SACRAMENTO MUNICIPAL UTILITY DISTRICT
UPPER AMERICAN RIVER PROJECT
(FERC Project No. 2101)

and

PACIFIC GAS AND ELECTRIC COMPANY
CHILI BAR PROJECT
(FERC Project No. 2155)

RIPARIAN VEGETATION AND WETLANDS TECHNICAL REPORT

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5.6 Riparian Vegetation Study Plan

5.6.1 Pertinent Issue Questions

The riparian vegetation study plan addresses Terrestrial Resource Issue Questions:

29. What is the distribution of riparian areas/zones surrounding project reservoirs and along stream reaches where flows are altered by project operations and in other areas influenced by project facilities or operations?

40: What is the current condition of the riparian habitat along each affected stream reach? Is there information on historical conditions that would be of use in evaluating potential improvement to the riparian habitat? How has the condition changed?

5.6.2 Background

Riparian vegetation refers to plants species that are associated with the banks of a river or lake and require a dependable supply of ground or surface water for their growth and development. Mountain alder, white alder, willows, cottonwoods, and valley oak are typical woody riparian species that may be found in the Project area. It is known that flow regime alteration can result in changes in riparian vegetation communities, which are dependent on several variables, including the magnitude and timing of flow alteration. This study is designed to determine how Project operations may affect riparian communities through a phased-approach of mapping, analysis and ground characterization.

Mapping of dominant vegetation types within much of the UARP Project Boundary was previously conducted in 2000 (KEA 2000). Specifically, riparian vegetation areas around the reservoirs and project facilities were mapped; riparian areas along affected stream reaches have yet to be mapped. SMUD (Licensee) also has recent aerial photography and videography that will facilitate additional mapping efforts. Information from the geomorphological studies will also be used to determine the location and sustainability of riparian communities. Further mapping will be conducted as part of the 2002 vegetation mapping study.

Some information is available on existing conditions for riparian areas based on the 2000 botanical resources inventory (KEA 2000). Historical information for the project was included in the Initial Information Package (IIP) prepared by the Licensee in July 2001. The UARP was constructed over a period of years beginning in the late 1950s. Consequently, flow regimes in the UARP below project reservoirs have been altered for nearly 50 years. It is not known if information relative to the distribution and extent of plant communities present at these sites prior to project development is available, or if there are usable quantitative data available on the plant species that occupied these plant communities. To the extent that they are available, historic photos of the UARP will be reviewed in an attempt to obtain information on historical conditions within the project relative to existing conditions. This information will be used to determine if there have been any significant changes to riparian communities resulting from project operations.

5.6.3 Study Objectives

This study has the following objectives: 1) determine the distribution and frequency of riparian plant communities in sufficient detail to understand if the Project does or could affect riparian vegetation, and, if so, identify feasible opportunities to enhance riparian vegetation; 2) obtain information on the current condition of the riparian habitat along each affected stream reach and determine its role in maintaining channel stability; and 3) obtain information on historic conditions to compare these conditions with current conditions.

5.6.4 Study Area and Sampling Locations

The study area will include: 1) the area identified within the FERC Project boundary; and 2) affected flow reaches of streams regulated by Project facilities (Table 1). This includes the area within 300 feet of the normal high water line along Project-affected reaches. At locations where riparian plant communities extend outside the above width, the

study area will be extended as needed to describe the full extent of these communities. Additional study areas will be included as deemed appropriate (e.g., the developed and dispersed recreation areas being identified by the Recreation TWG, other areas as determined by the Fire and Fuels Management Plan, and Project roads that would be identified through the Project Sources of Sediment Study in coordination with the Recreation and Aquatic TWGs).

Sampling locations (in Phase 3) will be established using the Greenline Riparian-Wetland Monitoring methodology (USDI 1993). The purpose of the greenline monitoring method is to provide riparian vegetation information suitable for use in evaluating the distribution and conditions of the riparian areas. The greenline is defined as: "*that specific area where a more or less continuous cover of vegetation is encountered when moving away from the center of an observable channel.*" The greenline is established as a permanent transect and is usually located at the water's edge. The greenline is established as a permanent transect so it can be monitored over time, if desired.

Table 1. River reaches in the Sacramento Municipal Utility District's Upper American River Project.

Reach	Length (mi)	Upstream Reservoir Capacity (ac-ft)	Comments
Rubicon Dam	5.7	1,435	Rubicon River downstream of Rubicon Reservoir. Reach extends to confluence with Little Rubicon River.
Rockbound Dam Reach	0.3	N/A	Little Rubicon River between Rockbound Lake and Buck Island Reservoir. Rockbound Lake has no releasable storage capacity.
Buck Island Dam	3.0	1,070	Little Rubicon River downstream of Buck Island Reservoir. Reach extends to confluence with Rubicon River.
Loon Lake Dam	8.5	76,200	Gerle Creek downstream of Loon Lake. Not typically subject to spill flows, due to headwater location of reservoir.
Gerle Creek Dam	1.2	1,260	Gerle Creek downstream of Gerle Reservoir. Reach extends to confluence with South Fork Rubicon River.
Robbs Peak Dam	1.1	30	South Fork Rubicon River downstream of Robbs Peak Reservoir. Reach extends to confluence with Gerle Creek. Robbs Peak Reservoir is a headwater forebay that receives most of its flow from Gerle Creek.
Ice House Dam	11.5	45,960	South Fork Silver Creek downstream of Ice House Reservoir
Junction Dam	8.3	280.540	Silver Creek downstream of Junction Reservoir
Camino Dam	6.2	825	Silver Creek downstream of Camino Reservoir
Brush Creek Dam	2.2	1,530	Brush Creek downstream of Brush Creek Reservoir. Bypass reach is over 9% gradient.
Slab Creek Dam	8.0	16,600	S.F. American River downstream of Slab Creek Reservoir
Chili Bar	20.0		Chili Bar Dam to Flosom Reservoir normal high water line

All Project-affected reaches will be included in Phase 1 described below.

5.6.5 Information Needed From Other Studies

The following sources of information will be used to initially establish the location and distribution of the riparian plant communities within the Study Area: 1) 2000 and 2002 Vegetation Mapping Study; 2) aerial videography of portions of the UARP Project area; and 3) other aerial photography. The presence of riparian plant communities may be limited in portions of the study area because of the geomorphological characteristics. Therefore, it will be important to obtain information from the geomorphological studies, which will be the first step in determining if further evaluation is needed to determine if there are any Project effects on riparian communities. Information from the wetland and various aquatic resources studies will also be used to identify riparian areas.

Information will be obtained relative to historic conditions. Potential sources of this information could include historical photos, archived files, newspaper records, published scientific records, and records from the Forest Service and Licensee.

A literature search of studies conducted for other similar hydropower projects will also be reviewed. Information from similar studies will be used to provide support for the analysis of potential effects from the project. The El

Dorado Irrigation District (EID) has completed studies for FERC Project No. 184 (Resource Insights 2001). This project has some similarities to the UARP and may provide useful information and analysis for evaluating the UARP project conditions.

5.6.6 Study Methods And Schedule

The existing riparian vegetation types within the UARP study area will be mapped. An initial vegetation map has been prepared for portions of the UARP (KEA 2000). Those areas that were not mapped in 2000 (e.g., affected reaches) will be mapped in 2002. The Licensee also has recent aerial videography that will be used for mapping vegetation types that are difficult or unsafe to access from the ground. Information from the geomorphological studies will also be used to analyze whether the riparian communities are limited by geomorphological characteristics or by project operations.

Information on the distribution and frequency of riparian plant communities will be gathered to provide sufficient detail to determine if project operations affect riparian vegetation. To the extent that information is available, historical photos and/or data available on communities within the study area will be used to evaluate if there have been significant changes to the riparian communities within the UARP.

Study methods will include:

Phase I - Aerial Photography: Obtain aerial photographs of the Study Area at a resolution of one pixel equaling one foot in the summer/fall of 2002 prior to leaf drop and georeference them on to orthophotos. Map riparian vegetation communities at a scale of 1:2400 using a combination of *A List of California Terrestrial Natural Communities Recognized by the Natural Diversity Data Base*, 1997, California Department of Fish and Game, Natural Heritage Division, the CalVeg (USDA 2000) classification system, and further descriptive modifiers that identify the dominant plant species within the mapping unit. Areas not well represented on the maps will be described in the narration.

The existing vegetation maps, videography, aerial photographs, and new vegetation maps generated from the vegetation mapping study for 2002 will also be used to map the distribution of riparian areas. Mapping done using aerial photographs of the study area will be ground-truthed in areas that are safely accessible.

Phase II: - Using the vegetation maps and information gathered from the stream geomorphological studies, analyze riparian community densities in conjunction with geomorphological characteristics and Project flow regimes. This evaluation will be useful in determining potential limitations (e.g., recruitment and/or encroachment) of riparian habitat growth. The purpose of this phase of the study is to identify those areas that may potentially be affected by the project and thus concentrate the studies on these areas. Stream reaches that are not likely to be affected by the Project because the limitation for riparian development is related directly to the geomorphology of the site will not be studied, other than they will be mapped and included in the description for the Project study area. The Terrestrial and Aquatics TWGs will be consulted to identify potential affected areas.

Phase III – Ground Sampling: Conduct stratified sampling of representative riparian areas identified in Phase I. Additional sample sites may be included based on the need as identified by other studies (e.g., dispersed recreation areas and modified stream channels). The purpose of this sampling is to characterize the riparian plant communities and select components (e.g. root density, bank stability, and recruitment) in enough detail to determine if the Project affects them. Develop appropriate strata after Phase I mapping is complete. Sampling would begin in summer and fall 2002 assuming timely approval and initiation of this study plan. Since sampling protocols for riparian vegetation are not standardized, testing and refining may be needed in 2003.

> Strata – Strata will include a combination of Phase I communities, stream channel type (i.e., Rosgen II classification and other relevant data , or other factors derived from information gained in Phase I and other related studies.
>
> Sampling Method – Within each strata, establish and measure greenline type vegetation plots. A plot is 100 meters in length along both sides of the stream. The plot begins at the greenline along the stream edge

or estimated bankfull height (based on a visual approximation of where the bankfull height), whichever occurs first, and extends to the outer edge of the floodprone area (approximately 2 times maximum bankfull depth). Greenline plots as described here conceptually follows Greenline Riparian-Wetland Monitoring (USDI 1993). The Greenline method is best applied to depositional streams. For non-depositional stream reaches that are identified for further study (based on Phase 2), a modified version of the Greenline method will be implemented that will provide information on species composition, canopy cover, and class size distribution using a sample plot size appropriate to the size of the riparian area.

Target Vegetation – Sample vegetation community types following A Riparian Community Type Classification of the West Slope of the Central Sierra Nevada of California (USDA 1999). Within each sample plot: 1) identify and describe each riparian plant community, including graminoid and herbaceous plants, shrubs and trees; 2) measure canopy cover; 3) characterize willows, cottonwoods and other riparian plants (e.g., species, diameter class, community structure, vigor, age and estimates of rooting depth); and 4) identify areas that have potential for enhancement.

Sample Location and Frequency – Sample all strata in the riparian vegetation identified during Phase I in the Study Area. Sample up to 10 percent of the riparian vegetation by area using a variable plot frequency based on the importance and/or extent of the strata. The total number of plots and distribution of plots within all strata should be determined following Phase I.

If available, information relative to historic conditions for riparian areas will be obtained. Potential sources of this information could include historical photos, archived files, newspaper records, published scientific records, and records from the Forest Service and Licensee. This information will be used to quantify historical conditions for the riparian areas.

A literature search of studies conducted for other, similar, hydropower projects will also be reviewed. Information from similar studies will be used to provide support for the analysis of potential effects (or non-effects) from the project. The El Dorado Irrigation District has completed studies for FERC Project No. 184 (Resource Insights 2001). This project has some similarities to the UARP and may provide useful information and analysis for evaluating the UARP project conditions.

5.6.7 Analysis

Species composition and factors contributing to the establishment (e.g., geomorphology) and disturbance of riparian vegetation communities in the Study Area will be analyzed. Existing riparian communities will be compared to nearby reference streams. Historical records will be examined and compared to existing conditions.

A similar analysis was made for the EID FERC Project No. 184. Field research was conducted at diversions or dams and at potentially sensitive downstream stream reaches. The assessment of potential effects was evaluated using past research in the Sierra Nevada based on criteria established for identifying effects of altered stream hydrology (Harris et al. 1987). The Harris et al. study (and others) has demonstrated that riparian vegetation expression and potential impacts of hydrologic changes are influenced by steam gradient, floodplain geomorphology, and substrate as well as by instream flows. The Rosgen system was used to identify potentially sensitive reaches using topographic maps and aerial photographs. Additional field data was collected on geomorphology and vegetation. All of this information was used to evaluate potential effects. A similar analysis will be used in this study plan to evaluate the species composition and establishment of riparian areas within the UARP study area.

5.6.8 Study Output

Study results will be presented to the Terrestrial and Aquatic Resources TWGs and UARP Plenary Group toward the end of 2002. However, the ultimate study output will be a written report that includes the issues addressed, objectives, study area, methods, analysis, results, discussion, and conclusions. The reports will be prepared in a format that allows the information to be inserted directly into the Licensee-prepared Draft Environmental Assessment that will be submitted to FERC with the Licensee's application for a new license. The report will

describe the existing riparian vegetation in the study area and compare it with vegetation commonly present on similar type streams with unimpaired flow regimes. Comparisons can be drawn from literature and reference reaches. The report will also describe opportunities to protect, restore or enhance riparian vegetation based on environmental and engineering feasibility.

5.6.9 Preliminary Estimated Study Cost

A preliminary cost estimate was not included in the version of this study plan approved by the Plenary Group.

5.6.10 TWG Endorsement

The Terrestrial TWG approved this plan on March 22, 2002. The participants at the meeting who said they could "live with" this study plan were USFS, CDFG, CNPS, and SMUD. None of the participants at the meeting said they could not "live with" this study plan. The Plenary Group approved this study plan on May 3, 2002. The participants at the meeting who said they could "live with" this study plan were Taxpayers of El Dorado County, Friends of El Dorado County, USFS, Camp Lotus American River Recreation Association, PG&E, SMUD, SWRCB, County of El County, El Dorado Citizens for Water, NPS, CalSPA, PCWA, FOR, City of Sacramento, CDFG, California Outdoors and USBLM. None of the participants at the meeting said they could not "live with" this study plan.

5.6.11 Literature Cited

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Harris, R.R., Fox, C.A., and Risser, R.J. 1987. Impacts of hydroelectric development on riparian vegetation in the Sierra Nevada region, California USA. Environmental Management 11:519-527.

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USDA (U.S. Department of Interior, Bureau of Land Mangement). 1999. Riparian Area Management, Greenline Riparian-Wetland Monitoring. Technical Reference 1737-8. Bureau of Land Management, Denver, Colorado.

1.5 Wetlands Study Plan

1.5.1 Pertinent Issue Questions

The Wetlands Study addresses Terrestrial Resource Issue Questions:

12. Are there wetlands in the Project area created by aboveground leaking facilities? Are they Project-created?
16. Are drawdown zones on high elevation reservoirs managed correctly to retain and support wetland/riparian plants (i.e., can the upper reservoir riparian zones look more like Secret Lake and less like Aloha Lake?
18. What are the beneficial and adverse effects on native plants and plant communities affected by leakage from project water conveyance systems (e.g., emphasis on adits)?
28. What are the Project-related impacts on existing wetlands?

1.5.2 Background

The purpose of this study is to identify areas where wetland communities are either being created or possibly enhanced by leakage from project water conveyance systems (in particular adits) as well as where there are existing, natural wetland communities. The vegetation mapping conducted in 2000 identified several potential wetland types, such as willow alliance, wet areas (includes seeps, shoreline, riverside and riparian) and wet meadow (includes the grass/sedge/ rush alliance).

1.5.3 Study Objectives

The objectives of the Wetlands Study are to:

- Identify wetlands that have been created by Project operations and facilities and their effects on native plants and plant communities; and
- Identify Project-related impacts to wetland resources
- Review the drawdown zones of the high elevation reservoirs, specifically the three storage reservoirs, and determine if there are opportunities to enhance wetland and riparian areas at these reservoirs.

1.5.4 Study Area and Sampling Locations

The Wetland Study Area corresponds to the study area defined for the Riparian and Vegetation Mapping study plans. Additional study areas will be included as deemed appropriate (e.g., the developed and dispersed recreation areas being identified by the Recreation TWG, other areas as determined by the fire and fuels management plan, and Project roads that would be identified through the Project Sources of Sediment Study in coordination with the Recreation and Aquatic TWGs).

1.5.5 Information Needed From Other Studies

Information is available from the existing vegetation mapping that was conducted in 2000 and the recent aerial photography obtained by SMUD. Information will also be used from the Riparian and Vegetation Mapping studies, Operations Model, and other information gained from the Aquatics TWG.

Information will be obtained relative to historic conditions. Potential sources of this information could include historical photos, archived files, newspaper records, published scientific records, and records from the Forest Service and Licensee.

1.5.6 Study Methods And Schedule

Information will be used from the 2000 mapping study, the information presented in the UARP Initial Information Package (IIP) (SMUD 2001), and the 2002 Vegetation Mapping Study to identify wetland areas. The identification of wetlands will be based on the dominance of wetland plant species and will not be a formal delineation of wetlands used by the U.S. Army Corps of Engineers. Additional surveys may be required for wetlands created by

leakage as these areas were not specifically identified in the 2000 mapping study. Interviews will be conducted with UARP operations staff stationed at SMUD's Fresh Pond office to help in determining the location of any wetlands that may have been created by leakage from UARP facilities. Field surveys for wetland mapping (e.g., at adits) will be done concurrent with the Vegetation Mapping Study in the spring and summer of 2002.

Aerial photographs used in the Riparian and Vegetation Mapping studies will be used to identify potential wetland areas. Wetland areas include wet meadows, seeps, and emergent wetlands. Areas mapped as wetlands will be defined by the presence of wetland vegetation and field verified. These vegetation types have been defined in the UARP IIP (SMUD 2001). Soils and hydrology are also a factor in determining wetlands and these parameters will also be reviewed in defining the limits of the wetland areas. Potential for existing and future encroachment in these areas will be evaluated.

1.5.7 Analysis

The locations of all wetland areas observed will be recorded and these data used to prepare Geographic Information System maps. This information will be analyzed to determine whether Project operations have any beneficial or adverse affects on the created and existing wetlands. For example, the relationship between reservoir management (e.g., drawdowns) and extent/quality of emergent wetland and meadow wetland habitat will be analyzed to determine potential for enhancement of wetland conditions. This analysis will consider the influence of non-project factors (e.g., geomorphology) in limiting wetland distribution.

1.5.8 Study Output

Study results will be presented to the Terrestrial Resources Technical Working Group (TWG) and the Plenary Group toward the end of 2002. However, the ultimate study output will be a written report that includes the issues addressed, objectives, study area, methods, results, analysis, discussion, and conclusions. The report will be prepared in a format that will allow the information to be inserted directly into the Licensee-prepared Draft Environmental Assessment that will be submitted to FERC with the Licensee's application for a new license.

1.5.9 Preliminary Estimated Study Costs

A preliminary cost estimate was not included in the version of this study plan approved by the Plenary Group.

1.5.10 TWG Endorsement

The Terrestrial TWG approved this plan, as amended, on March 22, 2002. The participants at the meeting who said they could “live with” this study plan were USFS, CDFG, CNPS, and SMUD. None of the participants at the meeting said they could not “live with” this study plan. The Plenary Group approved this study plan on May 3, 2002. The participants at the meeting who said they could “live with” this study plan were Taxpayers of El Dorado County, Friends of El Dorado County, USFS, Camp Lotus American River Recreation Association, PG&E, SMUD, SWRCB, County of El County, El Dorado Citizens for Water, NPS, CalSPA, PCWA, FOR, City of Sacramento, CDFG, California Outdoors and USBLM. None of the participants at the meeting said they could not “live with” this study plan.

1.5.11 Literature Cited

SMUD (Sacramento Municipal Utility District). 2001. Initial Information Package, Upper American River Project, FERC Project No. 2101. Submitted July 2001.

RIPARIAN VEGETATION AND WETLANDS TECHNICAL REPORT

SUMMARY

The distribution, abundance, and condition of riparian vegetation and wetlands in a study area was documented, including the Federal Energy Regulatory Commission (FERC) Project Boundary for the Sacramento Municipal Utility District's (SMUD) Upper American River Project (UARP) and Pacific Gas and Electric Company's (PG&E) Chili Bar Project, and affected stream reaches. Riparian vegetation studies were conducted in 2003 and included map preparation based on 2002 digitized aerial photos; geomorphological assessment of affected stream reaches to target those potentially influenced by operations of the projects; and intensive field assessments of representative sites within potentially affected reaches. Wetland studies were conducted in 2003 and included map preparation and field assessments of wetlands to describe the physical and biological character.

Mapping results indicate that the extent of riparian vegetation in stream reaches closely reflects the occurrence of suitable geomorphic conditions. About 360 acres of riparian vegetation were mapped during the study. Vegetation alliances follow predictable patterns based on elevation: higher elevation reaches (Rubicon Dam Reach to Camino Dam) mostly support the Mountain Alder (*Alnus incana*) CalVeg alliance, which includes *Salix lasiolepis* (arroyo willow), *Cornus sericea* (red-osier dogwood), and *Myrica hartwegii* (Sierra bayberry) commonly co-dominant. Mid-elevation reaches (Camino Dam Reach to White Rock Powerhouse) mostly support the White Alder (*Alnus rhombifolia*) CalVeg alliance, which includes *Salix lucida* (shining willow) and *Salix exigua* (coyote willow) commonly co-dominant. The Reach Downstream of Chili Bar mostly supports the Mixed Riparian Hardwoods alliance, which includes varying amounts of *Alnus rhombifolia*, *Fraxinus latifolia* (Oregon ash), *Salix lasiolepis, Salix exigua,* and *Populus fremontii* (Fremont cottonwood) in the riparian canopy. These results are similar to those reported elsewhere for North and Central Sierra Nevada riparian systems. Current conditions in affected stream reaches appear to meet vegetative criteria for proper functioning condition, with age structures generally suggesting frequent recruitment, expected levels of species richness, adequately vegetated and stable banks, and few indicators of moisture stress. Less frequent recruitment may occur in the uppermost portions of the Robbs Peak Dam Reach and Ice House Dam Reach. Age structures of *Populus fremontii* in parts of the Reach Downstream of Chili Bar may also be imbalanced, with large individuals mostly restricted to high banks.

Approximately 879 acres of wetland vegetation were mapped during the study, including approximately 149 acres adjacent to UARP storage reservoirs (Loon Lake, Ice House, and Union Valley), approximately one acre at Gerle Creek Reservoir, and approximately 89 acres associated with affected stream reaches. Most of reservoir-associated wetlands are in good condition, dominated by native plant species with few or no weeds. Few UARP reservoir wetlands exhibit signs of ORV use or other overt adverse effects from recreational use. Two wetland sites located near boat launches/campgrounds were in relatively poor condition. At Union Valley Reservoir, most of the wetlands are sloping meadows that begin at elevations much higher than the maximum water surface elevation of the reservoir. Wetlands associated with Loon Lake Reservoir are primarily located in and around shallow bays and are thus much more substantially under reservoir influence. Species richness of wetlands seasonally inundated by the reservoirs was much lower than in meadows that are never inundated. UARP created wetlands at tunnel adits, a substation, and a switchyard are generally small and isolated, and display limited ecological values, although one of the sites (Camino adit) provides habitat forfoothill yellow-legged frog. Each of these sites were excavated to provide UARP facilities and is thus, fundamentally disturbed, limiting the potential development of wetlands. Only a very narrow fringe of herbaceous wetlands occurs within the water fluctuation zone of Chili Bar Reservoir.

1.0 INTRODUCTION

This technical report is one in a series of reports prepared by Devine Tarbell and Associates, Inc., (DTA) for the Sacramento Municipal Utility District (SMUD) and Pacific Gas and Electric

Company (PG&E) (jointly referred to as the Licensees) to support the relicensing of SMUD's Upper American River Project (UARP) and PG&E's Chili Bar Project. The Licensees intend to append this technical report to their respective applications to the Federal Energy Regulatory Commission (FERC) for new licenses. This report addresses riparian vegetation and wetlands, and includes the following sections:

- **BACKGROUND** – Summarizes the applicable study plan approved by the UARP Relicensing Plenary Group; a brief description of the issue questions addressed, in part, by the study plan; the objectives of the study plan; the study area, and agency information requests. In addition, requests by resource agencies for additions to this technical report are described in this section.
- **METHODS** – A description of the methods used in the study, including a listing of study sites.
- **RESULTS** – A description of the most important data results. Raw data, where copious, and detailed model results are provided by request in a separate compact disc (CD) for additional data analysis and review by interested parties.
- **ANALYSIS** – A brief analysis of the data, where applicable.
- **LITERATURE CITED** – A listing of all literature cited in the report.

This technical report does not include detailed descriptions of the UARP Alternative Licensing Process (ALP) or the UARP; these can be found in the following sections of the Licensee's application for a new license: the UARP Relicensing Process, Exhibit A (Project Description), Exhibit B (Project Operations), and Exhibit C (Construction).

Also, this technical report does not include a discussion regarding the effects of the Projects on riparian and wetlands and related environmental resources, nor does the report include a discussion of appropriate protection, mitigation, and enhancement measures (PM&E). An impacts discussion regarding the UARP is included in the applicant-prepared preliminary draft environmental assessment (PDEA) document, which is part of SMUD's application for a new license. Development of resource measures will occur in settlement discussions, which will commence in 2004, and will be reported on in the PDEA.

2.0 BACKGROUND

The UARP Relicensing Plenary Group approved two study plans that pertain specifically to riparian and wetlands: the Riparian Vegetation Study Plan and the Wetlands Study Plan. Each of these is discussed below.

2.1 Riparian Vegetation Study Plan

On May 3, 2002, the UARP Relicensing Plenary Group approved the Riparian Vegetation Study Plan that was developed by and approved by the UARP Terrestrial Technical Working Group (TWG) on March 22, 2002. The study plan was designed to address, in part, the following issues questions developed by the UARP Relicensing Plenary Group:

Issue Question 29.	What is the distribution of riparian areas/zones surrounding project reservoirs and along stream reaches where flows are altered by project operations and in other areas influenced by project facilities or operations?
Issue Question 40.	What is the current condition of the riparian habitat along each affected stream reach? Is there information on historical conditions that would be of use in evaluating potential improvement to the riparian habitat? How has the condition changed?

The primary objectives of the study were to:

1. Determine the distribution and frequency of riparian plant communities in sufficient detail to understand if the projects do or could affect riparian vegetation, and if so, identify feasible opportunities to enhance riparian vegetation.

2. Obtain information on the current condition of the riparian habitat along each affected stream reach and determine its role in maintaining channel stability.

3. Obtain information on historical conditions to compare historical conditions with current conditions.

Note that, as stated above, this *Riparian Vegetation and Wetlands Technical Report* does not address the second part of the first objective (identify opportunities to enhance riparian vegetation), which will be done during settlement discussions.

The study area included: 1) the area within the UARP FERC Project Boundary and PG&E's Chili Bar Reservoir; and 2) the riparian corridor along the Rubicon, Rockbound, Buck Island, Loon Lake, Gerle Creek, Robbs Peak, Ice House Junction, Camino, Brush Creek, and Slab Creek Dam reaches. In addition, the study area included the Reach Downstream of Chili Bar.

As defined in the study plan "riparian vegetation refers to plant species that are associated with the banks of a river or lake and require a dependable supply of ground water or surface water for their growth and development." The study occurred in three phases. Phase I was a general riparian vegetation mapping exercise using aerial photography and other sources of information. Phase II included an analysis of riparian community densities in conjunction with geomorphological characteristics and flow regimes. Phase III included conducting stratified sampling of representative riparian areas identified in Phase I with a goal of characterizing the riparian plant communities and selecting components in enough detail to determine if the two projects affect them. Riparian vegetation was sampled using greenline transects and cross-section transects, and field data were evaluated based on criteria established for identifying effects of altered stream hydrology (Harris *et al.* 1987).

2.2 Wetlands Study Plan

On May 3, 2002, the UARP Relicensing Plenary Group approved the Wetlands Study Plan that was developed by and approved by the UARP Terrestrial Technical Working Group (TWG) on March 22, 2002. The study plan was designed to address, in part, the following issues questions developed by the UARP Relicensing Plenary Group:

Issue Question 12.	Are there wetlands in the UARP area created by aboveground leaking facilities? Are they created by the UARP?
Issue Question 16.	Are drawdown zones on high elevation reservoirs managed correctly to retain and support wetland/riparian plants (i.e., can the upper reservoir riparian zones look more like Secret Lake and less like Aloha Lake)?
Issue Question 18.	What are the beneficial and adverse effects on native plants and plant communities affected by leakage from project water conveyance systems (e.g., emphasis on adits)?
Issue Question 28.	What are the project-related impacts on existing wetlands?

The primary objectives of the study were to:

1. Identify wetlands that have been created by UARP and Chili Bar Project operations and facilities, and their effects on native plants and plant communities.

2. Identify project-related impacts to wetland resources.

3. Review the drawdown zones of the high elevation reservoirs, specifically the Loon Lake, Ice House, and Union Valley storage reservoirs, and determine if there are opportunities to enhance wetland and riparian areas at these reservoirs.

Note that, as stated above, this *Riparian and Wetlands Technical Report* does not address the last part of the third objective (identify opportunities to enhance wetlands and riparian vegetation), or Project impacts which will be done during settlement discussions.

The study area included the same area as Riparian Vegetation Study Plan, as well as any areas where leakage from Project facilities might produce wetlands.

The study methods were to identify wetlands using aerial photographs (including the photography described in the *Vegetation Mapping Technical Report*) and other sources, and ground surveys. The study plan states that "the identification of wetlands will be based on the dominance of wetland plant species and will not be a formal delineation of wetlands used by the U. S. Army Corps of Engineers."

2.3 Water Year Types

As described in the *Water Temperature Technical Report*, the UARP Relicensing Water Balance Model Subcommittee established five water year types to be applied to all preliminary analysis with the understanding that the UARP Relicensing Plenary Group, with cause, may modify the current water year types in the future. For reference purposes, the water types that would have applied to the period when the riparian vegetation and wetlands studies fieldwork was performed are described in Table 2.3-1 below.

Table 2.3-1. Water year types applied to individual months of 2003.

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2003	BN	BN	BN	D	BN	BN	BN	BN	BN	BN	BN	BN

D=Dry water year, BN=Below normal water year.

2.4 Agency Requested Information

In a letter dated December 17, 2003 to the Licensees, the agencies identified, by study, information they believed they needed to begin settlement discussions, with the understanding that additional information might be requested. While the Wetlands Study was not specifically addressed, the agencies general comment regarding terrestrial studies is pertinent:

- All studies will need GIS shape files showing habitat/vegetation types and spatial relationships with meta-data.
- All studies will need to include survey locations.

Vegetation types are shown graphically in the 123 map sheets provided in Appendix A (remotely mapped areas) and the 16 map sheets provided in Appendix C (study sites). Riparian and wetland study sites are described in Figure 3.4-1 sheets 1-3 (located at the end of the text).

With regards to the Riparian Vegetation Study, the agencies requested:

- Species composition and location of major associations in spatial format;
- Canopy closure;
- Historic riparian communities/composition; and
- Condition of riparian community and relation to channel stability.

Species composition, canopy cover, and riparian condition information at study sites is provided in section 4.1 of this document. The spatial location of major associations is described in Appendices A and C, as described above. Efforts to document historical vegetation conditions were largely unsuccessful, and are described in Section 3.3.

In a letter dated May 13, 2004, the agencies stated the following in regards to the *Riparian Vegetation and Wetlands Technical Report* (February 2004):

- To assist in completing this analysis, the Pacific Ranger District has a 1940 series of black and white aerial photos that covers the upper portions of the Project (UARP). This series can be loaned to SMUD for scanning. The photos do not cover the lower portions of the Project (UARP) but do cover the reservoirs and stream reaches between the reservoirs and can help determine the extent of riparian habitat that is being affected by the Project (UARP). Riparian vegetation and wetlands may be affected by other Project (UARP)-related activities (primarily dispersed recreation) not included in the current study boundary.

The 1940 aerial photographs were examined on August 25-27, 2004. These photographs provided partial coverage of the study area (areas west of the Junction Dam Reach were not covered). Within areas ostensibly covered there are numerous photographs missing from the set. Most of the photographs in the set are faded and display only a limited range of gray tones, inadequate to discern riparian vegetation. Stream courses on many of the photographs have also been marked with colored pencil lines obscuring the photographic image. However, some of the photographs were of good quality and were used to compare to current conditions. The results of these comparisons have been added to the text of this report.

The Terrestrial Resources TWG met on June 7, 2004 to draft conclusions relative to riparian vegetation and wetlands and to develop recommendations for consideration by the Settlement Negotiations Group. The TWG agreed on the following general conclusions:

1. The Issue Questions and Objectives stated in the study plan are adequately addressed by the information provided in the technical report; and

2. Methods employed were adequate to address Issue Questions and Objectives.

The Terrestrial Resources TWG developed the following recommendations for consideration by the Settlement Negotiations Group:

1. SMUD supports the concept of the ongoing Engineering, Education and Enforcement ("Triple Es") programs as administered by the USFS. There may be an opportunity to contribute to this program for educating Forest users regarding Wetland/riparian vegetation (e.g., Loon Lake Reservoir at Ellis Creek);

2. Periodic surveys should be conducted to assess the success of the EEE program as determined necessary by USFS and SMUD;

3. Some wetland areas have significant species diversity or wetland/riparian habitat values. Periodic surveys should be conducted to ensure the successful management of these areas;

4. If monitoring demonstrates a loss of wetland/riparian habitat value, an assessment needs to be made to determine the level of SMUD's participation in restoring the area (dependent on results of summer 2004 surveys);

5. Any actions proposed by USFS or SMUD need to be assessed for potential loss of wetland/riparian habitat values; and

6. Any recommendations for changes in the flow regimen for any project-influenced steam should be reviewed by the Terrestrial TWG for potential effects or enhancement opportunities on wetland/riparian habitat values.

3.0 METHODS

3.1 Riparian Vegetation Study Sites

The Riparian Vegetation Study examined: 1) areas identified by the Terrestrial TWG within the FERC Project Boundary of the UARP and Chili Bar Project; and 2) stream reaches affected by the two projects (Table 3.1-1). This includes the area within 300 feet of the normal high water line along affected reaches. Where riparian plant communities extended beyond 300 feet, the study was extended to describe the full extent of these communities.

Table 3.1-1. Riparian Vegetation Study Reaches.

Reach	Length (mi)	Comments
Rubicon Dam	4.2	Rubicon River downstream of Rubicon Reservoir (capacity 1,435 ac. ft) from the base of Rubicon Dam to confluence with Miller Creek. Elevation from 6,550 to 6,529 ft.
Rockbound Dam	0.26	Little Rubicon River between Rockbound Lake and Buck Island Reservoir. Rockbound Lake has no releasable storage capacity. Elevation from 6,529 to 6,430 ft.
Buck Island Dam	2.5	Little Rubicon River downstream of Buck Island Reservoir (capacity 1,070 ac. ft) to confluence with Rubicon River. Elevation from 6,420 to 6,035 ft.
Loon Lake Dam	8.5	Gerle Creek downstream of Loon Lake (capacity 76,200 ac. ft) to Gerle Reservoir. Not typically subject to spill flows, due to headwater location of reservoir. Elevation from 6,320 to 5,210 feet. Major inflows include Jerrett Creek, Barts Creek, Dellar Creek, and Rocky Basin Creek.
Gerle Creek Dam	1.2	Gerle Creek downstream of Gerle Reservoir (capacity 1,260 ac. ft) to confluence with South Fork Rubicon River. Elevation from 5,182 to 4,980 ft.
Robbs Peak Dam	5.9	South Fork Rubicon River downstream of Robbs Peak Reservoir (capacity 30 ac. ft) to confluence with Gerle Creek. Robbs Peak Reservoir is a headwater forebay that receives most of its flow from Gerle Creek. Elevation from 5,205 to 3,540 ft.
Ice House Dam	11.5	South Fork Silver Creek downstream of Ice House Reservoir (capacity 45,960 ac. ft). Elevations from 5,300 to 4,460 feet. Tributaries include Peavine Creek, Winmiller Ravine, Chicken Hawk Springs, Bryant Springs, and Big Hill Canyon.
Junction Dam	8.3	Silver Creek downstream of Junction Reservoir (capacity 280,540 ac. ft) to the normal high water line of Camino Reservoir. Elevation from 4,290 to 2,960 ft. Major inflows include Gray House Creek, Bear Creek, Davis Creek, and Onion Creek.
Camino Dam	6.2	Silver Creek downstream of Camino Reservoir (capacity 825 ac. ft.). Elevations from 2,810 to 2,055 ft. The major inflow to this reach is Round Tent Canyon.

Table 3.1-1. Riparian Vegetation Study Reaches.		
Reach	**Length (mi)**	**Comments**
Brush Creek Dam	2.2	Brush Creek downstream of Brush Creek Reservoir (1,530 ac. ft) to the normal high water line of Slab Creek Reservoir. Bypass reach is over 9% gradient. Elevation is 2,895 to 1,850 ft. There are no major tributaries to this reach.
Slab Creek Dam	8.0	S.F. American River from Slab Creek Reservoir (capacity 16,600 ac. ft) to Chili Bar Reservoir. Elevation 1,650 to 995 ft. Major inflows to this reach include Redbird Creek, Iowa Canyon, South Canyon, Mosquito Creek, Jaybird Creek, Rock Creek, and White Rock Creek.
South Fork American River	2.8	S.F. American River from Slab Creek Reservoir to confluence with Silver Creek. Elevation 2,040 to 1,850 ft. There are no major tributary inflows to this reach.
Downstream of Chili Bar	19.1	Chili Bar to Folsom Reservoir normal high water line. Elevation 940 to 420 ft. Major inflows to this reach include Ladies Canyon, Kelsey Canyon, Indian Creek, Chuck Ravine, Dutch Creek, Gambler Creek, Indian Creek, Shingle Creek, Brush Creek, Jacobs Creek, Greenwood Creek, Clark Creek, Hastings Creek, Bunt Shanty Creek, Norton Ravine, Weber Creek, Mosquito Creek, Jaybird Creek, and White Rock Creek.

As stated in the Riparian Vegetation Study Plan (SMUD 2003), "Stream reaches that are not likely to be affected by the Project because the limitation for riparian development is related directly to the geomorphology of the site will not be studied, other than they will be mapped and included in the description for the Project study area." Accordingly, each stream reach affected by the UARP or by the UARP and Chili Bar Project was examined to identify sub-reaches in which the local geomorphology, rather than the projects, would limit the development of riparian vegetation (Table 3.1-2). In addition, field studies were not conducted in any sub-reaches where access would have posed serious risk to field crews.

Table 3.1-2. Rosgen (1996) classifications rated for susceptibility to effects on riparian vegetation based on changes in flow.		
Channel/ Valley Type	**Description**	**Rating and Justification**
A/I	Steep, confined channel in V-shaped confined, structurally controlled valley.	***Low*** - Generally bedrock-controlled and thus stable (i.e., transport reaches).
A/II	Steep, confined channel with valley floor slopes less than 4% and soils developed on parent material, alluvium and colluvium.	***Low*** – Stable stream type and valley type with limited depositional forms (transport reach).
A/III	Steep, confined channel in valley that is depositional, e.g., colluvial or alluvial fans and steep slopes.	***Moderate*** – Fans are inherently unstable and deformable; streams are still transport reaches, but with potentially unstable riparian zones.
A/V	Steep, confined channel in glacially scoured U-shaped valley with lots of coarse deposits.	***Moderate*** – Substantial deformable substrate in riparian zones adjacent to transport streams.
B/II	Moderately steep channel with stable plan and profile with valley floor soils formed on parent material, colluvium, and alluvium.	***Low*** – Channel form is stable; project area reaches are likely bedrock-controlled with limited deformable substrate.
B/III	Moderately steep channel in depositional valley.	***Moderate*** – Fans are inherently unstable and deformable though channel form generally is considered a stable, transport reach.
C/V	Low gradient, meandering stream with broad,	***High*** – Channels have the potential to meander

Table 3.1-2. Rosgen (1996) classifications rated for susceptibility to effects on riparian vegetation based on changes in flow.		
Channel/ Valley Type	**Description**	**Rating and Justification**
	well-defined floodplains in glacially derived U-shaped valley.	all over the low gradient alluvial valley upon which riparian vegetation is likely established and can be modified.
C/VIII	Low gradient, meandering stream with broad, well-defined floodplains in broad valley with multiple terraces.	***High*** – Meandering channels where sediment supply is high, banks and riparian zones are deformable and potentially unstable and terraces indicate previous incision.
D/III	Braided, wide channel in depositional valley.	***High*** – Unstable banks in deformable valley deposits.
D/V	Braided, wide channel in glacially derived U-shaped valley.	***High*** – Unstable banks in low gradient deformable valley deposits.
D/VIII	Braided, wide channel in broad valley with multiple terraces.	***High*** – Unstable banks where sediment supply is high, banks and riparian zones are deformable and potentially unstable, and terraces indicate previous incision.
E/VIII	Low gradient, meandering, narrow, deep stream in broad valley with multiple terraces.	***High*** – Channel form is generally stable but valley type indicates sediment supply is high, banks and riparian zones are deformable and potentially unstable, and terraces indicate previous incision.
F/VIII	Entrenched (incised), low-gradient, meandering, wide, shallow stream in broad valley with multiple terraces.	***High*** – Channel is unstable (experiencing disequilibrium) and valley type indicates sediment supply is high, banks and riparian zones are deformable and potentially unstable, and terraces indicate previous incision in addition to current incision.
G/I-VIII	Entrenched "gully" in any valley type, incised into alluvial or colluvial materials.	***High*** – These are unstable channels with grade control problems and high bank erosion rates. Any vegetation adjacent to these stream types, regardless of valley type, would be subjected to inherent instability, which changes in flow could affect.

Sub-reaches were further examined for their potential sensitivity to alteration (e.g., changes in sediment transport or deposition) related to the projects. A cluster analysis indicated which sites were most similar based on stream elevation, confinement (ratio of channel width to valley width), gradient, and geology (*Channel Morphology Technical Report*). For each Rosgen class stream in each project-affected reach, sections within the same cluster were evaluated for similarity in vegetation and sediment as determined from aerial photography, ortho-photos, and videography.

Sub-reaches were given a two-letter code representing the reach (e.g., Slab Creek is SC, Robbs Peak is RP) with a number of the section, with number one (1) being the first section at the downstream end, and numbered consecutively upstream. Some sections did not have suitable photo coverage and were not part of the cluster analysis or ranking. Aerial photos, maps, and

descriptions were reviewed for each section and each reach. After an initial classification, aerial photographs were reviewed to see if riparian vegetation was evident. A ranking system using Table 3.1-2, aerial photographs, geology, and cluster analysis provided input to determine field-sampling sections.

There are three major sub-reaches in the Reach Downstream of Chili Bar: Gorge Sub-reach (CB1), Coloma Sub-reach (CB2), and Canyon Sub-reach (CB3). At least one study site was placed within each of these sub-reaches, with additional study sites in the Coloma sub-reach, where riparian vegetation is best developed and where more sites could be accessed.

Riparian study sites were located within a total of 24 sub-reaches (most ranked "high" for susceptibility to project effects) (Table 3.1-3). The study sites were generally located within sub-reaches that exhibited the following characteristics:

- Presence of an alluvial channel;
- The channel is not confined by bedrock banks or valley walls;
- Slopes less than 4 percent;
- Presence of a well-developed floodplains (relative to other sites in the reach);
- Accessibility by field crews; and
- Coincidence with the channel morphology study sites, whenever possible.

Table 3.1-3. Sites where riparian vegetation field investigations were conducted. (See Channel Morphology Technical Report for location of Sub-reaches).

Reach	Sub-reach	Survey Type
Slab Creek Dam	SC1	Intensive
Slab Creek Dam	SC3	Intensive
Slab Creek Dam	SC4	Ground truth
Slab Creek Dam	SC9	Ground truth
Camino Dam	C4	Intensive
Ice House Dam	IH1	Intensive
Ice House Dam	IH2	Reconnaissance
Ice House Dam	IH5	Intensive
Robbs Peak Dam	RP12	Ground truth
Robbs Peak Dam	RP15	Intensive
Robbs Peak Dam	RP16	Ground truth
Gerle Creek Dam	GC1	Intensive
Loon Lake Dam	LL1	Reconnaissance
Loon Lake Dam	LL3	Intensive
Loon Lake Dam	LL4	Reconnaissance
Loon Lake Dam	LL8	Reconnaissance
Loon Lake Dam	LL9	Reconnaissance
Loon Lake Dam	LL10	Intensive
Loon Lake Dam	LL14	Reconnaissance
Loon Lake Dam	LL17	Intensive
Rubicon Dam	RP9	Ground truth survey

Table 3.1-3. Sites where riparian vegetation field investigations were conducted. (See Channel Morphology Technical Report for location of Sub-reaches).		
Reach	**Sub-reach**	**Survey Type**
Downstream of Chili Bar	CB1	Intensive
Downstream of Chili Bar	CB2	Intensive and Reconnaissance
Downstream of Chili Bar	CB3	Intensive

3.2 Riparian Vegetation Mapping

Vegetation mapping presented in this technical report is based on aerial photographs taken on August 30, 2002 (UARP Project Boundary and affected reaches, exclusive of the Reach Downstream of Chili Bar) and June 30, 2003 (Chili Bar Project Boundary and the Reach Downstream of Chili Bar). Ortho-rectified 1:2,400 map sheets of these photos were prepared for field use, and riparian vegetation polygons were identified and field-mapped during riparian investigations. The resulting field data maps were viewed in conjunction with ground-based photos, stereo pairs of the 2003 flight, and low-elevation helicopter videos of some affected stream reaches. Helicopter-based aerial videos were available for the following reaches:

- Robbs Peak Dam (South Fork Rubicon);
- Junction Dam (Silver Creek);
- Camino Dam (Silver Creek);
- Slab Creek Dam (South Fork American River);
- Camino Dam (S.F. American River); and
- Downstream of Chili Bar (S.F. American River).

These data were collectively used to digitally delineate riparian vegetation polygons in AutoCAD and ArcGIS. Vegetation classification followed the CalVeg system described by Matyas and Parker (1980) and the United States Forest Service (USFS 2000). Potential vegetation alliances included all those known from the North Sierran and Central Valley Ecological provinces (USFS 2003a, USFS 2003b). The following alliances were identified during mapping:

- Fremont Cottonwood;
- California Sycamore;
- Lodgepole Pine;
- Mixed Riparian Hardwoods;
- Mountain Alder;
- Wet Meadow (Grass-Sedge-Rush);
- White Alder;
- Willow; and
- Willow-Alder.

The Alliance-level CalVeg system was used in place of a finer-scale system such as Potter (2003) or Sawyer and Keeler-Wolf (1995) because these systems consider vegetation units that cannot be discerned remotely, and often provide poor descriptions of the riparian communities in the study area. The use of the CalVeg system is also supported by the work of Harris (1988), who describes a total of seven vegetation types for eastern Sierra Nevada Riparian areas, each closely aligned with existing CalVeg alliances.

The identified vegetation types are all characteristic of riparian settings, although most may also occur in wetlands and one (Lodgepole Pine Alliance) also occurs in subalpine uplands. As such, the extent of the riparian vegetation zone may not be apparent where wetlands occur in the floodplain or where Lodgepole Pine Alliance surrounds riparian areas. Floodplain wetlands are addressed in Section 4.2.7. Absent other indicators (e.g., field data), the width of Lodgepole Pine Alliance polygons was arbitrarily drawn comparable to other riparian vegetation types.

Riparian areas that were devoid of vegetation or only sparsely vegetated were classified as Unconsolidated Shoreline (e.g., sand bars or cobble bars) or Rocky Shore (bedrock or boulders). Instream areas were mapped as Open Water except where there a majority of the stream course consisted of exposed boulders or bedrock; the latter areas were mapped as Rocky Shore. Instream areas mapped as Rocky Shore included areas vegetated with *Darmera peltata*.

Vegetation polygons were used to form a GIS layer using ArcGIS software, and this layer combined with orthophoto data to produce 1:2,400 scale vegetation type maps for the entire study area. The resulting maps are provided in Appendix A of this technical report and their associated GIS files are provided on CD by request..

3.3 Historical Conditions

Quantitative data describing historical vegetation conditions in Sierra Nevada riparian areas and wetlands are not available (Harris et al. 1987), (Harris 1989). Historical aerial photographs were requested from the USDA, Forest Service, but were not available when requested, as the Forest Service contact for all aerial imagery was on leave during the course of this study. Alternative sources of imagery were pursued through the University of California (UC) at Berkeley, UC Davis, and Stanford University.

No complete set of historical aerial photographs could be located. UC Davis maintains a set of 1976 aerial photos covering much of the study area (dated May 25 and 26, June 1 and 3, October 8; scale 1:15,840), and a set of 1952 aerials with partial coverage of the study area (scale 1:15,840). UC Berkeley's set from 1952 (dated August 12 and 13; scale 1:20,000) is more complete, but does not include the South Fork of the American River below Chili Bar. The only series providing usefully scaled coverage for this area is a 1985 series (dated April 24, scale 1:31,680) from UC Berkeley. Each of these sets were digitally scanned on location using a flatbed scanner (Canon Canoscan LIDE 30), and compared to 2002 photos in an attempt to discern substantial changes in vegetation or vegetation patterns.

As previously noted, SMUD was notified on May 13, 2004 that a set of aerial photographs dated June 26, 1940 was located at the U. S. Forest Service Eldorado National Forest Supervisor's Office in Placerville. These photographs were examined using a stereoscope. The set provided partial coverage of the study area (areas west of the Junction Dam Reach were not covered), although numerous photographs are missing.

3.4 Riparian Vegetation Field Data Collection

Within sub-reaches where reconnaissance-level surveys were conducted (Table 3.1-3 and Figure 3.4-1 – located at the end of the text), data collection consisted of the following:

- Listed plant species, noting dominants and special status species in the riparian zone;
- Photographed site conditions; and
- Noted general site conditions such as bank erosion, bank stability, and other characteristics.

At each intensive field study site (Table 3.1-3 and Figure 3.4-1 – located at the end of the text), data collection consisted of the following:

- Conducted a reconnaissance of the site, listing plant species, and noting dominants and special status species in the riparian zone;
- Photographed site conditions;
- Recorded vegetation community types and woody species composition along greenline vegetation transects (see detailed methods below);
- Noted indicators of shoreline stability (vegetation composition along "greenline");
- Mapped riparian zone on ortho-photos;
- Recorded vegetation composition along cross-sections profiles perpendicular to the stream, describing the successive vegetation zones and determining their vertical position relative to water surface elevation; and
- Sampled representative woody plants in riparian using increment bores or cross-sections to determine age.

Greenline transect methodology followed Winward (2000). The greenline is defined as "…the first perennial vegetation that forms a lineal grouping of community types on or near the water's edge…" (Winward 2000). The greenline transect is a step transect that follows the greenline. Each greenline is described by the cumulative distance in feet occupied by each community type. The "community types" along the greenline are floristically similar assemblages of vegetation, typically occurring as repeating patches or stringers. A wide variety of known greenline community types have been rated (on a 1 to 10 scale, with 10 representing the highest capability) for bank stability, a relative measure of capability for "buffering stream banks against erosive forces of moving water" (Winward 2000). Where greenline community types have not been rated, other sources of information, including rooting characteristics and field observations, were used to evaluate greenline communities that were observed during this study.

At sites within the Reach Downstream of Chili Bar, the same methods were applied; however, the much larger stream size dictated some changes in approach. Greenline transects were used at some sites, but the resulting data are likely less useful in assessing bank stability because the greenline often was located below the stream bank. Cross-section transects were not extended to both banks because water depths and flows generally did not permit crossing. Because sites, particularly within the same sub-reach, were generally similar to one another in riparian species composition and zonation, a more comparative approach was adopted, focusing on the vertical position of specific vegetation zones relative to water surface elevation at specific flows. Plant species (scientific and common names) documented during field surveys are listed in Table 3.4-1 (located at the end of the text).

3.5 Wetland Study Areas

Wetlands within the scope of this study included existing, natural wetlands and wetlands created by the projects. The wetlands study examined those wetlands: 1) associated with the UARP and Chili Bar Project reservoirs; 2) created by UARP water conveyance systems (e.g., leakage at tunnel adits); 3) along UARP transmission lines and penstocks; or 4) associated with project-affected stream reaches. Other wetlands located within 0.5 mile of the UARP and affected stream reaches (above 3,000 feet elevation) or within 500 feet of the UARP and affected stream reaches (below 3,000 feet elevation) were mapped as part of the Licensee's *Vegetation Mapping Technical Report*, but were not examined in the field.

3.6 Wetlands Mapping

Current (August 2002) aerial photographs (1:2400 scale) used in the riparian and vegetation mapping study were used to identify potential wetland areas. National Wetland Inventory (NWI) maps of the area (USFWS 1995) were also consulted.

Palustrine wetland types were mapped, but riverine or lacustrine deepwater habitats (e.g., R3UBH, riverine upper perennial, unconsolidated bottom, permanently flooded [Cowardin *et al*. 1979]) were not within the scope of this study. Wetlands were classified and mapped using the CalVeg vegetation classification system described by Matyas and Parker (1980) and the United States Forest Service (USFS 2000). Potential vegetation alliance included all those known from the North Sierran and Central Valley Ecological provinces (USFS 2003a, USFS 2003b). However, wetland areas below reservoir high water elevation were mapped separately in order to differentiate these areas from meadows that are not reservoir-influenced. The following Alliances were identified during mapping:

- Grass-Sedge-Rush Alliance (HJ);
- Lodgepole Pine Alliance (LP);
- Mountain Alder Alliance (TA);
- Open water (WA);
- Willow Alliance (QO); and
- Willow-Alder Alliance (QY).

3.7 Wetlands Field Data Collection

A sub-set of wetlands identified from the aerial photos or NWI maps (USFWS 1995) were field-verified and explored. Particular focus was devoted to the two types of wetland most likely to be affected by the UARP and/or the Chili Bar Project: 1) wetlands at UARP tunnel adits (i.e., wetlands created by leakage), and 2) reservoir-associated wetlands. Other types of wetlands that were examined were those within the FERC Project Boundary of the UARP, but not influenced by reservoir operations. This included wetlands along transmission line corridors and penstock rights-of-way. Wetlands associated with stream reaches affected by the UARP and/or Chili Bar Project were also examined. Wetlands that were field examined are indicated in Figure 3.4-1 (located at the end of the text).

Field examination of wetlands included compilation of plant species lists, noting the occurrence of species of special concern (special status plant species and noxious weeds, both defined in the *Special Status Plants and Noxious Weeds Technical Report*). Plant species (scientific and common names) documented during field investigations are listed in Table 3.6-1 (located at the end of the text). Most sites were photographed. Hydrologic indicators were evaluated for possible project effects. Other factors affecting wetland condition were also noted.

NWI categorization of wetlands was compared to field conditions. Because NWI maps are typically based on interpretation of aerial photographs without field verification, the general extent of wetlands (although wetland boundaries were not delineated), wetland types (e.g., "palustrine emergent" versus "palustrine scrub-shrub"), water regime (e.g., "temporarily flooded" versus "seasonally flooded") were compared, and the degree of reservoir influence was assessed.

Historical aerial photographs were used to compare the extent and types of wetlands (typically meadows) associated with affected stream reaches. Specifically, these wetlands were compared for the relative abundance of conifers and open meadow areas.

At representative UARP reservoir-associated wetlands, transects were established to identify discrete vegetation zones in relation to reservoir water surface elevations. Actual reservoir water surface elevations were obtained from California Department of Water Resources (2003). Some sites were examined on multiple occasions in order to document wetland conditions in response to declining reservoir levels. Investigations of wetland soil conditions were conducted on September 17, 2003 at two wetland sites at Loon Lake Reservoir and three wetland sites at Union Valley Reservoir. Soil pits were dug within obvious wetland areas and at wetland margins. Soils were examined for color, presence of mottles, texture, presence of organic material, and moisture.

4.0 RESULTS

4.1 Riparian Vegetation Study Results

4.1.1 Rubicon Dam Reach

The Rubicon Dam Reach is located on the Rubicon River and extends from the base of Rubicon Dam to the Miller Creek confluence. This section of river is approximately 4.1 miles long, ranges in elevation from 6,510 to 6,100 feet, and has a mean gradient of approximately 1.9 percent. However, the slope of the stream ranges from almost 13 percent to less than one percent in one sub-reach (*Channel Morphology Technical Report*).

The Rubicon Dam Reach contains nine geomorphic sub-reaches, ranging from Rosgen Type Aa+ to Rosgen Type C/F/G. A ground truth survey was conducted within sub-reach RD9. Riparian vegetation in this reach was comprised of *Alnus incana*, which was relatively sparse because of bedrock banks.

Ortho-photo coverage of the Rubicon Dam Reach encompasses the upper half of the reach. The reach is generally characterized by long stretches of bedrock and boulders confining small pools and an incised channel. Only 15.4 percent of the reach has riparian vegetation, occupying about 9.8 acres (Appendix A). The vegetation is comprised of discrete patches in polygons ranging in width from 5 to 50 feet (mean = 17.5). Three vegetation types occur: as a percentage of shoreline, they are Mountain Alder Alliance (9.6 percent of the reach), Lodgepole Pine Alliance (1.3 percent of the reach), and Wet Meadow Alliance (2.7 percent of the reach).

The 1952 and 1976 historical aerial photographs of this reach lacked sufficient resolution to draw definitive conclusions about the extent or types of riparian vegetation that may have occurred. Both of the photo sets are from relatively high elevation flights and are printed at 1:20,000 scale (1952 series) and 1:15,840 scale (1976 series). Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. The historical photos appear to indicate that extent of coverage by conifers has not changed markedly. The position of the stream channel has not undergone apparent change. The 1940 aerial photographic series encompassed a portion of this reach and the photographs were of good quality. The current pattern of occurrence of riparian vegetation is not substantially different than that evident in the 1940 photographs (Appendix B).

4.1.2 Rockbound Dam Reach

The Rockbound Dam Reach is located on Highland Creek and extends from the outlet of Rockbound Lake to the normal high water line of Buck Island Reservoir. This section of river is approximately 0.26 mile long, extends from an elevation of 6,520 to 6,440 feet, and has a mean gradient of approximately 7.2 percent.

The Rockbound Dam Reach consists of a single geomorphic sub-reach (Rosgen Type A), which is characterized by a bedrock channel and falls, with intermittent pools. No detectable riparian vegetation occurs (Appendix A).

The 1952 and 1976 historical aerial photographs of this reach lacked sufficient resolution to draw definitive conclusions about the extent or types of riparian vegetation that may have occurred. Both of the photo sets are from relatively high elevation flights and are printed at 1:20,000 scale (1952 series) and 1:15,840 scale (1976 series). Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. The historical photos appear to indicate that extent of coverage by conifers has not changed markedly. The position of the stream channel has not undergone apparent change. The 1940 aerial photographic series included one photograph of this reach and the photograph was of good quality. The current pattern of occurrence of riparian vegetation is not substantially different from that evident in the 1940 photograph (Appendix B).

4.1.3 Buck Island Dam Reach

The Buck Island Dam Reach is located on the Little Rubicon River and extends from the base of Buck Island Dam to the confluence with the Rubicon River. This section of river is 2.8 miles long, extends through a range of elevations from 6,420 to 5,940 feet.

The Buck Island Dam Reach contains eight geomorphic sub-reaches, including Rosgen Type Aa+, B, and C. Most of the reach has a steep gradient (up to 14% slopes) and the entire reach is characterized by bedrock. Accordingly, there is little suitable habitat for riparian vegetation.

Ortho-photo coverage of the Buck Island Dam Reach encompasses the upper half of the reach. This reach is characterized by long stretches of a narrow incised channel bounded by bedrock and low-lying vegetation. Small patches of Mountain Alder Alliance occur discontinuously, occupying only 0.14 acres (Appendix A). Overall, 1.5 percent of the shoreline in the reach has riparian vegetation. Riparian vegetation polygons ranged in width from 5 to 20 feet (mean = 10).

The 1952 and 1976 historical aerial photographs of this reach lacked sufficient resolution to draw definitive conclusions about the extent or types of riparian vegetation that may have occurred. Both of the photo sets are from relatively high elevation flights and are printed at 1:20,000 scale (1952 series) and 1:15,840 scale (1976 series). Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. The historical photos appear to indicate that extent of coverage by conifers has not changed markedly. The position of the stream channel has not undergone apparent change. The 1940 aerial photographic series encompassed most of this reach; the two photographs were of good quality for gray tones, but only fair for sharpness. The current pattern of occurrence of riparian vegetation is not substantially different from that evident in the 1940 photographs (Appendix B).

4.1.4 Loon Lake Dam Reach

The Loon Lake Dam Reach is located on Gerle Creek from the base of Loon Lake Dam to the normal high water line of Gerle Creek Reservoir. This section of river is approximately 9.3 miles long, extends from 6,310 to 5,231 feet, and has a mean gradient of approximately 2.2 percent. Major inflows to this reach include Jerrett Creek, Barts Creek, Dellar Creek, and Rocky Basin Creek.

Gerle Creek in the Loon Lake Dam Reach is a relatively small creek with a channel width ranging from approximately 10 to 40 feet. This reach contains 20 geomorphic sub-reaches, which are mostly Rosgen type A, with some type B, C and fewer D, E, and F sections (*Channel Morphology Technical Report*). Approximately a third of the reach is Rosgen type A or Aa+, with granitic geology. There are also long stretches where glacial till overlays bedrock, and areas that are predominantly alluvium. Overall, based on channel, valley, and other geological characteristics, and the occurrence of riparian vegetation, the Loon Lake Dam Reach contains the greatest number of sub-reaches that could be susceptible to UARP effects on riparian vegetation. Three study sites were selected, within sub-reaches LL3 (Site 1), LL10 (Site 2), and LL17 (Site 3). The study sites correspond to sites used in the channel morphology study. In addition to the study sites selected, reconnaissance-level surveys were conducted within five other sub-reaches (LL1, LL4, LL8, LL9 and LL14).

This reach is unique in the occurrence of several large meadows within the floodplain. The current extent and general pattern of vegetation was compared to historical conditions using aerial photographs. This analysis indicates an increase in the occurrence of conifers within some of these meadows from 1940 to the present, whereas other areas have not changed markedly (see Section 4.2.7).

Riparian vegetation was present throughout the Loon Lake Dam Reach, except in areas where restricted by bedrock and steep gradient (Appendix A). Based on field information, the predominant riparian vegetation alliance is Mountain Alder. The Mountain Alder Alliance can include areas where alder occurs with *Pinus contorta* or species of *Salix,* as was observed at some of the field survey sites. Areas where species of *Salix* occurred alone were generally small. Species of willow identified in the reach were *Salix geyeriana*, *Salix exigua,* and *Salix lucida.* Other minor woody species were *Cornus sericea, Spiraea densiflora, Populus balsamifera var. trichocarpa* (found at only one site), and *Populus tremuloides.* In places, *Darmera peltata* occurs in large patches among boulders within the channel. A total of 37.9 acres of riparian vegetation were mapped in this reach, including 34.5 acres of Mountain Alder Alliance (the rest is Lodgepole Pine Alliance). As indicated earlier, the width of Lodgepole Pine vegetation polygons was arbitrarily drawn comparable to other riparian vegetation types because this vegetation type may also be associated with wetlands or uplands. Floodplain wetlands not located on stream banks in this reach were not mapped as riparian vegetation. However, maps that include these floodplain wetlands are presented in the *Vegetation Mapping Technical Report*. Wetlands associated with the loon Lake Dam Reach are discussed in Section 4.2.7 of this report.

The map of the reach indicates that 89.3 percent of the shoreline in the reach has riparian vegetation, almost all of it Mountain Alder Alliance (82.6 percent of reach); Lodgepole Pine Alliance comprises the rest. Riparian vegetation polygons ranged in width from 5 to 35 feet (mean = 20).

The reconnaissance conducted in sub-reach LL1 documented a wide channel with abundant boulders and cobbles within the channel. *Alnus incana* dominated the riparian corridor of this sub-reach with concentrations of *Darmera peltata* and pockets of herbaceous and emergent species among the boulders (Table 4.1.4-1). Within sub-reach LL4, Gerle Creek begins to narrow and the low banks are heavily vegetated with a mosaic of *Alnus incana*, *Darmera peltata*, and variety of herbaceous species, creating a wide riparian zone. There is also a prominent fork in the creek and an associated island vegetated by *Pinus contorta* and *Calocedrus decurrens* (see photo in Appendix D).

The reconnaissance conducted in sub-reach LL8 showed that the downstream portion of the sub-reach exhibits somewhat high banks and a large in-stream boulder component. The riparian corridor was dominated exclusively by *Alnus incana* with little herbaceous vegetation (Table 4.1.4-1). Continuing upstream, the banks of Gerle Creek are less steep, encouraging a greater herbaceous community dominated by pockets of *Carex aquatilis*. Further upstream, the creek begins to braid and continues to be dominated by *Alnus incana* along slightly undercut banks. A large meadow is closely associated with the upper portions of sub-reach LL8. Here the overstory species are *Pinus contorta*, *Pinus lambertiana*, and *Abies magnifica*, with an understory of *Veratrum californicum*, *Lonicera conjugialis*, *Lupinus polyphyllus*, and *Solidago canadensis*.

The reconnaissance conducted in sub-reach LL9 showed the downstream portion of the sub-reach as having steep and undercut banks dominated by herbaceous species under a thick *Alnus incana* overstory (Table 4.1.4-1). Further upstream, moist depressions filled with sand along the banks suggesting recent overflow support *Carex aquatilis* and grass species. The channel begins to widen continuing upstream and the banks are densely covered with *Alnus incana* and *Pinus contorta* regeneration (see photo in Appendix D). Meadow-like openings are dominated by *Carex vesicaria*, *Mimulus primuloides*, *Hypericum anagalloides*, *Veratrum californicum*, and *Heracleum lanatum*.

Throughout sub-reach LL14, the riparian community is dominated by a thin, nearly continuous band of *Alnus incana*, with *Spiraea densiflora* and isolated stands of *Pinus contorta* (Table 4.1.4-1). Generally the herbaceous community occurs in pockets, and is made up of *Juncus xiphioides, Agrostis oregonensis*, *Mimulus primuloides*, *Carex vesicaria*, *Lotus pinnatus*, and *Hypericum anagalloides*.

Table 4.1.4-1. Loon Lake Dam Reach Reconnaissance Surveys Greenline Composition by Sub-reach.

Greenline Species Documented	LL1	LL4	LL8	LL9	LL14
Athyrium filix-femina		X	X		
Agrostis oregonensis	X	X	X		X
Alnus incana	X	X		X	X
Boykinia major	X	X			
Carex aquatilis	X	X		X	

Table 4.1.4-1. Loon Lake Dam Reach Reconnaissance Surveys Greenline Composition by Sub-reach.					
Greenline Species Documented	**LL1**	**LL4**	**LL8**	**LL9**	**LL14**
Carex vesicaria				X	X
Carex sp.			X		
Castilleja miniata					X
Cornus sericea		X	X	X	X
Darmera peltata	X	X	X		
Equisetum arvense	X		X		
Galium trifidum			X	X	
Glyceria sp.	X	X	X		X
Helenium bigelovii	X	X	X	X	X
Hypericum anagalloides	X	X	X	X	X
Juncus ensifolius		X			
Juncus howellii	X		X		
Juncus tenuis		X			
Juncus xiphioides	X	X	X	X	X
Lilium parvum					X
Lotus oblongifolius	X	X			
Lotus pinnatus					X
Lupinus polyphyllus				X	
Mimulus lewisii				X	
Mimulus moschatus				X	
Mimulus primuloides				X	X
Panicum acuminatum		X			
Perideridia parishii	X	X			
Pinus contorta				X	X
Platanthera leucostachys		X			
Poa sp.				X	
Populus tremuloides			X		
Prunus vulgaris				X	
Ranunculus occidentalis			X		
Salix sp.	X	X	X	X	X
Scirpus microcarpus				X	
Senecio triangularis		X	X	X	X
Solidago canadensis	X	X			
Spiraea densiflora	X	X		X	X
Spiranthes romanzoffiana	X				
Stachys alba	X	X	X		
Viola macloskeyi	X	X	X	X	

Reconnaissance of the sub-reaches immediately below the Loon Lake Reservoir Dam (LL20 and 19) on September 21, 2004 indicated that stream banks are well vegetated except where substrates are bedrock. Dense stands of *Alnus incana* occur where stream gradient and substrates are most favorable (see photo in Appendix D). Representative *Alnus incana* were determined to be 7-10 years old, and plants as old as 23 years occur in some protected sites. Less frequent riparian species in these favorable sites are *Cornus sericea*, *Salix spp*., *Spiraea densiflora*, and *Pinus contorta*. A representative *Pinus contorta* growing among *Alnus incana* on the bank was 19 years old. Within the first 200 feet of sub-reach LL20 below the dam there are a few small *Alnus incana* growing just above the water line among cobbles in the channel (see photo in

Appendix D). Further downstream two *Alnus incana* and one *Pinus contorta* grew just above the water line in cobbles mid-channel; one of the *Alnus incana* was11 years old and the *Pinus contorta* was 13 years old. In areas where the banks are bedrock, small trees and shrubs are often rooted directly at the water line, signifying very stable flows (see photo in Appendix D). Because instream flows in these sub-reaches are largely dictated by minimum flow releases, riparian vegetation is well developed and maintained; however, high flows capable of scouring vegetation may be infrequent.

The 1952 and 1976 historical aerial photographs of the Loon Lake Dam Reach lacked sufficient resolution to draw definitive conclusions about the extent or types of riparian vegetation that may have occurred. Both of the photo sets are from relatively high elevation flights and are printed at 1:20,000 scale (1952 series) and 1:15,840 scale (1976 series). Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. The historical photos appear to indicate that extent of coverage by conifers in the riparian zone has not changed markedly. It was not possible to detect small side channels on the 1952 series; however, in some stretches of the reach it is possible to see some open water, boulder, and riffle areas, which appear to have not changed. The position of the stream channel has not undergone apparent change.

The 1940 aerial photographic series encompassed most of this reach, although with only four photographs. Two of the photographs are faded and marred by colored pencil marks along parts of the stream course. However, one of the other photographs is adequate to suggest that occurrence of riparian vegetation is very similar to current conditions within the reach in the vicinity of Site 1 (see below) (Appendix B). The other photograph is of good quality and covers about three miles of the reach including "Neck Meadow," Wentworth Springs, and the current location of the Wentworth Springs Campground. This photograph suggests that the pattern of riparian vegetation occurrence is generally similar to current conditions. However, coniferous trees (mostly lodgepole pine) have increased in adjacent meadow areas (Appendix B; see also Appendix G). Portions of these meadows appear to have been shrub-dominated in 1940 and a stand of small deciduous trees (*Populus tremuloides* or *Populus balsamifera* var. *trichocarpa*) is discernible at the western end of Neck Meadow.

Loon Lake Dam Reach – Site 1 (Sub-reach LL3)

The study site encompasses a reach about 475 feet long (Appendix C). Representative site photographs are presented in Appendix D. Data collection at the site included greenline community types, woody species regeneration, and three vegetation cross-section transects. The site is approximately at elevation of 5,360 feet, and the stream gradient is approximately 1.6 percent. The valley floor is over 370 feet wide.

Gerle Creek at this site was between 25- and 40-feet-wide at the three transect locations (Tables 4.1.4-2 – 4.1.4-6, Figure 4.1.4-1 - 4.1.4-3, Appendix E). All three transects span the entire width of the riparian corridor. Bands of riparian shrubs occur on both banks in an almost continuous dense, although narrow band, with small areas of exposed boulders and cobble. The site includes a large vegetated point bar at Transect 1 and a small cobble bar at Transect 3. There are several

areas of instream boulder/cobble substrate at the site, which are all downstream of the large pool that terminates prior to Transect 1. The principal riparian shrub is *Alnus incana*, occurring sometimes with *Salix jepsonii* and another undetermined species of *Salix*. Woody riparian vegetation at this site was coverage class 4 (>75-100%) for both the left and right banks.

Herbaceous vegetation occurs on the edges of bars mostly on the left bank and there are small patches of *Darmera peltata* among boulders in the channel. On the right bank a backwater area is situated adjacent to the riparian shoreline and is intersected by Transect 2. This backwater area may have resulted from scouring in the last major flood. Transect 2 also intersects a large cobble bar vegetated around the margins by *Alnus incana* and *Salix* spp. In addition, two sapling *Pinus*, both estimated to be more than 20 years old, were located on the bar. Vegetation was sparse on the interior of the bar where there is little apparent soil development.

Community types along the greenline were largely comprised of *Alnus incana, Salix spp., Pinus contorta, Juncus xiphioides, Carex aquatilis, Lotus oblongifolius,* and *Darmera peltata*. Community types dominated by *Alnus incana* and most species of *Salix* are generally rated high for stability (Winward 2000), particularly when associated with *Carex aquatilis*. Winward (2000) does not present information on *Juncus xiphioides*; however, a similar species, *Juncus ensifolius,* is rated high for stability, and *J. xiphioides* is likely the same.

Exposed and undercut banks occurred in places at this site primarily along the right bank (where about 40 percent was described as undercut), and there is a steep slope with areas vulnerable to erosion on the left bank at the downstream end of the reach (about 18 percent of total left bank). Some conifers within the reach exhibited exposed root systems and there were several tree falls. Evidence of recent flooding was generally observed on both banks in the form of stained alder branches, flood debris, and scouring on boulders in the channel. There was no evidence for recent major floods; however, piles of flood-deposited large downed woody debris, damage to some older trees, and possibly the current distribution of cobble bars may be associated with flooding in 1986 and 1997. Despite these indicators, stream banks in the reach are generally well vegetated. Most of the plant species within the riparian zone are positively associated with the occurrence of moist soil conditions (Reed 1997). Sapling and seedling, *Alnus incana* and *Salix,* occurred in most riparian zones and were moderately well represented around the greenline. There was a relatively high proportion of dead or decadent *Alnus incana* at this site (most of these were categorized as "decadent" and occurred on the right bank), probably associated with areas of steep banks and undercutting.

