COMBINED AQUATICS STUDY PLANS

CAWG-11-RIPARIAN

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1.0 EXECUTIVE SUMMARY

In 2001 and 2002, the review of existing information, agency consultation, riparian vegetation mapping, helicopter reconnaissance survey, preliminary riparian data collection, and review of Rosgen Level 1.5 stream typing were completed.

A review of existing information on riparian species, riparian communities, and riparian systems was completed. Life history, germination, and habitat information was collected on all dominant species typically occurring in the riparian communities identified in the Big Creek ALP Project area. These species include: willows (*Salix* spp.), dogwoods (*Cornus* spp.), alders (*Alnus* spp.), cottonwoods (*Populus* spp.), quaking aspen (*Populus tremuloides*), bigleaf maple (*Acer macrophyllum*), oregon ash (*Fraxinus latifolia*), and western azalea (*Rhododendron occidentale*). A list of available historical aerial photography was developed.

Riparian vegetation mapping was completed through aerial photography interpretation and ground-truthing on all bypass and flow-augmented streams within the Project area. This information was incorporated into a GIS database. New false color infrared aerial photographs were taken specifically for the Big Creek ALP relicensing studies in 1-m pixel resolution in NAD83, Zone 11, Universal Transverse Mercator (UTM) projection within ½ mile of streams in the Project area. Black-and-white aerials at a 1-m pixel resolution, NAD83, Zone 11, UTM projection, from 1993 were obtained for the reservoirs within the Project area.

A helicopter reconnaissance survey was completed to collect more detailed information on the riparian vegetation identified within the Project area. This information was used to further distinguish the riparian vegetation into community types and was incorporated into a GIS database.

Preliminary riparian vegetation data was collected in conjunction with the CAWG-2, Geomorphology Study Report, field inventory. Data was collected during ground surveys along 25 miles of Project area streams. Information on riparian presence, length and width of riparian zone, species composition, age classes present, continuity, and percent cover was collected.

Geomorphology surveys were conducted on all Project area streams to collect information including: Rosgen Level 1.5 classifications; potential riparian encroachment; presence, distribution, frequency, and stability of channel bars; locations of floodplains; and erodibility and stability of streambanks. This information was incorporated into a GIS database.

Riparian vegetation communities, classified according to the *Preliminary Descriptions of Terrestrial Natural Communities in California* (Holland 1986), were noted within the Project area. These include: montane riparian scrub, white alder riparian scrub, white alder/montane riparian scrub, aspen riparian forest, and montane black cottonwood

riparian forest. The riparian vegetation in the Big Creek ALP Project vicinity is generally composed of narrow bands along steep, high gradient streams and is often interspersed with areas of unvegetated, boulder, or bedrock reaches. Where the terrain is level and open, the riparian zone is usually continuous, wider, and may merge into montane meadows.

2.0 STUDY OBJECTIVES

- Determine Project impacts on riparian communities.

3.0 STUDY IMPLEMENTATION

3.1 STUDY ELEMENT COMPLETED

- Mapped riparian communities by aerial photography interpretation and ground-truthing methods in conjunction with TERR-1, Vegetation Communities Study Report, based on agency consultation and review of existing information. This information was incorporated into a GIS database.

- Developed a list of historical aerial photography available in the Big Creek ALP Project area.

- Conducted a helicopter reconnaissance survey to identify and map in more detail the riparian habitat within the Project area.

- Collected preliminary riparian data in conjunction with CAWG-2, Geomorphology Study Report, surveys.

- Reviewed Rosgen Level 1.5 stream typing, collected as part of CAWG–2, Geomorphology Study Report.

3.2 OUTSTANDING STUDY ELEMENTS

- Compile and review pertinent data collected as part of CAWG-1, Characterize Stream and Reservoir Study Report; CAWG-2, Geomorphology Study Report; and CAWG-6, Hydrology Study Report.

- Based on review of existing information and preliminary data, select sample sites in bypass and flow-augmented reaches according to channel type, riparian vegetation type, and geomorphic and hydrologic condition; and reference sites that encompass the range of riparian plant community types and Rosgen channel types present in the bypass and flow-augmented reaches. Selection of qualitative and quantitative riparian study segments will be coordinated with geomorphology and hydrology studies and to the extent possible with fisheries and macroinvertebrates studies.

- Collect detailed riparian field data at all selected sample and reference sites.

- Assess the condition of riparian areas at representative sample and reference sites using Proper Functioning Condition (PFC) protocols (Prichard 1998 and 1999a).

4.0 STUDY METHODOLOGY

4.1 REVIEW OF EXISTING INFORMATION

Existing information on riparian systems was compiled and reviewed. This included a review of: (1) *An Ecosystem Perspective of Riparian Zones* (Gregory et. al 1991); (2) *Prescribing Flood Regimes to Sustain Riparian Ecosystems along Meandering Rivers* (Richter and Richter 2000); (3) *Impacts of Hydroelectric Development on Riparian Vegetation in the Sierra Nevada Region, California, USA* (Harris et. al 1987); (4) *Riparian Vegetation Response to Altered Disturbance and Stress Regimes* (Shafroth 2002); (5) *Function and Dynamics of Woody Debris in Stream Reaches in the Central Sierra Nevada, California* (Berg 1998); (6) *Riparian Area Management: A User Guide for Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas* (Prichard 1999a); (7) *Riparian Area Management: Using Aerial Photographs to Assess Proper Functioning Condition of Riparian-Wetland Areas* (Prichard 1999b); (8) *Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas* (Prichard 1998); (9) *Riparian Area Management: Observing Physical and Biological Change Through Historical Photographs* (Hindley 1996); (10) *Effects of Damming and Flow Stabilization on Riparian Processes and Black Cottonwoods along the Kootenay River* (Polzin and Rood 2000); (11) Ecological and geomorphological concepts for instream and out-of-channel flow requirements (Hill et. al. 1991); (12) Relationships between flood frequencies and riparian plant communities in the Upper Klamath Basin, Oregon (Chapin et. al. 2002); and (13) other documents that are referenced throughout the text.

4.2 HISTORICAL AERIAL PHOTOGRAPHY

A list was developed of historical aerial photography available in the Big Creek ALP Project area. Information was collected about each photograph including general location, year, scale, and film type (i.e., black and white, color).

4.3 RIPARIAN VEGETATION MAPPING

Aerial Photography Interpretation and Ground-Truthing

Riparian vegetation was mapped from aerial photography interpretation and ground-truthing methods in conjunction with TERR–1, Vegetation Communities Study Report. For a detailed methodology, refer to TERR–1, Vegetation Communities Study Report. False color infrared aerials were flown in 1-m pixel resolution in NAD83, Zone 11, UTM projection within ½ mile of streams in the Project area. Black-and-white aerials at a 1-m pixel resolution, NAD83, Zone 11, UTM projection from 1993 were obtained for the reservoirs within the Project area. Riparian communities were delineated as polygons with a minimum ¼-acre size during aerial photography interpretation. Thirty percent of

these polygons were ground-truthed. The remaining 70 percent were verified during helicopter reconnaissance surveys.

