sanitation Districts on February 19, 2010, and March 26, 2010

WATER RECLAMATION
SOLID WASTE MANAGEMENT

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

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STEPHEN R. MAGUIN
Chief Engineer and General Manager

February 19, 2010
File No. 98-50.1.10 SI

Jim Kellogg, President
Members of the California Fish and Game Commission
1416 Ninth Street
P.O. Box 944209
Sacramento, CA 94244-2090

Dear Commissioners:

Opposition to Proposed Marine Protected Areas in
South Palos Verdes – Integrated Preferred Alternative

The Sanitation Districts are a confederation of 23 independent special districts serving the wastewater and solid waste management needs for over 5.5 million people in Los Angeles County. For over 80 years, the Sanitation Districts have operated one of the largest regional wastewater collection and treatment systems in the nation, with a service area that covers approximately 820 square miles and encompasses 78 cities and unincorporated territories within Los Angeles County. Thus, it is with great interest that the Sanitation Districts have participated in the Marine Life Protection Act (MLPA) process in the South Coast Study Region, not only because of the essential public health infrastructure that the Districts operate offshore of the Palos Verdes Peninsula, but also because of the decades of comprehensive monitoring that the Districts have conducted to ensure the protection of the marine environment.

Throughout the MLPA process, the Sanitation Districts' Marine Biology staff has provided expertise and insight regarding how best to protect the many uses and interests in the coastal waters along the Palos Verdes Peninsula, while at the same time achieving the goals of the MLPA. Unfortunately, the Sanitation Districts' input was not reflected in the recommendations of the Blue Ribbon Task Force, whose Integrated Preferred Alternative (IPA) includes Marine Protected Areas (MPAs) offshore of south Palos Verdes that do not conform to the scientific guidelines of the MLPA, subject these MPAs to the local impacts of planned EPA remediation efforts that have been designed to protect the marine environment, and threaten important scientific receiving water monitoring activities. Moreover, the proposed MPAs offshore of south Palos Verdes jeopardize the ongoing operation of the Sanitation Districts' ocean outfall system, and would cause great socioeconomic impact to Los Angeles County residents should this infrastructure have to be relocated or costly, energy-intensive treatment upgrades have to be implemented, ultimately as a result of the proposed MPA designations. Despite our best efforts to inform the Blue Ribbon Task Force about these critical flaws associated with MPA placement off south Palos Verdes, the Blue Ribbon Task Force recommended an IPA proposal for the Commission's consideration incorporating south Palos Verdes MPAs.

As the Commission deliberates on the South Coast IPA proposal, the Sanitation Districts request that the Commission and staff seriously consider the many issues raised in the detailed comments that are attached to this letter. The Sanitation Districts have a responsibility to more than 5.5 million ratepayers to protect this essential public health infrastructure. We strongly recommend that the Commission prioritize science considerations and remove south Palos Verdes from further consideration for ultimate adoption of Palos Verdes area MPAs.

Very truly yours,

Stephen R. Maguin

Stephen R. Maguin

SRM:JRG:SMW:dhs

cc: Adrianna Shea
John Carlson
Sonke Mastrup
Becky Ota
Ken Wiseman

Attachment

ATTACHMENT

SPECIFIC COMMENTS REGARDING THE INAPPRORIATE PLACEMENT OF MARINE PROTECTED AREAS IN SOUTH PALOS VERDES IN THE INTEGRATED PREFERRED ALTERNATIVE

Introduction

The Sanitation Districts of Los Angeles County (Sanitation Districts) serve the wastewater and solid waste management needs for over 5.5 million people in Los Angeles County. One key element of the wastewater infrastructure operated by the Districts is the White Point ocean outfalls (Figure 1), located off the south coast of the Palos Verdes (PV) Peninsula. This outfall system constitutes essential public health infrastructure that cannot be practically moved without great expense to the public. It is also our responsibility to be stewards of the coastal environment and ensure that our operations have no discernable impact to local aquatic life. The Sanitation Districts have actively participated in the MLPA process and provided our expertise in an effort to help establish an array of Marine Protected Areas (MPAs) in the South Coast Study Region (SCSR) that would achieve the worthy goals of the Marine Life Protection Act (MLPA) in this region. However, we are deeply disappointed and concerned by the SCSR Blue Ribbon Task Force's (BRTF) Integrated Preferred Alternative (IPA) proposal because the proposed MPAs in PV fail to fully achieve the scientific goals of the MLPA and threaten significant regulatory and socioeconomic impacts to the Sanitation Districts and the more than 5.5 million people we serve.

Specifically, the south coast of PV contains poor quality habitats due to the Portuguese Bend Landslide (PBL) and the water and sediment contamination associated with the Palos Verdes Shelf Superfund Site. Also, critical rare habitats were not captured as a result of siting MPAs off south PV, resulting in exceedances of habitat spacing guidelines so great as to make the entire SCSR MPA network dysfunctional. The BRTF's IPA also subjects the MPAs to the local impacts (e.g. take) of long-term EPA DDT remediation efforts as well as NPDES monitoring programs that have been designed to protect the marine environment.

The BRTF's placement of MPAs in south PV in their IPA creates a high probability that these MPAs will underperform. Not only does this compromise the goals of the MLPA, but it jeopardizes the ongoing operation of the Sanitation Districts' ocean outfall system through potential imposition of future regulatory restrictions that would disallow continued operation of this outfall or require costly, energy-intensive treatment process upgrades. The socioeconomic impact of this outcome to Los Angeles County residents greatly exceed the socioeconomic impacts considered by the BRTF, which apparently were the basis for the proposed MPA placement off south PV.

Below, we have provided more detailed explanations of these issues. We are also providing copies of all literature cited and relevant supplemental material on the enclosed CD for your consideration. We hope that our discussion of these issues and the information in the supporting documents will clearly identify the inappropriateness of MPA placement along the south coast of PV. It should be noted that this information was also supplied by the Sanitation Districts to the Regional Stakeholder Group and BRTF as they developed MPA proposals, but it was not reflected in the BRTF recommendation of MPA designations of the IPA.

ISSUE 1: IPA Placement of MPAs off south Palos Verdes Fails to Achieve the Scientific Objectives of the MLPA

The PV Peninsula is an essential component of any MPA array in the SCSR. It is the only rocky headland in the central mainland portion of the region providing suitable habitat for a substantial kelp forest ecosystem. However, the IPA includes MPAs on the south face of PV that contains the least suitable habitat on the PV Peninsula. The south face of Palos Verdes (the area between Point Fermin and Point Vicente) is a poor choice for MPA placement due to: (1) Lack of key habitats outlined by the SCSR Science Advisory Team (SAT) as being important in a functional MPA network, causing spacing gaps that grossly exceed SAT guidelines (2) the sedimentation and turbidity associated with the ongoing Portuguese Bend landslide (PBL); and (3) the existing and ongoing risk to fish and wildlife from the EPA Superfund Site in this area. A detailed discussion of each of these issues is provided below.

SAT Habitat Spacing Guidelines Grossly Exceeded

The SAT analysis concluded that the IPA leaves a large habitat gap of persistent kelp (111 mile gap between habitats) and hard-bottom habitat (232 mile gap between habitats) (MLPA SAT 2009). The habitat spacing for both of these habitat types could have been significantly reduced had the BRTF chosen a different option in Palos Verdes (Figures 2 and 3). The SAT habitat spacing guidelines (31-62 miles between habitats) were put into place to ensure that species most likely to benefit from MPAs can successfully move between MPAs and that the goals of the MPA network will be met. *See* Fish and Game Code, Sections 2856(2)(D) and 2857(c). Because the proposed MPAs offshore of south PV failed to minimize the distance between critical habitat in comparison with other areas in PV, the entire MPA network of the BRTF's IPA proposal is less likely to succeed, due to the greatly reduced protection that will be provided for these species.

Degradation of Habitat from the Portuguese Bend Landslide (PBL)

The PBL, which began moving in 1956, has become a major source of sediment particulate and resulting turbidity to the PV rocky subtidal environment. Between 1956 and 1987, 9.0 million metric tons of material was introduced to the ocean from toe-erosion of the landslide (Kayen et al. 1994). Portuguese Bend is located about 2.1 miles west of the Sanitation Districts' outfall system. Slide movement was relatively slow until 1978, when increased annual rainfall caused it to accelerate rapidly. The mass emission rate of PBL materials to the nearshore rocky subtidal environment averaged approximately 146,000 cubic yards of material per year between 1977-2000 (USACE 2000) resulting in significant degradation of the marine rocky bottom and kelp habitat and ecosystem. The U.S. Army Corps of Engineers (USACE) Feasibility Study (2000) concludes that the eroded material was deposited in the nearshore area of south PV, burying many rocky reef areas and kelp habitats so highly valued in the MPA siting process. The findings also conclude that the remaining material has increased turbidity in the nearshore and downcoast areas, causing sustained losses and degradation of these habitats.

Figure 4 is a 1986 aerial photograph showing the general transport dispersal pattern of Portuguese Bend slide material. This material is typically carried east and offshore by the prevailing easterly nearshore current with much of the deposition occurring in the eastern rocky subtidal region between Point Vicente and Point Fermin. As a result of this input, low lying reefs in this region have, particularly at depths greater than 6 meters, been buried with PBL material, severely limiting the growth of Giant Kelp which is the basis for the entire kelp forest ecosystem in Southern California (Figure 5). Consequently, the rocky subtidal communities at survey sites between Abalone Cove and Bunker Point have been negatively impacted by turbidity and sedimentation from the PBL (LACSD 2002). Therefore, it can be expected that an MPA placed along this southern section of Palos Verdes will not perform as well as in other parts of Palos Verdes, which are not significantly affected by the PBL.

For additional information regarding the Portuguese Bend Landslide, please see the supplemental material provided via CD.

DDT Contamination off south PV Poses an Increased Risk to Aquatic Life

From the late 1940s to 1971, Montrose Chemical Company (Montrose), the nation's largest producer of the insecticide DDT (dichlorodiphenyltrichloroethane), relied upon the collection system tributary to the Sanitation Districts' Joint Water Pollution Control Plant (JWPCP) for disposal of process wastes containing high concentrations of DDT. Since the wastewater treatment process employed during this period was not designed to remove DDT, much of the DDT passed through the treatment system. It is estimated that between 800 and 1,800 metric tons (mt) of DDT were discharged through the JWPCP's White Point outfall system on the PV shelf during this period (Chartrand et al. 1985; Amendola 2000).

Following detection of DDT in the discharge and subsequent disconnection of Montrose from the sewer system in 1971, DDT discharged to the ocean through the JWPCP outfalls dropped dramatically. Effluent concentrations of total DDTs (the sum of six isomers) have been near or below detection for the past twenty years. In fact, DDTs have not been detected in JWPCP effluent since 2002. However, due to the historical discharge of DDT on the PV shelf, there is a very strong spatial gradient of DDTs in sediment beginning with the highest concentrations near the Sanitation Districts' outfall and decreasing in concentration to the northwest along the southern coastline of the PV shelf (Figure 6).

In 1990, the Federal government and the State of California filed a lawsuit under the federal "Superfund" law. The lawsuit charged that DDTs and PCBs discharged to the coastal environment damaged natural resources, including fish and wildlife that live in and around coastal waters of Southern California. The lawsuit was settled in 1999 for approximately $140 million dollars and the entire PV shelf between Point Fermin and Redondo Canyon was designated as a Superfund study area (i.e. site).

The United States Environmental Protection Agency (EPA) conducted an ecological risk assessment for the PV shelf, which was published in 2003 (USEPA 2003). The risk assessment found that the levels of DDT and PCBs in the sediment and overlying water were a substantial risk to the health of benthic infauna, fish, seabirds, and marine mammals. The EPA also concluded that the greatest risk is found near the outfalls and gradually declines with distance away from the outfall.

In 2009, the EPA issued an Interim Record of Decision (IROD) for remediation of the PV shelf which included a cleanup goal of 23 mg/kg organic carbon (OC) as the median DDT concentration in PV shelf surface sediments that is not expected to be attained within the PV shelf study area until 2039 (USEPA 2009). Because EPAs cleanup goal is a median for the entire PV shelf, it is important to recognize that the gradient of DDT in sediments will mean that even thirty years from now, when attainment of this goal is expected for the shelf as a whole, areas closer to the outfall will likely still exceed this cleanup goal. Further evidence demonstrating the long-term risk to aquatic life is displayed in Figure 6, which depicts 2004 surface sediment DDT concentrations in relation to the EPA's cleanup goal. As shown in this figure, there are no sediments in the monitoring area that meet the cleanup goal (i.e. there are no white areas). It should also be noted that, the sediments in portions of the IPA proposed MPAs exceed the cleanup goal by more than 15 times in the Abalone Cove SMCA (orange) and by more than 10 times (yellow) in the Point Vicente SMR. Therefore, placement of MPA's off south PV, where the exposure of aquatic life to DDT is greatest, is at odds with the goals of the MLPA because these areas include substandard habitats that are contaminated, and consequently not as suitable as other areas in PV for the protection of aquatic life. The proposed MPAs off south Palos Verdes are not pristine areas that can be maintained in an undisturbed and unpolluted state.

ISSUE 2: IPA Placement of MPA's off south Palos Verdes Subjects MPAs to Impacts of EPA Superfund Remediation and Monitoring Efforts

EPA's IROD (USEPA 2009) includes the placement of a sediment cap initially in the area between and just northwest of the Sanitation Districts' outfall system, but potentially as far west as

Bunker Point depending on the success of the initial capping effort and other factors (Figure 6). Placement of cap material is expected to take several years and may need to be repeated periodically to maintain the cap. Capping activities will be detrimental to benthic organisms and result in short–term increases in sedimentation and turbidity in these areas and to the northwest where the IPA proposed MPAs are located due to prevailing currents. Further, EPA's IROD includes periodic monitoring of sediment and fish tissue chemistry within the IPA proposed MPAs offshore of south PV, which would constitute "take" and therefore be in conflict with the proposed Point Vicente SMR designation. A description of these activities has been provided to the Fish and Game Commission in a letter from the PV Shelf Superfund Site Project Manager (Carmen White) on February 18, 2010 (USEPA 2010). Therefore, placement of MPA's in south PV, proximal to where the EPA will have ongoing activities including capping and monitoring operations over the next several decades, is inappropriate and contrary to the MLPA.

ISSUE 3: IPA Placement of MPAs off south Palos Verdes Threatens the Established Environmental Monitoring Program Network

The Sanitation Districts protect the environment by providing wastewater treatment services to over 5 million residents in 78 cities and unincorporated areas in Los Angeles County and by doing extensive environmental monitoring and research in local and regional waters. Approximately 300 MGD of wastewater is treated by the Sanitation Districts' Joint Water Pollution Control Plant (JWPCP) and subsequently discharged to the Pacific Ocean, through the White Point outfall system, located 1.5 miles offshore from the PV Peninsula (Figure 1).

The Sanitation Districts have conducted extensive monitoring of coastal conditions near the outfall for nearly 40 years to evaluate possible impacts to the coastal ecosystem as a result of our operations. We own and operate several research vessels including the 66-foot *Ocean Sentinel* and employ a staff of marine biologists, geologists, chemists, toxicologists, and engineers to ensure we carry out our duty to protect the environment and to fulfill our National Pollution Elimination Discharge System (NPDES) permit ocean receiving water monitoring requirements. The monitoring is focused along the PV Peninsula and includes physical and chemical water column profiling, surf-zone and nearshore bacteriology, physical and chemical characterization of sediments, benthic infauna and demersal fish and invertebrate assemblage characterization, and assessment of chemical contamination of local fish and invertebrate tissues.

Establishment of MPAs along the south Coast of PV as proposed in the IPA will result in 13 of 44 benthic stations (Figure 7), 4 of 16 trawl lines (Figure 8), and of 1 of 3 fish tissue collection zones (Figure 9) falling within the MPAs. These monitoring activities may be considered "take" by the Department of Fish and Game (DFG), consisting of hundreds of species and thousands of individual organisms removed annually within these MPAs, including species most likely to benefit from MPA protection such as California scorpionfish, kelp bass, and barred sand bass. It is our understanding that these monitoring activities would likely be deemed to be illegal by DFG. However, we are legally mandated by the Regional Water Quality Control Board, Los Angeles Region, to perform this monitoring under our NPDES permit or face severe penalties for non-compliance. Similar legal conflicts will arise during required regional monitoring efforts (i.e. Bight surveys), which involve extensive scientific collection efforts in the Southern California Bight every five years.

These monitoring activities are not only a legal requirement for the continued operation of our infrastructure, but, along with similar efforts by other dischargers, provide a highly valued assessment of environmental conditions in the SCSR which is complementary to the future MPA monitoring that will occur in the south coast region. If components of these monitoring activities are disallowed due to MPA designations, the scientific integrity of this effort will be diminished.

ISSUE 4: IPA Placement of MPAs off south Palos Verdes Jeopardizes the Ongoing Operation of the Sanitation Districts' Ocean Outfall System

As shown in Figure 1, the Sanitation Districts operate a major outfall system offshore of White Point to dispose of approximately 300 million gallons per day (MGD) of treated wastewater from a facility that serves over 5.5 million Los Angeles County residents. The four outfalls have been in place for four to seven decades, and cannot practically be removed or altered (in terms of their basic mode of operation), are essential for the protection of public health and safety, and are important infrastructure used for the provision of future regional water supplies through wastewater recycling. Placement of an MPA near this essential public health infrastructure is particularly ill-advised because of the high likelihood that the proposed MPAs will underperform for the many reasons previously discussed under Issue 1 (i.e., lack of habitat, degradation from historic landslides in Portugese Bend, historic sediment contamination and its impacts on aquatic life). With essential public health infrastructure so close to the proposed MPAs in south Palos Verde (within 1.9 miles), any underperformance of these MPAs will likely be attributed to this infrastructure, requiring either relocation or severe restrictions. The risk that this essential public health infrastructure would have to be moved or restricted to improve performance of marginal MPAs is unacceptable to the Los Angeles County residents that depend daily on this infrastructure.

This risk is further compounded given the uncertainty of how overlapping regulations between DFG and State Water Resources Control Board and/or Regional Water Quality Control Board, Los Angeles Region, will be implemented in the future. Of greatest concern is the ambiguity related to how water quality protection areas (established by the State Water Resources Control Board) will be set in the Marine Protected Areas established by this MLPA process. Currently, the State Water Resources Control Board has only one designation for their water quality protected areas, namely the designation of an Area of Special Biological Significance (ASBS). Any change in natural water quality associated with discharge into or proximal to an area designated as an ASBS is prohibited. With only one designation for water quality protected areas and provisions in the MLPA indicating that marine life reserves should receive the highest level of protection from human activities, it has to be assumed that the proposed State Marine Reserve off south Palos Verdes, if adopted by the Commission, will likely be designated as an ASBS. Given the close proximity of the essential public health infrastructure to this proposed reserve, the ASBS standard prohibiting changes in natural water quality cannot be achieved, which would require that this essential public health infrastructure be moved or treatment process upgrades be implemented at great expense to Los Angeles County residents (see Issue 5). The unintended consequences of these overlapping regulations cannot be dismissed by the Department of Fish and Game.

ISSUE 5: IPA Placement of MPAs off south Palos Verdes Threatens Great Socioeconomic Impact to Los Angeles County Residents

As described in Issue 4, the Sanitation Districts believe that the south Palos Verdes MPAs jeopardize ongoing operation of essential public health infrastructure, and will result in requirements for this infrastructure to be relocated or that costly, energy-intensive treatment upgrades be implemented. The Sanitation Districts have a fiduciary responsibility to protect the public's investment in this critical infrastructure and are obligated to exhaust all available administrative and legal remedies to prevent ultimate adoption of any MPAs in south Palos Verdes by the Commission. The Sanitation Districts are in the process of capital improvement planning related to the tunnel and outfall systems that are needed to convey treated wastewater for ocean disposal for the next 50 years. As these planning efforts continue, the threat that the south Palos Verdes MPAs pose to existing infrastructure may very well force the Sanitation Districts to no longer consider the use of existing infrastructure as a viable alternative over other more costly alternatives that involve the relocation of the tunnel and outfall systems. The cost to relocate this essential public health infrastructure is estimated to exceed $1.5 billions of dollars, fourteen times greater than the socioeconomic impacts considered by the BRTF (Ecotrust 2009).

Throughout the MLPA process, the Sanitation Districts have been clear about our concerns and the potential socioeconomic impacts associated with placing an MPA (such as those in the IPA) so close to the outfall system. We have submitted numerous oral and written comments throughout the process, including requests that outfall-related socioeconomic impacts be assessed as part of the Science Advisory Team socioeconomic analysis. Despite these repeated requests, to date there appears to have been no attempt to address socioeconomic impacts associated with restriction or relocation of this critical infrastructure. Rather, the focus appears to have been limited to other socioeconomic impacts. The Sanitation Districts consider the socioeconomic impact studies conducted in support of the South Coast process to be flawed due to the failure to account for outfall-related socioeconomic impacts to the millions of people served. We request that in the review of conflicts in use between proposed MPAs in the South Coast Region and existing use of the area, an analysis of socioeconomic impacts to the public served by coastal-dependent entities such as the Sanitation Districts be included in the report. These impacts should also be disclosed and discussed when the Department of Fish and Game prepares the Economic and Fiscal Impact Statement as part of the MLPA regulatory process for the South Coast Region, and as required under the state Administrative Procedure Act (Government Code, Section 11346.5(a)(6)).

Summary

The PV Peninsula is an essential part of any successful MPA array in the SCSR. However, the placement of MPAs along the southern face of the PV Peninsula in the IPA does not serve the scientific goals of the MLPA due to the poor habitat quality and failure to capture rare habitats found elsewhere in Palos Verdes. Further, the proposed MPAs will be impacted by ongoing EPA Superfund remediation efforts and will threaten a vital monitoring effort in Palos Verdes meant to ensure Sanitation Districts operations do not have an impact on the coastal environment. Finally, the IPA proposal would cause great socio-economic impact to Los Angeles County residents should the Districts' essential public health infrastructure be relocated or costly, energy-intensive treatment upgrades be implemented, ultimately as a result of the proposed MPA designations. Fortunately, there are other areas available to place MPAs that will better meet the goals of the MLPA and we fully expect the Commission to recognize and repair the BRTF's flawed decision-making in Palos Verdes.

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Detailed Supplemental Material provided via CD

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[USEPA] United States Environmental Protection Agency. 2003. Final ecological risk assessment for the Palos Verdes shelf. Prepared by CH2M Hill, Inc. Sacramento, CA.

Figure 1. Location of the JWPCP, Tunnels, and Ocean outfalls

Map of the Palos Verdes Peninsula depicting the location of the Joint Water Pollution Control Plant (JWPCP) in the City of Carson, two tunnels (8 ft and 12 ft diameter) under the peninsula which convey secondary effluent to the coast near White Point, and four outfalls (60", 72", 90", and 120" inner diameter) which discharge the effluent into the ocean. The two continuously active outfalls 90" and 120") are approximately 1.5 miles offshore and lie at a depth of approximately 200 feet. The 72" outfall, and to a lesser extent the 60" outfall, are only used occasionally to relieve hydraulic pressure, typically during heavy rain events. The MLPA SAT guidance of allowing a ½ mile buffer around major discharges is indicated via shaded area surrounding the outfall pipes.

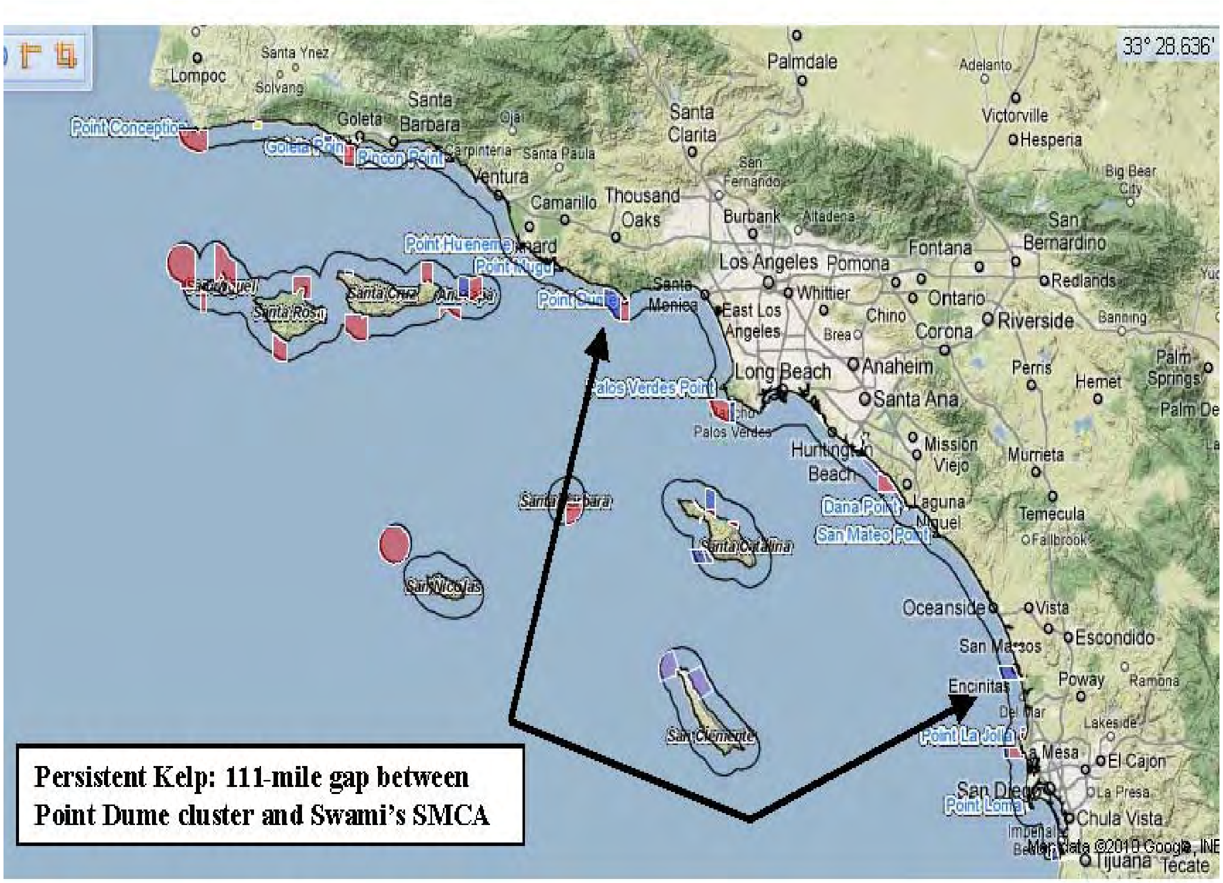
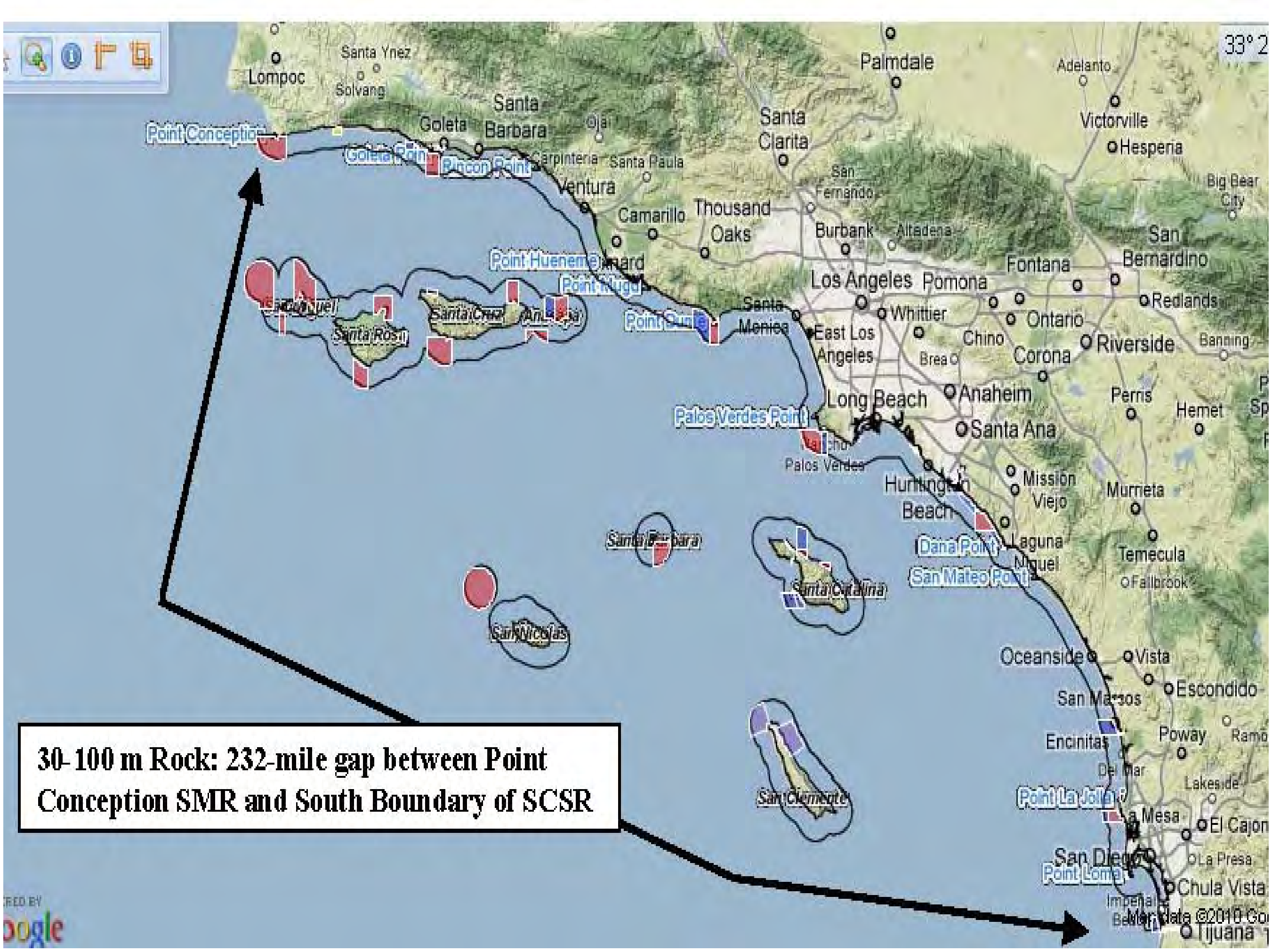


Figure 2. IPA Proposal: Persistent Kelp habitat identified as exceeding SAT spacing guidelines at Moderate-High protection. The habitat spacing for persistent kelp could have been significantly reduced had the BRTF chosen a different option in Palos Verdes.



30-100 m Rock: 232-mile gap between Point Conception SMR and South Boundary of SCSR

Figure 3. IPA Proposal: Offshore rock (30-100 m) habitat identified as exceeding SAT spacing guidelines at Moderate-High Protection. The habitat spacing for 30-100 m rock could have been significantly reduced had the BRTF chosen a different option in Palos Verdes.

Figure 4 Sedimentation and Turbidity from the Portuguese Bend Landslide Sediment plume from the Portuguese Bend Landslide (PBL) on the south face of Palos Verdes following a rain event in 1986. The continuous sediment input to this region of Palos Verdes has resulted in high turbidity and burial of low-lying reef environment essential for the establishment of kelp forest ecosystems. Similar plumes can be seen today.

Figure 5. Examples of Buried Reefs in the Portuguese Landslide Area.
Bunker Point (above), October 22, 2008 and White Point (below), June 3, 2009.

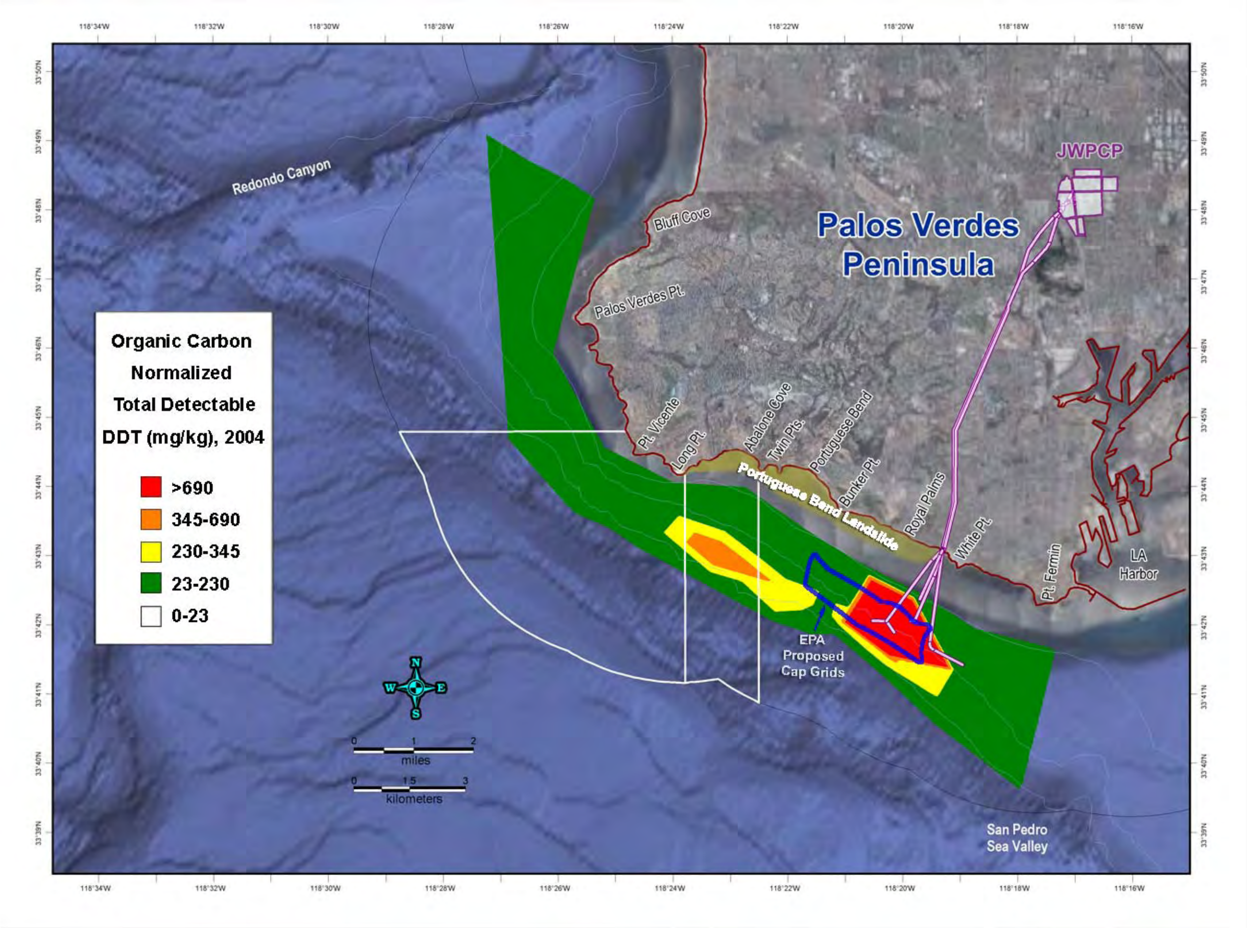


Figure 6. Total DDT in Palos Verdes Sediments. Total DDT normalized for organic carbon from sediment samples collected in 2004 in relation to the MPAs proposed in the IPA. Contamination results are expressed in relation to the EPA Superfund sediment cleanup goal of 23 mg/kg OC (organic carbon). Areas impacted by the Portuguese Bend Landslide and the proposed EPA Superfund capping areas are also depicted.

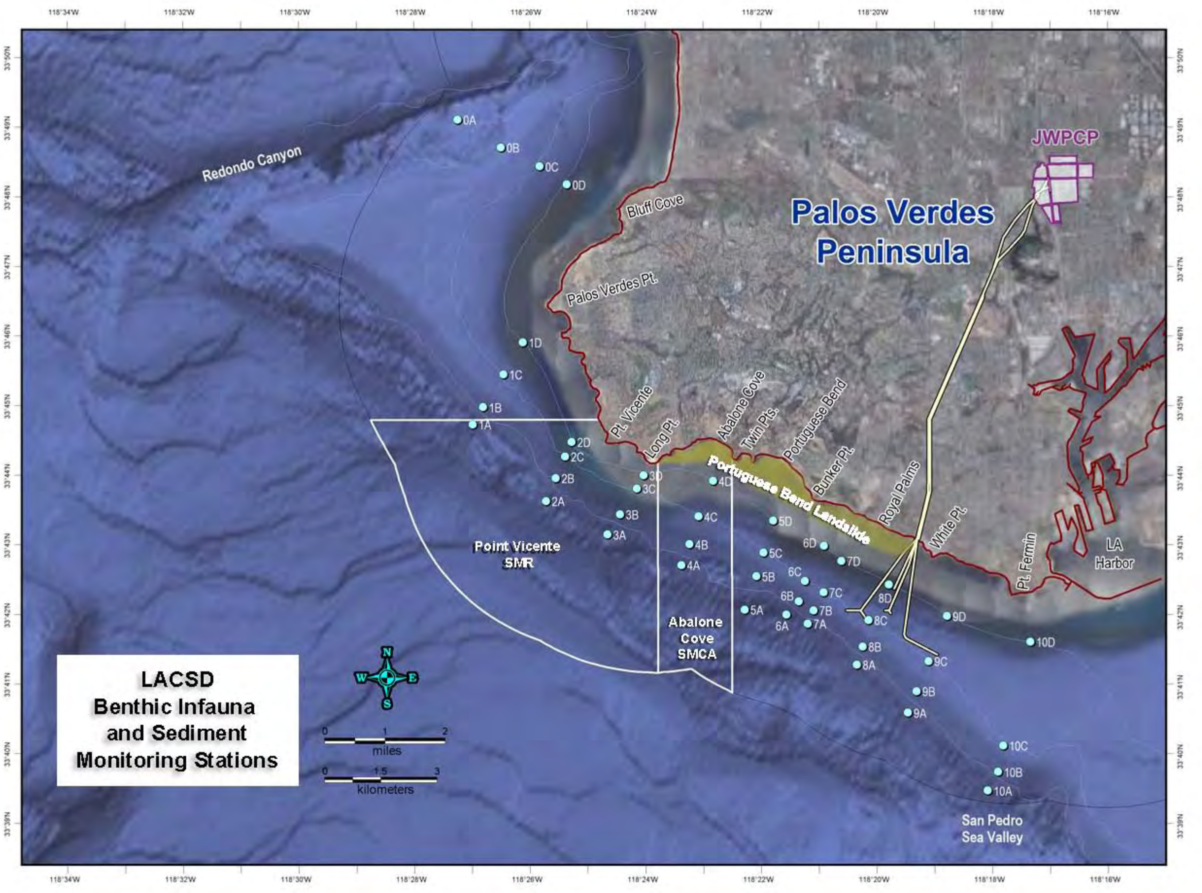


Figure 7 Benthic Infauna and Sediment Monitoring Stations

Map of the sampling sites for analysis of infaunal communities contained within the sediments and physical and chemical analysis of surficial (top two centimeters) sediments. This sampling is required by the Los Angeles Regional Water Quality Control Board, and would constitute significant take.

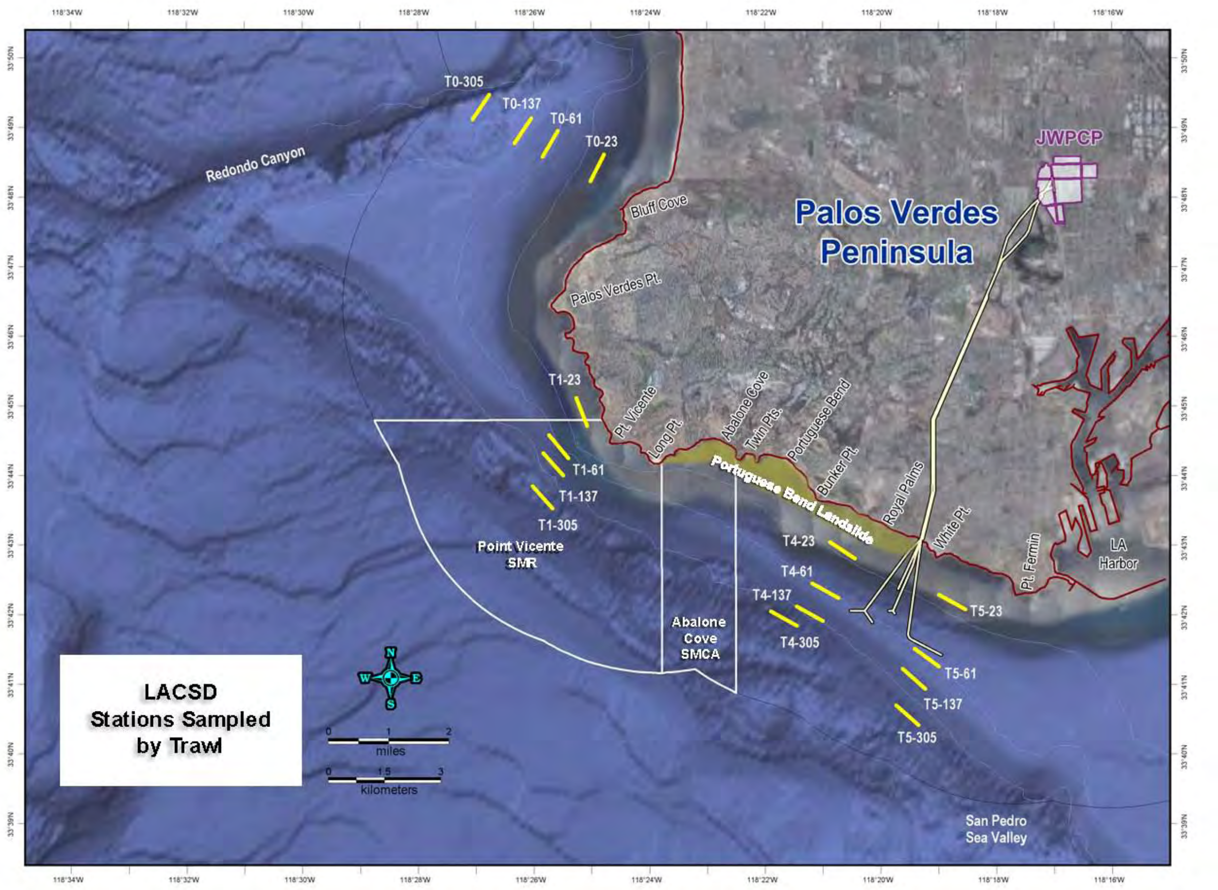


Figure 8 Stations Sampled by Trawl

Map of quarterly monitoring survey stations. The trawl is towed on bottom along the isobath of each station for 10 minutes approximately 1 m/sec, thus traversing about 0.6 km at each station. This sampling is required by the Los Angeles Regional Water Quality Control Board, and would constitute significant take.

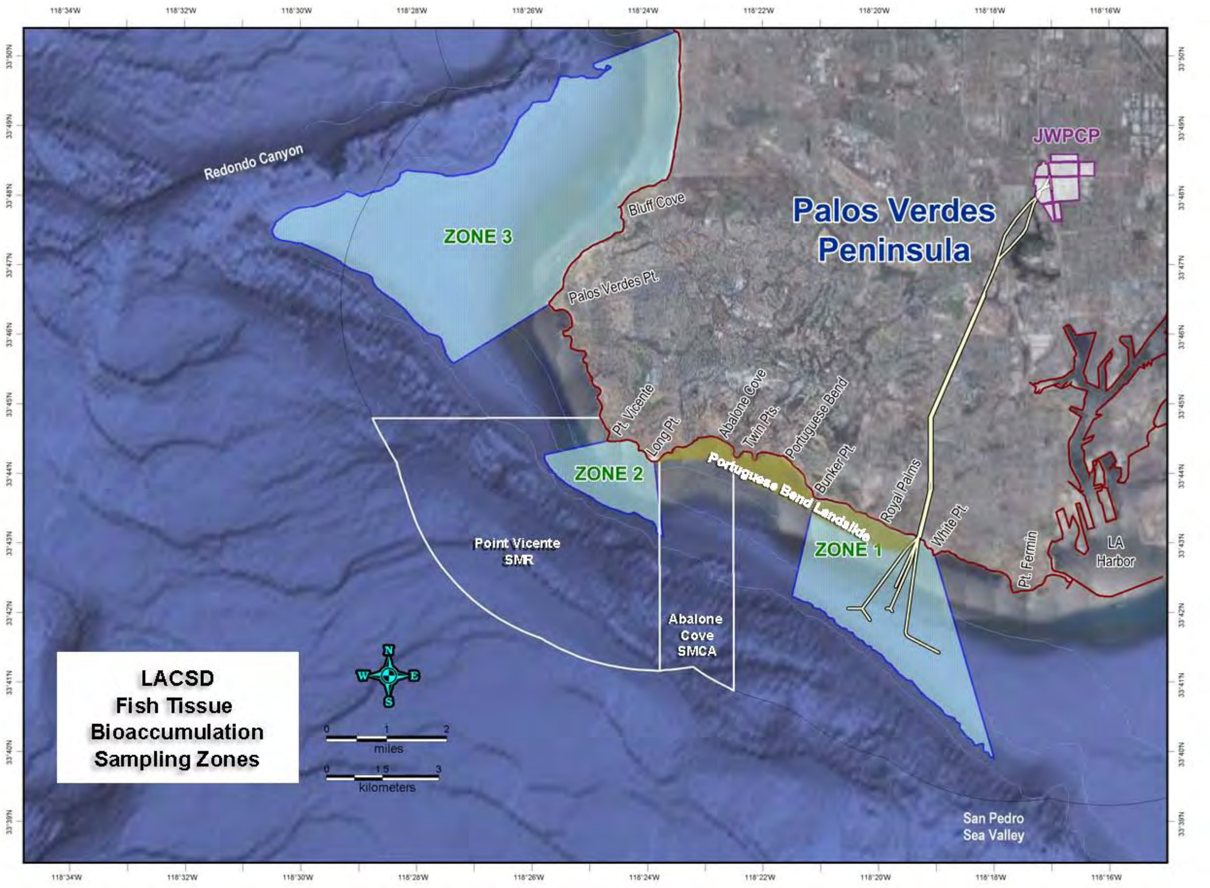


Figure 9 Fish Tissue Bioaccumulation Sampling Zones

Map of sampling zones associated with the local fish contamination trends and seafood safety monitoring. This sampling is required by the Los Angeles Regional Water Quality Control Board, and would constitute significant take.

WATER RECLAMATION
SOLID WASTE MANAGEMENT

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

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STEPHEN R. MAGUIN
Chief Engineer and General Manager

March 26, 2010
File No. 98-50.1.10 SI

Jim Kellogg, President
Members of the California Fish and Game Commission
1416 Ninth Street
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Dear Commissioners:

Comments on April 7, 2010 Fish and Game Commission Meeting Agenda Item 9:
Opposition to Proposed Marine Protected Areas in South Palos Verdes

Thank you for the opportunity to submit additional comments regarding the Sanitation Districts' opposition to adoption of the proposed South Palos Verdes Marine Protected Areas (MPAs) in the South Coast Region. In brief, the Blue Ribbon Task Force (BRTF) failed to adhere to requirements in the Marine Life Protection Act (MLPA) or the MLPA Master Plan to properly incorporate scientific and socioeconomic information when it selected the South Palos Verdes MPAs for inclusion in its Integrated Preferred Alternative (IPA). The proposed South Palos Verdes MPAs are of very low value with respect to habitats protected and potential for biological productivity, yet they threaten to inflict enormous socioeconomic impacts, that were never considered by the Regional Stakeholder Group or the BRTF for the South Coast region, to the millions of people the Sanitation Districts serve in the greater Los Angeles metropolitan area. The Sanitation Districts repeat our previous request to the Commission to eliminate these MPAs from consideration for CEQA analysis and ultimate adoption in the South Coast region MPA network.

The Sanitation Districts are a confederation of 23 independent special districts serving the wastewater and solid waste management needs for over 5.5 million people in Los Angeles County. For over 87 years, the Sanitation Districts have operated one of the largest regional wastewater collection and treatment systems in the nation, with a service area that covers approximately 820 square miles and encompasses 78 cities and the unincorporated territories within Los Angeles County. Within the greater Los Angeles metropolitan area, the Sanitation Districts operate an interconnected system of sewers and wastewater treatment plants called the Joint Outfall System (JOS), which serves 17 districts and 73 cities. The terminal treatment plant in the JOS is the Joint Water Pollution Control Plant (JWPCP), which discharges to an ocean outfall system offshore of White Point on the southern side of the Palos Verdes peninsula. The Sanitation Districts have actively participated in the MLPA process in the South Coast Study Region, not only because of our duty to protect the essential public health infrastructure that the Districts operate offshore of the Palos Verdes Peninsula, but also because of the decades of comprehensive monitoring that the Districts have conducted to ensure the protection of the marine environment.

Throughout the MLPA process, the Sanitation Districts have stated our concerns relating to the proposed MPAs offshore of South Palos Verdes. A compilation of these concerns is attached to this letter, detailing many scientific and legal issues. Unfortunately, the Sanitation Districts' input was not reflected in the recommendations of the BRTF, whose IPA includes low-value MPAs offshore of South Palos Verdes that would overlie one of the most contaminated areas of a Superfund site, would protect very low quality habitats, would add very little biological productivity to the South Coast region, and are in the immediate vicinity of the Sanitation Districts' ocean outfall system. Indisputably, these proposed MPAs are located in an area heavily impacted by human activities, as evidenced by the contaminated sediments in the area.

The Palos Verdes Shelf was designated as a Superfund site in 1997 due to the legacy DDT contamination in the area resulting from historical industrial wastewater discharge. As detailed in **Attachment 1**, the proposed MPAs offshore of South Palos Verdes overlie a portion of the site containing some of the most contaminated sediments and waters in the Region. The sediments exceed EPA's DDT cleanup goal, designated to be protective of human and aquatic life, by more than 20 times in the proposed Abalone Cove State Marine Conservation Area (SMCA) and by 10-20 times in the proposed Point Vicente State Marine Reserve ("SMR"), further demonstrating how low in value these MPAs are to the region as a whole. The Science Advisory Team (SAT) for the South Coast Study Region was specifically asked by the Sanitation Districts to provide guidance for appropriate placement of MPAs in these areas. A summary of these contamination issues and the SAT's guidance is provided in Attachment 1. Despite finding that sedimentation and turbidity associated with the Portuguese Bend Landslide, sediment and water contamination associated with the EPA Superfund site, and impacts associated with the Superfund site remedial actions make the proposed areas harmful to aquatic life, the SAT concluded that only a narrow portion of the Palos Verdes Shelf should be excluded from MPA consideration. That narrow portion did not include the Point Vicente SMR or Abalone Cove SMCA. Such a conclusion is inexplicable in light of the SAT's findings, and demonstrates a deliberate choice to issue guidance that does not adequately reflect the best available science, which must be considered under the MLPA and MLPA Master Plan. As detailed in **Attachment 2**, this choice to not consider the best available science makes the BRTF's designation of the South Palos Verdes MPAs legally and scientifically suspect.

Further, the habitats in both the proposed Abalone Cove SMCA and Point Vicente SMR are primarily characterized by soft bottom silt and sand, and provide negligible protection for "rare, threatened or endangered native plants, animals, or habitats" that should characterize SMCAs and SMRs as defined in the Marine Managed Areas Improvement Act. As such, removal of the proposed MPAs in South Palos Verdes from the IPA would not reduce replication between bioregions or cause exceedance of spacing guidelines. Also, removal of these MPAs would only cause a *de minimus* (<5%) reduction in the area of protected habitats (with the exception of >200m soft-bottom habitat) and potential for biological productivity associated with the IPA (**Attachment 3**).

Of critical importance, the proposed MPAs offshore of South Palos Verdes jeopardize the ongoing operation of the Sanitation Districts' JWPCP and ocean outfall system. The State Water Resources Control Board (SWRCB) is responsible for designating Water Quality Protection Areas, which may overlie MPAs to increase their overall level of protection and to ensure the best possible water quality in MPAs. SWRCB staff have indicated their intent to designate SMRs as Areas of Special Biological Significance (ASBSs), which would prohibit waste discharges should natural background levels within ASBSs be changed as a result of the discharges. The proposed Abalone Cove SMCA and Point Vicente SMR are only a short distance down-current from JWPCP's ocean outfall system. Even though the JWPCP effluent discharge meets all California Ocean Plan and permit standards, very low levels of some constituents can be measured above natural background levels in the waters of the proposed Abalone Cove SMCA and Point Vicente SMR.

The prospect that the discharge from the JWPCP would be restricted beyond current stringent permit requirements or that the outfall system would have to be relocated due to the placement of these MPAs threatens severe impacts to the millions of Los Angeles County residents who depend daily on this essential public health infrastructure. The socioeconomic impacts to Los Angeles County residents would be in the billions of dollars, which would dwarf the socioeconomic impacts considered by the BRTF. The Sanitation Districts repeatedly submitted this information to the BRTF to make clear that a MPA designation could cause significant socioeconomic impacts that require careful consideration. The recommendations of the BRTF, however, failed to reflect this testimony. Instead, the record indicates that the BRTF considered only socioeconomic impacts associated with fishing activities. However, the MLPA and Master Plan require that the socioeconomic impacts raised by the Sanitation Districts be evaluated before an IPA can be selected.

Had the BRTF adhered to the requirements of the MLPA, it is inconceivable that MPAs would have been proposed in such poor habitat, with well documented sediment and water quality impairments, contributing little or nothing toward the achievement of the stated goals of the MLPA, while simultaneously threatening major socioeconomic impact to 5 million people. In fact, it is legally impermissible to designate the Point Vicente MPA as an SMR because of existing incompatible uses as described above. Therefore, it is improper for the BRTF to have included these proposed MPAs in their proposed IPA and to have forwarded another Regional Stakeholder Group alternative also including these MPAs to the Commission.

Fortunately, the Commission can still act to eliminate these low value MPAs offshore of South Palos Verdes. As stated in our previous comment letter dated February 19, 2010, the Sanitation Districts have the responsibility to exhaust all administrative and legal remedies to ensure the public's investment in this critical infrastructure is protected. We strongly recommend that the Commission eliminate the proposed MPAs offshore of South Palos Verdes from further consideration.

In order to more fully discuss the specific issues associated with the proposed MPAs offshore of South Palos Verdes, the Sanitation Districts also request a special sub-agenda item be included during the April 7, 2010 Commission meeting. We look forward to discussing these matters with you in the future.

Very truly yours,

Stephen R. Maguin

Grace R. Chan

Grace R. Chan
Assistant Chief Engineer and Assistant
General Manager

GRC:JRG:SMW:dhs
Attachments

cc: Susan Ashcraft
John Carlson
Sonke Mastrup
Becky Ota
Adrianna Shea
Ken Wiseman

ATTACHMENT 1
Palos Verdes Shelf (PVS) Superfund Site is not Appropriate for MPA Placement

From the late 1940s to 1971, Montrose Chemical Company (Montrose), the nation's largest producer of the insecticide DDT (dichlorodiphenyltrichloroethane), relied upon the collection system tributary to the Joint Water Pollution Control Plant (JWPCP) for disposal of process wastes containing high concentrations of DDT. Since the wastewater treatment process employed during this period was primary treatment only, much of the DDT passed through the treatment system.

It is estimated that 1800 metric tons (mt) of DDT were discharged through the White Point outfall system during the subject period (Chartrand et al., 1985). Following disconnection of Montrose from the sewer system in 1971, DDT discharged to the ocean through the JWPCP outfalls dropped dramatically. Effluent concentrations of total DDTs (the sum of o,p'- and p, p'- isomers of DDT, DDE, and DDD) have been near or below detection for the past twenty years. In fact, DDTs have not been detected in JWPCP effluent since 2002. However, as a result of the past discharges discussed above, there is a very strong spatial gradient of DDTs with the highest sediment concentrations beginning at the Sanitation Districts' outfall and moving to the northwest along the southern coastline of the PV shelf (**Figure 1**).

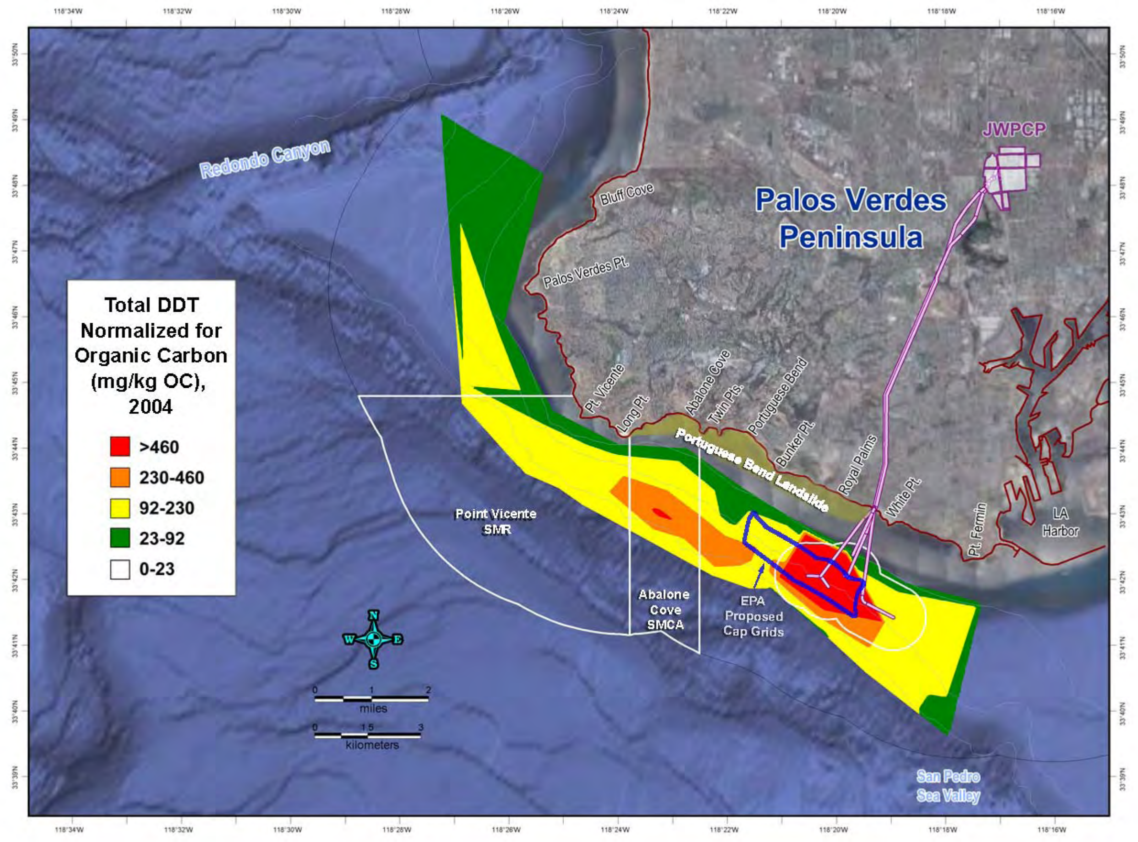

Figure 1. Proposed MPAs in relation to the gradient of DDT contamination in South Palos Verdes expressed as multiples of the EPA's cleanup goal to protect aquatic life and human health (23 mg DDT/kg organic carbon (OC)). White areas (none) are below the goal, while green, yellow, orange, and red areas are 1-4, 4-10, 10-20, and greater than 20 times the cleanup goal. Also depicted are the areas degraded by the Portuguese Bend Landslide and EPA's proposed capping area.

In 1990, the Federal government and the State of California filed a lawsuit under the federal "Superfund" law. The lawsuit charged that DDTs and PCBs damaged natural resources, including fish and wildlife that live in and around coastal waters of Southern California. EPA designated the entire PV shelf between Point Fermin and Redondo Canyon as a Superfund Site in 1997. The lawsuit was eventually settled through four separate consent decrees with the final agreement reached in 2001. A total of approximately $140 million dollars were collected from the defendants.

The United States Environmental Protection Agency (EPA) subsequently conducted an ecological risk assessment for the PV Shelf (USEPA, 2003). The risk assessment found that the levels of DDT and PCBs in the sediment and overlying water were a substantial risk to the health of benthic infauna, fish, seabirds, and marine mammals all of which are meant to benefit from the Marine Life Protection Act (MLPA) process. The EPA further concluded that the greatest risk is found near the outfalls and gradually declines with distance away from the outfall. Based upon this information and other subsequent research, EPA established a cleanup goal of 23 mg DDT/ kg organic carbon (OC) to protect aquatic life and human health in their Record of Decision for remediation of the PV Shelf (USEPA, 2009). The EPA predicts that the PV shelf median sediment DDT concentration will not meet the cleanup goal until the year 2039 even with planned remediation activities.

Examination of Figure 1 demonstrates that there are no areas within the Sanitation Districts' sediment monitoring grid (30-305 m depth range) that comply with EPA's cleanup goal. In fact, portions of the proposed Abalone Cove SMCA are more than 20 times the cleanup goal while parts of the Point Vicente SMR are 10-20 times the cleanup goal. One would expect areas with such highly contaminated sediments that threaten the health of the very species likely to benefit from the MLPA would never be considered for a Marine Protected Area (MPA). However, that is exactly what the Blue Ribbon Task Force (BRTF) proposed in their Integrated Preferred Alternative (IPA).

All parties involved in the development of the IPA were aware of the DDT contamination issues. The Sanitation Districts (and others) raised these concerns numerous times in both public testimony and written letters to South Coast MLPA planning groups including the BRTF, Regional Stakeholder Group (RSG), Science Advisory Team (SAT), and most recently to the Department of Fish and Game staff and Fish and Game Commission. In fact, the Sanitation Districts specifically asked the SAT to develop guidance for MPA placement in Palos Verdes in light of the DDT contamination and other sources of habitat degradation (LACSD 2009).

The resulting guidance document (SAT 2009) included the following statements regarding the significant threat the PV Shelf Superfund Site contaminated seawater, sediments, and associated remediation activities pose to aquatic life:

> *"The E[cological] R[isk] A[ssessment] results showed the highest biological risk to fish and invertebrates occurring near the immediate vicinity of the outfalls. Intermediate risk occur south to southwest of the outfalls as well as northwest of Point Vicente, while the lowest-risk area is around the northern areas of the PV shelf near Redondo Beach." (SAT 2009, page 4)*
>
> *"Although the waters overlaying PV Shelf have met the A[quatic] W[ater] Q[uality] C[riterion] for PCBs, they do not meet the AWQC for DDT. The AWQC for protection of aquatic life (including fish) is 1 nanogram/liter DDT. The no observable effects concentration (NOEC) for fish is 1,900 microgram/kilogram whole body tissue for DDT. White croaker, sanddabs, and kelp bass on the PV Shelf generally exceed the DDT NOEC, according to the EPAs standards." (SAT 2009, pages 4-5)*

> *"Based on the EPA standards for protecting wildlife, the EPA has determined that contaminants found in the water, sediment and in the fish do not meet the protective requirements of aquatic life." (SAT 2009, page 5)*
>
> *"As outlined above, capping will result in disturbance to the benthic environment, and the potential re-suspension and availability of legacy contaminants would deleteriously affect organisms and potentially community composition in the area. If capping at the first proposed site is successful, then additional sites in the area would be considered for treatment, which would occur approximately 5 to 7 years after initial treatment. This prolonged disturbance could reduce the effectiveness of MPAs that are placed near the mitigation site, and therefore MPA placement in the area should be avoided." (SAT 2009, page 7)*

Contrary to these statements and the goals of the MLPA to protect habitat suitable for the healthy propagation of marine life, the SAT guidance only suggested exclusion of "the mitigation sites identified by the EPA and the areas with the **highest** (emphasis added) known levels of toxicity and turbidity/sedimentation" (SAT 2009, page 8; **Figure 2**). According to the SAT's guidance, only the most severely contaminated areas closest to the outfall were recommended for exclusion, leaving many highly contaminated and unsuitable areas of the Superfund Site available for MPA placement. As such, the SAT failed to provide the RSG and BRTF with suitable guidance regarding the true areal extent of the threat posed by the PV Shelf Superfund Site to aquatic life, including species likely to benefit from the MLPA. Further, the BRTF failed to heed SAT warnings that placement of MPAs near future sediment capping sites should be avoided.

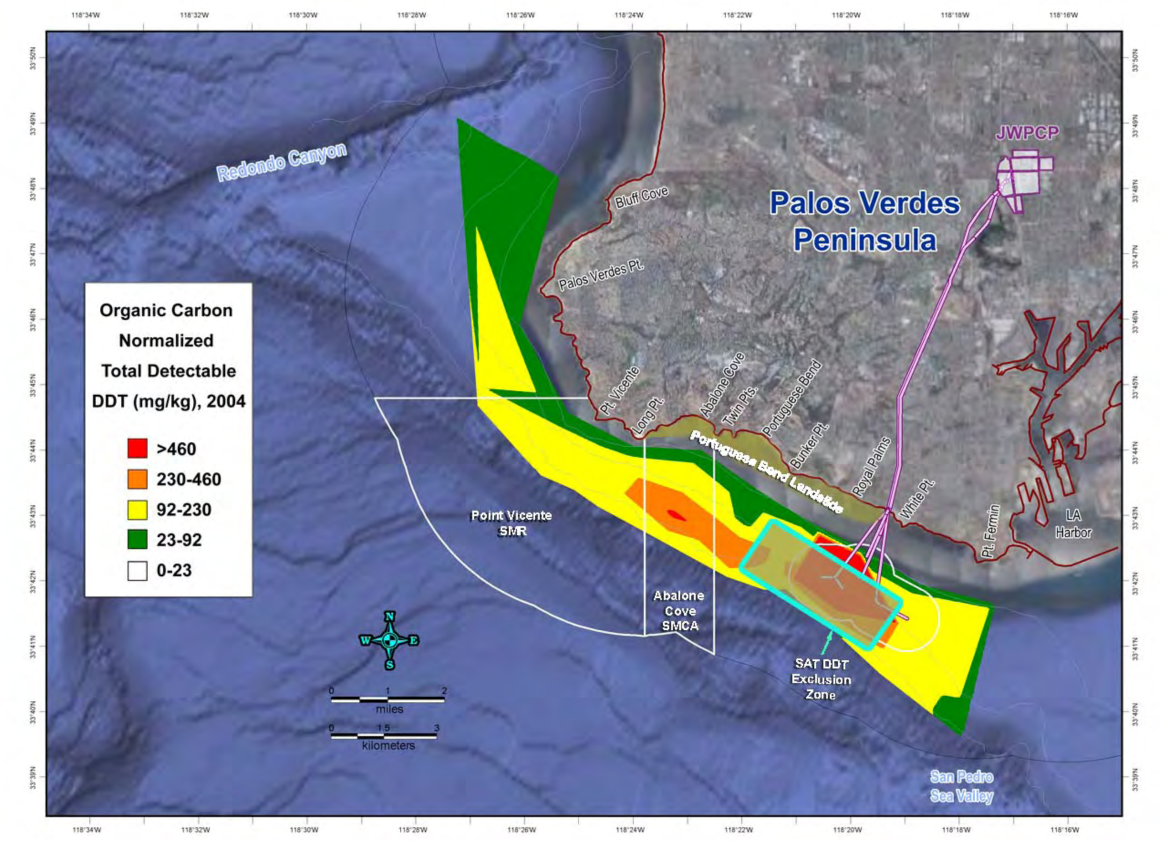

Figure 2. SAT recommended MPA exclusion zone (blue rectangle over outfalls) in relation to sediment DDT contamination (expressed as multiples of the EPA's cleanup goal of 23 mg/kg organic carbon (OC) to protect aquatic life and human health) and the proposed MPAs in South PV.

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ATTACHMENT 2
Legal Comments Related to Proposed Marine Protected Areas in South Palos Verdes

These comments are submitted by the Sanitation Districts of Los Angeles County (Sanitation Districts) to the Fish and Game Commission regarding the Marine Life Protection Act (MLPA) Blue Ribbon Task Force (BRTF) Integrated Preferred Alternative (IPA) and other network alternatives for the South Coast Region. The Sanitation Districts oppose the BRTF's proposal to include the proposed South Palos Verdes Marine Protected Areas (MPAs) in the IPA or other alternatives that include these or similar MPAs in South Palos Verdes because the BRTF developed them in violation of the requirements of the MLPA and Master Plan.

A. South Coast Study Region Blue Ribbon Task Force Failed to Properly Consider Water Quality Concerns and Socioeconomic Impacts When Approving MPA Boundary Alternatives for South Palos Verdes

The MLPA mandates that both water quality and socioeconomic impacts be evaluated in siting new Marine Protected Areas (MPAs) and modifying existing MPAs. The MLPA requires the Fish and Game Commission to adopt a Master Plan that guides the siting of new MPAs. FGC §2855(a). The BRTF was required to use the Master Plan to develop the MPAs for the South Coast Region, however, it is clear from the record that they did not adhere to it in several important respects. The failure of the BRTF to develop MPA alternatives in compliance with the MLPA and the Master Plan renders the entire process legally invalid.

1. The BRTF failed to properly consider water quality in the development of the South Palos Verdes MPAs

A primary goal of the MLPA is "[t]o protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems." FGC §2853(b)(1). Good water quality is critical to achieving this goal. In recognition of this, the MLPA specifies that the Department and "team" assembled to prepare the Master Plan "shall have expertise … with water quality and related issues." FGC §2855(b)(2). Additionally, staff from the State Water Resources Control Board "shall" be part of the team, and the Department and team "shall solicit comments and advice for the master plan from interested parties on issues including … (1) Practical information on the marine environment and the relevant history of fishing and other resources use … and water pollution in the state's coastal waters." FGC §2855(b)(3)(A); 2855(c)(1) (emphasis added). The Master Plan explains that water quality is one of the important biophysical indicators of the success of marine management actions to implement the MLPA, and recommends that the Science Advisory Team (SAT) work with the State Water Resources Control Board to more fully evaluate potential water quality impacts. Master Plan § 6.2.1, p. 78; *Id.* §3.8.1, p. 53. The MLPA mandates that the Master Plan be "based on the ***best readily available science***." FGC §2855(a) (emphasis added). And, the Master Plan requires that the BRTF evaluate water quality during the initial development of the proposed MPAs, and certainly prior to designating an IPA. *See* Master Plan §2.3, p. 21.

In light of the mandates of the MLPA and Master Plan, a Science Advisory Team was appointed that provided recommendations to the BRTF for considering water quality in developing alternative MPA proposals, and evaluated alternative MPA proposals using these recommendations. *See* California Marine Life Protection Act Initiative, Draft Methods Used to Evaluate Marine Protected Area Proposals in the MLPA South Coast Study Region (SAT Draft Methods) (October 6, 2009); California MLPA Master Plan Science Advisory Team, Summary of SAT Water and Sediment Quality Evaluation of Round 3 SCRSG MPA Proposals for the MLPA South Coast Study Region (SAT Evaluation) (October 7, 2009).

Significantly, the SAT concluded that "[w]here water quality is significantly compromised, marine life may be affected. Impaired water quality may lead to changes to population rates (growth, reproduction, and mortality), population abundance and ecological community composition through a variety of interactions (e.g., decreased diversity, loss of sensitive species and abundance of tolerant species)." SAT Draft Methods, p. xiv. The SAT also stated that "[i]t is generally accepted that degraded water and sediment quality results in impacts to marine life, including undesirable changes to community structure and function." California MLPA Master Plan Science Advisory Team, Draft Recommendations for Considering Water Quality and Marine Protected Areas in the MLPA South Coast Study Region (SAT Draft WQ Recommendations), p. 13 (April 30, 2009) (citations omitted). However, the SAT inexplicably, and contrary to law, concluded that [w]ater quality evaluations are not mandated by the MLPA, and should therefore be considered secondary to other MPA network design guidelines." *Id.*, p. 101. And, despite SAT's recommendation that "areas that are significantly impacted by a variety of pollutants from large industrial or developed watersheds" should be avoided as sites for MPAs, it failed to recommend that the Palos Verdes Shelf Superfund Site be avoided. *Id.*, pp. xiv-xv. Thus, while the SAT determined that placement of MPAs "in or near areas of impaired water quality (e.g. Santa Monica Bay)" would be acceptable if there are other reasons to place MPAs in such areas, this conclusion is at odds with the conclusions cited above as well as other scientific evaluations by the SAT. *Id.*

Specifically, in response to a request by the Sanitation Districts, the SAT performed a site-specific evaluation and provided additional guidance for MPA designation in the vicinity of the South Palos Verdes MPAs. The SAT included the following important information and conclusions regarding water and sediment quality and MPA placement in this area in its report:

- The waters overlaying the PV [Palos Verdes] Shelf do not meet the ambient water quality criteria for DDT, and based on the EPA standards for protecting wildlife, EPA has determined that contaminants found in the water, sediment and in the fish do not meet the protective requirements of aquatic life.

- Since the EPA will continually be working in this area through the next several years, if not longer, the SAT determines that it is important to include and consider the current process by the EPA of selecting an interim remedial action for the PV Shelf.

- Capping activities conducted as an interim remedial action could lead to re-suspension events of the contaminated layer and cause some temporary increase in bioavailability of the toxins and a temporary increase in fish exposure to legacy contaminants (i.e. DDT, PCB). If approved, initial capping activities would begin in 2011 and take one to two years to complete.

- If capping at the first proposed site is successful, then additional sites in the area would be considered for treatment, which would occur approximately 5 to 7 years after initial treatment. This prolonged disturbance could reduce the effectiveness of MPAs that are placed near the mitigation site, and therefore MPA placement in the area should be avoided.

SAT Draft Recommendations for Evaluating Water and Sediment Quality Along the Palos Verdes Shelf (SAT Draft PV Recommendations), pp. 4-7 (August 31, 2009) (emphasis added).

It is important to note that the additional sites that would be considered for remedial capping activity are even closer than the first proposed capping site to the proposed Abalone Cove SMCA and Point Vicente SMR, and would therefore be expected to potentially have even greater impacts on the proposed MPAs (s*ee* ***Attachment 1****)*. The SAT also found that sedimentation and turbidity associated with the Portuguese Bend landslide make the area off Portuguese Bend (from Long Point to White Point) the least suitable area for proposed MPAs on PV. *Id.*, pp. 5-7.

However, despite these findings acknowledging that the water and sediment quality of the proposed areas, including the Point Vicente SMR and the Abalone Cove SMCA, does not support inclusion in an MPA, the SAT concluded that only a small area should be excluded from MPA designation. That narrow exclusion area did not include the proposed Point Vicente SMR or the Abalone Cove SMCA, even though EPA has clearly documented and the SAT concurred that all along the PV shelf (and inclusive of the areas occupied by the proposed South Palos Verdes MPAs) "contaminants found in the water, sediment and in the fish do not meet the protective requirements of aquatic life." SAT Draft PV Recommendations, p. 5. The SAT's conclusion and the BRTF's proposed designation of the South Palos Verdes MPAs demonstrate that the MPAs are not supported by the best readily available science, in violation of the MLPA and the Master Plan. The SAT's recommendation is also at odds with the legal mandates for state marine reserves that they "be maintained to the extent practicable in an <u>undisturbed and unpolluted</u> state" and "be designed . . . to ensure that activities that <u>upset the natural ecological functions of the area are avoided</u>," and the overall goal of the MLPA "to improve recreational, educational, and study opportunities provided by marine ecosystems <u>that are subject to minimal human disturbance.</u>" PRC §36710(a); FGC §§2857(c)(4) and 2853(b)(3) (emphasis added). Thus, BRTF's decision to accept the SAT's flawed recommendations and ignore readily available scientific information about historic water and sediment pollution and the ongoing and anticipated future ecological impacts from human activities (due to EPA's Superfund cleanup activities) in the waters off of South Palos Verdes makes the proposed designation of the South Palos Verdes MPAs legally improper. The BRTF's failure in this matter is particularly egregious in that subsequent analyses demonstrate how little value these proposed South Palos Verdes MPAs provide to the overall MPA network of the IPA. (s*ee* ***Attachment 3***). Had the BRTF properly considered the poor sediment and water quality with respect to how little value the proposed Point Vicente SMR and the Abalone Cove SMCA provide to the overall MPA network for the IPA, it seems inconceivable that the proposed South Palos Verdes MPAs would ever have been proposed in the first place.

2. <u>BRTF failed entirely to consider the socioeconomic impacts of the proposed South Palos Verdes MPAs on the communities served by the Sanitation Districts</u>

The MLPA and the Master Plan include a legal mandate to consider the socioeconomic impacts of MPA alternatives. Section 2855(c)(2) of the California Fish and Game Code specifically states that the Department and the team responsible for preparing the Master Plan to implement the MLPA "shall" solicit advice on issues including "socioeconomic and environmental impacts of various alternatives." This advice is not limited to the preparation of the Master Plan, but includes soliciting advice on the various alternatives when the competing MPA proposals are being developed. Master Plan § 2.3, p. 21.

The Master Plan could not be clearer on the requirement to consider socioeconomic impacts: "Choosing a location for a marine reserve or protected area requires an understanding of probable socioeconomic impacts as well as the environmental criteria for siting." Master Plan §1.4, p. 12. Indeed, the Master Plan is replete with references to the importance of evaluating socioeconomic impacts early on and throughout the entire MLPA process. Master Plan §3.11, p. 59 ("The regional MPA process should make every effort to assemble socioeconomic information early and to apply it in the design and evaluation of MPAs."); *Id.* §2.3, p.21 (evaluation process includes conducting "environmental and <u>socioeconomic analysis as required by law</u>."); *Id.* §2.4, p. 28-29 (SAT and Department mandate to "prepare a preliminary socioeconomic analysis of potential impacts of each alternative proposal."); *Id.* §3.3, p. 41 (The design of MPA proposals should include consideration of "areas of intensive human use and the cost and benefit of establishing MPAs in these areas.") (emphasis added). This includes requirements for the Department of Fish and Game, MLPA Master Plan Team, and BRTF to consider information concerning socioeconomic impacts that affected communities provide during the development of each MPA under review. FGC §§2855(c), 2857.

The Sanitation Districts repeatedly submitted information to the BRTF emphasizing that the socioeconomic impacts to Los Angeles County residents could be in the billions of dollars should the Sanitation Districts be required to take measures in response to restrictions that could be imposed as a result of the designation of the South Palos Verdes MPAs. This is because the proposed MPAs offshore of South Palos Verdes jeopardize the ongoing operation of the Sanitation Districts' Joint Water Pollution Control Plant (JWPCP) and ocean outfall system in two ways. First, the placement of MPAs, such as the Point Vicente SMR and the Abalone Cove SMCA contained in the IPA over areas of impaired sediment and water quality and poor quality habitat creates a high likelihood that underperformance of these MPAs will occur and, as MPA performance is evaluated and adaptive management measures are applied, that this lack of success in attaining the goals of the MLPA could result in new restrictions being imposed on the discharge from the Sanitation Districts' infrastructure. The MLPA and Master Plan require monitoring of MPAs to ensure that they are meeting their stated goals. FGC §2853(c)(3); Master Plan §6, p. 73-79. Such new requirements on the Sanitation Districts' infrastructure could include relocation of the point of discharge (resulting in the need for significant investments in new infrastructure), restrictions on the quantity of flow allowed to be discharged, and/or restrictions on the mass or concentration of pollutants allowed to be discharged, resulting in the need for major treatment plant upgrades. Any of these scenarios could cost the Sanitation Districts, and the millions of Los Angeles metropolitan area residents served by these facilities, billions of dollars.

Second, these potential socioeconomic impacts could be effectuated by the designation of these MPAs, and the subsequent overlying designation of State Water Quality Protection Areas (SWQPAs) by the State Board. The State Water Resources Control Board (State Board) is responsible for designating SWQPAs, which may overlie MPAs to increase their overall level of protection and to ensure the best possible water quality in MPAs. PRC §36725(d). The State Board and Regional Water Quality Control Boards are charged with responsibility for taking appropriate actions to protect SWQPAs. PRC §36725(f)(3). According to the SAT, "[f]urther protection from water quality threats, or restoration of water quality to meet standards, should be targets to be accomplished after MPA implementation using the appropriate mechanisms." SAT Draft WQ Recommendations, p. 2. The SAT goes on to identify the following potential post MPA designation implementation strategies to protect and restore water quality: "for example, the regional water boards may recommend to the State Water Resources Control Board the designation of additional state water quality protection areas (SWQPAs), or work on priority total maximum daily loads that could restore water quality MPAs."[1] *Id.*, p. 13. Further, the Marine Managed

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[1] An MPA designation has important ramifications for the State Board's subsequent designation of ASBS pursuant to the Ocean Plan. Through the Ocean Plan, the State Board has the authority to control the discharge of waste to ocean waters to protect the quality of those waters. Ocean Plan Introduction. Included in the beneficial uses of the ocean that are protected by the Ocean Plan are ASBSs and marine habitats. Ocean Plan I(A). The State Board is responsible for designating an ASBS if the area is (1) located in ocean waters; (2) intrinsically valuable or has recognized value to man for scientific study, commercial use, recreational use, or esthetic reasons; and, (3) needs protection beyond that offered already. Ocean Plan Appendix IV. Once an ASBS has been designated, any change in the natural water quality associated with any discharge into or proximal to that area is prohibited. Ocean Plan III(E). Because the MLPA specifies that an area designated as a State Marine Reserve ("SMR") should receive the highest level of protection from human activities, an SMR would likely be designated as an ASBS. *See* FGC §2852 (d); PRC §36710(a).

Areas Improvement Act (MMAIA) establishes that Areas of Special Biological Significance (ASBS) are a subset of SWQPAs that require special protection. PRC §36700(f). In areas receiving the ASBS designation by the State Board, waste discharges are prohibited should natural background levels within that ASBS be changed as a result of the discharges. Ocean Plan III(E). The proposed Point Vicente SMR is only a short distance down current from JWPCP's ocean outfall system. Even though the JWPCP effluent discharge meets all Ocean Plan and permit standards, very low levels of some constituents can be measured above natural background levels in the waters of the proposed Abalone Cove SMCA and Point Vicente SMR. Thus, designation of these MPAs leads to a high likelihood that a series of related actions would be triggered that will result in the outfall system having to be relocated and/or treatment upgraded at JWPCP due to the placement of these MPAs.

Despite the Sanitation Districts' repeated submittals of comments to the BRTF relaying these concerns about socioeconomic impacts, the BRTF appears to have given no consideration to this testimony. Instead, the record reflects that the BRTF considered only the socioeconomic impacts to fishing interests from locating the Palos Verdes MPAs north of Point Vicente and Abalone Cove. *See e.g.* South Coast Study Region Blue Ribbon Task Force November 10, 2009 meeting video, statements by BRTF members Bill Anderson and Meg Caldwell (e.g. "although the science was clear as to what should ultimately take place there [Palos Verdes] . . . .it was ultimately a choice of the impacts to the fishing and boating community and the ultimate socioeconomics."); *also see,* Draft Methods, pp. 109-113 (description of methodology for conducting economic impact analysis for commercial and recreational fisheries). The MLPA and Master Plan require that the socioeconomic impacts raised by all affected communities be considered during the development of the MPAs. Futhermore, the BRTF's failure to even assess these cost impacts is particularly egregious given how little biological value the proposed South Palos Verdes MPAs provide to the overall MPA network of the IPA. S*ee* ***Attachment 3***.

In conclusion, the BRTF's failure to consider categories of socioeconomic impacts other than fishing, such as those of the public served by the Sanitation Districts, merits exclusion of the South Palos Verdes MPAs in the IPA and other alternatives under consideration for the South Coast Region.

B. Designation of a No-Take State Marine Reserve on South Palos Verdes Peninsula is Legally Impermissible

If any MPAs are to be designated on South Palos Verdes, designation as a No-Take State Marine Reserve (SMR) is legally impermissible. For instance, the BRTF's IPA includes an MPA at Point Vicente, which the BRTF has proposed to designate as an SMR. The designation of a SMR makes it illegal to engage in activities that result in a take as that term is defined. PRC §36710(a). Currently, the EPA Superfund Site remediation program described above necessitates periodic monitoring of sediment and fish tissue chemistry within the IPA proposed Point Vicente SMR and other MPAs offshore of South Palos Verdes, which would constitute "take." The EPA's activity is in direct conflict with the designation of the Point Vicente MPA as an SMR.

The California Attorney General (AG) has provided legal advice to the Natural Resources Agency for dealing with conflicts such as this one. The AG identified several options for how existing permitted activities, like those covered by EPA Superfund Site remediation, may be accounted for in designation of MPAs. Informal Advice from the Office of Attorney General regarding marine protected areas and the Marine Managed Areas Improvement Act (AG Memo), p.2 (October 1, 2009). The AG noted that "prohibitions for marine reserves are the strictest of all marine managed areas" and that "the Legislature intended marine reserves to be 'genuine no take areas.'" *Id.* p. 5. Thus, the AG concluded "The Fish and Game Commission . . . must exclude the area occupied by an existing incompatible use from a designation or choose a less stringent designation that can accommodate the use." *Id.* p. 2 (emphasis added). The proposed SMR on South Palos Verdes included in the IPA did not allow for "take," and thus is legally at odds with the MLPA and MMAIA due to these existing incompatible uses.

C. Conclusion

The BRTF's disregard of the clear requirements of the MLPA and Master Plan to consider water quality and socioeconomic impacts renders their decision to include the proposed South Palos Verdes MPAs in their proposed IPA legally invalid. The Fish and Game Commission can still act to eliminate the South Palos Verdes MPAs from further consideration in the South Coast Region. For all the reasons stated above and in the other Attachments, the Sanitation Districts strongly recommend that the Commission take such action.

ATTACHMENT 3

Exclusion Analysis for South Palos Verdes MPAs

The Abalone Cove SMCA/Point Vicente SMR Marine Protected Areas (South Palos Verdes MPAs) cluster proposed in the Blue Ribbon Task Force's (BRTF's) Integrated Preferred Alternative (IPA) represents low-value habitats that only minimally contribute to the overall habitat protection within the IPA. The following information demonstrates this point by quantifying the impact to the IPA if the South Palos Verdes MPAs were removed from the IPA. This analysis uses several key parameters utilized by the MLPA Master Plan Science Advisory Team (SAT) in their evaluation of marine protected area (MPA) proposals in relation to the goals of the MLPA. SAT evaluations include: 1) an analysis of habitat representation within ecosystems and habitats; 2) habitat replication within ecosystems and habitats; 3) evaluation of MPA spacing with respect to marine life populations and connectivity; and 4) bioeconomic modeling which is used as an indicator of relative productivity in an MPA.

1) Area of Habitats Protected

The SAT habitat representation analysis addresses how well key habitat types are represented in individual MPAs or MPA clusters. In evaluating the key habitat types in the IPA, the South Palos Verdes MPAs only contributed between 0 and 5.2 percent or less of total areal or linear habitat in the region for all but one habitat (**Figure 1**). The exception was deep soft-bottom (200-3000 m) habitat, which within the South Palos Verdes MPAs, is heavily contaminated with DDT and PCBs (see **Attachment 1**). The loss of this contaminated soft-bottom habitat is even less significant in the context that offshore soft-bottom habitats are the most abundant habitats in the study region (>37 square miles in IPA). Removal of the South Palos Verdes MPAs still leaves approximately 24 square miles of deep (200-300 m) soft-bottom habitat and over 285 square miles of total soft-bottom habitat protected in the region. By comparison less than 28 square miles of crucial hard bottom habitats (sum of all depths) are protected by the IPA. Therefore, the removal of the South Palos Verdes MPAs from the IPA has little impact on the quantity of habitat protected in the region.

2) Habitat Replication

The science guidelines for design of MPAs recommend replication of habitats within 3-5 MPAs in the South Coast biogeographical region. Additionally, to represent the full diversity of marine ecosystems within the South Coast region, the SAT recommended that habitats should be replicated in at least one MPA in each of the five bioregions (south and north mainland, and west, mid-, and east Channel Islands), to the extent possible. Removal of the South Palos Verdes MPAs from the IPA does reduce the number of replicates obtained in some habitats at the high and very high levels of protection by one replicate. However, the loss of a single replicate within the south mainland bioregion does not result in any exceedances of the SAT guidelines for habitat replication. Additionally, the South Palos Verdes MPAs do not sufficiently represent enough hard-bottom habitat (both inshore and offshore), or kelp persistence, to even form a replicate. Therefore, removal of the South Palos Verdes MPAs from the IPA would have no impact on the replication of these crucial habitats in the South Coast region.

3) Habitat Spacing

SAT spacing guidelines were developed to provide for the dispersal of larvae for a range of important bottom-dwelling fish and invertebrate groups between MPAs and to promote connectivity in the network. To facilitate dispersal and connectivity, spacing guidelines along the mainland recommend that habitats replicated in MPAs be placed at a maximum of 31-62 statute miles from each other. Since marine populations are generally habitat specific, the spacing evaluation was conducted for each habitat. Spacing analyses included the maximum distance (gap) between MPA clusters that include a replicate of each habitat for MPAs at very high, high, and moderate-high levels of protection.

Removal of the South Palos Verdes MPAs did not cause any exceedences of the SAT guidelines for habitat spacing. For habitats in which removal of the South Palos Verdes MPAs caused a habitat gap increase, the SAT guideline for maximum spacing (62 miles) had already been exceeded. Therefore, the existing IPA is already deficient in terms of larval connectivity for the habitats represented by the South Palos Verdes MPAs. The removal of the South Palos Verdes MPAs from the IPA will not further add to these deficiencies as defined by the SAT guidelines.

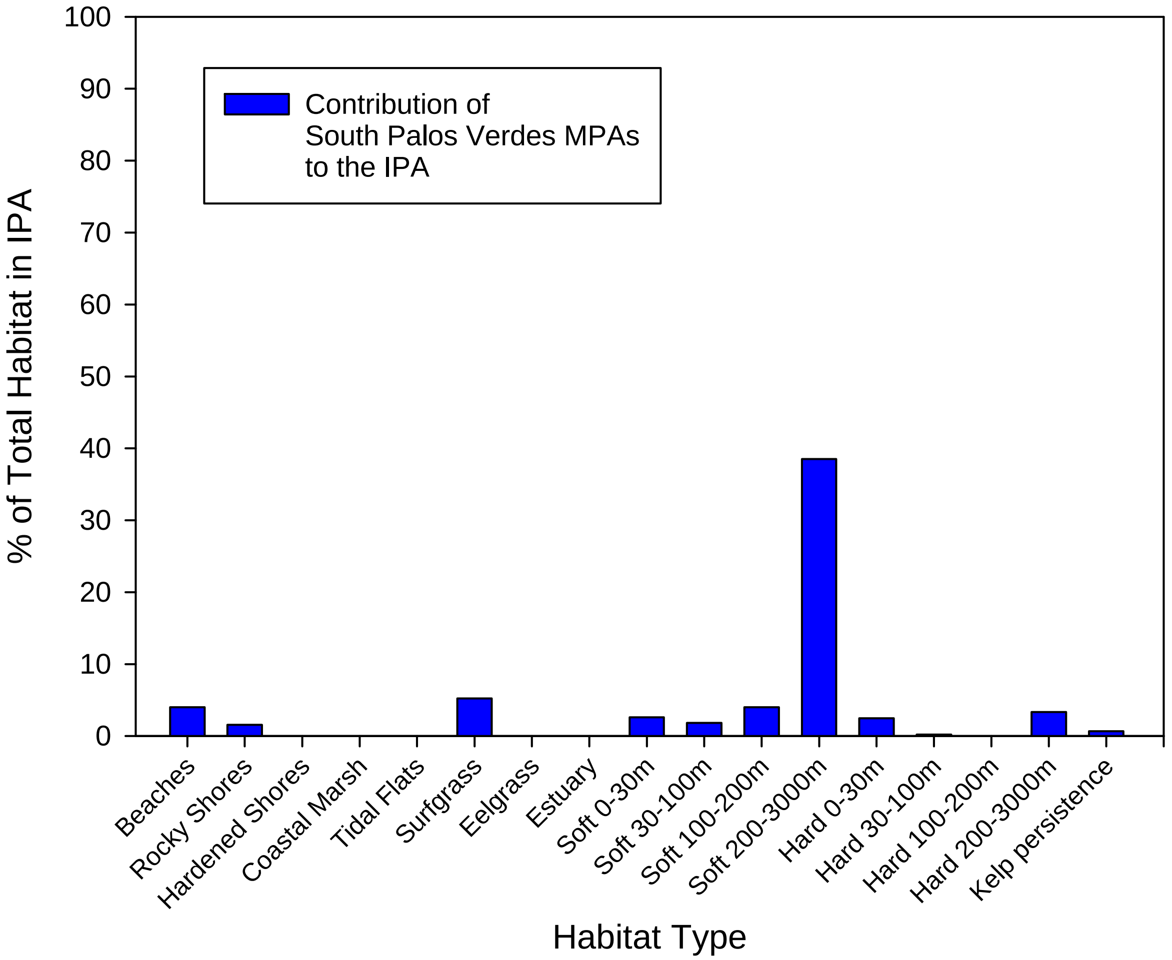

Figure 1. Percent of total area represented by South Palos Verdes MPAs. Data taken from Habitat Calculations for MLPA South Coast Integrated Preferred Alternative (IPA). November 30, 2009. http://www.dfg.ca.gov/mlpa/pdfs/scsr_habcalcs_ipa.pdf

4) Effect on Biomass

SAT bioeconomic model analyses of the MPA proposals were performed by the UC Davis (UCD) and UC Santa Barbara (UCSB) modeling research groups. The results of the bioeconomic modeling evaluations indicate a direct relationship between biomass and fishery production (productivity). The analysis may be used to evaluate whether a particular MPA is attaining a desired level of biomass production (or supporting a desired level of fishery yield). The bioeconomic analysis can also reveal which MPAs are particularly successful in improving connectivity with the MPA network, and which locations are predicted to benefit most from increased larval production inside MPAs.

Included in the modeling was a deletion analysis, in which each MPA in a proposal is sequentially removed, one-at-a-time, and conservation value is recalculated. The difference between the biomass with and without a given MPA is an indication of that MPA's relative contribution to the MPA network. Comparison of the IPA network with and without the South Palos Verdes MPAs reveals little change on the conservation value (biomass) over the entire network (**Figure 2**). In either model, there was a less than five percent contribution of the South Palos Verdes MPAs to network biomass. Therefore, removal of the South Palos Verdes MPAs will have negligible impact to the overall biomass and productivity of fisheries within the South Coast region.