Table 4.1.4-2. Loon Lake Dam Reach - Site 1 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Right Bank		Left Bank	
Alnus incana	237	*50.0*	120	*25.2*
Alnus incana-Spiraea densiflora	12	*2.5*	0	*0.0*
Alnus incana-Salix lucida	0	*0.0*	9	*1.9*
Alnus incana-Pinus contorta-Calocedrus decurrens	75	*15.8*	0	*0.0*
Alnus incana-Juncus xiphioides	0	*0.0*	18	*3.8*
Alnus incana-Darmera peltata	33	*7.0*	6	*1.3*
Salix jepsonii	0	*0.0*	60	*12.6*

Table 4.1.4-2. Loon Lake Dam Reach - Site 1 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.				
Greenline Community Type	**Right Bank**		**Left Bank**	
Salix lucida	0	*0.0*	18	*3.8*
Juncus xiphioides	69	*14.6*	153	*32.1*
Juncus xiphioides-Carex aquatilis	12	*2.5*	0	*0.0*
Juncus xiphioides-Carex aquatilis-Lotus oblongifolius	0	*0.0*	63	*13.2*
Juncus xiphioides-Lotus oblongifolius	0	*0.0*	9	*1.9*
Juncus xiphioides-Hypericum anagalloides	6	*1.3*	0	*0.0*
Carex aquatilis-Darmera peltata	0	*0.0*	15	*3.1*
Lotus oblongifolius	9	*1.9*	0	*0.0*
Lotus oblongifolius-Stachys alba	0	*0.0*	6	*1.3*
Solidago canadensis	6	*1.3*	0	*0.0*
Cobble with sparse herbs	9	*1.9*	0	*0.0*
Disturbed (trail) (no vegetation)	6	*1.3*	0	*0.0*

Table 4.1.4-3. Loon Lake Dam Reach - Site 1 Greenline Composition – Summary. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.				
Greenline Community Types	**Right Bank**		**Left Bank**	
TREE AND SHRUB DOMINATED TYPES	75	*15.8*	0	*0*
SHRUB DOMINATED TYPES	282	*59.5*	231	*48.5*
HERB DOMINATED TYPES	102	*21.6*	246	*51.5*
OTHER TYPES	15	*3.1*	0	*0.0*
TOTAL – ALL TYPES	474	100.0	477	100.0

Table 4.1.4-4. Loon Lake Dam Reach - Site 1 – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus incana* (8-12 ft tall). With *Spiraea densiflora, Hypericum anagalloides, Stachys alba, Panicum sp.,* and *Pteridium aquilinum.*	Riparian. Evidence of recent flooding.
Zone 2	Dominants: Mixed conifer forest (*Abies magnifica, Calocedrus decurrens,* and *Pinus contorta*). With *Pteridium aquilinum, Panicum sp.,* and *Linanthus sp.*	Upland. No evidence of flooding.
Left Bank:		
Zone 1	Dominants: *Salix sp.* (dense, 4-6 ft. tall). With *Alnus incana, Salix jepsonii, Lotus oblongifolius, Juncus xiphioides, Hypericum anagalloides, Stachys alba, Solidago canadensis, Viola macloskeyi, Helenium bigelovii, Platanthera leucostachys,* and *Juncus sp.*	Riparian. Cobble bar in stream
Zone 2	Dominants: Scattered *Alnus incana* and *Pinus contorta.* With *Cornus sericea, Spiraea densiflora, Solidago canadensis, Rumex sp., Pteridium aquilinum, Stachys alba, Boykinia major,* and *Carex aquatilis* (in a depression).	Cobble bar, sparsely vegetated. Older trees are flood damaged and there is flood deposited woody debris.

Table 4.1.4-4. Loon Lake Dam Reach - Site 1 – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 3	Dominants: Mixed conifer forest (large *Pinus lambertiana*, *Calocedrus decurrens*, and *Abies magnifica*). With *Pinus ponderosa* (sapling), *Quercus sp*. (seedling), *Arctostaphylos sp., Ribes sp*., and *Pteridium aquilinum*.	Upland. No evidence of flooding.

Table 4.1.4-5. Loon Lake Dam Reach - Site 1 – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus incana* (8-10 ft.) and *Juncus xiphioides*. With *Lotus oblongifolius; Hypericum anagalloides; Solidago canadensis, Viola macloskeyi, Carex aquatilis, Glyceria sp., Pteridium aquilinum,* and *Boykinia major*.	Riparian.
Zone 2	Dominants: *Alnus incana* (6-8 ft.), *Calocedrus decurrens* (8-12 ft.), and *Pinus contorta* (5-8 ft.). With *Spiraea densiflora, Thalictrum sp.*, *Pteridium aquilinum*, *Solidago canadensis*, *Oenothera sp*., *Achillea millefolium, Horkelia fusca,* and *Rumex acetosella*	Transitional. Coarse woody flood debris.
Zone 3	Dominants: Dense *Alnus incana* and *Pinus contorta* (trees 80 ft. tall and saplings). With *Pteridium aquilinum, Ribes lacustre*, *Calocedrus decurrens* (trees and saplings), and *Abies concolor* (saplings).	Transitional. On old cobble bar. Abundant large woody flood debris from major flood.
Zone 4	Dominants: *Pinus lambertiana* (125 ft. tall). With *Arctostaphylos sp. Symphoricarpos sp, Pteridium aquilinum, Abies magnifica,* and *Calocedrus decurrens* (few, more than 100 ft.)	Upland. On old cobble bar.
In channel:	Dominants: Sparse *Sparganium emersum* and *Juncus xiphioides.*	Backwater area with limited emergent vegetation.
Left Bank:		
Zone 1	Dominants: *Alnus incana* (8-12 ft.) and *Salix jepsonii* (2-4 ft.). With *Cornus sericea* (3-5 ft.), *Salix lucida* (3-10 ft.), *Pinus contorta* (10-15 ft.), *Juncus xiphioides, Scirpus macrocarpus*, *Lotus oblongifolius, Juncus howellii*, *Equisetum arvense*, *Helenium bigelovii*, *Viola macloskeyi*, *Veronica scutellata*, *Lupinus sp*, *Boykinia major*, *Platanthera leucostachys*.	Riparian. Herbaceous species concentrated near the water. Evidence of recent flooding.
Zone 2	Dominants: Patchy *Alnus incana* (8-12 ft.) and *Salix jepsonii*. With sparse *Equisetum arvense, Lotus oblongifolius, Poa sp., Carex aquatilis, Arctostaphylos sp, Pinus contorta* (20 ft), and *Calocedrus decurrens* (few, less than 3 ft.)	Transitional. On cobble bar. No evidence of recent flooding, but possible scouring during last major flood event.
Zone 3	Dominants: Mixed conifer forest (*Calocedrus decurrens* 100 ft. tall and *Pinus lambertiana* about 130 ft.). With *Spiraea densiflora, Symphoricarpos sp.,* and *Ribes sp.*	Upland. No evidence of flooding.

Table 4.1.4-6. Loon Lake Dam Reach - Site 1 – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Juncus xiphioides.* With *Salix jepsonii* (few, 4-6 ft. tall), *Alnus incana* (few, 5-6 ft. tall), *Lotus oblongifolius, Hypericum anagalloides, Helenium bigelovii, Rosa woodsii,* and *Glyceria sp.*	Riparian. Lower bank subject to periodic flooding.
Zone 2	Dominants: *Alnus incana* (6-10 ft. tall) and *Calocedrus decurrens* (50-100 ft. tall). With *Spiraea densiflora, Darmera peltata, Pteridium aquilinum, Arctostaphylos sp., Symphoricarpos sp., Pinus contorta* (saplings), and *Pinus ponderosa* (saplings).	Transitional. Sandy, with no evidence of recent flooding.
Zone 3	Dominants: Mixed conifer forest (*Pinus lambertiana, Calocedrus decurrens,* and sapling *Pinus contorta*). With *Pteridium aquilinum*, *Symphoricarpos sp., Alnus incana* (5-9 ft. tall), *Spiraea densiflora, Arctostaphylos sp*., and *Quercus sp*. (seedling).	Upland. No evidence of flooding.
Left Bank:		
Zone 1	Dominants: *Alnus incana* (6-15 ft. tall) and *Darmera peltata.* With *Spiraea densiflora, Carex aquatilis,* and *Equisetum arvense.*	Riparian. Flood evidence observed.
Zone 2	Dominants: Mixed conifer forest (large *Calocedrus decurrens* and *Abies magnifica*). With *Pinus ponderosa* (saplings), *Pinus contorta* (25 ft. tall), *Arctostaphylos sp*., and *Ribes sp*.	Upland. No evidence of flooding.

Table 4.1.4-7. Loon Lake Dam Reach - Site 1 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.

	RB Transect (645 feet)				LB Transect (597 feet)			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus incana	27	16	16	22	19	6	2	4
Salix sp	1		1		21	14	6	
Cornus sericea							4	
Spiraea densiflora	12	10	13		4	1		
Rosa sp.	1	6						
Pinus contorta	4	1	1	1			1	
Calocedrus decurrens	4	1						
Abies concolor		1						

Loon Lake Dam Reach – Site 2 (sub-reach LL10 and LL9)

The site encompasses a reach about 800 feet long (Appendix C), extending throughout most of sub-reach LL10 and into LL9. Representative site photographs are presented in Appendix D. Data on greenline community types (Table 4.1.4-8 and 4.1.4-9) and woody species regeneration (Table 4.1.4-13) were collected for the right bank and left bank, and data for three vegetation cross-section transects was collected and is presented in Tables 4.1.4-10 - 4.1.4-12, and Figures 4.1.4-4 - 4.1.4-6, Appendix E.

This site lies at the head of a meadow downstream of a steeper reach (A and Aa+) where the valley floor width is more than 400 feet wide; Gerle Creek was approximately 20 feet wide at this site. The riparian zone is generally about 40 feet wide on each bank, but merges with the meadow on the right bank, such that it is impossible to differentiate riparian from wetland influence. Overall, the right bank is characterized by a moderately wide, continuous band of riparian shrubs with some boulders and cobble covered by mud and organics. Similarly, the left bank is a continuous band of riparian shrubs although generally narrower and comprised of fewer woody species and a more confining upland community. The site is located in a Type V valley and has moderately low gradient. The primary riparian community type was mapped as *Alnus incana*-*Cornus sericea* although additional subordinate species were nearly as common in pockets.

The left bank community was characterized by a nearly continuous band of woody species, especially *Alnus incana, Pinus contorta, Cornus sericea,* and *Spiraea densiflora*. The right bank community was similar, except for a greater incidence of herbaceous vegetation at the edge of the channel and the occurrence of old channels and patches of meadow. The latter areas exhibited the high species richness typical for high elevation meadows. Woody riparian vegetation at this site was classified as canopy coverage class 4 (>75-100%) for both the left and right banks.

At this site, the banks generally appear stable with some evidence of bank undercutting and channel incision. Other signs of higher flows were a blown out side channel, and piles of woody debris found at the base of some existing trees.

Nearly 100 percent of the greenline was vegetated. Community types were primarily characterized by *Alnus incana*, *Pinus contorta*, *Cornus sericea*, and *Spiraea densiflora*; other woody species included *Salix geyeriana* and *Populus balsamifera var. trichocarpa*. Herbaceous greenline community types were principally characterized by *Juncus xiphioides* and *Lotus pinnatus*. Community types comprised of *Alnus incana, Cornus sericea*, and *Salix geyeriana* are generally rated high for stability, particularly when mesic forbs are also prominent (Winward 2000). Information on *Juncus xiphioides* and *Lotus pinnatus* is lacking; however, *Juncus ensifolius,* a species similar to *J. xiphioides*, is rated high for stability (Winward 2000).

There was some evidence of exposed and undercut banks at this site primarily along the right bank. Evidence for flooding was also observed on the right bank which had a bank crest approximately 3.2 feet above the water surface, but flattened out dramatically beyond the crest. Conversely, the left bank rose rapidly to upland zones with some boulder/cobble areas. Bank scour appeared limited to the areas with cobble or finer substrates. Most of the plant species within the riparian zone are positively associated with the occurrence of moist soil conditions (Reed 1997). There was a high proportion of mature *Alnus incana* (especially on the left bank), which may reflect the occurrence of relatively high banks not subject to scour except during periodic major flood events. The greatest number of saplings and seedlings were of the species *Alnus incana*, *Cornus sericea*, and *Pinus contorta*.

Table 4.1.4-8. Loon Lake Dam Reach - Site 2 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Right Bank		Left Bank	
Alnus incana	69	*8.4*	0	*0.0*
Alnus incana-Populus balsamifera var. trichocarpa	18	*2.2*	0	*0.0*
Alnus incana-Spiraea densiflora	0	*0.0*	117	*16.2*
Alnus incana-Pinus contorta	222	*26.9*	213	*29.5*
Alnus incana-Pinus contorta-Spiraea densiflora	12	*1.5*	114	*15.8*
Alnus incana-Lotus pinnatus-Helenium bigelovii	9	*1.1*	0	*0.0*
Cornus sericea	120	*14.6*	51	*7.1*
Cornus sericea-Populus balsamifera var. trichocarpa	0	*0.0*	9	*1.2*
Cornus sericea-Pinus contorta	39	*4.7*	105	*14.5*
Cornus sericea-Lotus pinnatus	39	*4.7*	0	*0.0*
Salix geyeriana	18	*2.2*	0	*0.0*
Spiraea densiflora	0	*0.0*	6	*0.8*
Spiraea densiflora-Pinus contorta	0	*0.0*	6	*0.8*
Spiraea densiflora-Lotus pinnatus	0	*0.0*	6	*0.8*
Spiraea densiflora-Lotus pinnatus-Juncus xiphioides-Glyceria elata	27	*3.3*	0	*0.0*
Pinus contorta	39	*4.7*	45	*6.2*
Pinus contorta-Glyceria elata	36	*4.4*	0	*0.0*
Juncus xiphioides	48	*5.8*	12	*1.7*
Juncus xiphioides-Lotus pinnatus	66	*8.0*	0	*0.0*
Juncus xiphioides-Lotus pinnatus-Senecio triangularis	51	*6.2*	0	*0.0*
Lotus pinnatus	6	*0.7*	0	*0.0*
Lupinus sp.	3	*0.6*	0	*0.0*
Boulder (no vegetation)	0	*0.0*	39	*5.4*

Table 4.1.4-9. Loon Lake Dam Reach - Site 2 Greenline Composition – Summary. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Types	Right Bank		Left Bank	
TREE DOMINATED TYPES	366	*44.4*	180	*24.9*
SHRUB DOMINATED TYPES	282	*34.3*	492	*68.0*
HERB DOMINATED TYPES	174	*21.3*	12	*1.7*
BOULDER COMMUNITY TYPES	0	*0.0*	39	*5.4*
TOTAL – ALL TYPES	822	*100.0*	723	*100.0*

Table 4.1.4-10. Loon Lake Dam Reach - Site 2 – Transect 1

	SPECIES AND ABUNDANCE	HABITAT
Right Bank:		
Zone 1	Dominants: *Alnus incana* (5-8 ft. tall), *Juncus xiphioides,* and *Lotus oblongifolius*. With *Senecio triangularis, Perideridia parishii, Lupinus polyphyllus, Mimulus primuloides, Hypericum anagalloides, Viola macloskeyi, Scirpus microcarpus, Glyceria sp., Carex aquatilis*, and *Poa sp.*	Riparian
Zone 2	Dominants: *Juncus xiphioides.* With *Mimulus primuloides, Hypericum anagalloides, Scirpus microcarpus, Carex aquatilis, Poa sp., Perideridia parishii, and Lotus oblongifolius.*	Flood water channel.

Table 4.1.4-10. Loon Lake Dam Reach - Site 2 – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 3	Dominants: *Pinus contorta* (mostly 10-18 ft. tall), *Alnus incana* (3-8 ft.), and *Cornus sericea.* With *Senecio triangularis, Solidago canadensis, Mimulus primuloides, Helenium bigelovii, Lotus oblongifolius, Poa sp., Glyceria sp., Lupinus polyphyllus, Juncus xiphioides, Prunus vulgaris, Lilium parvum,* and sapling *Calocedrus decurrens.*	Transitional. Some flooding evidence in low spots and meadow-like herbaceous species composition.
Left Bank:		
Zone 1	Dominants: *Alnus incana* and *Spiraea densiflora.* With *Senecio triangularis, Lotus oblongifolius, Athyrium filix-femina, Glyceria sp., Epilobium angustifolium, Ligusticum grayi, Ribes nevadense,* and *Lonicera sp.*	Riparian. Some scouring apparent along bank.
Zone 2	Dominants*:* Mixed conifer forest (*Calocedrus decurrens* and *Abies magnifica*). With *Juncus occidentalis, Ligusticum grayi, Viola sp., Aquilegia formosa, Amelanchier alnifolia, Lonicera sp., Symphoricarpos sp., Quercus sp.,* and *Rhododendron occidentale.*	Upland. Blown-out floodwater channel with abundant woody debris, gravel and rocks, and areas without vegetation.

Table 4.1.4-11. Loon Lake Dam Reach - Site 2 – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Juncus xiphioides.* With *Lotus oblongifolius, Perideridia parishii,* and *Viola macloskeyi.*	Riparian. On edge of channel, low and subject to periodic flooding.
Zone 2	Dominants: *Alnus incana* and *Pinus contorta.* With *Cornus sericea* and *Spiraea densiflora.*	Flood water channel with encroachment by woody vegetation.
Left Bank:		
Zone 1	Dominants: *Alnus incana* (8-10 ft. tall) and *Cornus sericea* (less than 8 ft. tall). With *Senecio triangularis, Athyrium filix-femina, Viola macloskeyi, Lotus oblongifolius,* and *Glyceria sp.*	Riparian. On stream bank (relatively steep).
Zone 2	Dominants*: Alnus incana* (5-13 ft. tall) and *Pinus contorta* (10-20 ft.). With *Cornus sericea, Populus balsamifera var. trichocarpa, Spiraea densiflora, Abies magnifica* (few, small), *Castilleja miniata, Senecio triangularis, Veratrum californicum, Viola macloskeyi, Stachys alba, Pyrola asarifolia, Orthilia secunda, Camassia quamash, Athyrium filix-femina,* and *Thalictrum sp.*	Transitional. Abundant LWD.

Table 4.1.4-12. Loon Lake Dam Reach - Site 2 – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus incana* (4-12 ft.) *and Pinus contorta* (8-25 ft.). With *Cornus sericea, Calocedrus decurrens,* and *Spiraea densiflora.*	Riparian. Scant herbaceous vegetation, abundant LWD.

Table 4.1.4-12. Loon Lake Dam Reach - Site 2 – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 2	Dominants: *Alnus incana* and *Pinus contorta.* With *Calocedrus decurrens, Veratrum californicum, Perideridia parishii, Prunella vulgaris, Fragaria virginiana, Solidago canadensis, Senecio triangularis, Horkelia sp. Lotus oblongifolius, Platanthera leucostachys, Castilleja miniata, Helenium bigelovii, Lilium parvum, Potentilla sp., Epilobium minutum, Glyceria sp, Camassia quamash, Rumex acetosella, Thalictrum sp., Mimulus guttatus, Stachys alba, Athyrium filix-femina, Circaea alpina, Cerastium, Mimulus guttatus,* and *Galium trifidum.*	Riparian merges with meadow.
Left Bank:		
Zone 1	Dominants: *Juncus xiphioides* and *Lotus oblongifolius.* With *Glyceria sp., Platanthera leucostachys, a*nd *Poa sp.*	Riparian. Cobble bar in stream.
Zone 2	Dominants*: Pinus contorta* (4 -20 ft.) and *Alnus incana* (5-12 ft. tall). With *Solidago canadensis*, *Glyceria sp, Athyrium filix-femina, Lotus oblongifolius, Viola macloskeyi, Horkelia sp., Stachys alba, a*nd *Cornus sericea.*	Riparian.
Zone 3	Dominants*: Carex aquatilis* and *Carex vesicaria.* With *Scirpus sp., Glyceria sp*, *Juncus xiphioides, Mimulus primuloides, Veratrum californicum,* and *Stachys alba.*	Moist depression.
Zone 4	Dominants*: Pinus contorta* (10-90 ft.) and *Populus balsamifera var. trichocarpa* (about 60 ft tall.). With *Spiraea densiflora, Alnus incana,* and *Abies magnifica.*	Transitional. Abundant LWD. Evidence of light flooding.
Zone 5	Dominants*: Alnus incana* (less than 3 ft.) and *Cornus sericea* (less than 3 ft.). With *Senecio triangularis, Glyceria sp., Lotus oblongifolius, Poa sp.,* and *Lilium parvum.*	Old channel.
Zone 6	Dominants*: Alnus incana* (4 to 6 ft.) and *Cornus sericea* (less than 5 ft. tall). With *Athyrium filix-femina, Glyceria sp.,* and *Lotus oblongifolius*	Edge of old channel, possibly still functioning as floodwater channel.
Zone 7	Dominants*:* Mixed conifer forest (*Pinus contorta* 20-50 ft. and *Abies magnifica* 20-40 ft.). With *Solidago canadensis*, *Viola sp.*, *Ribes nevadense*, *Horkelia sp.*, *Artemisia sp., Cornus sericea, Stachys alba, Mitella sp.,* and *Lotus oblongifolius.*	Upland, with no evidence of flooding.

Table 4.1.4-13. Loon Lake Dam Reach - Site 2 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.

	RB Transect (645 feet)				**LB Transect (597 feet)**			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus incana	57	25	4	12	75	1		6
Pinus contorta	33	36	6	8	20	15	5	1
Cornus sericea	50	17	5		56	14		1
Spiraea densiflora	32	1	1		72	5		
Populus balsamifera var. trichocarpa	1	1				3		
Salix lucida		1						

Table 4.1.4-13. Loon Lake Dam Reach - Site 2 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.

	RB Transect (645 feet)				LB Transect (597 feet)			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**	**Mature**	**Sapling**	**Seedling**	**Dead**
Calocedrus decurrens						1		
Abies magnifica			4		1	2		
Juniperus sp.	1		2			1		1
Sorbus californica				1		1		

Loon Lake Dam Reach – Site 3 (Sub-reach LL17)

This study site encompasses a Rosgen Type C/E reach with a 0.7% slope, about 650 ft in length (Appendix C). Representative site photographs are presented in Appendix D. Data on greenline community type (Table 4.1.4-14 and 4.1.4-15) and woody species regeneration (Table 4.1.4-19) were collected for the right bank and left bank. In addition, data were collected for three vegetation cross-section transects (Table 4.1.4-16 - 4.1.4-18, and Figure 4.1.4-7 - 4.1.4-9, Appendix E).

Gerle Creek at this site is a small stream. On the right bank, a large wet meadow is situated adjacent to and, in places, is almost indistinguishable from the riparian zone. Old channels were evident on the right bank; standing water in some of these channels may indicate seasonal over-bank flooding.

The banks at this site (Table 4.1.4-14) are entirely vegetated, mostly by dense, mature shrubs of *Alnus incana* and occasional *Salix* or mixed *Alnus-Salix. Pinus contorta* forest also occurs for short distances, with or without an understory of *Alnus incana.* The reach was mapped as Mountain Alder Alliance. Woody riparian vegetation at this site was classified as canopy coverage class 4 (>75-100%) for both the left and right banks.

Where the banks are low or where lateral bars have formed, herbaceous community types are prevalent, particularly communities that include *Juncus xiphioides, Carex aquatilis,* or *Carex vesicaria*. *Alnus incana* was a dominant species within about 41 and 35 percent of both the right and left bank greenline, respectively. Overall, shrub or tree and shrub-dominated communities comprised about half of the greenline. Willows were a minor component along the greenline. Herb-dominated community types occupied the rest of the greenline, occurring either on the bank or as plants rooted in shallow water. The principal herbaceous species of the emergent communities were *Juncus xiphioides* and *Carex vesicaria*. Community types comprised of *Alnus incana,* particularly with *Carex aquatilis, Glyceria spp.,* or other mesic herbs, are generally rated high for stability (Winward 2000). *Carex vesicaria* and *Carex aquatilis* are both rhizomatous and deep-rooted species (Potter 2003) likely to be effective in maintaining bank stability. Information on *Juncus xiphioides* is unavailable; however, Winward (2000) indicates that a similar species, *Juncus ensifolius,* is rated high for stability.

The extent of herbaceous vegetation within the channel suggests an absence of recent high flows. Fine sediments have accumulated at the stream margins and in backwaters. Short sections along

the right bank were slightly undercut. Most of the plant species within the riparian zones are positively associated with the occurrence of moist soil conditions (Reed 1997). A large number of mature *Alnus incana* occurred around the greenline, but good numbers of saplings, seedlings, dead, and decadent plants are indicative of periodic replacement. Two mature *Alnus incana* from the site were aged at least eight and 17 years old.

Table 4.1.4-14. Loon Lake Dam Reach - Site 3 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Right Bank		Left Bank	
Alnus incana	201	*31.2*	36	*6.0*
Alnus incana-Spiraea densiflora	45	*6.9*	33	*5.5*
Alnus incana-Carex aquatilis	0	*0.0*	63	*10.4*
Alnus incana-Carex vesicaria	0	*0.0*	12	*2.0*
Alnus incana-Juncus xiphioides	0	*0.0*	18	*3.0*
Alnus incana-Glyceria elata	0	*0.0*	27	*4.4*
Alnus incana-Athyrium filix-femina	15	*2.3*	0	*0.0*
Salix sp.	21	*3.3*	57	*9.5*
Salix exigua	0	*0.0*	9	*1.5*
Spiraea densiflora	0	*0.0*	33	*5.5*
Spiraea densiflora-Carex aquatilis	0	*0.0*	*9*	*1.5*
Pinus contorta	12	*1.9*	9	*1.5*
Pinus contorta-Alnus incana	0	*0.0*	21	*3.4*
Pinus contorta-Alnus incana-Spiraea densiflora	3	*0.5*	0	*0.0*
Pinus contorta-Spiraea densiflora	12	*1.9*	12	*1.9*
Pinus contorta-Carex aquatilis	9	*1.4*	0	*0.0*
Carex aquatilis	90	*13.9*	45	*7.5*
Carex aquatilis-Glyceria elata	0	*0.0*	6	*1.0*
Carex aquatilis-Juncus xiphioides	0	*0.0*	15	*2.5*
Carex vesicaria	0	*0.0*	30	*4.9*
Carex vesicaria-Juncus xiphioides	0	*0.0*	99	*16.4*
Juncus xiphioides	231	*35.8*	48	*8.0*
Juncus xiphioides-Poa sp.	0	*0.0*	9	*1.5*
Athyrium filix-femina	0	*0.0*	6	*1.0*
Unidentified grass	6	*0.9*	0	*0.0*

Table 4.1.4-15. Loon Lake Dam Reach - Site 3 Greenline Composition – Summary.

Greenline Community Types	Right Bank		Left Bank	
TREE AND SHRUB DOMINATED TYPES	36	*5.6*	42	*7.0*
SHRUB DOMINATED TYPES	282	*43.7*	297	*49.7*
HERB DOMINATED TYPES	327	*50.7*	258	*43.3*
TOTAL - ALL TYPES	645	*100.0*	597	*100.0*

Table 4.1.4-16. Loon Lake Dam Reach - Site 3 – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Carex aquatilis.* With *Juncus xiphioides* (on water's edge only)*, Veratrum californicum*, *Viola sp., Poa sp.*, *Mentha spicata, Galium trifidum,* and *Spiraea densiflora*.	Riparian.
Zone 2	Dominants: *Carex aquatilis* and *Poa sp.* With *Juncus xiphioides, Carex vesicaria, Galium trifidum, Veratrum californicum, Mentha spicata, Carex sp.*, and *Alnus incana* (few saplings).	Meadow depression.
Zone 3	Dominants: *Veratrum californicum.* With *Senecio triangularis, Poa sp., Viola sp., Helenium bigelovii, Stachys alba, Mentha spicata,* and *Spiraea densiflora.*	Meadow.
Zone 4	Dominants: *Carex aquatilis, Carex vesicaria, Carex jonesii* (few), *Viola sp., Veratrum californicum* (edge). Scattered *Alnus incana* and small *Pinus contorta.*	Meadow.
Zone 5	Dominants: *Spiraea densiflora* and *Vaccinium sp.*	Meadow.
Zone 6	Dominants: patches of small *Pinus contorta* (10-15 ft. tall). With *Poa sp., Spiraea densiflora,* and *Salix* (6 ft.). Dominants (in depression): *Veratrum californicum, Juncus xiphioides,* and *Mimulus primuloides.*	Transitional (meadow to forested). Wet depression.
Left Bank:		
Zone 1	Dominants: *Alnus incana* and *Carex aquatilis.* With *Pinus contorta* (one sapling).	Riparian
Zone 2	Dominants: *Pinus contorta* (20-25 ft.) and *Carex aquatilis.* With scattered *Alnus incana, Salix sp., Poa palustris, Viola sp,* and *Veratrum californicum.*	Upland or transitional. Scattered depressions are moist.

Table 4.1.4-17. Loon Lake Dam Reach - Site 3 – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus incana* (8 ft. tall*)* and *Pinus contorta* (12-15 ft.). With *Carex aquatilis* and *Pyrola asarifolia.*	Riparian.
Zone 2	Dominants: *Carex aquatilis* and *Poa sp.* With *Veratrum californicum.*	Meadow.
Zone 3	Dominants: *Carex aquatilis.*	Side channel in meadow.
Zone 4	Dominants: *Pinus contorta*, *Veratrum californicum*, and *Senecio triangularis*.	Transitional (meadow to forested).
Left Bank:		
Zone 1	Dominants: *Carex aquatilis.* With *Juncus xiphioides, Galium sp.,* and *Poa sp.*	Riparian (emergent at water's edge).
Zone 2	Dominants: *Juncus xiphioides, Carex vesicaria,* and *Poa sp.* With scattered *Pinus contorta* (12 ft.). .	Riparian (stream bank).
Zone 3	Dominants*:* Dense, even-aged *Pinus contorta.* With *Galium sp., Poa sp., Pyrola asarifolia, Glyceria sp., Veratrum californicum,* and *Spiraea densiflora.*	Upland.

Table 4.1.4-18. Loon Lake Dam Reach - Site 3 – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: Dense *Alnus incana* (8-12 ft.) and *Carex aquatilis.* With *Pinus contorta* (12-15 ft.), *Salix sp., Athyrium filix-femina*, *Poa sp,* and *Mimulus primuloides*.	Riparian. Moderately sloped, undercut banks.
Zone 2	Dominants: *Carex aquatilis.* With *Salix sp.* (10-12 ft.) and *Poa sp.*	Riparian. Meadow area adjacent to creek. Evidence of flooding.
Left Bank:		
Zone 1	Dominants: *Carex vesicaria.* With *Juncus xiphioides* and *Carex aquatilis.*	Riparian (backwater currently flooded).
Zone 2	Dominants: *Pinus contorta* (5-10 ft.) and *Abies magnifica* (2-6 ft.). *With Juncus effusus, Mitella breweri, Pteridium aquilinum,* and *Spiraea densiflora.*	Upland. No evidence of flooding.

Table 4.1.4-19. Loon Lake Dam Reach - Site 3 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.

	RB Transect (645 feet)				LB Transect (597 feet)			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus incana	74	41	19	10	46	28	8	5
Pinus contorta	38	42	24	8	69	45	13	29
Salix sp	10	10	3	11	28	4		5
Spiraea densiflora	52	30	32	2	76	39	27	
Abies magnifica	1							
Lonicera sp.	1				3	7		

4.1.5 Gerle Creek Dam Reach

The Gerle Creek Dam Reach is located on Gerle Creek, extending from the base of Gerle Creek Dam to the confluence with the South Fork Rubicon River. This section of river is 1.1 miles long, extends through a range of elevations from 5,182 to 4,980 feet, and has a mean gradient of approximately 3.5 percent.

Gerle Creek is a small creek with a channel about 15-60 feet wide. The Gerle Creek Dam Reach contains only two geomorphic sub-reaches: the upper reach (GC2) is a narrow bedrock canyon classified Rosgen type A, whereas portions of the lower reach (GC1) (Rosgen type B) are alluvial (*Channel Morphology Technical Report*).

The reach is characterized by narrow and discontinuous bands of riparian shrubs, reflecting the occurrence of exposed bedrock and large boulders, a Type II valley, and moderately steep gradient (Appendix A). Areas of bedrock and boulders are devoid of vegetation or sparsely vegetated. Based on information from an intensive survey site, riparian vegetation was mapped as Mountain Alder Alliance; this vegetation type occupies 1.67 acres. Overall, 40 percent of the shoreline in the reach has riparian vegetation, all of it Mountain Alder Alliance. Riparian vegetation polygons ranged in width from 5- to 30-feet (mean = 14).

The 1952 and 1976 historical aerial photographs of this reach lacked sufficient resolution to draw definitive conclusions about the extent or types of riparian vegetation that may have occurred. Both of the photo sets are from relatively high elevation flights and are printed at 1:20,000 scale (1952 series) and 1:15,840 scale (1976 series). Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. The historical photos appear to indicate that extent of coverage by conifers has not changed markedly. It was possible to see the boulder and riffle areas in the stream, which appear to have not changed. The position of the stream channel has not undergone apparent change. The 1940 aerial photographic series encompassed a portion of this reach; however, the photographs were of poor quality (badly faded), inadequate to detect riparian vegetation, and marred by colored pencil marks along the stream course.

Gerle Creek Dam Reach - Site 1 (Sub-reach GC1)

The study site encompasses a reach about 500 feet in length (Appendix C). Representative site photographs are presented in Appendix D. Data on greenline community type (Table 4.1.5-1 and 4.1.5-2) and woody species regeneration (Table 4.1.5-5) were collected for the right bank and left bank, and there were two vegetation cross-section transects (Tables 4.1.5-3 and 4.1.5-4).

The riparian zone at this site is generally narrow (Figure 4.1.5-1 and 4.1.5-2, Appendix E), and vegetation is discontinuous due to the frequency of boulders and bedrock. However, a wider zone is riparian-influenced and is floristically transitional to uplands where no riparian species occur. The stream banks are well vegetated relative to the presence of suitable substrates and even some of the rocky substrates are vegetated by *Darmera peltata* (Indian rhubarb) and occasional *Alnus incana*. Overall, woody riparian vegetation at this site was classified as canopy coverage class 2 (>25-50%) for both the left and right banks.

Within the channel there are numerous boulders and scattered patches of *Darmera peltata*. At both cross-sections there are scattered boulders on the left and right banks. There is a terrace on the right bank, whereas the left bank is located near the valley slope. Nonetheless, *Darmera peltata*, *Alnus incana*, and other characteristic riparian species occur at high elevation positions on the left side of the valley, suggesting that they are supported by seasonal seepage.

Bank stability at this site is largely governed by bedrock and massive boulders, which constitute more than half of the greenline. Dominant species within the greenline were *Alnus incana*, *Carex aquatilis* (water sedge), and *Darmera peltata*; other species that characterized much smaller sections of the greenline were *Cornus sericea*, *Salix jepsonii*, *Spiraea densiflora,* and *Lotus oblongifolius*. Community types dominated by *Alnus incana*, *Cornus sericea*, and most species of *Salix* are generally rated high for stability (Winward 2000), particularly when associated with *Carex aquatilis*. Winward does not present information on *Juncus xiphioides*; however, a similar species, *Juncus ensifolius,* is indicated to be an effective bank stabilizer. Based on observations of *Darmera peltata* firmly rooted in fast flowing water at this and other sites, it is also probably an effective bank stabilizer. There were no exposed banks at this site except where substrates (rock) precluded vegetation. Evidence for flooding, including scoured vegetation and deposits of sand, were observed high on the right bank. Most of the plant species

within the riparian zones are positively associated with the occurrence of moist soil conditions (Reed 1997). A representative mature *Alnus incana* at this site was determined to be 14 years old based on analysis of annual growth rings. The relatively high incidence of seedlings, saplings, and dead or decadent *Alnus incana* at this site may indicate periodic scouring or reflect the challenging conditions associated with bedrock and boulder substrates.

Table 4.1.5-1. Gerle Creek Dam Reach - Site 1 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Right Bank		Left Bank	
Alnus incana	54	*10.8*	18	*3.6*
Alnus incana-Salix lucida	6	*1.2*	0	*0.0*
Alnus incana-Spiraea densiflora	3	*0.6*	0	*0.0*
Alnus incana-Cornus sericea	0	*0.0*	3	*0.6*
Alnus incana-Carex aquatilis	39	*7.8*	3	*0.6*
Alnus incana-Darmera peltata	9	*1.8*	33	*6.6*
Alnus incana-Carex aquatilis-Darmera peltata	6	*1.2*	0	*0.0*
Cornus sericea	3	*0.6*	0	*0.0*
Salix jepsonii-Darmera peltata	6	*1.2*	0	*0.0*
Darmera peltata	66	*13.2*	114	*22.9*
Darmera peltata-Carex aquatilis	36	*7.2*	0	*0.0*
Darmera peltata-Lotus oblongifolius	0	*0.0*	24	*4.8*
Juncus xiphioides-Lotus oblongifolius	3	*0.6*	0	*0.0*
Bedrock/Boulder (no vegetation)	261	*52.1*	258	*51.8*
Bedrock- sparse Darmera peltata	9	*1.8*	42	*8.4*
Bedrock- sparse Alnus incana	0	*0.0*	3	*0.6*

Table 4.1.5-2. Gerle Creek Dam Reach - Site 1 Greenline Composition – Summary.

Greenline Community Types	Right Bank		Left Bank	
SHRUB DOMINATED TYPES	126	*25.2*	57	*11.4*
HERB DOMINATED TYPES	105	*21.0*	138	*27.7*
BEDROCK/BOULDER COMMUNITY TYPES	270	*53.8*	303	*60.9*
TOTAL - ALL TYPES	501	*100.0*	498	*100.0*

Table 4.1.5-3. Gerle Creek Dam Reach - Site 1– Transect 1

	SPECIES AND ABUNDANCE	HABITAT
Right Bank:		
Zone 1	Dominants: *Alnus incana* (shrubs 5-8 ft. tall) and *Darmera peltata*. With few *Cornus sericea*. Other herbs are *Carex aquatilis, Lotus oblongifolius, Juncus xiphioides, Epilobium sp., Lupinus sp., Helenium bigelovii, Perideridia parishii,* and *Platanthera leucostachys*	Riparian. Narrow zone
Zone 2	Dominants: Mixed conifer forest (*Abies magnifica*, *Pinus ponderosa*, and *Pseudotsuga menziesii*). With *Amelanchier alnifolia* (shrubs less than 3 ft. tall), and *Rosa sp*.	Upland. Numerous boulders

Table 4.1.5-3. Gerle Creek Dam Reach - Site 1– Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	Dominants: *Alnus incana* (shrubs 5-15 ft. tall). With few *Salix jepsonii* (shrubs less than 3 ft. tall), *Cornus sericea* (shrubs 5-10 ft. tall); and *Darmera peltata*, *Juncus xiphioides, Epilobium sp. Hypericum anagalloides, Glyceria sp.,* and *Pteridium aquilinum.*	Riparian. Species composition similar on valley slope above obvious riparian influence (probably supported by groundwater seepage).

Table 4.1.5-4. Gerle Creek Dam Reach - Site 1 – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus incana* (shrubs 6-9 ft. tall) and *Carex aquatilis*. With *Cornus sericea, Darmera peltata, Perideridia parishii, Angelica sp., Hypericum anagalloides, Poa sp., Helenium bigelovii, Platanthera leucostachys,* and *Lotus oblongifolius.*	Riparian. Bedrock with narrow riparian zone. Flooding evidence observed.
Zone 2	Dominants: Mixed conifer forest: *Abies concolor* (20-75 ft. tall), *Pseudotsuga menziesii* (trees 130 ft. tall), *Pinus ponderosa* (saplings 10-15 ft. tall), and *Calocedrus decurrens* (saplings 5-15 ft. tall). With *Prunus sp.*, *Amelanchier alnifolia, Rosa sp., Symphoricarpos sp., Chamaebatia foliolosa, Ribes sp., Spiraea densiflora, Lonicera sp.*	Upland. Some apparent flood debris observed.
Left Bank:		
Zone 1	Dominants: *Alnus incana* (shrubs 5-12 ft. tall). With *Darmera peltata, Poa sp., Carex sp., Epilobium sp., Aquilegia sp., Viola sp., Senecio triangularis,* and *Galium sp.*	Riparian. Flooding evidence observed.
Zone 2	Dominants: Mixed conifer forest. With scattered *Alnus incana*.	Transitional zone. Scattered boulders. No evidence of flooding.

Table 4.1.5-5. Gerle Creek Dam Reach - Site 1 Greenline Woody Species Composition. Woody species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.

	RB Transect (501 feet)				**LB Transect (498 feet)**			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus incana	41	32	62	14	2	15	27	6
Salix jepsonii	1	2				1		
Cornus sericea	2	3	2		4	1	1	
Spiraea densiflora	14	10	13	2	5	10	17	
Amelanchier alnifolia			4					
Rosa sp.	8	5						
Rubus parviflorus					2			
Rhododendron occidentale		2						
Ribes nevadense								1
Lonicera involucrata?						2		
Arctostaphylos sp.			1					
Calocedrus decurrens		1	3					
Abies magnifica			6					
Abies concolor			1					

4.1.6 Robbs Peak Dam Reach

The Robbs Peak Dam Reach is located on the South Fork Rubicon River and extends from the base of Robbs Peak Dam to the confluence with the Rubicon River. This section of river is 5.6 miles long, extends through a range of elevations from 5,190 to 3,540 feet, and has a mean gradient of about 293 feet/mile (5.5 percent). Major inflows to this reach include Gerle Creek and South Creek.

South Fork Rubicon River is a small creek with a channel about 10-45 ft wide. The Robbs Peak Dam Reach contains 17 geomorphic sub-reaches, most of which are Rosgen type A, Aa+, or B (*Channel Morphology Technical Report*). The lower reaches are steep and within bedrock canyons with minimal habitat for riparian vegetation, whereas the upper reaches exhibit a much more moderate gradient and are alluvial. There was one study site located within the upper section (sub-reach RP15). The site corresponds to the channel morphology study site. In addition to the study site, ground-truth surveys were conducted at three other sites located in sub-reach 12, 15, and 16 (see Figure 3.4-1 – located at the end of the text).

The aerial video of the reach indicates that downstream of sub-reach RP9 riparian vegetation is extremely scarce because of bedrock confinement. In this part of the reach there are a few small patches of *Darmera peltata* on the banks or within the channel, and occasional low shrubs. The subsequent reach includes limited areas of alluvium, and riparian shrubs occur intermittently. Large patches of *Darmera peltata* are found in sub-reach 14. It is not until sub-reach 15 that conditions are suitable for a well-developed riparian corridor. At three ground-truth sites and at the study site (see below), riparian vegetation is classifiable as Mountain Alder Alliance. Other minor shrubs within the riparian corridor were *Cornus sericea*, *Salix* spp., *Spiraea densiflora*, and *Rhododendron occidentale. Darmera peltata* occurred in varying extent, mostly in patches within the channel. There are about 4.6 acres of riparian vegetation on this reach, 98 percent of which is Mountain Alder Alliance (the rest is Willow Alliance) (Appendix A). Overall, 43.2 percent of the shoreline in the reach has riparian vegetation. Riparian vegetation polygons ranged in width from 5 to 65 feet (mean = 22).

The 1952 and 1976 historical aerial photographs of this reach lacked sufficient resolution to draw definitive conclusions about the extent or types of riparian vegetation that may have occurred. Both of the photo sets are from relatively high elevation flights and are printed at 1:20,000 scale (1952 series) and 1:15,840 scale (1976 series). Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. The historical photos appear to indicate that extent of coverage by conifers has not changed markedly. It was not possible to see the in-stream habitats with any clarity due to poor resolution. The position of the stream channel has not undergone apparent change. The 1940 aerial photographic series encompassed a portion of this reach; however, the photographs were of poor quality (badly faded), inadequate to detect riparian vegetation, and marred by colored pencil marks along the stream course.

Robbs Peak Dam Reach – Site 1 (Sub-reach RP15)

The study site encompasses a reach approximately 400 feet long (Appendix C). Representative site photographs are presented in Appendix D. Data on greenline community type (Table 4.1.6-1 and 4.1.6-2) and woody species regeneration (Table 4.6.1-5) were collected for the right bank and left bank, and there were two vegetation cross-section transects (Table 4.6.1-3 and 4.6.1-4).

The width of the riparian zone at this site largely reflects the presence of two point bars within the reach (Figure 4.1.6-1 and 4.1.6-2, Appendix E). A large point bar consisting of sand, gravel, and cobbles is located on the left bank and is followed downstream by a sandy point bar on the right bank. Shrubs (mostly *Alnus incana*) are generally dense within the riparian zone except in the driest parts of the bars where little or no vegetation occurs. Overall, woody riparian vegetation at this site was classified as canopy coverage class 4 (>75%-100%) for both the left and right banks.

The banks at this site are almost entirely vegetated; boulders that were devoid of vegetation or sparsely vegetation comprised only a small part of the greenline (Table 4.1.6-1). *Alnus incana* was a dominant species within about 70 percent of both the left and right bank greenline. The abundance of *Cornus sericea* was greatest on the left bank where it was in dominant species along 48 percent of the greenline. Herb-dominated community types occupied about 25 percent of each greenline and *Juncus xiphioides* was by far the most prevalent herbaceous species. This species along with *Darmera peltata*, *Carex vesicaria*, and *Glyceria elata*, typically occurred rooted underwater in shallow water. Community types characterized by *Alnus incana, Cornus sericea,* and *Glyceria spp.* are rated high for stability (Winward 2000). Based on rooting characteristics and other field observations, *Carex vesicaria, Darmera peltata,* and *Juncus xiphioides* are also almost certainly effective bank stabilizers.

Evidence of flooding included the presence of an overflow channel. However, dense woody vegetation has colonized alluvial bars on both sides of the stream and herbaceous vegetation was rooted underwater in places, suggesting an absence of recent high flows capable of scouring vegetation. Most of the plant species within the riparian zones are positively associated with the occurrence of moist soil conditions (Reed 1997). Three mature *Alnus incana* from the site were aged at least 12, 13, and 18 years old. Mature *Alnus incana* were predominant around the greenline, with scarce saplings or seedlings. However, sapling or seedling *Alnus incana* were observed in all riparian zones.

Table 4.1.6-1. Robbs Peak Dam Reach - Site 1 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Right Bank		Left Bank	
Alnus incana	204	*50.1*	84	*21.5*
Alnus incana-Cornus sericea	42	*10.5*	168	*42.7*
Alnus incana-Cornus sericea-Salix sp.	0	*0.0*	21	*5.3*
Alnus incana-Salix sp.-Juncus xiphioides	9	*2.2*	0	*0.0*
Alnus incana-Carex aquatilis- Juncus xiphioides	18	*4.5*	0	*0.0*
Alnus incana-Juncus xiphioides-Glyceria elata	6	*1.5*	0	*0.0*
Alnus incana-Darmera peltata	12	*3.0*	0	*0.0*

Table 4.1.6-1. Robbs Peak Dam Reach - Site 1 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.				
Greenline Community Type	**Right Bank**		**Left Bank**	
Cornus sericea	18	*4.5*	0	*0.0*
Juncus xiphioides	6	*1.5*	0	*0.0*
Juncus xiphioides-Carex vesicaria	0	*0.0*	36	*9.2*
Juncus xiphioides-Glyceria elata	21	*5.2*	48	*12.2*
Juncus xiphioides-Juncus effusus-Boykinia major	0	*0.0*	6	*1.5*
Juncus xiphioides-Lotus sp.	0	*0.0*	6	*1.5*
Juncus xiphioides-Mimulus guttatus	9	*2.2*	0	*0.0*
Juncus xiphioides-Lupinus polyphyllus-Boykinia major	12	*3.0*	0	*0.0*
Darmera peltata	12	*3.0*	0	*0.0*
Glyceria elata-Senecio triangularis-Lotus sp.	15	*3.7*	0	*0.0*
Senecio triangularis-Mimulus guttatus-Lotus sp.-Boykinia major	9	*2.2*	0	*0.0*
Rumex acetosella - Luzula sp.	9	*2.2*	0	*0.0*
Boulders (no vegetation)	0	*0.0*	9	*2.3*
Boulders- sparse Darmera peltata	0	*0.0*	15	*3.8*

Table 4.1.6-2. Robbs Peak Dam Reach - Site 1 Greenline Composition – Summary.				
Greenline Community Types	**Right Bank**		**Left Bank**	
SHRUB DOMINATED TYPES	309	*76.9*	273	*69.5*
HERB DOMINATED TYPES	93	*23.1*	96	*24.4*
BOULDER COMMUNITY TYPES	0	*0.0*	24	*6.1*
TOTAL - ALL TYPES	402	*100.0*	393	*100.0*

Table 4.1.6-3. Robbs Peak Dam Reach - Site 1 – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank		
Zone 1	Dominants: Scattered conifers 30-40 ft. tall (*Pinus contorta* and *Calocedrus decurrens*), with dense *Alnus incana* along the stream. Also *Rosa woodsia, Rhododendron occidentale, Lonicera sp., Smilacina stellata,* and *Monardella odoratissima.*	Riparian. Relatively high bank (4 ft. above current water)
Left Bank		
Zone 1a	Dominants: Dense *Alnus incana* (shrubs 6 ft. tall), *Cornus sericea* (shrubs 5 ft. tall), and abundant herbaceous cover (*Lotus oblongifolius, Glyceria, Juncus xiphioides, Boykinia major, Luzula sp., Senecio triangularis*). Other species include *Salix sp.* and few *Pinus contorta*.	Riparian on edge of main channel.
Zone 1b	Dominants: *Juncus xiphioides, Carex vesicaria, Hypericum formosum, Lotus oblongifolius, Panicum, Luzula, Lonicera,* and *Alnus incana* (saplings).	Riparian (herbaceous greenline community, including plants rooted under water) on low edge of backwater bay. Consistently moist and subject to flooding.
Zone 2	Dominants: *Alnus incana* (shrubs 6 ft. tall) and *Cornus sericea* (shrubs 6 ft. tall). With scattered small *Pinus contorta* (17 ft. tall), *Glyceria sp.*, *Boykinia major*, *Lonicera sp.*, *Rubus parviflorus*, *Ribes sp.*, and *Spiraea densiflora.*	Riparian on alluvial bar (sand and gravel).

Table 4.1.6-3. Robbs Peak Dam Reach - Site 1 – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 3	Dominants: Patchy *Alnus incana* (shrubs 7 ft. tall). Coverage by other shrubs and herbs is also variable: *Spiraea densiflora*, *Thalictrum sp.*, *Lotus oblongifolius*, *Polygonum phytolaccifolium*, *Scirpus microcarpus*, *Aquilegia* sp., and *Penstemon laetus.*	Riparian on alluvial bar (gravel, cobble, and small boulders). No evidence of recent flooding. The pattern of vegetation is indicative of drier conditions than in preceding zones.
Zone 4	Dominants: *Alnus incana.* Herbs more sparse than in zone 3: *Dicentra formosa, Thalictrum sp., Rumex acetosella, Senecio triangularis, Polygonum phytolaccifolium, Ribes sp., Calocedrus decurrens* (seedlings), and *Agastache urticifolia.*	Riparian transitional on alluvial bar (sandy). No evidence of recent flooding.
Zone 5	Dominants: Mixed conifer forest (*Calocedrus decurrens* and *Abies concolor*). With *Aquilegia formosa*, and *Ribes sp*.	Upland.

Table 4.1.6-4. Robbs Peak Dam Reach - Site 1 – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: Mixed herbaceous (*Senecio triangularis, Boykinia major, Galium sp., Circaea alpina, Glyceria sp., Geum macrophyllum,* and *Thalictrum sp.*	Riparian. Bank slightly undercut.
Zone 2	Dominants: *Alnus incana* (8-9 ft. tall). With *Cornus sericea* (8 ft. tall), *Salix sp., Glyceria sp., Mimulus moschatus, Equisetum arvense, Galium sp., Thalictrum sp., Stellaria longipes, Artemisia douglasiana, Stachys alba, Cicuta douglasii* (?), and *Polygonum phytolaccifolium.*	Riparian.
Zone 3	Dominants: *Rubus parviflorus* (small) and *Ribes sp.* With *Senecio triangularis, Abies sp.* (seedlings), *Galium aparine, Circaea alpina, Cornus sericea* (small), *Aquilegia formosa, Mimulus guttatus, Osmorhiza sp., Geum macrophyllum, Equisetum arvense, Mitella sp.,* and *Lonicera sp.*	Upland. No evidence of recent flooding, but there is sandy alluvium.
In Channel:	Scattered herbaceous vegetation (*Panicum sp., Glyceria sp., Mimulus guttatus, Juncus xiphioides, Senecio triangularis, Athyrium filix-femina, Hypericum anagalloides, Luzula sp., Viola macloskeyi, Galium sp., Lotus oblongifolius, Equisetum arvense, Darmera peltata,* and occasional seedling *Alnus incana* and *Salix sp.*	Shallow water areas and cobbles subject to periodic flooding.
Left Bank:		
Zone 1	Dominants: Mixed herbs (*Boykinia major, Senecio triangularis, Lotus sp., Glyceria sp., Rumex acetosella, Geum macrophyllum, Juncus xiphioides, Circaea alpina, Mimulus guttatus, Platanthera leucostachys, Prunella vulgaris,* and *Hypericum anagalloides*). *Salix sp.* (saplings only) and *Alnus incana* (saplings only).	Riparian on lower bank and emergent edge; also includes a small floodwater channel.

Table 4.1.6-4. Robbs Peak Dam Reach - Site 1 – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 2	Dominants: *Alnus incana*. With *Pinus contorta* (saplings, few), *Mimulus moschatus, Lupinus polyphyllus, Senecio triangularis, Rumex acetosella, Glyceria sp., Hypericum formosum, Hypericum anagalloides, Athyrium filix-femina, Boykinia major, Dicentra formosa, Lotus oblongifolius, Spiraea densiflora, Juncus effusus, Cornus sericea, Galium aparine, Carex vesicaria, Carex aquatilis, Ribes sp., Prunella vulgaris, Rubus parviflorus, Lilium parvum, Juncus tenuis* (?)*, Juncus chlorocephalus, Luzula sp., Panicum acuminatum,* and *Calocedrus decurrens* (seedling).	Riparian on upper bank.
Zone 3	Dominants: Dense thicket of *Alnus incana* (to 10 ft. tall). With *Cornus sericea, Salix sp., Thalictrum sp., Rubus parviflorus, Athyrium filix-femina, Circaea alpina, Dicentra formosa, Stachys alba, Lotus sp., Galium triflorum, Ribes spp., Boykinia major,* and *Pteridium aquilinum.*	Riparian on sandy bar. No evidence of recent flooding.
Zone 4	Dominants: *Alnus incana* (7 ft. tall) and *Carex aquatilis.* With *Salix sp.* (8 ft. tall), *Panicum sp., Pteridium aquilinum, Athyrium filix-femina, Equisetum arvense, Lotus oblongifolius, Solidago canadensis, Heracleum lanatum, Boykinia major, Spiraea densiflora, Prunella vulgaris, Galium aparine, Galium triflorum, Hypericum anagalloides, Glyceria sp., Luzula sp., Carex feta* (?)*, Carex athrostachya, Pinus contorta* (sapling), and *Circaea alpina.*	Depression (old channel) that floods during high water periods
Zone 5	Dominants: *Alnus incana* (8 ft. tall) thicket. With *Cornus sericea, Populus tremuloides* (saplings), *Pinus contorta* (sapling), *Rosa sp., Dicentra formosa, Agastache urticifolia,* and unknown grass.	Riparian on sandy bar. No evidence of recent flooding.
Zone 6	Dominants: Sparsely vegetated, with scattered sapling *Pinus contorta* and *Populus tremuloides,* and sparse herbs (*Sidalcea sp., Ceanothus sp., Mimulus moschatus, Polygonum phytolaccifolium, Eriophyllum lanatum,* and *Lomatium sp.*).	Sandy bar. No evidence of recent flooding.
Zone 7	Dominants: Mixed conifer forest (*Abies concolor, Pinus contorta* [80 ft. tall]) and *Populus tremuloides.* With *Alnus incana.*	Upland.

Table 4.1.6-5. Robbs Peak Dam Reach - Site 1 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.				
	LB Transect (393 feet)			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus incana	Not recorded*	12	1	1
Salix sp	14	15		
Cornus sericea	26	14	2	
Spiraea densiflora	4			
Rosa sp.	6			
Rhododendron occidentale	3			

Table 4.1.6-5. Robbs Peak Dam Reach - Site 1 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.				
	LB Transect (393 feet)			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**
Lonicera sp.	2			
Calocedrus decurrens		1	1	
Pinus contorta	2	9		

*Because *Alnus incana* occurred in an almost unbroken thicket of mature plants along the stream, the number of mature plants was not determined. Data were not collected for the right bank.

4.1.7 Ice House Dam Reach

The Ice House Dam Reach is located on South Fork Silver Creek and extends from the base of Ice House Dam to the normal high water line of Junction Reservoir. This section of river is 11.5 miles long, extends through a range of elevations from 5,290 to 4,450 feet, and has a mean gradient of about 73 feet/mile (1.4 percent). Tributaries to this reach include Peavine Creek, Winmiller Ravine, Chicken Hawk Springs, Bryant Springs, and Big Hill Canyon.

South Fork Silver Creek is a small stream at the beginning of the reach (15 to 41 feet wide), becoming 42 to 75 feet wide as it approaches Junction Reservoir. This reach contains six geomorphic sub-reaches, classified Rosgen type B, C, and C/F (*Channel Morphology Technical Report*). The upper reach is a moderately steep canyon channel with a Rosgen B classification. This quickly gives way to several miles of open wider canyon where the channel becomes broader and shallower (Rosgen C/F). The remainder of the stream reach below this area alternates between short stretches of Rosgen type B and long type C channels.

The lower portion of this reach experienced a catastrophic fire (Cleveland Fire) in 1992, removing most of the conifer forest adjacent to the stream. Presumably, the fire also directly affected riparian plant communities. Intensive surveys were conducted at two sites, Site 1 in the burned area (IH1 sub-reach) and Site 2 upstream of the burned area (sub-reach IH5). The sites correspond to the channel morphology study sites. In addition to the study sites, an extensive reconnaissance was performed at another site near the middle of the reach primarily in sub-reach IH2 (but including upstream end of IH1), and a ground-truth survey was conducted at a site within sub-reach IH5 (see Figure 3.4-1 – located at the end of the text).

A total of 37.8 acres of riparian vegetation were mapped on this reach, comprised of about 37.9 acres of Mountain Alder Alliance, 4.5 acres of Willow-Alder Alliance, and 0.2 acres of Willow Alliance (Appendix A). Overall, 81.5 percent of the shoreline in the reach has riparian vegetation. Riparian vegetation polygons ranged in width from 5 to 80 (mean = 16.5). Based on field information, riparian vegetation in this reach was predominantly mapped as Mountain Alder Alliance (79.3 percent of reach) with several small areas of Willow-Alder Alliance (2.0 percent of reach) and one patch of Willow Alliance (0.2 percent of reach); areas of Rocky Shore (often vegetated with *Darmera peltata*) occur in places in-channel (Appendix A). Another riparian shrub, *Myrica hartwegii,* was prominent (co-dominant to dominant) for stretches at the two sites examined in sub-reach IH1 and IH3. Other shrubs found in sub-reach IH3 were *Salix jepsonii*, *Salix lucida,* and a third undetermined species of *Salix*, *Cornus sericea*, *Spiraea*

densiflora, and *Rhododendron occidentale*. Conditions were similar to those observed in sub-reach IH1 (see below), except for the occurrence of patches of conifer forest that survived the 1992 Cleveland Fire, greater abundance of *Darmera peltata*, and the presence of a stream-associated wetland (see Section 4.2.7). Riparian vegetation at the reconnaissance site is dense, beginning at the water's edge, but the width of the riparian zone is restricted by the valley form and limited floodplain. Greenline composition was broadly classified within the reach. Shrub communities were dominated by *Alnus incana* and *Myrica hartwegii*. Herb communities were diverse; representative species included *Carex aquatilis*, at least two other undetermined species of *Carex*, species of *Juncus* (*xiphioides, effusus, howellii, tenuis, acicularis*, and another undetermined species), *Scirpus microcarpus*, *Scirpus diffusus, Glyceria sp.*, *Agrostis oregonensis, Lotus oblongifolius, Euthamia occidentalis, Hypericum anagalloides, Mimulus guttatus, Mimulus moschatus, Senecio triangularis,* and *Perideridia parishii.*

At a reconnaissance survey site in sub-reach IH5, riparian shrubs occurred in a dense band about 25 feet wide. There were large boulders scattered along the shore and few herbaceous plants were present at the water's edge. *Darmera peltata* did not occur at this site. *Alnus incana* comprised 45 percent coverage in the riparian zone, *Myrica hartwegii* 20 percent, and *Cornus sericea* 20 percent. Other shrubs were *Salix lasiolepis*, *Salix exigua*, *Spiraea densiflora*, *Lonicera* sp., and *Rhododendron occidentale*.

The 1952 and 1976 historical aerial photographs of this reach lacked sufficient resolution to draw definitive conclusions about the extent or types of riparian vegetation that may have occurred. Both of the photo sets are from relatively high elevation flights and are printed at 1:20,000 scale (1952 series) and 1:15,840 scale (1976 series). Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. It is clear from the photos that the extent of conifer coverage was far greater in 1952 than 1976 due to logging activity in many of the areas of this reach; generally the logging appears more concentrated along the left bank of the reach. As a result of the reduced conifer coverage in the 1976 series, it is possible to see point bars that appear to have either remained the same or changed shape only slightly. In general, the position and appearance of the stream channel has not undergone apparent change. The 1940 aerial photographic series encompassed most of this reach; however, the photographs were of poor quality (badly faded), inadequate to detect riparian vegetation, and often marred by colored pencil marks along the stream course. An example is included in Appendix B.

Ice House Dam Reach – Site 1 (Sub-reach IH1)

The study site encompasses a reach about 450 feet in length (Appendix C). Representative site photographs are presented in Appendix D. Data on greenline community type (Table 4.1.7-1 and 4.1.7-2) and woody species regeneration (Table 4.1.7-6) were collected for the right bank and left bank, and there were three vegetation cross-section transects (Table 4.1.7-3 - 4.1.7-5 and Figure 4.1.7-1 - 4.1.7-3, Appendix E).

At this site, the zones exhibiting obvious riparian influence extend up to about 60 feet from the stream channel; however, dense riparian shrubs are generally concentrated in a band no more

than about 25 feet wide and the transition to upland plant communities is rather abrupt due to steep topography and rocky, well-drained substrates. On the right bank, this band of shrubs is particularly narrow for most of the reach because the steep valley slope extends through the riparian zone. At the downstream end of the reach, there is a large point bar on the right bank, comprised of large cobbles and boulders. Here, riparian shrubs occur at greater distance from the stream bank, but sparsely. Overall, woody riparian vegetation at this site was classified as canopy coverage class 3 (>50-75%) for both left and right banks.

The results of the greenline transects illustrate the well-vegetated stream banks in the reach, with only small areas of boulders or bedrock that are devoid of vegetation. The greenline was unusually diverse and defied easy characterization to community types, because there were few repeating combinations of species. This was particularly true on the left bank where the greenline occurred slightly more as herb-dominated community types than as shrub-dominated types. Herb-dominated community types typically occurred on low, flat or gently sloping shorelines, which were scarce on the steep right bank. Most of the dominant herbs are strongly associated with wetland conditions (*Juncus xiphioides, Carex aquatilis, Scirpus microcarpus, Darmera peltata, Eleocharis acicularis, Glyceria sp.,* and *Lotus oblongifolius* are all rated "OBL" for wetland indicator status, and *Juncus effusus* is rated "FACW+") (Reed 1997), exemplifying habitats subject to periodic flooding. Shrub species were also numerous along the greenline: *Alnus incana, Myrica hartwegii, Rhododendron occidentale,* two species of *Salix, Cornus sericea, Rosa sp.* occur as community dominants. Within the channel there are also patches of *Darmera peltata.* Community types characterized by *Alnus incana*, most species of *Salix, Cornus sericea*, *Carex aquatilis*, *Scirpus microcarpus,* and *Glyceria spp.* are rated high for stability (Winward 2000). *Juncus xiphioides* and *Darmera peltata* also appear to be effective bank stabilizers based on field observations. We did not have information on the rooting characteristics of *Myrica hartwegii*; however, we saw no evidence of rooting failure or bank erosion associated with this species.

Overall, there were no exposed banks at this site except where substrate (rock) precluded vegetation. Bank undercutting was observed in places on the steep right bank, but obvious bank erosion was limited to small areas within a 40 feet stretch. Because of site geomorphology, bank stability on the right bank may not substantially improve until the area fully recovers from the Cleveland Fire. Evidence for recent minor flooding was observed in limited areas of on both banks. Bank scour appeared limited to only the boulder/cobble and small in-stream cobble bar areas. Large piles of down woody debris were observed at or above the high water mark at several locations within the reach, probably resulting from the 1997 flood. Fire evidence was noted throughout the reach but current woody riparian vegetation on both sides appears to be of various age classes (Table 4.1.7-6) and is well rooted in the soil. Few dead or decadent woody plants occurred around the greenline.

Table 4.1.7-1. Ice House Dam Reach - Site 1 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Right Bank		Left Bank	
Alnus incana	27	*6.1*	57	*13.2*
Alnus incana-Salix sp.	0	*0.0*	15	*3.5*

Table 4.1.7-1. Ice House Dam Reach - Site 1 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Right Bank		Left Bank	
Alnus incana-Darmera peltata	18	*4.1*	0	*0.0*
Alnus incana-Glyceria elata	0	*0.0*	6	*1.4*
Salix sp.	0	*0.0*	27	*6.2*
Salix sp.- Scirpus microcarpus	9	*2.0*	30	*6.9*
Salix sp.-Scirpus microcarpus-Juncus xiphioides	24	*5.4*	0	*0.0*
Salix sp 2	15	*3.4*	6	*1.4*
Cornus sericea	9	*2.0*	6	*1.4*
Myrica hartwegii	159	*36.1*	27	*6.2*
Myrica hartwegii-Rhododendron occidentale	21	*4.8*	0	*0.0*
Myrica hartwegii-Scirpus macrocarpus	9	*2.0*	6	*1.4*
Myrica hartwegii-Darmera peltata	9	*2.0*	0	*0.0*
Myrica hartwegii-Juncus xiphioides	6	*1.4*	0	*0.0*
Rosa sp.-Glyceria elata	0	*0.0*	9	*2.1*
Carex aquatilis	0	*0.0*	6	*1.4*
Carex aquatilis-Lotus oblongifolius	0	*0.0*	6	*1.4*
Carex aquatilis-Glyceria elata	0	*0.0*	6	*1.4*
Carex aquatilis-Juncus effusus	0	*0.0*	3	*0.7*
Carex sp.	9	*2.0*	3	*0.7*
Carex sp.- Solidago canadensis	0	*0.0*	1	*0.2*
Scirpus microcarpus	12	*2.7*	78	*18.0*
Scirpus microcarpus-Solidago canadensis	0	*0.0*	18	*4.2*
Scirpus microcarpus-Juncus effusus	15	*3.4*	0	*0.0*
Scirpus microcarpus-Juncus effusus-Juncus xiphioides	9	*2.0*	0	*0.0*
Scirpus microcarpus-Juncus effusus-Glyceria elata	0	*0.0*	18	*4.2*
Scirpus microcarpus-Eleocharis acicularis	6	*1.4*	0	*0.0*
Juncus xiphioides	30	*6.8*	57	*13.2*
Juncus xiphioides-Eleocharis acicularis	0	*0.0*	6	*1.4*
Juncus effusus	9	*2.0*	3	*0.7*
Darmera peltata	21	*4.8*	6	*1.4*
Darmera peltata-Glyceria elata	0	*0.0*	15	*3.5*
Glyceria elata	0	*0.0*	3	*0.7*
Solidago canadensis	0	*0.0*	9	*2.1*
Helenium bigelovii	0	*0.0*	6	*1.4*
Mixed herb community (8 co-dominant sp.)	9	*2.0*	0	*0.0*
Bedrock/Boulder (no vegetation)	15	*3.4*	0	*0.0*

Table 4.1.7-2. Ice House Dam Reach - Site 1 Greenline Composition – Summary.

Community Types	Right Bank		Left Bank	
TREE - SHRUB DOMINATED TYPES	306	*69.4*	189	*43.6*
HERB DOMINATED TYPES	120	*27.2*	244	*56.4*
OTHER COMMUNITY TYPES	15	3.4	0	0.0
TOTAL - ALL TYPES	441	*100.0*	433	*100.0*

Table 4.1.7-3. Ice House Dam Reach - Site 1– Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: Shrubs mostly less than 6 ft. tall: *Alnus incana*, *Salix sp.*, and *Rhododendron occidentale*. With few herbs: *Darmera peltata, Juncus effusus, Solidago canadensis,* and *Athyrium filix-femina.*	Riparian. Narrow zone
Zone 2	Dominants: *Ceanothus cordulatus, Ceanothus sp*., *Rhamnus sp*., and *Arctostaphylos patula.*	Upland. Abundant down woody debris with no trees
Left Bank:		
Zone 1	Dominants: Mixed herbs: *Juncus xiphioides*, *Solidago canadensis, Lotus oblongifolius, Viola macloskeyi, Scirpus microcarpus, Glyceria sp., Carex sp,* and *Deschampsia sp.* With small *Cornus sericea*, *Alnus incana*, and *Salix sp*.	Riparian. Low and subject to periodic flooding. Narrow zone with small boulders.
Zone 2	Dominants: Mixed shrubs 4-11 ft. tall: *Cornus sericea*, *Alnus incana*, and *Salix sp*.	Riparian. Evidence of flooding.
Zone 3	Dominants: Patchy *Rhododendron occidentale* and *Spiraea densiflora.* With *Amelanchier alnifolia, Pinus sp.* (few saplings), *Plantago lanceolata, Artemisia sp., Panicum acuminatum,* and *Hypericum perforatum.*	Riparian on bar. No evidence of recent flooding.
Zone 4	Dominants: *Pinus sp*. (young saplings) and grasses. With scattered *Lupinus sp., Collomia sp., Lomatium sp., Artemisia sp., Solidago sp.,* and *Hypericum perforatum*.	Sandy bar. Upland but somewhat mesic. Abundant down woody debris.
Zone 5	Dominants: *Pinus sp*. (young saplings), grasses, and *Carex sp*. (few).	Upland. Steep slope with down woody debris and sparse vegetation

Table 4.1.7-4. Ice House Dam Reach - Site 1 -Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: Scattered low shrubs (*Alnus incana*, *Salix sp*. and *Myrica hartwegii*) and abundant mixed herbs*: Glyceria sp., Juncus effusus, Juncus ensifolius, Solidago canadensis, Horkelia sp., Aster sp., Lotus oblongifolius, Boykinia major, Artemisia douglasiana, Platanthera leucostachys, Mimulus sp., Darmera peltata* (few), *Viola macloskeyi,* and *Scirpus microcarpus.*	Riparian. Cobbles and small boulders, subject to periodic flooding.
Zone 2	Dominants: Sparse *Alnus incana* and *Rubus parviflorus*. With *Lilium parvum, Monardella odoratissima,* and *Pinus sp*. (one seedling).	Riparian on cobble bar.
Zone 3	Dominants: Scattered *Arctostaphylos patula* and *Ceanothus cordulatus*. With sparse to patchy herbs: *Dicentra formosa, Artemisia sp., Rhamnus sp., Monardella odoratissima, Hypericum perforatum, Eriophyllum sp., Eriogonum sp., Solidago canadensis, Rumex acetosella, Amelanchier alnifolia* (few), *Lomatium sp., Bromus sp.* and other grasses.	Transitional on sand/cobble/boulder bar with irregular surface (upland vegetation but some species characteristic of mesic habitats, especially in depressions. Massive piles of flood deposited woody debris.
Zone 4	Dominants: Sapling *Pinus sp*. With scattered shrubs (*Ceanothus cordulatus* and *Arctostaphylos patula*), *Eriogonum sp.,* and *Calystegia sp.*	Upland. Abundant down woody debris and fire evidence.
In-channel:	Dominants: *Darmera peltata* with *Glyceria sp*.	Shallow persistently flooded area.

Table 4.1.7-4. Ice House Dam Reach - Site 1 -Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	Dominants*:* Patchy (both dense and sparse areas) shrubs about 8 ft. tall (*Alnus incana*, *Salix sp*., *Myrica hartwegii,* and *Spiraea densiflora*). With *Solidago canadensis, Pinus sp.* (one seedling), and *Ceanothus cordulatus* (few and small).	Riparian. No evidence of recent flooding and no seedlings of riparian shrubs species.
Zone 2	Dominants: Scattered sapling *Pinus sp.* (6-8 ft. tall) and *Amelanchier alnifolia*. With *Solidago canadensis, Verbascum thaspus, Rumex acetosella, Lupinus sp.,* and grasses.	Transitional (upland vegetation but some species characteristic of mesic habitats). Abundant down woody debris with evidence of fire.
Zone 3	Dominants: *Pinus sp*. (saplings), *Ceanothus cordulatus, Arctostaphylos patula,* and grasses.	Upland at base of slope.