Helicopter Reconnaissance Survey

In the fall of 2001, helicopter reconnaissance surveys were conducted to collect riparian vegetation community information in finer detail than the riparian vegetation mapping completed through aerial photography interpretation. The surveys were completed by two botanists on November 19 and 20, 2001, and consisted of an overflight of all Project bypass and flow-augmented reaches. Photographs, species composition information, GPS coordinates, and descriptions of the extent of riparian present along bypass and flow-augmented reaches within the Project area were collected. This information was incorporated into a GIS database. Species composition information was used to further categorize the delineated riparian vegetation into community types. Riparian community classification was based on *Preliminary Descriptions of Terrestrial Natural Communities in California* (Holland 1986) and cross-referenced to the series in *A Manual of California Vegetation* (Sawyer & Keeler-Wolf 1995).

Information collected during the helicopter surveys was used in conjunction with aerial photography interpretation to locate riparian vegetation that did not have a large enough extent (i.e., riparian less than ¼-acre) to be included in the vegetation polygons. These areas were incorporated into a GIS layer and are displayed as lines and points. Each line represents the length of a riparian vegetation corridor. The line is displayed as either continuous or non-continuous. The continuous line represents an uninterrupted corridor of riparian vegetation. The non-continuous line represents a length of riparian vegetation that is either sparse, scattered, or consists of patches of riparian vegetation. The mapped line does not represent the width of the riparian vegetation corridor. Each line can vary in width from one to four shrubs. Points represent patches of vegetation that are not large enough to be represented as polygons and are not continuous with the surrounding riparian vegetation and therefore, cannot be represented as a line. Each point and line is also designated by a riparian vegetation community type.

Geomorphology Data Collection

Geomorphology information was collected during 2001 and 2002 and is displayed with the riparian vegetation mapping results. A summary of geomorphology data is provided below. This includes river station miles, geomorphic classification based on Rosgen Level 1.5, inactive and active channel bars, floodplains, streambank erodibility, and potential riparian encroachment.

- River mile stationing was completed in increments of 0.1 miles using GIS to establish a standardized spatial reference.

- Geomorphic classification of Project area streams was performed based on Rosgen (1996) and on data collection that is intermediate between Rosgen Level I and II, as discussed with the CAWG. This classification is referred to as Level 1.5.

- Channel bars were identified and determined to be active or inactive, based on evidence of recent mobility or stability, including the presence of riparian vegetation growing on the bars.

- Floodplains are identified at locations where there is a valley flat adjacent to a channel reach that is moderately to weakly entrenched, and where the valley flat on either side of the stream is at least twice the estimated bankfull width of the channel.

- Entrenchment is defined as the vertical containment of a river and the degree to which it is incised in the valley floor (Kellerhalls et al. 1972). Bankfull width was measured using field indicators as outlined in *Stream Channel Reference Sites: An Illustrated Guide to Field Technique* (Harrelson et al. 1994). Bankfull indicators include changes in bank slope, presence of woody riparian vegetation, changes in particle size of bank materials, and other features such as bank undercuts, stain lines, and the top of bars or localized bank deposition.

- Streambank erodibility was categorized using a combination of aerial and ground surveys as either “erodible” or “non-erodible” based on the streambank composition and susceptibility to erosion or scour.

- Potential riparian encroachment (i.e., vegetation within the existing or former bankfull channel) was identified and classified as dense and continuous or limited and discontinuous. Because the geomorphology classification of riparian encroachment includes presence of riparian in the bankfull channel, further clarification of this information in relation to the riparian mapping is provided below.

A riparian vegetation encroachment rating for geomorphology studies was based on the relative density and maturity of vegetation, and extent of establishment. It was not determined by the presence of vegetation within the active channel only, but rather, vegetation anywhere within the bankfull width. The bankfull width represents the width of the channel at bankfull stage flows based on average flows occurring at a frequency of every 1.5 to 2 years (Mount 1995).

Typically, riparian vegetation is limited to the margins of the active channel during average runoff years. During the summer, the banks and exposed bars are covered with willow, alder, and other seedlings or sprouts. Riparian seedlings are usually inundated and scoured during moderate flows approaching bankfull discharge (Mount 1995). During extended periods of drought, gravel bars and banks may become colonized by riparian vegetation that can establish extensive root systems. These root systems are resistant to scour by bankfull flows. Dams are known to mimic the effects of long-term droughts on riparian vegetation. Reduced peak flows, can cause establishment of vegetation on bars and banks within the formerly unvegetated cross-sectional area of the channel.

Designation of potential riparian encroachment could consist of some of the following examples: a few mature woody shrubs on a channel bar; a narrow band of riparian vegetation above the active channel, but within the bankfull width; a few woody shrubs

rooted on the bed of the channel; and an extensive amount of riparian vegetation within the bankfull width and some vegetation also within the active channel. A schematic showing vegetation above the active channel, but within the bankfull width is provided in Appendix A. The intent of designating areas of potential encroachment during the 2002 geomorphology surveys was to "red-flag" stream reaches that may be considered for additional, quantitative study in order to confirm encroached conditions or to describe the extent of encroachment in greater detail. Designations of potential encroachment, at this time, are not definitive statements of an encroached condition. Areas that are designated as potentially encroached can be simply a few shrubs within bankfull width. Refer to CAWG 2, Geomorphology Study Report for study results.

Preliminary Riparian Data Collection

In the summer of 2002, preliminary riparian data was collected in conjunction with the geomorphology field inventory. Data was collected during ground surveys along 25 miles of Project area streams. Refer to CAWG-2, Geomorphology Study Report, for a detailed methodology. This information was not required as part of the Final Technical Study Plan Package (SCE 2001) for CAWG-11, but was requested through consultation with the CAWG during development of data sheets for CAWG 2, Geomorphology Study Report. Project area streams were inventoried using a sub-sampling procedure based on stream size. An inventoried study reach length was equivalent to approximately 25 bankfull widths. Every third study reach length within the same Rosgen Level 1.5 stream type was inventoried. This sub-sampling protocol was developed with approval from the CAWG in the spring of 2002.

A datasheet for the preliminary riparian data collection was developed with the CAWG and the Riparian Subgroup. The preliminary riparian data collected includes information on riparian presence, length and width of riparian zone, composition, age classes present, continuity, substrate, and percent cover. Preliminary riparian data was collected during the weeks of August 5 to 9, August 19 to 22, and September 9 to 12, 2002. This information was compiled and used as a cross-check for the riparian vegetation mapping.

5.0 STUDY RESULTS AND ANALYSIS

5.1 REVIEW OF EXISTING INFORMATION

Riparian Vegetation Communities

A description of each riparian vegetation community found in the Project area is provided below. The descriptions are based on the *Preliminary Descriptions of Terrestrial Natural Communities in California* (Holland 1986). Representative photographs of each community are provided in Appendix B. Elevation ranges of these riparian vegetation communities in the Project area are represented by the schematic provided in Appendix C.

Montane Riparian Scrub (Holland code #63500) consists of open to dense, shrubby riparian thickets and is widely scattered above 5,000 and 7,000 feet in elevation

throughout montane parts of the Sierra. This riparian scrub is usually dominated by any of several species of willow, alder, or dogwood. In the Project area, mountain alder (*Alnus incana* ssp*. tenuifolia*) is the predominant species, interspersed with occasional stands of willow. This community often lacks an herbaceous understory. When an understory is present, it consists of species typical of wet montane meadows, as well as some woody species such as California wild grape (*Vitis californica*).