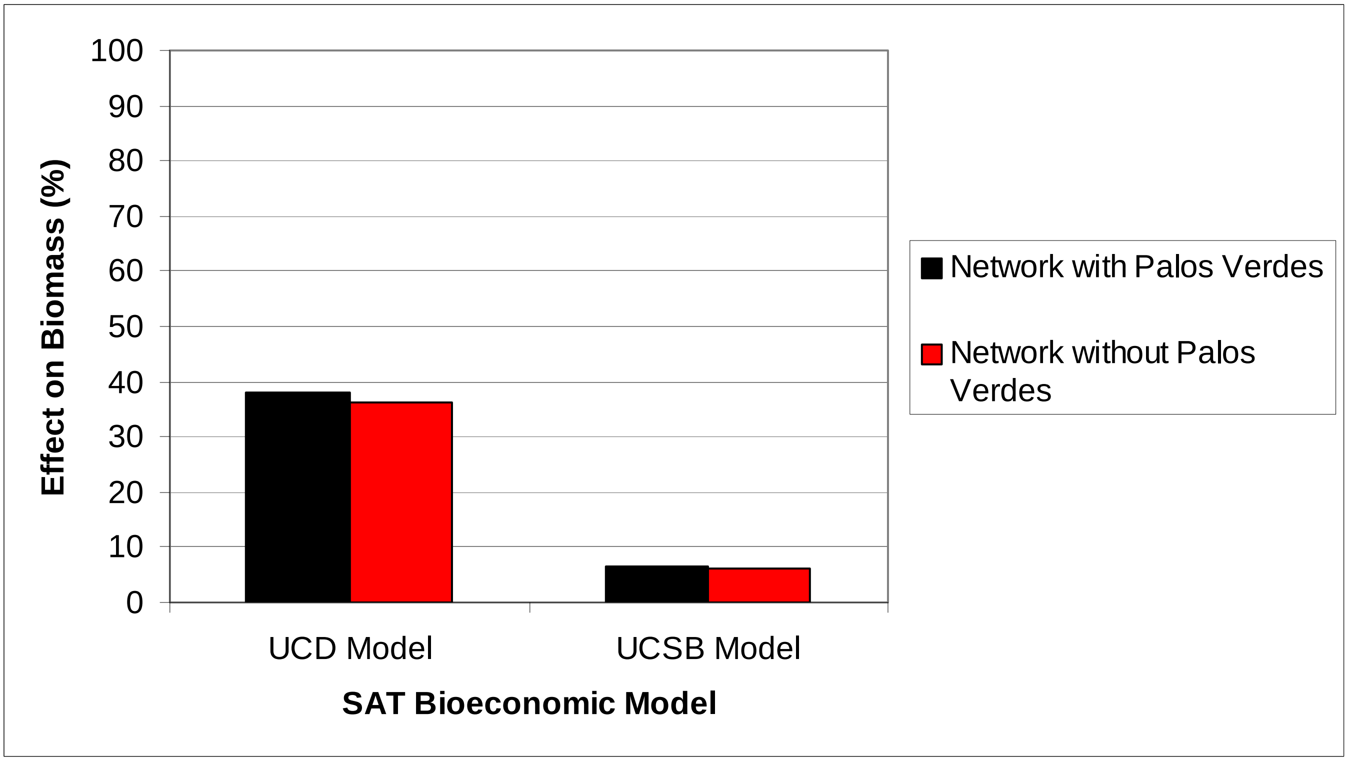

Figure 2. SAT Bioeconomic Models of the effect that the IPA Network has on total Biomass of the region, with and without South Palos Verdes MPAs. Data taken from California MLPA Master Plan Science Advisory Team Outputs from Bioeconomic Model Evaluations of Revised SCRSG MPA Proposals and MLPA South Coast Integrated Preferred Alternative: MPA Deletion Evaluations. December 7, 2009. http://resources.ca.gov/mlpa_scrsg/2009_DEC_9_FGC_BRTF_MEETING/Model_Table4_MPA_deletion_eval_091208.pdf

Attachment C

DEIR Statements Requiring Clarification

DEIR Statements Requiring Clarification

Page	DEIR Statement	Reason Statement Requires Clarification
Section 6.1, Air Quality		
6.6.1-15 and 6.61-16	"These vessels [recreational vessels] would have significantly less emissions per hour of operation than the diesel engines typically used by commercial vessels. Even if the recreational fleet doubled the number of trips and hours of the commercial fleet, the emissions expected to be produced as a result of the proposed Project IPA would be less than the existing significance thresholds."	This statement presents information that purportedly supports the lead agency's conclusion that the impact of the proposed action is less than significant. However, this statement is not substantiated and there are no facts to support this claim. CEQA requires that the conclusions regarding significance be based upon substantial evidence (CEQA Guidelines Section 15064). Substantial evidence is defined by the CEQA Guidelines as "facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts" (CEQA Guidelines 15384). DFG has presented no sources for the information on which it bases its assertions. In addition, the statement does not identify the size of the recreational fleet in comparison to the commercial fleet. This assumption is used in the methodology of the air quality analysis and is not based on any identified facts. Therefore, the air quality analysis associated with recreational vessels is inadequate.
Section 6.3, Water Quality		
6.3-30	**Criterion WQ-1: Violate any water quality standards or waste discharge requirements.** "The MLPA does not provide the Department regulatory authority over water quality discharges; however, the MPAs have been located in areas some distance from regulated discharges to ensure that water quality within the MPAs is suitable for the beneficial uses to the degree feasible."	There are no facts presented to support the assertion that the location of MPAs "some distance" from regulated discharges would, in fact, "ensure" water quality within the MPAs. Facts, evidence, and expert opinion based on facts that the proposed Abalone Cove and Point Vicente MPAs are indeed located the appropriate distance from the existing White Point Ocean Outfall are needed to adequately comply with CEQA's requirement to support significance determinations with substantial evidence. These facts and evidence would include information regarding plume dispersion from the existing White Point Ocean Outfall.
6.3-30	"The previous clarifying language in the ISOR has been included in the MPA regulations for sites where possible conflicts would occur. Further, should presently unknown conflicts be identified in the future the MPA Master Plans adaptive management strategy would result in these conflicts being reviewed and if feasible or necessary mitigated."	This section needs to discuss the nature of the "adaptive management strategy" and possible future mitigation mentioned so that readers can understand future potential conflicts. If the conflicts are reasonably foreseeable, the analysis should also include a description of any "necessary mitigation" because CEQA requires mitigation for all indirect and direct impacts described in a project-level EIR and does not allow the

Page	DEIR Statement	Reason Statement Requires Clarification
		deferral of mitigation to some future time or future CEQA document. There would be no future CEQA document for a project-level EIR.
6.3-31	**Criterion WQ-2: Otherwise Substantially Degrade Water Quality.** “Shifts in boating associated with prohibition of consumptive uses would be similar to those described above, although more consumptive users are likely to be displaced due to the new regulations. The actual locations selected by displaced users and associated incremental travel time and/or increase in risk of collisions cannot be predicted; however, they are expected to be slight. Areas of high boat density fishing activity already occur within the SCSR during sand bass spawning season on the Huntington Beach flats and at times near smaller artificial and natural reefs along the SCSR. Should high fish densities occur along the edges of MPAs then these areas may attract fisherman and may become crowded during times of increased fish bite. The Commission does not expect this to result in significant impacts to water quality (T. Napoli Personal communication 2010).”	There are no facts or evidence presented in these two statements. There is very little discussion in these two statements and the entire paragraph above them as to how fish densities and populations would be affected as a result of the designations of the proposed Abalone Cove and Point Vicente MPAs. These statements are also not supported by any factual discussion explaining why the movement of the fish and thus the movement of consumptive use fishing would not be expected to result in significant impacts to water quality. There is no evidence about the specific knowledge possessed by the person identified permitting that person to adequately assess any potential impact and conclude whether it was significant.
Chapter 7, Biological Resources		
7-70	**Potential Impact BIO-3: Impacts on Marine Species Populations and Habitats Inside MPAs Habitat Protection.** “There would be substantial biological resource benefits because of the increased habitat protection that would occur under the revised MPA network”	The analysis does not identify how or why substantial benefits would occur. This statement is not based on any facts, evidence, or expert opinion presented in the analysis. CEQA requires that conclusions regarding significance be based upon substantial evidence (CEQA Guidelines Section 15064). Substantial evidence is defined as “facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts” (CEQA Guidelines 15384). DFG presents no sources for the information forming the basis of its assertions regarding projected benefits other than the assumption that protecting areas from fishing automatically benefits fish. However, as the Sanitation Districts have pointed out, because of the presence of the existing Superfund site, protecting fish in this area could have the opposite effect.
7-70	“Marine biological resources within MPAs would be expected to benefit from the proposed project, and impacts on species within the MPAs would be less than significant.”	The analysis does not explain how or why substantial benefits would occur. This statement is not based on any facts or evidence presented in the analysis. See the previous comment.
7-75	**Potential Impact BIO-4: Impacts on Special-Status Marine**	These discussions of potential impacts upon the bald eagle, golden eagle,

Page	DEIR Statement	Reason Statement Requires Clarification
and 7-77	**Species Resulting from Removal or Modification of Existing MPAs.** "Bald Eagle In 2007, the bald eagle (*Haliaeetus leucocephalus*) was delisted from the Endangered Species Act and their current protection comes from the Bald and Golden Eagle Act. Additionally, they are listed as endangered by the CESA, and fully protected by the Department. While recreational or commercial fisheries do not target marine birds, they can benefit both directly and indirectly from the establishment of MPAs. Direct benefits include reduced disturbance at breeding and roosting sites and lower probability of interaction with humans and fishing gear at foraging areas. Indirect benefits include reduced competition for important prey resources. The proposed Project IPA and its alternatives each provide an increased level of protection for seabirds (SAT 2009). With the expansion of the proposed MPAs this species will be further protected and conserved. The proposed Project IPA involves designation of a network of MPAs and impacts of the proposed Project IPA will be evaluated as a whole…As such, bald eagle prey species occurring within the SCSR would likely benefit from the proposed Project IPA. Impacts would be less than significant. Golden Eagle The golden eagle (*Aquila chrysaetos*) is fully protected by the Department…Due to the golden eagle's primarily terrestrial habitat and food requirements, it would not commonly use the habitat within the SCSR, therefore the proposed Project IPA would not adversely affect this species. American Peregrine Falcon The American peregrine falcon (*Falco peregrinus anatum*) is fully protected by the Department…Due to the American peregrine falcon's habitat and food requirements, it would not commonly use the habitat within the SCSR, therefore the proposed Project IPA would not adversely affect this species…"	American peregrine falcon, and brown pelican do not mention the potential indirect or direct effects of bioaccumulation of DDT in the food chain due to the proposed designation of the Point Vicente and Abalone Cove MPAs. Therefore, this analysis is incomplete and inadequate. The analysis does not identify how or why benefits would occur. These statements are not based on any identified facts, evidence, or expert opinion. CEQA requires that the conclusions regarding significance be based on substantial evidence (CEQA Guidelines Section 15064). Substantial evidence is defined as "facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts" (CEQA Guidelines 15384). The DEIR does not identify the supporting facts, which it contends are contained in the cited reference (SAT 2009). All of these birds identified as benefiting from the proposed action have been affected in the past by legacy DDT contamination. While the analysis does identify the decreased level of persistent compounds in the environment and the slow recovery of the brown pelican, the analysis completely omits any discussion of the Palos Verdes Superfund site and the creation of two MPAs in this superfund area. One of the aspects of the Montrose Settlements Restoration Program (MSRP) is the enhancement of these species by restricting further access to DDT. Under the IPA the opposite is likely to occur. Designation of the proposed Point Vicente and Abalone Cove MPAs in an area with large legacy DDT deposits would facilitate further dispersal of the DDT. Fish would eventually be forced to leave the MPAs and would take the body burden of the DDT they have acquired with them. The net result would be a wider dissemination of increased DDT via contaminated fish. The upward movement of this contamination would increase the chances for additional DDT uptake by marine mammals and birds feeding on the contaminated fish and ultimately increased DDT exposure for raptors scavenging carcasses found on beaches. Tests of such food sources have routinely shown high body burdens of DDT and its metabolites accumulated in fats of higher-level predators. Since it is fully acknowledged that the brown pelicans were subject to diminishing populations from exposure to organochloride pesticide residues, and it is acknowledged that the MPAs increase fish species within an organochlorine Superfund site, the analysis should discuss why brown

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	“California Brown Pelican The California brown pelican was protected under both the ESA and the CESA due to diminishing populations stemming from exposure to organochloride pesticide residues…As a result, the environmental residue levels of these persistent compounds have steadily decreased in most areas. Pesticide residue levels in brown pelican eggs have steadily decrease since they were first measured…Consequently, populations of brown pelicans on the west coast of the U.S. have substantially increased during the past two decades. Impacts to this species [California Brown Pelican] would be less than significant.”	pelicans and other special status bird species would not be indirectly affected by the designation of the MPAs in a Superfund site. Therefore, the analysis in the DEIR of these special-status species is incomplete, and the findings are unsubstantiated.
Section 8.2, Public Services and Utilities		
8.2-7	**8.2.2 Environmental Setting** “Proposed marine protected areas (MPAs) are not currently served by public services and utilities due to their nature as protected, offshore areas for underwater habitats. Establishment of MPAs within SCSR would not impact the existing utilities identified in Table 8.2-1. Intake and discharge locations within proposed MPAs would continue to operate based on existing permitted conditions.”	There are no facts, evidence, or existing analysis in the section that support the second statement. One of the primary public services providers that would be affected by the implementation of the Proposed IPA, the Sanitation Districts, has submitted several documents presenting the substantial evidence to the contrary. However, DFG has not sought or cited any information from the Sanitation Districts and provides no other sources of substantial evidence to make this significance determination. Furthermore, the statement is made in the environmental setting section of the document, whereas statements such as these should be reserved for the impact analysis section.
8.2-10	**8.2.2 Environmental Setting** “…The permit requirements for these facilities will continue to be monitored under the terms and conditions of the existing NPDES permits issued by the RWQCB. The permit conditions include discharge prohibitions, treated water limitations, receiving water limitations, pretreatment specifications, infiltration/inflow and spill prevention program requirements and other provisions intended to protect the beneficial uses of the receiving water body. The establishment of the MPAs will not result in a modification of the permit requirements for POTWs and/or outfalls these permit requirements would be retained.”	The concluding sentence is not supported by substantial evidence because it is an assumption based on an incomplete factual basis. As identified in the Sanitation Districts’ NOP Comment Letter dated August 3, 2010, and as discussed in previously submitted comment letters dated February 19, 2010, and March 26, 2010, a reasonably foreseeable indirect effect of including Abalone Cove and Point Vicente as MPAs as part of the IPA would be to restrict the discharge from the Sanitation Districts’ outfall system. Specifically, the State Water Resources Control Board (SWRCB) has stated that the designation of new state water quality protection areas (SWQPAs) to protect water quality in MPAs will occur sometime in the near future following the completion of the updated statewide MLPA network. Therefore, the MPAs would result in an indirect effect of modifying permit requirements, and this indirect

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		effect needs to be analyzed.
Section 8.3, Land Use and Recreational Resources		
8.3-22	**Criterion LAND-2: Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.** "The proposed Project IPA is consistent with the polices contained in the California Coastal Act…"	The significance conclusion is not supported by substantial evidence because it is an assumption made based upon incomplete facts. There are policies underlying the California Coastal Act relevant to the proposed project that were omitted in the analysis. These include: *Section 30212.5 Public Facilities; distribution* *Whenever appropriate and feasible, public facilities, including parking areas or facilities, shall be distributed throughout an area so as to mitigate against the impacts, social and otherwise, of overcrowding and over use by the public of any single area.* Although the proposed project is a set of regulatory changes, those changes may result in an overuse of existing public fishing locations by constraining the number of accessible locations. Therefore, this issue should be discussed under Criterion LAND-2. *Section 30230 Marine Resources; Maintenance* *Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.* The proposed Point Vicente and Abalone Cove MPAs will not maintain healthy populations of all species of marine organisms. The protection of these areas, as discussed in comments relating to Sections 6.3 and 7.0 above, would subject marine organisms to contamination and may increase bioaccumulation and spread contamination throughout the food chain and noncontaminated areas. Therefore, this issue should be discussed under Criterion LAND-2. *Section 30234.5 Economic, commercial, and recreational importance of*

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		fishing *The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.* The proposed project clearly would have some effect on the economic, commercial, and recreational importance of fishing. This policy should be discussed under Criterion LAND-2 and should cross-reference Section 5 of the DEIR where appropriate. *Section 30254.5 Terms or conditions on sewage treatment plant development; prohibition* *Notwithstanding any other provision of law, the commission may not impose any term or condition on the development of any sewage treatment plant, which is applicable to any future development that the commission finds, can be accommodated by that plant consistent with this division. Nothing in this section modifies the provisions and requirements of Sections 30254 and 30412.* Since there are several POTWs within the immediate vicinity of the proposed MPAs, this policy should be included and discussed under Criterion LAND-2.
Section 8.4, Vessel Traffic		
8.4-20	**Criterion VT-1: Substantially increase oceanic hazards, in particular due to changes in vessel traffic concentration (i.e., congestion).** "The primary vessel groups that would be potentially impacted by the proposed MPAs are those engaged in commercial and recreational fishing….Because the area available for fishing uses greatly exceeds the area from which fishing effort would be displaced by the proposed Project IPA, it is reasonable to conclude that substantial vessel congestion in fishing grounds would not occur…"	The conclusion that "…it is very unlikely boat concentrations within the proposed MPAs would cause congestion…" is contradicted by the claims in the first paragraph. The first paragraph states that commercial and recreational fishing may be forced to conduct their activities at the periphery of proposed MPA boundaries, and divers and scientific researchers would be attracted to the proposed MPAs resulting in additional wildlife viewing vessel trips.
8.4. -21	**Criterion VT-2: Result in disruption of existing vessel traffic patterns and marine navigation.** The offshore boundary of the proposed Point Vicente SMR is	As stated in the environmental setting, the Los Angeles/Long Beach ports are the two busiest ports in the nation. The claim that "Because of this limited interface between shipping lanes and proposed MPAs, and

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	adjacent to the northbound coastwise shipping lane leaving the Los Angeles/Long Beach port complex, and the southern extent of the proposed Abalone Cove SMCA, which would border the Point Vicente SMR to the east, is only slightly further away. With the exception of these two locations, all other MPAs designated by the IPA would be located at least one nautical mile from designated shipping lanes. Because of this limited interface between shipping lanes and proposed MPAs, and because boaters are generally familiar with the locations of shipping lanes, it is unlikely that implementation of the proposed Project IPA would result in a substantial increase in the number of fishing vessels within commercial shipping lanes. Thus, the proposed Project IPA would not significantly disrupt vessel traffic patterns and marine navigation with respect to the coastwise shipping lanes.	because boaters are generally familiar with the locations of shipping lanes, it is unlikely that implementation of the proposed Project IPA would result in a substantial increase in the number of fishing vessels within commercial shipping lanes" is unsubstantiated. CEQA requires that the conclusions regarding significance be based on substantial evidence (CEQA Guidelines Section 15064). Substantial evidence is defined as "facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts" (CEQA Guidelines 15384). DFG, however, has presented no sources for the facts it purports to assert. In addition, Criterion VT-1 states that commercial and recreational fishing may be forced to conduct activities at the periphery of proposed MPA boundaries. The impact of commercial and recreational fishing forced to the periphery of the boundaries of the proposed Abalone Cove and Point Vicente MPAs and the potential for additional wildlife viewing vessel trips within and adjacent to shipping lanes leaving the two busiest ports in the nation is not discussed.
Section 8.5, Hazards and Hazardous Materials		
8.5-14 and 8.5-15	"Desktop research as performed as well as consultation with various agencies including the DTSC and RWQCBs. The understanding that the project, as a set of regulations, will not utilize hazardous materials in its implementation provided context for analysis in relation to CEQA's significance criteria…"	The context for environmental evaluation should always be the baseline. It is not appropriate to narrow the scope of the analysis simply because the project is a set of regulations and would not physically utilize hazardous materials. CEQA is clear that both direct and indirect effects of the proposed action must be addressed in the EIR (CEQA Guidelines Sections 15126, 15126.2, 15358). DFG presents no information to support the conclusion that, because the regulation will not "utilize hazardous materials," there would be no impact regarding hazardous materials. The Sanitation Districts have in fact presented evidence to the contrary: that the regulations would in fact cause possible effects in relation to the existing environment with the implementation of the Proposed IPA.
8.5-17	**Criterion HAZ-4: Be located on a site, which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create significant hazard to the public or the environment.** "There are areas within the Southern California Bight that have been identified on lists compiled pursuant to Government Code Section 65962.5 as having contaminated sediments. Many of	The significance conclusions are not supported by substantial evidence because they are assumptions made based upon incomplete facts. The designated MPAs *have not* avoided known contaminated sediment areas. The Palos Verdes Shelf Superfund site is a *known* contaminated sediment area that is listed pursuant to Government Code 65962.5. The designation of the proposed Point Vicente MPA and the enlargement of the Abalone Cove MPA would locate them over the Palos Verdes

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	these sites are currently undergoing assessment, monitoring and remediation. The designation process of the MPAs has avoided known contaminated sediment areas. MPAs could be located in areas where contaminated sediments exist, but have not been identified. However, the designations of the MPAs would not create a hazard to the public or the environment. Therefore, there would be no impact."	Superfund site, where there is known contamination that has been regularly sampled and mapped by both the USEPA and the Sanitation Districts. Furthermore, the Sanitation Districts identified the listing of the Palos Verdes Superfund site pursuant to Government Code 65962.5 in their NOP Comment Letter dated August 3, 2010. The statement that the designation process has avoided known contaminated sediment areas is erroneous. Based on this error, the conclusion "that the MPAs would not create a hazard to the public or environment" is also in incorrect and is not substantiated by facts, evidence, or the existing analysis in the chapter. The ultimate conclusion that impacts would not occur is also not supported by facts, evidence, or the existing analysis in the chapter. As discussed in the comment letter, direct and indirect impacts could occur to the environment by designating Point Vicente and Abalone Cove as MPAs. To appropriately analyze the direct and indirect impacts in the DEIR, the following information should have been included in Section 8.5 and in HAZ-4 analysis: • A description of the existing quantity, variation, and type of habitat in the proposed Abalone Cove and Point Vicente MPAs, and on the greater Palos Verdes Shelf. • A description of the PBL, the water quality characteristics generated by the PBL (e.g., turbidity, sedimentation, etc.), and the impact of these water quality characteristics on the proposed Abalone Cove and Point Vicente MPAs. • A description of the existing levels of DDT/PCB in the sediment and water column at the proposed Abalone Cove and Point Vicente MPAs, and at the Palos Verdes Shelf along with a quantitative analysis of the impact of these levels on the biological communities at the proposed MPAs (e.g., degraded habitat; only species tolerant of contaminated sediment are supported; reproductive impairment; etc.). • A description of the existing quantity, variation, and type of invertebrate, fish, bird, and mammal species located at the proposed Abalone Cove and Point Vicente MPAs, and at the greater Palos Verdes Shelf. • A description of the existing levels of DDT/PCB in these species. • A description of the bioaccumulation of DDT/PCB through each species and through the food chain.

Page	DEIR Statement	Reason Statement Requires Clarification
		• A quantitative analysis of the changes in the existing species populations as a result of locating the proposed Abalone Cove and Point Vicente MPAs within the Palos Verdes Shelf Superfund Site (i.e., analyze the relationship between an increase in the population of species [due to the protection offered by Abalone Cove and Pointe Vicente] and the increased number of species with DDT/PCB due to bioaccumulation in each species and in the food chain). • A quantitative assessment of the change in health risk to wildlife and humans from locating the proposed Abalone Cove and Point Vicente MPAs within the Palos Verdes Shelf Superfund Site. None of this information was included in Section 8.5 or cross-referenced between hazards and other resource areas such as water quality and biology. Therefore, the analysis is inaccurate and incomplete, and the impact determination is unsubstantiated.
8.5-19 & 8.5-20	**Criterion HAZ-9: Have Environmental Effects which will result in substantial adverse effects on human beings, either directly or indirectly?** “Because marine waters in certain portions of the SCSR are contaminated to the extent where consuming particular fish or shellfish species may be unhealthful, it is possible that commercial or recreational fishing efforts could be displaced from an area of acceptable water quality into such contaminated waters…For the purposes of this impact, displacement to areas of lower water quality is of concern only if the reduced water quality could result in excess contaminant levels in the seafood or ocean vegetables harvested for consumption…If the users comply with the consumption guidelines, then potential adverse effects from consuming fish from this area would be considered acceptable, and therefore potential impacts would be less than significant…The percentage of the entire SCSR that would be closed to consumptive uses compared to the area available for consumptive uses is small. Thus potential impacts of displacement of uses from open water areas (i.e., areas only accessible by boat) would be considered less than significant; users could travel to near-by open water areas to obtain the same or similar type of seafood or sea vegetables (kelp).”	This discussion completely ignores the direct and indirect impacts of protecting species of fish within a known Superfund site and the bioaccumulation that would likely occur or the migration of contaminated biomass (e.g., fish); therefore, these “reasonable” assumptions predicated upon facts are incomplete because they are based upon an incomplete set of facts. The existence of bioaccumulation through the food chain has been acknowledged by DFG in its discussion of the California brown pelican in the biology section. The protection of fish species known to pose a risk to wildlife and humans (e.g., White Croaker) through the designation of the proposed Point Vicente and Abalone Cove MPAs are environmental impacts that could result in substantial adverse effects on human beings, either indirectly or directly. Bioaccumulation and the hazard it poses to humans needs to be analyzed under this criterion. Furthermore, reports have consistently shown that fish frequenting areas of legacy deposits have elevated toxic body burdens as a function of their location, and that the sites more distant from the hot spots have fish with reduced toxic body burdens. The MPAs will likely generate numerous fish of larger size known to uptake the existing toxins in the PVSS. These fish would then migrate outside the MPA boundaries to adjacent nontoxic areas. This is contrary to the MSRP’s goals to limit public exposure to elevated tissue burdens of toxic materials through not-take and limited take zones and public education, and it is completely contrary to the activities outlined in the USEPA’s

Page	DEIR Statement	Reason Statement Requires Clarification
		IROD.
Chapter 9, Cumulative Impacts		
9-2	"Because the SCSR is fully encompassed within the bight and because the bight is distinct from the surrounding waters from an oceanographic and biological perspective, the limits of the bight represent reasonable and logical study boundaries for the cumulative impact analysis…Because of this, and because of the very large geographic context of the bight, the list of past, present, and probable future projects considered in this section is not exhaustive, but instead focuses on the most prominent projects in the bight…"	The significance conclusions in the cumulative impact analysis are not supported by substantial evidence because they are assumptions made based upon incomplete facts. Prominent projects in the bight were omitted from the cumulative project list. These are described below. • future regulations imposed by the RWQCB to maintain water quality in coastal areas as described in the Ocean Plan. The cumulative analysis needs to consider the reasonably foreseeable condition of the Regional Water Quality Control Board establishing SWQPAs because this is a future project. The analysis needs to include the associated potential cumulative environmental effects resulting from the placement of MPAs in and around the White Point outfall system. • A prominent project in the bight is the Long Beach Terminal Island Rail Project, which would create efficiencies in the rail system and remove an at-grade crossing by filling sections of the harbor. This project was omitted from the cumulative projects list and needs to be included in the analysis.
9-13	"In 2005 the resource trustee agencies identified above prepared a joint programmatic Environmental Impact Statement (EIS)/EIR for the proposed restoration effort. In 2006, the Department issued a Notice of Determination stating that the restoration program would not have a significant impact on the environment, and approving the project (Department 2006)."	It is unclear from this description whether this is referring to the EPA signed interim Record of Decision (IROD) discussed in the EPA letter to the California Fish and Game Commission dated February 18, 2010. The IROD specifically identifies the type of future activities EPA will conduct to remediate the superfund site. The IROD and these activities should be described in the cumulative section for a complete identification of the future actions that may have a cumulative effect when combined with the proposed project.

Attachment D

An Analysis of the Proposed Point Vicente and Abalone Cove Marine Protected Areas

An Analysis of the Proposed Point Vicente and Abalone Cove Marine Protected Areas

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October 14, 2010

Qualifications: The major focus of my research program is the fish assemblages of the rocky reefs in the Southern California Bight. The field portion of my research program is based out of King Harbor, Redondo Beach; thus, the most of my work has been conducted at the Palos Verdes Peninsula. I started completing subtidal surveys of this region in 1985 when I started as a technician with the Vantuna Research Group (VRG). One of the core research projects of the VRG, which has been studying the fishes at Palos Verdes since the mid-1960s, is the long-term monitoring of fishes at Rocky Point and King Harbor (1974-present). In the late 1980s and early 1990s, I completed biological assessments of both Abalone Cove and Portuguese Bend Landslides (Envirosphere 1989; Pondella 1996). Since becoming the director of the VRG, I expanded this program to include spatial surveys of rocky-reefs throughout the Southern California Bight (Clark 2005; Pondella et al. 2005). Recently, my program has completed extensive surveys of Santa Monica Bay and the Palos Verdes Peninsula (Pondella 2009; Pondella et al. 2010).

In addition, to the dozens of published peer-reviewed I have also edited the volume “The Ecology of Marine Fishes: California and Adjacent Waters”, the most comprehensive work on fishes in California. Beyond my current research program, I am also the Editor of the Bulletin of the Southern California Academy of Sciences, chair of the Santa Monica Bay Restorations Commission’s Marine Resources Technical Advisory Committee, chair of Southern California Coastal Water Research Project Bight ’08 Rocky Reef Committee and just finished serving on the California Marine Life Protection Act’s Master Plan Science Advisory Team for the South Coast Study Region. This research and service has given me a unique insight into the issues concerning the Palos Verdes Peninsula.

SUMMARY

Question 1: *Are the habitats being protected in the proposed Abalone Cove and Point Vicente Marine Protected Areas (MPA) sufficient for meeting the goals of the Marine Life Protection Act (MLPA), Marine Managed Areas Improvement Act (MMAIA), and the regional guidelines provided for the South Coast Study Region (SCSR) MPA process?*

Answer 1: The Abalone Cove and Point Vicente MPAs contain poor-quality nearshore habitats as a result of the continued sedimentation and turbidity associated with the Portuguese Bend Landslide and the historic landslide in Abalone Cove. Indications of this poor habitat quality are defaunated reefs and purple urchin barrens. These deleterious effects are greatest in Abalone Cove, but also present at Point Vicente.

Question 2: *Evaluate the anticipated effectiveness of the proposed Abalone Cove and Point Vicente MPAs as part of an interconnected network of MPAs in the context of the MLPA, MMAIA, and the regional guidelines provided for the SCSR MPA process.*

Answer 2: In the Abalone Cove and Point Vicente MPAs, all habitats with exception of soft bottom habitats do not meet the recommended scientific guidelines established by the Science Advisory Team (SAT) . The lack of the anticipated benefits is particularly significant with respect to critical rocky reef habitats that are most likely to benefit from a reserve network. As such, these proposed reserves have little individual bioeconomic value.

Question 3: *How do the proposed Abalone Cove and Point Vicente MPAs compare to other MPAs of similar size in the IPA in terms of meeting the goals of the MLPA, MMAIA, and regional guidelines provided for the SCSR MPA process?*

Answer 3: They do not adequately compare to the proposed MPAs of similar size. The size of this reserve cluster has been intentionally inflated by the inclusion of deep soft bottom habitat. Thus, it is more similar to a small MPA.

Question 4: *Is the document "MPA Options for Consideration and Review by BRTF: Description of Palos Verdes MPA Options" comprehensive and accurate in describing the proposed Abalone Cove and Point Vicente MPAs?*

Answer 4: No, this document is inaccurate and appears to be intentionally misleading.

INTRODUCTION

The Blue Ribbon Task Force (BRTF) has forwarded an Integrated Preferred Alternative (IPA) reserve network proposal to the Fish and Game Commission for approval. After a two-year stakeholder process, the BRTF apparently ignored the stakeholder proposals and the scientific guidelines from its Science Advisory Team (SAT). The area where these discrepancies occur is located at the center of the Southern California Bight, the Palos Verdes Peninsula. At this location, the BRTF ignored critical and limiting habitats, reduced the remaining rocky-reef habitats below the recommended habitat size guidelines, and disregarded spacing guidelines. Being at the center of the bight, the Palos Verdes Peninsula is critical for network connectivity. The limited habitat size and importance of Palos Verdes for connectivity were confirmed by two separate bioeconomic models. Further complicating the long term performance of the Palos Verdes MPAs and associated network connectivity is the lack of integration into the analysis of the IPA of known empirical studies of the region that demonstrate the known poor habitat quality of these proposed MPAs. The designation of the proposed Point Vicente and Abalone Cove MPAs compromises a long term assessment of the MPA network and the performance of the proposed MPAs.

Question 1: Are the habitats being protected in the proposed Abalone Cove and Point Vicente MPAs sufficient for meeting the goals of the MLPA, MMAIA, and the regional guidelines provided for the SCSR MPA process?

According to the scientific guidelines for the *California Marine Life Protection Act Master Plan for Marine Protected Areas*, MPAs should have a minimum alongshore span of 3-6 statute miles (preferably 6-12.5 miles) and should extend offshore to deep waters. The SCSR SAT combined these guidelines to recommend that an individual MPA or MPA cluster should have a minimum area of 9-18 square statute miles (preferably 18-36 square miles). The Point Vicente SMCA has an alongshore span of 3.69 mi (minimum = 3.0 mi), while the Abalone Cove SMCA has an alongshore span of 1.23 mi for a total of 4.92 mi (Table 1). While the MPA cluster is near the minimum guidelines, these measures fall significantly below even the low end of the range of the preferred size guidelines for the individual MPAs**.**

In addition, the individual habitats represented in the Palos Verdes IPA proposal are either of significantly lower quality than required by the science guidelines or are absent. First, the reported habitat area calculations are inconsistent (Table 1). Both maximum kelp (Point Vicente SMCA = 1.23 mi, Abalone Cove SMCA = 0.86 mi) and surfgrass (Point Vicente SMCA = 1.14 mi, Abalone Cove SMCA = 1.41 mi) estimates are greater than the estimates of rocky shore habitat (Point Vicente SMCA = 1.06 mi, Abalone Cove SMCA = 0.23 mi). Since both; the kelp and surfgrass habitats are themselves dependent upon rocky habitat, these estimates are incorrect. The only habitats that meet the scientific guidelines are soft bottom habitats, rocky shores and rock proxy.

The critical and limiting habitats along this stretch of coastline are all associated with hard bottom features. None of these habitats are represented below 30 m below the surface. Also, the estimates for the nearshore (0-30 m) rocky reef habitats are incorrect. The proposed Point Vicente SMCA contains 0.138 mi^2 (358,074 m^2) of nearshore rocky reef habitat (Pondella 2009), 55% of the reported value. While the Abalone Cove MPA appears to have a higher estimated amount of nearshore rocky habitat, that area is either buried reef or under intense sediment load from the Portuguese Bend Landslide.

Table 1. Reported overall sizes and habitat sizes for the IPA proposed Point Vicente SMCA and Abalone Cove SMCA. Minimum scientific guidelines where evaluated are in parentheses. Values below scientific guidelines are highlighted in yellow.

	Point Vicente SMCA	**Abalone Cove SMCA**	**Total**
Area (9-18 mi^2)	15.12	4.75	19.87
Alongshore span (3-6 mi)	3.69	1.23	4.92
Depth range (ft)	0-2640	0-2181	0-2640
Beaches (1 mi)	1.4	0.76	2.16
Rocky shores (1 mi)	0.21	0.87	1.08
hardened shores (1 mi)	0	0	0
coastal marsh (mi)	0	0	0
coastal marsh area (mi^2)	0	0	0
tidal flats (mi)	0	0	0
surfgrass (mi)	1.14	1.41	2.55
eelgrass (mi^2)	0	0	0
estuary(0.12 mi^2)	0	0	0
soft 0-30 m (10 mi^2)	0.41	0.51	0.92
soft 0- 30 m proxy (1 mi)	0.47	1.09	1.56
soft 30-100 m (mi^2)	1.09	1.17	2.26
soft 100-200 m (mi^2)	1.05	0.56	1.61
soft 200-3000 m (mi^2)	12.24	2.32	14.56
hard 0-30 m (1 mi)	0.25	0.14	0.39
hard 0-30 m proxy (1 mi)	1.06	0.23	1.29
hard 30-100 m (0.3 mi^2)	0	0.02	0.02
hard 100-200 m (0.28 mi^2)	0	0	0
hard 200-3000 m (mi^2)	0.03	0	0.03
unknown 0-30 m (mi^2)	0.02	0.03	0.05
maximum kelp (linear) (1 mi)	1.23	0.86	2.09
kelp persistence (linear) (1 mi)	0.13	0.08	0.21

Road construction on Palos Verdes Drive triggered the Portuguese Bend Landslide in 1956. From 1956 to 1999, approximately 5.7 to 9.4 million metric tons of sediment slid onto the inner shelf (Kayen 2002). By 1999, the landslide was dewatered, slowed appreciably and now only releases sediment due to wave action. Unfortunately sedimentation and associated turbidity continue to have chronic impacts. First there is continued turbidity, sediment transport and scour associated with the sediment deposited in Portuguese Bend from the landslide (Figure 1). In 1999, the Klondike Canyon Landslide was triggered by water issues associated with the Trump National Golf Course, adding to the sediment load in this area (Figure 1). The third slide track, the Abalone Cove Landslide, occupied approximately 80 acres extending west of Portuguese Point into Abalone Cove County Beach from the surf zone inland nearly 2,200 feet with a slide plane located 84 feet below sea level (Figure 2). The Abalone Cove Landslide includes an ancient slide tract exacerbated by an increase in ground water levels beginning in 1948 that were caused by increased development. Historic and continued sedimentation from these three slides continues to plague this stretch of the peninsula. First, this turbidity plume (Figure 3) transports sediment toward Point Fermin and Rocky Point following the longshore current and associated longshore transport on the Palos Verdes Peninsula (Hickey 1993). In addition, rocky reefs continue to be buried by sediment in this area (USACE 2000; Pondella 2009; Pondella et al. 2010). These chronic stressors continue to cause deleterious impacts to the nearshore rocky environment (Stephens et al. 1996). Reef loss due to burial has significantly reduced kelp canopy and persistent kelp in this area.

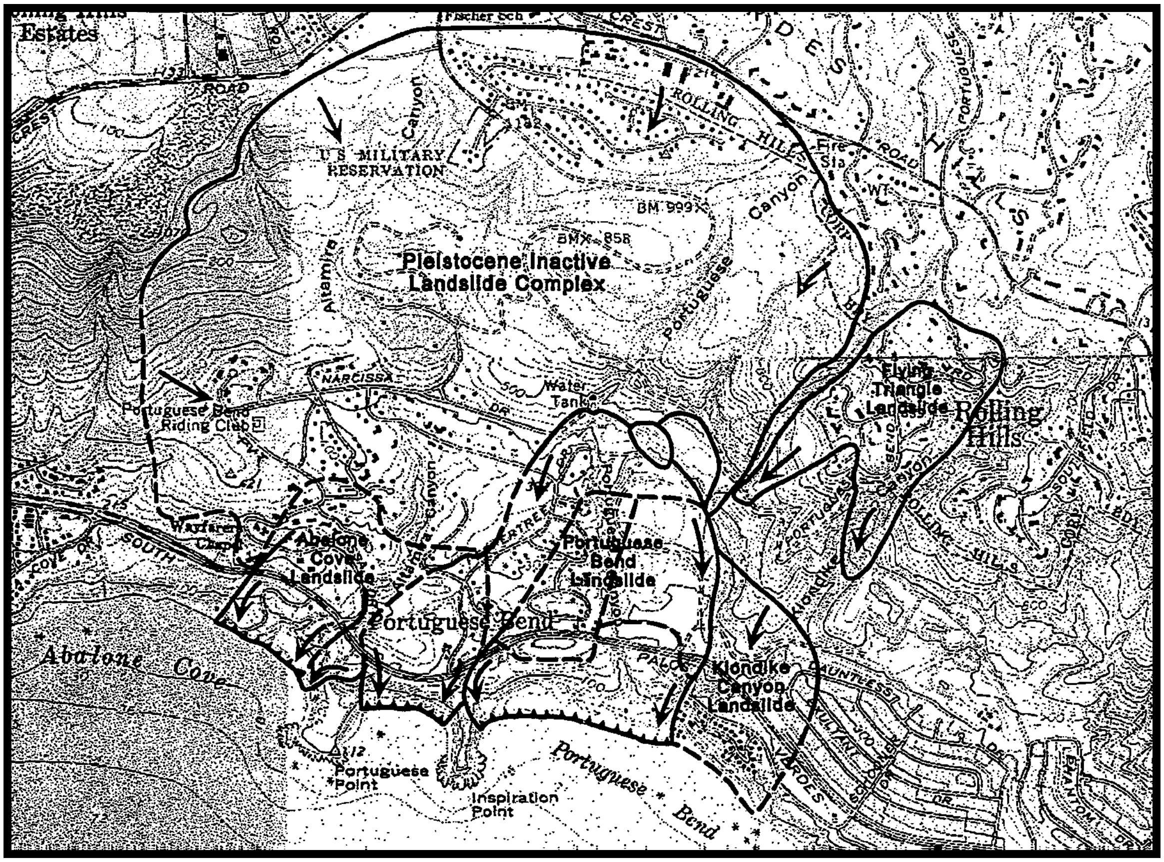


Figure 1. Landslides of the Palos Verdes Peninsula (USACE 2000).

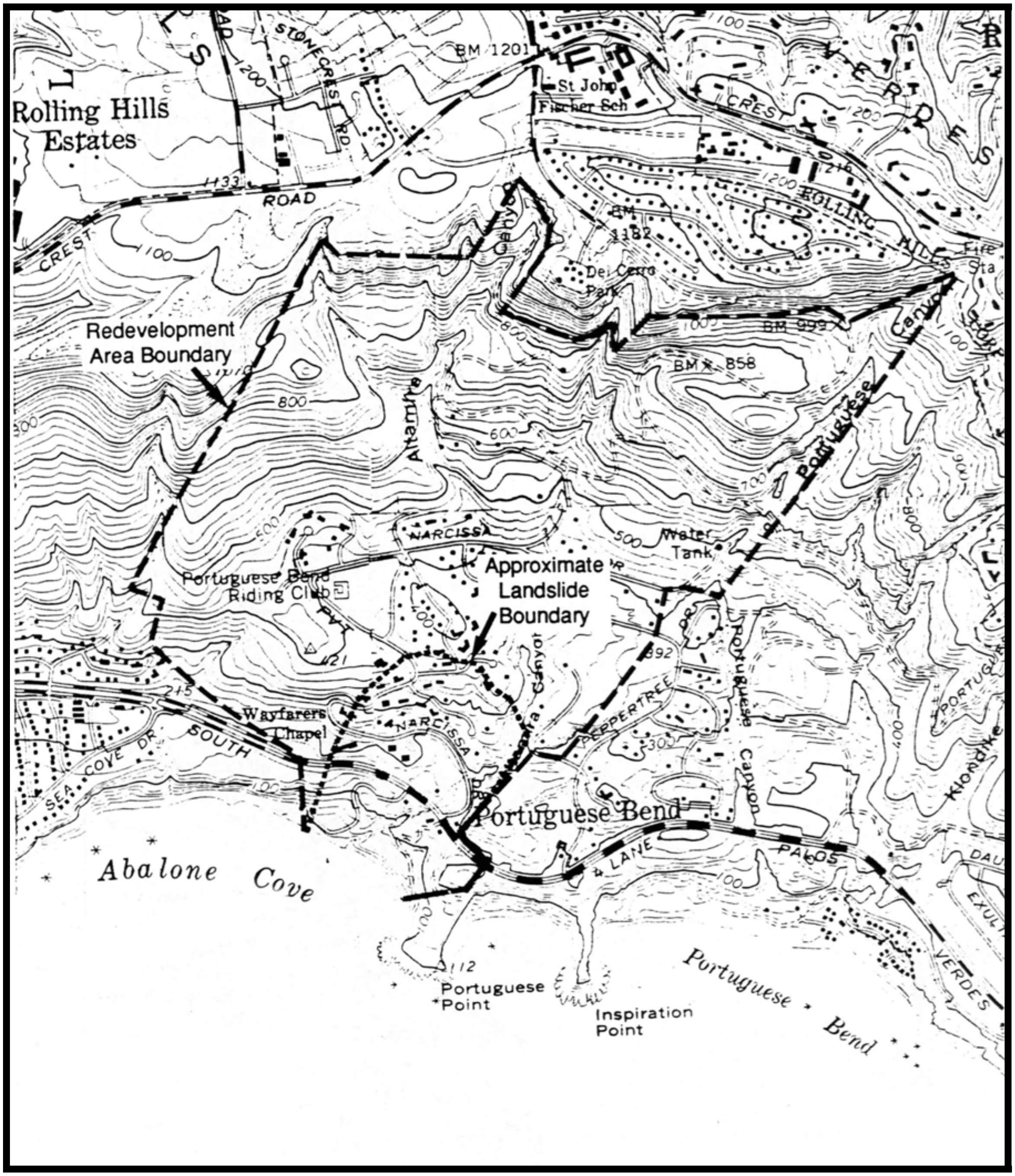


Figure 2. The Abalone Cove Landslide (Envirosphere 1989).

Figure 3. Turbidity plume from the Portuguese Bend Landslide (Pondella et al. 2010).

The chronic damage associated with the turbidity along the southern face of the Palos Verdes Peninsula was demonstrated from an empirical survey of the water column profile of light energy (measured as photosynthetically active radiation or PAR) conducted monthly from 1982-2009 at seven nearshore sites along the Palos Verdes Peninsula demonstrates the chronic damage associated with turbidity along the southern face of the Palos Verdes Peninsula (Figure 4). This survey is part of the Joint Water Pollution Control Plant (JWPCP) NPDES monitoring program. The survey included readings taken at 0.5 m and 1m below the surface and then at 2 m intervals until contact with the bottom or 20 m, whichever comes first. The light energy value measured at each depth (quanta/sec/cm^2) is divided by the surface light energy measurement (also quanta/sec/cm^2) to obtain a percentage of surface light energy that passes through the water column to each depth. That percentage was then averaged over every sampling period from April 1982 to December 2009 to obtain a mean percentage of surface light energy captured at each depth. By plotting the difference between the percentage at each site/depth and the average percentage of all sites at each depth, discernable patterns begin to appear (Figure 5). The upcoast stations Rocky Point (L1) and Long Point (L2) have greater light penetration at depth than at stations between Abalone Cove and Point Fermin (L3-L7). At 18 meters, there is significant variation among these sites (ANOVA: $F_{1,6} = 6.862$, $p < 0.000001$). Thus, turbidity associated with the Portuguese Bend Landslide may be limiting algal growth from Abalone Cove to Point Fermin. This turbidity plus the previously described reef burial limit kelp canopy density, persistence and the corresponding performance of the associated biota.

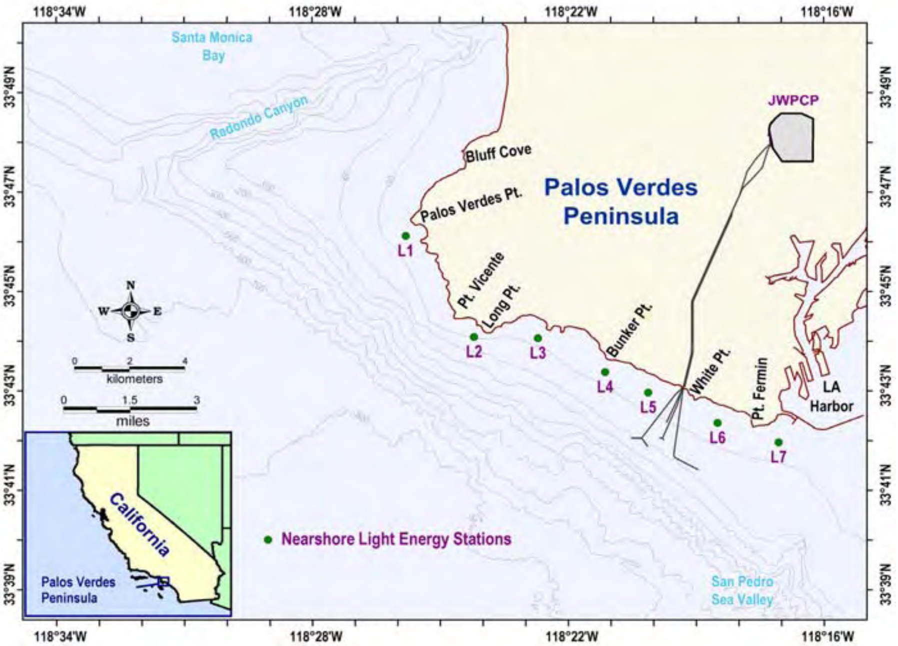


Figure 4. Map showing locations of the Sanitation Districts' light energy stations. Stations names are as follows: L1 = Rocky Point, L2 = Long Point, L3 = Abalone Cove, L4 = Bunker Point, L5 = 3 Palms, L6 = East of Whites Point, L7 = Point Fermin.

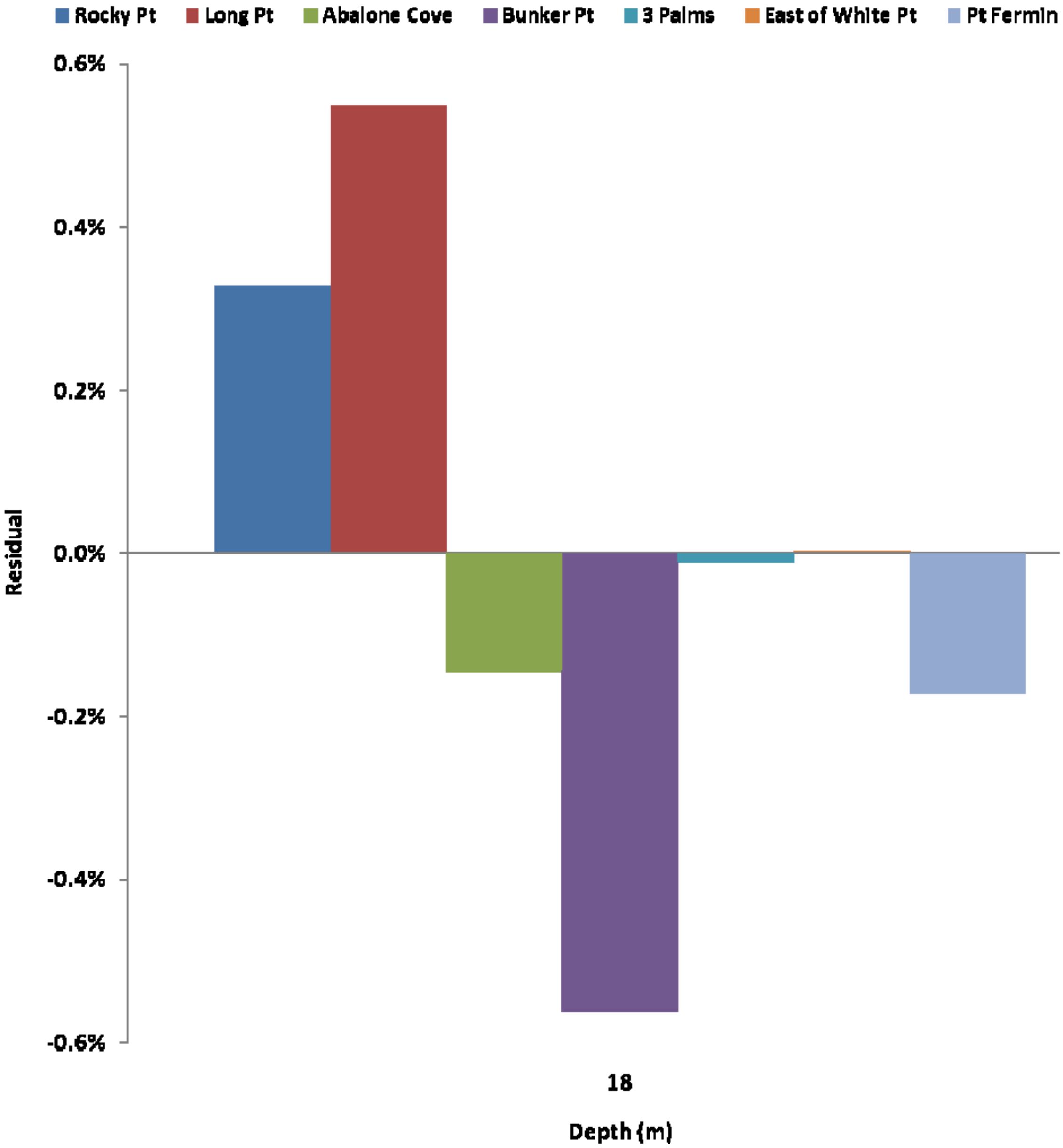


Figure 5. Light attenuation % difference from the mean at seven Palos Verdes Peninsula locations by depth.

This degradation of reef habitat has had significant biological consequences, particularly to the area associated with the Abalone Cove SMCA. To examine this area (Abalone Cove-Point Vicente) 27 CRANE (Tenera 2006; Pondella 2009) surveys of fishes, invertebrates and benthic characteristics were conducted (Table 2, Figure 6). The rocky reefs in the proposed IPA are degraded by anthropogenic impacts (turbidity, sedimentation etc). Characteristic of this degraded habitat are urchin barrens (North 1964) and buried reefs (USACE 2000, Pondella et al. 2010). Abalone Cove and Point Vicente have been dramatically affected by these ongoing processes. This degraded habitat quality has resulted in unusually high fractions of biota-free reef (Table 3). Up to 33% of the area on these reefs has no invertebrate or algal cover which is at least twice the percentage that would be expected for a healthy reef. The resulting invertebrate and benthic fauna (Appendix I and II) is dominated by purple urchin barrens. The appearance of these barrens appears to be linked to poor reef quality associated with ongoing problems with sedimentation and turbidity (Foster 2010). Particularly problematic is the Abalone Cove MPA, where there is significantly lowered fish diversity (17 fish species versus 40) and reef fish biomass compared to the proposed Point Vicente MPA (Figure 7, Table 4). This low species richness is a result of both poor habitat quality and habitat diversity. The assemblage found in the proposed Point Vicente MPA is more typical of what is expected on nearshore rocky reefs in the Southern California Bight (Pondella et al. 2005; Stephens 2006). Comparing biomass between the two reefs, the dominant nearshore rocky reef species (blacksmith, sheephead, garibaldi, senorita, etc.) dominate the biomass density (g/m^2) plot for the proposed Point Vicente MPA. By contrast, at the proposed Abalone Cove MPA, excluding jack mackerel, which is a pelagic species, biomass density is lower and many key species (i.e. opaleye and topsmelt) are absent.

Fish diversity and biomass are the key factors in evaluating the performance of MPAs and assessing their design. Although the 2008 data were provided to the BRTF, these recent surveys were not incorporated into the SAT evaluations, including the bioeconomic models. Those modeling products treat all rocky reef habitats as equal and do not account for variations in habitat quality due to turbidity or reef burial. In addition, modeling products assumed that Abalone Cove’s biological metrics (i.e. biomass) were the same as those for the proposed Point Vicente MPA. This over-emphasizes the value of this degraded habitat. The inclusion of the proposed Abalone Cove MPA with the proposed Point Vicente MPA adds very little biological value to this MPA cluster. In summary, the Point Vicente and Abalone Cove SMCAs encompass degraded habitats that individually or as a cluster are not likely sufficient to meet the goals of the MLPA, MMAIA, and the regional guidelines provided for the SCSR MPA process.

Table 2. Locations of 27 natural reef zones surveyed within the Point Vicente and Abalone Cove SMCAs, 2004-2010. Point Vicente North coordinates are approximate; no coordinates were recorded at this site by zone.

Station	Zone	Latitude	Longitude
120 Reef	Inner	33.73766	-118.39196
120 Reef	Middle	33.73693	-118.39213
Abalone Cove Kelp East	Inner	33.74154	-118.38373
Abalone Cove Kelp East	Middle	33.73981	-118.38309
Abalone Cove Kelp West	Inner	33.73945	-118.38753
Abalone Cove Kelp West	Middle	33.73923	-118.38695
Hawthorne Reef	Inner	33.74684	-118.41522
Hawthorne Reef	Middle	33.74654	-118.41658
Hawthorne Reef	Outer	33.74637	-118.41745
Hawthorne Reef	Deep	33.74648	-118.41817
Long Point East	Inner	33.73620	-118.39983
Long Point East	Middle	33.73588	-118.40040
Long Point East	Outer	33.73546	-118.40118
Long Point West	Inner	33.73845	-118.40320
Long Point West	Middle	33.73803	-118.40398
Point Vicente North	Inner	33.74514	-118.41562
Point Vicente North	Middle	33.74514	-118.41562
Point Vicente North	Outer	33.74514	-118.41562
Point Vicente East	Inner	33.74063	-118.40822
Point Vicente East	Middle	33.74042	-118.40745
Point Vicente East	Outer	33.74013	-118.40748
Point Vicente West	Inner	33.74130	-118.41208
Point Vicente West	Middle	33.73912	-118.41451
Point Vicente West	Outer	33.73807	-118.41488
Point Vicente West	Deep	33.73759	-118.41522
Portuguese Point	Inner	33.73713	-118.38373
Portuguese Point	Middle	33.73692	-118.37700

Figure 6. Overlain on the South Coast Integrated Preferred Alternative (IPA) for the Palos Verdes Coast are the natural reef zone locations for the 2004 (white), 2007 (yellow), 2008 (red), 2009 (green) and 2010 (blue) field seasons sampling stations, as well as the location of the 1995-1997 fish transects (orange circle). The Point Vicente SMCA is outlined (in white) on the left and the Abalone Cove State Marine Conservation Area is outlined on the right.

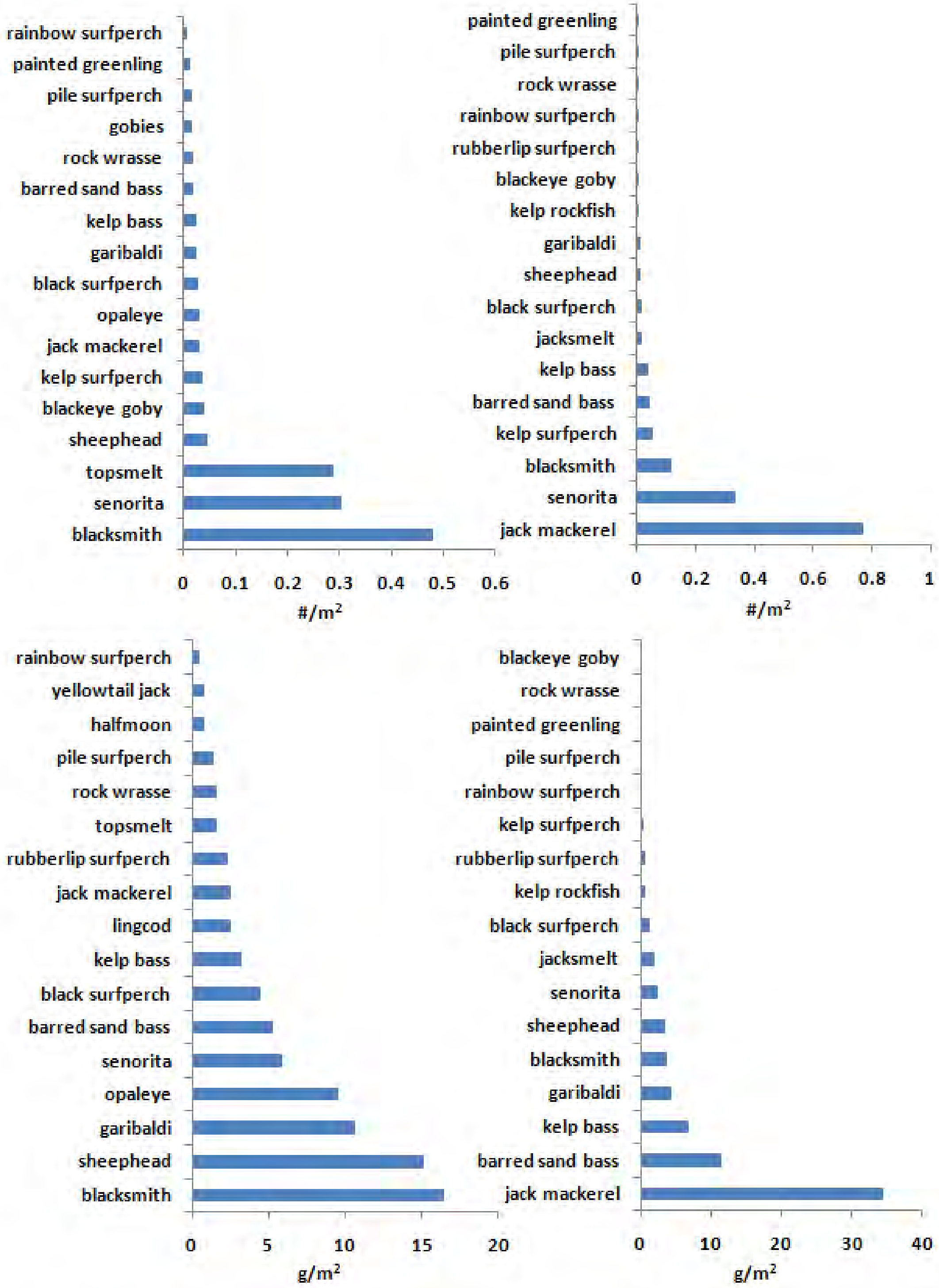


Figure 7. Density (abundance/m^2) and biomass (g/m^2) of top 17 fishes observed at sites within the Point Vicente SMCA (left) and Abalone Cove SMCA (right).

Table 3. Reef classification characteristics (% cover categories) including average relief (m) from sites within the Point Vicente and Abalone Cove SMCAs, 2004-2010.

Reef (SMCA)	Relief (m)	no biota	algal coverage	Invertebrate cover
Hawthorne Reef (Pt. Vicente)	0.41	19.43%	65.18%	15.38%
Point Vicente North (Pt. Vicente)	1.41	25.56%	65.56%	8.89%
Point Vicente West (Pt. Vicente)	0.80	17.79%	57.44%	24.77%
Point Vicente East (Pt. Vicente)	0.64	33.33%	56.45%	10.22%
Long Point West (Pt. Vicente)	1.61	13.71%	54.03%	32.26%
Long Point East (Pt. Vicente)	0.75	12.37%	75.27%	12.37%
120 Reef (A. Cove)	0.63	32.26%	34.68%	33.06%
Abalone Cove Kelp West (A. Cove)	0.21	19.35%	61.29%	19.35%
Abalone Cove Kelp East (A. Cove)	0.34	21.77%	68.55%	9.68%
Portuguese Point (A. Cove)	0.62	8.06%	63.71%	28.23%

Table 4. Species list, density (#/m^2) and biomass (g/m^2) of all fishes observed at sites within the Point Vicente and Abalone Cove SMCAs.

		Point Vicente SMCA		**Abalone Cove SMCA**	
Species	**Common Name**	**#/m^2**	**g/m^2**	**#/m^2**	**g/m^2**
Alloclinus holderi	island kelpfish	0.0001	0.0004		
Anisotremus davidsonii	sargo	0.0015	0.291		
Atherinops affinis	topsmelt	0.2893	1.5876		
Atherinopsis californiensis	jacksmelt	0.0022	0.2428	0.0174	1.8883
Brachyistius frenatus	kelp surfperch	0.0371	0.4656	0.0521	0.4889
Cheilotrema saturnum	black croaker	0.001	0.1121		
Chromis punctipinnis	blacksmith	0.4814	16.4342	0.1174	3.8061
Embiotoca jacksoni	black surfperch	0.0262	4.4449	0.0146	1.3745
Girella nigricans	opaleye	0.0293	9.5154		
Gobiidae sp	gobies	0.0149	0.0001		
Halichoeres semicinctus	rock wrasse	0.0176	1.5664	0.0014	0.0819
Hermosilla azurea	zebra perch	0.0004	0.2454		
Hypsurus caryi	rainbow surfperch	0.0065	0.532	0.0021	0.163
Hypsypops rubicundus	garibaldi	0.0241	10.6356	0.0097	4.4653
Medialuna californiensis	halfmoon	0.0039	0.8457		
Ophiodon elongatus	lingcod	0.0006	2.5734		
Orthonopias triacis	snubnose sculpin	0.0001	0		
Oxyjulis californica	senorita	0.3042	5.9106	0.3368	2.2966
Oxylebius pictus	painted greenling	0.0115	0.2123	0.0014	0.0911
Paralabrax clathratus	kelp bass	0.024	3.2417	0.0396	6.8052
Paralabrax nebulifer	barred sand bass	0.0195	5.3272	0.0444	11.4331
Phanerodon furcatus	white surfperch	0.0001	0.0074		
Rhacochilus toxotes	rubberlip surfperch	0.0051	2.3491	0.0035	0.627
Rhacochilus vacca	pile surfperch	0.0149	1.3815	0.0014	0.1225
Rhinogobiops nicholsii	blackeye goby	0.0387	0.205	0.0042	0.024
Scorpaena guttata	California scorpionfish	0.0003	0.1276		
Scorpaenichthys marmoratus	cabezon	0.0004	0.3978		
Sebastes atrovirens	kelp rockfish	0.0003	0.0165	0.0063	0.6904
Sebastes carnatus	gopher rockfish	0.0001	0.0377		
Sebastes caurinus	copper rockfish	0.0001	0.0046		
Sebastes chrysomelas	black and yellow rockfish	0.0003	0.0006		
Sebastes miniatus	vermilion rockfish	0.0015	0.1254		
Sebastes mystinus	blue rockfish	0.0016	0.1079		
Sebastes rosaceus	rosy rockfish	0.0001	0.0042		
Sebastes serriceps	treefish	0.0009	0.1637		
Sebastes umbrosus	honeycomb rockfish	0.0009	0.047		
Semicossyphus pulcher	California sheephead	0.0451	15.1494	0.0097	3.5183
Seriola lalandi	yellowtail jack	0.0006	0.8079		
Trachurus symmetricus	jack mackerel	0.0298	2.5714	0.7674	34.5991
Urobatis halleri	round stingray	0.0001	0.0732		

Question 2: Evaluate the anticipated effectiveness of the proposed Abalone Cove and Point Vicente MPAs as part of an interconnected network of MPAs in the context of the MLPA, MMAIA, and the regional guidelines provided for the SCSR MPA process.

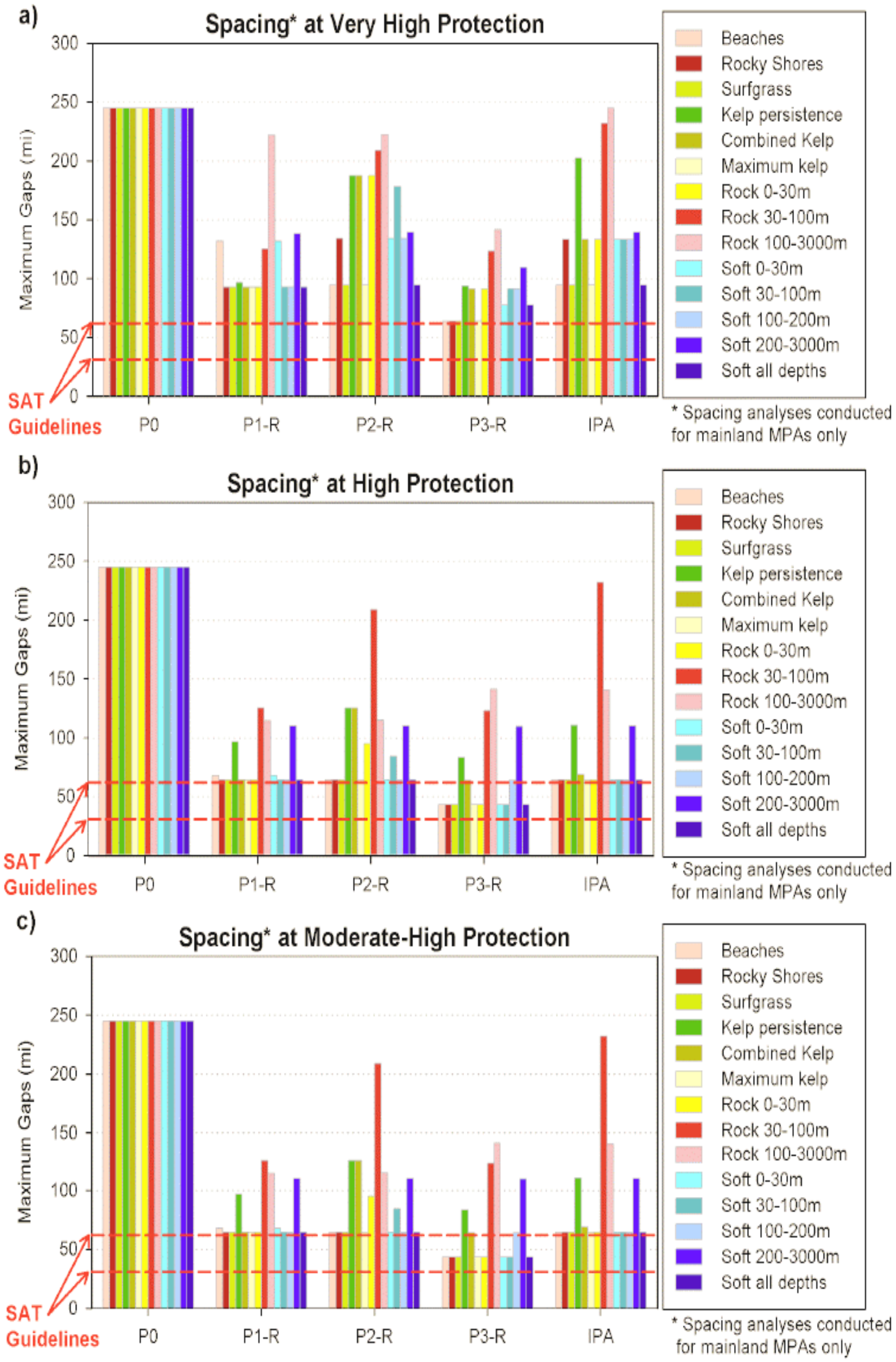
Habitat size within reserves and spacing among reserves are the critical components of the bioeconomic models. The IPA proposal, especially with reference to the proposed Point Vicente and Abalone Cove MPAs, ignores the science guidelines for both components. Key habitats associated with rocky reefs are either not present, or are present in a degraded state (particularly in the proposed Abalone Cove MPA) that compromises network performance. Further complicating these bioeconomic assessments are the overestimated and inaccurate nearshore rocky-reef habitats (Question 1) and a disconnect between the model inputs and realistic empirical data. This is especially true for biomass estimates, which are dated and not fine scaled enough to make realistic assumptions of relative biomass estimates. The effectiveness of the network with respect to the proposed Palos Verdes MPAs is discussed in greater detail in Question 3.

The replication and spacing guidelines from the MLPA Master Plan for Marine Protected Areas (Fish and Game Commission 2008) are as follows:

Replication: Recommendation of replication of habitats within three to five SMCA's in each biogeographical region. The SCSR SAT then recommended that habitats should be replicated in at least one MPA in each of the five bioregions within the SCSR to the extent possible.

Spacing (along mainland coast): "for an objective of facilitating dispersal of important bottom-dwelling fish and invertebrate groups among MPAs, based on currently known scales of larval dispersal, MPAs should be placed within 50-100 kilometers (31-62 miles) of each other." Neighboring MPAs placed closer than 50 kilometers apart also meet the spacing guidelines.

Since the spacing guidelines were formed to connect marine life populations (and have the MPA design work as a true network), and populations only occur within suitable habitat, the habitats encompassed within each individual MPA must also be considered in a spacing analysis. In order for the MPAs to meet the spacing guidelines, the habitat type must be protected in each MPA in a sufficient amount to be counted as a replicate (amount of habitat needed to include 90% of the associated species, see habitat replication guidelines above). In addition, MPAs and MPA clusters also must meet minimum size guidelines (9 mi^2) to count as a replicate in the MPA network spacing analysis (Figure 8).



* Spacing analyses conducted for mainland MPAs only

Figure 8. Spacing and SAT guidelines for the various habitats used in the MPA analyses for the Southern California Bight. P0 is the no new MPA option; P1R-P3R are the three regional stakeholder proposals; and, the IPA proposal is on the right.

Table 5. Gaps that exceed the SAT spacing guidelines for the IPA.

Very High Protection

Habitat	# gaps over guideline	gap #1	gap #1 location	gap #2	gap #2 location
Beaches	2	94	Campus Point SMR to Point Vicente Cluster	78	Laguna Cluster to south boundary of SCSR
Rocky shores	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
Surfgrass	2	94	Campus Point SMR to Point Vicente Cluster	78	Laguna Cluster to south boundary of SCSR
kelp persistance (linear)	1	202	Campus Point SMR to south bundary of SCSR		
Combined kelp	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
maximum kelp (linear)	2	94	Campus Point SMR to Point Vicente Cluster	78	Laguna Cluster to south boundary of SCSR
hard 0-30 m proxy	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
hard 30-100 m	1	232	Point Conception SMR to south boundary of SCSR		
hard 100-3000 m	1	245	Vandenberg SMR to south boundary of SCSR		
soft 0- 30 m proxy	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
soft 30-100 m	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
soft 100-200 m	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
soft 200-3000 m	2	140	Vandenberg SMR to Point Vicente cluster	78	Laguna Cluster to south boundary of SCSR
soft 0-3000m	2	94	Campus Point SMR to Point Vicente Cluster	78	Laguna Cluster to south boundary of SCSR

High Protection

Habitat	# gaps over guideline	gap #1	gap #1 location	gap #2	gap #2 location
Beaches	1	64	Campus Point SMR to Point Dume cluster		
Rocky shores	1	64	Campus Point SMR to Point Dume cluster		
Surfgrass	1	64	Campus Point SMR to Point Dume cluster		
kelp persistance (linear)	2	111	Point Dume cluster to Swami's SMCA	64	Campus Point to Point Dume cluster
Combined kelp	2	69	Point Dume cluster to Laguna cluster	64	Campus Point to Point Dume cluster
maximum kelp (linear)	1	64	Campus Point SMR to Point Dume cluster		
hard 0-30 m proxy	1	64	Campus Point SMR to Point Dume cluster		
hard 30-100 m	1	232	Point Conception SMR to south boundary of SCSR		
hard 100-3000 m	2	141	Point Dume cluster to south boundary of SCSR	110	Vandenberg SMR CCSR to Point Dume cluster
soft 0- 30 m proxy	1	64	Campus Point SMR to Point Dume cluster		
soft 30-100 m	1	64	Campus Point SMR to Point Dume cluster		
soft 100-200 m	1	64	Campus Point SMR to Point Dume cluster		
soft 200-3000 m	1	110	Vandenberg SMR CCSR to Point Dume cluster		
soft 0-3000m	1	64	Campus Point SMR to Point Dume cluster		

Moderate-High Protection

Habitat	# gaps over guideline	gap #1	gap #1 location	gap #2	gap #2 location
Beaches	1	64	Campus Point SMR to Point Dume cluster		
Rocky shores	1	64	Campus Point SMR to Point Dume cluster		
Surfgrass	1	64	Campus Point SMR to Point Dume cluster		
kelp persistance (linear)	2	111	Point Dume cluster to Swami's SMCA	64	Campus Point to Point Dume cluster
Combined kelp	2	69	Point Dume cluster to Laguna cluster	64	Campus Point to Point Dume cluster
maximum kelp (linear)	1	64	Campus Point SMR to Point Dume cluster		
hard 0-30 m proxy	1	64	Campus Point SMR to Point Dume cluster		
hard 30-100 m	1	232	Point Conception SMR to south boundary of SCSR		
hard 100-3000 m	2	141	Point Dume cluster to south boundary of SCSR	110	Vandenberg SMR CCSR to Point Dume cluster
soft 0- 30 m proxy	1	64	Campus Point SMR to Point Dume cluster		
soft 30-100 m	1	64	Campus Point SMR to Point Dume cluster		
soft 100-200 m	1	64	Campus Point SMR to Point Dume cluster		
soft 200-3000 m	1	110	Vandenberg SMR CCSR to Point Dume cluster		
soft 0-3000m	1	64	Campus Point SMR to Point Dume cluster		

Figure 8 (from the 'SAT Evaluation of Final MPA Proposals from the SCSR: Habitat Representation, Habitat Replication, MPA Size, and MPA Spacing Analyses' document) shows that the IPA proposal does not meet the minimum SAT guidelines for spacing at very high protection for any of the listed habitats. For rock 30-100 m, rock 100-3000 m, and kelp persistence, the spacing between these habitats in the IPA is more than three times larger than the SAT's suggested spacing guidelines. In addition, combined kelp and rock 0-30 m in the IPA have double the spacing distance between MPAs as that set by the SAT guidelines. At high protection (Figure 8) in the IPA, rock 30-100 m, rock 100-3000 m, and kelp persistence all have much larger gaps between MPAs than is suggested by the SAT.

Table 5 (Table 5.2d in the SAT Evaluation) lists the location of the gaps that exceed SAT-suggested guidelines for spacing in the IPA. For very high protection, the majority of habitat types have gaps between MPAs that are much larger than is suggested for these MPAs to act as a network (allowing larval dispersal between them). For rocky shores, kelp persistence, combined kelp, hard 0-30 m proxy, hard 0-30 m, hard 30-100 m, soft 0-30 m, soft 30-100 m, and soft 100-200 m, there is a spacing gap exceeding SAT guidelines that ranges from Campus Point SMCA (Santa Barbara County) to either the Laguna SMCA, or the southern boundary of the SCSR. Therefore, the Palos Verdes Cluster (which is in between these two locales) does not connect MPAs to the north or south for any of these key habitat types. Spacing between very high protection MPAs of 202 miles for kelp persistence, and 232 miles for hard 30-100 m habitat (IPA proposal) is much greater than suggested for the majority of species' larval duration and dispersal.

The spacing guidelines and analysis are compromised even further by the fact that the minimum guidelines for habitat size were not met for the PV cluster. The lack of adequate habitat representation for rocky reefs of all depths and associated kelp bed communities indicates that the IPA proposal will not operate as a MPA network and will not satisfy the goals of MLPA or MMAIA or the regional guidelines.

The bioeconomic models used for analysis in the South Coast IPA were performed by the UC Davis (UCD) and UC Santa Barbara (UCSB) modeling research groups. These models utilized spatial data on habitat, fishery effort, and proposed MPA locations (from the IPA) to simulate population dynamics of fished species (n = 8) and generate predicted spatial distributions of species abundance and fishery yield. These analyses resulted in a calculation of long-term equilibrium estimates of conservation value (i.e. biomass) and economic value (i.e. fishery yield and profit). Structural elements of these models include: larval connectivity across patches driven by currents (Watson 2010); pelagic larval duration and spawning season; larval settlement, growth and survival dynamics of resident adult populations; reproductive output (increasing with adult size); adult movement; and harvest in areas outside MPAs. Appendix B3 in the MLPA master plan contains additional detailed parameter values and literature sources for each estimate (life history information in a model). Detailed and spatially explicit model outputs, including maps for each response variable and sub-regional summaries of key statistics for each species and management scenario can be found online at http://www.dfg.gov/mlpa.

The information in Table 6 may be used to evaluate whether the proposed Palos Verdes MPAs in the IPA are attaining a desired level of biomass production. Values of biomass are scaled relative to total unfished biomass such that values of 0 indicate no biomass and values of 1 indicate maximum unfished biomass (these values provide no measures (kg/m^2) of actual fish biomass in these regions). Biomass production in the proposed Abalone Cove and Point Vicente MPAs is very low, particularly for recreationally important and overfished species along the peninsula like kelp bass (0.0043 and 0.0050, respectively).

'Self- recruitment' is the proportion of settling larvae in an MPA that were produced within that MPA. This metric (values of 0 to 1) provides info on the relative isolation of the MPA from other larval sources, such that a value of 0 indicates the population is completely isolated. It is a modeled estimate that accounts for MPA size, currents and the early life history of the study species. Most species have a pelagic larval stage (days to months) and under the proper oceanographic conditions, in a MPA of significant size these larvae will recruit to the MPA. As MPA size decreases, the likelihood of 'self-recruitment' diminishes. Optimally a MPA would be self sustaining, independent of the MPA network.

'Self-persistence' is only calculated by the UCD model, and is defined as the degree to which an MPA is self-sustaining. It is calculated based on larval production and the proportion of larvae produced within an MPA that return to that MPA, also on a scale of 0 to >1 (values <1 are dependent on larvae from elsewhere, values > 1 are self-sufficient). Self persistence', which provides an indication of the MPA's self sufficiency in terms of larval production (i.e. its reliance on larval sources from elsewhere), have very low values for all the species listed except for black perch. However, black perch are live bearers and do not rely on pelagic larval dispersal to sustain the population. On a scale of 0 to 1, important fish species such as kelp bass and kelp rockfish scored 0.0444 and 0.0095, respectively, for the proposed Point Vicente MPA, probably because: 1) the habitat type protected within the proposed MPAs lacks a sufficient hard bottom habitat for these species to feed and reproduce; and 2) the proposed MPAs' boundaries are located over somewhat-continuous reef around the peninsula. Since the proposed MPA cluster lacks sufficient hard bottom habitat for these species, it is likely that the majority of larvae that support the reserve will come from better habitat outside of the cluster (following dominant current patterns). In other words, these proposed MPAs as designated in the IPA are not self sufficient for larval dispersal.

Even in the document that contains Table 6 and describes the bioeconomic models (”Bioeconomic Model evaluations of revised 3rd-round proposals and IPA, 12/8/2009”), the proposed Point Vicente and Abalone Cove MPAs demonstrate relatively poor performance. The biomass estimates for this proposed MPA cluster may represent the poorest bioeconomic results from the entire IPA proposal for the SCSR.

Table 6. Bioeconomic outputs for the Abalone Cove SMCA and Point Vicente SMCA.

	Species	Biomass (UCSB)	Biomass (UCD)	Self-recruitment (UCSB)	Self-recruitment (UCD)	Self-persistence (UCD)
Abalone Cove SMCA	black perch	0.0024	0.0011	1.0000	1.0000	4.0000
	halibut	0.0039	0.0006	0.0091	0.0043	0.0068
	kelp bass	0.0043	0.0017	0.0039	0.0108	0.0235
	kelp rockfish	0.0039	0.0008	0.0027	0.0045	0.0058
	whitefish	0.0030	0.0011	0.0042	0.0056	0.0186
	opaleye	0.0034	0.0013	0.0026	0.0052	0.0100
	red urchin	0.0023	0.0013	0.0028	0.0036	0.0155
	sheephead	0.0040	0.0017	0.0054	0.0115	0.0272
Point Vicente SMCA	black perch	0.0022	0.0010	1.0000	1.0000	4.0000
	halibut	0.0038	0.0006	0.0124	0.0052	0.0123
	kelp bass	0.0050	0.0020	0.0092	0.0158	0.0444
	kelp rockfish	0.0047	0.0008	0.0063	0.0057	0.0095
	whitefish	0.0028	0.0011	0.0103	0.0055	0.0274
	opaleye	0.0041	0.0016	0.0091	0.0112	0.0278
	red urchin	0.0022	0.0012	0.0074	0.0034	0.0246
	sheephead	0.0045	0.0019	0.0088	0.0120	0.0362

Question 3: How do the proposed Abalone Cove and Point Vicente MPAs compare to other MPAs of similar size in the IPA in terms of meeting the goals of the MLPA, MMAIA, and regional guidelines provided for the SCSR MPA process?

The proposed Abalone Cove and Pt. Vicente MPAs may be compared to those IPA-designated MPAs of similar size to the Point Vicente MPA (10.42 – 22.51 mi^2) with respect to the habitat types represented and the existing protection level (Table 7). Other than the previously described deficiencies in all habitats except for sand for the Palos Verdes cluster, the most noteworthy habitat for comparison is the soft bottom habitat (200-3000 m^2). This habitat alone represents 81% of the proposed Point Vicente MPA, is greater in size than that found in all other MPAs of similar size combined, and is 2 to 1200 times larger than that found in any other similarly-sized MPAs. Critical habitats, such as kelp persistence and hard bottom habitats are at the same level or are markedly below those in MPAs of similar size. With the exception of the Santa Barbara Island SMCA, (a known urchin barren and thus does not support kelp) kelp persistence in other comparable MPAs ranged from 0.65 to 4.26 linear miles, well above the 0.13 and 0.08 linear miles reported for the proposed Point Vicente and Abalone Cove MPAs, respectively. Also, the lowest combined values for all hard bottom habitats (0 - 3000m) were reported for this MPA cluster (Table 7). Thus the site-specific rationale for designating this MPA cluster at a larger than preferred size (19.85 sq. statute miles) is missing since this cluster's size has been artificially inflated by the inclusion of soft bottom habitat.

The pie-shaped design of the proposed Point Vicente/Abalone Cove MPA cluster is intentionally misleading. By encircling 14.56 mi^2 of deep soft bottom habitat (200-3000 m) it is disproportionately large relative to the proportion of soft bottom and rocky reef habitats at similarly-sized reserves. Based solely on habitat sizes, this cluster will perform in a similar fashion to a small reserve or small reserve cluster. Unfortunately, as discussed in Question 1, the relative quality of this habitat is poor.

Table 7. Habitat measures of MPAs of similar size in the IPA.

	MPAs of similar size in IPA											
	Point Conception SMCA	Campus Point SMCA	Point Dume SMCA	Point Vicente SMCA	Abalone Cove SMCA	San Clemente Milt Closure 1	San Clemente Milt Closure 2	South Point SMCA	Carrington Point SMCA	Gull Island SMCA	Anacapa Island SMCA	Santa Barbara Island SMCA
Area (mi^2)	22.5	10.4	15.9	15.1	4.75	17.4	19.2	13.1	12.8	19.9	11.5	12.8
Alongshore span (mi)	5.27	2.86	4.24	3.69	1.23	3.93	5.37	3.55	4.02	4.78	3.05	0.95
Depth (ft)	489	748	2023	2640	2181	1682	3938	1071	211	2205	709	1655
Beaches (mi)	1.53	1.97	4.03	1.4	0.76	0.79	5.25	1.45	0.81	2.1	0.79	0.15
Rocky shores (mi)	3.14	1.32	0.44	0.21	0.87	1.04	0.77	3.34	5.35	1.88	6.38	1.02
hardened shores (mi)	0	0	0	0	0	0	0.11	0	0	0	0	0
coastal marsh (mi)	0	0	0	0	0	0	0	0	0	0	0	0
coastal marsh area (mi^2)	0	0	0	0	0	0	0	0	0	0	0	0
tidal flats (mi)	0	0	0	0	0	0	0	0	0	0	0	0
surfgrass (mi)	3.65	1.14	0.87	1.14	1.41	0.63	2.11	1.77	3.99	1.14	3.23	0.78
Eelgrass (mi^2)	0	0	0	0	0	0	0	0	0	0	0	0
Estuary (mi^2)	0	0	0	0	0	0	0	0	0	0	0	0
soft 0-30 m (mi^2)	2.14	0.89	2.02	0.41	0.51	0.01	0	1.22	7.15	1.9	0.87	0.47
soft 0- 30 m proxy (mi)	1.83	1.21	3.14	0.47	1.09	0	1.3	1.7	3.32	2.77	2.59	0.72
soft 30-100 m (mi^2)	15.8	7	5.94	1.09	1.17	0.96	0	3.51	3.82	3.76	7.25	1.69
soft 100-200 m (mi^2)	3.26	1.41	1.38	1.05	0.56	0	0	5.34	0	3.2	0.78	0.42
soft 200-3000 m (mi^2)	0	0.05	5.79	12.2	2.32	0	0	0.05	0	1.43	0	0.02
hard 0-30 m (mi^2)	0.49	0.76	0.29	0.25	0.14	1.17	0.61	0.55	1.35	0.78	0.27	0.11
hard 0-30 m proxy (mi)	1.84	1.85	1.06	1.06	0.23	2.45	4.57	2.05	1.97	2.36	0.65	0.36
hard 30-100 m (mi^2)	0.32	0.04	0	0	0.02	1.04	0.03	0.26	0.27	0.12	0.1	0.1
hard 100-200 m (mi^2)	0.1	0	0	0	0	0	0	0.01	0	0.13	0	0.02
hard 200-3000 m (mi^2)	0	0	0	0.03	0	0	0	0	0	0	0	0
unknown 0-30 m (mi^2)	0.2	0.26	0.41	0.02	0.03	0.01	0.45	0.06	0.16	0.09	0.01	0
unknown 30-100 m (mi^2)	0.01	0	0	0	0	3.73	2.16	0.01	0	0	0	0.07
unknown 100-200 m (mi^2)	0.19	0	0	0	0	4.84	1.58	0.25	0	0.21	1.48	1.28
unknown 200-3000 m (mi^2)	0	0	0	0	0	5.66	14.4	1.79	0	8.26	0.77	8.57
maximum kelp (linear) (mi)	1.79	2.51	1.34	1.23	0.86	2.96	5.47	3.67	3.68	3.29	1.46	0.76
kelp persistance (linear) (mi)	1.29	1.62	0.84	0.13	0.08	2.75	4.26	3.25	1.24	1.88	0.65	0.1

The bioeconomics of the proposed Palos Verdes MPAs may be compared to those of the other MPAs included in the IPA through an 'MPA Deletion' analysis in which each MPA is sequentially removed, one-at-a-time, and the biomass of the system is recalculated. These calculations were performed using two separate bioeconomic models (see model descriptions) and provide two values for each analysis. The 'effect on biomass' shown in Table 8 reflects the relative loss of biomass when each MPA is removed from the network. This effect is calculated as the difference between the biomass with the MPA and without it, divided by the biomass with the MPA and multiplied by 100 (a large value here indicates that MPA contributes greatly to the overall network, a small number means that it is less important). The 'efficiency of effect on biomass' value is the 'effect on biomass' value divided by the area of a specific habitat being protected (a measure of the efficiency of the MPA at increasing biomass). Large numbers here indicate places where protection of an additional unit of habitat is likely to result in the greatest increase in overall biomass. Results are averaged across all eight species used for analysis (ocean whitefish, black surfperch, opaleye, kelp bass, kelp rockfish, sheephead, red urchin, and halibut).

Removal of the proposed Point Vicente MPA, by comparison to values for other MPAs of similar size (Pt. Dume SMCA, Point Conception SMR, and Campus Point SMR), would have a smaller effect on the change in overall biomass of the system. However, the 'efficiency of effect on biomass' values for the proposed Point Vicente MPA are higher than those for other MPAs of similar size within the IPA, indicating that protecting additional habitat around this area (alongshore miles) would greatly increase the overall biomass. This seems counterintuitive based upon the relatively small amount of rocky habitat in this cluster. Thus, it appears that the assumed connectivity aspect of the bioeconomic models is driving this effect and therefore this metric is misleading due to the previously discussed gaps in critical habitat spacing in the array. The proposed MPAs offshore of the Palos Verdes Peninsula, the only rocky headland in the middle of the Southern California Bight, do not effectively connect the northern and southern MPAs as intended by the MLPA.

Table 8. Deletion results from the bioeconomic analyses.

MPA deletion results for IPA

PV cluster	effect on biomass (UCSB)	efficiency of effect on biomass (UCSB)	effect on biomass (UCD)	efficiency of effect on biomass (UCD)
Point Vicente SMCA	0.1882	0.3893	0.9499	2.0531
Abalone Cove SMCA	0.0885	0.1573	0.8433	2.0329
mainland MPAs of similar size				
Point Dume SMCA	0.3400	0.2359	2.1271	1.4862
Campus Point SMR	0.5173	0.2629	1.9725	0.8999
Point Conception SMR	0.1039	0.0502	1.1740	0.5941

Question 4: Is the document "MPA Options for Consideration and Review by BRTF: Description of Palos Verdes MPA Options" comprehensive and accurate in describing the proposed Abalone Cove and Point Vicente MPAs?

The document,"MPA Options for Consideration and Review by BRTF: Description of Palos Verdes MPA Options" incorrectly states that several goals and associated objectives specific to the SCSR are met by the proposed Pt. Vicente/Abalone Cove MPA cluster. The stated regional goals and objectives and a discussion of their compatibility with the proposed MPAs are set forth below. A number of statements describing the ''site-specific rationale' and 'other considerations' that the document purports support the designation of the proposed Point Vicente and Abalone Cove MPAs are also further analyzed below. A significant issue associated with the proposed Point Vicente and Abalone Cove MPAs is the lack of hard bottom and kelp persistence habitat types, which support nearly all the species of interest (species likely to benefit from MPAs) to be protected within the South Coast region. In view of the small amount of these habitat types protected within the proposed MPAs, it is unlikely that any heavily fished species along the Palos Verdes Peninsula would show associated biomass increases due to the presence of MPAs—one of the main goals of the entire statewide MLPA process.

The following regional goals and objectives are stated as being met by the Point Vicente and Abalone Point MPAs (IPA) in the document, 'MPA Options for Consideration and Review by BRTF: Description of Palos Verdes MPA Options':

<u>Point Vicente SMCA:</u> Goal 1, objectives 1-5; Goal 2, objectives 1-3; Goal 4, objectives 1-3; Goal 5, objectives 2, 3, 5; Goal 6, objectives 1-4

<u>Abalone Cove SMCA:</u> Goal 1, objectives 1-5; Goal 2, objectives 1, 2, 4; Goal 3, objectives 1-2, Goal 4, objectives 1-2, Goal 6, objectives 1, 4.

In several instances, the goals and objectives stated as being met by the BRTF are incorrect as discussed below. These goals are first stated with specific aspects of the goals and objectives in question underlined prior to the discussion.

> Goal 1, Objective 1: 'Protect and maintain species diversity and abundance consistent with natural fluctuations, <u>including areas of high native species diversity and representative habitats.'</u>
>
> Goal 2, Objective 1: 'Help protect or rebuild populations of rare, threatened, endangered, depressed, depleted, or overfished species, and <u>the habitats and ecosystem functions upon which they rely.'</u>
>
> The majority of the habitat available in the proposed Point Vicente and Abalone Cove MPAs is deep sand habitat (soft 200-3000 m), which does not support high native species diversity. The majority of the species of interest in these MPAs live near or over rocky substrate, in much shallower regions than

200 m. Several depleted and overfished species of interest in the Palos Verdes shelf region (black sea bass, kelp bass, barred sand bass, white sea bass, red urchin, sheephead, spiny lobster, etc) occur within shallow rocky habitats, but the majority of the area of the proposed MPAs does not include this type of habitat. In addition, the proposed MPAs do not include sufficient persistent kelp to satisfy SAT habitat guidelines. Persistent kelp beds provide key habitat that supports a large percentage of the depressed and depleted species along Palos Verdes and in the Southern California Bight.

Goal 2, Objective 2: 'Sustain or increase reproduction by species likely to benefit from MPAs, with emphasis on those species identified as more likely to benefit from MPAs, and promote retention of large, mature individuals.'

Species 'more likely to benefit' from MPAs include bocaccio, giant sea bass, broomtail grouper, canary rockfish, pink/green/white/black abalone, and purple hydrocoral, all of which occur on or near shallow rock habitat within the south coast region. Since the proposed Point Vicente and Abalone Cove MPAs protect mostly deep sand habitat, the habitat for these species is mostly absent from these proposed MPAs. Therefore, the proposed MPAs are unlikely to increase or sustain these species or to promote retention of "large, mature individuals." In addition, due to the proposed MPA cluster including a smaller than recommended size of reef habitats, there is a reduced opportunity to protect these species within these boundaries because their adult home range is greater than the MPAs' boundaries.

Goal 4, Objective 1: 'Include within MPAs key and unique habitats identified by the MLPA Master Plan Science Advisory Team for this study region.'

Goal 4, Objective 2: 'Include and replicate to the extent possible [practicable], representatives of all marine habitats identified in the MLPA or the *California Marine Life Protection Act Master Plan for Marine Protected Areas* across a range of depths.'

Goal 1, Objective 2: 'Protect areas with diverse habitat types in close proximity to each other.' (also refer to Goal 6, Objective 3 below, with comments on MPA connectivity)

Goal 1, Objective 4: 'Protect biodiversity, natural trophic structure and food webs in representative habitats.'

One of the rarest habitats within the South Coast region, deep rock (hard bottom 30-100 m) will not be protected within the proposed Point Vicente and Abalone Cove MPAs. In addition, persistent kelp habitat, which has become increasingly rare in the SCSR over the past 50 years, is also not captured within these MPAs. Therefore, these proposed MPAs do not provide replication of these key habitats within this region, nor is there a representation of such key habitats (hard bottom) across a range of depths.

Goal 1, Objective 4 is not met for hard bottom habitats within this cluster. By far the most biodiverse habitats within the south coast region occur within these habitats. The biodiversity, trophic structure, and food webs that occur within hard bottom and persistent kelp habitat will not be protected in sufficient amounts in the proposed Point Vicente and Abalone Cove MPAs to allow Goal 1, Objective 4 to be met. The diversity of food webs and trophic interactions within a kelp/hard bottom habitat far exceed those that exist over soft bottom habitats (Allen 1985; Bond et al. 1999; Allen 2006). In addition, soft bottom 200- 3000 m habitat, which encompasses the majority of this MPA cluster, is much less diverse than shallow rock habitat.

Goal 5, Objective 3: 'Effectively use scientific guidelines in the *California Marine Life Protection Act Master Plan for Marine Protected Areas*.'

None of the spacing guidelines have been met for the proposed MPAs themselves (31-62 sq miles apart) or for key habitat types in the region such as hard 0 – 30 m, hard 30- 100 m, and kelp persistence (see details of habitat replication and MPA spacing from #2 above). In addition, the size guidelines are barely met: "MPAs should have a minimum alongshore span of 3-6 statute miles (preferably 6-12.5 miles) and should extend offshore to deep waters." The proposed Point Vicente MPA has an alongshore span of 3.69 sq miles, and the proposed Abalone Cove MPA is only 1.23 sq miles alongshore.

Goal 6, Objective 3: 'Ensure ecological connectivity within and between regional components of the statewide network'

The proposed MPA cluster does not meet the minimum SAT guidelines for spacing at very high protection for any of the listed habitats. For rock 30-100 m, rock 100-3000 m, and kelp persistence, the spacing between these habitats in the IPA is more than three times larger than the suggested spacing guidelines set by the SAT. In addition, combined kelp and rock 0-30 m in the IPA have double the spacing distance between these MPAs that is set by the SAT guidelines. At the 'high protection' level in the IPA, rock 30-100 m, rock 100-3000 m, and kelp persistence all again have much greater gaps between MPAs than is suggested by the SAT. For rocky shores, kelp persistence, combined kelp, hard 0-30 m proxy, hard 0-30 m, hard 30-100 m, soft 0-30 m, soft 30-100 m, and soft 100-200 m, there is a spacing gap exceeding SAT guidelines that ranges from Campus Point (Santa Barbara County) to either Laguna, or the southern boundary of the SCSR. Therefore, the proposed Point Vicente MPA (which is located between these two locales) does not connect MPAs to the north or south for any of these key habitat types. Spacing between very high protection MPAs of 202 miles for kelp persistence, and 232 miles for hard 30-100 m habitat (IPA proposal) is certainly greater than is suggested for the majority of species' larval duration and dispersal (see Fig 5.1 and Table 5.2d from 'SAT Evaluation of Final MPA Proposals from the South Coast Study Region: Habitat Representation, Habitat Replication, MPA Size, and MPA Spacing Analyses 12/7/2009' and question #2 for additional information).

<u>Goal 6, Objective 4: 'Provide for protection and connectivity of habitat for those species that utilize different habitats over their lifetime.'</u>

Since the proposed Point Vicente and Abalone Cove MPAs contain mostly sandy subtidal habitat, they do not protect diverse habitat types (e.g., the rock bottom habitat is poorly represented). Therefore, protection of species that utilize different habitat types over their lifetime, or those that utilize boundaries or edges between different types of habitat (i.e. sheephead with sand/rock interface) will not be promoted by the designation of these proposed MPAs. In addition, there is little connectivity of habitats between the proposed MPA cluster and other clusters because the gaps between such MPAs far exceed those that are suggested by the South Coast SAT.

The following excerpts from the "site-specific rationale" for inclusion of the proposed MPAs in the IPA also contain inaccuracies (underlined) which are discussed below.

Point Vicente MPA: "<u>Located at the only true headland (Palos Verdes Peninsula) within the Southern Biogeographical Region and the South Coast Study Region</u>, this Point Vicente SMCA/Abalone Cove SMCA cluster <u>captures all but 3 key habitats</u> across a broad range of depths. <u>It provides a high level of protection, at larger than preferred size (19.85 sq statute miles)</u> and solves the complex puzzle of accomplishing all of this within the most highly populated coastal county in all of California, while being mindful of the likelihood of extreme negative socioeconomic impacts to the surrounding ports, communities, and coastal dependant entities."

Although, the Palos Verdes Peninsula, in its entirety, is the only true headland in the South Coast region this does not constitute a convincing rationale for designating either of the proposed MPAs. The proposed Point Vicente MPA does not protect any of the unique habitat type along the Palos Verdes shelf that occurs in very limited areas within the region, deep rock habitat (hard 30-100 m). The proposed Abalone Cove MPA protects only 0.02 sq miles of this type of habitat. The proposed Point Vicente MPA is large in size (19.85 sq miles) only because the majority of it (12.24 sq miles) encompasses deep sand habitat (soft 200-3000 m) that does not protect the majority of ‘species of concern’ contained on the list of ”species likely to benefit from MPAs”.

> Abalone Cove MPA: “This MPA cluster protects the only true headland in the study region. Species afforded protection are lobsters, sea urchins, rockfish, and rocky intertidal (tide pool) inhabitants. Together with Point Vicente SMCA a total area of 19.85sq statute miles is covered. For additional details refer to rationale for Point Vicente SMCA.”

The irrelevance of the ‘only rocky headland’ and total area rationales are discussed above with respect to the proposed Point Vicente MPA. Lobster, urchins, and rockfish occur over hard bottom habitat (hard 0-30 m and 30-100 m mostly), which are present in only 0.14 sq mi. of the proposed Point Vicente MPA and in only 0.02 sq. mi. of the proposed Abalone Cove MPA. Within the entire proposed Point Vicente/Abalone Cove MPA cluster, only 0.39 and 0.02 sq miles of these respective habitat types are represented.

Inaccuracies associated with excerpts from “Other Considerations” for designation of the proposed Point Vicente MPA are similarly discussed below.

> ‘This cluster along the Palos Verdes peninsula provides a unique opportunity in that numerous studies for water and sediment quality have been conducted for many years, providing baseline information. This MPA is lacking persistent kelp and hard 30-100 m habitat due to socioeconomic impacts and water/sediment quality issues.’

And from the Abalone Cove SMCA:

> ‘Persistent kelp guideline is not met in this area due to requirement to stay ½ mile from major outfall, however this MPA cluster should meet maximum kelp guideline. This MPA contains nearly a third of the available deep rock in the study area, the rarest habitat in this region. In addition coupled with the Point Vicente SMCA, this MPA cluster achieves the preferred size in the most densely populated area of the south coast.’

Actually, this MPA cluster contains little, if any, deep rock habitat. The statement in the “Other Considerations” that ”this MPA contains nearly a third of the available deep rock in the study area” is false whether it refers to either the proposed Point Vicente or Abalone Cove MPAs, or to both of them. Hard 200-3000 m habitat is represented in the proposed MPA cluster by a total of 0.03 sq miles. By contrast, Point Dume SMCA contains 0.84 sq miles of this habitat type. The proposed MPA cluster contains no hard 100-200 m habitat, and only 0.02 square miles of hard 30-100 m habitat is included in that cluster. The Point Conception SMR, Harris Point SMR, and Gull Island SMR, which are all MPAs of similar size to the proposed MPA cluster, include 0.1, 0.25, and 0.13 sq miles of hard 100-200 m habitat, and 0.32, 2.4, and 0.12 sq miles of hard 30-100 m habitat, respectively.

Because the proposed Point Vicente/Abalone Cove MPA cluster contains mostly sandy subtidal habitat, it does not protect diverse habitat types (rock bottom habitat poorly represented). Therefore, creation of these proposed MPAs will do little to protect species that utilize different habitat types over their lifetime, or those that utilize boundaries/edges between different types of habitat (i.e. sheephead with sand/rock interface). Also, designation of the proposed MPAs will not promote connectivity of habitats with other clusters because the gaps between the proposed cluster and other MPAs far exceed those that are suggested by the South Coast SAT.

Designation of the proposed MPAs will also not advance the goals underlying the MLPA, MMAIA or the IPA because they do not meet the persistent kelp guideline because of the turbidity and sedimentation issues present there. The proposed Abalone Cove MPA also does not meet the maximum kelp guideline (1 mi) because there are only 0.86 miles of maximum kelp and 0.08 sq miles of persistent kelp present within it. In total, the proposed MPA cluster protects only 0.21 sq miles of persistent kelp, which is less than ¼ of the amount suggested in the guidelines for protection within this crucial habitat type.

As stated earlier, this MPA cluster is 19.85 sq miles, of which 14.56 sq miles represents soft 200- 3000 m habitat, and in which few if any species of concern, or species likely to benefit from MPAs, are present. If the Fish & Game Commission approves the proposed MPAs, the majority of habitat types (hard 0-30, 30-100, 100-200 meters) that support the diverse and unique assemblage of marine species found along Palos Verdes will not be protected in sufficient amounts to achieve regional goals.

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Appendix I. Density (per 100m^2) of invertebrates and algae by depth zone within the Point Vicente and Abalone Cove SMCAs, 2004-2010.

Station	**Zone**	***Anthopleura artemisia***	***Anthopleura elegantissima***	***Anthopleura sola***	***Anthopleura* sp**	***Anthopleura xanthogrammica***	***Aplysia californica***	***Aplysia vaccaria***	***Asterina miniata***
120 Reef	Inner			4.2					40.0
120 Reef	Middle			0.8					36.7
Abalone Cove Kelp East	Inner			45.8			0.8		15.0
Abalone Cove Kelp East	Middle			0.8				0.8	0.8
Abalone Cove Kelp West	Inner	0.8		0.8			0.8		0.8
Abalone Cove Kelp West	Middle								5.8
Hawthorne Reef	Inner			21.7			0.8		
Hawthorne Reef	Middle			2.5					92.5
Hawthorne Reef	Outer			1.7					119.1
Hawthorne Reef	Deep								110.8
Long Point East	Inner			28.8			6.7		12.5
Long Point East	Middle			7.1			7.5		47.9
Long Point East	Outer			4.6			0.4		56.6
Long Point West	Inner			78.3			2.5		30.0
Long Point West	Middle			7.5					46.7
Point Vicente East	Inner								8.3
Point Vicente East	Middle								29.2
Point Vicente East	Outer		0.8				1.7		21.7
Point Vicente North	Middle			10.0			7.5		29.2
Point Vicente North	Outer			5.0			4.2		33.3
Point Vicente West	Inner		123.3	94.0			0.2		8.8
Point Vicente West	Middle		5.4	4.6	0.2	0.4	1.0		42.5
Point Vicente West	Outer		1.5	5.2					81.1
Point Vicente West	Deep		0.4						43.8
Portuguese Point	Inner			300.8					10.8
Portuguese Point	Middle			3.3					16.7

Appendix I. continued.

Station	**Zone**	***Boltenia villosa***	***Centrostephanus coronatus***	***Crassedoma giganteum***	***Cypraea spadicea***	***Cystoseira osmundacea***	***Dermasterias imbricata***	***Diaulula sandiegensis***	***Egregia menziesii***
120 Reef	Inner	0.8				4.2			0.8
120 Reef	Middle					0.8			0.8
Abalone Cove Kelp East	Inner					114.2			3.3
Abalone Cove Kelp East	Middle	2.5				42.5			
Abalone Cove Kelp West	Inner					11.7			4.2
Abalone Cove Kelp West	Middle				0.8	7.5			
Hawthorne Reef	Inner					3.3			
Hawthorne Reef	Middle					36.7			
Hawthorne Reef	Outer								
Hawthorne Reef	Deep					2.5		0.8	
Long Point East	Inner					36.5			26.3
Long Point East	Middle			0.8		12.5			3.3
Long Point East	Outer			0.8					
Long Point West	Inner								
Long Point West	Middle			0.8					
Point Vicente East	Inner		6.7						
Point Vicente East	Middle		41.7				0.8		
Point Vicente East	Outer		3.3						
Point Vicente North	Middle								
Point Vicente North	Outer								
Point Vicente West	Inner		7.5	1.5					3.5
Point Vicente West	Middle		14.6	1.3		2.3	0.8		
Point Vicente West	Outer	0.8	27.6	2.3	0.8		2.5		0.2
Point Vicente West	Deep			0.4	2.1	0.8			
Portuguese Point	Inner					9.2			
Portuguese Point	Middle	0.8				11.7			

Appendix I. continued.