Table 4.1.7-5. Ice House Dam Reach - Site 1 – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: Shrubs 5-12 ft. tall (*Alnus incana*, *Salix sp.*, *Cornus sericea,* and *Myrica hartwegii) and abundant mixed herbs: Glyceria sp., Scirpus microcarpus, Juncus xiphioides, Solidago canadensis, Horkelia sp., Aster sp., Lotus oblongifolius, Boykinia major, Deschampsia sp., Panicum acuminatum, Gentianopsis simplex,* and *Centaurea sp.*	Riparian. Cobble and boulder substrate.
Zone 2	Dominants: Sparse. Scattered sapling *Pinus sp.*, *Ceanothus cordulatus,* and *Arctostaphylos patula.* With *Artemisia sp., Calystegia sp.,* and *Rumex acetosella.*	Transitional (upland vegetation but appears more mesic than zone 3). Located on bar (areas of boulders, cobbles, gravel, and sand) with irregular surface and massive piles of woody flood debris. No recent evidence of recent flooding.
Zone 3	Dominants: Scattered sapling and seedling *Pinus sp*., *Arctostaphylos patula, Ceanothus cordulatus, Eriogonum sp.,* and *Calystegia sp.*	Upland at base of slope.
Left Bank:		
Zone 1	Dominants: Mixed herbs (with small *Salix sp*): *Darmera peltata, Glyceria sp*., *Solidago canadensis*, *Juncus xiphioides, Carex aquatilis, Scirpus microcarpus, Geum macrophyllum,* and *Equisetum arvense.*	Riparian on low bank subject to periodic flooding and in shallow water along shore.
Zone 2	Dominants: Shrubs 8-12 ft. tall (*Alnus incana* and *Salix sp*). With *Spiraea densiflora, Solidago sp., Lotus oblongifolius, Glyceria sp.,* and *Heracleum lanatum.*	Riparian. No evidence of recent flooding.
Zone 3	Dominants: *Ceanothus cordulatus*.	Upland at base of slope.

Table 4.1.7-6. Ice House Dam Reach -Site 1 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.								
	RB Transect (441 feet)				LB Transect (433 feet)			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus incana	14	18	0	0	27	44	48	1
Salix sp.	12	9	0	0	40	22	6	0
Myrica hartwegii	64	36	10	0	16	7	5	0
Rosa woodsii	5	1	0	0	8	4	0	0
Ribes nevadense	1	2	1	0	0	0	0	0
Cornus sericea	2	1	0	0	5	1	0	0
Spiraea densiflora	13	4	5	0	1	0	1	0
Rhododendron occidentale	34	2	0	0	1	0	0	0
Arctostaphylos patula	4	1	0	0	1	0	0	0
Ceanothus cordulatus	0	0	0	0	0	1	0	0
Lonicera sp.	1	0	0	0	0	0	0	0

Ice House Dam Reach – Site 2 - (Sub-reach IH5)

This study site encompasses a relatively long reach, 770 feet along the right bank and 1,200 feet along the left bank (Appendix C). In addition, a small island approximately 110 feet in length was examined. Representative site photographs are presented in Appendix D. Data on greenline community types for the main-stem channel banks and the island were collected (Table 4.1.7-7 - 4.1.7-10) and there were three vegetation cross-sections transects (Table 4.1.7-11 - 4.1.7-13, and Figure 4.1.7-4 - 4.1.7-6, Appendix E).

The width of the riparian zone on each side of the stream at this site ranges from as little as nine feet to as wide as 50 feet, but for most of the site riparian shrubs and herbaceous plants occur in a narrow band. Upland species grow in close proximity to the riparian shrubs along the left bank, where riparian shrubs (*Alnus incana* and *Salix* sp.) occur in a thin band throughout the upper three-quarters of the reach. In the lower quarter of the site, vegetation follows braided channels with broad areas of mixed gravel in between. Upland areas and part of the riparian areas of the right bank show regular disturbance from nearby outdoor recreation (camping).

The island has extensive, sparsely vegetated areas of cobbles. Interspersed among these are thin bands and clumps of riparian shrubs and herbaceous riparian plants. Shrubs dominate the right bank of the island, whereas the left bank has a higher percentage of herbaceous plants. Overall, woody riparian vegetation at Site 2 was classified as canopy coverage class 3 (>50-75%) for both the left and right banks.

The principal species that characterize greenline community types at this site are *Alnus incana, Salix sp., Juncus xiphioides, Scirpus microcarpus,* and a variety of mesic herbs. *Carex aquatilis, Carex vesicaria,* and *Glyceria sp.* occur, but are minor constituents. Community types characterized by *Alnus incana*, most species of *Salix, Glyceria spp.,* and *Scirpus microcarpus* are generally rated high for stability (Winward 2000). Stability ratings for *Juncus xiphioides* community types are not available, but the *Juncus ensifolius* community type is rated high for

stability (Winward 2000), and field observations suggest that *Juncus xiphioides* merits a similar rating.

The stream channel at the site is braided and shows evidence of channel migration. Broad cobble/gravel bar areas are common on both sides of the stream and are sparsely vegetated. The upper area of the study reach has somewhat higher gradient and larger substrate. The lower end has more depositional areas on both banks and the gradient lessens.

There are few exposed banks at this site; most occur on the right bank and are associated with recreational use. Scouring is observed at various areas primarily along the gravel and cobble bars. Larger areas of non-vegetated exposed sand/gravel/cobble are common. Thin to nonexistent soils on most of the bars and along the braided channel edges are also common. Bank scour appears limited, but undercut banks were observed, particularly on the right bank in the lower half of the site. Evidence of recent minor flooding can be seen in limited areas of both banks. Large woody debris and occasional piles of down woody debris were noted at or above the high water mark at several locations within the reach. Most of the plant species within the riparian zones are positively associated with the occurrence of moist soil conditions (Reed 1997). Age composition of woody vegetation at this site was not quantified except on the island, where there were 24 mature, 32 sapling, nine seedling, and no dead or decadent *Alnus incana.* Numbers for *Salix sp.* were similar: 15 mature, 25 sapling, and two seedlings. Saplings and seedlings of these species occurred on the greenline and were present in most riparian vegetation zones.

Table 4.1.7-7. Ice House Dam Reach - Site 2 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Right Bank		Left Bank	
Alnus incana	96	*12.5*	111	*9.2*
Alnus incana-Salix sp.	66	*8.6*	15	*1.3*
Alnus incana-Juncus xiphioides	9	*1.2*	0	*0.0*
Alnus incana - Scirpus microcarpus	0	*0.0*	12	*1.0*
Alnus incana - Darmera peltata	9	*1.2*	0	*0.0*
Alnus incana - Pteridium aquilinum	39	*5.1*	0	*0.0*
Alnus incana- Juncus xiphioides-Darmera peltata	0	*0.0*	30	*2.4*
Salix sp.	6	*0.8*	15	*1.3*
Salix sp.-Scirpus microcarpus	21	*2.6*	0	*0.0*
Salix sp. (saplings)-Juncus xiphioides	60	*7.8*	42	*3.4*
Carex aquatilis-Carex vesicaria	0	*0.0*	6	*0.5*
Carex aquatilis- Scirpus microcarpus	48	*6.2*	0	*0.0*
Carex aquatilis- Geum macrophyllum	0	*0.0*	18	*1.5*
Rhododendron occidentale –Myrica hartwegii- Spiraea densiflora	30	*3.8*	0	*0.0*
Rhododendron occidentale - Pteridium aquilinum	9	*1.2*	0	*0.0*
Scirpus microcarpus	0	*0.0*	39	*3.3*
Scirpus microcarpus – grass	12	*1.6*	0	*0.0*
Pteridium aquilinum	10	*1.3*	0	*0.0*
Juncus xiphioides	135	*17.5*	510	*42.5*
Juncus xiphioides-Scirpus microcarpus	69	*9.0*	15	*1.3*
Juncus xiphioides-Scirpus microcarpus-Equisetum arvense	27	*3.5*	0	*0.0*
Juncus xiphioides-Geum macrophyllum	0	*0.0*	12	*1.0*

Table 4.1.7-7. Ice House Dam Reach - Site 2 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.				
Greenline Community Type	**Right Bank**		**Left Bank**	
Juncus xiphioides-Glyceria sp.	0	*0.0*	9	*0.8*
Juncus xiphioides - Scirpus microcarpus – Carex sp.	0	*0.0*	21	*1.7*
Mimulus guttatus	12	*1.6*	63	*5.3*
Mimulus guttatus-Equisetum arvense	27	*3.5*	0	*0.0*
Senecio triangularis	12	*1.6*	0	*0.0*
Lotus sp.	0	*0.0*	21	*1.7*
Senecio triangularis-grass	0	*0.0*	6	*0.5*
Panicum sp.	0	*0.0*	9	*0.8*
Grass	12	*1.6*	0	*0.0*
Grass-Galium trifidum	0	*0.0*	6	*0.5*
Cobble/gravel (no vegetation)	18	*2.3*	138	*11.5*
Bedrock/Boulder (no vegetation)	0	*0.0*	27	*2.3*
Large Woody Debris (logs)	42	*5.5*	75	*6.2*

Table 4.1.7-8. Ice House Dam Reach - Site 2 Greenline Composition – Summary.				
Greenline Community Types	**Right Bank**		**Left Bank**	
SHRUB DOMINATED TYPES	306	*39.8*	225	*18.7*
HERB DOMINATED TYPES	403	*52.4*	735	*61.3*
OTHER COMMUNITY TYPES	60	*7.8*	240	*20.0*
TOTAL - ALL TYPES	769	*100.0*	1200	*100.0*

Table 4.1.7-9. Ice House Dam Reach - Site 2 (Island Area) Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.				
Community Type	**Right Bank**		**Left Bank**	
Alnus incana	9	*7.0*	9	*9.6*
Alnus incana- unknown grass	24	*18.6*	0	*0.0*
Alnus incana - Salix sp.	9	*7.0*	0	*0.0*
Alnus incana - Scirpus microcarpus	15	*11.6*	0	*0.0*
Salix sp.- unknown grass	6	*4.7*	0	*0.0*
Salix sp.-	0	*0.0*	6	*6.5*
Salix sp. – Lupinus sp.	3	*2.3*	0	*0.0*
Carex aquatilis-Carex vesicaria	9	*7.0*	0	*0.0*
Scirpus microcarpus	0	*0.0*	6	*6.5*
Scirpus microcarpus – unknown grass	0	*0.0*	15	*16.1*
Juncus xiphioides	0	*0.0*	27	*29.0*
Juncus xiphioides-Geum macrophyllum	0	*0.0*	12	*12.9*
Boulder (no vegetation)	54	*41.9*	18	*19.4*

Table 4.1.7-10. Ice House Dam Reach - Site 2 (Island Area) Greenline Composition – Summary.				
Community Types	**Right Bank**		**Left Bank**	
SHRUB DOMINATED TYPES	66	*51.2*	15	*16.1*
HERB DOMINATED TYPES	9	*6.9*	60	*64.5*
BOULDER COMMUNITY TYPES	54	*41.9*	18	*19.4*
TOTAL - ALL TYPES	129	*100.0*	93	*100.0*

Table 4.1.7-11. Ice House Dam Reach - Site 2 – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus incana* (Shrubs 4-8 ft. tall). With *Scirpus microcarpus, Lotus oblongifolius, Juncus effusus, Luzula sp., Galium sp., Stellaria sp.*, *Darmera peltata, Potentilla sp, Rumex acetosella, Montia sp., Senecio triangularis,* and *Hypericum formosum.*	Riparian.
Zone 2	Dominants: *Pinus contorta* (15-45 ft. tall). With *Alnus incana* (4-8 ft.), *Darmera peltata, Potentilla sp., Phacelia sp., Ribes cereum, Verbascum thaspus, Montia sp., Senecio triangularis,* and *Rumex acetosella.*	Upland.
In channel:	*Mimulus guttatus* and *Poa sp.*	
Left Bank:		
Zone 1	Dominants: *Juncus xiphioides* and *Mimulus guttatus*. With *Alnus incana* (seedlings), *Pinus sp*. (seedling), *Salix sp.* (seedlings), *Juncus covillei* (?), *Carex sp., Juncus effusus, Hypericum anagalloides, Cardamine oligosperma, Poa sp. Galium sp, Geum macrophyllum, Epilobium sp.,* and *Prunella vulgaris.*	Riparian.
Zone 2	No vegetation	Gravel/sand bar.
Zone 3	Dominants: *Alnus incana* (4.5-9 ft. tall) and *Cornus sericea* (6 ft.). With Pinus *contorta* (few, 25 ft.), *Abies sp* (saplings), *Ribes sp., Spiraea densiflora, Dicentra formosa, Phacelia sp., Agrostis exarata, Allium sp., Darmera peltata,* and *Rumex acetosella.*	Riparian. On bar (narrow zone).
Zone 4	Dominants: Mixed conifer forest (*Pinus contorta* 80 ft. tall, *Abies concolor* (70-80 ft.), *Calocedrus decurrens* (saplings), and *Pinus ponderosa* (50 ft. tall). With *Carex sp*., *Ribes sp., Rumex sp., Allium sp., Aquilegia formosa, Penstemon sp., Lupinus sp., Calyptridium sp.,* and *Phacelia sp.*	Upland.
Zone 5	Dominants: *Pinus contorta* (80 ft. tall) and *Carex sp*. With *Abies concolor* (saplings), *Calocedrus decurrens, Epilobium sp., Spiraea densiflora, Panicum sp., Rumex acetosella, Senecio triangularis, Aquilegia formosa, Mimulus primuloides, Nemophila maculata, Ribes sp., Penstemon sp., Phacelia sp., Symphoricarpos sp., Rhododendron occidentale,* and *Geum macrophyllum.*	Swale.

Table 4.1.7-12. Ice House Dam Reach - Site 2 – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus incana* (4-8 ft. tall) and *Juncus xiphioides*. With *Pinus contorta* (saplings), *Panicum sp., Poa sp.,* and *Equisetum arvense.*	Riparian.
Zone 2	*Pinus contorta* (15-30 ft. tall)-C, *Pinus ponderosa* (40 ft. tall) (sparse), With *Solidago canadensis*, *Spiraea densiflora, Gayophytum racemosum,* and *Poa sp.*	Transitional (Riparian to Upland).

Table 4.1.7-12. Ice House Dam Reach - Site 2 – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
In channel:	Dominants: *Juncus xiphioides* and *Salix sp.* With *Mimulus guttatus, Panicum sp*., *Epilobium sp*., *Carex aquatilis, Prunella vulgaris, Lotus oblongifolius, Hypericum anagalloides,* and *Veronica sp.*	
Left Bank:		
Zone 1	Dominants: *Juncus xiphioides* and *Trifolium monanthum.* With *Alnus incana* (seedlings), *Pinus sp*. (sapling), *Salix sp.* (3 ft.), *Mimulus guttatus*, *Juncus effusus, Hypericum anagalloides, Hypericum formosum, Poa sp, Prunella vulgaris, Senecio triangularis, Scirpus microcarpus, Lotus oblongifolius, Rumex acetosella, Geum macrophyllum, Fragaria sp.,* and *Trifolium monanthum.*	Riparian.
Zone 2	Dominants: *Alnus incana* (8 ft tall), *Salix sp.* (6 ft.), and *Scirpus microcarpus.* With *Pinus contorta* (few, 20 ft.), *Juncus ensifolius*, *Mimulus sp*., *Hypericum formosum, Carex sp., Senecio triangularis, Scirpus microcarpus, Rumex acetosella, Fragaria sp., Trifolium monanthum,* and *Gayophytum racemosum.*	Riparian.
Zone 3	Dominants: *Pinus contorta* (22 ft tall). With *Populus tremuloides* (7 ft tall), *Ribes sp., Dicentra formosa, Phacelia sp., Poa sp., Rumex acetosella, Fragaria sp, Carex sp., Epilobium sp., Galium sp., Scirpus microcarpus, Kelloggia galioides, Thalictrum sp.,* and *Penstemon laetus.*	Transitional.

Table 4.1.7-13. Ice House Dam Reach - Site 2 – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus incana* (6 ft. tall) and *Juncus xiphioides.* With *Pinus contorta* (saplings 8 ft. tall), *Scirpus microcarpus, Juncus xiphioides, Mimulus guttatus, Geum macrophyllum, Galium sp., Arctostaphylos sp.* (one plant)*, Hypericum formosum, Equisetum arvense, Viola sp., Lupinus sp,* and *Eleocharis sp.*	Riparian.
Zone 2	Dominants: *Alnus incana* (8 ft. tall). With *Salix sp*. *Pinus contorta* (one sapling 11 ft. tall), *Phacelia sp., Scirpus microcarpus, Epilobium sp., Rumex acetosella, Lupinus sp., Thalictrum sp.,* and *Allophyllum integrifolium.*	Riparian. On sand bar.
Zone 3	Dominants: *Salix sp*. (8 ft. tall) and *Alnus incana* (8 ft. tall). With *Pinus contorta* (saplings 6 ft. tall), *Rumex acetosella, Lotus purshianus, Allophyllum integrifolium, Juncus xiphioides, Juncus effusus, Hypericum anagalloides, Geum macrophyllum, Carex aquatilis, Hypericum formosum, Epilobium sp.,* and *Sisyrinchium elmeri.*	Riparian. On sand bar.
Zone 4	Dominants: Mixed conifer forest (*Pinus jeffreyi* 150 ft. tall and *Pinus ponderosa* 20 ft. tall)	Upland
Left Bank:		
Zone 1	Dominants: *Alnus incana* (to 6 ft. tall). With *Salix sp., Juncus xiphioides, Mimulus primuloides, Carex aquatilis, Poa sp., Geum macrophyllum, Senecio triangularis, Equisetum sp., Galium sp., Juncus effusus, Scirpus*	Riparian. Narrow zone

Table 4.1.7-13. Ice House Dam Reach - Site 2 – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
	microcarpus, Rumex acetosella, and *Platanthera leucostachys.*	
Zone 2	Dominants: *Artemisia douglasiana* and *Carex sp.* With *Populus tremuloides* (13 ft. tall), *Mertensia ciliata, Aster sp., Hypericum formosum, Poa sp., Senecio triangularis,* and *Aquilegia formosa.*	Riparian.
Zone 3	Dominants: *Pinus contorta* (up to 60 ft. tall) and *Agastache urticifolia.* With sapling *Pinus* and *Abies, Geum macrophyllum*, *Galium trifidum, Poa sp., Lupinus sp., Nemophila maculata*, and *Fragaria sp.*	Transitional

4.1.8 Junction Dam Reach

The Junction Dam Reach is located on Silver Creek and extends from the base of Junction Dam to the normal high water line of Camino Reservoir. This section of river is 8.3 miles long, extends through a range of elevations from 4,300 to 2,195 feet, and has a mean gradient of about 167 feet/mile (3.2 percent). Major inflows to this reach include Gray House Creek, Bear Creek, Davis Creek, and Onion Creek.

The reach contains ten geomorphic sub-reaches of A, B, and C Rosgen types (*Channel Morphology Technical Report*), characterized by long stretches of bedrock banks and limited riparian vegetation. Small patches or narrow stringers of shrubs (presumed to be *Alnus rhombifolia*) occur intermittently along banks and the few boulder bars in the reach, sometimes with *Darmera peltata*, which also occurs among boulders in the channel. About 11.3 acres of riparian vegetation were mapped, most of which is White Alder Alliance (11.0 acres), with Willow-Alder Alliance constituting the rest (Appendix A). Overall, 29.7 percent of the shoreline in the reach has riparian vegetation (Appendix A), comprised of White Alder Alliance (29.1 percent of reach), and Willow-Alder Alliance (0.6 percent of reach). Riparian vegetation polygons ranged in width from 5 to 35 (mean = 17).

The 1952 and 1976 historical aerial photographs of this reach lacked sufficient resolution to draw definitive conclusions about the extent or types of riparian vegetation that may have occurred. Both of the photo sets are from relatively high elevation flights and are printed at 1:20,000 scale (1952 series) and 1:15,840 scale (1976 series). Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. It is possible to view the channel with some detail and see some open water and depositional areas, which appear to be remarkably similar to current conditions. In general, the position and appearance of the stream channel has not undergone apparent change. The 1940 aerial photographic series encompassed less than half of the reach; the photographs were of poor quality (badly faded), inadequate to detect riparian vegetation.

4.1.9 Camino Dam Reach

Camino Dam Reach is located on Silver Creek from the base of Camino Dam to the confluence with the South Fork American River. This six-mile-long section of river ranges in elevation from 2,785 to 2,060 feet, with a mean gradient of 2.3 percent. The reach is within a deep, generally steep-sided valley. Round Tent Canyon (Creek), the only prominent tributary to Silver Creek in this reach, is located just over one-quarter mile downstream of Camino Dam.

Silver Creek is a relatively large stream in the reach (30-80 feet wide) and widens to 100 feet just before the confluence with the South Fork American River. The reach contains nine geomorphic sub-reaches, all but one of which (Rosgen A type) is Rosgen type B, or C (*Channel Morphology Technical Report*). The sub-reaches generally alternate between Rosgen B and C types.

Riparian vegetation occurs discontinuously along the reach, limited largely by long stretches of bedrock and steep slopes (Appendix A). The aerial video indicates that where there are low terraces, boulder bars, and occasionally on bedrock, vegetation consists of stands of small trees and shrubs. Based on interpretation of the aerial video and observations at the study site (see below), a total of about 15.2 acres of White Alder Alliance and 0.1 acre of Willow Alliance were mapped. Overall, 42.1 percent of the shoreline in the reach has riparian vegetation; nearly all of this (41.5 percent of reach) is White Alder. Riparian vegetation polygons ranged in width from 10 to 85 (mean = 37). At the study site, willows were *Salix lasiolepis* and *Salix exigua*. Large *Alnus* (more than 50 feet tall) occur occasionally.

The 1952 and 1976 historical aerial photographs of this reach lacked sufficient resolution to draw definitive conclusions about the extent or types of riparian vegetation that may have occurred. Both of the photo sets are from relatively high elevation flights and are printed at 1:20,000 scale (1952 series) and 1:15,840 scale (1976 series). Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. It is clear from the photos that the extent of conifer coverage was far greater in 1952 than in 1976 along this reach, but the reason for this is unclear in that logging was not apparent. Due to the width of the channel, it is possible to see bars in both photos sets, which appear to have either remained the same or changed shape only slightly. In general, the position and appearance of the stream channel has not undergone apparent change. The 1940 aerial photographic series did not encompass this reach.

Based on the patterns of occurrence of riparian vegetation and difficult access throughout the reach, only one study site was examined and there were no additional ground-truth survey sites. The study site corresponds to the channel morphology study site in sub-reach C4 (Rosgen type C).

Camino Dam Reach – Site 1 (Sub-reach C4)

The study site encompasses a reach about 350 feet in length (Appendix C). Representative site photographs are presented in Appendix D. The site consisted primarily of a large pool, surrounded by bedrock, with scattered pockets of riparian vegetation. A small seep located on

the right bank in the middle of the site supported additional shrub development beyond the riparian influence. Data on greenline community types (Table 4.1.9-1 and 4.1.9-2) and woody species regeneration (Table 4.1.9-5) were collected for the right bank and left bank. In addition, data were collected for two vegetation cross-section transects (Table 4.1.9-3 and 4.1.9-4, and Figure 4.1.9-1 and 4.1.9-2, Appendix E).

The riparian zone is narrow and restricted by the abundance of large outcrops of bedrock and boulders confining the site. However, where substrates were suitable, vegetation was well developed. At both transects bedrock, boulder, or cobble substrate separate upland vegetation from the riparian corridor. An island comprised of boulders and cobbles, intersected by transect 2, was well vegetated by *Salix lasiolepis*; however, the low-lying bar (cobble and boulder) on the left bank is vegetated only on the fringe. There was evidence of frequent flooding and scouring on this bank.

Bank stability was almost exclusively determined by the presence and arrangement of bedrock and boulder outcrops that comprised a majority of the left bank and a large part of the right bank. The principal woody species in the riparian zone were *Alnus rhombifolia* and *Salix lasiolepis*. *Brickellia californica*, *Rubus discolor, Acer macrophyllum* (one sapling), and *Populus fremontii* (none larger than sapling) also occurred infrequently. Overall, woody riparian vegetation at this site was classified as canopy coverage class 2 (>25-50%) for the right bank and class 1 (<25%) for the left bank.

Dominant communities along the greenline were comprised of *Alnus rhombifolia, Salix lasiolepis*, and *Carex aquatilis.* Other species that characterized much smaller sections of greenline were *Darmera peltata, Agrostis gigantea, Brickellia californica, Panicum acuminatum, Mimulus guttatus,* and *Dryopteris sp.* Community types that include *Carex aquatilis* are rated high for stability, and community types of *Salix lasiolepis* are rated moderately high (Winward 2000). Winward (2000) does not provide information for communities dominated by *Alnus rhombifolia*; however, field observations suggest that these communities would also merit high ratings for stability. *Rubus discolor* is an aggressive, weedy shrub of suitably moist, disturbed areas.

Other species along the greenline or in adjacent patches along bedrock seams included *Agrostis exarata*, *Athyrium alpestre, Woodwardia fimbriata, Juncus effusus, Lotus purshianus, Aster campestris, Conyza canadensis, Artemisia douglasiana, Helenium bigelovii, Cirsium vulgare* (few), and *Aquilegia formosa.* Most of the plant species within the riparian zones are positively associated with the occurrence of moist soil conditions (Reed 1997). The relatively high incidence of seedlings, saplings, and dead or decadent *Alnus incana* and *Salix lasiolepis* may indicate periodic scouring or reflect the challenging conditions associated with bedrock and boulder substrates.

Table 4.1.9-1. Camino Dam Reach - Site 1 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.				
Greenline Community Type	**Right Bank**		**Left Bank**	
Alnus rhombifolia	150	*37.3*	75	*24.5*
Alnus rhombifolia-Carex aquatilis	*0*	*0.0*	9	*2.9*
Salix lasiolepis	12	*3.0*	33	*10.8*
Brickellia californica-Agrostis gigantea-Panicum acuminatum-Mimulus guttatus	0	*0.0*	18	*5.9*
Carex aquatilis	48	*11.9*	3	*1.0*
Carex aquatilis-Darmera peltata.	6	*1.5*	0	*0.0*
Agrostis gigantea-Panicum acuminatum	21	*5.2*	0	*0.0*
Dryopteris sp.	0	*0.0*	6	*2.0*
Bedrock (no vegetation)	165	*41.0*	105	*34.3*
Cobbles- sparsely vegetated	0	*0.0*	57	*18.6*

Table 4.1.9-2. Camino Dam Reach - Site 1 Greenline Composition – Summary.				
Greenline Community Types	**Right Bank**		**Left Bank**	
TREE – SHRUB DOMINATED TYPES	*162*	*40.3*	*135*	*44.1*
HERB DOMINATED TYPES	*75*	*18.6*	*9*	*3.0*
BEDROCK/COBBLE COMMUNITY TYPES	*165*	*41.1*	*162*	*52.9*
TOTAL – ALL TYPES	*402*	*100.0*	*306*	*100.0*

Table 4.1.9-3. Camino Dam Reach - Site 1– Transect 1.		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: Sparse cover: *Alnus rhombifolia* (shrubs 7 ft. tall) and *Salix lasiolepis* (1.3 ft. tall). With *Panicum acuminatum*, *Aster campestris,* and *Carex aquatilis.*	Riparian. Sparse vegetation on bedrock, on edge of pool, and in small run-off areas.
Left Bank:		
Zone 1	Dominants: *Alnus rhombifolia* (small trees 18 ft. tall) and *Salix lasiolepis* (5 ft. tall). With few *Salix exigua* (1.5 ft. tall). Herbs were *Darmera peltata*, *Carex aquatilis*, *Aster campestris*, and *Panicum acuminatum.*	Riparian. On small cobble/boulder bar, surrounded by bedrock.

Table 4.1.9-4. Camino Dam Reach - Site 1– Transect 2.		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: Patches of herbaceous vegetation on bedrock: *Mimulus guttatus, Darmera peltata, Aster campestris, Panicum acuminatum, Lotus purshianus, Epilobium sp. Juncus tenuis*	Riparian. Bedrock with no woody vegetation.
Island:	Dominants: *Alnus rhombifolia* (shrubs 12 ft. tall) and *Salix lasiolepis* (7-15 ft. tall). With *Populus fremontii* (one sapling 6 ft. tall), *Mimulus guttatus, Conyza canadensis, Potentilla glandulosa, Aster campestris,* and *Lactuca sp.*	Riparian on island.

Table 4.1.9-4. Camino Dam Reach - Site 1– Transect 2.		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	Dominants: Sparse *Brickellia californica*, *Acer macrophyllum* (one sapling 6 ft. tall), *Conyza canadensis, Philadelphus lewisii, Epilobium sp., Lactuca sp. Cirsium vulgare,* and *Mimulus cardinalis.*	Riparian. Fringe of low-lying cobble bar. Evidence of frequent flooding and scouring.
Zone 2	No vegetation	Riparian. Higher positions on the cobble bar may not be vegetated because of annual scouring and dry conditions at other times.

Table 4.1.9-5. Camino Dam Reach - Site 1 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.

	RB Transect (402 feet)				LB Transect (306 feet)			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus rhombifolia	15	20	6	10	16	16	12	5
Salix lasiolepis	4	17	11	5	6	12	5	4
Rubus discolor		1	2					
Populus fremontii		1	1					
Cornus sericea						3	2	

4.1.10 South Fork American River Reach

The South Fork American River Reach is located on the South Fork of the American River from the confluence with Silver Creek to the normal high water line of Slab Creek Reservoir. This section of river is approximately 2.8 miles long, ranging in elevation from 2,040 to 1,850 feet, and has a mean gradient of approximately1.3 percent). The reach contains two geomorphic sub-reaches (Rosgen type B and C) (*Channel Morphology Technical Report*).

The aerial video indicates that riparian vegetation is extremely scarce in this reach. For much of the reach, the stream is confined within a bedrock canyon. There are few bars comprised of boulders and these are only sparsely vegetated with low shrubs (probably *Salix* sp. or Alnus *rhombifolia*). In total, detectable riparian vegetation was noted along six short stretches of stream bank (each generally less than about 200 feet long). A total of about 5.8 acres of riparian vegetation were mapped: 3.2 acres of White Alder Alliance, 2.3 acres of Willow Alliance, and 0.4 acre of Wet Meadow Alliance (Appendix A). Overall, riparian vegetation occurs along 27.3 percent of the shoreline of the reach, comprised of White Alder Alliance (19.0 percent of reach), Willow Alliance (6.9 percent of reach) and Wet Meadow Alliance (1.4 percent of reach). The width of riparian vegetation polygons ranged from 5 to 70 feet (mean = 29).

4.1.11 Brush Creek Dam Reach

The Brush Creek Dam Reach is located on Brush Creek from the base of Brush Creek Dam to the normal high water line of Slab Creek Reservoir. This 2.3 miles long section of river extends

through a range of elevations from 2,710 to 1,850 feet, with a mean gradient of 7.7 percent, although much of the reach is steeper than that. There are no major tributaries to this reach.

Brush Creek consists of 4 geomorphic sub-reaches, one Aa+, 2 rated A, and one B. type (*Channel Morphology Technical Report*). Because the adjacent conifer forest completely obscures the stream channel on the aerial photographs, it was not possible to map riparian vegetation. However, based on steep topography, riparian vegetation is likely to be minimal. Due to inaccessibility, an absence of alluvial habitat, and lack of susceptibility to project effects, no study sites or ground truth survey were selected.

The 1952 and 1976 historical aerial photographs of this reach lacked sufficient resolution to draw any conclusions about the extent or types of riparian vegetation that may have occurred. In both photos sets the stream channel cannot be seen clearly due to significant conifer tree coverage, but looks identical between the two years. In general, it appears that the position and appearance of the stream channel has not undergone apparent change. The 1940 aerial photographic series did not encompass this reach.

4.1.12 Slab Creek Dam Reach

The Slab Creek Dam Reach is located on the South Fork of the American River from the base of Slab Creek Reservoir to the normal high water line of Chili Bar Reservoir. This section of river is 8.0 miles long, extends from 1,620 to 990 feet, and has a mean gradient of about 79 feet/mile (1.5 percent). Major inflows to this reach include Redbird Creek, Iowa Canyon, South Canyon, Mosquito Creek, Jaybird Creek, Rock Creek, and White Rock Creek.

The South Fork American River in the Slab Creek Dam Reach is a comparatively large stream. Channel width in the reach is generally about 35 -150 feet. This reach contains nine geomorphic sub-reaches, primarily Rosgen type B and C (one reach is type A), and the entire reach is characterized by bedrock geology (*Channel Morphology Technical Report*). The reach lies within a relatively deep canyon. Riparian vegetation occurs at the water's edge (at base flow) more-or-less continuously through the reach, on the banks and on lateral bars comprised of boulders and cobbles. In places, small islands of vegetation also occur, emergent (e.g., tussocks of sedge) or rooted on small bars within the channel. Riparian vegetation is comprised of a narrow stringer of shrubs or small trees, with occasional areas as wide as 85 feet. Steep bedrock slopes, cliffs, areas of unbroken bedrock, and massive boulders are generally devoid of riparian vegetation. Based on the potential for project effects two study sites were selected; one of these sites (Site 2 in sub-reach SC3) corresponds to the channel morphology study site. Site 1 is located within sub-reach SC1. In addition to the intensive study sites, ground truth surveys were conducted at two other sites within sub-reaches 4 and 9 (Figure 3.4-1 – located at the end of the text).

A total of about 42.3 acres of riparian vegetation were mapped in the reach (Appendix A). Based on field information and the aerial video, the following vegetation types were identified: White Alder Alliance (35.6 acres), Willow Alliance (5.1 acres), Wet Meadow Alliance (1.3 acres), Mixed Riparian Hardwood Alliance (0.2 acre), California Sycamore Alliance (0.1 acre),

and Fremont Cottonwood Alliance (less than 0.1 acre). Most of the shoreline in the reach (87.2 percent) has riparian vegetation, most of which is White Alder Alliance (82.7 percent of reach). Willow Alliance occurs along 4.0 percent of reach and the remaining types each occur on 0.1 to 0.3 percent of the reach. Willows at the field survey sites were *Salix lasiolepis* and *Salix exigua*. Areas dominated by willows occur (e.g., at the confluence of a tributary), but generally in patches that did not warrant separate mapping. *Alnus rhombifolia* occurs as a tree or as a shrub. Other shrubs found at ground-truth survey sites were *Cornus sericea* (uncommon), *Rubus discolor*, and *Rubus laciniatus*. Occasional *Populus fremontii*, *Acer macrophyllum*, and *Platanus occidentalis* also occur, usually as saplings. Herbaceous species were not diverse at the ground truth sites, perhaps in part because two of the sites were in an area with construction disturbance.

The 1952 and 1976 historical aerial photographs of this reach lacked sufficient resolution to draw definitive conclusions about the extent or types of riparian vegetation that may have occurred. Both of the photo sets are from relatively high elevation flights and are printed at 1:20,000 scale (1952 series) and 1:15,840 scale (1976 series). Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. Due to the width of the channel, it is possible to see bars in both photos sets, which appear to have either remained the same or changed shape only slightly. In general, the position and appearance of the stream channel has not undergone apparent change. The 1940 aerial photographic series did not encompass this reach.

Slab Creek Dam Reach – Site 1 (Sub-reach 1)

The study site encompasses a reach approximately 1,350 feet in length (Appendix C). Representative site photographs are presented in Appendix D. Data on greenline community type (Table 4.1.12-1 and 4.1.12-2) and woody species regeneration (Table 4.1.12-6) were collected for the right bank and left bank, and there were three vegetation cross-section transects (Table 4.1.12-3 - 4.1.12-5, and Figure 4.1.12-1 - 4.1.12-3, Appendix E).

For this reach, two of the three transects characterized only the right bank, as the left bank was inaccessible and dominated by a steep slope, largely devoid of vegetation. Overall, the right bank of the site is characterized by narrow and continuous bands of riparian shrubs, with limited bedrock and boulders and the majority of the area covered with organic/silts. The site is located in a Type I valley, with a moderately low gradient. Areas of bedrock and boulders, primarily on the left bank, are devoid of vegetation or sparsely vegetated. Areas on the right bank show moderate disturbances from a road cutting into the riparian vegetation. The principal riparian community type on the right bank was *Alnus rhombifolia/Salix lucida* dominated. The community on the left bank was dominated by *Carex aquatilis.*

The riparian zone at this site is generally narrow along the left bank because of a steep, rocky slope. Vegetation on the left bank largely consists of a fringe of *Carex aquatilis* until the downstream end of the reach, where the valley slope is located further from the bank and a thicket of *Alnus rhombifolia* occurs. A dense band of *Alnus rhombifolia* lines the right bank. This species occurs mostly as a small tree (generally less than 20 feet tall) at this site; however, a few *Alnus rhombifolia* as large as 45 feet tall occurred near the base of the left bank hill slope.

Overall, woody riparian vegetation at this site was classified as canopy coverage class 3 (>50-75%) for both left and right banks.

A small backwater area on the left bank (intersected by transect 1) includes a variety of species that are otherwise uncommon or not found elsewhere in the site: *Eleocharis* sp., *Ludwigia*, *Gratiola* sp., *Epilobium ciliatum*, *Typha* sp., *Cyperus bipartitus*, as well as *Paspalum dilatatum* and *Polygonum persicaria.* There are also emergent tussocks of *Carex aquatilis* (including some colonized by small *Alnus* and *Salix*) within the reach.

Dominant communities along the greenline were comprised of *Alnus rhombifolia, Salix exigua* (mostly just on the right bank)*, Salix lucida, Carex aquatilis*, and *Solidago occidentalis* (right bank). Other species that characterized much smaller sections of greenline included *Paspalum dilatatum* and *Rubus discolor*. *Carex aquatilis, Salix exigua*-mesic forb, and *Salix-Carex aquatilis* community types have high ratings for bank stability (Winward 2000). *Paspalum dilatatum* is a rhizomatous species (Hickman 1996) and its presence should increase bank stability. Winward (2000) does not provide information for communities dominated by *Alnus rhombifolia*; however, field observations suggest that these communities also merit high ratings for stability. *Rubus discolor* is an aggressive, weedy shrub of suitably moist, disturbed areas. Several other weedy species also occur within the riparian zone at this site: *Saponaria officinalis* (soapwort), which was common; *Cytisus scoparius* (Scotch broom, a noxious weed), generally scattered and sparse; and *Chondrilla juncea* (rush skeleton weed, a noxious weed), primarily associated with a road that bisects the right bank riparian zone.

There were no exposed banks at this site except where substrates (rock) precluded vegetation. Evidence for flooding was observed in limited areas on both banks. The left bank had a greater area dominated by a steep rapid rise to upland zones and by bedrock and boulder/cobble areas. Because of these factors, limited evidence was noted for scoured banks. Several small areas showed debris lines more than 2.5 feet higher than water surface elevation when the site was examined, but the majority of riparian areas appeared stable. The right bank, with its flatter topography, showed more evidence of flooding. Water line marks 2.5-3 feet high and as far as 20 feet inland of existing water levels were observed on *Alnus rhombifolia* stems. Bank scour appeared limited to only the cobble bar areas. Most of the plant species within the riparian zones are positively associated with the occurrence of moist soil conditions (Reed 1997). The site was presumably subject to the large floods of 1986 and 1997. Two representative, mature *Alnus rhombifolia* at this site were determined to be 16 and 20 years old based on analysis of annual growth rings. A high proportion of saplings and seedlings for the three principal woody species (*Alnus rhombifolia, Salix exigua,* and *S. lucida*) may indicate irregular scouring, although few dead or decadent individuals were observed (Table 4.1.12-6).

Table 4.1.12-1. Slab Creek Dam - Site 1 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Right Bank		Left Bank	
Alnus rhombifolia-Salix exigua	66	*7.0*	0	*0.0*
Alnus rhombifolia-Salix exigua-Carex aquatilis	162	*17.1*	0	*0.0*
Alnus rhombifolia-Salix exigua-Salix lucida-Carex aquatilis	510	*54.0*	0	*0.0*
Alnus rhombifolia-Salix exigua-Rubus discolor	0	*0.0*	57	*4.2*

Table 4.1.12-1. Slab Creek Dam - Site 1 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.				
Greenline Community Type	**Right Bank**		**Left Bank**	
Alnus rhombifolia-Salix lucida-Carex aquatilis	0	*0.0*	99	*7.3*
Alnus rhombifolia-Salix lucida-Carex aquatilis-Solidago occidentalis	0	*0.0*	303	*22.4*
Alnus rhombifolia-Carex aquatilis	78	*8.3*	93	*6.9*
Alnus rhombifolia-Mimulus guttatus	0	*0.0*	18	*1.3*
Alnus rhombifolia-Salix exigua-Paspalum dilatatum.	78	*8.3*	0	*0.0*
Alnus rhombifolia-Apocynum cannabinum	0	*0.0*	36	*2.7*
Salix exigua	9	*1.0*	0	*0.0*
Salix exigua-Salix lucida	9	*1.0*	0	*0.0*
Salix exigua-Carex aquatilis	0	*0.0*	6	*0.4*
Salix exigua-Solidago occidentalis	0	*0.0*	10	*0.7*
Salix exigua-Rubus discolor-Paspalum dilatatum	0	*0.0*	45	*3.3*
Salix lucida-Carex aquatilis.	0	*0.0*	138	*10.2*
Carex aquatilis	9	*1.0*	156	*11.5*
Carex aquatilis- Paspalum dilatatum.	0	*0.0*	45	*3.3*
Carex aquatilis-Solidago occidentalis	0	*0.0*	15	*1.1*
Paspalum dilatatum-Bidens frondosa-Polygonum sp.-Typha	18	*1.9*	0	*0.0*
Polygonum persicaria	0	*0.0*	6	*0.4*
Palustrine emergent community (10 co-dominant sp.)	0	*0.0*	87	*6.4*
Ludwigia sp.	0	*0.0*	33	*2.4*
Ludwigia sp. – Eleocharis sp. – Polygonum sp.	0	*0.0*	8	*0.6*
Bedrock/Boulder (no vegetation)	0	*0.0*	120	*8.9*
Bedrock with sparse herbs	0	*0.0*	78	*5.8*
Recreation disturbed (no vegetation)	6	*0.6*	0	*0.0*

Table 4.1.12-2. Slab Creek Dam - Site 1 Greenline Composition – Summary.				
Greenline Community Types	**Right Bank**		**Left Bank**	
TREE - SHRUB DOMINATED TYPES	912	*96.5*	805	*59.6*
HERB DOMINATED TYPES	27	*2.9*	350	*25.7*
OTHER COMMUNITY TYPES	6	*0.6*	198	*14.7*
TOTAL - ALL TYPES	945	*100.0*	1353	*100.0*

Table 4.1.12-3. Slab Creek Dam Reach - Site 1 – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus rhombifolia* (most numerous at water's edge; small trees to 16 ft. tall) and *Salix exigua* (4-12 ft. tall). With *Salix lucida* (6-12 ft. tall), *Vitis californica*, *Epilobium ciliatum*, and *Bidens frondosa*.	Riparian.
Zone 2	Dominants: Salix *exigua* (8-14 ft. tall) and *Saponaria officinalis*. With *Alnus rhombifolia* (one small tree 12 ft. tall), *Cytisus scoparius* (few), and *Chondrilla juncea* (few).	Riparian on cobble bar with areas of gravel. No apparent soil development, suggesting flood scour.

Table 4.1.12-3. Slab Creek Dam Reach - Site 1 – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	Dominants: *Alnus rhombifolia* (small trees 16 ft. tall and shrub size) and *Salix lucida* (3-8 ft. tall). With *Salix exigua* (4-8 ft. tall), *Rubus discolor* (low stature), *Equisetum arvense*, *Mimulus guttatus*, *Mimulus cardinalis*, *Juncus effusus*, *Juncus ensifolius*, and *Melilotus alba* (few).	Riparian with flood evidence (flood debris).

Table 4.1.12-4. Slab Creek Dam Reach - Site 1 –Transect 2.		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus rhombifolia* (small trees 12-16 ft. tall and low shrubs), *Salix lucida* (2-4 ft. tall), and *Carex aquatilis* (primarily at water's edge). With *Paspalum dilatatum* and *Cyperus sp*. (few).	Riparian. Flood evidence (debris) more than 3 ft. above current water surface elevation.
Zone 2	Dominants: *Salix lucida* (to 18 ft.) (clumped). With sparse *Saponaria officinalis*, *Melilotus alba*, and *Lotus purshianus*.	Riparian transitional on cobble/gravel bar. Two roads bisect Willow stand.
Zone 3	*Dominants: Eriodictyon sp. and Cytisus scoparius.*	Upland transitional
Left Bank:		
	Transect was not extended to left bank because of deep pool and little riparian vegetation	

Table 4.1.12-5. Slab Creek Dam Reach - Site 1 – Transect 3.		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus rhombifolia* (trees 18 ft. tall), *Salix exigua* (saplings to 6 ft. tall), *Salix lucida* (saplings to 5 ft. tall), *Carex aquatilis*, *Melilotus alba*, and *Bidens frondosa.*	Riparian. Dense thicket. Flood debris extensive, extending 20 ft. from shoreline.
Zone 2	Dominants: *Salix lucida* (12-20 ft. tall) and *Salix exigua* (to 12 ft. tall). With *Cytisus scoparius, Lotus purshianus, Saponaria officinalis, Melilotus alba, Bromus diandrus,* and *Chondrilla juncea* (in disturbed area by road).	Riparian. Flood evidence (debris) extends into the zone. Disturbed by road bisecting the zone.
In-channel:	Scattered emergent tussocks of *Carex aquatilis.* With *Bidens frondosa, and Paspalum dilatatum.*	Shallow water.
Left Bank:		
Zone 1	Dominants: *Alnus rhombifolia* (trees to 25 ft. tall) and *Salix exigua* (to 18 ft. tall). With *Rubus discolor.*	Riparian. Narrow band among boulders at base of steep cliff.

Table 4.1.12-6. Slab Creek Dam Reach - Site 1 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.

	RB Transect (945 feet)				**LB Transect (1353 feet)**			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus rhombifolia	49	35	4	0	28	66	23	1
Salix exigua	18	41	13	0	16	30	15	1
Salix lucida	36	52	34	0	15	117	144	1
Fraxinus latifolia	0	0	0	0	1	8	1	0

Table 4.1.12-6. Slab Creek Dam Reach - Site 1 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.								
	RB Transect (945 feet)				LB Transect (1353 feet)			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**	**Mature**	**Sapling**	**Seedling**	**Dead**
Populus tremuloides	0	0	0	0	1	3	6	0
Populus fremontii	0	0	0	0	0	0	1	0
Rubus discolor	7	0	0	0	14	8	1	0
Rubus laciniatus	0	0	0	0	1	1	0	0
Cephalanthus occidentalis	0	0	0	0	6	2	0	0
Cytisus scoparius	0	0	0	1	0	0	0	0

Slab Creek Dam Reach - Site 2 (Sub-reach 3)

The study site encompasses a reach about 600 feet in length (Appendix C). Representative site photographs are presented in Appendix D. Data on greenline community type (Table 4.1.12-7 and 4.1.12-8) and woody species regeneration (Table 4.1.12-12) were collected for the right bank and left bank, and there were three vegetation cross-section transects (Table 4.1.12-9 - 4.1.12-11, and Figure 4.1.12-4 - 4.1.12-6, Appendix E).

The width of the riparian zone at this site ranges from four to 45 feet, with the majority of riparian areas comprised of bands interrupted by sparsely vegetated boulder fields. The upstream end of the reach has the greater riparian plant diversity, consisting of two main communities. The left bank consists of *Carex aquatilis* and *Salix exigua* with large boulders interspersed. Located behind this zone is a community of *Alnus rhombifolia/Salix lucida* with abundant boulders. The right bank is similar but the riparian bands are thinner with even distributions of *Alnus rhombifolia/Salix exigua/Carex aquatilis* frequented by boulders. The lower portions of the reach become predominantly boulder fields with thin riparian areas on both banks and wider riparian-to-upland transitional zones. Riparian shrubs (mostly *Alnus rhombifolia* and *Salix sp.*) are generally sparse and transition quickly to upland tree species such as *Quercus wislizeni* and *Acer macrophyllum*, and shrubs such as *Ceanothus integerrimus*. *Populus fremontii* occurs at the site primarily as saplings. Overall, woody riparian vegetation at this site was classified as canopy coverage class 3 (>50-75%) for the left bank and class 4 (>75-100%) for the right bank.

Dominant communities along the greenline were comprised of *Alnus rhombifolia, Salix lucida*, *Salix exigua* (left bank only), *Paspalum dilatatum*, *Carex aquatilis,* and *Rubus discolor.* Other species that characterized much smaller sections of greenline were *Setaria sp.* and *Melilotus alba. Carex aquatilis, Salix*-mesic forb, and *Salix-Carex aquatilis* community types have high ratings for bank stability (Winward 2000). *Paspalum dilatatum* is a rhizomatous species Hickman 1996) and probably contributes to bank stability. Winward (2000) does not provide information for communities dominated by *Alnus rhombifolia* or mixed willow communities; however, field observations suggest that these communities would also merit high ratings for stability. *Rubus discolor* is an aggressive, weedy shrub of suitably moist, disturbed areas. Several other weedy species also occur within the riparian zone at this site, but none were

abundant: *Saponaria officinalis*, *Cytisus scoparius*, *Rubus laciniatus, Verbascum thaspus,* and *Chondrilla juncea* (only one plant observed).

Evidence for flooding was observed over much of the length of this reach on both banks in the form of scant soil development, areas of shallow scour around boulders, and the presence of debris piles. Flood evidence does not indicate flood frequency; however, neither side of the river appeared to show much evidence of active scour. Vegetation occurred along all banks where substrates were suitable, suggesting that fluctuating water levels have not hindered the establishment of stable riparian communities. Most of the plant species within the riparian zones are positively associated with the occurrence of moist soil conditions (Reed 1997). Shrub sized *Alnus rhombifolia* at this site were determined to be 4-5 years old based on analysis of annual growth rings, possibly suggesting regeneration after the 1997 flood. A tree about 30 feet tall was 13 years old.

Table 4.1.12-7. Slab Creek Dam Reach - Site 2 Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Right Bank		Left Bank	
Alnus rhombifolia	33	*6.2*	0	*0.0*
Alnus rhombifolia -Salix lucida	0	*0.0*	18	*2.9*
Alnus rhombifolia-Salix lucida-Salix exigua	0	*0.0*	9	*1.5*
Alnus rhombifolia-Salix lucida-Paspalum dilatatum.	111	*20.8*	0	*0.0*
Alnus rhombifolia-Salix exigua	54	*10.1*	0	*0.0*
Alnus rhombifolia-Salix exigua-Paspalum dilatatum -Carex aquatilis	57	*10.7*	0	*0.0*
Alnus rhombifolia-Rubus discolor	9	*1.7*	12	*2.0*
Alnus rhombifolia-Carex aquatilis	75	*14.0*	57	*9.3*
Alnus rhombifolia- Paspalum dilatatum.	9	*1.7*	0	*0.0*
Salix lucida-Populus fremontii (saplings)	6	*1.1*	0	*0.0*
Salix lucida-Rubus discolor	21	*3.9*	0	*0.0*
Salix lucida-Carex aquatilis	0	*0.0*	72	*11.8*
Salix lucida-Salix exigua-Rubus discolor-Carex aquatilis	0	*0.0*	147	*24.0*
Salix lucida-Salix exigua-Carex aquatilis-Melilotus alba	0	*0.0*	81	*13.2*
Salix exigua-Rubus discolor	51	*9.6*	0	*0.0*
Salix exigua-Carex aquatilis	0	*0.0*	78	*12.7*
Carex aquatilis-Setaria sp.	6	*1.1*	0	*0.0*
Bedrock/Boulder (no vegetation)	102	*19.1*	102	*16.7*
Bedrock- sparse Salix lucida and Carex aquatilis	0	*0.0*	36	*5.9*

Table 4.1.12-8. Slab Creek Dam Reach - Site 2 Greenline Composition – Summary.

Greenline Community Types	Right Bank		Left Bank	
TREE - SHRUB DOMINATED TYPES	426	*79.8*	510	*83.3*
HERB DOMINATED TYPES	6	*1.1*	0	*0.0*
OTHER COMMUNITY TYPES	102	*19.1*	102	*16.7*
TOTAL - ALL TYPES	534	*100.0*	612	*100.0*

Table 4.1.12-9. Slab Creek Dam Reach – Site 2 – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Alnus rhombifolia* (small trees mostly about 20 ft. tall), *Salix lucida* (10 ft. tall), and *Rubus discolor*. With *Populus fremontii* (one tree 55 ft. tall and saplings), *Melilotus alba*, *Vitis californica*, *Baccharis sp.*, *Equisetum arvense*, *Carex aquatilis* (common, but scattered patches), *Panicum sp*., and *Setaria sp*.	Riparian. On cobble/boulder bar, parts of which are periodically flooded.
Left Bank:		
Zone 1	Dominants: *Salix exigua* (shrubs 6 ft. tall) and *Carex aquatilis*. With *Alnus rhombifolia* (shrubs 9 ft. tall), *Salix lucida* (6 ft. tall), *Equisetum arvense*, *Bidens sp*., *Epilobium ciliatum*, *Mimulus guttatus*, *Mimulus cardinalis*, *Juncus effusus*, *Juncus ensifolius*, and *Setaria sp.*	Riparian. On cobble/boulder bar, parts of which are periodically flooded.
Zone 2	Dominants: *Alnus rhombifolia* (small trees 12 ft. tall and shrub size) and *Salix lucida* (up to 12 ft. tall). With *Acer macrophyllum* (sapling 8 ft. tall), *Populus fremontii* (seedling 4 ft. tall), *Pinus sp*. (saplings, few), *Rubus discolor* (low stature), *Solidago canadensis*, *Rubus laciniatus*, *Juncus balticus, Melilotus alba, Artemisia douglasiana, Hypericum perforatum, Saponaria officinalis, Plantago lanceolata* and *Panicum sp.*	Riparian. On cobble/boulder bar with woody flood debris.

Table 4.1.12-10. Slab Creek Dam Reach – Site 2 – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank		
Zone 1	Dominants: *Alnus rhombifolia* (shrubs 13 ft. tall) and *Salix exigua* (3-7 ft. tall). With *Rubus discolor*, *Carex aquatilis* (along water's edge), and *Apocynum cannabinum*.	Riparian, interspersed boulders. Flooded annually.
Zone 2	Dominants: *Cercocarpus betuloides*. With *Toxicodendron diversilobum* (few), *Rhamnus sp.* (few), and *Cytisus scoparius* (few, to 6 ft. tall).	Upland shrub. Among boulders with scant soil development.
Left Bank:		
Zone 1	Dominants: *Carex aquatilis* (only along shore) and *Rubus discolor* (low and patchy, but numerous). With *Salix lucida* (3 ft. tall), *Bidens sp*., and *Melilotus alba* (few).	Riparian. Flooded annually.
Zone 2	Dominants: *Salix lucida* (one clump 12 ft. tall), *Rubus discolor*, and *Saponaria officinalis*. With *Verbascum thaspus* (one plant) and *Artemisia douglasiana.*	Riparian. On cobble/boulder bar with no evidence of recent flooding.

Table 4.1.12-11. Slab Creek Dam Reach – Site 2 – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Dominants: *Salix lucida* (less than 4 ft. tall), *Carex aquatilis, Paspalum dilatatum*, and *Setaria* sp.	Riparian. Narrow zone flooded annually.
Zone 2	Dominants: *Alnus rhombifolia* (small trees 16 ft. tall and shrubs 7-12 ft. tall) and *Salix lucida* (3-8 ft. tall). With *Rubus discolor* (few), *Mimulus cardinalis, Carex aquatilis, Bidens sp.*	Riparian. Flooded annually.

Table 4.1.12-11. Slab Creek Dam Reach – Site 2 – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 3	Dominants: Sparse cover (all species): *Vitis californica, Rubus discolor, Cytisus scoparius, Amelanchier alnifolia, Toxicodendron diversilobum*, *Saponaria officinalis*, *Lotus purshianus*, *Artemisia douglasiana*, and *Chondrilla juncea* (one plants).	Upland on boulder and cobble substrate.
Left Bank:		
Zone 1	Dominants: *Salix lucida* (5 ft. tall) and *Carex aquatilis.* With *Alnus rhombifolia* (shrubs to 8 ft. tall), *Rubus discolor* (low stature and sparse), *Populus fremontii* (one sapling 3 ft. tall) and *Aster sp.*	Riparian. Flooded annually.
Zone 2	Dominants: Sparse *Quercus wislizeni* (30 ft. tall). With *Acer macrophyllum* (one tree 25 ft. tall and few saplings) and sparse shrubs and herbs: *Cytisus scoparius*, *Philadelphus lewisii*, *Heteromeles sp*., *Toxicodendron diversilobum*, *Ceanothus integerrimus*, *Amelanchier alnifolia*, and *Iris hartwegii* (?).	Upland but with some species indicative of mesic conditions. Minimal soil development, but leaf litter present.

Table 4.1.12-12. Slab Creek Dam Reach - Site 2 Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.

	RB Transect (534 feet)				LB Transect (612 feet)			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus rhombifolia	24	27	10	0	5	13	14	2
Salix exigua	6	13	3	0	27	24	12	0
Salix lucida	3	30	20	0	7	40	25	0
Rubus discolor	10	6	0	0	14	12	8	0
Populus fremontii	0	1	0	0	0	3	0	0
Cephalanthus occidentalis	2	0	0	0	0	0	0	0

4.1.13 Reach Downstream of Chili Bar

This reach of the South Fork American River extends from the base of Chili Bar to the normal high water line of Folsom Lake. This 19.1-miles long section of river ranges in elevation from 960 feet to approximately 470 feet. Major tributaries include Dutch Creek, Granite Creek, Greenwood Creek, Hastings Creek, Jacobs Creek, Norton Ravine, and Weber Creek.

The Reach Downstream of Chili Bar contains three geomorphic sub-reaches: the Gorge Sub-reach (CB1), the Coloma Sub-reach (CB2), and the Canyon Sub-reach (CB3). Of these, only the Coloma Sub-reach supports substantial development of riparian forest. Elsewhere, much of the channel is confined and lined with poorly vegetated boulder/cobble complexes, areas that are geomorphically unable to sustain well-developed stands of riparian vegetation. Overall, 62 percent of the shoreline of the Reach Downstream of Chili Bar supports riparian vegetation.

A total of about 192 acres of riparian vegetation were mapped, 167.4 acres (87.3 percent of total) of which were Mixed Riparian Hardwood. Other vegetation alliances mapped were Willow

(11.7 acres), Fremont Cottonwood (6.5 acres), White Alder (5.8 acres), and Wet Meadow (0.4 acre).

The overall species composition of areas that are vegetated is similar in each sub-reach. Overstory dominants are typically *Alnus rhombifolia*, *Salix lasiolepis*, or *S. lucida*, most often 10-20 feet in height and fewer than 20 years old, based on increment bores collected in 2003. In the Coloma Sub-reach, but rarely elsewhere, *Populus fremontii* is well represented, either as large trees on high banks, or as young saplings (few *P. fremontii* of intermediate size occur anywhere on the Reach Downstream of Chili Bar).

Where allowed by channel morphology (i.e., on low-gradient shorelines), the vegetation occurs in predictable bands largely corresponding to river flows. In the Coloma sub-reach, comparisons to established river gauges at Camp Lotus and Henningson-Lotus County Park found that herbaceous vegetation and occasional seedling willows begin approximately at the 1,000-1,200 cfs waterline, larger woody vegetation (e.g., *Salix lasiolepis* 10-16 feet tall) begins at the 1,800-2,000 cfs waterline, and larger trees (e.g., *Alnus rhombifolia* 25-35 feet tall) at approximately the 2,700 cfs mark. Large *Populus fremontii* are only found well above these levels. Helicopter-based aerial video taken in August 2003 documents a similar pattern throughout the entire Reach Downstream of Chili Bar: riparian vegetation does not begin until well above water elevation at 200 cfs, and woody shrubs are partially submerged at flows greater than 2,000 cfs.

The 1985 historical aerial photographs of this reach do not allow detailed assessments of vegetation composition. Shrubs and other deciduous vegetation are generally undetectable or only vaguely suggested by gray tones, that, when enlarged digitally, are inconclusive. However, when compared with 2003 photos, the photos document substantial movement of cobble bars and in-stream islands since 1985, especially in the confined channel areas of the Gorge Sub-reach and Upper Canyon Sub-reach (Appendix F). Changes are less apparent in the wider valley bottom of the Coloma Sub-reach (Appendix F). However, in each of these areas, riparian vegetation is observably more widespread and better developed in 2003 than in 1985.

Reach Downstream of Chili Bar - Gorge Sub-reach (CB1)

The Gorge Sub-reach is characterized by steep, confining valley walls and a moderate stream gradient that ranges from 0.57 percent to 0.80 percent. Most of the canyon is bedrock or boulder-lined, with very limited development of riparian vegetation. However, alluvial deposition occurs on both banks in a widened canyon bottom area approximately 2,500 feet upstream of the confluence with Weber Creek, and again at Weber Creek itself. Site assessments were conducted on the left bank of both of these areas, representing the most well developed riparian vegetation in the Gorge Sub-reach. Greenline composition (Table 4.1.13-1 and 4.1.13-2) and dominant woody species were documented, and vegetation cross-sections were completed both sites (Tables 4.1.13-3 and 4.1.13-4, and Figures 4.1.13-1 and 4.1.13-2, Appendix E). Representative site photographs are presented in Appendix D.

The site upstream of the confluence corresponds with one selected for the Channel Morphology Study. Riparian plant diversity here, as elsewhere in the Reach Downstream of Chili Bar, is low.

The left bank consists of a frequently scoured cobble bar bordered at the water's edge with scattered clumps of *Salix exigua*, *Cephalanthus occidentalis*, and *Alnus rhombifolia* growing from 5-20 feet high. An increment bore from 16-foot tall *A. rhombifolia* on the water's edge found it to have established in 1988. The cobble bar extends a maximum of 182 feet from the wetted edge to the toe of the slope; most of it poorly vegetated (less than 33 percent cover). Away from the greenline, the vegetation quickly becomes transitional to upland, with *Brickellia californica*, *Lupinus* sp., and occasional *Chondrilla juncea* (a noxious weed) along with *Fraxinus latifolia* shrubs and small trees growing to 25 feet tall. Evidence for seasonal flooding is clear throughout this area: many shrubs have obvious flood damage or hanging debris, including the *Fraxinus latifolia* in the center of the cobble bar. At 124 feet from the water, the riparian influence is limited and soil formation is occurring, supporting upland obligates such as *Pinus sabiniana*, *Quercus wislizeni, Heteromeles arbutifolia*, and *Cytisus scoparius* (a noxious weed).

The right bank upstream of the confluence with Weber Creek was not directly examined, but it was observed to support *Alnus rhombifolia* at the riparian edge, with no evident flood damage. A sparse greenline supports *Verbena hastata* and other forbs common in the area. The riparian zone proper is limited (estimated at less than 75 feet wide), but an adjacent mesic uplands area supports a large stand of shrub to small tree sized *Ailanthus altissima*, a *Rubus discolor* thicket, and a stand of large *Juglans* sp. trees. Mid-channel, a frequently flooded cobble island is ringed on its outside edge with 12-20 foot tall *Alnus rhombifolia* and lower *Salix exigua*; upland species such as *Brickellia californica* dominate the interior.

At the confluence of Weber Creek and the South Fork American River, a large, partially vegetated alluvial fan supports a similar suite of species as above, although with a better-developed herbaceous layer owing to a somewhat lower gradient. Common herbaceous species include *Verbena hastata*, *Myosotis laxa*, *Mentha arvensis*, *Centaurium muehlenbergii*, *Paspalum dilatatum*, and *Aster campestris*. Shoreline stands of *Salix exigua*, *Alnus rhombifolia*, and *Fraxinus latifolia* are found downstream of the confluence, and above the herbaceous zone at the confluence. None of these plants was observed to have flood damage. One *Populus fremontii* sapling occurs (9-10 feet tall, less than 0.5 inch DBH). The adjacent uplands are disturbed by road access and recreational use, and support *Cytisus scoparius* in places.

Table 4.1.13-1. Reach Downstream of Chili Bar -Gorge Sub-reach (Weber Creek Site) Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Greenline Community Type	Left Bank	
Alnus rhombifolia	9	*0.8*
Alnus rhombifolia-Salix lasiolepis	9	*0.8*
Salix lasiolepis	24	*2.1*
Salix exigua	165	*14.4*
Salix exigua – Salix lasiolepis	15	*1.3*
Salix lasiolepis- Fraxinus latifolia	3	*0.3*
Salix exigua - Fraxinus latifolia	6	*0.5*
Fraxinus latifolia	18	*1.6*
Verbena hastata– Hypericum mutilum	45	*3.9*
Verbena hastata – Hypericum mutilum - Myosotis laxa. – Paspalum dilatatum	42	*3.7*
Verbena hastata. – Paspalum dilatatum	27	*2.4*

Table 4.1.13-1. Reach Downstream of Chili Bar -Gorge Sub-reach (Weber Creek Site) Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.		
Greenline Community Type	**Left Bank**	
Paspalum dilatatum- Hypericum mutilum	117	*10.2*
Verbena hastata – Hypericum mutilum	45	*3.9*
Poa sp.	21	*1.8*
Paspalum dilatatum	24	*2.1*
Lycopus americanus – Paspalum dilatatum	51	*4.5*
Carex aquatilis- Hypericum mutilum	24	*2.1*
Cephalanthus occidentalis	3	*0.3*
Boulder (no vegetation)	462	*40.4*
Disturbed (no vegetation)	33	*2.9*

Table 4.1.13-2. Reach Downstream of Chili Bar - Gorge Sub-reach (Weber Creek Site) Greenline Composition – Summary		
Community Types	**Left Bank**	
TREE – SHRUB DOMINATED TYPES	249	*21.8*
HERB DOMINATED TYPES	399	*34.9*
OTHER TYPES	495	*43.3*
TOTAL – ALL TYPES	1143	*100.0*

Table 4.1.13-3. Reach Downstream of Chili Bar- Gorge Sub-reach (Weber Creek Site) – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	Dominants: *Hypericum mutilum*. With *Juncus sp*., *Paspalum dilatatum, Polygonum sp.,* and *Verbena hastata*.	Riparian – poorly vegetated cobble
Zone 2	Dominants: *Ludwigia palustris, Juncus sp*., *Cyperus bipartitus, Alisma lanceolatum*. With seedling *Salix lasiolepis* (2 ft. tall).	Riparian – emergent
Zone 3	Dominants: *Verbena hastata, Hypericum* sp., *Ludwigia palustris, Lycopus americanus, Paspalum dilatatum, Myosotis laxa, Mimulus guttatus, Juncus sp*., *Mentha arvensis,* and *Centaurium muehlenbergii*.	Riparian – upper herbaceous
Zone 3	Dominants: *Alnus rhombifolia* (to 16 ft.)*, Salix lasiolepis* (to 14 ft.)*, Salix exigua.* With *Fraxinus latifolia* (to 12 ft.), *Verbena hastata*, *Artemisia douglasiana*, *Rubus discolor*, *Aster campestris, Plantago lanceolata*, *Oenothera elata ssp. hirsutissima*, and *Panicum acuminatum*.	Riparian – woody vegetation
Zone 4	Dominants: *Fraxinus latifolia* (to 12 ft.), *Brickellia californica, Cytisus scoparius, Aira sp*., and *Populus fremontii* (one, 9-10 ft. tall)	Transition – poorly vegetated boulder/bedrock
Zone 5	Upland vegetation (not recorded).	Upland – estimated extent of annual flood

Table 4.1.13-4. Reach Downstream of Chili Bar - Gorge Sub-reach (Weber Creek Site) – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	Mixed Dominance (sparse): *Verbena hastata, Epilobium densiflorum, Mentha arvensis, Solidago occidentalis, Plantago lanceolata, Xanthium strumarium,* and *Paspalum dilatatum*.	Riparian (sparsely vegetated cobbles)..
Zone 2	Mixed Dominance (sparse)*: Polygonum* sp.*, Ludwigia palustris, Veronica* sp.*, Paspalum dilatatum, Xanthium strumarium,* and *Mimulus guttatus.*	Riparian - Weber Creek overflow channel. Cobble/boulder.
Zone 3	Mixed Dominance (dense): *Hypericum mutilum, Paspalum dilatatum, Polygonum sp*., *Veronica* sp.*, Xanthium strumarium,* and *Mimulus guttatus.*	Riparian - protected area with soil development.
Zone 4	Dominants: *Salix exigua* (to 10 ft. tall), *Salix lasiolepis*. With *Cirsium vulgare, Rubus discolor*, *Cephalanthus occidentalis* (2 ft. tall), *Populus fremontii* (2 ft. tall), *Xanthium strumarium,* and *Solidago occidentalis.*	Riparian.
Zone 5	*Ambrosia sp., Digitaria sp., Conyza canadensis, Chondrilla juncea, Melilotus alba, Foeniculum sp.,* and *Centaurea solstitialis*	Transitional – occasionally flooded upland.
Zone 6	*Pinus sabiniana* and *Quercus wislizeni*	Upland.

Reach Downstream of Chili Bar - Coloma Sub-reach (CB2)

The Coloma sub-reach is characterized by a wide channel and broad floodplains. In places, suction dredging and tailings piling have artificially deepened the channel. Outside of these areas, the Coloma sub-reach represents the most substantial development of riparian vegetation in the Reach Downstream of Chili Bar.

The Coloma sub-reach supports the only concentrations of *Populus fremontii* in the study area. Rarely occurring in large stands, this species appeared to have a bimodal size and age distribution, occurring either as large, older trees or as infrequent saplings and seedlings. The large old trees are generally restricted to high banks 8 to 10 feet above river elevation (when flows are low) or in upland, developed areas where they may have been planted. Based on increment bores, five *P. fremontii* from the Coloma sub-reach were determined to have become established in 1960, 1970, 1993, 1996, and 1998. Three of these plants exhibited their greatest radial growth (width of annual growth-rings) in 1998, and one in 1997. Increased radial growth may reflect the presence of ample water after the 1997 flood event (see Section 5.1.3).

Site assessments were conducted in the following areas in the Coloma sub-reach: downstream of Camp Lotus (UTM 0680487 4297678, NAD83); Camp Lotus (UTM 0680727 4297224); Downstream of Marshall Gold Discovery State Historic Park (UTM 0682664 4297631); the OARS Campground (right bank, upstream of Greenwood Creek, UTM 0679005 4299033); New River Road (left bank, upstream of Coloma, UTM 0683586 4296676); across from the confluence with Clark Creek; and at the confluence with Hastings Creek. Because linear transects did not appear to adequately describe many of these sites, relative elevation was often measured at points of interest (e.g., *Populus* recruitment areas) instead. These data are described in the text. Representative site photographs are presented in Appendix D.

Downstream of Camp Lotus, a thin riparian zone is bordered on the upland side by development, but still supports many of the characteristic species of the Reach Downstream of Chili Bar. *Salix exigua* roots at the edge of the bank, protecting a small, muddy backwater area with *Typha latifolia*, *Ludwigia palustris*, and other wetland obligates. Large woody vegetation, mostly *Alnus rhombifolia*, begins at 2.4 feet above water level at low flow (less than 500 cfs). Occasionally flooded upland transitional zones occur at 3.3 feet, and true uplands at 5.6 feet above water level at low flow. On the opposite (right bank) shore, large *Populus fremontii* grow on high banks in a partially developed landscape, but no trees taller than 20 feet occur adjacent to the main river channel.

Table 4.1.13-5. Reach Downstream of Chili Bar- Coloma Sub-reach (Site Downstream of Camp Lotus) - Transect 1.

	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	*Salix exigua.*	Riparian, edge of bank
Zone 2	*Hypericum mutilum* and *Centaurium sp.*	Riparian – sparse forbs on cobble
Zone 3	*Typha latifolia, Ludwigia palustris, Polygonum sp.,* and *Limosella sp.*	Backwater
Zone 4	*Salix exigua.*	Riparian – equivalent elevation to zone 1
Zone 5	*Alnus rhombifolia* (to 25 ft tall).	Riparian
Zone 7	*Lupinus sp.* and *Oenothera elata.*	Transitional – occasionally flooded cobble.
Zone 8	*Melilotus alba* and *Daucus carota.*	Upland

At Camp Lotus, a broad, low-gradient floodplain supports some of the best-developed stands of riparian vegetation observed in the Reach Downstream of Chili Bar. Large *Populus fremontii* are scattered throughout the site, growing in excess of 36 inches DBH; these are matched with numerous small and medium sized trees, a size distribution suggesting strong recruitment in the area. Because this species is known to reproduce asexually through root sprouts, it is unclear to what degree these trees represent genetically separate individuals. Increment bores from 9- and 20-inch DBH trees in the area found them to have established in 1985 and 1968, respectively. Site measurements indicate that *Populus* at Camp Lotus occur from 4.8 to 11.0 feet above river elevation at low flow (less than 500 cfs), persisting at lower elevations than elsewhere in the Coloma sub-reach. *Populus* recruitment in Camp Lotus may have been influenced by irrigation; the site is partially developed and sprinklers are in use throughout much of the summer.

Although *Populus fremontii* is conspicuous at Camp Lotus, other species are more common and represent the bulk of the riparian vegetation, especially within 50 feet of the channel. *Salix exigua, Salix lasiolepis, Fraxinus latifolia,* and *Alnus rhombifolia* are all common, growing in excess of 20 feet tall in places. Flood damage to these shrubs and trees is uncommon. *Rubus discolor* and *Cephalanthus occidentalis* are common understory shrubs, as is *Cytisus scoparius* in upland or transitional habitats. *Juncus effusus, Carex aquatilis, Mentha arvensis*, and *Solidago occidentalis* are common representatives of a well developed herbaceous layer where not excluded by shrubs.

The upstream end of the Camp Lotus site includes a series of backwater pools that flood to approximately two feet deep, supporting wetland obligates such as *Tillaea aquatica, Eleocharis acicularis*, and *Limosella* sp. in addition to a few stems of the aquatic plant *Elodea canadensis*. Although these pools are somewhat protected, they remain riverine in nature, with a cobble-sand substrate and little soil development. Several *Populus fremontii* have established adjacent to the pools, ranging in size from one to nine inches DBH and up to 35 feet tall. Herbaceous species prevalent elsewhere on the Reach Downstream of Chili Bar are dominant here as well: *Verbena hastata*, *Solidago occidentalis*, *Mimulus guttatus*, *Epilobium densiflorum*, *Mentha arvensis*, *Hypericum* sp., and numerous others are all well-represented, as are *Carex aquatilis* and *Juncus supiniformis* to a lesser degree. Adjacent areas mapped by NWI as PSSC (palustrine scrub-shrub seasonally flooded) wetlands are cobble bars similar to those found throughout the Coloma sub-reach: dry and poorly vegetated in the center, they are ringed with *Salix exigua, Salix lasiolepis, Alnus rhombifolia,* small *Populus fremontii*, and *Rubus discolor* over a sparse herbaceous layer.