White Alder Riparian Scrub (Holland code #61510) is the equivalent to white alder riparian forest in Holland (1986), but consists of a shorter canopy height. This community is a broadleaved, deciduous stream-side scrub and is usually located below 6,000 feet in elevation. It is best developed along rapidly flowing, well-aerated perennial streams with coarse bedloads. It is dominated by white alder (*Alnus rhombifolia*), but also consists of other species including: big-leaf maple, oregon ash, western azalea, willow, and poison oak (*Toxicodendron diversilobum*).

White Alder/Montane Riparian Scrub (Holland codes #61510 and #63500) is a category that encompasses white alder riparian scrub, montane riparian scrub, or a combination of the two. This category was used for communities consisting of alder and/or willow species located between 5,000 and 7,000 feet in elevation.

Aspen Riparian Forest (Holland code # 61520) is a streamside forest found along relatively level, slow-flowing stream reaches between 4,000 and 8,500 feet in elevation. This forest is dominated by quaking aspen, which may reach a height of 50 feet. The tree canopy is nearly closed, which precludes the development of an extensive shrubby understory. The herb layer, however, is rich and varied, including western columbine (*Aquilegia formosa*), larkspur (*Delphinium* spp.), Fendler's meadow rue (*Thalictrum fendleri*), California corn lily (*Veratrum californicum* var. *californicum*), various lilies (*Lilium* spp.), and sedges (Carex spp.).

Montane Black Cottonwood Riparian Forest (Holland code # 61530) is a fairly dense, mixed riparian forest usually found below 8,500 feet in elevation. This forest is dominated by black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), sometimes with emergent Jeffrey pine (*Pinus jeffreyi*). The understory shrub canopy is well developed. Herb cover also is high, including silver wormwood (*Artemisia ludoviciana*), slender hairgrass (*Deschampsia elongata*), and sedges. This vegetation cover type is found at scattered locations throughout the Project area.

Dominant Riparian Species

A review of existing information was conducted on the dominant riparian species typically found in the riparian communities discussed above. A list of typical dominant species found in each riparian community is provided in Table CAWG-11-1. This includes willow, dogwood, alder, cottonwood, quaking aspen, bigleaf maple, Oregon ash, and western azalea. In addition to these broad categories, specific species identified in the Big Creek ALP Project area are also listed. Information on these species was reviewed to determine specific requirements for overbanking flows, flood

regimes, and water tables for successful seed dispersal and regeneration. A description of the riparian species identified within the Project area is provided in Appendix D.

Historical Aerial Photography

Historical aerial photography available for the Big Creek ALP Project area was reviewed in the USDA-FS Supervisor's office in Clovis, California. This included review of photographs taken in the years of 1944, 1970, 1976, 1981, 1991 to 1994, and 1996. Table CAWG-11-2 provides general information about the area of the photograph and the type (i.e., black and white or color, and scale) of aerial photographs that are available during these years. Refer to Appendix E for detailed information about each photograph.

5.2 RIPARIAN VEGETATION MAPPING

Riparian vegetation was mapped within the Project area and is displayed as polygons, lines, and points in Figure CAWG-11-1. Fresh emergent marsh and wet meadow habitats were mapped for TERR-1, Vegetation Communities Study Report, and are displayed in Figure CAWG-11-1 a through c. Photographs were taken during helicopter reconnaissance surveys and were provided on the *SCE Big Creek ALP Amphibian, Reptile, and Riparian Data March 2002 Version 1.0* distribution C.D. Geomorphology data collected in 2001 and 2002 is displayed with the riparian vegetation mapping in Figure CAWG-11-1a through c. A summary table of the preliminary riparian data collected is provided in Appendix F.

Overview

Riparian vegetation within the Project area is limited and primarily consists of continuous or non-continuous bands along Project area streams. The majority of streams within the Project area are steep, high gradient channels that have a large percentage of unvegetated reaches with sparse riparian vegetation or bands of non-continuous riparian vegetation along the channel. There are, however, a few streams that have riparian vegetation that consists generally of wide bands of riparian vegetation along the channel. The following streams generally have riparian vegetation that consists of a continuous narrow band of riparian along the channel: Tombstone, Crater, Hooper, Bear, Camp 62, Chinquapin, Bolsillo creeks and portions of the South Fork San Joaquin River. Stevenson, North Fork, Adit 8, Ely, Pitman, Balsam, Ross, and Rock creeks, Big Creek downstream of Kerckhoff Dome, the San Joaquin River, and portions of the South Fork San Joaquin River generally have sparse riparian vegetation or non-continuous bands of riparian along the channel.

There are wide corridors of riparian vegetation found along a few streams in the Project area. These include North Slide, South Slide, Mono creeks and Big Creek upstream of Kerckhoff Dome. These streams range from entrenched, high gradient, steep channels to moderately entrenched, moderate gradient streams. In a few areas in the Project vicinity the riparian zone is wide and continuous, and may merge into montane meadows in areas where the terrain is level and open.

The most extensive riparian vegetation community found in the Big Creek ALP Project area is white alder riparian scrub, generally dominated by white alder. Willow may be interspersed with the alder or may occasionally form mono-specific stands. White alder riparian scrub transitions to montane riparian scrub in the higher elevations. Aspen groves are fairly extensive in the level areas immediately downstream of Florence Lake (intermingled with lodgepole pine and white fir (*Abies concolor*)) and are scattered elsewhere in the system. Black cottonwood is found only in small, scattered stands from Florence Lake to Redinger Lake. In a few locations, the only riparian vegetation present is herbaceous, with species characteristic of montane freshwater marsh or wet montane meadows.

Descriptions of Streams by Area

The Project area was divided into eight areas. Streams were grouped according to geographic location, general similarities in slope, gradient, substrate, and elevation, as well as in riparian community type, distribution, and extent. In each area, there may be streams that have different characteristics than the other streams in that area, but are sufficiently similar to remain classified within that group. A discussion of each group is provided below. Refer to CAWG–2, Geomorphology Study Report, for a detailed geomorphic description of each stream. General geomorphic descriptions are based on the *Field Guide for Stream Classification* (Rosgen and Silvey 1998).

Florence Area

The study reaches on Tombstone, Crater, Hooper, North Slide, and South Slide creeks are all located between 6,800 and 8,600 feet in elevation and are tributaries of the South Fork San Joaquin River, with the exception of Crater Diversion Channel, which flows into Florence Lake. Large portions of each of these study reaches consist of bedrock or boulder substrate and some also have segments with cobble or sand substrate. These streams all consist of steep, entrenched, confined channel reaches. Some contain segments that are moderately entrenched and controlled. The riparian vegetation along Tombstone, Crater, and Hooper creeks are predominantly continuous narrow bands of riparian dominated by aspen riparian forest, interspersed with montane riparian scrub. North Slide and South Slide creeks have slight differences in slope, riparian vegetation, and substrate than the others in this group and are discussed below.