Station	**Zone**	***Eisenia arborea***	***Eugorgia rubens***	***Flabellina iodinea***	***Henricia leviuscula***	***Kelletia kelletii***	***Lithopoma undosum***	***Lophogorgia chilensis***	***Lytechinus anamesus***
120 Reef	Inner					15.0			
120 Reef	Middle		6.7	4.2		9.2			
Abalone Cove Kelp East	Inner					10.8	1.7		
Abalone Cove Kelp East	Middle					3.3	0.8	0.8	
Abalone Cove Kelp West	Inner					0.8			
Abalone Cove Kelp West	Middle					28.3			
Hawthorne Reef	Inner					1.7			
Hawthorne Reef	Middle	0.8				0.8			
Hawthorne Reef	Outer	4.2				1.7	0.8		
Hawthorne Reef	Deep	5.8		4.2		8.3	0.8	23.3	
Long Point East	Inner	25.4				13.8	2.9		
Long Point East	Middle	3.3				9.2	3.3		
Long Point East	Outer					11.7	2.5		70.3
Long Point West	Inner	5.8				7.5	1.7		
Long Point West	Middle					25.8	0.8	1.7	
Point Vicente East	Inner					3.3	1.7		
Point Vicente East	Middle					2.5	4.2	0.8	
Point Vicente East	Outer					2.5	6.7		
Point Vicente North	Middle	0.8				31.7	1.7	17.5	
Point Vicente North	Outer					24.2	1.7	24.2	
Point Vicente West	Inner	12.7		1.0		11.3	0.8		
Point Vicente West	Middle	2.1		1.3		6.9	1.0		
Point Vicente West	Outer	0.6		2.7	0.4	5.6	1.9	1.3	0.2
Point Vicente West	Deep			5.0	0.4	2.5	0.4	16.3	
Portuguese Point	Inner					1.7			
Portuguese Point	Middle					8.3			

Appendix I. continued.

Station	Zone	*Macrocystis pyrifera*	*Megathura crenulata*	*Muricea californica*	*Muricea fruticosa*	*Navinax inermis*	*Norrisia norrisi*	*Octopus bimaculoides*	*Ophioderma panamensis*
120 Reef	Inner	34.2	0.8	22.5	0.8				15.8
120 Reef	Middle	31.7	0.8	48.3	1.7				2.5
Abalone Cove Kelp East	Inner	15.8	0.8	1.7					
Abalone Cove Kelp East	Middle	15.8	0.8	13.3	1.7				
Abalone Cove Kelp West	Inner	37.5	1.7	4.2					
Abalone Cove Kelp West	Middle	22.5	0.8	20.0					
Hawthorne Reef	Inner	5.8					0.8		
Hawthorne Reef	Middle	57.5		13.3	0.8				
Hawthorne Reef	Outer	32.5		34.2	3.3				
Hawthorne Reef	Deep	21.7		36.7	0.8				
Long Point East	Inner	49.6	30.8	0.4					
Long Point East	Middle	24.6	11.3	14.6	1.3	5.0			
Long Point East	Outer	39.6	8.3	40.8	2.1				
Long Point West	Inner		13.3						
Long Point West	Middle		5.0	14.2	1.7				
Point Vicente East	Inner			51.7					
Point Vicente East	Middle		0.8	57.5					
Point Vicente East	Outer								
Point Vicente North	Middle		0.8	27.5	3.3				
Point Vicente North	Outer	1.7		52.5	8.3				
Point Vicente West	Inner	27.9	7.3	0.2			0.2		
Point Vicente West	Middle	26.9	2.7	2.7	0.4				
Point Vicente West	Outer	42.5	2.5	14.0	2.1			0.2	
Point Vicente West	Deep	3.8	2.1	6.7	0.4				
Portuguese Point	Inner	24.2	5.0	0.8					
Portuguese Point	Middle	14.2		190.0	1.7				

Appendix I. continued.

Station	**Zone**	***Ophioplocus esmarki***	***Orthasterias koehleri***	***Pachycerianthus fimbriatus***	***Panulirus interruptus***	***Parastichopus californicus***	***Parastichopus parvimensis***	***Peltodoris nobilis***	***Pisaster brevispinus***
120 Reef	Inner			2.5			2.5	1.7	1.7
120 Reef	Middle			9.2			0.8	0.8	4.2
Abalone Cove Kelp East	Inner						6.7		
Abalone Cove Kelp East	Middle			3.3	0.8		4.2		
Abalone Cove Kelp West	Inner				5.0		5.0		0.8
Abalone Cove Kelp West	Middle			5.8			2.5		
Hawthorne Reef	Inner						0.8		
Hawthorne Reef	Middle				1.7				4.2
Hawthorne Reef	Outer			10.0					
Hawthorne Reef	Deep			0.8		0.8	2.5		2.5
Long Point East	Inner				0.4	0.4	2.5		0.4
Long Point East	Middle						3.8		0.4
Long Point East	Outer					3.8			0.8
Long Point West	Inner						1.7		0.8
Long Point West	Middle								
Point Vicente East	Inner								
Point Vicente East	Middle				2.5		0.8		
Point Vicente East	Outer				0.8		2.5		
Point Vicente North	Middle					0.8	1.7		
Point Vicente North	Outer					0.8	3.3		1.7
Point Vicente West	Inner				0.2		6.5		5.2
Point Vicente West	Middle						3.5		1.5
Point Vicente West	Outer	0.4				0.2	11.5		0.6
Point Vicente West	Deep		0.4				1.3		0.4
Portuguese Point	Inner						0.8		
Portuguese Point	Middle			6.7			5.0		

Appendix I. continued.

Station	Zone	*Pisaster giganteus*	*Pisaster giganteus*	*Pisaster ochraceus*	*Pterygophora californica*	*Pugettia producta*	*Pycnopodia helianthoides*	*Sargassum* sp	*Strongylocentrotus franciscanus*
120 Reef	Inner	44.2			7.5		1.7		29.2
120 Reef	Middle	20.8			9.2				6.7
Abalone Cove Kelp East	Inner	20.0		16.7	15.0				55.8
Abalone Cove Kelp East	Middle	5.8			91.7	1.7			114.2
Abalone Cove Kelp West	Inner	19.2			10.8		1.7		200.0
Abalone Cove Kelp West	Middle	13.3			2.5		0.8		99.2
Hawthorne Reef	Inner	14.2		18.3					86.7
Hawthorne Reef	Middle	17.5					0.8		148.3
Hawthorne Reef	Outer	6.7			6.7		0.8		23.3
Hawthorne Reef	Deep	11.7					0.8		6.7
Long Point East	Inner	19.2		28.3				7.5	134.6
Long Point East	Middle	34.6		7.5	0.8		0.4	0.4	92.9
Long Point East	Outer	22.9		0.4	5.0				50.6
Long Point West	Inner	28.3		32.5					115.8
Long Point West	Middle	22.5		4.2			1.7		141.5
Point Vicente East	Inner	18.3							1.7
Point Vicente East	Middle	16.7							2.5
Point Vicente East	Outer	10.0		29.2					16.7
Point Vicente North	Middle	33.3		7.5			0.8		90.8
Point Vicente North	Outer	11.7		1.7					44.2
Point Vicente West	Inner	17.5		29.2	0.8		0.4	4.0	22.7
Point Vicente West	Middle	41.9		13.8	0.6		0.4		36.7
Point Vicente West	Outer	65.2		6.0	0.6		0.2		63.8
Point Vicente West	Deep	14.2		2.9	0.4		0.8		51.3
Portuguese Point	Inner		49.2	43.3	2.5				216.7
Portuguese Point	Middle		8.3	0.8	8.3	1.7	0.8		46.7

Appendix I. continued.

Station	Zone	*Strongylocentrotus purpuratus*	*Styela montereyensis*	*Stylasterias forreri*	*Tethya californiana*	*Urticina crassicornis*	*Urticina mcpeaki*
120 Reef	Inner	71.7	5.0		5.0		
120 Reef	Middle		11.7		20.8		
Abalone Cove Kelp East	Inner	1125.0					
Abalone Cove Kelp East	Middle	128.3	1.7				
Abalone Cove Kelp West	Inner	435.0					
Abalone Cove Kelp West	Middle	197.5					
Hawthorne Reef	Inner	1500.0					
Hawthorne Reef	Middle	292.8	0.8		4.2		
Hawthorne Reef	Outer	5.0	3.3		19.2		
Hawthorne Reef	Deep		5.0		36.7		
Long Point East	Inner	516.3			0.4		
Long Point East	Middle	141.3			13.3		
Long Point East	Outer	28.8			20.0		
Long Point West	Inner	150.0					
Long Point West	Middle	233.3			1.7		
Point Vicente East	Inner	1083.3			8.3		
Point Vicente East	Middle	78.3			7.5		
Point Vicente East	Outer	1416.7					
Point Vicente North	Middle	56.7			49.2		
Point Vicente North	Outer	78.3			55.0		
Point Vicente West	Inner	745.2					
Point Vicente West	Middle	522.4	0.2		2.9		
Point Vicente West	Outer	71.9	1.7		4.0		0.2
Point Vicente West	Deep	32.1	2.1	0.4	17.5	0.8	
Portuguese Point	Inner	812.5					
Portuguese Point	Middle		20.8		11.7		

Appendix II. Substrate percent cover by depth zone within the Point Vicente and Abalone Cove SMCAs, 2004-2010.

Station	**Zone**	***brown algae - erect***	***brown algae - filamentous***	***coralline algae - crustose***	***coralline algae - erect***	***Cystoseira osmundacea***	***Eisenia arborea***	***green algae***	***Macrocystis holdfast***
120 Reef	Inner	3%		18%	6%				5%
120 Reef	Middle	2%		15%					3%
Abalone Cove Kelp East	Inner	2%		47%	8%	2%			
Abalone Cove Kelp East	Middle	3%		3%	24%				10%
Abalone Cove Kelp West	Inner		13%	45%	6%				2%
Abalone Cove Kelp West	Middle	2%	15%	26%					5%
Hawthorne Reef	Inner	5%		10%	2%		3%		5%
Hawthorne Reef	Middle	2%		61%	8%				
Hawthorne Reef	Outer	3%		35%	5%				13%
Hawthorne Reef	Deep	2%		34%	2%				11%
Long Point East	Inner	2%		38%	7%	2%			6%
Long Point East	Middle			41%	2%	2%			5%
Long Point East	Outer	3%		36%					4%
Long Point West	Inner	2%		50%	3%				
Long Point West	Middle			35%					
Point Vicente East	Inner			58%					
Point Vicente East	Middle	5%		32%					
Point Vicente East	Outer	2%		21%					
Point Vicente North	Middle			60%					
Point Vicente North	Outer			43%					
Point Vicente West	Inner	2%		28%					1%
Point Vicente West	Middle	1%		25%	1%	1%	1%		10%
Point Vicente West	Outer	2%		25%	2%			2%	2%
Point Vicente West	Deep			32%	0%				4%
Portuguese Point	Inner	3%		19%	32%				3%
Portuguese Point	Middle	10%		26%	2%				8%

Appendix II. continued.

Station	Zone	*Other holdfast*	*Pterygophora holdfast*	*red algae - erect*	*red algae - turf*	*Sargassum sp*	*anemone*	*Anthopleura elegantissima*	*Anthopleura sola*
120 Reef	Inner			10%					
120 Reef	Middle			8%					
Abalone Cove Kelp East	Inner			8%	8%				2%
Abalone Cove Kelp East	Middle		10%	13%					2%
Abalone Cove Kelp West	Inner			3%	3%				
Abalone Cove Kelp West	Middle			2%	2%				
Hawthorne Reef	Inner			16%	3%				
Hawthorne Reef	Middle				2%				
Hawthorne Reef	Outer			6%	18%				
Hawthorne Reef	Deep			5%	11%				
Long Point East	Inner	1%	2%	8%	20%				
Long Point East	Middle			2%	19%				
Long Point East	Outer			6%	19%				
Long Point West	Inner			2%	3%		6%		
Long Point West	Middle			3%	10%		2%		
Point Vicente East	Inner								
Point Vicente East	Middle				13%				
Point Vicente East	Outer			2%	37%		3%		
Point Vicente North	Middle								
Point Vicente North	Outer				25%				
Point Vicente West	Inner			11%	7%				
Point Vicente West	Middle			5%	17%	0%	6%	0%	2%
Point Vicente West	Outer		1%	11%	14%	1%	2%		
Point Vicente West	Deep			7%	10%		2%		
Portuguese Point	Inner			2%	19%				3%
Portuguese Point	Middle			3%					

Appendix II. continued.

Station	Zone	*bryozoan*	*Chaceia ovoidea*	*Corynactis californica*	*Crassedoma giganteum*	*Cup coral*	*Diopatra ornata*	*Eudistylia polymorpha*	*Hippodiplosia insculpta*
120 Reef	Inner	3%							
120 Reef	Middle	3%	2%	6%		5%	13%	2%	
Abalone Cove Kelp East	Inner	2%							
Abalone Cove Kelp East	Middle			2%			5%		
Abalone Cove Kelp West	Inner		5%			2%	2%		
Abalone Cove Kelp West	Middle					5%	13%		3%
Hawthorne Reef	Inner			3%		3%	3%		
Hawthorne Reef	Middle		2%						
Hawthorne Reef	Outer	2%				2%	2%		
Hawthorne Reef	Deep	3%					2%	3%	
Long Point East	Inner	1%	2%	2%		2%	2%		
Long Point East	Middle	6%	2%	5%		1%	1%		
Long Point East	Outer	1%		5%		1%			
Long Point West	Inner	2%	3%	2%		10%	2%		
Long Point West	Middle			10%		11%	6%		
Point Vicente East	Inner								
Point Vicente East	Middle		8%	2%		3%	5%		
Point Vicente East	Outer		2%	2%		2%			
Point Vicente North	Middle					3%			
Point Vicente North	Outer					3%			
Point Vicente West	Inner	5%		9%	1%	9%			
Point Vicente West	Middle	0%	2%	7%		2%	0%		
Point Vicente West	Outer	2%		2%		7%	1%		
Point Vicente West	Deep	7%		12%		2%			
Portuguese Point	Inner	6%							
Portuguese Point	Middle		16%						

Appendix II. continued.

Station	Zone	*Hydroid*	*Lophogorgia chilensis*	*Muricea californica*	*Muricea fruticosa*	*Pachycerianthus fimbratus*	*Phidolopora labiata*	*Phragmatopoma californica*	*Sabellid/Serpulid/Spirobranchus/Eudistylia*
120 Reef	Inner							2%	
120 Reef	Middle				3%				
Abalone Cove Kelp East	Inner								
Abalone Cove Kelp East	Middle			2%					
Abalone Cove Kelp West	Inner			2%			2%		
Abalone Cove Kelp West	Middle						2%		
Hawthorne Reef	Inner		2%	2%		2%			
Hawthorne Reef	Middle								
Hawthorne Reef	Outer			5%					
Hawthorne Reef	Deep			2%					
Long Point East	Inner								
Long Point East	Middle	1%		1%					
Long Point East	Outer			1%					
Long Point West	Inner								3%
Long Point West	Middle								
Point Vicente East	Inner								
Point Vicente East	Middle								
Point Vicente East	Outer								
Point Vicente North	Middle								
Point Vicente North	Outer	2%							
Point Vicente West	Inner		1%	1%	1%			1%	
Point Vicente West	Middle							0%	
Point Vicente West	Outer	2%							
Point Vicente West	Deep								
Portuguese Point	Inner								
Portuguese Point	Middle			19%				2%	

Appendix II. continued.

Station	Zone	*Salmacina tribranchiata*	*Serpulorbis squamigerus*	*Spirobranchus spinosus*	*sponge*	*Tethya californiana*	*Tetilla sp. B*	*Tubeworm*	*tunicate - colonial*
120 Reef	Inner	5%			5%				2%
120 Reef	Middle	5%			8%				3%
Abalone Cove Kelp East	Inner	2%	2%						
Abalone Cove Kelp East	Middle				2%				
Abalone Cove Kelp West	Inner								
Abalone Cove Kelp West	Middle				2%		2%		
Hawthorne Reef	Inner	5%			2%	2%			3%
Hawthorne Reef	Middle								
Hawthorne Reef	Outer	3%			2%				
Hawthorne Reef	Deep				5%				3%
Long Point East	Inner				1%				
Long Point East	Middle	2%			1%				
Long Point East	Outer							1%	
Long Point West	Inner							2%	
Long Point West	Middle	2%						5%	
Point Vicente East	Inner								
Point Vicente East	Middle				2%				
Point Vicente East	Outer							3%	
Point Vicente North	Middle							13%	
Point Vicente North	Outer								
Point Vicente West	Inner	1%		1%	6%	1%			
Point Vicente West	Middle		0%						
Point Vicente West	Outer				3%				
Point Vicente West	Deep				2%			0%	1%
Portuguese Point	Inner		3%					2%	
Portuguese Point	Middle				2%				3%

Appendix II. continued.

Station	Zone	tunicate - solitary	bare rock	bare sand	Detritus	sediment/mud	shell debris
120 Reef	Inner		21%	16%			5%
120 Reef	Middle		3%	8%			11%
Abalone Cove Kelp East	Inner		10%	10%			
Abalone Cove Kelp East	Middle	2%		24%			
Abalone Cove Kelp West	Inner		11%	2%			3%
Abalone Cove Kelp West	Middle	2%	10%	5%			8%
Hawthorne Reef	Inner			10%	10%		11%
Hawthorne Reef	Middle		18%	5%			3%
Hawthorne Reef	Outer				2%		3%
Hawthorne Reef	Deep	2%	8%	8%			
Long Point East	Inner		2%	2%	2%		
Long Point East	Middle		1%	3%			4%
Long Point East	Outer		3%	12%	5%		4%
Long Point West	Inner			3%	6%		2%
Long Point West	Middle		2%	6%	5%		3%
Point Vicente East	Inner		40%	2%			
Point Vicente East	Middle		2%	5%	6%	15%	3%
Point Vicente East	Outer			18%	2%	6%	2%
Point Vicente North	Middle			17%			7%
Point Vicente North	Outer			2%	5%		20%
Point Vicente West	Inner		8%	3%			5%
Point Vicente West	Middle	1%	16%	1%			1%
Point Vicente West	Outer		13%	3%	1%	0%	1%
Point Vicente West	Deep	2%	8%	5%	2%		1%
Portuguese Point	Inner		6%				
Portuguese Point	Middle		6%	3%			

Attachment E

An Evaluation of the Impacts of the Palos Verdes Shelf Superfund Site on Proposed Marine Protected Areas off the Palos Verdes Peninsula

An evaluation of the impacts of the Palos Verdes Shelf Superfund Site on Proposed Marine Protected Areas off the Palos Verdes Peninsula

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Author’s Qualifications

Dr. Robert Spies has a Ph.D. in Biological Sciences from the University of Southern California and has 40 years of experience in marine pollution work, mainly in California and Alaska. He has over 40 articles in the peer-reviewed scientific literature addressing marine pollution issues. He has studied contaminants on the Palos Verdes Shelf including investigations of chlorinated hydrocarbons in fish and invertebrates and their effects on reproduction. Dr. Spies is Chief Editor of Marine Environmental Research, a scientific journal that deals with human effects on the marine environment. Dr. Spies was Chief Scientist for the Exxon Valdez Trustee Council, from 1990 to 2001. He now serves as Senior Environmental Advisor to the Presidential Commission on the Deep Horizon Oil Spill and Offshore Drilling.

SUMMARY

In the implementation of the Marine Life Protection Act (MLPA) in the Southern California Bight, the South Coast Study Region Blue Ribbon Task Force (BRTF) identified in its preferred alternative two Marine Protected Areas (MPAs) on the Palos Verdes Shelf, Point Vicente and Abalone Cove (both nominated as State Marine Conservation Areas) in the Palos Verdes Superfund Site. Among the most important functions of MPAs is to provide good biological habitat, protection from exploitation and good water quality so that stocks of depleted fishes and invertebrates can grow and reproduce and thereby act as sources for stock replenishment.

The Palos Verdes Shelf is contaminated with dichlorobiphenyltrichloroethane and its metabolites (DDTs) and polychlorinated biphenyls (PCBs), powerful reproductive toxins that biomagnify through the food web. These chemicals degrade slowly and pose a hazard to fish, birds and mammals. The water and sediment quality objectives for DDTs set by the US Environmental Protection Agency in 1980 are exceeded in the vicinity of the effluent outfalls of the Los Angeles County Sanitation Districts due to past discharges of DDTs. The US EPA has declared the Palos Verdes Shelf a superfund site and has selected a preferred alternative for remediation that involves placing a 40-cm thick coat of clean sediment on the seafloor at depths from 147-230 ft over the most contaminated portions. The capping procedure will inevitably suspend some of the buried contaminated sediments that will be carried down current in a northwesterly direction into the two designated MPA areas. In addition, the capping will affect the productivity and diversity of a portion of the shelf communities after burial, thereby compromising ecosystem function and production for as many as 9 years while the area recovers its bottom communities. The abilities of fish and invertebrates to grow and reproduce in the two proposed MPAs are at risk by locating them in a superfund site containing reproductive toxins. It is recommended that some other location be found for these MPAs where they have a better chance of achieving the goals of the MLPA.

Introduction

Applied Marine Sciences, Inc. (AMS) has prepared this report for the Los Angeles County Sanitation Districts. Its purpose is to evaluate the potential impact of the Palos Verdes Superfund Site (PVSS) on the establishment of effective MPAs off the southern portion of the Palos Verdes Peninsula. During the current effort to identify a series of Marine Protected areas in the South Coast region of California in order to implement the MLPA, an integrated preferred alternative has been identified by the BRTF. As part of the process to implement the MPLA the BRTF makes its recommendations to the State Fish and Game Commission and the Commission designates the MPAs. The BRTF selects the preferred alternative from the many different nominations made by the stakeholder groups during the regional studies. In this case the BRTF's preferred alternative includes the proposed Abalone Cove and Point Vicente MPAs, which are part of the PVSS (Fig. 1).

AMS has been asked to evaluate five questions in regard to this proposal, with particular attention to the consistency of these designations with the goals and objectives of the MPLA, the Marine Managed Areas Improvement Act (MMAIA), and the South Coast Regional Guidance (http://www.dfg.ca.gov/mlpa/southcoast.asp). These questions are:

1. Does the presence of the PVSS pose a significant heath risk to aquatic life, including those species likely to benefit from MPAs living within the proposed Palos Verdes MPAs?

2. Does the presence of the PVSS likely reduce ecosystem productivity and function within the proposed Palos Verdes MPAs?

3. Will the ongoing monitoring and proposed remediation activities within the PVSS negatively impact ecosystem productivity and function within the proposed Palos Verdes MPAs?

4. Was the South Coast Study Region (SCSR) Science Advisory Team's (SAT) guidance regarding water quality and the PVSS adequate to ensure that the PVSS would not negatively impact ecosystem productivity and function of MPAs placed in the Palos Verdes region?

5. Was the document "MPA Options for Consideration and Review by BRTF: Description of Palos Verdes MPA Options" comprehensive and accurate in its characterization of the PVSS and potential negative impacts to ecosystem productivity and function associated with the proposed Abalone Cove and Point Vicente MPAs?

After review of the available literature and documents relating to marine life and existing marine communities on the Palos Verdes Shelf, the impacts of contaminants on that marine life, the establishment of the PVSS, and the MPLA process I present my evaluation based on the five questions above.

BACKGROUND

Habitats on the Palos Verdes Shelf

The relatively narrow Palos Verdes shelf (Fig. 1) is a unique habitat in southern California, an extension of Palos Verdes Peninsula, the only true headland in southern California. The inshore portion of the shelf is a combination of rocky bottom and sand, derived from the Palos Verdes Peninsula by slumping and erosion into the nearshore area. These unconsolidated materials are mixed with organic matter derived from anthropogenic inputs and *in situ* biological production. The rocky areas support seasonal growth of kelps and are prime habitats for marine life, including a variety of fishes. The benthic habitats of the Palos Verdes Shelf in the deeper areas (>20m water depth) consist mainly of fine sand and mud substrate.

The sandy areas of the Palos Verdes Shelf have an abundant infauna dominated by polychaete worms, bivalve mollusks and small crustaceans (Barnard and Hartman, 1959; Diener et al., 1995; Bergen et al., 2000). The benthic invertebrate megafauna in this habitat is dominated by echinoderms, crustaceans and mollusks (Thompson et al., 1993). A variety of fish species are also found in these soft sediment areas (Allen, 1977; Love et al., 1986; Stull and Tang, 1996) with flatfish such as turbot, halibut, sanddabs, and Dover sole predominant in deeper waters.

The rocky habitats of the inshore area support beds of large brown kelps and a diverse fauna dominated by echinoderms, coelenterates, sponges, mollusks, bryozoans, crustaceans, polychaete worms and fishes (e.g., Stull, 1995). These are also the habitats for numerous sport fish species including various kinds of rockfish, greenling, cabezon, kelp bass and lingcod. Many, if not most, of these species are expected to benefit from the establishment of MPAs in the Southern California Bight (CDFG, 2010).

A brief history of anthropogenic contamination of the Palos Verdes shelf

Domestic treated wastewater effluent from Los Angeles County has been discharged to the ocean off White’s Point since 1937 (Rawn, 1965), initially at a water depth of 34 m and ultimately in deeper water as the volume of effluent increased. Currently, treated effluent is discharged through 2 outfalls centered at a depth of 61 m: a 90-inch diameter pipe at 64 m depth and a 120-inch diameter pipe at 58 m. There are two shallower outfalls that were formerly the main outfalls, which are now used only during emergencies. Prior to 1971 effluent discharged from the White’s Point Outfall received only primary treatment. Starting in 1972 and throughout the 1980s implementation of various control measures and upgraded treatment greatly altered the nature of the discharges, decreasing the mass emission rates of nearly all effluent constituents, especially organic particulate material (Stein and Cadien, 2009). Secondary treatment was fully implemented in 2002. At present approximately 280 million gallons (average daily dry weather flow) of secondary-treated effluent is discharged to the ocean each day through the LACSD outfall system, with only a small fraction of the mass loading of particulates that occurred before implementation of full secondary treatment.

Contaminants in Palos Verdes Shelf

A large variety of chemicals have been discharged to the Palos Verdes Shelf over the years, including metals, various hydrocarbons, and other organic contaminants. The discharge to the Los Angeles County sewage system of as much as 1700 tons of DDTs and its metabolites and lesser quantities of polychlorinated biphenyls (PCBs) and their metabolites by chemical companies primarily in the period from 1947 to 1971 resulted in more than 200 tons of these persistent organic toxins being bound to sediments on the Palos Verdes shelf (CH2MHill, 2007). There are now an estimated 100 metric tons present due to diffusion into water that is carried off the shelf and *in situ* metabolism, that converts these compounds to more soluble and generally less toxic byproducts. The contaminated sediments form a layer up to 60 cm deep (http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dec8ba3252368428825742600743733/e61d5255780dd68288257007005e9422!OpenDocument&Start=1&Count=200&Collapse=2) and has an estimated volume of 9 million cubic meters. The area of elevated concentrations of these contaminants is about 20 km^2 (Stull et al., 1996). In addition to these toxins, effluent-influenced sediments contain large quantities of other organic contaminants and metals. These include polynuclear aromatic hydrocarbons (PAHs), phthalates, cadmium, chromium, copper, zinc and lead (Stull et al., 1986; Anderson and Gossett, 1987; Swartz et al., 1991).

This contaminated material is buried under more recently deposited sediments from the less contaminated effluent discharged from the late 1970s through 2002 as well as naturally eroded and slumped material from the Palos Verdes Peninsula and material from natural biological production. The contaminated sediments are located starting about 5 cm below the surface of the sediment (Lee et al., 2002). Maximum concentrations of contaminants are located approximately 30 cm below the sediment surface (CH2M Hill, 2009). The surface sediments in the area of the outfall are less dense than the nearby natural sediments at similar depths (CH2M Hill, 2009), making them more likely to be resuspended when disturbed by, for example, winter storms.

This layer of contaminated sediment is likely to stay in place (Sherwood et al., 2002) over the short to mid-term, with concomitant slow decreases in concentrations of DDTs. However, sediments may be disturbed by a variety of erosional and resuspension events until they eventually move off the shelf (Emery, 1960) and the DDTs and PCBs become more biologically available to animals in the water. In addition, the virtual elimination of hydrogen sulfide from the sediments in recent years (LACSD, 2010) also means that more deeply burrowing and bioturbating fauna will return to the area and their activities will also resuspend sediment-bound contaminants from at least the top of this contaminated layer in places (Niedoroda et al., 1996). Studies of sediment resuspension on the Palos Verdes shelf have identified sediment erosion near the southeast portion of the outfall (Sherwood et al., 2002). The lack of significant new particulate material from the outfalls since the shift to full secondary treatment in 2002 means that at least the upper layers of contaminated material will likely remain within 5-10 centimeters of the surface of the seabed for the foreseeable future, unless remediation through sediment capping, such as that proposed by the Environmental Protection Agency for implementation in the next several years, takes place.

The concentrations of sediment contaminants on the Palos Verdes Shelf have been decreasing due to natural processes. For example, between 1992 and 2002-2003 the seafloor covered by sediments with concentrations of DDTs in excess of 1 mg/kg shrunk by 12% to 39.1 km^2 and that of sediment with greater than 10 mg/kg shrunk by 56% (CH2M Hill, 2009). Despite the reduction in ambient concentrations of sediment contaminants, current levels of contamination greatly exceed EPAs remediation targets for the protection of humans and wildlife and the proposed capping with thousands of tons of sand and silt carries its own risks of resuspending contaminated sediments.

The DDTs present in the contaminated layer still exchange with the ocean water as reflected in concentrations in the water and in the tissues of local marine animals. Water concentrations of DDTs were detected up to 0.29 ng/L over the Palos Verdes Shelf in 2003 (Zeng et al., 2005). Zeng et al (2005) estimated total fluxes of *p,p*-DDE to be in the range of 0.8 to 2.3 metric tons per year in the Southern California Bight with most of the material probably originating from the Palos Verdes Shelf . In contrast, measurements taken with in-situ sampling devices in 1997 revealed concentrations of DDTs up to about 16 ng/L (Zeng et al., 1998), indicating a decrease in water concentrations in recent years and suggesting a gradual decrease of DDTs fluxing from the sediment. Despite the reduction in ambient concentrations of sediment contaminants, current levels of contamination greatly exceed EPAs remediation targets for the protection of humans and wildlife, and the proposed capping with thousands of tons of sand and silt carries its own risk of resuspending contaminated sediments

Numerous studies over the last several decades have documented the accumulation of DDTs and PCBs in marine animals of the Palos Verdes Shelf (e.g., Young et al., 1978; Spies et al., 1989), particularly with fishes (e.g., McDermott-Ehrlich, 1978; Gosset et al., 1983; Schiff and Allen, 2000). In 1996 and 1997, horny head turbot (Zeng and Tran, 2002) contained liver concentrations of DDTs up to 203 ppm (lipid-normalized wet wt.), corresponding to a wet-weight concentration of approximately 1 – 4 ppm. (Since lipid weight concentrations are based on just the lipid present in a sample rather than the weight of all the constituents they are higher than wet concentrations, often by two orders of magnitude.) In the following discussion DDTs are expressed in wet-weight concentrations that are not lipid-normalized.

There have been declines in concentrations of contaminants in fishes over the past 20 years. As late as 1994, two species of sand dabs caught near municipal wastewater discharges in the Southern California Bight had mean liver concentrations of DDTs around 3-4 ppm (wet wt.) (Schiff and Allen, 2000). At about the same time, kelp bass collected along the Palos Verdes Shelf had mean liver concentrations of DDTs and PCBs of 3.4 ppm and about 1 ppm, respectively (Spies and Thomas, 1996). Monitoring of DDTs in the muscle of kelp bass has revealed a downward trend from the 1970s to the present. Muscle tissue concentrations of DDTs have decreased from a height of near 12 ppm DDT in the 1970s to less than 1 ppm as late as 2001 (Stein and Cadien, 2009).

Effects of effluent discharge and DDTs and PCBs on the marine ecology of the Palos Verdes Shelf

It should be emphasized that since 2002 when full secondary treatment of effluent was attained it is the legacy of past discharges that is the main concern and a potential problem on the Palos Verdes Shelf. This concern remains despite what seem to be decreases of 2-3 orders of magnitude of DDTs in the livers of sanddabs and Dover sole from reference areas in the Southern California Bight (Schiff and Allen, 2000). Also, implementation of advanced primary treatment in the 1970s and partial secondary treatment in the mid 1980s resulted in great decreases in the amount of organic matter discharged to the ocean over the last 30+ years and therefore a strong recovery of the benthic communities which were formerly affected by organic enrichment (Stein and Cadien, 2009; LACSD, 2010). The following discussion will focus to a greater extent on results of recent studies after a brief review of older investigations that documented large effects of effluent discharges, particularly from chlorinated hydrocarbons, on the Palos Verdes Shelf.

The scope of the impact of treated domestic wastewater and industrial wastewater containing chemical wastes on the Palos Verdes shelf became apparent in the 1970s. The alteration of infaunal and epifaunal macrobenthic communities, including fish, birds, and marine mammals was documented in a series of studies around the LACD's White's Point outfalls.

Benthic communities--Bottom communities are traditionally defined to a large extent by the methods used to sample them: either sediment grabs at a fixed location, the infauna, or macrobenthos from trawls towed across the bottom (including bottom fish). Below we discuss the infauna communities as defined by grab sampling followed by the macrobenthos and bottom fish communites, defined from trawl catches.

Since hundreds of species are caught in grab samples in southern California and the presence and numbers of each of these species varies with a host of factors, an index that summarizes the main features of their environmental responses, such as effluent input, is useful. The effects of effluent discharges on the communities of animals on the sea bottom, both in severity and spatial extent, have been assessed and summarized by the use of various indices. In southern California the Benthic Response Index (BRI) first described by Smith et al. (2001) has been a useful tool for summarizing the historical changes observed in the infaunal benthos (species living on and in the sandy and muddy sea floor and captured by sediment grab devices and retained on 0.5 or 1-mm mesh screens after washing). Bergen et al. (2000) provide a synoptic overview of the changes of the benthos since the 1970s using the four levels of disturbance in the BRI. Those levels are: I. Minor alteration in the presence of species, II. Loss of biodiversity, III. Loss in community function, and IV. Defaunation. A fifth level in the index is the reference condition with no disturbance.

In 1973 the sea bottom within 2 kilometers of the White's Point outfalls had a nearly complete loss of infauna (Level IV) and most of the remainder of Palos Verdes Shelf showed loss of community function (Level III). By 1985, the area around the outfall had improved and the whole shelf was Level III or better with some areas of improving to "Loss of Diversity" status (Level II), particularly in the inshore areas. By 1994 the entire shelf except immediately around the outfall had improved to Level II, loss of biodiversity, with a few areas to the northwest and southeast improving to minor alteration (Level 1). By 2007 about half of the Palos Verdes Shelf was in the unaffected category and about half in the Level I condition of minor alteration. There was a small wedge of deeper sediments offshore of the outfall that was at a Level II condition, loss of biodiversity (Stein and Cadien, 2009). Sampling in 2008-2009 yielded similar results (LACSD, 2010)

As for infauna, multiple species of animals are caught in trawls in southern California shelf environments. A similar approach to that taken with the infauna using the BRI has been applied to fish caught in trawls, the Fish Response Index (FRI) (Allen et al., 2001), which produces values between 0 and 120. A value of 45 was considered the threshold for the reference condition in southern California, with values higher than that indicating loss of diversity. Values in the early 1970s at the outset of sampling had a FRI of about 80, revealing an altered fish community. The FRI values rapidly decreased through the next decade and crossed over the reference threshold value of 45 in about 1982, stabilized around mean values in the 30's by the late 1980s, and have remained relatively stable since that time (Stein and Cadien, 2009).

Parallel trends in the macrobenthic communities of large trawl-caught invertebrates were described by Thompson et al. (1993). Within 10 years of the initiation of monitoring in the 1970s and during a time of rapid improvement of effluent water quality, the macrobenthic community was very similar to reference areas distant from the outfall.

Fish health--Several past studies have documented changes in the demersal fish communities on the Palos Verdes Shelf (e.g., Allen et al., 1977), the occurrence of disease (Sherwood and Mearns, 1976; McDermott-Ehrlich et al., 1977) and reproductive function (Cross and Hose, 1988, 1989, Hose et al., 1989; Spies and Thomas, 1997) in response to effluent discharges. The occurrence of fin rot and epidermal papillomas were documented in Dover sole in the 1970s (Sherwood and Mearns, 1976), but those conditions returned to background rates of occurrence more than 20 years ago (Stein and Cadien, 2009). The negative effects were identified in white croaker, Dover sole and kelp bass, all species that are likely to benefit from MPAs.

There have been several documented changes in reproductive function in fishes living in the area influenced by the outfalls. White croaker collected from the Palos Verdes Shelf had fewer mature eggs in their ovaries than fish collected at Dana Point, a less contaminated environment, at the same time. Fewer of the more contaminated croaker could be spawned artificially, oocyte atresia (regression and absorption) was higher and fecundity was lower (Cross and Hose, 1988; Hose et al., 1989). These authors proposed that spawning of these species was inhibited at ovarian DDT concentrations of 4 ppm, which would correspond to approximately 8 ppm in the liver. A contemporary but less extensive study of kelp bass at these same two locations indicated less response to a hormone initiating spawning, poorer egg quality and poorer fertilization success compared to kelp bass from a less contaminated location, Dana Point (Hose et al., 1989).

Kelp bass reproductive impairment was studied in more depth in1992, contrasting fish from the Palos Verdes Shelf and Dana Point (Spies and Thomas, 1997). Maturational gonadotropin (Gth) is released from the pituitary gland of female fish into the blood, inducing the final stages of oocyte maturation in the ovary and spawning. Females collected from Palos Verdes during the spawning season that were without measurable Gth in their blood had higher concentrations of DDTs in liver (6 ppm) than those with measurable amounts of blood Gth (>2ppm), suggesting inhibition of spawning or alteration of spawn timing by DDTs. In addition, Palos Verdes females had lower concentrations of estradiol in the blood, but higher rates of testosterone production. Increased rates of testosterone production were correlated with increased gonadal concentrations of DDTs. These observations are consistent with the inhibition of testosterone conversion to estradiol by DDTs, perhaps through inhibition of aromatase activity. Further evidence of hormonal interference with normal reproduction was the weaker binding of estradiol to its receptor in liver tissue of Palos Verdes females and that o,p'-DDE and o,p'-DDT were capable of displacing estradiol from its liver receptor. DDT compounds (especially o,p'-DDE) are known inhibitors of reproduction, capable of binding to various receptors and interfering with the normal cascade of hormonal events necessary for successful reproduction (Kimbrough, 1974).

These measures of abnormal hormonal control suggest that reproduction could be compromised by DDTs. Further studies are needed to determine if these findings apply to kelp bass currently living on the Palos Verdes Shelf and, if so, what the consequences are for reproductive success.

Marine Bird and Mammal Health

The DDTs are serious reproductive and metabolic toxins to birds and mammals (Bernacke and Kohler, 2009), as are PCBs (Ross et al., 2000). The risks to these higher-trophic-level predators are quite significant as DDTs and PCBs are biomagnified in marine food webs and reach much higher concentrations in top predators than in the organisms on which they feed. It has been well established that brown pelicans in southern California have accumulated high concentrations of DDTs with subsequent negative effects on reproduction (Keith, 1978; Risebrough, 1972). Egg shell thinning is one of the main effects of exposure to DDTs and was responsible for a decrease in the brown pelican population in southern California. DDTs have also been implicated in eggshell thinning in the bald eagles (Wiemeyer et al., 1984). There is also experimental evidence that exposure of developing sea gull embryos to DDTs skews sex ratios, producing more females in the population (Fry and Toone, 1981).

PCBs have also been found to be toxic to aquatic mammals, for example mink (Aulerich and Ringer, 1977) and killer whales (Hicke et al., 2007). Although PCB contamination occurs on the Palos Verdes Peninsula, the links to effects on fish, birds and mammals has not been as strong as for DDTs.

PROPOSED MANAGEMENT CHANGES TO THE PALOS VERDES SHELF

There are two proposed changes in the management of human uses on the Palos Verdes Shelf. The first of these is the further cleanup of the Palos Verdes Shelf under the Environmental Protection Agency's Superfund Program, and the second of these is the aforementioned establishment of MPAs to replenish marine life along the California coast. These efforts will be briefly summarized and the compatibility of the decisions made in each of these actions will be evaluated in the Discussion section.

The EPA Superfund Site on the Palos Verdes Shelf

In 1994, in response to the findings of a Natural Resource Damage Assessment action and report on the impact of DDTs and PCBs on the Palos Verdes Shelf, EPA initiated a Superfund investigation designed to identify possible remedial actions. In 2009 a preferred alternative of capping the affected areas with clean sediment was identified (http://www.pvsfish.org/pdf/PVS_Proposed_Plan_6.11.09.pdf). This was based partly on findings from a pilot program that placed sediment caps on three 45-acre sites in 2000. The post-capping sampling program confirmed that the cap had covered the contaminated sediments but that there were some areas in which the contaminated sediments at depth were closer to the surface than before the capping operation. This may have been caused by natural erosion or turbulence from the capping process. Based on an evaluation of human health and ecological risks, EPA determined that existing conditions exceed ambient water quality objectives and pose a threat to human health and to the ecosystem. Consequently, EPA decided that allowing natural processes to remedy the threat of DDT and PCB to the local marine ecosystem and human health was not sufficient.

A food-web exposure model for estimating doses to fish, birds and mammals has been created that is coupled with screening level concentrations of DDT to estimate the risk to these fauna. Measured concentrations of DDTs in fish collected from the Southern California Bight exceeded screening levels in northern anchovy, Pacific sardine and Pacific chub mackerel (CH2M Hill, 2009). Concentrations of DDTs in sea lions and their pups were some of the highest in the world. The Remedial Action objectives outlined by EPA are to reduce DDTs sediment concentrations to 230 ppm with 1% total organic carbon and water concentration to below a mean of 0.22 ng/L. These targets were intended to protect human consumers of seafood, whereas the existing screening level for the protection of saltwater life is 1 ng/L DDTs in water (EPA, 1980).

From the modeling, it was estimated that the Preferred Alternative would achieve the targeted screening level much earlier than relying only on natural degradation and dispersion. The preferred alternative, Option 3 in the Proposed Plan, would cap cell 8C that is centered around the deepest of the outfalls at 61 m and covers an area approximately 1.3 km^2, about twice as long in the along-shore direction as in the onshore-offshore direction (Fig. 1). The estimated dates for achieving the objectives under the preferred alternative are 2023 for water and 2039 for sediment. The estimated dates for achieving these objectives with no action are 2037 to 2067, respectively.

The EPA activities in the area of the outfall will follow a staged approach. Although still under consideration, Alternative 3 is likely to be selected. This alternative involves capping cell 8C (Fig. 1). It is quite possible that once cell 8C is capped the area of capped sediments will be extended to cells 6C and 7C, immediately to the northwest of Cell 8C. These two cells are the sites identified for capping under Alternative 4. The execution of Alternative 3 will take about 2 years, which will be followed by a period of evaluation. Execution of extended capping identified under Alternative 4, and which may follow the work under Alternative 3, would likely take at least 2 or 3 additional years. In all perhaps 5 or 6 years of disturbance would occur, followed by some years of recovery of the bottom communities.

EPA acknowledges that successful capping of soft sediments at this depth (147 to 230 ft or 45-70 m) is challenging and carries risks of resuspension of contaminated sediments and moving some contaminated sediments closer to the sediment surface. The prevailing bottom currents could carry suspended sediments to the northwest of the capping activities towards and into the proposed MPAs. The projected cap thickness of 45 cm will smother the existing fauna and it will require time for a normal benthic community of infauna, megafauna and demersal fish to re-colonize. Return to existing conditions after capping could take several years after the 5-6 year period of disturbance from capping and the possible resuspension of toxic compounds. In order to recover 9 or more years may be required to reach a fully diverse and functional ecosystem.

The MPLA process

As part of a state-wide effort to protect and restore marine habitats off the California Coast through the MPLA process, a series of sites have been designated in the Southern California Bight for MPA status. A variety of marine invertebrates and fishes have been identified as likely benefiting from the establishment of MPAs in southern California. Likely candidates for the greatest benefit have limited movement so that they would spend most or all of their lives within the designated MPAs. Most benthic invertebrates will benefit from protection from human disturbances, assuming good sediment and water quality. Among the many fish that are likely to benefit the kelp bass, a popular sport fish, is specifically named in the recently issued Draft Environmental Impact Report (DEIR) (p. 6-70; CDFG, 2010).

During the process of site selection, in which nominations were made by the South Coast Regional Stakeholders Group to the State Fish and Game Commission, the BRTF selected the proposed Point Vicente and Abalone Cove MPAs (Fig. 1) as part of their preferred alternative. The document transmitted to the BRTF, “MPA Options for consideration and review by BRTF: Description of Palos Verdes MPA options”, (October 30, 2009) consisted of a spreadsheet with some brief text under “Site specific rationale” and “Other considerations” but did not include any meaningful analysis of water and sediment quality issues associated with legacy contaminant remediation. No mention was made of the capping activities at the PVSS. Before the BRTF made their selection, public concerns were raised about the contamination in the proposed MPAs. Subsequently the Science Advisory Team (SAT) drafted recommendations regarding use of these two areas as MPAs. The SAT concluded that because of the potential disturbance from capping near the outfalls the areas of capping should be avoided in MPA selection. In general the SAT considered the southern portion of the Palos Verdes Peninsula as not the best choice for location of MPAs (SAT, 2009). The DEIR for the South Coast Study Region MLPA implementation concluded that the preferred alternative had no impact or less than significant impact on water quality (Table ES-1, p. ES-6; CDFG, 2010).

DISCUSSION

The following is my professional opinion based on: 1. Study of the published literature and available reports, 2. Personal experience with and knowledge of contaminants and marine life, specifically on the Palos Verdes Shelf, from original research there (e.g., Spies et al., 1987; Spies and Thomas, 1997) and 3. Serving on the Consulting Board of the Southern California Coastal Water Research Project (1986-1989). I have also had experience with the MPLA process in the Central Coast and North Central Coast study areas.

The general purpose of the MPAs is to provide refugia where ecosystems can recover from human impacts (e.g., harvesting and contaminant effects) and ecosystem productivity can be improved such that a complement of species with normal ages and sizes can develop and act also as a source of recruits to surrounding areas without such protections. A key feature of successful MPAs is the development of populations of large adult fish especially larger females, which usually contribute many more eggs or young than smaller, younger females, and thereby enhance the chances of maintaining their populations. Many fish populations are also key to the survival of larger predators such as birds and marine mammals, as well as other fish species. Moreover, some fish are bottom feeders and depend on a healthy benthic environment for food.

The establishment of MPAs in California is an important step in marine conservation and will be watched closely by other states. It is important that California select those areas that will provide the best opportunities for success, both for the long-term health of California's marine ecosystems and fisheries and to set an example for marine conservation initiatives elsewhere.

Although the ecosystem of the Palos Verdes Shelf area has been severely degraded with loss of biodiversity and ecosystem function due to past effluent discharges, improvements in treatment have brought about a remarkable recovery of the marine ecosystem in recent decades, mainly by reduced organic loading and burial of contaminated sediments under cleaner material. However, the recovery is not complete, and injury could still exist that was not uncovered in past studies. The system remains in jeopardy from buried contaminants. Screening level criteria for human and wildlife health are still exceeded for DDTs on the Palos Verdes Shelf. In addition the California Office of Environmental Health Assessment recommends limiting fish consumption for a variety of species caught between Santa Monica Pier and Seal Beach Pier in southern California, an area that includes the Palos Verdes Peninsula (http://www.oehha.ca.gov/fish/so_cal/pdf_zip/SoCalFactsheet61809.pdf.)

There are still lingering biological effects evident, for example the benthic communities in the deeper areas of the Palos Verdes Shelf have a reduced biodiversity/ecosystem function, and about half the shelf has a slight degradation of the benthic response index (Fig. 2). Also, indications of reproductive dysfunction in kelp bass and white croaker due to DDTs and possibly other contaminants found in the studies of the 1990s have not been thoroughly investigated with regard to their full consequences or thresholds of effect for successful reproduction. None of the work done in the 1990s has been repeated to determine if such effects still exist, whether in these species or others that should have been investigated. In addition, the screening level criteria for DDTs in fish for protection of higher-level predators (e.g. birds and marine mammals) established by EPA still indicates potential risk to such predators from consuming contaminated fish.

Given the above review of the literature on the marine life on the Palos Verdes Shelf, the effects of effluent discharge and contamination by DDTs and PCBs, and proposed changes in management of this area, I provide the following expert opinion in response to the five questions posed in the introduction.

1. Does the presence of the PVSS pose a significant health risk to aquatic life including species likely to benefit from MPAs ?

In the DEIR (CDFG, 2010) Goal 2 is, "Help sustain, conserve and protect marine life populations, including those of economic value, and rebuild those that are depleted". Two relevant objectives are identified for this goal: “Sustain or increase reproduction by species likely to benefit from MPAs, with emphasis on those species that are more likely to benefit from MPAs, and promote retention of large, mature individuals.” (Objective 2.2), and “Sustain or increase reproduction by species likely to benefit from MPAs with emphasis on those species identified as more likely to benefit from MPAs through protection of breeding, spawning foraging, rearing or nursery areas or other areas where species congregate” (Objective 2.3). To place MPAs in areas with still substantial amounts of biomagnifying reproductive toxins exceeding screening levels established by the USEPA compromises achieving this goal and these objectives.

The management of PVSS over the next 5-10 years likely will result in several increased risks to marine organisms within and down current from the PVSS. The pattern of effluent particle distribution on the Palos Verdes Shelf leaves little doubt that prevailing northwesterly currents will carry sediment with associated contaminants suspended from the capping operations into the proposed Abalone Cove and Point Vicente MPAs affecting water and sediment quality to an unknown degree. The present concentrations of DDTs in the surface sediments on the Palos Verdes Shelf in relation to these proposed MPAs is shown in Fig. 3. Disturbance from the capping will occur periodically over 5 or more years as hundreds of tons of sediments are dumped on the bottom 147 to 230 feet below the surface of the ocean. The timing and extent of these side effects of capping depends on the effectiveness of the operations and the adaptive management decisions made by EPA, both of which are unknown. These operations will have several potential effects on organism health in the area. First, there is a risk to the food sources for many animals, particularly bottom-feeding fish. Specifically, benthic communities will be greatly diminished in the area of capping from being smothered under 40 or more centimeters of sediment and there will be a depression of productivity in a larger area than the area of capping, due to the effects on fish that may spend part of their time in the MPAs but feed over a wider area. It is also possible that a reduction of infauna due to capping activities will mean less biological material, such as invertebrate larvae, will be carried down current from the capping area into the MPAs than is now the case. Consequently, food for an anticipated increased population of fish within the proposed MPAs could be diminished. Second, marine life on the Palos Verdes Shelf remains contaminated with unacceptable levels of DDTs that could be affecting vital life functions, such as reproductive fitness. There is strong evidence from past studies that DDTs negatively affects fish reproduction and such effects could still be occurring. In addition there are risks to wildlife and humans from eating contaminated fish from the PVSS. So, it seems prudent to take a cautious approach to establishing MPAs where it is recognized that a massive amount of toxic contaminants remain buried in sediments. Further, if these MPAs succeed in attracting many kelp bass, one of the species proposed to be helped by MPAs because of the limited movements of adults, then the proportion of the population exposed to DDT will actually shift upwards and further increase the risk to the health of the population. Third, additional particulate matter in water might increase water turbidity and add to the already turbid conditions of the southern Palos Verdes Shelf due to slumping of sediments in the Portuguese Bend area into the ocean. Kelp in the area of Palos Verdes, including the two proposed MPAs, has been under stress from this turbidity with documented diminished health, and the capping operations will only increase the stress on these plants that support an important nearshore habitat in coastal southern California.

2. Does the presence of the PVSS likely reduce ecosystem productivity and function within the proposed Palos Verdes MPAs?

One of the main specific goals for the South Coast Study Region was to “Protect and maintain species diversity and abundance consistent with natural fluctuations, including areas of high native species diversity” (Goal 1). Two of the main objectives under this goal were to “”Protect biodiversity, natural trophic structure and food webs in representative habitats” (Objective 1.4) and to “Promote recovery of natural communities from disturbances, both natural and human-induced, including water quality” (Objective 1.5). The location of the MPAs within a superfund site puts achievement of these goals and objectives at risk. In practical terms reduced abundances of marine organisms will result in lower productivity in the ecosystem and reduced species diversity will result in reduced ecosystem function.

So what about ecosystem function? If the diversity of the fauna is impaired one could infer that “ecosystem function” could be impaired. For example, if deep burrowing deposit feeders, such as maldanid polychaetes (which feed below the surface on sediment and expel processed sediment on the ocean floor), are missing from the benthos of an organically enriched area because of the presence of reducing chemical conditions (e.g., hydrogen sulfide and ammonia), then one can infer that a vital ecosystem function is lacking. The BRI is an example of an indirect measure of “ecosystem function” as it reflects the deviation of the infaunal community from a fully diverse state (i.e. the reference condition). Because the BRI reflects loss of diversity in the benthos as late as 2009, it is likely that some ecosystem function has been lost in the deeper parts of the two proposed MPAs (see Figs. 1 and 2).

3. Will the ongoing monitoring and proposed remediation activities within the PVSS negatively impact ecosystem productivity and function within the proposed Palos Verdes MPAs?

The dumping of hundreds of tons of sand on the ocean bottom at a depth of 147-230 feet during remediation of the PVSS will likely resuspend sediments with legacy DDTs and other contaminants. This suspended material will then will be carried into the adjacent MPAs. This activity will go on for several years and increase the risk of reduced productivity of marine life on the shelf in and around the two proposed MPAs. There is already reduced biodiversity in bottom communities in the area and the capping operations will increase the chances of further reductions in diversity in the next decade, certainly in parts of the PVSS and quite possibly including the two proposed MPAs.

Reducing benthic productivity in the area of the capping could well effect down current areas including the proposed MPAs on the Palos Verdes Shelf, reducing ecosystem productivity in two ways. First, as mentioned above, benthic productivity of the shelf will be reduced from the smothering effects of the capping itself. Second, decreased health of individuals from contaminant exposure, such as reproductive dysfunction caused by DDT, reduces productivity in the ecosystem.

In my opinion there is an increased risk of reduced productivity in the two proposed MPAs on the Palos Verdes Shelf as a result of capping activities. There is no doubt that there is reduced biodiversity there now and there will likely be an increased risk of biodiversity loss, hence a reduction in ecosystem function, in the future from the PVSS management.

4. Was the South Coast Study Region (SCSR) Science Advisory Team's (SAT) guidance regarding water quality and the PVSS adequate to ensure that the PVSS would not negatively impact ecosystem productivity and function of the MPAs placed in the Palos Verdes region?

The SAT correctly identified the risks to marine life from the legacy contaminants and the capping operations at the PVSS, but in my opinion did not fully consider the potential down-current effects of these legacy contaminants. In particular, EPA has found that the water quality criterion for DDT is being exceeded on the Palos Verdes Shelf and that there is continuing elevated risk to marine birds and mammals from DDTs. These risks are not limited to the capping area and the SAT guidance was not sufficiently strong on negative effects in adjacent areas. The SAT did not fully consider or explain increased risk to marine life of placing the proposed Abalone cove and Point Vicente MPAs in the areas designated by the BRTF.

5. Was the document "MPA Options for Consideration and Review by the BRT: Description of Palos Verdes MPA Options" comprehensive and accurate in its characterizations of the PVSS and potential negative impacts to ecosystem productivity and function associated with the proposed Abalone Cove and Point Vicente MPAs?

This document mentions that the proposed PVSS remediation as being adjacent to the proposed MPAs for the Palos Verdes Shelf, but does not discuss the risks or potential negative impacts of locating the MPAs in that location. The only activity mentioned in the MPAs is "collection for monitoring"; capping operations are not mentioned.

The history of marine contamination and its effects suggest that we should err on the side of caution in our management of ocean ecosystems. The exact future conditions for the Palos Verdes Shelf cannot be known and there are identified potential and likely unknown threats to marine life from remediation of sediments in the PVSS. Therefore the location of these two MPAs must be reconsidered.

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Zeng, E.Y.D., C. C. Yu and K. Tran. 1998. *In-Situ* measurements of chlorinated hydrocarbons in the water column off the Palos Verdes Peninsula, California. Southern California Coastal Water Research Project Annual Report.

Figure Captions:

Fig. 1. The Palos Verdes Peninsula and shelf showing the BRTF-nominated MPAs (blue, red), the outline of the Palos Verdes Superfund Site (black line), Cell 8C (dark green)(to be capped under EPA's preferred alternative, 3) and cells 7C and 6C (light green) (slated for capping under alternative 4). Lines radiating from near White's Point are the 4 wastewater outfalls.

Fig. 2. The Benthic Response Index categories for infauna of the Palos Verdes Shelf in 2009 (after LACSD, 2010). Lines radiating from near White's Point are the 4 wastewater outfalls.

Fig. 3. The Palos Verdes Peninsula and Shelf showing the BRTF-nominated MPAs (outlined in dashed lines), the Palos Verdes Superfund Site (outlined in a solid black line), and the sediment concentrations of DDT.

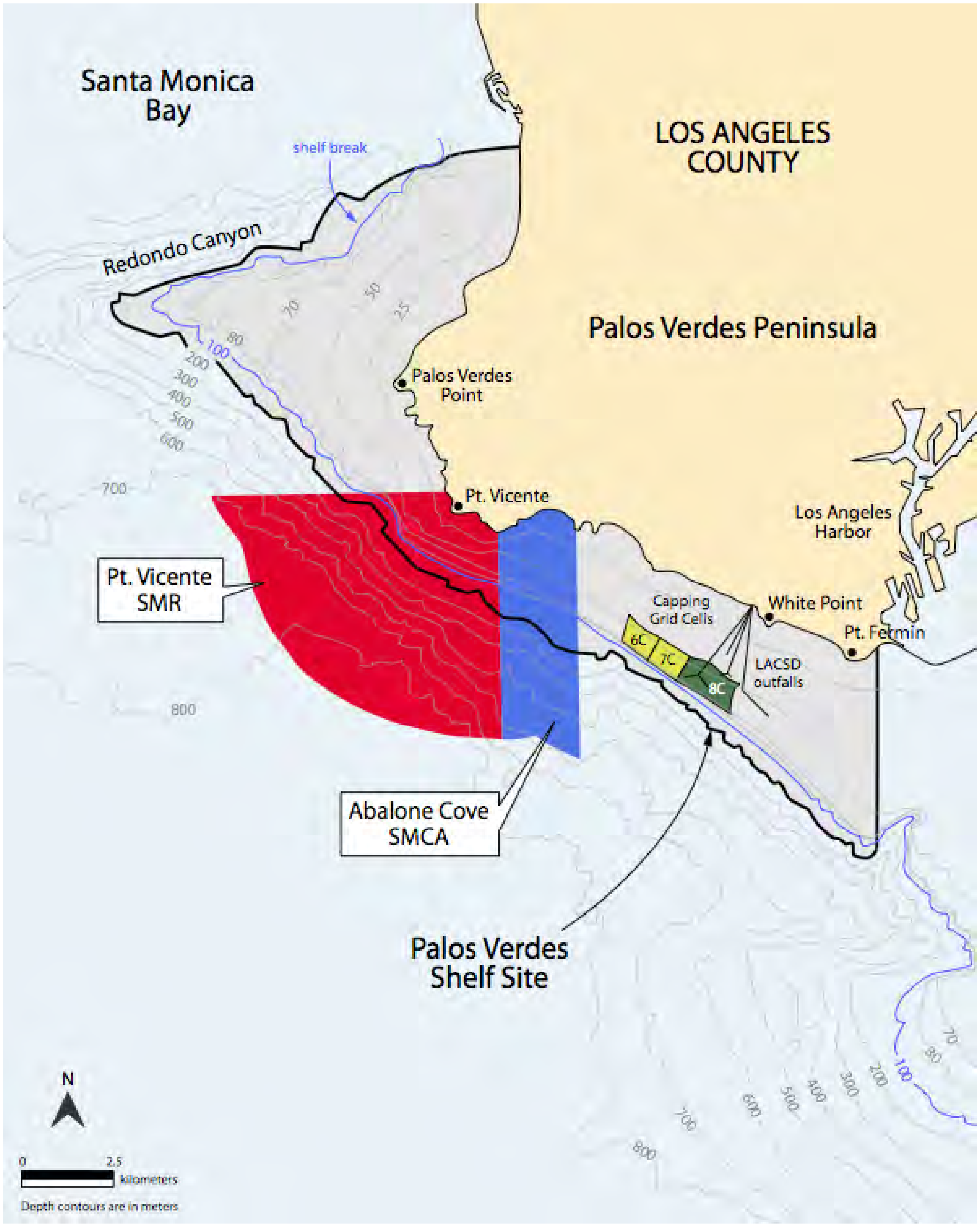

Santa Monica Bay
LOS ANGELES COUNTY
shelf break
Redondo Canyon
Palos Verdes Peninsula
Palos Verdes Point
Pt. Vicente
Los Angeles Harbor
Pt. Vicente SMR
Capping Grid Cells
White Point
Pt. Fermin
6C
7C
8C
LACSD outfalls
Abalone Cove SMCA
Palos Verdes Shelf Site
25
50
70
80
100
200
300
400
500
600
700
800
N
0
2.5
kilometers
Depth contours are in meters

Fig. 1

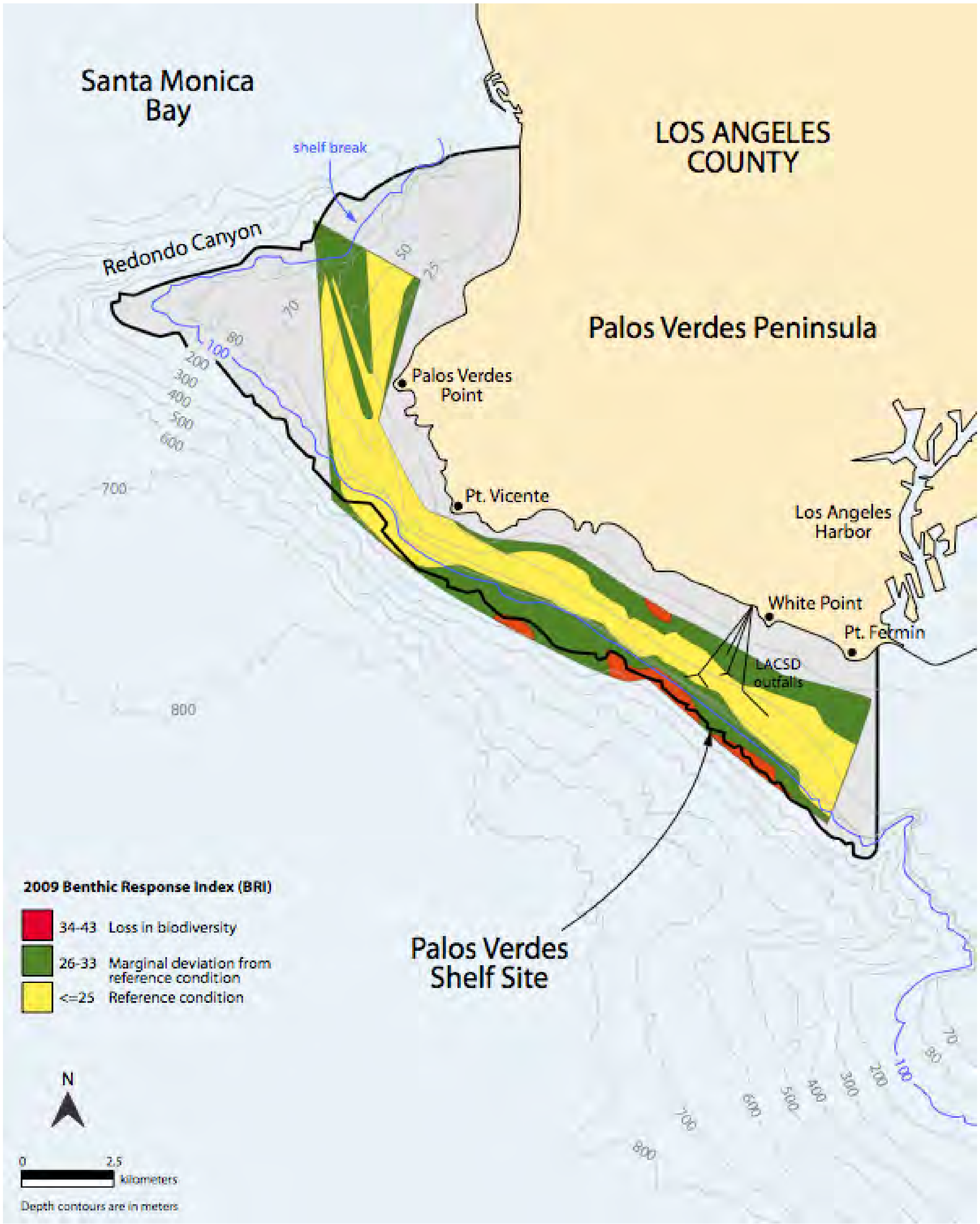
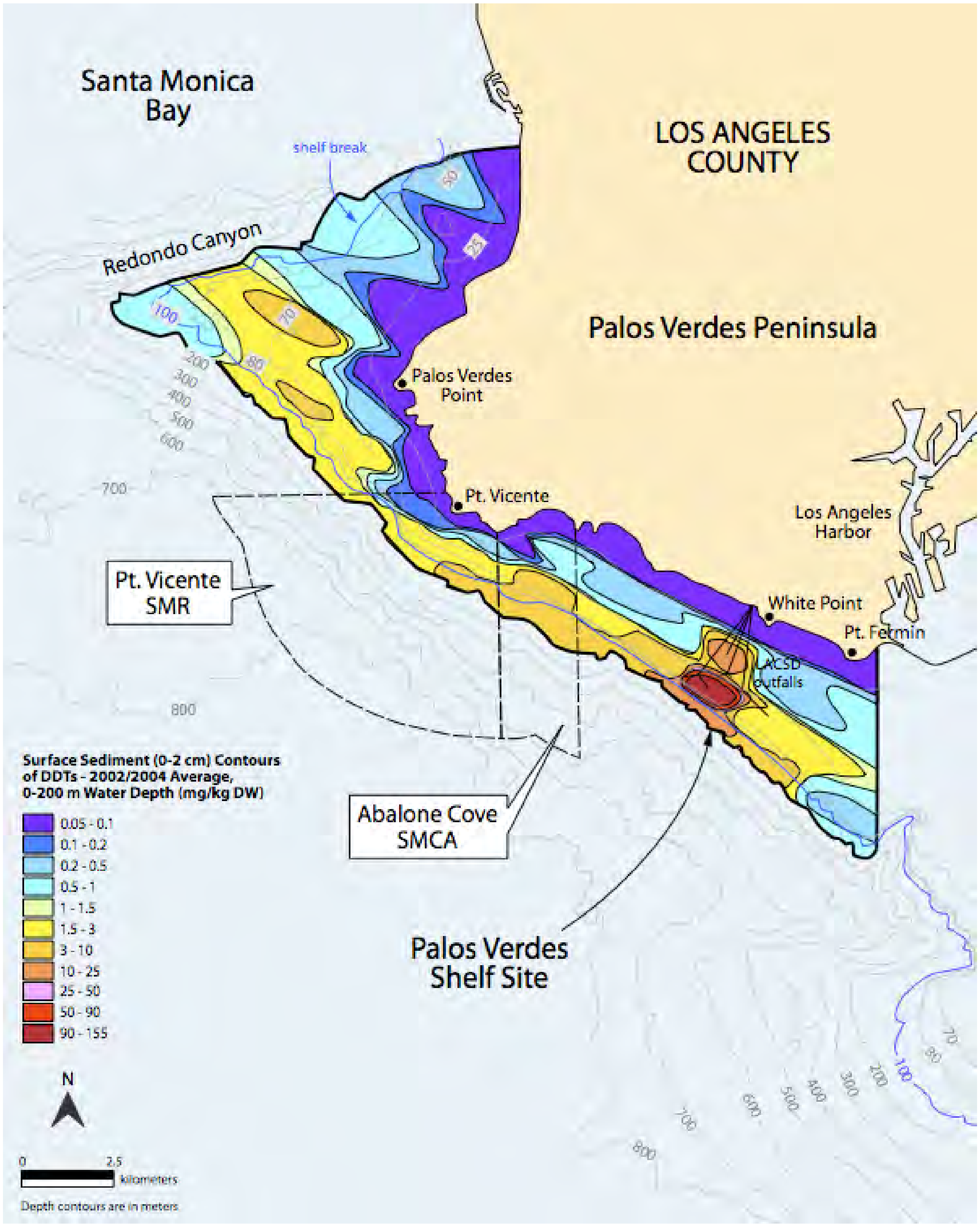

Santa Monica Bay
LOS ANGELES COUNTY
shelf break
Redondo Canyon
Palos Verdes Peninsula
Palos Verdes Point
Pt. Vicente
Los Angeles Harbor
White Point
Pt. Fermin
LACSD outfalls
Palos Verdes Shelf Site
25
50
70
80
100
200
300
400
500
600
700
800
2009 Benthic Response Index (BRI)
🟥 34-43 Loss in biodiversity
🟩 26-33 Marginal deviation from reference condition
🟨 <=25 Reference condition
N
0
2.5
kilometers
Depth contours are in meters

Fig. 2


Santa Monica Bay
LOS ANGELES COUNTY
shelf break
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Palos Verdes Peninsula
Palos Verdes Point
Pt. Vicente
Los Angeles Harbor
White Point
Pt. Fermin
LACSD outfalls
Pt. Vicente SMR
Abalone Cove SMCA
Palos Verdes Shelf Site
50
25
70
80
100
200
300
400
500
600
700
800
Surface Sediment (0-2 cm) Contours of DDTs - 2002/2004 Average, 0-200 m Water Depth (mg/kg DW)
0.05 - 0.1
0.1 - 0.2
0.2 - 0.5
0.5 - 1
1 - 1.5
1.5 - 3
3 - 10
10 - 25
25 - 50
50 - 90
90 - 155
N
0
2.5
kilometers
Depth contours are in meters

Fig. 3

WATER
RECLAMATION
SOLID WASTE MANAGEMENT

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

1955 Workman Mill Road, Whittier, CA 90601-1400
Mailing Address: P.O. Box 4998, Whittier, CA 90607-4998
Telephone: (562) 699-7411, FAX: (562) 699-5422
www.lacsd.org

STEPHEN R. MAGUIN
Chief Engineer and General Manager

December 9, 2010

Mr. Jim Kellogg, President and Members
California Fish and Game Commission
1416 Ninth Street
P.O, Box 944209
Sacramento, CA 94244-2090

Dear Commissioners:

**Abeyance of Opposition to Proposed Changes to
California Code of Regulations, Fish and Game Code, Title 14, Section 632
Designating Marine Protected Areas (South Coast)**[1]

Thank you for the opportunity to submit comments on the proposed changes in regulations stemming from implementation of the Marine Life Protection Act (MLPA) in the South Coast Study Region (SCSR). The Sanitation Districts have actively participated in the MLPA implementation process in the SCSR since its beginning in 2008. The Sanitation Districts operate a major wastewater treatment facility known as the Joint Water Pollution Control Plant (JWPCP) that discharges treated effluent through an ocean outfall system off the south coast of the Palos Verdes Peninsula. The JWPCP serves about 5 million people in 17 Districts, represents a multi-billion dollar public infrastructure investment, and is one of the two largest wastewater treatment facilities on the west coast of the United States. The Sanitation Districts have the duty both to protect the public safety through the operation of the JWPCP and to protect the public's investment in the facility. The Sanitation Districts have conducted decades of comprehensive monitoring proximate to JWPCP's discharge location and possess expert knowledge regarding the marine environment in the area.

In August 2010, the Department of Fish and Game released a Draft Environmental Impact Report (DEIR) and in September 2010, the Fish and Game Commission published the proposed regulations to establish a network of Marine Protected Areas (MPAs) for the SCSR. The Integrated Preferred Alternative identified in the DEIR and proposed regulations include two proposed State Marine Conservation Areas off the south coast of the Palos Verdes Peninsula, which are located immediately down current of the JWPCP discharge. The Sanitation Districts have consistently advocated against placement of Marine Protected Areas off South Palos

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[1] California Regulatory Notice Register 2010, Volume No. 38-Z, File No. Z2010-0907-08 and Revised Proposed Changes in Regulations, November 22, 2010.

Verdes, having submitted 14 comment letters expressing that opposition to the Blue Ribbon Task Force, Department of Fish and Game, and Fish and Game Commission between March 3, 2009 and October 15, 2010.

In particular, with respect to the two South Palos Verdes MPAs included in the Integrated Preferred Alternative now being considered for adoption, the Sanitation Districts have asserted and continue to assert:

- The proposed MPAs would protect intrinsically marginal habitats that are further reduced in value by the ongoing Portuguese Bend landslide. These proposed MPAs do not satisfy the scientific requirements set forth in the MLPA and would contribute very little toward the ability of the overall MPA array to achieve the goals of the MLPA, as detailed in Exhibit A.

- The proposed MPAs would overlie a portion of the Palos Verdes Shelf Superfund Site that contains some of the most contaminated waters and sediments in the region. This contamination and planned remediation activities in the area by the U.S. Environmental Protection Agency would further impact the performance of the MPAs and present significant ongoing risk to marine organisms within the MPAs.

- Designation of the MPAs as described in the IPA could trigger subsequent water quality regulation by the State Water Resources Control Board (SWRCB), which has been acknowledged by the SWRCB. The socioeconomic impacts to the five million ratepayers served by the JWPCP that could result from such regulations, which are detailed in Exhibits B, C and D, greatly exceed the socioeconomic impacts considered by the Blue Ribbon Task Force during the development of the Integrated Preferred Alternative.

- The Final Environmental Impact Report (EIR), which was received on December 3, 2010, does not adequately address the comments on the Draft EIR set forth in the Districts' comment letter dated October 15, 2010, and does not comply with the California Environmental Quality Act.

In addition, the Sanitation Districts understand that the inclusion of the South Palos Verdes MPAs in the Integrated Preferred Alternative by the Blue Ribbon Task Force was the result of a closed process that did not comply with the requirements of the Bagley-Keene Open Meeting Act, as detailed in Exhibit E.

The Sanitation Districts have sought assurance from the SWRCB that additional regulation of the discharge from JWPCP, with attendant unacceptable socioeconomic impacts to its ratepayers, will not be triggered by designation of these inappropriately sited MPAs. To date, the SWRCB has not taken an action that provides the Sanitation Districts with the requested regulatory assurance. However, on November 16, 2010, the SWRCB did adopt the attached Resolution, included as Exhibit F, advising its staff to consider a specific approach for water quality requirements in future State Water Quality Protection Areas (SWQPAs) proximate to existing municipal wastewater ocean outfalls, and directing staff to prepare and propose amendment(s) to the California Ocean Plan to formalize this approach. The Resolution also directs SWRCB staff to prepare further amendments to the California Ocean Plan to clarify that no new or modified limitations, substantive conditions, or prohibitions will be imposed upon existing municipal wastewater discharge outfalls based on the designation of MPAs, other than State Marine Reserves. An 18-month time frame was established to prepare the Ocean Plan Amendments and to make them available for consideration by the SWRCB.

If the Ocean Plan amendments are adopted as currently described in the Resolution and within the timeframe specified, they would provide the regulatory certainty required by the Sanitation Districts to fully withdraw their opposition to the designation of the South Palos Verdes MPAs. However, adoption of Ocean Plan amendments incorporating the current language in the Resolution will be subject to a public review process and the outcome is by no means assured. While the ongoing regulatory uncertainty and the serious deficiencies associated with the South Palos Verdes MPAs still justify withdrawal of the South Palos Verdes MPAs from consideration and designation, in consideration of the positive action taken by the SWRCB in adopting the Resolution, the Sanitation Districts will hold their opposition to designation of the South Palos Verdes MPAs in abeyance at this time. In the case that acceptable amendments to the California Ocean Plan are not timely adopted by the SWRCB, the Sanitation Districts are reserving the right to challenge the designation of the South Palos Verdes MPAs at a later time.

Please contact me, or Phil Friess of my staff, at (562) 699-7411 should there be any questions regarding this matter.

Very truly yours,

Stephen R. Maguin

Stephen R. Maguin

SRM:PLF:rb
Attachments

cc: Charles R. Hoppin, Chair and Members, State Water Resources Control Board (w/o attachments)
Tom Howard, Executive Director, State Water Resources Control Board (w/o attachments)

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Attachments

cc: Charles R. Hoppin, Chair and Members, State Water Resources Control Board (w/o attachments)
Tom Howard, Executive Director, State Water Resources Control Board (w/o attachments)

EXHIBIT A

An Analysis of the Proposed Point Vicente and Abalone Cove Marine Protected Areas

Daniel J. Pondella, II, MA, Ph.D.
Director of the Vantuna Research Group
Associate Professor of Biology
Moore Laboratory of Zoology
Occidental College

October 14, 2010

Qualifications: The major focus of my research program is the fish assemblages of the rocky reefs in the Southern California Bight. The field portion of my research program is based out of King Harbor, Redondo Beach; thus, the most of my work has been conducted at the Palos Verdes Peninsula. I started completing subtidal surveys of this region in 1985 when I started as a technician with the Vantuna Research Group (VRG). One of the core research projects of the VRG, which has been studying the fishes at Palos Verdes since the mid-1960s, is the long-term monitoring of fishes at Rocky Point and King Harbor (1974-present). In the late 1980s and early 1990s, I completed biological assessments of both Abalone Cove and Portuguese Bend Landslides (Envirosphere 1989; Pondella 1996). Since becoming the director of the VRG, I expanded this program to include spatial surveys of rocky-reefs throughout the Southern California Bight (Clark 2005; Pondella et al. 2005). Recently, my program has completed extensive surveys of Santa Monica Bay and the Palos Verdes Peninsula (Pondella 2009; Pondella et al. 2010).

In addition, to the dozens of published peer-reviewed I have also edited the volume “The Ecology of Marine Fishes: California and Adjacent Waters”, the most comprehensive work on fishes in California. Beyond my current research program, I am also the Editor of the Bulletin of the Southern California Academy of Sciences, chair of the Santa Monica Bay Restorations Commission’s Marine Resources Technical Advisory Committee, chair of Southern California Coastal Water Research Project Bight ’08 Rocky Reef Committee and just finished serving on the California Marine Life Protection Act’s Master Plan Science Advisory Team for the South Coast Study Region. This research and service has given me a unique insight into the issues concerning the Palos Verdes Peninsula.

SUMMARY

Question 1: *Are the habitats being protected in the proposed Abalone Cove and Point Vicente Marine Protected Areas (MPA) sufficient for meeting the goals of the Marine Life Protection Act (MLPA*), *Marine Managed Areas Improvement Act (MMAIA), and the regional guidelines provided for the South Coast Study Region (SCSR) MPA process?*

Answer 1: The Abalone Cove and Point Vicente MPAs contain poor-quality nearshore habitats as a result of the continued sedimentation and turbidity associated with the Portuguese Bend Landslide and the historic landslide in Abalone Cove. Indications of this poor habitat quality are defaunated reefs and purple urchin barrens. These deleterious effects are greatest in Abalone Cove, but also present at Point Vicente.

Question 2: *Evaluate the anticipated effectiveness of the proposed Abalone Cove and Point Vicente MPAs as part of an interconnected network of MPAs in the context of the MLPA, MMAIA, and the regional guidelines provided for the SCSR MPA process.*

Answer 2: In the Abalone Cove and Point Vicente MPAs, all habitats with exception of soft bottom habitats do not meet the recommended scientific guidelines established by the Science Advisory Team (SAT) . The lack of the anticipated benefits is particularly significant with respect to critical rocky reef habitats that are most likely to benefit from a reserve network. As such, these proposed reserves have little individual bioeconomic value.

Question 3: *How do the proposed Abalone Cove and Point Vicente MPAs compare to other MPAs of similar size in the IPA in terms of meeting the goals of the MLPA, MMAIA, and regional guidelines provided for the SCSR MPA process?*

Answer 3: They do not adequately compare to the proposed MPAs of similar size. The size of this reserve cluster has been intentionally inflated by the inclusion of deep soft bottom habitat. Thus, it is more similar to a small MPA.

Question 4: *Is the document "MPA Options for Consideration and Review by BRTF: Description of Palos Verdes MPA Options" comprehensive and accurate in describing the proposed Abalone Cove and Point Vicente MPAs?*

Answer 4: No, this document is inaccurate and appears to be intentionally misleading.

INTRODUCTION

The Blue Ribbon Task Force (BRTF) has forwarded an Integrated Preferred Alternative (IPA) reserve network proposal to the Fish and Game Commission for approval. After a two-year stakeholder process, the BRTF apparently ignored the stakeholder proposals and the scientific guidelines from its Science Advisory Team (SAT). The area where these discrepancies occur is located at the center of the Southern California Bight, the Palos Verdes Peninsula. At this location, the BRTF ignored critical and limiting habitats, reduced the remaining rocky-reef habitats below the recommended habitat size guidelines, and disregarded spacing guidelines. Being at the center of the bight, the Palos Verdes Peninsula is critical for network connectivity. The limited habitat size and importance of Palos Verdes for connectivity were confirmed by two separate bioeconomic models. Further complicating the long term performance of the Palos Verdes MPAs and associated network connectivity is the lack of integration into the analysis of the IPA of known empirical studies of the region that demonstrate the known poor habitat quality of these proposed MPAs. The designation of the proposed Point Vicente and Abalone Cove MPAs compromises a long term assessment of the MPA network and the performance of the proposed MPAs.

Question 1: Are the habitats being protected in the proposed Abalone Cove and Point Vicente MPAs sufficient for meeting the goals of the MLPA, MMAIA, and the regional guidelines provided for the SCSR MPA process?

According to the scientific guidelines for the *California Marine Life Protection Act Master Plan for Marine Protected Areas*, MPAs should have a minimum alongshore span of 3-6 statute miles (preferably 6-12.5 miles) and should extend offshore to deep waters. The SCSR SAT combined these guidelines to recommend that an individual MPA or MPA cluster should have a minimum area of 9-18 square statute miles (preferably 18-36 square miles). The Point Vicente SMCA has an alongshore span of 3.69 mi (minimum = 3.0 mi), while the Abalone Cove SMCA has an alongshore span of 1.23 mi for a total of 4.92 mi (Table 1). While the MPA cluster is near the minimum guidelines, these measures fall significantly below even the low end of the range of the preferred size guidelines for the individual MPAs**.**

In addition, the individual habitats represented in the Palos Verdes IPA proposal are either of significantly lower quality than required by the science guidelines or are absent. First, the reported habitat area calculations are inconsistent (Table 1). Both maximum kelp (Point Vicente SMCA = 1.23 mi, Abalone Cove SMCA = 0.86 mi) and surfgrass (Point Vicente SMCA = 1.14 mi, Abalone Cove SMCA = 1.41 mi) estimates are greater than the estimates of rocky shore habitat (Point Vicente SMCA = 1.06 mi, Abalone Cove SMCA = 0.23 mi). Since both; the kelp and surfgrass habitats are themselves dependent upon rocky habitat, these estimates are incorrect. The only habitats that meet the scientific guidelines are soft bottom habitats, rocky shores and rock proxy.

The critical and limiting habitats along this stretch of coastline are all associated with hard bottom features. None of these habitats are represented below 30 m below the surface. Also, the estimates for the nearshore (0-30 m) rocky reef habitats are incorrect. The proposed Point Vicente SMCA contains 0.138 mi^2 (358,074 m^2) of nearshore rocky reef habitat (Pondella 2009), 55% of the reported value. While the Abalone Cove MPA appears to have a higher estimated amount of nearshore rocky habitat, that area is either buried reef or under intense sediment load from the Portuguese Bend Landslide.

Table 1. Reported overall sizes and habitat sizes for the IPA proposed Point Vicente SMCA and Abalone Cove SMCA. Minimum scientific guidelines where evaluated are in parentheses. Values below scientific guidelines are highlighted in yellow.

	Point Vicente SMCA	**Abalone Cove SMCA**	**Total**
Area (9-18 mi^2)	15.12	4.75	19.87
Alongshore span (3-6 mi)	3.69	1.23	4.92
Depth range (ft)	0-2640	0-2181	0-2640
Beaches (1 mi)	1.4	0.76	2.16
Rocky shores (1 mi)	0.21	0.87	1.08
hardened shores (1 mi)	0	0	0
coastal marsh (mi)	0	0	0
coastal marsh area (mi^2)	0	0	0
tidal flats (mi)	0	0	0
surfgrass (mi)	1.14	1.41	2.55
eelgrass (mi^2)	0	0	0
estuary(0.12 mi^2)	0	0	0
soft 0-30 m (10 mi^2)	0.41	0.51	0.92
soft 0- 30 m proxy (1 mi)	0.47	1.09	1.56
soft 30-100 m (mi^2)	1.09	1.17	2.26
soft 100-200 m (mi^2)	1.05	0.56	1.61
soft 200-3000 m (mi^2)	12.24	2.32	14.56
hard 0-30 m (1 mi)	0.25	0.14	0.39
hard 0-30 m proxy (1 mi)	1.06	0.23	1.29
hard 30-100 m (0.3 mi^2)	0	0.02	0.02
hard 100-200 m (0.28 mi^2)	0	0	0
hard 200-3000 m (mi^2)	0.03	0	0.03
unknown 0-30 m (mi^2)	0.02	0.03	0.05
maximum kelp (linear) (1 mi)	1.23	0.86	2.09
kelp persistence (linear) (1 mi)	0.13	0.08	0.21

Road construction on Palos Verdes Drive triggered the Portuguese Bend Landslide in 1956. From 1956 to 1999, approximately 5.7 to 9.4 million metric tons of sediment slid onto the inner shelf (Kayen 2002). By 1999, the landslide was dewatered, slowed appreciably and now only releases sediment due to wave action. Unfortunately sedimentation and associated turbidity continue to have chronic impacts. First there is continued turbidity, sediment transport and scour associated with the sediment deposited in Portuguese Bend from the landslide (Figure 1). In 1999, the Klondike Canyon Landslide was triggered by water issues associated with the Trump National Golf Course, adding to the sediment load in this area (Figure 1). The third slide track, the Abalone Cove Landslide, occupied approximately 80 acres extending west of Portuguese Point into Abalone Cove County Beach from the surf zone inland nearly 2,200 feet with a slide plane located 84 feet below sea level (Figure 2). The Abalone Cove Landslide includes an ancient slide tract exacerbated by an increase in ground water levels beginning in 1948 that were caused by increased development. Historic and continued sedimentation from these three slides continues to plague this stretch of the peninsula. First, this turbidity plume (Figure 3) transports sediment toward Point Fermin and Rocky Point following the longshore current and associated longshore transport on the Palos Verdes Peninsula (Hickey 1993). In addition, rocky reefs continue to be buried by sediment in this area (USACE 2000; Pondella 2009; Pondella et al. 2010). These chronic stressors continue to cause deleterious impacts to the nearshore rocky environment (Stephens et al. 1996). Reef loss due to burial has significantly reduced kelp canopy and persistent kelp in this area.

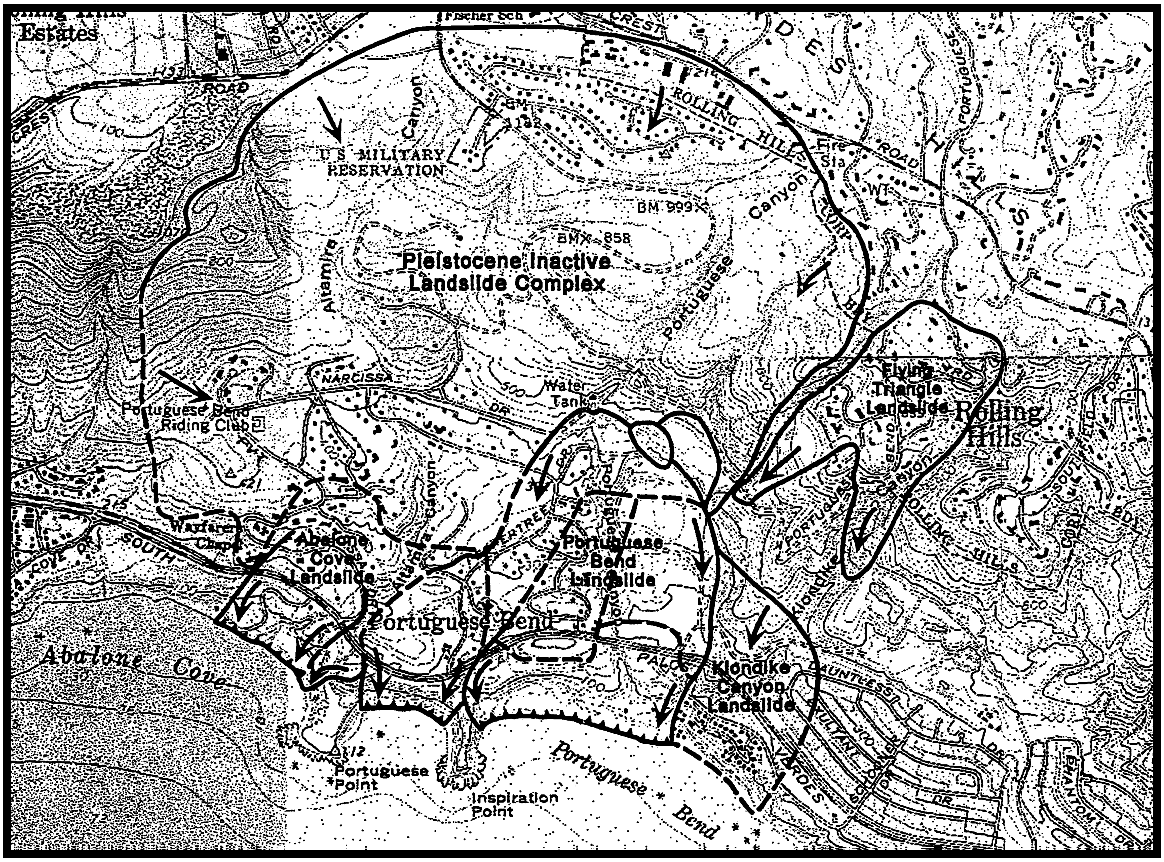


Figure 1. Landslides of the Palos Verdes Peninsula (USACE 2000).

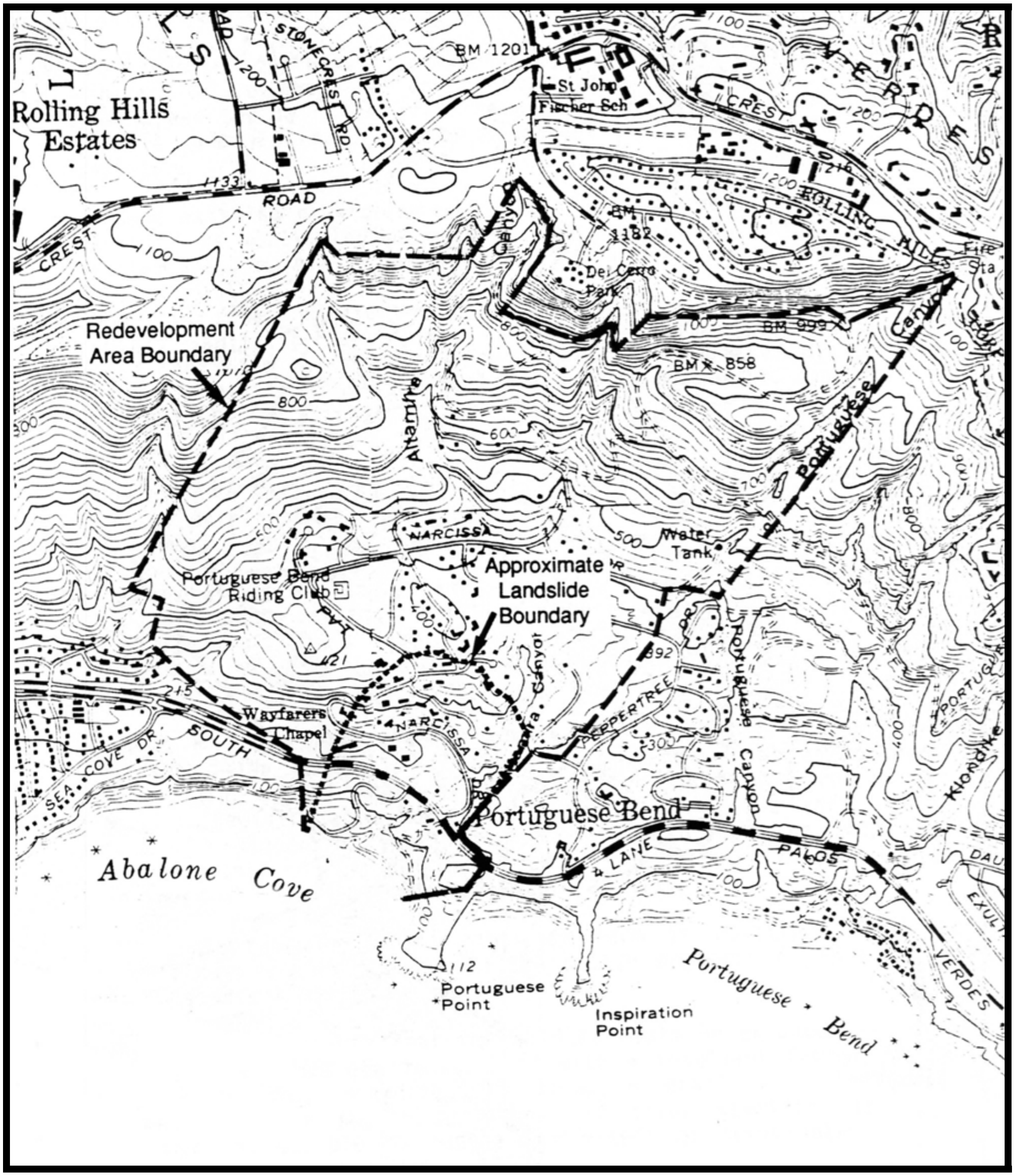


Figure 2. The Abalone Cove Landslide (Envirosphere 1989).

Figure 3. Turbidity plume from the Portuguese Bend Landslide (Pondella et al. 2010).

The chronic damage associated with the turbidity along the southern face of the Palos Verdes Peninsula was demonstrated from an empirical survey of the water column profile of light energy (measured as photosynthetically active radiation or PAR) conducted monthly from 1982-2009 at seven nearshore sites along the Palos Verdes Peninsula demonstrates the chronic damage associated with turbidity along the southern face of the Palos Verdes Peninsula (Figure 4). This survey is part of the Joint Water Pollution Control Plant (JWPCP) NPDES monitoring program. The survey included readings taken at 0.5 m and 1m below the surface and then at 2 m intervals until contact with the bottom or 20 m, whichever comes first. The light energy value measured at each depth (quanta/sec/cm^2) is divided by the surface light energy measurement (also quanta/sec/cm^2) to obtain a percentage of surface light energy that passes through the water column to each depth. That percentage was then averaged over every sampling period from April 1982 to December 2009 to obtain a mean percentage of surface light energy captured at each depth. By plotting the difference between the percentage at each site/depth and the average percentage of all sites at each depth, discernable patterns begin to appear (Figure 5). The upcoast stations Rocky Point (L1) and Long Point (L2) have greater light penetration at depth than at stations between Abalone Cove and Point Fermin (L3-L7). At 18 meters, there is significant variation among these sites (ANOVA: $F_{1,6} = 6.862$, $p < 0.000001$). Thus, turbidity associated with the Portuguese Bend Landslide may be limiting algal growth from Abalone Cove to Point Fermin. This turbidity plus the previously described reef burial limit kelp canopy density, persistence and the corresponding performance of the associated biota.

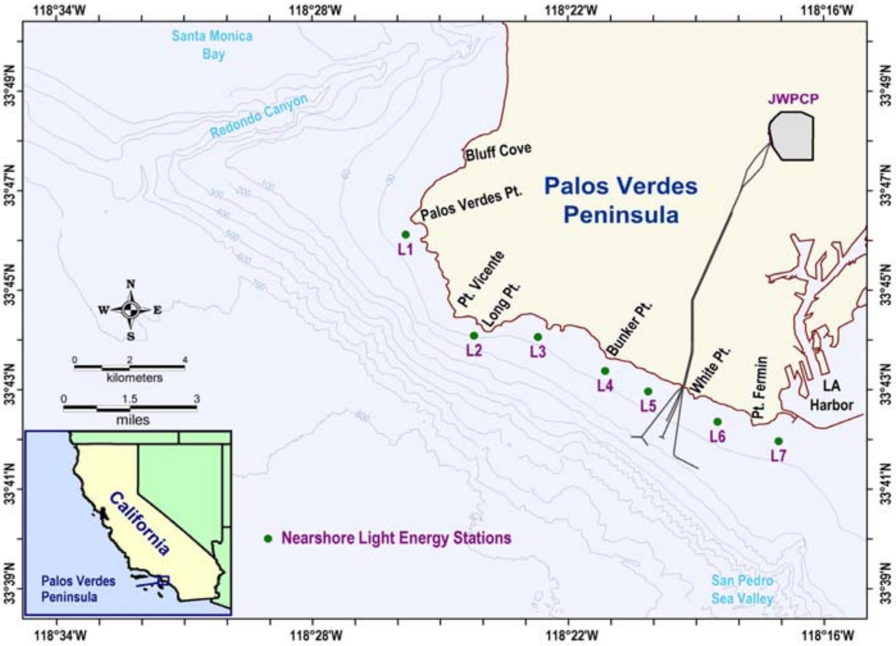


Figure 4. Map showing locations of the Sanitation Districts' light energy stations. Stations names are as follows: L1 = Rocky Point, L2 = Long Point, L3 = Abalone Cove, L4 = Bunker Point, L5 = 3 Palms, L6 = East of Whites Point, L7 = Point Fermin.

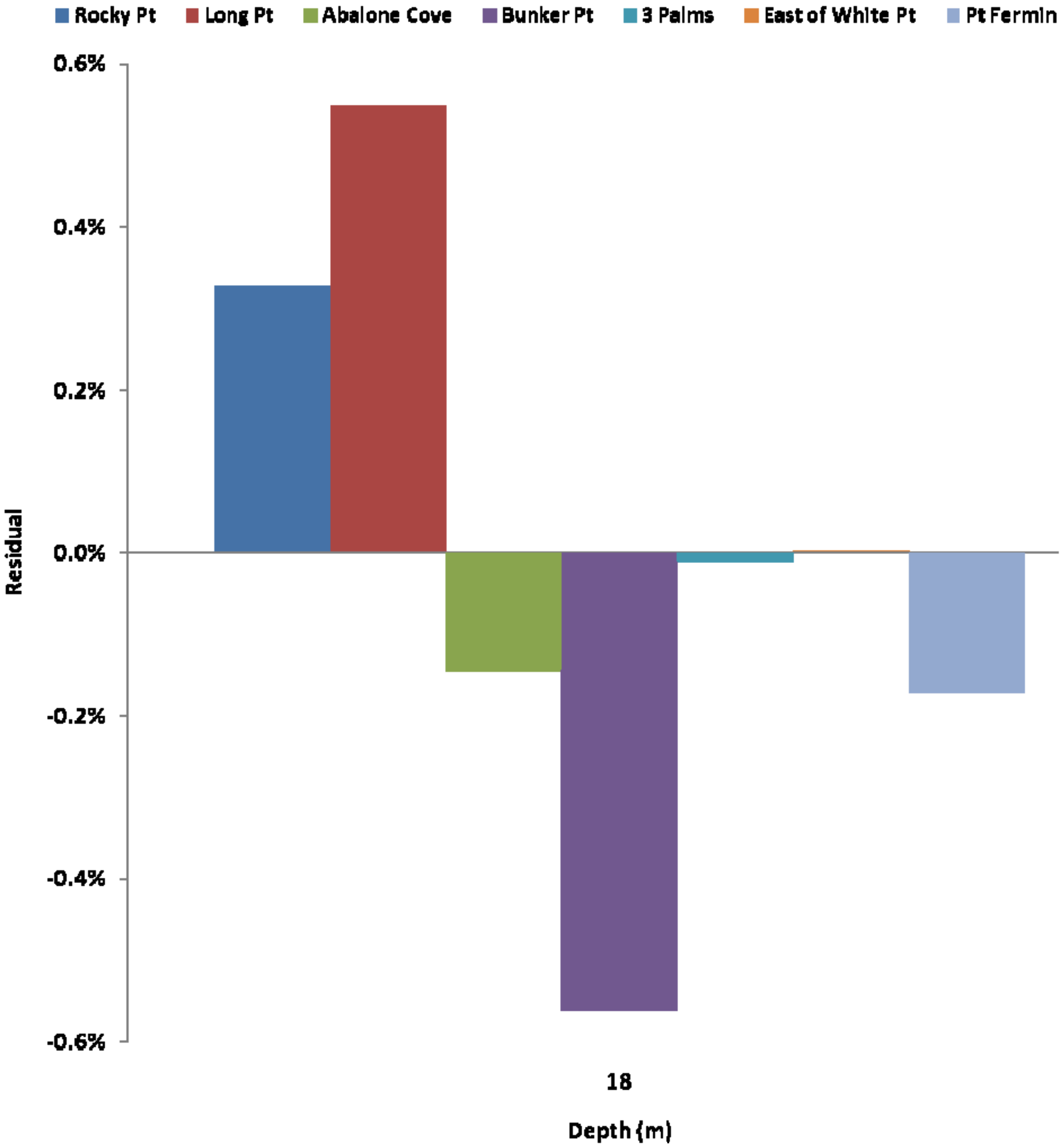


Figure 5. Light attenuation % difference from the mean at seven Palos Verdes Peninsula locations by depth.