Upstream of Coloma at New River Road, the left bank is steep and eroded in places. At its base is a thin, sparse array of herbaceous species, including *Prunella vulgaris, Panicum acuminatum*, and *Hypericum mutilum*, bordered on its upper edge by woody shrubs, including *Salix lasiolepis, Alnus rhombifolia, Fraxinus latifolia*, and *Rubus discolor*. These quickly transition to include upland species such as *Cytisus scoparius*. At this level, measured at 8.0 feet above water level (less than 500 cfs) and nearing the top of the bank, *Populus fremontii* first becomes established, in the form of 12-foot tall saplings. Larger trees are established a foot higher, at the top of the bank. An increment bore from a 16 inch DBH *Populus fremontii* in this area indicated it became established in 1952.

Slightly downstream of Marshall Gold Discovery State Historic Park, large *Populus fremontii* are growing on a high, eroded bank, with *Fraxinus latifolia* (9-15 inches DBH) and numerous snags, the only ones observed in the Coloma sub-reach. Medium sized (about 12 inches DBH and more than 40 feet tall) *P. fremontii* growing here may be clonal, or may instead represent some of the only medium sized *Populus* established from seedlings in the Reach Downstream of Chili Bar. This small stand of trees is growing in a thicket with *Rubus discolor*, *Cytisus scoparius*, and *Cephalanthus occidentalis*, and was measured at 9.9 feet above water level (less than 500 cfs). Little was growing at the base of the bank.

Large *Populus fremontii* also occurs at the top of a tall, eroded bank at the OARS campground site, interspersed with *Salix exigua*. This area is cleared, irrigated, and partially developed, and was measured at 8.32 feet above water level (less than 500 cfs). Numerous other large *Populus fremontii* occur on the right bank in this area, all well removed from the channel. At the base of the bank, at elevations more typical of the bulk of riparian development in the Reach Downstream of Chili Bar, a flood-damaged *Alnus rhombifolia* was rooted at 3.22 feet above water level, an elevation equivalent to the high water mark for the day. Downstream, in-channel cobble bars and islands support mixed riparian hardwoods similar to those at Hastings Creek, all less than 25 feet tall and some observably flood-damaged.

Across from the confluence of the South Fork American River and Clark Creek (downstream of Greenwood Creek), the river enters a more confined segment of the Coloma sub-reach, although

the river corridor remains wide and flat relative to the Canyon or Gorge sub-reaches. Only the right bank was examined at this site. Gently sloping banks here allow water to move 20 feet or more laterally with only minor water elevation changes. Some small standing water areas with little or no growing vegetation were apparent in several areas and obvious "bathtub" rings on boulders and adjacent vegetation were noted. Large woody debris and piles of smaller debris high on the banks were observed. Two vegetation zone transects and a greenline transect were used to characterize this area (Table 4.1.13-8 - 4.1.13.9, and Figure 4.1.13-3 - 4.1.13-4, Appendix E). A third vegetation zone transect (Table 4.1.13-10 and Figure 4.1.13-5, Appendix E) was placed upstream where the bank is higher, through a stand of very large cottonwoods.

The width of the riparian zone at the site across from Clark Creek is variable, extending more than 100 feet in places, and most areas at or immediately above the greenline are well vegetated. The greenline is dominated to varying degrees by *Verbena hastata*, with a diverse mixture of other forbs and grasses (including *Juncus xiphioides, Panicum acuminatum, Hypericum mutilum, Polygonum sp., Xanthium strumarium, Agrostis gigantea, Mentha arvensis, Centaurium muehlenbergii, Solidago occidentalis, Prunella vulgaris, Epilobium densiflorum*, and *Gnaphalium palustre)*, small *Salix lasiolepis*, and occasional seedling *Fraxinus latifolia*. Behind the greenline, *Verbena hastata* and scattered clumps of *Salix exigua* are dominant, with occasional small *Fraxinus latifolia* Subsequently, elevation increases quickly, supporting first scattered *Brickellia californica*, *Rubus discolor*, *Cytisus scoparius*, *Artemisia douglasiana*, and *Centaurea solstitialis* (few) (a noxious weed); and then a *Quercus wislizeni* woodland.

Transect 3 was located upstream on a high bank through a dense thicket of 20-ft tall *Salix exigua*, *Alnus rhombifolia* up to 30 feet tall, and *Rubus discolor*, under eight very large *Populus fremontii* (80-90 feet tall and up to about 4.5 feet DBH). These trees were rooted less than 3.5 feet above the water surface (less than 500 cfs). The transect also intersected an old side channel where the vegetation did not indicate regular flooding.

Table 4.1.13-6. Reach Downstream of Chili Bar -Coloma Sub-reach (Clark Creek Site) Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Community Type	**Right Bank**	
Salix lasiolepis /Verbena hastata/Fraxinus latifolia	117	*16.2*
Salix lasiolepis /Verbena hastata	30	*4.2*
Verbena hastata	357	*49.4*
Verbena hastata – sparse with boulders	*39*	*5.4*
Forbs/grass – sparse	*78*	*10.7*
Forbs/grass – dense	102	*14.1*

Table 4.1.13-7. Reach Downstream of Chili Bar - Coloma Sub-reach (Clark Creek Site) Greenline Composition – Summary.

Community Types	**Right Bank**	
TREE – SHRUB DOMINATED TYPES	147	20.4
HERB DOMINATED TYPES	576	79.6
TOTAL - ALL TYPES	723	100

Table 4.1.13-8. Reach Downstream of Chili Bar- Coloma Sub-reach (Clark Creek Site) – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	*Verbena* (sparse), *Plantago lanceolata* (sparse).	Frequently inundated cobble.
Zone 2	*Verbena hastata* (small), *Plantago lanceolata, Hypericum mutilum, Panicum, Mimulus guttatus,* and *Fraxinus latifolia (seedlings)*.	Riparian.
Zone 3	Dominants: *Verbena hastata.* With *Plantago lanceolata, Hypericum mutilum, Prunella vulgaris, Vitis californica, grasses,* and *Xanthium strumarium.*	Cobble bar.
Zone 4	*Salix exigua* (scattered, 6-10 ft. tall), *Fraxinus latifolia* (8-10 ft. tall), *Brickellia californica, Vitis californica,* and *Artemisia douglasiana.*	Crest of cobble bar.
Zone 5	*Brickellia californica* and *Sisymbrium occidentalis*	Upland transitional.
Zone 6	*Cytisus scoparius* and *Artemisia douglasiana.* With *Centaurea solstitialis* (few).	Riparian, edge of bank.

Table 4.1.13-9. Reach Downstream of Chili Bar - Coloma Sub-reach (Clark Creek Site) - Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	*Verbena hastata, Hypericum mutilum,* and *Xanthium strumarium.*	Frequently inundated cobble.
Zone 2	Mixed Dominance: *Juncus xiphioides, Hypericum mutilum, Polygonum sp., Xanthium strumarium, Agrostis sp., Mentha arvensis, Centaurium muehlenbergii, Solidago occidentalis, Bidens sp., Prunella vulgaris, Epilobium densiflorum,* and *Gnaphalium.* With *Salix lasiolepis, Fraxinus latifolia,* and *Cephalanthus occidentalis* (less than 2 ft. tall).	Riparian. Greenline.
Zone 3	Dominants: *Verbena hastata* and *Salix exigua.* With *Plantago lanceolata, Hypericum mutilum, Prunella vulgaris, Panicum sp.,* and *Daucus carota.*	Cobble bar.
Zone 4	Dominants: *Salix exigua* (scattered, 6-8.5 ft. tall), *Brickellia californica, Rubus discolor, Vitis californica, Panicum acuminatum, Sisymbrium sp.,* and *Eschscholzia californica.*	Mesic.
Zone 5	Dominants: *Artemisia sp.* (shrubs)*, Lotus sp., Rumex acetosella,* and *Chamaesyce sp.*	Upland/transitional.

Table 4.1.13-10. Reach Downstream of Chili Bar- Coloma Sub-reach (Clark Creek Site) – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	*Populus fremontii* (trees 80-90 ft. tall)*, Alnus rhombifolia* (15-25 ft. tall), *Salix exigua* (20 ft. tall), and *Rubus discolor* (4 ft. tall). With *Melilotus alba* and *Juncus effusus* on the bank.	Riparian.

Table 4.1.13-10. Reach Downstream of Chili Bar- Coloma Sub-reach (Clark Creek Site) – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 2	*Rubus discolor* (dense thicket dominating most of the zone). With *Alnus rhombifolia, Fraxinus latifolia, Salix lasiolepis, Cytisus scoparius,* and *Melilotus alba*.	Mesic transitional.
Zone 3	*Rubus discolor, Cytisus scoparius, Ambrosia psilostachya,* and *Artemisia douglasiana.*	Mesic. Located in relictual channel.
Zone 4	*Quercus wislizeni, Cytisus scoparius, Centaurea solstitialis,* and *Daucus carota.*	Upland.

Table 4.1.13-11. Reach Downstream of Chili Bar- Coloma Sub-reach (Clark Creek Site) Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.				
	RB transect (723 feet)			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus rhombifolia	0	1	3	0
Salix exigua	20	22	110	0
Rubus discolor	1	1	4	0
Fraxinus latifolia	0	0	50	0
Vitis californica	0	2	22	0
Cephalanthus occidentalis	0	0	1	0

At Hastings Creek, the channel has narrowed from the wide floodplain evident upstream. This is especially the case on the left bank, where riparian vegetation is restricted to a thin band of *Alnus rhombifolia* growing to approximately 20 feet tall at the base of a steep slope (Table 4.1.13-12 and Figure 4.1.14-6, Appendix E). The cobble they grow in supports few herbaceous species. On the left bank, strong development of woody riparian vegetation is limited to the alluvial fan created by Hastings Creek itself, where some of the largest *Alnus rhombifolia* observed on the Reach Downstream of Chili Bar occur (more than 30 feet tall and 12 inches DBH); they share dominance with *Salix* spp. and *Fraxinus latifolia*. Herbaceous species are common in the Hastings Creek area as well. Upstream of this site, mid-channel cobble bars and deposition in river bends support mixed riparian hardwoods (*Alnus rhombifolia, Salix lucida, Salix exigua, Fraxinus latifolia, Platanus racemosa*, and a single observed *Populus fremontii*), but most of these trees appear flood-damaged, often multi-stemmed, and are restricted to approximately 25 feet tall.

Table 4.1.13-12. Reach Downstream of Chili Bar -Coloma Sub-reach (Hastings Creek Site) - Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Right Bank:		
Zone 1	Mixed dominance: *Verbena hastata, Juncus effusus, Hypericum mutilum*, *Lycopus americanus, Mimulus guttatus, Myosotis laxa, Solidago occidentalis, Prunella vulgaris, Cyperus eragrostis, Paspalum dilatatum,* and *Panicum acuminatum.*	Riparian – herbaceous

Table 4.1.13-12. Reach Downstream of Chili Bar -Coloma Sub-reach (Hastings Creek Site) - Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 2	No vegetation.	Backwater channel - cobble
Zone 3	Mixed dominance: *Verbena hastata, Juncus effusus, Hypericum* sp., *Lycopus americanus, Mimulus guttatus, Myosotis laxa, Solidago occidentalis, Prunella vulgaris, Cyperus eragrostis, Paspalum dilatatum,* and *Panicum acuminatum.*	Riparian - herbaceous
Zone 4	Dominants: *Alnus rhombifolia, Salix lucida.* With *Oenothera elata, Juncus effusus,* and *Solidago occidentalis*.	Riparian edge
Zone 5	Dominants: *Rubus discolor.*	Transitional
Zone 6	Dominants: *Ambrosia psilostachya, Centaurea solstitialis, Lotus purshianus,* and *Bromus diandrus.*	Upland floodplain – weedy and poorly vegetated

Reach Downstream of Chili Bar - Upper Canyon Sub-reach (CB3)

The Upper Canyon Sub-reach, the first reach downstream from Chili Bar, is characterized by steep, confining valley walls and a moderate stream gradient. Most of the canyon is bedrock or boulder-lined, with very limited development of riparian vegetation. Few sizeable areas of alluvial deposition occur. The riparian study site in the Upper Canyon Sub-reach was the same as that examined during the Channel Morphology Study, a straight run of river approximately 415 feet long. Data on greenline community type (Table 4.1.13-13 and 4.1.13-14) and woody species regeneration (Table 4.1.13-15) were collected for the left bank, and there were three vegetation cross-section transects (Table 4.1.13-16 - 4.1.13-18, and Figure 4.1.13-7 - 4.1.13-9, Appendix E). Representative site photographs are presented in Appendix D.

The left bank is poorly vegetated, lined with a boulder complex interspersed with areas of sand and silt. Silt deposition on the boulders is prevalent throughout the study site. A thin (6-10 foot wide) band of *Carex aquatilis* and mixed forbs forms much of the greenline, bordered on its upper edge by sparse but continuous band of *Salix exigua* and *S. lasiolepis*. In places, these shrubs themselves form the greenline. Adjacent, somewhat higher areas support a mixture of small (less than 25 feet tall) riparian trees, including *Alnus rhombifolia*, *Acer macrophyllum*, and a single larger *Populus fremontii*. Increment bores from 6 and 8 inch DBH *Alnus rhombifolia* in this area found them to have established in 1989 and 1986, respectively. Seedling and sapling size *A. rhombifolia* and *P. fremontii* were observed as well. *Rubus discolor* is the dominant shrub in this area; *Cytisus scoparius* also occurs in the transition to uplands. Slightly downstream, a concentration of unidentifiable snags and stumps 6-10 inches in diameter occurs. Adjacent true uplands are forested and dominated by *Quercus wislizeni*.

Table 4.1.13-13. Reach Downstream of Chili Bar - Upper Canyon Sub-reach Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.		
Community Type	**Left Bank**	
Alnus rhombifolia- Carex aquatilis	*9*	*2.2*
Salix exigua – w/boulders	15	*3.6*

Table 4.1.13-13. Reach Downstream of Chili Bar - Upper Canyon Sub-reach Greenline Composition. Cumulative distance (feet) occupied by each community type is followed (in italics) by the percentage of the total distance.

Community Type	Left Bank	
Salix lasiolepis-mixed forbs (*Prunella vulgaris, Panicum acuminatum, Mimulus guttatus, Xanthium sp., Solidago occidentalis, Bidens sp., Mentha arvensis, Aster campestris*)	24	*5.8*
Salix exigua-Carex aquatilis	96	*23.2*
Verbena hastata	69	*16.7*
Verbena hastata – w/ boulder	72	*17.4*
Mixed forbs – (*Prunella vulgaris, Panicum acuminatum, Mimulus guttatus, Xanthium strumarium, Solidago occidentalis, Bidens sp., Mentha arvensis, Aster campestris*)	42	*10.1*
Hypericum mutilum – Cephalanthus occidentalis	*30*	*7.2*
Hypericum mutilum – w/boulders	*57*	*13.8*

Table 4.1.13-14. Reach Downstream of Chili Bar - Upper Canyon Sub-reach Greenline Composition – Summary.

Community Types	Left Bank	
TREE - SHRUB DOMINATED TYPES	144	*34.8*
HERB DOMINATED TYPES	270	*65.2*
TOTAL – ALL TYPES	414	*100.0*

Table 4.1.13-15. Reach Downstream of Chili Bar - Upper Canyon Sub-reach Greenline Woody Species Composition. Species recorded up to 3 feet on either side of the greenline transect. "Dead" = dead or decadent plants.

	LB Transect			
Species	**Mature**	**Sapling**	**Seedling**	**Dead**
Alnus rhombifolia	2	12	5	1
Salix exigua	40	40	84	2
Salix lasiolepis	8	8	28	0
Fraxinus latifolia	0	0	1	0
Populus fremontii	0	0	1	0
Quercus sp.	0	0	1	0
Rubus discolor	4	8	0	0
Vitis californica	0	2	10	0
Cephalanthus occidentalis	3	2	0	0

Table 4.1.13-16. Reach Downstream of Chili Bar - Canyon Sub-reach – Transect 1

	SPECIES AND ABUNDANCE	HABITAT
Left Bank:		
Zone 1	Sparse cover: *Panicum sp*., *Vitis californica,* and *Salix sp.* (seedlings).	Mostly bare boulders and sand.
Zone 2	Sparse cover: *Salix exigua* (to 5 ft. tall)*, Fraxinus latifolia* (to 7 ft. tall)*, Populus fremontii* (to 8 ft. tall)*, Rubus discolor* (to 2 ft. tall)*, Salix lasiolepis, Plantago lanceolata*, *Panicum sp.*, and *Melilotus alba.*	Boulders, flooded frequently.
Zone 3	Dominants: *Rubus discolor* (to 3 ft. tall). With *Vitis californica*, *Cytisus scoparius* (to 6 ft. tall), *Verbascum thaspus, Artemisia sp.*, and *Daucus carota.*	Upper boulder bar area; scouring and flood debris is evident.

Table 4.1.13-16. Reach Downstream of Chili Bar - Canyon Sub-reach – Transect 1		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 4	Dominants: *Salix exigua* (to 7 ft. tall), *Salix lasiolepis,* and *Rubus discolor* (to 4 ft. tall). With *Populus fremontii* (to 3 ft. tall), *Cytisus scoparius* (to 3 ft. tall), *Equisetum hyemale*, *Juncus sp., Panicum sp., Vitis californica, Daucus carota,* and *Cirsium sp.*	Flood channel area; scouring and flood debris is evident.
Zone 5	Dominants: *Salix lasiolepis* (to 16 ft. tall), *Rubus discolor* (to 3 ft. tall), and *Cytisus scoparius* (to 6 ft. tall). With *Juncus sp.* and *Vinca major.*	Transitional area on bar, large flood debris is evident.
Zone 6	Dominants: *Cytisus scoparius.* With *Vitis californica*, *Juncus sp., Artemisia, Vinca major*, and various grasses.	Upland. No flood evidence. Adjacent to large cottonwood.

Table 4.1.13-17. Reach Downstream of Chili Bar - Canyon Sub-reach – Transect 2		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	Mixed community: *Salix sp.* (seedlings), *Alnus rhombifolia* (seedlings), *Hypericum mutilum*, *Hypericum anagalloides, Myosotis laxa, Mentha arvensis*, *Mimulus guttatus*, *Panicum sp., Epilobium sp., Xanthium strumarium, Solidago occidentalis, Centaurium muehlenbergii, Polygonum, Rubus discolor,* and *Plantago lanceolata*.	At waters' edge. Frequently inundated. Caked mud on cobbles.
Zone 2	Dominants: *Salix exigua* (to 5 ft. tall) and *Salix lasiolepis* (to 3 ft. tall). With *Rubus discolor* (to 3 ft. tall), *Lotus sp., Artemisia douglasiana, Panicum sp., Hypericum mutilum, Bidens frondosa,* and *Helenium puberulum.*	Riparian, periodically inundated.
Zone 3	Dominants: *Rubus discolor* (to 2.5 ft. tall) and *Salix spp.* (to 3.5 ft. tall). With *Aster sp, Vitis californica, Melilotus alba, Daucus carota*, *Leucanthemum vulgare*, and *Lotus sp.*	Transitional, much drier, on boulders,
Zone 4	Sparse: *Rubus discolor, Salix lasiolepis, Vitis californica,* and *Melilotus alba.*	Upland or transitional (may receive seepage from slope).

Table 4.1.13-18. Reach Downstream of Chili Bar- Canyon Sub-reach – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Left Bank:		
Zone 1	Sparse cover: few *Salix* (seedlings) and *Verbena hastata.*	Submerged area on boulders and gravel, frequently inundated.
Zone 2	Dominants: *Verbena hastata*, *Alnus rhombifolia* (to 2 ft. tall), and *Salix exigua* (to 3 ft. tall). With *Panicum sp., Myosotis laxa, Lotus sp.*, *Mimulus guttatus, Plantago lanceolata, Hypericum mutilum, Solidago occidentalis,* and *Stellaria sp.*	Periodically inundated boulder area.
Zone 3	Dominants: *Salix exigua* (to 15 ft. tall) and *Salix lasiolepis* (to 8 ft. tall). With *Aster sp., Lotus sp.*, *Panicum sp.*, and *Verbena hastata.*	Moist. Boulders.
Zone 4	Mixed herbaceous: *Hypericum mutilum, Prunella vulgaris, Xanthium strumarium, Plantago lanceolata, Epilobium sp., Lotus sp., Vitis californica, Solidago occidentalis, Polygonum sp., Panicum sp., Myosotis laxa, Centaurium muehlenbergii, Aster sp., Juncus sp., Cyperus sp., Gnaphalium sp.,* and *Bidens frondosa.*	Wet area in a depression.

Table 4.1.13-18. Reach Downstream of Chili Bar- Canyon Sub-reach – Transect 3		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 5	Dominants: *Cytisus scoparius* (to 4 ft. tall), *Quercus sp.* (to 5 ft. tall), *Lotus sp., Vitis californica, Bromus sp.* and other grasses.	Upland transition on bedrock, with large boulders.

4.1.14 Riparian Vegetation at the UARP Reservoirs

Vegetation Alliances mapped around the UARP reservoirs are predominantly upland types (SMUD 2001 and summarized in Table 4.1.14-1). Smaller areas are mapped as Alliances that can be classified as characteristic of riparian or wetland settings (Wet Meadow, Lodgepole Pine, Mountain Alder, and White Alder). Wetlands associated with UARP reservoirs are discussed in Sections 4.2.1 to 4.2.5. Steep slopes and well-drained substrates (or bedrock) generally constrain the occurrence of riparian vegetation around the UARP reservoirs, although thin bands, small patches, or individual shrubs or trees characteristic of riparian settings (e.g., *Salix spp*.) may occur. At Brush Creek Reservoir and Slab Creek Reservoir, White Alder Alliance occurs only around the mouths of streams that flow into each reservoir.

Table 4.1.14-1. Summary of Vegetation Alliances along shorelines of UARP reservoirs.	
Reservoir	**Vegetation Alliances Along Shorelines (Listed In Order of Abundance)**
Rubicon	Huckleberry Oak, Lodgepole Pine, Wet Meadow, Barren/Rocky
Buck Island	Huckleberry Oak, Lodgepole Pine, Mixed Conifer/Fir, Barren/Rocky
Loon Lake	Mixed Conifer/Fir, Huckleberry Oak, Barren/Rocky, Wet Meadow, Lodgepole Pine
Gerle Creek	Mixed Conifer/Fir, Wet Meadow, Huckleberry Oak
Robbs Peak	Mixed Conifer/Fir
Ice House	Mixed Conifer/Fir, Barren/Rocky, Montane Mixed Chaparral, Wet Meadow
Union Valley	Mixed Conifer/Fir, Barren/Rocky, Wet Meadow (inclusions of Mountain Alder)
Junction	Mixed Conifer/Pine, Montane Mixed Chaparral
Camino	Canyon Live Oak, Douglas-fir/Pine
Brush Creek	Douglas-fir/Pine, Douglas-fir, Canyon Live Oak, White Alder
Slab Creek	Douglas-fir/Pine, Canyon Live Oak, White Alder

4.1.15 Riparian Vegetation at Chili Bar Reservoir

The dominant vegetation alliances around Chili Bar Reservoir are upland forests supporting *Pseudotsuga menziesii*, *Pinus ponderosa*, and *Quercus chrysolepis*. In general, the occurrence of riparian vegetation is constrained by steep slopes and well-drained substrates. However, small areas of riparian-influenced vegetation do occur, most often as patches or thin bands of relatively modest gradient. These riparian habitats are dominated by tree and shrub-sized *Salix lucida*, *Platanus racemosa*, *Populus fremontii*, and *Alnus rhombifolia*, with lesser coverage of *Juglans californica*, *Ailanthus altissima*, and occasional upland species such as *Quercus kelloggii*. This varied overstory composition differs from the typical *Alnus rhombifolia*-dominated riparian habitats found further east on the SFAR (including parts of the Chili Bar Project upstream of White Rock Powerhouse) and is best described within the CalVeg system as a Mixed Riparian Hardwoods Alliance. Less commonly, some riparian forests are dominated solely by *Salix spp*. and *Alnus rhombifolia* and are best described as the Willow-Alder Alliance. In each case, the riparian forests are of limited extent and occur above the apparent high water mark.

4.2 Wetlands Study Results

4.2.1 Loon Lake Reservoir Wetlands

Loon Lake Reservoir is one of the three primary storage reservoirs in the UARP, capturing water from the Gerle Creek watershed and storing approximately 18 percent of UARP capacity. The elevation at the spillway is 6,410 feet. The storage of water at Loon Lake Reservoir typically follows an annual cycle, with increasing reservoir elevations through the spring (as a result of rain and melting snow-pack) reaching highest elevations during the early summer (in 2003 this was 6408.68 feet on July 6, 2003, with seven days over 6408.0 between June 22 and July 8, 2003) (Figure 4.2.1-1). The reservoir levels gradually lower throughout the summer due to generation, which continues on through the winter months; this allows for adequate water storage capacity for the spring to follow. The annual cycle creates a typical seasonal change of about 36 feet (37.9 feet in 2003) and a median low water elevation of 6,370 feet in March.

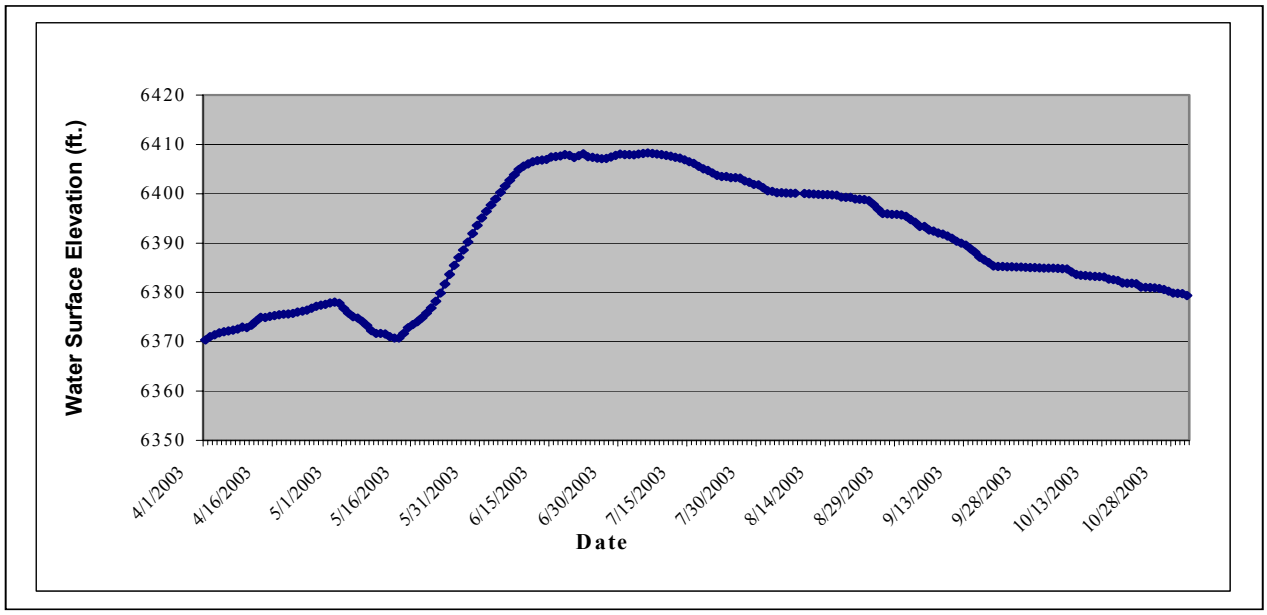

Figure 4.2.1-1. Loon Lake Reservoir Water Surface Elevation April – October, 2003. Highest elevation recorded on July 6 at 6,408.68 feet.

Two primary kinds of wetlands occur contiguous to Loon Lake Reservoir: 1) lakeshore-basin meadows on seasonally or persistently flooded shorelines and in shallow bays; and 2) depressional meadows within swales. The largest complex of wetlands is at the north end of the reservoir where there may be a combination of reservoir-induced flooded, accumulation of snowmelt, and inflow from a creek (Ellis Creek) (Figure 4.2.1-2, Appendix A). The total area of wetlands associated with Loon Lake Reservoir is 37.9 acres. The NWI map (USFWS 1995) indicates the following types of palustrine wetland types around Loon Lake Reservoir: PEMC, PEMF, PEMFh, PSSA, PSSC, PUBF, and PFOA. The topography of the area and information

collected during site investigations, which are discussed below, suggest that NWI underestimates the extent of reservoir-influence to these wetlands. Wetland occurrence at Loon Lake Reservoir is limited by extensive areas of bedrock along shorelines and in seasonally submerged areas.

Field surveys were conducted at a total of four wetland sites around Loon Lake Reservoir (Figure 4.2.1-2, Appendix A). These sites encompass most of the total wetland area and wetland types associated with the reservoir. Representative site photographs are presented in Appendix D.

Loon Lake Reservoir Wetland Site 1

Wetland Site 1 is located on a peninsula on the west side of the reservoir and occupies about 3.1 acres. The NWI map (USFWS 1995) shows this wetland as three small, separate areas classified as PUBF (palustrine unconsolidated bottom, semi-permanently flooded). The site investigation indicated that the wetland was more extensive than shown by NWI and is predominantly PEMCh.

When the site was examined on July 9, 2003, most of the wetland area was submerged by 2-4 feet of water. A transect 200.6 feet in length was placed from shallow water to an upland area to describe wetland vegetation zones and determine elevations relative to the reservoir water surface. The transect results illustrate only slight topographic relief. According to California Department of Water Resources (2003), the water surface elevation of Loon Lake Reservoir on July 9 was 6,407.95, or just slightly less than the highest level for the year. Species composition varied in apparent relation to differences in wetland hydrology along the transect (Table 4.2.1-1, Figure 4.2.1-3, Appendix E). Based on this information, only vegetation zones 5 and 7 were above annual high water in 2003 (Table 4.2.1-1). The principal species that characterized seasonally submerged zones was *Carex vesicaria.* Only a few other species of vascular plants were found along the transect or in more extensive surveys of the site. None of the forbs that are characteristic of wet meadows (e.g., sloping meadows around Union Valley Reservoir) were found at this site.

The site was examined a second time on September 19, 2003 when the water surface elevation was approximately 20 feet lower (6,386.59 feet) than the previous visit. This decrease in water surface elevation created two isolated pools disjunct from the reservoir; boulder and gravely patches dominated exposed areas. The vegetation surrounding these pools was largely comprised of *Carex vesicaria*, with *Carex aquatilis* and *Eleocharis acicularis*. Only a few other plants species were observed in this area. *Taeniatherum caput-medusae*, a species targeted by the noxious weed survey, occurred at the margin of the site, but was not common.

Soil sampling at this site 1 was conducted on the north edge of the wetland approximately five feet upslope of the high water mark for 2003. The soil pit was dug at UTM 0733931E 4320945N in an area dominated by *Carex vesicaria* (occurred one foot down slope). The soil pit was dug 10.5 inches deep to subsurface bedrock. In general, the soil was relatively dry loamy sand with a prominent O horizon in the upper four inches of the core and mostly mineral soil characteristics with some brown/red mottling. The soil exhibited a hue of 7.5 YR with a chroma

of 3/3 and gritty texture. Despite the high chroma value, mottling was present, indicating wetness probably sufficient to create hydric soils.

Table 4.2.1-1. Loon Lake Reservoir Wetland Site 1 – Transect 1 (July 9, 2003)		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 1	Dominants: Abundant *Carex vesicaria* (submerged).	Zone is below the water surface elevation. Located 0.3 ft. below annual high water.
Zone 2	Dominants: Abundant *Carex vesicaria* (emergent) heavily grazed throughout zone.	Zone is below the water surface elevation.
Zone 3	Dominants: *Carex vesicaria.*	At first waters edge; above water surface only recently.
Zone 4	Dominants: *Carex vesicaria, Juncus xiphioides,* and *Scirpus diffusus.* Other species: *Poa* sp.	At second waters edge.
Zone 5	Dominants: *Gnaphalium palustre.* Other species: *Pinus* (sapling), and *Verbascum thaspus*.	Extreme high water line.
Zone 6	Dominants: *Poa* sp.	Lowest point in moist depression, just recently flooded.
Zone 7	Dominants: *Pinus contorta.*	Above the high water line, no herbaceous vegetation present. Bedrock and boulders.

Loon Lake Reservoir Wetland Site 2

This site is a complex of lakeshore basin meadow (Pleasant Meadow) connected to a gently sloping, semi-circular swale (Figure 4.2.1-2, Appendix A). These wetlands occupy 10.7 acres. According to the NWI map (USFWS 1995), the complex is comprised of a large area of PSSC and smaller areas classified as PEMF, PEMFh and PUBF. When the area was examined on July 14, 2003, more than half of the area was flooded by the reservoir. Information collection during the site investigation suggests that the wetland would be better described as predominantly PEMCh, with areas of PEMF (or PEMFh), PSSC, and PFOA.

Two transects were placed within the wetland to describe vegetation zones, topography, and relation to reservoir water surface elevation (Table 4.2.1-2 and 4.2.1-3; and Figure 4.2.1-4 and 4.2.1-5, Appendix E). Along both transects, there is only slight topographic relief. Based on water surface elevation data (California Department of Water Resources 2003), only vegetation zone 8 and 9 on Transect 1 (Table 4.2.1-2) and zone 4 on Transect 2 (Table 4.2.1-3) are above the annual high water line. The principal species in areas subject to prolonged annual inundation is *Carex vesicaria.* Few other species were observed along the transects.

The site was examined a second time on September 19, 2003 when the water surface elevation was approximately 20 feet lower (6,386.59 feet) than the previous visit. This decrease in water surface elevation exposed virtually all of the Pleasant Meadow area leaving only a small-incised channel in the southern portion of the meadow with standing water. The exposed meadow was dominated by *Carex vesicaria*, along with *Carex aquatilis*, *Juncus xiphioides*, and *Eleocharis acicularis*. Only a few other plants species were observed in this area.

A soil pit to describe soils was located on the north edge of the wetland at the approximate high water mark for 2003 (UTM 0733326E 4322144N, the same location as Transect 1) in an area dominated by *Carex vesicaria.* The soil pit was dug 12 inches deep. Soil had a sandy-clay-loam texture and was moist to the touch. The soil was generally peat with both intact and decomposed organics observed. The soil exhibited a hue of 10 YR with a chroma of 2/2 and was very dark brown in color. As a result, the soil was characterized as being organic histosol (histic epipedon).

A second soil pit was placed at the location of Transect 2 well above the approximate high water mark for 2003. The soil pit was dug at 0733429E 4321946N in an area dominated by grasses and herbaceous species at the *Pinus contorta* tree line. Soil was dry to the touch, with no bedrock and some moisture at the 12-inch depth. The soil was generally highly organic with a well-developed O horizon and distinguishable plant material. The soil was determined to have a hue of 10 YR with a chroma of 2/1, and was very dark brown and dark red in color. As a result, the soil was characterized as being organic histosol (peat-like) with loamy-sand soil texture.

A reconnaissance survey of wetland areas along the swale north of the reservoir indicated more diverse plant communities. Near the reservoir this swale was a backwater that appears to be flooded at the same elevation as the reservoir. Further from the reservoir there are occasional pools and depressional meadow, dominated by *Carex vesicaria*, *Carex aquatilis*, and *Juncus balticus*; and areas that appeared to be wet for short periods. Areas of *Alnus incana* and *Pinus contorta* also occurred within the swale and these represent PSS and PFO wetland. Some of the species found along this swale were not documented at the other sites examined around Loon Lake Reservoir, including *Camassia quamash*, *Senecio triangularis*, *Perideridia parishii* (or *P. lemmonii*), *Veratrum californicum*, *Juncus chlorocephalus*, and *Lilium parvum*.

Table 4.2.1-2. Loon Lake Reservoir Wetland Site 2 – Transect 1 (July 14, 2003)

	SPECIES AND ABUNDANCE	HABITAT
Zone 1	Dominants: *Carex vesicaria* (emergent).	Depth of water 1.0 ft. Located 1.4 ft. below annual high water elevation.
Zone 2	Dominants: *Carex vesicaria*. Other species: *Scirpus microcarpus and Viola macloskeyi.*	Submerged/emergent. Depth of water 1.6 ft.
Zone 3	Dominants: *Scirpus microcarpus* and *Viola macloskeyi*. Other species: *Juncus xiphioides*.	Waters edge.
Zone 4	Dominants: *Scirpus microcarpus* and *Viola macloskeyi*. Other species: *Galium sp., Juncus xiphioides, Pinus* (seedling), and *Poa* sp.	Located on slightly higher area.
Zone 5	Dominants: *Juncus xiphioides, Carex vesicaria,* and *grass*.	Waters edge of channel /pool.
Zone 6	Dominants: *Carex vesicaria, Carex aquatilis, Juncus xiphioides, Hypericum anagalloides, Viola macloskeyi, Scirpus microcarpus,* and *Pinus contorta* (seedlings).	Highest point on hummock (higher ground) within the wetland.
Zone 7	Dominants: *Carex vesicaria, Carex aquatilis, Juncus xiphioides, Hypericum anagalloides, Viola macloskeyi, Scirpus microcarpus,* and *Pinus contorta (seedlings).*	At waters' edge of pool. Deepest point in pool is 1.35 ft.
Zone 8	Dominants: *Pinus contorta.* Other species*: Mimulus primuloides.*	Highest point between the two pools near the outlet for the

Table 4.2.1-2. Loon Lake Reservoir Wetland Site 2 – Transect 1 (July 14, 2003)		
	SPECIES AND ABUNDANCE	**HABITAT**
		interior swale.
Zone 9	Dominants: *Carex vesicaria,* and *Juncus xiphioides.* Other species: *Epilobium* sp.*, Scirpus microcarpus,* and *Viola macloskeyi.*	High point at the outlet of interior swale.
Zone 10	Dominant: *Carex vesicaria*. Other species: *Mimulus primuloides.*	Low point within the swale and along the side of the swale.

Table 4.2.1-3. Loon Lake Reservoir Wetland Site 2 – Transect 2 (July 14 2003)		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 1	Dominants: *Carex vesicaria* (emergent) and *Scirpus microcarpus* (emergent).	Depth of water 1.6 ft. Located 1.4 ft. below annual high water elevation.
Zone 2	Dominants: *Carex vesicaria* and *Scirpus microcarpus*. Other species: *Viola macloskeyi, Galium* sp., and *Poa* sp.	Water's edge
Zone 3	Dominants: *Poa* sp. Other species: *Carex vesicaria* and *Viola macloskeyi*.	Upland of water's edge within the wetland zone.
Zone 4	Dominants: *Pinus contorta*. Other species: *Viola macloskeyi* and *Poa* sp.	Upland into tree line.

Loon Lake Reservoir Wetland Site 3

Wetland site 3 is located at the north end of the reservoir in a shallow bay into which flows a creek (Ellis Creek). A reconnaissance survey of this area was conducted on July 14, 2003, at which time most of the area was flooded by the reservoir. The area is a lakeshore-basin meadow that is seasonally flooded. The channel of Ellis Creek is incised extending far out into the wetland and the creek bed is probably permanently flooded. The shores of the creek were sandy. Margins of the wetland that were not inundated during the site visit were vegetated predominantly by *Carex vesicaria*. This wetland site occupies about 2.1 acres, most or all presumed to be reservoir influenced.

Loon Lake Reservoir Wetland Site 4

This site is located on the south shore of Loon Lake Reservoir and occupies about 1.8 acres. The wetland is not mapped by NWI. A site investigation on August 13, 2003 indicated this is lakeshore meadow that should be classified as PEMCh. A road bisects the wetland.

Vegetation was comprised of mostly *Carex aquatilis*, with *Carex vesicaria* and *Mimulus primuloides*. A transect was extended from the water edge to the tree line to examine the topography of the site and the relation to reservoir water surface elevation (Figure 4.2.1-6, Appendix E). The transect indicated that the entire wetland is located below the 2003 annual high water line.

4.2.2 Gerle Creek Reservoir Wetlands

Gerle Creek Reservoir is a run-of-the-river reservoir that serves as an afterbay for the Loon Lake Powerhouse. The maximum usable storage capacity is 547 acre-feet with the capability to impound 1,260 acre-feet at a water elevation of 5,231 feet. Because the reservoir is operated as run-off-the-river, water level in the reservoir fluctuates with changing volumes of in-flow, typically ranging from 5,226 feet to 5,231 feet (Figure 4.2.2-1). During 2003 (April 1-Oct 31), Gerle Creek Reservoir fluctuated between the elevation 5223.1 feet (October 15) and 5230.75 feet (August 31) reaching elevations over 5,230 feet in June, August, and September.

Wetlands at Gerle Creek Reservoir consist of small lakeshore-basin meadows with only slight topographic relief. The total area of wetlands at Gerle Creek Reservoir is 0.9 acre. Compared to other reservoirs in the UARP, large expanses of lakeshore devoid of vegetation do not occur. All wetlands were examined on August 13, 2003. Representative site photographs are presented in Appendix D.

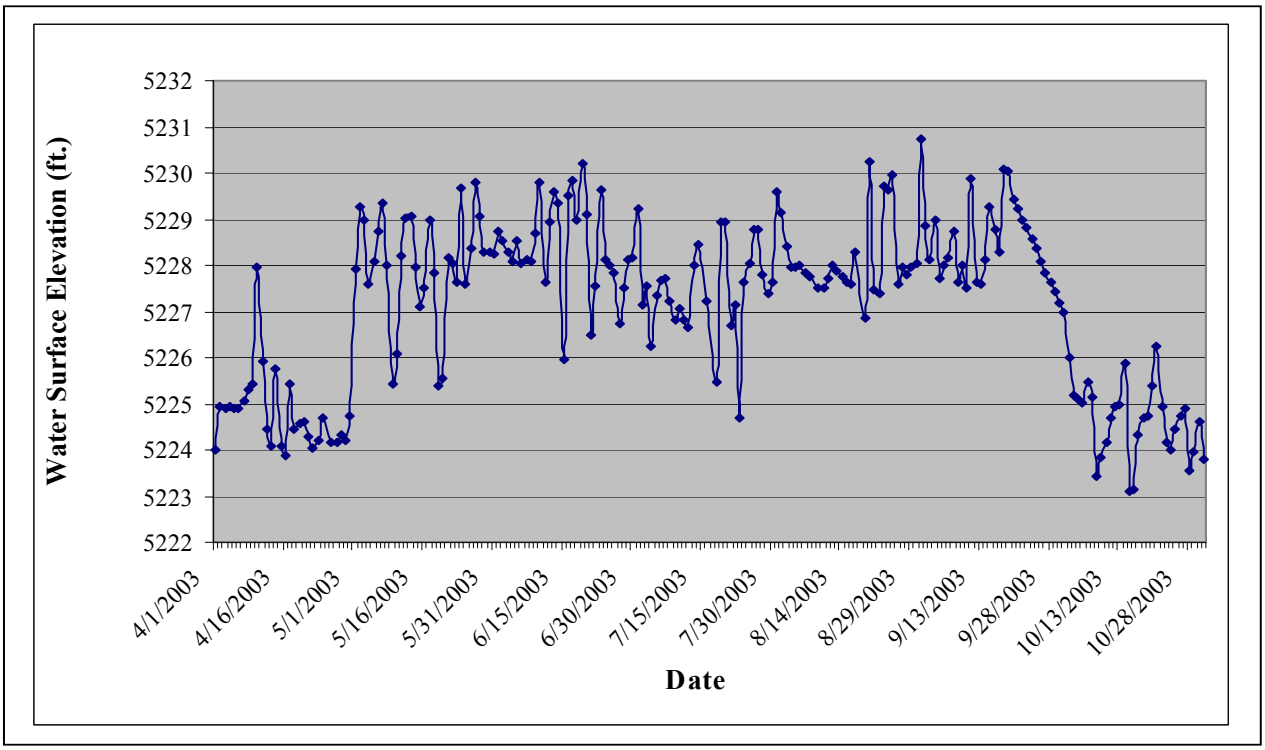

Figure 4.2.2-1. Gerle Creek Reservoir Water Surface Elevation April – October, 2003. Highest elevation recorded on August 31 at 5,230.75 feet.

Gerle Creek Reservoir Site 1

Located on the north shore of the reservoir (UTM 0725622 4316876) (Figure 4.2.2-2, Appendix A), this is a lakeshore-basin meadow occupying about 0.4 acre (based on wetland extent evident

on the August 2002 aerial photograph). The entire wetland appears to be influenced (and possibly created by) the reservoir.

A transect 214 feet in length and extending from shallow water (1.32 feet deep) to the tree line was used to describe the topography of the site (Figure 4.2.2-3, Appendix E). Because wetland species occurrence was patchy rather than zonal, only limited information on wetland species occurrence along the transect was collected. Vegetation began approximately 0.3 foot above water surface elevation, where *Eleocharis acicularis* and some *Carex vesicaria* occurred. Overall, *Carex vesicaria* is a major species in the wetland. Other principal species are *Agrostis gigantea, Juncus xiphioides*, *Carex aquatilis*, and *Lotus pinnatus*. Additional species include *Hypericum anagalloides*, *Geum macrophyllum*, *Juncus balticus*, *Solidago occidentalis*, *Veratrum californicum*, *Mimulus guttatus*, *Mimulus moschatus*, *Salix lucida*, *Stachys ajugoides*, *Epilobium ciliatum*, *Prunella vulgaris*, *Mentha arvensis*, *Helenium bigelovii*, *Aster foliaceus*, and *Scirpus diffusus*. There are small patches of *Alnus incana* (mostly saplings). *Hypericum perforatum* is present, but limited to the upper zones and generally sparse.

An apparent drift line, suggesting the maximum annual high water mark, was located at an elevation about three feet above the current water surface elevation. This drift line elevation was closely comparable to (about 0.5 feet lower than) the highest water surface elevation reported for 2003, which occurred on August 20. Above the apparent high water line, there is an increase in the number of patches of sapling *Alnus incana*, and the first *Veratrum californicum* appear. The first *Pinus contorta* and large patches of *Lotus pinnatus* occurred at a point 3.77 feet above the water surface elevation (approximately 0.77 feet higher than the drift line). Wetland vegetation is no longer dominant at an elevation 6.8 feet above the water surface (or 4.25 feet above the apparent high water line), and the tree line begins soon after.

Conditions were similar at another small lakeshore meadow at UTM 0725950 4316766. Here the upper zones consist of shrubby *Pinus contorta* and *Alnus incana*, with *Helenium bigelovii* and *Solidago occidentalis*. The lower zones contain *Juncus tenuis*, *Hypericum anagalloides*, *Prunella vulgaris*, *Limosella* sp., *Juncus xiphioides*, *Agrostis gigantea*, and *Aster foliaceus*. Vegetation began about 0.5 foot above current water surface elevation.

Gerle Creek Reservoir Site 2

This small (0.3 acre) wetland site located at UTM 0725577 4316790 is to the south of wetland 1 and along the northwest shore of Gerle Creek Reservoir (Figure 4.2.2-2, Appendix A). One transect was placed at this site, extending 140.7 feet in length (Figure 4.2.2-4, Appendix E). In general, this site is poorly vegetated with much of the vegetation within six inches of the water surface elevation, including a deep 30 feet x 25 feet pool at the west end. The occasional shoreline patches are dominated by moss, with *Prunella vulgaris*, *Helenium bigelovii*, *Aster foliaceus*, *Lotus pinnatus*, *Juncus xiphioides*, *and Carex* spp. Other species that are found in the area are *Hypericum anagalloides, Geum macrophyllum, Juncus balticus, Solidago occidentalis, Veratrum californicum, Mimulus guttatus, Salix lucida, Stachys ajugoides, Epilobium ciliatum, Prunella vulgaris, Mentha arvensis, Helenium bigelovii, Aster foliaceus, Scirpus diffusus.*

An adjacent wetland area at UTM 0725588 4316662, just south of wetland site 2, was similar, with submerged Carex vesicaria and shoreline meadows dominated by moss, with *Prunella vulgaris*, *Carex* spp., *Helenium bigelovii*, *Aster foliaceus*, *Lotus pinnatus*, and *Juncus xiphioides*.

4.2.3 Ice House Reservoir Wetlands

Ice House Reservoir is the second of three UARP storage reservoirs storing water from the inflowing South Fork Silver Creek and storing approximately 11% of the UARP capacity. The maximum gross storage capacity is 45,960 acre-feet at the spillway elevation 5,450 feet, with a maximum usable capacity of 36,360 acre-feet. Similar to Loon Lake Reservoir, storage volume at Ice House Reservoir typically follows an annual cycle with increasing reservoir elevations through the spring and achieving their highest elevations during the early summer (in 2003, 5448.11 feet on June 29) (Figure 4.2.3-1). The reservoir levels gradually lower throughout the summer due to generation, creating a typical seasonal change of about 42 feet (34.0 feet, April-October, 2003) and a median low water elevation of 5,404 feet in March.

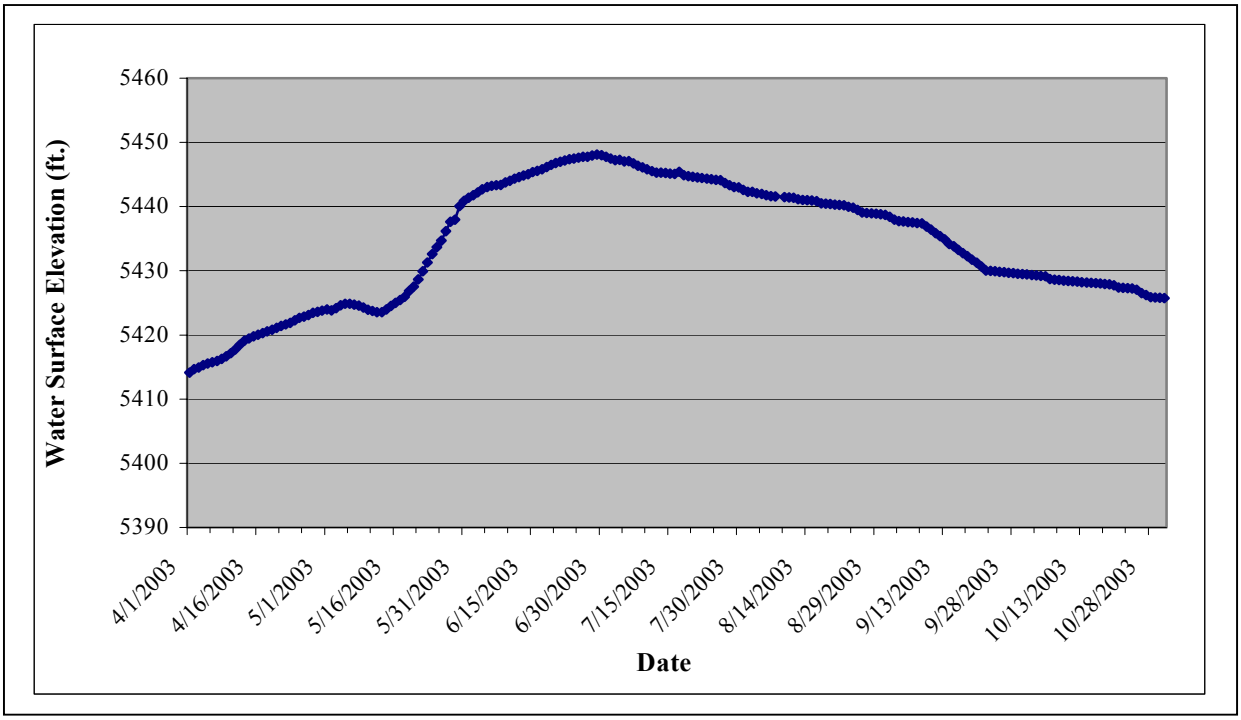

Figure 4.2.3-1. Ice House Reservoir Water Surface Elevation April – October, 2003. Highest elevation recorded on June 29 at 5,448.11 feet.

Wetlands are scarce around the margins of Ice House Reservoir (Figure 4.2.3-2, Appendix A). A narrow fringe of *Carex* spp. occurs in some areas near the high water line and vegetation sometimes develops in areas exposed by declining water level as water is seasonally withdrawn from the reservoir. There is also a seasonally wet meadow near the campgrounds at the west end of the reservoir. There are no significant drainage-associated wetlands around Ice House

Reservoir. The total wetland area is about 4.9 acres, mostly lakeshore meadows that are only exposed at lower water levels. Wetlands are limited by geomorphic factors (steep slopes and extensive areas of bedrock).

4.2.4 Union Valley Reservoir Wetlands

Union Valley Reservoir is the third and largest of the three primary storage reservoirs in the UARP. Union Valley Reservoir stores water transported from the Jones Fork and Robbs Peak powerhouses and as well as inflows from Tells Creek, Big Silver Creek, and Jones Fork Silver Creek storing approximately 65% of the Project area capacity. The maximum gross storage capacity is 277, 290 acre-feet at the spillway elevation 4,870 feet, with a maximum usable capacity of 269,370 acre-feet. Similar to the Ice House and Loon Lake Reservoirs, Union Valley Reservoir typically follows an annual cycle with increasing reservoir elevations through the spring and achieving their highest elevations during the early summer (4,867.22, feet, June 24, 2003 with two additional days over 4,867 feet (4,867.06 feet on June 23 and 4867.1 on June 25, 2003) (Figure 4.2.4-1). The reservoir levels gradually lower throughout the summer due to generation, creating a typical seasonal change of about 53 feet (33.8 feet, April-October, 2003) and a median low water elevation of 4,809 feet in January.

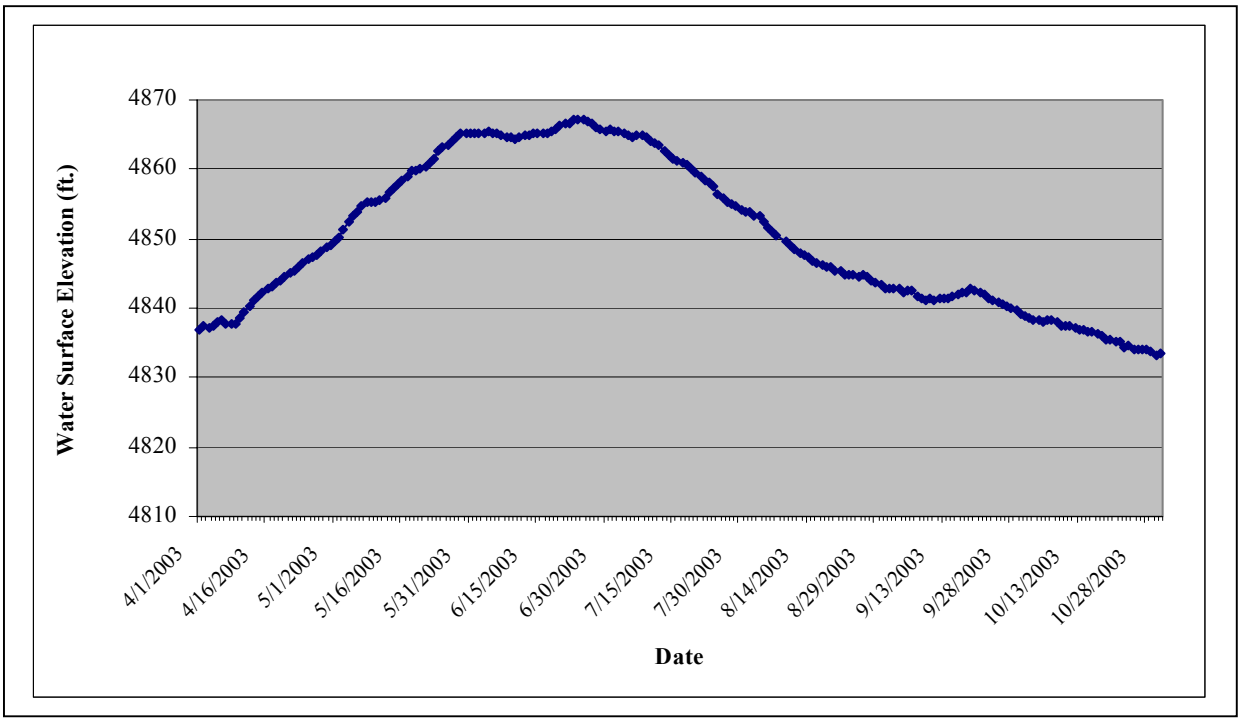

Figure 4.2.4-1. Union Valley Reservoir Water Surface Elevation April – October, 2003. Highest elevation recorded on June 24 at 4,867.22 feet.

Union Valley Reservoir has a large area of associated wetlands (140.0 acres) (Figure 4.2.4-2, Appendix A). All of these wetlands are mapped by NWI (USFWS 1995) as "PEMCh" (palustrine emergent seasonally flooded, diked or impounded"). A total of 11 wetland sites

around Union Valley Reservoir were field examined. With one exception (Wetland Site 5), each site represented a single drainage-fed meadow or lakeshore meadow. Wetland Site 5 consists of a large complex of drainage-fed meadows that are connected by lakeshore meadows.

Based on information collected in the field (see below) and USGS topographic maps, the NWI categorization of all of Union Valley Reservoir as "diked or impounded" ("h") is misleading. The total area of wetlands that actually appear to be strongly influenced by the reservoir is 23.0 acres, or 16.5 percent of the total area. Representative site photographs are presented in Appendix D.

Union Valley Reservoir Wetland Site 1

This is a sloping meadow located on the southeast shore of the reservoir. Almost the entire wetland can be classified as palustrine emergent wetland, with only a very small fringe of scrub-shrub (*Alnus incana*) wetland on the forest edge at the highest point in the meadow. The NWI map (USFWS 1995) of the area categorizes this wetland as PEMCh. A small channel (with water flowing on June 10, 2003, but dry on September 17, 2003) runs along the axis of the wetland and drains into the reservoir. There were also areas with standing water on June 10. When the wetland was revisited on September 17, 2003, water was not flowing in the channel and areas that were submerged on June 10 were exposed and dry.

The total area of the wetland is 1.9 acres. Approximately 0.2 acre (10.5 percent of total wetland area at this site) is below the apparent high reservoir water surface elevation. The hydrology of the wetland above this point appears to be driven by drainage from areas unrelated to reservoir operations (the highest measured point in the wetland was approximately 4,875.2 feet elevation or almost eight feet above the highest recorded reservoir water surface elevation in 2003). This indicates that most of the wetland is best described as PEMC or PEMB (B = saturated), and only part of the wetland should be classified as PEMCh.

On June 10, a transect 462 feet in length was placed along the long axis of the wetland in order to describe wetland vegetation zones and determine elevations relative to the reservoir water surface. Species composition varied in apparent relation to differences in wetland hydrology along the transect (Table 4.2.4-1 and Figure 4.2.4-3, Appendix E). According to California Department of Water Resources (2003) the water surface elevation of Union Valley Reservoir was 4,864.3 feet on June 10. California Department of Water Resources data (2003) also indicates that the reservoir was at its highest level for 2003 on June 23. Based on this information, vegetation zones 1 and 2 lie entirely below the highest reservoir water surface elevation in 2003. The principal species that characterized these seasonally submerged zones were *Carex vesicaria*, *Carex aquatilis*, *Carex athrostachya*, *Juncus tenuis*, *Eleocharis acicularis*, and *Viola macloskeyi*. Most of the other species of vascular plants identified at this wetland occurred only at higher positions where submergence does not occur.

Vegetation within the subsidence zone on September 17 was dominated by a few species, not all of which could be identified because they were not in flower. *Eleocharis acicularis* and *Rorippa curvisiliqua* (?) were the principal species in this zone; minor species included *Viola macloskeyi,*

Anaphalis margaritacea, Chamaesyce serpyllifolia, Verbascum thaspus, Carex aquatilis, Carex vesicaria, Equisetum arvense, Juncus bufonius, and at two unidentified species of small grasses.

Soil sampling at the site was conducted in the eastern portion of the wetland above the approximate high water mark for 2003. The soil pit location was at UTM 0726671E 4305641N in an area dominated by *Carex aquatilis*, *Prunella vulgaris*, and *Viola macloskeyi*. This site was meant to identify the upland edge/transition zone of the wetland boundary. The soil pit was dug 13.5 inches deep. Soil was slightly moist to the touch at the bottom of the pit. The soil was generally mineral with an O horizon in the upper 1.5 inches and distinguishable plant material with conspicuous red mottling. Soil was dark brown and exhibited a hue of 7.5 YR with a chroma of 3/3. As a result, the soil was characterized as being mineral with sandy-loam soil texture and was not characteristic of a hydric soil. The site was determined to be beyond the wetland boundary.

Nearly all of the species recorded at this wetland are strongly associated with wetlands (FACW or OBL) (Reed 1997). There were no apparent signs of disturbance associated with recreation at this wetland. No significant weed infestations were noted. *Verbascum thaspus* occurred mostly in adjacent mesic areas where it was not abundant. Interestingly, remnant inflorescences of this biennial species were observed at positions deep within the lower subsidence zone, evidently responding to low water conditions in 2001 and 2002. Evidence of grazing by Canada geese at this site was noted, but the extent of grazing appeared minor on June 10.

This was the only wetland at Union Valley Reservoir where round-leaved sundew (*Drosera rotundifolia*) was observed. A population of at least 450 plants was observed, within an area of less than 500 ft^2 at an elevation of 4,869-4,871 feet. This part of the wetland was unusual in the preponderance of moss-cover. Dominant vascular plants were *Juncus xiphioides* and *Polygonum bistortoides*; other associates included *Carex feta*, *Carex jonesii, Saxifraga oregana*, *Luzula comosa*, *Ranunculus occidentalis*, *Mimulus primuloides*, *Lotus pinnatus,* and *Equisetum arvense*.

Table 4.2.4-1. Union Valley Reservoir Wetland Site 1 – Transect 1 (June 10, 2003)

	SPECIES AND ABUNDANCE	HABITAT
Zone 1	Dominants: *Carex vesicaria*. Other species: *Carex aquatilis, Carex athrostachya, Carex feta, Scirpus microcarpus, Eleocharis acicularis, Veronica scutellata, Mimulus primuloides, Viola macloskeyi, Juncus tenuis, Juncus xiphioides,* and *Rumex salicifolius.*	Zone begins at current water surface elevation. Moist and subject to annual flooding (inundated maximum of about 3 ft. in 2003).
Zone 2	Dominants: *Carex aquatilis* and *Juncus tenuis.* Other species: *Juncus xiphioides, Eleocharis acicularis, Mimulus primuloides, Hypericum anagalloides, Rumex salicifolius, and Galium trifidum var. pusillum.*	Moist, but drier than zone 1. Surrounds drainage channel.
Zone 3	Dominants: *Pinus contorta* (one tree 30 ft. tall and 3 saplings), *Rumex acetosella,* and an unidentified grass. Other species: *Galium sp. Verbascum thaspus, Geum macrophyllum, Hypericum anagalloides, Fragaria vesca. Cirsium sp., Viola sp., Clarkia sp., Anaphalis margaritacea, and Lotus argophyllus var. argophyllus*.	Upland area on higher ground within the wetland boundaries.

Table 4.2.4-1. Union Valley Reservoir Wetland Site 1 – Transect 1 (June 10, 2003)		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 4	Dominants: *Scirpus microcarpus* and *Sidalcea reptans*. Other species: *Carex aquatilis, Carex vesicaria, Juncus effusus, Panicum acuminatum, Mimulus guttatus, Mimulus moschatus, Verbascum thaspus, Hypericum anagalloides, Polygonum bistortoides, Saxifraga oregana, Ranunculus occidentalis, Veronica scutellata, Equisetum arvense, Rumex salicifolius, Geum macrophyllum, Epilobium palustre, Calocedrus decurrens* (a few, scattered seedlings)*, and Pinus contorta* (one tree 30 ft. tall and a few saplings).	Moist
Zone 5	Dominants: *Juncus xiphioides, Carex jonesii, Sidalcea reptans,* and *Saxifraga oregana.* Other species: *Scirpus microcarpus, Juncus effusus, Carex aquatilis, Platanthera leucostachys, Polygonum bistortoides, Ranunculus occidentalis, Mimulus guttatus, Luzula sp., Geum macrophyllum, Fragaria virginiana, Montia fontana, Lotus pinnatus, Equisetum arvense, Veratrum californicum, Oxypolis occidentalis,* and *Alnus incana* (2 small shrubs).	Saturated to flooded (2-3 inches standing water). Surrounds drainage channel (4-6 ft. wide)
Zone 6	Dominants: *Veratrum californicum, Juncus xiphioides, Carex jonesii, Oxypolis occidentalis, Sidalcea reptans, Equisetum arvense, Senecio triangularis, Ranunculus occidentalis,* and *Saxifraga oregana.* Other species: *Platanthera leucostachys, Epilobium palustre, Montia palustris, Asarum lemmonii, Polygonum bistortoides, Mimulus guttatus, Glyceria sp., Juncus effusus, Stellaria longipes,* and *Luzula sp.*	Saturated to flooded (2-3 inches deep)
Zone 7	Dominants: *Veratrum californicum, Senecio triangularis, Geum macrophyllum, Mimulus guttatus, Lilium parvum,* and *Ranunculus occidentalis*. With *Delphinium sp., Viola adunca, Taraxacum officinale, Stellaria longipes, Calocedrus* (saplings), *Sisyrinchium bellum, Nemophila maculata, Thalictrum fendleri, Aquilegia formosa*, *Calochortus minimus,* and *Achillea millefolium*.	Edge of forest at 462 ft. on transect (elevation not recorded)

Union Valley Reservoir Wetland Site 2

Site 2 on the southeast shore of the reservoir is primarily situated below the annual high water elevation. Located in a shallow bay, it is best described as a lakeshore-basin meadow. The wetland extends around the shores of the bay; however, only the south shore was field examined on June 10. Compared to most of the wetlands at Union Valley Reservoir, the topography is relatively flat, and strong wetland indicators were not present more than about three feet above the water's edge on June 10. There were no channels within the area of the wetland that were field-examined on June 10. When the site was re-examined on September 17, the area of exposed wetland was much greater and a channel with standing water was evident. This wetland is mapped by NWI as PEMCh.

The total area of the wetland as mapped from August 30, 2002 conditions was 7.5 acres. The entire wetland is below the apparent high reservoir water surface elevation. Based on topography and species occurrence (see below), wetland hydrology at this site may be almost entirely related to reservoir hydrology.

On June 10, a transect 223 feet in length was situated to extend from the vegetated shallow water to the point where sapling conifers occurred in obvious upland conditions. Species composition varied in apparent relation to differences in wetland hydrology along the transect (Table 4.2.4-2 and Figure 4.2.4-4, Appendix E). Based on reservoir water surface data, vegetation zones 1 and 2 were flooded by the reservoir in 2003. Zone 3 was not flooded; however, the vegetation mostly consists of hydrophytes, suggesting strong reservoir influence. The principal species that characterized these zones were *Carex vesicaria*, *Carex aquatilis*, *Carex athrostachya*, *Juncus balticus*, *Scirpus microcarpus*, and *Eleocharis acicularis.* Most of the species within zone 1-3 are hydrophytes (FACW or OBL) (Reed 1997). Vegetation zones above zone 3 are not dominated by hydrophytes; these zones appear to be transitional, not wetland. Most of the forbs that are prominent in sloping meadows around Union Valley Reservoir were not present at this site and the total number of species was lower than at those other sites.

On September 17, the subsidence zone was well vegetated, probably reflecting relatively shallow water conditions and a long period of exposure. Dominant species in this zone were *Carex vesicaria*, *Carex aquatilis*, *Carex athrostachya* (?), *Eleocharis acicularis*, and *Juncus balticus.* Other species were mostly localized in wetter areas (e.g., adjacent to channels): *Rorippa curvisiliqua* (?), *Equisetum acicularis* var. *bella* (?), *Eleocharis macrostachya*, *Mimulus moschatus*, *Ranunculus occidentalis*, and unidentified grasses. *Lotus argophyllus var. argophyllus* (?) was present in drier areas within the subsidence zone.

A soil pit was placed at UTM 0726911E 4305962N at the location of Transect 1 approximately three feet lower than the high water mark for 2003. The soil pit was dug at in an area dominated by *Carex vesicaria* and was meant to show the location as being in within the wetland boundary. The depth of the pit was 13.0 inches deep; soil was moist to the touch at the 13.0-inch depth. The soil was generally mineral (sandy-loam with silt) and had obvious organics visible. Soil color was dark brown, with a hue of 7.5 YR and a chroma of 3/2. Oxidized root channels and some peat were evident. The soil was determined to a hydric soil due to mottling and presence of oxidized root channels.

A second pit was placed at UTM 0726887E 4305810N, approximately 40 feet above the approximate high water mark for 2003. The soil pit was dug to a depth of 13.0 inches in an area dominated by *Carex vesicaria* and was meant to show the location as being in the upland zone above the wetland boundary. The soil was not moist to the touch. Soil was generally mineral (sandy-loam) with no obvious horizons or some organics visible. Color was brown, with a hue of 7.5 YR and a chroma of 3/3. The soil characteristics did not indicate a hydric soil.

A small number of *Hypericum perforatum* was present at the fringe of the wetland and *Verbascum thaspus* occurred sparsely in the wetland. No other weeds were observed.

Table 4.2.4-2. Union Valley Reservoir Wetland Site 2 – Transect 1 (June 10, 2003)

	SPECIES AND ABUNDANCE	HABITAT
Zone 1	Dominants: *Carex vesicaria*. Other species: *Carex aquatilis, Carex athrostachya, Scirpus microcarpus, Eleocharis acicularis, Veronica scutellata, Mimulus primuloides, Barbarea orthoceras, Galium trifidum var. pusillum.*	Zone begins in shallow water. Subject to annual flooding (inundated maximum of 3.7 ft. in 2003).

Table 4.2.4-2. Union Valley Reservoir Wetland Site 2 – Transect 1 (June 10, 2003)		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 2	Dominants: *Carex vesicaria* and *Juncus balticus.* Other species: *Carex aquatilis.*	Moist and most of the zone is subject to annual flooding (inundated maximum of 1.5 ft. in 2003).
Zone 3	Dominants: *Carex vesicaria* and *Carex aquatilis*. Other species: *Scirpus microcarpus, Epilobium palustre, Lotus argophyllus var. argophyllus* (few)*, Mimulus primuloides,* and *Galium trifidum var. pusillum.*	Moist, but not flooded in 2003.
Zone 4	Dominants: *Poa palustris* and *Lotus argophyllus var. argophyllus.* Other species: *Carex aquatilis, Scirpus microcarpus* (few), *Phacelia sp.*, *Luzula sp.*, *Clarkia sp.* (small annuals), *Cirsium sp*., *Juncus balticus*, *Fragaria vesca*, *Verbascum thaspus*, *Hypericum anagalloides*, and *Pinus contorta* (tree 35 ft. tall).	Transitional (seasonally moist but not wetland).
Zone 5	Dominants: *Poa palustris* and *Carex integra.* Other species: *Juncus balticus* (few)*, Carex vesicaria* (few)*, Carex aquatilis* (few)*, Clarkia sp.* (small annuals)*, Fragaria vesca, Mimulus primuloides, Mimulus moschatus, Cirsium sp.,* and *Juncus xiphioides*.	Transitional.
Zone 6	Dominants: *Pinus sp.* (saplings) and *Calocedrus decurrens* (saplings). With *Ranunculus occidentalis, Fragaria vesca*, *Ranunculus occidentalis*, *Luzula sp.*, *Phacelia sp.*, and *Taraxacum officinale.*	Upland.

Union Valley Reservoir Wetland Site 3

Located on the northwest shore at Camino Cove, this is a sloping meadow occupying about 12.2 acres. Approximately 6.4 acres (52.5 percent of total wetland area at this site) are below the apparent high reservoir water surface elevation. The subsidence zone extends into Camino Cove and is contiguous other wetland areas around the edge of the cove that are best described as lakeshore basin wetlands. This wetland is classified as PEMCh on the NWI map (UFWS 1995) of the area, but the NWI shows the meadow extending about 0.25 mile from the reservoir to an elevation of more than 4,960 feet, where it is associated with a small channel.

The hydrology of the wetland is generally associated with drainage from areas unrelated to reservoir operations. Strong wetland indicators were present 9.7 feet above reservoir water surface elevation on June 10, more than seven feet above the highest water level in 2003, and (as noted above) the meadow continues to an even higher elevation.

On June 11, a transect 337 feet in length, extending from the vegetated shallow water almost to the tree line, was used to describe vegetation zones within the wetland (Table 4.2.4-3 and Figure 4.2.4-5, Appendix E). Based on reservoir water surface data, vegetation zones 1 and 2, and part of zone 3 were flooded by the reservoir in 2003. The principal species that characterized the first three vegetation zones were *Carex vesicaria*, *Carex aquatilis*, *Carex athrostachya*, *Juncus balticus*, *Scirpus microcarpus*, and *Eleocharis acicularis.* Species richness is greater in successive zones. Most of the species within the wetland boundaries are strongly associated with wetland conditions (FACW or OBL) (Reed 1997).

Vegetation within the draw-down zone on September 17 was dominated by a few species, not all of which could be identified because they were not in flower. In areas exposed for the longest period, the principal species were *Eleocharis macrostachya, Eleocharis acicularis, Carex vesicaria,* and *Carex aquatilis,* along with *Rorippa curvisiliqua* (?)*, Chamaesyce serpyllifolia,* and *Mentha spicata.*

A soil pit was dug at UTM 0723068E 4306553N about 20 feet from the approximate high water mark for 2003 in an area dominated by *Juncus balticus* and *Carex* vesicaria, and within the presumed wetland boundary. At 12.5 inches, soil was dry to the touch. The soil was generally a mineral soil (loamy-sand) with organics present throughout the pit. Color was black with a hue of 10 YR and a chroma of 2/1. This confirmed the presence of hydric soils.

No significant weed occurrences were noted in this wetland. *Hypericum perforatum* was present on the edge of the wetland in small numbers. On June 11, it was apparent that Canada geese had been heavily grazing vegetation (especially *Carex vesicaria*) near the water's edge.