Tombstone Creek has a continuous narrow band of aspen riparian forest lining the channel, which transitions into a non-continuous band as it flows through Jackass Meadow. The segment downstream of the diversion, between river mile (RM) 0.98 and 0.56, is a steep, entrenched, confined channel composed of bedrock and boulder, lined with a continuous narrow band of aspen riparian forest. Downstream, between RM 0.56 and 0.00, the channel is moderately entrenched for a short segment and then consists of a gentle to moderate sloped channel composed of sand substrate, adjacent to Jackass Meadow. The riparian vegetation along this segment consists of a non-continuous band of aspen riparian forest.

Hooper Creek has almost non-existent riparian vegetation along the channel, with the exception of a small segment near the diversion where there is narrow band of montane riparian scrub lining the channel. The segment downstream of the diversion, between RM 0.63 and 0.21, consists of a steep, deeply entrenched, confined channel with boulder substrate. Just downstream of the diversion, between RM 0.63 and 0.55, there is a short segment with montane riparian scrub lining the channel. Downstream from this segment, between RM 0.55 and 0.00, the riparian is sparse to non-existent. From RM 0.21 and 0.00 the segment consists of a moderately entrenched channel with cobble substrate.

Crater Creek consists of various riparian vegetation types, including aspen riparian forest, montane riparian scrub, and white alder/montane riparian scrub. These communities are present in continuous and non-continuous narrow bands of riparian vegetation. From RM 2.85 and 0.41, Crater Creek consists of a steep, deeply entrenched, confined stream channel with segments that are moderately entrenched and have gradients of two to four percent. It consists primarily of boulder substrate, but is interspersed with cobble. Downstream of Crater Creek Diversion Dam, between RM 2.85 and 1.81, there is a non-continuous corridor of riparian vegetation composed of aspen riparian forest in some segments and montane riparian scrub in other segments. Farther downstream, between RM 1.81 and 0.00, there is a band of riparian vegetation along the channel that is continuous. It is composed of montane riparian scrub and white/alder montane riparian scrub in some segments, and aspen riparian forest in other segments. Closer to the South Fork San Joaquin River, between RM 0.41 and 0.18, the channel consists of a gentle slope with a sandy substrate and a low gradient stream, adjacent to Hell Hole Meadow. There is a continuous band of white alder/montane riparian scrub lining the creek and aspen riparian forest corridors surrounding the meadow.

Crater Diversion Channel has a dense conifer canopy above the channel. If riparian vegetation is present, it was not visible from the helicopter or the aerial photography. The channel consists primarily of a steep, entrenched, confined channel interspersed with bedrock, boulder, and sand with one segment upstream of Florence Lake that is moderately entrenched (i.e., RM 0.84 and 0.66). This channel will be surveyed during 2003.

Unlike other streams in the Florence area with similar gradient and substrate, North and South Slide Creeks both have wide corridors of riparian vegetation along their channels. Both study reaches consist entirely of high gradient, steep, entrenched, confined channels, and are composed of bedrock or boulder substrate. They each have a wide, continuous, dense corridor of aspen riparian forest.

South Fork of the San Joaquin Tributaries

The study reaches on Bear, Camp 62, Chinquapin, and Bolsillo creeks are all located between 6,600 and 7,600 feet in elevation and are tributaries to the South Fork San Joaquin River, with the exception of Chinquapin Creek which is a tributary to Camp 62 Creek. Each of these study reaches has a large portion of the channel consisting

primarily of bedrock or boulder. They all consist of steep, high-gradient, entrenched, confined channels interspersed with segments that are moderately entrenched. The riparian vegetation present along these channels is predominantly montane riparian scrub or white alder/montane riparian scrub, depending on elevation. There are some areas with wide segments of riparian vegetation.

Bear Creek is lined with a continuous narrow band of riparian vegetation, interspersed with non-continuous bands, and composed of montane riparian scrub or white alder/montane riparian scrub, depending on elevation. Bear Creek consists of a high gradient, steep, entrenched, confined channel with boulder or bedrock substrate. Downstream of the diversion (RM 1.56), the riparian vegetation along the channel consists of a continuous narrow band of montane riparian scrub which transitions into white alder/montane riparian scrub at RM 0.71. The white alder/montane riparian scrub consists of a narrow band along the channel until approximately RM 0.32. Downstream, from RM 0.32, until the confluence with the South Fork San Joaquin River (RM 0.00), the white alder/montane riparian scrub is non-continuous along the channel.

Chinquapin Creek is lined with narrow bands of montane riparian scrub, interspersed with wide corridors along the channel. Just downstream of the diversion, between RM 0.50 and 0.38, the channel is composed of a moderately entrenched channel with a gradient of two to four percent and cobble substrate. The remainder of the channel, with the exception of a small segment near RM 0.10, consists of a steep, high gradient, entrenched channel with boulder substrate. The riparian communities along the channel are montane riparian scrub. The riparian vegetation is primarily composed of a narrow, continuous band of montane riparian scrub, interspersed with wider riparian bands along the channel.

The riparian communities along Camp 62 Creek are dominated by montane riparian scrub or white alder/montane riparian scrub, depending on elevation, and consist of narrow bands and wide corridors interspersed along the channel. The Creek is composed of a steep, entrenched, confined channel interspersed with segments that are more moderately entrenched and is composed of boulder and cobble substrate. Downstream of the diversion, between RM 1.35 and 1.22, there is a wide corridor of montane riparian scrub lining the channel. From RM 1.22 to 1.10, there is limited to non-existent riparian along the channel. From RM 1.10 to the confluence with Chinquapin Creek (RM 0.93) there is a continuous narrow band of montane riparian scrub, followed by a short segment of riparian vegetation dominated by montane black cottonwood forest. The riparian vegetation along the channel from the confluence with Chinquapin Creek to the confluence with the South Fork San Joaquin River, between RM 0.93 and 0.00, is predominantly a continuous, narrow band of white alder/montane riparian scrub with one segment consisting of a wide corridor along the channel (RM 0.70 to 0.59).

The riparian communities along Bolsillo Creek are dominated by a montane riparian scrub, which transitions into an aspen riparian forest, and then a white alder/montane riparian scrub. The vegetation predominantly consists of continuous narrow bands of riparian vegetation along the channel. The creek is composed primarily of a high gradient, steep, entrenched, confined channel, interspersed with segments that are

moderately entrenched and segments that are deeply entrenched and slightly meandering. The channel substrate is boulder or bedrock, interspersed with some cobble and sand. Just downstream of the diversion, between RM 1.58 and 1.50, there are wide patches of montane riparian scrub. Downstream, from RM 1.58 to 0.96, there is a narrow band of continuous montane riparian scrub lining the channel. Between RM 0.98 to 0.70, the montane riparian scrub is non-continuous along the channel. From RM 0.70 to the confluence with the South Fork San Joaquin River (RM 0.00), the riparian vegetation is a narrow continuous band along the channel. The riparian communities are dominated by montane riparian scrub until RM 0.58, aspen riparian forest between RM 0.58 and 0.50, and white alder/montane riparian scrub between RM 0.50 and 0.00.