This degradation of reef habitat has had significant biological consequences, particularly to the area associated with the Abalone Cove SMCA. To examine this area (Abalone Cove-Point Vicente) 27 CRANE (Tenera 2006; Pondella 2009) surveys of fishes, invertebrates and benthic characteristics were conducted (Table 2, Figure 6). The rocky reefs in the proposed IPA are degraded by anthropogenic impacts (turbidity, sedimentation etc). Characteristic of this degraded habitat are urchin barrens (North 1964) and buried reefs (USACE 2000, Pondella et al. 2010). Abalone Cove and Point Vicente have been dramatically affected by these ongoing processes. This degraded habitat quality has resulted in unusually high fractions of biota-free reef (Table 3). Up to 33% of the area on these reefs has no invertebrate or algal cover which is at least twice the percentage that would be expected for a healthy reef. The resulting invertebrate and benthic fauna (Appendix I and II) is dominated by purple urchin barrens. The appearance of these barrens appears to be linked to poor reef quality associated with ongoing problems with sedimentation and turbidity (Foster 2010). Particularly problematic is the Abalone Cove MPA, where there is significantly lowered fish diversity (17 fish species versus 40) and reef fish biomass compared to the proposed Point Vicente MPA (Figure 7, Table 4). This low species richness is a result of both poor habitat quality and habitat diversity. The assemblage found in the proposed Point Vicente MPA is more typical of what is expected on nearshore rocky reefs in the Southern California Bight (Pondella et al. 2005; Stephens 2006). Comparing biomass between the two reefs, the dominant nearshore rocky reef species (blacksmith, sheephead, garibaldi, senorita, etc.) dominate the biomass density (g/m^2) plot for the proposed Point Vicente MPA. By contrast, at the proposed Abalone Cove MPA, excluding jack mackerel, which is a pelagic species, biomass density is lower and many key species (i.e. opaleye and topsmelt) are absent.

Fish diversity and biomass are the key factors in evaluating the performance of MPAs and assessing their design. Although the 2008 data were provided to the BRTF, these recent surveys were not incorporated into the SAT evaluations, including the bioeconomic models. Those modeling products treat all rocky reef habitats as equal and do not account for variations in habitat quality due to turbidity or reef burial. In addition, modeling products assumed that Abalone Cove's biological metrics (i.e. biomass) were the same as those for the proposed Point Vicente MPA. This over-emphasizes the value of this degraded habitat. The inclusion of the proposed Abalone Cove MPA with the proposed Point Vicente MPA adds very little biological value to this MPA cluster. In summary, the Point Vicente and Abalone Cove SMCAs encompass degraded habitats that individually or as a cluster are not likely sufficient to meet the goals of the MLPA, MMAIA, and the regional guidelines provided for the SCSR MPA process.

Table 2. Locations of 27 natural reef zones surveyed within the Point Vicente and Abalone Cove SMCAs, 2004-2010. Point Vicente North coordinates are approximate; no coordinates were recorded at this site by zone.

Station	**Zone**	**Latitude**	**Longitude**
120 Reef	Inner	33.73766	-118.39196
120 Reef	Middle	33.73693	-118.39213
Abalone Cove Kelp East	Inner	33.74154	-118.38373
Abalone Cove Kelp East	Middle	33.73981	-118.38309
Abalone Cove Kelp West	Inner	33.73945	-118.38753
Abalone Cove Kelp West	Middle	33.73923	-118.38695
Hawthorne Reef	Inner	33.74684	-118.41522
Hawthorne Reef	Middle	33.74654	-118.41658
Hawthorne Reef	Outer	33.74637	-118.41745
Hawthorne Reef	Deep	33.74648	-118.41817
Long Point East	Inner	33.73620	-118.39983
Long Point East	Middle	33.73588	-118.40040
Long Point East	Outer	33.73546	-118.40118
Long Point West	Inner	33.73845	-118.40320
Long Point West	Middle	33.73803	-118.40398
Point Vicente North	Inner	33.74514	-118.41562
Point Vicente North	Middle	33.74514	-118.41562
Point Vicente North	Outer	33.74514	-118.41562
Point Vicente East	Inner	33.74063	-118.40822
Point Vicente East	Middle	33.74042	-118.40745
Point Vicente East	Outer	33.74013	-118.40748
Point Vicente West	Inner	33.74130	-118.41208
Point Vicente West	Middle	33.73912	-118.41451
Point Vicente West	Outer	33.73807	-118.41488
Point Vicente West	Deep	33.73759	-118.41522
Portuguese Point	Inner	33.73713	-118.38373
Portuguese Point	Middle	33.73692	-118.37700

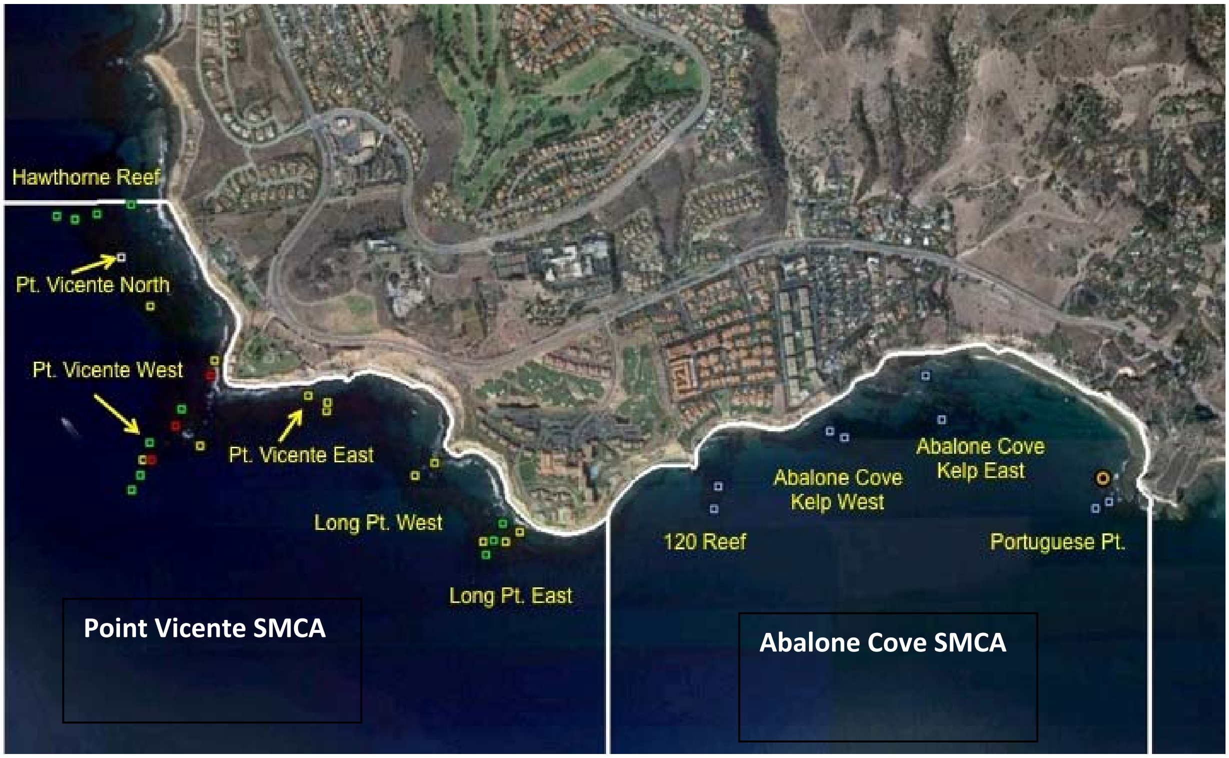


Figure 6. Overlain on the South Coast Integrated Preferred Alternative (IPA) for the Palos Verdes Coast are the natural reef zone locations for the 2004 (white), 2007 (yellow), 2008 (red), 2009 (green) and 2010 (blue) field seasons sampling stations, as well as the location of the 1995-1997 fish transects (orange circle). The Point Vicente SMCA is outlined (in white) on the left and the Abalone Cove State Marine Conservation Area is outlined on the right.

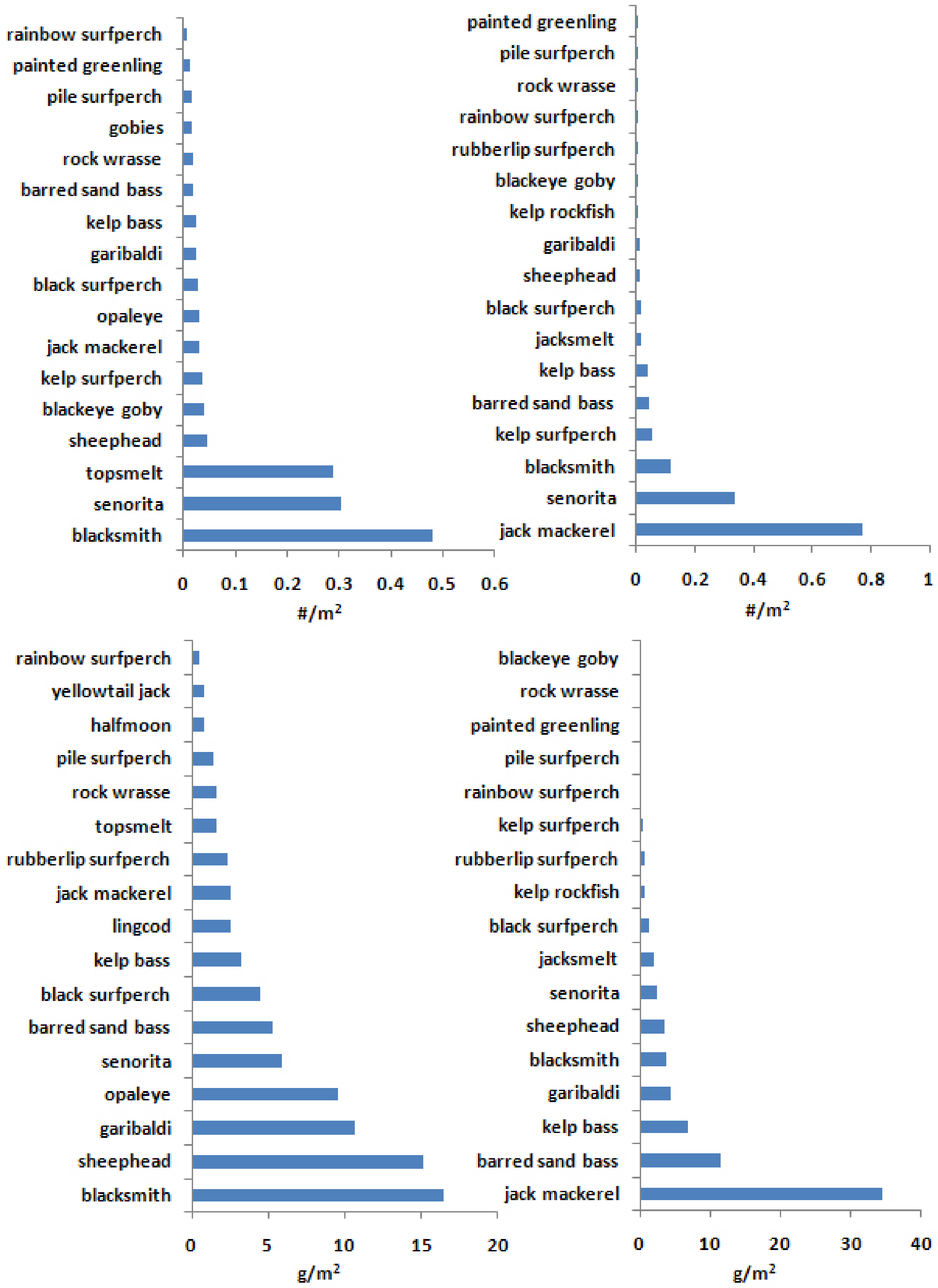


Figure 7. Density (abundance/m^2) and biomass (g/m^2) of top 17 fishes observed at sites within the Point Vicente SMCA (left) and Abalone Cove SMCA (right).

Table 3. Reef classification characteristics (% cover categories) including average relief (m) from sites within the Point Vicente and Abalone Cove SMCAs, 2004-2010.

Reef (SMCA)	**Relief (m)**	**no biota**	**algal coverage**	**Invertebrate cover**
Hawthorne Reef (Pt. Vicente)	0.41	19.43%	65.18%	15.38%
Point Vicente North (Pt. Vicente)	1.41	25.56%	65.56%	8.89%
Point Vicente West (Pt. Vicente)	0.80	17.79%	57.44%	24.77%
Point Vicente East (Pt. Vicente)	0.64	33.33%	56.45%	10.22%
Long Point West (Pt. Vicente)	1.61	13.71%	54.03%	32.26%
Long Point East (Pt. Vicente)	0.75	12.37%	75.27%	12.37%
120 Reef (A. Cove)	0.63	32.26%	34.68%	33.06%
Abalone Cove Kelp West (A. Cove)	0.21	19.35%	61.29%	19.35%
Abalone Cove Kelp East (A. Cove)	0.34	21.77%	68.55%	9.68%
Portuguese Point (A. Cove)	0.62	8.06%	63.71%	28.23%

Table 4. Species list, density (#/m^2) and biomass (g/m^2) of all fishes observed at sites within the Point Vicente and Abalone Cove SMCAs.

		Point Vicente SMCA		**Abalone Cove SMCA**	
Species	**Common Name**	**#/m^2**	**g/m^2**	**#/m^2**	**g/m^2**
Alloclinus holderi	island kelpfish	0.0001	0.0004		
Anisotremus davidsonii	sargo	0.0015	0.291		
Atherinops affinis	topsmelt	0.2893	1.5876		
Atherinopsis californiensis	jacksmelt	0.0022	0.2428	0.0174	1.8883
Brachyistius frenatus	kelp surfperch	0.0371	0.4656	0.0521	0.4889
Cheilotrema saturnum	black croaker	0.001	0.1121		
Chromis punctipinnis	blacksmith	0.4814	16.4342	0.1174	3.8061
Embiotoca jacksoni	black surfperch	0.0262	4.4449	0.0146	1.3745
Girella nigricans	opaleye	0.0293	9.5154		
Gobiidae sp	gobies	0.0149	0.0001		
Halichoeres semicinctus	rock wrasse	0.0176	1.5664	0.0014	0.0819
Hermosilla azurea	zebra perch	0.0004	0.2454		
Hypsurus caryi	rainbow surfperch	0.0065	0.532	0.0021	0.163
Hypsypops rubicundus	garibaldi	0.0241	10.6356	0.0097	4.4653
Medialuna californiensis	halfmoon	0.0039	0.8457		
Ophiodon elongatus	lingcod	0.0006	2.5734		
Orthonopias triacis	snubnose sculpin	0.0001	0		
Oxyjulis californica	senorita	0.3042	5.9106	0.3368	2.2966
Oxylebius pictus	painted greenling	0.0115	0.2123	0.0014	0.0911
Paralabrax clathratus	kelp bass	0.024	3.2417	0.0396	6.8052
Paralabrax nebulifer	barred sand bass	0.0195	5.3272	0.0444	11.4331
Phanerodon furcatus	white surfperch	0.0001	0.0074		
Rhacochilus toxotes	rubberlip surfperch	0.0051	2.3491	0.0035	0.627
Rhacochilus vacca	pile surfperch	0.0149	1.3815	0.0014	0.1225
Rhinogobiops nicholsii	blackeye goby	0.0387	0.205	0.0042	0.024
Scorpaena guttata	California scorpionfish	0.0003	0.1276		
Scorpaenichthys marmoratus	cabezon	0.0004	0.3978		
Sebastes atrovirens	kelp rockfish	0.0003	0.0165	0.0063	0.6904
Sebastes carnatus	gopher rockfish	0.0001	0.0377		
Sebastes caurinus	copper rockfish	0.0001	0.0046		
Sebastes chrysomelas	black and yellow rockfish	0.0003	0.0006		
Sebastes miniatus	vermilion rockfish	0.0015	0.1254		
Sebastes mystinus	blue rockfish	0.0016	0.1079		
Sebastes rosaceus	rosy rockfish	0.0001	0.0042		
Sebastes serriceps	treefish	0.0009	0.1637		
Sebastes umbrosus	honeycomb rockfish	0.0009	0.047		
Semicossyphus pulcher	California sheephead	0.0451	15.1494	0.0097	3.5183
Seriola lalandi	yellowtail jack	0.0006	0.8079		
Trachurus symmetricus	jack mackerel	0.0298	2.5714	0.7674	34.5991
Urobatis halleri	round stingray	0.0001	0.0732		

Question 2: Evaluate the anticipated effectiveness of the proposed Abalone Cove and Point Vicente MPAs as part of an interconnected network of MPAs in the context of the MLPA, MMAIA, and the regional guidelines provided for the SCSR MPA process.

Habitat size within reserves and spacing among reserves are the critical components of the bioeconomic models. The IPA proposal, especially with reference to the proposed Point Vicente and Abalone Cove MPAs, ignores the science guidelines for both components. Key habitats associated with rocky reefs are either not present, or are present in a degraded state (particularly in the proposed Abalone Cove MPA) that compromises network performance. Further complicating these bioeconomic assessments are the overestimated and inaccurate nearshore rocky-reef habitats (Question 1) and a disconnect between the model inputs and realistic empirical data. This is especially true for biomass estimates, which are dated and not fine scaled enough to make realistic assumptions of relative biomass estimates. The effectiveness of the network with respect to the proposed Palos Verdes MPAs is discussed in greater detail in Question 3.

The replication and spacing guidelines from the MLPA Master Plan for Marine Protected Areas (Fish and Game Commission 2008) are as follows:

<u>Replication</u>: Recommendation of replication of habitats within three to five SMCA's in each biogeographical region. The SCSR SAT then recommended that habitats should be replicated in at least one MPA in each of the five bioregions within the SCSR to the extent possible.

<u>Spacing (along mainland coast):</u> "for an objective of facilitating dispersal of important bottom-dwelling fish and invertebrate groups among MPAs, based on currently known scales of larval dispersal, MPAs should be placed within 50-100 kilometers (31-62 miles) of each other." Neighboring MPAs placed closer than 50 kilometers apart also meet the spacing guidelines.

Since the spacing guidelines were formed to connect marine life populations (and have the MPA design work as a true network), and populations only occur within suitable habitat, the habitats encompassed within each individual MPA must also be considered in a spacing analysis. In order for the MPAs to meet the spacing guidelines, the habitat type must be protected in each MPA in a sufficient amount to be counted as a replicate (amount of habitat needed to include 90% of the associated species, see habitat replication guidelines above). In addition, MPAs and MPA clusters also must meet minimum size guidelines (9 mi^2) to count as a replicate in the MPA network spacing analysis (Figure 8).

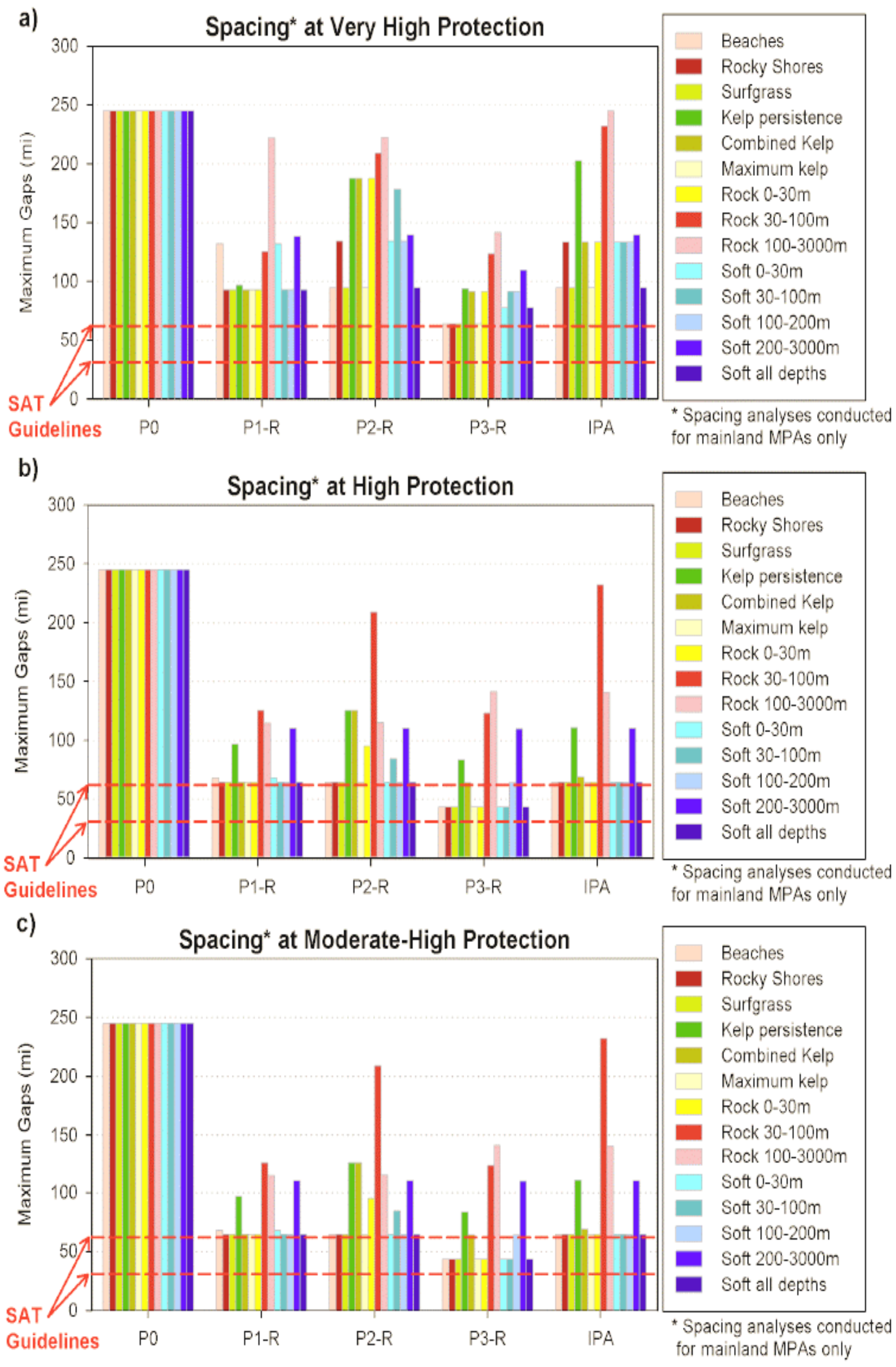
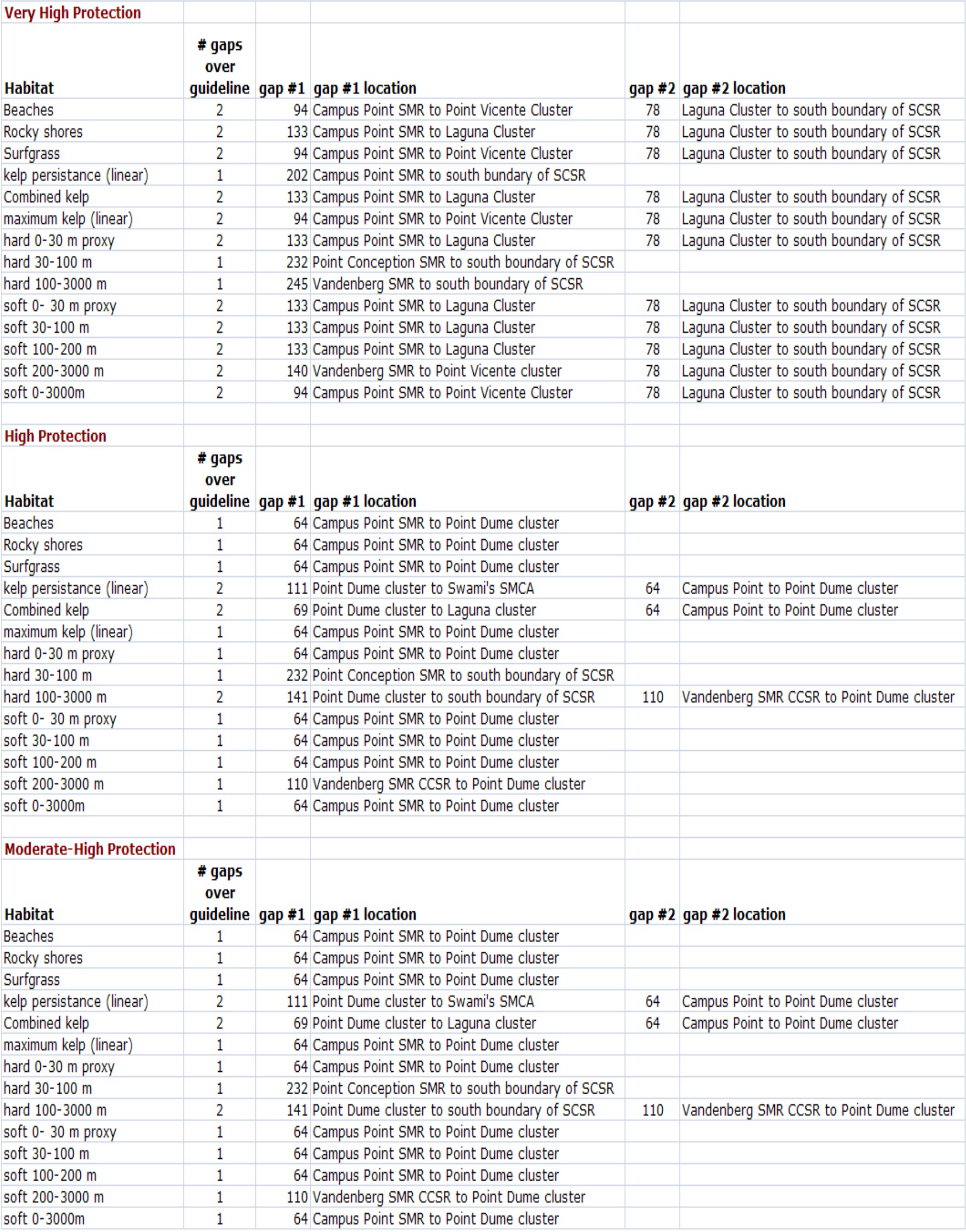


Figure 8. Spacing and SAT guidelines for the various habitats used in the MPA analyses for the Southern California Bight. P0 is the no new MPA option; P1R-P3R are the three regional stakeholder proposals; and, the IPA proposal is on the right.

Table 5. Gaps that exceed the SAT spacing guidelines for the IPA.



Very High Protection					
Habitat	**# gaps over guideline**	**gap #1**	**gap #1 location**	**gap #2**	**gap #2 location**
Beaches	2	94	Campus Point SMR to Point Vicente Cluster	78	Laguna Cluster to south boundary of SCSR
Rocky shores	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
Surfgrass	2	94	Campus Point SMR to Point Vicente Cluster	78	Laguna Cluster to south boundary of SCSR
kelp persistance (linear)	1	202	Campus Point SMR to south bundary of SCSR		
Combined kelp	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
maximum kelp (linear)	2	94	Campus Point SMR to Point Vicente Cluster	78	Laguna Cluster to south boundary of SCSR
hard 0-30 m proxy	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
hard 30-100 m	1	232	Point Conception SMR to south boundary of SCSR		
hard 100-3000 m	1	245	Vandenberg SMR to south boundary of SCSR		
soft 0- 30 m proxy	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
soft 30-100 m	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
soft 100-200 m	2	133	Campus Point SMR to Laguna Cluster	78	Laguna Cluster to south boundary of SCSR
soft 200-3000 m	2	140	Vandenberg SMR to Point Vicente cluster	78	Laguna Cluster to south boundary of SCSR
soft 0-3000m	2	94	Campus Point SMR to Point Vicente Cluster	78	Laguna Cluster to south boundary of SCSR
High Protection					
Habitat	**# gaps over guideline**	**gap #1**	**gap #1 location**	**gap #2**	**gap #2 location**
Beaches	1	64	Campus Point SMR to Point Dume cluster		
Rocky shores	1	64	Campus Point SMR to Point Dume cluster		
Surfgrass	1	64	Campus Point SMR to Point Dume cluster		
kelp persistance (linear)	2	111	Point Dume cluster to Swami's SMCA	64	Campus Point to Point Dume cluster
Combined kelp	2	69	Point Dume cluster to Laguna cluster	64	Campus Point to Point Dume cluster
maximum kelp (linear)	1	64	Campus Point SMR to Point Dume cluster		
hard 0-30 m proxy	1	64	Campus Point SMR to Point Dume cluster		
hard 30-100 m	1	232	Point Conception SMR to south boundary of SCSR		
hard 100-3000 m	2	141	Point Dume cluster to south boundary of SCSR	110	Vandenberg SMR CCSR to Point Dume cluster
soft 0- 30 m proxy	1	64	Campus Point SMR to Point Dume cluster		
soft 30-100 m	1	64	Campus Point SMR to Point Dume cluster		
soft 100-200 m	1	64	Campus Point SMR to Point Dume cluster		
soft 200-3000 m	1	110	Vandenberg SMR CCSR to Point Dume cluster		
soft 0-3000m	1	64	Campus Point SMR to Point Dume cluster		
Moderate-High Protection					
Habitat	**# gaps over guideline**	**gap #1**	**gap #1 location**	**gap #2**	**gap #2 location**
Beaches	1	64	Campus Point SMR to Point Dume cluster		
Rocky shores	1	64	Campus Point SMR to Point Dume cluster		
Surfgrass	1	64	Campus Point SMR to Point Dume cluster		
kelp persistance (linear)	2	111	Point Dume cluster to Swami's SMCA	64	Campus Point to Point Dume cluster
Combined kelp	2	69	Point Dume cluster to Laguna cluster	64	Campus Point to Point Dume cluster
maximum kelp (linear)	1	64	Campus Point SMR to Point Dume cluster		
hard 0-30 m proxy	1	64	Campus Point SMR to Point Dume cluster		
hard 30-100 m	1	232	Point Conception SMR to south boundary of SCSR		
hard 100-3000 m	2	141	Point Dume cluster to south boundary of SCSR	110	Vandenberg SMR CCSR to Point Dume cluster
soft 0- 30 m proxy	1	64	Campus Point SMR to Point Dume cluster		
soft 30-100 m	1	64	Campus Point SMR to Point Dume cluster		
soft 100-200 m	1	64	Campus Point SMR to Point Dume cluster		
soft 200-3000 m	1	110	Vandenberg SMR CCSR to Point Dume cluster		
soft 0-3000m	1	64	Campus Point SMR to Point Dume cluster		

Figure 8 (from the 'SAT Evaluation of Final MPA Proposals from the SCSR: Habitat Representation, Habitat Replication, MPA Size, and MPA Spacing Analyses' document) shows that the IPA proposal does not meet the minimum SAT guidelines for spacing at very high protection for <u>any</u> of the listed habitats. For rock 30-100 m, rock 100-3000 m, and kelp persistence, the spacing between these habitats in the IPA is more than three times larger than the SAT's suggested spacing guidelines. In addition, combined kelp and rock 0-30 m in the IPA have double the spacing distance between MPAs as that set by the SAT guidelines. At high protection (Figure 8) in the IPA, rock 30-100 m, rock 100-3000 m, and kelp persistence all have much larger gaps between MPAs than is suggested by the SAT.

Table 5 (Table 5.2d in the SAT Evaluation) lists the location of the gaps that exceed SAT-suggested guidelines for spacing in the IPA. For very high protection, the majority of habitat types have gaps between MPAs that are much larger than is suggested for these MPAs to act as a network (allowing larval dispersal between them). For rocky shores, kelp persistence, combined kelp, hard 0-30 m proxy, hard 0-30 m, hard 30-100 m, soft 0-30 m, soft 30-100 m, and soft 100-200 m, there is a spacing gap exceeding SAT guidelines that ranges from Campus Point SMCA (Santa Barbara County) to either the Laguna SMCA, or the southern boundary of the SCSR. Therefore, the Palos Verdes Cluster (which is in between these two locales) does not connect MPAs to the north or south for any of these key habitat types. Spacing between very high protection MPAs of 202 miles for kelp persistence, and 232 miles for hard 30-100 m habitat (IPA proposal) is much greater than suggested for the majority of species' larval duration and dispersal.

The spacing guidelines and analysis are compromised even further by the fact that the minimum guidelines for habitat size were not met for the PV cluster. The lack of adequate habitat representation for rocky reefs of all depths and associated kelp bed communities indicates that the IPA proposal will not operate as a MPA network and will not satisfy the goals of MLPA or MMAIA or the regional guidelines.

The bioeconomic models used for analysis in the South Coast IPA were performed by the UC Davis (UCD) and UC Santa Barbara (UCSB) modeling research groups. These models utilized spatial data on habitat, fishery effort, and proposed MPA locations (from the IPA) to simulate population dynamics of fished species (n = 8) and generate predicted spatial distributions of species abundance and fishery yield. These analyses resulted in a calculation of long-term equilibrium estimates of conservation value (i.e. biomass) and economic value (i.e. fishery yield and profit). Structural elements of these models include: larval connectivity across patches driven by currents (Watson 2010); pelagic larval duration and spawning season; larval settlement, growth and survival dynamics of resident adult populations; reproductive output (increasing with adult size); adult movement; and harvest in areas outside MPAs. Appendix B3 in the MLPA master plan contains additional detailed parameter values and literature sources for each estimate (life history information in a model). Detailed and spatially explicit model outputs, including maps for each response variable and sub-regional summaries of key statistics for each species and management scenario can be found online at http://www.dfg.gov/mlpa.

The information in Table 6 may be used to evaluate whether the proposed Palos Verdes MPAs in the IPA are attaining a desired level of biomass production. Values of biomass are scaled relative to total unfished biomass such that values of 0 indicate no biomass and values of 1 indicate maximum unfished biomass (these values provide no measures (kg/m^2) of actual fish biomass in these regions). Biomass production in the proposed Abalone Cove and Point Vicente MPAs is very low, particularly for recreationally important and overfished species along the peninsula like kelp bass (0.0043 and 0.0050, respectively).

'Self- recruitment' is the proportion of settling larvae in an MPA that were produced within that MPA. This metric (values of 0 to 1) provides info on the relative isolation of the MPA from other larval sources, such that a value of 0 indicates the population is completely isolated. It is a modeled estimate that accounts for MPA size, currents and the early life history of the study species. Most species have a pelagic larval stage (days to months) and under the proper oceanographic conditions, in a MPA of significant size these larvae will recruit to the MPA. As MPA size decreases, the likelihood of 'self-recruitment' diminishes. Optimally a MPA would be self sustaining, independent of the MPA network.

'Self-persistence' is only calculated by the UCD model, and is defined as the degree to which an MPA is self-sustaining. It is calculated based on larval production and the proportion of larvae produced within an MPA that return to that MPA, also on a scale of 0 to >1 (values <1 are dependent on larvae from elsewhere, values > 1 are self-sufficient). Self persistence', which provides an indication of the MPA's self sufficiency in terms of larval production (i.e. its reliance on larval sources from elsewhere), have very low values for all the species listed except for black perch. However, black perch are live bearers and do not rely on pelagic larval dispersal to sustain the population. On a scale of 0 to 1, important fish species such as kelp bass and kelp rockfish scored 0.0444 and 0.0095, respectively, for the proposed Point Vicente MPA, probably because: 1) the habitat type protected within the proposed MPAs lacks a sufficient hard bottom habitat for these species to feed and reproduce; and 2) the proposed MPAs' boundaries are located over somewhat-continuous reef around the peninsula. Since the proposed MPA cluster lacks sufficient hard bottom habitat for these species, it is likely that the majority of larvae that support the reserve will come from better habitat outside of the cluster (following dominant current patterns). In other words, these proposed MPAs as designated in the IPA are not self sufficient for larval dispersal.

Even in the document that contains Table 6 and describes the bioeconomic models ("Bioeconomic Model evaluations of revised 3rd-round proposals and IPA, 12/8/2009"), the proposed Point Vicente and Abalone Cove MPAs demonstrate relatively poor performance. The biomass estimates for this proposed MPA cluster may represent the poorest bioeconomic results from the entire IPA proposal for the SCSR.

Table 6. Bioeconomic outputs for the Abalone Cove SMCA and Point Vicente SMCA.

	Species	Biomass (UCSB)	Biomass (UCD)	Self-recruitment (UCSB)	Self-recruitment (UCD)	Self-persistence (UCD)
Abalone Cove SMCA	black perch	0.0024	0.0011	1.0000	1.0000	4.0000
	halibut	0.0039	0.0006	0.0091	0.0043	0.0068
	kelp bass	0.0043	0.0017	0.0039	0.0108	0.0235
	kelp rockfish	0.0039	0.0008	0.0027	0.0045	0.0058
	whitefish	0.0030	0.0011	0.0042	0.0056	0.0186
	opaleye	0.0034	0.0013	0.0026	0.0052	0.0100
	red urchin	0.0023	0.0013	0.0028	0.0036	0.0155
	sheephead	0.0040	0.0017	0.0054	0.0115	0.0272
Point Vicente SMCA	black perch	0.0022	0.0010	1.0000	1.0000	4.0000
	halibut	0.0038	0.0006	0.0124	0.0052	0.0123
	kelp bass	0.0050	0.0020	0.0092	0.0158	0.0444
	kelp rockfish	0.0047	0.0008	0.0063	0.0057	0.0095
	whitefish	0.0028	0.0011	0.0103	0.0055	0.0274
	opaleye	0.0041	0.0016	0.0091	0.0112	0.0278
	red urchin	0.0022	0.0012	0.0074	0.0034	0.0246
	sheephead	0.0045	0.0019	0.0088	0.0120	0.0362

Question 3: How do the proposed Abalone Cove and Point Vicente MPAs compare to other MPAs of similar size in the IPA in terms of meeting the goals of the MLPA, MMAIA, and regional guidelines provided for the SCSR MPA process?

The proposed Abalone Cove and Pt. Vicente MPAs may be compared to those IPA-designated MPAs of similar size to the Point Vicente MPA (10.42 – 22.51 mi^2) with respect to the habitat types represented and the existing protection level (Table 7). Other than the previously described deficiencies in all habitats except for sand for the Palos Verdes cluster, the most noteworthy habitat for comparison is the soft bottom habitat (200-3000 m^2). This habitat alone represents 81% of the proposed Point Vicente MPA, is greater in size than that found in all other MPAs of similar size combined, and is 2 to 1200 times larger than that found in any other similarly-sized MPAs. Critical habitats, such as kelp persistence and hard bottom habitats are at the same level or are markedly below those in MPAs of similar size. With the exception of the Santa Barbara Island SMCA, (a known urchin barren and thus does not support kelp) kelp persistence in other comparable MPAs ranged from 0.65 to 4.26 linear miles, well above the 0.13 and 0.08 linear miles reported for the proposed Point Vicente and Abalone Cove MPAs, respectively. Also, the lowest combined values for all hard bottom habitats (0 - 3000m) were reported for this MPA cluster (Table 7). Thus the site-specific rationale for designating this MPA cluster at a larger than preferred size (19.85 sq. statute miles) is missing since this cluster's size has been artificially inflated by the inclusion of soft bottom habitat.

The pie-shaped design of the proposed Point Vicente/Abalone Cove MPA cluster is intentionally misleading. By encircling 14.56 mi^2 of deep soft bottom habitat (200-3000 m) it is disproportionately large relative to the proportion of soft bottom and rocky reef habitats at similarly-sized reserves. Based solely on habitat sizes, this cluster will perform in a similar fashion to a small reserve or small reserve cluster. Unfortunately, as discussed in Question 1, the relative quality of this habitat is poor.

Table 7. Habitat measures of MPAs of similar size in the IPA.

	MPAs of similar size in IPA											
	Point Conception SMCA	Campus Point SMCA	Point Dume SMCA	Point Vicente SMCA	Abalone Cove SMCA	San Clemente Milt Closure 1	San Clemente Milt Closure 2	South Point SMCA	Carrington Point SMCA	Gull Island SMCA	Anacapa Island SMCA	Santa Barbara Island SMCA
Area (mi^2)	22.5	10.4	15.9	15.1	4.75	17.4	19.2	13.1	12.8	19.9	11.5	12.8
Alongshore span (mi)	5.27	2.86	4.24	3.69	1.23	3.93	5.37	3.55	4.02	4.78	3.05	0.95
Depth (ft)	489	748	2023	2640	2181	1682	3938	1071	211	2205	709	1655
Beaches (mi)	1.53	1.97	4.03	1.4	0.76	0.79	5.25	1.45	0.81	2.1	0.79	0.15
Rocky shores (mi)	3.14	1.32	0.44	0.21	0.87	1.04	0.77	3.34	5.35	1.88	6.38	1.02
hardened shores (mi)	0	0	0	0	0	0	0.11	0	0	0	0	0
coastal marsh (mi)	0	0	0	0	0	0	0	0	0	0	0	0
coastal marsh area (mi^2)	0	0	0	0	0	0	0	0	0	0	0	0
tidal flats (mi)	0	0	0	0	0	0	0	0	0	0	0	0
surfgrass (mi)	3.65	1.14	0.87	1.14	1.41	0.63	2.11	1.77	3.99	1.14	3.23	0.78
Eelgrass (mi^2)	0	0	0	0	0	0	0	0	0	0	0	0
Estuary (mi^2)	0	0	0	0	0	0	0	0	0	0	0	0
soft 0-30 m (mi^2)	2.14	0.89	2.02	0.41	0.51	0.01	0	1.22	7.15	1.9	0.87	0.47
soft 0- 30 m proxy (mi)	1.83	1.21	3.14	0.47	1.09	0	1.3	1.7	3.32	2.77	2.59	0.72
soft 30-100 m (mi^2)	15.8	7	5.94	1.09	1.17	0.96	0	3.51	3.82	3.76	7.25	1.69
soft 100-200 m (mi^2)	3.26	1.41	1.38	1.05	0.56	0	0	5.34	0	3.2	0.78	0.42
soft 200-3000 m (mi^2)	0	0.05	5.79	12.2	2.32	0	0	0.05	0	1.43	0	0.02
hard 0-30 m (mi^2)	0.49	0.76	0.29	0.25	0.14	1.17	0.61	0.55	1.35	0.78	0.27	0.11
hard 0-30 m proxy (mi)	1.84	1.85	1.06	1.06	0.23	2.45	4.57	2.05	1.97	2.36	0.65	0.36
hard 30-100 m (mi^2)	0.32	0.04	0	0	0.02	1.04	0.03	0.26	0.27	0.12	0.1	0.1
hard 100-200 m (mi^2)	0.1	0	0	0	0	0	0	0.01	0	0.13	0	0.02
hard 200-3000 m (mi^2)	0	0	0	0.03	0	0	0	0	0	0	0	0
unknown 0-30 m (mi^2)	0.2	0.26	0.41	0.02	0.03	0.01	0.45	0.06	0.16	0.09	0.01	0
unknown 30-100 m (mi^2)	0.01	0	0	0	0	3.73	2.16	0.01	0	0	0	0.07
unknown 100-200 m (mi^2)	0.19	0	0	0	0	4.84	1.58	0.25	0	0.21	1.48	1.28
unknown 200-3000 m (mi^2)	0	0	0	0	0	5.66	14.4	1.79	0	8.26	0.77	8.57
maximum kelp (linear) (mi)	1.79	2.51	1.34	1.23	0.86	2.96	5.47	3.67	3.68	3.29	1.46	0.76
kelp persistance (linear) (mi)	1.29	1.62	0.84	0.13	0.08	2.75	4.26	3.25	1.24	1.88	0.65	0.1

The bioeconomics of the proposed Palos Verdes MPAs may be compared to those of the other MPAs included in the IPA through an 'MPA Deletion' analysis in which each MPA is sequentially removed, one-at-a-time, and the biomass of the system is recalculated. These calculations were performed using two separate bioeconomic models (see model descriptions) and provide two values for each analysis. The 'effect on biomass' shown in Table 8 reflects the relative loss of biomass when each MPA is removed from the network. This effect is calculated as the difference between the biomass with the MPA and without it, divided by the biomass with the MPA and multiplied by 100 (a large value here indicates that MPA contributes greatly to the overall network, a small number means that it is less important). The 'efficiency of effect on biomass' value is the 'effect on biomass' value divided by the area of a specific habitat being protected (a measure of the efficiency of the MPA at increasing biomass). Large numbers here indicate places where protection of an additional unit of habitat is likely to result in the greatest increase in overall biomass. Results are averaged across all eight species used for analysis (ocean whitefish, black surfperch, opaleye, kelp bass, kelp rockfish, sheephead, red urchin, and halibut).

Removal of the proposed Point Vicente MPA, by comparison to values for other MPAs of similar size (Pt. Dume SMCA, Point Conception SMR, and Campus Point SMR), would have a smaller effect on the change in overall biomass of the system. However, the 'efficiency of effect on biomass' values for the proposed Point Vicente MPA are higher than those for other MPAs of similar size within the IPA, indicating that protecting additional habitat around this area (alongshore miles) would greatly increase the overall biomass. This seems counterintuitive based upon the relatively small amount of rocky habitat in this cluster. Thus, it appears that the assumed connectivity aspect of the bioeconomic models is driving this effect and therefore this metric is misleading due to the previously discussed gaps in critical habitat spacing in the array. The proposed MPAs offshore of the Palos Verdes Peninsula, the only rocky headland in the middle of the Southern California Bight, do not effectively connect the northern and southern MPAs as intended by the MLPA.

Table 8. Deletion results from the bioeconomic analyses.

MPA deletion results for IPA

PV cluster	effect on biomass (UCSB)	efficiency of effect on biomass (UCSB)	effect on biomass (UCD)	efficiency of effect on biomass (UCD)
Point Vicente SMCA	0.1882	0.3893	0.9499	2.0531
Abalone Cove SMCA	0.0885	0.1573	0.8433	2.0329
mainland MPAs of similar size				
Point Dume SMCA	0.3400	0.2359	2.1271	1.4862
Campus Point SMR	0.5173	0.2629	1.9725	0.8999
Point Conception SMR	0.1039	0.0502	1.1740	0.5941

Question 4: Is the document “MPA Options for Consideration and Review by BRTF: Description of Palos Verdes MPA Options” comprehensive and accurate in describing the proposed Abalone Cove and Point Vicente MPAs?

The document,”MPA Options for Consideration and Review by BRTF: Description of Palos Verdes MPA Options” incorrectly states that several goals and associated objectives specific to the SCSR are met by the proposed Pt. Vicente/Abalone Cove MPA cluster. The stated regional goals and objectives and a discussion of their compatibility with the proposed MPAs are set forth below. A number of statements describing the ‘’site-specific rationale’ and ‘other considerations’ that the document purports support the designation of the proposed Point Vicente and Abalone Cove MPAs are also further analyzed below. A significant issue associated with the proposed Point Vicente and Abalone Cove MPAs is the lack of hard bottom and kelp persistence habitat types, which support nearly all the species of interest (species likely to benefit from MPAs) to be protected within the South Coast region. In view of the small amount of these habitat types protected within the proposed MPAs, it is unlikely that any heavily fished species along the Palos Verdes Peninsula would show associated biomass increases due to the presence of MPAs—one of the main goals of the entire statewide MLPA process.

The following regional goals and objectives are stated as being met by the Point Vicente and Abalone Point MPAs (IPA) in the document, ‘MPA Options for Consideration and Review by BRTF: Description of Palos Verdes MPA Options’:

<u>Point Vicente SMCA:</u> Goal 1, objectives 1-5; Goal 2, objectives 1-3; Goal 4, objectives 1-3; Goal 5, objectives 2, 3, 5; Goal 6, objectives 1-4

<u>Abalone Cove SMCA:</u> Goal 1, objectives 1-5; Goal 2, objectives 1, 2, 4; Goal 3, objectives 1-2, Goal 4, objectives 1-2, Goal 6, objectives 1, 4.

In several instances, the goals and objectives stated as being met by the BRTF are incorrect as discussed below. These goals are first stated with specific aspects of the goals and objectives in question underlined prior to the discussion.

> Goal 1, Objective 1: ‘Protect and maintain species diversity and abundance consistent with natural fluctuations, <u>including areas of high native species diversity and representative habitats.’</u>
>
> Goal 2, Objective 1: ‘Help protect or rebuild populations of rare, threatened, endangered, depressed, depleted, or overfished species, and <u>the habitats and ecosystem functions upon which they rely.’</u>
>
> The majority of the habitat available in the proposed Point Vicente and Abalone Cove MPAs is deep sand habitat (soft 200-3000 m), which does not support high native species diversity. The majority of the species of interest in these MPAs live near or over rocky substrate, in much shallower regions than

200 m. Several depleted and overfished species of interest in the Palos Verdes shelf region (black sea bass, kelp bass, barred sand bass, white sea bass, red urchin, sheephead, spiny lobster, etc) occur within shallow rocky habitats, but the majority of the area of the proposed MPAs does not include this type of habitat. In addition, the proposed MPAs do not include sufficient persistent kelp to satisfy SAT habitat guidelines. Persistent kelp beds provide key habitat that supports a large percentage of the depressed and depleted species along Palos Verdes and in the Southern California Bight.

Goal 2, Objective 2: 'Sustain or increase reproduction by species likely to benefit from MPAs, with emphasis on those species identified as more likely to benefit from MPAs, and promote retention of large, mature individuals.'

Species 'more likely to benefit' from MPAs include bocaccio, giant sea bass, broomtail grouper, canary rockfish, pink/green/white/black abalone, and purple hydrocoral, all of which occur on or near shallow rock habitat within the south coast region. Since the proposed Point Vicente and Abalone Cove MPAs protect mostly deep sand habitat, the habitat for these species is mostly absent from these proposed MPAs. Therefore, the proposed MPAs are unlikely to increase or sustain these species or to promote retention of "large, mature individuals." In addition, due to the proposed MPA cluster including a smaller than recommended size of reef habitats, there is a reduced opportunity to protect these species within these boundaries because their adult home range is greater than the MPAs' boundaries.

Goal 4, Objective 1: 'Include within MPAs key and unique habitats identified by the MLPA Master Plan Science Advisory Team for this study region.'

Goal 4, Objective 2: 'Include and replicate to the extent possible [practicable], representatives of all marine habitats identified in the MLPA or the *California Marine Life Protection Act Master Plan for Marine Protected Areas* across a range of depths.'

Goal 1, Objective 2: 'Protect areas with diverse habitat types in close proximity to each other.' (also refer to Goal 6, Objective 3 below, with comments on MPA connectivity)

Goal 1, Objective 4: 'Protect biodiversity, natural trophic structure and food webs in representative habitats.'

One of the rarest habitats within the South Coast region, deep rock (hard bottom 30-100 m) will not be protected within the proposed Point Vicente and Abalone Cove MPAs. In addition, persistent kelp habitat, which has become increasingly rare in the SCSR over the past 50 years, is also not captured within these MPAs. Therefore, these proposed MPAs do not provide replication of these key habitats within this region, nor is there a representation of such key habitats (hard bottom) across a range of depths.

Goal 1, Objective 4 is not met for hard bottom habitats within this cluster. By far the most biodiverse habitats within the south coast region occur within these habitats. The biodiversity, trophic structure, and food webs that occur within hard bottom and persistent kelp habitat will not be protected in sufficient amounts in the proposed Point Vicente and Abalone Cove MPAs to allow Goal 1, Objective 4 to be met. The diversity of food webs and trophic interactions within a kelp/hard bottom habitat far exceed those that exist over soft bottom habitats (Allen 1985; Bond et al. 1999; Allen 2006). In addition, soft bottom 200- 3000 m habitat, which encompasses the majority of this MPA cluster, is much less diverse than shallow rock habitat.

Goal 5, Objective 3: 'Effectively use scientific guidelines in the *California Marine Life Protection Act Master Plan for Marine Protected Areas*.'

None of the spacing guidelines have been met for the proposed MPAs themselves (31-62 sq miles apart) or for key habitat types in the region such as hard 0 – 30 m, hard 30- 100 m, and kelp persistence (see details of habitat replication and MPA spacing from #2 above). In addition, the size guidelines are barely met: "MPAs should have a minimum alongshore span of 3-6 statute miles (preferably 6-12.5 miles) and should extend offshore to deep waters." The proposed Point Vicente MPA has an alongshore span of 3.69 sq miles, and the proposed Abalone Cove MPA is only 1.23 sq miles alongshore.

Goal 6, Objective 3: 'Ensure ecological connectivity within and between regional components of the statewide network'

The proposed MPA cluster does not meet the minimum SAT guidelines for spacing at very high protection for any of the listed habitats. For rock 30-100 m, rock 100-3000 m, and kelp persistence, the spacing between these habitats in the IPA is more than three times larger than the suggested spacing guidelines set by the SAT. In addition, combined kelp and rock 0-30 m in the IPA have double the spacing distance between these MPAs that is set by the SAT guidelines. At the 'high protection' level in the IPA, rock 30-100 m, rock 100-3000 m, and kelp persistence all again have much greater gaps between MPAs than is suggested by the SAT. For rocky shores, kelp persistence, combined kelp, hard 0-30 m proxy, hard 0-30 m, hard 30-100 m, soft 0-30 m, soft 30-100 m, and soft 100-200 m, there is a spacing gap exceeding SAT guidelines that ranges from Campus Point (Santa Barbara County) to either Laguna, or the southern boundary of the SCSR. Therefore, the proposed Point Vicente MPA (which is located between these two locales) does not connect MPAs to the north or south for any of these key habitat types. Spacing between very high protection MPAs of 202 miles for kelp persistence, and 232 miles for hard 30-100 m habitat (IPA proposal) is certainly greater than is suggested for the majority of species' larval duration and dispersal (see Fig 5.1 and Table 5.2d from 'SAT Evaluation of Final MPA Proposals from the South Coast Study Region: Habitat Representation, Habitat Replication, MPA Size, and MPA Spacing Analyses 12/7/2009' and question #2 for additional information).

Goal 6, Objective 4: 'Provide for protection and connectivity of habitat for those species that utilize different habitats over their lifetime.'

Since the proposed Point Vicente and Abalone Cove MPAs contain mostly sandy subtidal habitat, they do not protect diverse habitat types (e.g., the rock bottom habitat is poorly represented). Therefore, protection of species that utilize different habitat types over their lifetime, or those that utilize boundaries or edges between different types of habitat (i.e. sheephead with sand/rock interface) will not be promoted by the designation of these proposed MPAs. In addition, there is little connectivity of habitats between the proposed MPA cluster and other clusters because the gaps between such MPAs far exceed those that are suggested by the South Coast SAT.

The following excerpts from the "site-specific rationale" for inclusion of the proposed MPAs in the IPA also contain inaccuracies (underlined) which are discussed below.

Point Vicente MPA: "Located at the only true headland (Palos Verdes Peninsula) within the Southern Biogeographical Region and the South Coast Study Region, this Point Vicente SMCA/Abalone Cove SMCA cluster captures all but 3 key habitats across a broad range of depths. It provides a high level of protection, at larger than preferred size (19.85 sq statute miles) and solves the complex puzzle of accomplishing all of this within the most highly populated coastal county in all of California, while being mindful of the likelihood of extreme negative socioeconomic impacts to the surrounding ports, communities, and coastal dependant entities."

Although, the Palos Verdes Peninsula, in its entirety, is the only true headland in the South Coast region this does not constitute a convincing rationale for designating either of the proposed MPAs. The proposed Point Vicente MPA does not protect any of the unique habitat type along the Palos Verdes shelf that occurs in very limited areas within the region, deep rock habitat (hard 30-100 m). The proposed Abalone Cove MPA protects only 0.02 sq miles of this type of habitat. The proposed Point Vicente MPA is large in size (19.85 sq miles) only because the majority of it (12.24 sq miles) encompasses deep sand habitat (soft 200-3000 m) that does not protect the majority of ‘species of concern’ contained on the list of ”species likely to benefit from MPAs”.

Abalone Cove MPA: “This MPA cluster protects the only true headland in the study region. Species afforded protection are lobsters, sea urchins, rockfish, and rocky intertidal (tide pool) inhabitants. Together with Point Vicente SMCA a total area of 19.85sq statute miles is covered. For additional details refer to rationale for Point Vicente SMCA.”

The irrelevance of the ‘only rocky headland’ and total area rationales are discussed above with respect to the proposed Point Vicente MPA. Lobster, urchins, and rockfish occur over hard bottom habitat (hard 0-30 m and 30-100 m mostly), which are present in only 0.14 sq mi. of the proposed Point Vicente MPA and in only 0.02 sq. mi. of the proposed Abalone Cove MPA. Within the entire proposed Point Vicente/Abalone Cove MPA cluster, only 0.39 and 0.02 sq miles of these respective habitat types are represented.

Inaccuracies associated with excerpts from “Other Considerations” for designation of the proposed Point Vicente MPA are similarly discussed below.

‘This cluster along the Palos Verdes peninsula provides a unique opportunity in that numerous studies for water and sediment quality have been conducted for many years, providing baseline information. This MPA is lacking persistent kelp and hard 30-100 m habitat due to socioeconomic impacts and water/sediment quality issues.’

And from the Abalone Cove SMCA:

‘Persistent kelp guideline is not met in this area due to requirement to stay ½ mile from major outfall, however this MPA cluster should meet maximum kelp guideline. This MPA contains nearly a third of the available deep rock in the study area, the rarest habitat in this region. In addition coupled with the Point Vicente SMCA, this MPA cluster achieves the preferred size in the most densely populated area of the south coast.’

Actually, this MPA cluster contains little, if any, deep rock habitat. The statement in the “Other Considerations” that ”this MPA contains nearly a third of the available deep rock in the study area” is false whether it refers to either the proposed Point Vicente or Abalone Cove MPAs, or to both of them. Hard 200-3000 m habitat is represented in the proposed MPA cluster by a total of 0.03 sq miles. By contrast, Point Dume SMCA contains 0.84 sq miles of this habitat type. The proposed MPA cluster contains no hard 100-200 m habitat, and only 0.02 square miles of hard 30-100 m habitat is included in that cluster. The Point Conception SMR, Harris Point SMR, and Gull Island SMR, which are all MPAs of similar size to the proposed MPA cluster, include 0.1, 0.25, and 0.13 sq miles of hard 100-200 m habitat, and 0.32, 2.4, and 0.12 sq miles of hard 30-100 m habitat, respectively.

Because the proposed Point Vicente/Abalone Cove MPA cluster contains mostly sandy subtidal habitat, it does not protect diverse habitat types (rock bottom habitat poorly represented). Therefore, creation of these proposed MPAs will do little to protect species that utilize different habitat types over their lifetime, or those that utilize boundaries/edges between different types of habitat (i.e. sheephead with sand/rock interface). Also, designation of the proposed MPAs will not promote connectivity of habitats with other clusters because the gaps between the proposed cluster and other MPAs far exceed those that are suggested by the South Coast SAT.

Designation of the proposed MPAs will also not advance the goals underlying the MLPA, MMAIA or the IPA because they do not meet the persistent kelp guideline because of the turbidity and sedimentation issues present there. The proposed Abalone Cove MPA also does not meet the maximum kelp guideline (1 mi) because there are only 0.86 miles of maximum kelp and 0.08 sq miles of persistent kelp present within it. In total, the proposed MPA cluster protects only 0.21 sq miles of persistent kelp, which is less than ¼ of the amount suggested in the guidelines for protection within this crucial habitat type.

As stated earlier, this MPA cluster is 19.85 sq miles, of which 14.56 sq miles represents soft 200- 3000 m habitat, and in which few if any species of concern, or species likely to benefit from MPAs, are present. If the Fish & Game Commission approves the proposed MPAs, the majority of habitat types (hard 0-30, 30-100, 100-200 meters) that support the diverse and unique assemblage of marine species found along Palos Verdes will not be protected in sufficient amounts to achieve regional goals.

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Appendix I. Density (per 100m^2) of invertebrates and algae by depth zone within the Point Vicente and Abalone Cove SMCAs, 2004-2010.

Station	**Zone**	***Anthopleura artemisia***	***Anthopleura elegantissima***	***Anthopleura sola***	***Anthopleura* sp**	***Anthopleura xanthogrammica***	***Aplysia californica***	***Aplysia vaccaria***	***Asterina miniata***
120 Reef	Inner			4.2					40.0
120 Reef	Middle			0.8					36.7
Abalone Cove Kelp East	Inner			45.8			0.8		15.0
Abalone Cove Kelp East	Middle			0.8				0.8	0.8
Abalone Cove Kelp West	Inner	0.8		0.8			0.8		0.8
Abalone Cove Kelp West	Middle								5.8
Hawthorne Reef	Inner			21.7			0.8		
Hawthorne Reef	Middle			2.5					92.5
Hawthorne Reef	Outer			1.7					119.1
Hawthorne Reef	Deep								110.8
Long Point East	Inner			28.8			6.7		12.5
Long Point East	Middle			7.1			7.5		47.9
Long Point East	Outer			4.6			0.4		56.6
Long Point West	Inner			78.3			2.5		30.0
Long Point West	Middle			7.5					46.7
Point Vicente East	Inner								8.3
Point Vicente East	Middle								29.2
Point Vicente East	Outer		0.8				1.7		21.7
Point Vicente North	Middle			10.0			7.5		29.2
Point Vicente North	Outer			5.0			4.2		33.3
Point Vicente West	Inner		123.3	94.0			0.2		8.8
Point Vicente West	Middle		5.4	4.6	0.2	0.4	1.0		42.5
Point Vicente West	Outer		1.5	5.2					81.1
Point Vicente West	Deep		0.4						43.8
Portuguese Point	Inner			300.8					10.8
Portuguese Point	Middle			3.3					16.7

Appendix I. continued.

Station	**Zone**	***Boltenia villosa***	***Centrostephanus coronatus***	***Crassedoma giganteum***	***Cypraea spadicea***	***Cystoseira osmundacea***	***Dermasterias imbricata***	***Diaulula sandiegensis***	***Egregia menziesii***
120 Reef	Inner	0.8				4.2			0.8
120 Reef	Middle					0.8			0.8
Abalone Cove Kelp East	Inner					114.2			3.3
Abalone Cove Kelp East	Middle	2.5				42.5			
Abalone Cove Kelp West	Inner					11.7			4.2
Abalone Cove Kelp West	Middle				0.8	7.5			
Hawthorne Reef	Inner					3.3			
Hawthorne Reef	Middle					36.7			
Hawthorne Reef	Outer								
Hawthorne Reef	Deep					2.5		0.8	
Long Point East	Inner					36.5			26.3
Long Point East	Middle			0.8		12.5			3.3
Long Point East	Outer			0.8					
Long Point West	Inner								
Long Point West	Middle			0.8					
Point Vicente East	Inner		6.7						
Point Vicente East	Middle		41.7				0.8		
Point Vicente East	Outer		3.3						
Point Vicente North	Middle								
Point Vicente North	Outer								
Point Vicente West	Inner		7.5	1.5					3.5
Point Vicente West	Middle		14.6	1.3		2.3	0.8		
Point Vicente West	Outer	0.8	27.6	2.3	0.8		2.5		0.2
Point Vicente West	Deep			0.4	2.1	0.8			
Portuguese Point	Inner					9.2			
Portuguese Point	Middle	0.8				11.7			

Appendix I. continued.

Station	**Zone**	***Eisenia arborea***	***Eugorgia rubens***	***Flabellina iodinea***	***Henricia leviuscula***	***Kelletia kelletii***	***Lithopoma undosum***	***Lophogorgia chilensis***	***Lytechinus anamesus***
120 Reef	Inner					15.0			
120 Reef	Middle		6.7	4.2		9.2			
Abalone Cove Kelp East	Inner					10.8	1.7		
Abalone Cove Kelp East	Middle					3.3	0.8	0.8	
Abalone Cove Kelp West	Inner					0.8			
Abalone Cove Kelp West	Middle					28.3			
Hawthorne Reef	Inner					1.7			
Hawthorne Reef	Middle	0.8				0.8			
Hawthorne Reef	Outer	4.2				1.7	0.8		
Hawthorne Reef	Deep	5.8		4.2		8.3	0.8	23.3	
Long Point East	Inner	25.4				13.8	2.9		
Long Point East	Middle	3.3				9.2	3.3		
Long Point East	Outer					11.7	2.5		70.3
Long Point West	Inner	5.8				7.5	1.7		
Long Point West	Middle					25.8	0.8	1.7	
Point Vicente East	Inner					3.3	1.7		
Point Vicente East	Middle					2.5	4.2	0.8	
Point Vicente East	Outer					2.5	6.7		
Point Vicente North	Middle	0.8				31.7	1.7	17.5	
Point Vicente North	Outer					24.2	1.7	24.2	
Point Vicente West	Inner	12.7		1.0		11.3	0.8		
Point Vicente West	Middle	2.1		1.3		6.9	1.0		
Point Vicente West	Outer	0.6		2.7	0.4	5.6	1.9	1.3	0.2
Point Vicente West	Deep			5.0	0.4	2.5	0.4	16.3	
Portuguese Point	Inner					1.7			
Portuguese Point	Middle					8.3			

Appendix I. continued.

Station	Zone	*Macrocystis pyrifera*	*Megathura crenulata*	*Muricea californica*	*Muricea fruticosa*	*Navinax inermis*	*Norrisia norrisi*	*Octopus bimaculoides*	*Ophioderma panamensis*
120 Reef	Inner	34.2	0.8	22.5	0.8				15.8
120 Reef	Middle	31.7	0.8	48.3	1.7				2.5
Abalone Cove Kelp East	Inner	15.8	0.8	1.7					
Abalone Cove Kelp East	Middle	15.8	0.8	13.3	1.7				
Abalone Cove Kelp West	Inner	37.5	1.7	4.2					
Abalone Cove Kelp West	Middle	22.5	0.8	20.0					
Hawthorne Reef	Inner	5.8					0.8		
Hawthorne Reef	Middle	57.5		13.3	0.8				
Hawthorne Reef	Outer	32.5		34.2	3.3				
Hawthorne Reef	Deep	21.7		36.7	0.8				
Long Point East	Inner	49.6	30.8	0.4					
Long Point East	Middle	24.6	11.3	14.6	1.3	5.0			
Long Point East	Outer	39.6	8.3	40.8	2.1				
Long Point West	Inner		13.3						
Long Point West	Middle		5.0	14.2	1.7				
Point Vicente East	Inner			51.7					
Point Vicente East	Middle		0.8	57.5					
Point Vicente East	Outer								
Point Vicente North	Middle		0.8	27.5	3.3				
Point Vicente North	Outer	1.7		52.5	8.3				
Point Vicente West	Inner	27.9	7.3	0.2			0.2		
Point Vicente West	Middle	26.9	2.7	2.7	0.4				
Point Vicente West	Outer	42.5	2.5	14.0	2.1			0.2	
Point Vicente West	Deep	3.8	2.1	6.7	0.4				
Portuguese Point	Inner	24.2	5.0	0.8					
Portuguese Point	Middle	14.2		190.0	1.7				

Appendix I. continued.

Station	**Zone**	***Ophioplocus esmarki***	***Orthasterias koehleri***	***Pachycerianthus fimbriatus***	***Panulirus interruptus***	***Parastichopus californicus***	***Parastichopus parvimensis***	***Peltodoris nobilis***	***Pisaster brevispinus***
120 Reef	Inner			2.5			2.5	1.7	1.7
120 Reef	Middle			9.2			0.8	0.8	4.2
Abalone Cove Kelp East	Inner						6.7		
Abalone Cove Kelp East	Middle			3.3	0.8		4.2		
Abalone Cove Kelp West	Inner				5.0		5.0		0.8
Abalone Cove Kelp West	Middle			5.8			2.5		
Hawthorne Reef	Inner						0.8		
Hawthorne Reef	Middle				1.7				4.2
Hawthorne Reef	Outer			10.0					
Hawthorne Reef	Deep			0.8		0.8	2.5		2.5
Long Point East	Inner				0.4	0.4	2.5		0.4
Long Point East	Middle						3.8		0.4
Long Point East	Outer					3.8			0.8
Long Point West	Inner						1.7		0.8
Long Point West	Middle								
Point Vicente East	Inner								
Point Vicente East	Middle				2.5		0.8		
Point Vicente East	Outer				0.8		2.5		
Point Vicente North	Middle					0.8	1.7		
Point Vicente North	Outer					0.8	3.3		1.7
Point Vicente West	Inner				0.2		6.5		5.2
Point Vicente West	Middle						3.5		1.5
Point Vicente West	Outer	0.4				0.2	11.5		0.6
Point Vicente West	Deep		0.4				1.3		0.4
Portuguese Point	Inner						0.8		
Portuguese Point	Middle			6.7			5.0		

Appendix I. continued.

Station	**Zone**	***Pisaster giganteus***	***Pisaster giganteus***	***Pisaster ochraceus***	***Pterygophora californica***	***Pugettia producta***	***Pycnopodia helianthoides***	***Sargassum* sp**	***Strongylocentrotus franciscanus***
120 Reef	Inner	44.2			7.5		1.7		29.2
120 Reef	Middle	20.8			9.2				6.7
Abalone Cove Kelp East	Inner	20.0		16.7	15.0				55.8
Abalone Cove Kelp East	Middle	5.8			91.7	1.7			114.2
Abalone Cove Kelp West	Inner	19.2			10.8		1.7		200.0
Abalone Cove Kelp West	Middle	13.3			2.5		0.8		99.2
Hawthorne Reef	Inner	14.2		18.3					86.7
Hawthorne Reef	Middle	17.5					0.8		148.3
Hawthorne Reef	Outer	6.7			6.7		0.8		23.3
Hawthorne Reef	Deep	11.7					0.8		6.7
Long Point East	Inner	19.2		28.3				7.5	134.6
Long Point East	Middle	34.6		7.5	0.8		0.4	0.4	92.9
Long Point East	Outer	22.9		0.4	5.0				50.6
Long Point West	Inner	28.3		32.5					115.8
Long Point West	Middle	22.5		4.2			1.7		141.5
Point Vicente East	Inner	18.3							1.7
Point Vicente East	Middle	16.7							2.5
Point Vicente East	Outer	10.0		29.2					16.7
Point Vicente North	Middle	33.3		7.5			0.8		90.8
Point Vicente North	Outer	11.7		1.7					44.2
Point Vicente West	Inner	17.5		29.2	0.8		0.4	4.0	22.7
Point Vicente West	Middle	41.9		13.8	0.6		0.4		36.7
Point Vicente West	Outer	65.2		6.0	0.6		0.2		63.8
Point Vicente West	Deep	14.2		2.9	0.4		0.8		51.3
Portuguese Point	Inner		49.2	43.3	2.5				216.7
Portuguese Point	Middle		8.3	0.8	8.3	1.7	0.8		46.7

Appendix I. continued.

Station	Zone	*Strongylocentrotus purpuratus*	*Styela montereyensis*	*Stylasterias forreri*	*Tethya californiana*	*Urticina crassicornis*	*Urticina mcpeaki*
120 Reef	Inner	71.7	5.0		5.0		
120 Reef	Middle		11.7		20.8		
Abalone Cove Kelp East	Inner	1125.0					
Abalone Cove Kelp East	Middle	128.3	1.7				
Abalone Cove Kelp West	Inner	435.0					
Abalone Cove Kelp West	Middle	197.5					
Hawthorne Reef	Inner	1500.0					
Hawthorne Reef	Middle	292.8	0.8		4.2		
Hawthorne Reef	Outer	5.0	3.3		19.2		
Hawthorne Reef	Deep		5.0		36.7		
Long Point East	Inner	516.3			0.4		
Long Point East	Middle	141.3			13.3		
Long Point East	Outer	28.8			20.0		
Long Point West	Inner	150.0					
Long Point West	Middle	233.3			1.7		
Point Vicente East	Inner	1083.3			8.3		
Point Vicente East	Middle	78.3			7.5		
Point Vicente East	Outer	1416.7					
Point Vicente North	Middle	56.7			49.2		
Point Vicente North	Outer	78.3			55.0		
Point Vicente West	Inner	745.2					
Point Vicente West	Middle	522.4	0.2		2.9		
Point Vicente West	Outer	71.9	1.7		4.0		0.2
Point Vicente West	Deep	32.1	2.1	0.4	17.5	0.8	
Portuguese Point	Inner	812.5					
Portuguese Point	Middle		20.8		11.7		

Appendix II. Substrate percent cover by depth zone within the Point Vicente and Abalone Cove SMCAs, 2004-2010.

Station	Zone	brown algae - erect	brown algae - filamentous	coralline algae - crustose	coralline algae - erect	Cystoseira osmundacea	Eisenia arborea	green algae	Macrocystis holdfast
120 Reef	Inner	3%		18%	6%				5%
120 Reef	Middle	2%		15%					3%
Abalone Cove Kelp East	Inner	2%		47%	8%	2%			
Abalone Cove Kelp East	Middle	3%		3%	24%				10%
Abalone Cove Kelp West	Inner		13%	45%	6%				2%
Abalone Cove Kelp West	Middle	2%	15%	26%					5%
Hawthorne Reef	Inner	5%		10%	2%		3%		5%
Hawthorne Reef	Middle	2%		61%	8%				
Hawthorne Reef	Outer	3%		35%	5%				13%
Hawthorne Reef	Deep	2%		34%	2%				11%
Long Point East	Inner	2%		38%	7%	2%			6%
Long Point East	Middle			41%	2%	2%			5%
Long Point East	Outer	3%		36%					4%
Long Point West	Inner	2%		50%	3%				
Long Point West	Middle			35%					
Point Vicente East	Inner			58%					
Point Vicente East	Middle	5%		32%					
Point Vicente East	Outer	2%		21%					
Point Vicente North	Middle			60%					
Point Vicente North	Outer			43%					
Point Vicente West	Inner	2%		28%					1%
Point Vicente West	Middle	1%		25%	1%	1%	1%		10%
Point Vicente West	Outer	2%		25%	2%			2%	2%
Point Vicente West	Deep			32%	0%				4%
Portuguese Point	Inner	3%		19%	32%				3%
Portuguese Point	Middle	10%		26%	2%				8%

Appendix II. continued.

Station	Zone	*Other holdfast*	*Pterygophora holdfast*	*red algae - erect*	*red algae - turf*	*Sargassum sp*	*anemone*	*Anthopleura elegantissima*	*Anthopleura sola*
120 Reef	Inner			10%					
120 Reef	Middle			8%					
Abalone Cove Kelp East	Inner			8%	8%				2%
Abalone Cove Kelp East	Middle		10%	13%					2%
Abalone Cove Kelp West	Inner			3%	3%				
Abalone Cove Kelp West	Middle			2%	2%				
Hawthorne Reef	Inner			16%	3%				
Hawthorne Reef	Middle				2%				
Hawthorne Reef	Outer			6%	18%				
Hawthorne Reef	Deep			5%	11%				
Long Point East	Inner	1%	2%	8%	20%				
Long Point East	Middle			2%	19%				
Long Point East	Outer			6%	19%				
Long Point West	Inner			2%	3%		6%		
Long Point West	Middle			3%	10%		2%		
Point Vicente East	Inner								
Point Vicente East	Middle				13%				
Point Vicente East	Outer			2%	37%		3%		
Point Vicente North	Middle								
Point Vicente North	Outer				25%				
Point Vicente West	Inner			11%	7%				
Point Vicente West	Middle			5%	17%	0%	6%	0%	2%
Point Vicente West	Outer		1%	11%	14%	1%	2%		
Point Vicente West	Deep			7%	10%		2%		
Portuguese Point	Inner			2%	19%				3%
Portuguese Point	Middle			3%					

Appendix II. continued.

Station	**Zone**	***bryozoan***	***Chaceia ovoidea***	***Corynactis californica***	***Crassedoma giganteum***	***Cup coral***	***Diopatra ornata***	***Eudistylia polymorpha***	***Hippodiplosia insculpta***
120 Reef	Inner	3%							
120 Reef	Middle	3%	2%	6%		5%	13%	2%	
Abalone Cove Kelp East	Inner	2%							
Abalone Cove Kelp East	Middle			2%			5%		
Abalone Cove Kelp West	Inner		5%			2%	2%		
Abalone Cove Kelp West	Middle					5%	13%		3%
Hawthorne Reef	Inner			3%		3%	3%		
Hawthorne Reef	Middle		2%						
Hawthorne Reef	Outer	2%				2%	2%		
Hawthorne Reef	Deep	3%					2%	3%	
Long Point East	Inner	1%	2%	2%		2%	2%		
Long Point East	Middle	6%	2%	5%		1%	1%		
Long Point East	Outer	1%		5%		1%			
Long Point West	Inner	2%	3%	2%		10%	2%		
Long Point West	Middle			10%		11%	6%		
Point Vicente East	Inner								
Point Vicente East	Middle		8%	2%		3%	5%		
Point Vicente East	Outer		2%	2%		2%			
Point Vicente North	Middle					3%			
Point Vicente North	Outer					3%			
Point Vicente West	Inner	5%		9%	1%	9%			
Point Vicente West	Middle	0%	2%	7%		2%	0%		
Point Vicente West	Outer	2%		2%		7%	1%		
Point Vicente West	Deep	7%		12%		2%			
Portuguese Point	Inner	6%							
Portuguese Point	Middle		16%						

Appendix II. continued.

Station	Zone	*Hydroid*	*Lophogorgia chilensis*	*Muricea californica*	*Muricea fruticosa*	*Pachycerianthus fimbratus*	*Phidolopora labiata*	*Phragmatopoma californica*	*Sabellid/Serpulid/Spirobranchus/Eudistylia*
120 Reef	Inner							2%	
120 Reef	Middle				3%				
Abalone Cove Kelp East	Inner								
Abalone Cove Kelp East	Middle			2%					
Abalone Cove Kelp West	Inner			2%			2%		
Abalone Cove Kelp West	Middle						2%		
Hawthorne Reef	Inner		2%	2%		2%			
Hawthorne Reef	Middle								
Hawthorne Reef	Outer			5%					
Hawthorne Reef	Deep			2%					
Long Point East	Inner								
Long Point East	Middle	1%		1%					
Long Point East	Outer			1%					
Long Point West	Inner								3%
Long Point West	Middle								
Point Vicente East	Inner								
Point Vicente East	Middle								
Point Vicente East	Outer								
Point Vicente North	Middle								
Point Vicente North	Outer	2%							
Point Vicente West	Inner		1%	1%	1%			1%	
Point Vicente West	Middle							0%	
Point Vicente West	Outer	2%							
Point Vicente West	Deep								
Portuguese Point	Inner								
Portuguese Point	Middle			19%				2%	

Appendix II. continued.

Station	Zone	*Salmacina tribranchiata*	*Serpulorbis squamigerus*	*Spirobranchus spinosus*	*sponge*	*Tethya californiana*	*Tetilla sp. B*	*Tubeworm*	*tunicate - colonial*
120 Reef	Inner	5%			5%				2%
120 Reef	Middle	5%			8%				3%
Abalone Cove Kelp East	Inner	2%	2%						
Abalone Cove Kelp East	Middle				2%				
Abalone Cove Kelp West	Inner								
Abalone Cove Kelp West	Middle				2%		2%		
Hawthorne Reef	Inner	5%			2%	2%			3%
Hawthorne Reef	Middle								
Hawthorne Reef	Outer	3%			2%				
Hawthorne Reef	Deep				5%				3%
Long Point East	Inner				1%				
Long Point East	Middle	2%			1%				
Long Point East	Outer							1%	
Long Point West	Inner							2%	
Long Point West	Middle	2%						5%	
Point Vicente East	Inner								
Point Vicente East	Middle				2%				
Point Vicente East	Outer							3%	
Point Vicente North	Middle							13%	
Point Vicente North	Outer								
Point Vicente West	Inner	1%		1%	6%	1%			
Point Vicente West	Middle		0%						
Point Vicente West	Outer				3%				
Point Vicente West	Deep				2%			0%	1%
Portuguese Point	Inner		3%					2%	
Portuguese Point	Middle				2%				3%

Appendix II. continued.

Station	Zone	tunicate - solitary	bare rock	bare sand	Detritus	sediment/mud	shell debris
120 Reef	Inner		21%	16%			5%
120 Reef	Middle		3%	8%			11%
Abalone Cove Kelp East	Inner		10%	10%			
Abalone Cove Kelp East	Middle	2%		24%			
Abalone Cove Kelp West	Inner		11%	2%			3%
Abalone Cove Kelp West	Middle	2%	10%	5%			8%
Hawthorne Reef	Inner			10%	10%		11%
Hawthorne Reef	Middle		18%	5%			3%
Hawthorne Reef	Outer				2%		3%
Hawthorne Reef	Deep	2%	8%	8%			
Long Point East	Inner		2%	2%	2%		
Long Point East	Middle		1%	3%			4%
Long Point East	Outer		3%	12%	5%		4%
Long Point West	Inner			3%	6%		2%
Long Point West	Middle		2%	6%	5%		3%
Point Vicente East	Inner		40%	2%			
Point Vicente East	Middle		2%	5%	6%	15%	3%
Point Vicente East	Outer			18%	2%	6%	2%
Point Vicente North	Middle			17%			7%
Point Vicente North	Outer			2%	5%		20%
Point Vicente West	Inner		8%	3%			5%
Point Vicente West	Middle	1%	16%	1%			1%
Point Vicente West	Outer		13%	3%	1%	0%	1%
Point Vicente West	Deep	2%	8%	5%	2%		1%
Portuguese Point	Inner		6%				
Portuguese Point	Middle		6%	3%			

EXHIBIT B

COST ESTIMATE FOR IMPLEMENTATION OF NITRIFICATION/DENITRIFICATION

at the

JOINT WATER POLLUTION CONTROL PLANT

for

POTENTIAL IMPACTS of the MARINE LIFE PROTECTION ACT

for

County Sanitation Districts of Los Angeles County

1955 Workman Mill Road
Whittier, CA 90601-1400

September 2010

Joseph C. Reichenberger, P.E., BCEE

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Project Number 10-01

COST ESTIMATE FOR IMPLEMENTATION OF NITRIFICATION/DENITRIFICATION at the JOINT WATER POLLUTION CONTROL PLANT for POTENTIAL IMPACTS of the MARINE LIFE PROTECTION ACT

for

County Sanitation Districts of Los Angeles County

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September 2010

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Project Number 10-01

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9/5/2010

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ABBREVIATIONS AND ACRONYMS

A_2O	Anaerobic-Anoxic-Oxic (Process configuration)
BAF	Biological Aerated Filter
BNR	Biological Nutrient Removal
BOD_5	5-day Biochemical Oxygen Demand
$CaCO_3$	Calcium Carbonate (standard for expressing alkalinity)
COD	Chemical Oxygen Demand
cy	cubic yard
DFG	California Department of Fish and Game
DO	Dissolved Oxygen
HP	horsepower
HPO or HPOAS	High Purity Oxygen or High Purity Oxygen Activated Sludge
IDI	Infilco Degremont Inc.
JWPCP	Joint Water Pollution Control Plant
JOS	Joint Outfall System
KMT	Kaldness biofilm carrier
LACSD	Los Angeles County Sanitation Districts
kWh	kilowatt hour
LS	Lump Sum
MBBR	Moving bed, biofilm reactor
MG	million gallons
mgd	million gallons per day
MLE	Modified Ludzack Ettinger (Process)
MLPA	Marine Life Protection Act
NaOH	Sodium Hydroxide
NdN	Nitrification followed by Denitrification
RAS	Return Activated Sludge
RC	Reinforced concrete (cast in place concrete)
SMR	State Marine Reserve
SMCA	State Marine Conservation Area
SRT	Solids Retention Time
TSS	Total Suspended Solids
VSS	Volatile Suspended Solids
WAS	Waste Activated Sludge

SECTION 1
INTRODUCTION AND EFFLUENT CHARACTERISTICS AND REQUIREMENTS

The work presented herein was developed to identify the costs of construction and operation of nitrification/denitrification (NDN)facilities at the County Sanitation Districts of Los Angeles County (Sanitation Districts or LACSD) Joint Water Pollution Control Plant (JWPCP) in Carson, CA. The NDN facilities are in anticipation of more stringent effluent limits which will be imposed on the plant by the Regional Water Quality Control Board in response to the Marine Life Protection Act (MLPA). The cost estimates are intended only as guidance in assessing the economic impacts of the decision to implement these requirements.

MARINE LIFE PROTECTION ACT

The MLPA is contained within §2850 -§2863 of the Fish and Game Code of the State of California. The legislature established the MLPA which required the Department of Fish and Game (DFG) to develop a master plan of marine protected areas (MPAs) and have the Fish and Game Commission establish regulations to implement the master plan and the goals of the MLPA. This is to ensure that California's existing MPAs are properly managed. The process of developing the master plan has been through a series of meetings which actually began in 2008 for the South Coast biogeographical area – one of the three regions identified in the legislation. The planning process has identified some 35 MPAs in the South Coast Zone.

Of concern to the Sanitation Districts is the Point Vicente State Marine Reserve (SMR) which is a designated "no take" zone and the Abalone Cove State Marine Conservation Area (SMCA). These areas are in proximity to the outfalls from the JWPCP. These are shown in Figure 1.

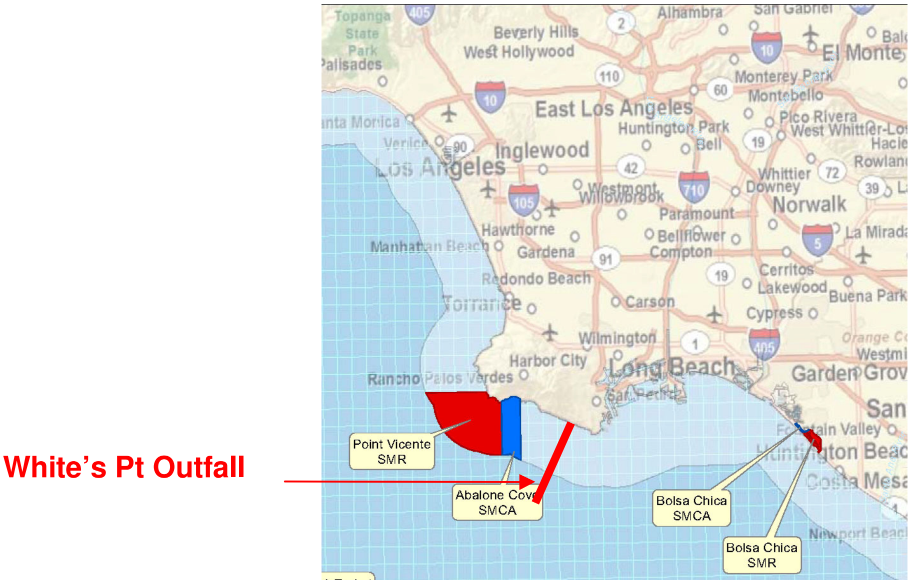

Figure 1
Location of the Point Vicente SMR and Abalone Cove SMCA

Because the master plan and the MPAs are still in the public comment period, the Sanitation Districts are interested in evaluating the potential cost implications of upgrading treatment processes at the JWPCP to reduce ammonia-N and total nitrogen levels in the effluent.

EFFLUENT REQUIREMENTS FOR THIS STUDY

For purposes of this study, treatment upgrades to meet and effluent concentration for total inorganic nitrogen (TIN) concentrations 33.6 mg/L and 10 mg/L are considered. In addition, this study will identify treatment upgrades to meet natural sea water background levels for certain nitrogen species including ammonia-nitrogen (NH3-N) and nitrate-nitrogen (NO3-N) based on the specified dilution ratio for JWPCP discharges. Data on the natural sea water background levels, the laboratory reporting levels as well as target concentrations for various nitrogen species are presented in Table 1-1.

Table 1-1
Natural Background Levels and Reporting Levels for Nitrogen Species

Nitrogen Species	Natural Background Levels in Sea Water, µg/L	Laboratory Method Reporting Level, µg/L	JWPCP Dilution Ratio	Effluent Target for Background Levels in Sea Water, mg/L
NH_3-N	1	20	166:1	0.166
NO_2-N	1	10	166:1	0.166
NO_3-N	200	100	166:1	33.2
Organic N	50	1000	166:1	8.3

ANALYSIS OF JWPCP SECONDARY EFFLUENT

Flow Rate

Figure 1-2 presents the average annual flow rate at the JWPCP from 1971 to 2009. Also shown on Figure 1-2 are the Average Design Flow (400mgd), the Peak Daily Flow (540 mgd) and the Hydraulic Peak Flow (700 mgd). Discharges from the JWPCP have generally declined the late 1990s and have shown a significant drop the last few years. The principal reasons for this are the reduction of influent to the JWPCP due to diversion of flows to upstream treatment plants for water recycling and the impact of water conservation during the drought of the last several years. The state of the economy could also have an effect since a significant portion of the flow to the JWPCP is industrial. Table 1-2 presents statistical data on the JWPCP flow rate since 2008.

Table 1-2
Statistical analysis of Effluent Flow at JWPCP
January 2008 through March 2010

Flow Condition	Average Day, mgd	Daily Peak, mgd
Maximum	**427.9**	**544**
Mean	**287.57**	**360.27**
Median	**286.03**	**357.00**
95th%ile	**310.86**	**394.00**
99%ile	**345.61**	**464.40**
Npts	**821**	**821**

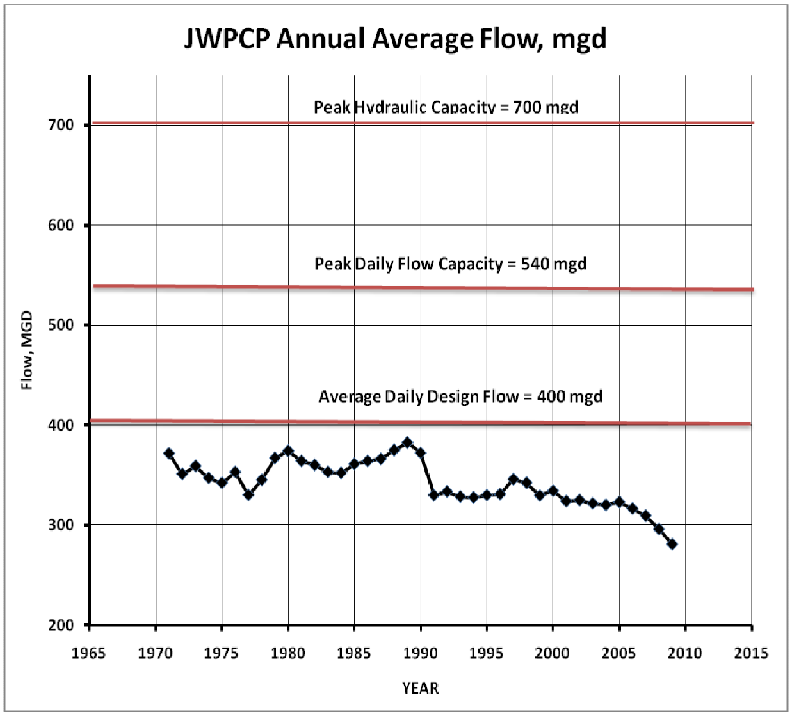

Figure 1-2
JWPCP Average Annual Flow Rate,1971 -2009

Although the historic flow rates are less than the design capacity, the following flow rates will be used in this study. The reason for this is to match the design capacity of the secondary treatment system.

Average Daily Flow	400 mgd
Peak Daily Flow	540 mgd
Peak Hydraualic Capacity	700 mgd

For peak flows over 540 mgd, an extremely rare event, an overflow structure will be provided. The overflow structure will allow excess secondary effluent (over 540 mgd) to go directly to the outfall pumping station where it will blend with the proposed nitrified-denitrified (NdN) effluent.

Nitrogen Species

Figure1- 3 presents historic data on the nitrogen species in the JWPCP effluent. As can be seen there is a decrease in the total nitrogen and organic nitrogen over time due to improvement in the primary treatment and since about 2005 when full secondary treatment was implemented. It is clear in Figure 1-3 that the plant effluent is not nitrified which is typical of HPOAS treatment facilities. Organic nitrogen is generally less than 3 mg/L. This is the non-biodegradable organic nitrogen the bulk of which is soluble that is not converted to ammonia-N. The concentration of less than 3 mg/L is typical of well operated activated sludge plants.

Table 1-3 presents statistical data on the nitrogen species in the JWPCP secondary effluent for the period after full secondary treatment sytem was in operation (2005 – 2010).

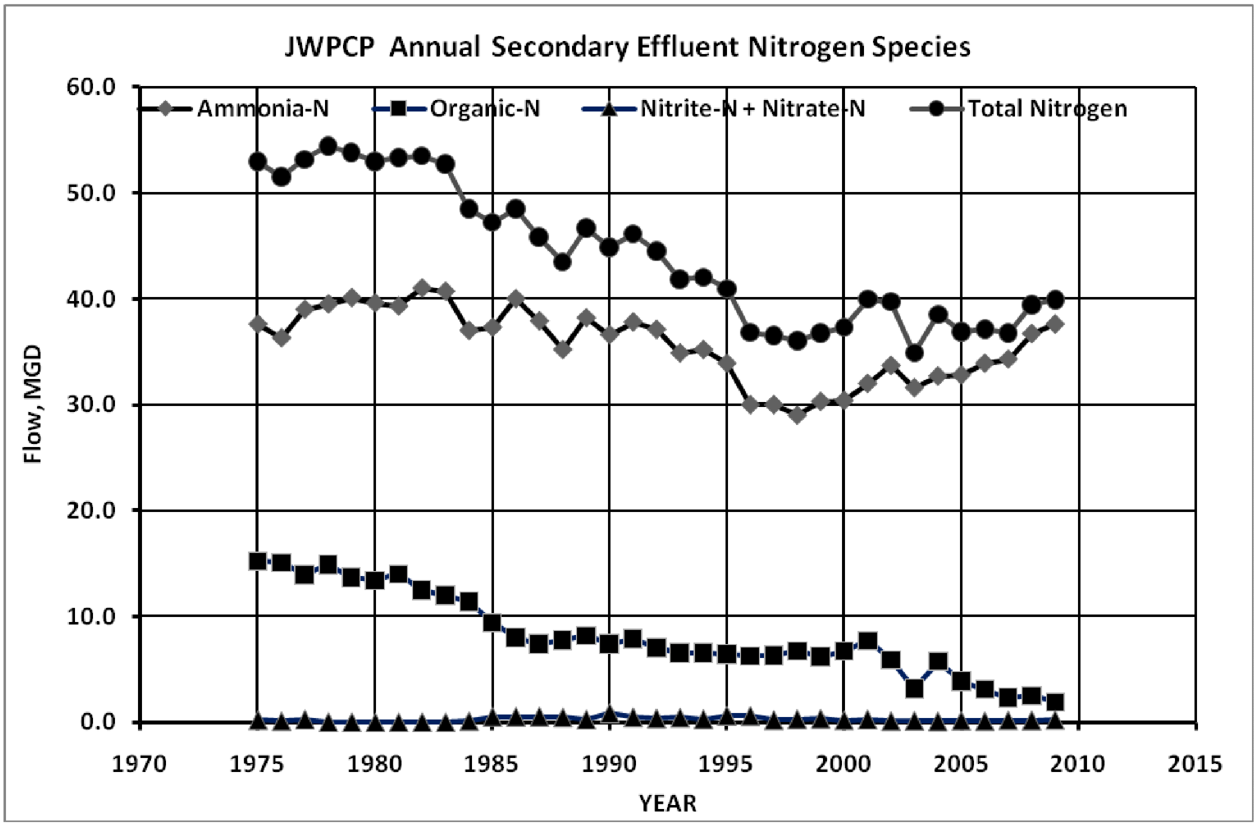

Figure 1-3
JWPCP Annual Effluent Nitrogen Species 1975 - 2009

Table 1-3
Statistical analysis of Effluent Nitrogen Species at JWPCP
January 2005 through April 2010

Parameter	NH3-N, mg/L	NO3-N, mg/L	NO2-N, mg/L
Maximum	39.8	0.2	0.3
Mean	35.3	0.1	0.1
95th%ile	39.1	0.1	0.2
99th%ile	39.7	0.2	0.3
No of Points	265.	35	36

BOD5, COD, TSS and Alkalinity

Table 1-4 presents statistical data on the secondary effluent in terms of residual organics, suspended solids and alkalinity. It should be noted that the percentile values for alkalinity represent the minimums, i.e., the 5 and 1 percentile values since it is the minimum values which control the design.

Table 1-4
Statistical analysis of Effluent TSS, BOD_5, COD and TSS
at JWPCP
January 2005 through April 2010***

Parameter	Alkalinity, mg/L as CaCO3	Total BOD, mg/L	COD, mg/L	TSS, mg/L***
Maximum	430	14	88.0	33
Mean	361.7	5.8	58.2	13.8
95th%ile	308*	9.7	68.0	19.0
99st%ile	308**	12.1	77.9	21.0
No of Points	22.0	229.0	234.0	821

* Represents the 5th percentile since the minimum alkalinity is of concern
** Represents the 1st percentile since the minimum alkalinity is of concern
*** TSS data is from January 2008 through March 2010

DESIGN FLOW, INFLUENT AND EFFLUENT CONCENTRATIONS FOR STUDY

The data presented to the equipment suppliers by the Sanitation Districts at the end of 2008 was not necessarily based on the most stringent design criteria. At this point it is not known what the actual final effluent limits would be should the MLPA requirements be imposed on the Sanitation Districts' discharge. The Sanitation Districts have the philosophy of designing for the 99th percentile for regulatory compliance and as such, this is the basis for this report. Table 1-5 contains the influent and effluent characteristics used in this study.

Table 1-5
JWPCP NdN Design Criteria
Secondary Effluent from High Purity Oxygen Activated Sludge
Based on Statistical Analysis of Data

FLOW	
Design Average Daily Flow	400 million gallons/day (mgd)
Design Peak Flow	540 mgd
Design Minimum Flow	300 mgd
Peak Hydraulic Capacity	700 mgd
INFLUENT CHARACTERISTICS	
Alkalinity	
Maximum	430 mg/L as $CaCO_3$
Mean	362 mg/L as $CaCO_3$
5%tile	308 mg/L as $CaCO_3$
1%tile	308 mg/L as $CaCO_3$
COD	
Maximum	88 mg/L
Mean	58 mg/L
95th %tile	68mg/L
99th %tile	78mg/L
Total BOD5	
Maximum	14 mg/L
Mean	6 mg/L
95th %tile	10 mg/L
99th %tile	12 mg/L
TSS	
Maximum	33 mg/L
Mean	14 mg/L
95th %tile	19 mg/L
99th %tile	21mg/L

Table 1-5 Continued
JWPCP NdN Design Criteria
Secondary Effluent from High Purity Oxygen Activated Sludge
Based on Statistical Analysis of Data

Ammonia-N	
Maximum	39.8 mg/L
Mean	35.3 mg/L
95th %tile	39.1mg/L
99th %tile	39.7mg/L Design value to meet daily maximum
Nitrite-N	
Maximum	0.3 mg/L
Mean	0.1 mg/L
95th %tile	0.2 mg/L
99th %tile	0.3 mg/L Design value to meet daily maximum
Nitrate-N	
Maximum	0.2 mg/L
Mean	0.1 mg/L
95th %tile	0.1 mg/L
99th %tile	0.2 mg/L Design value to meet daily maximum
Design Wastewater Temperature	21 degrees C
pH	7.7

Table 1-5 Continued
JWPCP NdN Design Criteria
Secondary Effluent from High Purity Oxygen Activated Sludge
Based on Statistical Analysis of Data

EFFLUENT REQUIREMENTS	
Option 1	
Ammonia-N daily maximum	< 0.17 mg/L
Nitrite-N daily maximum	< 0.17 mg/L
Nitrate-N daily maximum	< 33.2 mg/L
Total Inorganic-N daily max	< 33.6 mg/L
Option 2	
Ammonia-N daily maximum	< 0.17 mg/L
Nitrite-N daily maximum	< 0.17 mg/L
Nitrate-N daily maximum	< 9.6 mg/L
Total Inorganic-N daily max	< 10 mg/L

The existing secondary treatment processes at JWPCP already reduces the organic-N concentration to less than 3 mg/L, well below the estimated final effluent target of 8.3 mg/L needed to meet the natural background concentration levels (see Table 1-1 and Figure 1-3). Additional treatment to reduce organic nitrogen levels is not required for compliance and as such, this will not be addressed any further.

ACHIEVING OPTION 1 (TIN < 33.6 mg/L) EFFLUENT REQUIREMENTS

The most practical approach to meeting the effluent requirements in Table 1-5 is to denitrify a portion of the nitrified effluent and blend it in the correct proportions to meet the effluent requirements for Option 1. The portion which is denitrified will have the same effluent quality as that of Option 2 in Table 1-5. Denitrification levels for the blending would correspond to Option 2.

Figure 1-4 shows the flows, process effluent qualities, and the blending scheme. To meet the Option 1 effluent quality, 90 mgd of the nitrified effluent will need to be denitrified. The 90 mgd of denitrified effluent (corresponding to Option 2 quality) would be blended with 310 mgd of nitrified effluent.