Table 4.2.4-3. Union Valley Reservoir Wetland Site 3 – Transect 1 (June 11, 2003)

	SPECIES AND ABUNDANCE	HABITAT
Zone 1	Dominants: *Juncus balticus*. Other species: *Carex vesicaria, Carex athrostachya.*	Zone begins in shallow water. Subject to annual flooding (inundated maximum of about 3.5 ft. in 2003).
Zone 2	Dominants: *Carex vesicaria.* Other species: *Carex aquatilis, Carex athrostachya, Scirpus microcarpus, Eleocharis acicularis, Epilobium palustre, Barbarea orthoceras,* and *Lotus pinnatus* (?).	Moist. Inundated maximum of 1 ft. in 2003).
Zone 3	Dominants: *Juncus balticus,* and *Carex aquatilis*. Other species: *Carex vesicaria, Scirpus microcarpus, Montia fontana, Viola macloskeyi, Eleocharis macrostachya* (?)*, Ranunculus occidentalis, Poa palustris,* and *Polygonum bistortoides (few)*.	Moist and partially inundated in 2003.
Zone 4	Dominants: *Carex vesicaria, Poa palustris,* and *Rumex acetosella.*	
Zone 5	Dominants: *Poa palustris,* and *Rumex acetosella.* Other species: *Carex feta, Scirpus microcarpus, Ranunculus occidentalis, Mimulus guttatus, Geum macrophyllum, Nemophila maculata, Lotus sp., Barbarea orthoceras, Viola macloskeyi, Veronica scutellata,* and *Verbascum thaspus.*	Higher ground with abundant LWD (reduced vegetation cover).
Zone 6	Dominants: *Juncus balticus, Carex aquatilis, Juncus xiphioides,* and *Sidalcea reptans*. Other species: *Ranunculus occidentalis, Fragaria, Veratrum californicum* (scattered), *Helenium bigelovii, Sisyrinchium bellum, Polygonum bistortoides,* and *Poa palustris.*	
Zone 7	Dominants: *Sidalcea reptans, Veratrum californicum,* and scattered *Pinus sp.* (seedlings). Other species: *Carex aquatilis, Carex subfusca, Fragaria sp.* (scattered)*, Equisetum arvense, Juncus xiphioides, Juncus balticus, Ranunculus occidentalis, Epilobium sp., Polygonum bistortoides, Poa palustris, Luzula comosa*, and unknown grass.	Channel passes through the zone.
Zone 8	Dominants: *Sidalcea reptans* (decreasing), *Veratrum californicum*, and unidentified grass. Other species: *Viola adunca, Fragaria sp., Carex subfusca, Carex aquatilis, Helenium bigelovii, Lupinus sp., Potentilla sp.*, *Quercus sp*. (one sapling)	Transitional, near tree line.

Union Valley Reservoir Wetland Site 4

Site 4 is a sloping meadow located on the north shore of the reservoir, northwest of Camino Cove. The wetland occupies an area of about 4.3 acres and is classified as PEMCh by NWI (USFWS 1995). However, almost the entire wetland occupies a perched position well above the annual reservoir high water level (Figure 4.2.4-2, Appendix A). Based on field measurements the meadow extends to at least 4,890 feet elevation. The hydrology of this wetland appears to be governed by groundwater seepage in that no conspicuous drainage channel leads to the head of the wetland.

On June 11, 2003 a transect 363 feet long, extending from the vegetated shallow water almost to the tree line, was used to describe vegetation zones within the wetland (Table 4.2.4-4 and Figure 4.2.4-6, Appendix E). Based on reservoir water surface data, vegetation zone 1 and part of zone 2 were flooded by the reservoir in 2003. The principal species that characterized the vegetation zones subject to inundation were *Carex vesicaria*, *Carex aquatilis*, *Juncus balticus*, *Eleocharis acicularis, Hypericum anagalloides, Viola macloskeyi,* and *Veronica scutellata.* Species richness is greater in successive zones. Most of the species found at other sloping meadows around Union Valley Reservoir were also found at this site. Nearly all of the species are strongly associated with wetland conditions (FACW or OBL) (Reed 1997). There were no significant weed occurrences.

Table 4.2.4-4. Union Valley Reservoir Wetland Site 4 – Transect 1 (June 11, 2003)

	SPECIES AND ABUNDANCE	HABITAT
Zone 1	Dominants: *Carex vesicaria, Viola macloskeyi,* and *Eleocharis acicularis.* Other species: *Veronica scutellata, Helenium bigelovii, Carex aquatilis, Hypericum anagalloides, Juncus balticus, Juncus xiphioides, Sisyrinchium elmeri,* and *Poa palustris.*	Zone begins in shallow water. Subject to annual flooding (inundated maximum of about 2.6 ft. in 2003).
Zone 2	Dominants: *Carex aquatilis.* Other species: *Scirpus microcarpus, Eleocharis acicularis, Veronica scutellata, Juncus xiphioides, Poa palustris, Carex vesicaria, Hypericum anagalloides, Mimulus guttatus, Ranunculus occidentalis, Juncus balticus,* and *Juncus effusus*.	Partially inundated in 2003.
Zone 3	Dominants: *Eleocharis macrostachya, Sidalcea reptans*, and *Carex aquatilis*. Other species: *Polygonum bistortoides, Scirpus microcarpus, Lotus sp., Mimulus guttatus, Saxifraga oregana, Sisyrinchium elmeri, Camassia quamash,* and *Pinus contorta* (1 sapling and 1 mature).	Moist to boggy.
Zone 4	Dominants: *Polygonum bistortoides, Carex vesicaria, Eleocharis macrostachya,* and *Oxypolis occidentalis.* Other species: *Lotus sp.*, *Lupinus polyphyllus*, *Scirpus microcarpus, Mimulus guttatus, Saxifraga oregana, Camassia quamash, Carex aquatilis, Platanthera leucostachys (few), Spiranthes romanzoffiana* (few), *Vaccinium uliginosum, Juncus xiphioides, Ranunculus occidentalis, Sidalcea reptans* (decreasing), and *Senecio clarkianus.*	Moist to boggy.

Table 4.2.4-4. Union Valley Reservoir Wetland Site 4 – Transect 1 (June 11, 2003)		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 5	Dominants: *Lupinus polyphyllus, Sidalcea reptans,* and *Veratrum californicum.* Other species: *Carex feta, Carex aquatilis, Phalaris sp.* (?), *Poa palustris, Luzula comosa, Platanthera leucostachys* (increasing), *Juncus xiphioides, Oxypolis occidentalis* (decreasing), *Helenium bigelovii, Equisetum arvense, Geum macrophyllum,* and *Senecio clarkianus.*	Moist. A transitional zone 15 ft. wide follows and then the tree line begins.

Union Valley Reservoir Wetland Site 5

This is the largest complex of wetlands at Union Valley Reservoir occupying about 64.1 acres, approximately 39.5 percent of which lies below the annual high water level. There are four main swales within the complex. Although the entire wetland is categorized as PEMCh by NWI, the NWI map (USFWS 1995) shows each of the four meadows in the complex extending far above any possible reservoir influence (about 4,920 feet to 5,000 feet elevation), and each is fed by a drainage originating even further upslope (as much as 1.5 miles from the reservoir).

An extensive survey was conducted at the site on June 12, 2003 to compile a plant species list, determine whether any special status species occurred, and to compare vegetation patterns to wetlands previously examined at Union Valley Reservoir. No special status plant species or significant weed infestations were found, and the sequence of vegetation zones was similar to that observed at previous sites. Given the large size of these wetlands, transects were not used except to obtain relative elevation information from areas adjacent to the main body of the wetland.

Almost all of the species found at other wetlands at Union Valley Reservoir were documented within this complex, although this was the only site where *Lewisia nevadensis* was recorded. As at other sites, vegetation nearest the water (or submerged) largely consisted of a few species, notably *Carex vesicaria, Juncus balticus,* and *Eleocharis acicularis.* Vegetation within a lakeshore meadow adjacent to the main sloping meadow complex was substantially similar to the lakeshore component of the main wetland (Table 4.2.4-5 and 4.2.4-6, and Figure 4.2.4-7 and 4.2.4-8, Appendix E).

This wetland was revisited on August 4, 2003. Mudflats created by receding water levels were generally well vegetated by a few species of vascular plants, but some plants were not identifiable because they had not yet flowered. *Eleocharis acicularis* formed dense mats no more than 1 dm tall. There were also scattered patches of *Juncus balticus* and *Carex vesicaria*. Other identified species were *Rorippa curvisiliqua* (?), *Viola macloskeyi*, *Polygonum amphibium* var. *stipulaceum*, and *Lythrum portula.* On September 17, 2003, conditions were similar, although water levels had continued to decline and the most recently exposed areas were sparsely vegetated or devoid of vegetation.

A soil pit was placed at the location of Transect 1 (UTM 0723550E 4306852N) above the approximate high water mark for 2003. Vegetation consisted of a variety of grasses and sparse

Pinus contorta. This site was meant to show the location as being beyond the wetland boundary of the site. At 13.0 inches deep, soil was not moist to the touch. The soil was generally mineral (sandy) with virtually no organics. Color was brown with a hue of 10 YR and a chroma of 3/4, indicating the soil was not hydric.

A second pit was placed at the location of Transect 2, approximately five feet from the high water mark for 2003 (UTM 0723590E 4306800N) in an area dominated by *Juncus balticus* and *Carex vesicaria*. The pit was meant to show the location as being within the wetland boundary. Soil at 12 inches deep was dry to the touch, and generally highly organic with a well-developed O horizon and distinguishable plant material. Color was black with a hue of 10 YR and a chroma of 2/1, indicative of a hydric mineral soil with a silt-loam texture.

Weedy species documented at this site were *Hypericum perforatum* and *Verbascum thaspus*. These species were not abundant and occurred only on the edges of wetland areas.

Table 4.2.4-5. Union Valley Reservoir Wetland Site 5 – Transect 1 (June 12, 2003)

	SPECIES AND ABUNDANCE	HABITAT
Zone 1	Dominants: *Juncus balticus*. Other species: *Carex vesicaria, Carex aquatilis, Eleocharis acicularis,* and *Viola macloskeyi.*	Zone begins in shallow water and entirely subject to annual flooding.
Zone 2	Dominants: Sparsely vegetated (probably due to grazing by Canada geese): *Carex vesicaria, Carex aquatilis,* and an unidentifiable asteraceous species. Other species: *Juncus balticus, Hypericum anagalloides, Mimulus primuloides, Barbarea orthoceras, Juncus xiphioides*, and *Viola macloskeyi.*	Zone begins at approximately the same elevation as highest water surface elevation in 2003, and extends to the point where scattered *Pinus* begin to appear.
Zone 3	Dominants: *Pinus sp.* (*P. jeffreyi* or *P. ponderosa*, large trees). Other species: *Fragaria sp., Potentilla sp., Carex sp., Nemophila maculata,* and *Epilobium sp.*	Upland

Table 4.2.4-6. Union Valley Reservoir Wetland Site 5 – Transect 2 (June 12, 2003)

	SPECIES AND ABUNDANCE	HABITAT
Zone 1	Dominants: *Juncus balticus*. Other species: *Carex vesicaria,* and an unidentifiable asteraceous species.	Zone begins in shallow water and entirely subject to annual flooding.
Zone 2	Dominants: Patchy *Juncus balticus* (decreasing), *Juncus effusus, Juncus xiphioides, Rumex acetosella, Poa sp., Carex feta*, and *Barbarea orthoceras*.	Zone begins at approximately the same elevation as highest water surface elevation in 2003 and extends to the tree line
Zone 3	Dominants: *Pinus* (large trees)	Upland.

Union Valley Reservoir Wetland Site 6

Site 6 is a small sloping meadow located on the southeast shore of the reservoir. The wetland occupies an area of about 2.2 acres and is classified as PEMCh by NWI. However, almost the entire wetland lies well above the annual reservoir high water level (Figure 4.2.4-2, Appendix

A). The NWI map (USFWS 1995) shows the highest point in the meadow to be about 4,860 feet elevation. The hydrology of this wetland is associated with drainage from higher elevations.

On July 8, 2003, a transect 198 feet long (Figure 4.2.4-9, Appendix E), extending from an incised drainage channel below the water surface up through a patch of *Alnus incana* (more than 18 feet above current water surface elevation), was used to describe the topography of the wetland and relationship to reservoir hydrology. This meadow is floristically similar to other sloping meadows around the reservoir. Based on reservoir water surface data, vegetation in areas flooded by the reservoir in 2003 consisted of relatively sparse *Carex vesicaria*, *Carex aquatilis*, *Carex athrostachya, Scirpus microcarpus, Juncus effusus* (occasional), *Eleocharis acicularis, Epilobium sp., Viola macloskeyi,* and *Prunella vulgaris. Sidalcea reptans*, a dominant species in this wetland, first appears just above the maximum high water level, and additional species appear in the higher zones. Most of the species within the wetland boundaries are strongly associated with wetland conditions (FACW or OBL) (Reed 1997).

For comparative purposes, a second transect (Figure 4.2.4-10, Appendix E) was placed at an adjacent lakeshore location flanking this wetland. Here, the tree line began 7.9 feet above current water surface elevation (or about 5.7 feet above annual high water in 2003). Areas subject to seasonal inundation were largely devoid of vegetation, followed by sparse cover of *Carex aquatilis* and *Juncus effusus* (both species had been heavily grazed by Canada geese). Successive vegetation zones represent mesic conditions (with mostly *Lupinus* sp., with few *Juncus effusus*, *Verbascum thaspus*, *Calyptridium sp*., *Achillea millefolium*, and *Symphoricarpos sp*.), followed by upland forest conditions.

Union Valley Reservoir Wetland Site 7

Located on the west shore of the reservoir is a sloping meadow that occupies an area of about 5.3 acres and is classified as PEMCh by NWI. However, almost the entire wetland lies well above the annual reservoir high water level (Figure 4.2.4-2, Appendix A) and the NWI map (USFWS 1995) shows the wetland extending to about 5,000 feet elevation. The hydrology of this wetland is associated with drainage from higher elevations.

The site was surveyed on July 8, 2003. Floristically this wetland was substantially similar to other sites examined, except for the occurrence of *Platanthera sparsiflora*, which was not found elsewhere. Portions of this meadow were dry when examined, but the ground was substantially moister at higher positions on the slope, to the extent that in the some areas there was standing water and there was a flowing channel near the head of the meadow. Most of the wetland is PEM, but areas of PSS also occur, primarily consisting of *Alnus incana* (to about 12 feet tall), with scattered small *Pinus contorta*. There were no significant weed occurrences.

A transect was placed on the east side of the sloping meadow, extending from the water to the tree line, to examine the relationship of reservoir water surface elevation to wetland conditions. Here, the tree line was located 11.8 feet above current water elevation (9.6 feet above the highest water level in 2003). A second transect was situated entirely outside of the meadow and here the

tree line began only 3.8 feet above the water surface (1.5 feet above the highest water level in 2003).

Union Valley Reservoir Wetland Site 8

Site 8 is located on the west shore of the reservoir (Figure 4.2.4-2, Appendix A). The wetland is a sloping meadow, occupying about 5.6 acres, and is classified as PEMCh by NWI. However, most of the wetland area (64.3 percent) lies above the annual high water level and the NWI map (USFWS 1995) shows the wetland extending to approximately 4,940 feet elevation. The wetland is primarily PEM, but some areas on the west side of the meadow could be described as PSS (*Alnus incana*).

On July 8, 2003, two transects were placed at the site to examine site topography and the relation to reservoir water elevation, one within the meadow and the other entirely outside of the meadow. California Department of Water Resources (2003) indicates that the highest reservoir water surface elevation in 2003 was 2.25 feet higher than that observed on July 8. The transect indicated that vegetation subject to seasonal inundation consisted of *Eleocharis acicularis*, *Carex vesicaria*, *Carex aquatilis*, *Viola macloskeyi*, *Veronica scutellata*, and *Epilobium* sp. The forbs characteristic of sloping meadows around Union Valley Reservoir (e.g., *Sidalcea reptans*, *Mimulus guttatus*, *Veratrum californicum*, *Polygonum bistortoides*, etc.) do not appear until higher positions on the slope. Wetland vegetation was clearly evident until about 4,874 feet elevation, at which point some transitional species (e.g., *Nemophila maculata*) appeared. The tree line within the meadow along this transect was located at about 4,877 feet elevation (more than 12 feet above the current water surface elevation, or nearly 10 feet above 2003 high water).

Along the second transect, wetland vegetation was limited to patches of *Juncus balticus*, *Juncus effusus*, *Carex vesicaria* (heavily grazed by Canada geese), *Viola macloskeyi*, and *Prunella vulgaris*. The latter species occurred until about 4,870 feet, at which point the species composition (*Clarkia sp.*, *Verbascum thaspus*, *Fragaria* sp., *Cirsium sp*., *Juncus parryi*, *Juncus chlorocephalus,* and *Juncus effusus*) suggests seasonally mesic rather than wetland conditions. The tree line began at elevation of approximately 4,970.5 feet.

Union Valley Reservoir Wetland Site 9

Site 9 was situated east of the Sunset-Fashoda campground and north of the boat launch area (Figure 4.2.4-2, Appendix A). This is a lakeshore-basin meadow mapped as PEMCh by NWI (USFWS 1995) and occupying about 5.1 acres. Vegetation occurs in patches, and overall the site is not well vegetated. The species at this site were a mixture of hydrophytes and species more indicative of mesic conditions. Campers may use the site for recreational activities. *Verbascum thaspus* occurs in moderate numbers and *Hypericum perforatum* was documented as well. Species richness was low, and nearly all of the forbs characteristic of sloping meadows were absent. Species found at the site included *Lupinus lepidus*, *Hypericum anagalloides*, *Juncus balticus*, *Juncus effusus*, *Carex aquatilis*, *Carex vesicaria*, *Veronica scutellata*, *Prunella vulgaris*, *Trifolium monanthum*, *Epilobium sp.*, and *Horkelia tridentata.*

Union Valley Reservoir Wetland Site 10

Site 10 is a sloping meadow located on the north shore of the reservoir, northwest of Camino Cove (Figure 4.2.4-2, Appendix A). The wetland occupies an area of about 5.6 acres and is classified as PEMCh by NWI. However, the NWI map (USFWS 1995) also shows the wetland extending to an elevation of more than 4,960 feet, far above the highest reservoir water surface elevation. The hydrology of this wetland is largely associated with drainage from higher elevations.

The wetland was surveyed on July 16, 2003. A transect 296 feet long was placed within the meadow at a slight diagonal to extend from the shoreline to the east edge of the meadow, where upland vegetation became prevalent. Vegetation along the transect was described and the relation to reservoir water surface elevation was recorded (Table 4.2.4-7 and Figure 4.2.4-11, Appendix E). This wetland was floristically similar to other sloping meadows around the reservoir, although it was apparent that conditions were drier than at other sites, probably because of lateness in the season. The wetland boundaries also encompass an area of drier meadow with *Wyethia angustifolia*, *Chlorogalum pomeridianum*, *Achillea millefolium*, *Lupinus sp*., and small *Pinus*. *Hypericum perforatum* occurs only on the margin of the wetland and is not common.

Vegetation zones 1-4 are subject to reservoir inundation. The lowermost vegetation zones consisted of recently exposed *Callitriche heterophylla*, grazed *Eleocharis* (probably *E. macrostachya*), *Eleocharis acicularis*, large patches of *Juncus balticus* and smaller patches of *Carex vesicaria.* The forbs characteristic of sloping meadows around Union Valley Reservoir do not appear until higher positions on the slope.

A second transect 112 feet long was placed in a position adjacent to, but outside of the sloping meadow, to illustrate a lakeshore meadow area (Table 4.2.4-8, and Figure 4.2.4-12, Appendix E). Similar to the previous transect, the lower vegetation zones are comprised of only a few species, including heavily grazed *Carex vesicaria*. Transitional vegetation appears about 5.8 feet above current water surface elevation, which almost exactly corresponds to the point of maximum reservoir flooding in 2003 (which was about 6.0 feet above current water surface elevation). Upland conditions were apparent in the next successive zone.

Table 4.2.4-7. Union Valley Reservoir Wetland Site 10 – Transect 1 (July 16, 2003)

	SPECIES AND ABUNDANCE	HABITAT
Zone 1	Dominants: *Juncus balticus, Eleocharis acicularis, and Callitriche heterophylla.*	Zone in shallow water. Inundated maximum of 6.5 ft. in 2003.
Zone 2	Dominants: *Carex vesicaria* and *Eleocharis acicularis.* Other species: *Marsilea vestita* ssp. *vestita*, *Chamaesyce serpyllifolia*, and *Callitriche heterophylla.*	Zone in shallow water and entirely subject to annual flooding.
Zone 3	Dominants: *Juncus balticus* and *Eleocharis macrostachya.*	Zone entirely subject to annual flooding. Inundated 2-5.7 ft in 2003.
Zone 4	Dominants: *Juncus balticus* (heavily grazed by Canada geese) and *Carex vesicaria*. Other species: *Hypericum anagalloides* and	Zone entirely subject to annual flooding (up to 2 ft.).

Table 4.2.4-7. Union Valley Reservoir Wetland Site 10 – Transect 1 (July 16, 2003)		
	SPECIES AND ABUNDANCE	**HABITAT**
	Callitriche heterophylla.	
Zone 5	No clear dominants: *Sidalcea reptans, Verbascum thaspus, Mimulus guttatus, Triteleia hyacinthina, Trifolium monanthum, Rumex acetosella, Prunella vulgaris, Epilobium sp., Viola sp., Carex vesicaria, Juncus balticus, Potentilla sp., Microseris sp.* (?)*, Ranunculus occidentalis,* and *Achillea millefolium.*	Zone not inundated in 2003 (begins at reservoir high water line).
Zone 6	No clear dominants: *Sidalcea reptans, Zigadenus venenosus, Trifolium monanthum, Perideridia parishii, Potentilla sp., Luzula sp., Navarretia sp., Achillea millefolium, Juncus sp., Pinus contorta* (few, 16 ft tall)*,* and *Wyethia angustifolia* (few).	Zone appears to reflect drier, transitional conditions.
Zone 7	No clear dominants: *Achillea millefolium*, *Sidalcea reptans* (few), *Plantago lanceolata*, *Zigadenus venenosus*, *Madia elegans*, *Wyethia angustifolia*, and *Sisyrinchium sp*.	Steep slope, with clearly drier conditions.
Zone 8	No clear dominants: *Helenium bigelovii*, *Carex aquatilis*, *Sidalcea reptans, Potentilla sp*., *Veratrum californicum*, *Triteleia hyacinthina*, *Ranunculus occidentalis*, *Hypericum formosum*, *Polygonum bistortoides*, *Lotus oblongifolius*, *Epilobium sp*., and *Cirsium sp*.	Conditions wetter.
Zone 9	Dominants: *Carex aquatilis*, *Juncus xiphioides*, and *Polygonum bistortoides*. Other species: *Epilobium sp*., *Poa sp*., *Lotus oblongifolius*, *Hypericum formosum*, *Sidalcea reptans*, and *Trifolium sp*.	In small depression on hill slope.
Zone 10	Dominants: *Sidalcea reptans*, *Carex aquatilis*, and *Juncus xiphioides*. Other species: *Lotus oblongifolius*, *Mimulus guttatus*, *Epilobium sp*., *Hypericum formosum*, *Polygonum bistortoides*, and *Phleum pratense*.	
Zone 11	Dominants: *Sidalcea reptans* and *Carex sp*. Other species: *Carex aquatilis*, *Carex athrostachya*, *Poa sp*., *Hypericum formosum*, *Juncus effusus*, *Lotus oblongifolius*, *Ranunculus occidentalis*, *Helenium bigelovii*, *Triteleia hyacinthina*, and *Epilobium sp*.	Within main swale of the meadow and much wetter conditions.
Zone 12	Dominants: *Trifolium monanthum*, *Ranunculus occidentalis*, and *Achillea millefolium*. Other species: *Heterocodon rariflorum*, *Veratrum californicum*, *Plantago lanceolata*, *Sidalcea reptans*, *Stachys ajugoides*, *Cirsium sp*., and *Pinus ponderosa* (saplings).	Transitional.
Zone 13	Dominants: *Pinus contorta* (saplings), *Poa sp*., *Perideridia sp.,* and dry grasses	Upland.

Table 4.2.4-8. Union Valley Reservoir Wetland Site 10 – Transect 2 (July 16, 2003)		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 1	Dominants: *Juncus balticus, Carex vesicaria, Eleocharis acicularis, and Callitriche heterophylla.*	Zone begins in shallow water and entirely subject to annual flooding (up to 6.3 ft.). Some grazing by Canada geese is evident.
Zone 2	Dominants: *Eleocharis acicularis* and *Callitriche heterophylla*.	Zone entirely subject to annual flooding (at depths of 4.5-2.7 ft.)
Zone 3	Dominants: *Carex vesicaria* (heavily grazed by geese), *Juncus effusus* (moderately grazed), and *Scirpus microcarpus* (grazed). With *Rumex acetosella* and *Trifolium monanthum.*	Zone entirely subject to annual flooding. Zone ends at reservoir high water line.

Table 4.2.4-8. Union Valley Reservoir Wetland Site 10 – Transect 2 (July 16, 2003)		
	SPECIES AND ABUNDANCE	**HABITAT**
Zone 4	No clear dominants: *Juncus xiphioides, Juncus effusus, Lupinus sp., Hypericum anagalloides*, *Scirpus microcarpus*, *Verbascum thaspus*, *Trifolium monanthum*, *Mimulus leptaleus, Rumex acetosella*, *Panicum acuminatum*, and *Gayophytum sp.*	Transitional.
Zone 5	Dominants: sapling *Pinus contorta* and *P. ponderosa*, *Achillea millefolium*, *Verbascum thaspus,* and *Lupinus sp*. Other species: *Fragaria sp*., *Gayophytum sp*., *Trifolium monanthum*, *Poa sp*., *Plantago lanceolata*, *Anaphalis margaritacea*, *Ribes sp*., and *Horkelia sp*.	Upland.

Union Valley Reservoir Wetland Site 11

This small wetland (0.8 acre) is located at the West Point boat launch and is mapped by NWI as PEMCh (USFWS 1995). The site gradually slopes up from the reservoir. Hydrology appears to be reservoir-associated only near the shore, where vegetation was very sparse and sandy soils were evident. The principal hydrology is probably groundwater seepage or drainage. The site is predominantly PEM but includes patches of willows. The wetland area is intersected by a paved road and parking lot. No transect was used at this site.

Wetland vegetation at the site reflects conditions that are more disturbed and less hydric than at other sites around Union Valley Reservoir. Weeds and other alien species documented at this site included *Hypericum perforatum*, *Trifolium pratense*, *Plantago lanceolata*, *Cirsium sp*., *Melilotus alba*, *Conyza canadensis*, *Phleum pratense*, and *Polypogon* sp. Species in areas that are periodically submerged included *Juncus balticus*, *Juncus effusus, Rorippa curvisiliqua*, *Callitriche heterophylla*, and a single *Salix.* Some of the species characteristic of other Union Valley Reservoir meadows occurred (*Sidalcea reptans*, *Lotus oblongifolius*, *Geum macrophyllum*, *Mimulus guttatus*, *Juncus xiphioides*, and *Ranunculus occidentalis*), but many did not (e.g., *Carex vesicaria*, *Carex aquatilis*, *Oxypolis occidentalis*, *Polygonum bistortoides*, *Helenium bigelovii*, *Platanthera leucostachys*, or *Saxifraga oregana*), probably because of insufficient hydrology.

4.2.5 Wetlands at Other Reservoirs

Rubicon Reservoir

Rubicon Reservoir is the uppermost reservoir in the UARP, capable of impounding 1,450-acre feet of water. The reservoir is operated primarily in a run-of-the-river mode to capture and divert water from the Rubicon River into the Rubicon-Rockbound Tunnel. As a result, the water level in the Rubicon Reservoir fluctuates with changing volumes of inflow ranging between 6,533.2 and 6,545.0 (approximately 5.8-11.8 feet annually). Small wetlands occupying 15.0 acres line the small coves on Rubicon Reservoir and are mapped by NWI as PEMF, PSSA, PUBF, and PSSCh (USFWS 1995). These shoreline wetlands exhibit limited topographic relief. Hydrology appears to be largely reservoir-associated, except where the inflow from Rubicon River fills several depressional areas.

On October 21, 2003, field investigations of the wetlands associated with Rubicon Reservoir documented small wetland areas on the east and west shores, but the majority of the wetlands were located throughout the southern end of the reservoir at the site of the Rubicon River inflow. Along the east and west shores wetlands occur within coves and are dominated by *C. vesicaria* with few other species. Associated areas of sparse *Pinus contorta* appear to also be wetlands. However, where *Pinus contorta* meadows exist along the east shore of the reservoir they are almost entirely mesic, supporting *Prunus emarginata*, *Pteridium aquilinum*, and *Spiraea densiflora*. Wetlands at the south end of the reservoir are within coves. Here, the dominant species are *Lotus* spp., *Viola macloskeyi*, *Agrostis gigantea*, *Botrychium multifidum*, and low (less than 6 feet tall) *Salix lasiolepis*, in a matrix of mostly *Carex vesicaria*; other areas with large hummocks scattered throughout the *Pinus contorta* stands support *Senecio triangularis*, *Spiraea densiflora*, *Allium* sp., and *Lilium parvum*. Where noted, the wetland influence was observed to extend 1.5 feet above the apparent high water mark.

Buck Island Reservoir

Buck Island Reservoir, located immediately outside the Desolation Wilderness Area, is capable of impounding 1,070-acre feet of water. The reservoir is operated primarily in run-of-the-river mode passing water transported from Rubicon Reservoir and capturing water from Highland Creek and other small tributaries. Because Buck Island Reservoir is operated as a run-of-the-river reservoir, the water level in the reservoir fluctuates with changing volumes of inflow ranging between 6,425.0 and 6,436.0 (approximately 5.0-11.0 feet annually). Between May 1 and September 10, the minimum operating pool level increases by six feet to accommodate summer recreation needs. The small wetlands (8.2 acres) at Buck Island Reservoir are mapped by NWI as LlUBH, and PFOA (USFWS 1995). The area exhibits limited topographic relief and hydrology appears to be largely reservoir-associated.

On October 21, 2003, field investigations of the wetlands associated with Buck Island Reservoir documented several, small isolated wetland areas on the west, north, and south shores. In these areas, the reservoir fringe supports a 40-60 ft-wide band of *Eleocharis acicularis* in areas that are flooded earlier in the season, which give way to *Carex vesicaria* dominated PEM up to the *Pinus contorta* tree line. Throughout the reservoir, the maximum water level is estimated at about three feet above current water surface elevation (6429.34 feet on October 21). Thus, where it occurs along the reservoir shore, *Carex vesicaria* extends from the surface of the water to about one foot above the high water line and is then replaced by a fringe of *Pinus contorta*.

Chili Bar Reservoir

Chili Bar Reservoir encompasses approximately three river-miles of the South Fork American River (SFAR) upstream of Chili Bar. The Chili Bar Project operates on a water-available, peaking basis, with no seasonal or long-term storage capability. Typical operations are to cycle Chili Bar Reservoir on a daily basis from low flow of 200 cfs to peak flows of about 1,980 cfs, depending on availability of discharge from White Rock Powerhouse. Water levels at Chili Bar Reservoir normally fluctuate between 990 and 997 feet elevation at Chili Bar. NWI maps

(USFWS 1995) do not indicate the presence of wetlands along this steep-sided reservoir, and none are evident in the June 2003 aerial photographs.

On September 14, 2004, field investigations documented occasional small herbaceous wetlands within the water fluctuation zone of Chili Bar Reservoir. These areas are not evident in aerial photographs, or when the Reservoir water surface elevation is high. In general, they are too small to map and exist as a thin (less than seven feet wide), steep fringe of hydrophytes that is frequently submerged. The widest such area (see Appendix D for a representative photograph), covering less than 0.1 acre and of an unusually moderate gradient, was sufficiently large to be mapped (see PG&E's *Vegetation Mapping Technical Report* for the Chili Bar Project).

Dominant herbaceous species in wetland fringe areas of Chili Bar Reservoir include *Mentha sp*., *Hypericum formosum*, *Myosotis scorpioides*, and *Prunella vulgaris*. Shrubs are also scattered throughout these herb-dominated wetland fringes, most often *Salix exigua* and *S. lucida*. The upper edge is typically defined by upland forest or small patches of riparian forests dominated by *Salix lucida*, *Platanus racemosa*, *Populus fremontii*, *Alnus rhombifolia*, and other mesic species. In all cases, the wetland influence does not extend beyond the apparent high water mark.

4.2.6 UARP Created Wetlands (Tunnel Adits and Other Facilities)

Jaybird Canyon Adit Wetland

The wetland at the Jaybird Canyon Tunnel adit (UTM 0717395 4301696) was examined on September 16, 2003. This is a very small wetland (less than 0.1 acre) created by tunnel leakage flowing from the adit. The adit provides perpendicular access to the middle of the tunnel. Water was observed flowing into a small channel that subsequently flows over a steeply cut bank down to Silver Creek, which is located more than 100 feet below. Vegetation is relatively weedy, with *Hypericum perforatum*, *Potentilla glandulosa*, *Cirsium vulgare*, and *Melilotus alba*, but also includes *Salix lasiolepis*, *Epilobium* sp., and abundant *Mimulus guttatus*. A dense swath of *Mimulus guttatus, Mimulus cardinalis*, and the four weedy species indicated above is associated with the drainage on the cut bank.

SMUD contractors were working to stem the leakage on September 16. Randy Dutton of Mining Construction, Inc. indicated that the flow would be sharply curtailed after the work was completed.

Camino Tunnel Adit Wetland

Minor leakage of the Camino Tunnel supports a small, weedy wetland at UTM 0710136 4298890 (examined on September 18, 2003). The wetland covers an area approximately 60 feet by 10 feet, including a shallow pond-like area about 15 feet by 10 feet. The substrate is hard-packed gravel. Vegetation consists of a small patch of *Typha latifolia* (up to 5 feet tall), *Salix lasiolepis*, *Mimulus guttatus*, *Centaurea solstitialis, Melilotus alba, Lotus purshianus, Avena fatua,* and *Polypogon sp*. Few botanical resource values observed. The adit was examined previously (August 14, 2003) for the presence of bats (see *Technical Reports on Bats*), at which

time juvenile foothill yellow-legged frogs were observed in the wetland. The site is located about 480 feet above Silver Creek and is separated from the stream by a very steep slope.

Slab Creek Dam Adit Wetland

A wetland was also found at the adit at UTM 0710124 4298866. This is a small wetland that appears to be associated with seepage. The site was examined on September 16, 2003. Ecological and botanical resource values appeared to be low. Vegetation consisted of the following species: *Melilotus alba*, *Panicum* sp., *Mimulus guttatus*, *Cardamine* sp., *Epilobium* sp., *Rorippa nasturtium-aquaticum*, *Alnus rhombifolia*, *Salix lasiolepis*, and *Rubus discolor*.

Gerle Creek Adit Wetland

No tunnel leakage was apparent at this small wetland located at UTM 0726082 4316005. The wetland consists of a shallow depression that is seasonally wet. The hydrology of this site is uncertain, but may derive from hill-slope seepage or precipitation, which collects in the depression. Compacted soils may prolong seasonal flooding or soil saturation. When examined on July 28, 2003, a variety of small plants, many of them annuals, were predominant. The substrate in the wetland was firm and only slightly moist. Ecological and botanical resource values appear to be low. *Hypericum perforatum* and *Melilotus alba* were present on the margins. The following species were also documented: *Rumex acetosella, Chamaesyce serpyllifolia, Lotus purshianus, Epilobium brachycarpum, Antennaria geyeri, Lythrum hyssopifolium, Agrostis exarata, Rumex salicifolius*, *Polygonum* sp., three unidentified species of *Carex* (none abundant), and *Juncus balticus* (few).

Jaybird Substation

This is a large wetland located at UTM 0721767 4304697 and examined on June 9, 2003. The wetland consists mostly of open water areas (up to two feet deep) with a limited fringe of emergent vegetation. The wetland was created by rock removal and construction of the substation at the end of the Jones Fork transmission line and the beginning of Union Valley-Camino line. It is bordered on three sides by cliffs and the fourth by the substation. Vegetation is scant due to limited soil development on the rocky canyon floor. *Carex fracta, Juncus balticus, Juncus xiphioides,* and *Eleocharis acicularis* were all common in vegetated areas. No weeds targeted by the noxious weed study were observed. In general, this wetland exhibits low quality habitat.

Union Valley Switchyard

A large (more than 100 feet by 100 feet) wetland created by rock removal and construction of Union Valley Switchyard. Bordered on three sides by cliffs and the fourth by the substation, this isolated wetland appears to be a by-product of site excavation. Most of the wetland was open water to approximately two feet deep on June 9, 2003. On June 29, standing water was limited to a small pool. Vegetation formation is poor in this wetland due to the limited soil development possible on the rocky canyon floor. A minor emergent vegetation component includes *Carex*

fracta, Juncus balticus, Juncus xiphioides, and *Eleocharis acicularis*. Small, annual species dominate the site, parts of which were sparsely vegetated. Overall, relatively few species were apparent. Common species on the site included *Juncus bufonius*, *Lotus purshianus*, and *Chamaesyce serpyllifolia*. *Mimulus guttatus*, *Mimulus moschatus*, *Veronica scutellata*, and *Galium trifidum* were also present but not common.

This wetland is traversed by UARP transmission lines, and adjacent to a switchyard. A small patch of *Hypericum perforatum* occurred at the edge of the wetland, but no other weeds targeted by the noxious weed survey were observed.

4.2.7 Wetlands Associated with Stream Reaches

Loon Lake Dam Reach

Wetlands closely associated with the Look Lake Dam Reach are extensive around sub-reaches LL8, LL9, LL10, LL14, and LL17. Two of the intensive survey sites for the riparian vegetation survey were located adjacent to meadows in sub-reaches LL10 and LL17. Reconnaissance-level surveys were conducted along the other sub-reaches with wetlands. A survey was also conducted at a depressional wetland adjacent to Gerle Creek in sub-reach LL17. All of the wetlands appear to be in good condition. Representative site photographs are presented in Appendix D.

The NWI map (USFWS 1995) for this area shows a variety of palustrine wetland types: PEMA, PEMB, PEMC, PEMF, PSSA, PSSC, PFOA, PABH, and PUBH. The site investigations indicated that areas mapped as PFOA include both meadows with scattered *Pinus contorta*; more densely forested tracts of *Pinus contorta*; mixed conifer stands comprised of *Pinus contorta*, *Pinus lambertiana*, and *Calocedrus decurrens*; and areas in which occasional *Populus balsamifera* var. *trichocarpa* and *Populus tremuloides* occur with *Pinus contorta*. Aerial photographs from 1940, 1952, 1976, and 2002 show a general increase in the occurrence of conifers within "Neck Meadow" and the meadow south of the current Wentworth Spring Campground (and where Loon Lake Dam Reach riparian investigation Site 3 was located), changes that appear to have occurred after 1976 (Appendix G). Some areas within "Gerle Meadow" also display a similar increase in conifers evident in the 2002 aerial photograph, but not in the 1976 aerial photograph, although other areas appear relatively unchanged (Appendix G).

In the vicinity of "Gerle Meadow" (sub-reaches LL8 and LL9), a large meadow complex was field examined where it is adjacent to Gerle Creek. Meadows occur in both small and large forest openings. Moist sites are dominated by *Veratrum californicum, Lonicera conjugialis*, *Lupinus polyphyllus*, *Solidago canadensis*, *Castilleja miniata*, and *Spiraea densiflora*, whereas wetter depressions are dominated by *Carex vesicaria*, or both *Carex vesicaria* and *Carex aquatilis.* A small emergent wetland was also documented within a side channel in this sub-reach. Here, *Carex vesicaria* and *Nuphar lutea* were dominant, along with *Scirpus microcarpus*, *Juncus xiphioides*, *Carex aquatilis*, *Potamogeton sp*., and *Sparganium emersum*.

Meadows also occur in forest openings adjacent to the creek in sub-reach LL9 and LL10 within an area identified as "Neck Meadow" on the Wentworth Springs USGS topographic map. At riparian investigation Site 2 (sub-reach LL9 and LL10), meadows occur in an open canopy forest of *Pinus contorta* and *Populus balsamifera* var. *trichocarpa*. Many of the herbaceous species that characterized meadows elsewhere were found here: *Veratrum californicum*, *Camassia quamash*, *Lilium parvum*, *Perideridia parishii*, *Polygonum bistortoides*, *Solidago canadensis*, *Senecio triangularis*, *Helenium bigelovii*, *Mimulus guttatus*, *Juncus xiphioides*, and *Platanthera leucostachys*.

Within sub-reach LL17, the wetland adjacent to riparian investigation Site 3 is a mosaic of open meadows and mostly small *Pinus contorta*. *Veratrum californicum* and *Carex aquatilis* are common. A wetland at UTM 731707E 4321271N is mapped by NWI as PEMF with PSSC (USFWS 1995). A field examination on July 10, 2003 indicated a depressional wetland that is persistently flooded up to about 2.25 feet deep. An overflow channel led to Gerle Creek. *Carex vesicaria*, *Carex aquatilis*, *Nuphar lutea*, and *Potamogeton natans* were common. There are also patches of *Salix lemmonii* at the margin of the pool. *Sparganium angustifolium* (or *S. emersum*) and *Utricularia vulgaris* were uncommon. Large tadpoles of *Hyla regilla* (Pacific treefrog) had apparently over wintered.

Ice House Dam Reach

Wetlands associated with the Ice House Dam Reach occur in two general locations: within sub-reach IH5 and IH6 up to about 0.5 mile downstream of the dam and at the upstream end of sub-reach IH1. All of the wetlands appear to be in good condition, except for disturbance by off-road vehicles at three of the sites. Representative site photographs are presented in Appendix D.

A small drainage at the base of the dam supports a small wetland, before flowing into South Fork Silver Creek. Woody vegetation (*Alnus incana*, *Cornus sericea*, and *Salix* sp.) had been recently cut when the site was examined on June 13, 2003. The site also includes an adjacent seep on bedrock east of the creek. The two areas support a large population of *Drosera rotundifolia*, almost certainly numbering much more than 1,000 individuals. Most of the plants occur on the seep, but at least 300 plants grow on a rock outcrop that is kept wet by flows from the valve house. Although the total wetland area is small, a surprising variety of species was present, including *Sisyrinchium elmeri*, *Saxifraga oregana*, *Hypericum anagalloides*, *H. formosum*, *Geum macrophyllum*, *Viola macloskeyi*, *Senecio triangularis*, *Epilobium minutum*, *Lotus oblongifolius*, *Polygonum bistortoides*, *Gentianopsis simplex*, *Mimulus moschatus*, *Scirpus microcarpus*, *Juncus effusus*, *J. xiphioides*, *J. ensifolius*, *Carex aquatilis*, *C. echinata*, *C. jonesii*, *Carex illota*, and *Platanthera leucostachys.*

Three meadows flank South Fork Silver Creek within the next 0.5 mile downstream of the dam. Two are mapped by NWI as PEMB and the other PEMC (USFWS 1995). The lowermost meadow is located west of the creek. When examined on August 5, 2003 there were pools of standing water, flowing water in places, and saturated soils elsewhere. There were signs of disturbance by off-road vehicles. A few small *Pinus contorta* were present on the margins. The wetland is adjacent to a gauge pool and may be supported by occasional flooding from the creek,

as well as drainage from another meadow. Dominant species were *Carex aquatilis*, *Eleocharis macrostachya*, and *Juncus xiphioides*, but many other species characteristic of meadows occurred (e.g., *Camassia quamash*, *Veratrum californicum*, *Lotus oblongifolius*, *Senecio triangularis*, *Helenium bigelovii*, *Sidalcea reptans*, *Saxifraga oregana*, *Platanthera leucostachys*, *Juncus tenuis*, *Carex vesicaria*, and *Glyceria* sp.). North of this site there is a second meadow, which is less wet. This wetland appears to be supported by drainage from the slope above it. When examined on June 9 and August 5, 2003 there were scattered pools of standing water, but otherwise hydrology was best described as saturated. A diverse array of meadow-associated species was observed, including most of the species found in the lower meadow, as well as *Perideridia lemmonii*, *P. parishii*, *Madia bolanderi*, *Carex disperma*, *C. hassei*, and *C. integra*. Vehicular disturbance was observed, although it was less extensive than in the lower meadow. *Hypericum perforatum* occurred on the margin of the wetland. West of the creek a third meadow was generally similar in species composition, but with more extensive encroachment by *Pinus contorta*. *Perideridia lemmonii* and *Solidago canadensis* were particularly common in parts of this wetland. Pools of standing water and limited vehicular disturbance were noted.

There is also a wetland at the upstream end of sub-reach IH1. Mapped by NWI as PSSC (USFWS 1995), this is an isolated depressional meadow (PEMC) flanked by a thicket of *Alnus incana* (PSSC). The wetland is adjacent to the creek and probably connected at high flows. Field examination of the site on July 28, 2003 indicated dominance by *Carex vesicaria* in the wettest part of the basin, with a patch of *Scirpus microcarpus*.

Reach Downstream of Chili Bar

The NWI (USFWS 1995) indicates that a series of wetlands occur along the Reach Downstream of Chili Bar, mostly within the Coloma Sub-reach. Categories of palustrine wetlands indicated by NWI are PSSA, PSSAx (associated with suction dredge tailings), PSSC, PFOA, and PFOC. No palustrine emergent wetlands are shown to occur.

Putative wetland areas were field investigated to determine whether wetland characteristics were present. Because the wetland types shown to occur are characterized by woody vegetation, the investigation was focused on comparing these sites to other riparian areas along the reach not classified by NWI as wetlands. Most species associated with riparian habitats are hydrophytes; thus, dominance by hydrophytes was not alone sufficient to determine the presence of wetlands. However, the presence of wetland obligates can be determinative, if other criteria are met. Soils generally could not be examined except at the surface because many of these sites were located on cobble substrates.

Sites mapped as wetlands (PSSA, PSSAx, PSSC, PFOA, and PFOC) were examined at Marshall Gold Discovery State Historic Park, Henningson-Lotus County Park, Camp Lotus, upstream of Camp Lotus, downstream of Camp Lotus, opposite Clark Creek, 0.5 mile upstream of Hastings Creek, and at the mouth of Hastings Creek. In addition, an old oxbow channel mapped as PSSA was examined. All of these sites are shown on a copy of the NWI map (USFWS 1995) in Appendix F. Representative site photographs are presented in Appendix D. Areas mapped by

NWI as wetlands were among the sites subject to study for the riparian investigation of the Reach Downstream of Chili Bar and these areas are also discussed in Section 4.1.13.

Most of the sites were not markedly different in species composition than what occurred in riparian areas not mapped by NWI as wetlands. Sites mapped as PSSC were generally situated at lower positions on lateral bars or instream cobble bars that are flooded more frequently than sites mapped as PSSA. *Alnus rhombifolia* (FACW) and *Salix lasiolepis* (FACW) were typically the dominant species in areas mapped as PSSC, whereas *Salix exigua* (FACW) often characterized areas mapped as PSSA. At Hastings Creek, mid-channel cobble bars are mapped by NWI as PSSC. Vegetation here consists of mixed riparian hardwoods (*Alnus rhombifolia, Salix lucida, Salix exigua, Fraxinus latifolia, Platanus racemosa*, and a single observed *Populus fremontii*). The stands are flooded at high operational flows. At Henningson-Lotus County Park, an area mapped by NWI as PSSAx was a thicket of *Salix exigua* (FACW) and *Rubus discolor* (FAC+). The substrate was comprised of cobbles and sand, and there were no herbaceous hydrophytes. An adjacent area mapped as PFOC was closely associated with Shingle Creek and was dominated by small *Populus fremontii*. The high banks at Henningson-Lotus County Park, where a row of *Populus fremontii* occurs, are mapped by NWI as PFOA.

Some sites mapped by NWI as PSSC are located at positions where they may be less frequently flooded than the NWI classification would indicate. At Camp Lotus a cobble bar mapped by NWI as PSSC wetland was dry and poorly vegetated in the center, with a ring of *Salix exigua, Salix lasiolepis, Alnus rhombifolia,* small *Populus fremontii*, and *Rubus discolor* over a sparse herbaceous layer. The area opposite Clark Creek mapped by NWI as PSSC consists of several large *Populus fremontii* among a dense thicket of *Salix lasiolepis* and *Rubus discolor*. The relative elevation of the Clark Creek site (see Section 4.1.13) suggests that it would not be flooded as frequently as other areas mapped as PSSC.

At Marshall Gold Discovery State Historic Park a stand of *Salix exigua*, *Salix lasiolepis*, and scattered *Populus fremontii* is mapped by NWI as a PSSA wetland. The old oxbow channel mapped as PSSA included areas of dense *Salix exigua*, often with *Rubus discolor* at the margins, and wetter depressions with *Cephalanthus occidentalis*, *Xanthium strumarium*, and *Typha latifolia.*

Few areas that could be considered PEM wetlands occur along the Reach Downstream of Chili Bar. The upstream end of the Camp Lotus site includes a series of backwater pools that flood to approximately two feet deep, supporting sparse coverage by wetland obligates such as *Tillaea aquatica, Eleocharis acicularis*, and *Limosella* sp. in addition to a few stems of the aquatic plant *Elodea canadensis*. These pools may be considered PEM wetlands, although they remain riverine in nature, with a cobble-sand substrate and little soil development.

4.2.8 Other Wetlands

Other wetlands documented in the study area include those occurring within the UARP transmission lines corridor, or near penstocks or substations. Each of these was examined during special-status plant and noxious weed surveys conducted in 2003 and are described below.

Numerous other wetlands that are removed from UARP influence also occur in the study area (especially at higher elevations), most of these were not directly examined and are not described here (but see the *Vegetation Mapping Technical Report* for mapping that includes remote wetlands). All wetlands, whether directly examined or remotely mapped, are included in acreage calculations for the Wetlands Study area.

Location: Jones Fork –Union Valley transmission line corridor
UTM (NAD83): 10S 0725568 4303780
Survey Date: 9 June 2003

A small (50 feet by 50 feet) depressional wetland with emergent vegetation ringed by wetland shrubs, and standing water to 4 inches deep in the center. The emergent area is dominated by *Lotus pinnatus,* with *Juncus xiphioides, Poa pratensis, Carex* spp., *Ranunculus occidentalis,* and *Senecio triangularis*. The shrub zone is dominated by *Cornus sericea*, *Rhododendron occidentalis*, and *Leucothoe davisiae*. The surrounding forested lands support *Calocedrus decurrens*, *Pinus jeffreyi, Abies concolor, Pinus lambertiana*, and *Pinus contorta*.

This wetland is traversed by UARP transmission lines, and associated roads run near but not through the area. Some damage was observed from tree clearing activities (the area was previously forested), including substantial amounts of LWD piled in the wetland. No weeds targeted by the noxious weed study were observed.

Location: Jones Fork –Union Valley transmission line corridor
UTM (NAD83): 10S 0726173 4303407
Survey Date: 9 June 2003; August 7 2003

A small (100 feet by 100 feet) emergent wetland with a minor shrub component, with soils saturated to the surface during both visits. The wetland is associated with an unnamed creek in the area. The emergent areas are dominated by *Lotus oblongifolius, Lotus pinnatus,* and *Juncus xiphioides*, with *Mimulus guttatus, Prunella vulgaris, Juncus effusus*, and various *Carex* spp. each common, and *Alnus incana* dominates the shrub layer. The surrounding forested lands are dominated by smaller *Abies magnifica* and *Pinus jeffreyi*; the area appears to have recently burned.

This wetland is traversed by UARP transmission lines, and associated roads run near but not through the area. No weeds targeted by the noxious weed study were observed.

Location: Jones Fork –Union Valley transmission line corridor
UTM (NAD83): 10S 0724621 4303355
Survey Date: June 9 2003

A very small (20 feet by 20 feet) emergent seep on a hill slope. The ground is moss-covered, with low vascular plant cover, but *Juncus xiphioides*, *Salix lasiolepis*, *Lotus pinnatus*, and *Carex* sp. are all common. The surrounding transmission line corridor is dominated by upper montane chaparral, and maintained as such by vegetation clearing. *Ceanothus cordulatus, Prunus*

emarginata, and *Arctostaphylos patula* share dominance. Surrounding forest is the mixed conifer-fir alliance (MF), with *Calocedrus decurrens*, *Pinus jeffreyi, Abies concolor, Pinus lambertiana*, and *Pinus contorta*.

This wetland is traversed by UARP transmission lines. A transmission tower 60 feet to the west of the wetland (and its associated access road) appear to have corralled seepage from the slope, creating or maintaining wetland conditions. No stumps indicating tree removal occur, and no weeds targeted by the noxious weed study were observed.

Location: Jones Fork –Union Valley transmission line corridor
UTM (NAD83): Not available
Survey Date: 9 June 2003

A small (50 feet by 100 feet) wetland approximately 200 feet east of the Union Valley Switchyard. Situated at the base of small cliffs, the area is dominated by diverse emergent species, including *Juncus chlorocephalus, Lotus pinnatus*, *Hypericum anagalloides, Hypericum formosum, Viola macloskeyi, Carex aquatilis, Carex laeviculmis,* and *Juncus balticus*. The center of the wetland supports a thick mat of moss inundated to the surface and dotted with vascular plants, and an edge includes some shrub coverage of *Salix lasiolepis.* The surrounding forest is mixed confer-pine, with *Pinus ponderosa, Pseudotsuga menziesii, Abies concolor*, and *Calocedrus decurrens*. Disturbed, poorly vegetated occur between the wetland and adjacent switchyard, with *Dactylis glomerata, Verbascum thaspus,* and *Hypericum perforatum* each common.

This wetland is traversed by UARP transmission lines. An adjacent road and disturbed staging area may be corralling runoff from the cliffs above, creating or maintaining wetland conditions. No weeds targeted by the noxious weed study were observed.

Location: Robbs Peak Penstock
UTM (NAD83): Not available
Survey Date: July 1 2003

A very small (5 feet by 25 feet) wetland directly below Ice House Road, apparently created by excavation for the penstock and maintained by the poor drainage afforded by a small culvert. The area is very weedy, with *Hypericum perforatum, Vulpia myuros, Madia minimus, Lotus purshianus, and Aira caryophyllea* each well represented. However, no weeds targeted by the noxious weed study occur. Co-dominant native species include *Mimulus guttatus, Juncus balticus, Carex fracta,* and *Heterocodon rariflorum*.

Location: Loon Lake-Union Valley transmission line corridor
UTM (NAD83): 10S 0727111 4310868; 10S 0727021 4311046
Survey Date: July 1 2003

A small (100 feet by 100 feet) wetland associated with hill slope seepage supports *Carex* spp, *Juncus oxymeris, Agrostis exarata, Scirpus diffusus*, but is dominated by the common weeds

Potentilla glandulosa and *Lotus purshianus*. The area becomes much wetter at the base of the hill (second UTM, above), where a 100 feet by 40 feet patch above a road is dominated by *Juncus oxymeris*, with the above species as associates. The surrounding vegetation in the transmission line corridor is mixed chaparral dominated by *Ceanothus cordulatus*, and maintained as such by vegetation clearing. The adjacent forest is dominated by mixed conifers including *Abies concolor*, *Pinus lambertiana*, and *Calocedrus decurrens*.

These areas are traversed by UARP transmission lines, and a transmission line access road runs through runs through the lower section, where tire ruts are evident in the saturated soil. No weeds targeted by the noxious weed study were observed.

Location: Robbs Valley
UTM (NAD83): 10S 0726907 4311234 (south end, extends >500 feet to north)
Survey Date: July 3 2003, August 13 2003

A very large (more than ten acres) wetland complex behind a commercial campground includes emergent, shrubs, and forested components. The southernmost end is stream-associated, and consists of a meandering *Alnus* thicket dotted with *Pinus contorta*, or *Calocedrus decurrens* on higher ground. The understory is remarkably diverse, supporting dense *Juncus oxymeris, Juncus balticus, Ranunculus occidentalis, Juncus nevadensis, Scirpus diffusus, Mimulus floribundus, Helenium bigelovii, Lotus oblongifolius, Mimulus guttatus, Castilleja* sp., *Senecio triangularis, Veratrum californicum*, *Platanthera sparsiflora,* and numerous other species, including some (e.g., *Sisyrinchium elmeri*) found nowhere else in the study area. Northeast of the stream (moving away from the transmission line corridor) is a large meadow dominated by various *Carex* spp., with many of the above species represented as well. To the north, the wetland continues under a tree canopy dominated by mature *Pinus contorta*.

This wetland complex is partially traversed (on its west side) by UARP transmission lines, and associated access roads run through the area. Tire ruts, some severe, are evident in the saturated soil of the road, part of which has been washed out by a stream. Much of the use of the area appears recreational, including various user trails. No weeds targeted by the noxious weed study were observed, although *Potentilla glandulosa*, a widespread, potentially invasive exotic species, is common.

Location: Loon Lake-Union Valley transmission line corridor
UTM (NAD83): 10S 731336 4318327
Survey Date: August 13 2003

A small, tear-shaped pond with directly under transmission lines, this wetland consists of an open water area bordered by a dense edge of *Carex vesicaria*. The wetland is traversed by the lines, which do not require vegetation clearing. The pond is separated from an access road by a narrow fringe of trees. It appears uninfluenced by the UARP, and no weeds targeted by the noxious weed study were observed.

Location: Loon Lake Boat Launch area

UTM (NAD83): Not available
Survey Date: August 13 2003

A large (more than 100 feet by 100 feet) depressional wetland complex hydrologically removed from Loon Lake Reservoir, this area is situated approximately 300 feet inland from the main boat launch parking lot. Emergent, shrub-dominated, and forested components are all present, with emergent vegetation covering an estimated 80 percent of the wetland. The emergent component is exceptionally diverse, dominated by *Carex vesicaria*, but also supporting *Poa palustris, Potentilla glandulosa, Aster alpigenus, Viola macloskeyi, Spiranthes romanzoffiana, Mimulus primuloides, Juncus xiphioides, Juncus balticus, Camassia quamash,* and *Scirpus diffusus*. A small (20 feet by 20 feet) shrub patch in the center of the emergent vegetation is composed of *Salix lemmonii* and *Alnus incana*. The wetland is ringed by *Pinus contorta* to 90 feet tall and a shrub mixture dominated by *Ledum glandulosum*, *Phyllodoce breweri* and *Vaccinium scoparium*. The upland forest edge supports dense *Pteridium aquilinum* as well as occasional *Alnus incana* interspersed with *Botrychium multifidum*. The surrounding forest is open, with Pinus jeffreyi and Abies magnifica over a *Quercus vaccinifolia* shrub layer.

This wetland is removed from UARP influence, but partially within the FERC Project Boundary of the UARP. No roads or disturbances were observed. No weeds targeted by the noxious weed study occur, although *Potentilla glandulosa*, a widespread, potentially invasive exotic species, is common.

Location: Gerle Creek Canal area
UTM (NAD83): 10S 0726367 4316279
Survey Date: August 13 2003

A large (more than 100 feet by 100 feet) wetland hydrologically removed from Gerle Greek Canal. The wetland is dominated by *Carex vesicaria*, with *Eleocharis* sp., *Poa palustris, Ranunculus occidentalis,* and *Mimulus primuloides* each common. In addition, the strong presence of *Potamogeton* sp. at ground level indicates that the area is flooded to a considerable depth for much of the year (it is moist to the surface in August). The wetland is ringed by Pinus contorta, but otherwise the surrounding forest is dominated by mixed conifers including *Pinus jeffreyi* and *Abies concolor*.

This wetland is removed from UARP influence, and outside the FERC Project Boundary of the UARP. No direct disturbances were observed.

5.0 ANALYSIS

5.1 Riparian Vegetation Study Analysis

The study objectives set by the Technical Working group were to: 1) determine the extent and frequency of riparian vegetation in the study area; 2) describe the current condition of riparian vegetation; and 3) if possible, obtain information on historical riparian conditions so as to shed light on objectives 1 and 2.

The extent and frequency of riparian vegetation in the study area is provided in Appendix A, which includes high-resolution ortho-photography and riparian vegetation typing for all stream reaches affected by the two Projects. Riparian vegetation areas surrounding the UARP reservoirs were mapped in 2000 (KEA 2000). The mapping phase indicates that the occurrence of riparian vegetation closely reflects the occurrence of suitable geomorphic conditions (see Sections 5.1.1-5.1.3). The types (vegetation alliances) of riparian vegetation along the stream reaches also correspond to those found on similar sized streams at similar elevations on the western slope of the Sierra Nevada (Harris *et al*. 1987, Harris 1988, Potter 2000).

Riparian vegetation around the UARP reservoirs and Chili Bar Reservoir was limited in extent, generally restricted to a narrow band, small patches, individual trees or shrubs characteristic of riparian settings. The prevalence of steep slopes, well-drained substrates, or bedrock constrain the occurrence of riparian vegetation, even at run-of-the-river or peaking reservoirs.

Current condition of riparian vegetation is described in detail in Section 4.1 and Table 5.1-1 provides a summary of major findings for each sub-reach subject to intensive study. The characteristics listed in Table 5.1-1 closely conform to those used by USBLM (1998) to assess "proper functioning condition" (PFC) of riparian areas. A complete evaluation of PFC is based on these aspects of riparian vegetation, as well as hydrologic functions and erosion processes. This report has addressed riparian vegetation; hydrologic and erosion processes are discussed in the *Channel Morphology Technical Report*. Proper functioning condition generally occurs when riparian vegetation exhibits the following characteristics to the degree that site potential[1] permits (USBLM 1998):

- Diverse age structure of vegetation;
- Diverse composition of vegetation;
- Species present indicate maintenance of riparian soil moisture characteristics;
- Stream bank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high stream flow events;
- Riparian plants exhibit high vigor;
- Adequate vegetative cover present to protect banks and dissipate energy during high flows; and
- Plant communities in the riparian area are an adequate source of coarse and/or large woody debris.

A comparison to historical conditions was intended to evaluate potential improvements to current conditions. However, only a limited comparison to historical conditions was possible. Historical aerial photographs were generally lacking in resolution for anything more than gross comparisons. Where these comparisons were possible, the extent of riparian vegetation does not appear to have substantially changed. Gross changes in composition (e.g., replacement of deciduous vegetation by conifers) are also not apparent.

[1] Site potential represents “the highest ecological status an area can attain given no political, social, or economical constraints”.

Nonetheless, some aspects of current conditions may still be compared to expected conditions. In the largest study of riparian vegetation response to stream flow diversion, Harris *et al.* (1987) described the response of riparian vegetation along different streams as "individualistic" and generally unpredictable, particularly where riparian vegetation is supported by minimum flows. Simply stated, a parameter of riparian vegetation might increase on one stream, but decrease on another. Based on their findings, they concluded that potential changes to riparian vegetation following diversion are generally limited to the following:

- Increase in canopy cover;
- Decrease in canopy cover;
- Changes in vegetation structure;
- Changes in species composition;
- Changes in species richness (generally a decrease);
- Encroachment into formerly scoured locations; and
- Losses at floodplain margins that are no longer irrigated by over-bank floods.

Harris *et al*. (1987) suggest that an increase in canopy cover is related to reduction in the intensity of peak flood events, but that this effect is likely to be significant only on certain moderately steep reaches. A decrease in canopy cover may follow a reduction in soil moisture and thus could be evident on reaches with very well drained substrates, particularly on wide floodplains. Changes in vegetation structure and species composition are complex and may not be predictable without substantially greater understanding of the moisture requirements and growth rates of key species (Harris et al. 1987, Stromberg and Patten 1991). Encroachment into formerly scoured locations and losses at floodplain margins should be detectable. Each of these aspects is discussed below.

Table 5.1-1. Summary of vegetative components of riparian function and condition (USBLM 1993)[1]						
Woody Species Age Structure	**Riparian Species Richness**	**Soil Moisture Indicators[2]**	**Adequate Bank Root-Density[3]**	**Riparian plants exhibit high vigor**	**Adequate Bank Cover[4]**	**Sources of Woody Debris[5]**
Loon Lake Dam Reach (Sub-reach LL3)						
Diverse ages of *Alnus incana* and *Salix,* suggesting periodic loss and replacement.	More than 5 woody riparian species and diverse herbaceous species.	Dominant species in Zone 1 are FACW or OBL; cobble bar interiors include some OBL species, although sparse.	Banks well vegetated and appear stable and intact, although some are undercut. Community types on banks rated high for stability.	Riparian plants are vigorous and do not indicate moisture stress. Decadent *Alnus incana* are associated with areas where banks are undercut.	Greenline cover almost 100%. CC of woody species 75-100%.	Tall conifers are a source of LWD and riparian shrubs a source of CWD to channel.
Loon Lake Dam Reach (Sub-reach LL10)						
Diverse ages of *Alnus incana*, *Pinus contorta,* and *Cornus sericea,* suggesting periodic loss and replacement.	More than 5 woody riparian species and diverse herbaceous species.	Dominant species in Zone 1 are FACW or OBL; species in interior zones reflect presence of wet meadows and side channels.	Banks well vegetated and appear stable and intact, with slight undercutting. Community types on banks rated high for stability.	Riparian plants are vigorous and do not indicate moisture stress. Number of dead or decadent shrubs is not excessive.	Greenline cover almost 100%. CC of woody species 75-100%.	Tall conifers are a source of LWD and riparian shrubs a source of CWD to channel.
Loon Lake Dam Reach (Sub-reach LL17)						
Mature *Alnus incana* are predominant, but good numbers of younger plants. Also diverse ages of *Pinus contorta* and *Salix*. Suggests periodic loss and replacement.	5 woody riparian species with diverse herbaceous species	Dominant species in Zone 1 are FACW or OBL; species in interior zones reflect presence of wet meadow and side channel.	Banks well vegetated and appear stable and intact, with slight undercutting. Community types on banks rated high for stability.	Riparian plants are vigorous and do not indicate moisture stress. Number of dead or decadent shrubs is not excessive.	Greenline cover almost 100%. CC of woody species 75-100%.	Adequate. Conifers are generally not large, but occur in proximity to channel. Riparian shrubs are a source of CWD.
Gerle Creek Dam Reach (Sub-reach GC1)						
High percentage of younger age classes of *Alnus incana*; growing conditions restricted because of	4 woody riparian shrubs with moderate number of herbaceous species reflecting limited	Dominant species in Zone 1 are mostly FACW or OBL (*Myrica* is FAC+); cobble bar interiors	Banks are predominantly bedrock, but where substrates suitable is well vegetated.	Riparian plants are vigorous and do not indicate moisture stress. Very few decadent obser5ved.	Greenline cover about 40% (rest is bedrock). CC of woody species about 20%.	Tall conifers are a source of LWD and Riparian shrubs are a source of CWD to channel.

Table 5.1-1. Summary of vegetative components of riparian function and condition (USBLM 1993)[1]						
Woody Species Age Structure	**Riparian Species Richness**	**Soil Moisture Indicators[2]**	**Adequate Bank Root-Density[3]**	**Riparian plants exhibit high vigor**	**Adequate Bank Cover[4]**	**Sources of Woody Debris[5]**
bedrock	habitat.	include some FACW or OBL species.	Community types on banks rated high for stability.			
Robbs Peak Dam Reach (Sub-reach RP15)						
Mature *Alnus incana* predominant, although some younger plants occur. *Salix* saplings also present. Suggests stable conditions, with infrequent replacement.	4 woody riparian species with moderately diverse herbaceous species.	Dominant species in Zone 1 are FACW or OBL; cobble/boulder bar interior includes some FACW or OBL species.	Banks well vegetated and appear stable and intact. Community types on banks rated high for stability.	Riparian plants are vigorous and do not indicate moisture stress. Very few dead or decadent shrubs.	Greenline cover almost 100%. CC of woody species 75-100%.	Tall conifers are a limited source of LWD because point bars occupy much of area near the channel. Riparian shrubs a source of CWD to channel.
Ice House Dam Reach (Sub-reach IH1)						
Diverse ages of *Alnus incana* and *Myrica hartwegii*, suggesting periodic loss and replacement.	More than 5 woody riparian species with diverse herbaceous species.	Dominant species in Zone 1 are FACW or OBL; cobble/boulder bar interior includes some FACW or OBL species, generally sparse.	Banks well vegetated and generally appear stable and intact, with limited erosion. Community types on banks generally rated high for stability (ratings for *Myrica* and *Rhododendron* are unknown).	Riparian plants are vigorous and do not indicate moisture stress. Only one decadent shrub recorded.	Greenline cover almost 100%. CC of woody species on left bank is 75-100% and on right bank is 50-75%.	No standing source of LWD because of forest fire. Most DWD appears to be left over from fire and 1996 high water. Little or no local recruitment.
Ice House Dam Reach (Sub-reach IH5)						
Mature *Alnus incana* and Salix are predominant, but sapling *Salix* occur. Suggests stable conditions, with infrequent	5 woody riparian species and diverse herbaceous species.	Dominant species in Zone 1 are FACW or OBL; cobble bar interiors include some FACW or OBL species, but sparse.	Banks well vegetated (except for areas disturbed by recreation) and appear stable and intact, with slight undercutting.	Riparian plants are vigorous and do not indicate moisture stress. Few dead or decadent shrubs.	Greenline cover 80-90%. CC of woody species 75-100%.	Tall conifers are a source of LWD and riparian shrubs a source of CWD to channel.

Table 5.1-1. Summary of vegetative components of riparian function and condition (USBLM 1993)[1]						
Woody Species Age Structure	**Riparian Species Richness**	**Soil Moisture Indicators[2]**	**Adequate Bank Root-Density[3]**	**Riparian plants exhibit high vigor**	**Adequate Bank Cover[4]**	**Sources of Woody Debris[5]**
replacement.			Community types on banks rated high for stability.			
Camino Dam Reach (Sub-reach C4)						
Diverse ages of *Alnus rhombifolia* and *Salix lasiolepis,* suggesting periodic loss and replacement.	5 woody riparian species occur, but limited number of herbaceous species.	Dominant species in Zone 1 are FAC with few FACW or OBL species.	Banks are predominantly bedrock, but where substrates suitable is well vegetated. Community types on banks rated high for stability.	Riparian plants are vigorous and do not indicate moisture stress. Dead *Salix* mostly on bank exposed to high flows.	Greenline cover 50-60% (limited by bedrock). CC of woody species patchy; on right bank 25-50% and less than 25% on left bank.	Sources of LWD are limited to trees on valley slopes. Riparian shrubs are a source of CWD; but most debris would be flushed out of the channel.
Slab Creek Dam Reach (Sub-reach SC1)						
Diverse ages of *Salix lucida, Salix exigua,* and *Alnus rhombifolia*, suggesting periodic loss and replacement.	More than 5 woody riparian species occur, but limited number of herbaceous species.	Dominant woody species in Zone 1 are FACW or OBL, although herbaceous species are not strong indicators.	Banks well vegetated and generally appear stable and intact. Community types on banks rated high for stability.	Riparian plants are vigorous and do not indicate moisture stress. Few dead shrubs observed.	Greenline cover 85% to almost 100%. CC of woody species is 75-100% on right bank and 50-75% on left bank.	Sources of LWD are limited. Riparian shrubs are a source of CWD to channel.
Slab Creek Dam Reach (Sub-reach SC3)						
Diverse ages of *Alnus rhombifolia, Salix exigua*, and *Salix lucida,* suggesting periodic loss and replacement.	5 riparian tree and shrub species, but limited number of herbaceous species.	Dominant species in Zone 1 are mostly FACW or OBL. Cobble bar interior includes few FACW or OBL species.	Banks well vegetated and generally appear stable and intact. Community types on banks rated high for stability.	Riparian plants are vigorous and do not indicate moisture stress. Few dead shrubs observed.	Greenline cover totals are 82% (RB) and 83% (LB). CC of woody species is 50-75%.	Sources of LWD limited to trees on left valley slope. Riparian shrubs are a source of CWD, but debris may be flushed out of the channel.
Reach Downstream of Chili Bar - Gorge Sub-reach (CB1)						
Ages of *Alnus rhombifolia, Salix,* and *Fraxinus latifolia* suggest frequent loss and	More than 4 woody riparian species and numerous herbaceous species.	Dominant species in Zone 1 are FACW or OBL; species in interior zones are often transitional to	Banks often boulder-lined, appearing stable and intact. Cobble bars support vegetation	Riparian plants are vigorous and do not indicate moisture stress. Many shrubs have regenerated	Greenline cover is 35% and significantly limited by bedrock. CC of woody species is 0-	Sources of LWD limited to upland valley slopes. Riparian shrubs are a source of CWD,

Table 5.1-1. Summary of vegetative components of riparian function and condition (USBLM 1993)[1]						
Woody Species Age Structure	**Riparian Species Richness**	**Soil Moisture Indicators[2]**	**Adequate Bank Root-Density[3]**	**Riparian plants exhibit high vigor**	**Adequate Bank Cover[4]**	**Sources of Woody Debris[5]**
replacement.		upland.	rated high for stability, but bars are mobile over time.	following flood damage.	25%.	but debris likely to be flushed out of the channel.
Reach Downstream of Chili Bar - Coloma Sub-reach (CB 2)						
Ages of A*lnus rhombifolia*, *Salix*, and *Fraxinus latifolia* suggest frequent loss and replacement in main riparian channel. Elsewhere, *Populus fremontii* age structure may be imbalanced, and large individuals are restricted to high banks.	More than 5 woody riparian species and numerous herbaceous species.	Dominant species in Zone 1 are FACW or OBL; species in interior zones are often transitional to upland.	Banks are well vegetated, but occasionally undercut. Cobble bars support vegetation rated high for stability, but bars are mobile over time.	Riparian vegetation near channel is vigorous.	Greenline cover is 60-80%. CC of woody species is 50-75%.	Sources of LWD are few. Riparian shrubs are a source of CWD, but debris likely to be flushed out of the channel.
Reach Downstream of Chili Bar - Canyon Sub-reach (CB3)						
Ages of *Alnus rhombifolia, Salix,* and *Fraxinus latifolia* suggest frequent loss and replacement.	More than 4 woody riparian species and numerous herbaceous species.	Dominant species in Zone 1 are FACW or OBL; species in interior zones are often transitional to upland	Banks often boulder-lined, appearing stable and intact. Cobble bars support vegetation rated high for stability, but bars are mobile over time.	Riparian plants are vigorous and do not indicate moisture stress. Many shrubs have regenerated following flood damage.	Greenline cover is 65%. CC of woody species is 25-50%.	Sources of LWD limited to upland valley slopes. Riparian shrubs are a source of CWD, but debris likely to be flushed out of the channel.