Mono Creek

The study reach of Mono Creek is located between 6,400 and 7,400 feet in elevation. It has an extensive amount of riparian vegetation along the channel. There are wide corridors of riparian vegetation along almost the entire channel with small meadows in areas adjacent to the creek. It consists primarily of boulder, interspersed with sand substrate throughout the channel. Downstream from the diversion, between RM 5.80 and 5.68, there is a short segment consisting of a steep, high gradient, confined channel. From RM 5.68, downstream to the confluence with the South Fork San Joaquin River (RM 0.00), almost the entire creek consists of a moderately entrenched channel with a gradient of two to four percent. Downstream from the diversion, between RM 5.80 and 5.04, there is a continuous band of montane riparian scrub lining the channel. From RM 5.04 to the confluence with the South Fork San Joaquin River (RM 0.00), the riparian vegetation is dominated by a white alder/montane riparian scrub. The riparian vegetation predominantly consists of wide corridors lining the channel, interspersed with short segments of non-continuous bands of riparian vegetation along the channel.

South Fork San Joaquin River

The study reach on the South Fork San Joaquin River is located between 3,800 and 7,300 feet in elevation. It was split into three segments. Segment one extends from RM 27.9 to 24.50; segment two extends from RM 24.5 to 6.40; and segment three extends from RM 6.4 to 0.00.

Segment one of the South Fork San Joaquin River study reach consists primarily of a narrow continuous band of riparian vegetation along the channel. This segment of the river is composed of a meandering channel interspersed with sections that are moderately entrenched. The channel is composed of sand substrate, interspersed with cobble and boulder. There is a section downstream of Florence Lake that consists of a narrow continuous band of montane riparian scrub (RM 27.73 to 26.75). From RM 27.73 to just downstream of North and South Slide creeks confluences (RM 25.65), the riparian vegetation is composed primarily of a narrow continuous band of aspen riparian forest. From RM 25.65 to downstream of Hooper Creek (RM 24.5), the riparian vegetation consists of a narrow continuous band of montane riparian scrub.

Segment two of the South Fork San Joaquin River study reach consists of riparian vegetation dominated by white alder/montane riparian scrub. Sub-reaches of this segment of the study reach consist of riparian vegetation in narrow continuous bands, large corridors of riparian vegetation interspersed with short unvegetated sections, and sparse riparian vegetation. Segment two consists of a moderate gradient channel that is moderately entrenched, interspersed with sections that are deeply entrenched and slightly meandering. The bed of the stream is composed of cobble interspersed with boulder. From RM 24.5 to the Bear Creek confluence (RM 22.30), the riparian vegetation consists of a continuous, narrow band of white alder/montane riparian scrub. From the Bear Creek confluence (RM 22.30) to the Mono Creek confluence (RM 16.54), the riparian vegetation consists of non-continuous, narrow bands of riparian vegetation interspersed with wider corridors of riparian vegetation lining the channel. This area is dominated by white alder/montane riparian scrub. From the Mono Creek confluence (RM 16.54) to RM 6.40, the end of segment two, the riparian vegetation consists of non-continuous, narrow bands of riparian vegetation interspersed with areas of sparse riparian vegetation.

Segment three of the South Fork San Joaquin River study reach does not contain an extensive amount of riparian vegetation. The vegetation here is composed primarily of sparse to almost no riparian vegetation, interspersed with non-continuous narrow bands of riparian vegetation. This section is dominated by white alder riparian scrub. These areas of non-continuous narrow bands of white alder riparian scrub are located between RM 6.35 and 5.90, 5.60 and 5.50, 5.40 and 5.35, 5.20 and 5.15, 3.10 and 2.90, 2.68 and 2.60, and from 2.53 to 2.40. There are two sections with wide corridors of white alder riparian located between RM 3.75 and 3.62, and at the confluence with the San Joaquin River between RM 0.18 and 0.00. Segment three consists of a moderate gradient channel that is moderately entrenched, interspersed with sections that are deeply entrenched and slightly meandering. The channel is composed of boulder substrate interspersed with cobble.

Shaver and Huntington Lake Area

The study reaches of Stevenson Creek, Big Creek downstream of Kerckhoff Dome, Big Creek upstream of Kerckhoff Dome, and North Fork Stevenson Creek are located between 1,800 and 7,000 feet in elevation. They all are predominantly composed of bedrock and boulder substrate. The study reach of Big Creek was divided into two segments, upstream and downstream of Kerckhoff Dome, because they contain different substrates and extent of riparian vegetation. Stevenson Creek, Big Creek downstream of Kerckhoff Dome, and North Fork Stevenson Creek all have steep, high gradient, entrenched channels interspersed with segments that are moderately entrenched, and with some segments with a meandering channel. The riparian vegetation predominantly consists of a non-continuous, narrow bands dominated either by white alder or white alder/montane riparian scrub depending on the elevation. Upstream of Kerckhoff Dome, the study reach of Big Creek exhibits differences in substrate and riparian community extent and is discussed below.

The riparian vegetation along the study reach of Stevenson Creek is dominated primarily by white alder riparian scrub. This reach consists of narrow continuous bands, non-continuous bands, or sparse to non-existent riparian vegetation along the channel. The segment just below Shaver Lake, between RM 4.27 and 3.89, consists of a moderately entrenched channel with cobble substrate interspersed with sand substrate. The riparian vegetation is a continuous band of white alder/montane riparian scrub. Downstream, between RM 3.89 and 1.35, the channel primarily consists of a steep, high gradient, confined channel, interspersed with segments that are moderately entrenched and moderate in gradient. The majority of the riparian communities consist of a sparse, non-continuous band of white alder riparian scrub along the channel. From RM 1.35 to the confluence with the San Joaquin River (RM 0.00), the riparian vegetation consists of a narrow, continuous band of white alder riparian along the channel.

The study reach of Big Creek below Kerckhoff Dome, primarily consists of non-continuous bands of riparian vegetation to sparse riparian vegetation along the channel, dominated by white alder riparian scrub. The study reach predominantly consists of a steep, high gradient, entrenched stream, interspersed with segments that are moderately entrenched and moderate in gradient. The reach is composed of a bedrock and boulder substrate. There is one short segment just upstream from the San Joaquin River confluence, between RM 0.22 and 0.13, consisting of a narrow band of montane black cottonwood riparian forest lining the channel.

The riparian vegetation along the study reach of North Fork Stevenson Creek primarily consists of non-continuous bands along the channel, interspersed with wide corridors. The study reach is a steep, high gradient, entrenched channel interspersed with segments that are moderately entrenched to segments with a meandering channel. The substrate is composed of bedrock, interspersed with cobble and gravel. Downstream of the diversion, between RM 3.55 and 2.40, the riparian vegetation is sparse to almost non-existent, with the exception of one segment (RM 2.80 to 2.65) consisting of a narrow continuous band of riparian vegetation along the channel. Downstream, between RM 2.40 and 1.10, the riparian vegetation is a narrow non-continuous band along the channel with two areas of wide corridors of riparian vegetation, between RM 1.83 to 1.72 and RM 1.35 to 1.23.

Unlike other streams in this area with similar gradient and slope, the study reach of Big Creek, upstream of Kerckhoff Dome, is composed of wide corridors of white alder/montane riparian scrub along the entire channel reach. This riparian corridor is much wider than the riparian vegetation on any of the creeks discussed above. It consists of a bedrock and boulder substrate, but unlike the streams discussed above, the channel is interspersed with segments of sandy substrate.