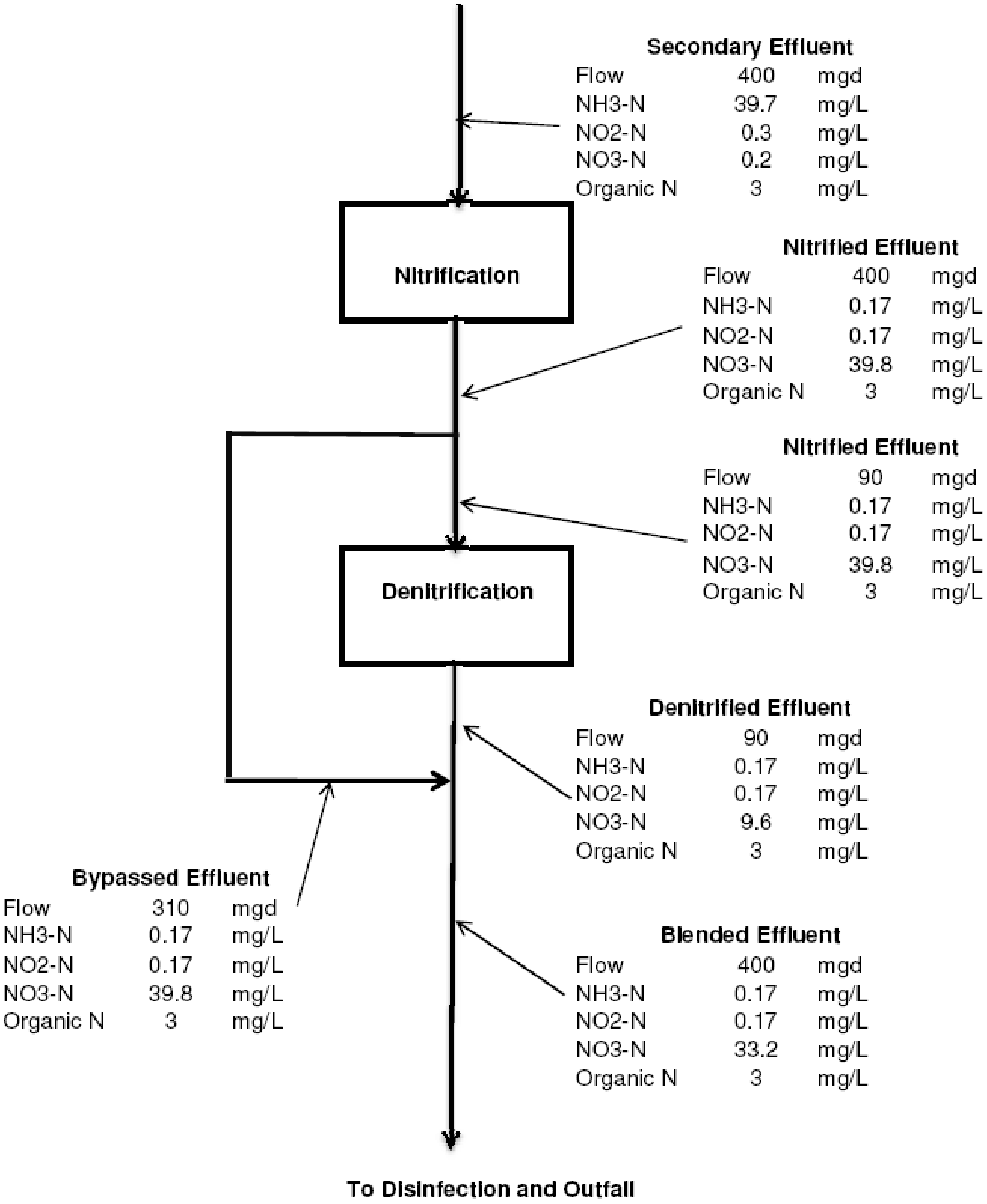

Figure 1-4
Option 1TIN < 33.6 mg/L Bypass Flows and Quality

ALKALINITY CHECK

With nitrification, 7.1 mg/L of alkalinity as $CaCO_3$ will be consumed for each mg/L of ammonia-N oxidized to nitrate-N. If insufficient alkalinity is present, the pH will drop and the nitrifier growth rate will be severely impacted. When considering such low levels of ammonia-N in the effluent as required by Table 1-1, careful review of the alkalinity is necessary. Table 1-6 presents the alkalinity check for the nitrification process. It should be pointed out that the expected effluent is only 27mg/L as $CaCO_3$. This is low; ideally a value of 60 to 80 mg/L or more would be desired to avoid changes in pH[1]. WEF (2009)[2] suggests operating at 60 mg/L as $CaCO_3$ with a minimum of 50 mg/L as $CaCO_3$.

Table 1-7 shows the percentile values for secondary effluent alkalinity at the JWPCP and the residual alkalinity which would be expected assuming the alkalinity consumption in the nitrification process is 281 mg/L as $CaCO_3$. (Note the 281 mg/L consumption of alkalinity as CaCO3 is conservative since it is based on the 99th percentile of nitrification need.)

Setting a target residual of 70 mg/L as $CaCO_3$, less 40 percent of the time, alkalinity addition would theoretically be needed. At worst case, addition of 43 mg/L of alkalinity as $CaCO_3$ would be required. A likely "average dose of alkalinity addition" would be about 25 mg/L. The alkalinity addition can occur at or shortly downstream of the location where the HPOAS process effluent is diverted to the NdN process or at the inlet to the secondary treatment (HPOAS) system. For purposes of this study, the addition is assumed to occur after the diversion to the NdN process.

There are several options for the chemical used for the alkalinity addition:

- Quicklime CaO
- Hydrated Lime ($Ca(OH)_2$
- Sodium Hydroxide (NaOH)

Quicklime would require a lime silo, dry chemical feed system, and lime slaker. Hydrated lime would not require slaking and can be fed directly into the secondary effluent. (It could be fed dry or as a slurry with water. The latter would be recommended.) The sodium hydroxide is the easiest of the chemicals to feed as it is fed as a liquid (typically 50% concentration). It should be pointed out that 50% sodium hydroxide will freeze at about 53 degrees F so the storage tanks and piping should be heat traced. Assuming there is no need to add calcium to provide a "stable water", sodium hydroxide would be the chemical of choice.

A cost analysis was prepared which showed the cost of the chemical on an annual basis is roughly the same for either lime or sodium hydroxide but the cost for the sodium hydroxide feed system is significantly less costly and hence is recommended.

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[1] Metcalf and Eddy (2003), "Wastewater Engineering, Treatment and Reuse, "4th Ed page 718, McGraw Hill Boston.

[2] Water Environment Federation and American Society of Civil Engineers (2009), "Design of Municipal Wastewater Treatment Plants", 5th ed, pg 14-46,McGraw Hill New York.

Table 1-6

Process Alkalinity Check for Nitrification and Denitrification

Secondary Effluent	
99^{th} %tile secondary effluent NH_3-N	39.7 mg/L
99^{th} %tile secondary effluent NO_2-N	0.3 mg/L
99^{th} %tile secondary effluent NO_3-N	0.2 mg/L
Total reduced NOx-N in secondary effluent	40.0 mg/L
TIN in secondary effluent	40.2 mg/L
Secondary Effluent Alkalinity, 1% tile, i.e., 99% of the values exceed this concentration	308 mg/L as $CaCO_3$
Nitrified Effluent	
NH_3-N in nitrified effluent	0.17 mg/L
NO_2-N in nitrified effluent	0.17 mg/L
Total reduced NOx-N in nitrified effluent	0.34 mg/L (say 0.4 mg/L)
Nitrification required	39.6 mg/L, (i.e. 40.0 – 0.4)
NO_3-N in nitrified effluent	39.8 mg/L (i.e. 39.6 + 0.2)
TIN in nitrified effluent	40.2 mg/L
Alkalinity consumed	281 mg/L as $CaCO_3$
Alkalinity in nitrified effluent	27 mg/L as $CaCO_3$
Denitrified Effluent (Option 2)	
NH_3-N in denitrified effluent	0.17 mg/L
NO_2-N in denitrified effluent	0.17 mg/L
NO_3-N in denitrified effluent	9.6 mg/L
TIN in denitrified effluent	10 mg/L
Denitrification required	30.2 mgL (i.e. 40.2 – 0.4 - 9.6)
Alkalinity recovered	109 mg/L as $CaCO_3$
Alkalinity in denitrified effluent	136 mg/L as $CaCO_3$ (i.e. 27 + 109)
Blended Effluent (Option 1)	
Blend Flows	310 mgd nitrified (77.5%) 90 mgd denitrified (22.5%)
Alkalinity in blended effluent	52 mg/L as $CaCO_3$

Table 1-7

Estimated Residual Alkalinity in Nitrified Effluent

Percentile of Occurrence	Secondary Effluent Alkalinity, mg/L $CaCO_3$	Alkalinity Consumption in Nitrification Process, mg/L $CaCO_3$	Residual Alkalinity in Nitrified Effluent, mg/L $CaCO_3$
50th Percentile (mean)	362	281	81
40th Percentile	351	281	70
30th Percentile	346	281	65
20th Percentile	344	281	62
10th Percentile	320	281	39
5th Percentile	308	281	27
1st Percentile	308	281	27

Table 1-6 also presents the expected effluent quality for the denitrified effluent (Option 2). About one half of the alkalinity (3.6 mg/L of alkalinity recovered per mg/L of nitrate-N denitrified, however in the proposed separate stage, fixed film nitrification and denitrification systems, the "recovery" comes too late affect the nitrification process. The recovered alkalinity will be manifested in the denitrified effluent. The alkalinity in the denitrified effluent will increase to 136 mg/L as $CaCO_3$, The effluent alkalinity will be greater than 136 mg/L as $CaCO_3$ if alkalinity addition to the secondary effluent is performed as discussed above, i.e., probably closer to 161 mg/L as $CaCO_3$.

Table 1-6 shows the calculation for the alkalinity in the blended effluent (Option 1). For the blended effluent, the alkalinity will be about 52 mg/L as $CaCO_3$. But with alkalinity addition as discussed above, the final effluent alkalinity would be expected to be 75 ot 80 mg/L as $CaCO_3$ which should be adequate. Since the Sanitation Districts uses sodium hypochlorite for disinfection, the alkalinity and pH should increase slightly after disinfection.

SECTION 2
LITERATURE SEARCH AND REVIEW

Biological nutrient removal experience in conventional activated sludge treatment facilities is well established; however, in the case of high-purity oxygen activated sludge, which is currently used at the JWPCP, biological nutrient removal experience is limited. A brief literature search was conducted using Ebsco Host, Wilson Omni file, J-store, Ingenta, Engineering Village and ASCE Journals. Pertinent references are presented below along with a "digest" of the material.

In the discussion to follow several abbreviations are used:

HPO or HPOAS	High purity oxygen or high purity oxygen activated sludge
SRT	Solids Retention Time
MBBR	Moving-bed Biofilm Reactor
DO	Dissolved Oxygen
BNR	Biological Nutrient Removal

RELEVANT LITERATURE

1. Bonomo, L., et al. *Tertiary nitrification in pure oxygen moving bed biofilm reactors*. Water Science & Technology, 2000. 41(4/5): p. 361. 2000. New York, NY, USA: IWA Publishing.

    Bench scale reactors, fed with secondary effluent from a municipal wastewater treatment plant, were used to study tertiary nitrification in pure oxygen moving bed KMT (Kaldnes) biofilm carriers. The process measured very high nitrification rates both in ammonia limiting conditions (up to 7 g N/m^2/d and oxygen:ammonia-N ratio greater than 3-4 mg O_2/mg N) and in oxygen limiting conditions (up to 8 g N/m^2/d and oxygen to ammonia-N ratio lower than 1 – 1.2mg O_2/mg N). The process proved flexible and reliable. Typical application could include tertiary nitrification of secondary effluent from a high purity oxygen activated sludge systems designed only for carbon removal.

2. Sova, R, Neethling, J. B., Kinnear, D, Bakke, B, Brandt, G, Wilson, R, and Crisler, S. *Prenitrification and Seeding for Enhanced Nitrification* . Proceedings of the Water Environment Federation, 2004.

    A prenitrification basin was used at the Lincoln, NE Theresa Street WWTF to enhance nitrification capacity and reduce the impact of high ammonia recycle streams from solids processing operations on the main process nitrification process. The recycle streams are combined with a portion of the return activated sludge in an aerated prenitrification basin reducing ammonia from over 500 mg/L to 10 to 30 mg/L before combining with the main plant flow.

3. Fergen, R., et al., *Nitrite Reduction Evaluation for the Miami-Dade WASD South District Wastewater Treatment Plant*. Proceedings of the Water Environment Federation, 2005. p. 576-593.

    The Miami-Dade facility is a HPOAS facility. The facility experienced nitrite-N concentrations exceeding 3 mg/L in the summer when the effluent limit is 1.0 mg/L. The source of the nitrifiers which brought about partial nitrification included hauled-in aerobically digested sludge and landfill leachate. Because of the warm wastewater temperature and the lower pH from the HPO system, the oxidation from ammonia-N to nitrite-N occurs at a faster rate than the rate of oxidation from nitrite-N to nitrate-N. Furthermore, if nitrite concentrations are greater than 0.1 mg/L, the conversion to nitrate is inhibited. This is the reverse of what is typical in most systems. To eliminate the nitrite-N, an anoxic zone was created by turning off the oxygen supply to reactor 5 (in a series of 6 reactors per train).

4. Jang, A. and I.S. Kim. *Effect of High Oxygen Concentrations on Nitrification and Performance of High-Purity Oxygen A/O Biofilm Process*. Environmental Engineering Science, 2004. 21(3): p. 273-281.

Respirometric methods were used to show that dissolved oxygen concentration has an effect on the growth of nitrifying micro-organisms. Oxygen uptake rates were normal at dissolved oxygen (DO) concentrations of 5 to 15 mg/L, but at 15 mg/L and greater, oxygen uptake was reduced and these DO levels may be toxic to the nitrifiers. The anoxic/aerobic high purity oxygen submerged biofilm process was tested using synthetic wastewater influent. The biofilm carrier was a fibrous rope-like material.

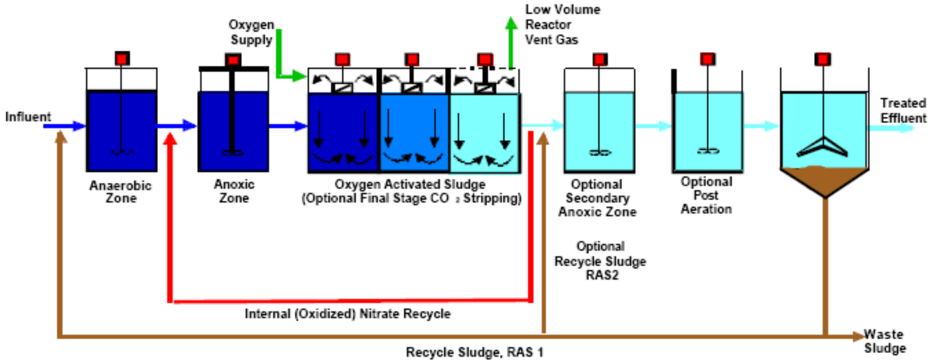
5. Kaldate, A., T. Holst, and V. Pattarkine. *MBBR Pilot Study for Tertiary Nitrification of HPOAS Wastewater at Harrisburg AWTF*. Proceedings of the Water Environment Federation, 2008.: p. 5080-5091.

A pilot study used moving bed bioreactors (MBBRs) to nitrify effluent from an existing high purity oxygen activated sludge. Target ammonia-N concentrations of less than 3 mg/L and 1 mg/L were achieved. The work was done at Harrisburg, PA, a facility with a flow of 23.5 mgd. The pilot plant was a trailer mounted unit with flows ranged from 3 to 8 gpm. The biofilm carrier fraction ranged from 35% to 50%. Nitrification reactors in series proved to be very effective with 97% ammonia-N removal compared to 76 to 82% when operated singularly. An ammonia-N loading rate of approximately 0.5 g ammonia-N/m^2/d resulted in over 98% removal of ammonia-N. IDI Active Cell™ biofilm carriers were used in the test.

6. Morin, A.L. and Gilligan, Thomas P., *High Purity Oxygen Biological Nutrient Removal*. undated, Belco Technologies and Lotepro Environmental Systems.

Nineteen biological nutrient removal high purity oxygen plants in the U.S. were identified ranging in size from 4 mgd to 200 mgd (Houston, TX). The systems used single or two stage processes. In the two stage system, nitrification follows the carbonaceous removal; clarifiers were installed prior to nitrification.

Nitrified effluent is recycled to an anoxic zone upstream of the high purity oxygen (HPO) activated sludge reactor. Effluent total N concentrations of less than 9 mg/L can be achieved. To achieve levels of total N less than 5 mg/L will require a second anoxic zone and supplemental carbon (e.g., methanol). To improve the pH, the final stage of the HPO plant should be open to the atmosphere to strip off excess carbon dioxide. (Note that the JWPCP already does this for corrosion control.)



A schematic of the BNR system is shown above. The anaerobic stage would only be needed is phosphorus removal was anticipated. Experience at Lancaster, PA and Rocky Mount, NC demonstrate that low levels of ammonia can be achieved.

7. Neethling, J.B., Danzer, J., Spani, C. and Willey, B., *Achieving Nitrification in Pure Oxygen Activated Sludge by Seeding*. Water Science & Technology, 1998. 37(4/5): p. 573.

A seeding approach was used to increase nitrification capacity of a pure oxygen activated sludge plant. WAS from a parallel air activated sludge system was used to seed nitrifiers to the pure oxygen system. Full scale tests showed that nitrification could be achieved at a seed rate of 35% and a sludge age of 4.6 days resulting in an ammonia concentration less than 5 mg/L. Secondary clarification remained good even at higher solids loading rates.

8. Parker, D.S,and Jiri, A.W., *Improving Nitrification through Bioaugmentation*. in WEF/IWA Nutrient Removal Specialty Conference. 2007. Baltimore, MD.

Bioaugmentation was investigated to increase nitrification rates and decrease space requirements. Both external and in situ systems were investigated. Both types are applicable to activated sludge; only in situ is applicable to fixed film systems. The external option provides an external source of nitrifiers; the in situ option provides internal process enhancements to increase nitrifier activity or increase the nitrifier population.

The more proven bioaugmentation schemes are separate stage processes, the TF/PAS (trickling filter/pushed activated sludge), parallel processes, BAR (Bioagumentation regeneration) process among others. The BAR process involves sending ammonia-rich filtrate/centrate from aerobically digested sludge to a reaeration or regeneration tank receiving RAS. This effectively reduces the SRT for nitrification.

In-situ options seem to be more effective than external schemes because the seed nitrifiers are grown under conditions most similar to the conditions in the mainstream process. Constraints limit the ability to reduce the size of the activated sludge process by bioaugmentation due to the ability to transfer sufficient oxygen at low aerobic SRTs without causing oxygen depletion, sludge bulking or floc breakup.

9. Randall, C.W. and ,Ubay. C., E., *Modification and Expansion of a Pure Oxygen WWTP for Biological Nutrient Removal*. Water Science & Technology, 2001. 44(1): p. 167-172.

A pure oxygen activated sludge system was converted to a Virginia Initiative Process (VIP) configuration BNR system and compared to a side-by-side modified University of Cape Town (MUCT) system. The processes provided an effluent total phosphorus concentration of 2 mg/L however, they were not able to produce a total nitrogen less than 10 mg/L the Chesapeake Bay standard.

10. Sears, K., J.A. Oleszkiewicz, and P. Lagasse, *Nitrification in Pure Oxygen Activated Sludge Systems*. Journal of Environmental Engineering, 2003. 129(2): p. 130-135.

The objective of the study was to determine if pH depression could be alleviated by alkalinity recovery through denitrification in an HPO system. The work was done at the University of Manitoba using laboratory scale reactors fed with primary effluent. When denitrification was not performed, headspace carbon dioxide reached 15% by volume. This, in conjunction with low alkalinity, dropped the pH to 5.5. At this pH and a temperature of 24 degrees C, and SRT of 12 days was required for nitrification. When denitrification was practiced, the pH of the mixed liquor was 6.4 and only 5.6 days were required for nitrification.

The specfic nitrifier growth rate at 12 degrees C was observed to be about 50 percent of that at 24 degrees C. For a pH of 6.0 to 6.3 the specific nitrifier growth rate was 0.12 to 10.15 d^{-1}. For 24 degrees C and pH of 5.0 to 6.1 the specific nitrifier growth rate was 0.25 to 0.30 d^{-1}.

Pre-denitrification restored some of the alkalinity and stripped off carbon dioxide from the recycle stream.

11. Sierra, N., et al., *Whole-Plant Simulations for Two Pure-Oxygen Activated Sludge Plants in San Francisco*. Proceedings of the Water Environment Federation, 2006.: p. 4291-4308.

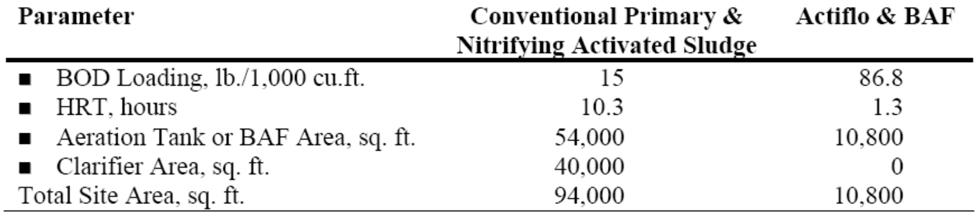
The City of San Francisco operates two HPOAS facilties – the Southeast Plant and the Oceanside Plant. Settling column tests, clarifier stress tests and BioWin modeling of the plant processes were used to evaluate plant capacity under varying hydraulic and organic loading conditions.

12. Slack, D., *Managing nutrient pollution*. Water and Wastes Digest, 2008. 48(5): p. 32.

Describes the Howard F. Curren WWTP (in Tampa Bay area of Florida) which uses HPO plus nitrification and denitrification.

13. Vik, T.E. and M. Surwillo, *Site Constraints Ammonia Limits Peak Wet Weather Flows = High Rate Treatment Biosolids Technology For The Heart of the Valley Metropolitan Sewerage District*. Proceedings of the Water Environment Federation, 2007.: p. 3452-3466.

The Heart of the Valley WWTP is a HPOAS facility located in Kaukauna, WI. The facility needed to meet a 3.6 mg/L effluent ammonia and, due to site constraints, selected a biological aerated filter (BAF) using a Biostyr for carbonaceous removal and nitrification. The existing HPOAS was decommissioned and the reactors used for other purposes. A size comparison between conventional primary clarification and nitrifying activated sludge vs. ballasted sedimentation (Actiflo) and the BAF is shown below. The Actiflo™ plus BAF represented a significant savings in space.



Parameter	Conventional Primary & Nitrifying Activated Sludge	Actiflo & BAF
■ BOD Loading, lb./1,000 cu.ft.	15	86.8
■ HRT, hours	10.3	1.3
■ Aeration Tank or BAF Area, sq. ft.	54,000	10,800
■ Clarifier Area, sq. ft.	40,000	0
Total Site Area, sq. ft.	94,000	10,800

14. Vinci, P.J., et al., *Pure Oxygen Plus Nitrification? Biowin Modeling Plus Full-Scale Experience*. Proceedings of the Water Environment Federation, 2007.: p. 1550-1570.

Experience indicates that low reactor pH, SRT limitations, relatively high mixed liquor concentration, increased foaming potential, temperature etc. inhibit nitrification/denitrification in HPO activated sludge plants. BioWin® modeling with limited field testing at Hollywood (48.75 mgd), Miami South District WWTP (112.5 mgd) supplemented by operating data at Curren AWWTP (in Tampa Bay and 96 mgd) in Florida support that with proper control and operating conditions, nitrogen removal can be achieved.

At Miami South District limited nitrification was achieved at an SRT of 3 to 5 days. For denitrification, oxygenation equipment was removed from the fifth of six stages, replaced with low energy mixers and converted to an anoxic zone. This system was capable of achieving less than 1 mg/L nitrite and 3 mg/L of nitrate plus nitrite on a relatively consistent basis.

The Curren AWWTP uses a two stage carbonaceous plus clarification followed by nitrification plus clarification followed by denitrification filters. Annual average TN limit is 3mg/L with 5 mg/L a daily maximum. At the Curren AWWTP achieving total N limits of 3 mg/L are likely not cost effective based on BioWin® modeling. Air activated sludge has a significant economic advantage.

BioWin® Modeling at Hollywood WWTP showed that an HPO-MLE process with 5.5 days of aerobic SRT resulted in a 59 percent removal of TN. If the aerobic SRT was extended to 12 days, 90 percent TN reduction could be achieved and to achieve less than 3.0 mg/L TN, 13.6 days of aerobic SRT were required. By comparison a conventional air activated sludge using the MLE process with a secondary anoxic zone was able to achieve less than 3.0 mg/L TN.

15. Kaldnes. *The Compact Solution for Biological Wastewater Treatment, The Kaldnes Moving Bed™ Process*, product literature, undated.

Decribes technical features of the media: total surface area of 800 m2/m3 in bulk, protected surface area of 500 m^2/m^3, nitrification rate of 400 g ammonia-$N/m^3/d$ at 15 degrees C, denitrification rate of 670 g NOx-$N/m^3/d$ at 15 degrees C.

16. Metcalf & Eddy revised by Tchobanoglous, G., Burton, F. L., and H. D. Stensel. *Wastewater Engineering Treatment and Reuse*, 4th ed. McGraw Hill, Boston, 2003, pg. 952-971

There are at least 10 different variations of processes in which a packing material is suspended in the aeration tank of an activated sludge process. Captor® and Linpor® use a sponge type foam pad. Results show that nitrification can occur at lower SRT values than for conventional activated sludge without internal packing. Kaldnes developed a technology called moving bed biofilm reactor (MBBR) by adding cylindrically shaped polyethylene carrier elements to the reactor. The packing fills 25 to 50 percent of the volume of the reactor.

17, Water Environment Federation. *Design of Municipal Wastewater Treatment Plants*, 5th ed., WEF and ASCE, WEF Press, McGraw Hill, New York, 2010, pg 13-36 and following.

Nitrification with MBBR is in the range of 0.7 to 1.2 $g/m^2/d$ when Total BOD_5 loading is 1 to 2 $g/m^2/d$. Nitrification rates deceased as the BOD_5 loading increased and there is essentially no nitrification when the BOD_5 loading exceeded 5 $g/m^2/d$. Nitrification can be achieved as a combined carbonaceous/nitrification system or as an “add-on.”

Submerged attached growth processes such as Biostyr® and Biofor® are also discussed.

18. Thomson, PJH; Wang, G.; Wimmer; Martin, J.Mukira, D. *Attenuation of Nitrification Inhibition in a High Purity Oxygen Secondary Treatment Reactor*, Proceedings of the Water Environment Federation, 2005.: p. 7321-7333

The Patapsco WTP is a HPOAS plant located in Baltimore, MD and discharges into the Chesapeake Bay and must meet 3 mg/L annual average total nitrogen and 0.3 mg/L total phosphorus limits. A demonstration project was operated intermittently for several years which converted one of the 6 HPO reactors to an MLE/A_2O process (Modified Ludzak Ettinger, Anaerobic, Anoxic, Oxic). Caustic soda was fed to control pH and the hydraulic retention time in the reactors was increased to allow for nitrification. The process was unstable and nitrification was inhibited periodically. The inhibition was believed to be due to substances present in one of the influent sewers. An extensive investigation was conducted to determine the source of the inhibition but no single compound was found. The inhibition was believed to be a combination of substances that when together brought about the inhibition.

Additional pilot testing was performed using activated sludge NDN, Biofor®, Biostyr®, and Severn Trent’s SAF (submerged aerated filter). All performed well. (see Wimmer et.al. below)

19. Riska, Ron; Husband, Joseph A.; Kos, Peter; Johansen, Richard. *Pilot Scale Tests of a Unique Approach For BNR Upgrade of a Short SRT High Purity Oxygen System at Pima County, AZ*, Proceedings of the Water Environment Federation, 2004. p. 258-284.

The facility was the Ina Road HPOAS facility in Tucson, AZ, has a 25 mgd design flow which also receives anaerobically digested sludge from the 41 mgd Rogers Road facility. The InNitri™ process was piloted. This process requires the addition of a small aeration tank and clarifier to treat the centrate return stream and growing nitrifiers. The system is about 2 to 5% of the main stream aeration tankage. Alkalinity addition is provided to the centrate treatment system.

The study demonstrated the centrate at 800 mg/L ammonia-N could be completely nitrified to an effluent concentration of 0 mg/L ammonia-N. Operation of the HPO system with an initial anoxic zone was stable. When seeded with nitrifiers from the centrate nitrification system, the HPO system removed an average of 20 mg/L of ammonia-N. When seeding stopped, nitrification performance decreased.

The HPOAS system has a pre-anoxic zone, an HPO aeration zone and a final stage using air in an open reactor to strip excess carbon dioxide from the mixed liquor before it is recycled.

Data from the pilot plant did not demonstrate that ammonia-N could be reduced to very low levels however. This may be an artifact of the pilot testing itself.

20. Wimmer, RF; Wang, G.; Tomaskovic, P; Martin, J. *Pilot Testing of Two-Sludge ENR Systems, Success Despite Murphy*. Proceedings of the Water Environment Federation, 2005. p. 1919-1939.

The Patapsco WTP is a HPOAS plant located in Baltimore, MD and discharges into the Chesapeake Bay and must meet 3mg/L annual average total nitrogen and 0.3 mg/L total phosphorus limits. An add-on second stage activated sludge process for nitrification complete with clarifiers followed by a denitrfication filter using methanol was piloted along with a biological aerated filter for nitrification followed by a denitrification filter with methanol. Three suppliers of BAFs were piloted – Severn Trent SAF, Biostyr®, and Biofor®.

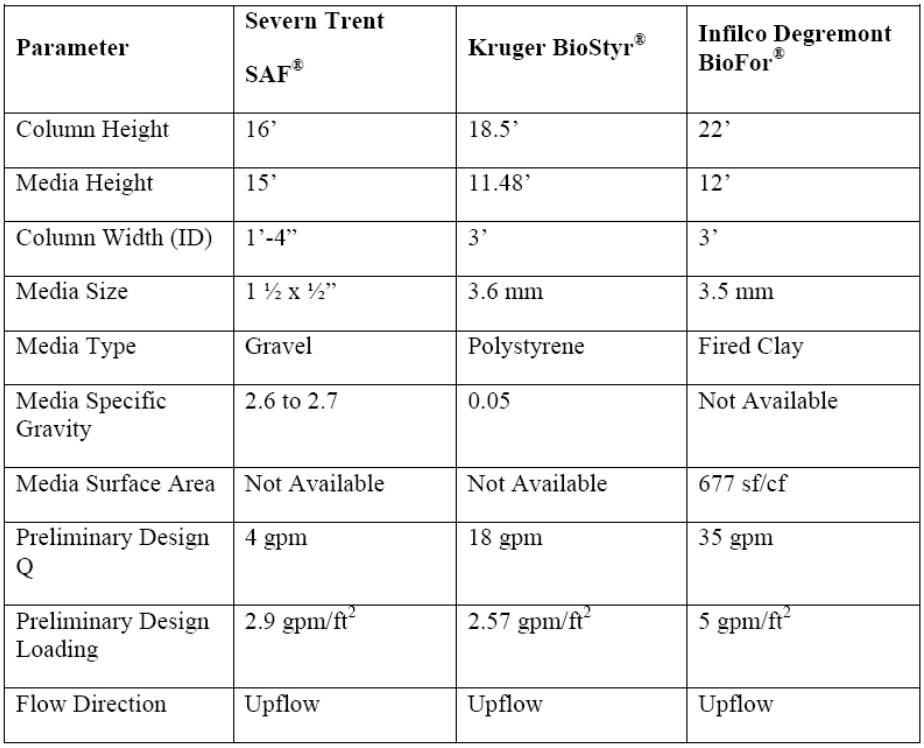
The 2-stage activated sludge process operated successfully for 10 months without nitrification inhibition which limited the first stage HPOAS. The BAF processes reliably nitrified to 1 mg/L ammonia-N when loaded at or near the design level and the wastewater temperature was at the design level. The ability to nitrify effectively and consistently is highly dependent on the media volume. Ammonia breakthrough occurred when the load exceeded the design point and the wastewater temperature fell below 12 degrees C.

The BAF continued to fully nitrify until a maximum load is reached. At this point either the ammonia cannot fully diffuse into the biofilm or insufficient oxygen is being transferred into the biofilm. The maximum load must be determined on an empirical basis and extrapolated to the design configuration.

For a lightly loaded BAF, a stable, healthy population of nitrifiers will not be established throughout the depth of the media and when loading increases there may be insufficient nitrifiers available when needed. The filters should be operated in a concentration range close to the design load to maintain a complete bed of nitrifiers.

The design characteristics of the pilot BAF units are presented below.

Table 2 BAF Pilot Unit Characteristics



Parameter	Severn Trent SAF®	Kruger BioStyr®	Infilco Degremont BioFor®
Column Height	16’	18.5’	22’
Media Height	15’	11.48’	12’
Column Width (ID)	1’-4”	3’	3’
Media Size	1 ½ x ½”	3.6 mm	3.5 mm
Media Type	Gravel	Polystyrene	Fired Clay
Media Specific Gravity	2.6 to 2.7	0.05	Not Available
Media Surface Area	Not Available	Not Available	677 sf/cf
Preliminary Design Q	4 gpm	18 gpm	35 gpm
Preliminary Design Loading	2.9 gpm/ft^2	2.57 gpm/ft^2	5 gpm/ft^2
Flow Direction	Upflow	Upflow	Upflow

SUMMARY

There is not a large amount of reference material on nitrification in HPO facilities, but what there is concludes that achieving nitrification (necessary for nitrogen removal via denitrification to occur) is not realistic at the SRTs commonly found in the HPO systems. An open final reactor which will strip carbon dioxide in combination with denitrification for alkalinity recovery and long SRT aerobic system (perhaps approaching 12 to 14 days) is necessary. At JWPCP this would require construction of more reactors to accommodate the longer SRT.

Suspended growth nitrification systems can follow HPO facilities as is the case at the Curren AWWTP in the Tampa Bay area, but this too would add significant reactor volume plus the need for clarifiers for the nitrification reactors. It is likely this would more than double the size of the existing system at JWPCP. A moving bed biofilm reactor (MBBR) using biofilm carriers, such as Kaldnes may be an option.[1]

Submerged attached growth processes such as Biostyr® and Biofor® are well proven and do not need a follow-on clarification process. For the purposes of this cost analysis, submerged attached growth processes will be used. However, this is not to say this is the only system which can achieve the results.

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[1] The Sanitation Districts obtained a proposal for a tertiary MBBR from IDI; however the price was higher and the space requirements greater than the biologically aerated filters discussed later in this study and the basis for the cost estimates.

SECTION 3
NITRIFICATION AND DENITRIFICATION PROCESS DESIGN CRITERIA

BACKGROUND

Based on the need for the Sanitation Districts to ensure conformance with effluent discharge limits, if imposed, only thoroughly proven processes will be considered for the process design. For purposes of this cost analysis, submerged, fixed film processes will be considered, e.g., Kruger's Biostyr™ and IDI's Biofor™.

In December 2008, the Sanitation Districts received proposals from Kruger and IDI for their respective processes to meet an effluent Total Inorganic Nitrogen Limit of 10 mg/L or less for a design capacity of 400 mgd. Secondary effluent quality provided to the equipment suppliers was roughly the average influent nitrogen species. In March 2009, the Sanitation Districts asked the two suppliers to provide a cost if the system were staged in modules with design flows of 100 and 200 mgd. These proposals provided design criteria, sizing, concrete quantities, sludge production, methanol requirements etc. Because the Sanitation Districts practice is to design for regulatory compliance on the basis of the 99th percentile, the costs and data from the December 2008 proposals had to be adjusted. The adjustment was done on the basis of ammonia-N loading and nitrate-N loading and removal requirements. This will be discussed later in this section.

SITE LOCATION

An aerial view of the JWPCP is provided in Figure 3-1. The JWPCP currently provides preliminary and primary treatment and biosolids handling on a site on the west side of Figueroa Street, north of Lomita Avenue. Secondary Treatment is provided on the west side of Figueroa St. Existing secondary treatment is provided in four 100 mgd batteries using on-site generated (cryogenically produced) high purity oxygen activated sludge (HPOAS). Each battery is comprised of 2 parallel trains. The effluent from the secondary clarifiers is collected in a large, below ground reinforced concrete box conduit that exits the southeast corner of Battery A of the HPOAS system. At the point where it exits Battery A, there is a double reinforced concrete box conduit estimated to be 12 ft x 12 ft (each barrel) which leads to the outfall pump station. The location where the flow leaves Battery A is the ideal location to construct a diversion/overflow structure for the proposed nitrification/denitrification (NdN) processes.

The NdN facility will be located on the old Fletcher Oil Property which is now owned by the Sanitation Districts. This site is in the final stages of being "cleaned up" by Fletcher. This property contains some substructures and easements which affect the design and siting of the NdN facility. See Figure 3-2.

- There is a Los Angeles County Department of Public Works easement which crosses the southerly portion of the property. This is the location for County Project No. 690, the Panama Avenue Carson Drain. The drain is a box culvert 10.5 ft wide by 12 ft high and slopes from east to the southeast. To properly use the site, this drain is recommended to be relocated to follow the east and south property lines. The cost for this has been included in the project cost estimate.
- There is a 72-in diameter LACSD trunk sewer that cuts through the property about 700 ft north of the centerline of Lomita Avenue. It is not considered necessary to relocate the existing trunk sewer; however, the NdN processes will need to be situated such that additional load stresses are not imposed on the trunk sewer..
- There is a petroleum pipeline easement shown that crosses the property from east to west. It is not known if this is still active. It does not interfere at this time with the layout however.

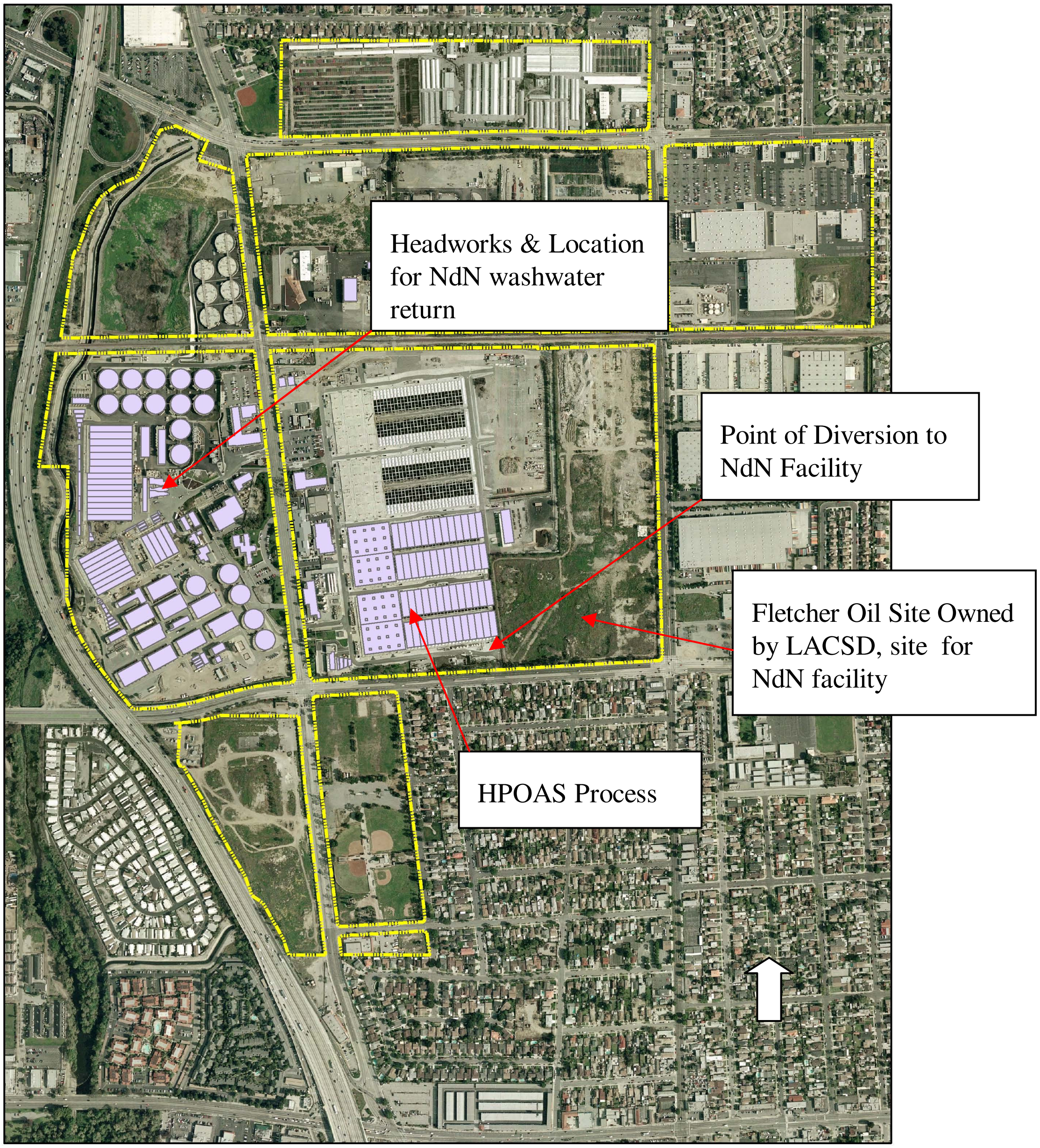
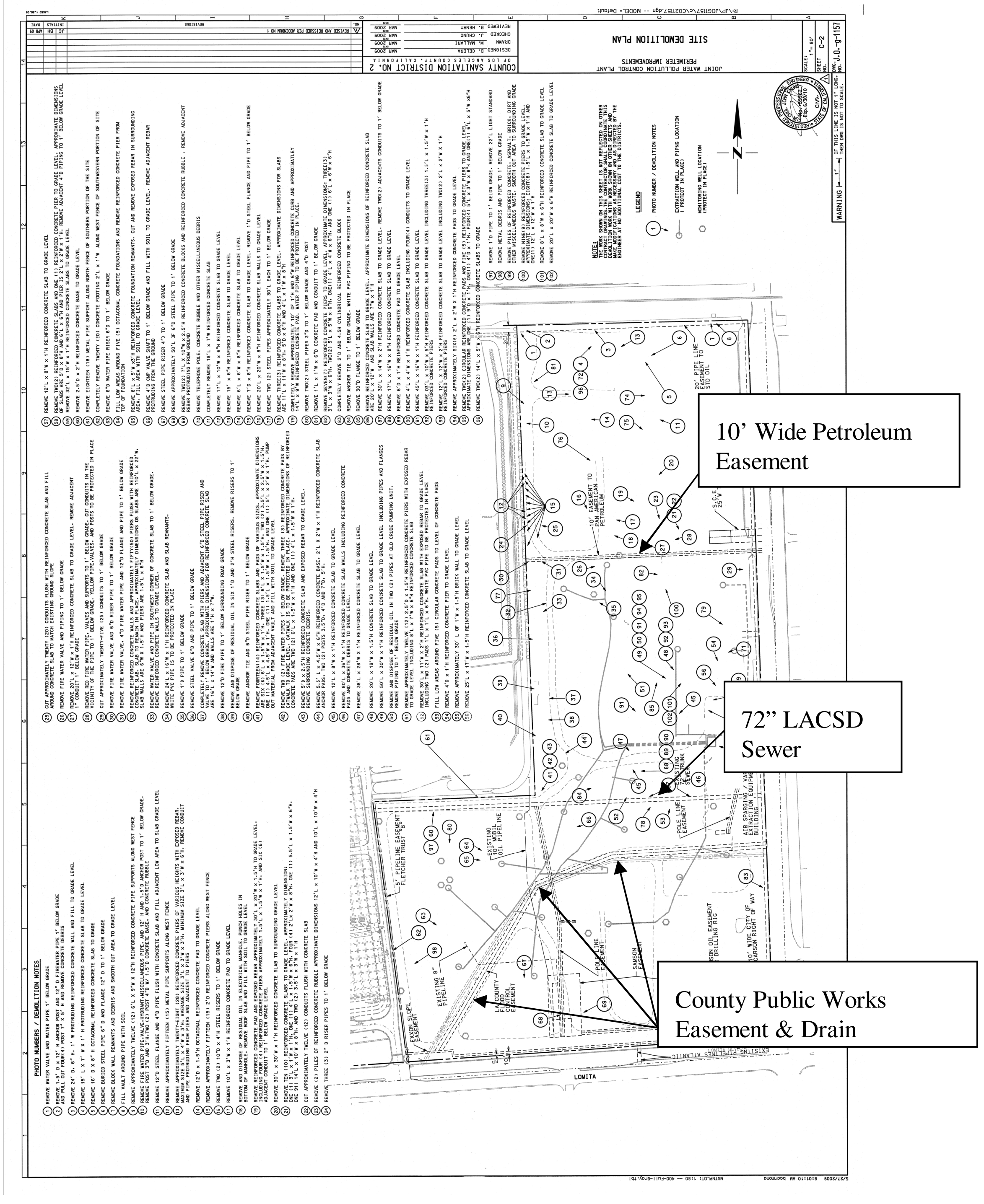


Figure 3-1
Aerial View of JWPCP



10’ Wide Petroleum Easement

72” LACSD Sewer

County Public Works Easement & Drain

Figure 3-2
Site Plan of Old Fletcher Oil Property

NITRIFICATION-DENITRIFICATION PROCESS DESCRIPTION

Nitrification System

Secondary effluent will be diverted at a new diversion structure constructed at the southeast corner of the HPOAS as shown in Figure 3-1. From there the secondary effluent will flow in a double barrel reinforced concrete box to the proposed nitrification facility influent pump station. A series of variable speed vertical, mixed flow pumps (8 duty and 2 standby) that will lift the secondary effluent to the influent of the nitrification process. Just downstream from the diversion facility, a lime feed system will be installed to maintain sufficient alkalinity in the nitrified effluent. The proposed nitrification process is a submerged media, biologically active filter. Nitrifying microorganisms grow on the media and convert the ammonia-N in the secondary effluent to nitrate-N in the presence of oxygen. The type of media and mode of operation varies from supplier to supplier but for purposes of this cost estimate, the Kruger Biostyr ™ is used. Final selection will depend on the final design and equipment supplier final quotations. By using Biostyr™ in this study is for convenience only; there is no intent to exclude others. The proposed nitrification system consists of 4 batteries of nitrification cells.

The nitrification system is backwashed with air and water once per day to keep the microorganism growth under control. This water along with the solids flow to a “mudwell” for equalization. From there the solids and washwater are pumped back to the JWPCP headworks to be retreated. A 39-inch diameter pipeline (54-inch diameter in Option 2) is installed for this purpose.

Denitrification System

The nitrified effluent flows out of the nitrification process through pipes to the denitrification system. The denitrification system is located vertically lower than the nitrification system to permit gravity flow from the nitrification system to the denitrification system thereby eliminating second stage pumping. The denitrification system is similar in appearance to the nitrification system except that the denitrification takes place in the absence of oxygen. A carbon source such as methanol is fed to the influent to the denitrification system to provide carbon for microbial cell synthesis. The effluent from the denitrification process flows through double barrel reinforced concrete box back to the existing conduit leading to the outfall pump station.

A methanol feed and storage system will be constructed in a contained area near the denitrification facility. Methanol is not the only carbon source that can be used, but it is the most common. During final design other carbon sources should be investigated as methanol requires special storage and handling since it is a flammable liquid. MicroC™, manufactured by Environmental Operating Solutions is a non-flammable alternative to methanol. However it is a bit more expensive. Its use should be evaluated during the final design.

The denitrification system is similarly backwashed with water and air scour to keep the biomass under control. This waste washwater collects in a mudwell and is then pumped back to the JWPCP headworks in the same 54-in pipeline as the nitrification system waste washwater.

Flow Control

The NdN facility is designed for an average day flow of 400 mgd and a peak flow of 540 mgd. However, peak hydraulic flows up to 700 mgd are possible. There is no intent to take any flow greater than 540 mgd through the NdN facility. The flow through the NdN facility is controlled by the nitrification system influent pumps which are designed to limit the flow to 540 mgd. For flows in excess of 540 mgd, an overflow weir structure should be designed into the secondary effluent diversion structure. During high flows in excess of 540 mgd, the water level in the secondary effluent conduit leading from the HPOAS to the nitrification system pumps will build up and then overflow the weir and then on to the outfall pump station. This diversion weir will need to accommodate about 250 cubic feet per second (cfs) with relatively low weir head. A 25-ft long weir is needed to limit the weir head to 2.5 feet. Constructing this diversion structure will be costly and difficult as the entire plant flow will have to be bypassed. Some by-pass pumping will be needed. But this is a design issue and will not be addressed at this time.

Option 1 (TIN < 33.6 mg/L)

The denitrification system for Option 1 will consist of a single battery of denitrification cells designed to achieve a TIN < 10 mg/L. The denitrified effluent will be blended with the fully nitrified effluent in a 77.5%/22.5% percent blend, i.e., 310 mgd average daily flow of nitrified effluent with 90 mgd average daily flow of denitrified effluent. Flows over or under 400 mgd will be split in the same proportion. At design peak flow of 540 mgd, 415 mgd of nitrified effluent will be blended with 125 mgd of denitrified effluent. See Figure 3-3.

The nitrified effluent will flow in a pair of 120 inch diameter pipes to a gravity diversion/over flow structure. A portion of the nitrified effluent (90 mgd) will be diverted to the denitrification process with the excess flow discharged to a conduit leading to the outfall. Flow to the denitrification process will be controlled with a modulating butterfly valve through a venturi or magnetic flow meter. The system will be designed so the flow proportions can be adjusted.

Option 1 will be laid out and designed to allow expansion of the battery should more flow and greater levels of treatment ever be required in the future. Piping will be designed to accommodate full denitrification of the effluent should this ever be a requirement in the future.

Option 2 (TIN < 10 mg/L)

The denitrification system for Option 2 will consist of a four batteries of denitrification cells designed to achieve a TIN < 10 mg/L.

The nitrified effluent will flow in a pair of 120 in diameter pipes to a gravity diversion/over flow structure. A portion of the nitrified effluent (up to 100 mgd average daily flow) will be diverted to each of the denitrification batteries. Flow to each of the denitrification batteries will be controlled with a modulating butterfly valves through individual venturi or magnetic flow meters. The system will be designed so the flow proportions can be adjusted.

See Figure 3-4.

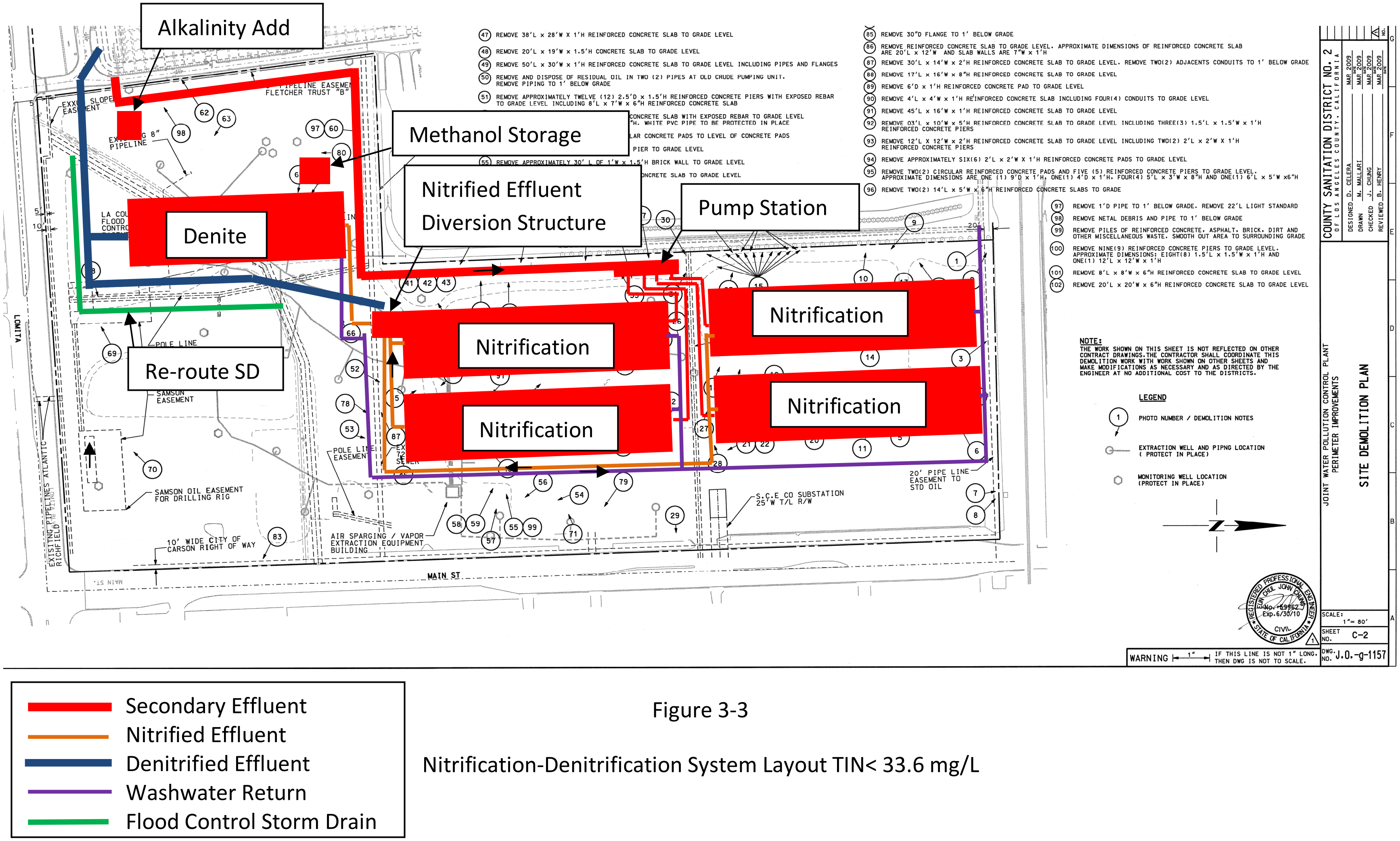
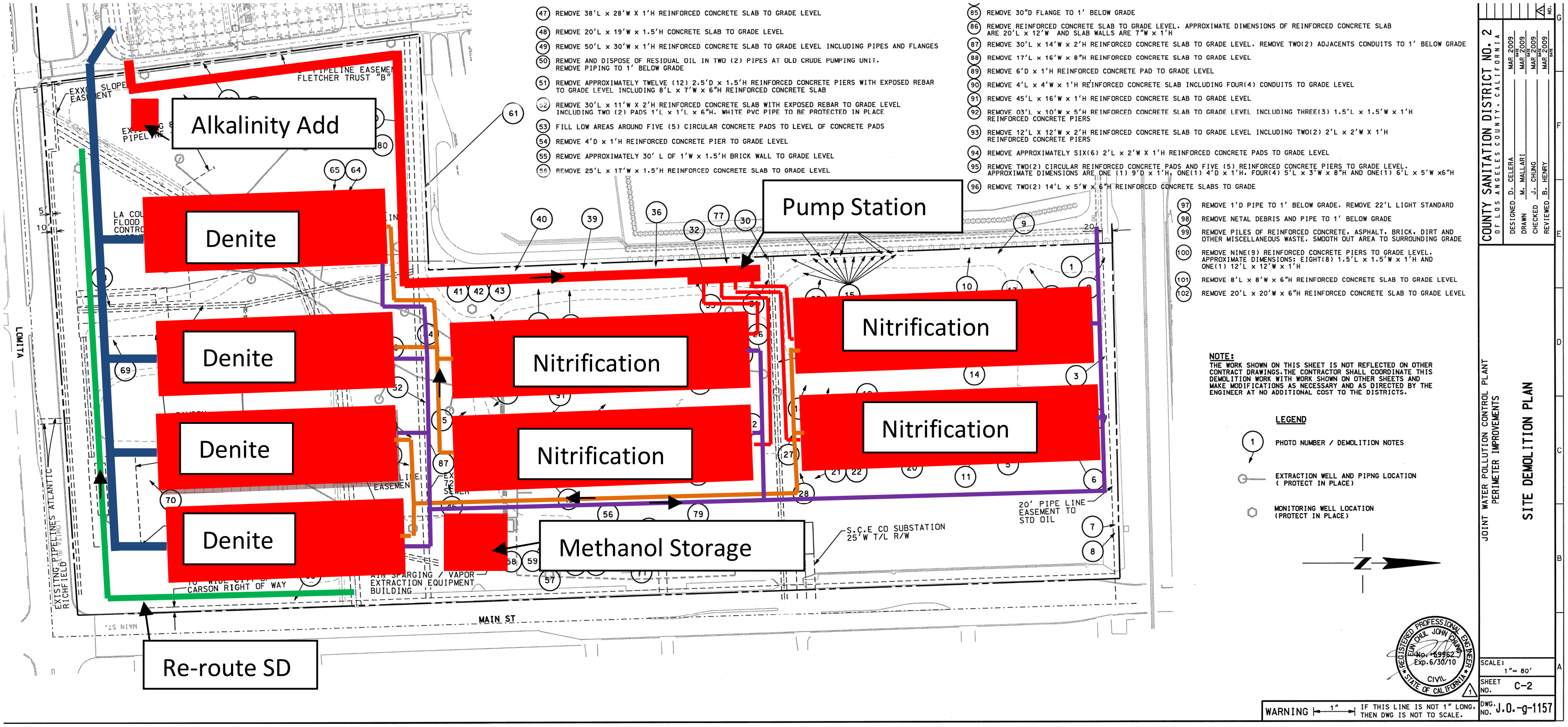


Figure 3-3

Nitrification-Denitrification System Layout TIN< 33.6 mg/L



(47) REMOVE 38'L x 28'W X 1'H REINFORCED CONCRETE SLAB TO GRADE LEVEL

(48) REMOVE 20'L x 19'W x 1.5'H CONCRETE SLAB TO GRADE LEVEL

(49) REMOVE 50'L x 30'W x 1'H REINFORCED CONCRETE SLAB TO GRADE LEVEL INCLUDING PIPES AND FLANGES

(50) REMOVE AND DISPOSE OF RESIDUAL OIL IN TWO (2) PIPES AT OLD CRUDE PUMPING UNIT. REMOVE PIPING TO 1' BELOW GRADE

(51) REMOVE APPROXIMATELY TWELVE (12) 2.5'D x 1.5'H REINFORCED CONCRETE PIERS WITH EXPOSED REBAR TO GRADE LEVEL INCLUDING 8'L x 7'W x 6"H REINFORCED CONCRETE SLAB

(52) REMOVE 30'L x 11'W X 2'H REINFORCED CONCRETE SLAB WITH EXPOSED REBAR TO GRADE LEVEL INCLUDING TWO (2) PADS 1'L x 1'L x 6"H. WHITE PVC PIPE TO BE PROTECTED IN PLACE

(53) FILL LOW AREAS AROUND FIVE (5) CIRCULAR CONCRETE PADS TO LEVEL OF CONCRETE PADS

(54) REMOVE 4'D x 1'H REINFORCED CONCRETE PIER TO GRADE LEVEL

(55) REMOVE APPROXIMATELY 30' L OF 1'W x 1.5'H BRICK WALL TO GRADE LEVEL

(56) REMOVE 25'L x 17'W x 1.5'H REINFORCED CONCRETE SLAB TO GRADE LEVEL

(85) REMOVE 30"D FLANGE TO 1' BELOW GRADE

(86) REMOVE REINFORCED CONCRETE SLAB TO GRADE LEVEL. APPROXIMATE DIMENSIONS OF REINFORCED CONCRETE SLAB ARE 20'L x 12'W AND SLAB WALLS ARE 7"W x 1'H

(87) REMOVE 30'L x 14'W x 2'H REINFORCED CONCRETE SLAB TO GRADE LEVEL. REMOVE TWO(2) ADJACENTS CONDUITS TO 1' BELOW GRADE

(88) REMOVE 17'L x 16'W x 8"H REINFORCED CONCRETE SLAB TO GRADE LEVEL

(89) REMOVE 6'D x 1'H REINFORCED CONCRETE PAD TO GRADE LEVEL

(90) REMOVE 4'L x 4'W x 1'H REINFORCED CONCRETE SLAB INCLUDING FOUR(4) CONDUITS TO GRADE LEVEL

(91) REMOVE 45'L x 16'W x 1'H REINFORCED CONCRETE SLAB TO GRADE LEVEL

(92) REMOVE 03'L x 10'W x 5'H REINFORCED CONCRETE SLAB TO GRADE LEVEL INCLUDING THREE(3) 1.5'L x 1.5'W x 1'H REINFORCED CONCRETE PIERS

(93) REMOVE 12'L X 12'W x 2'H REINFORCED CONCRETE SLAB TO GRADE LEVEL INCLUDING TWO(2) 2'L x 2'W X 1'H REINFORCED CONCRETE PIERS

(94) REMOVE APPROXIMATELY SIX(6) 2'L x 2'W X 1'H REINFORCED CONCRETE PADS TO GRADE LEVEL

(95) REMOVE TWO(2) CIRCULAR REINFORCED CONCRETE PADS AND FIVE (5) REINFORCED CONCRETE PIERS TO GRADE LEVEL. APPROXIMATE DIMENSIONS ARE ONE (1) 9'D x 1'H, ONE(1) 4'D x 1'H, FOUR(4) 5'L x 3'W x 8"H AND ONE(1) 6'L x 5'W x6"H

(96) REMOVE TWO(2) 14'L x 5'W x 6"H REINFORCED CONCRETE SLABS TO GRADE

(97) REMOVE 1'D PIPE TO 1' BELOW GRADE. REMOVE 22'L LIGHT STANDARD

(98) REMOVE NETAL DEBRIS AND PIPE TO 1' BELOW GRADE

(99) REMOVE PILES OF REINFORCED CONCRETE, ASPHALT, BRICK, DIRT AND OTHER MISCELLANEOUS WASTE. SMOOTH OUT AREA TO SURROUNDING GRADE

(100) REMOVE NINE(9) REINFORCED CONCRETE PIERS TO GRADE LEVEL. APPROXIMATE DIMENSIONS: EIGHT(8) 1.5'L x 1.5'W x 1'H AND ONE(1) 12'L x 12'W x 1'H

(101) REMOVE 8'L x 8'W x 6"H REINFORCED CONCRETE SLAB TO GRADE LEVEL

(102) REMOVE 20'L x 20'W x 6"H REINFORCED CONCRETE SLAB TO GRADE LEVEL

NOTE:
THE WORK SHOWN ON THIS SHEET IS NOT REFLECTED ON OTHER CONTRACT DRAWINGS.THE CONTRACTOR SHALL COORDINATE THIS DEMOLITION WORK WITH WORK SHOWN ON OTHER SHEETS AND MAKE MODIFICATIONS AS NECESSARY AND AS DIRECTED BY THE ENGINEER AT NO ADDITIONAL COST TO THE DISTRICTS.

LEGEND

① PHOTO NUMBER / DEMOLITION NOTES

EXTRACTION WELL AND PIPNG LOCATION (PROTECT IN PLACE)

MONITORING WELL LOCATION (PROTECT IN PLACE)

COUNTY SANITATION DISTRICT NO. 2
OF LOS ANGELES COUNTY, CALIFORNIA

DESIGNED D. CELERA MAR 2009
DRAWN M. MALLARI MAR 2009
CHECKED J. CHUNG MAR 2009
REVIEWED B. HENRY MAR 2009

JOINT WATER POLLUTION CONTROL PLANT
PERIMETER IMPROVEMENTS

SITE DEMOLITION PLAN

SCALE: 1"= 80'
SHEET NO. C-2
DWG. NO. J.O.-g-1157

WARNING 1" IF THIS LINE IS NOT 1" LONG, THEN DWG IS NOT TO SCALE.

🟥 Secondary Effluent
🟧 Nitrified Effluent
🟦 Denitrified Effluent
🟪 Washwater Return
🟩 Flood Control Storm Drain

Figure 3-4

Nitrification-Denitrification System Layout TIN< 10 mg/L

SUMMARY DESIGN CRITERIA FOR NITRIFICATION FACILITY

Table 3-1 presents the summary design parameters for the nitrification system based on the Kruger Biostyr™ Process. As stated before, the intent is not to limit the process suppliers; but rather to limit the number of permutations in preparing this cost estimate. The nitrification system design presented in Table 3-1 will be the same regardless of the final effluent TIN. The reason is the ammonia-N limit of 0.17 mg/L is the controlling factor.

It should be pointed out that achieving a limit of 0.17 mg/L ammonia-N as a maximum daily limit will be difficult to achieve since upsets to the nitrification process can easily occur. This should be taken into consideration when the final effluent limits and duration are being considered as the 0.17 mg/L ammonia-N concentration is below the level that practical treatment technologies can provide on a consistent basis. The nitrification system will be conservatively designed, but even so, there will be excursions. The use of a fixed film process, such as Biostyr™ or Biofor™, minimizes the frequency and duration of the excursions as these systems are not subject to "washout" of the biomass as suspended growth systems. On a monthly or annual level, the 0.17 mg/L ammonia-N should be able to be met assuming careful operation and monitoring of the influent water quality for toxics, alkalinity, pH, and avoiding rapid changes in influent flow rate.

Table 3-1
Nitrification System Design Criteria

TIN Influent	40.2 mg/L
NO_3-N Influent	0.2 mg/L
TIN Effluent	40.2
NH_3-N Effluent	0.17 mg/L
NO_2-N Effluent	0.17 mg/L
Nitrification Required	39.6 mg/L (40.2- 0.17-0.17-0.2)
Nitrification Load Total all Batteries	60,050 kg NH_3-N/d
Nitrification Loading Rate Design	1 kg NH_3-N/m_3/d
Number of Batteries	4
Number of Cells/Battery	22
Total Number of Cells	88
Size of Cells	2582 sq ft
Size of Media	3.6 mm
Thickness of Media	9.84 ft (3 m)
Media Volume/Cell	720 m^3 (25,400 cu ft)
Media Volume w/1 cell in backwash/battery	533,400 cu ft/battery 15,120 cu meters
Actual Ammonia-N loading w/1 cell in backwash/battery	0.99 kg NH_3-N/m_3/d
Hydraulic Peak Loading w/1 cell in backwash/battery	1.7 gpm/sq ft
Average Hydraulic Loading w/1 filter in backwash/battery	1.3 gpm/sq ft
Waste Wash Water Production, Average	20.9 mgd
Sludge Production, Average Flow and 99th percentile nitrification	140,600 lb/d
Process Air/Cell Average	1730 scfm
Backwash Air/Cell Average	1695 scfm
Battery Footprint	567 ft x 152 ft

SUMMARY DESIGN CRITERIA FOR DENITRIFICATION FACILITY

Tables 3-2A and 3-2B present the denitrification system design criteria for Option 1 (Blended TIN < 33.6 mg/L and Option 2 (TIN < 10 mg/L) respectively

Table 3-2A
Denitrification System Design Criteria TIN <33.6 mg/L

Average Design Flow	90 mgd (390 mgd bypassed)
Peak Design Flow	125 mgd (415 mgd bypassed)
TIN Influent	40.2 mg/L
NH_3-N Influent and Effluent	0.17 mg/L
NO_2-N Influent and Effluent	0.17mg/L
NO_3-N Effluent	9.6 mg/L
Nitrate-N Removed	30.2 mg/L (40.2 -0.17-0.17-9.6)
Nitrate Load Total all Batteries	10,300 kg NO_3-N/d
Nitrate Loading Rate Design	1.12 kg NH_3-N/m^3/d
Number of Batteries	1
Number of Cells/Battery	18
Total Number of Cells	18
Size of Cells	2582 sq ft (240 sq m)
Size of Media	4.5 mm
Thickness of Media	8.20 ft (2.5 m)
Media Volume w/1 cell in backwash/battery	360,000cu ft/battery 10,200 cu meters
Actual Nitrate-N loading w/1 cell in backwash/battery	1.0 kg NO_3-N/m_3/d
Hydraulic Peak Loading w/1 cell in backwash/battery	2.0 gpm/sq ft
Average Hydraulic Loading w/1 filter in backwash/battery	1.4 gpm/sq ft
Waste Wash Water Production, Average	7.1 mgd
Sludge Production, Average Flow and 99th percentile nitrification	31,300lb/d
Backwash Air/Cell Average	1695 scfm
Methanol Required Average Flow and Average Influent Nitrate-N	9,300gal/day 61,250 lb/d
Battery Footprint	477ft x 152 ft

Table 3-2B
Denitrification System Design Criteria TIN <10mg/L

Average Design Flow	400 mgd
Peak Design Flow	540 mgd
TIN Influent	40.2 mg/L
NH_3-N Influent and Effluent	0.17 mg/L
NO_2-N Influent and Effluent	0.17mg/L
NO_3-N Effluent	9.6 mg/L
Nitrate-N Removed	30.2 mg/L (40.2 -0.17-0.17-9.6)
Nitrate Load Total all Batteries	45,800 kg NO_3-N/d
Nitrate Loading Rate Design	1.1 kg NH_3-N/m_3/d
Number of Batteries	4
Number of Cells/Battery	18
Total Number of Cells	72
Size of Cells	2582 sq ft (240 sq m)
Size of Media	4.5 mm
Thickness of Media	8.20 ft (2.5 m)
Media Volume w/1 cell in backwash/battery	360,000 cu ft/ battery 10,200 cu meters
Actual Nitrate-N loading w/1 cell in backwash/battery	1.1 kg NO_3-N/m_3/d
Hydraulic Peak Loading w/1 cell in backwash/battery	2.1 gpm/sq ft
Average Hydraulic Loading w/1 filter in backwash/battery	1.6 gpm/sq ft
Waste Wash Water Production, Average	28.5 mgd
Sludge Production, Average	139,150 lb/d
Backwash Air/Cell Average	1695 scfm
Methanol Required Average Flow and Average Influent Nitrate-N	41,250gal/day 272,300 lb/d
Battery Footprint	477ft x 152 ft

SUMMARY DESIGN CRITERIA FOR SUPPORT SYSTEMS

Tables 3-3, 3-4, 3-5 and 3-6 summarize the design criteria for the nitrification system influent pump station, the methanol feed system, alkalinity addition system and the major interconnecting conduits. These form the basis for the cost estimate in the following sections.

Table 3-3
Nitrification Influent Pump Station

Peak Flow Capacity	540 mgd 840 cfs
Average Day Flow Capacity	400 mgd 620 cfs
Number of Duty Pumps	8
Number of Standby (swing) Pumps	2
Capacity each	105 cfs
Type	Vertical Mixed Flow, Variable Speed
Horsepower	900
Pump Discharge Size	60 in
Wet Well Volume	200,000 gal
Dimensions	90 ft x 25 ft x 12 ft deep (water level change)
Construct on the end of the double barrel reinforced concrete box from HPOAS Diversion	

Table 3-4
Methanol Feed System Design Parameters

	Option 1 (Blended TIN < 33.6 mg/L	Option 2 (TIN < 10 mg/L)
Methanol Usage Average Day and Average NO_3-N	9,300 gal/d	41,250 gal/d
Methanol Unit Weight	6.6 lb/gal	
Methanol Feed Rate	3.2 lb methanol/lb NO_3-N removed	
Number of Duty Pumps	1	1
Number of Standby (swing) Pumps	1	1
Capacity each (max feed rate at peak design flow)	11 gpm	46 gpm
Type	Variable speed gear or progressing cavity	
Discharge pressure	100 psi	100 psi
Horsepower	2	3
Methanol Storage Capacity	125,000 gal	500,000 gal
Days of Storage at Ave. Use	13.5 days	12 days
No of Tanks	1	4
Capacity Each	125,000 gal	125,000 gal

Table 3-5
Alkalinity Feed System Design Parameters

Maximum Alkalinity Dose	43 mg/L as $CaCO_3$
Design Maximum Alkalinity Dose	50 mg/L as $CaCO_3$
Average Alkalinity Dose	25 mg/L as $CaCO_3$ 40% of the time
Maximum Alkalinity Feed at Peak Design Flow	225,180 lb/day as $CaCO_3$
Average Alkalinity Feed	33,400 lb/day as $CaCO_3$
Chemical used	50% Sodium Hydroxide
NaOH Unit Weight	12.72lb/gal or
Lb NaOH/gallon	6.36 lb NaOH/gal
NaOH Feed Rate at Peak Design Flow and Maximum Dose	270,960 lb/day as $CaCO_3$ 42,600 gal/d of 50% NaOH
NaOH Feed Rate Average	41,800 lb/d as NaOH 6572 gal/d of 50% NaOH
Number of Duty Pumps	1
Number of Standby (swing) Pumps	1
Capacity each (max feed rate at peak design flow)	1775 gal/hr
Type	Variable speed gear or progressing cavity
Discharge pressure	100 psi
Horsepower	3
NaOH Storage Capacity	70,000 gal
Days of Storage at Ave. Use	10.7 days
No of Tanks	2
Capacity Each	35,000 gal

Table 3-6
Major Conduit Sizes

Conduit	Peak Flow	Size
Influent to NdN Facility from HPOAS diversion structure	540 mgd 840 cfs	Double 12 ft x 12 Reinforced Concrete Box
Effluent from NdN Facility to Outfall Conduit	540 mgd 840 cfs	Double 12 ft x 12 Reinforced Concrete Box
Influent Pump Discharge to Nitrification Batteries	135 mgd 210 cfs	96 in (4 conduits, one to each Nitrification Battery)
Effluent From Individual Nitrification Batteries	135 mgd 210 cfs	96 in (4 conduits, one to each Nitrification Battery)
Waste Washwater Return to Headworks	43 cfs (TIN < 33.6 mg/L) 76.6 cfs (TIN< 10 mg/L)	39-in (Option 1) 54 in (Option 2)
Process Air to Each Nitrification Battery	38,060 scfm	36 in
From Nitrification to Denitrification Process	270 mgd (pair of batteries) 420 cfs	120 in (2 conduits, one from each pair of Nitrification Batteries)
Effluent from Each Denitrification Battery	135 mgd 210 cfs	96 in

SECTION 4
CONSTRUCTION COST ESTIMATE

Using the information in Section 3 as a basis, the cost estimate for the 400 mgd average flow (540 mgd peak flow) NdN system was developed at the budgetary stage for achieving an effluent TIN less than 33.6 mg/L (Option 1) and TIN of < 10 mg/L (Option 2). Major piping and conduits were included as was the relocation of the storm drain box culvert that crosses the old Fletcher Oil property. As described later in this section appropriate adjustments had to be made for the more stringent influent (99th percentile) and effluent requirements. Appropriate contingencies were included.

Principal assumptions and criteria in the cost estimate are:

- Reinforced concrete cast in place box conduit concrete thicknesses from CalTrans standard drawings
- Concrete quantities for the NdN facilities was obtained from the Biostyr™ proposal where the quantities for walls, slabs, elevated slabs etc. were identified. These quantities were adjusted upward and downward depending on the number of cells actually constructed.
- Cost for equipment for the NdN facilities was obtained from the Biostyr™ proposal adjusted as appropriate for the increased number of cells to meet the more stringent influent and effluent criteria
- Installation cost for the Biostyr™ equipment was estimated to be 40% of the cost of the equipment. This percentage is based on experience with this type of work.
- The excavation and backfill quantities for the NdN facilities was based on an example hydraulic profile provided by Kruger which shows the vertical relation between the nitrification facilities and the denitrification facilities. This was for different project, but does provide information on the system headloss etc. A copy is included in an Appendix.
- Large diameter pipe and pump costs were obtained from a draft study that Parsons Corporation prepared for the Southern Nevada Water Authority in 2004 updated to current costs. These costs appear reasonable and appropriate.
- Percentages were used for miscellaneous yard piping (10% of the process cost), site work and paving (5% of the process cost) and electrical and instrumentation (20% of the process cost). These are typical based on experience for this type of work.
- A contingency of 20% is included; engineering, legal, administration, and inspection costs totaling 35%. were also included.
- Disposal of surplus excavated material was not included as it was assumed this would be utilized on site or sold.
- For amortization and present worth costs an interest rate of 5% over a 20 year period was used. (The resulting present worth factor is 12.46 and the capital recovery factor is 0.080.)

- The secondary effluent diversion structure was only very roughly located and sketched out. This will be a very expensive structure because of the need to by-pass the peak hydraulic capacity of 700 mgd during the demolition of the existing double RC box conduit and construction of the diversion structure in the same location. The diversion structure includes an overflow weir to discharge flows in excess of 540 mgd directly to the outfall pump station. Also the structure should include the tie in from the denitrified effluent conduit.

SUMMARY

Tables 4-1A and 4-1B present the project costs for the two effluent options.

The total project costs can be summarized as follows:

TIN < 33.6 mg/L	\$403 million or \$1.00 /gallon/day capacity
TIN < 10 mg/L	\$578 million or \$1.45/gallon/day capacity

The costs appear reasonable when considering a new, large secondary wastewater treatment plant is on the order of \$8/gallon/day capacity.

Amortizing the cost, using the factors presented previously, i.e., converting it to an annual cost, the annualized cost would range from \$32.2 million to \$46.3 million for TIN < 33.6 mg/L and TIN < 10 mg/L respectively.

Table 4-1A
Project Cost for NdN Facilties
TIN < 33,6 mg/L

LACSD MLPA
Construction Cost Estimate for TIN < 33.6 mg/L

Item	Unit	Quantity	Materials	Installation	Materials and Installation	Cost
Site preparation	ac	18.5			$ 1,500	$ 27,750
Major Piping and Conduits						
Relocate 10.5 x 12 RC Box Flood Control Conduit	ft	800			$ 1,500	$ 1,200,000
Diversion Structure and connection to outfall channel	LS	1			$ 4,000,000	$ 4,000,000
Double 12 x 12 RC Box from Sec Clarifiers	ft	1600			$ 2,100	$ 3,360,000
Double 12 x 12 RC Box from Denit unit to Outlet Channel	ft	540			$ 2,100	$ 1,134,000
Double 12 x 12 RC Box from Denit Overflow to Outlet Channel	ft	700			$ 2,100	$ 1,470,000
96 in dia from pumps to N Units	ft	1200			$ 1,000	$ 1,200,000
120 in from N to DN Overflow structure	ft	1120			$ 1,300	$ 1,456,000
Nitrification/Denitrification Diversion Structure	LS	1			$ 950,000	$ 950,000
96 in dia from N Batteries and from DN Overflow to DN battery	ft	600			$ 1,000	$ 600,000
96 in dia from DN Units to Effluent Conduit	ft	80			$ 1,000	$ 80,000
39 in diameter waste washwater return to headworks	ft	5850			$ 425	$ 2,486,250
42 in Air supply	ft	2200			$ 475	$ 1,045,000
16 in Backwash Air N & DN	ft	2700			$ 200	$ 540,000
Subtotal						$ 19,521,250
Pump Stations						
Influent PumpStation 6 duty/2 standby 140 cfs, 55 ft, 900 hp	Connected HP	7200			$ 3,000	$ 21,600,000
Influent Pump Station Forebay,110 ft x 50 ft W x 20 ft deep (850000 gal)	gal	850000			$ 2.00	$ 1,700,000
Washwater Return incl in Equip Quote						$ -
						$ -
Subtotal						$ 23,300,000
Nitrification/Denitrification System						
BioStyr Equipment per proposal			$ 80,200,000			$ 80,200,000

Table 4-1A
Project Cost for NdN Facilties
TIN < 33,6 mg/L

BioStyr Equipment Installation	percent	40%	$ 32,080,000		$ 32,080,000
Concrete and Excavation for N	Battery	4		$ 8,018,310	$ 32,073,240
Concrete and Excavation for DN	Battery	1		$ 6,952,890	$ 6,952,890
Subtotal					$ 151,306,130
Methanol Feed System					
Storage Tanks	gal	125000		$ 3.00	$ 375,000
Metering Gear Pumps at 1 gpm	ea	2		$ 45,000	$ 90,000
Concrete Containment and Slab	cy	165		$ 500	$ 82,500
Overexcavation and Recompact	cy	500		$ 6.00	$ 3,000
Safety equip, flame arrestors etc	per tank	1		$ 20,000	$ 20,000
Subtotal					$ 570,500
					$ -
Alkalinity Addition (50% Sodium Hydroxide)					
Storage Tanks	gal	70000		$ 4.00	$ 280,000
Metering Pumps at 275 gal/hr	ea	2		$ 30,000	$ 60,000
Concrete Containment and Slab	cy	180		$ 500	$ 90,000
Overexcavation and Recompact	cy	520		$ 6.00	$ 3,120
Subtotal					$ 433,120
Subtototal Piping, NdN, Methanol and Alkalinity Addition					$ 195,158,750
Miscellaneous Yard Piping percent of process cost (NDN + Methanol + Alk)		10%		$ 152,309,750	$ 15,230,975
Miscellaneous Site Work/Paving etc as a percent of process cost		5%		$ 152,309,750	$ 7,615,488
Electrical and Instrumentation as a percent of process cost	percent	20%		$ 152,309,750	$ 30,461,950
Subtototal					$ 248,467,163
Contingencies	percent	20%		$ 248,467,163	$ 49,693,433
Subtotal					$ 298,160,595
Engineering, Legal, Admin, Inspection etc.		35%		$ 298,160,595	$ 104,356,208
Total Project Cost					$ 402,516,803

Table 4-1B
Project Cost for NdN Facilties
TIN < 10 mg/L

LACSD MLPA
Construction Cost Estimate for TIN < 10 mg/L

Item	Unit	Quantity	Materials	Installation	Materials and Installation	Cost
Site preparation	ac	24			$ 1,500	$ 36,000
Major Piping and Conduits						
Relocate 10.5 x 12 RC Box Flood Control Conduit	ft	1450			$ 1,500	$ 2,175,000
Diversion Structure and connection to outfall channel	LS	1			$ 4,000,000	$ 4,000,000
Double 12 x 12 RC Box from Sec Clarifiers	ft	1600			$ 2,100	$ 3,360,000
Double 12 x 12 RC Box from Denit unit to Outlet Channel	ft	960			$ 2,100	$ 2,016,000
96 in dia from pumps to N Units	ft	1200			$ 1,000	$ 1,200,000
120 in from N to DN	ft	830			$ 1,300	$ 1,079,000
96 in dia from N Batteries and to DN Batteries	ft	820			$ 1,000	$ 820,000
96 in dia from DN Units to Effluent Conduit	ft	600			$ 1,000	$ 600,000
54 in diameter waste washwater return to headworks	ft	5850			$ 575	$ 3,363,750
42 in Air supply	ft	2200			$ 475	$ 1,045,000
16 in Backwash Air N & DN	ft	4400			$ 200	$ 880,000
Subtotal						$ 20,538,750
Pump Stations						
Influent PumpStation 6 duty/2 standby 140 cfs, 55 ft, 900 hp	Connected HP	7200			$ 3,000	$ 21,600,000
Influent Pump Station Forebay,110 ft x 50 ft W x 20 ft deep (850000 gal)	gal	850000			$ 2.00	$ 1,700,000
Washwater Return incl in Equip Quote						$ -
						$ -
Subtotal						$ 23,300,000
Nitrification/Denitrification System						
BioStyr Equipment per proposal			$ 121,000,000			$ 121,000,000
BioStyr Equipment Installation	percent	40%		$ 48,400,000		$ 48,400,000
Concrete and Excavation for N	Battery	4			$ 8,018,310	$ 32,073,240
Concrete and Excavation for DN	Battery	4			$ 6,952,890	$ 27,811,560

Table 4-1B
Project Cost for NdN Facilties
TIN < 10 mg/L

Subtotal				$ 229,284,800
Methanol Feed System				
Storage Tanks	gal	500000	$ 3.00	$ 1,500,000
Metering Gear Pumps at 46 gpm	ea	2	$ 50,000	$ 100,000
Concrete Containment and Slab	cy	600	$ 500	$ 300,000
Overexcavation and Recompact	cy	1860	$ 6.00	$ 11,160
Safety equip, flame arrestors etc	per tank	4	$ 20,000	$ 80,000
Subtotal				$ 1,991,160
				$ -
Alkalinity Addition (50% Sodium Hydroxide)				
Storage Tanks	gal	70000	$ 4.00	$ 280,000
Metering Pumps at 275 gal/hr	ea	2	$ 30,000	$ 60,000
Concrete Containment and Slab	cy	180	$ 500	$ 90,000
Overexcavation and Recompact	cy	520	$ 6.00	$ 3,120
Subtotal				$ 433,120
Subtototal Piping, NdN, Methanol and Alkalinity Addition				$ 275,583,830
Miscellaneous Yard Piping percent of process cost (NDN + Methanol + Alk)		10%	$ 231,709,080	$ 23,170,908
Miscellaneous Site Work/Paving etc as a percent of process cost		5%	$ 231,709,080	$ 11,585,454
Electrical and Instrumentation as a percent of process cost	percent	20%	$ 231,709,080	$ 46,341,816
Subtototal				$ 356,682,008
Contingencies	percent	20%	$ 356,682,008	$ 71,336,402
Subtotal				$ 428,018,410
Engineering, Legal, Admin, Inspection etc.		35%	$ 428,018,410	$ 149,806,443
Total Project Cost				$ 577,824,853

SECTION 5
OPERATION AND MAINTENANCE COST ESTIMATE

Operation and Maintenance (O&M) costs for the 400 mgd average flow (540 mgd peak flow) NdN system are presented in this section for achieving an effluent TIN of < 10 mg/L and < 33.6 mg/L. The O and M costs include the electrical power to operate the pumps and aeration blowers, methanol and sodium hydroxide (for alkalinity addition) cost, and the costs to retreat the waste washwater which is recycled back to the headworks. In addition there are costs for labor to operate and maintain the system and parts and materials to ensure continued operation over time.

When looking at the annual O&M cost the major cost factors are electrical power for the influent pumps and process air blowers. Together they comprise about ¾ of the electrical power cost. But by far the largest share of the O&M cost is due to the methanol feed for denitrification.

Principal criteria used in the O&M cost analysis:

- Electrical power cost at $0.125/kWh (provided by LACSD)
- Operating labor at $65.00/hour including benefits. It was assumed 2.5 full time employees would be assigned to the NdN system.
- Methanol costs at $1.10/gallon (current market cost). LACSD may be able to secure a lower unit cost through bidding considering the amount that is used per day.
- Sodium hydroxide cost is $400/Dry Ton based on 50% concentration. LACSD may be able to secure a lower unit cost through bidding considering the amount that is used per day.
- Retreating the waste washwater is based on the flow rate, estimated COD and TSS and the current industrial wastewater surcharge. The current surcharge for District No. 2 is $147 per sewage unit. The $147 surcharge is broken down as follows: A = 0.3049 * flow in million gallons (MG); B = 0.3348 * COD/10^3 lb and C = 0.3603 * TSS/10^3 lb. The flow and TSS were obtained from the vendor proposals and adjusted for the influent and effluent criteria. The COD is estimated as 1.42*Volatile Suspended Solids (VSS) in the return flow. The VSS was estimated to be 0.80 * TSS. It is possible there may be some traces of methanol in the effluent which would add to the soluble COD; however, this is considered to be small compared to the COD of the VSS. Similarly there will be some non-biodegradable COD in the effluent, but this should not be included in the surcharge anyway since it will not add to the operating cost of the main liquid processing stream.
- Annual parts and materials for maintenance and operation is estimated to be 2% of the construction cost.
- A contingency of 15% was included in the costs.

SUMMARY

Tables 5-1A and 5-1B present the annual O&M costs for the two effluent options.

Table 5-1A
O and M Cost for NdN Facilities
TIN < 33.6 mg/L

LACSD MLPA

Annual Operation and Maintenance Cost Estimate for TIN < 33.6 mg/L

Item	Unit	Quantity/yr	Unit Cost	Cost	
Electrical Power					
Influent Pumps	kWhr	33710000	$ 0.125	$ 4,213,750	
Methanol Feed Pumps	kWhr	20000	$ 0.125	$ 2,500	
Alkalinity Addition Pumps	kWhr	13000	$ 0.125	$ 1,625	
Backwash Return Pumps	kWhr	1287000	$ 0.125	$ 160,875	
Process Air Blowers	kWhr	63258000	$ 0.125	$ 7,907,250	
Backwash Air Blowers(N)	kWhr	659000	$ 0.125	$ 82,375	
Backwash Air Blowers(DN)	kWhr	135000	$ 0.125	$ 16,875	
Subtotal		99082000		$12,385,250	
Labor, Chemicals & WW Processing					
Methanol	gal	3400000	$ 1.10	$ 3,740,000	
Sodium Hydroxide (50%)	gal	2400000	$ 1.27	$ 3,048,000	
Waste Washwater	MG	10300	$ 44.82	$ 461,649	Based on IW ordinance
Sludge biosolids (TSS)	1000 lbs	62750	$ 52.96	$ 3,323,497	$147/sewage unit
COD in Return (1.42 * 0.8*TSS)	1000 lbs	71284	$ 49.22	$ 3,508,285	80% of TSS is VSS
Annual Maintenance Parts & Materials	percent	2%	$ 297,020,595	$ 4,455,309	all but engineering etc.
Operating and Maintenance Labor	hours	4000	$ 65.00	$ 260,000	
Subtotal				$18,796,740	
Subtotal				$31,181,990	
Contingencies	percent	15%	$ 31,181,990	$ 4,677,299	
Total				$35,859,289	
Cost/MG				$ 245.61	

Table 5-1B
O and M Cost for NdN Facilities
TIN < 10 mg/L

LACSD MLPA
Annual Operation and Maintenance Cost Estimate for TIN < 10 mg/L

Item	Unit	Quantity/yr	Unit Cost	Cost	
Electrical Power					
Influent Pumps	kWhr	33710000	$ 0.125	$ 4,213,750	
Methanol Feed Pumps	kWhr	20000	$ 0.125	$ 2,500	
Alkalinity Addition Pumps	kWhr	13000	$ 0.125	$ 1,625	
Backwash Return Pumps	kWhr	2272000	$ 0.125	$ 284,000	
Process Air Blowers	kWhr	63258000	$ 0.125	$ 7,907,250	
Backwash Air Blowers(N)	kWhr	659000	$ 0.125	$ 82,375	
Backwash Air Blowers(DN)	kWhr	539000	$ 0.125	$ 67,375	
Subtotal		100471000		$12,558,875	
Labor, Chemicals & WW Processing					
Methanol	gal	15000000	$ 1.10	$16,500,000	
Sodium Hydroxide (50%)	gal	2400000	$ 1.27	$ 3,048,000	
Waste Washwater	MG	18000	$ 44.82	$ 806,765	Based on IW ordinance
Sludge biosolids (TSS)	1000 lbs	102200	$ 52.96	$ 5,412,931	$147/sewage unit
COD in Return (1.42 * 0.8*TSS)	1000 lbs	116099	$ 49.22	$ 5,713,892	80% of TSS is VSS
Annual Maintenance Parts & Materials	percent	2%	$ 428,018,410	$ 6,420,276	all but engineering etc.
Operating and Maintenance Labor	hours	5000	$ 65.00	$ 325,000	
Subtotal				$38,226,864	
Subtotal				$50,785,739	
Contingencies	percent	15%	$ 50,785,739	$ 7,617,861	
Total				$58,403,600	
Cost/MG				$ 400.02	

The annual O&M costs can be summarized as follows:

TIN < 10 mg/L	$35.9 million/year or $245.61/MG
TIN < 33.6 mg/L	$58.4 million/year or $400.02/MG

Looking at the project on a life cycle cost basis basis (present worth for 20 years at 5% interest), the total life cycle cost for the two alternative levels of treatment are $880 million and $1.3 billion as shown in Table 5-2.

Table 5-2
Total Present Worth over 20 years ($ millions)

	TIN < 33.6mg/L	TIN < 10 mg/L
Capital Cost	$403	$578
O&M Cost	$447	$728
Total Present Worth or Life Cycle Cost	$850	$1,306

ENERGY CONSUMPTION

The primary electrical energy consumed treating the design flow of 400 mgd for the two levels of treatment are presented below:

- TIN < 33.6 mg/L: 99.1 million kWh/year
- TIN < 10 mg/L: 100.5 million kWh/year

There is significant secondary electrical energy consumed in the production of methanol and sodium hydroxide. The quantities of these chemicals are presented in Section 3.

APPENDIX A

BACKUP SPREADSHEETS

BioStyr N Units per Battery

LACSD MLPA
Construction Cost Estimate
Nitrification Units per Battery for BioStyr

Item	Unit	Quantity	Materials	Installation	Materials and Installation	Cost
Reinforced Concrete per Battery for 20 cells						$ -
Slabs on Grade	cy	6044			$ 400	$ 2,417,600
Elevated Slabls	cy	2353			$ 600	$ 1,411,800
Walls	cy	4876			$ 500	$ 2,438,000
Support Columns	cy	945			$ 500	$ 472,500
Supporting Beams	cy	587			$ 600	$ 352,200
Subtotal for 20 cells/battery		14805				$ 7,092,100
Increase for 22 cells/battery		16286				$ 7,801,310
Excavation	cy	19700			$ 10.00	$ 197,000
Backfill and compact	cy	4000			$ 5.00	$ 20,000
Well pointing	lf	500			$ 50.00	$ 25,000
Subtotal						$ 8,018,310

LACSD MLPA
Construction Cost Estimate
TIN <10 mg/L

Item	Unit	Quantity	Materials	Installation	Materials and Installation	Cost
Reinforced Concrete per Battery						$ -
Slabs on Grade	cy	6044			$ 400	$ 2,417,600
Elevated Slabls	cy	2353			$ 600	$ 1,411,800
Walls	cy	4876			$ 500	$ 2,438,000
Support Columns	cy	945			$ 500	$ 472,500
Supporting Beams	cy	587			$ 600	$ 352,200
		14805				
Subtotal for 20 cells/battery						$ 7,092,100
Reduce for 18 cells/battery						$ 6,382,890
Overexcavation depth of 5 ft assumed	cy	51000			$ 10.00	$ 510,000
Recompaction	cy	12000			$ 5.00	$ 60,000
Well Pointing	lf	470			$ 50.00	
Subtotal						$ 6,952,890

All costs are per battery

LACSD MLPA
Electrical Power Consumption TIN < 10 mg/L

Item	Flow,cfs	Head	Efficiency	HP	KW	Hours/day	KWh/yr
Influent Pumps	620	55	0.75	5158	3848.2	24	33710000
Methanol Feed Pumps				3	2.2	24	20000
Alkalinity Feed Pumps				2	1.5	24	13000
Backwash Return Pumps	76.6	30	0.75	348	259.3	24	2272000
Process Air Blowers				9680	7221.3	24	63258000
Backwash Air Blowers(N)				110	82.1	22	659000
Backwash Air Blowers(DN)				110	82.1	18	539000

	Cells	Air flow/Cell, scfm	HP/cell	Total HP
Process Air Blowers	88	1730	110	9680

LACSD MLPA
Electrical Power Consumption TIN < 33.6 mg/L

Item	Flow,cfs	Head	Efficiency	HP	KW	Hours/day	KWh/yr
Influent Pumps	620	55	0.75	5158	3848.2	24	33710000
Methanol Feed Pumps				3	2.2	24	20000
Alkalinity Feed Pumps				2	1.5	24	13000
Backwash Return Pumps	43.4	30	0.75	197	146.9	24	1287000
Process Air Blowers				9680	7221.3	24	63258000
Backwash Air Blowers(N)				110	82.1	22	659000
Backwash Air Blowers(DN)				110	82.1	4.5	135000

	Cells	Air flow/Cell, scfm	HP/cell	Total HP
Process Air Blowers	88	1730	110	9680

BioStyr N Units per Battery

LACSD MLPA
Construction Cost Estimate
Nitrification Units per Battery for BioStyr

Item	Unit	Quantity	Materials	Installation	Materials and Installation	Cost
Reinforced Concrete per Battery for 20 cells						$ -
Slabs on Grade	cy	6044			$ 400	$ 2,417,600
Elevated Slabls	cy	2353			$ 600	$ 1,411,800
Walls	cy	4876			$ 500	$ 2,438,000
Support Columns	cy	945			$ 500	$ 472,500
Supporting Beams	cy	587			$ 600	$ 352,200
Subtotal for 20 cells/battery		14805				$ 7,092,100
Increase for 22 cells/battery		16286				$ 7,801,310
Excavation	cy	19700			$ 10.00	$ 197,000
Backfill and compact	cy	4000			$ 5.00	$ 20,000
Well pointing	lf	500			$ 50.00	$ 25,000
Subtotal						$ 8,018,310

LACSD MLPA
Construction Cost Estimate
TIN <10 mg/L

Item	Unit	Quantity	Materials	Installation	Materials and Installation	Cost
Reinforced Concrete per Battery						$ -
Slabs on Grade	cy	6044			$ 400	$ 2,417,600
Elevated Slabls	cy	2353			$ 600	$ 1,411,800
Walls	cy	4876			$ 500	$ 2,438,000
Support Columns	cy	945			$ 500	$ 472,500
Supporting Beams	cy	587			$ 600	$ 352,200
		14805				
Subtotal for 20 cells/battery						$ 7,092,100
Reduce for 18 cells/battery						$ 6,382,890
Overexcavation depth of 5 ft assumed	cy	51000			$ 10.00	$ 510,000
Recompaction	cy	12000			$ 5.00	$ 60,000
Well Pointing	lf	470			$ 50.00	
Subtotal						$ 6,952,890

All costs are per battery

LACSD MLPA
Electrical Power Consumption TIN < 33.6 mg/L

Item	Flow,cfs	Head	Efficiency	HP	KW	Hours/day	KWh/yr
Influent Pumps	620	55	0.75	5158	3848.2	24	33710000
Methanol Feed Pumps				3	2.2	24	20000
Alkalinity Feed Pumps				2	1.5	24	13000
Backwash Return Pumps	43.4	30	0.75	197	146.9	24	1287000
Process Air Blowers				9680	7221.3	24	63258000
Backwash Air Blowers(N)				110	82.1	22	659000
Backwash Air Blowers(DN)				110	82.1	4.5	135000

	Cells	Air flow/Cell, scfm	HP/cell	Total HP
Process Air Blowers	88	1730	110	9680

LACSD MLPA
Electrical Power Consumption TIN < 10 mg/L

Item	Flow,cfs	Head	Efficiency	HP	KW	Hours/day	KWh/yr
Influent Pumps	620	55	0.75	5158	3848.2	24	33710000
Methanol Feed Pumps				3	2.2	24	20000
Alkalinity Feed Pumps				2	1.5	24	13000
Backwash Return Pumps	76.6	30	0.75	348	259.3	24	2272000
Process Air Blowers				9680	7221.3	24	63258000
Backwash Air Blowers(N)				110	82.1	22	659000
Backwash Air Blowers(DN)				110	82.1	18	539000

	Cells	Air flow/Cell, scfm	HP/cell	Total HP
Process Air Blowers	88	1730	110	9680

APPENDIX B

MANUAL CALCULATIONS

BioStyr Loadings

Per Proposal 12/17/2008 – page 4

NH_3-N 0.98 Kg/m³/d
NO_x-N 1.12 Kg/m³/d

Nitrification 60 cells @ 2582 ft² each
Denite " "

Media Depth: 9.84' Nitrification
8.20' Denitrification

Media Volume/Cell:

Nitrification – $(2582 ft^2)(9.84') = 25400 ft^3$
$* 1 m^3/(3.28)^3 ft^3 = 720 m^3/cell$

Denitrification – $(2582 ft^2)(8.20 ft) = 21170 ft^3$
$\times 1 m^3/(3.28)^3 ft^3 = 600 m^3/cell$

Media Volume Total:

Nitrification = $(720)(60) = 43200 m^3$
Denitrification = $(600)(60) = 36000 m^3$

Krueger Influent per proposal = 27.5 mg/L NH_3-N
(12/17/2008 page 3) 25°C

Influent Loading to N stage check:

$(400 mgd)(27.5 mg/L)(8.34) = 91740$ lb NH_3-N/d
$* 1 Kg/2.2 lb = 41700$ Kg $\frac{NH_3\text{-}N}{d}$

Loading check = $41700/43200 = 0.97$ Kg $\frac{NH_3\text{-}N/d}{m^3}$

OK

Influent Loading to DN stage:

NH_3-N < 2
NO_x-N < 10

Denite

27.5 mg NH_3-N in from BioStyr proposal
− 2 mg/L NH_3-N out " "
− 10 mg/L NO_x-N out

15.5 mg/L NO_x to denitrify minimum

Assume all influent NH_3-N → NO_x-N
then loading:

$(400\,mgd)(27.5\,mg/L)(8.34) = 91740\ \frac{lb\,NH_3\text{-}N}{d}$

$= 41\,700\ \frac{Kg\,NH_3\text{-}N}{d}$

Loading Rate $= \frac{41200\,kg\,NH_3\text{-}N/d}{36000\,m^3} = 1.16\ \frac{Kg\,NH_3\text{-}N}{m^3/d}$

M&E Table 9-23 indicates
1-1.5 Kg NO_x-N/m3/d
1.2 Kg NO_x-N/m3/d typical

OK matches text book values

New Influent Criteria - Nitrification

Base on 99th %tile

99th %tiles
NH_3-N in = 39.7 mg/L
NO_2-N in = 0.3 mg/L
NO_3-N in = 0.2 mg/L

Total reduced NO_x-N = 40.0 mg/L in
NH_3-N out = 0.17 mg/L, NO_2-N out = 0.17 mg/L
Total reduced NO_x-N out = 0.34 → 0.4 mg/L
Nitrification Req'd = (40.0 − 0.4) mg/L = 39.6 mg/L
Load = (39.6)(400)(8.34) = 132,106 lb NH_3-N/d
× 1 Kg/2.2 lb = 60,048 Kg NH_3-N/d
M&E states limits are 1-1.7 Kg NH_3-N/m3/d
Table 9-19 Kruger used 0.98 Kg NH_3-N/m³/d
@ 1 Kg NH_3-N/m³/d = 60048 m³ of media
No of Cells = 60,048 m³ / 720 m³/cell = 83.4 cells
Provide some redundancy for maintenance etc

Use 4 Batteries of 22 cells each
567' L × 152' W each

From Proposal
Media thickness = 9.84'
× $\frac{1\,m}{3.28\,ft}$ = 3.00 m

Cell Area = 2582 ft²
× $\frac{1\,m^2}{(3.28)^2\,ft^2}$ = 240 m³

V/cell = (240)(3)
= 720 m³

New Influent Criteria for Denitrification (TIN < 10)

0.2 mg/L NO_3-N in

TIN in = 40.2 mg/L

NH_3-N + NO_2-N in = 40 mg/L

NH_3-N out — = 0.17 mg/L

NO_2-N out = 0.17 mg/L

NO_3-N out = 9.6 mg/L

} TIN = 10 mg/L

Denite Req'd = (40.2 − 0.17 − 0.17 − 9.6) mg/L = 30.2 mg/L

loading : (400)(30.2)(8.34) = 100,750 lb NO_x-N/d

× 1 Kg/2.2 lb = 45,794 Kg NO_x-N/d

M&E says 1.2 Kg NO_3-N/d/m^3 is typical

@ 1.12 Kg NO_3-N/d/m^3 From Kruger proposal

V = 40890 m^3

Media thickness from proposal = 8.20 ft × $\frac{1 m}{3.28 ft}$ = 2.5 m

V/cell = 2.5 m × 240 m^2 = 600 m^3/cell

No Cells = 40890/600 = 68.2 cells

400 mgd → Use 4 Batteries of 18 cells = 72 cells (provides redundancy)

L = 477′ W = 152′

Methanol use 3.2 lb methanol / lb NO_3-N removed

Denitrify 100,750 lb NO_3-N/d avg day @ 99th %tile

= (540/400)(100750) = 136000 lb NO_3-N/d @ MAX Q

× 3.2 lb methanol / lb NO_3-N

= 435,240 lb methanol/day

MAX Methanol Feed Rate → × 1 gal methanol/6.6 lb = 65945 gal/d

= 46 gpm

TIN = 35.5 mg/L

Avg (NH_3-N + NO_2-N) in = (35.3 + 0.1) mg/L = 35.4 mg/L

Denite Req'd = (35.5 − 0.17 − 0.17 − 9.6) = 25.5 mg/L

Avg Methanol Use = (25.5)(400)(8.34)(3.2)/6.6 = 41,250 gal/d

= 15.1 MG/yr

30′ϕ A = 706 ft² H = 23′ ← Select

10 day supply = 412,500 gal

30′ϕ, A = 706 ft² H = 23′ V = 121,460 gal

Use 4 @ 30′ϕ × 125,000 gal = 500,000 gal

= 12 days storage

For Option 1 with 90 mgd to be Denitrified

Same Denite req'd per Option 2 = 30.2 mg/L

Loading = (90 mgd)(8.34)(30.2) = 22700 lb NO_3-N/d

× 1 kg/2.2 lb = 10,300 kg NO_3-N/d

@ 1.12 kg NO_3-N/m^3/d

∀ media = 10300/1.12 = 9200 m^3

Media thickness in proposal = 2.5 m

∀/cell = 600 m^3 media/cell

No cells = 9200 m^3/600 m^3/cell = 15.3 cells

Use 18 cells to provide redundancy

1 battery w/ 18 cells L = 477' × W = 152'

Denite @ 99th %tile = 22700 lb/d

Qpeak = (540/400)(90 mgd) = 125 mgd (rounded)

Max Denite = $\left(\frac{125}{90}\right)$(22700 lb/d) = 31,550 lb/d @ Max Q

× 3.2 lb methanol/lb NO_3-N = 100,900 lb/d

× 1 gal methanol/6.6 lb = 15300 gal/d

= **10.6 gpm**

@ Avg Flow & NH_3-N

Denite Req'd = 25.5 mg/L

Avg Methanol Use = (25.5)(8.34)(90)(3.2)/6.6 = 9280 gal/d

= 3.4 MG/yr

10 day supply = 92800 gal

Use 30'ϕ A = 706 ft^2 ∀ = 125000 gal

= **13.5 days storage**

Biomass Production

Original BioStyr proposal:

N = 89800 lb/d   DN = 71400 lb/d

Nitrification original BioStyr

27.5 mg/L influent NH_3-N out = 2 mg/L

Nitrification = (27.5 − 2) mg/L = 25.3 mg/L

New nitrification = 39.6 mg/L

Assume biomass production proportional to nitrification requirements

New biomass N = 89800 * 39.6/25.3 = 140,600 lb/d ✓

N phase

For 400mgd

Denitrification

Original BioStyr to < 10 mg/L TIN

denite = 15.5 $\frac{mg\ NO_x\text{-}N}{L}$

New criteria NO_x-N denitrified = 30.2 $\frac{mg\ NO_x\text{-}N}{L}$

Biomass production

= 71400 * (30.2/15.5) = 139,150 lb/d

DN phase to < 10 mg/L

For 400mgd

For 90mgd

(90/400)(139150) = 31300 lb/d

Option 1

Check Biomass Production Table 8-20 & see M&E pg 967

synthesis yield w/methanol

$$\left(\frac{0.18\,g\,VSS}{g\,COD}\right)\left(\frac{1.5\,g\,COD}{g\,methanol}\right) = \frac{0.27\,g\,VSS}{g\,methanol}$$

$$\left[CH_3OH + 1.5O_2 \rightarrow CO_2 + 2H_2O\right]$$

Based on Avg Q & NH_3-N

Avg methanol use = (400 mgd)(8.34)(25.5)(3.2) = 272,200 lb methanol/d

× 0.27 g VSS/g methanol

73500 lb/d (VSS)

if 80% VSS then

91,900 lb TSS/d @ T<10

vs 139,150 lb/d by prorata

Note: if 80% Volatile

$\frac{0.27\,g\,VSS}{g\,methanol} / 0.80$

= 0.34 g TSS/g methanol

Use larger amount

From original proposal

71400 lb solids/d from 195200 lb/d methanol

$71400/195200 = 0.37 \frac{lb\ solids}{lb\ methanol}$

Conclusion: Using prorata approach is OK - probably conservative.