[1]Vegetative components of riparian function and condition are assessed "Relative to Capability" in all instances (USBLM 1993). For example, undisturbed montane riparian communities in the Sierra Nevada typically support relatively few tree and shrub species (Harris et al. 1987). Similarly, Loon Lake Dam Reach Site 3 is dominated by one species – *Alnus incana*, but as other species are common, it is considered to support a diverse vegetation composition relative to its capability.
[2]Soil moisture indicators based on Reed (1997).
[3]Stability ratings based on Stability Classes in Winward (2000) or professional judgment for riparian community types not listed in Winward.
[4]CC = canopy cover. [5]LWD = large woody debris; CWD = coarse woody debris.

5.1.1 Higher Elevation Reaches – Loon Lake Dam Reach to Camino Dam

The extent of riparian vegetation in these reaches closely reflects the occurrence of suitable geomorphic conditions. Riparian vegetation occurred throughout the reaches except where limited by bedrock or boulders.

Current conditions in these reaches appear to meet vegetative criteria for PFC. At most sites there were seedlings and saplings of the dominant riparian shrub species in numbers that suggest frequent regeneration. Infrequent loss and replacement of riparian shrubs may occur at the Robbs Peak Dam Reach site in sub-reach 15 and at the uppermost Ice House Dam Reach site in sub-reach 5. Only a few species of riparian shrubs occurred at the study sites; however, this condition reflects the normal composition of riparian vegetation communities in the north and central Sierra Nevada, where the characteristic species are limited to *Alnus incana,* several species of *Salix*, *Cornus sericea*, *Spiraea densiflora*, and less frequently, *Myrica hartwegii* (Harris et al. 1997, Harris 1989, Potter 2000). A riparian tree, *Populus balsamifera* var. *trichocarpa*, also occurs occasionally. Species richness of herbaceous species was high at the study sites and dominant species were strongly indicative of moist soil conditions.

Stream banks of study sites were generally well vegetated, except where bedrock or boulders precluded vegetation. Recreational disturbance accounted for reduced stream bank vegetation at one site. Minor bank erosion or under-cutting was observed at five of the seven sites, but banks generally appeared stable and correspond to high stability rankings of dominant greenline community types. Riparian vegetation (mostly *Alnus incana* and *Cornus sericea*) is encroaching into formally scoured areas (i.e., within the bankfull channel, although not below baseflow water surface elevation) at the Robbs Peak Dam Reach study site. None of the other study sites exhibited evidence of channel encroachment by woody species. However, significant channel encroachment by *Alnus incana* was noted at a site not hydrologically influenced by the UARP (Rocky Basin Creek). Comparison of current aerial photographs to a 1940 aerial photograph of the Loon Lake Dam Reach encompassing the study sites in sub-reach LL10 and LL17 revealed little discernible change in the pattern of riparian vegetation.

5.1.2 Mid-elevation Reaches - Camino Dam Reach to White Rock

The extent and frequency of riparian vegetation in these stream reaches closely reflects the occurrence of suitable geomorphic conditions. Riparian vegetation is sparse or absent in sub-reaches characterized by bedrock or boulder banks, but occurs wherever there are suitable substrates (even growing in crevices on bedrock).

Current conditions in these reaches appear to meet vegetative criteria for proper functioning condition. At all sites there were seedlings and saplings of the dominant riparian shrub species in numbers that suggest periodic regeneration. At each study site, at least five species of riparian shrubs were documented reflecting suitable species richness in the reaches. Characteristic woody species for these reaches are *Alnus rhombifolia*, *Salix exigua*, *Salix lucida*, *Rubus discolor*, and *Populus fremontii*. Other less frequently occurring species are *Populus tremuloides Cephalanthus occidentalis*, *Salix lasiolepis*, and *Fraxinus latifolia*. These species occur with

regularity within mid-elevation areas of the north and central Sierra Nevada. *Rubus discolor* also occurred at the study sites. This is a widely occurring exotic that favors disturbed sites, including riparian habitats. Species richness of herbaceous species was generally low, but dominant species were mostly indicative of moist soil conditions.

Stream banks at study sites were generally not well vegetated, as bedrock or boulders often preclude extensive vegetation along the banks. No bank erosion or under-cutting was observed. Banks appeared highly stable, with correspondingly high stability rankings of dominant greenline community types. Greenline community species are vigorous and do not indicate moisture stress; few decadent or dead shrubs or trees were observed.

No evidence of channel encroachment by woody species was observed. Throughout the middle reaches, bedrock and boulders limit the extent of riparian vegetation. As a result, sources of large woody debris are limited to the upland trees lining the adjacent slopes. Riparian shrubs are common and represent a source of coarse woody debris. However, the stream channel appears unlikely to retain woody debris.

5.1.3 Reach Downstream of Chili Bar

The extent and frequency of riparian vegetation in this stream reach closely reflects the occurrence of suitable geomorphic conditions. Riparian vegetation is sparse or absent in sub-reaches characterized by bedrock or boulder banks, but occurs wherever there are suitable substrates.

The Gorge and Upper Canyon sub-reaches are similar in their riparian vegetation and condition. Current conditions in both appear to meet vegetative criteria for proper functioning condition. At all sites there were seedlings and saplings of the dominant riparian shrub species in numbers that suggest periodic regeneration. Few snags or large trees were observed. Characteristic woody species for these reaches are *Alnus rhombifolia, Salix lasiolepis*, and *Salix lucida*. Other less frequently occurring species are *Cephalanthus occidentalis, Salix exigua*, and *Fraxinus latifolia*. These species occur with regularity within low and mid-elevation areas of the north and central Sierra Nevada. Species richness of herbaceous species was generally low, but dominant species were indicative of moist soil conditions.

The dominant near-channel vegetation of the Coloma sub-reach is typical of that found elsewhere in the Reach Downstream of Chili Bar (e.g., *Alnus rhombifolia* and *Salix lasiolepis*), but the wide floodplain and lower shoreline gradients allow larger riparian zones and better riparian development overall. Flood damage is less common relative to the Canyon and Gorge sub-reaches. In addition, the Coloma sub-reach supports the only concentrations of *Populus fremontii* in the study area. Rarely occurring in large stands, this species appeared to have a bimodal size and age distribution, occurring either as large, older trees or as infrequent saplings and seedlings. The large old trees are generally restricted to high banks eight to ten feet above river elevation (when flows are low) or in upland, developed areas where they may have been planted. Although a complete examination of *Populus* age distributions in the Reach Downstream of Chili Bar is beyond the scope of this study, similar age distributions have been

described as indicative of impaired germination or recruitment in *Populus* (Nilsson and Berggren 2000). Mahoney and Rood (1998) have noted that water level fluctuations and stage decline related to hydroelectric operations often interfere with *Populus* recruitment by creating moisture stress in seedlings. Seedlings are cued to germinate at inappropriate bank elevations and then unable to reach ground water as stage rapidly declines after flood events. Similar moisture stress has been observed in established saplings and trees in regulated rivers, resulting in slow radial growth rates and high mortality rates relative to those in unregulated areas (Stromberg and Patten 1991). Direct evidence for moisture stress in the Reach Downstream of Chili Bar is lacking: few decadent or dead *Populus* were observed. However, radial growth in a small sample of *P. fremontii* individuals from the Coloma sub-reach was greatest for most of the trees (4 of 5) in 1998 or 1997, which could indicate a positive growth response to water availability due to the 1997 flood event (Figure 5.1.3-1).

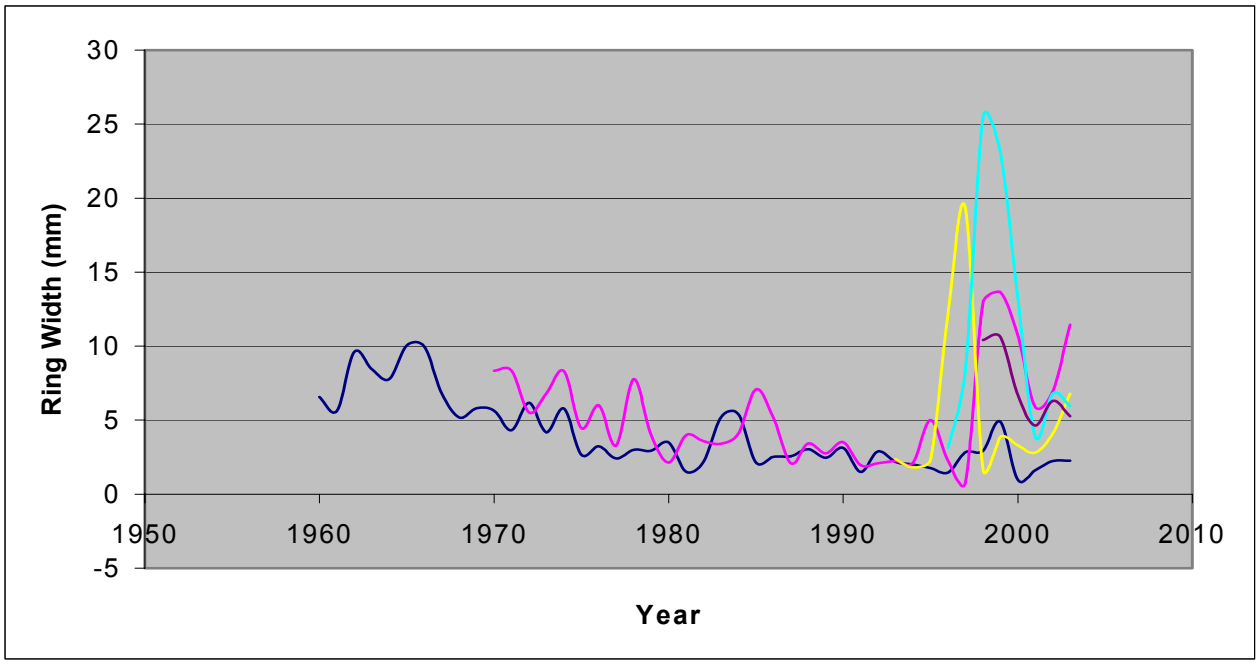

Figure 5.1.3-1. Annual tree ring widths (mm) in five *Populus fremontii* individuals in the Reach Downstream of Chili Bar - Coloma sub-reach.

5.2 Wetlands Study Analysis

The largest areas of wetlands within and adjacent to the UARP boundary are located at Union Valley Reservoir and Loon Lake Reservoir. Much smaller areas of wetland occur at Ice House Reservoir, Gerle Creek Reservoir, Rockbound Reservoir, and Rubicon Reservoir. Most of these reservoir-associated wetlands are in good condition, dominated by native plant species with few or no weeds. One special-status plant, round-leaved sundew (*Drosera rotundifolia*), was found at one wetland. Few reservoir wetlands exhibit signs of ORV use or other overt adverse effects from recreational use. Two wetland sites located near boat launches/campgrounds were in

relatively poor condition. At Chili Bar Reservoir, where slopes are generally steep, only a very narrow fringe of periodically flooded wetlands (less than 10 feet wide) occurs in some places.

At Union Valley Reservoir most of the wetlands are sloping meadows that begin at elevations much higher than the maximum water surface elevation of the reservoir. The hydrology of these wetlands consists of two components: the discharge and drainage of surface and ground water from slopes high above the maximum surface elevation of the reservoir, and inundation by reservoir water, followed by exposure as water is withdrawn each year. Inundation affects areas from the point of annual high water to the point of annual low water. In 2003, water surface elevation at Union Valley Reservoir declined almost 34 feet during the growing season. Wetlands associated with Loon Lake Reservoir are primarily located in and around shallow bays and are thus much more substantially under reservoir influence.

Species richness of wetlands seasonally inundated by the reservoirs was much lower than in meadows that are never inundated. A few perennial emergent species characterized areas under shallow inundation seasonally (most notably, *Carex vesicaria*), whereas areas deeply inundated for prolonged periods typically lacked perennial emergent species. At the same time, perennial aquatic species generally did not occur in these areas because of long periods of exposure in the latter part of the growing season. As a result, large wetland areas that become exposed as the reservoir surface elevation declines are vegetated only by quickly germinating perennials and a few species of small annuals. Based on observations in 2003, the rate of water surface decline does not greatly exceed the rate at which plants appear on exposed wetlands. However, at maximum draw-down the last areas to be exposed may develop little or no vegetative cover.

UARP-created wetlands at tunnel adits and sub-stations are generally small and isolated, and display limited ecological values, although one of the sites (Camino adit) provides habitat forfoothill yellow-legged frog. Each of these sites was excavated to provide UARP facilities, and is thus, fundamentally disturbed, limiting the potential development of wetlands.

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TABLES

Table 3.4-1. Vascular Plant Species Found within the Reach Downstream of Chili Bar. "Indicator" = Wetland Indicator Status (Reed 1997).		
Scientific Name	**Common Name**	**Indicator**
EQUISETACEAE	**HORSETAIL FAMILY**	
Equisetum hyemale	Scouring rush	FACW
ACERACEAE	**MAPLE FAMILY**	
Acer macrophyllum	Big-leaf maple	FAC
APIACEAE	**CARROT FAMILY**	
Daucus carota	Wild carrot	NI
Foeniculum vulgare	Sweet fennel	FACU-
ASTERACEAE	**SUNFLOWER FAMILY**	
Agoseris heterophylla	Annual agoseris	NI
Ambrosia psilostachya	Western ragweed	FAC
Artemisia douglasiana	California mugwort	FAC+
Aster campestris	Meadow aster	NI
Aster heterophylla	Aster	NI
Aster occidentalis	Western aster	FAC
Bidens frondosa	Beggar ticks	FACW
Brickellia californica	California brickellbush	FACU
Cichorium intybus	Chicory	NI
Chondrilla juncea	Bull thistle	FAC
Conyza canadensis	Canadian horseweed	FAC
Gnaphalium palustre	Western marsh cudweed	FACW
Helenium puberulum	Rosilla	FACW
Solidago occidentalis	Goldenrod	NI
Xanthium strumarium	Rough cocklebur	FAC+
BETULACEAE	**BIRCH FAMILY**	
Alnus rhombifolia	White alder	FACW
BIGNONIACEA	**BIGNONIA FAMILY**	
Catalpa bignonioides	Southern catalpa	NI
BORAGINACEAE	**BORAGE FAMILY**	
Myosotis laxa	Bay forget-me-not	OBL
BRASSICACEAE	**MUSTARD FAMILY**	
Sisymbrium altissimum	Tumble mustard	FACU
Sisymbrium officinale	Hedge mustard	FACU
BUDDLEJACEAE	**BUDDLEJA FAMILY**	
Buddleja davidii	Butterfly bush	NI
EUPHORBIACEAE	**SPURGE FAMILY**	
Chamaesyce sp.	Prostrate spurge	Various
FABACEAE	**PEA FAMILY**	
Lotus purshianus	Spanish clover	NI
Cytisus scoparius	Scotch broom	NI
Melilotus alba	White sweetclover	NI
Lupinus latifolius var. columbianus	Broad-leaved lupine	FAC
GENTIANACEAE	**GENTIAN FAMILY**	
Centaurium muehlenbergii	Muehlenberg's centaury	FAC
HYPERICACEAE	**ST. JOHN'S WORT FAMILY**	
Hypericum perforatum	Klamath weed	NI
Hypericum mutilum	Dwarf St. John's wort	FACW
LAMIACEAE	**MINT FAMILY**	
Lycopus americanus	Water horehound	OBL
Mentha arvensis	Wild mint	FACW
Prunella vulgaris	Self-heal	FAC
OLEACEA	**OLIVE FAMILY**	
Fraxinus latifolia	Oregon ash	FACW
ONAGRACEAE	**EVENING-PRIMROSE FAMIY**	
Epilobium densiflorum		NI

Table 3.4-1. Vascular Plant Species Found within the Reach Downstream of Chili Bar. "Indicator" = Wetland Indicator Status (Reed 1997).		
Ludwigia hexapetala	Uruguayan primrose-willow	NI
Ludwigia palustris	Water purslane	OBL
Oenothera elata sp. hirsutissima	Hooker's evening-primrose	FACW
PAPAVERACEAE	**POPPY FAMILY**	
Eschscholzia californica	California poppy	NI
PLATANACEAE	**SYCAMORE FAMILY**	
Platanus racemosa	Western sycamore	FACW
PLANTAGINACEAE	**PLANTAIN FAMILY**	
Plantago lanceolata	English plantain	FAC-
POLYGONACEA	**BUCKWHEAT FAMILY**	
Polygonum punctatum	Dotted smartweed	OBL
ROSACEAE	**ROSE FAMILY**	
Rubus discolor	Himalayan blackberry	FAC+
RUBIACEAE	**MADDER FAMILY**	
Cephalanthus occidentalis	Common buttonbush	OBL
SALICACEAE	**WILLOW FAMILY**	
Salix exigua	Sandbar willow	FACW
Salix lasiolepis	Arroyo willow	FACW
Populus fremontii	Fremont cottonwood	FAC+
SCROPHULARIACEAE	**FIGWORT FAMILY**	
Limosella sp.	Mudwort	OBL
Mimulus guttatus	Seep-spring monkey-flower	FACW+
Veronica sp.	Speedwell	OBL
SIMAROUBACEAE	**QUASSIA FAMILY**	
Ailanthus altissima	Tree-of-heaven	FACU
VERBENACEAE	**VERBENA FAMILY**	
Verbena hastata	Verbena	FACW
VITACEAE	**GRAPE FAMIY**	
Vitis californica	California wild grape	FACW
ALISMATACEAE	**WATER-PLANTAIN FAMILY**	
Alisma lanceolatum	Lance-leaf water plantain	OBL
CYPERACEAE	**SEDGE FAMILY**	
Carex aquatilis	Water sedge	OBL
Cyperus bipartitus	Slender flatsedge	NI
Cyperus strigosus	Straw-colored flatsedge	FACW
Eleocharis acicularis	Needle spike rush	OBL
Juncus acuminatus	Taper-tip rush	OBL
Juncus effusus	Common rush	NI
Juncus supiniformis	Hair-leaved rush	OBL
HYDROCHARITACEAE	**WATERWEED FAMILY**	
Elodea sp.	Waterweed	OBL
POACEAE	**GRASS FAMILY**	
Aira caryophyllea	Annul hair grass	NI
Digitaria sp.	Crabgrass	Various
Eragrostis sp.	Love grass	Various
Panicum acuminatum	Western panic-grass	NI
Paspalum dilatatum	Dallas grass	FAC
Polypogon interruptus	Ditch beard grass	OBL
Setaria sp.	Bristle-grass	Various
POTAMOGETONACEAE	**PONDWEED**	
Potamogeton sp	Pondweed	OBL
TYPHACEAE	**CATTAIL FAMILY**	
Typha sp.	Cattail	OBL

Table 3.6-1. Vascular plant species found at wetlands at Union Valley Reservoir ("Union") and Loon Lake Reservoir ("Loon"). "Indicator" = Wetland indicator status (Reed 1997)				
Scientific Name	**Common Name**	**Indicator**	**Union**	**Loon**
PTEROPHYTES AND SPHENOPHYTES	**FERNS AND FERN ALLIES**			
Pteridium aquilinum	Bracken	FACU	X	
Athyrium filix-femina	Lady fern	FAC	X	
Botrychium multifidum	Leather grape-fern	FAC		X
Equisetum arvense	Common horsetail	FAC	X	
Marsilea vestita spp. vestita	Hairy water-clover	OBL	X	
GYMNOSPERMS	**CONIFER FAMILYS**			
Pinus contorta	Lodgepole pine	FAC	X	X
Calocedrus decurrens	Incense cedar	NI	X	
APIACEAE	**CARROT FAMILY**			
Angelica breweri	Brewer's angelica	NI	X	
Heracleum lanatum	Cow parsnip	FACU	X	
Oxypolis occidentalis	Cow bane	OBL	X	
Perideridia parishii	Parish's yampah	FACW	X	X
ARISTOLOCHIACEAE	**BIRTHWORT FAMILY**			
Asarum lemmonii	Lemmon's wild-ginger	OBL	X	
ASTERACEAE	**ASTER FAMILY**			
Achillea millefolium	Yarrow	FACU	X	X
Artemisia douglasiana	California mugwort	FAC+	X	
Aster eatonii	Eaton's aster	FAC	X	
Aster frondosus	Marsh aster	NI	X	
Cirsium sp.	Thistles	Various	X	
Conyza canadensis	Horseweed	FAC	X	
Erigeron peregrinus	Sub-alpine daisy	FACW		X
Gnaphalium palustre	Marsh cudweed	FACW	X	X
Helenium bigelovii	Bigelow's sneezeweed	OBL	X	
Helianthella californica	California helianthella	NI	X	
Madia bolanderi	Bolander's tarweed	NI	X	
Madia minima	Hemizonella	NI	X	X
Phalacroseris bolanderi	Bolander's dandelion	OBL	X	
Rudbeckia californica	California cone-flower	FACW	X	
Senecio clarkianus	Clark's butterweed	FACW	X	
Senecio triangularis	Triangle leaved butterweed	OBL	X	X
Solidago canadensis	California goldenrod	FACU	X	
Taraxacum officinale	Common dandelion	FACU	X	
BETULACEAE	**BIRCH FAMILY**			
Alnus incana	Mountain alder	OBL	X	X
BORAGINACEAE	**BORAGE FAMILY**			
Mertensia ciliata	Lungwort	FACW+	X	
BRASSICACEAE	**MUSTARD FAMILY**			
Barbarea orthoceras	Winter cress	FACW	X	X
Cardamine oligosperma	Few-seeded bitter cress	FACW	X	
Rorippa curvisiliqua	Water cress	OBL	X	
CALLITRICHACEAE	**WATER-STARWORT FAMILY**			
Callitriche heterophylla	Water-starwort	OBL	X	
CAMPANULACEAE	**BELLFLOWER FAMILY**			
Heterocodon rariflorum	Heterocodon	FACW	X	
CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**			
Lonicera conjugialis	Double honeysuckle	FAC	X	
Lonicera involucrata	Black twinberry	FAC	X	

Table 3.6-1. Vascular plant species found at wetlands at Union Valley Reservoir ("Union") and Loon Lake Reservoir ("Loon"). "Indicator" = Wetland indicator status (Reed 1997)				
Scientific Name	**Common Name**	**Indicator**	**Union**	**Loon**
CAROPHYLLACEAE	**PINK FAMILY**			
Cerastium fontanum	Mouse-eared chickweed	FACU	X	
Stellaria longipes	Long-stalked starwort	FACW	X	
CORNACEAE	**DOGWOOD FAMILY**			
Cornus sericea	American dogwood	FACW	X	
DROSERACEAE	**SUNDEW FAMILY**			
Drosera rotundifolia	Round-leaved sundew	OBL	X	
ERICACEAE	**HEATH FAMILY**			
Ledum glandulosum	Western Labrador tea	OBL		X
Phyllodoce breweri	Mountain heather	FAC		X
Rhododendron occidentale	Western azalea	FAC	X	
Vaccinium scoparium	Little-leaf huckleberry	FACU		X
Vaccinium uliginosum	Bog huckleberry	FACW	X	
EUPHORBIACEAE	**SPURGE FAMILY**			
Chamaesyce serpyllifolia	Thyme-leaved spurge	NI	X	
FABACEAE	**PEA FAMILY**			
Lotus argophyllus	Silver lotus	NI	X	
Lotus oblongifolius	Narrow-leaved clover	OBL	X	
Lotus pinnatus	Pinnate-leaved lotus	FACW	X	
Lotus purshianus	Spanish clover	NI	X	X
Lupinus lepidus	Torrey's dwarf lupine	NI	X	
Lupinus polyphyllus	Large leave lupine	FACW	X	
Melilotus alba	White sweetclover	NI	X	
Trifolium monanthum	Carpet clover	FACW	X	
Trifolium repens	White clover	FAC	X	
Trifolium willdenovii	Tomcat clover	NI	X	
Trifolium wormskioldii	Mountain clover	FACW	X	
Vicia americana	American vetch	FACU	X	
GERANIACEAE	**GERANIUM FAMILY**			
Geranium californicum	California geranium	FAC	X	
Geranium richardsonii	Richard's geranium	FACW	X	
HYDROPHYLLACEAE	**WATERLEAF FAMILY**			
Nemophila maculata	Fivespot	NI	X	
HYPERICACEAE	**ST. JOHN'S WORT FAMILY**			
Hypericum anagalloides	Tinker's penny	OBL	X	X
Hypericum formosum var. scouleri	Scouler's St. John's wort	NI	X	
Hypericum perforatum	Klamath weed	NI	X	
LAMIACEAE	**MINT FAMILY**			
Mentha arvensis	Field mint	FACW	X	
Prunella vulgaris	Self-heal	FAC	X	
Stachys ajugoides	Hedge nettle	OBL	X	
LYTHRACEAE	**LOOSESTRIFE FAMILY**			
Lythrum portula		OBL	X	
MALVACEAE	**MALLOW FAMILY**			
Sidalcea reptans	Creeping checker	OBL	X	
NYMPHACEAE	**WATER-LILY FAMILY**			
Nuphar lutea	Yellow pond lily	OBL		X
ONAGRACEAE	**EVENING PRIMROSE FAMILY**			
Circaea alpina	Enchanter's nightshade	FACW	X	
Epilobium ciliatum	Northern willow-herb	FACW	X	

Table 3.6-1. Vascular plant species found at wetlands at Union Valley Reservoir ("Union") and Loon Lake Reservoir ("Loon"). "Indicator" = Wetland indicator status (Reed 1997)				
Scientific Name	**Common Name**	**Indicator**	**Union**	**Loon**
Epilobium glaberrimum	Glaucous willow-herb	OBL	X	
Epilobium palustre	Swamp willow-herb	OBL	X	
Gayophytum racemosum	Black-foot gayophytum	FAC	X	
PLANTAGINACEAE	**PLANTAIN FAMILY**			
Plantago lanceolata	English plantain	FAC-	X	
POLYGONACEAE	**BUCKWHEAT FAMILY**			
Polygonum amphibium var. stipulaceum	Water smartweed	OBL	X	
Polygonum bistortoides	Western bistort	OBL	X	
Polygonum phytolaccifolium	Alpine knotweed	NI	X	
Rumex acetosella	Sheep sorrel	FAC-	X	X
Rumex paucifolius	Alpine sheep sorrel	OBL		X
Rumex salicifolius	Willow dock	FACW	X	
PORTULACACEAE	**PURSLANE FAMILY**			
Claytonia palustris	Marsh claytonia	FACW	X	
Lewisia nevadensis	Nevada lewisii	NI	X	
Montia fontana	Water chickweed	FACW	X	
RANUNCULACEAE	**BUTTERCUP FAMILY**			
Aconitum columbianum	Monkshood	FACW	X	
Aquilegia formosa	Red columbine	FAC	X	
Delphinium sp.	Larkspur	Various	X	
Ranunculus occidentalis	Western buttercup	FACW	X	
Thalictrum fendleri	Fendler's meadow rue	FACU	X	
ROSACEAE	**ROSE FAMILY**			
Fragaria vesca	Woods strawberry	UPL	X	
Fragaria virginiana	Broad-petaled strawberry	FAC	X	X
Geum macrophyllum	Large-leaved avens	FACW	X	
Horkelia tridentata	Three-leaved horkelia	NI	X	X
Potentilla glandulosa	Sticky cinquefoil	FAC	X	X
Potentilla gracilis	Slender cinquefoil	FACW		X
Spiraea densiflora	Mountain spiraea	NI	X	X
RUBIACEAE	**MADDER FAMILY**			
Galium aparine	Goose grass	FACU	X	
Galium triflorum	Fragrant bedstraw	FACU	X	
Galium trifidum	Trifid bedstraw	OBL	X	X
Kelloggia galioides	Kelloggia	NI	X	
SALICACEAE	**WILLOW FAMILY**			
Salix exigua	Sandbar willow	FACW	X	
Salix lasiolepis	Arroyo willow	FACW	X	X
Salix lemmonii	Lemmon's willow	OBL		X
Salix lucida spp. lasiandra	Red willow	OBL	X	
Salix scouleriana	Scouler's willow	FAC	X	X
SAXIFRAGACEAE	**SAXIFRAGE FAMILY**			
Mitella breweri	Bishop's cap	FAC	X	
Saxifraga oregana	Oregon saxifrage	OBL	X	
SCROPHULARIACEAE	**FIGWORT FAMILY**			
Castilleja miniata	Great red paintbrush	OBL	X	X
Limosella aquatica	Northern mudwort	OBL	X	
Mimulus floribundus	Floriferous monkey-flower	OBL	X	
Mimulus guttatus	Common large monkey-flower	FACW+	X	
Mimulus leptaleus	Least-flowered monkey-flower	NI	X	
Mimulus moschatus	Musk flower	OBL	X	X

Table 3.6-1. Vascular plant species found at wetlands at Union Valley Reservoir ("Union") and Loon Lake Reservoir ("Loon"). "Indicator" = Wetland indicator status (Reed 1997)				
Scientific Name	**Common Name**	**Indicator**	**Union**	**Loon**
Mimulus primuloides	Primrose monkey flower	OBL	X	X
Mimulus torreyi	Torrey's monkey flower	NI	X	X
Verbascum thaspus	Common mullein	NI	X	X
Veronica scutellata	Marsh speedwell	OBL	X	
VIOLACEAE	**VIOLET FAMILY**			
Viola adunca	Western dog violet	FAC	X	
Viola macloskeyi	Macloskey's violet	OBL	X	X
CYPERACEAE	**SEDGE FAMILY**			
Carex athrostachya	Slender beaked sedge	FACW	X	X
Carex aquatilis	Water sedge	OBL	X	X
Carex deweyana spp. Leptopoda	Dewey's sedge	FACW	X	
Carex feta	Green sheathed sedge	OBL	X	
Carex hassei	Golden sedge	FACW	X	
Carex integra	Smooth-beaked sedge		X	
Carex jonesii	Jones's sedge	FACW	X	
Carex vesicaria	Inflated sedge	OBL	X	X
Eleocharis acicularis	Needle spike rush	OBL	X	
Eleocharis macrostachya	Pale spike rush	OBL	X	
Eleocharis obtusa var. engelmannii	Ovoid spike-rush	FACW+	X	
Scirpus congdonii	Congdon's bulrush	OBL	X	
Scirpus diffusus	Diffuse bulrush	NI		X
Scirpus microcarpus	Small-fruited bulrush	OBL	X	X
IRIDACEAE	**IRIS FAMILY**			
Sisyrinchium bellum	Blue-eyed grass	FAC+	X	
Sisyrinchium elmeri	Yellow blue-eyed grass	OBL	X	
JUNCACEAE	**RUSH FAMILY**			
Juncus balticus	Baltic rush	FACW+	X	X
Juncus chlorocephalus	Green-headed rush	FACW	X	X
Juncus ensifolius	Dagger-leaf rush	FACW	X	
Juncus effusus	Common rush	FACW+	X	
Juncus nevadensis	Sierra rush	FACW		X
Juncus occidentalis	Western rush	FACW	X	
Juncus parryi	Parry's rush	FACU	X	
Juncus tenuis	Slender rush	FACW	X	
Juncus xiphioides	Iris-leaved rush	OBL	X	X
Luzula comosa	Hairy wood rush	NI	X	X
Luzula parviflora	Small-flowered wood rush	FAC	X	
LILIACEAE	**LILY FAMILY**			
Calochortus minimus	Lesser star tulip	FAC	X	X
Camassia quamash	Common camas	FACW	X	X
Lilium parvum	Alpine lily	OBL	X	X
Triteleia hyacinthina	White brodiaea	FACW	X	
Veratrum californicum.	Corn lily	OBL	X	X
Zigadenus venenosus	Death camas	FAC	X	
ORCHIDACEAE	**ORCHID FAMILY**			
Platanthera leucostachys	White-flowered bog-orchid	FACW	X	
Platanthera sparsiflora	Sparse-flowered bog-orchid	FACW	X	
Spiranthes romanzoffiana	Lady's tresses	OBL	X	
POACEAE	**GRASS FAMILY**			
Agrostis exarata	Spike bentgrass	FACW		X
Agrostis oregonensis	Oregon bentgrass	OBL	X	

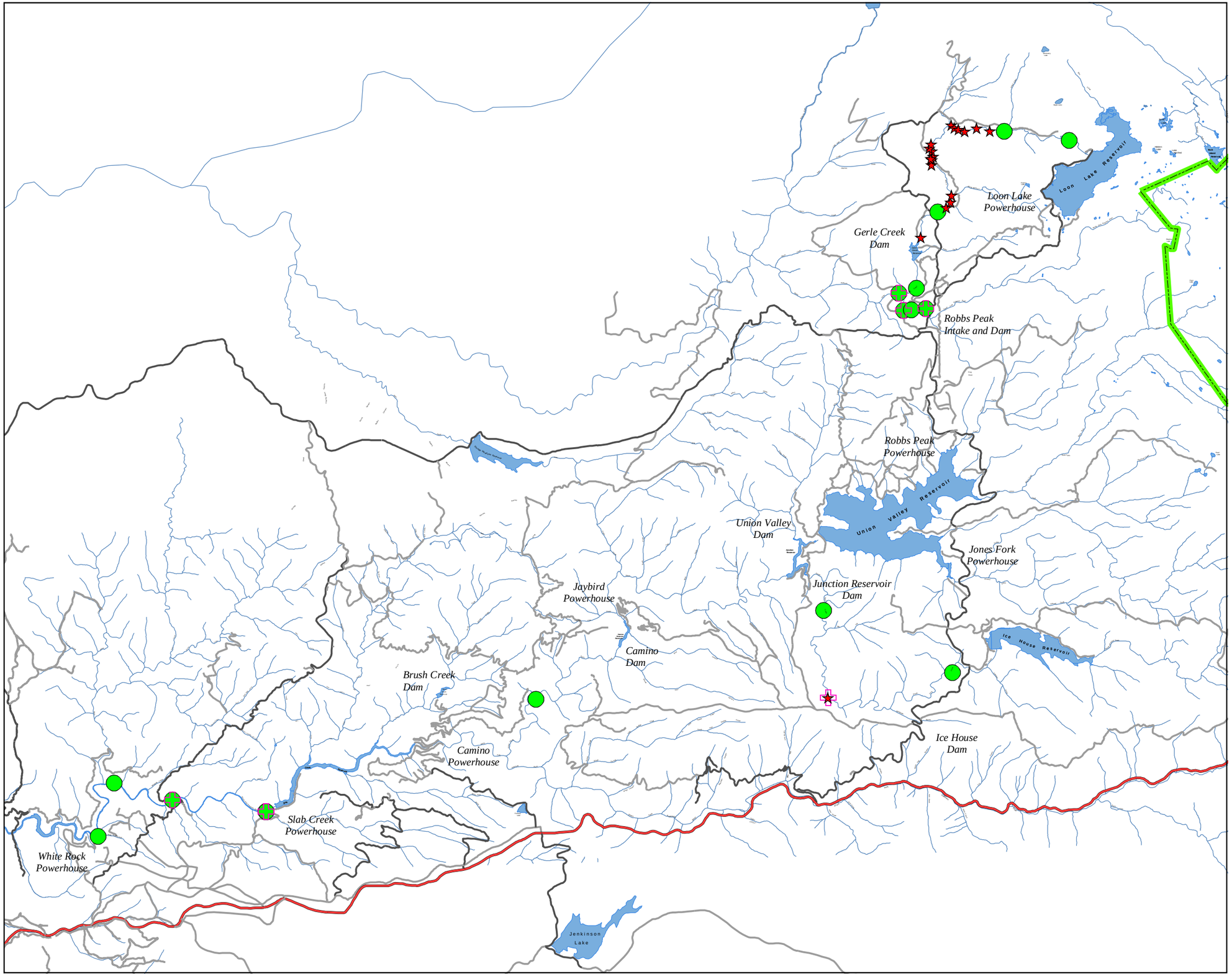
Table 3.6-1. Vascular plant species found at wetlands at Union Valley Reservoir ("Union") and Loon Lake Reservoir ("Loon"). "Indicator" = Wetland indicator status (Reed 1997)				
Scientific Name	**Common Name**	**Indicator**	**Union**	**Loon**
Deschampsia cespitosa	Tufted hairgrass	FACW		X
Deschampsia elongata	Slender hairgrass	FACW	X	X
Elymus glaucus var. glaucus	Western ryegrass	FACU	X	
Glyceria elata	Tall mannagrass	OBL	X	X
Hordeum brachyantherum	Meadow barley	FACW		X
Panicum acuminatum	Western panic-grass	NI		X
Phleum alpinum	Mountain timothy	FACW	X	
Phleum pratense	Common timothy	FAC	X	
Poa palustris	Fowl bluegrass	FACW	X	
POTAMOGETONACEAE	**PONDWEED FAMILY**			
Potamogeton natans	Floating-leaved pondweed	OBL		X

FIGURES

Upper American River Project

SMUD

Figure 3.4-1 (Sheet 1) 2003 UARP Riparian Study Sites

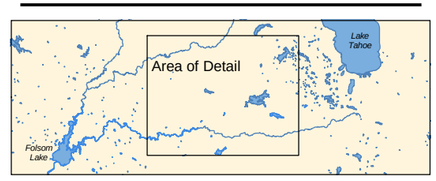


Divided Highway
County Roads
Other Roads

Wilderness Boundary

Riparian Study Sites

Intensive
Ground-truth
Recon



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SCALE 1:15000

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Upper American River Project

SMUD

Figure 3.4-1 (Sheet 2) 2003 UARP Riparian Study Sites

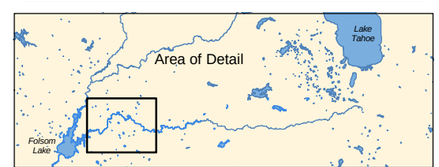
Folsom Lake

White Rock Powerhouse

Divided Highway
County Roads
Other Roads

Riparian Survey Sites

Survey Site



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Prepared by VESTRA Resources, Inc., Redding. CA. Feb. 11, 2004

Upper American River Project

SMUD

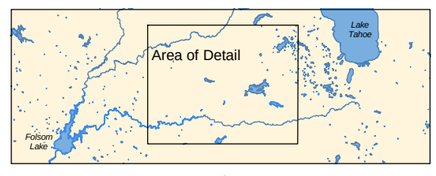
Figure 3.4-1 (Sheet 3) 2003 UARP Wetland Study Sites

Loon Lake Powerhouse
Gerle Creek Dam
Robbs Peak Intake and Dam
Robbs Peak Powerhouse
Union Valley Dam
Jones Fork Powerhouse
Junction Reservoir Dam
Jaybird Powerhouse
Camino Dam
Brush Creek Dam
Camino Powerhouse
Ice House Dam
Slab Creek Powerhouse
White Rock Powerhouse
Loon Lake Reservoir
Union Valley Reservoir
Ice House Reservoir
Jenkinson Lake

Divided Highway
County Roads
Other Roads
Wilderness Boundary

Wetland Survey Sites

Survey Site



N

SCALE 1:15000

0 1 2 3 4 Miles

Prepared by VESTRA Resources, Inc., Redding. CA. Feb. 10, 2004

APPENDIX A

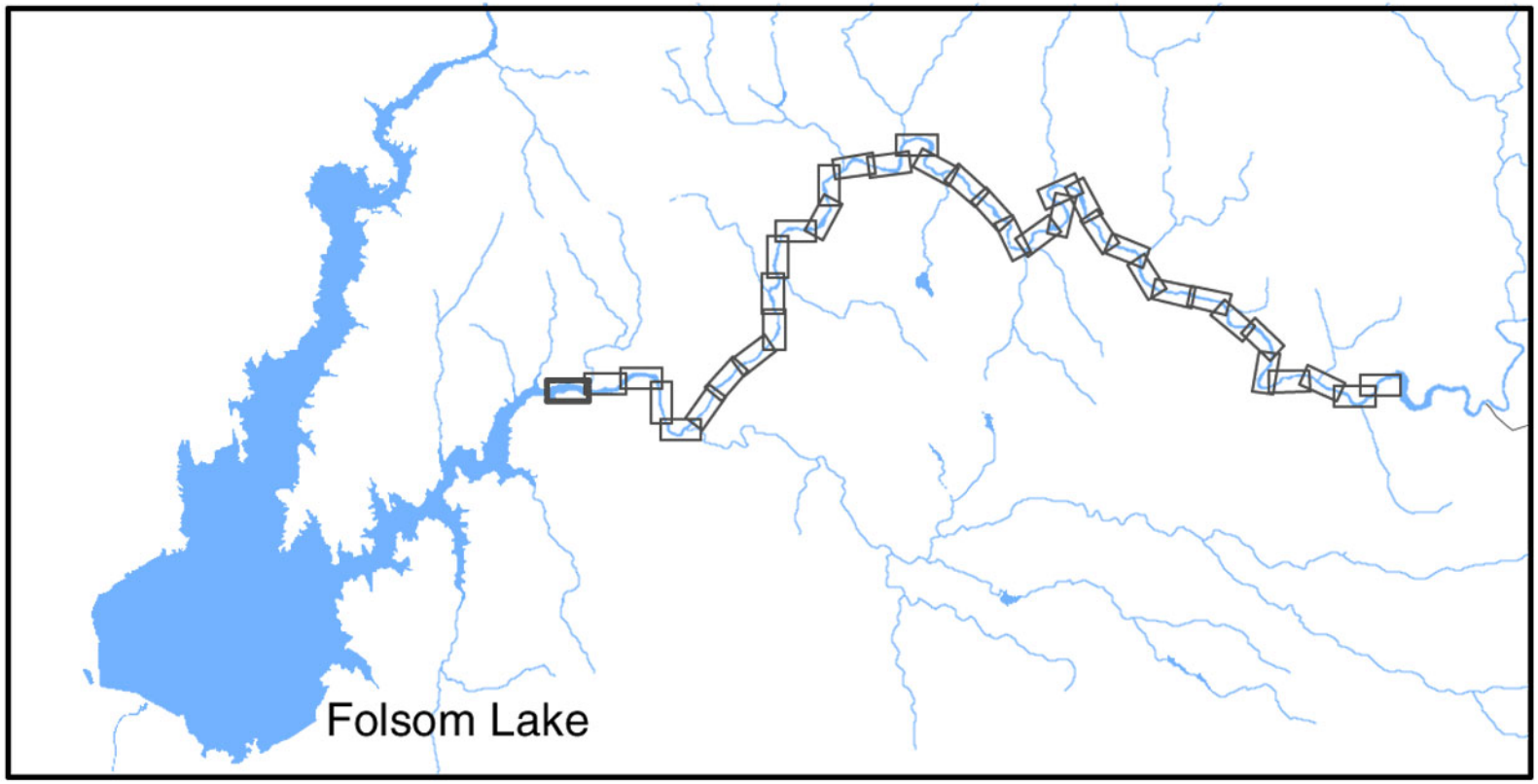
SITE MAPS

- **Summary**
- **Riparian Cover Type Maps**
  - **Output CB Map Legend**
  - **Output CB Intensive Map Legend**
  - **Output UARP Map Legend**
  - **Output UARP Intensive Map Legend**
- **Wetlands at Loon Lake Reservoir with Study Sites Indicated**
- **Wetlands at Gerle Creek Reservoir with Study Sites Indicated**
- **Wetlands at Ice House Reservoir with Study Sites Indicated**
- **Wetlands at Union Valley Reservoir with Study Sites Indicated**

(Riparian Cover Type Maps Provided on CD Linked from Legend Maps)

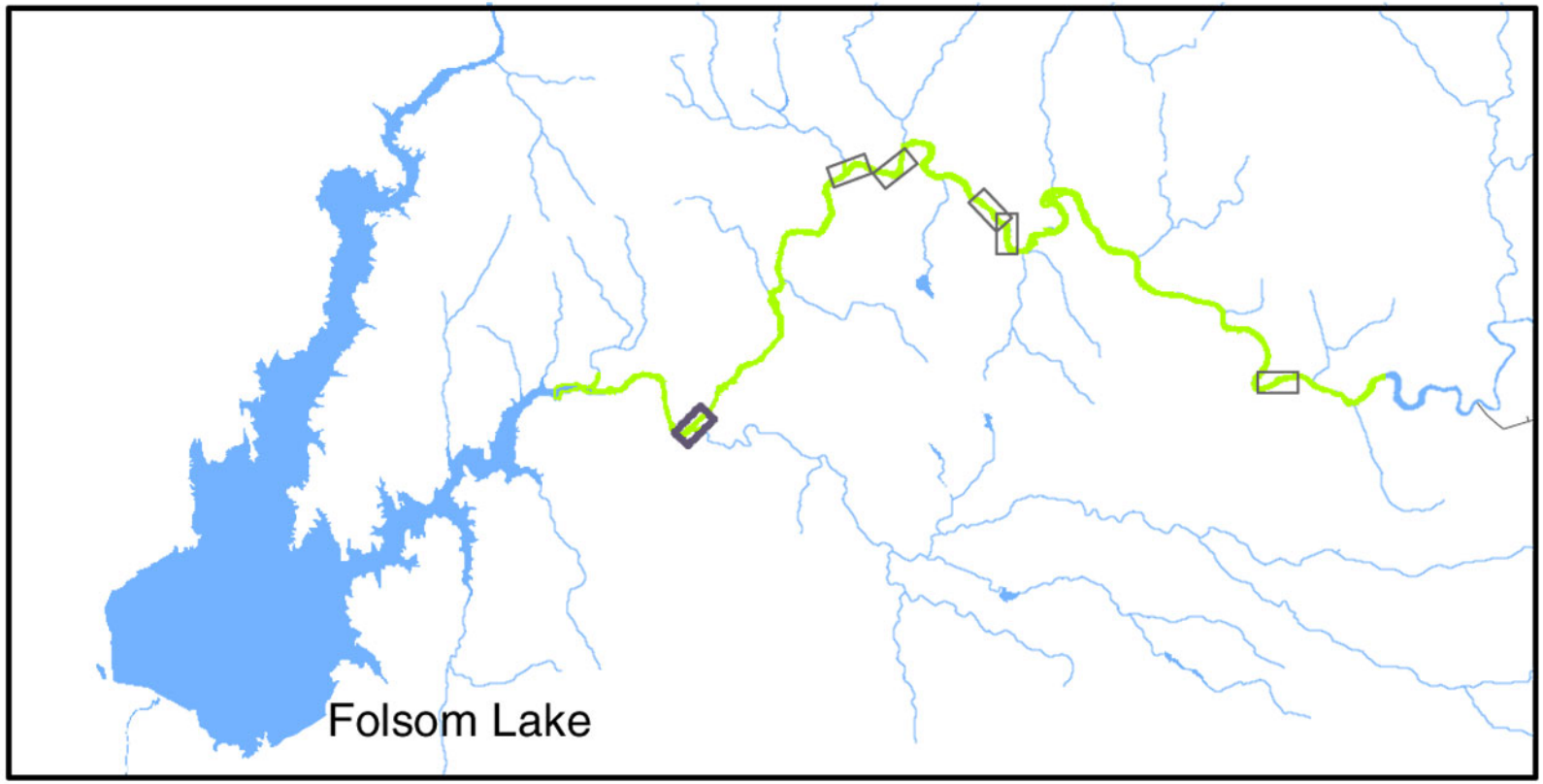
Table A-1. Riparian Vegetation Summary - Acreage of Each Riparian Vegetation Alliance by Stream Reach.

Reach	Fremont Cottonwood (QF)	California Sycamore (QP)	Mixed Riparian Hardwood (NR)	White Alder (QE)	Willow-Alder (QY)	Willow (QO)	Wet Meadow (HJ)	Mountain Alder (TA)	Lodgepole Pine (LP)	TOTAL ACRES
Rubicon Dam							6.40	1.69	1.67	**9.76**
Rockbound Dam										**0.00**
Buck Island Dam								0.14		**0.14**
Loon Lake Dam								34.47	3.40	**37.87**
Gerle Creek Dam								1.67		**1.67**
Robbs Peak Dam						0.07		4.56		**4.63**
Ice House Dam					4.51	0.15		33.15		**37.81**
Junction Dam				10.97	0.28					**11.25**
Camino Dam				15.21		0.12				**15.33**
Brush Creek Dam										**0.00**
Slab Creek Dam	0.04	0.14	0.22	35.57		5.08	1.29			**42.34**
South Fork American River				3.16		2.25	0.43			**5.84**
Downstream of Chili Bar	6.49		167.44	5.84		11.71	0.42			**191.90**



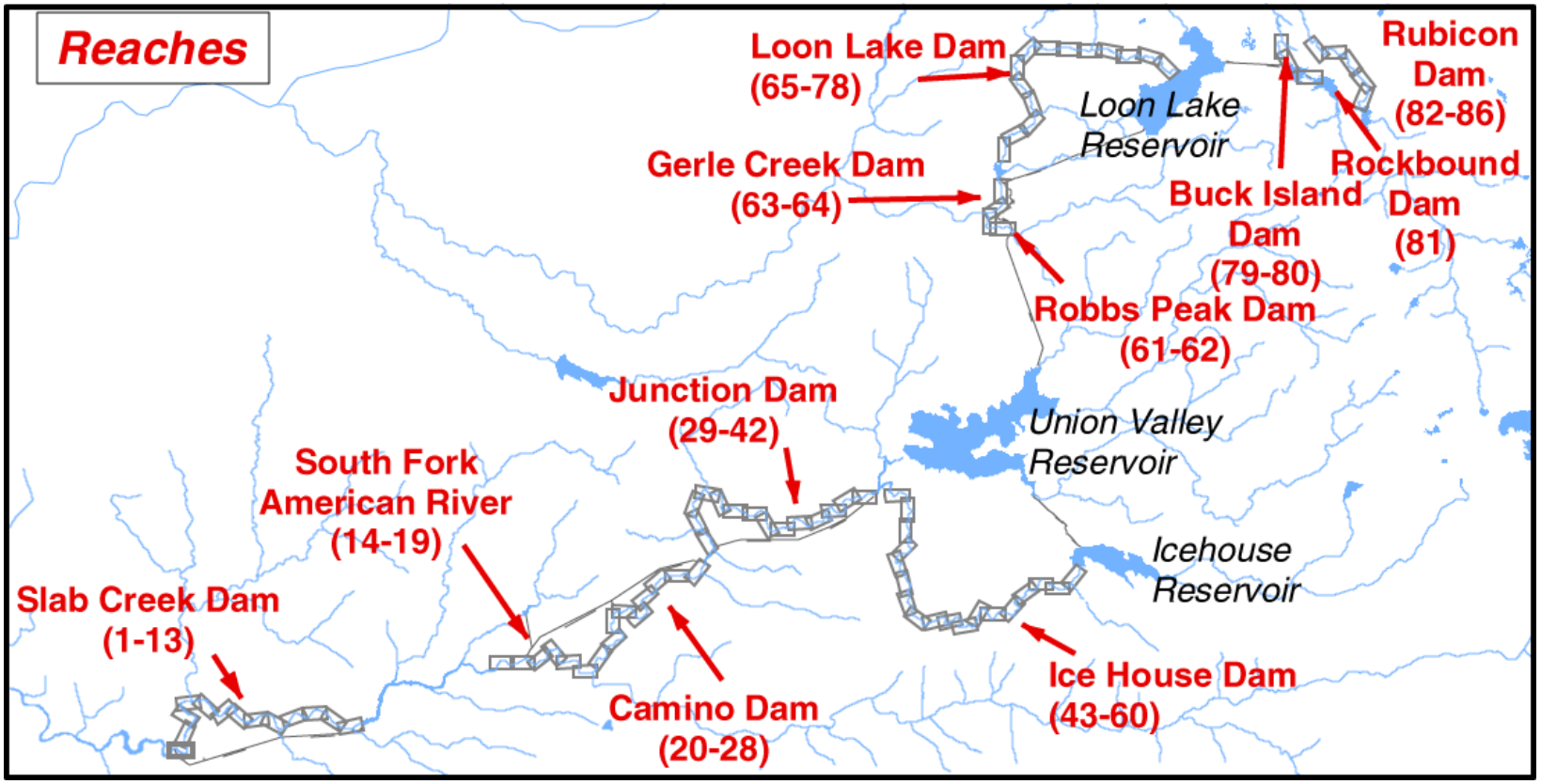
Output CB Map Legend: Click on the Box Outline on the Map to View that Area

Use the Back Arrow to Return to the Report



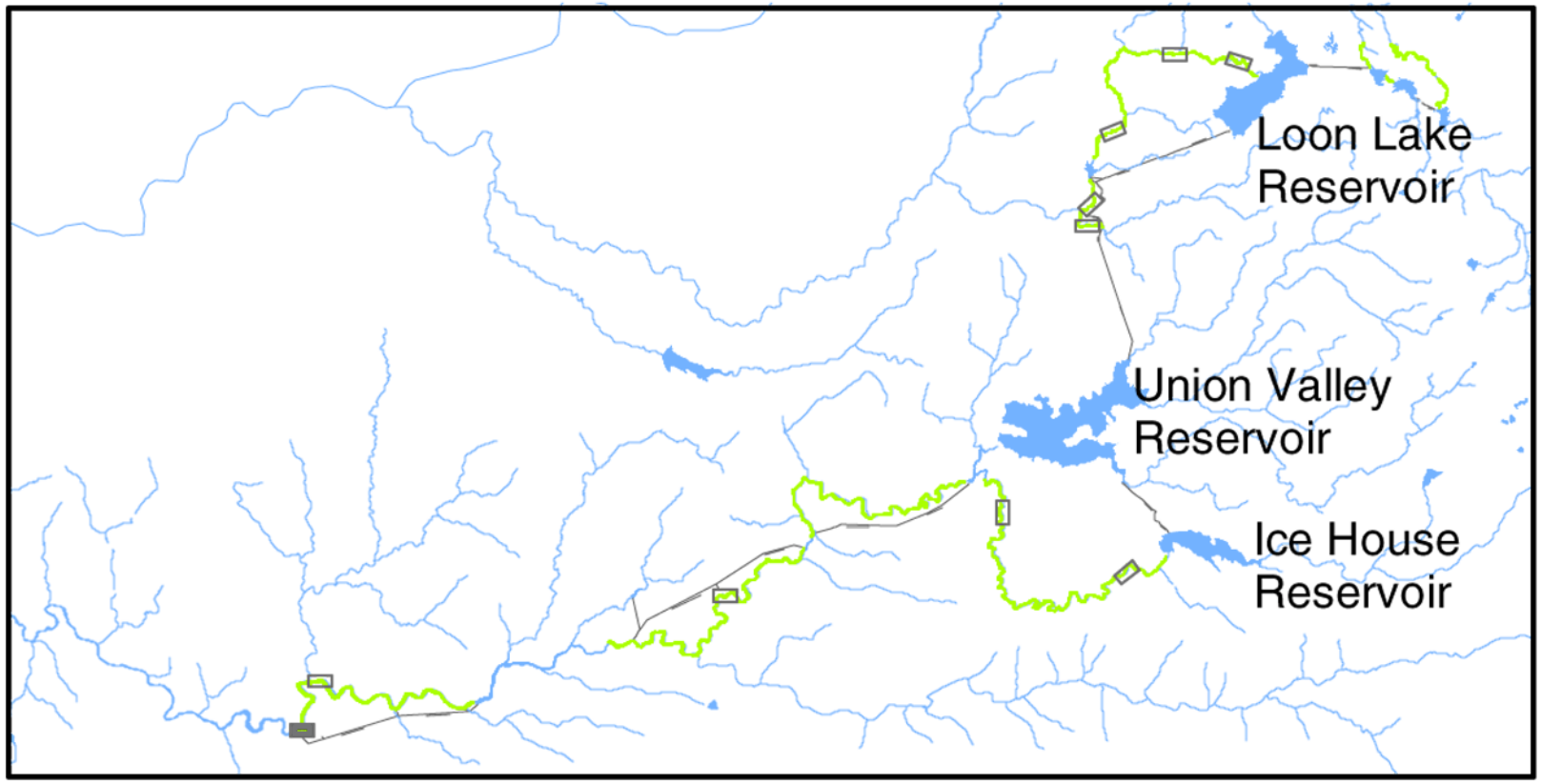
Output CB Intensive Map Legend: Click on the Box Outline on the Map to View that Area

Use the Back Arrow to Return to the Report



Output UARP Map Legend: Click on the Box Outline on the Map to View that Area

Use the Back Arrow to Return to the Report



Output UARP Intensive Map Legend: Click on the Box Outline on the Map to View that Area

Use the Back Arrow to Return to the Report

Upper American River Project

SMUD

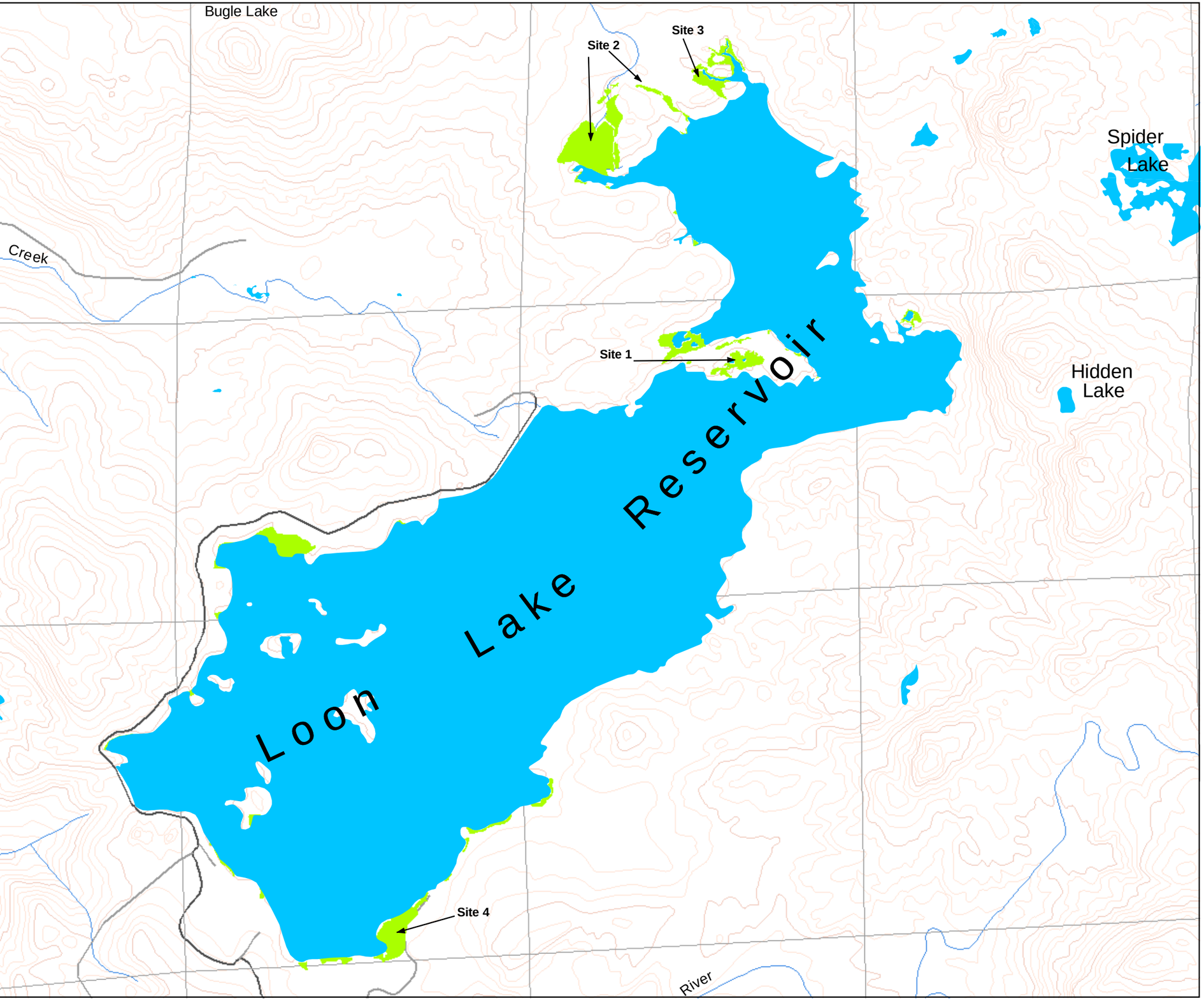
Figure 4.2.1-2
Major Wetlands Associated with Upper American River Project Reservoirs

Loon Lake Reservoir

Numbered Sites Indicate
Field Examined Wetlands
Discussed in the Text

Wetland Sites

Wetlands



N

SCALE 1:18,000

0 0.09 0.18 0.27 0.36
Miles

Prepared by VESTRA Resources, Inc., Redding. CA. Feb. 05, 2004

Upper American River Project

SMUD

Figure 4.2.2-2
Major Wetlands Associated with Upper American River Project Reservoirs

Gerle Creek Reservoir

Numbered Sites Indicate
Field Examined Wetlands
Discussed in the Text

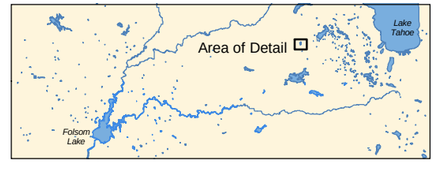
Site 1

Site 2

Gerle Creek Reservoir

Wetland Sites

Wetlands



N

SCALE 1:5,000

0 0.025 0.05 0.075 0.1

Miles

Prepared by VESTRA Resources, Inc., Redding. CA. Feb. 05, 2004

Upper American River Project

SMUD

Figure 4.2.3-2
Major Wetlands Associated with Upper American River Project Reservoirs

Ice House Reservoir

Driscoll Creek

Ice House Reservoir

Creek

Peavine

Creek

Wetland Sites

Wetlands

N

SCALE 1:15,000

0 0.07 0.14 0.21 0.28

Miles

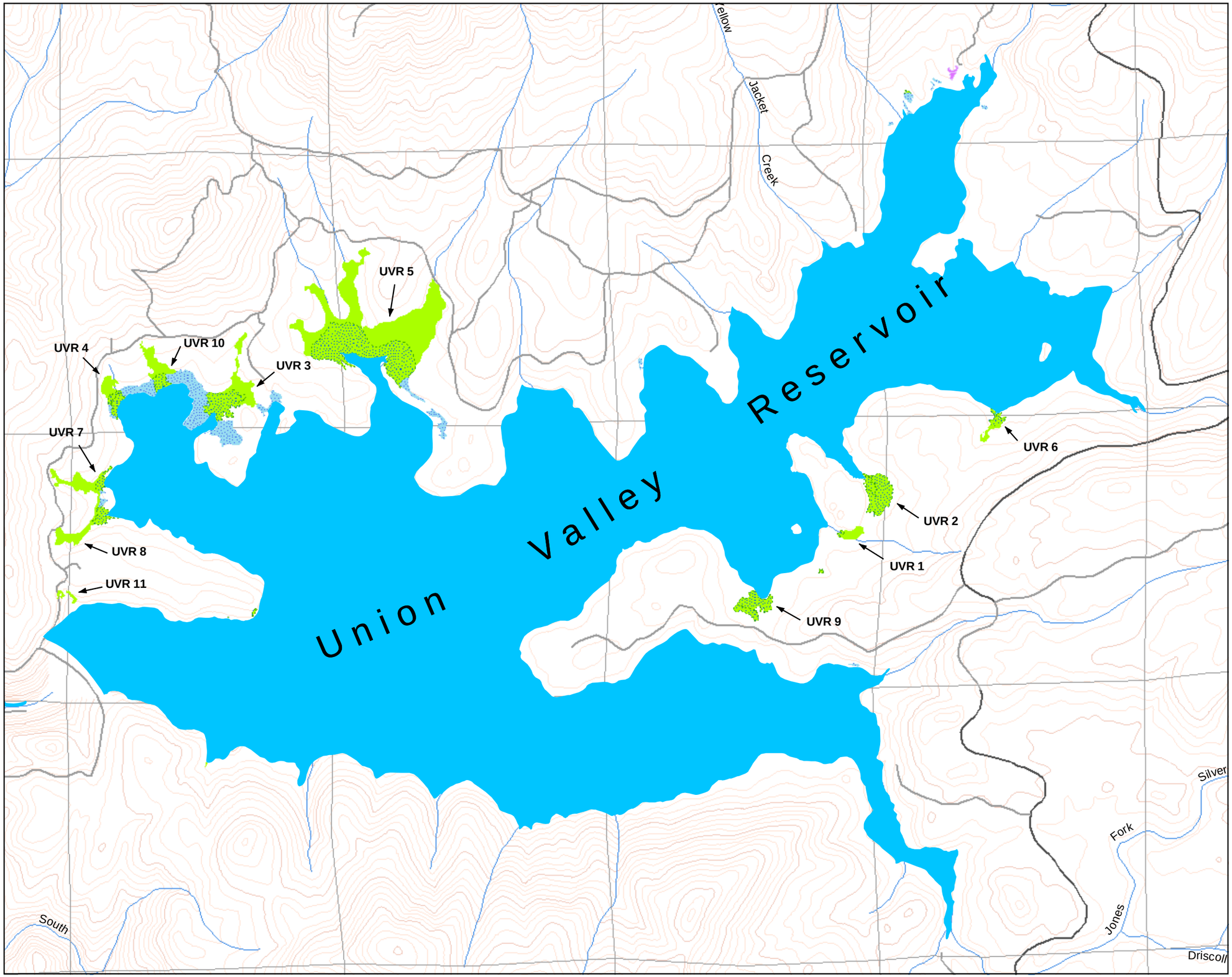
Prepared by VESTRA Resources, Inc., Redding. CA. Feb. 05, 2004

Upper American River Project

SMUD

Figure 4.2.4-2
Major Wetlands Associated with Upper American River Project Reservoirs

Union Valley Reservoir



Wetland Sites

- Wetland Site - Above High Water
- Wetland Site - Below High Water
- Lakeshore Basin Below High Water
- Wetland Above High Water Not Visited

SCALE 1:22,000

0 0.1 0.2 0.3 0.4 Miles

Prepared by VESTRA Resources, Inc., Redding. CA. Feb. 05, 2004

APPENDIX B

PROJECT REACHES 1940 AND 2002 AERIAL PHOTOGRAPHS

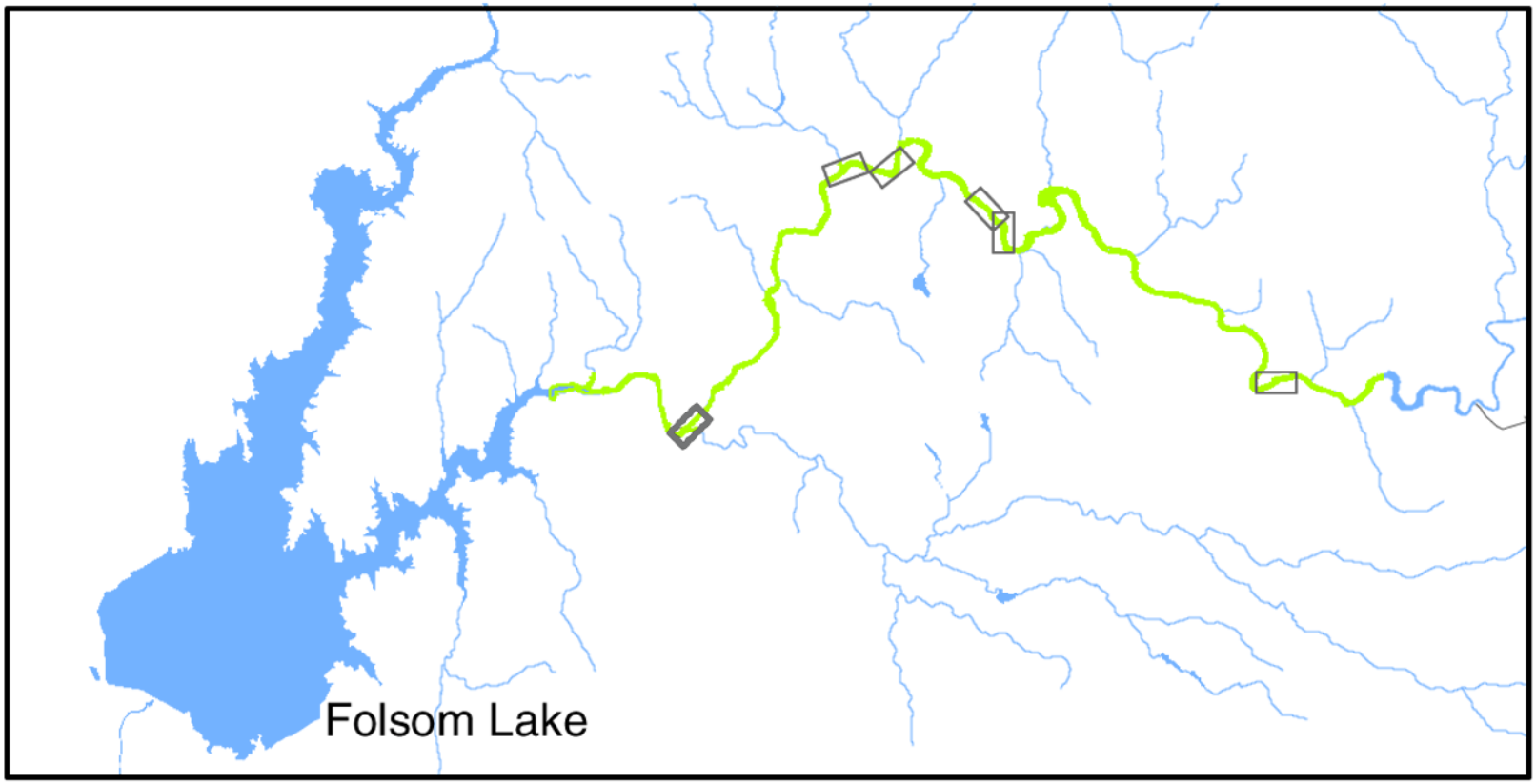
- **Rubicon Dam Reach**
- **Buck Island Dam Reach**
- **Loon Lake Dam Reach**
- **Ice House Dam Reach**

APPENDIX C

INTENSIVE RIPARIAN SITE COVER TYPE MAPS

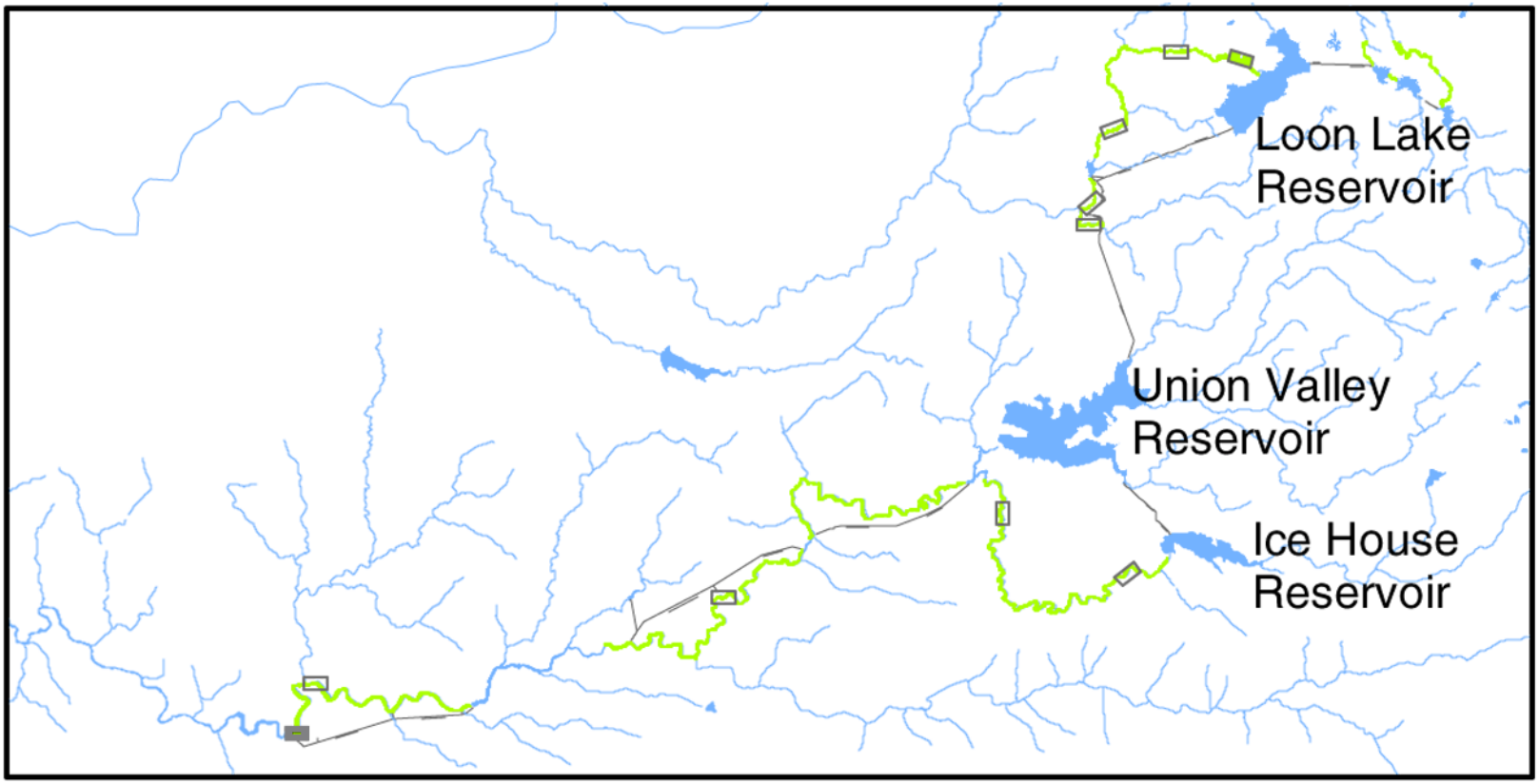
- **Reach Downstream of Chili Bar Riparian Intensive Sites Map Legend**
- **UARP Riparian Intensive Sites Map Legend**

(Maps Provided on CD)



Reach Downstream of Chili Bar Riparian Intensive Map Legend: Click on the Box Outline on the Map to View that Area

Use the Back Arrow to Return to the Report



UARP Riparian Intensive Map Legend: Click on the Box Outline on the Map to View that Area

Use the Back Arrow to Return to the Report

APPENDIX D

STUDY SITE PHOTOGRAPHS

- **Riparian Vegetation Sites**
  - **Buck Island Dam Reach**
  - **Camino Dam Reach**
  - **Gerle Creek Dam Reach**
  - **Ice House Dam Reach**
  - **Loon Lake Dam Reach**
  - **Reach Downstream of Chili Bar**
  - **Robbs Peak Dam Reach**
  - **Rubicon Dam Reach**
  - **Slab Creek Dam Reach**

- **Wetlands Sites**
  - **Gerle Creek Reservoir Wetlands**
  - **Ice House Reservoir Wetlands**
  - **Loon Lake Reservoir Wetlands**
  - **Other Reservoir Wetlands**
    - **Chili Bar Reservoir**
  - **Project Created Wetlands**
  - **Project Reach Wetlands**
  - **Union Valley Reservoir Wetlands**

(Provided on CD)

(Click on the Reach or Wetlands in the List Above to View the Photographs)

APPENDIX E

RIPARIAN AND WETLAND TRANSECT FIGURES

Figure 4.1.4-1. Loon Lake Dam Reach Site 1: Transect 1. Transect is shown so that the right bank headpin is equal to a distance of 178.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

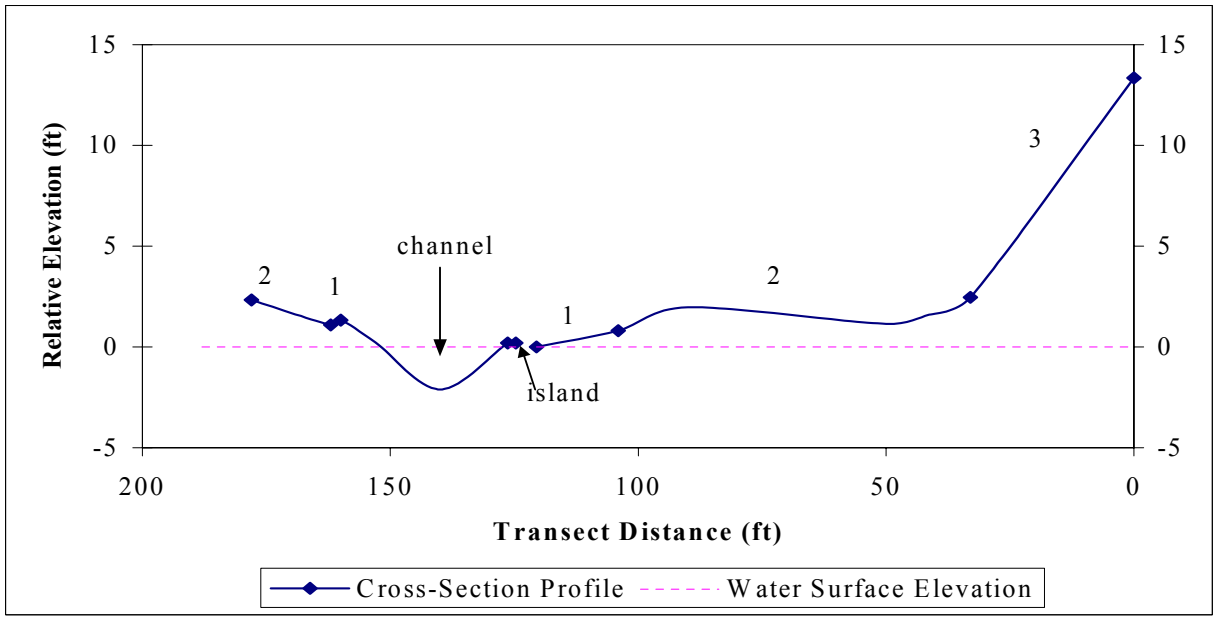


Figure 4.1.4-2. Loon Lake Dam Reach Site 1: Transect 2. Transect is shown so that the right bank headpin is equal to a distance of 240.0 ft.