San Joaquin River

The study reach on the San Joaquin River is located between 1,500 and 3,800 feet in elevation. The riparian communities along the river are dominated by white alder riparian scrub. The riparian vegetation is predominantly sparse along the channel, interspersed with segments of non-continuous narrow bands of riparian vegetation

along the channel. There are a few short segments with wide corridors of white alder riparian scrub located between RM 25.00 and 24.85, 25.24 and 25.10, 37.78 and 37.65, and at the confluence with the South Fork San Joaquin River (RM 38.50 to 38.30). The study reach of the San Joaquin River consists of a moderately entrenched, moderate gradient channel, interspersed with areas that are deeply entrenched and slightly meandering. It is composed primarily of boulder, but is interspersed with some segments of sand and cobble.

Big Creek Tributaries

The study reaches of Adit 8, Ely, Pitman, and Balsam creeks are located between 3,400 and 6,600 feet in elevation and are tributaries of Big Creek. All of these reaches consist of steep, high gradient, entrenched channels. They are composed predominantly of bedrock or boulder substrate. The riparian vegetation along the channels primarily consists of non-continuous, narrow bands of white alder or white alder/montane riparian scrub, depending on the elevation. The study reach of Adit 8 is slightly different from the other streams in this group in substrate and the extent of riparian vegetation.

The study reach of Ely Creek consists of a steep, high gradient, bedrock and boulder stream with a non-continuous band of riparian vegetation along almost its entire channel (RM 0.98 to 0.20). Ely Creek is dominated by white alder riparian scrub.

The riparian vegetation along the study reach of Pitman Creek consists of non-continuous bands of white alder/montane riparian scrub to sparse or almost non-existent riparian vegetation. The reach is a steep, high gradient, bedrock channel. Downstream of the diversion, between RM 1.53 and 0.92, the riparian vegetation consists of a non-continuous band along the channel. From RM 0.92 to the confluence with Big Creek, the riparian vegetation is sparse to almost non-existent along the channel.

The riparian vegetation along the study reach of Balsam Creek is composed predominantly of non-continuous, narrow bands of riparian vegetation, interspersed with segments of continuous bands of riparian vegetation lining the channel. The study reach is a steep, high gradient, entrenched, bedrock channel with some boulder and a short segment interspersed with cobble (RM 0.85 to 0.75). From Balsam Meadow Forebay (RM 2.70) to RM 0.88, the riparian communities are dominated by white alder/montane riparian scrub. Downstream, from RM 0.88 to the confluence with Big Creek (RM 0.00), the riparian communities are dominated by white alder riparian scrub.

Similar to the creeks discussed above, the study reach of Adit 8 is a steep, high gradient, entrenched stream composed of bedrock and boulder substrate. The riparian vegetation along the channel consists of non-continuous narrow bands of white alder riparian scrub. Unlike other streams in this area with similar gradient and slope, the study reach of Adit 8 Creek has a large segment (RM 0.70 to 0.55) consisting of gravel substrate and a wide corridor of riparian vegetation dominated by white alder riparian scrub.

Ross and Rock Creeks

The study reaches of Ross and Rock creeks are located between 2,400 and 3,400 feet in elevation and are tributaries to the San Joaquin River. They are both high gradient, steep, entrenched, bedrock and boulder channels. The riparian vegetation on both reaches is sparse to almost non-existent. The shrubs that are present along the channel are components of a white alder riparian scrub community (i.e., white alder, willow, big-leaf maple, oregon ash, and western azalea).

Riparian Associated with Meadows

Wet and dry meadows and fresh emergent marsh areas were mapped from aerial photography interpretation and ground-truthing methods in conjunction with TERR-1, Vegetation Communities Study Report. Wet meadows in the Project area are typical of those found in the western Sierra Nevada Mountain Range. They typically consist of a dense growth of sedges and other perennial herbs, usually from 1.5 to 3 feet high, with some taller herbs reaching 6.5 feet high (Holland 1986). Wet montane meadows have soils that remain saturated throughout the year (Holland 1986). Large meadows within the Project area that support extensive woody riparian vegetation within or on the edges of the meadows are described below. However, all wet meadows and fresh emergent marsh areas that were identified in conjunction with TERR-1, Vegetation Communities Study Report, are depicted in Figure CAWG-11-1a through c. These areas will be considered for further quantitative studies. Refer to TERR-1, Vegetation Communities Study Report, for dry meadow locations within the study area.

Jackass Meadow

Jackass Meadow complex is composed of a few large meadow areas situated below Florence Lake at 7,200 feet in elevation. The meadow complex is along Tombstone Creek and the South Fork San Joaquin River. As Tombstone Creek becomes less steep, a non-continuous band of aspen riparian forest lines the creek and the edges of the meadow. The northern edge of that meadow area is lined with a continuous band of montane riparian scrub. There are willow trees scattered within the meadow. Downstream of Tombstone Creek, along the South Fork San Joaquin River, there is a narrow, continuous band of montane riparian scrub, extending around to the opposite edges of the meadow area. Downstream, there are meadow areas on each side of the South Fork San Joaquin River, with aspen riparian forest lining the edges.

Hell Hole Meadow

Hell Hole Meadow is situated along Crater Creek, near the confluence with the South Fork San Joaquin River, at 6,800 feet in elevation. Riparian communities along Crater Creek and the edge of Hell Hole Meadow are dominated by montane riparian scrub, and consist of a narrow, continuous band along the creek. There are patches of riparian scrub within the meadow, and on the outer edges of the meadow, there are large patches of aspen riparian forest, interspersed with conifers.

POISON MEADOW

Poison Meadow is situated on the north side of the South Fork San Joaquin River, near the confluence with Crater Creek, at 6,800 feet in elevation. Unlike the meadows described above, the meadow is open, without scattered riparian vegetation throughout the meadow. There are patches of aspen riparian forest on the northeast and northwest edges of the meadow. There is a narrow band of continuous montane riparian scrub on the edges of the meadow near the South Fork San Joaquin River.

6.0 LITERATURE CITED

Anderson, B.W., J. Disano, D.L. Brooks, and R.D. Ohmart. 1984. Mortality and Growth of Cottonwood on Dredge-Spoil. In: Warner, Richard E.; Hendrix, Kathleen M., eds. California riparian systems: Ecology, conservation, and productive management: Proceedings of a conference; 1981 September 17-19; Davis, CA. Berkeley, CA: University of California Press: 110-119.

Argus, George W. 1973. The genus Salix in Alaska and the Yukon. Publications in Botany, No. 2. Ottowa, ON: National Museums of Canada, National Museum of Natural Sciences. 279 p.

Argus, G.W. 2002. A Guide to the Identification of California Salix (Salicaceae). Prepared for Jepson Herbarium Workshop July 19-21, 2002.

Berg, Neil, A. Carlson, and D. Azuma. 1998. Function and Dynamics of Woody Debris in Stream Reaches in the Central Sierra Nevada, California. Can. J. Fish. Aquat. Sci., 55: 1807-1820.Braatne, Jeffrey H.; Rood, Stewart B.; Heilman, Paul E. 1996. Life history, ecology, and conservation of riparian cottonwoods in North America. In: Steller, R. F., ed. Biology of Populus and its implications for management and conservation. Ottawa, ON: National Research Council of Canada, NRC Research Press: 57-85.