Backwash Air Scour

Assume 2 in wash/Gallery worst case
1695 scfm/cell × 2cells = 3400 scfm
@ 3000 ft/min A=1.13ft² φ = 1.2'
Use 16"φ for
each Gallery
× 4 on plans

12"-24"φ
V = 2700-4000 ft/min
per M&E Table 5-28

Methanol Storage Costs

2@ 10500 gal + Metering pumps $400000
TM-7 Wastewater Treatment to Achieve <3mg/L TN
Arlington County Water Pollution Control Plant
Master Plan 2001 Update
NFPA Code 30 and 820
25 ft from R
Class I Div. I Group D
Micro C alternative
Concrete Coated up to 50000 gal

Process Air Header in each Gallery

22 cells/battery × 1730 scfm/cell = 38000 scfm
V = 4000 ft/min; A = 9.5 ft² = 3.5' → 42"φ

Length of each Gallery = 568'
Estimate Air piping @ 550'/Battery

× 4 = 2200 ft total

Water levels relative to G.S * 8/

Min Wet well = -15
Bottom of Walls = -5
Top Inf. channel = +38

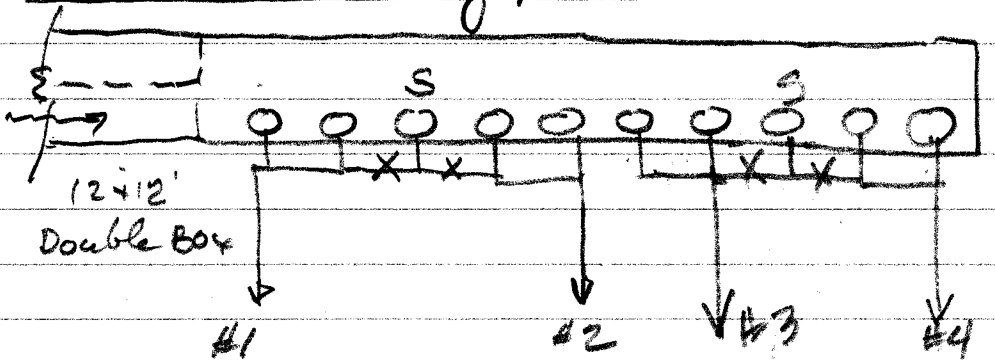
Pumphead Req'd = 38+15 = 53'

Ref: hyd. profile By kruger

→ No intershage pump req'd

Pumping Configuration

4 Battery Configuration



For 4 Batteries

S = swing pump

Total 10 pumps 8 duty Variable Speed
2 standby " "

H = 53' → say 55' incl. Friction + Minor

Q = 540 mgd = 840 cfs

840 cfs / 8 pumps = 105 cfs each
= 47125 gpm

$$HP = \frac{(105)(62.4)(55)}{(550)(0.75)} = 873 HP$$

Say 900

Discharge Pipe = 105 ft³/s x 2 pumps = 210 cfs
@ 5 ft/sec need 42 ft² = 7.3' ϕ
Use 96" ϕ

Each pump discharge = 105 cfs/5 = 21 ft² = 5.2' ϕ
Use 60" ϕ

Wet Well ∀ needed for Pumping

Q = 105 cfs each = 47125 gpm pump capacity

T critical @ Min Q = 1/2 design Q = 23500 gpm

Using variable speed

52.5 cfs ≈ 34 mgd/pump × 4 pumps = 135 mgd min Q possible w/4 pumps

2 starts/hr = T = 30 min

$$\forall = CQ/4 = \frac{(30)(23500)}{4}$$

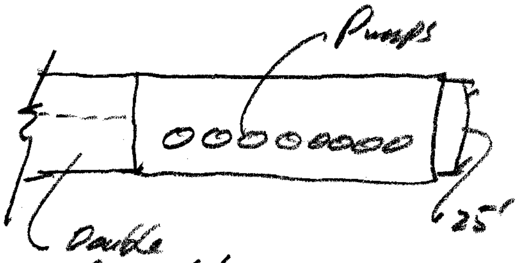
= 176000 gal

say 200000 gal

26700 ft³

@ 12' deep = 2230 ft²

190' long × 25' wide



Consider an extension of 2 Barrel influent conduit

Backwash Return Piping

Pumps included in Bio Stor scope

Original Proposal		New Criteria TIN<10		New Criteria TIN<336	
Nit 60cells	14.25 mgd	88 cells	20.9 mgd	88 cells	20.9 mgd
Denit 60cells	23.76 mgd	72 cells	28.5 mgd	18 cells	7.1 mgd
Total	38.0 mgd		49.4 mgd		28.0 mgd
cfs	59 cfs		76.6 cfs		43.4 cfs
V=5'/sec A=			15.3 ft²		A= 8.7 ft²
φ			4.4'		3.3'
Use			54" φ		39" φ

Air Supply Piping

22 cells/battery × 1730 scfm = 38060 scfm

@ 5000 ft/min = 7.6 ft²

= 3.1' φ

36" φ air header each battery

30" φ - 60" φ
3800 - 6500 ft/min
per M&E Table 5-28

Interstage Connection

Q = 840 cfs (540 mgd)
@ 5'/sec $v^2/2g$ = 25/64.4 = 0.39'
Hent + exit = 1.5(0.39) = 0.58'
should be tolerable

Area 2 pipes 420cfs/5'/sec = 84°' ; 10.3'ϕ 10'ϕ
3 pipes 280cfs/5'/sec = 56° ; 8.4'
4 pipes ϕ = 96" same as influent
Use 4 @ 96"ϕ for now

Pipe Connections to/from Units

Denite individual effluent
4 batteries Q = 840cfs/4 batteries = 210 cfs
V = 5'/sec A = 42 ft² ϕ = 7.3' → 96"ϕ

Nitrification to Denite

Pair of Conduits that take 2 batteries
Q = 840cfs/2 = 420 cfs
V = 5'/sec A = 420/5 = 84°' ϕ = 10.3'
Use 120"ϕ

Process air Blowers   TIN=10 mg/L

Ref: Kruger Proposal
12/17/2008
page 5
Range
12-14 psig

Nitrification Facilities

Q: 1730 cfm @ 13 psig /cell

$$P_2 \quad \frac{wRT}{550\,ne}\left[\left(\frac{P_2}{P_1}\right)^{0.283}-1\right]$$

$n = 0.283$ for air

w = wt flow rate = (1730 cfm)(0.075 lb/ft^3)/60
= 2.17 lb/sec

e = 0.70 R = 53.3 ft-lb/lb °R

P_2 = 13 + 14.7 = 27.7 psia

P_1 = 14.7 psia

T_1 = 459° + 68° = 527°R

$$P = \frac{(2.17)(527)(53.3)}{(550)(0.283)(0.7)}\left[\left(\frac{27.7}{14.7}\right)^{0.283}-1\right]$$

P = 559(1.196 - 1) = (32741)(0.196)

P_2 = $\underline{\underline{110\ HP}}$ /cell

Backwash air scour — 1695 scfm ≈ same as Process Air
(88 cells + 72 cells) TIN <10 = 160 cells

Backwash each cell once/day
estimate 15 min/cell

Denite Facilities

Backwash air same as Nitrification
Backwash except media depth is
slightly smaller 8.20 ft vs 9.84
= 1.64 * 0.433 = 0.7 psi
Ignore difference at this time (small)

Backwash Air Scour

N cells = 88

say 15min/BW = 88×15min = 1320min

= 22hrs

DN cells = 72 for TIN < 10mg/L

say 15min/BW = 15min × 72 = 1080min

= 18hrs

DN cells = 18 for TIN < 33.6

@15min/BW = 15×18 = 270min

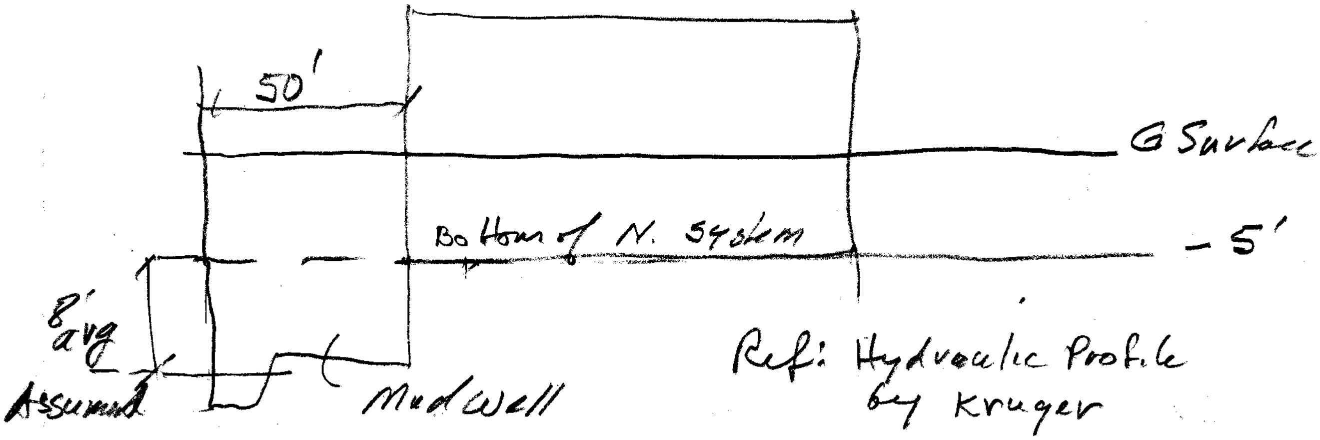
= 4.5hr.

Excavation & Backfill

Nitrification Battery

4 Batteries w/ 22 cells each

L= 567' W= 152'



Ref: Hydraulic Profile by Kruger

Assume 15' Below ground excavation

clearance for forms

A@bottom = 567+6' by 152+6'

= 573' × 158' ; A=90700□'

Area top = 580 × 165 = A=95700□' Avg = 93200□'

$V = (93200\ ft^2)(5)/27 = 17260\ cy$ main structure

$V_{mwell} = (50 \times 165)(8)/27 = 2440\ cy$

Total Excavation = 19700 cy Battery

Say 20000 cy

Backfill

V of structure = (567)(152)(5)/27 = 16000 cy

Backfill/battery = (19700-16000) cy

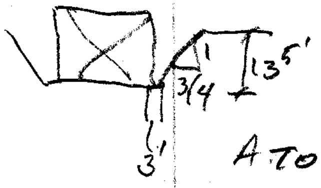
= 3700 cy

Say 4000 cy

Denik Battery

L = 477' 4 batteries @ 18 cells each for TIN < 10 mg/L
1 battery @ 18 cells each for TIN < 33.6 mg/L

L = 477' × 152'W
only 8.5' deeper to avoid
interphase pumping



$A_{TOP} = (477+26)(152+26) = 89500^{\square'}$ $A_{BOTTOM} = (477+6)(152+6) = 76300^{\square'}$

$V = \left(\frac{89500+76300}{2}\right)(5'+8.5')/27 = 41500$ cy

$V_{mudcell} = (50 \times 165)(8'+8.5')/27$ $\underline{5040 \text{ cy}}$

Total = $\underline{\underline{46540 \text{ cy}}}$ /battery

Say $\underline{50000 \text{ cy}}$/battery

$V_{structure} = (477)(152)(13.5)/27 = 36300$ cy

Backfill = 50000 − 36300 = $\underline{\underline{13700 \text{ cy}}}$

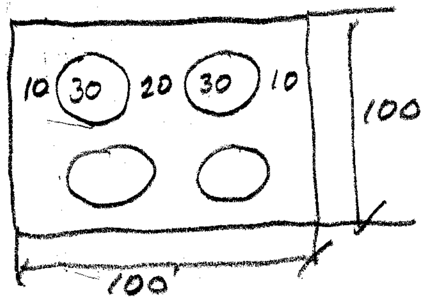
Say 14000 cy
$\underline{\text{backfill}}$/
/battery

Methanol Storage

Refer to calcs pages 3&4

TIN < 10 mg/L Need 4 @ 125,000 gal

40'ϕ = 1256 ft^2
30'ϕ = 706 ft^2 ← use
20'ϕ = 314 ft^2



Concrete Containment, 3' high walls

A_{Cont} = (100)(100) − 4(706) = 10000 − 2880 = 7176 ft^2
× 7.48 gal = 53,700 gal/ft use 3'

Concrete Slab

18" × 100 × 100 /27 = 555 cy

Walls 400' × 3' × 12"/27 = 44 cy

Total 599 cy × $500/cy = $ 300000

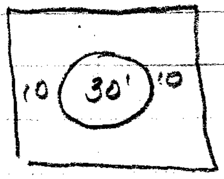
Overexcav. & recompact

5' × 100 × 100 /27 = 1860 cy
× 6.00/cy = $ 12000

Safety venting, Flame arrestors etc.

Methanol Storage Tan < 33.6 mgls

1 @ 30'ϕ Tank



50'x50'

Concrete:

18" thick

Slab = (1.5')(50')(50)/27 = 139 cy

Walls = (3')(1' thick)(200')/27 = 22 cy

161 cy → 165 cy

Overexcav. & Recompact:

5' (50 x 50) /27 = 463 cy → 500 cy

Safety, venting, flame arrestors etc

Waste charges LACSD

Sewage unit:

260 gal/day × 365 d/yr = 94900 gal/yr

1.22 lb COD/d

0.59 lb/d TSS

"District Coefficients" → $a = 0.3049$ $b = 0.3348$ $C = 0.3603$

Current $ 147/sewage unit District #2

$$\text{Surcharge} = a\underset{\llcorner 10^6 \text{gal}}{V} + b\underset{\llcorner 10^3 \text{lb/yr}}{COD} + c\underset{\llcorner 10^3 \text{lb/yr}}{TSS}$$

Surcharge Rates: $44.82/MG 49.22/10³ lb COD 52.96/10³ lb TSS

TIN < 10 mg/L

See page 9 of calcs → Return Flow = 49.4 mgd × 365 = 18000 MG/yr

See page 5 → TSS = (140,600 + 139150) lb/d = 279750 lb/d

$\times 365 = 102{,}100 \times 10^3$ lb/yr

$COD = 1.42 \times VSS$; $VSS = 0.80 \times TSS$

$COD = 1.42(0.80)(102100 \times 10^3) = 116{,}000 \times 10^3$ lb/yr

TIN < 33.6 mg/L

Return Flow = 28.0 mgd × 365 = 10,200 MG/yr

TSS = (140,600+31,300) lb/d = 171,900 lb/d

$\times 365 = 62{,}800 \times 10^3$ lb/yr

$COD = (1.42)(0.80)(62800 \times 10^3) = 71{,}400 \times 10^3$ lb/yr

Comparison & Reality Check

Current SF Domestic Rate

$= (\$147 / 94{,}900) \times 10^6 = \$1550/MG$

Looks in the range expected

BioStyr Costs

$90, 750,000 for 60 cells each N & DN
Total 120 cells original proposal

To meet effluent limits for nitrification there are 88 cells

For TIN < 10 mg/L 72 cells DN [4 @ 18]
TIN < 33.6 mg/L 18 cells DN [1 @ 18]

Total Cells < 10 TIN = 88 + 72 = 160 cells
" " < 33.6 TIN = 88 + 18 = 106 cells

Revised Costs —

TIN < 10:
$90.75 million × $\frac{160}{120}$ = $ 121 million
≈ 33% more

TIN < 33.6
$90.75 million * $\frac{106}{120}$ = $ 80.2 million

Converting Costs to Residential Equivalent

Per LACSD 1.95 million sewer units
in the JOS

Capital Cost:

TIN < 33.6 mg/L = $403 million
TIN < 10 mg/L $578 million

Present Worth Factor 5% for 20 yrs = 12.46

Capital Recovery Factor = 1/PWF = 0.080

Annual Capital Cost:

TIN < 33.6 mg/L = (403)(0.080) = $32.2 million
TIN < 10 mg/L = (578)(0.080) = $46.3 "

Per sewer Unit

TIN < 33.6 mg/L = $32.2 million/1.95 million = $16.53/yr

TIN < 10 mg/L = $46.3 million/1.95 million = $23.74/yr

O&M Cost

TIN < 33.6 mg/L = $35.9 million
TIN < 10 mg/L = $58.4 million

Per sewer unit:

TIN < 33.6 mg/L = $35.9 million/1.95 million = $18.41/yr

TIN < 10 mg/L = $58.4 million/1.95 million = $29.95/yr

Total Cap + annual O&M / sewer Unit

TIN < 10 mg/L		TIN < 33.6 mg/L
$23.74	Capital	$16.53
29.95	O&M	18.41
$53.69	total	$34.94

Total Present Worth

	Cap.	P.W of O&M	Total
TIN < 33.6 mg/L	$403 million	12.46 (35.9 million) = $447 million	$850 million
TIN < 10 mg/L	$578 million	12.46 (58.4 mill) = $728 million	$1,306 million

1/3

Nitrification System Design Parameters Table 3-1

Media Volume / Cell cu ft $=(720\,m^3)(35.28) = \underline{\underline{25400}}\,ft^3$

Ammonia-N loading w/ 1 cell in BW:

NH_3-N total: 60048 kg/day @ Avg Q & 99th percentile

$$\text{Media Loading} = \frac{60048\,kg/d}{(4)(21)(720\,m^3)} = \underline{\underline{0.99\ \frac{kg\ NH_3\text{-}N}{m^3 \cdot d}}}$$

Hydraulic Loading Rate @ Q peak

540 mgd = 375,000 gpm

Area / cell = 2582 ft^2

$$HLR = \frac{375000}{(4)(2582)(21)} = \underline{\underline{1.73\ gpm/ft^2}}$$

Average Hydraulic Loading Rate

400 mgd = 277,800 gpm

$$HLR = \frac{277,800}{(4)(2582)(21)} = \underline{\underline{1.28\ gpm/ft^2}}$$

Media Volume / Battery 1 cell in BW

$=(25400\,ft^3)(21) = 533,400\,m^3$

or $(720\,m^3)(21) = 15120\,m^3$

Denitrification Parameters Option 1   TIN < 33.6 mg/L

Cell area = 2582 ft^2

Media thickness = 8.20 ft

∀/cell = (2582)(8.20) = 21180 ft^3/cell

x 1 m^3/35.28 ft^3 = 600 m^3/cell

Media ∀ w/ 1 cell in BW/Battery

18 cells − 1 cell in BW = 17 cells

∀ = 21180 ft^3 * 17 = 360,000 ft^3

= (600 m^3)(17) = 10200 m^3

NO_3-N Loading Rate w/ 1 cell in BW

NO_3-N = 45794 kg/d @ 400 mgd

NO_3-N Loading rate @ 90 mgd

= (90/400)(45794) = 10300 kg/d

= 10300 kg NO_3-N/d / 10200 m^3

= 1.01 kg NO_3-N/d/m^3

Hydraulic Loading Rate @ Peak Flow = 125 mgd

= 86800 gpm

= 86800 gpm/(2582)(17) = 1.98 gpm/ft^2

Avg Hydraulic loading rate 90 mgd = 62500 gpm

= 62500 gpm/(2582)(17) = 1.4 gpm/ft^2

3/3

Denitrification Parameters Option 2 TIN < 10 mg/L

Cell area = 2582 ft^2 = 240 m^2

Media Thickness = 8.20 ft = 2.5 m

V/cell = 21,180 ft^3, 600 m^3

Media V w/ 1 cell in BW / Battery

(17 cells)(21180) = 360,000 ft3 / Battery

= (17)(600) = 10200 m^3/ Battery

NO_3-N loading Rate w/ 1 cell in BW / Battery

NO_3-N = 45794 Kg/d @ 400 mgd

$$NO_3\text{-}N \text{ Loading} = \frac{45794 \text{ kg/d}}{(4)(10200)} = 1.12 \frac{\text{Kg } NO_3\text{-}N}{m^3 \cdot d}$$

Hydraulic Loading Rate @ Peak Flow 1 Cell in BW / Battery

540 mgd = 375000 gpm

$$\text{HLR @ peak} = \frac{375000 \text{ gpm}}{(4)(17)(2582)} = 2.1 \frac{\text{gpm}}{ft^2}$$

Avg hydraulic Load w/ 1 Cell in BW / Battery

400 mgd = 277,800 gpm

$$\text{HLR} = \frac{277{,}800 \text{ gpm}}{(4)(17)(2582)} = 1.58 \text{ gpm}/ft^2$$

Process Alkalinity check

Secondary Effluent

99th %tile NH_3-N = 39.7 mg/L
99th %tile NO_2-N = 0.3 mg/L
99th %tile NO_3-N = 0.2 mg/L
Total reduced NO_x-N = 40.0 mg/L
1% tile Alkalinity = 308 mg/L as $CaCO_3$
→ TIN = 40.2 mg/L

Nitrified Effluent

NH_3-N = 0.17 mg/L
NO_2-N = 0.17 mg/L
Total reduced NO_x-N = 0.34 mg/L → 0.4 mg/L
Nitrification required = (40 − 0.4) mg/L = <u>39.6 mg/L</u>
→ TIN = (0.17 + 0.17 + 0.2 + 39.6) = 40.2 mg/L

check

Alkalinity reduction = $\dfrac{7.1 \text{ mg Alk as } CaCO_3}{\text{mg } NO_x\text{-N} \rightarrow NO_3\text{-N}}$

Alkalinity reduction = $(39.6 \frac{mg}{L})(7.1) = 281 \frac{mg}{L}$ as $CaCO_3$

Alkalinity in nitrified effluent = $(308 - 281)\frac{mg}{L}$ = 27 mg/L as $CaCO_3$

Low

From "JWPCP Monthly Avg Composite Data"

40th %tile 351 mg/L as $CaCO_3$ 70 mg/L as $CaCO_3$ left
30th %tile 346 " " 65 mg/L " "
20th %tile 344 " " 63 mg/L " " ← OK
10th %tile 320 " " 39 mg/L " "

20% ✓ of [illegible] feed time

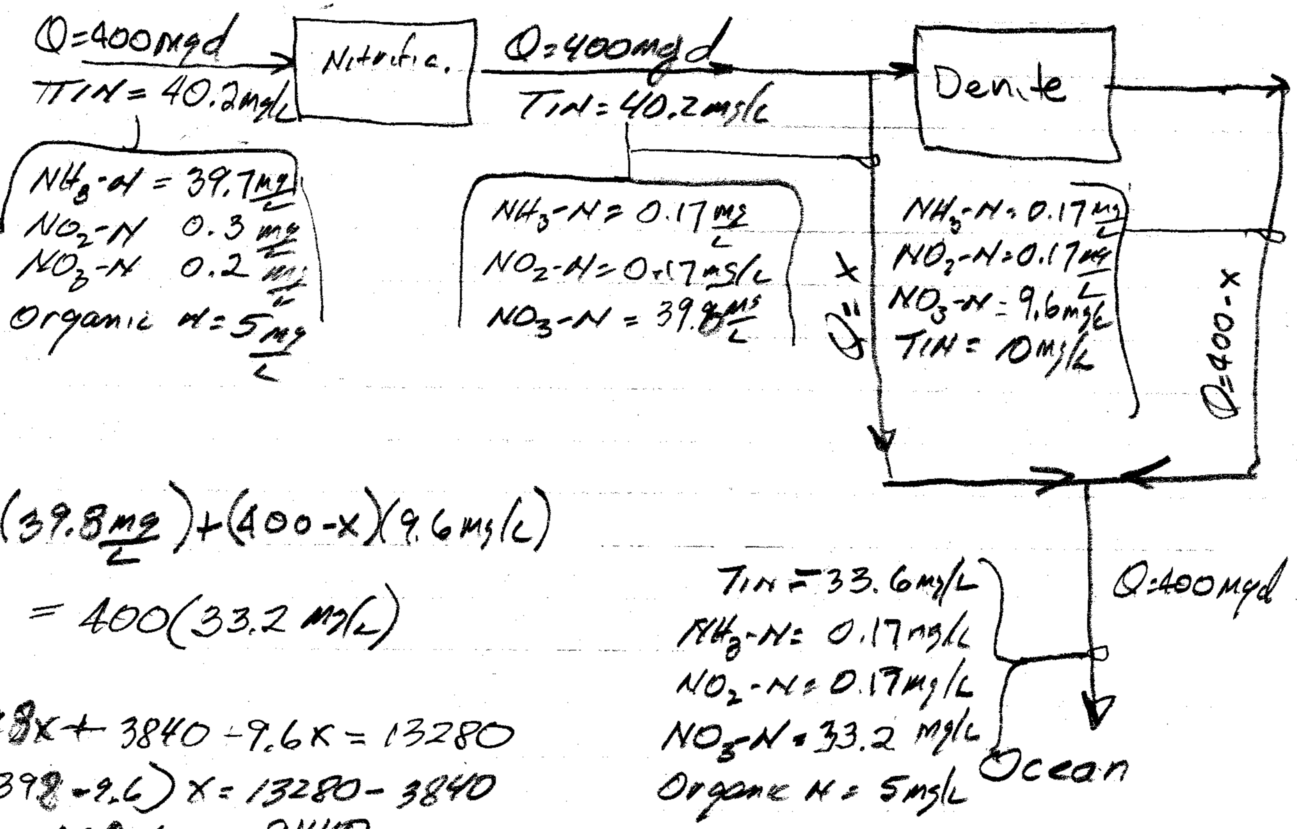
Denitrified Effluent - Option 1

$$\left.\begin{array}{lcl} NH_3\text{-N} & = & 0.17 \text{ mg/L} \\ NO_2\text{-N} & = & 0.17 \text{ mg/L} \\ NO_3\text{-N} & = & 33.2 \text{ mg/L} \\ TIN & = & 33.6 \text{ mg/L} \end{array}\right\} \text{Characteristics}$$

Amount of Bypassed Flow to achieve Option 1 Effluent

Basis: Denitrified Effluent = 10 mg/L TIN
− 0.17 mg/L NH_3-N
−0.17 " NO_2-N
NO_3-N = 9.6 mg/L

TIN 99th %tile in Secondary Effluent = 40.2 mg/L
−0.17 mg/L NH_3-N
−0.17 " NO_2-N
NO_3-N in = 39.8 mg/L



$x(39.8\frac{mg}{L})+(400-x)(9.6 mg/L)$
$= 400(33.2 mg/L)$

$39.8x + 3840 - 9.6x = 13280$
$(39.8 - 9.6)x = 13280 - 3840$
$30.2x = 9440$
x = 312 mgd (Bypass Flow) say 310 mgd (77.5%)
400−x = 88 mgd Thru Denite " 90 mgd (22.5%)

Denitrified Effluent Option 2

NH_3-N = 0.17 mg/L
NO_2-N = 0.17 mg/L
NO_3-N = 9.6 mg/L
TIN = < 10 mg/L

Denitrification Req'd = (40.2 - 0.17 - 0.17 - 9.6)
= 30.2 mg/L

Alkalinity recovery = 3.6 mg $CaCO_3$/mg NO_3-N → N_2↑
= (30.2)(3.6) = 109 mg/L as $CaCO_3$

Alkalinity of Denitrified Flow =
27 mg/L + 109 mg/L = 136 mg/L
as $CaCO_3$

This is very satisfactory

Check Alkalinity of Blended Effluent Option 1

as $CaCO_3$
77.5% Bypassed @ 27 mg/L $CaCO_3$ = 21 mg/L
22.5% @ 136 mg/L $CaCO_3$ = 31 mg/L
Σ = 52 mg/L as $CaCO_3$

This will be satisfactory particularly since Districts use NaOCl which will increase pH

LIME SYSTEM FOR ALKALINITY ADDITION

- M&E 4th Ed pg 718 recommend residual alkalinity around 70-80 $\frac{mg}{L}$ as $CaCO_3$
- WEF "Design of Municipal Wastewater Treatment Plants" - 5th Ed pg 14-46
  - at least 60 mg/L Alkalinity as $CaCO_3$
    50 mg/L minimal
    80-100 mg/L best.

For design basis use **70 mg/L as $CaCO_3$ Residual**

Secondary Effluent Alkalinity @ JWPCP – mg/L $CaCO_3$

Mean	362 mg/L	−	281 mg/L	81 mg/L
40%tile	351 "		−281 "	70 "
30%tile	346 "		−281 "	65 "
20%tile	344 "		−281 "	63 "
10%tile	320 "		−281 "	39 "
5%tile	308 "		−281 "	27 "
1%tile	308 "		−281 "	27 "

See process Alk. check calcs

Setting target residual @ 70 mg/L (40% of time it will be less)
Min residual 27 mg/L
Add 43 mg/L

Design to add 50 mg/L as $CaCO_3$

Alkalinity as $CaCO_3$
(540 mgd Peak)(8.34)(50 mg/L) = 225180 lb/d max
(400 mgd)(8.34)(25 mg/L) * 0.40 = 33,400 lb/d **avg**
avg dose — only 40% of time

Assume CaO is used 90% pure

$Eq\,wt = \left(\frac{40+16}{2}\right) = 28\ g/eq = 28\ \frac{mg}{me}$

$CaCO_3$ eq wt = 50 g/eq = 50 mg/me

CaO req'd dry = $33400\ \frac{lb}{d} \times \frac{50}{28} = 59600\ \frac{lb}{d}$

@ 100%

$\div 0.90$ 66,200 lb/d feed rate

Hydrated Lime $Ca(OH)_2$, 37 g/eq = 37 mg/me

93% pure

$Ca(OH)_2$ req'd = $33400\ \frac{lb}{d} \times \frac{50}{37} = 45100\ \frac{lb}{d}$

$\div 0.93$ = 48500 lb/d

40 cu.ft/ton CaO

60 cuft/ton $Ca(OH)_2$

CaO 10 days V = 662000 lb/2000 lb/T = 331 T

$\times$ 40 = 13240 ft³

314 ft² 20' ϕ silo × 42' High

$Ca(OH)_2$ 10 days V = 485000 lb/2000 lb/T = 243 T

$\times$ 60 = 14550 ft³

25' ϕ silo × 30' High

Tampa Bay Water Dec 2009 hydrated lime bid

@ \$238/dry ton ≈ \$0.12/lb

Quicklime 1993 cost \$0.06/lb

\$255/ton Tampa Bay Water Dec 2009

226/ton Lake Worth FL 2009 PO

Option to use NaOH for alk. addition

NaOH eq wt = 40g/eq.

NaOH req'd = 33400 $\frac{lb}{d} \times \frac{50}{40}$ = 41800 lb/day @100%

50% NaOH typically purchased = $\frac{41800}{0.50}$ = $\frac{83600\ lb}{d}$ /50%

SpGr 50% = 1.525   Un. Wt = 8.34(1.525) = 12.72 $\frac{lb}{gal}$

Volume used/day   83600/12.72 = 6572 gal/day

= 274 gal/hr

= 365(6572) = 2,400,000 gal/yr

10 days Storage = 65720 gal = 4680 ft^3

2 tanks @ 35000 gal each

ϕ = 20 = A = 314 ft^2 H = 14.9' (2 tanks)

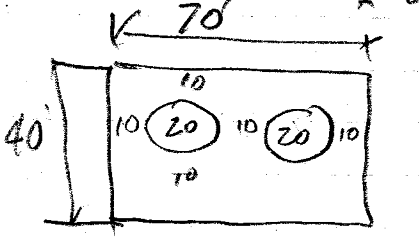
Cost based on bid by City of Benicia June 2007

\$350/Dry Ton

escalation estimated based on ENR Index

× 8865/7900 = \$393/DT → \$400/DT

6.36 $\frac{lb\ NaOH}{gal\ 50\%} \times \frac{\$400}{2000\ lb}$ = 1.27/gal



Concrete slab = (1.5')(70)(40)/27 = 156 CY
18" thick

walls (110+110)(3')(1')/27 = 24 CY

total 180 CY

Overex + Backfill

(70)(40)(5)/27 = 520 CY

Cost of Lime Feed System

"Cost Estimating Manual for Water Treatment Facilities"
WT McGivney
Susumu Kawamura 2008

Current ENR = 8865 ∴ No Correction Needed

$Cost\ \$ = 12985\,X^{0.5901} - X$

X = Lime Feed lb/d   max value = 10500 lb/d

X = 66200 lb/d   ENR = 8889

$\$ = 12985\,(66200)^{0.5901} - 66200$

$\$ = 12985\,(699) - 66200$

\$ = 9.1 million − 66200 → \$9 million OK.

Cost of NaOH Feed

$\$ = 118.68\,X + 38701$

X = 6572 gal 50%/d

$\$ = 118.68(6572) + 38701$

\$ = 780000 + 38701 = \$819,000 → Say \$850000

@ \$400/dry ton

Annual chem. cost

$\frac{41800\ lb/d}{2000} \times \$400 \times 365 = \$3.05\ million/yr$

Chemical Cost of Lime Feed

Use \$230/ton

Feed = 66200 lb/d / 2000 lb/T = 33.1 T/d

× 365 d = 12100 T/yr

× \$230/ton = \$ 2.8 million/yr

Chemical costs ≅ same on annual basis
capital cost of NaOH feed considerably less
and easier to feed – **Use NaOH**

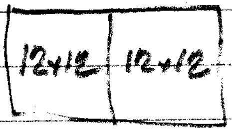
Design of Channel to NOM

$Q = 540$ mgd
$= 840$ cfs
$V = 3$ ft/sec

$A = 280 \text{ ft}^2$

Assume Flow over 540 mgd would go directly to outfall PS

700 mgd − 540 mgd = 160 mgd
= 248 cfs



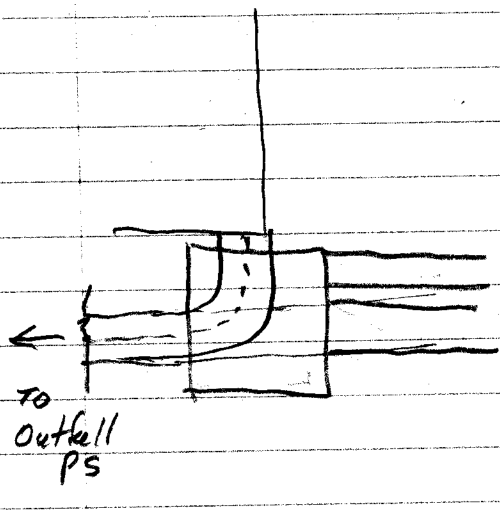
2 ~ 12'x12' RC Box
$A = 288 \text{ ft}^2$
$V = 840/288 = 2.9$ ft/s

$R = \frac{144}{48} = 3$ $V = \frac{1.49}{n} R^{2/3} S^{1/2}$ $n = 0.013$

$$\frac{(2.9)(0.013)}{(1.49)\underset{\overset{\downarrow}{2.6}}{(3.0)}^{0.67}} = S^{1/2} ; \quad S^{1/2} = 0.012$$
$S = 0.00015$

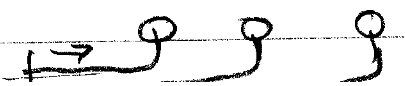
Overflow weir $Q = 840$ cfs − s

$Q = CLH^{3/2} ; H^{3/2} = Q/CL$
say $L = 20'$
$H^{3/2} = 240/(20)(3) = 4.0$
$H = (4.0)^{0.67} = 2.5'$



$L = 40'$
$H^{3/2} = 2.0$
$H = (2)^{0.67} = \underline{1.6'}$
Use $L = 40'$

What i'd be pumped to NOM
$Q = 133$ mgd avg ; 180 mgd peak = 279 cfs
$A = 279/5 \text{ ft/sec} = 55.8 \text{ ft}^2 = 8.5'\phi$
Use 3 @ 9' φ pipes



2/3

SPAN			4′						5′								6′								7′										8′									
HEIGHT			2′		3′		4′		2′		3′		4′		5′		3′		4′		5′		6′		3′		4′		5′		6′		7′		4′		5′		6′		7′		8′	
Maximum Earth Cover			10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′
Conc	Roof	T1	7"	7"	7"	7"	7"	7"	7"	7½"	7"	7½"	7"	7½"	7"	7½"	7"	9"	7"	9"	7"	9"	7"	9"	7½"	10"	7½"	10"	7½"	10"	7½"	10"	8"	10"	8"	11"	8"	11"	8"	11"	8"	11"	8"	11"
	Walls	T2	6"	6"	6"	6"	6"	7"	6"	6"	6"	6"	6"	7"	6½"	7½"	6"	6"	6"	7"	6½"	8"	7"	8½"	6"	6"	6"	7"	6½"	7½"	7"	9"	8"	9½"	6"	7½"	6½"	8"	7"	9"	8"	10"	8½"	11"
	Invert	T3	7"	7"	7"	7"	7"	7"	7"	8"	7"	8"	7"	8"	7"	8"	7"	9"	7"	9"	7"	9"	7"	9"	7½"	10½"	7½"	10½"	7½"	10½"	7½"	10½"	7½"	10½"	8"	11½"	8"	11½"	8"	11½"	8"	11½"	8"	11½"
Reinf	Spacing		1′-4"	1′-3"	1′-4"	1′-3"	1′-4"	1′-3"	11½"	1′-2"	11½"	1′-2"	11½"	1′-2"	11½"	1′-3"	11½"	1′-0"	11½"	1′-0"	11½"	1′-0"	11½"	1′-0"	11"	10½"	11"	10½"	11"	10½"	11"	10½"	11"	10½"	9"	10"	9"	10"	9"	10"	9"	10"	9"	10"
	"g"	Size Bar	#4	#7	#4	#7	#4	#7	#4	#7	#4	#7	#4	#7	#4	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7
	"f"	Size Bar	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#6	#5	#6	#5	#6	#5	#6	#5	#6	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5	#5
	"a"	Size Bar	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#7	#4	#7	#4	#7	#4	#7	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4	#6	#4
	"e"	Size Bar	#4	#4	#4	#5	#5	#6	#4	#4	#4	#5	#5	#6	#5	#7	#4	#5	#4	#6	#5	#6	#6	#7	#4	#5	#5	#5	#5	#6	#6	#7	#6	#7	#4	#5	#5	#6	#6	#6	#6	#7	#6	#7
Quantities	Concrete	CF/LF	14.0	14.0	15.5	15.5	17.0	17.8	16.3	17.8	17.8	19.3	19.3	21.6	21.3	23.8	20.1	24.6	21.6	27.0	23.6	29.7	25.8	32.2	23.7	30.8	25.2	33.3	27.2	35.5	29.4	39.1	32.4	41.8	29.2	40.1	31.2	42.4	33.4	45.5	36.4	48.9	39.0	52.6
	Reinforcement	LB/LF	78	89	84	95	93	112	119	112	122	121	134	137	145	162	186	162	192	179	206	190	227	212	207	197	220	208	227	228	252	262	260	276	283	237	302	266	340	279	350	312	360	326

SPAN			10′-0												12′														14′															
HEIGHT			5′		6′		7′		8′		9′		10′		6′		7′		8′		9′		10′		11′		12′		7′		8′		9′		10′		11′		12′		13′		14′	
Maximum Earth Cover			10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′	10′	20′
Conc	Roof	T1	9"	1′-½"	9"	1′-½"	9"	1′-½"	9"	1′-½"	9½"	1′-½"	9½"	1′-½"	10"	1′-2½"	10"	1′-2½"	10"	1′-2½"	10"	1′-2½"	10"	1′-2½"	10"	1′-2½"	10"	1′-2½"	11½"	1′-4½"	11½"	1′-4½"	11½"	1′-4½"	11½"	1′-4½"	11½"	1′-4½"	11½"	1′-4½"	11½"	1′-4½"	11½"	1′-4½"
	Walls	T2	8"	8"	8"	8½"	8"	9½"	8"	10½"	8½"	11½"	9½"	1′-½"	8"	8½"	8"	9"	8½"	10½"	9"	11½"	9½"	12½"	10"	1′-2"	11"	1′-3"	8½"	9½"	8½"	10½"	9"	11½"	9½"	12½"	10½"	1′-2"	11½"	1′-3"	12½"	1′-4½"	1′-1"	1′-5½"
	Invert	T3	9"	1′-½"	9"	1′-½"	9"	1′-½"	9"	1′-½"	9"	1′-½"	9"	1′-½"	10"	1′-3"	10"	1′-3"	10"	1′-3"	10"	1′-3"	10"	1′-3"	10"	1′-3"	10"	1′-3"	11½"	1′-5"	11½"	1′-5"	11½"	1′-5"	11½"	1′-5"	11½"	1′-5"	11½"	1′-5"	11½"	1′-5"	11½"	1′-5"
Reinf	Spacing		11"	7½"	10½"	7½"	10"	8"	10"	8"	10½"	8"	10½"	8½"	9"	8"	9"	8"	8"	7½"	8"	7½"	8½"	7½"	8½"	8"	8½"	8"	8½"	8"	8½"	8"	8½"	8"	8½"	8"	8½"	8"	8½"	8"	9"	8"	9"	8"
	"g"	Size Bar	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8	#8
	"f"	Size Bar	#7	#5	#6	#5	#6	#5	#6	#5	#6	#5	#6	#5	#7	#7	#7	#7	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6
	"a"	Size Bar	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4
	"b"	Size Bar	#5	#5	#4	#5	#5	#5	#6	#5	#6	#6	#6	#6	#5	#5	#5	#6	#5	#6	#5	#6	#6	#6	#5	#6	#6	#6	#5	#6	#6	#6	#5	#6	#6	#6	#6	#6	#6	#7	#7	#7	#7	#7
		Dim "B" Ft-inches	1-9	2-7	2-0	2-9	2-3	2-9	2-7	3-1	2-7	3-1	2-7	3-1	2-7	3-1	3-0	3-2	3-6	3-2	3-6	3-4	3-9	3-4	3-9	3-4	3-9	3-4	2-7	2-7	3-3	3-3	4-0	4-0	4-0	4-0	4-7	4-4	4-7	4-11	5-3	4-11	5-3	4-11
		Dim "Bw" Ft-inches	4-0	4-11	4-0	4-11	4-0	4-11	4-0	4-11	4-0	4-11	4-0	4-11	4-1	3-2	4-1	3-4	4-1	3-4	4-1	3-7	3-9	3-7	3-9	3-7	3-7	3-7	5-0	3-9	5-0	4-6	5-0	5-0	5-0	5-0	4-9	5-6	4-9	6-2	5-2	6-2	5-2	6-2
	"c"	Size Bar	#5	#5	#6	#6	#6	#6	#6	#6	#7	#6	#7	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#6	#7	#7	#7	#7	#6	#6	#6	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#8	#8
		Dim "C" Ft-inches	3-1	2-9	3-9	3-3	4-6	4-3	5-6	4-6	6-0	4-9	6-0	4-9	3-10	3-7	4-6	4-4	5-7	5-0	6-6	5-2	7-2	5-4	7-5	5-7	7-5	5-7	4-3	3-11	5-6	5-2	7-9	5-8	8-6	6-5	8-10	6-6	9-0	6-10	9-3	6-10	9-3	6-10
	* "e"	Size Bar	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#5	#5	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#5	#5	#5	#5	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#5	#5	#5	#5	#6	#6
Quantities	Concrete	CF/LF	42.7	55.6	44.7	58.2	46.7	61.8	48.7	65.6	52.5	70.0	56.3	74.5	55.0	76.3	57.0	79.1	59.8	83.8	62.7	88.1	65.9	92.7	69.1	98.8	73.7	104.0	71.8	99.7	73.9	104.0	76.9	108.0	80.0	113.0	84.2	119.1	88.8	124.0	94.1	131.0	98.1	137.0
	Reinforcement	LB/LF	370	454	381	494	418	494	460	510	486	550	518	568	543	604	563	646	600	663	614	688	627	691	701	749	733	764	662	710	715	783	756	820	807	846	833	873	881	958	884	978	1002	1110

* See Note 5

"d" bars, for earth covers up to and including 10′-0"								
Span	4′	5′	6′	7′	8′	10′	12′	14′
Number	5	6	8	10	13	14	16	19

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

Dallas J. Forester
REGISTERED CIVIL ENGINEER

May 1, 2006
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
Dallas Forester
No. C37765
Exp. 12-31-06
CIVIL
STATE OF CALIFORNIA

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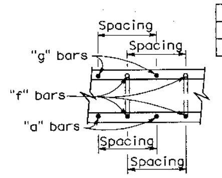
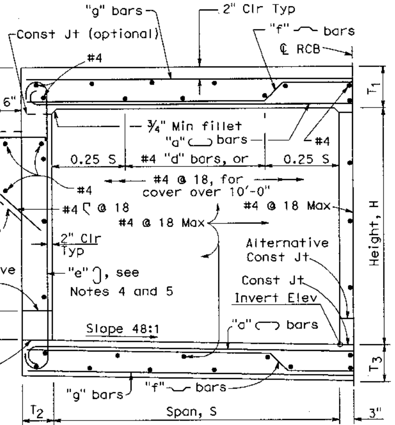
NOTES:

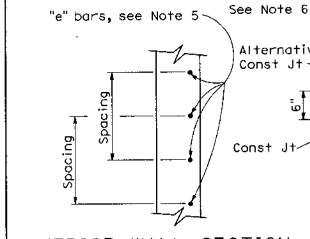
1. For boxes with span or height less than any of those shown in table, use next greater size box concrete dimensions and reinforcement. Make necessary changes in bar lengths and quantities.
2. For boxes with span or height or cover greater than those shown in tables, a special design is required.
3. Quantities are approximate and for design purposes only.
4. It is permissible to eliminate the 180° hooks on every other "e" bar.
5. "e" bars are at half spacing.
6. Provide paving notch when top is exposed and when pavement is portland cement concrete, and adjust quantities.
7. For design and details not shown, see Standard Plan D82.
8. This plan sheet may be used for multiple cell culverts by making necessary adjustments.



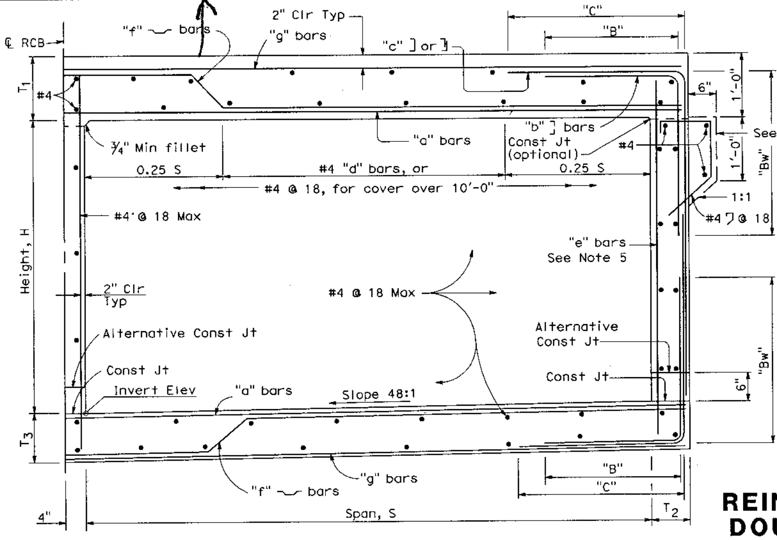
ROOF SECTION
SPANS 4′ THRU 8′
INVERT SIMILAR



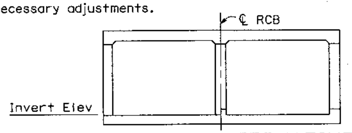
TYPICAL SECTION
SPANS 4′ THRU 8′



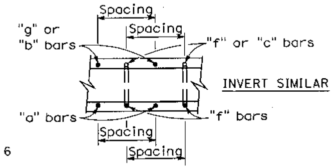
EXTERIOR WALL SECTION
SPANS 4′ THRU 8′



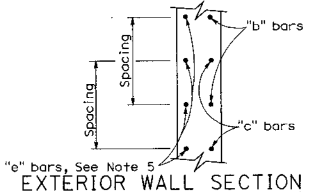
TYPICAL SECTION
SPANS 10′ THRU 14′



FLAT INVERT ALTERNATIVE



ROOF SECTION
SPANS 10′ THRU 14′



EXTERIOR WALL SECTION
SPANS 10′ THRU 14′

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

CAST-IN-PLACE REINFORCED CONCRETE DOUBLE BOX CULVERT

NO SCALE

D81

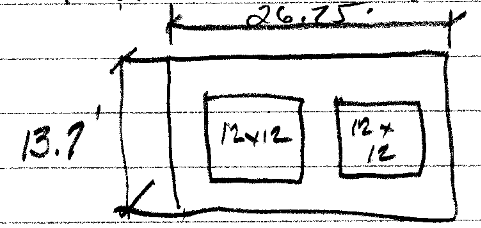
1-24-06

Return to Table of Contents

3/3

Double 12×12 Box @ 10' Cover

From Cal Trans Std Plans



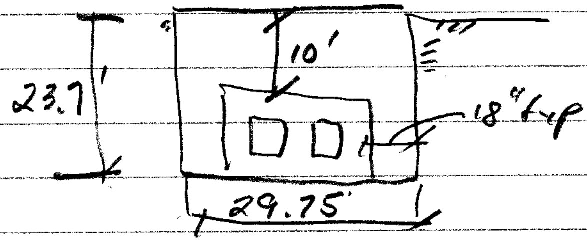
Concrete

Top Slab 10"

Walls 11"

Invert Slab 10"

Concrete Volume 73.7 Ft^3/Ft = 2.72 cy/LF



Excavation

$V = (23.7)(29.75)/27 = $ 26.1 cy/LF

Backfill

V of Conduit = (13.7)(26.75)/27 = 13.6 cy/LF

Backfill V: 26.1 − 13.6 = 12.5 cy/LF

Shoring: 2(23.7) = 47.4 ft^2/Ft say 48 ft^2/Ft

Excavation \$10.00/cy × 26.1 cy/LF = \$261.00

Backfill 2.39/cy × 12.5 cy/LF = 29.90

Compaction 2.50/cy × 12.5 cy/LF = 31.25

Shoring 1.00/ft^2 × 48 ft^2/LF = 48.00

Well points \$50/LF = 50.00

Concrete \$600/cy × 2.72 cy/LF = 1632.00

Total \$2052.15

See Sacramento Data

say \$2100/LF

LA Co Dept of Public Works Project No 690

10.5' w × 12' H RCBox SD

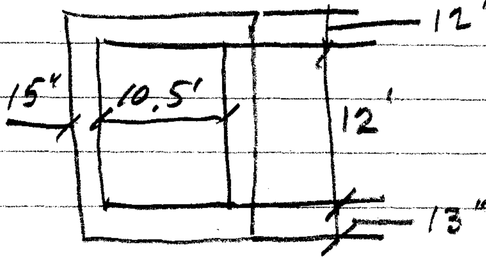
From Caltrans Std Plan D80

12' × 12' Box w/20' cover

Top = 12"

Walls = 15"

Invert = 13"



Top Slab = $[10.5 + 2(1.25)](1)$ = 13 ft^3

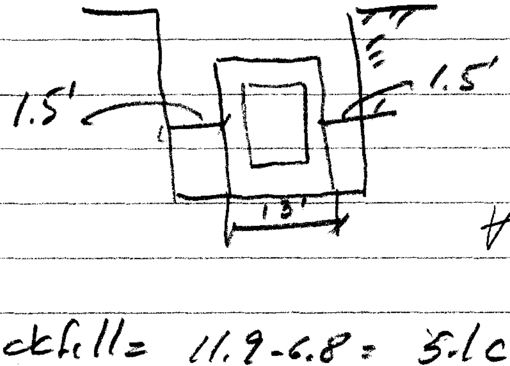
Walls = $(2)(1.25)(12)$ = 30 ft^3

Invert slab = $(1.08)(10.5 + 2(1.25))$ = 14 ft^3

total = 57 ft^3

÷ 27 ft^3/yd^3 = 2.11 cy/LF

Excavation:



Assume 20' depth to invert

$\forall_{excav.}$ = (16)(20)/27 = 11.9 cy/LF

$\forall$ of Drain = (13')(12+1+1.08)/27 = 6.8 cy/LF

Backfill = 11.9 - 6.8 = 5.1 cy/LF

Shoring = 40 ft^2/LF

SPAN			4'						5'							
HEIGHT			2'		3'		4'		2'		3'		4'		5'	
Maximum Earth Cover			10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'
Conc	Roof	T_1	7"	7"	7"	7"	7"	7"	7½"	7½"	7½"	7½"	7½"	7½"	7½"	7½"
	Walls	T_2	6"	6"	6"	6"	6"	6½"	6"	6"	6"	6"	6"	7"	6½"	7½"
	Invert	T_3	6"	6"	6"	6"	6"	6½"	6½"	7"	6½"	7"	6½"	7"	6½"	7"
Reinf	Spacing		7"	7"	7"	7"	7"	7"	8½"	6"	8½"	5½"	8½"	5½"	8½"	5½"
	"a"	Size Bar	#6	#6	#6	#6	#6	#6	#7	#6	#7	#6	#7	#6	#7	#6
	"e"	Size Bar	#4	#4	#4	#5	#5	#6	#4	#4	#4	#4	#5	#5	#6	#6
Quantities	Concrete	CF/LF	7.4	7.4	8.4	8.4	9.4	10.1	8.9	9.2	10.0	10.2	11.0	12.0	12.5	13.7
	Reinforcement	LB/LF	48	48	50	55	58	67	58	60	58	68	67	81	82	105

SPAN			6'							
HEIGHT			3'		4'		5'		6'	
Maximum Earth Cover			10'	20'	10'	20'	10'	20'	10'	20'
Conc	Roof	T_1	8"	8"	8"	8"	8"	8"	8"	8"
	Walls	T_2	6"	6"	6"	7"	6½"	7½"	7"	8½"
	Invert	T_3	7"	8"	7"	8"	7"	8"	7"	8"
Reinf	Spacing		7½"	5"	7½"	5"	7½"	5"	7½"	4½"
	"a"	Size Bar	#7	#6	#7	#6	#7	#6	#7	#6
	"e"	Size Bar	#4	#4	#5	#5	#6	#6	#7	#6
Quantities	Concrete	CF/LF	11.7	12.3	12.7	14.2	14.2	15.9	15.9	18.3
	Reinforcement	LB/LF	70	81	82	96	97	120	124	148

SPAN			7'									
HEIGHT			3'		4'		5'		6'		7'	
Maximum Earth Cover			10'	20'	10'	20'	10'	20'	10'	20'	10'	20'
Conc	Roof	T_1	8"	9"	8"	9"	8"	9"	8½"	9"	8½"	9"
	Walls	T_2	6"	6"	6"	7"	6½"	7½"	7"	8½"	8"	9½"
	Invert	T_3	8"	9"	8"	9"	8"	9"	8"	9"	8"	9"
Reinf	Spacing		6½"	5"	6½"	4½"	6½"	5½"	6½"	5½"	6½"	5½"
	"a"	Size Bar	#7	#6	#7	#6	#7	#7	#7	#7	#7	#7
	"e"	Size Bar	#4	#4	#5	#5	#6	#6	#6	#7	#7	#7
Quantities	Concrete	CF/LF	13.7	14.9	14.6	16.8	16.1	18.5	18.1	21.0	20.7	23.8
	Reinforcement	LB/LF	94	94	105	118	121	147	130	177	160	192

SPAN			8'									
HEIGHT			4'		5'		6'		7'		8'	
Maximum Earth Cover			10'	20'	10'	20'	10'	20'	10'	20'	10'	20'
Conc	Roof	T_1	8½"	9½"	8½"	9½"	8½"	10"	8½"	10"	8½"	10"
	Walls	T_2	6"	7"	6½"	7½"	7"	8½"	8"	9½"	8½"	10½"
	Invert	T_3	8"	9½"	8"	10"	8"	10"	8"	10"	8"	10"
Reinf	Spacing		6"	5"	6"	5"	6"	4½"	6"	5"	6"	4½"
	"a"	Size Bar	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7
	"e"	Size Bar	#5	#5	#5	#6	#6	#6	#6	#7	#7	#7
Quantities	Concrete	CF/LF	16.4	19.0	17.9	21.1	19.5	24.1	22.1	26.9	24.1	30.1
	Reinforcement	LB/LF	123	151	131	171	137	198	160	215	192	252

SPAN			10'											
HEIGHT			5'		6'		7'		8'		9'		10'	
Maximum Earth Cover			10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'
Conc	Roof	T_1	8"	10½"	8"	10½"	8"	10½"	8"	10½"	8"	10½"	8½"	11"
	Walls	T_2	8"	8"	8"	9"	8"	9"	8"	10"	8½"	11½"	9½"	12½"
	Invert	T_3	8"	11"	8"	11"	8"	11"	8"	11"	8"	11"	8½"	11"
Reinforcement	Spacing		13"	12"	12"	12"	11"	11"	10"	11"	11"	10"	11"	10"
	**"a"	Size Bar	#6	#7	#6	#7	#6	#7	#6	#7	#6	#6	#6	#6
	"b"	Size Bar	#6	#7	#6	#7	#6	#7	#6	#7	#6	#6	#7	#7
		Dimension "B" Feet-inches	2-11	2-11	2-11	3-0	2-11	3-9	2-11	3-9	2-11	3-9	2-11	3-9
		Dimension "Bw" Feet-inches	4-10	5-0	4-10	5-0	4-10	5-0	4-10	5-0	4-10	5-0	4-7	4-7
	"c"	Size Bar #	#6	#7	#6	#7	#6	#7	#6	#7	#7	#7	#7	#7
		Dimension "C" Feet-inches	3-4	3-4	7-4	4-8	7-7	4-8	8-2	4-8	7-7	4-8	7-7	4-8
	*"e"	Size Bar	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#5	#5
Quantities	Concrete	CF/LF	21.6	26.8	23.0	29.5	24.3	31.0	25.6	34.1	27.8	37.7	32.1	42.3
	Reinforcement	LB/LF	191	267	233	285	260	325	300	339	314	327	360	373

SPAN			12'													
HEIGHT			6'		7'		8'		9'		10'		11'		12'	
Maximum Earth Cover			10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'
Conc	Roof	T_1	8½"	12"	8½"	12"	8½"	12"	8½"	12"	9"	12"	9½"	12"	9½"	12"
	Walls	T_2	8"	10"	8½"	10½"	8½"	10½"	8½"	11½"	9"	12½"	10½"	13½"	11½"	15"
	Invert	T_3	8½"	12½"	9"	12½"	9"	12½"	9"	12½"	9"	12½"	9½"	13"	10"	13"
Reinforcement	Spacing		9"	10"	9"	10"	9"	10"	8"	10"	8"	10"	10"	9"	9"	8"
	**"a"	Size Bar	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#6	#6	#6	#6
	"b"	Size Bar	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#7	#7	#6	#7
		Dimension "B" Feet-inches	3-1	3-2	3-9	3-9	3-9	3-9	3-7	3-9	3-7	4-4	3-7	4-4	4-4	4-4
		Dimension "Bw" Feet-inches	6-0	5-10	6-2	6-7	6-2	6-7	4-11	4-11	4-11	4-11	4-11	4-11	4-4	4-4
	"c"	Size Bar #	#6	#7	#6	#7	#6	#7	#6	#7	#6	#7	#7	#7	#7	#7
		Dimension "C" Feet-inches	4-4	3-7	8-1	5-7	8-1	5-7	8-1	5-7	8-1	5-7	8-1	5-7	8-1	5-7
	*"e"	Size Bar	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#5	#5	#5	#5
Quantities	Concrete	CF/LF	26.8	37.7	29.3	40.1	30.3	41.9	32.2	45.4	34.5	49.8	40.7	54.2	45.4	59.9
	Reinforcement	LB/LF	295	362	353	409	365	420	402	413	415	424	440	471	468	534

SPAN			14'															
HEIGHT			7'		8'		9'		10'		11'		12'		13'		14'	
Maximum Earth Cover			10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'	10'	20'
Conc	Roof	T_1	9½"	14"	9½"	14"	9½"	14"	9½"	14"	10"	14"	10"	14"	10½"	14"	11"	14"
	Walls	T_2	9½"	11"	9½"	11½"	9½"	11½"	10"	12½"	10½"	14"	11½"	15"	12½"	16½"	13½"	17½"
	Invert	T_3	10"	14½"	10"	14½"	10"	14½"	10"	14½"	10½"	14½"	10½"	15"	11"	15"	11½"	15"
Reinforcement	Spacing		10"	9"	10"	9"	10"	8"	10"	8"	10"	8"	8"	10"	10"	10"	10"	9"
	**"a"	Size Bar	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#6	#7	#6	#7	#6	#7
	"b"	Size Bar	#6	#7	#7	#7	#7	#7	#7	#7	#7	#7	#6	#8	#7	#8	#7	#8
		Dimension "B" Feet-inches	2-9	4-2	3-4	4-4	3-4	4-6	3-4	4-6	3-6	4-6	3-6	4-6	3-6	4-6	4-9	6-0
		Dimension "Bw" Feet-inches	6-5	7-0	7-0	8-4	7-0	8-4	6-0	6-0	6-0	6-0	6-0	6-0	5-0	6-0	4-6	6-0
	"c"	Size Bar #	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#7	#8	#8	#8	#8	#8
		Dimension "C" Feet-inches	4-0	4-2	6-9	6-9	5-10	5-10	6-0	6-4	8-11	6-4	8-11	6-4	8-11	6-4	8-11	6-4
	*"e"	Size Bar	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#4	#5	#6	#6	#6	#6
Quantities	Concrete	CF/LF	36.2	51.0	37.8	53.1	39.5	54.9	41.9	58.7	45.9	64.1	49.9	69.5	55.6	75.8	61.6	81.3
	Reinforcement	LB/LF	374	471	449	522	446	587	449	580	492	596	537	605	564	634	604	759

* See Note 5
** See Note 6

"d" bars, for earth covers up to and including 10'-0"								
Span	4'	5'	6'	7'	8'	10'	12'	14'
Number	7	8	9	10	11	12	15	20

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS

Dallas J. Forester
REGISTERED CIVIL ENGINEER

May 1, 2006
PLANS APPROVAL DATE

Dallas Forester
No. C37765
Exp. 12-31-06
CIVIL

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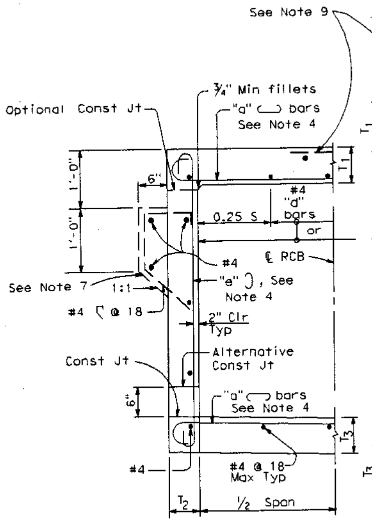
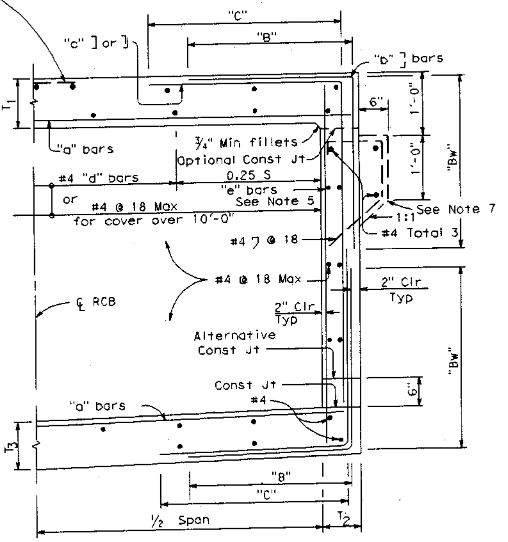
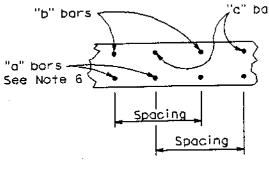


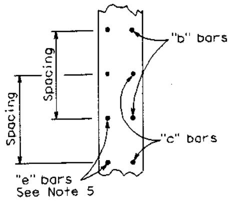
TYPICAL SECTION
SPANS 4' THRU 8'



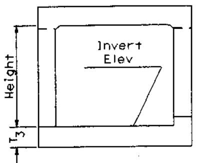
TYPICAL SECTION
SPANS 10' THRU 14'



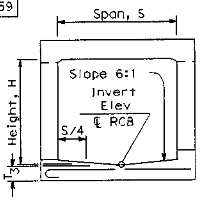
ROOF SECTION
SPANS 10' THRU 14'
INVERT SIMILAR



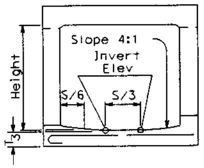
WALL SECTION
SPANS 10' THRU 14'



FLAT INVERT

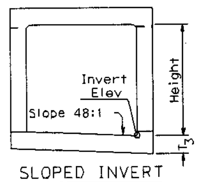


V INVERT



TRAPEZOIDAL INVERT

ALTERNATIVE INVERTS



SLOPED INVERT

NOTES:

1. For boxes with span or height less than any of those shown in table, use next greater size box concrete dimensions and reinforcement. Make necessary changes in bar lengths and quantities.
2. Quantities are approximate and for design purposes only.
3. For boxes with span or height or cover greater than those shown in tables, a special design is required.
4. It is permissible to eliminate the 180° hooks on every other bar.
5. "e" bars are at half spacing (spans 10' - 14' only).
6. "a" bars are at half spacing (spans 10' - 14' only).
7. Provide paving notch when top is exposed and when pavement is portland cement concrete, and adjust quantities.
8. For design and details not shown, see Standard Plan D82.
9. For exposed top, provide #4 @ 1'-6" each way 2'-0" lap "c" bars or full span and adjust).

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

CAST-IN-PLACE REINFORCED CONCRETE SINGLE BOX CULVERT

NO SCALE

D80

1-24-06

2/3

3/3

Excavation	@ $10.00/cy	x 11.9 cy/LF =	$119.00
Backfill	@ $2.39/cy	x 5.1 cy/LF =	12.20
Compaction	@ $2.50/cy	x 5.1 cy/LF	12.75
Shoring	@ $1.00/sq ft	* 40 Ft²/LF	40.00
Well Pointing	@ $50.00/LF	* 1 Ft/LF	50.00
Concrete	@ $600/cy	* 2.11 cy/LF	1266
		total Cost =	$1500/LF

1378
92
[illegible]

Option 1

Diversion Structure Nitrification/Denitrification

Need to split flows such that 90 mgd avg
125 mgd peak
goes to denitrification and 310 mgd avg
415 mgd peak
to outfall

Need weir length for 415 mgd
×1.55 = 643 cfs

$H = 3'$ $Q = CLH^{3/2}$ $L = \frac{Q}{CH^{3/2}} = \frac{643}{(3)(5.2)}$

$H^{3/2} = 5.2$

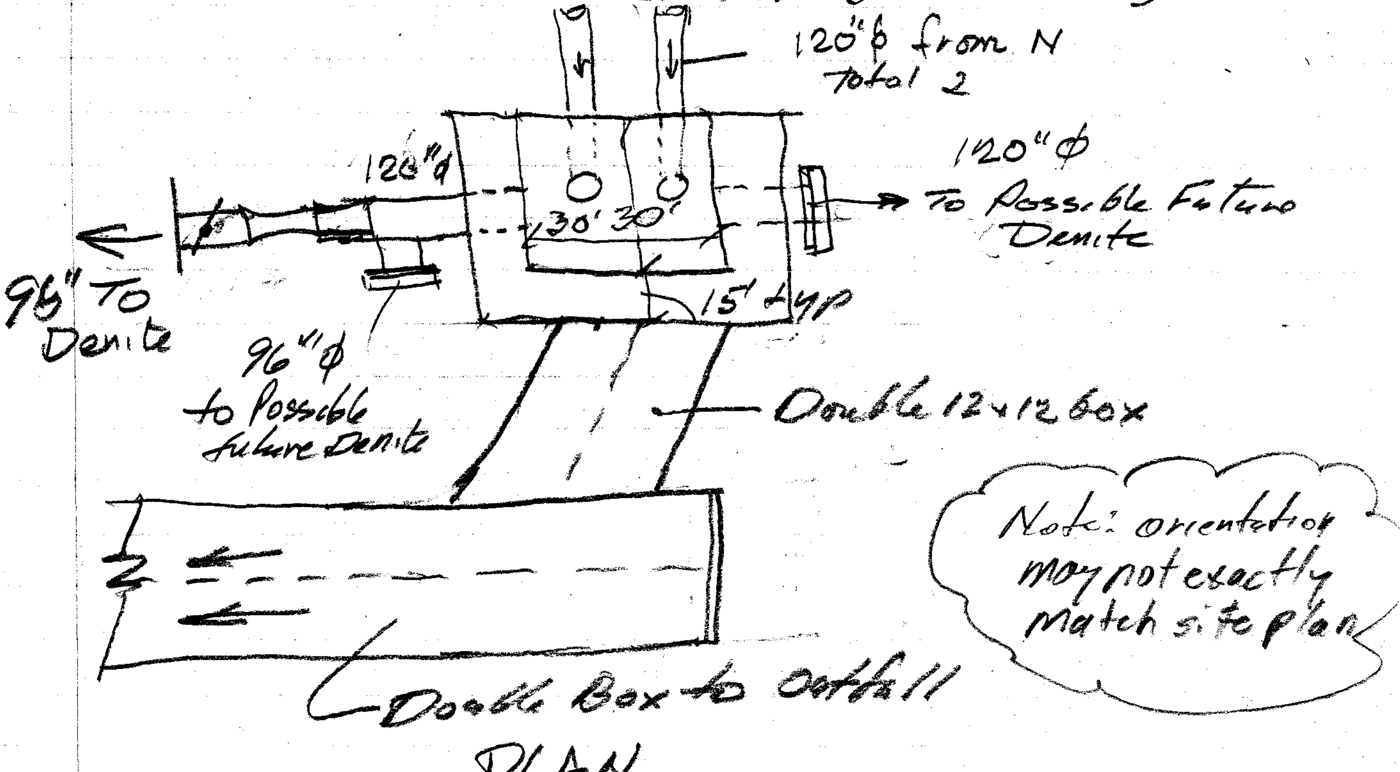
$L = \underline{\underline{42'}}$

Rise rate in structure set to 1 ft/sec

$Q = (540\text{ mgd})(1.55) = 840\text{ cfs}$

$A = Q/V = 840\text{ cfs}/1\text{ ft/sec} = 840\text{ ft}^2$

29' × 29' (Use 30'×30')



Note: orientation may not exactly match site plan

PLAN

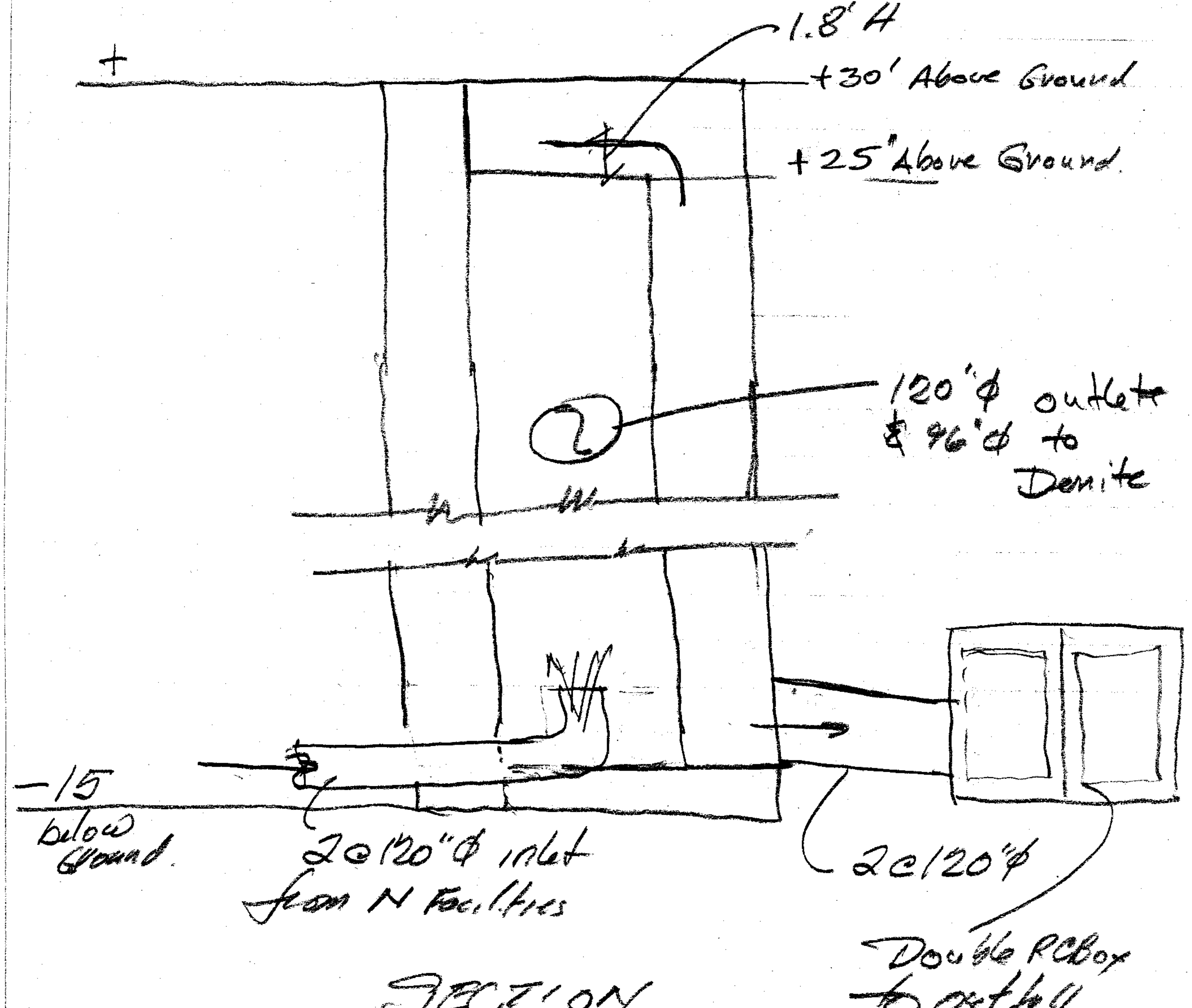
DIVERSION TO DENITE
OPTION 1 ONLY

Calc Actual Head over Weir

Q = 643 cfs

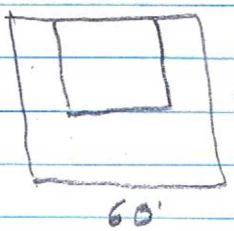
$$H^{3/2} = \frac{Q}{CL} = \frac{643}{(3.)(90)} = 2.38$$

$$H = \underline{\underline{1.8'}} \text{ ok}$$



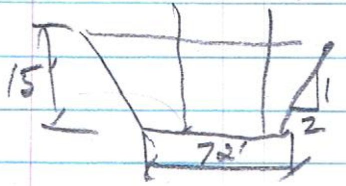
SECTION

Quantities



Outer Walls = (60 × 4)(45')(1.5' thick)/27 = 600 cy
Inner Walls = (30 × 3)(40)(1.5' thick)/27 = 200 cy
Bottom = (60)(60)(2' thick)/27 = 270 cy
270 cy
Total 1340 cy

Excavation



Top A = (72+15) = (84)^2 = 7920 ft^2
Bottom A = (72)^2 8 = 5180 ft^2
avg = 6550 ft^2

V excav = (6550)(15)/27 = 3640 cy

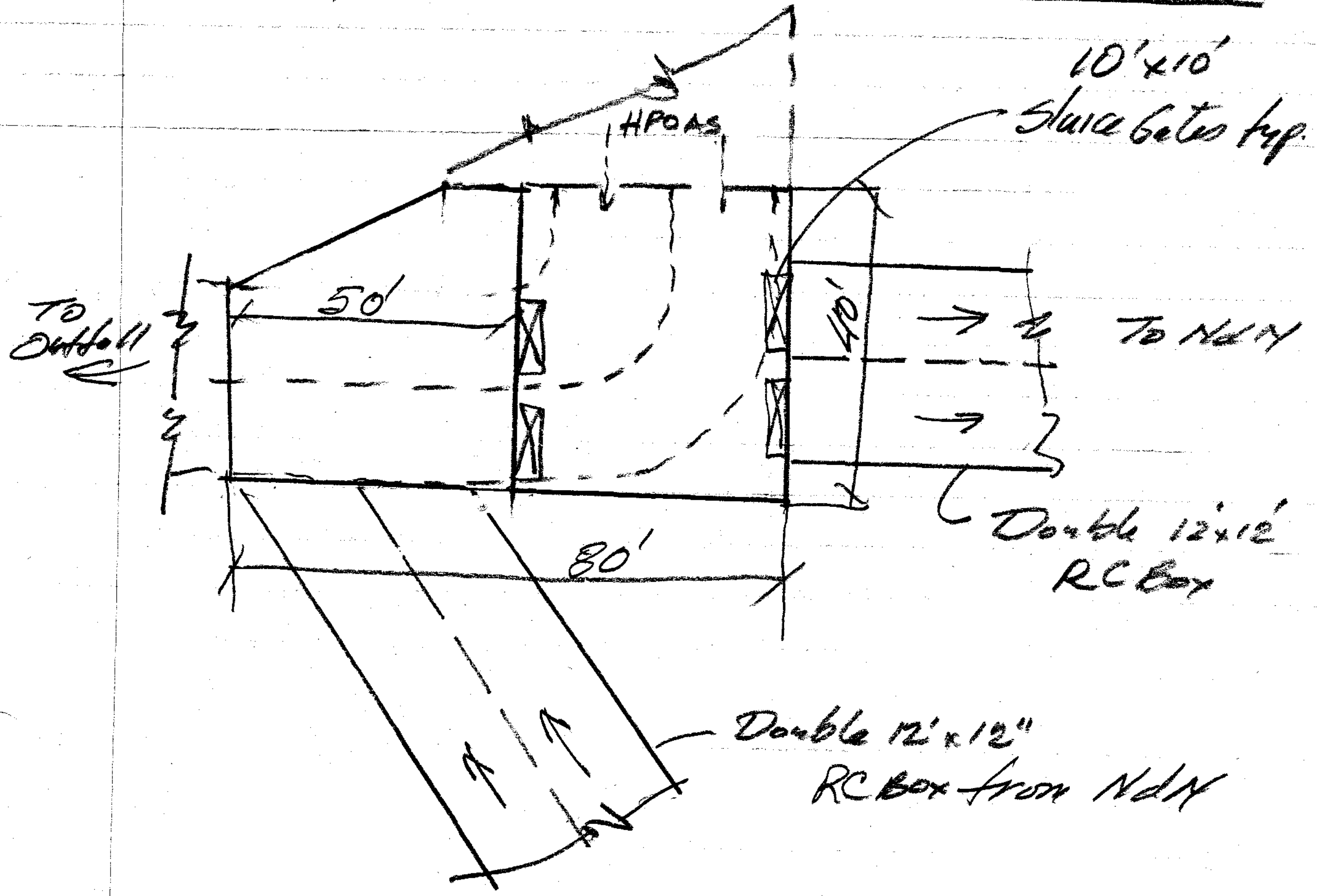
V structure = (60)(60)(15)/27 = 2000 cy

Backfill = 3640 cy − 2000 cy = 1640 cy

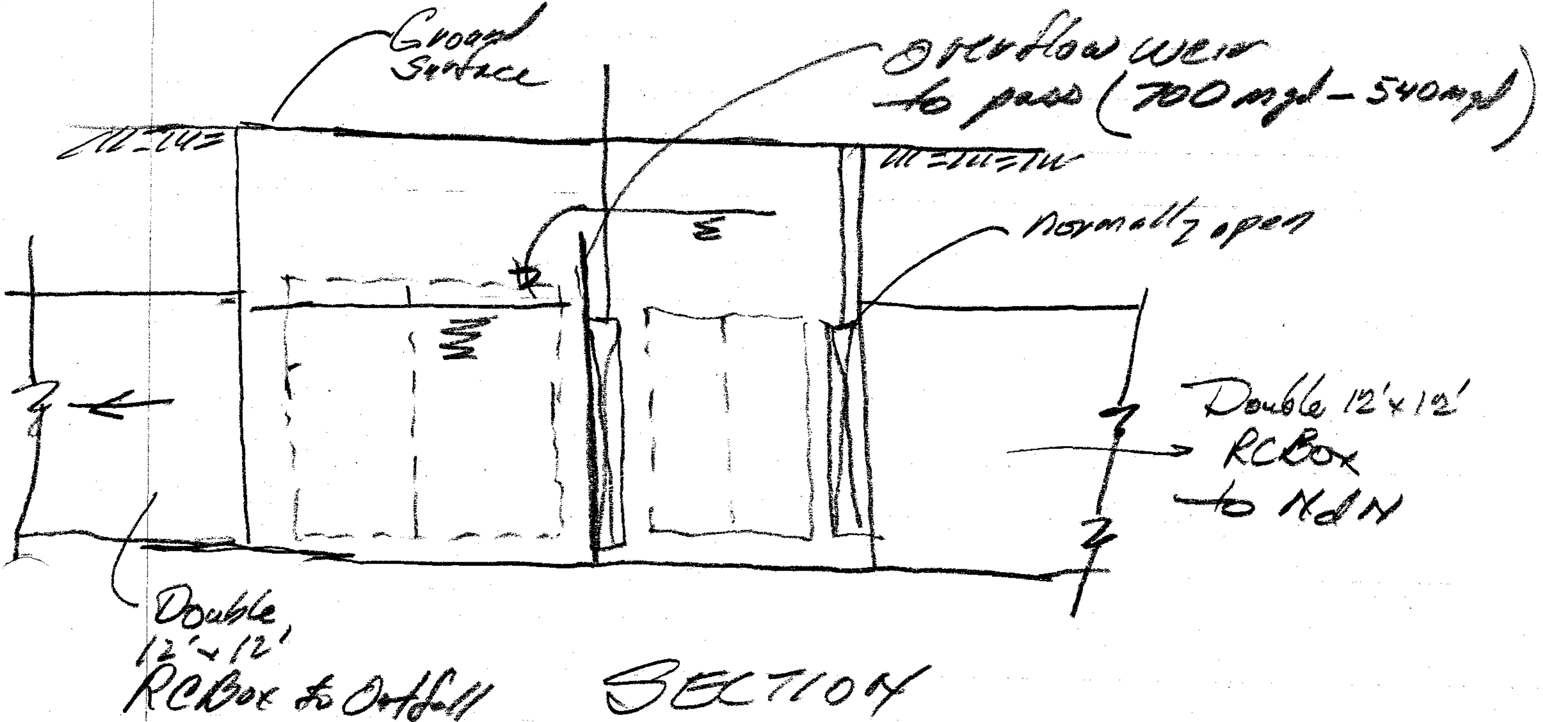
Shoring: 15' × 4(72) = 4320 ft^2
Well point dewatering around perimeter = 4(80) = 320'

Excavation	= (3640 cy)(20.00/cy) =	$73000
Backfill =	(1640 cy) (5.00/cy) =	8000
Compaction	(1640 cy) (5.00/cy =	8000
Shoring	(4320 ft^2) (1.00/sq ft)	4000
Well point	(320 ft)($50/ft) =	16000
Concrete	(1340 yd^3)($600/cy) =	805000
		$914000
		Say $950000

Concept of HPOAS Diversion Structure



PLAN



SECTION

HPOAS Diversion Structure

Excavation (90' x 50')(15' deep)/27 = **2500 cy**

Concrete

Slab (40)(80)(1.5' thick)/27 = 180 cy
Roof 180 cy
Walls [[(40+80)2] + 40'](15'H)(1.5 thick)/27 = 233 cy
(weirwall

Total 593 cy → **600 cy**

V structure = (80)(40)(15)/27 = 1780 cy
Backfill = 2500 − 1780 = 722 cy say **800 cy**

Demolition 90' / Double RCBox
2.72 cy/LF = 244 cy → **250 cy**

$300/cy + Haulaway & Disposal, say $400/cy.

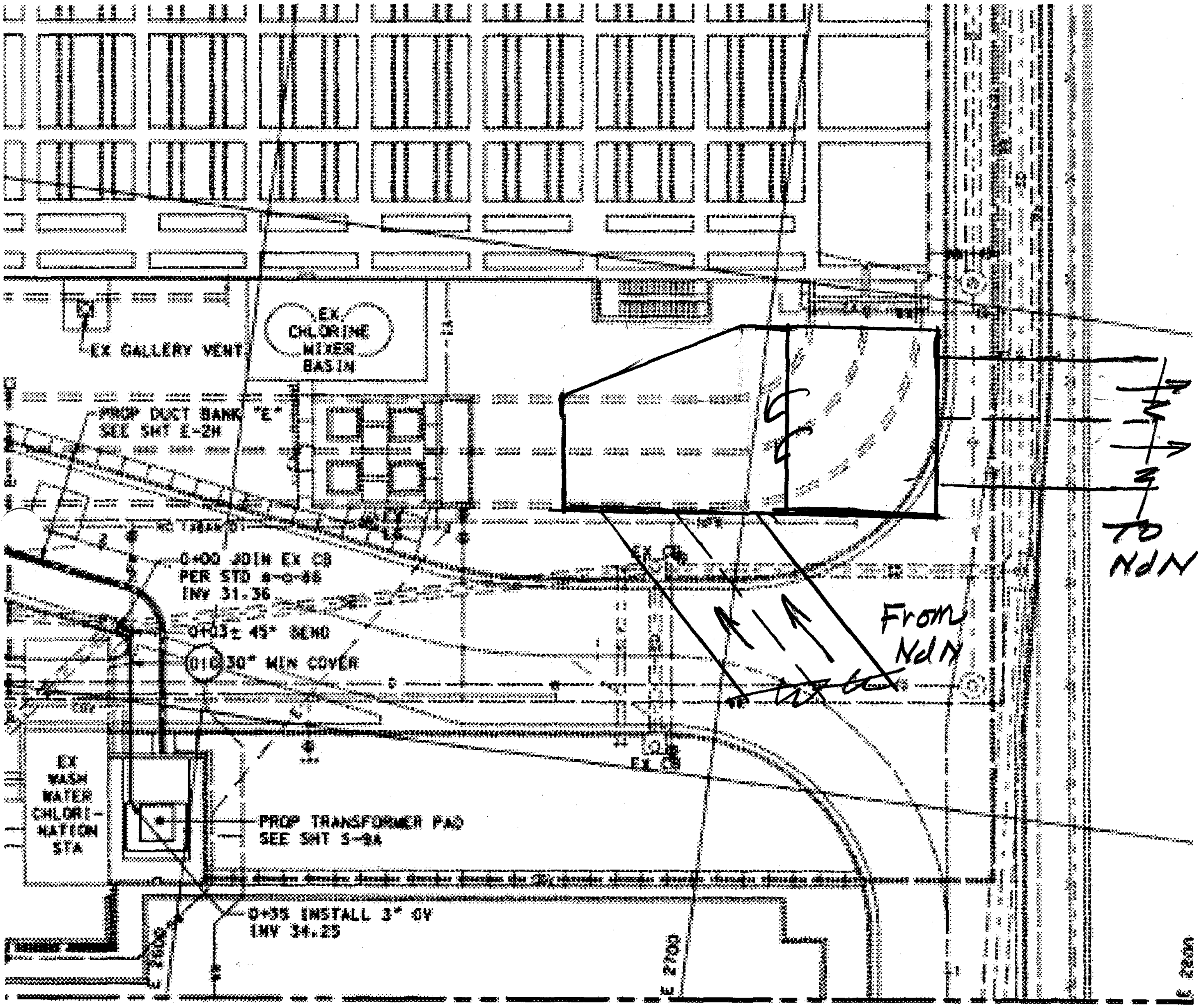
Diversion Weir

700 mgd − 540 mgd = 160 mgd
×1.55 = 250 cfs

$H = 2.5'$ $H^{3/2} = 3.95$ $L = Q/CH^{3/2}$
$L = (250)/(3)(3.95)$
= 21' use **25'**

Other items

Shoring (90+50)(2)(15) = 5600 ft²
Well points Assume 2 Lines 90' each = 180 ft
Gates 10×10' heavy duty $84000 each (material only)
Bypassing. 700 mgd. = 1085 cfs = 487000 gpm
Velocity = 5 ft/sec = 217 ft²
Use 4 @ 96"ϕ
Rainfor Rent ~ 30"x24" Rental 28000 gpm ≈ 200HP
Nedd 18 pumps.


EX GALLERY VENT
EX CHLORINE MIXER BASIN
PROP DUCT BANK "E"
SEE SHT E-2H
0+00 JOIN EX CB
PER STD a-o-46
INV 31.36
0+03± 45° BEND
010 30" MIN COVER
EX WASH WATER CHLORI-NATION STA
PROP TRANSFORMER PAD
SEE SHT S-9A
0+35 INSTALL 3" GV
INV 34.25
EX CB
EX CB
E 2700
E 2600
To NdN
From NdN

Site Plan

^ Confined

Excavation	$20.00/cy	× 2500 cy	=	50000
Backfill	$5.00/cy	× 800 cy	=	4000
Compaction	$5.00/cy	× 800 cy	=	4000
Shoring	$1 1/sqft	× 5000 ft^2	=	5000
Demolition	$400/cy	× 250 cy	=	100,000
Well points	$50/LF	× 180 ft	=	9000
Concrete	$600/cy	× 600 cy	=	360,000
10×10 Sluice Gates	4 each	× $110000	=	440000
		Total	-	$972,000

Bypassing for 120 days =
120 × $45000/d = $5,400,000

Let's use $1,000,000 for structure
3,000,000 for bypass
const. & operation
as there might be something easier than pumping

Bypassing Cost
Rental of 28000 gpm ~ 200HP pump
× $2000/HP ≐ 400,000 each
Assume recover cost over 2 yr
$200000/yr = $550/day
+ Fuel @ 500 gal/day × 3.30/gal = $1650/day
$2200/day

96" pipe @ $300/ft
× 3600 ft total = $1,080,000
÷ 365 (1 yr recovery) = $3000/day

18 pumps @ $2200/day =	$40000/day
Pipe	$3000
Operator full time	500
	$43500

Say $45000/day

EXHIBIT C

CONCEPT LEVEL COST ESTIMATE FOR IMPLEMENTATION OF ADVANCED WASTEWATER TREATMENT and ZERO LIQUID DISCHARGE at the JOINT WATER POLLUTION CONTROL PLANT

for

County Sanitation Districts of Los Angeles County

1955 Workman Mill Road
Whittier, CA 90601-1400

December, 2010

Joseph C. Reichenberger, P.E., BCEE

Consulting Civil and Environmental Engineer
Registered Professional Engineer: CA, NV, NM, AZ, HI

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Monterey Park, CA 91755
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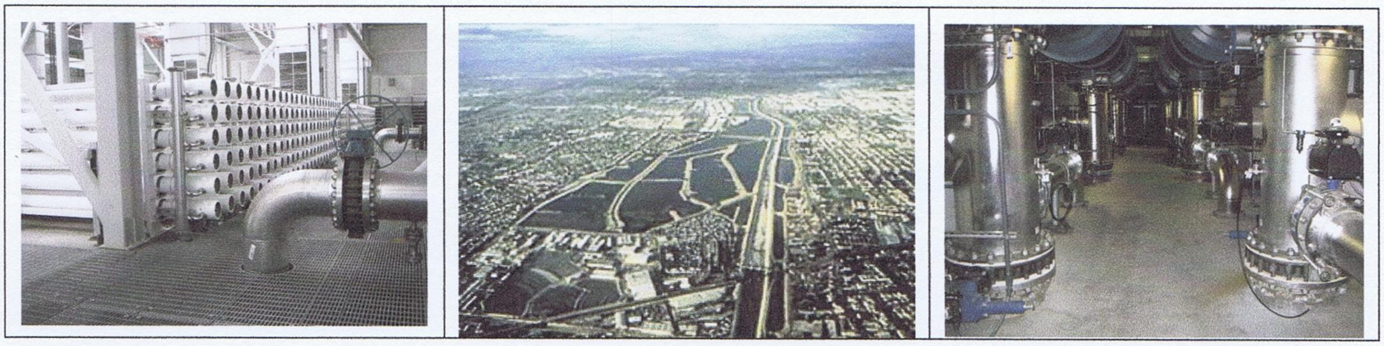
Fax (626)-571-6099
e-mail: jreichenberger@lmu.edu
jreichenberger@charter.net

Project Number 10-01

CONCEPT LEVEL COST ESTIMATE FOR IMPLEMENTATION OF ADVANCED WASTEWATER TREATMENT and ZERO LIQUID DISCHARGE at the JOINT WATER POLLUTION CONTROL PLANT



for

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1955 Workman Mill Road
Whittier, CA 90601-1400

December, 2010

REGISTERED PROFESSIONAL ENGINEER
J. C. REICHENBERGER
No. 18034
Exp 6/30/2011
CIVIL
STATE OF CALIFORNIA

12/6/2010

Joseph C. Reichenberger, P.E., BCEE
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Project Number 10-01

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ABBREVIATIONS AND ACRONYMS

AFY	Acre-ft per year
AOP	Advanced oxidation process (hydrogen peroxide and UV)
AWT	Advanced wastewater treatment
BOD_5	5-day Biochemical Oxygen Demand
$CaCO_3$	Calcium Carbonate (standard for expressing alkalinity)
Cfs	Cubic feet per second
COD	Chemical Oxygen Demand
DFG	California Department of Fish and Game
DPH	California Department of Public Health
DWI	Deep well injection
EDR	Electrodialysis reversal
H2O2	Hydrogen peroxide
HP	horsepower
HPO or HPOAS	High Purity Oxygen or High Purity Oxygen Activated Sludge
JWPCP	Joint Water Pollution Control Plant
LACDPW	Los Angeles County Department of Public Works
LACSD	Los Angeles County Sanitation Districts
kWh	kilowatt hour
MF	Microfiltration
MG	million gallons
mgd	million gallons per day
MSL	Mean sea level
NaOH	Sodium hydroxide
NdN	Nitrification followed by Denitrification
OCWD	Orange County Water District
RO	Reverse osmosis
TDH	Total dynamic head
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TS	Total Solids
UV	Ultraviolet Light
VSS	Volatile Suspended Solids
WAS	Waste Activated Sludge
ZLD	Zero Liquid Discharge

SECTION 1
INTRODUCTION AND PROJECT REQUIREMENTS

The work presented herein presents the concept level costs of construction and operation of advanced wastewater treatment (AWT) facilities at the County Sanitation Districts of Los Angeles County (Sanitation Districts or LACSD) Joint Water Pollution Control Plant (JWPCP) in Carson, CA for possible groundwater recharge in spreading basins and recharge wells. The Sanitation Districts also desire to evaluate concept level costs for a high recovery, zero liquid discharge (ZLD) facility for the brine waste from the AWT. Costs for deep well injection (DWI) of the AWT brines was evaluated as an alternative to the high recovery, ZLD facility. The cost estimates are intended only as guidance in assessing the economic impacts of a decision to implement these projects, should they become necessary. The costs are rough order of magnitude costs since detailed routing studies and feasibility level engineering studies, permits, utility searches, etc. have not been completed as they were not a part of the scope of work.

Note that the term “injection well” is sometimes used in this report for “recharge well.” This is not to be confused with DWI where the term “deep injection well” or “brine disposal well” is used.

The scope of work established by the Sanitation Districts for this study envisioned the use of cost information and previous studies and reports for similar projects as the basis for the cost estimates. The costs for conveyance pipelines used unit costs based on cost per inch diameter per unit length of pipeline. Sources for the costs are discussed in the various sections of this report.

PROCESS BASIS

The intent is to model the AWT at the JWPCP after the advanced treatment facility constructed by the Orange County Water District (OCWD) for their groundwater recharge and barrier water project. The studies and costs reported by OCWD form the basis for the costs presented herein.

Several studies were reviewed for the ZLD facility, which included a study prepared by Trussell Technologies, Inc. for the Sanitation Districts (Trussell, 2009a, 2009b), a Water Reuse Association Publication survey of high recovery and ZLD technologies (Mickley, 2008), and an alternatives assessment of technologies for the Virgin and Muddy Rivers prepared by MWH Global for the Southern Nevada Water Authority (SNWA, 2006).