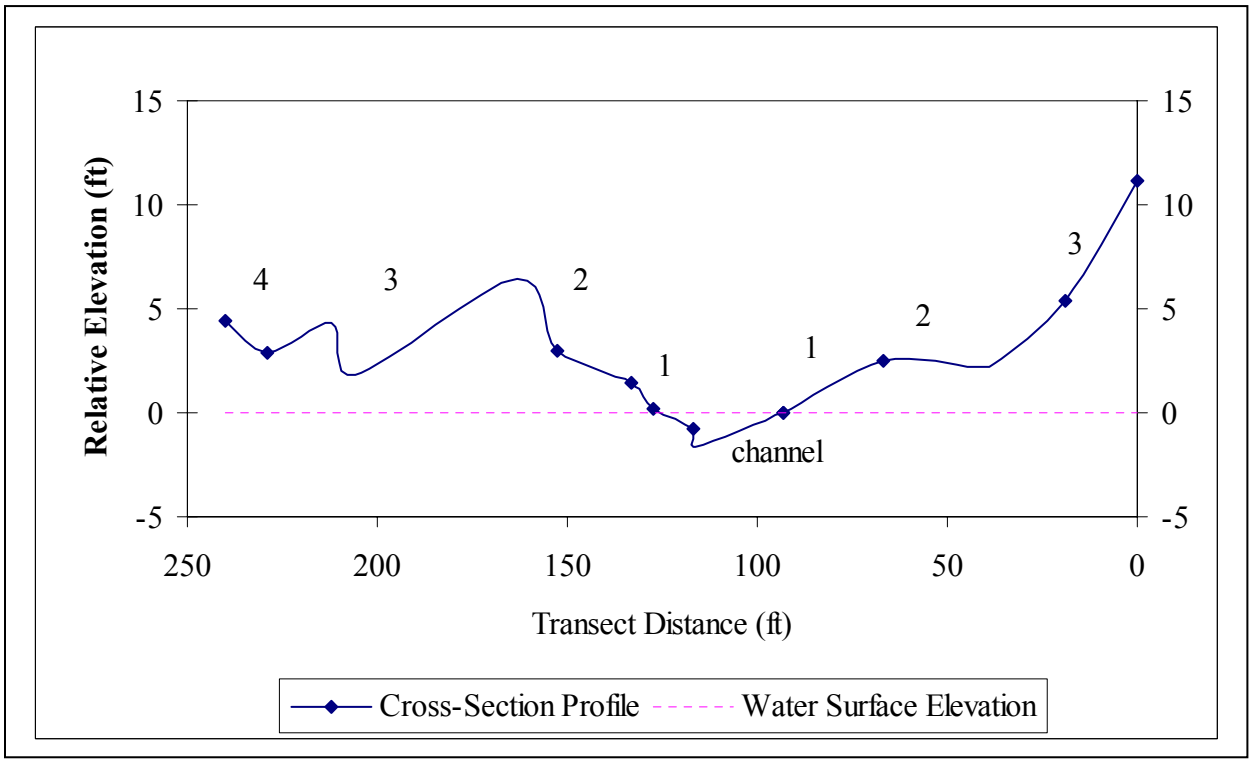


Figure 4.1.4-3. Loon Lake Dam Reach Site 1: Transect 3. Transect is shown so that the right bank headpin is equal to a distance of 190.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

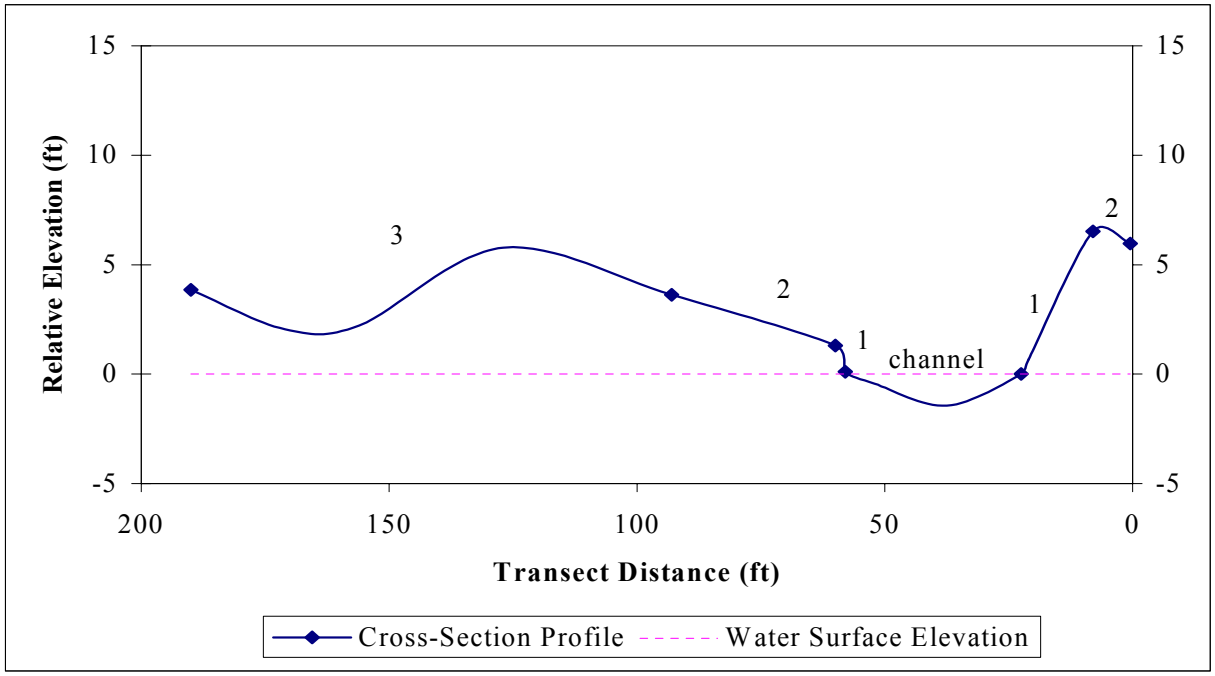


Figure 4.1.4-4. Loon Lake Dam Reach Site 2: Transect 1. Transect is shown so that the right bank headpin is equal to a distance of 96.7 ft.

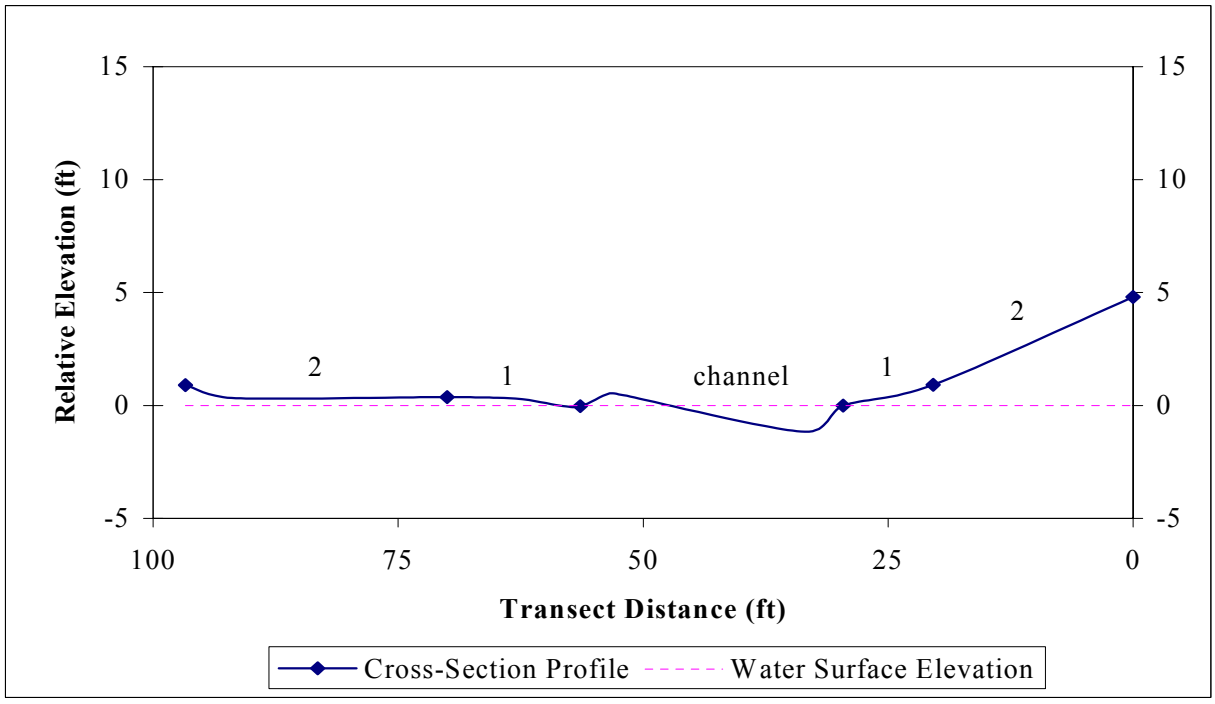


Figure 4.1.4-5. Loon Lake Dam Reach Site 2: Transect 2. Transect is shown so that the right bank headpin is equal to a distance of 80.6 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

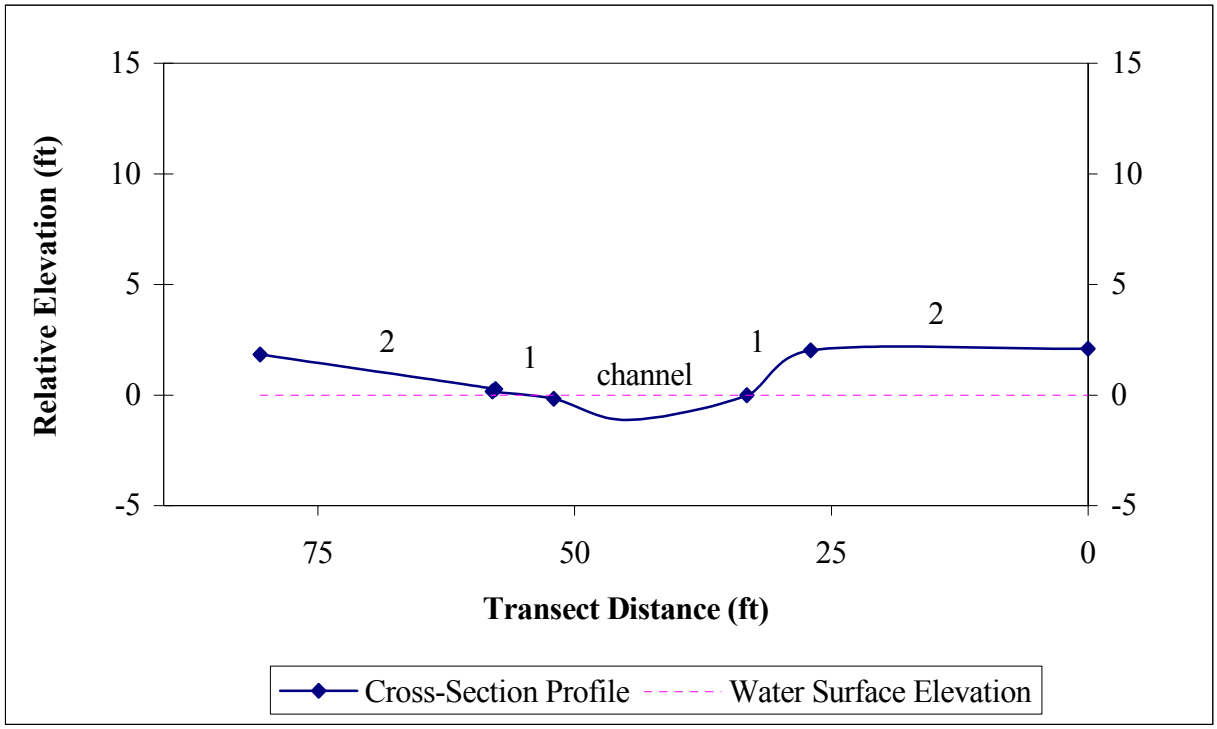


Figure 4.1.4-6. Loon Lake Dam Reach Site 2: Transect 3. Transect is shown so that the right bank headpin is equal to a distance of 200 ft.

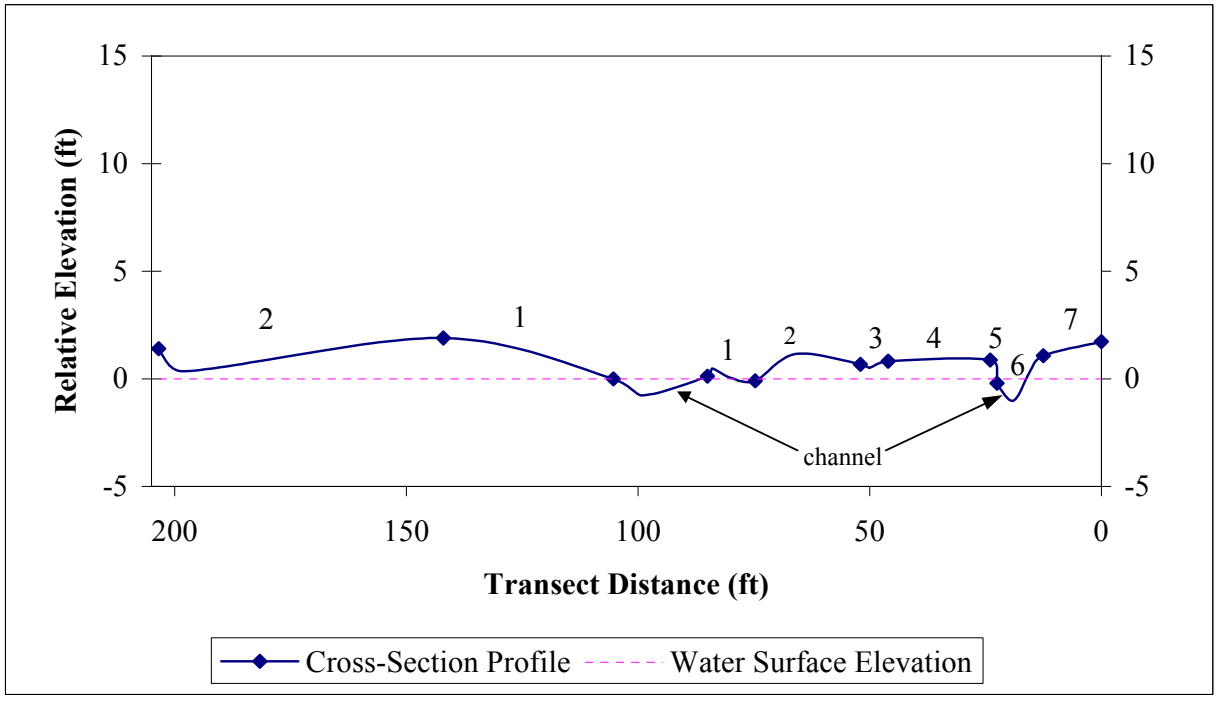


Figure 4.1.4-7. Loon Lake Dam Reach Site 3: Transect 1. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

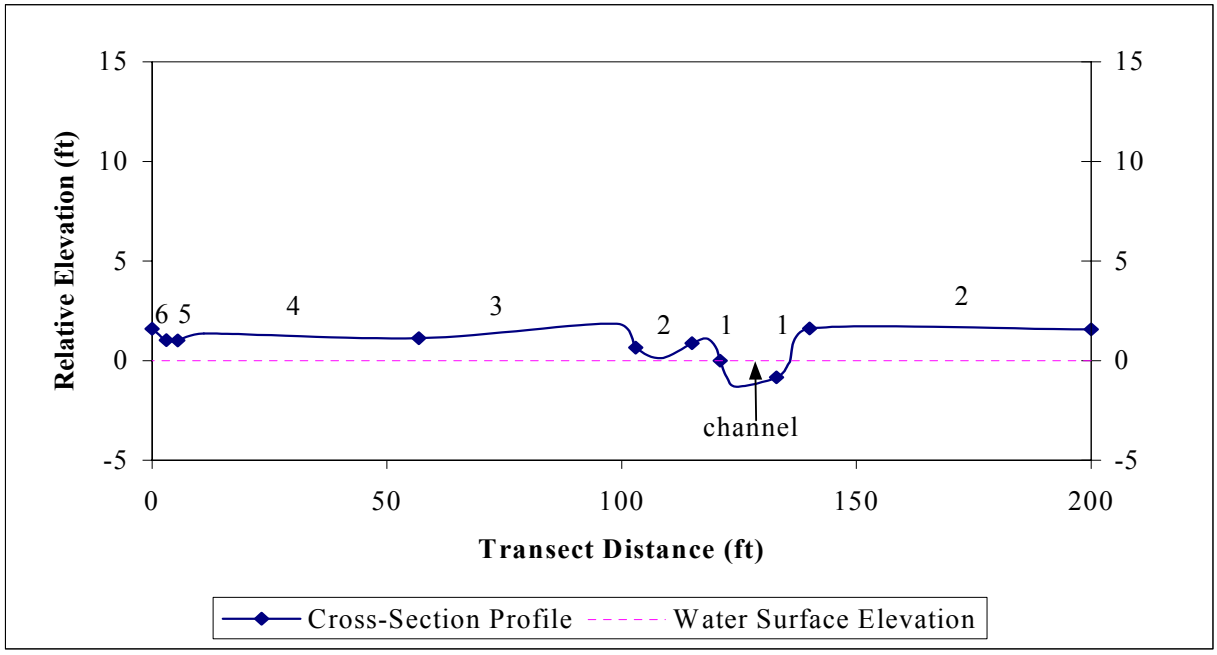


Figure 4.1.4-8. Loon Lake Dam Reach Site 3: Transect 2. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft.

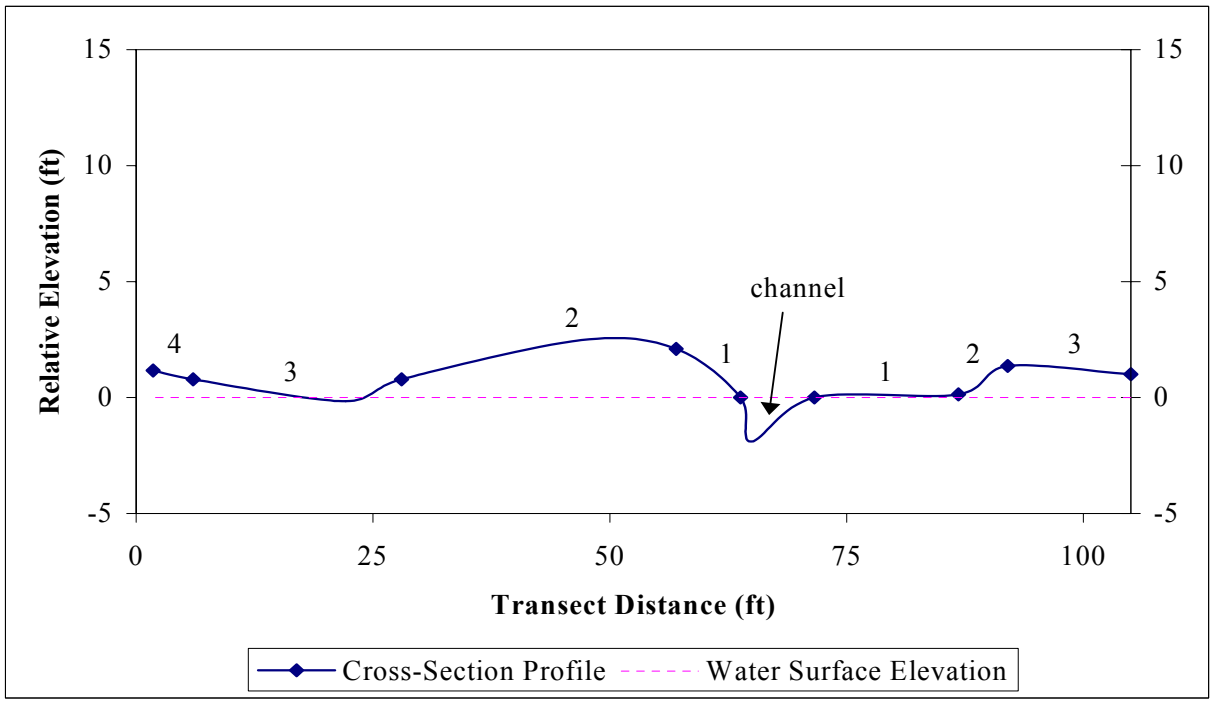


Figure 4.1.4-9. Loon Lake Dam Reach Site 3: Transect 3. Transect is shown so that the right bank headpin is equal to a distance of 105.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

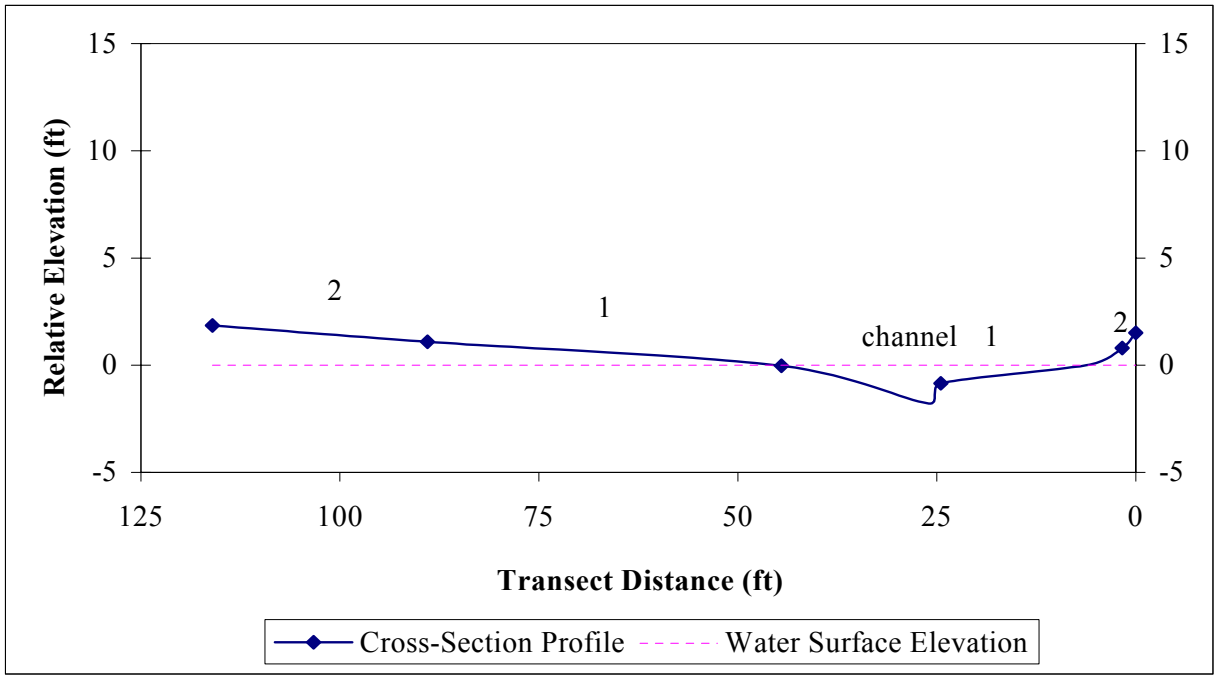


Figure 4.1.5-1. Gerle Creek Dam Reach: Transect 1. Transect is shown so that the right bank headpin is equal to a distance of 58.6 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

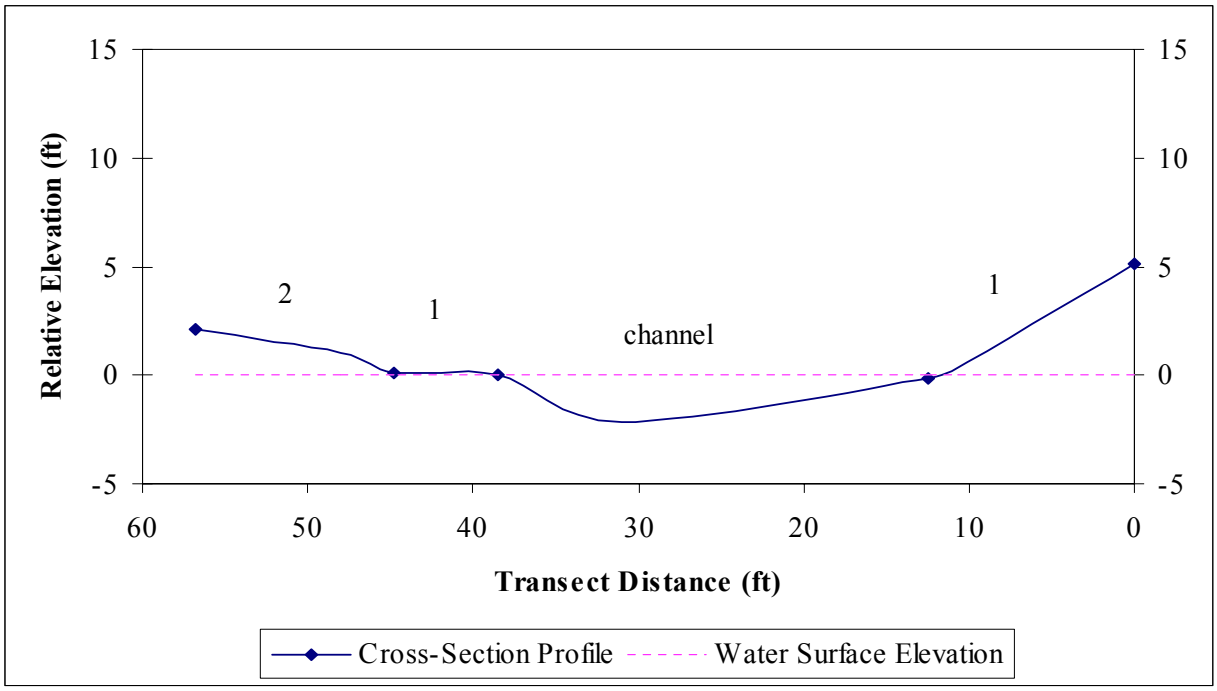


Figure 4.1.5-2. Gerle Creek Dam Reach: Transect 2. Transect is shown so that the right bank headpin is equal to a distance of 102.7 ft.

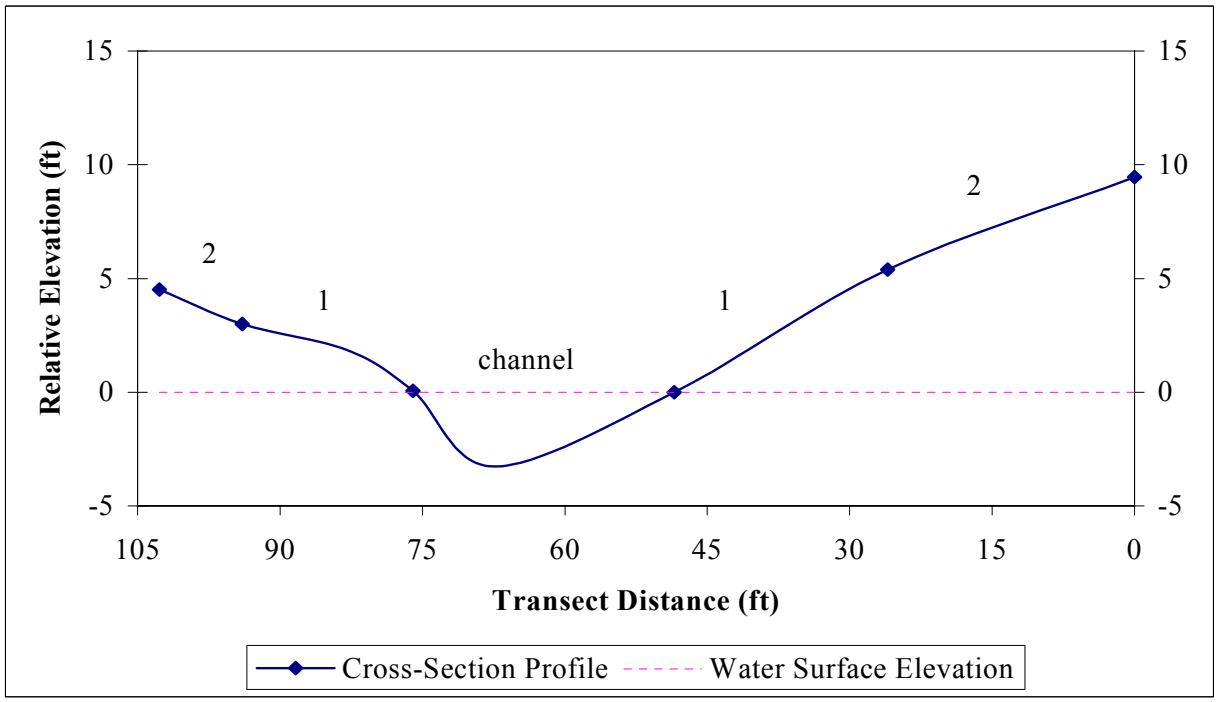


Figure 4.1.6-1. Robb's Peak Dam Reach: Transect 1. Transect is shown so that the left bank headpin is equal to a distance of 0.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

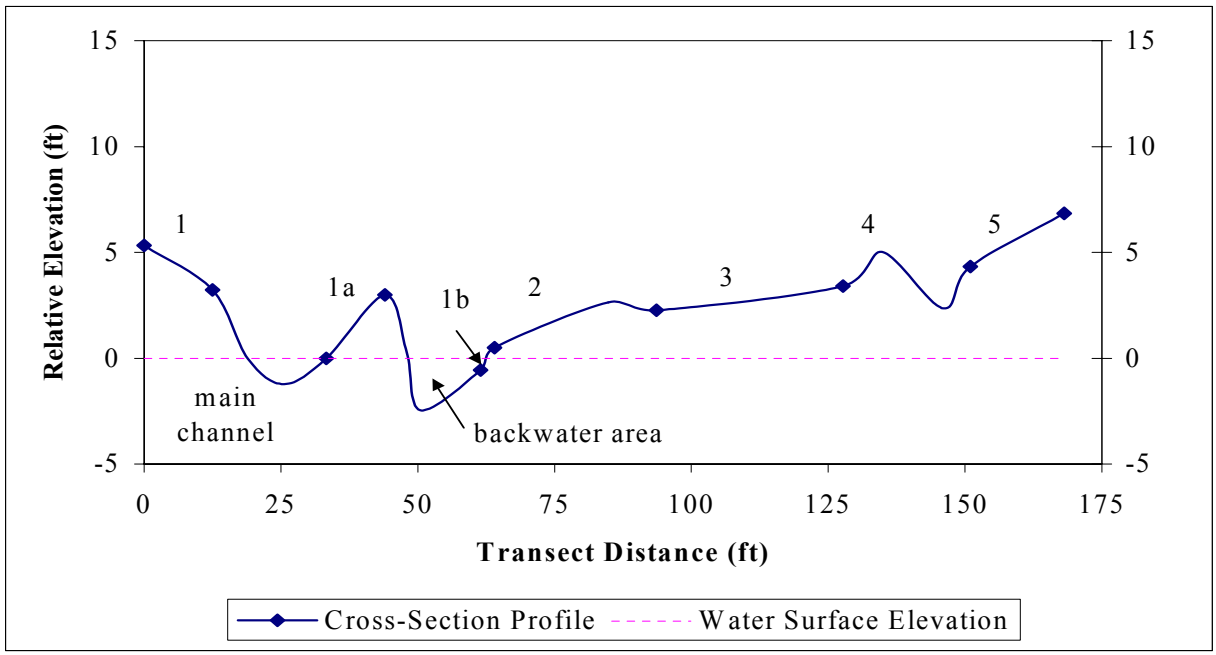


Figure 4.1.6-2. Robb's Peak Dam Reach: Transect 2. Transect is shown so that the left bank headpin is equal to a distance of 245.0 ft.

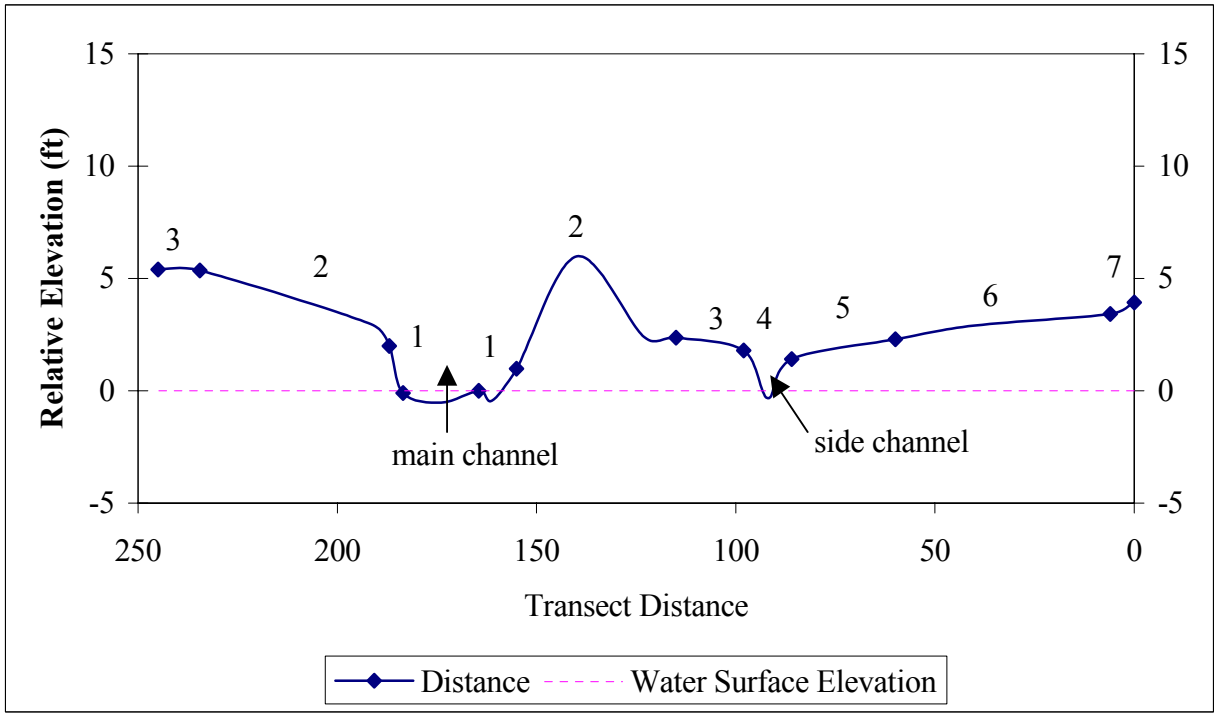


Figure 4.1.7-1. Ice House Dam Reach Site 1: Transect 1. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

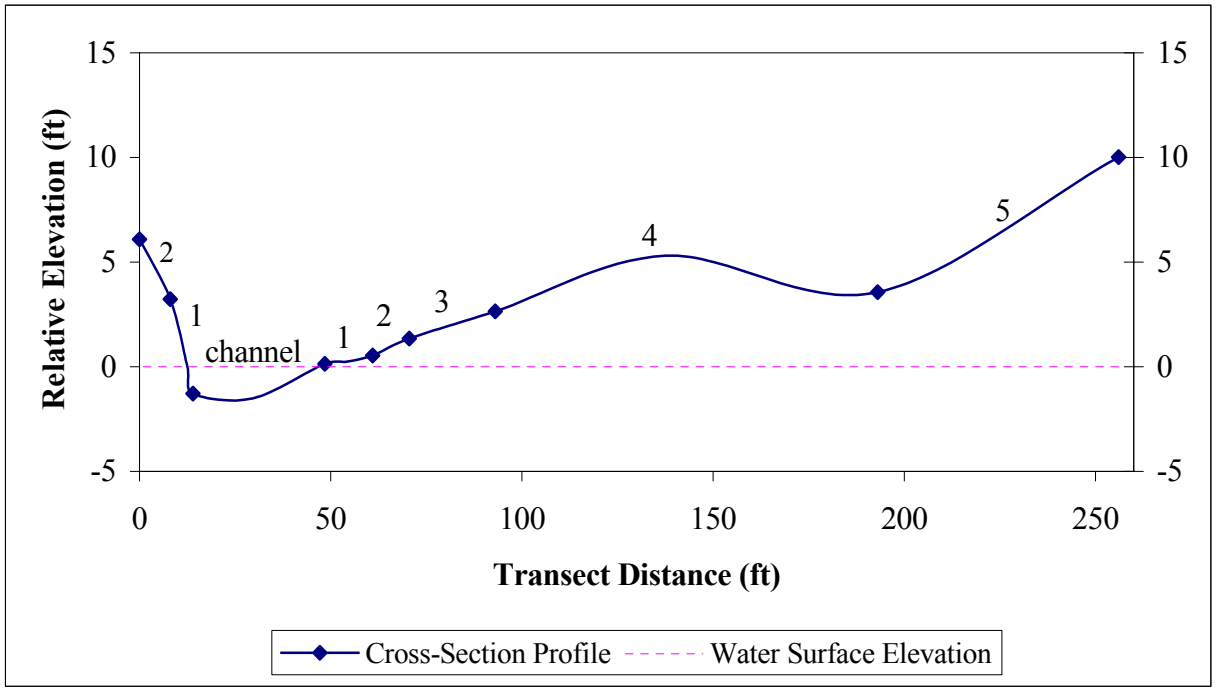


Figure 4.1.7-2. Ice House Dam Reach Site 1: Transect 2. Transect is shown so that the right bank headpin is equal to a distance of 316.0 ft.

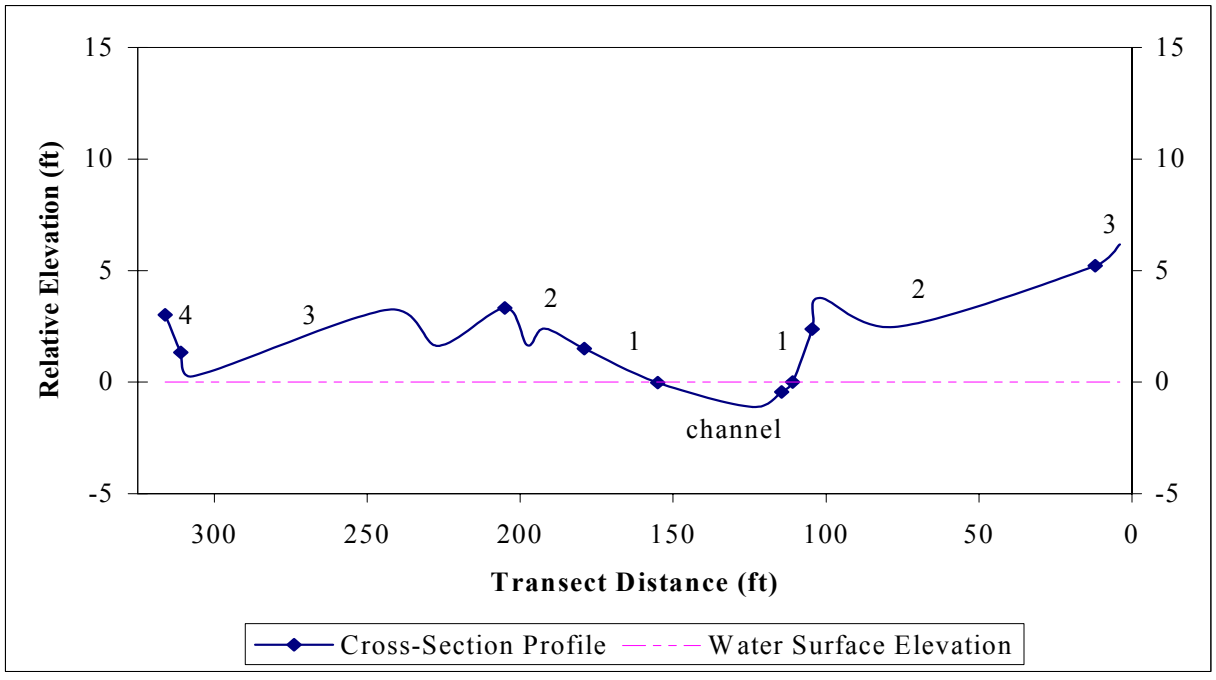


Figure 4.1.7-3. Ice House Dam Reach Site 1: Transect 3. Transect is shown so that the right bank headpin is equal to a distance of 251.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

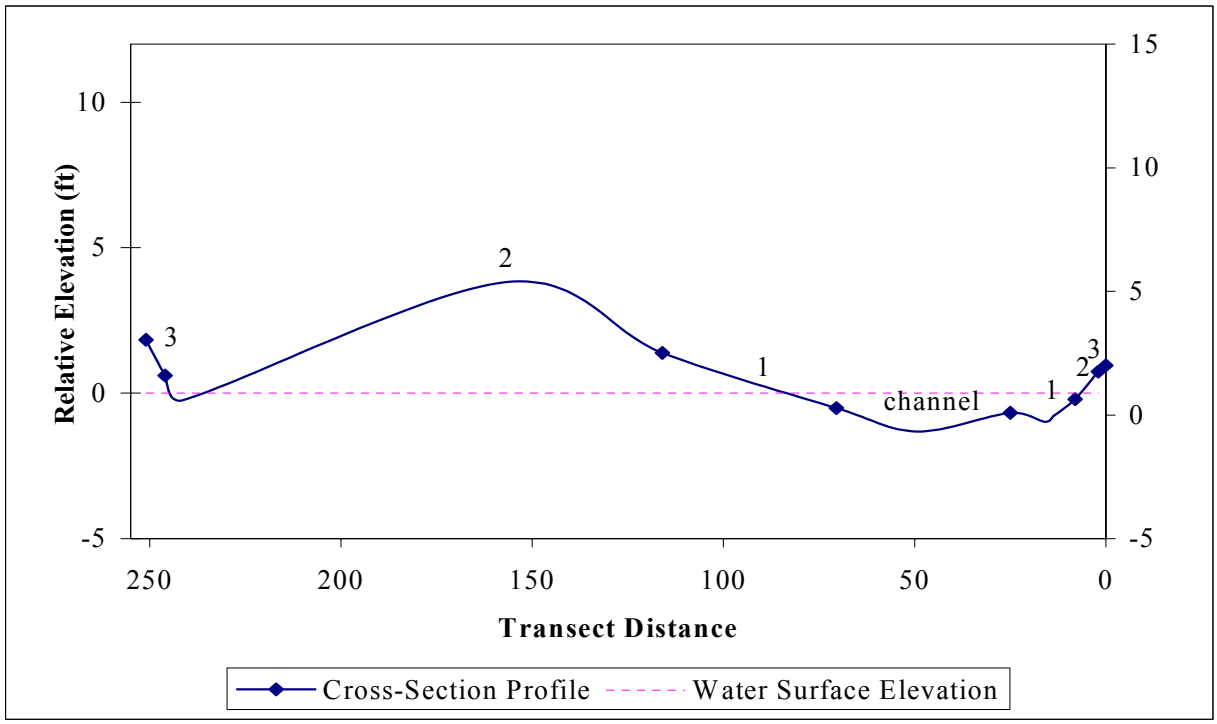


Figure 4.1.7-4. Ice House Dam Reach Site 2: Transect 1. Transect is shown so that the right bank headpin is equal to a distance of 302 ft.

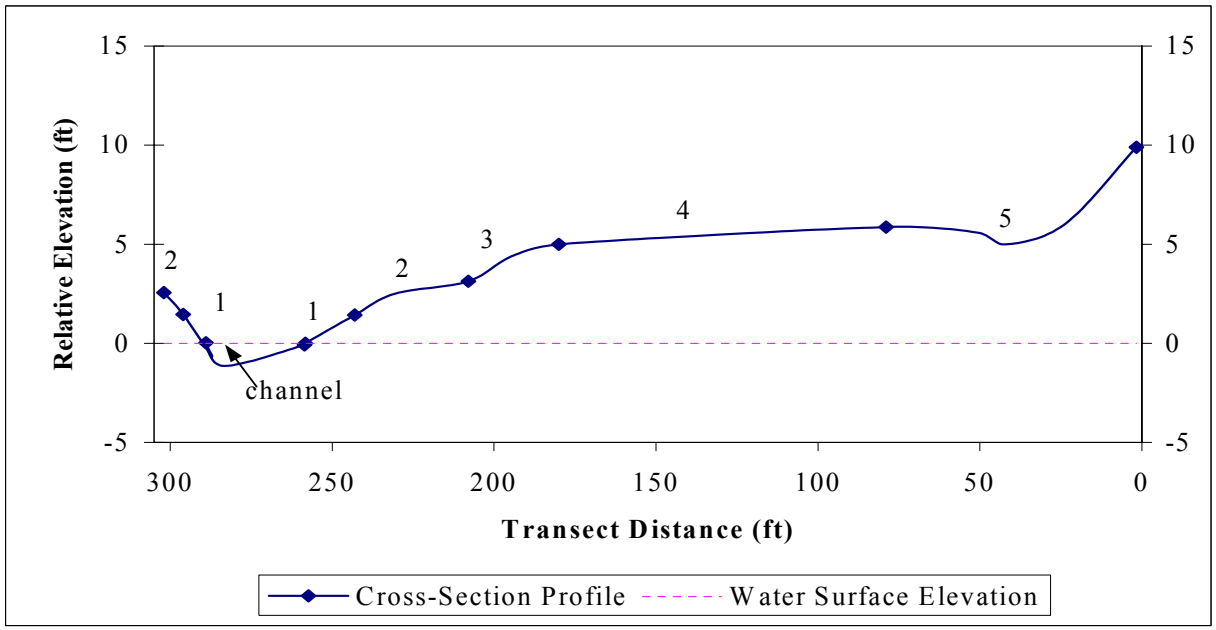


Figure 4.1.7-5. Ice House Dam Reach Site 2: Transect 2. Transect is shown so that the right bank headpin is equal to a distance of 146.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

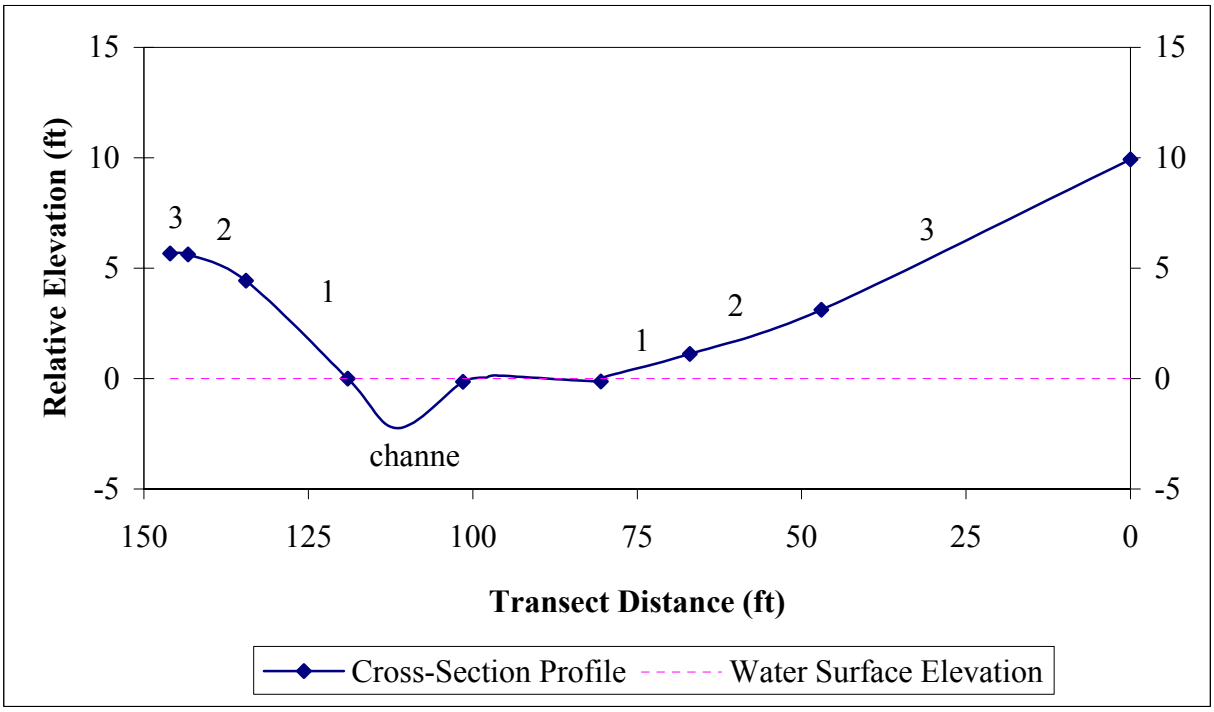


Figure 4.1.7-6. Ice House Dam Reach Site 2: Transect 3. Transect is shown so that the right bank headpin is equal to a distance of 182.0 ft.

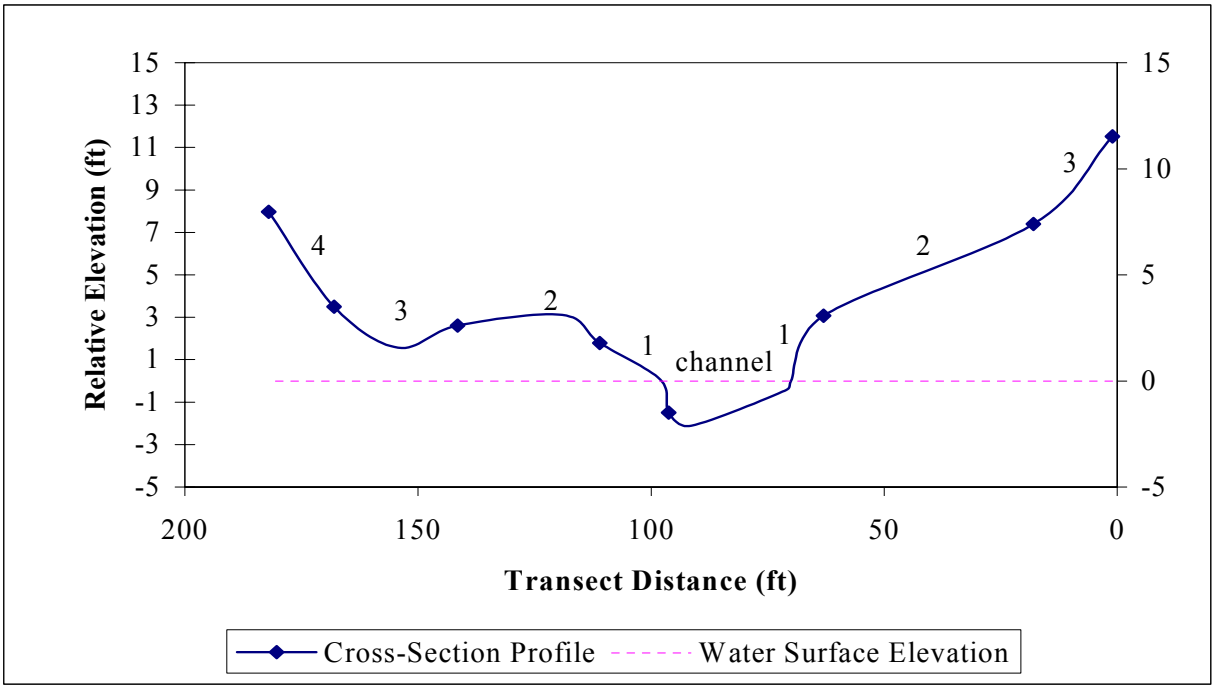


Figure 4.1.9-1. Camino Dam Reach: Transect 1. Transect is shown so that the right bank headpin is equal to a distance of 18.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

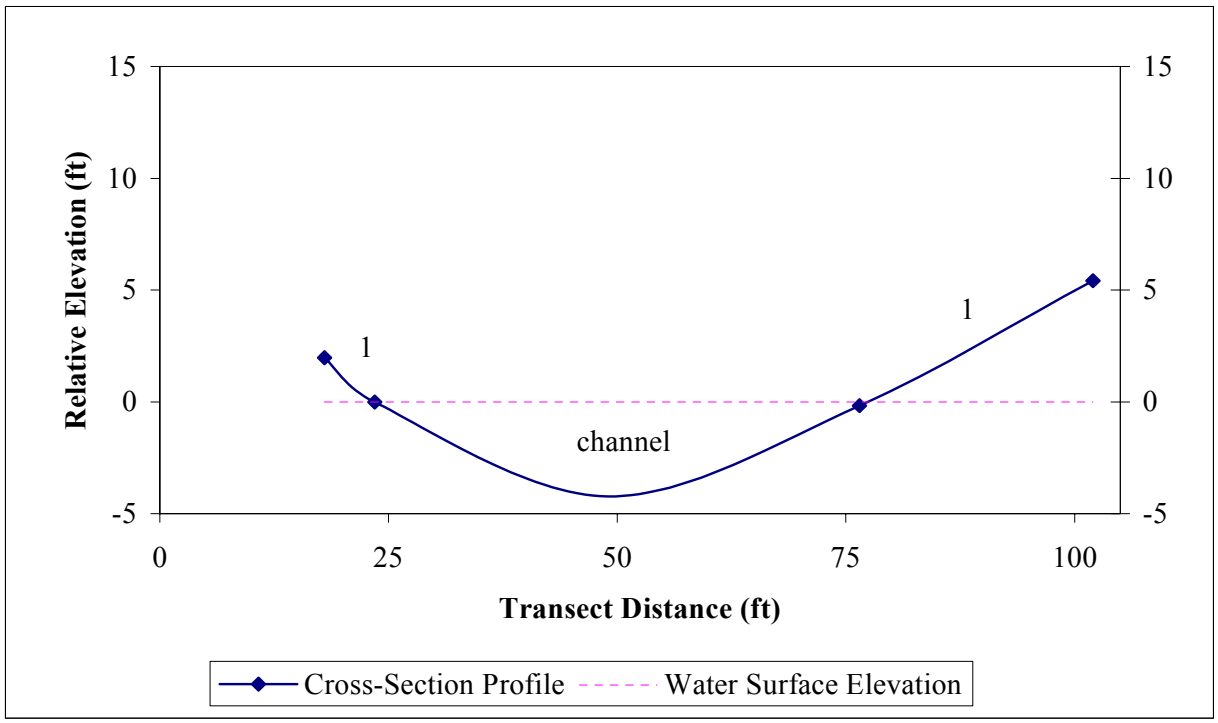


Figure 4.1.9-2. Camino Dam Reach: Transect 2. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft.

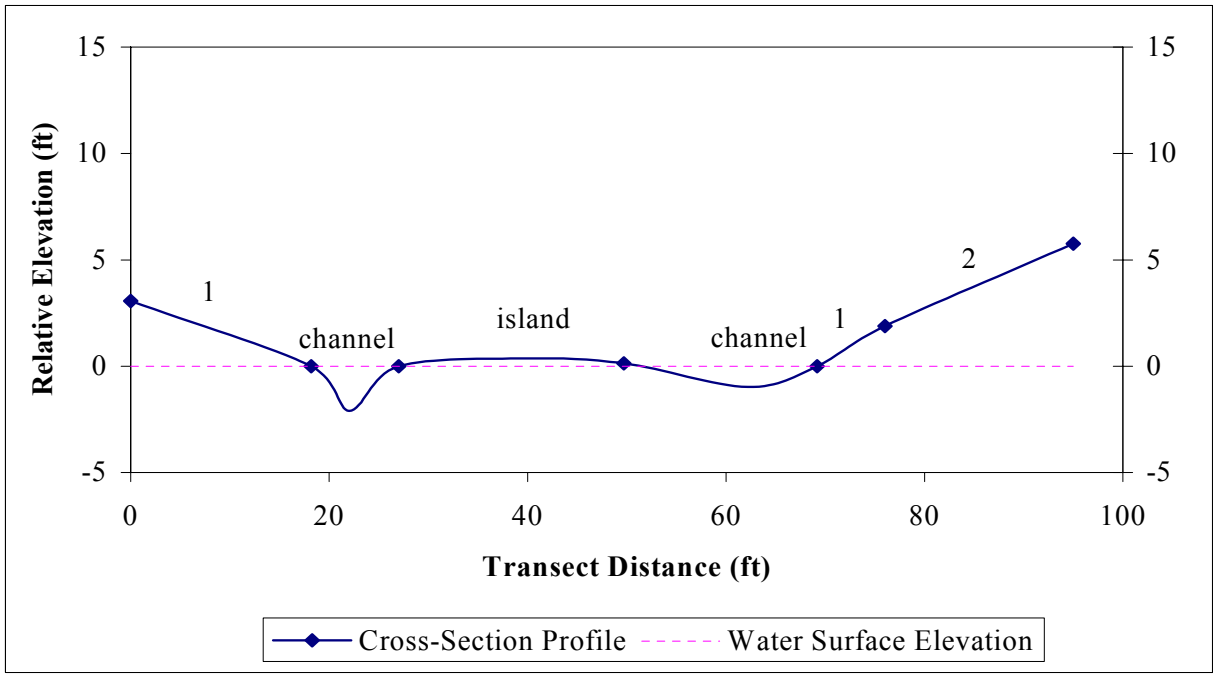


Figure 4.1.12-1. Slab Creek Dam Reach 1: Transect 1. Transect is shown so that the right bank headpin is equal to a distance of 215 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

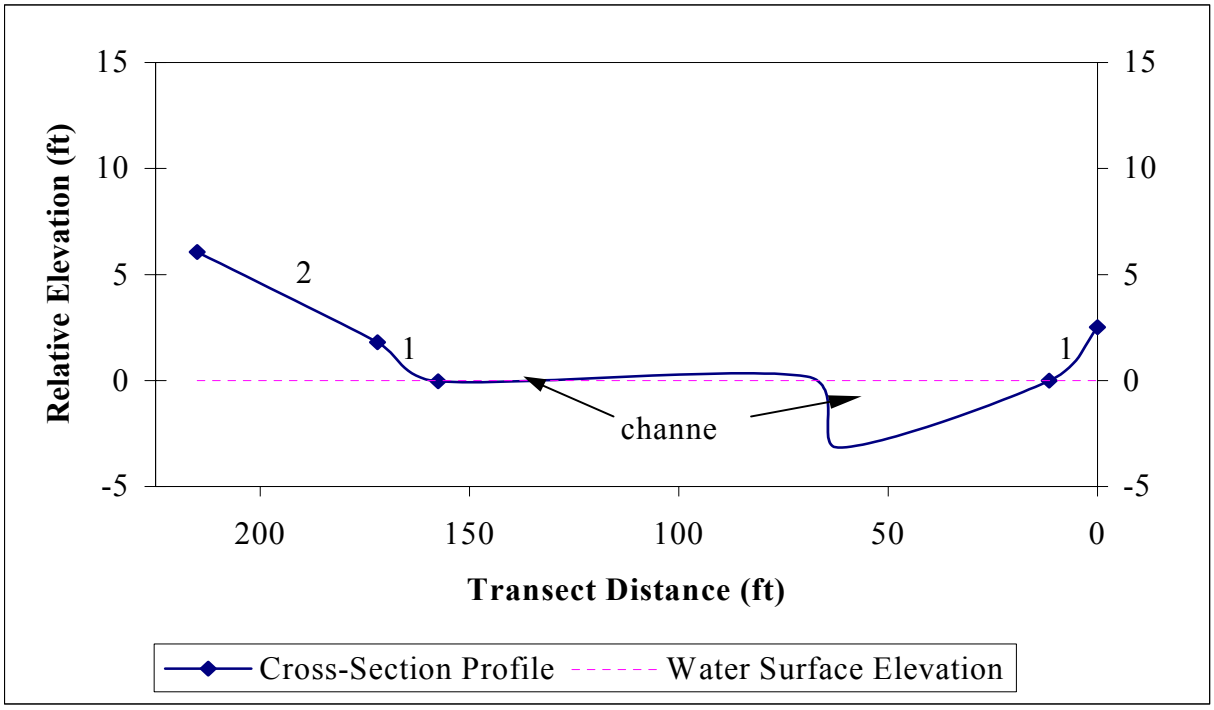


Figure 4.1.12-2. Slab Creek Dam Reach Site 1: Transect 2. Transect is shown so that the left bank headpin is equal to a distance of 160.5 ft.

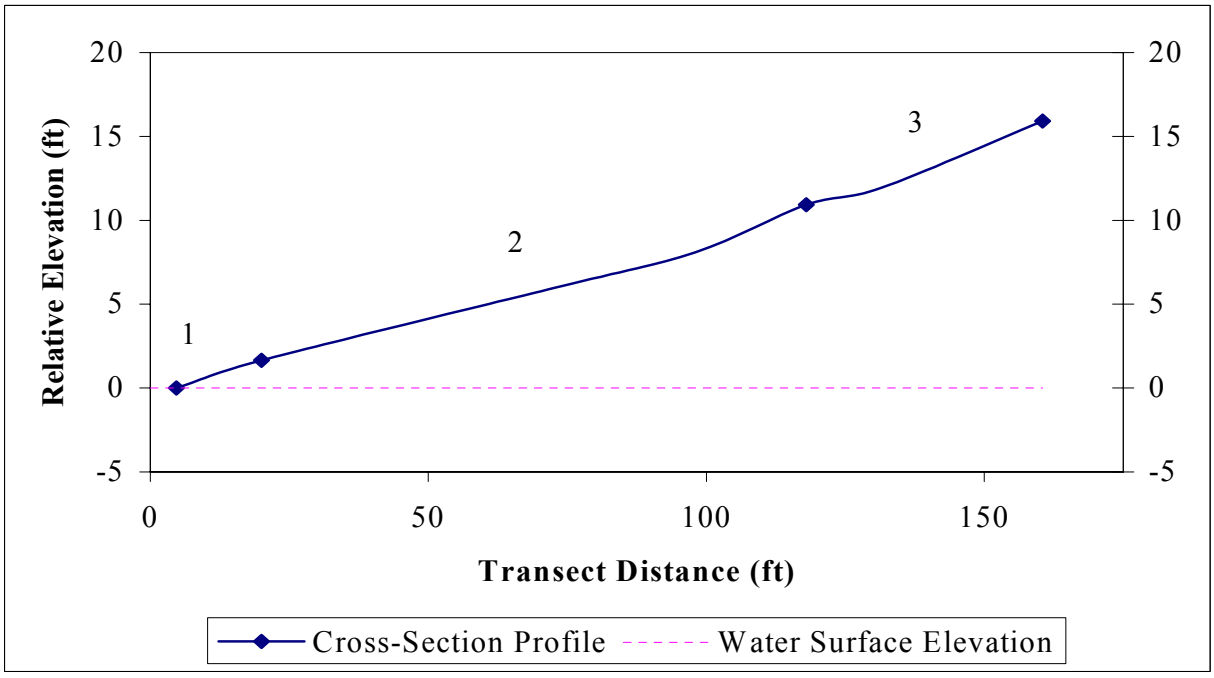


Figure 4.1.12-3. Slab Creek Dam Reach Site 1: Transect 3. Transect is shown so that the right bank headpin is equal to a distance of 155.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

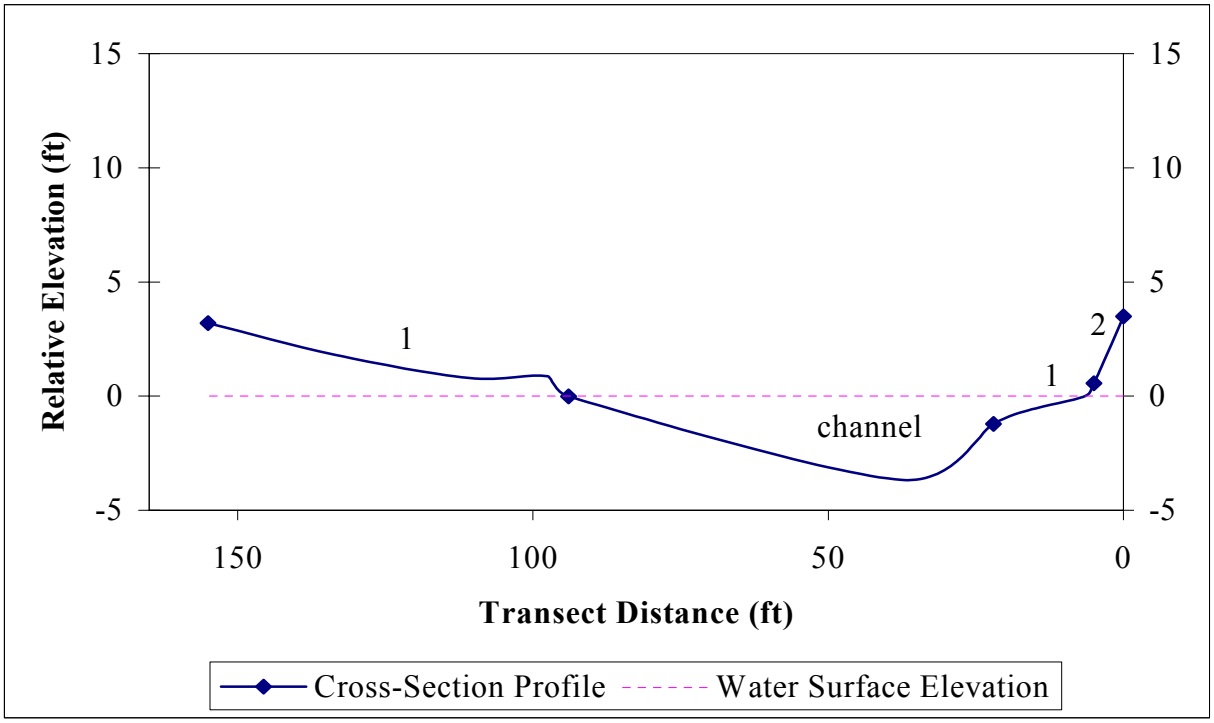


Figure 4.1.12-4. Slab Creek Dam Reach Site 2: Transect 1. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft.

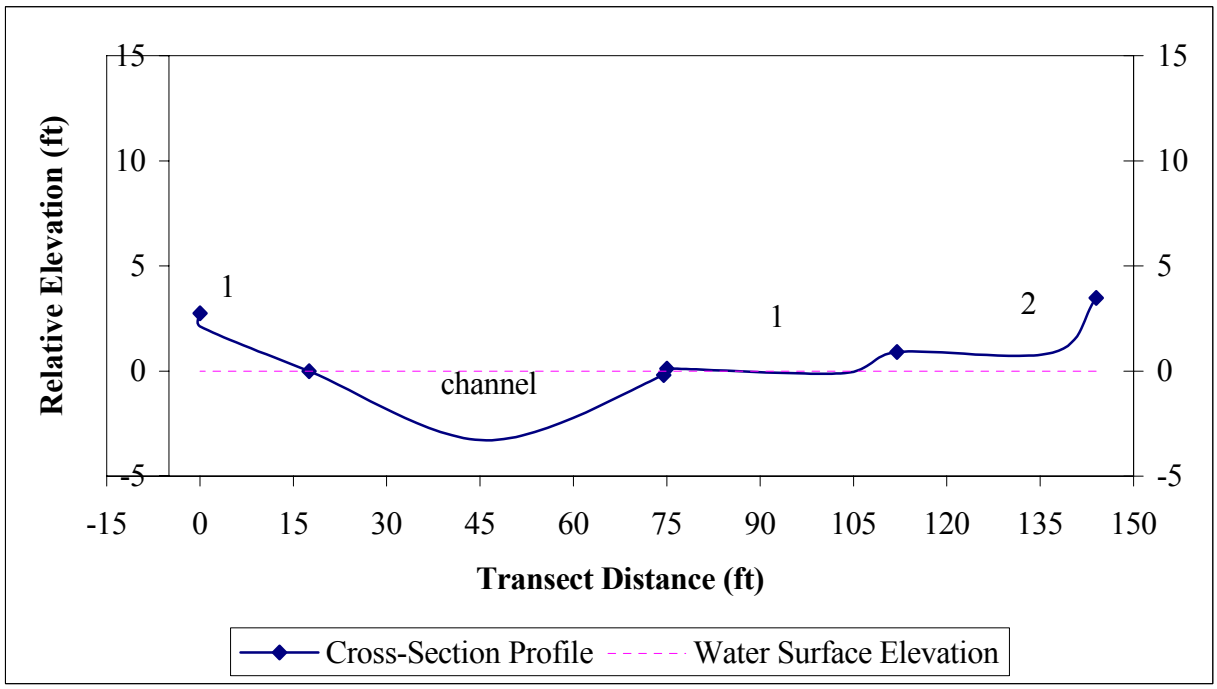


Figure 4.1.12-5. Slab Creek Dam Reach Site 2: Transect 2. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft. Water surface elevation extended beyond channel for diagrammatic purposes only.

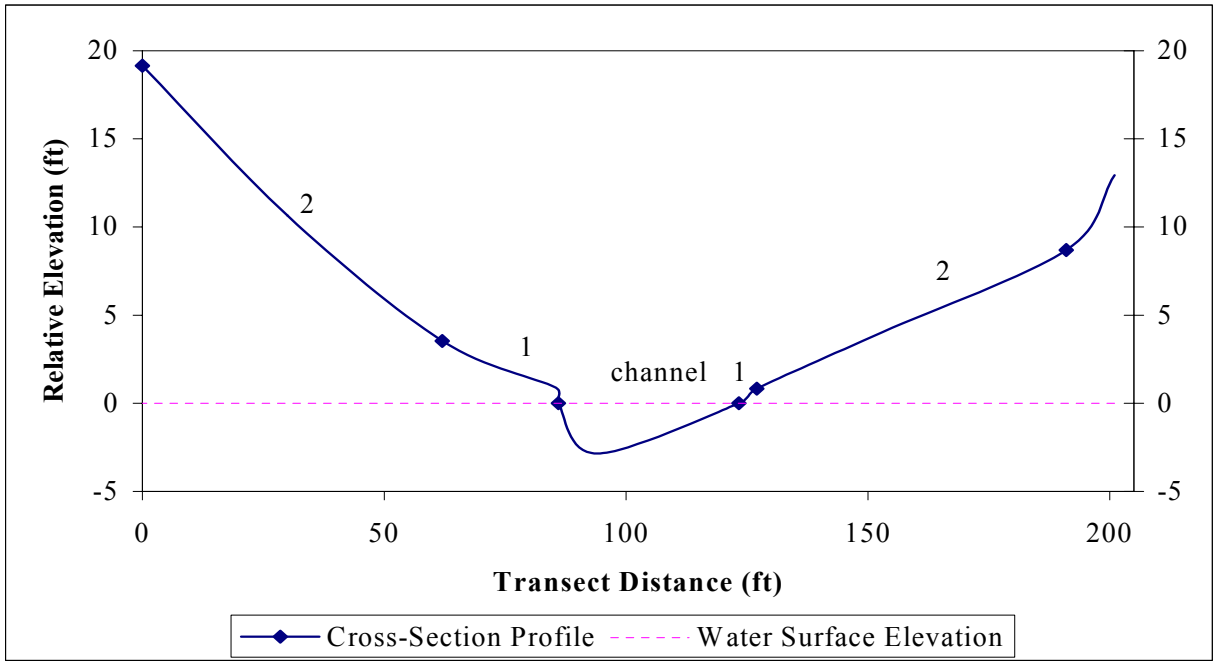


Figure 4.1.12-6. Slab Creek Dam Reach Site 3: Transect 3. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft.