Braatne, Jeffrey H.; Rood, Stewart B.; Heilman, Paul E. 1996. Life history, ecology, and conservation of riparian cottonwoods in North America. In: Steller, R. F., ed. Biology of Populus and its implications for management and conservation. Ottawa, ON: National Research Council of Canada, NRC Research Press: 57-85.

Chapin, D.M., R.L. Beschta, and H.W. Shen. 2002. Relationships between flood frequencies and riparian plant communities in the Upper Klamath Basin, Oregon. Journal of the American Water Resources Association. Vol. 38, no. 3: pp. 603-617.

Bradley, C.E., D.G. Smith. 1986. Plains cottonwood recruitment and survival on a prairie meandering river floodplain, Milk River, southern Alberta and northern Montana. Canadian Journal of Botany 64(7):1433-1442.

Brothers, Timothy S. 1984. Historical vegetation change in the Owens River riparian woodland. In: Warner, Richard E.; Hendrix, Kathleen M., eds. California riparian systems: Ecology, conservation, and productive management: Proceedings of the conference; 1981 September 17-19; Davis, CA. Berkeley, CA: University of California Press: 75-84.

Brothers, Timothy S. 1985. Riparian species distributions in relation to stream dynamics, San Gabriel River, California. Los Angeles: University of California. 120 p. Dissertation.

Brunsfeld, Steven J.; Johnson, Frederic D. 1985. Field guide to the willows of east-central Idaho. Bulletin Number 39. Moscow, ID: University of Idaho; College of Forestry, Wildlife and Range Sciences; Forest, Wildlife and Range Experiment Station. 82 p.

Chan, Franklin J.; Wong, Raymond M. 1989. Reestablishment of native riparian species at an altered high elevation site. In: Abell, Dana L., technical coordinator. Proceedings of the California riparian systems conference: Protection, management, and restoration for the 1990's; 1988 September 22-24; Davis, CA. Gen. Tech. Rep. PSW-110. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station: 428-435.

Crocker, J.L., W.T. Witte, & R.M. Auge. 1998. Stomatal sensitivity of six temperate, deciduous tree species to non-hydraulic root-to-shoot signaling of partial soil drying. Journal of Experimental Botany 49(321): 761-774.

Davidson, Ross W.; Hinds, Thomas E.; Hawksworth, Frank G. 1959. Decay of aspen in Colorado. Station Paper No. 45. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 14 p.

EDAW, Inc. 1999. Draft Environmental Impact Report for the Water Forum Proposal. Prepared for Sacramento City – County Office of Metropolitan Water Planning. Sacramento, CA.

Fenner, Pattie; Brady, Ward W.; Patton, David R. 1985. Effects of regulated water flows on regeneration of Fremont cottonwood. Journal of Range Management. 38(2): 135-138.

Fried, Jeremy S.; Tappeiner, John C., II; Hibbs, David E. 1988. Bigleaf maple seedling establishment and early growth in Douglas-fir forests. Canadian Journal of Forest Research. 18: 1226-1233.

Gregory, S.V., F.J. Swanson, W. A. McKee, and K. W. Cummins. 1991. An Ecosystem Perspective of Riparian Zones. Bioscience, 41: 540-551.

Haard R.T. 1996. The Electric Native plant Book. 1996. [Online]. Available: http://www.nas.com/~rchaard/electricnp/native_plants/tech_sheets.html.

Haeussler, S.; Coates, D. 1986. Autecological characteristics of selected species that compete with conifers in British Columbia: a literature review. Land Management Report No. 33. Victoria, BC: Ministry of Forests, Information Services Branch. 180 p.

Hansen, Paul L.; Chadde, Steve W.; Pfister, Robert D. 1988. Riparian dominance types of Montana. Misc. Publ. No. 49. Missoula, MT: University of Montana, School of Forestry, Montana Forest and Conservation Experiment Station. 411 p.

Harrelson, Cheryl C, C.L. Rawlins, and John P. Potyondy. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, GTR RM-245.

Harris, R.R., C.A. Fox, and R. Risser. 1987. Impacts of Hydroelectric Development on Riparian Vegetation in the Sierra Nevada Region, California, USA. Environmental Management, 11(4): 519-527.

Hickman, J.C. 1993. The Jepson Manual. University of California Press, Berkeley, California.

Hill, M.T., W.S. Platts, and R.L. Beschta. 1991. Ecological and geomorphological concepts for instream and out-of-channel flow requirements. Rivers: Vol. 2, no. 3: pp. 198-210.

Hindley, Earl. 1996. Riparian Area Management: Observing Physical and Biological Change Through Historical Photographs. U.S. Department of the Interior, Bureau of Land Management, Denver, Colorado.

Holland, R.F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Game, Sacramento, California.

Krastinic, Ante, Joso Gracan, and Davorin Kajba. 2000. Black alder (Alnus spp.) genetic resources conservation strategy. [Online]. Accessed January 23, 2003. Available: http://www.ipgri.org/networks/euforgen/Networks/Noble_hardwoods/Strategies/nhalderstra.

Jones and Stokes Associates, Inc. 1983. Riparian Vegetation Analysis, Upper Sacramento River, California. Prepared for the U.S. Army Corps of Engineers, Sacramento District.

Kellerhals, R., C.R. Neill & D.I. Bray. 1972. Hydraulic and Geomorphic Characteristics of Rivers in Alberta. Research Council of Alberta, River Engineering and Surface Hydrology as cited in: Rosgen, Dave. 1994. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado.

Lines, G.C. and T.W. Bilhorn. 1996. Riparian vegetation and its water use during 1995 along the Mojave River, Southern California. U.S. Government Printing Office 1996-583-568.

Malanson, George P.; Butler, David R. 1991. Floristic variation among gravel bars in a subalpine river, Montana, U.S.A. Arctic and Alpine Research. 23(3): 273-278.

McBride, Joe R.; Strahan, Jan. 1984. Fluvial processes and woodland succession along Dry Creek, Sonoma County, California. In: Warner, Richard E.; Hendrix, Kathleen M., eds. California riparian systems: Ecology, conservation, and productive management: Proceedings of a conference; 1981 September 17-19; Davis, CA. Berkeley, CA: University of California Press: 110-119.

Mount, J.F. 1995. California Rivers and Streams. University of California Press, Berkeley and Los Angeles, California.

Mozingo, Hugh N. 1987. Shrubs of the Great Basin: A natural history. Reno, NV: University of Nevada Press. 342 p.

OSU (Oregon State University) 2003. Landscape Plants. [Online]. Accessed January, 2003. Available: http://oregonstate.edu/dept/ldplants/2plants.htm#frla.

Paruk, J. 1997 Sierra Nevada Tree Identifier. The Yosemite Association. Yosemite National Park, CA.

Perala, D. A. 1990. Populus tremuloides Michx. quaking aspen. In: Burns, Russell M.; Honkala, Barbara H., technical coordinators. Silvics of North America: Volume 2, Hardwoods. Agriculture Handbook 654. Washington, DC: U.S. Department of Agriculture, Forest Service: 555-569.

Polzon, M.L. and S.B. Rood. 2000. Effects of Damming and Flow Stabilization on Riparian Processes and Black Cottonwoods along the Kootenay River. Rivers, 7(3): 221-232.