High recovery, ZLD facilities typically include precipitation softening to remove calcium and silica, followed by filtration, membrane treatment (reverse osmosis (RO) or electrodialysis reversal (ERD), brine concentration, brine crystallization and solids disposal. The proposed facility at JWPCP would involve these processes.

JWPCP SECONDARY EFFLUENT QUALITY

This study assumes secondary treatment in the existing, high-purity oxygen activated sludge treatment plant followed by full nitrification as a minimum. Recent studies have shown that long solids residence time (SRT) in the biological process [5 to 10 days or more], in conjunction with ammonia concentrations less than 0.5 mg/L as ammonia, minimize the biological fouling rate of microfiltration membrane systems.[1] Inclusion of denitrification preceding the AWT facility is optional. Denitrification recovers some of the alkalinity, but would likely increase the acid feed needed for calcium carbonate scale mitigation in the AWT process.

The costs for implementing the nitrification and denitrification system were presented in a previous report to

---

[1] Email D. Kasper to J. Reichenberger, 10/19/2010

the Santitation Districts (LACSD, 2010).

DESIGN FLOWS

Table 1-1 presents the design flow rates provided by the Sanitation Districts for this study.

Table 1-1
Planned Annual Recycled Water Recharge Volumes

Groundwater Basin	Annual Recharge Volume, AFY	Average Annual Recharge Flow Rate, mgd
West Coast Basin	13,000	12
Central Basin	53,000	47
Main San Gabriel Basin	39,000	35
Raymond Basin	18,000	16
Total	123,000	110

AFY – acre-ft/year; mgd – million gallons per day

AWT PRODUCT WATER QUALITY

The product water quality from the advanced wastewater treatment plant will meet the California Department of Public Health (DPH) requirements for planned groundwater recharge using either surface spreading or recharge (injection) wells as of the date of this report. The process model for achieving this is the process which has been permitted and made operational at the OCWD. This AWT process is approved by DPH and is the level of treatment expected by the regulatory agencies and the general public for indirect recycled water use.

LIMITATIONS

The cost estimates herein should be considered no better than Class 5, as designated by the Association for the Advancement of Cost Engineering (AACE, 2005). Class 5 estimates are based on limited information and have a wide accuracy range. The Class 5 estimate is the equivalent of an ANSI Z94.2-1989 Order of Magnitude estimate which has a range of accuracy from -30% to +50%. These types of estimates rely on cost/capacity curves and project “scale up” factors. Factors that affect costs include environmental mitigation and permitting, weather, material and equipment availability, labor productivity, contractors’ means and methods, the bidding climate and market conditions at the time of bidding or other factors.

In the preparation of this conceptual cost estimate report, the scope did not permit modeling of the membrane systems; past reports and outside data were used to assist in the estimate. Constructing and operating a zero liquid discharge facility of the size conceptualized herein is stretching the technology experience. This project would be the largest ZLD facility for either water supply or reclamation. Similarly DWI of the AWT brine is subject to considerable technical and regulatory uncertainties and requires further study, including extensive subsurface investigations, before determining its feasibility.

No investigations were made relative to the capacity and operation of the existing spreading grounds, specific locations for possible recharge wells, sites for reservoirs and pumping stations, or brine disposal wells. The project, if constructed, will be in public rights-of-way in Los Angeles County and a number of incorporated cities. No contact has been made with these agencies to identify permit and traffic control, trenching, or zoning and land use requirements.

PROCESS FLOW

Advanced Wastewater Treatment Facility

The Process Flow at the OCWD facility is shown in Figure 1-1. This process will be similar at the JWPCP except the reject waters from the reverse osmosis systems will not be discharged to the ocean but instead will be treated in a zero discharge facility or deep well injected.

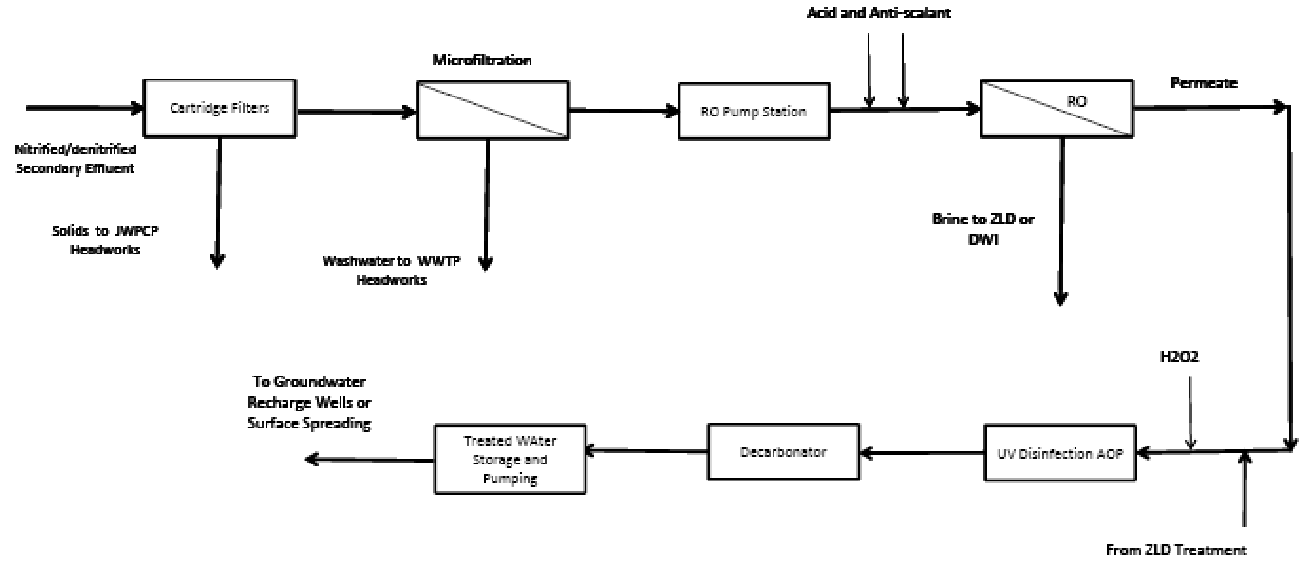

Figure 1-1
OCWD AWT Simplified Process Flow Diagram

The nitrified, and optionally partially denitrified, JWPCP secondary effluent will pass through motorized strainers for the purpose of removing any carry-over materials that could damage the membrane systems downstream. The screened water will then enter the microfiltration (MF) process for removal of fine particulates that could clog and foul the downstream reverse osmosis process. The product water from the MF process enters a break tank to break the pressure; a transfer pump then pumps it through cartridge filters – again to protect the reverse osmosis membranes. The MF effluent is then acidified, converting the bicarbonates (and any carbonates) to carbon dioxide to prevent calcium carbonate scaling of the reverse osmosis membranes downstream; an anti-scalant is also added to prevent scaling from such ions as fluoride, silica, and sulfates. The pretreated MF product water is then pumped through the reverse osmosis system and then through a high intensity ultraviolet light irradiation system supplemented by hydrogen peroxide for disinfection and enhanced removal of any compounds such as 1-4 dioxane and N-nitrosodimethylamine (NDMA) along with any chemicals of emerging concern. The disinfected product water is then passed through a decarbonator (stripping tower) to remove the carbon dioxide that has passed through the reverse osmosis membrane, and lime is added to stabilize the water (make it non-corrosive). The water can now be used for groundwater recharge using either surface spreading or recharge wells.

The motor-operated screens require periodic flushing and the MF system requires periodic backwashing. This washwater will be recycled back to the JWPCP influent since it only contains particulate matter. The reject water from the reverse osmosis system will be separately treated for zero liquid discharge or pumped to disposal in deep injection wells. The membrane systems will require periodic chemical cleaning through clean-in-place systems and the reject water from the chemical cleaning will be conveyed to the ZLD treatment or brine injection system.

The OCWD RO system operates at 85% recovery, i.e. 85% of the feedwater is product water; 15% is reject water. The facility uses a three –stage array configuration 78:48:24 vessels. The capacity is 5 mgd per train with a design flux rate of 12 gallons/sq ft/day (gfd). The system has production targets of 70 mgd (72,000 AFY), but, for a number of reasons, is only averaging 62 mgd, or 89% of capacity (OCWD, 2010).

Zero Liquid Discharge Facility Process Considerations

Trussell Technologies, Inc.

Trussell Technologies, Inc., (Trussell 2009a, 2009b), prepared a conceptual study for the Sanitation Districts estimating, for planning purposes only, the costs of construction and operation and maintenance for an MF/RO facility with various reject disposal options. Two technical memoranda were developed for the planning level capital cost (6 January 2009) and the operating cost (30 January 2009) for concentrate disposal for a 3 mgd MF/RO advanced treatment facility. The MF/RO was planned to provide 85% recovery, i.e., for every 100 gallons entering the MF/RO 85 gallons of product water would be generated and 15 gallons of concentrate (brine) would be produced. Three main treatment alternatives were evaluated at the conceptual/planning level to improve the MF/RO recovery and minimize the brine disposal volumes:

- Lime softening of the brine using an Accelator® by Infilco Degremont followed by brine MF and brine electrodialysis reversal (EDR). This would provide 90% overall recovery. The Accelator is a proprietary softening/recirculation clarifier.
- Lime softening of the brine using CONTRAFAST by Siemans or Densadeg ® by Infilco Degremont followed by brine MF and brine EDR. This would provide 95% overall recovery. The CONTRAFAST and Densadeg are high rate softening/thickening clarifiers. This provides 95% overall recovery.
- Lime softening of the brine using Tubular Microfilter by Siemans followed by brine MF and brine EDR. This would provide 97% overall recovery. The tubular microfilter uses high velocity flow through vessel lined with a membrane. The purpose is to permit greater concentration of the solids.
- Lime softening of the brine using CONTRAFAST by Siemans or Densadeg ® by Infilco Degremont followed by brine MF and brine EDR, brine concentrator and brine crystallizer. This would provide 98% overall recovery with no brine flow. Crystallized solids must be transported for disposal offsite.

Trussell (2009a) recommended the brine from the AWT be softened using lime and sodium hydroxide to reduce the calcium and magnesium. The pH of the effluent from the softening process would be adjusted using hydrochloric acid (HCl) and pumped through a microfiltration system to remove particulates (precipitates) that escape the softening process. The effluent from the microfiltration system would pass through cartridge filters and then will enter the EDR process. Anti-scalant would be added prior to the EDR system. The reject water from the EDR facility will flow to a brine concentrator for concentration.

The EDR process was selected due to the potential for elevated levels of silica in the brine from the AWT process. But Trussell states if pilot studies confirm the removal of silica in the softening process, then RO should be considered for brine treatment in place of EDR.

The influent to the brine concentrator, (EDR reject in this case), is heated until it becomes steam. The steam is cooled inside the evaporator (typically a vapor compression evaporator is used) and condenses as a high purity water. The brine is condensed at the bottom of the concentrator as a slurry. Typical feedwater recoveries range from 95 to 99%, with Total Solids in the concentrate about 250,000 mg/L (i.e. about 25% solids). The brine concentrator is made of special metallurgy, (titanium, Hastelloy and other exotic alloys) and is quite energy intensive—approximately 90 kW/1000 gallons (Zacheis, 2010). Sodium hydroxide is added to the brine concentrator. The brine concentrator produces a distillate which is high quality and it will be blended with the AWT product water and become part of the overall product water. The slurry from the brine concentrator will flow to a crystallizer.

A crystallizer further concentrates the slurry from the brine concentrator. It too uses steam and is constructed of expensive alloys. The crystallized solids are usually centrifuged or dewatered in an alternative process and then hauled offsite. Depending on the concentration of the metals and other constituents, this material may need special disposal. Crystallizers are also very energy intensive, requiring 200 to 250 kW/1000 gallons (Zacheis, 2010).

Other Studies

Mickley (2008) prepared cost estimates of several high recovery/ZLD facilities. One of the processes evaluated was lime softening, second stage RO, brine concentration and crystallization with the solids disposed of in a dedicated landfill. The process is essentially the same as that proposed by Trussell (2009a) with the exception that RO is recommended over EDR.

A study by the Southern Nevada Water Authority (SNWA, 2006) also used second stage RO for the ZLD process.

ZLD Process Treatment Considerations for JWPCP

Trussell (2009a) recommended the use of EDR in the ZLD process due to the silica in the brine from the AWT facility. The EDR does not provide a pathogen barrier and therefore does not produce Title 22 product water without additional treatment. If EDR were selected as part of the treatment process, the product water would have to pass through the first stage MF facility or be treated with a separate MF system. It would be more cost effective to have a separate MF facility for the EDR product water as it contains few solids and can be filtered at high flux rate in a dedicated MF facility. Furthermore there is minimal experience with EDR on concentrating brine from wastewater RO systems.

Another consideration is there is currently only one manufacturer of EDR and the Sanitation Districts may not want to select a process that sole sources the work to a single supplier – GE Ionics. When detailed studies indicate both processes are “equal,” often only RO is specified. If EDR is somewhat better than RO based on life-cycle costs, then both process are often specified to ensure competition.

Based on the above, and for purposes of this study, a second stage RO will be used in lieu of the EDR for cost estimating purposes.

ZLD Process Recommendation for JWPCP

Based on the discussion above, and for purposes of estimating the ZLD cost, second stage RO will be used. The ZLD process flow schematic is shown in Figure 1-2.

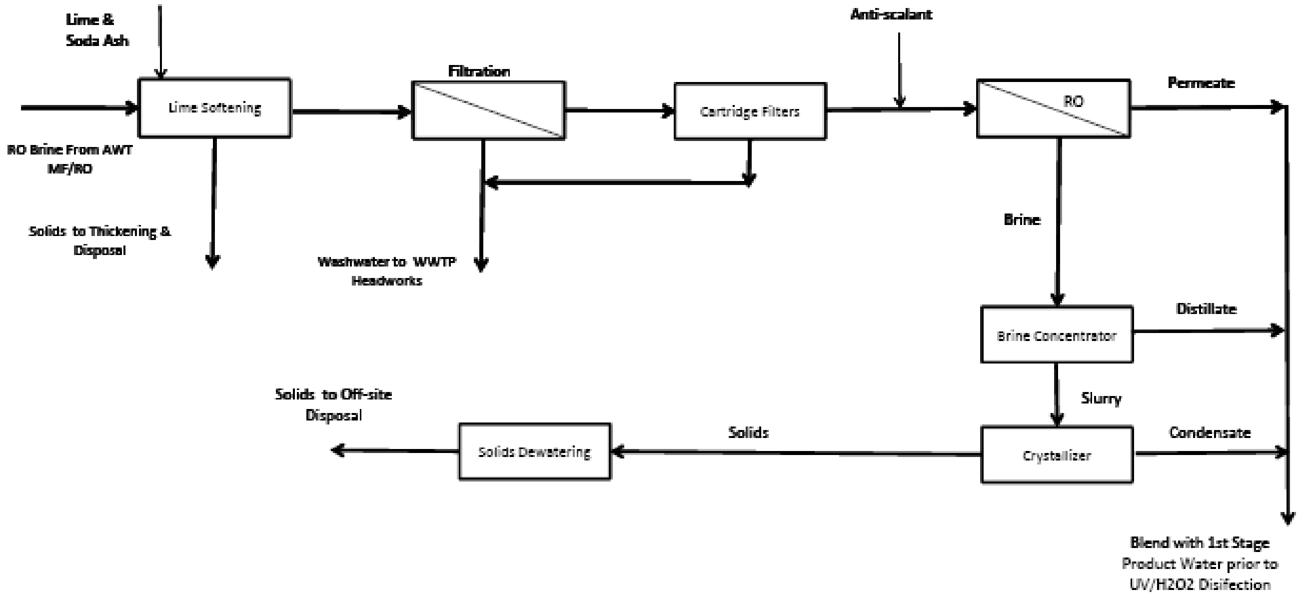

Figure 1-2
JWPCP Brine Treatment
ZLD Process Flow Diagram

ACKNOWLEDGEMENT

This report was reviewed by Dr. Dennis R. Kasper, PE, Environmental Consultant. He has extensive experience in membrane treatment systems and was part of the Parsons project team involved with the large scale ZLD facility for Southern Nevada Water Authority's Muddy River and Virgin River Project. His valuable comments and effort have made a significant contribution to this report.

AUTHORIZATION

This report was prepared by Joseph C. Reichenberger PE BCEE, Consulting Engineer, under contract with the County Sanitation Districts of Los Angeles County, blanket contract no B100482.

SECTION 2
GROUNDWATER RECHARGE AND INJECTION LOCATION

Table 2-1 presents the information presented previously in Section 1 for convenience. Table 2-1 lists the quantities of recharge water to be spread or injected by recharge wells into the four major groundwater basins within the San Gabriel Valley and Coastal Plain of Los Angeles County.

Table 2-1
Planned Annual Recycled Water Recharge Volumes

Groundwater Basin	Annual Recharge Volume, AFY	Average Annual RechargeFlow, mgd
West Coast Basin	13,000	12
Central Basin	53,000	47
Main San Gabriel Basin	39,000	35
Raymond Basin	18,000	16
Total	123,000	110

AFY – acre-ft/year, mgd – million gallons per day

THE GROUNDWATER BASINS

The West Coast Basin and a major portion of the Central Basin have a series of aquifers isolated by low permeability formations as shown in Figure 2-1. As a result, injection is the only suitable means of recharging the basins. The Central Basin, however, has significant forebay areas, where surface spreading can be performed (Montebello and Los Angeles Forebays). Little surface spreading occurs in the Los Angeles Forebay due to the lack of spreading facilities. These are shown in Figure 2-2.

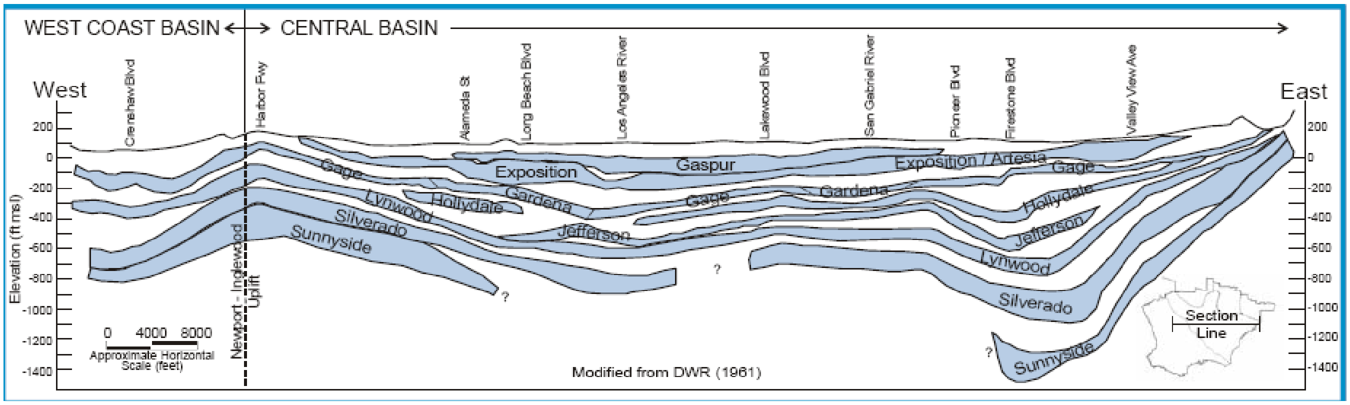

Figure 2-1
Cross Section Through the Central Basin and West Coast Basins
(Source: Water Replenishment District of Southern California Tech Bulletin Vol 1, Fall 2004)

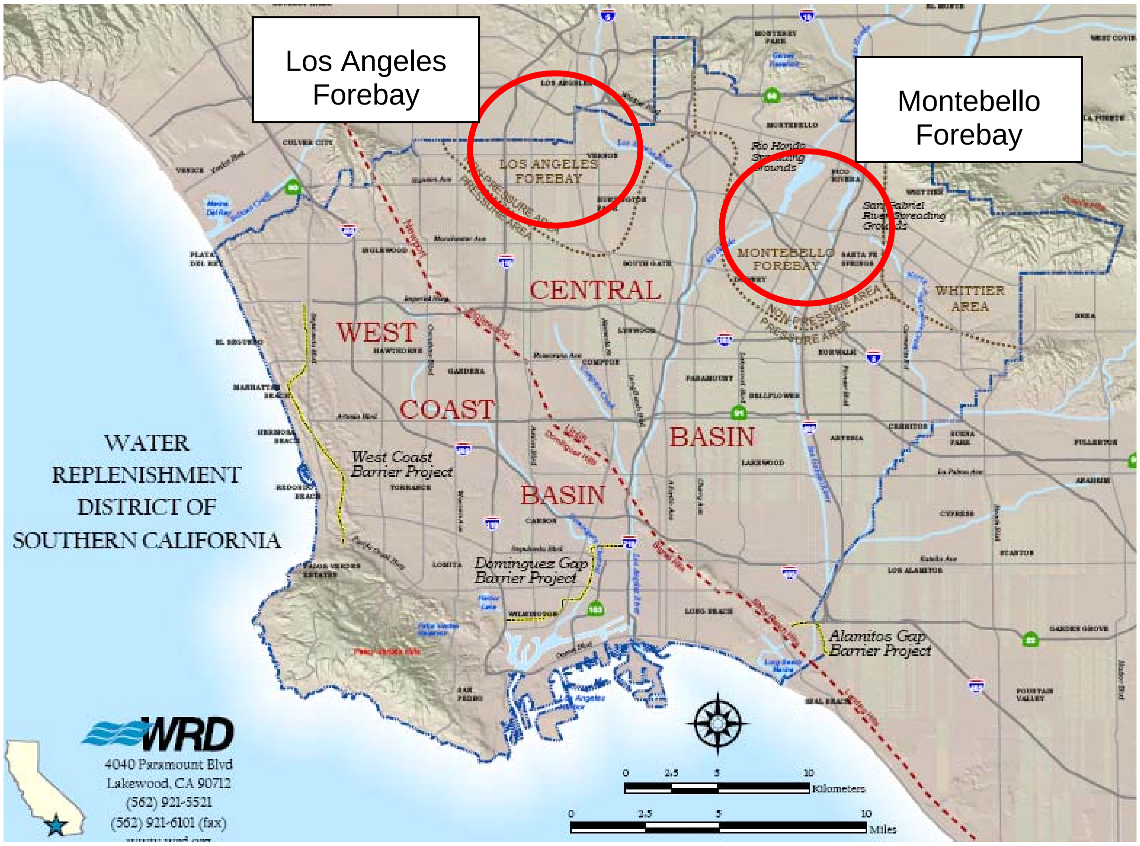

Figure 2-2
Location of Central and West Coast Basins

The Raymond Groundwater Basin is located along the foothills of the San Gabriel Mountains underlying Pasadena and Sierra Madre. See Figure 2-3. The Raymond Basin is an unconfined aquifer which can be recharged through surface spreading. This is currently done with storm water, recycled water and imported water.

The Main San Gabriel Basin underlies most of the San Gabriel Valley and is south and east of the Raymond Basin (see Figure 2-4). The Raymond Fault, which follows Huntington Drive, separates the Raymond Basin from the Main San Gabriel Basin. The Main San Gabriel Basin, like the Raymond Basin is unconfined and easily recharged through surface spreading. Many such recharge facilities exist and are used to recharge local runoff, captured mountain runoff, and imported water. Recycled water is not currently spread in the Main San Gabriel Basin.

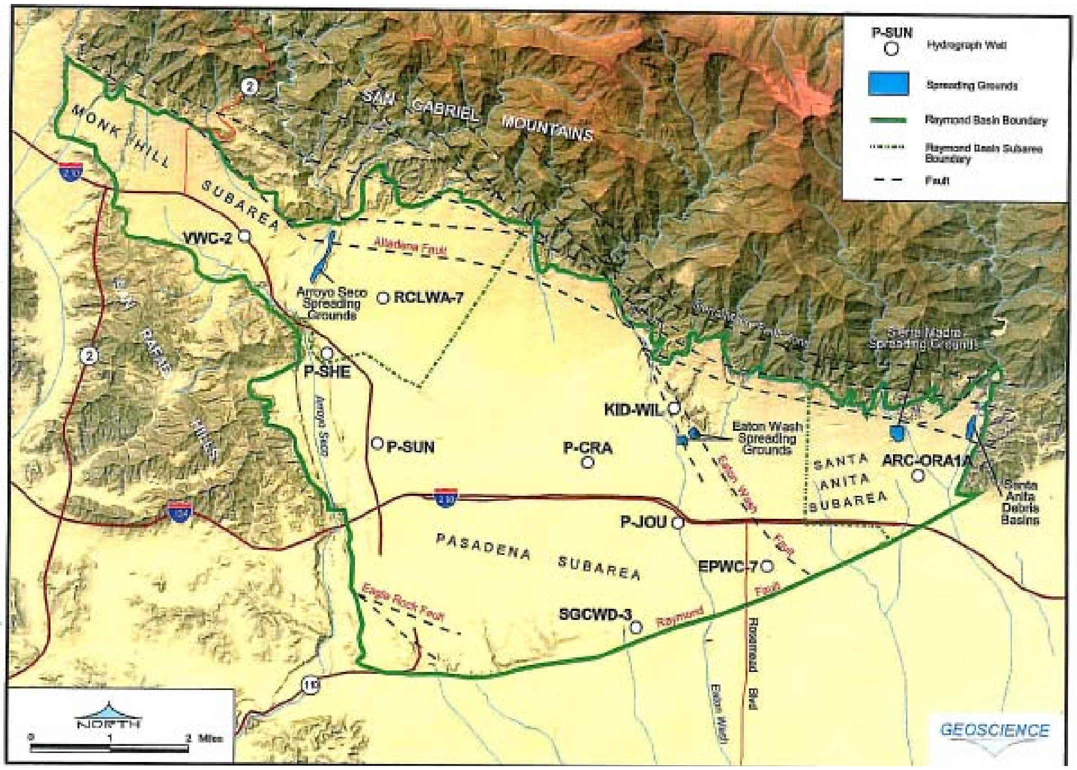

Figure 2-3
Location of the Raymond Groundwater Basin

EXISTING GROUNDWATER RECHARGE FACILITIES

West Coast Basin

The West Coast Basin is recharged by injection wells, which are part of the West Coast Basin and Dominguez Gap Seawater Intrusion Barrier Projects operated by the Los Angeles County Department of Public Works (LACDPW). Water, which is recharged in the Montebello Forebay, does “leak” across the Newport-Inglewood Fault Zone into the West Coast Basin and supplements the water from the recharge wells. There are no surface spreading facilities overlying the basin; so any planned recharge will have to be done through injection wells. See Table 2-2 for details on the injection wells.

The information in Table 2-2 indicates that injection wells are quite feasible and will be used as the basis for the concept recharge facilities for the product water from the JWPCP AWT.

Central Basin

Recharge in the Central Basin is primarily through surface spreading operations in the Montebello Forebay and San Gabriel River between Whittier Narrows and Firestone Blvd. There is also a surface recharge facility along the Los Angeles River, called the Dominguez Gap Spreading Grounds.

Some injection is done at the Alamitos Sea Water Barrier.

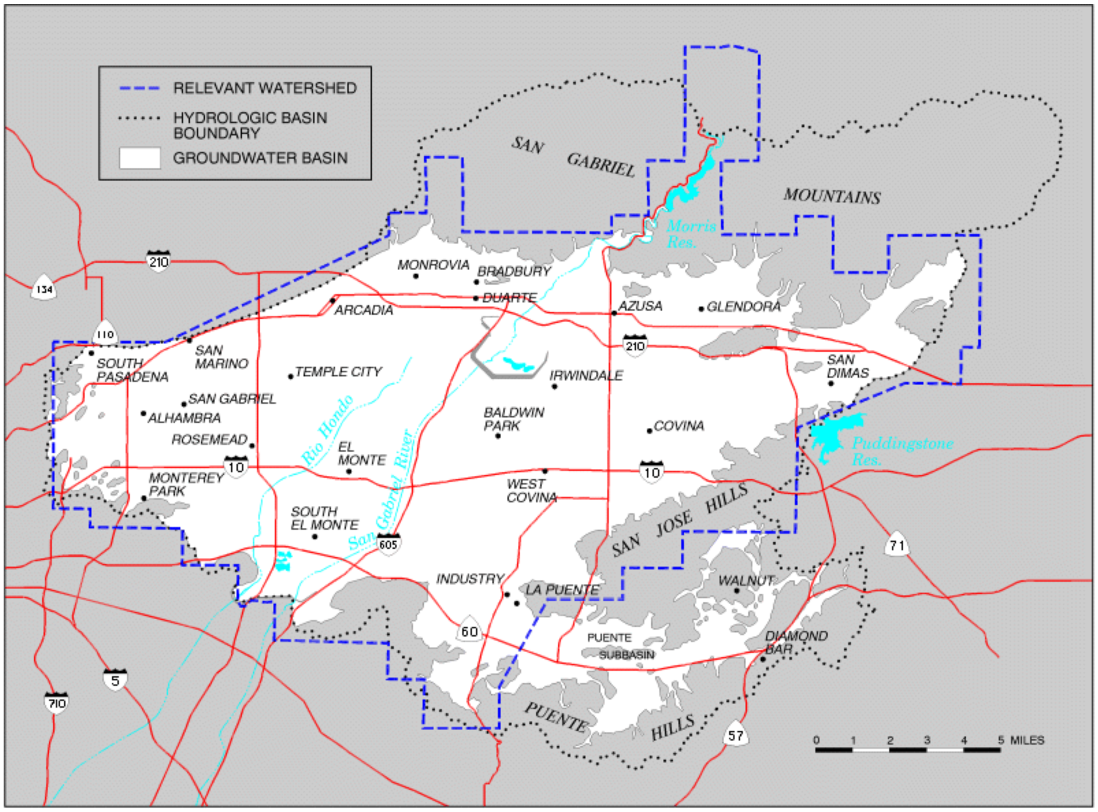

Figure 2-4
Main San Gabriel Basin

Table 2-2
West Coast Basin Injection Wells

Parameter	West Coast Basin Barrier	Dominguez Gap Barrier
Approximate Length	9 miles	6 miles
Number of Wells	153	94
Depth of Wells	700 ft	450 ft
Average Well Spacing	300	340 ft
Water Injected	13,600 AFY (08-09)	6,300 AFY (08-09)
Average Injection/Well	90 AFY (80,000 gal/day)	67 AFY (60,000 gal/day)
Source of Injection Water	Imported water and reclaimed water	Imported water and reclaimed water

Source: Water Replenishment District

Table 2-3
Central Basin Injection Wells

Parameter	Alamitos Barrier
Approximate Length	2 miles
Number of Wells	43
Depth of Wells	450 ft
Average Well Spacing	250 ft
Water Injected	7800 AFY (08-09)
Average Injection/Well	181 AFY (160,000 gal/day)
Source of Injection Water	Imported water and reclaimed water

Source: Water Replenishment District

Table 2-4 presents some of the characteristics of the spreading basins in the Central Basin as well as the Raymond and Main San Gabriel Basins. For the Central Basin, the major recharge areas are the Rio Hondo Coastal and San Gabriel Coastal Spreading Grounds, which are located in the Montebello Forebay along the San Gabriel River downstream of Whittier Narrows. Conveying recycled water to this area would require a lift of about 165 ft (plus the friction loss in the pipeline); so this is very feasible. The Dominguez Gap Spreading Basin is small in terms of recharge capacity compared to the Rio Hondo and San Gabriel Coastal spreading grounds. Although the Dominguez Gap Spreading Basin could be used, it is not considered in this study.

The recharge capacity in the Rio Hondo Coastal and San Gabriel Spreading Grounds is estimated to be over 260,000 AFY. However, this capacity has never been reached. The maximum historic amount of water percolated is just over 181,000 AFY, with the long term average of just over 87,000 AFY. It is clear there is ample capacity in this area for recharge of the additional 53,000 AFY considered in this study providing the timing of the recharge can be coordinated with the storm water spreading. Note that some of the 53,000 AFY could be recharged via injection, but that would be more costly that surface spreading.

Main San Gabriel Basin and Raymond Basin

Table 2-4 contains a list of all of the spreading basins in the Main San Gabriel Basin and the Raymond Basin. In the Raymond Basin the largest recharge area is the Arroyo Seco Spreading Grounds behind Devil’s Gate Dam. This area has been studied by the City of Pasadena and others as a possible conjunctive use site. The elevation is 1100 ft above sea level which is substantially higher than the other Raymond Basin Spreading Grounds, however.

The estimated capacity of the Raymond Basin Spreading Grounds is just over 18,000 AFY, not including the Arroyo Seco, but it is possible that more capacity exists. Considering the desire to also spread local runoff, there does not appear to be adequate capacity available in the Raymond Basin without using the Arroyo Seco spreading grounds.

In the Main San Gabriel Basin there is spreading capacity for about 350,000 AFY just considering the spreading grounds that are below elevation 800 ft MSL. The historical maximum annual water spread was just under 275,000 AFY so the additional 39,000 AFY proposed in this study from the JWPCP AWT should be able to be accommodated without having to pump to higher elevations, i.e., basins above 800 ft MSL.

Table 2-4
Characteristics of Surface Spreading Basins

Spreading Basin	Wetted Area, acres	Percolation Rate, cfs	Estimated capacity, AFY	Average AFY	Maximum Historic AFY	Ground Surface Elev MSL
Raymond Basin						
Arroyo Seco	15	18	9900	3770		1100
Eaton Wash Grounds	25	14	7700	945	4761	785
Santa Anita	8	5	2750	473	1641	745
Sierra Madre	9	15	8250	1682	5003	750
Total			28600	6870		
Total not incl Arroyo Seco			18700	3100	11405	
Main San Gabriel Basin						
Ben Lomond	17	30	16500	3108	8160	560
Big Dalton	8	12	6600	636	3766	1100
Buena Vista	6	6	3300	610	2731	340
Citrus	15	28	15400	938	6478	560
Eaton Basin	10	20	11000	1050	1078	515
Forbes	10	5	2750	776	2628	830
Irwindale Manning	30	60	33000	5466	41280	425
Little Dalton	5	15	8250	567	5546	1050
Live Oak	3	13	7150	210	1660	1270
Peck Road	105	25	13750	7817	50026	300
San Dimas Canyon	11	12	6600	1746	6049	1115
San Gabriel Canyon	140	50	27500	14575	33577	710
Santa Fe	168	400	220000	27236	124478	510
Sawpit	4	12	6600	769	2926	760
Walnut Wash	8	5	2750	1378	3261	490
Total			381150	66882	293644	
Total below 800 ft MSL			349800	62947	273995	
Central Basin						
Dominguez Gap	24	1	550	570	2414	15
Rio Hondo Coastal	430	400	220000	62006	96363	165
San Gabriel Coastal	96	75	41250	24792	82586	165
Total			261800	87368	181363	
Estimated capacity based on approx. 75% availability (275 days/yr)						

PROPOSED FACILITIES FOR TRANSPORT AND RECHARGE

The selection of the pipeline routes was based on the most direct route following public rights-of-way and streets. The route selection was solely to be able to obtain a rough length of pipeline. No attempt was made to refine the routing considering traffic and other utilities. The pipeline diameter selected was the most economical pipeline diameter determined by spreadsheet based on a Hazen-Williams C = 140, an installed cost of $8/ft/inch diameter, a power cost of $0.125/kWh, a pump efficiency of 0.75, a motor efficiency of 0.95 and an interest rate of 5% for 20 years. This spreadsheet was used to determine the size of all of the pipelines in this study.

West Coast Basin

Due to the presence of confining subsurface strata, any recharge in the West Coast Basin will have to be done using injection wells. The siting of the injection wells should consider the existing groundwater elevations (consider injecting where levels are the lowest) and the ability of the aquifer to "take" water. This would be reflected in the aquifer's specific capacity (gallons/minute of well yield per foot of drawdown). Figure 2-5 shows the water level contours in the West Coast and Central Basins in Fall 2009. Figure 2-6 shows the location of the major groundwater extractions. There is a significant amount groundwater production occurring between the 710 and 110 freeways, south of the 405 freeway. This would seem like an ideal location for injection wells, as this locations also appears to be a pumping "hole."

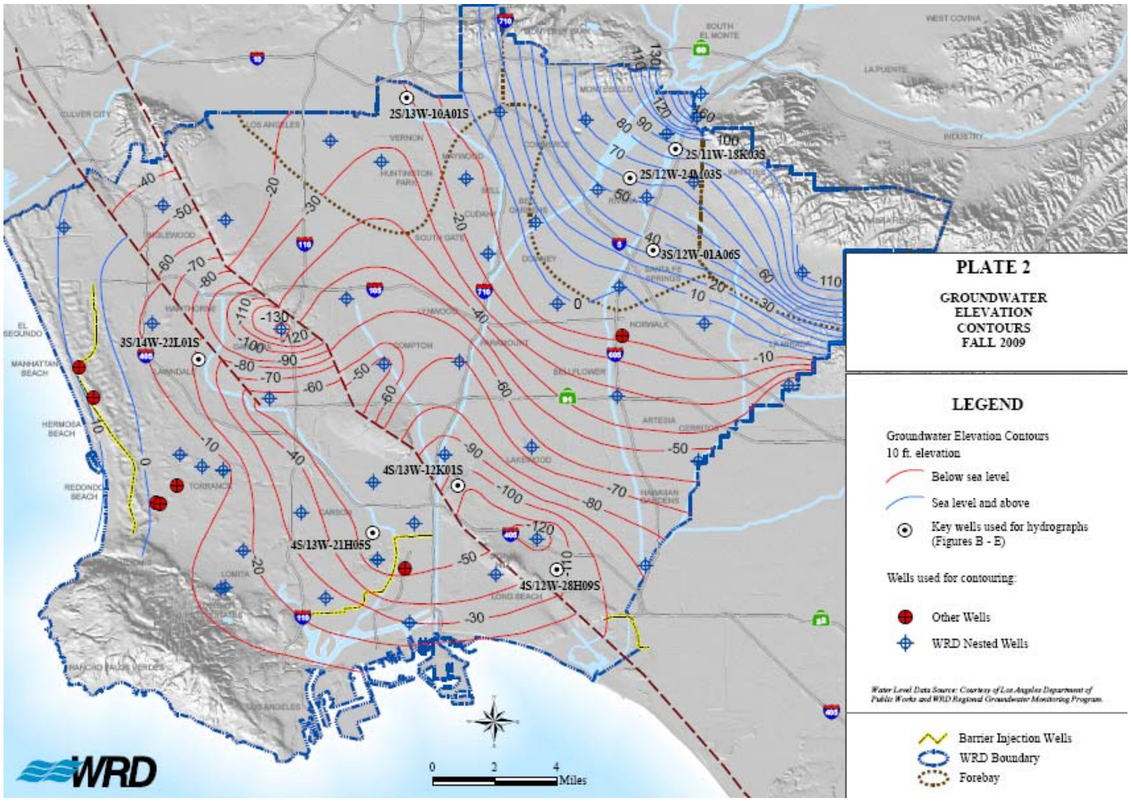

Figure 2-5

Groundwater Level in the West Coast and Central Basins

Figure 2-7 shows that the specific capacity of the aquifer in the areas with the significant extractions is high, which could lead to the conclusion that this might be an good area for injection wells. It is proposed that a series of injection wells be located along a new pipeline from the JWPCP AWT running along the southwest side of the 405 freeway from the 710 freeway to the 105 freeway.

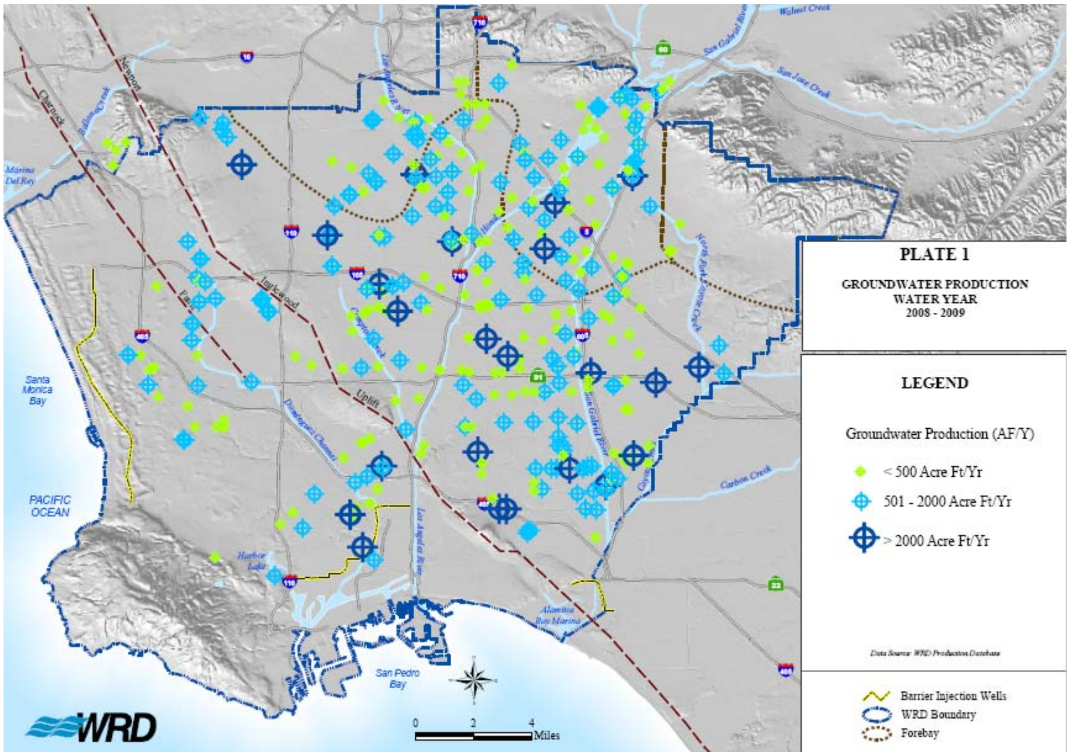

Figure 2-6

Groundwater Extractions in West Coast and Central Basins 2008-09

Table 2-5
Proposed West Coast Basin Injection Wells

Amount of Water Recharged	13,000 AFY
Pipeline Capacity	20 cfs (14,600 AFY)
Pipeline Diameter	30 in reducing to 12 in
Injection Well Capacity, each	90 AFY (80,000 gal/day)
Number of Wells (rounded)	150
Well Spacing	350 ft
Depth	700 ft
Length	11 miles
Maximum Ground Surface Elevation	100 ft MSL

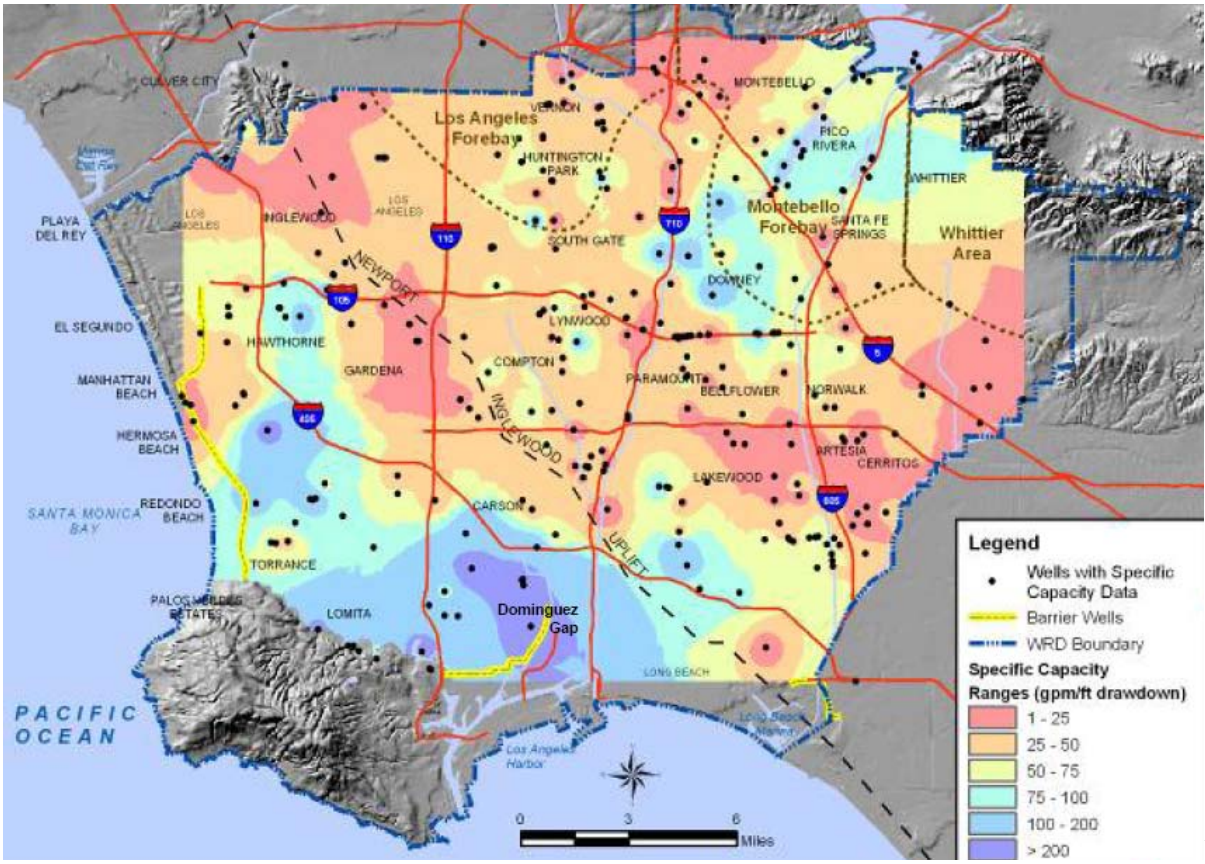

Figure 2-7
Generalized Specific Capacity of Wells in the West Coast and Central Basins
Source: Water Replenishment District of Southern California

Figure 2-8 shows the general alignment of the pipeline to serve the injection wells to recharge the West Coast Basin. This pipeline would be connected to the main conveyance pipe for the Central, Main San Gabriel, and Raymond Basins.

Central Basin

Figure 2-8 shows the alignment of the pipeline to convey recharge water to the Central Basin spreading grounds in the Montebello Forebay. The pipeline will also serve to convey the recharge water to the Main San Gabriel Basin and the Raymond Basin. It is anticipated there will be a pump station near the Rio Hondo and San Gabriel Coastal Spreading Grounds to boost the recycled water into the Main San Gabriel and Raymond Basins. This is an ideal location, since space should be available; and due to the significant elevation difference between the Rio Hondo/San Gabriel Coastal Spreading Grounds and the spreading basins in the Raymond and Main San Gabriel Basins, this would be an ideal location for re-pumping.

The pipeline northward from the JWPCP AWT facility will be 96-in diameter for the first 2 miles, until the branch off to West Basin is reached; then a 90-in diameter pipeline will extend to the Rio Hondo Coastal Spreading Grounds. The route is north on Delores Street to Carson St, then east to Lakewood/Rosemead and then north to the spreading grounds. A terminal reservoir will be located at the end of the pipeline at the San Gabriel Coastal/Rio Hondo Coastal Spreading Grounds to maintain pressurization in the line. The route is just approximate at this time as no utility surveys or traffic studies have been conducted. Table 2-6 contains information on the pipeline; Table 2-7 provides information on the pump station at JWPCP.

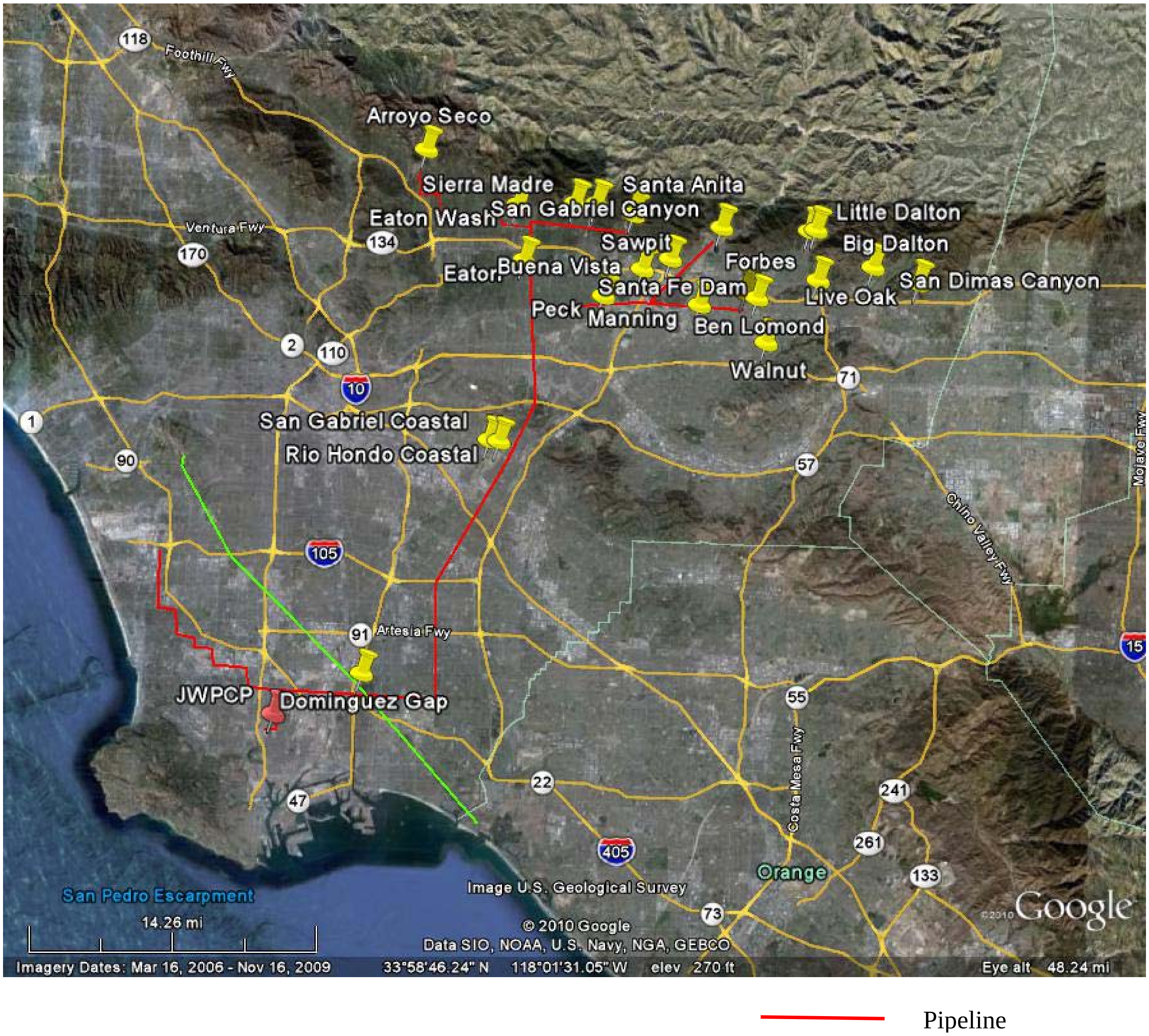

Figure 2-8
Location of Spreading Grounds and Conveyance Pipelines

In sizing the pump station and the pipeline in Tables 2-6 and 2-7, the capacity was increased to account for the surface spreading basins only being available 75% of the time, i.e., there would be times when storm water would be recharged and extra capacity for recycled water recharge might not be available at specific spreading basins.

Table 2-6
Proposed Pipeline to Rio Hondo Coastal Spreading Grounds

Amount of Water Conveyed	110,000 AFY
Pipeline Capacity	204 cfs (150,000 AFY)
Pipeline Diameter	90 in
Pipeline Length	120 000 ft
Friction loss in pipeline	60 ft

Table 2-7
Proposed Pump Station at JWPCP

Capacity	123,000 AFY
Total Pump Capacity (Allows for some periods when spreading facilities may not be fully available due to storm flows)	224 cfs (163,000 AFY)
Number of Pumps	6 (5 Duty)
Capacity each	45 cfs each (20,200 gpm)
JWPCP Elevation	30 MSL
Spreading Basins	165 MSL
Static Lift	135 ft
Friction Loss	60 ft
TDH	195 ft (200 ft)
Horsepower each pump	1400

Main San Gabriel and Raymond Basins

The recycled water would be pumped by a pump station at the Rio Hondo Coastal Spreading Grounds (or in close proximity) to a reservoir at or near the Eaton Wash Basins in the San Gabriel Valley. The reservoir would be located at El 800 MSL. A branch pipeline would extend from the main pipeline eastward to the Citrus Spreading Basins at El 560 MSL and to the San Gabriel Canyon Spreading Basins at El 710. Another pipeline would extend to the Sawpit Spreading Basins at El 710. With this piping arrangement, all spreading basins below El 800 would be able to receive recycled water from the same pipeline system.

Figure 2-9 is a schematic of the recycled water conveyance system. In the Main San Gabriel and Raymond Basins, the sum of the design flows leaving a particular pipeline junction or node exceed the flow into the junction or node. The reason for this is to provide some flexibility in the operation of the system.

Tables 2-7 and 2-8 present information on the pump station at the Rio Hondo Coastal Spreading Grounds and at Eaton Wash in Sierra Madre. Table 2-9 presents information on the conveyance pipelines in the Raymond and Main San Gabriel Basins.

Table 2-8
Proposed Pump Station at Rio Hondo Coastal Spreading Grounds

Capacity	57,000 AFY
Total Pump Capacity (Allows for some periods when spreading facilities may not be fully available due to storm flows)	106 cfs (77,400 AFY)
Number of Pumps	6 (5 Duty)
Capacity each	22 cfs each (9900 gpm)
Rio Hondo Spreading Ground Elevation	165 MSL
Reservoir at Eaton Wash Basins	800 MSL
Static Lift	635 ft
Friction Loss	60 ft
TDH	695 ft (700 ft)
Horsepower each pump	2400

Table 2-9
Proposed Pump Station at Eaton Wash Spreading Grounds

Capacity	9,000 AFY
Total Pump Capacity (Allows for some periods when spreading facilities may not be fully available due to storm flows)	20 cfs (14,600 AFY)
Number of Pumps	5 (4 Duty)
Capacity each	5 cfs each (2250 gpm)
Eaton Wash Spreading Ground Elevation	800 MSL
Arroyo Seco Spreading Grounds	1100 MSL
Static Lift	365 ft
Friction Loss	55 ft
TDH	420 ft
Horsepower each pump	400

Table 2-10
Summary of Pipelines in the Raymond and Main San Gabriel Basins

From	To	Diameter, in	Capacity, cfs	Length, Miles	Head loss ft/ft
Rio Hondo Coastal Spreading Grounds	Pipeline to Citrus and San Gabriel Canyon Spreading Grounds	66	106	8	0.00071
Connection to Pipeline from Rio Hondo Coastal Spreading Grounds	Pipeline to San Gabriel Canyon Spreading Grounds	54	75	6	0.00099
Connection to pipeline to Citrus Spreading Grounds	Citrus Spreading Grounds	30	25	5	0.0023
Connection to pipeline to Citrus Spreading Grounds	San Gabriel Canyon Spreading Grounds	48	50	4.5	0.00083
Connection to pipeline to Citrus Spreading Grounds	Tee to Eaton Wash and Sawpit Spreading Grounds	48	60	4	0.0012
Tee	Sawpit Spreading Grounds	42	45	5	0.0013
Tee	Eaton Wash Spreading Grounds Reservoir	36	30	0.75	0.0013
Eaton Wash Spreading Grounds Reservoir	Arroyo Seco Spreading Grounds	30	20	7	0.0015

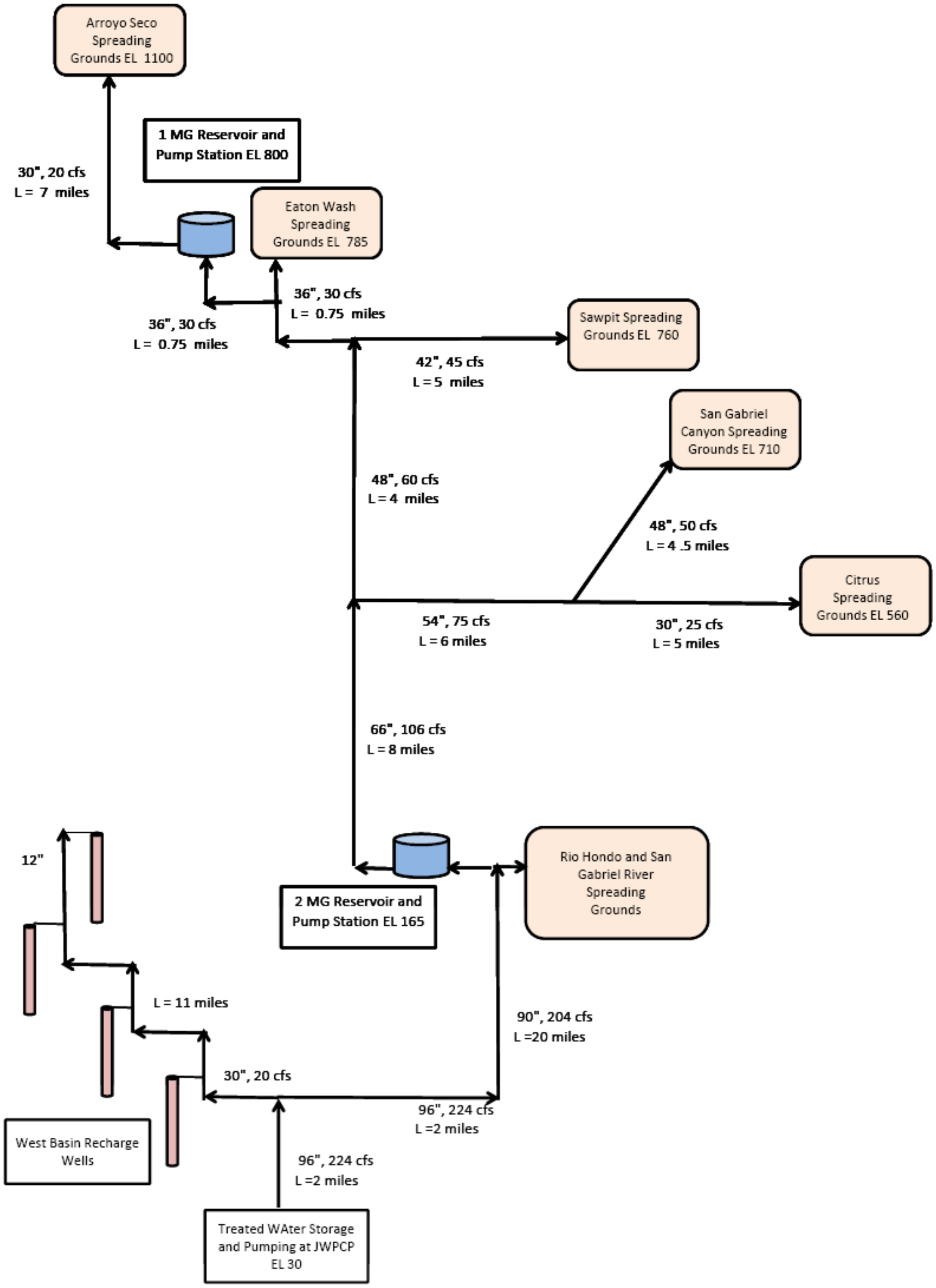

Figure 2-9
Pumping and Piping Schematic

SECTION 3

ADVANCED WASTEWATER TREATMENT AND ZERO LIQUID DISCHARGE FACILITIES

This section describes the basis for the costs of a possible advanced wastewater treatment (AWT) facility and zero liquid discharge (ZLD) facility at the JWPCP. The costs for the conceptualized JWPCP facilities are developed from costs experienced at the Orange County Water District's Groundwater Recharge Facility, and the ZLD facility costs developed by Mickley (2008). These costs were confirmed by similar ZLD work done for the Southern Nevada Water Authority (2006).

AWT INFLUENT WATER QUALITY CHARACTERISTICS

Nitrified/denitrified secondary effluent from the JWPCP is assumed as the influent to the advanced wastewater treatment facility. Influent water quality is taken from a previous report to the Sanitation Districts (LACSD, 2010). The influent water quality is assumed to have a total inorganic nitrogen of <10 mg/L, nitrite-N and ammonia-N of less than 0.2 mg/L each, and an alkalinity of 136 mg/L as $CaCO_3$. Note that denitrification is not required as part of the advanced treatment process; but for purposes of this cost study, denitrification is assumed. These and other characteristics are presented in Table 3-1. These influent characteristics have been supplemented with other data presented later in this section.

Table 3-1
Estimated AWT Influent Characteristics at JWPCP[1]

Constituent	Estimated Concentration, mg/L
Total Dissolved Solids	1400
Calcium Hardness, as $CaCO_3$	208
Magnesium Hardness, as $CaCO_3$	103
Calcium (calc)	83
Magnesium (calc)	25
Alkalinity, as CaCO3	136
Nitrate-N	9.6
Nitrite-N	0.2
Ammonia-N	0.2
Sulfate	240

calc – calculated from the hardness concentrations

AWT Influent Characteristics and the Impact on the AWT and ZLD Process

Table 3-2 presents the concentration of additional characteristics of the influent to the AWT process at the

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[1] From email F. Guerrero to J. Reichenberger, 9/22/2010 and LACSD (2010)

JWPCP. This is taken from the Sanitation Districts Annual Monitoring Report, (Effluent Monitoring Laboratory Data), for 2009. Data in Table 3-2 provides some indication of the factors that will affect the capital and the operating costs for the JWPCP AWT facility. The main constituents of concern for a membrane system are: $CaCO_3$, $CaSO_4$, $Ca_3(PO_4)_2$, CaF_2, $BaSO_4$, $SrSO_4$ and silica (SiO_2). The calcium carbonate ($CaCO_3$) can be accommodated with acid addition and changing the Langlier Saturation Index of the brine. The other compounds are more difficult to deal with. Since the nitrification/denitrification facility at JWPCP has not been constructed data was not available for these constituents. Instead, secondary effluent from the high purity oxygen secondary treatment process at JWPCP presented in the Sanitation Districts' Annual Monitoring Report for 2009 was used. It is assumed that these constituents will not be removed to any great degree as a result of treatment through a nitrification/denitrification facility. One element in Table 3-2 that was found to be relatively high was fluoride. Although the fluoride concentration is high, it should not limit the recovery significantly assuming adequate inhibitor is added.[2]

AWT AND ZLD PROCESS SCHEMATIC AND FLOW BALANCE

Figure 3-1 presents a process flow diagram and flow balance for a potential AWT and ZLD facility at JWPCP. This is based on the ZLD process presented in Section 1 and can only be considered very preliminary at this point since detailed modeling and pilot studies have not been performed. However,it will be used as a basis for the concept level cost estimate. The recovery is estimated to be 83% for the AWT RO process (74% for the combined AWT MF/RO process). For the second pass (brine) RO, 70% recovery is estimated. Note that 17 mgd of product water is obtained from the ZLD facility; therefore only 93 mgd is required as product water from the first stage (AWT) RO system.

AWT CONSTRUCTION AND OPERATION AND MAINTENANCE COST ESTIMATE

Figure 1-1 presented the process flow diagram for the OCWD AWT. As stated in Section 1, this is a state of the art facility for groundwater recharge by surface spreading and injection and meets current California Department of Public Health treatment requirements. The project had a total cost of $485 million for a 70 mgd product water AWT facility, which is ultimately expandable to 140,000 AFY (125 mgd). The OCWD treatment facility itself had an estimated cost of $305.3 million (OCWD, 2005). It was constructed between Jan 2004 and late 2007; it came on line in January 2008. This project took several years to construct, so it can be estimated that the costs are close to mid-2006 values. The project has 85% recovery. The plant is currently operating at 88% of capacity, on an annual basis (OCWD, 2010).

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[2] Email D. R. Kasper to J. C. Reichenberger PE dated October 28, 2010. CaF_2 concentrations in the brine can be up to 100 times saturation.

Table 3-2
Additional AWT Influent Characteristics at JWPCP

Constituent	Estimated Value or Concentration JWPCP , mg/L
Temperature	80°F
Bicarbonate Alkalinity, as $CaCO_3$	136
Carbonate Alkalinity, as $CaCO_3$	Negl
Estimated Total Hardness, as $CaCO_3$	311 (calc)
Carbonate Hardness, as $CaCO_3$	136 (calc)
Non-carbonate Hardness, as $CaCO_3$	175 (calc)
Chloride	380
Fluoride	1.4
Boron	0.8
Potassium	21
Sodium	396
Silica	No data
Strontium	No data
Barium	No data

calc = calculated value; alkalinity assumed to be all bicarbonate based on pH

Given:		Lime Sludge	5%
MF Recovery:	90.0%	Filter BW	7%
First Pass RO Recovery:	83.0%	BC Rec.	80%
Second Pass RO Recovery	70.0%	Crystal. Rec	70%

Indicates Input Data

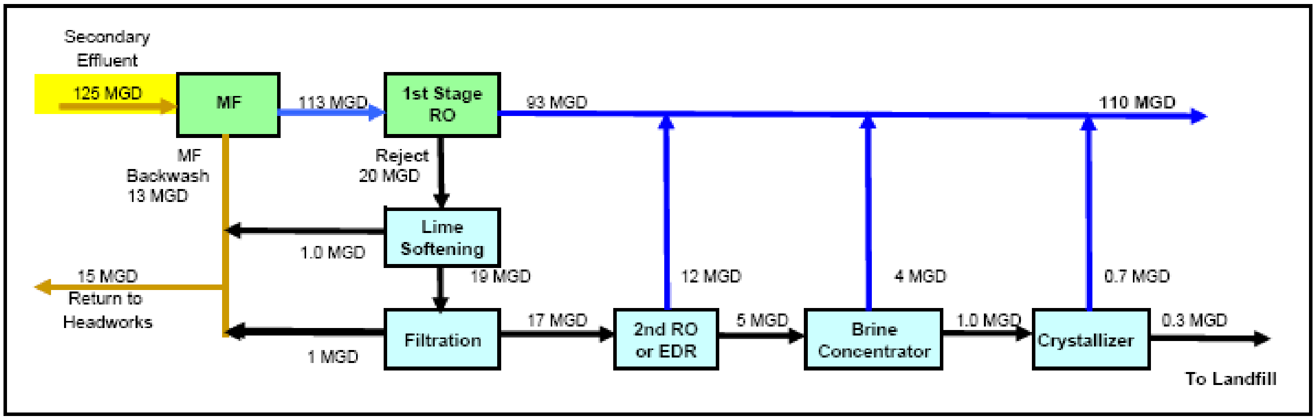


Figure 3-1
Process Schematic and Flow Balance for AWT and ZLD at JWPCP
(note that flows are rounded)

To account for a difference in the size of the OCWD AWT (70 mgd) and the proposed larger facility at JWPCP (93 mgd with 17 mgd (rounded) derived from the ZLD facility as shown in Figure 3-1), a “scale up factor” is used to account for the economy of size. In other words, the cost for construction is not linear with the design flow. Cost curves and equations in McGivney and Kawamura (2008) were used to account for facility size. The scale up factor is typically an exponent of the flow, i.e., Q^x. For membrane treatment facilities, as reported in McGivney and Kawamura (2008), x ranges from 0.72 for reverse osmosis membrane systems to 0.73 for MF/NF systems. An exponent of 0.72 will be used. The 0.72 exponent is close to the “rule of thumb” ratio of 0.6 that is commonly used to scale up costs on the basis of size (Whitesides, 2007). Based on this, the construction cost for the AWT at JWPCP will be adjusted by $(93/70)^{0.72}$ or 1.23. Thus the proposed 93 mgd facility at JWPCP would cost 1.23 * $305.3 million or $375 million (mid-2006 cost).

The Engineering News Record, Construction Cost Index (average of 20 cities) was 7700 in 2006. The current (October 2010) index is 8920 on the same basis. Based on this, it is anticipated the cost for a similar AWT facility at the JWPCP would cost about $435 million in October 2010.

Figure 3-1 shows approximately 17 mgd of product water from second stage RO/EDR, brine concentrator and crystallizer. This product water will need advanced oxidation/disinfection in the peroxide/UV process. In scaling up the cost of the OCWD AWT facility, the peroxide/UV system was scaled up from 70 mgd to 93 mgd. The construction cost for the facility will need to be further adjusted upward for the additional 17 mgd of peroxide/UV treatment. King County (2008) and WateReuse (2006) included costs for advanced oxidation using peroxide /UV at OCWD and West Basin MWD. Based on the information in those sources, and adjusting to current construction (October 2010) cost, the perxoxide/UV system costs approximately $300,000 per mgd capacity.

Operation and Maintenance Cost

The estimated operation and maintenance costs reported for the AWT at OCWD is $26.7 million, broken down as shown in Table 3-3 (OCWD, 2005). This is an estimate and is assumed to be at full capacity and mid-2006 cost.

Table 3-3
OCWD AWT Operation and Maintenance Costs
70 mgd product water
(mid-2006 dollars)

Component	Annual Cost, millions
Power (based on $0.10/kWh)	$11.5
Chemicals	$5.4
Membrane Replacement	$2.8
UV Lamp Replacement	$0.3
Compliance Monitoring	$1.5
Labor	$3.6
Contract Maintenance	$0.4
Plant Refurbishment	$1.2
Total	$26.7

Source: (OCWD, 2005)

Based on the OCWD Facility operating at full capacity, the cost to produce one million gallons of product water (mid-2006 dollars) is $1045/million gallons (MG) of product water or $340/acre-ft. This is based on the OCWD's reported power cost of $0.10/kWh. Extending this to current costs based on the estimated ENR construction cost index of 7700 in mid-2006 and adjusting the power costs from $0.10/kWh to $0.125/kWh, the current annual operating and maintenance cost is $1252/MG of product water ($408/acre-ft).

Although the OCWD AWT plant is currently only operating at 89% of capacity, no attempt was made to adjust the full capacity operation and maintenance costs since the original costs were only estimates and assumed to be based on full capacity. Table 4-4 presents the current costs for a 93 mgd product water AWT facility at JWPCP.

As stated previously the 17 mgd of product water from the second stage RO/EDR will require advanced oxidation treatment and disinfection. Using the information in King County (2008) and WateReuse (2006), the current operation and maintenance cost for the peroxide/UV system is $65/MG.

Table 3-4

Adjusted OCWD AWT Operation and Maintenance Costs
70 mgd product water
(October 2010 costs)

Component	Annual Cost, millions
Power (based on $0.125/kWh) (Approx. 4500 kWh/MG)	$14.4
Chemicals	$6.3
Membrane Replacement	$3.2
UV Lamp Replacement	$0.3
Compliance Monitoring	$1.7
Labor	$4.2
Contract Maintenance	$0.5
Plant Refurbishment	$1.4
Total	$39.0
Annual Water Production, MG	25,550
Cost per Million Gallons	$1252 round to $1,260
Cost per Acre-ft	$408 round to $410

ZERO LIQUID DISCHARGE

The process flow schematic and flow balance for the brine from the proposed AWT facility at the JWPCP was presented in Figure 3-1 Table 3-5 presents a conceptual level flow balance for the proposed ZLD facility at JWPCP and construction and operation and maintenance costs for a proposed ZLD facility. The costs were developed based on Mickley's study for the WaterReuse Association (Mickley, 2008). These costs were then compared with a ZLD facility evaluated for the Southern Nevada Water Authority (SNWA, 2006), which was prepared by consultant MWH.

Table 3-5
Conceptual Level Flow Balance and Construction and Operation and Maintenance Cost for ZLD at JWPCP

1st Stage RO Reject	Flow	19.13	MGD
	Reject TDS	8,000	mg/L [b/]
Lime Softener	Influent Flow	19.13	MGD
Includes Sludge	Sludge Flow	5%	percent of inflow
Thickener, and	Sludge Flow	0.96	MGD
Filtration	Lime Dose	120	mg/L
	Use	3,494	tons/year
	Unit Cost - Hydrated	$80	per ton
	Annual Cost	$280,000	per year
	Soda Ash Dose	70	mg/L
	Use	2,038	tons/year
	Unit Cost - 58%	$145	per ton
	Annual Cost	$296,000	per year
	Solids Produced (dry)	23	tons/day (dry weight)
	Unit Capital Cost	$1.71	per gpd installed capacity
	Construction Cost	**$32.71**	**million**
	Annual Chemical Cost	$576,000	
	Other Annual O&M Costs	3%	of capital cost
	Other Annual O&M Costs	$981,369	
	Total Anual O&M	**$1,557,369**	**per year**
	Filter Backwash	7%	of feedwater
	Filter Backwash	1.27	MGD
	Filtrate Flow Rate	16.90	MGD

Table 3-5 (Cont'd)
Conceptual Level Flow Balance and Construction and Operation and Maintenance Cost for ZLD at JWPCP

2nd Stage RO	Influent Flow	16.90	MGD
	Recovery	70%	
	Permeate Flow	11.83	MGD
	Reject Flow	5.07	MGD
	Feed TDS	7,800	mg/L
	Reject TDS	26,000	mg/L
	Unit Capital Cost	$2.80	per gpd permeate capacity
	Construction Cost	**$91.59**	**million**
	Energy	5	kWh/1000 gallons influent
	Energy Unit Cost	$0.125	per kWh
	Energy Cost	$3,856,000	per year
	Other Annual O&M	$0.70	per 1,000 gallons produced
	Other Annual O&M	$3,023,000	
	Annual O&M	**$6,879,000**	**per year**
Brine Concentrator	Influent Flow	5.07	MGD
	Recovery	80%	
	Distillate Flow	4.06	MGD
	Brine Flow	1.01	MGD
	Feed TDS	26,000	mg/L
	Reject TDS	130,000	mg/L
	Unit Capital Cost	$16.00	per gpd feed
	Construction Cost	**$81.1**	**million**
	Energy	90	kWh/1000 gallons influent
	Energy Unit Cost	$0.125	per kWh
	Energy Cost	$20,820,000	per year
	Other Annual O&M Costs	4%	of capital cost
	Other Annual O&M Costs	$3,245,000	per year
	Annual O&M	**$24,065,000**	**per year**

Table 3-5 (Cont'd)
Conceptual Level Flow Balance and Construction and Operation and Maintenance Cost for ZLD at JWPCP

Crystallizer	Influent Flow	1.01	MGD
	Recovery	70%	
	Distillate Flow	0.71	MGD
	Feed TDS	130,000	mg/L
	Solids Produced	550	dry tons/day
	Water in Sludge	0.30	MGD
	Water in Sludge	1269	tons/day
	Wet Sludge	1,818	wet sludge tons/day
	Unit Capital Cost	$65	per gpd feed
	Construction Cost	**$65.9**	**million**
	Energy	225	kWh/1000 gallons influent
	Energy Unit Cost	$0.125	per kWh
	Energy Cost	$10,410,000	per year
	Other Annual O&M Costs	4%	of capital cost
	Other Annual O&M Costs	$2,637,000	per year
	Annual O&M	**$13,047,000**	**per year**
Sludge Disposal	Unit Rate	$50	per ton
	Total Sludge Generated	2,103	tons/day (wet sludge) [a/]
	Annual Sludge Disposal	**$38,371,000**	per year
TOTALS	**Construction Cost**	**$271**	**million**
	Annual O&M incl sludge disposal	**$84**	**million per year**

a/ Assumes thickened lime sludge at 8% w/w solids

b/ Based on 1,400 mg/L TDS in Secondary Effluent and 83% Recovery in 1st Stage RO

Table 3-6 presents a summary of the electrical energy associated with the AWT and the ZLD facility proposed for JWPCP.

Table 3- 6
Estimated Annual Electric Power Consumption for AWT and ZLD at JWPCP
(from Tables 3-4 and 3-5)

Item	Million kWh/year
Softening and filtration	Negl.
Brine Second Stage RO	30.8
Brine Concentrator	166.6
Crystallizer	83.3
Total Electric Power ZLD Facility @ 17 mgd	280.7 Round to 290
Electric Power/MG of Reject Water treated in ZLD Facility based on 17 mgd	46,000 kWh/MG
Total Electrical Power for 93 mgd AWT Facility @4500 kWh/MG	152.8
Total Electrical Power for AWT and ZLD Facilities	433.5 Round to 440

Sludge Processing and Disposal

Table 3-7 presents the sludge disposal quantities for the proposed ZLD at the JWPCP.

Table 3-7
Estimated Sludge Quantities for ZLD at JWPCP from Table 3-5

Item	Dry Tons/day	Wet Tons/day
Softening Sludge	23	300
Crystallizer Sludge	550	1800
Total Sludge for Disposal	580 (rounded)	2100

The Sanitation Districts estimates the sludge disposal costs at $50 per wet ton, providing it can be disposed of in a conventional municipal landfill.

In reviewing the secondary effluent monitoring data (LACSD, 2009), the pesticides, chlorinated organics and similar organics were “non-detect.” So accumulation of organics in the sludge does not appear to be a concern. Table 3-8 presents a summary of the metals expected to be in the sludge from the crystallizer alone. It is based on assuming that all of the metals in the secondary effluent entering the second stage RO are removed and is in the sludge. This is a conservative assumption. From Table 3-8 it appears there should not be a problem disposing of the sludge in a conventional landfill based on the regulations in effect today. Nevertheless, some actual testing should be performed before the project is implemented.

Table 3-8
Estimated Metals Concentration in the ZLD Sludge from JWPCP*

JWPCP Secondary Effluent Constituent	Secondary Effluent Concentration, ug/L	mg/day	mg/kg dry weight crystallizer sludge	EPA Table 1 Reqmnts, mg/kg	EPA Table 2 Reqmnts, mg/kg
Antimony	ND				
Arsenic	2.08	732170	1.46	75	41
Berrylium	ND				
Cadmium	ND			85	39
Total Chromium	1.76	619529	1.24		
Hexavalent Chromium	ND				
Copper	3.05	1073615	2.15	4300	1500
Lead	0.02	7040	0.01	840	300
Mercury	ND			57	17
Nickel	7.87	2770279	5.54	420	420
Selenium	5.44	1914907	3.83	100	100
Silver	ND				
Thallium	ND				
Zinc	14.7	5174474	10.35	7500	2800

*Considers all metals are in the crystallizer sludge; based on 550 Dry Tons/day sludge (Table 3-7)

Retreatment of MF Wash Water at JWPCP

Retreating the waste washwater at JWPCP from the AWT primary MF treatment facility and the ZLD filtration facility is based on the flow rate, estimated COD and TSS and the current industrial wastewater surcharge. The current surcharge for District No. 2 is $147 per sewage unit. The $147 surcharge is broken down as follows: A = 0.3049 * flow in million gallons (MG); B = 0.3348 * COD/10^3 lb and C = 0.3603 * TSS/10^3 lb.

The influent to the primary MF process is 125 mgd and 19 mgd influent to the brine treatment filtration system from Figure 3-1. The TSS in the influent to the primary MF was estimated to be 15 mg/L and the TSS in the influent to the ZLD filtration system was estimated to be 10 mg/L. Removal of TSS in these processes is assumed to be 100 percent. Consequently all of the captured solids are returned to the JWPCP for treatment. The COD is estimated as 1.42*Volatile Suspended Solids (VSS) in the return flow from the primary MF in the AWT. The VSS was estimated to be 0.80 * TSS. The VSS portion of the solids in the ZLD filtration washwater was assumed to be negligible since they are primarily softening precipitates. There will be some non-biodegradable COD in the effluent, but this should not be included in the surcharge anyway since it will not add to the operating cost of the main liquid processing stream. The returned washwater is approximately 6110 “sewage units” per year which costs $0.9 million per year for reprocessing.

Summary of Cost for AWT and ZLD

A summary of the construction and operation and maintenance cost factors are presented in Tables 3-9 and 3-10. These costs do not include engineering, contingencies, or other soft costs. These will be added in Section 4.

Table 3-9
Estimated Construction Cost for AWT and ZLD at JWPCP

Item	Cost, Million $*	Source
AWT Facility	$435	Text
ZLD Reject Water Handling (19 mgd)	$271	Table 3-5
ZLD Advanced Oxidation Disinfection @ $300,00/mgd (17mgd)	$5	Text
Total Construction Cost	$711	

*Does not include contingencies, engineering, permits, etc.

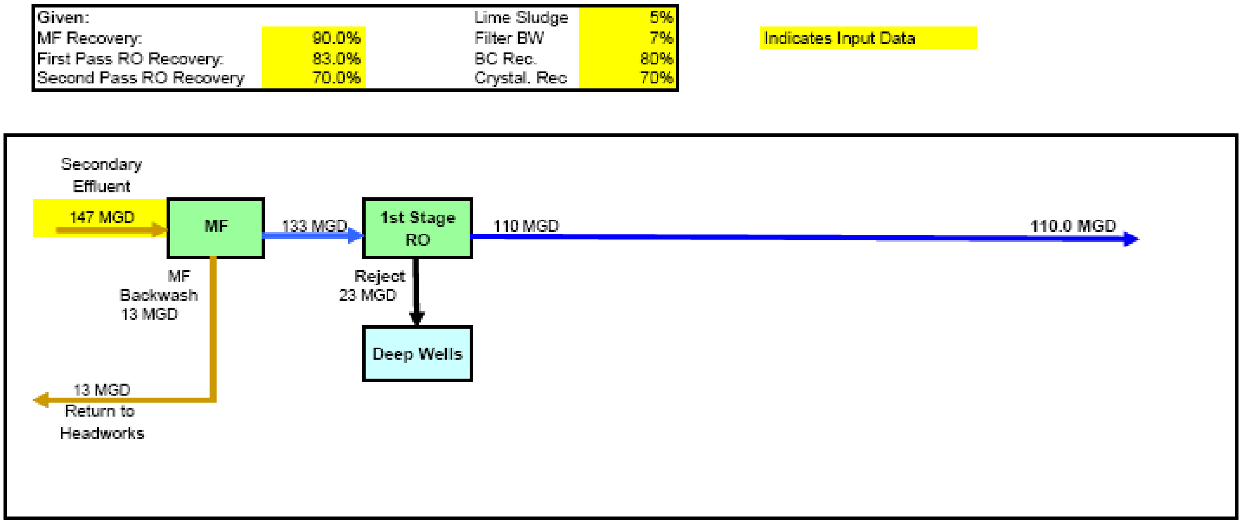
Table 3-10
Estimated Annual O&M Cost for AWT and ZLD at JWPCP

Item	Cost, Million $*	Source
AWT Facility @ $1260/MG product water (based on 93 mgd product water)	$44.1	Table 3-4
ZLD Brine Handling and sludge processing and disposal @ $50/wet ton (based on 2100 wet tons/day)	$84	Table 3-5
ZLD Advanced Oxidation Disinfection @ $65/MG (17 mgd product water)	$0.4	Text
Reprocessing of Primary MF Washwater and ZLD Filtration Washwater at JWPCP	$0.9	Text
Subtotal ZLD Annual O&M	$85.3	
Total Annual O & M	$129.4 round to $130	

*Does not include contingency.

DEEP WELL DISPOSAL OF BRINE FROM AWT FACILITY

An alternative worth consideration is the use of deep well injection for brine disposal. This would eliminate AWT brine softening, second pass RO, brine concentrator, crystallizer and sludge disposal. However, if this alternative is considered, then the size of the MF/RO facility must be increased to provide 110 mgd of product water. Figure 3-2 presents flow diagram and flow balance for the deep well injection disposal alternative.



Given:		Lime Sludge	5%
MF Recovery:	90.0%	Filter BW	7%
First Pass RO Recovery:	83.0%	BC Rec.	80%
Second Pass RO Recovery	70.0%	Crystal. Rec	70%

Figure 3-2
Process Schematic and Flow Balance for AWT and Deep Well Injection at JWPCP
(note that flows are rounded)

Deep well injection (DWI) has been practiced extensively for liquid industrial and hazardous waste disposal. Deep well disposal of brines from desalination plants is not a common practice in the US, except in Florida. In Florida several membrane plants have successfully used deep well injection. (Glater and Cohen, 2003). Care must be taken to prevent clogging due to crystallization and suspended solids. The former could be an issue if high recovery systems are used. Neither of these issues should be a major consideration for disposal of AWT brine from the JWPCP.

Concerns in the use of DWI technology are selection of an appropriate well site, brine conditions, corrosion and possible leakage of the well casing, seismic activity which could damage the well, and well-life expectancy. (Mickley, 2001)

A summary of brine concentrate disposal using deep wells is presented below excerpted from USBR (2009).

- Implementation issues for concentrate disposal by DWI include site availability, well classification, concentrate compatibility, and public perception. The site must have favorable underground geology conducive to DWI, with a porous injection zone capable of sustaining adequate injection rates over the life of the membrane facility. In addition, an impermeable layer is required to prevent the migration of the injected concentrate into an underground source of drinking water (USDW). The site should be a sufficient distance from any wells going through the impermeable layer that could serve as a pathway to a USDW.
- DWI is feasible only in specific geological and site conditions. One important consideration regarding the use of DWI is proximity to faults because injecting concentrate could increase water pressure on fault lines resulting in earth movement
- Existing DWI wells in southern California achieve injection rates of approximately 60 to 100 gpm, with decreasing injection rates over time. Reduction in injection rate over time is caused by clogging and can be reversed with periodic well redevelopment.
- To permit a Class I well, the project proponent must show, through extensive geologic testing and

modeling, that injected water quality will not degrade the USDW. Class I injection wells must have special protection against contamination of the USDW. The permitting process for an injection well can be a labor-intensive process. The permitting process involves drilling a test well that is completed to Class I standards. Permit requirements for a Class I injection well as stipulated under Subpart B, Section 146.12, of the underground injection control (UIC) regulations state:

> *All Class I wells shall be sited in such a fashion that they inject into a formation which is beneath the lowermost formation containing, within 0.25 mile of the well bore, an underground source of drinking water.*

- In addition, an impermeable geologic stratum must be located above the injection zone to prevent the migration of the injectate into an overlying USDW. Extensive geologic modeling would be required to demonstrate the effectiveness of the impermeable strata in preventing migration. In many cases, geologic investigations are required to collect data used for modeling purposes. USEPA requires that Class I wells be placed in areas free of vertically transmissive faults and fissures and that the region be characterized by low seismicity and a low probability of earthquakes. In California, locating a site that could be shown to have no faults or fissures and a low probability of earthquakes would be difficult. In other regions, DWI has resulted in a rise in pore pressures and activation of faults, causing increased seismicity. Proving that seismicity would not increase as a result of any given project would be difficult. Old oil and gas wells can potentially be used for DWI if site-specific hydrogeological conditions comply with regulatory requirements. If suitable geology is determined to be present, a test well is drilled, completed, and used to confirm adequate injection capacity. The test well typically is completed to Class I standards, but initially permitted as a Class II well to expedite the permit process.

In summary, DWI may be difficult to implement in Southern California. There are numerous abandoned oil wells in the vicinity of the JWPCP and it also appears there may be active wells in the area. Figure 3-3 shows the location of oil fields in the vicinity of JWPCP. Unfortunately there are also some faults in the area. Additional studies would be required to determine the feasibility of DWI for disposal of brine from JWPCP AWT facilities.

For purposes of estimating the costs it is assumed that 0.5 acre of land will be required for each to accommodate drill rigs constructing and maintaining the facilities and the high pressure pump station and electrical equipment. A conveyance pipeline, 5 miles in length, is assumed to convey the brine from JWPCP to the deep injection wells.

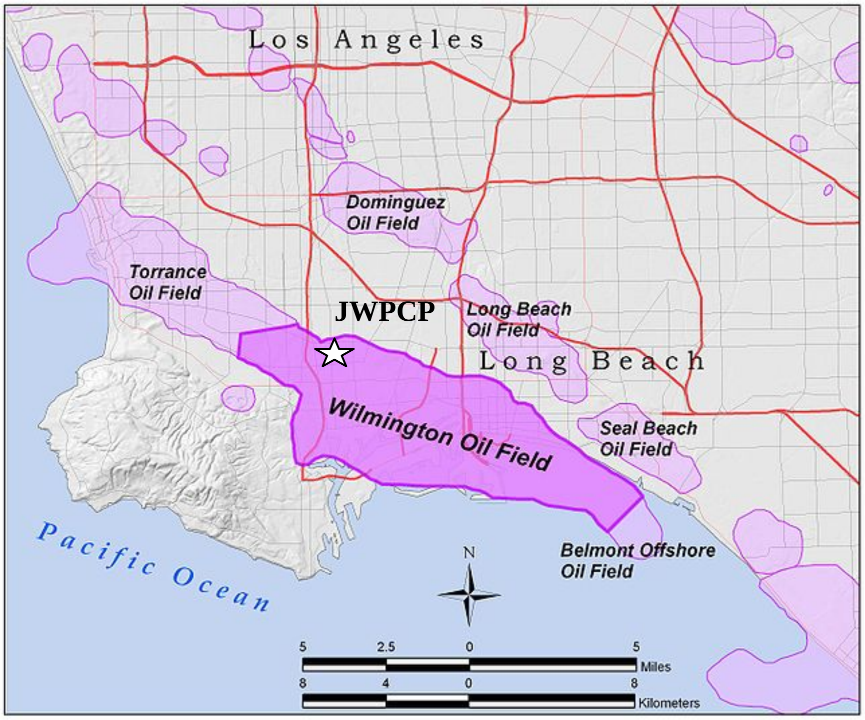


Figure 3-3
Location of Oil and Gas Fields in the Vicinity of JWPCP

Retreatment of MF Wash Water at JWPCP

Retreating the waste washwater at JWPCP from the AWT primary MF treatment process is based on the flow rate, estimated COD and TSS and the current industrial wastewater surcharge. The current surcharge for District No. 2 is $147 per sewage unit. The $147 surcharge is broken down as follows: A = 0.3049 * flow in million gallons (MG); B = 0.3348 * COD/10^3 lb and C = 0.3603 * TSS/10^3 lb.

The influent to the primary MF process is 147 mgd from Figure 3-2. The TSS in the influent to the primary MF was estimated to be 15 mg/L. Removal of TSS in the primary MF process is assumed to be 100 percent, so consequently all of the influent solids are returned to the JWPCP for treatment. The COD is estimated as 1.42*Volatile Suspended Solids (VSS) in the return flow from the primary MF in the AWT. The VSS was estimated to be 0.80 * TSS. There will be some non-biodegradable COD in the effluent, but this should not be included in the surcharge anyway since it will not add to the operating cost of the main liquid processing stream. The returned washwater is approximately 6425 “sewage units” per year which costs $0.94 million per year for reprocessing.

Summary of Cost for AWT at JWPCP with Deep Well Injection

Using the scale up factors presented previously for the AWT Facility at OCWD, the cost for a 110 mgd product water AWT facility would be $(110/70)^{0.72}$ = 1.38 times the cost for the OCWD facility or 1.38 * $305.3 million = $423 million (mid-2006 costs). Bringing this to current, October 2010 cost, requires a 16% increase. Current cost would be $490 million. The Operation and Maintenance cost would also increase.

Based on the 83% recovery estimated previously, 23 mgd of brine must be disposed of. A cost analysis based on a United States Bureau of Reclamation (USBR, 2006) study for injection well disposal of the proposed JWPCP brine was prepared and is summarized in Table 3-11.

Table 3-11
Alternative Deep Well Injection Disposal

Item	Parameter
Total Flow	23 mgd
Number of Wells	4
Capacity each	10 to 20 mgd
Diameter	24-in
Land (0.5 acre each site)	$2 million
Injection Well Cost, each, not including contingencies, engineering, permitting etc	$11.7 million
Total DWI Well cost each, not including contingencies, engineering, permitting etc	$13.7 million
Injection pressure	2000 psi
Horsepower required	27,000
Annual power requirement, kWh	175 million
Annual power cost	$22 million
Annual chemicals, labor, and materials	$6.5million
Total annual O&M not including contingencies	$28.5 million round to $29 million

Two wells will provide the needed brine disposal capacity; this allows 2 wells to be down for maintenance.

A summary of the cost for the deep well injection alternative is presented in Table 3-12.

Table 3-12
Estimated Construction Cost for AWT and Deep Well Injection at JWPCP

Item	Cost, Million $*	Source
AWT Facility (110 mgd)	$490	Text
Deep Well Injection (23 mgd of brine), 4 wells @ $13.7 million each	$55	Table 3-11
Pipeline to convey brine to DWI sites, 25,000 ft, 42-in diameter (allowance)	$9	
Total construction cost	$554 round to $560	

*Does not include contingencies, engineering, permits, etc.

The $560 million construction cost can be compared with the $711 million for the ZLD facility in Table 3-9. Note that these costs do not include contingencies, engineering, permitting etc. Table 3-13 presents a summary of the annual operation and maintenance cost for the AWT and DWI. The annual operation and maintenance cost is about $80 million not including contingencies. This compares to the $130 million for the AWT and ZLD facility presented in Table 3-10. Again these costs do not include contingencies.

Table 3-13
Estimated Annual O&M Cost for AWT and DWI at JWPCP

Item	Cost, Million $*	Source
AWT Facility @ $1260/MG product water (based on 110 mgd product water)	$50.6	Table 3-4
DWI	$29	Table 3-11
Total Annual O & M	$79.6 round to $80	

*Does not include contingency.

Table 3-14 presents a summary of the electric power requirements for AWT and DWI at JWPCP.

Table 3- 14
Estimated Annual Electric Power Consumption for AWT and DWI at JWPCP

Item	Million kWh/year	Source
Total Electric Power for 110 mgd AWT Facility @ 4500 kWh/MG	181	
DWI Electric Power	175	Table 3-11
Total Electrical Power for AWT and DWI Facilities	356 Round to 360	

SECTION 4
CONSTRUCTION COST ESTIMATE

Using the information in Section 3 as a basis, the cost estimate for the 110 mgd, product water AWT facility at JWPCP, including the 19 mgd ZLD facilities and the recycled water transmission piping, pumping, and injection wells is presented in this section. It is based on the effluent from the conceptual nitrification-denitrification facility as described in Section 3 for a TIN of < 10 mg/L. An alternative of using deep well injection (DWI) for the brine is also included. Appropriate contingencies were included.

Principal assumptions and criteria in the cost estimate are:

- Land is available at JWPCP or adjacent to JWPCP for this facility. Land costs for the AWT/ZLD are not included. Land costs for reservoirs and offsite pumping stations was estimated to be $75/sq ft. The deep injection wells for brine disposal will require land for drilling, maintenance and pumping. Each site is assumed to need 0.5 acre. Land cost for the DWI wells is estimated at $92/sq ft.
- Costs are very conceptual and will require bench scale and pilot scale facilities to confirm the design and operating parameters.
- Pipeline routes were not evaluated; the purpose was to obtain an approximate length only.
- Precise locations for recharge wells were not determined. Detailed hydrogeologic work will need to be performed before the locations can be selected. Siting will need to conform to Department of Public Health requirements for recycled water injection wells. Costs for mitigation of local groundwater producer wells has not been included.
- The recharge wells will be located in vaults in public rights-of-way and land purchase will not be needed.
- All regulatory permits can be obtained and agreements with Los Angeles County Public Works and other local agencies can be obtained for surface spreading and recharge.
- The basis for this conceptual level cost estimate was the cost experience at the 64 mgd OCWD AWT (OCWD, 2005) and reports by USBR, Mickley and others. (USBR, 2006, 2009, Mickley, 2008)
- A contingency of 35% is included due to uncertainties in process and facility location; engineering, legal, administration, and inspection costs totaling 35% were also included. For the DWI alternative, the deep well system administration, engineering, etc. costs were estimated to be 40% due to permitting issues.
- For amortization and present worth costs an interest rate of 5% over a 20 year period was used. (The resulting present worth factor is 12.46 and the capital recovery factor is 0.080.)

AWT AND ZLD PROJECT

Tables 4-1 through 4-5 presents a summary of the costs for the AWT, ZLD, and pipelines, reservoirs, recharge wells, and pump stations associated with the groundwater spreading basins. Table 4-6 presents a summary of all of the facilities. Table 4-7 presents the capital cost component of producing recycled water at the JWPCP and distributing it to spreading grounds and recharge facilities in the West Coast, Central, Main San Gabriel, and Raymond Basins. The capital cost component is about $1430 per acre-ft including conveyance, storage, pumping and treatment, annualized over a 20-year period at 5% interest. (See Table 4-7.)

Table 4-1
Project Cost Estimate for AWT Facility

Item	Cost, million $	Source
93 mgd AWT Facility (total 110 mgd incl. ZLD product water)	$435	Table 3-9
Contingencies @ 35%	$150	
Subtotal	$585	
Engineering, Legal, Administration, Inspection, Permits etc @35%	$200	
Total Project Cost	$785	

Table 4-2
Project Cost Estimate for ZLD Facility

Item	Cost, million $	Source
19 mgd ZLD Facility	$271	Table 3-9
ZLD Advanced Oxidation Disinfection System for 17 mgd of ZLD product water	$5	Table 3-9
Contingencies @ 35%	$100	
Subtotal	$376	
Engineering, Legal, Administration, Inspection, Permits etc @35%	$130	
Total Project Cost	$506	

Table 4-3
Project Cost Estimate for West Coast Basin Facilities

Item	Cost, million $
Pipelines (58,000 ft, 12” – 30” dia)	$11.0
Recharge Wells (150 estimated needed)	$240.0
Subtotal	$251
Contingencies @ 35%	$87.8
Subtotal	$338.8
Engineering, Legal, Administration, Inspection, Permits etc @35%	$118.6
Total Project Cost	$457.4 round to $460

Table 4-4

Project Cost Estimate for Central Basin Facilities

Item	Cost, million $
Pipelines (120,000 ft, 90” dia)	$86.4
Pump Stations	
JWPCP	$16.8
Rio Hondo Coastal Spreading Grounds	$23.0
Reservoirs and Clearwells	
JWPCP	$7.0
Rio Hondo Coastal Spreading Grounds	$3.0
Land Purchase	$6.6
Spreading Ground Modifications	$0.2
Subtotal	$143
Contingencies @ 35%	$50
Subtotal	$193
Engineering, Legal, Administration, Inspection, Permits etc @35%	$68
Total Project Cost	$261

Table 4-5
Project Cost Estimate for Main San Gabriel and Raymond Basin Facilities

Item	Cost, million $
Pipelines (212,800 ft, 30” – 66”)	$78.5
Pump Stations	
Eaton Wash Spreading Grounds	$7.2
Reservoirs and Clearwells	
Eaton Wash Spreading Grounds	$2.0
Land Purchase	$6.6
Spreading Ground Modifications	$1.4
Subtotal	$95.7
Contingencies @ 35%	$33.5
Subtotal	$130
Engineering, Legal, Administration, Inspection, Permits etc @35%	$45
Total Project Cost	$175

Table 4-6
Project Cost Estimate for Entire Project AWT and ZLD

Item	Cost, million $	Source
93 mgd AWT at JWPCP	$785	Table 4-1
19 mgd ZLD at JWPCP	$506	Table 4-2
Subtotal Treatment and ZLD	$1,291	
West Coast Basin Facilities	$460	Table 4-3
Central Basin Facilities	$261	Table 4-4
Main San Gabriel Basin and Raymond Basin Facilities	$175	Table 4-5
Subtotal Conveyance and Recharge Facilities	$896	
Total Project Cost	$2,187 Round to $2,200	

Table 4-7
Unit Capital Cost Component for Project Water for AWT and ZLD

Project	Annual Capital Cost, Million $*	Product Water, Acre-ft/year	Unit Capital Cost, $/Acre-ft
AWT and ZLD Facilities (from Table 4-6)	$103	123,000	$837
Conveyance, Storage, and Pumping (from Table 4-6)	$72	123,000	$585
Total Project	$175	123,000	$1422 Say $1430

*Based on 5% interest over 20 years, Capital Recovery Factor = 0.080

AWT WITH DEEP WELL INJECTION

If deep well injection is used for brine disposal the AWT facility will need to be slightly larger to produce 110 mgd of product water. The total construction cost is shown in Table 3-12 and is summarized in Table 4-8 including the "soft" costs.

Table 4-8
Project Cost Estimate for AWT Facility with Deep Well Injection

Item	Cost, million $	Source
110 mgd AWT Facility	$490	Table 3-12
Contingencies @ 35%	$170	
Subtotal	$660	
Engineering, Legal, Administration, Inspection, Permits etc @40%	$230	
Total AWT Facility	$890	
Deep Well Injection (23mgd of brine), 4 wells	$55	Table 3-12
Conveyance Pipeline (allowance)	$9	Table 3-12
Subtotal	$64	
Contingencies @ 35%	$20	
Subtotal	$84	
Engineering, Legal, Administration, Inspection, Permits etc @40%	$30	
Total Deep Well Injection Cost	$114	
Total AWT and Deep Well Injection	$1,004	

Table 4-9
Project Cost Estimate for Entire Project with Deep Well Injection

Item	Cost, million $	Source
110 mgd AWT at JWPCP and deep well injection	$1,004	Table 4-8
West Coast Basin Facilities	$460	Table 4-3
Central Basin Facilities	$261	Table 4-4
Main San Gabriel Basin and Raymond Basin Facilities	$175	Table 4-5
Subtotal Conveyance and Recharge Facilities	$896	
Total Project Cost	$1,900	

Table 4-10
Unit Capital Cost Component for Project Water based on Deep Well Injection

Project	Annual Capital Cost, Million $	Product Water, Acre-ft/year	Unit Capital Cost, $/Acre-ft
AWT and DWI Facilities	$80	123,000	$650
Conveyance, Storage, and Pumping	$72	123,000	$585
Total Project	$152	123,000	$1,235 round to $1,240

*Based on 5% interest over 20 years, Capital Recovery Factor = 0.080

SECTION 5
OPERATION AND MAINTENANCE COST ESTIMATE

Using the information in Section 3 as a basis, the operation and maintenance cost estimate for the 93 mgd product water AWT facility at JWPCP including the 19 mgd ZLD and the recycled water transmission piping, pumping, and recharge wells is presented in this section. An alternative of using deep well injection (DWI) for the brine is also included. Appropriate contingencies were included.