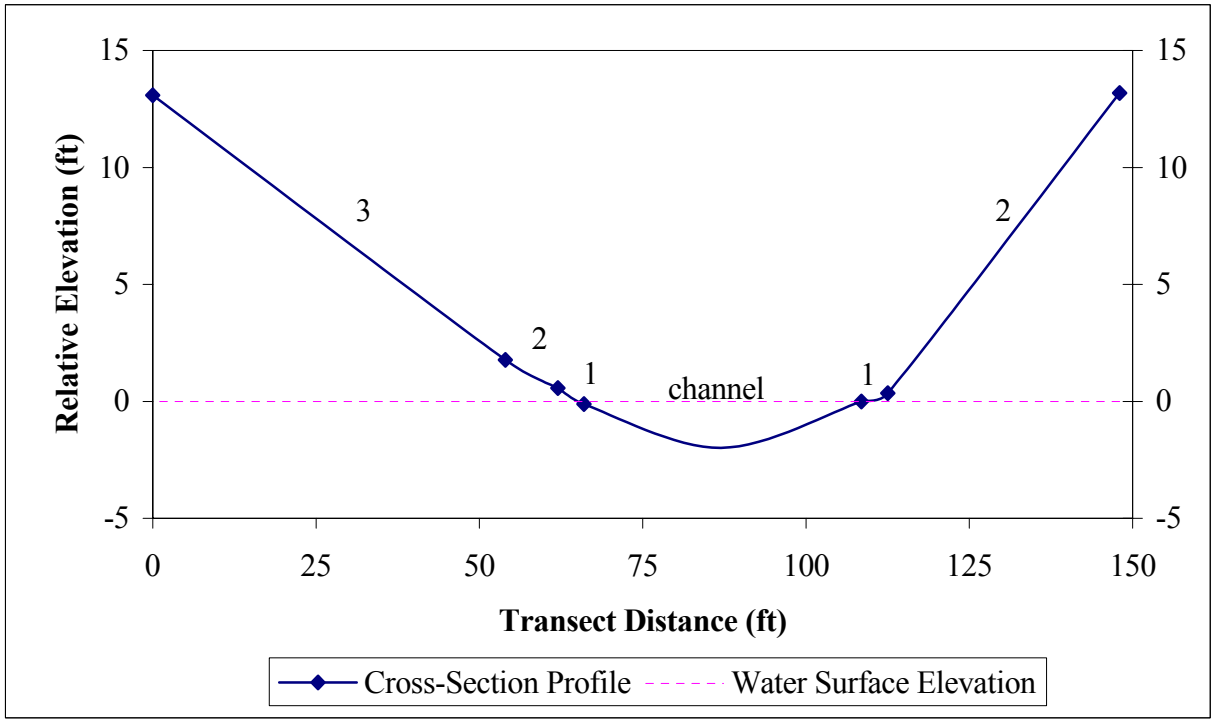


Figure 4.2.1-3. Loon Lake Reservoir Wetland Site 1. Y axis 0 at -1.3 ft water depth.

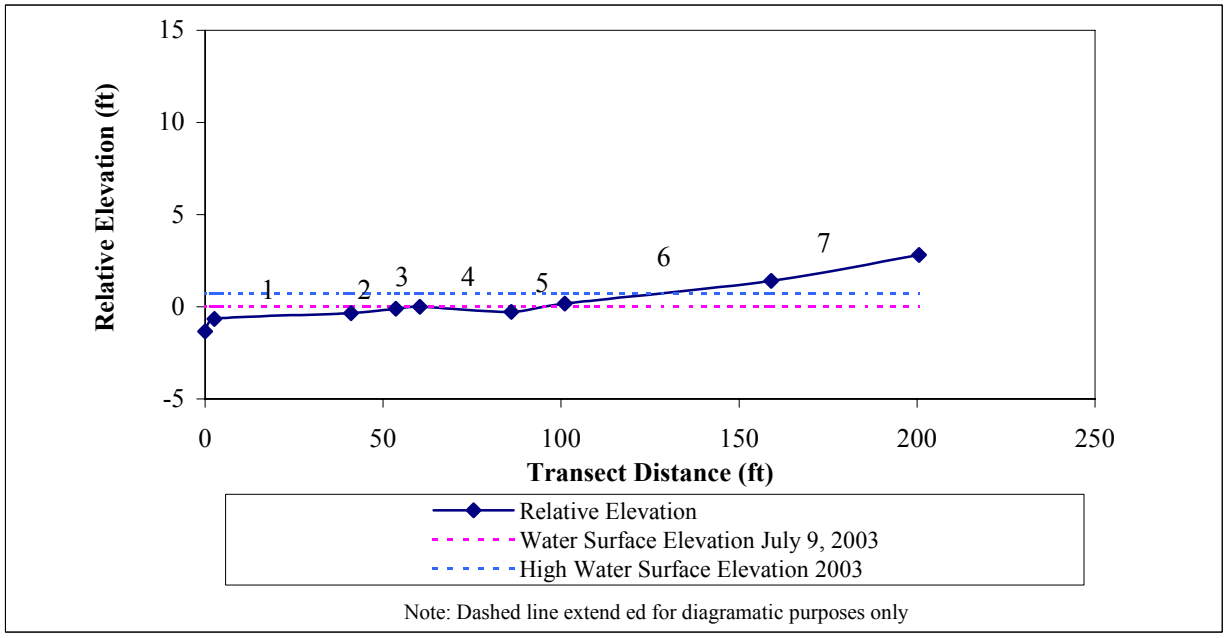


Figure 4.2.1-4. Loon Lake Reservoir Wetland Site 2: Transect 1. Y axis 0 at -1.0 ft water depth.

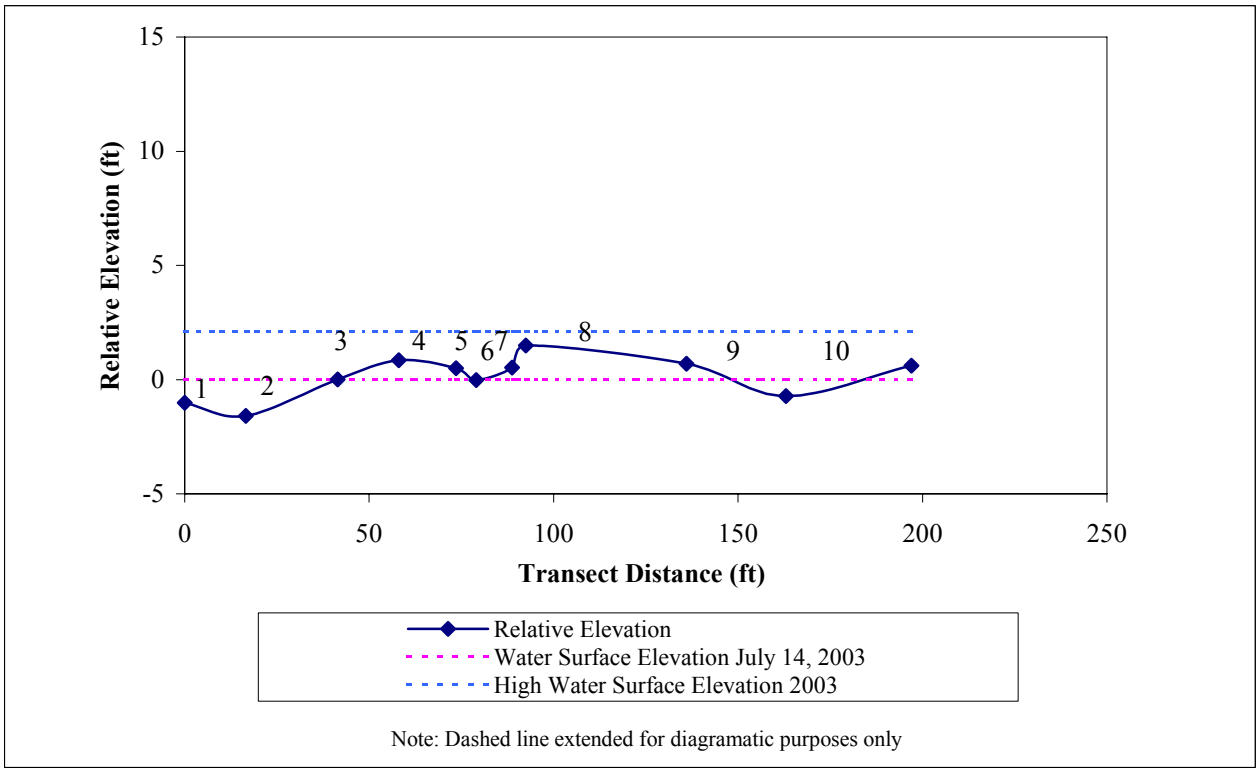


Figure 4.2.1-5. Loon Lake Reservoir Wetland Site 2: Transect 2. Y axis 0 at -1.0 ft water depth.

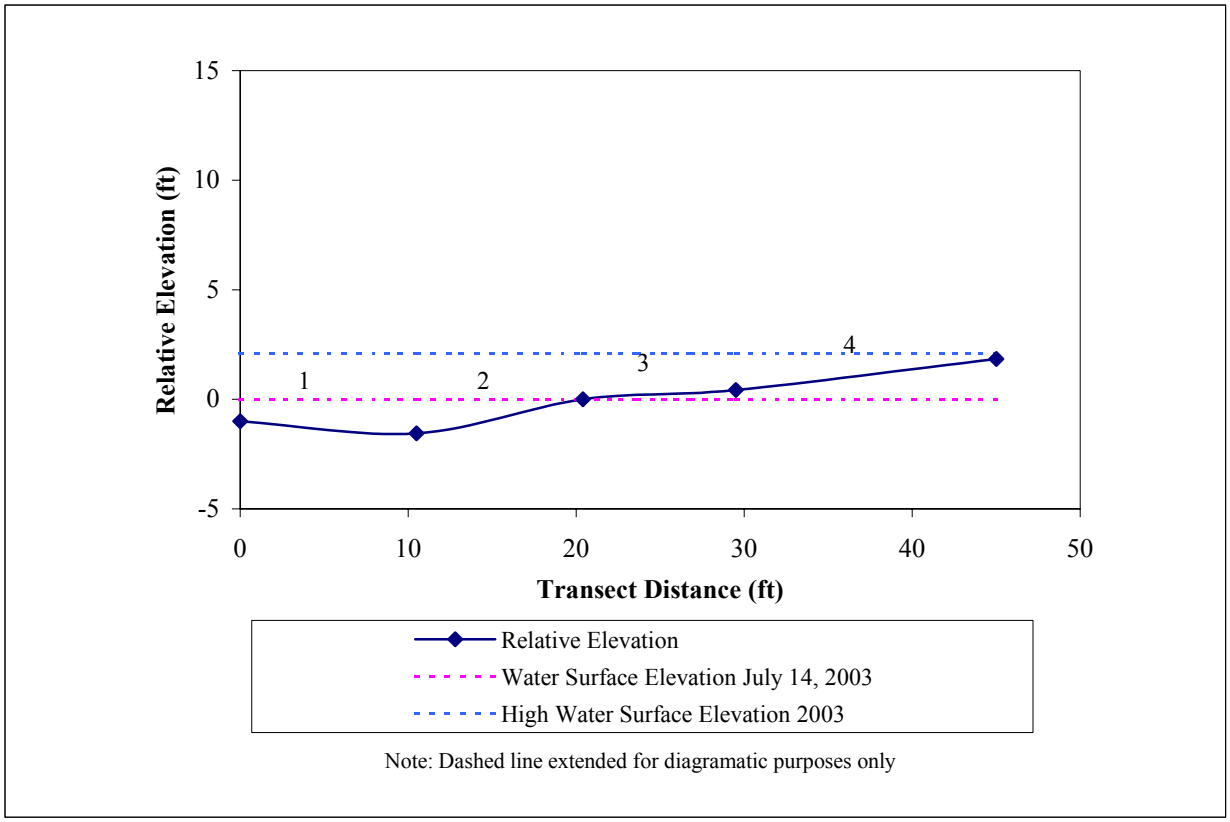


Figure 4.2.1-6. Loon Lake Reservoir Wetland Site 4. Y axis 0 at -0.4 ft water depth.

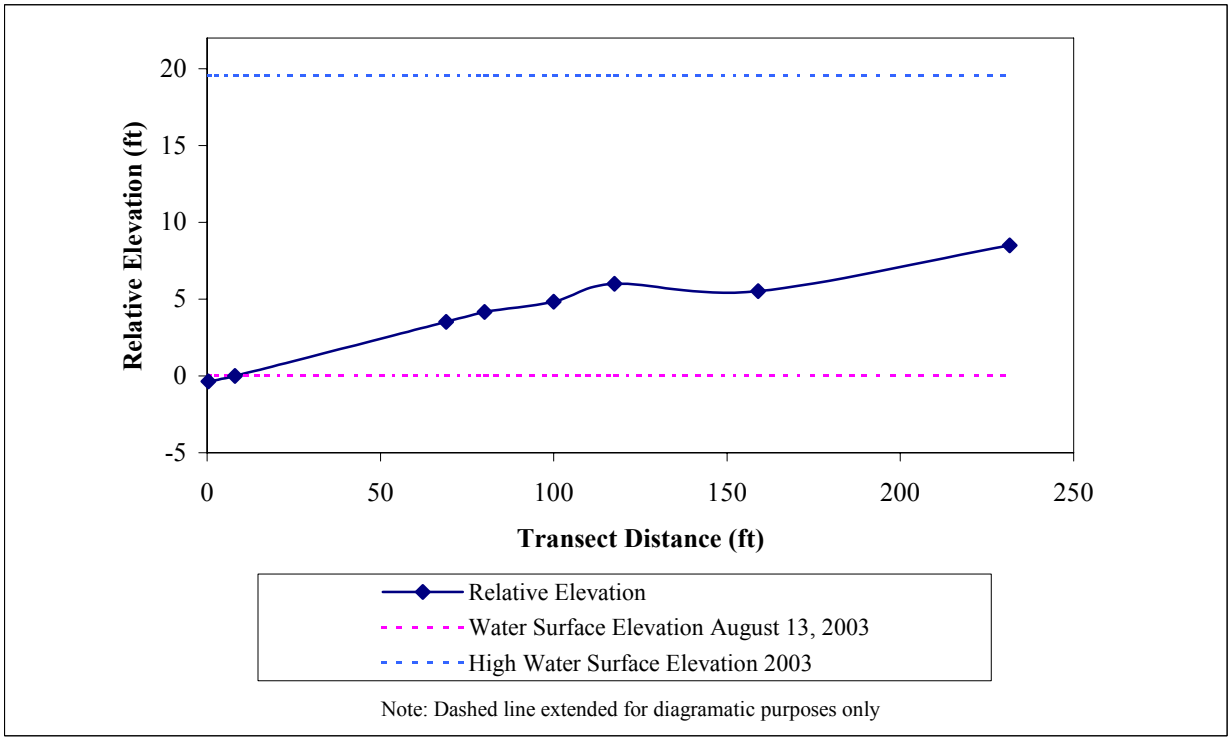


Figure 4.2.2-3. Gerle Creek Reservoir Wetland Site 1. Y axis 0 at -1.3 ft water depth.

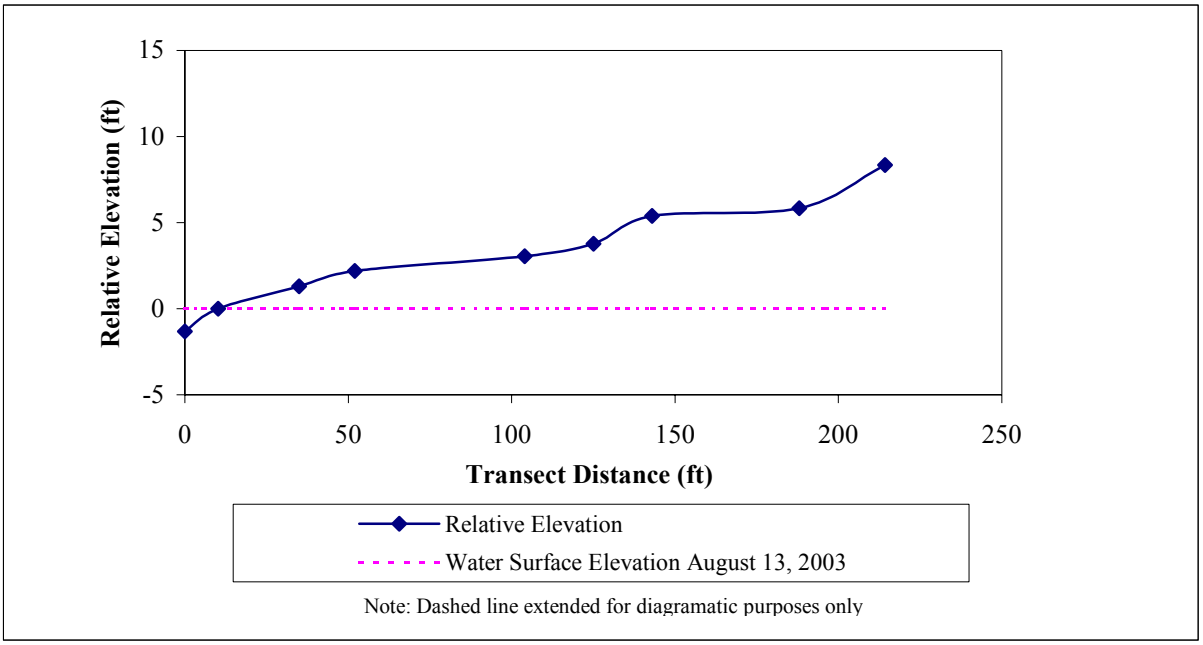


Figure 4.2.2-4. Gerle Creek Wetland Site 2. Y axis 0 at 0 ft water depth.

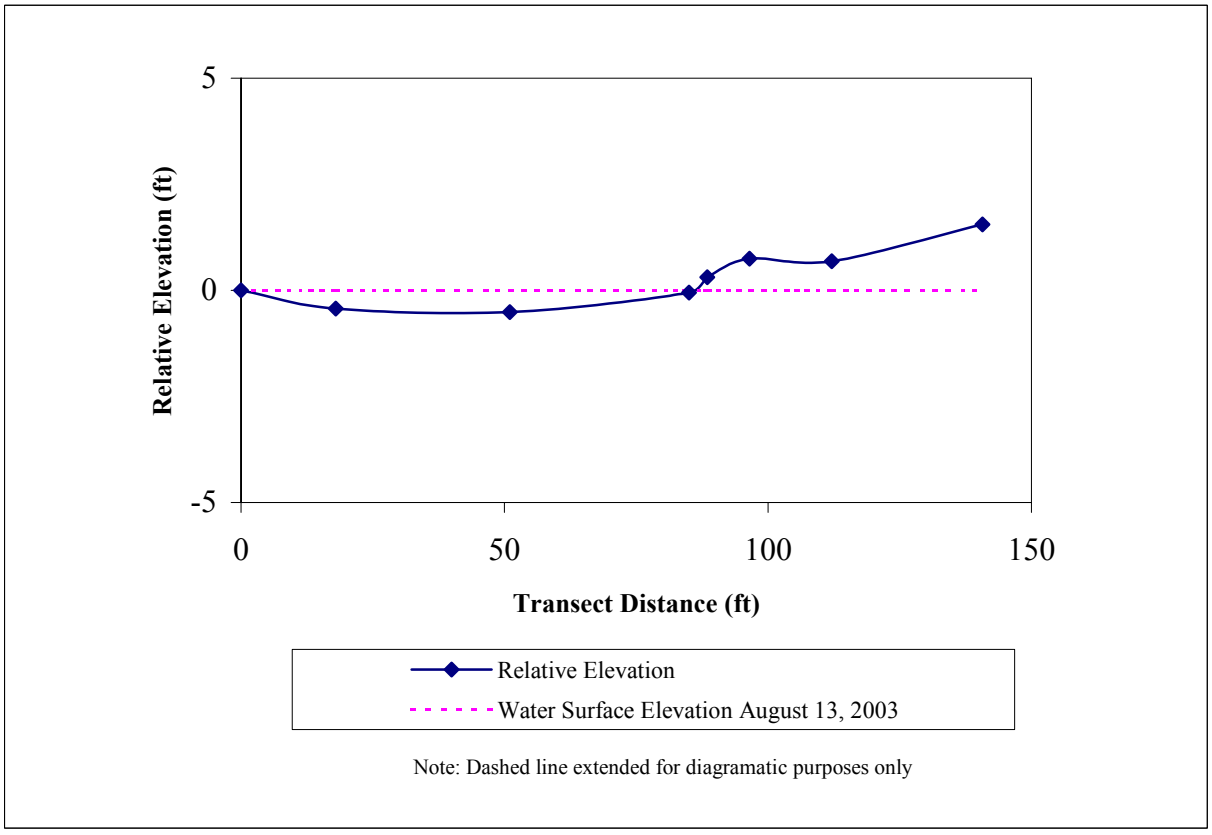


Figure 4.2.4-3. Union Valley Reservoir Wetland Site 1. Y axis 0 at 0.0 ft water depth.

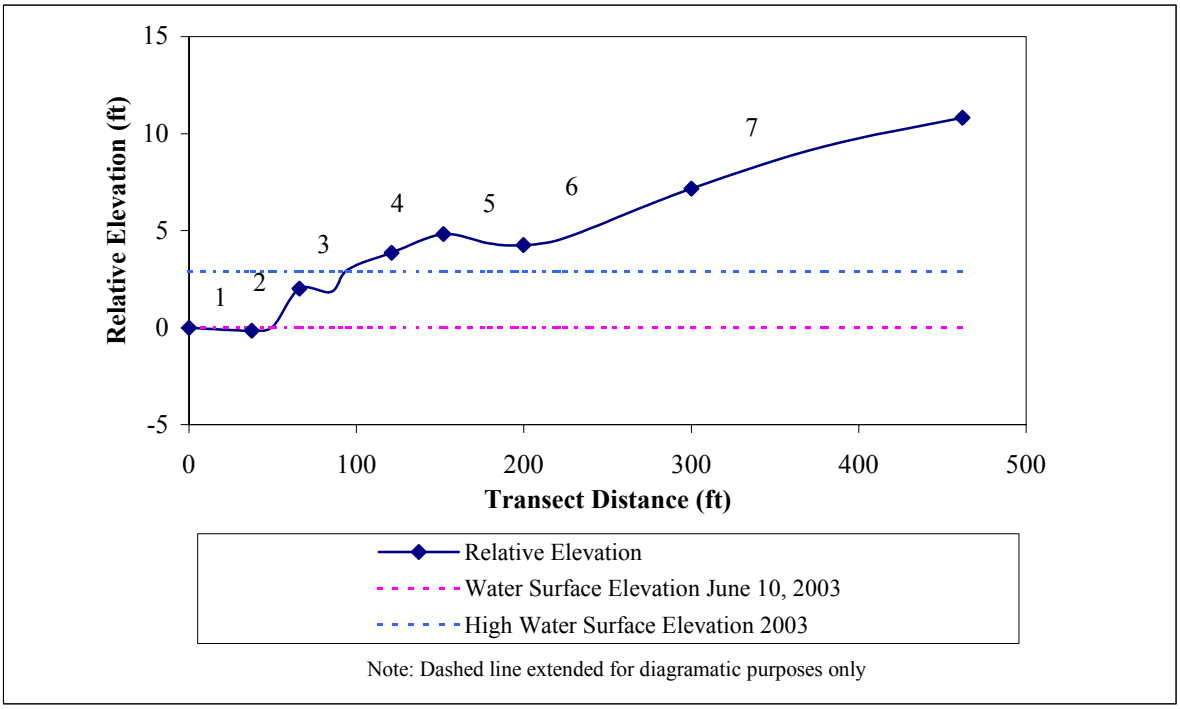


Figure 4.2.4-4. Union Valley Reservoir Wetland Site 2. Y axis 0 at 0 ft water depth.

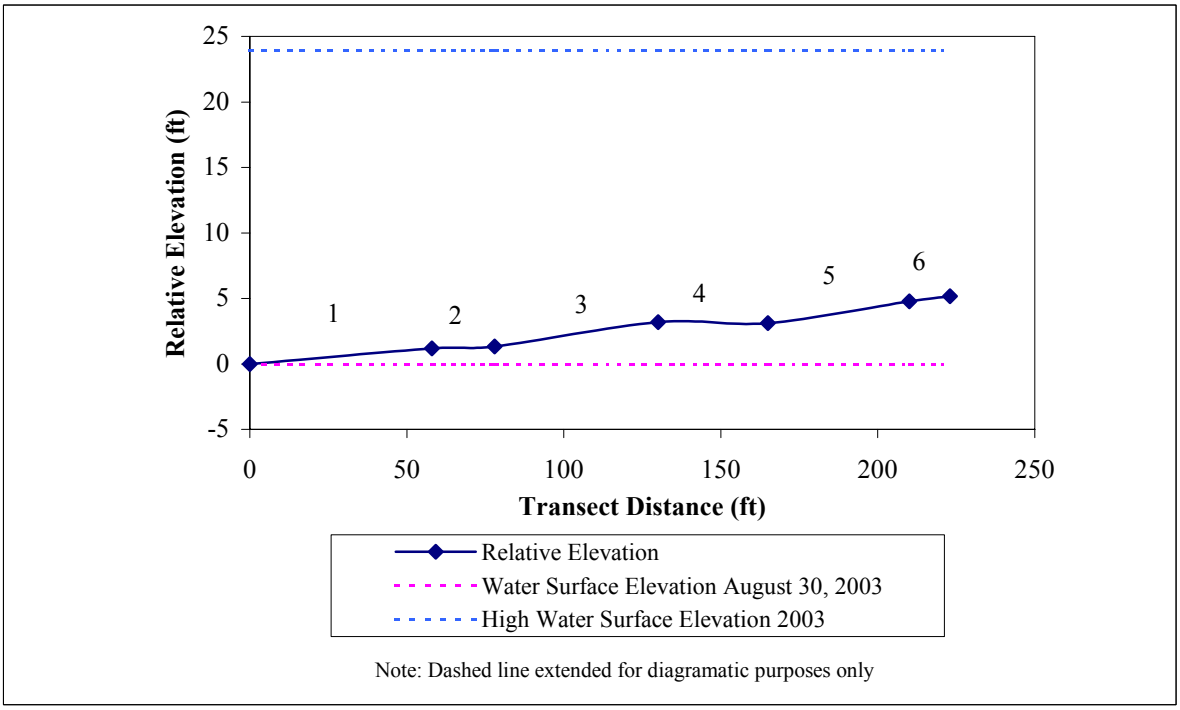


Figure 4.2.4-5. Union Valley Reservoir Wetland Site 3. Y axis 0 at 0 ft water depth.

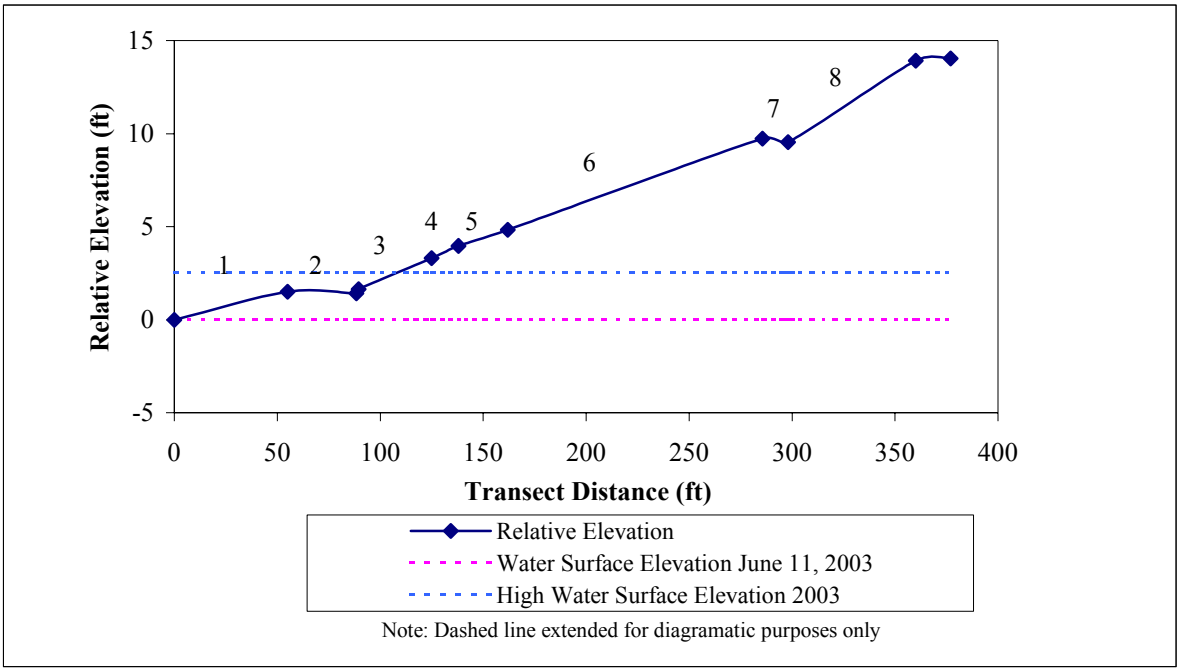


Figure 4.2.4-6. Union Valley Reservoir Wetland Site 4. Y axis 0 at 0 ft water depth.

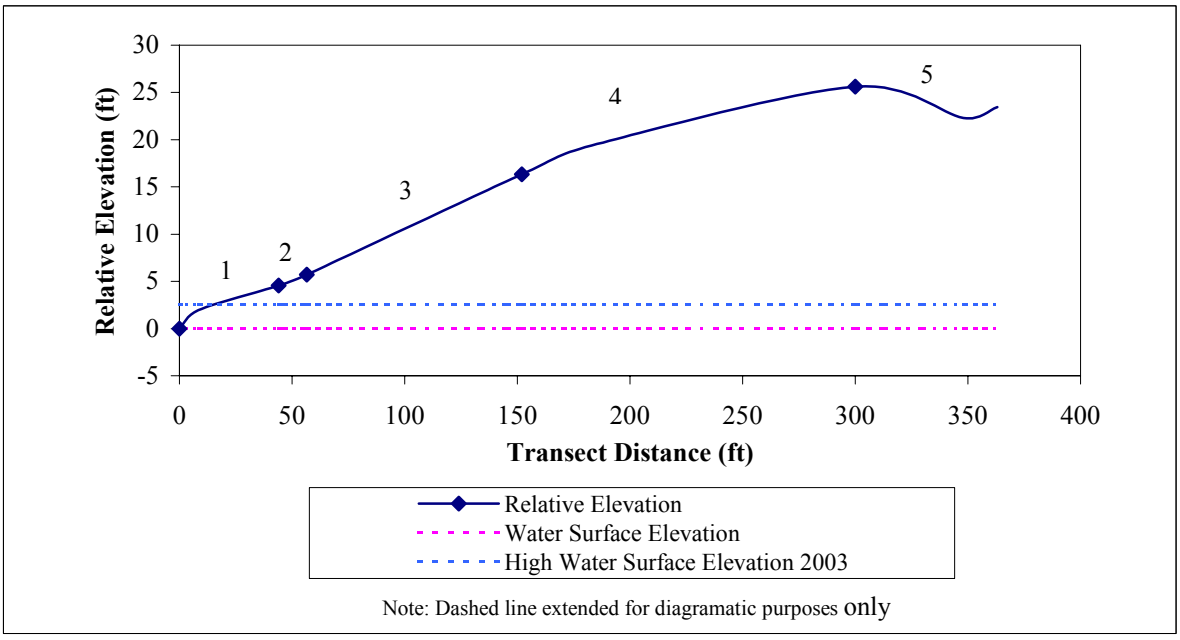


Figure 4.2.4-7. Union Valley Reservoir Wetland 5: Transect 1. Y axis 0 at -1.3 ft water depth.

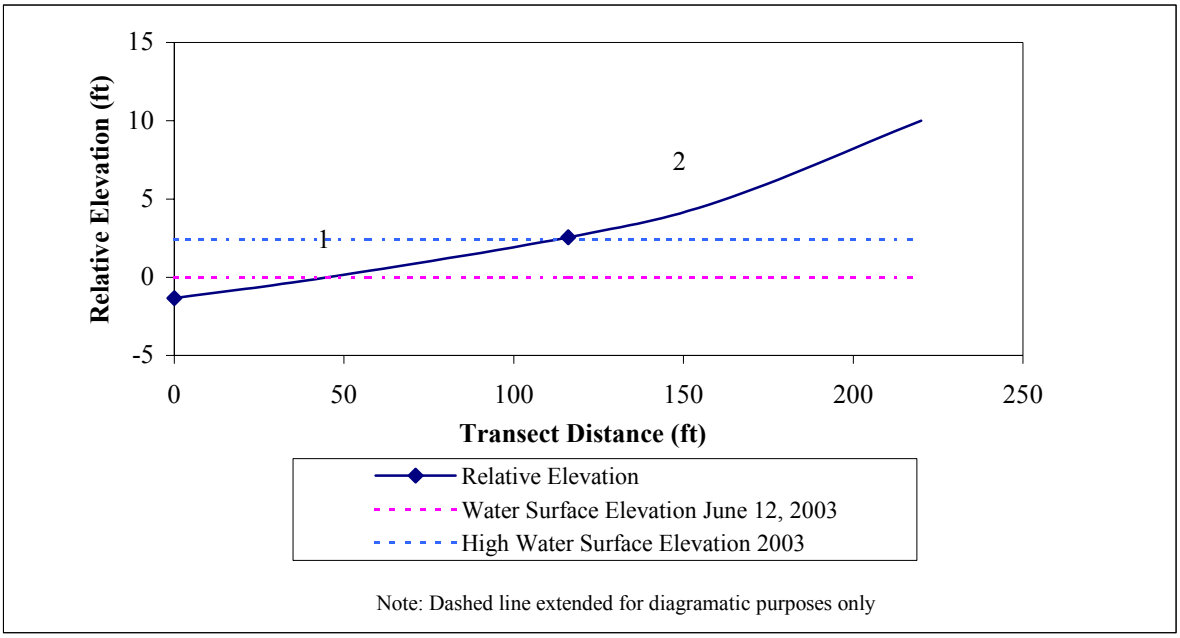


Figure 4.2.4-8. Union Valley Reservoir Wetland 5: Transect 2. Y axis 0 at -1.2 ft water depth.

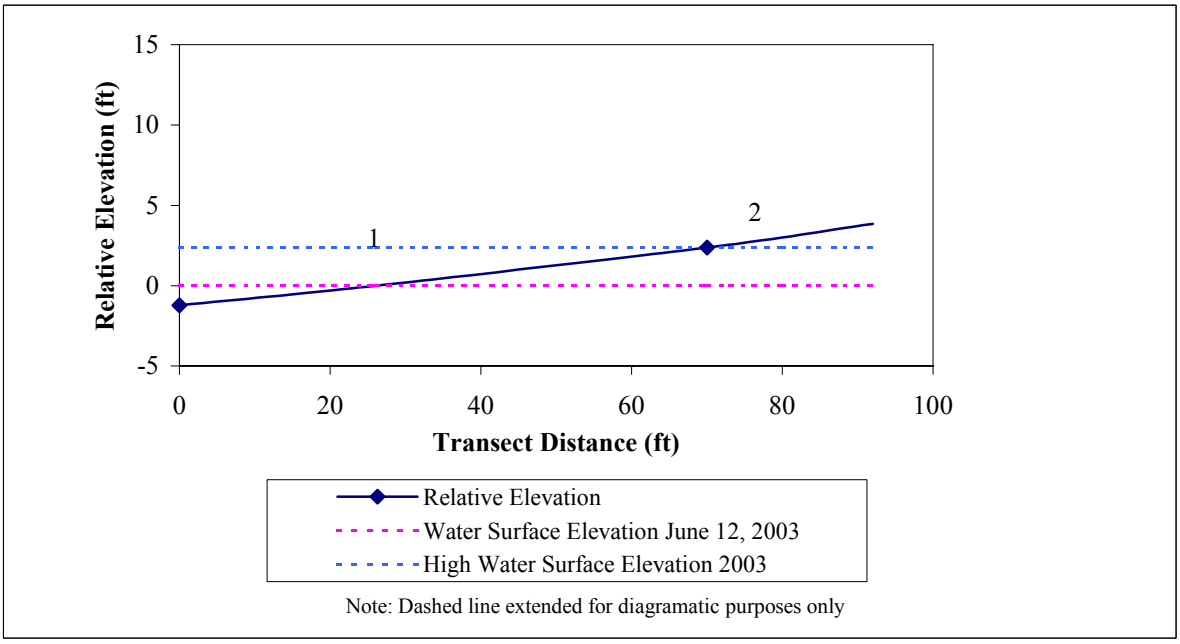


Figure 4.2.4-9. Union Valley Reservoir Wetland 6: Transect 1. Y axis 0 at -1.2 ft water depth.

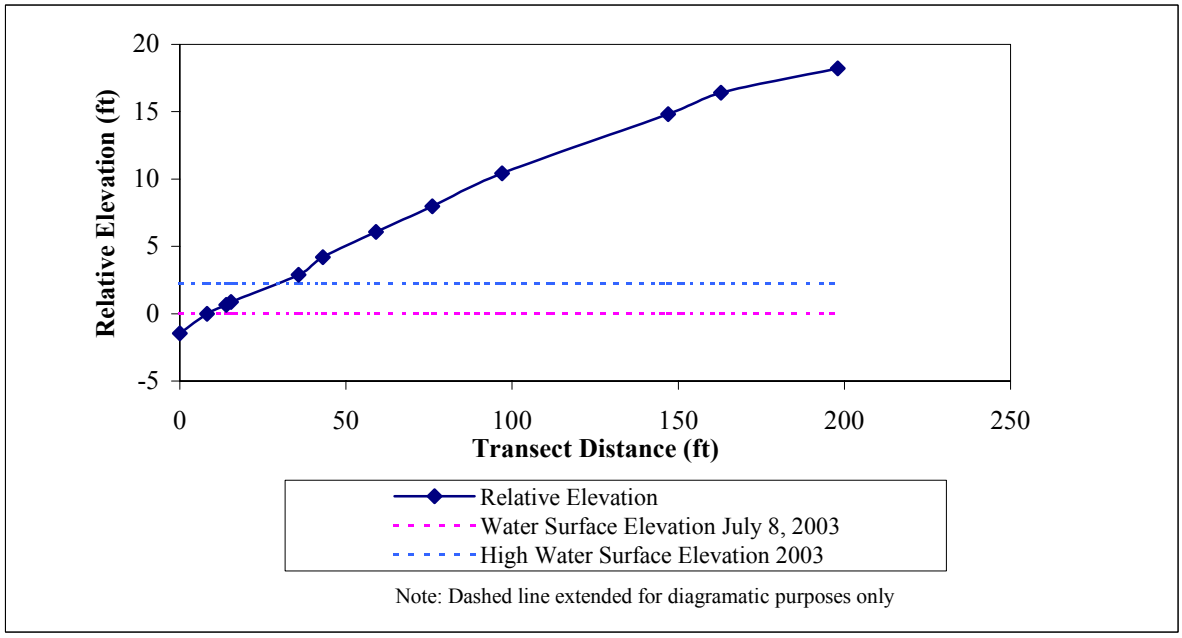


Figure 4.2.4-10. Union Valley Reservoir Wetland 6: Transect 3. Y axis 0 at -0.8 ft water depth.

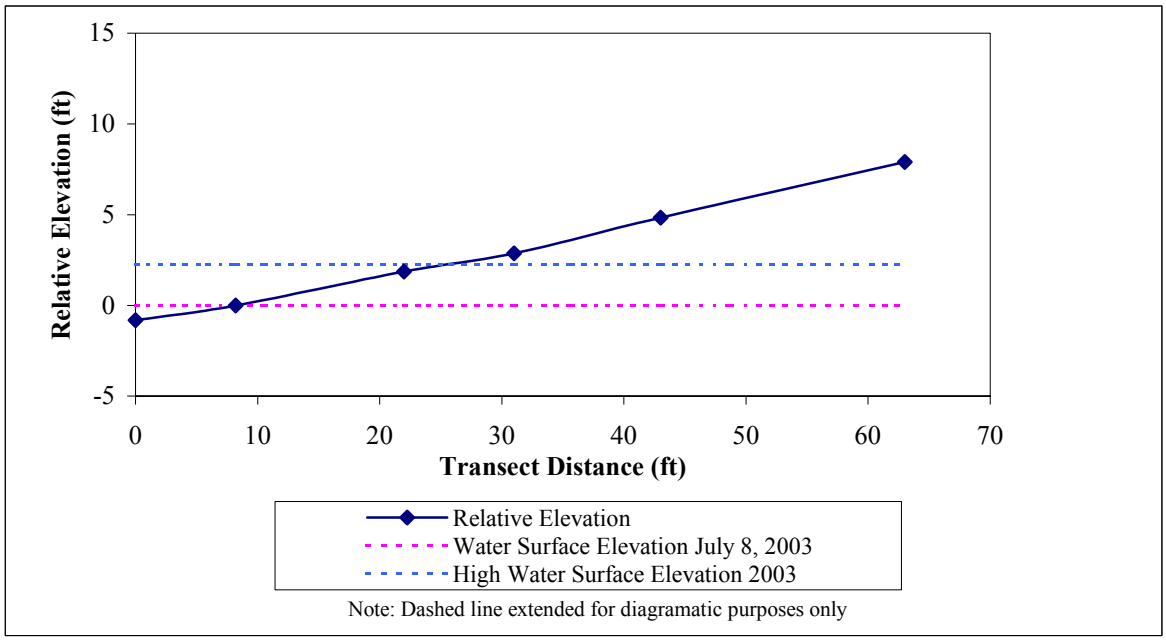


Figure 4.2.4-11. Union Valley Reservoir Site 10: Transect 1. Y axis 0 at -0.9 ft water depth.

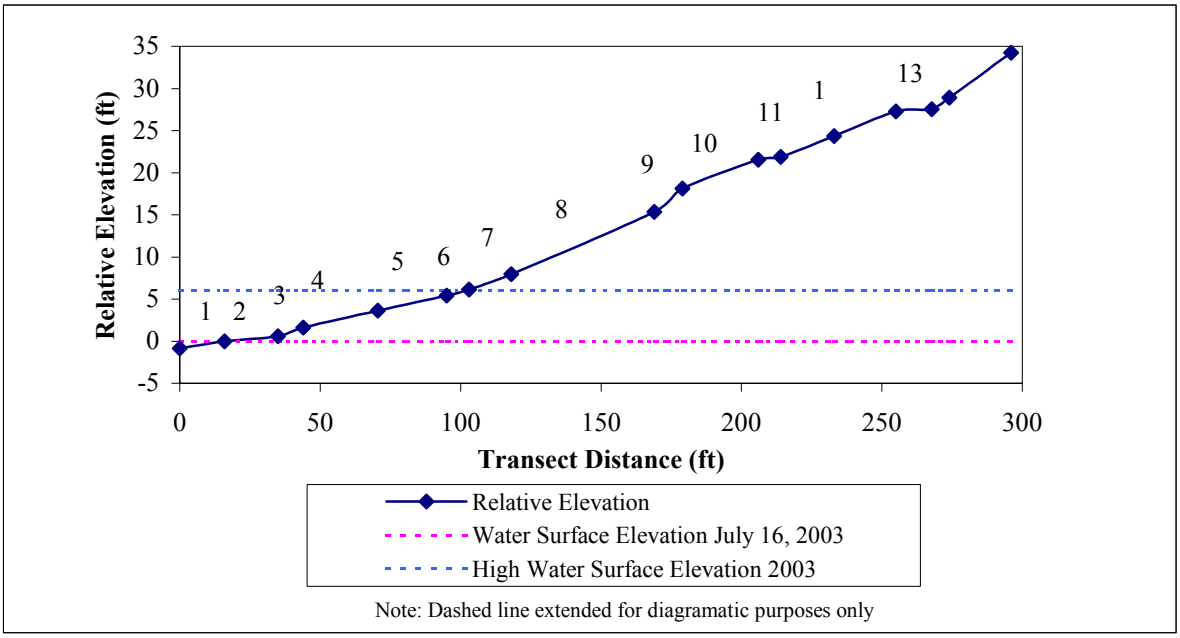


Figure 4.2.4-12. Union Valley Reservoir Wetland 10: Transect 2. Y axis 0 at -0.5 ft water depth.

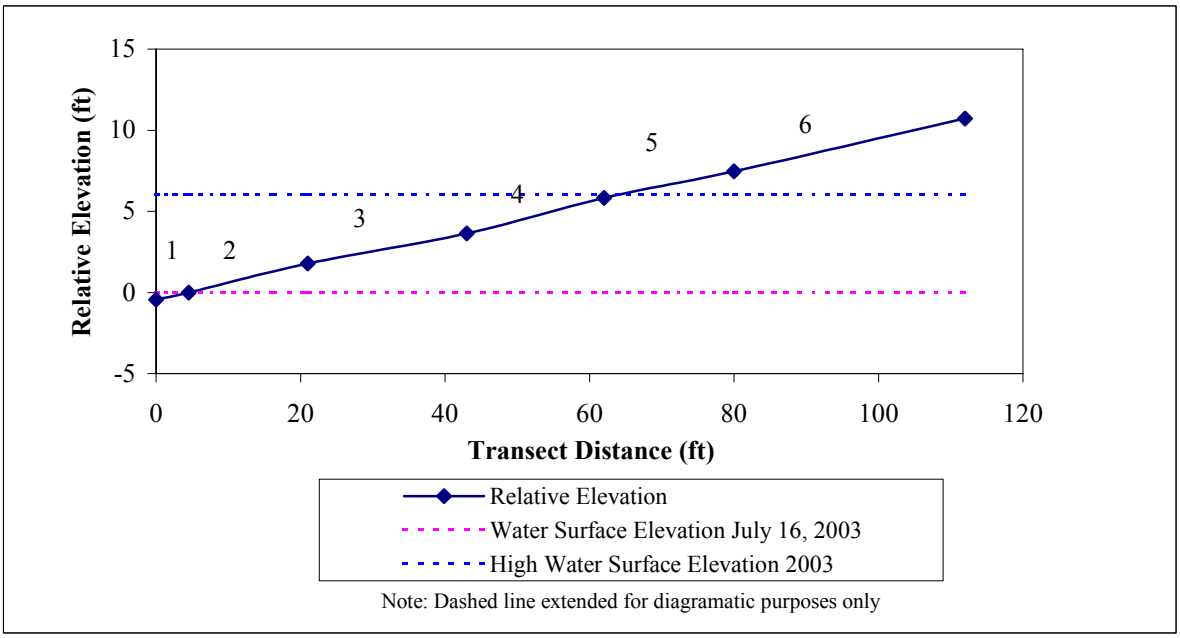


Figure 4.1.13-1. Reach Downstream of Chili Bar-Gorge Sub-Reach-Weber Creek: Transect 1. Transect is shown so that the left bank headpin is equal to a distance of 0.0 ft.

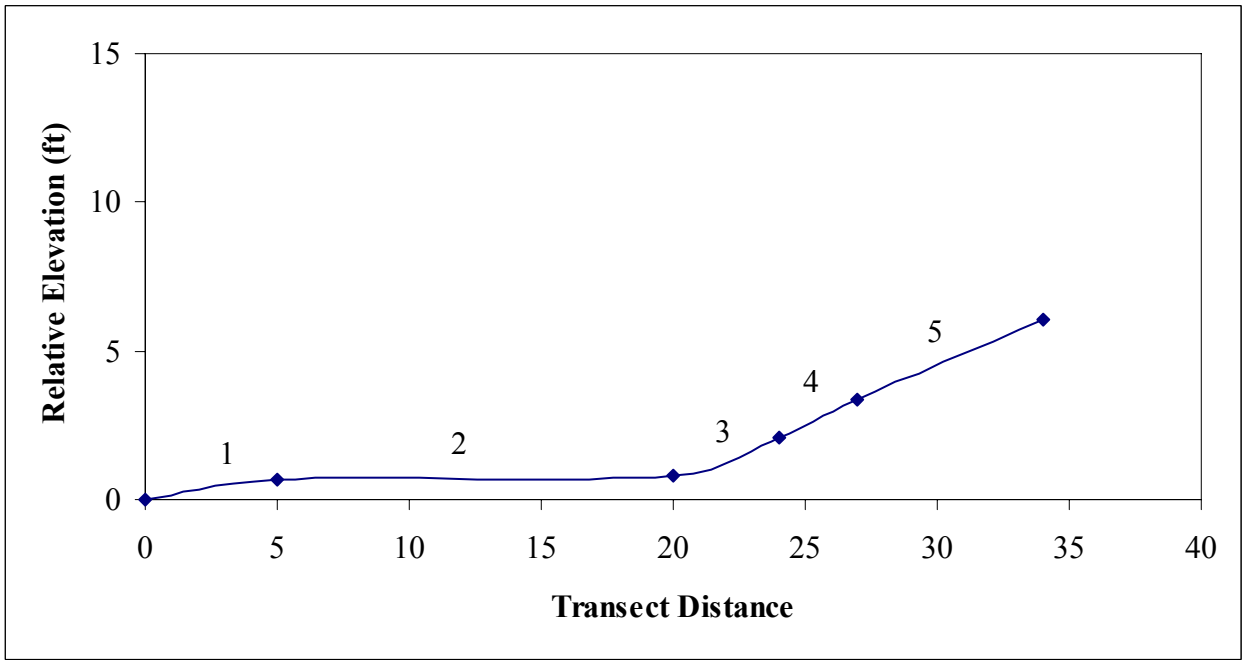


Figure 4.1.13-2. Reach Downstream of Chili Bar-Gorge Sub-Reach-Weber Creek: Transect 2. Transect is shown so that the left bank headpin is equal to a distance of 0.0 ft.

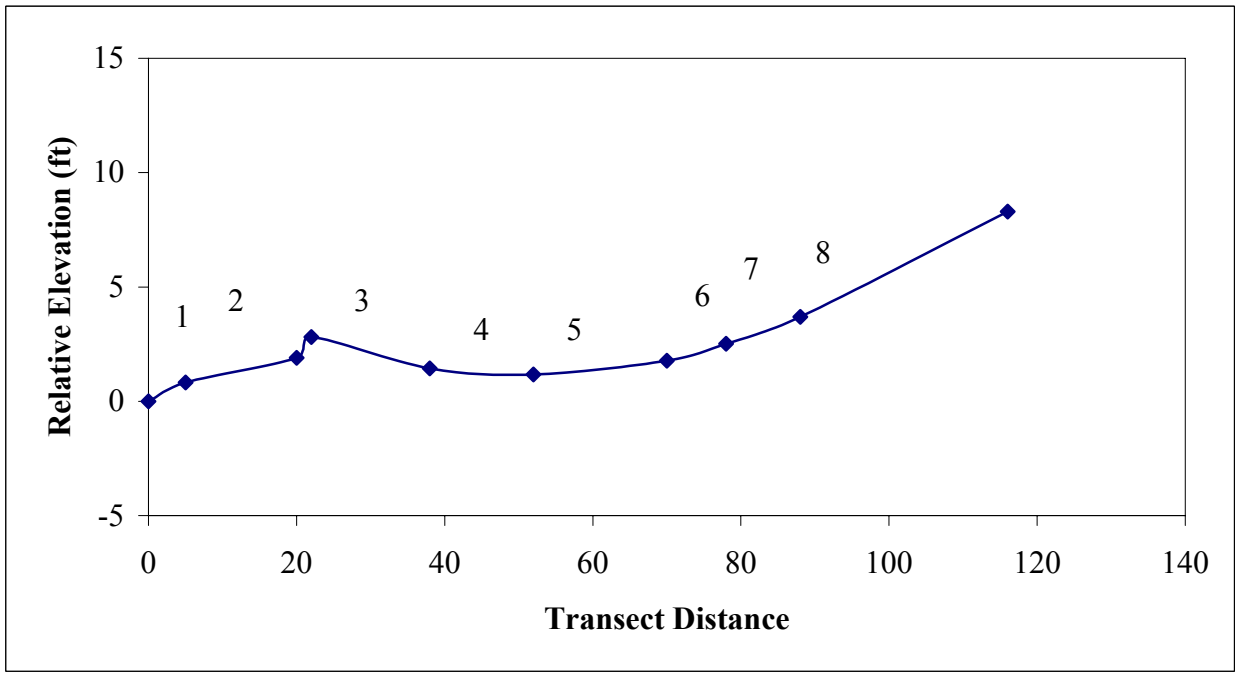


Figure 4.1.13-3. Reach Downstream of Chili Bar-Coloma Sub-Reach-Clark Creek Site: Transect 1. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft.

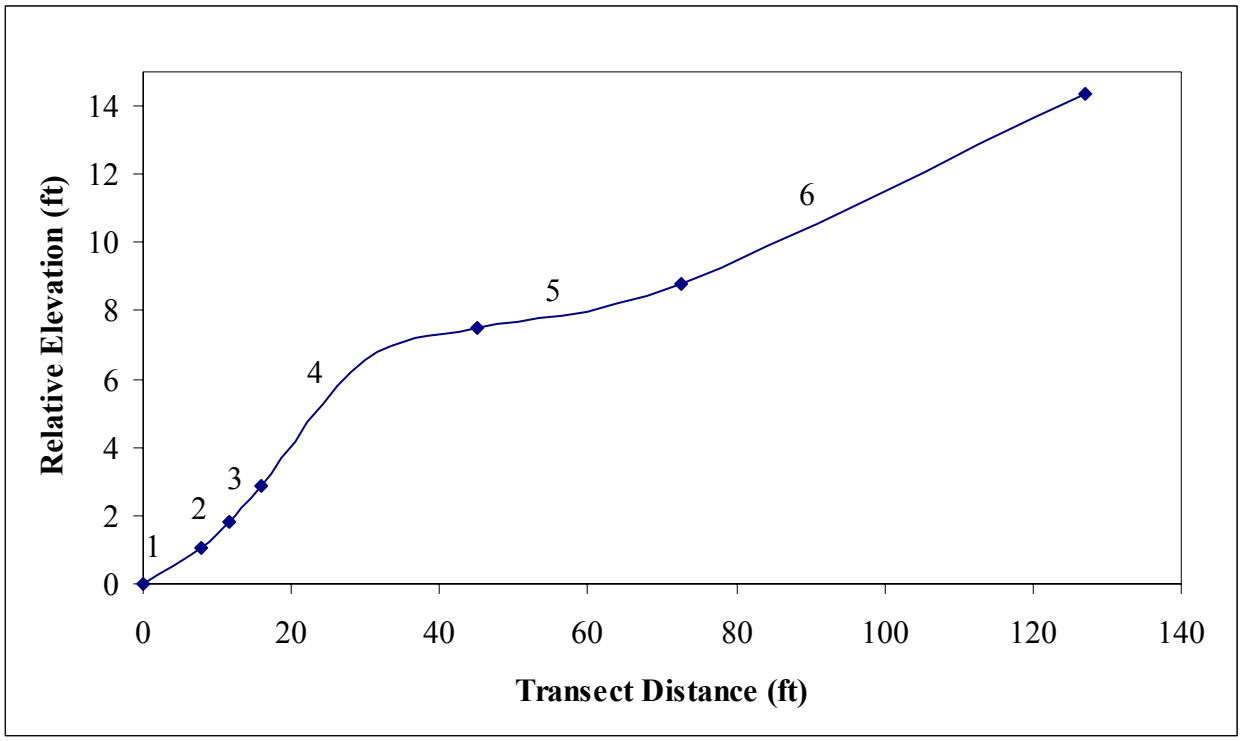


Figure 4.1.13-4. Reach Downstream of Chili Bar-Coloma Sub-Reach-Clark Creek Site: Transect 2. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft.

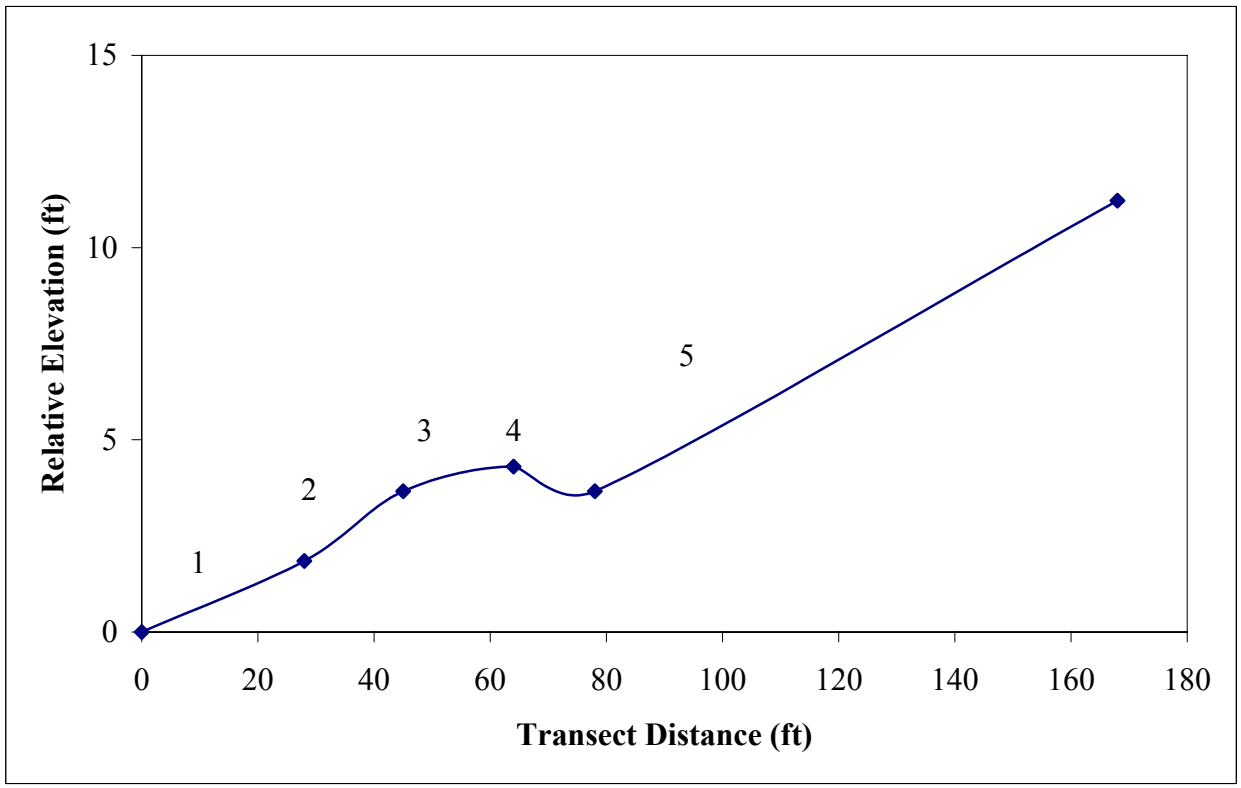


Figure 4.1.13-5. Reach Downstream of Chili Bar-Coloma Sub-Reach-Clark Creek Site: Transect 3. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft.

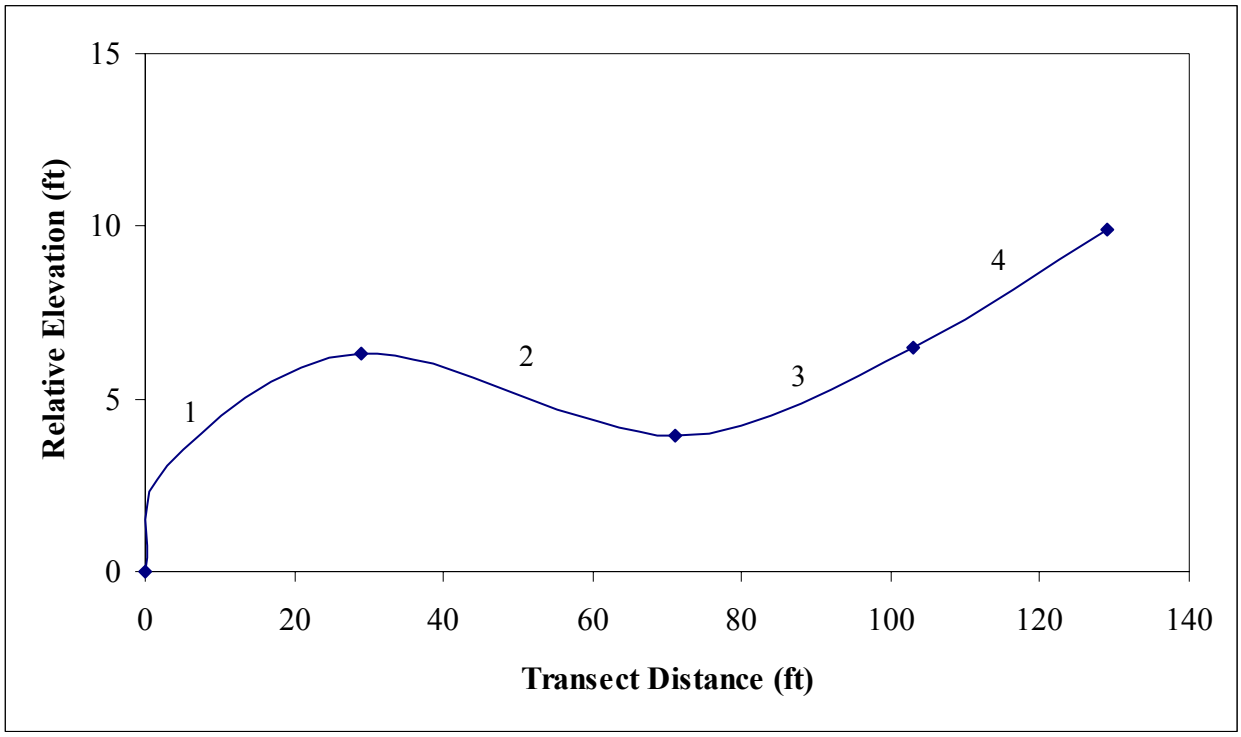


Figure 4.1.13-6. Reach Downstream of Chili Bar-Coloma Sub-Reach-Hastings Creek. Transect is shown so that the right bank headpin is equal to a distance of 0.0 ft.

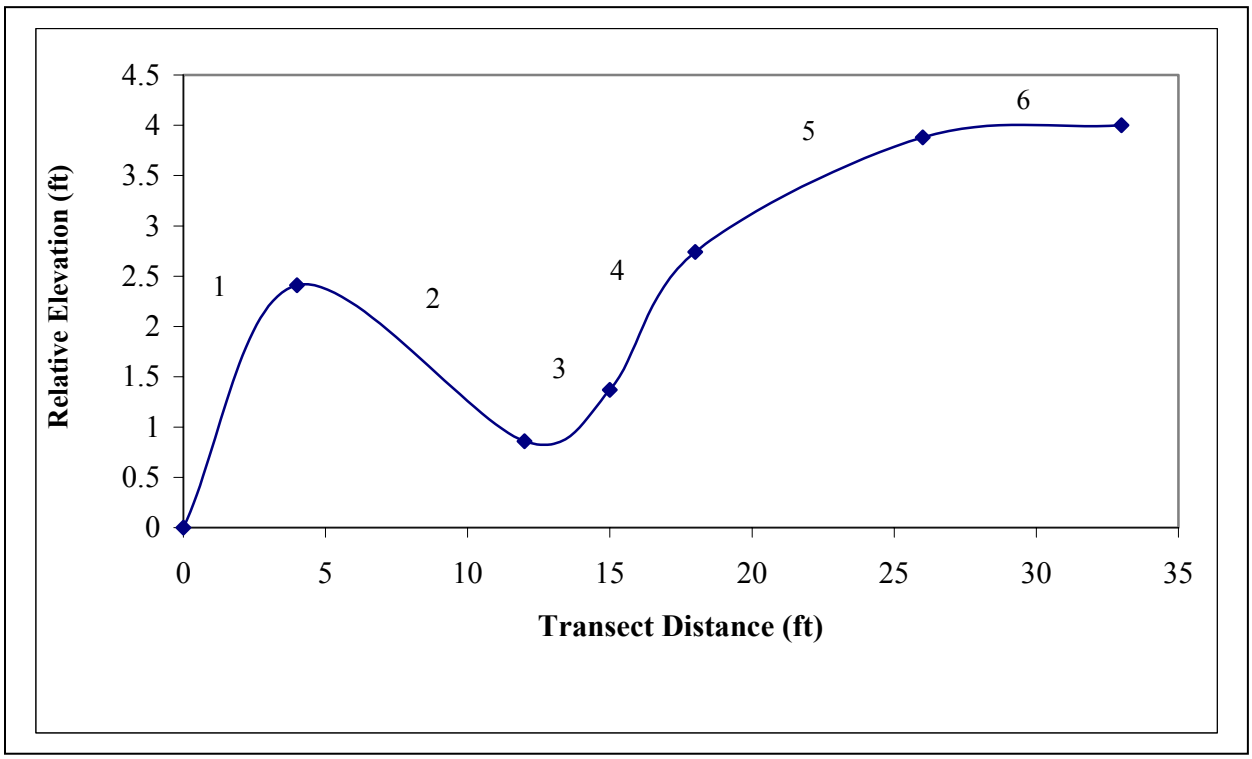


Figure 4.1.13-7. Reach Downstream of Chili Bar-Upper Canyon Sub-Reach: Transect 1. Transect is shown so that the left bank headpin is equal to a distance of 0.0 ft.

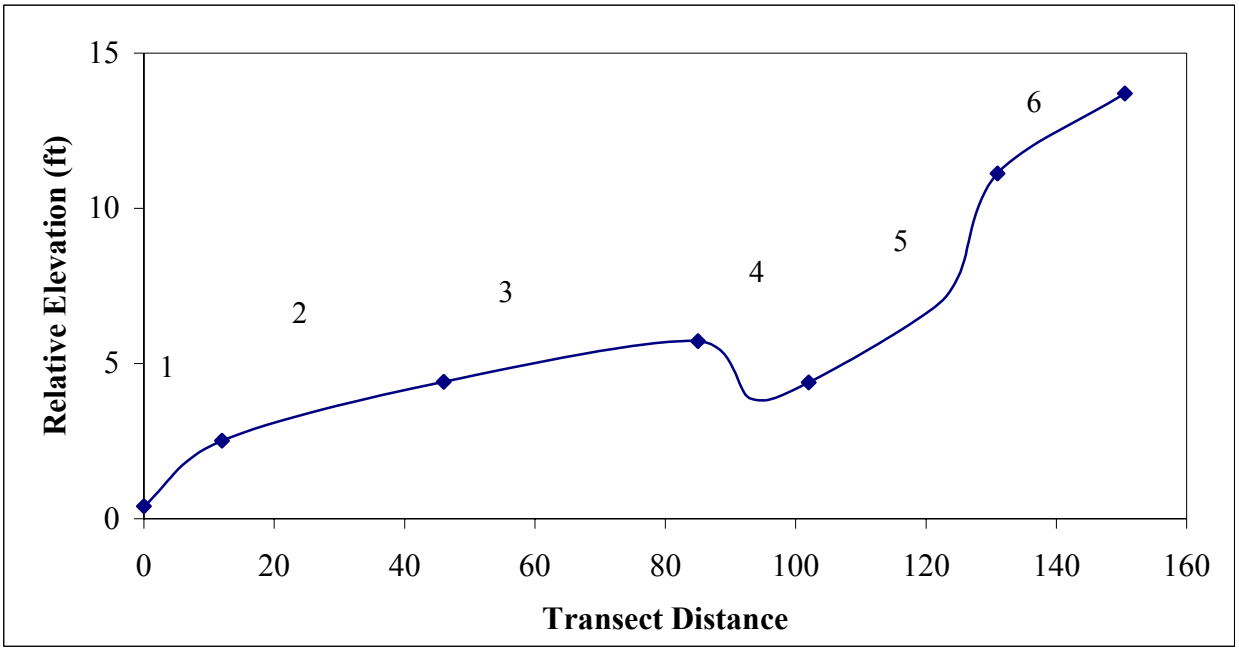


Figure 4.1.13-8. Reach Downstream of Chili Bar-Upper Canyon Sub-Reach: Transect 2. Transect is shown so that the left bank headpin is equal to a distance of 0.0 ft.

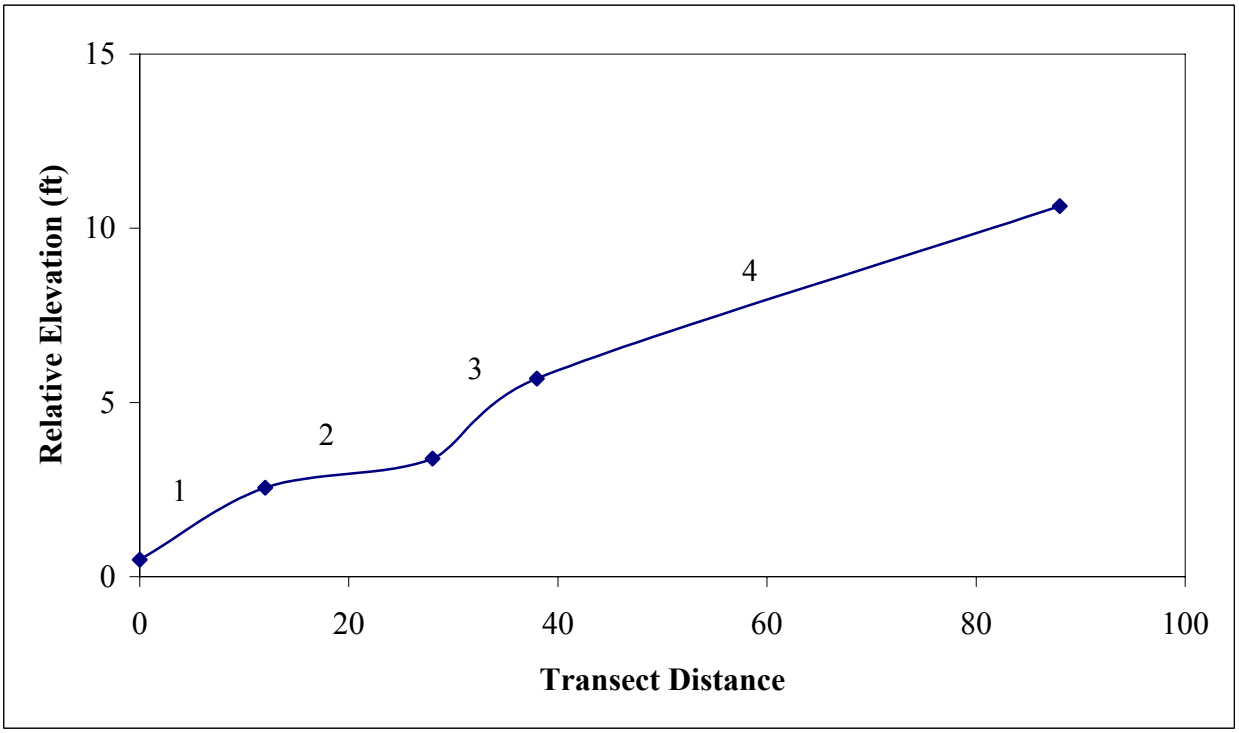
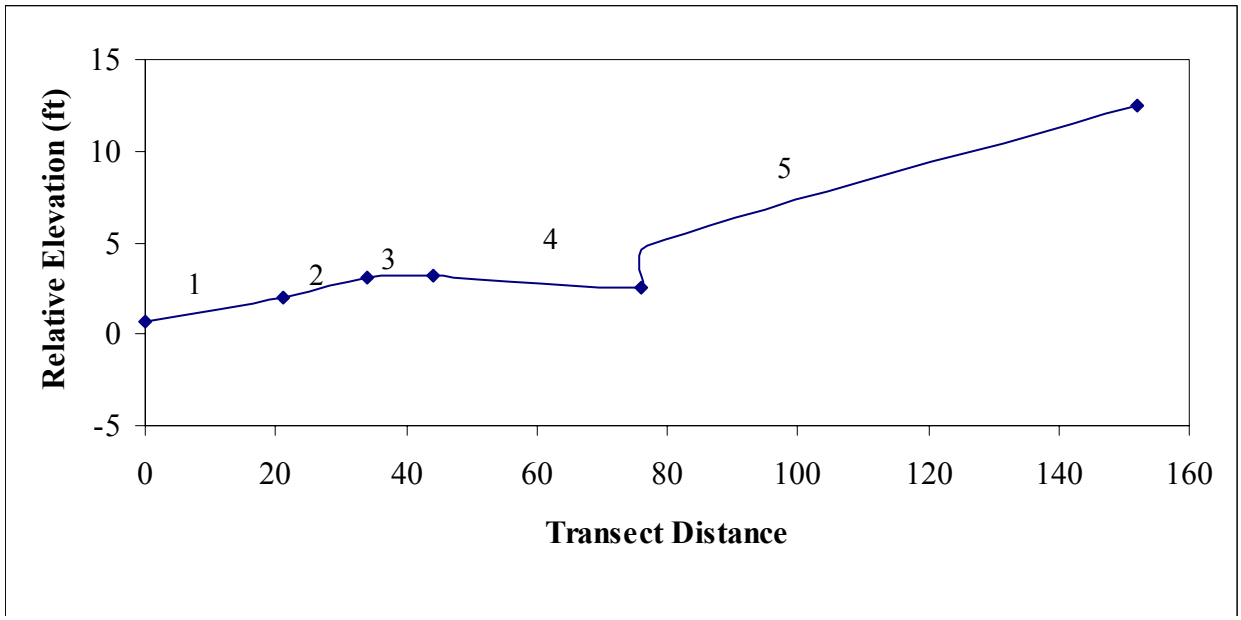


Figure 4.1.13-9. Reach Downstream of Chili Bar-Upper Canyon Sub-reach: Transect 3. Transect is shown so that the left bank headpin is equal to a distance of 0.0 ft.



APPENDIX F

REACH DOWNSTREAM OF CHILI BAR 1985 AND 2003 AERIAL PHOTOGRAPHS AND NWI MAPS

APPENDIX G

LOON LAKE DAM REACH 1940, 1952, 1976 AND 2002 AERIAL PHOTOGRAPHS