Principal assumptions and criteria in the cost estimate are:

- Costs are very conceptual and will require bench scale and pilot scale facilities to confirm the design and operating parameters.
- Pump station discharge pressures are only approximate and are based on the approximate pipe lengths.
- The recharge wells will be located in vaults in public rights-of-way and land purchase will not be needed.
- The Los Angeles County Public Works and other local agencies that operate spreading grounds will not charge for the water spread.
- The basis for this conceptual level cost estimate was the cost experience at the 70 mgd OCWD AWT (OCWD, 2005) and reports by USBR, Mickley and others. (USBR, 2006, 2009, Mickley, 2008)
- A contingency of 15% is included in the pump station, pipeline and reservoir maintenance and 20% for the AWT and 30% for ZLD and DWI facilities. This is an indicator of the level of uncertainty in the estimates for the various facilities.
- For amortization and present worth costs an interest rate of 5% over a 20 year period was used. (The resulting present worth factor is 12.46 and the capital recovery factor is 0.080.)

Principal criteria used in the O&M cost analysis:

- Electrical power cost at $0.125/kWh (provided by the Sanitation Districts)
- Retreating the waste washwater from the primary MF treatment facility in the AWT and the ZLD filtration facility is based on the flow rate, estimated COD and TSS and the current industrial wastewater surcharge. This is discussed in more detail in Chapter 3.
- Recharge wells will require maintenance and inspection every two years. Annual cost per well based on LA County Department of Public Works experience at the Alamitos Barrier is $42,000 per well. A value of $50,000 per well is used in this study and covers the cost for the monitoring of observation wells and administration.
- Reservoirs and clearwells are assumed to be steel and above ground and require inspection every third year and recoating every 10 years. A value of 2% of the construction cost is used for maintenance, cleanout and inspection. Another 1% for labor associated with routine operation etc. is added for a total of 3% of the construction cost for annual maintenance and operation.
- Annual cost for parts and materials for maintenance and operation of the pump stations is estimated to be 1% of the construction cost. Labor for monitoring and administration of the system is estimated to be 2% of the construction cost per year. Total is 3% per year.
- Annual cost for parts and materials for maintenance and operation of the pipelines is estimated to be 1%

of the construction cost. Labor for monitoring and administration of the system is estimated to be 1% of the construction cost per year. The total is 2% per year.

- Sludge disposal cost is estimated to be $50 per wet ton and can be disposed of in a conventional municipal landfill. Appropriate testing will be needed to confirm this.

AWT AND ZLD PROJECT

Tables 5-1 through 5-4 present the annual O&M costs for the various facilities.

Table 5-1
Annual O&M Cost for the 93 mgd JWPCP AWT and ZLD Facility

Item	Annual Cost, Million $	Source
AWT Facility @ $1260/MG product water at 93 mgd product water flow rate	$44.1	Table 3-10
Contingencies (20%)	$8.8	See Text
Subtotal	$52.9	
ZLD Facility	$85.3	Table 3-10
Contingencies (30%)	$25.6	See Text
Subtotal	$110.9	
Total AWT and ZLD Facility O&M	$163.8 round to $165	

Table 5-2
Annual O&M Cost for Conveyance Pump Stations

Item	kWhr/yr, millions	Power Cost, Millions $	Labor and Maintenance, Millions $
JWPCP Pump Station	35.4	$4.4	$0.58
Rio Hondo Spreading Grounds PS	57.4	$7.2	$0.93
Eaton Wash Spreading Grounds PS	5.4	$0.7	$0.29
Subtotal	98.1	$12.3	$1.90
Subtotal O&M		$14.2	
Contingencies (15%)		$2.1	
Total Pump Station O&M		$16.3 round to $17	

Table 5-3
Annual O&M Cost for the Pipelines

Item	Annual Cost, Million $
West Coast Basin	$0.3
Central Basin	$2.3
Main San Gabriel and Raymond Basins	$2.1
Subtotal	$4.7
Contingencies (15%)	$0.7
Total O&M for the Pipelines	$5.5

Table 5-4
Annual O&M Cost for the Reservoirs and Recharge Wells

Item	Annual Cost, Million $
Reservoirs	
JWPCP	$0.28
Rio Hondo Coastal Spreading Grounds	$0.12
Eaton Wash Spreading Grounds	$0.08
Subtotal Reservoirs	$0.48
West Coast Basin Recharge Wells (150)	$7.5
Contingencies (15%)	$1.2
Total O&M for the Reservoirs and Injection Wells	$9.2

Table 5-5 presents a summary of the power requirements and the O&M costs for the entire project. Table 5-7 shows the O&M cost in terms of $/Acre-ft based on 123,000 acre-ft produced per year.

Table 5-5
Annual Power Requirement and O&M Cost for the Project AWT, ZLD and Conveyance

Item	kWhr/yr, Million	Total Annual O&M Cost, Million $	Source
JWPCP AWT Facility (93 mgd)	153*	$52.9	Table 5-1
JWPCP ZLD Facility (19 mgd) incl sludge disposal	281*	$110.9	Table 5-1
Pump Stations	98.1	$17	Table 5-2
Pipelines	--	$5.5	Table 5-3
Reservoirs and West Coast Basin Recharge Wells	--	$9.2	Table 5-4
Total O&M including ZLD Facility	532.1 round to 540	$195.5 round to $200	

*See Table 3-6 for AWT and ZLD power requirements

Table 5-6
Annual O&M Cost for the Project $/Acre-ft AWT, ZLD and Conveyance

Item	Annual O&M Cost, Million $	Annual Product Water, AF	$/acre-ft
JWPCP AWT Facility (93 mgd)	$52.9	123,000	$430
JWPCP ZLD Facility (19 mgd) incl sludge disposal	$110.9	123,000	$992
Conveyance and Recharge Wells	$31.7	123,000	$258
Total O&M including ZLD Facility	$195.5 round to $200		$1680/acre-ft round to $1700/acre-ft

Looking at the project on a life cycle cost basis (present worth for 20 years at 5% interest), the total life cycle cost for the project is shown in Table 5-8.

Table 5-7
Total Present Worth over 20 years for AWT, ZLD and Conveyance

Cost Item	Total Project ($ millions)
Capital Cost (Table 4-6)	$2,200
Annual O&M Cost (Table 5-5)	$200
Present Worth of Annual O&M *	$2,500
Total Present Worth or Life Cycle Cost*	$4,700

* Based on5% interest for 20 years; Uniform Series Present Worth Factor = 12.46

ENERGY CONSUMPTION FOR PROJECT INCLUDING ZLD FACILITY

The primary electrical energy consumed by the project was presented previously in Table 5-5 and amounts to about 540 million kWhr/year including the ZLD.

AWT WITH DEEP WELL INJECTION

Table 5-8 presents a breakdown of the operating costs for the 110 mgd AWT facility at JWPCP and the DWI system. As stated in Section 3, the AWT must produce 110 mgd of product water and hence is larger. Table 5-9 presents electrical power requirement and the O&M cost assuming deep well injection will be used for brine disposal. Table 5-10 presents the cost per acre-ft for the O&M component assuming deep well injection and 123,000 acre-ft annual output. Table 5-11 presents the total present worth (life cycle) costs for 20 years of operation.

Table 5-8
Annual O&M Cost for the 110 mgd JWPCP AWT Facility and DWI

Item	Annual Cost, Million $	Source
AWT Facility @ $1260/MG product water at 110 mgd product water flow rate	$50.6	Table 3-13
Contingencies (20%)	$10.1	See Text
Subtotal	$60.7	
DWI Facility	$29	Table 3-13
Contingencies (30%)	$8.7	See Text
Subtotal	$37.7	
Total AWT and DWI Facility O&M	$98.4 round to $100	

Table 5-9
Annual Power Requirement and O&M Cost for the AWT Facility and DWI

Item	kWhr/yr, Million	Total Annual O&M Cost, Million $	Source
JWPCP AWT Facility (110 mgd)	181*	$60.7	Table 5-8
Deep Injection Wells	175*	$37.7	Table 5-8
Pump Stations	98.1	$17	Table 5-2
Pipelines	--	$5.5	Table 5-3
Reservoirs and West Coast Basin Recharge Wells	--	$9.2	Table 5-4
Total O&M including DWI Facility	454.1 round to 460	$130.1 round to $130	

*See Table 3-14 for AWT and DWI power requirements

Table 5-10
Annual O&M Cost for the Project, $/Acre-ft AWT with DWI

Item	Annual O&M Cost, Million $	Annual Product Water, AF	$/acre-ft
JWPCP AWT Facility (110mgd)	$60.7	123,000	$494
DWI Facility	$37.7	123,000	$307
Conveyance and Recharge Wells	$31.7	123,000	$258
Total O&M including DWI Facility	$130.1 round to $130		$1059/acre-ft round to $1060/acre-ft

Annual O&M Costs from Table 5-10

Table 5-11
Total Present Worth over 20 years for AWT, DWI and Conveyance

Cost Item	Total Project ($ millions)
Capital Cost (Table 4-9)	$1,900
Annual O&M Cost (Table 5-10)	$130
Present Worth of Annual O&M*	$1,620
Total Present Worth or Life Cycle Cost	$3,520 round to $3,600

* Based on5% interest for 20 years; Uniform Series Present Worth Factor = 12.46

ENERGY CONSUMPTION FOR PROJECT WITH DWI SYSTEM

The primary electrical energy consumed by the project was presented previously in Table 5-9 and amounts to about 460 million kWhr/year including the DWI system.

COMPARISON OF ZLD PROJECT AND DWI PROJECT

Table 5-12 presents a comparison of the unit water costs for the project with ZLD and with deep well injection. Deep well injection is significantly less costly but does have significant permitting issues to be addressed.

Table 5-12
Comparison of Alternatives on a $/Acre-ft Basis

Cost Component	AWT with ZLD and all Project Facilities, $/acre-ft	AWT with Deep Well Injection and all Project Facilities, $/acre-ft
Amortized Capital Cost (Tables 4-7,4-10)	$1,430	$1,240
Annual O&M Cost (Table 5-6, 5-10)	$1,700	$1,060
Total Cost	$3,130	$2,300

PROJECT COST SUMMARY

Tables 5-13 and 5-14 present a summary of the two project alternatives ZLD and DWI respectively.

Table 5-13
Project Cost Summary
AWT, ZLD and Groundwater Recharge

Cost Component	Capital Cost, Million $ (Table 4-6)	Annual O&M Cost, Million $ (Table 5-6)
JWPCP AWT Facility	$785	$52.9
JWPCP ZLD	$506	$110.9
Groundwater Recharge Pumps, Reservoirs and Conveyance	$896	$31.7
Total Cost	$2,187 round to $2,200	$195.5 round to $200

Table 5-14
Project Cost Summary
AWT, DWI and Groundwater Recharge

Cost Component	Capital Cost, Million $ (Table 4-8, 4-9)	Annual O&M Cost, Million $ (Table 5-10)
JWPCP AWT Facility	$890	$60.7
JWPCP DWI Facility	$114	$37.7
Groundwater Recharge Pumps, Reservoirs and Conveyance	$896	$31.7
Total Cost	$1,900	$130.1 round to $130

SECTION 6
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APPENDIX

BACKUP CALCULATION SPREADSHEETS

LACSD JWPCP MF/RO

Pipe cost $ 8.00 per inch diameter/ft

To West Coast Basin Injection Wells

Diameter, in	Length, ft	Unit Cost, $/ft	Cost
30	21000	$ 240	$ 5,040,000
24	17000	$ 192	$ 3,264,000
18	10000	$ 144	$ 1,440,000
16	8000	$ 128	$ 1,024,000
12	2000	$ 96	$ 192,000
subtotal	58000		$ 10,960,000

Central Basin to Rio Hondo Coastal Spreading Grounds

Diameter, in	Length, ft	Unit Cost, $/ft	Cost
90	120000	$ 720	$ 86,400,000

Main San Gabriel and Raymond Basins

Diameter, in	Length, ft	Unit Cost, $/ft	Cost
66	42300	$ 528	$ 22,334,400
54	31700	$ 432	$ 13,694,400
30	26400	$ 240	$ 6,336,000
48	23800	$ 384	$ 9,139,200
48	21200	$ 384	$ 8,140,800
42	26400	$ 336	$ 8,870,400
36	4000	$ 288	$ 1,152,000
30	37000	$ 240	$ 8,880,000
Subtotal	212800		$ 78,547,200

Total Pipelines	390800		$ 175,907,200

LACSD JWPCP MF/RO

Pump Station and Pipeline Operation and Maintenance

Cost per kWhr	$ 0.125
Labor Cost per hour	$ 65.00
Pump Efficiency	75%
Motor Efficiency	95%

Location	Capacity, Ac-ft/yr	Discharge Head, ft	kWhr/yr	Pumping Power Cost, $/yr	Construction Cost, Millions $	Labor, Maintenance and Materials	Total Operating Cost,
Pump Stations							
JWPCP Pump Station	123000	200	35,358,704	$ 4,419,838	$ 22,680,000	$ 680,400	$ 5,100,238
Rio Hondo Spreading Grounds PS	57000	700	57,350,093	$ 7,168,762	$ 31,104,000	$ 933,120	$ 8,101,882
Eaton Wash Spreading Grounds PS	9000	420	5,433,167	$ 679,146	$ 9,720,000	$ 291,600	$ 970,746
Subtotal			98,141,963	$ 12,267,745		$ 1,905,120	$ 14,172,865
Contingencies (15%)							$ 2,125,930
Total O&M							$ 16,298,795
Pipelines							
West Coast Basin					$ 14,796,000	$ 295,920	
Central Basin					$ 116,640,000	$ 2,332,800	
Main San Gabriel and Raymond Basins					$ 106,038,720	$ 2,120,774	$ 4,749,494
Contingencies (15%)							$ 712,424
Total O&M							$ 5,461,919
Reservoirs							
JWPCP					$ 9,450,000	$ 283,500	
Rio Hondo Coastal Spreading Grounds					$ 4,050,000	$ 121,500	
Eaton Wash Spreading Grounds					$ 2,700,000	$ 81,000	$ 486,000
Injection Wells							
West Coast Basin Injection Wells (150)						$ 7,500,000	$ 7,500,000
Subtotal Operating Costs							$ 7,986,000
Contingencies (15%)							$ 1,197,900
Total O&M							$ 9,183,900

Reservoir, Pump Station, Recharge Wells and Other Costs

LACSD JWPCP MF/RO

Pump Stations

Pump Efficiency	0.75
Motor Efficiency	0.95

	Capacity			No. of Pumps						
Location	AFY	cfs	TDH, ft	Duty	Standby	Installed HP	Operating HP	Const. Cost	Average Pumping, AFY	Annual kWh
JWPCP	150000	224	200	5	1	8400	7000	$ 16,800,000	123000	35358704
Rio Hondo Coastal SG	77400	106	700	5	1	14400	12000	$ 23,040,000	57000	57350093
Eaton Wash SG	14600	20	420	4	1	2000	1600	$ 7,200,000	9000	5433167
Subtotal								$ 47,040,000		98141963

Reservoirs

Unit Cost for Steel Tanks	$ 1.00	per gallon
Unit Cost for Buried Concrete Tanks	$ 1.75	per gallon

	Capacity, MG	Type	Const. Cost	Height, ft	Diameter, ft	Land Area, Acres	Land Cost
JWPCP	4	Concrete	$ 7,000,000	24	170	1.5	NA
Rio Hondo Coastal SG	3	Steel	$ 3,000,000	24	150	2	$ 6,600,000
Eaton Wash SG	2	Steel	$ 2,000,000	24	120	2	$ 6,600,000
Subtotal			$ 12,000,000				$ 13,200,000

Injection Wells

	number	Const Cost Each	Total Cost
West Coast Basin	150	$ 1,600,000	$ 240,000,000

Spreading Ground Modifications

	No of Spreading Grounds	Allowance Each	Const. Cost
Central Basin	2	$ 100,000	$ 200,000
Main San Gabriel Basin	10	$ 100,000	$ 1,000,000
Raymond Basin	4	$ 100,000	$ 400,000
Subtotal			$ 1,600,000

Conveyance Summary

LACSD JWPCP MF/RO

Pipelines, Reservoirs, PS, Injection Wells, etc

		Cost
West Coast Basin		
Pipelines	$	10,960,000
Recharge Wells	$	240,000,000
Subtotal	$	250,960,000
Contingencies 35%	$	87,836,000
Subtotal	$	338,796,000
Engineering, Legal, Administration, Inspection, Permits, etc. 35%	$	118,579,000
Total	$	457,375,000
Central Basin		
Pipelines	$	86,400,000
Pump Stations		
JWPCP	$	16,800,000
Rio Hondo Coastal Spreading Grounds	$	23,040,000
Reservoirs and Clearwells		
JWPCP	$	7,000,000
Rio Hondo Coastal Spreading Grounds	$	3,000,000
Land Cost	$	6,600,000
Spreading Ground Modifications	$	200,000
Subtotal	$	143,040,000
Contingencies 35%	$	50,064,000
Subtotal	$	193,104,000
Engineering, Legal, Administration, Inspection, Permits, etc. 35%	$	67,586,000
Total	$	260,690,000

Conveyance Summary

Main San Gabriel and Raymond Basins		
Pipelines	$	78,547,200
Pump Stations		
Eaton Wash Spreading Grounds	$	7,200,000
Reservoirs and Clearwells		
Eaton Wash Spreading Grounds	$	2,000,000
Land Cost	$	6,600,000
Spreading Ground Modifications	$	1,400,000
Subtotal	$	95,747,200
Contingencies 35%	$	33,512,000
Subtotal	$	129,259,000
Engineering, Legal, Administration, Inspection, Permits, etc. 35%	$	45,241,000
Total	$	174,500,000

LACSD JWPCP MF/RO

OCWD AWT O & M Costs

mid 2006 ENR CCI		7700
October 2010 ENRCCI		8920
Current Electric Power Cost	$	0.125
Plant Capacity		70 mgd
Annual Plant Production		25,550 MG
Percent Plant Operating Capacity		100%

Item	kWhr/yr	mid-2006 Cost, Millions $, Full Capacity	October 2010 Cost, Millions $, Full Capacity	$/ MG Product Water	93 mgd Annual Cost Millions $	110 mgd Annual Cost Millions $
Power	1.15E+08	$ 11.5	$ 14.4	$ 562.62	$ 19,098,214	$ 22,589,286
Chemicals		$ 5.4	$ 6.3	$ 244.84	$ 8,310,991	$ 9,830,204
Membrane Replacement		$ 2.8	$ 3.2	$ 126.95	$ 4,309,403	$ 5,097,143
UV Lamp Replacement		$ 0.3	$ 0.3	$ 13.60	$ 461,722	$ 546,122
Compliance Monitoring		$ 1.5	$ 1.7	$ 68.01	$ 2,308,609	$ 2,730,612
Labor		$ 3.6	$ 4.2	$ 163.22	$ 5,540,660	$ 6,553,469
Contract Maintenance		$ 0.4	$ 0.5	$ 18.14	$ 615,629	$ 728,163
Plant Refurbishment		$ 1.2	$ 1.4	$ 54.41	$ 1,846,887	$ 2,184,490
Total		$ 26.7	$ 32.0	$ 1,251.8	$ 42,492,114	$ 50,259,489.80

Note: mid-2006 Power Cost based on $0.10/kWhr
To adjust for actual capacity only power, chemicals, membrane replacement
and UV lamp replacement were adjusted.

Cost per MG	$ 1,045.01	$ 1,251.79
Cost per Acre-ft	$ 340.46	$ 407.83

EXHIBIT D

Economic Impact of Proposed Extension of Marine Life Protection Act to the South Coast Region

December 2010

Executive Summary

M.Cubed analyzed the economic impacts that are likely to occur as a result of extension of the Marine Life Protection Act (MLPA) to the South Coast Region, and particularly the Point Vicente Marine Reserve and Abalone Cove State Marine Conservation Area.[1] The proposed regulations could trigger the imposition of new requirements by the Regional Water Quality Control Board, such as the need to reduce effluent concentrations for certain water quality parameters, or even reduce the total volume of effluent discharged into the ocean, which would necessitate significantly upgraded treatment and conveyance facilities.[2]

M.Cubed's analysis found that, should the proposed regulations be implemented, higher wastewater treatment costs would be triggered that, over time, would reduce employment in Los Angeles County by between 220 and 1,125 jobs, total personal income would decline by from $10 to $45 million per year, state and local tax revenue would fall by between $2 and $8 million annually, total industry output would drop by approximately $25 to $115 million per year, and total value added would decline by roughly $15 to $70 million annually.

These impact estimates exclude other changes to the regional economy likely to be triggered by implementation of the proposed regulations. For example, recreational fishing patterns would be altered, leading to lower tourism expenditures in the affected areas. Likewise, subsistence fishing by low-income non-European-American families could be disrupted.

Introduction

M.Cubed, a consulting firm specializing in resource economics and public policy analysis, was asked by the Sanitation Districts of Los Angeles County (Districts) to estimate the economic implications of extension of Marine Life Protection Act (MLPA) regulations to the South Coast Region, and particularly the proposed Point Vicente State Marine Conservation Area and Abalone Cove State Marine Conservation Area. M.Cubed Partner Steven Moss, M.P.P., conducted this analysis, with assistance from Lori Higa. M.Cubed has developed a large number of economic analyses on a wide range of environmental issues, including examining the economic implications of state and regional air quality rules, water quality standards, and landfill developments.

The Sanitation Districts of Los Angeles County (Districts) operate an interconnected system of sewers and wastewater treatment plants – the Joint Outfall System ("JOS") – which serves 17 districts, 73 cities, and more than five million people. The terminal treatment plant in the JOS is the Joint Water

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[1] M.Cubed is a policy analysis and resource economics consulting firm with offices in Oakland and San Francisco.

[2] Joseph C. Reichenberger, *Concept Level Cost Estimate for Implementation of Advanced Wastewater Treatment and Zero Liquid Discharge at the Joint Water Pollution Control Plant,* prepared for County Sanitation Districts of Los Angeles County, December 2010, and Joseph C. Reichenberger, *Cost Estimate for Implementation of Nitrification/Denitrification at the Joint Water Pollution Control Plant for Potential Impacts of the Marine Life Protection Act,* prepared for County Sanitation Districts of Los Angeles County, September 2010.

Pollution Control Plant ("JWPCP"), which discharges to an ocean outfall system offshore of White Point, on the southern side of the Palos Verdes peninsula. This economic impact analysis was based on information provided by the Districts related to the scope and cost of the additional treatment technologies that could be required to comply with potential regulatory requirements imposed by the State or Regional Water Boards as a result of the proposed regulations, as well as Districts-specific demographic and economic data. Specifically, this analysis assumes that existing treatment processes would have to be upgraded to meet an effluent concentration for total inorganic nitrogen (TIN) of 10 mg/L, either alone (i.e., low-end cost estimate) or in combination with advanced treatment and conveyance facilities to deliver highly treated recycled water for storage and subsequent reuse (i.e., high-end cost estimate). This analysis excluded consideration of the changes to the regional economy likely to be triggered by a shift in tourism patterns.

Study Methodology and Results

Los Angeles County Economy Suffers From High Unemployment

Los Angeles County is one of the largest and most ethnically diverse regions in the United States. Almost half of the county's population is Hispanic/Latino, one-third European-American, with the remainder divided between Asian-Pacific Islanders and African-Americans. The county is home to individuals from more than 140 countries speaking 224 different languages.[3] The Los Angeles combined statistical area (CSA) has a gross metropolitan product (GMP) of $831 billion, making it the world's third largest economic center, after the greater Tokyo and the New York metropolitan areas. If Los Angeles was a country, its surrounding CSA would be the world's 15th largest economy, just after Australia and above the Netherlands, Turkey, Sweden, Belgium and Indonesia.[4]

Despite its size, Los Angeles County has experienced a significant economic decline as a result of the national recession, while remaining one of the country's most expensive places to live. According to Los Angeles Economic Development Corporation's (LAEDC) chief economist Nancy Sidhu, "As a result of the recession, the unemployment rate across the county has risen dramatically in the last few years…" Key indicators of the difficult economic conditions include:

- *High unemployment rates*. LA County's unemployment has more than doubled since 2008, and currently hovers at approximately12.6 percent, roughly equal to the state rate, but significantly higher than the 9.6 percent U.S. unemployment rate.[5]

- *High cost of living*. In 2009 LA County's cost of living index was 166, compared to the U.S. average of 100.

- *Low median household incomes*. LA County's median household income in 2008 was $48,882,

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[3] lacity.org.

[4] As of 2008. LAEDC, "2010-2011 Mid-Year Update Economic Forecast & Industry Outlook," July 2010; "Los Angeles (city) Quickfacts," United States Census Bureau, 25, http://quickfacts.census.gov/qfd/states/06/0644000.html; "Metropolitan Statistical Area| Population Estimates| July 1, 2007." http://www.census.gov/popest/metro/tables/2007/CBSA-EST2007-05.csv.

[5] As of October 2010. Data from the California Employment Development Department and U.S. Bureau of Labor Statistics, www.bls.gov/.

compared to $61,021 for the state-as-a-whole.[6]

- *High poverty rates*. In 2008 15.2 percent of LA County residents lived in poverty, compared to 13.3 percent for the state-as-a-whole.[7]

Los Angeles County has also been hit hard by the housing crisis. For instance, in November there were 11,042 foreclosed homes for sale in the City of Los Angeles, compared to 7,631 non-foreclosed homes.[8] In September, one out of every 224 housing units in Los Angeles County received a foreclosure filing, compared to one in every 389 units nationwide. Median home values in the county increased slightly – +0.2 percent – in August, to $330,000, compared to a year earlier, but the August median price was lower than the previous month's high of $339,000.[9]

Declines in housing prices have been dramatic in some neighborhoods. In the 90001 zip code, which includes the Florence-Graham neighborhood, and which consists predominantly of Central American immigrants, home values have plummeted from a high of more than $450,000 in 2006 to less than $200,000 this year. In the South Gate zip code, 90002, which is roughly 70 percent Hispanic and 30 percent African-American, median home values dropped from more than $400,000 in 2006 to less than $150,000 today.[10]

Significant Costs Engendered by Proposed MLPA Expansion

It is within this context that the Fish and Game Commission is proposing to expand Marine Protected Area status to the South Coast region, which could result in significant costs to the Districts and their ratepayers. In particular, the proposed regulations could trigger new requirements from the Regional Water Quality Control Board to reduce effluent concentrations for certain water quality parameters, or to reduce the total volume of effluent discharged to the ocean, which would necessitate significantly upgraded treatment and conveyance facilities. Total capital costs associated with compliance with the anticipated requirements prompted by the new regulations are estimated to be between approximately $580 million and $2.8 billion, or approximately $38 to $180 million on an annualized basis. Total annualized capital, operating, and maintenance costs are estimated to be between approximately $96 and $440 million.

Compliance Costs Would Result in Regional Employment Loss and Reductions in Economic Activity

Higher wastewater treatment costs would be passed on to the residents and businesses located in the Districts' service area in the form of additional service charges and connection fees to property owners and associated rent hikes.[11] The Districts' analysis indicates that permit-related costs could

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[66]The average household size in LA is 2.8 people, a bit less than the California average of 2.9.

[7] Poverty rates are particularly high for people of color, with a rate of 8.1 percent for European-Americans, 19.3 percent for African-Americans, 20.1 percent for Hispanic/Latino, and 14 percent for American-Indians.

[8] www.yahoo.com, November 12, 2010.

[9] California Association of Realtors, www.car.org.

[10] Obtained from city-data.com, a commercial website that aggregates data from a variety of sources, including users, the Los Angeles Chamber of Commerce, the United States Census, and LAEDC.

[11] Economic impacts were modeled based on the higher overall costs estimated to be experienced by various economic sectors in the region, without distinguishing between whether these additional expenses would take the form of increased

result in between an approximately $49 and $225 per single family home increase in annual rates. Water intensive sectors, such as restaurants and some manufacturers, would face even more significant rate hikes. As with any price increase, these additional expenses would prompt families and firms to reduce their purchases of other goods and services, decrease their savings, or borrow the necessary funds, all of which would impact the regional economy.[12]

The Impact Planning (IMPLAN) Input-Output model was used to estimate the economic impacts associated with the compliance cost increases. Input-Output models use disaggregated data on economic activity within specific geographic regions to estimate spending, income, and employment patterns in particular business sectors. In this case, the study area was developed by grouping economic data at the zip code level for the 165 zip codes within the 17 Districts' service area boundaries.

Initially developed by the U.S. Forest Service, IMPLAN is commonly used by a wide range of public and private sector organizations to examine the economic impacts of proposed public policies. IMPLAN is based on a table of "direct requirement coefficients" which indicates the inputs of goods and services required to produce a dollar's worth of output. Standard economic "production functions" – the capital, labor, and technology – needed to produce a given set of goods determine how changes in demand for goods and services will ultimately affect the demand for the inputs to these services. For example, producing a ton of steel may require three workers and a particular set of equipment, which would not be required if the steel were no longer needed. Likewise, wastewater treatment costs represent a significant element of overall production expenses for a number of industries.

IMPLAN contains more than five hundred economic sectors and uses economic census data to compile county-level wage and salary information at the four-digit North American Industry Classification System **(**NAICS**)** level. National data are adjusted for the industrial and trading patterns for the subject region; in this case, the Districts' service area. Based on this structure, IMPLAN estimates the regional economic impact that would result from a dollar change in the output of local industries delivered to final demand (i.e., to ultimate purchasers, such as consumers outside the region). IMPLAN was used to determine the economic impacts on Districts' service area of a $96 million and $440 million annual increase in wastewater treatment costs. The Districts serve approximately 5.1 million people.

Key findings are as follows:

- Employment within the Districts' service area would be reduced by 220 to 1,125 jobs. This reflects net job loss: in the short-term some employment gains would be triggered by treatment-related construction and ongoing operation and maintenance work. However, as construction activity is completed higher rates would serve as a drag on the regional economy. Overall employment would be permanently lower; higher wastewater treatment costs would result in fewer businesses locating into the area, and serve to dampen consumer purchases and activity at existing firms.

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rates or higher connection fees. Estimating the connection fees changes prompted by the proposed regulations was beyond the scope of this analysis.

[12] Firms could also raise their prices, depending on demand elasticities. However, consumer price hikes similarly serve to muffle overall demand, placing a drag on growth.

- Total personal income within the Districts' service area would decline by $10 to $45 million per year. This income loss is mostly related to the employment reductions; fewer jobs results in fewer paychecks, which in turn diminishes the amount of money spent within the area.

- State and local public sector tax revenues would fall by $2 and $8 million annually, principally related to declines in property and income tax revenues.

- Total industry output, or sales, within the Districts' service area would decline by approximately $25 to $115 million per year. That is, as a result of businesses leaving, not coming into, the service area, or reducing their activity, the production of goods and services in the area would fall.

- Total value added within the Districts' service area would drop by roughly $15 to $70 million annually. Total value added reflects the additional value of goods and services produced by local firms once input costs have been subtracted out. For example, the value added by a tomato processor is the price of the resulting spaghetti sauce minus the cost of raw tomatoes and other inputs.

Restaurants, Stand-Alone Laundromats and Manufacturers Particularly Hard Hit

Because of their high wastewater flows and contaminant concentrations, restaurants, stand-alone laundromats, and some manufacturers would be particularly hard-hit by the proposed regulations. As previously indicated, these sectors would face significant service rate hikes: between $430 and $2,000 per 1,000 square feet for restaurants, and upwards of $3,200 per 1,000 square feet for stand-alone laundromats. As a result, at least 180 restaurant jobs would potentially be eliminated. While this reflects a small fraction of total employment in the sector, given the current depressed economy, it is notable.[13,14]

Laundromats that are located in shopping centers pay wastewater service rates that are largely determined by their landlords, who pay service charges that, while higher than many other customer categories, are significantly lower than the rates charged to the 24 stand-alone laundromats in the Districts' service territory. Given this sector's low-labor dependence and capital-intensity, higher wastewater treatment costs would be reflected in lower profits, higher prices – charged to a customer base which largely consists of low-income minority women – and increased barriers to entry for small-scale entrepreneurs. [15] For example, while the sector would seem to present ownership opportunities for non-European-American families, high fixed costs – rent and utilities – makes buying into a business difficult.

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[13] There are 6,795 full-service restaurants in Los Angeles, employing 132,536 workers, with an average weekly wage of $371 and total annual revenues of $2.6 billion.EDD employment figures provided by Kimberly Ritter, associate economist for monetary & fiscal policy, Los Angeles Economic Development Corporation's Kyser Center for Economic Research; NAICS code 7221.

[14] There are 8,232 limited-service eating establishments, with 122,136 workers earning an average weekly wage of $294, for a total of $1.9 billion in annual sales. NAICS code 7222.

[15] Email from Anhdao Truong**,** EHS IV, Program Planning - Environmental Health Division, Los Angeles County Department of Public Health, September 22, 2010.

Water-intensive manufacturers, including petroleum refining,[16] textiles (e.g., carpet mills), paper mills, and food processing – particularly cheese and chip makers, bottlers, and breweries – would similarly face significant service rate increases, with costs doubling or tripling. Higher refinery expenses would most likely be passed onto consumers in the form of gasoline price hikes, while food processors, less able to pass on cost increases to consumers due to the sector's competitive nature, may see profit reductions. Smaller manufacturers – in food processing, metal finishers, and textiles[17] – which are less able to absorb rate increases, and unable to pass them on to consumers, are likely to be most hard-hit.

Higher Compliance Costs Would Worsen an Already Cloudy Economic Outlook

The California economy is being battered by a series of challenges, including the high cost of doing business, historically high unemployment rates, and high poverty levels. Although modest relative to the overall size of the LA economy, the costs that could be triggered by the proposed regulations would result in noticeable adverse economic impacts, and add to an already burdened regional economy.

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[16] Costs to oil refineries may be muffled to the extent that the facility recycles water internally.

[17] The apparel industry heavy reliance on water is associated with clothes washing.

EXHIBIT E

LEGAL COMMENTS

A. Legal Requirements for Designating MPAs Pursuant to the MLPA

1. Marine Managed Areas Improvement Act (MMAIA)

The California Legislature enacted the Marine Managed Areas Improvement Act ("MMAIA"), Cal. Public Resources Code sections 36600-36900, in 2000. In adopting the MMAIA, the Legislature intended to eliminate existing marine classifications, with the exception of state estuaries, and establish a new classification system. The Legislature found that California's existing marine managed areas ("MMAs") did not comprise an organized system, as the individual sites were not designated, classified, or managed in a systematic manner." These sites lacked "clearly defined purposes, effective management measures, and enforcement." *See* PRC §36601(a)(6). The MMAIA established six MMA classifications for designated managed areas in the marine and estuarine environments, with an associated range of prohibited activities.

2. Marine Life Protection Act (MLPA)

The Marine Life Protection Act ("MLPA"), adopted in 1999 and amended in 2004, was adopted for the more specific purpose of preserving and protecting marine habitat and species and sets forth a process to designate Marine Protected Areas ("MPAs"). The MMAIA defines MPAs designated pursuant to the MLPA as "a subset of MMAs," and the MLPA relies upon the MMAIA to define the three types of MPAs under the MLPA: State Marine Reserves ("SMRs"), State Marine Parks ("SMPs"), and State Marine Conservation Areas ("SMCAs"). *See* PRC §36602; F&G Code §2852(c) ("MPAs are primarily intended to protect or conserve marine life and habitat, and are therefore a subset of marine managed areas (MMAs), which are broader groups of named, discrete geographic areas along the coast that protect, conserve, or otherwise manage a variety of resources and uses"). Under the MLPA, a "marine life reserve" is synonymous with an SMR under the MMAIA. *See* Revised Draft Master Plan for Marine Protected Areas (January 2008) at p. 32 ("Master Plan").

Legislative goals of the MLPA include:

- To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.
- To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.
- To improve recreational, educational, and study opportunities provided by marine ecosystems that are *subject to minimal human disturbance*, and to manage these uses in a manner consistent with protecting biodiversity.
- To ensure that California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are *based on sound scientific guidelines*.

See F&G Code §2853(b)(1)-(4) (emphasis added). The MLPA requires the Fish & Game Commission ("Commission") to adopt a Master Plan that guides the adoption and implementation of the MLPA, and decisions regarding the siting of new MPAs. *See* F&G Code

§2855(a). The development of the Master Plan is statutorily delegated to the Department of Fish & Game ("Department"), which, in turn, is authorized to convene a team of resource agency and scientific experts to assist with the process. *See* F&G Code §2855(b). Importantly, the Department and its Team, in carrying out all activities pursuant to the MLPA "shall take into account relevant information from local communities, and shall solicit comments and advice for the master plan from interested parties on issues including, but not necessarily limited to, each of the following:

- Practical information on the marine environment and the relevant history of fishing and other resources uses, areas where fishing is currently prohibited, and water pollution in the state's coastal waters
- Socioeconomic and environmental impacts of various alternatives
- Design of monitoring and evaluation activities
- Methods to encourage public participation in the stewardship of the state's MPAs."

See F&G Code §2855(c)(1)-(4).

The MLPA mandates that the Master Plan be based on "the best readily available science." *See* F&G Code §2855(a). The "best readily available science" is further defined in Fish & Game Code section 2856. Among other requirements, section 2856 requires the Master Plan to include:

- Recommendations for the extent and types of habitat that should be represented in the MPA system and in marine life reserves. Habitat types described on maps shall include, to the extent possible using existing information, rocky reefs, intertidal zones, sandy or soft ocean bottoms, underwater pinnacles, sea mounts, kelp forests, submarine canyons, and seagrass beds.
- An identification of select species or groups of species likely to benefit from MPAs, and the extent of their marine habitat, with special attention to marine breeding and spawning grounds, and available information on oceanographic features, such as current patterns, upwelling zones, and other factors that significantly affect the distribution of those fish or shellfish and their larvae.
- Recommendations for a preferred siting alternative for a network of MPAs that is consistent with the goals of the MLPA set forth in section 2853 and with the siting guidelines described in section 2857.

See F&G Code §2856(a)(2)(A)-(K). The MLPA also requires that the preferred siting alternative be designed according to specified guidelines, which include:

- Each MPA shall have identified goals and objectives. Individual MPAs may serve varied primary purposes while collectively achieving the overall goals and guidelines of the MLPA.
- Similar types of marine habitats and communities shall be replicated, to the extent possible, in more than one marine life reserve in each biogeographical region.

- The MPA network and individual MPAs shall be of adequate size, number, type of protection, and location to ensure that each MPA meets its objectives and that the network as a whole meets the goals and guidelines of the MLPA.
- The Department and Team, in developing the preferred siting alternative, shall take into account the existence and location of commercial kelp beds.
- The Department and Team may provide recommendations for phasing in the new MPAs in the preferred siting alternative.

See F&G Code §2857(c)(1)-(5). The preferred siting alternative presented to the Commission for adoption may include MPAs that will achieve either or both of the following objectives: (1) protection of habitat by prohibiting potentially damaging fishing practices or other activities that upset the natural ecological functions of the area; and (2) enhancement of a particular species or group of species by prohibiting or restricting fishing for that species or group within the MPA boundary. *See* F&G Code §2857(b)(1)-(2).

B. MLPA Designation Process in the South Coast Study Region

In August 2004, the California Resources Agency, the Department, and the Resources Legacy Fund Foundation ("RLFF") launched an effort, via a Memorandum of Understanding ("MOU"), to implement the MLPA after two unsuccessful earlier attempts to implement the Act. This MLPA Initiative established a regional approach that included an MLPA Blue Ribbon Task Force ("BRTF") together with a Master Plan Science Advisory Team ("SAT"), and stakeholder advisory groups, to oversee the completion of MPA designations. The regional BRTFs, SATs, and stakeholder advisory groups are working with the Department as part of the Team described in Fish & Game Code section 2855(b).

The South Coast study region (Point Conception to the California/Mexico border, including offshore islands) is the third MLPA study region to undergo the regional MPA planning and design process. As a result of work performed by the South Coast Region SAT and BRTF, the South Coast Regional Stakeholder Group ("SCRSG"), and participating state agencies, the Commission was presented in December 2009 with proposed MPAs for the South Coast Region that included two MPAs in South Palos Verdes -- the Point Vicente SMR and the Abalone Cove SMCA.

The County Sanitation Districts of Los Angeles County (Districts) operate an interconnected system of sewers and wastewater treatment plants called the Joint Outfall System ("JOS"), which serves 17 districts, 73 cities, and a population of over 5 million. The terminal treatment plant in the JOS is the Joint Water Pollution Control Plant ("JWPCP"), which discharges to an ocean outfall system offshore of White Point, on the southern side of the Palos Verdes peninsula. Thus, the Districts have a particular interest in the siting of the South Palos Verdes MPAs, as such designations may negatively impact the operation of essential public health infrastructure and associated discharge from the JWPCP.

More importantly, though, the Districts have a keen understanding of the marine environment in and around the proposed South Palos Verdes MPAs due to decades of comprehensive monitoring undertaken in association with the Districts' discharge permit. The Districts disputed the factual and scientific basis for the originally proposed South Palos Verdes MPAs, in particular, the designation of Point Vicente as a SMR, the most stringent and protective MPA designation under the MLPA. In written comments submitted to the Commission on March 26, 2010, the Districts asserted that the proposed South Palos Verdes MPAs were in locations wholly unsuitable for such designations due to legacy contamination and technical issues, including the ongoing water and sediment quality concerns from, and remediation work at, the Palos Verdes Shelf Superfund Site that underlies the proposed MPAs and the existing and ongoing effects of the Portuguese Bend Landslide, Klondike Canyon Landslide, and Abalone Cove Landslide (collectively, the "PBL") on local habitat and species. The Districts asserted that the low quality habitats in both areas could not, by their very nature, achieve the legislative goals of the MLPA, and that the designations were not based on the best readily available science and did not meet the criteria and specified habitat, species, spacing, and size guidelines adopted during the MLPA process by the BRTF, SAT, and MLPA I-Team. Further, the Districts commented that important socioeconomic impacts were not being properly considered.

On April 7, 2010, the Department presented the Commission with a "Draft Initial Statement of Reasons for Regulatory Change regarding Agenda Item 9: Request for Authorization to Publish Notice of Commission Intent to Amend Section 632, Title 14, CCR, Re: South Coast Marine Protected Areas," ("Draft ISOR") setting forth the initial integrated preferred alternative ("Initial IPA") and seeking approval to begin the process of preparing environmental documents in support of formal regulatory action by the Commission to designate the MPAs. In the Draft ISOR, the Department modified the South Palos Verdes MPAs. The Point Vicente SMR was changed to a lesser designation, an "SMCA (No Take)" that prohibits "take" for commercial and recreational purposes except pursuant to specified permitted or authorized activities associated with the Palos Verdes Shelf Superfund Site remediation program.[1] *See* Draft ISOR at Table 1, p. 31. The Abalone Cove State Marine Conservation Area designation was unchanged; however, the Palos Verdes Shelf Superfund Site remediation program was also excepted from prohibitions associated with this designation. *Id.* at 32. An exemption for mandated water quality monitoring conducted pursuant to the federal Clean Water Act and state Porter-Cologne Act was also provided, applicable to all MPAs. *Id.* at 7.

This modified proposal was based, in part, on a March 3, 2010 report from the Department to the Commission regarding "Unresolved Issues and Potential Options for the Integrated Preferred Alternative of the MLPA in the South Coast Study Region," which identified four unresolved issues identified in several proposed MPAs in the Initial IPA. One of the unresolved issues

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[1] This modification was based on consideration of an October 1, 2009 memorandum transmitted from the MLPA I-Team to the BRTF and related stakeholder members, which forwarded informal advice from the Office of the Attorney General, dated September 25, 2009, ("AG Opinion") regarding establishment, use and enforcement of MPAs and MMAs. The Attorney General was asked to opine and clarify the effect of a SMR designation and the scope of activities the Departments of Fish & Game and Parks and Recreation may, or may not, allow within an area so designated. Concluding that the prohibitions in the MLPA and MMAIA for SMRs are the strictest of all marine managed areas, the Attorney General's office opined that the Commission must exclude an area occupied by an existing incompatible use from an SMR designation, or choose a less stringent designation (*e.g.,* SMCA) that can accommodate the use. *See* AG Opinion at p. 5. Both memoranda identified that MPA designations must be made carefully given the statutory mandate for strict preservation, enhancement, and enforcement of certain MPA designations.

addressed existing activities regulated by other agencies that need to be specifically recognized in regulations for at least 23 proposed MPAs. Included in the list were the South Palos Verdes MPAs. The Department recommended:

- For the Point Vicente SMR: the Department recognized that the MPA has ongoing activities that may result in take and prevent designation as an SMR, including, but not limited to, the Palos Verdes Shelf Superfund Study Area. The Department also noted that Clean Water Act required monitoring resulting in marine life and sediment collection occurs here. The Department recommended as follows: (a) change designation to SMCA; (b) craft area-specific allowances in regulation to allow necessary permitted activities and operations, pursuant to required permits, or as authorized by the Department, and (c) for required monitoring, add regulatory language.
- For the Abalone Cove SMCA: the Department recognized the same activities, and recommended the same area-specific allowances and regulatory language regarding monitoring activities.

Though the Department acknowledged one of the severe deficiencies of the proposed South Palos Verdes MPAs identified by the Districts (Palos Verdes Superfund Study Area that underlies the MPA designations), and downgraded the MPA designation for Point Vicente, the Department and the Team should have instead recommended removal of these proposed MPAs from the Draft ISOR, for the reasons set forth below.

C. The Proposed South Palos Verdes MPA Designations Do Not Comply with the MLPA, the Master Plan, Specified Guidelines for Siting Alternatives, and Regional Goals and Objectives Adopted for the South Coast Study Region.

As noted above, the MLPA mandates that MPA designations satisfy the following:

- Legislative Goals (F&G Code section 2853)
    - Marine ecosystems considered for designation should be subject to minimal human disturbance
    - MPAs must be based on sound scientific guidelines
- Proper evaluation of specified issues (F&G Code section 2855(c)(1)-(4))
    - Practical information on marine environment and water pollution
    - Socioeconomic and environmental impacts of various alternatives
- Specified Guidelines for Siting Alternatives (F&G Code section 2857(c)(1)-(5))
    - Regional goals, objectives, design, and implementation requirements must be satisfied
    - Similar habitats and communities shall be replicated
    - MPA network and individual MPAs shall be of adequate size, number, type of protection and location
    - Existence and location of commercial kelp beds must be taken into account
- MPA designations must be based on "best readily available science" (F&G Code section 2855(a) and 2856)), defined to include
    - Extent and type of habitat to be protected must be clear and consistent with specified goals and objectives adopted regionally and set forth in the MLPA.

- Species or groups of species likely to benefit from MPAs must be identified.

The proposed South Palos Verdes MPA designations fail to adhere to these requirements. These low quality habitats cannot, by their very nature, achieve the legislative goals of the MLPA. Further, the proposed South Palos Verdes MPA designations do not reflect proper evaluation of information submitted by the Districts on the marine environment and water pollution, are not based on the best readily available science, and do not meet the criteria and specified habitat, species, spacing, and size guidelines adopted during the MLPA process by the BRTF, SAT, and/or MLPA I-Team. Finally, the socioeconomic and environmental impacts of various alternatives were not properly considered.

1. The Proposed South Palos Verdes MPA Designations Fail to Properly Consider the Impact/Effect of the Palos Verdes Shelf Superfund Site and Related Remediation Activities.

a. Palos Verdes Shelf Superfund Site Summary

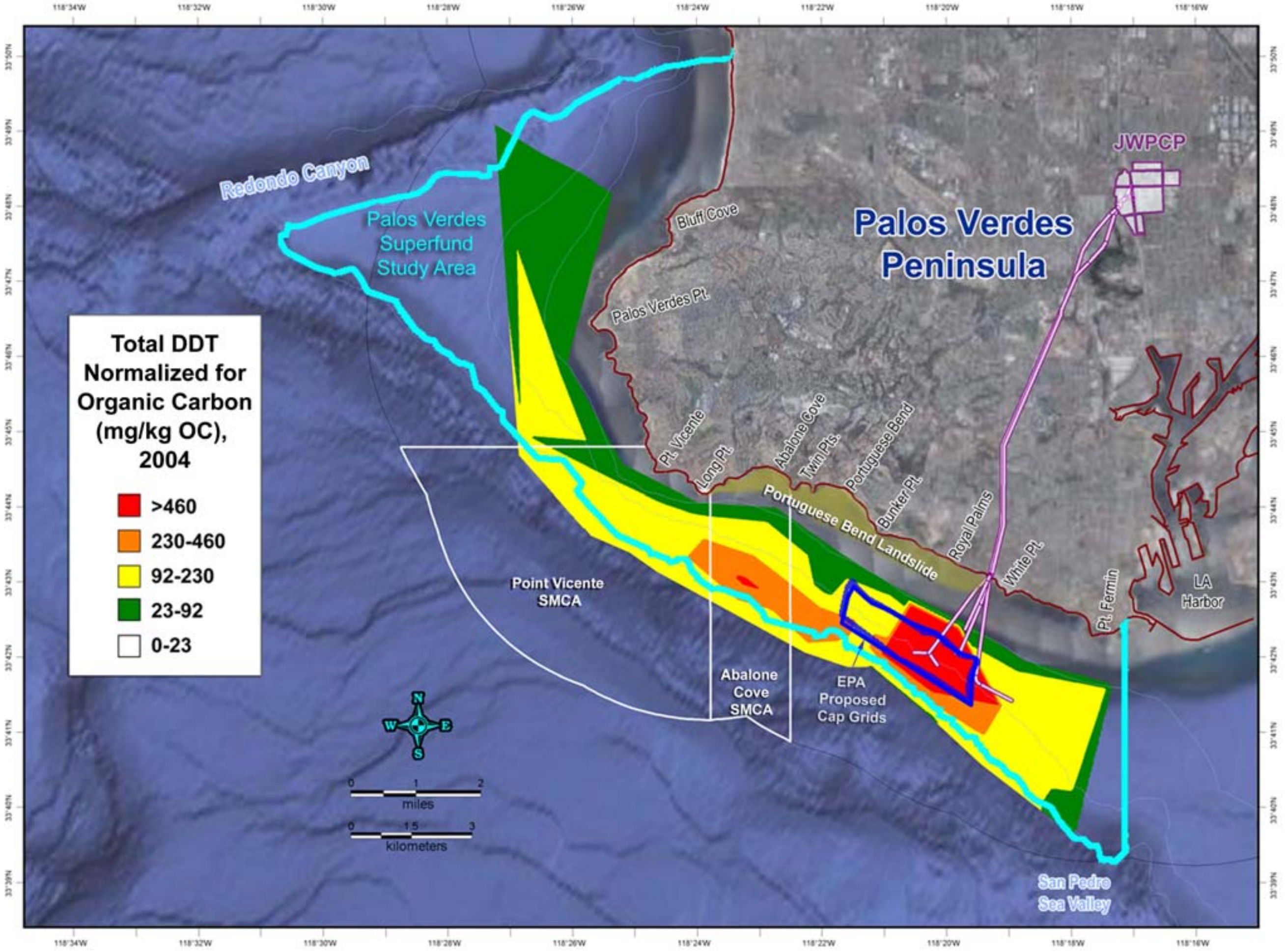
The Palos Verdes Shelf is contaminated with dichlorodiphenyltrichloroethane and its metabolites (DDTs) and polychlorinated biphenyls (PCBs), powerful reproductive toxins that biomagnify through the food web. These chemicals degrade slowly and pose a hazard to fish, birds and mammals. The water and sediment quality criteria for DDTs set by the US Environmental Protection Agency ("US EPA") have been and continue to be exceeded. The Palos Verdes Shelf was declared a Superfund Site by the USEPA and is listed on the Cortese List prepared by the Department of Toxic Substances Control (*see* Figure 1).

The USEPA has selected a preferred alternative for remediation of sediment contamination that involves placing a 40-cm thick cap of clean sediment on the seafloor at depths from 147-230 feet over the most contaminated portions of the seafloor. The capping procedure will inevitably suspend some of the buried contaminated sediments that will be carried down current in a northwesterly direction into the two proposed MPA designated areas. In addition, the capping will affect the productivity and diversity of a portion of the shelf communities after burial, thereby compromising ecosystem function and production for as many as nine (9) years while the area recovers its bottom communities. The abilities of fish and invertebrates to grow and reproduce in the two proposed MPAs are at risk by locating them in a Superfund site containing reproductive toxins. Due to the existing and ongoing water and sediment quality and its impacts on aquatic species, the proposed South Palos Verdes MPAs do not meet even the minimum requirements of the MLPA.

1. US EPA Remediation Activities That Will Impact Proposed South Palos Verdes MPAs

In response to the findings of a Natural Resource Damage Assessment action and report on the impact of DDTs and PCBs on the Palos Verdes Shelf, US EPA in 1994 initiated a Superfund

Figure 1. Proposed South Palos Verdes MPAs in relation to 1) the gradient of DDT contamination (expressed as multiples of the EPA's cleanup goal of 23 mg/kg organic carbon to protect aquatic life and human health), 2) the Palos Verdes Superfund area and proposed sediment remediation capping grids, and 3) the area impacted by the Portuguese Bend Landslide.



investigation designed to identify possible remedial actions. In 2009, EPA identified a preferred alternative of capping the affected areas with clean sediment. Documents describing this alternative can be found at: http://www.pvsfish.org/pdf/PVS_Proposed_Plan_6.11.09.pdf.

US EPA's selection of the preferred alternative was based partly on findings from a pilot program that placed sediment caps on three 45-acre sites in 2000. The post-capping sampling program confirmed that the cap had covered the contaminated sediments, but that there were some areas in which the contaminated sediments at depth were closer to the surface than before the capping operation. This may have been caused by natural erosion or turbulence from the capping process. Based on an evaluation of human health and ecological risks, EPA determined that existing conditions exceed ambient water quality and sediment criteria and pose a threat to human health and to the ecosystem. Consequently, EPA decided that allowing natural processes to remedy the threat of DDT and PCB to the local marine ecosystem and human health was not sufficient.

A food-web exposure model for estimating doses to fish, birds and mammals is coupled with screening level concentrations of DDT to estimate the risk to these fauna (CH2M Hill, 2009).

Measured concentrations of DDTs in fish collected from the Southern California Bight exceeded screening levels in northern anchovy, Pacific sardine and Pacific chub mackerel (Allan *et al*., 2007). White croaker, kelp bass, and sanddabs on the Palos Verdes Shelf generally exceed the DDT no observable effects concentration (NOEC) of 1,900 micrograms/kilograms whole body tissue. The Remedial Action objectives outlined by the US EPA are designed to reduce DDTs sediment concentrations to 23 µg/kg organic carbon and water concentration to below a mean of 0.22 ng/L. These targets were intended to protect human consumers of seafood, whereas the existing screening level for the protection of saltwater life is 1 ng/L DDTs in water (EPA, 1980).

From the modeling, it was estimated that the preferred "small cap" alternative would achieve the targeted screening level much earlier than relying only on natural degradation and dispersion. The preferred alternative, Option 3 in the Proposed Plan, would cap cell 8C, which covers an area approximately 1.3 km-- about twice as long in the along-shore direction as in the onshore-offshore direction. The estimated dates for achieving the objectives under the preferred alternative are 2023 for water and 2039 for sediment. The estimated dates for achieving these objectives with no action are 2037 to 2067, respectively.

The US EPA activities in the area of the proposed South Palos Verdes MPAs will follow a staged approach. Once cell 8C is capped, the area of capped sediments may be extended to cells 6C and 7C, immediately to the northwest of Cell 8C. These two cells are the sites identified for capping under Alternative 4. The execution of Alternative 3 will take approximately two years, which will be followed by a period of evaluation. Execution of extended capping identified under Alternative 4, and which may follow the work under Alternative 3, would likely take at least two or three additional years. In all, five to six years of disturbance would occur, followed by some years of recovery of the bottom communities.

The US EPA acknowledges that successful capping of soft sediments at this depth (147 to 230 ft or 45-70 m) is challenging and carries great risks of resuspension of contaminated sediments and moving some contaminated sediments closer to the sediment surface. The prevailing bottom currents could carry suspended sediments to the northwest of the capping activities towards and into the proposed South Palos Verdes MPAs. Further, the projected cap thickness of 45 cm will smother the existing fauna and it will require time for a normal benthic community of infauna, megafauna and demersal fish to re-colonize. It could take several years to return to existing conditions after the five to six year period of disturbance from capping and the possible resuspension of toxic compounds. In order to recover, at least nine or more years may be required to reach a fully diverse and functional ecosystem.

2. Effect of Palos Verdes Shelf Superfund Site and Remediation Activities on Local Habitat and Species.

The management of the Palos Verdes Shelf Superfund Site over the next five to ten years will result in several increased risks to marine organisms. Prevailing northwesterly currents will likely carry sediment with associated contaminants suspended from the capping operations into the proposed South Palos Verdes MPAs, affecting water and sediment quality to an unknown degree.

The present concentrations of DDTs in the surface sediments on the Palos Verdes Shelf in relation to the proposed South Palos Verdes MPAs are shown in Figure 1. Disturbance from the capping will occur periodically over five or more years as hundreds of tons of sediments are dumped 147 to 230 feet below the surface of the ocean. The timing and extent of these side effects of capping depends on the effectiveness of the operations and the adaptive management decisions made by US EPA, both of which are unknown. These operations will have several potential effects on organism health in the area.

Risks to food sources for many species, particularly bottom-feeding fish, are a primary concern. Specifically, benthic communities will be greatly diminished in the area of capping because they will be smothered under forty or more centimeters of sediment. There will also be a depression of productivity in a larger area than the area of capping because the capping may impact fish that may spend part of their time in the proposed MPAs but feed over a wider area. A reduction of infauna due to capping activities may mean less biological material, such as invertebrate larvae, will be carried down current from the capping area into the proposed MPAs than is now the case. Consequently, food for an anticipated increased population of fish within the proposed MPAs could be diminished.

Marine life on the Palos Verdes Shelf remains contaminated with DDT that could be affecting vital life functions like reproductive fitness. There is strong evidence from past studies that DDTs negatively affect fish reproduction and such effects could still be occurring. Further, if the proposed MPAs succeed in attracting kelp bass, one of the species proposed to be helped by MPA designation because of the limited movements of adults, then the proportion of the population exposed to DDT will actually increase and add to the risk to the health of the population.

Finally, additional particulate matter in water may increase water turbidity and add to the already turbid conditions of the southern Palos Verdes Shelf due to slumping of sediments in the PBL area into the ocean. Kelp in the area of Palos Verdes, including the two proposed South Palos Verdes MPAs, has been under stress from this turbidity with documented diminished health, and the capping operations will only increase the stress on these plants that support an important nearshore habitat in coastal southern California.

b. Ongoing Failure by Department and Team to Properly Consider the Palos Verdes Shelf Superfund Site as a Basis for Removing South Palos Verdes MPAs from the Final IPA

A primary goal of the MLPA is “[t]o protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems,” especially those that are “subject to minimal human disturbance.” *See* F&G Code §§ 2853(b)(1) and (3). The general purpose of the MPAs designated pursuant to the MLPA is to provide refugia where ecosystems can recover from human impacts (*e.g.*, harvesting and contaminant effects) and ecosystem productivity can be improved to the extent that a complement of species with normal ages and sizes can develop and act also as a source of recruits to surrounding areas that lack protection. Good water quality is critical to achieving this goal.

In view of these goals, the MLPA specifies that the Commission, Department and Team (including the BRTF and SAT) assembled to prepare the Master Plan “shall have expertise … with water quality and related issues.” *See* F&G Code §2855(b)(2). Additionally, staff from the State Water Board “shall” be part of the team, and the Department and team “shall solicit comments and advice for the master plan from interested parties on issues including … (1) Practical information on the marine environment and the relevant history of fishing and other resources use … and water pollution in the state’s coastal waters.” *See* F&G Code §2855(b)(3)(A); 2855(c)(1). The Master Plan explains that water quality is one of the important biophysical indicators of the success of marine management actions to implement the MLPA, and recommends that the SAT work with the State Water Board to more fully evaluate potential water quality impacts. *See* Master Plan at § 6.2.1, p. 78; §3.8.1, p. 53. Further, the MLPA mandates that the Master Plan be “based on the best readily available science.” *See* F&G Code §2855(a).

The SAT concluded that “[w]here water quality is significantly compromised, marine life may be affected. Impaired water quality may lead to changes to population rates (growth, reproduction, and mortality), population abundance and ecological community composition through a variety of interactions (*e.g.,* decreased diversity, loss of sensitive species and abundance of tolerant species).” *See* SAT Draft Methods, at p. xiv. The SAT also stated that “[i]t is generally accepted that degraded water and sediment quality results in impacts to marine life, including undesirable changes to community structure and function.” *Id.* at p. 13. However, contrary to the clear and specific language of the MLPA, the SAT concluded that [w]ater quality evaluations are not mandated by the MLPA, and should therefore be considered secondary to other MPA network design guidelines.” *Id.*, at p. 101. Despite the SAT’s recommendation that “areas that are significantly impacted by a variety of pollutants from large industrial or developed watersheds” should be avoided as sites for MPAs, it did not find that MPAs should be avoided for South Palos Verdes, even though the proposed MPAs there overlie the Palos Verdes Shelf Superfund Site. *Id.*, at pp. xiv-xv.

In response to a request by the Districts, the SAT performed a site-specific evaluation and provided additional guidance for MPA designation in the vicinity of the South Palos Verdes MPAs. The SAT included the following important information and conclusions regarding water and sediment quality and MPA placement in this area in its report:

- The waters overlying the PV [Palos Verdes] Shelf do not meet the ambient water quality criteria for DDT, and, based on the EPA standards for protecting wildlife, EPA has determined that contaminants found in the water, sediment and in the fish do not meet the protective requirements of aquatic life.

- Since the EPA will continually be working in this area through the next several years, if not longer, the SAT determined that it is important to include and consider the current process by the EPA of selecting an interim remedial action for the PV Shelf.

- Capping activities conducted as an interim remedial action could lead to re-suspension of the contaminated layer and cause some temporary increase in bioavailability of the toxins and a temporary increase in fish exposure to legacy contaminants (*e.g.,* DDT, PCB). If approved, initial capping activities would begin in 2011 and take one to two years to complete.

- If capping at the first proposed site is successful, additional sites in the area would be considered for treatment, which would occur approximately 5 to 7 years after initial treatment. This prolonged disturbance could reduce the effectiveness of MPAs that are placed near the mitigation site, and MPAs should not be placed in the area.

See SAT Draft Recommendations for Evaluating Water and Sediment Quality Along the Palos Verdes Shelf ("SAT Draft PV Recommendations"), at pp. 4-7 (August 31, 2009). Nonetheless, the SAT inexplicably concluded that only a small area should be excluded from MPA designation. That narrow exclusion area did not include the proposed South Palos Verdes MPAs, even though US EPA documented and the SAT concurred that all along the Palos Verdes Shelf (including the areas occupied by the proposed South Palos Verdes MPAs) "contaminants found in the water, sediment and in the fish do not meet the protective requirements of aquatic life." *See* SAT Draft PV Recommendations, p. 5.

Given the existence of the Palos Verdes Shelf Superfund Site and its associated water and sediment quality issues, along with the long-term impacts and effects of US EPA's remediation activities, inclusion of the South Palos Verdes MPAs in the Final IPA is inconsistent with the legislative goals of the MLPA (F&G Code §2853), demonstrates a failure to properly evaluate information supplied regarding the marine environment and water pollution (F&G Code §2855), and is not based on the best readily available science (F&G Code §§2855(a) and 2856). Further, the designation of these proposed MPAs is inconsistent with the Master Plan's method for evaluating water and sediment quality (F&G Code §§2855(a) and 2856).

The Department and Team's failure to remove the proposed South Palos Verdes MPAs is particularly egregious in that the analyses set forth in this letter demonstrates how little value (habitat and species) the proposed South Palos Verdes MPAs provide to the overall MPA network of the Final IPA. Had the poor sediment and water quality been properly considered in combination with how little value the proposed South Palos Verdes MPAs provide to the overall MPA network for the IPA, the South Palos Verdes MPAs would have never been considered for inclusion in the Final IPA.

2. The Proposed MPA Designations Fail to Properly Consider the Impact/Effect of the PBL and Do Not Meet the Specified Habitat, Species, Spacing or Size Requirements set forth in the Master Plan or Scientific Guidance

The Districts have consistently asserted that the landslide activity in the area of the proposed South Palos Verdes MPAs has so negatively affected the habitat and species, that the proposed MPAs cannot satisfy the legislative goals of the MLPA (F&G Code §2853), or the specified habitat, species, spacing or size requirements set forth in the Master Plan or specified statewide or regional guidance (F&G Code §§2856(a)(2)(A)-(K) and 2857(c)(1)-(5)). Thus, the proposed South Palos Verdes MPAs are not based on practical information on the marine environment (F&G Code §2855(c)(1)) or the best readily available science (F&G Code §§2855(a) and 2856), and must be removed from the Final IPA. Similarly, the SAT also determined that sedimentation and turbidity associated with the Portuguese Bend landslide make the area off Portuguese Bend (from Long Point to White Point) the least suitable area for proposed MPAs. *See* SAT Draft PV Recommendations at pp. 5-7.

The Districts retained Dr. Daniel J. Pondella to provide an analysis of the proposed South Palos Verdes MPAs. Dr. Pondella recently completed his service as a member of the SAT for the South Coast Study Region, and is aware of the landslide activity, its impact and ongoing effects on the habitat and species sought to be protected by the MPA program, and the inconsistency of the proposed South Palos Verdes MPAs with the applicable Master Plan and scientific guidelines adopted for the region. A copy of Dr. Pondella's analysis is contained in Exhibit A (cited herein as "Pondella Report"), and is discussed in further detail below.

a. Portuguese Bend Landslide, Klondike Canyon Landslide, and Abalone Cove Landslide

Road construction on Palos Verdes Drive triggered the Portuguese Bend Landslide in 1956. From 1956 to 1999, approximately 5.7 to 9.4 million metric tons of sediment slid onto the inner shelf (Kayen 2002). By 1999, the landslide was dewatered, slowed appreciably and now only releases sediment due to wave action. Unfortunately, sedimentation and associated turbidity continue to have chronic impacts. There is continued turbidity, sediment transport and scour associated with the sediment deposited in Portuguese Bend from the landslide (Pondella Report, Figure 1). In 1999, the Klondike Canyon Landslide was triggered by watering issues associated with the Trump National Golf Course. This added to the sediment load in this area (Pondella Report, Figure 1). The third slide tract, the Abalone Cove Landslide, occupied approximately 80 acres extending west of Portuguese Point into Abalone Cove County Beach from the surf zone inland nearly 2,200 feet with a slide plane located 84 feet below sea level (Pondella Report Figure 2). The Abalone Cove Landslide includes an ancient slide tract that moved following an increase in ground water levels beginning in 1948 that was caused by increased development.

Historic and continued sedimentation from these three slides continues to plague this stretch of the peninsula. This turbidity plume (Pondella Report, Figure 3) transports sediment toward Point Fermin and Rocky Point following the longshore current and associated longshore transport on the Palos Verdes Peninsula (Hickey 1993). In addition, rocky reefs continue to be buried by sediment in this area (USACE 2000; Pondella 2009; Pondella et al. 2010). These chronic stressors continue to cause deleterious impacts to the nearshore rocky environment (Stephens et al. 1996). Burial of reefs has significantly reduced kelp canopy and persistent kelp in this area. For these reasons, and others described below, the proposed South Palos Verdes MPAs do not satisfy the legislative goals of the MLPA, or the specified habitat, species, spacing or size requirements set forth in the Master Plan or other scientific or regional guidance.

b. The Proposed South Palos Verdes MPAs Do Not Meet the Specified Habitat, Species, Spacing or Size Requirements set forth in the Master Plan or Scientific Guidance

The Pondella Report identifies various technical requirements for MPAs that the proposed South Palos Verdes MPAs cannot satisfy. Dr. Pondella concludes that the proposed South Palos

Verdes MPAs encompass degraded habitats that individually or as a cluster are not sufficient to meet the goals of the MLPA and the regional guidelines provided for the South Coast Study Region MPA designation process. Dr. Pondella's conclusion is based, in part, on the following findings:

- According to the scientific guidelines for the *California Marine Life Protection Act Master Plan for Marine Protected Areas*, MPAs should have a minimum alongshore span of 3-6 statute miles (preferably 6-12.5 miles) and should extend offshore to deep waters. The SAT combined these guidelines to recommend that an individual MPA or MPA cluster should have a minimum area of 9-18 square statute miles (preferably 18-36 square miles). The Point Vicente SMCA has an alongshore span of 3.69 mi (minimum = 3.0 mi), while the Abalone Cove SMCA has an alongshore span of 1.23 mi for a total of 4.92 mi (Pondella Report Table 1). While the MPA cluster is near the lower level of these guidelines, they fall significantly below even the low end of the range of the preferred size guidelines for the individual MPAs. (Pondella Report at p. 4).

- The individual habitats of the proposed South Palos Verdes MPAs are either of significantly lower quality than required by the scientific guidelines or are absent. First, the reported habitat area calculations are inconsistent (Pondella Report Table 1). Both maximum kelp (Point Vicente SMCA = 1.23 mi, Abalone Cove SMCA = 0.86 mi) and surfgrass (Point Vicente SMCA = 1.14 mi, Abalone Cove SMCA = 1.41 mi) estimates are greater than the estimates of rocky shore habitat (Point Vicente SMCA = 1.06 mi, Abalone Cove SMCA = 0.23 mi). Since both the kelp and surfgrass habitats are themselves dependent upon rocky habitat, these estimates are incorrect. The only habitats that meet the scientific guidelines are soft bottom habitats, rocky shores and rock proxy. (Pondella Report at p. 4).

- The critical and limiting habitats along this stretch of coastline are all associated with hard bottom features. None of these habitats is adequately represented deeper than 30 m below the surface. Also, the estimates for the nearshore (0-30 m) rocky reef habitats are incorrect. The proposed Point Vicente SMCA contains 0.138 mi (358,074 m) of nearshore rocky reef habitat (Pondella 2009), 55% of the reported value. While the Abalone Cove SMCA appears to have a higher estimated amount of nearshore rocky habitat, that area is either buried reef or under intense sediment load from the Portuguese Bend Landslide. (Pondella Report at p. 4, footnotes omitted)

- Chronic damage associated with turbidity from landslide activity along the southern face of the Palos Verdes Peninsula was demonstrated by an empirical survey of the water column profile of light energy (measured as photosynthetically active radiation or PAR) conducted monthly from 1982-2009 at seven nearshore sites along the Palos Verdes Peninsula. Turbidity associated with the PBL may be limiting algal growth from Abalone Cove to Point Fermin. This turbidity plus the reef burial limit kelp canopy density, persistence and the corresponding performance of the associated biota. (Pondella Report at p. 9)

- The degradation of reef habitat has had significant biological consequences, particularly to the area associated with the Abalone Cove SMCA. Low species richness resulting from poor habitat quality and diversity dominates this area. Recent fish diversity and biomass data available to the BRTF were not incorporated into the SAT evaluations, including the bioeconomic models, resulting in an over-emphasis of the value of this degraded habitat. (Pondella Report at p. 12)

- Science guidelines for habitat size, replication, and spacing were ignored and were not met for the proposed South Palos Verdes MPAs. (Pondella Report at 18 - 26)

    - Key habitats associated with rocky reefs are either not present or present in a degraded state. Overestimated and inaccurate nearshore rocky-reef habitats are cited.
    - Biomass production is very low, particularly for recreationally important and overfished species (*e.g.*, kelp bass), with very low self-recruitment and self-persistence scores, meaning that the area is not self-sufficient for larval dispersal. This may be due to the area of the proposed MPAs lacking a sufficient hard bottom and kelp persistence habitat that support nearly all the species of interest and are necessary for these species to feed and reproduce.
    - The minimum guidelines for habitat size were not met, indicating that the proposed South Palos Verdes MPAs will not operate as part of the MPA network, and will not satisfy the goals of the MLPA or regional guidelines.
    - The size of the proposed MPAs has been artificially inflated by the inclusion of substantial low value and readily abundant soft bottom habitat.
    - The proposed MPAs do not meet the minimum SAT guidelines for spacing at very high protection for any of the listed habitats.
    - The proposed MPAs do not effectively connect the northern and southern MPAs for any of the identified key habitat types as intended by the MLPA. The "effect on biomass" is very low, meaning that the proposed South Palos Verdes MPAs add very little to the overall biomass and productivity of fisheries within the South Coast Region.

Given the deficiencies identified by the Districts and Dr. Pondella, the proposed South Palos Verdes MPAs cannot satisfy the legislative goals of the MLPA (F&G Code §2853), or the specified habitat, species, spacing or size requirements set forth in the Master Plan or specified statewide or regional guidance (F&G Code §§2855(a), 2856, and 2857). Thus, the proposed South Palos Verdes MPAs are not based on practical information on the marine environment (F&G Code §2855), or the best readily available science (F&G Code §§2855(a) and 2856), and must be removed from the Final IPA.

3. The Proposed Designations Do Not Satisfy the Adopted Regional Goals and Objectives and Design and Implementation Considerations for the MLPA South Coast Study Region

In accordance with Fish and Game Code section 2857(c), the BRTF adopted the "*California MLPA South Coast Project Regional Goals and Objectives and Design and Implementation*

Considerations for the MLPA South Coast Study Region" ("South Coast Goals and Objectives") *on* February 26, 2009. MPA designations in the South Coast Study Region, including the proposed South Palos Verdes MPAs, must adhere to these five stated goals and objectives. *See* F&G Code §2857.

As discussed in detail below, the South Coast Goals and Objectives of the MLPA are not met by the inclusion of the proposed South Palos Verdes MPAs in the Final IPA or its alternatives. The proposed South Palos Verdes MPAs have been subject to high levels of disturbance over the years, and they hold very little intrinsic habitat or species value. For these reasons, the proposed South Palos Verdes MPAs violate Fish and Game Code section 2857, and must be removed from the Final IPA.

Goal 1. To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.

1. Protect and maintain species diversity and abundance consistent with natural fluctuations, including areas of high native species diversity and representative habitats.
2. Protect areas with diverse habitat types in close proximity to each other.
3. Protect natural size and age structure and genetic diversity of populations in representative habitats.
4. Protect biodiversity, natural trophic structure and food webs in representative habitats.
5. Promote recovery of natural communities from disturbances, both natural and human induced, including water quality.

- <u>Goal 1, Objective 1 is not met</u>: the majority of the habitat available in the proposed South Palos Verdes MPAs is deep sand habitat, which does not support high native species diversity. The majority of species of interest in these MPAs live near or over rocky substrate, in much shallower regions, but the majority of the area of the proposed MPAs does not include this type of habitat. The proposed MPAs also do not include sufficient persistent kelp. (Pondella Report at 27-28)
- <u>Goal 1, Objective 2 is not met</u>: rare deep rock habitat (hard bottom 30-100m) will not be protected within the proposed South Palos Verdes MPAs. Persistent kelp habitat is also not captured within the proposed MPAs. (Pondella Report at p. 28)
- <u>Goal 1, Objective 4 is not met</u>: the biodiversity, trophic structure, and food webs that occur within hard bottom and persistent kelp habitat will not be protected in sufficient amounts in the proposed South Palos Verdes MPAs. Soft bottom habitat, which encompasses the majority of these proposed MPAs, is much less diverse than shallow rock habitat. (Pondella Report at pp. 28-29)
- <u>Goal 1, Objective 5 is not met</u>: designation of the proposed South Palos Verdes MPAs will not promote recovery of natural communities from disturbances, especially those induced by humans, since remediation of the Palos Verdes Shelf Superfund Site and the impacts and effects of the PBL will continue for many decades.

Goal 2. To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.

1. Help protect or rebuild populations of rare, threatened, endangered, depressed, depleted, or overfished species, and the habitats and ecosystem functions upon which they rely.
2. Sustain or increase reproduction by species likely to benefit from MPAs, with emphasis on those species identified as more likely to benefit from MPAs, and promote retention of large, mature individuals.
3. Sustain or increase reproduction by species likely to benefit from MPAs with emphasis on those species identified as more likely to benefit from MPAs through protection of breeding, spawning, foraging, rearing or nursery areas or other areas where species congregate.
4. Protect selected species and the habitats on which they depend while allowing some commercial and/or recreational harvest of migratory, highly mobile, or other species; and other activities.

- Goal 2, Objective 1 is not met: the majority of the habitat available in the proposed South Palos Verdes MPAs is deep sand habitat, which does not support high native species diversity. The majority of species of interest in these MPAs live near or over rocky substrate, in much shallower regions, but the majority of the area of the proposed MPAs does not include this type of habitat. The proposed MPAs also do not include sufficient persistent kelp. (Pondella Report at pp. 27-28)
- Goal 2, Objective 2 is not met: Species "most likely to benefit" from MPAs include bocaccio, giant sea bass, broomtail grouper, canary rockfish, pink/green/white/black abalone, and purple hydrocoral, all of which occur on or near shallow rock habitat within the South Coast Region. Since the proposed South Palos Verdes MPAs protect mostly deep sand habitat, the habitat for these species is mostly absent from the proposed MPAs. Therefore, the proposed MPAs are unlikely to increase or sustain these species or to promote retention of "large, mature individuals." Also, due to the proposed MPA cluster including a smaller-than recommended amount of reef habitats, there is less opportunity to protect these species within the proposed MPAs' boundaries because their adult home range extends beyond these boundaries. (Pondella Report at p. 28)
- Goal 2 is not met: the inclusion of the proposed South Palos Verdes MPAs does not support any objective listed in Goal 2. It is illogical to rebuild, sustain, or increase reproduction of fish populations in this location if those populations are going to be adversely affected by the DDT/PCB contamination and the ongoing remediation activities at the Palos Verdes Shelf Superfund Site.

Goal 3. Improve recreational, educational and study opportunities provided by marine ecosystems that are subject to minimal human disturbance, and to manage these uses in a manner consistent with protecting biodiversity.

1. Sustain or enhance cultural, recreational, and educational experiences and uses (for example, by improving catch rates, maintaining high scenic value, lowering congestion, increasing size or abundance of species, and protection of submerged sites).

2. Provide opportunities for scientifically valid studies, including studies on MPA effectiveness and other research that benefits from areas with minimal or restricted human disturbance.
3. Provide opportunities for collaborative scientific monitoring and research projects that evaluate MPAs that promote adaptive management and link with fisheries management, seabird and mammals information needs, classroom science curricula, cooperative fisheries research and volunteer efforts, and identify participants.

   - Goal 3, Objective 2 is not met: the proposed South Palos Verdes MPAs are not areas with minimal or restricted human disturbance. The Palos Verdes Shelf has been highly disturbed by the presence of DDT/PCB, US EPA remediation activities, and the PBL.

Goal 4. Protect marine natural heritage, including protection of representative and unique marine life habitats in CA waters for their intrinsic values.

1. Include within MPAs key and unique habitats identified by the MLPA Master Plan Science Advisory Team for this study region.
2. Include and replicate to the extent possible [practicable], representatives of all marine habitats identified in the MLPA or California Marine Life Protection Act Master Plan for Marine Protected Areas across a range of depths.

   - Goal 4, Objectives 1 and 2 are not met: rare deep rock habitat (hard bottom 30-100m) will not be protected within the proposed South Palos Verdes MPAs. Persistent kelp habitat is also not captured within the proposed MPAs. Thus, no replication of key habitats will occur and there is no representation of such key habitats across a range of depths. (Pondella Report at p. 28)

Goal 5. To ensure that south coast California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines.

1. Minimize negative socio-economic impacts and optimize positive socio-economic impacts for all users including coastal dependent entities, communities and interests, to the extent possible, and if consistent with the Marine Life Protection Act and its goals and guidelines.
2. Provide opportunities for interested parties to help develop objectives, a long-term monitoring plan that includes standardized biological and socioeconomic monitoring protocols, a long-term education and outreach plan, and a strategy for MPA evaluation.
3. Effectively use scientific guidelines in the California Marine Life Protection Act Master Plan for Marine Protected areas.
4. Ensure public understanding of, compliance with, and stakeholder support for MPA boundaries and regulations.
5. Include simple, clear, and focused site-specific objectives/rationales for each MPA and ensure that site-level rationales for each MPA are linked to one or more regional objectives.

- Goal 5, Objective 1 is not met: as discussed in Section E of these comments, negative socio-economic impacts on uses other than fishing were not evaluated or minimized.
- Goal 5, Objective 3 is not met: scientific guidelines for habitat, species, size, and spacing have not been met for the proposed South Palos Verdes MPAs. (Pondella Report at p. 29)
- Goal 5, Objective 5 is not met: as discussed in Section D of these comments, the site-specific objectives and rationales for the proposed South Palos Verdes MPAs issued by the BRTF are inaccurate, unclear, and are not linked to one or more regional objectives.

Goal 6. To ensure that the south coast's MPAs are designed and managed, to the extent possible, as a component of a statewide network.

1. Provide opportunities to promote a process that informs adaptive management and includes stakeholder involvement for regional review and evaluation of management effectiveness to determine if regional MPAs are an effective component of a statewide network.
2. Provide opportunities to coordinate with future MLPA regional stakeholder groups in other regions to ensure that the statewide MPA network meets the goals of the MLPA.
3. Ensure ecological connectivity within and between regional components of the statewide network.
4. Provide for protection and connectivity of habitat for those species that utilize different habitats over their lifetime.

- Goal 6, Objective 3 is not met: the proposed South Palos Verdes MPAs do not meet the minimum SAT guidelines for spacing at very high protections for any of the listed habitats. The proposed MPAs do not connect MPAs to the north or south for any of the key habitat types. (Pondella Report at pp. 29-30)
- Goal 6, Objective 4 is not met: since the proposed South Palos Verdes MPAs contain mostly sandy subtidal habitat, they do not protect diverse habitat types. Protection of species that utilize different habitat types over their lifetime, or those that utilize boundaries or edges between different types of habitat will not be promoted by the designation of the South Palos Verdes MPAs. There is little connectivity of habitats between the proposed South Palos Verdes MPAs and other MPAs because the spacing gaps between such MPAs far exceed those suggested by the SAT. (Pondella Report at p. 30)

4. The BRTF's Description of Palos Verdes MPA Options and the Site-Specific Rationale that Resulted in the Currently Proposed MPA Designations in South Palos Verdes Are Severely Flawed

In October 2009, the BRTF created an alternatives analysis document for the South Coast Study Region, entitled, "*MPA Options for Consideration and Review by BRTF: Description of Palos Verdes MPA Options*." This document formed the basis for the Department and Team's proposal to designate the South Palos Verdes MPAs. However, this document contains serious factual and technical flaws that require removal of the MPAs from consideration.

For the Point Vicente SMCA (at that point, a SMR), the BRTF states that the Point Vicente/Abalone Cove MPA cluster "captures all but 3 key habitats across a broad range of depths," and it "provides a high level of protection at larger than preferred size…." Contrary to the BRTF's statements, the proposed South Palos Verdes MPAs do not protect any of the unique deep rock habitat type along the Palos Verdes Shelf, and the size of the MPAs is large only because the majority encompasses deep sand habitat that does not protect the majority of species of concern contained on the list of species likely to benefit from MPAs. (Pondella Report at pp. 30-31)

For the Abalone Cove SMCA, the BRTF states that "species afforded protection are lobsters, sea urchins, rockfish, and rocky intertidal (tide pool) inhabitants. Together with Point Vicente, a total area of 19.85 sq statute miles is covered." The BRTF failed to recognize that lobster, urchins, and rockfish occur over hard bottom habitat, which is present in only .14 square miles of the proposed Abalone Cove SMCA. Within the entire proposed South Palos Verdes MPA cluster, only .39 and .02 sq miles of nearshore (0-30 m depth) and deep (30-100 m depth) rock habitat, respectively, are represented. (Pondella Report at p. 31)

Similar inaccuracies are contained in the "Other Considerations" section of the document. The BRTF states that the Abalone Cove SMCA contains "nearly a third of the available deep rock in the study area, the rarest habitat in this region" and that the MPA cluster "achieves the preferred size in the most densely populated area of the south coast." The BRTF's statement is incorrect because the proposed South Palos Verdes MPAs contain little, if any, deep rock habitat. (Pondella Report at pp. 31-32)

For these reasons, inclusion of the South Palos Verdes MPAs in the Final IPA is inconsistent with the legislative goals of the MLPA (F&G Code §2853), demonstrates a failure to properly evaluate information supplied regarding the marine environment and water pollution (F&G Code §2855), and is not based on the best readily available science (F&G Code §§2855(a) and 2856).

D. The Final IPA Must Be Clear That Permitted Wastewater Discharges Do Not Result in "Take" Under the MLPA.

The Final IPA states that "For purposes of the MLPA, wastewater discharge permitted by the state water quality control board is not considered to involve "take" within MPAs." *See* Final IPA at p. 1472. However, the next sentence states that "A clarification will be added to the draft master plan that, for purposes of MPA management, the relation of wastewater discharge to allowable take is at the discretion and jurisdiction of the state and regional water quality control boards." *Id*. The Final IPA is inconsistent with respect to whether permitted treated wastewater discharges constitute a "take" under the MLPA. At first, the IPA conclusively determines that no such "take" can occur, but then provides that the State and Regional Water Boards possess discretion to determine that issue at a later date. The MLPA does not confer authority to the State and Regional Water Boards to determine "take" under the MLPA, only the Commission is authorized to do so. *See* F&G Code §2860(a). Thus, the Final IPA will result in improper delegation and confusion by regulatory agencies and will lead to uncertainty on the part of the regulated community, including the Districts.

The Commission should clarify that treated wastewater discharges permitted via the separate Clean Water Act regulatory program unequivocally do not involve "take" under the MLPA. The State and Regional Water Boards have no authority under the MLPA to make such a determination; therefore, the sentence referencing those agencies' later discretionary determination of "allowable take" should be removed as contrary to Fish and Game Code section 2860. For the foregoing reasons, the Districts request that the sentence beginning with "A clarification…" be removed from the adopted IPA.

E. The Socioeconomic Impacts of the Proposed South Palos Verdes MPAs on the Communities Served by the Sanitation Districts Have Not Been Properly Considered

The MLPA and the Master Plan require consideration of the socioeconomic impacts of MPA alternatives. *See* F&G Code § 2855(c)(2). Accordingly, the Master Plan states: "Choosing a location for a marine reserve or protected area requires an understanding of probable socioeconomic impacts as well as the environmental criteria for siting." *See* Master Plan §1.4, p. 12. The Master Plan is replete with references to the importance of evaluating socioeconomic impacts early in and throughout the MLPA process. *See* Master Plan §3.11, p. 59 ("The regional MPA process should make every effort to assemble socioeconomic information early and to apply it in the design and evaluation of MPAs."); *Id.* §2.3, p.21 (evaluation process includes conducting "environmental and socioeconomic analysis as required by law."); *Id.* §2.4, p. 28-29 (SAT and Department mandate to "prepare a preliminary socioeconomic analysis of potential impacts of each alternative proposal."); *Id.* §3.3, p. 41 (The design of MPA proposals should include consideration of "areas of intensive human use and the cost and benefit of establishing MPAs in these areas."). This requires the Commission, Department, and the Team to consider information concerning socioeconomic impacts that affected communities provide during the development of each MPA. *See* F&G Code §§2855(c), 2857.

The Districts submitted written comments and information to the Commission, Department, and BRTF emphasizing that the socioeconomic impacts to Los Angeles County residents could be in the billions of dollars should the Districts be required to take measures in response to restrictions that could be imposed as a result of the designation of the South Palos Verdes MPAs. The Districts emphasized that placement of MPAs over areas of impaired sediment and water quality and poor quality habitat creates a high likelihood that these MPAs will not perform as required. The existence of the MPAs, as well as any lack of success in attaining the goals of the MLPA or under-performance of the MPAs, could result in new restrictions being imposed on the discharge from the Districts' infrastructure. The Districts stated that new infrastructure requirements could include relocation of the point of discharge, resulting in the need for significant investments in new infrastructure, restrictions on the quantity of flow allowed to be discharged, and/or restrictions on the mass or concentration of pollutants allowed to be discharged. This would require major treatment plant upgrades. The Districts also noted that the State Water Board may also designate the proposed South Palos Verdes MPAs as State Water Quality Protection Areas

("SWQPAs") to increase their overall level of protection and to ensure the best possible water quality in the MPAs.[2]

Despite the Districts' submittal of comments relaying these concerns about socioeconomic impacts, the Commission, Department, and Team, including the BRTF, to date have given no apparent consideration to this information or have minimized the relevance of this information. Instead, the record reflects that the BRTF considered only the socioeconomic impacts to fishing interests from locating the Palos Verdes MPAs north of Point Vicente and Abalone Cove. *See e.g.* South Coast Study Region Blue Ribbon Task Force November 10, 2009 meeting video, statements by BRTF members Bill Anderson and Meg Caldwell (*e.g.,* "although the science was clear as to what should ultimately take place there [Palos Verdes] . . . .it was ultimately a choice of the impacts to the fishing and boating community and the ultimate socioeconomics."); *also see,* Draft Methods, pp. 109-113 (description of methodology for conducting economic impact analysis for commercial and recreational fisheries).

The Districts' analysis of socioeconomic impacts reveals that total capital costs associated with compliance with regulatory requirements likely to be imposed based on the new MPA designations are estimated to be between $580 million and $2.8 billion, or $96 to $440 million on an annualized basis, when operations and maintenance costs are included. *See* Exhibits B, C and D. These higher wastewater treatment costs would, over time, reduce employment in Los Angeles County by between 220 and 1,125 jobs, and total personal income would decline by from $10 to $45 million per year. State and local tax revenue would fall by between $2 and $8 million annually, total industry output would drop by approximately $25 to $115 million per year, and total value added would decline by roughly $15 to $70 million annually.

The Commission's continued failure to assess and consider the potential socioeconomic impacts on the ratepayers in Los Angeles County is particularly egregious given how little biological value the proposed South Palos Verdes MPAs provide to the overall MPA network of the Final IPA. The complete failure to consider categories of socioeconomic impacts other than fishing, such as impacts to the public served by the Districts, merits exclusion of the proposed South

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[2] The State Water Board is responsible for designating SWQPAs, which may overlie MPAs to increase their overall level of protection and to ensure the best possible water quality in MPAs. *See* Public Res. Code §36725(d). The State Water Board and Regional Water Quality Control Boards are charged with responsibility for taking appropriate actions to protect SWQPAs. *See* PRC §36725(f)(3). According to the SAT, "[f]urther protection from water quality threats, or restoration of water quality to meet standards, should be targets to be accomplished after MPA implementation using the appropriate mechanisms." *See* SAT Draft WQ Recommendations, p. 2. The SAT identified following potential post-MPA designation implementation strategies to protect and restore water quality: "for example, the regional water boards may recommend to the State Water Board the designation of additional state water quality protection areas (SWQPAs), or work on priority total maximum daily loads that could restore water quality MPAs." *Id.*, p. 13. Further, the MMAIA establishes that Areas of Special Biological Significance ("ASBS") are a subset of SWQPAs that require special protection. PRC §36700(f). In areas receiving the ASBS designation by the State Water Board, waste discharges are prohibited should natural background levels within that ASBS be changed as a result of the discharges. Ocean Plan III(E). The proposed Point Vicente SMCA is only a short distance down current from JWPCP's ocean outfall system. Even though the JWPCP effluent discharge meets all Ocean Plan and permit standards, very low levels of some constituents may be measured above natural background levels in the waters of the proposed South Palos Verdes MPAs. Thus, designation of these MPAs may result in the outfall system having to be relocated and/or treatment upgraded at the JWPCP.

Palos Verdes MPAs in the Final IPA and other alternatives under consideration for the South Coast Region.

F. The Environmental Impacts of the Proposed South Palos Verdes MPAs Have Not Been Properly Considered

The MLPA and the Master Plan include a legal mandate to consider the environmental impacts of MPA alternatives. *See* F&G Code § 2855(c)(2). The Districts submitted detailed comments to the Department on August 3, 2010 in response to the June 29, 2010 Notice of Preparation of the Draft Environmental Impact Report and on October 15, 2010 in response to the Draft Environmental Impact Report. These comments describe the Department's and the Team's failure to properly consider the environmental impacts of the proposed South Palos Verdes MPAs. The Districts incorporate these comments herein.

On December 3, 2010, the Districts received the Department's Final EIR and response to comments on the Draft Environmental Impact Report. Although the Final EIR contained additional information about the environmental setting by adding descriptions of the Palos Verdes Superfund Site and the PBL, most of the substantive environmental impact concerns identified by the Districts were not adequately addressed. A number of impacts were found to be less than significant in the Final EIR based upon incomplete analyses, making these findings unsubstantiated.

For the reasons set forth in this letter and in the earlier letters noted above, the Districts assert that the Department and Team did not comply with Fish and Game Code section 2855(c)(2), and that the Commission will violate the same section if it adopts the Final IPA.

G. The BRTF and SAT Failed to Comply with Bagley-Keene Open Meeting Act

The Bagley-Keene Open Meeting Act ("Bagley-Keene Act" or "Act"), set forth in Cal. Gov't Code sections 11120-11132, applies to all state boards and commissions, and those bodies that are advisory to and are delegated duties from those boards and commissions. Generally, the Bagley-Keene Act requires these bodies to publicly notice their meetings, prepare agendas, accept public testimony and conduct their meetings in public unless specifically authorized by the Act to meet in closed session.

The Bagley-Keene Act applies to the BRTF and SAT as "advisory bodies" to the California Natural Resources Agency, the Department, and the Commission. *See* Gov't Code §11121(c) (the Act governs two types of advisory bodies – those created by the Legislature and those having three or more members that are created by formal action of another body regulated by the Act). The Bagley-Keene Act also applies to the BRTF and the SAT to the extent that they are "delegated bodies" to the California Resources Agency, the Department, and the Commission. *See* Gov't Code §11121(b). The Act expressly prohibits the use of direct communication, personal intermediaries, or technological devices that are employed by a majority of the members of the state body to develop a collective concurrence as to action to be taken on an item by the members of the state body outside of an open meeting. *See* Gov't Code §11122.5(b).

This can include a series of communications, each of which involves less than a quorum of the body, but which taken as a whole involves a majority of the body's members.

The District has significant concerns regarding the BRTF and SAT processes and how proposed MPAs were selected. Public allegations have been made regarding "closed door" meetings between members of the BRTF and MLPA I-Team, respectively, and BRTF and/or MLPA I-Team members and fishing/business interests, to avoid siting MPAs in areas that would have an unacceptable affect on fishing activities and the economy related thereto. Specific comments and references by BRTF members during meetings, such as the October 22, 2009 meeting, confirm that substantial conversation occurred outside the public meeting process for the purpose of developing a collective concurrence as to the selection of preferred MPAs in the South Coast Region. Because the BRTF and SAT violated the Bagley-Keene Act's requirements for open meetings, the Commission should reject the Final IPA and the proposed Palos Verdes MPAs.

EXHIBIT F

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 2010-0057

MARINE PROTECTED AREAS AND STATE WATER QUALITY PROTECTION AREAS

WHEREAS:

1. The Marine Life Protection Act (MLPA; Fish & Game Code §§ 2850 et seq.) directs the state to redesign California's system of marine protected areas (MPAs) to function as a network in order to: increase coherence and effectiveness in protecting the state's marine life and habitats, marine ecosystems, and marine natural heritage, as well as to improve recreational, educational and study opportunities provided by marine ecosystems subject to minimal human disturbance.

2. According to the Marine Managed Areas Improvement Act (MMAIA; Cal. Pub. Resources Code §§ 36600 et. seq.) a "marine managed area" (MMA) is a named, discrete geographic marine or estuarine area along the California coast designated by law or administrative action, and intended to protect, conserve, or otherwise manage a variety of resources and their uses.

3. The Public Resources Code states that one classification of MMA is a State Water Quality Protection Area (SWQPA), which is "a nonterrestrial marine or estuarine area designated to protect marine species or biological communities from an undesirable alteration in natural water quality, including, but not limited to, areas of special biological significance that have been designated by the State Water Resources Control Board …" The statute further states: "In a state water quality protection area, point source waste and thermal discharges shall be prohibited or limited by special conditions."

4. The California Ocean Plan requires protection of species or biological communities in areas of special biological significance, and requires that waste discharges are prohibited in ASBS. In addition, discharges shall be at a sufficient distance from an ASBS to assure natural water quality. The California Ocean Plan states that all ASBS are a subset of SWQPAs, but does not have specific requirements for other SWQPAs that are not ASBS.

5. In August 2004, the California Resources Agency, the Department of Fish and Game, and the Resources Legacy Fund Foundation launched an effort, initiated by a Memorandum of Understanding, to implement the MLPA. This MLPA initiative established an MLPA Blue Ribbon Task Force together with a Master Plan Science Advisory Team and stakeholder advisory groups, to oversee the preparation of proposed statewide designations for ultimate adoption by the California Fish & Game Commission.

6. The California Office of the Attorney General has provided informal advice, dated September 25, 2009, regarding establishment, use, and enforcement of MPAs and MMAs. As a result of the Attorney General's advice, the MLPA staff concluded that the designation of MPAs cannot restrict non-fishing uses and activities that have already received approved regulatory permits.

7. The Fish and Game Commission released for public comment a Draft Environmental Impact Report on August 18, 2010, analyzing the environmental impacts of implementing MPAs in southern California.

8. On September 17, 2010, the Fish and Game Commission published for public comment a Notice of Proposed Changes to Section 632, Title 14, California Code of Regulations regarding South Coast Marine Protected Areas (known as the Initial Statement of Reasons or "ISOR"). The ISOR states that pre-existing activities including, but not limited to, wastewater outfalls occur throughout the south coast study region and that these are activities that may result in incidental take. However, these activities are regulated by the water boards under National Pollution Discharge Elimination System (NPDES) permits. The proposed MPA regulations state that wastewater outfalls are allowed to continue pursuant to NPDES permits.

9. Mandated water quality monitoring activities are required under the federal Clean Water Act and California Water Code, and may include monitoring stations within the MPAs. The MLPA specifically states that monitoring and research are permissible in all MPA designations. Monitoring may be authorized pursuant to a scientific collecting permit issued by the Department of Fish and Game, and the proposed regulation adds a general provision to Title 14, California Code of Regulations, Section 632, subdivision (a), to clarify that this activity is authorized in all MPAs pursuant to a scientific collecting permit.

10. The MLPA Master Plan Science Advisory Team has provided guidance with regard to water quality and MPAs. The siting of MPAs should consider avoiding areas of poor or threatened water quality, such as at intake sites for power plants, storm runoff from developed watersheds, and municipal sewage or industrial wastewater outfalls. The Science Advisory Team has also stated that of these three water quality threats, wastewater effluents are of the least concern, but still may pose a risk.

11. The Science Advisory Team has further recommended that marine water quality will play a role in the success of MPAs, and the regional water boards may recommend to the State Water Resources Control Board the designation of additional SWQPAs, or work on priority total maximum daily loads that could restore water quality in MPAs.

12. Regulatory requirements applicable to discharges from existing treated municipal wastewater outfalls, including discharges within or in the vicinity of MPAs, are derived primarily from the water quality standards in the California Ocean Plan.

13. Because of limited staff resources, it is desirable and necessary for the Board to set priorities and provide direction on tasks and goals.

THEREFORE BE IT RESOLVED THAT:

The State Water Board:

1. Directs staff to prioritize ongoing work related to exceptions for current discharges to ASBS ahead of new work related to designation of new ASBS and SWQPA until all of the current ASBS discharge issues are resolved through the exception process, and all of the MPAs are designated and implemented statewide.

2. Upon completion of all work associated with ASBS discharges, and once all MPAs are implemented by the Department of Fish and Game and the Department of Parks and Recreation, directs staff to work with the Regional Water Boards to develop recommendations for new SWQPAs to protect water quality in MPAs.

3. For SWQPAs, that are not ASBS, the Board directs staff to consider the following approach in developing new SWQPAs. The Board further directs staff to propose amendments to the Ocean Plan consistent with this approach, as appropriate:

   a) SWQPAs should not be established over existing wastewater outfalls or the zone of initial dilution (ZID) of such existing wastewater outfalls;
   b) where new SWQPAs are established in the vicinity of existing municipal wastewater outfalls, there shall be no new or modified limiting conditions or prohibitions for the SWQPAs relative to those wastewater outfalls;
   c) regulatory requirements for discharges from existing treated municipal wastewater outfalls shall be derived from the California Ocean Plan;
   d) no new wastewater outfalls may be established within SWQPAs;
   e) conditions to protect water quality in SWQPAs would be required to address storm water and nonpoint sources; and
   f) assure that the designation of any new SWQPA would not include a condition to move existing wastewater outfalls, which represent an important public service and substantial infrastructure.

4. Directs staff to propose an amendment to the Ocean Plan clarifying that no new or modified limitations, substantive conditions, or prohibitions will be imposed upon existing municipal wastewater discharge outfalls based on the designation of MPAs other than State Marine Reserves.

5. Directs staff to include issues described in this resolution in the current Ocean Plan Triennial Review, and further directs staff to prepare amendments consistent with resolved paragraphs 3 and 4 for State Water Board consideration within 18 months.

6. Nothing in this Resolution shall be construed as limiting or restricting the mandates of the State Water Board or Regional Water Boards to protect the beneficial uses of the waters of the state as required by federal and state law.

CERTIFICATION

The undersigned Clerk to the Board does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on November 16, 2010.

AYE:	Chairman Charles R. Hoppin Vice Chair Frances Spivy-Weber Board Member Arthur G. Baggett, Jr.
NAY:	Board Member Tam M. Doduc
ABSENT:	None
ABSTAIN:	None

Jeanine Townsend

Jeanine Townsend
Clerk to the Board