Prichard, Don. 1998. Riparian Area Management: A user Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas. U.S. Department of the Interior, Bureau of Land Management, Denver, Colorado.

Prichard, Don. 1999a. Riparian Area Management: A User Guide for Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas. U.S. Department of the Interior, Bureau of Land Management, Denver, Colorado.

Prichard, Don. 1999b. Riparian Area Management: Using Aerial Photographs to Assess Proper Functioning Condition of Riparian-Wetland Areas. U.S. Department of the Interior, Bureau of Land Management, Denver, Colorado.

Richter, B. D., and H. E. Richter. 2000. Prescribing Flood Regimes to Sustain Riparian Ecosystems along Meandering Rivers. Conservation Biology, 14(5): 1467-1478.

Roberts, R. Chad. 1984. The transitional nature of northwestern California riparian systems. In: Warner, Richard E.; Hendrix, Kathleen M., eds. California riparian systems: Ecology, conservation, and productive management: Proceedings of the conference; 1981 September 17-19; Davis, CA. Berkeley, CA: University of California Press: 85-91.

Rosgen, D. 1996. Applied River Morphology. Printed Media Companies, Minneapolis, Minnesota.

Rosgen, D. and L. Silvey. 1998. Field Guide for Stream Classification. Wildland Hydrology, Pagosa Springs, Colorado.

Sawyer, J.O., and T. Keeler-Wolf. 1995. A Manual of California Vegetation. California Native Plant Society, Sacramento, California.

Scott, M.L., J.M. Friedman, and G.T. Auble. 1996. Fluvial processes and establishment of bottomland trees. Geomorphology 14:327-339.

Shafroth, P.B., J.C. Stromberg, and D.T. Patten. 2002. Riparian Vegetation Response to Altered Disturbance and Stress Regimes. Ecological Applications, 12(1): 107-123.

Shelford, V. E. 1954. Some lower Mississippi valley flood plain biotic communities; their age and elevation. Ecology. 35(2): 126-142.

Southern California Edison (SCE). 2001. Final Technical Study Plan Package for the Big Creek Hydroelectric System Alternative Licensing Process. August 2001.

Stromberg, J.L., T.P. Duncan, and B.D. Richter. 1991. Flood flows and dynamics of Sonoran riparian forests. Rivers 2:221-235.

Stuart, J.D., and J.O. Sawyer. 2001. Trees and Shrubs of California. University of California Press. Berkeley, CA.

Taylor, Jennifer L. 2000. Populus fremontii. In: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2003, January). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/ [Accessed January, 2003].

Uchytil, R.J. 1989. Salix lemmonii. In: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2003, January). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/ [Accessed January, 2003].

US Fish and Wildlife Service. 1988. *National list of vascular plant species that occur in wetlands.* US Fish & Wildlife Service Biological Report 88 (24).

U.S. Fish and Wildlife Service. 1996. National Wetlands Inventory. [Online]. Available: http://www.nwi.fws.gov/bha/ [Accessed January, 2003].

USDA Forest Service Rocky Mountain Research Station's Fire Sciences Laboratory in Missoula, Montana. Fire Effects Information Service (FEIS). [Online]. Accessed January, 2003. Available: http://www.fs.fed.us/database/feis/index.html.

Ware, George H.; Penfound, W. T. 1949. The vegetation of the lower levels of the floodplain of the South Canadian River in Central Oklahoma. Ecology. 30: 478-484.

WSU (Washington State University). 2003. Gardening in Western Washington. [Online] Accessed: January 2003. Available: http://cahedb.wsu.edu/nativePlant/scripts/webDisplayPlant.asp?ID=nv009.

Zasada, J. 1986. Natural regeneration of trees and tall shrubs on forest sites in interior Alaska. In: Van Cleve, K.; Chapin, F. S., III; Flanagan, P. W.; [and others], eds. Forest ecosystems in the Alaska taiga: A synthesis of structure and function. New York: Springer-Verlag: 44-73. [2291].

TABLES

Table CAWG-11-1. Dominant Species Typically Occurring within the Riparian Communities Identified in the Big Creek ALP Project Area[1].

	Montane Riparian Scrub	White Alder Riparian Scrub	White Alder / Montane Riparian Scrub	Aspen Riparian Forest	Montane Black Cottonwood Riparian Forest
Willow (*Salix* spp.):	X	X	X		
Narrowleaf willow					
Yellow willow					
Lemmon's willow					
Scouler's willow					
Jepson's willow					
Shining willow					
Sierra willow					
Arroyo willow					
Gray-leaf Sierra willow					
Strap-leaf willow					
Dogwood (*Cornus* spp.):	X		X		
Mountain dogwood					
Red osier dogwood					
Alder (*Alnus* spp.):	X	X	X		
White alder					
Mountain alder					
Cottonwood (*Populus* spp.):					X
Fremont cottonwood					
Black cottonwood					
Quaking aspen (*Populus tremuloides*)				X	X
Bigleaf maple (*Acer macrophyllum*)		X	X		
Oregon ash (*Fraxinus latifolia*)		X	X		
Western azalea (*Rhododendron occidentale*)		X	X		

[1] Dominate genera (e.g. willow, alder, etc.) and species (e.g. quaking aspen, bigleaf maple, etc.) occurring in each community were determined by using Holland (1986), cross-referenced with Sawyer and Keeler-Wolf (1995).

Table CAWG-11-2. Historical Aerial Photography for Review Information Summary

Year	Scale	Type	General Locations in Project Area
1944	1:15,840	Black & White	Mammoth Pool, Florence Lake, Mono and Bear creeks, Redinger Lake, Balsam Meadow Forebay, Powerhouse 1 and 2, Ward Tunnel, Tunnel 3 and 5, Huntington and Shaver lakes, Ely and Balsam diversions.
1970	1:15,840	Black & White	Mammoth Pool, Florence Lake, Mono-Bear Siphon, Redinger Lake, Balsam Meadow Forebay, Powerhouse 1 and 2, Ward Tunnel, Tunnel 3 and 5, Huntington and Shaver lakes, Ely and Balsam diversions.
1976	1:5840	Color	Mammoth Pool, Florence Lake, Mono-Bear Siphon, Powerhouse 1 and 2, Ward Tunnel, Tunnel 3 and 5, and Huntington Lake.
1981	1:12,000	Color	Mammoth Pool, Redinger Lake, Balsam Meadow Forebay, Powerhouse 1 and 2, Ward Tunnel, Tunnel 3 and 5, Huntington and Shaver lakes, Ely and Balsam diversions.
1991-1994	1:12,000	Color	Mammoth Pool, Florence Lake, Redinger Lake, Balsam Meadow Forebay, Powerhouse 1 and 2, Ward Tunnel, Tunnel 3 and 5, Huntington and Shaver lakes, Ely and Balsam diversions.
1996	1:12,000	Color Negative	Mammoth Pool, Florence Lake, Redinger Lake, Balsam Meadow Forebay, Powerhouse 1 and 2, Ward Tunnel, Tunnel 3 and 5, Huntington and Shaver lakes, Ely and Balsam diversions.
2001	1:12,000	Color	Entire Sierra National Forest.

FIGURES

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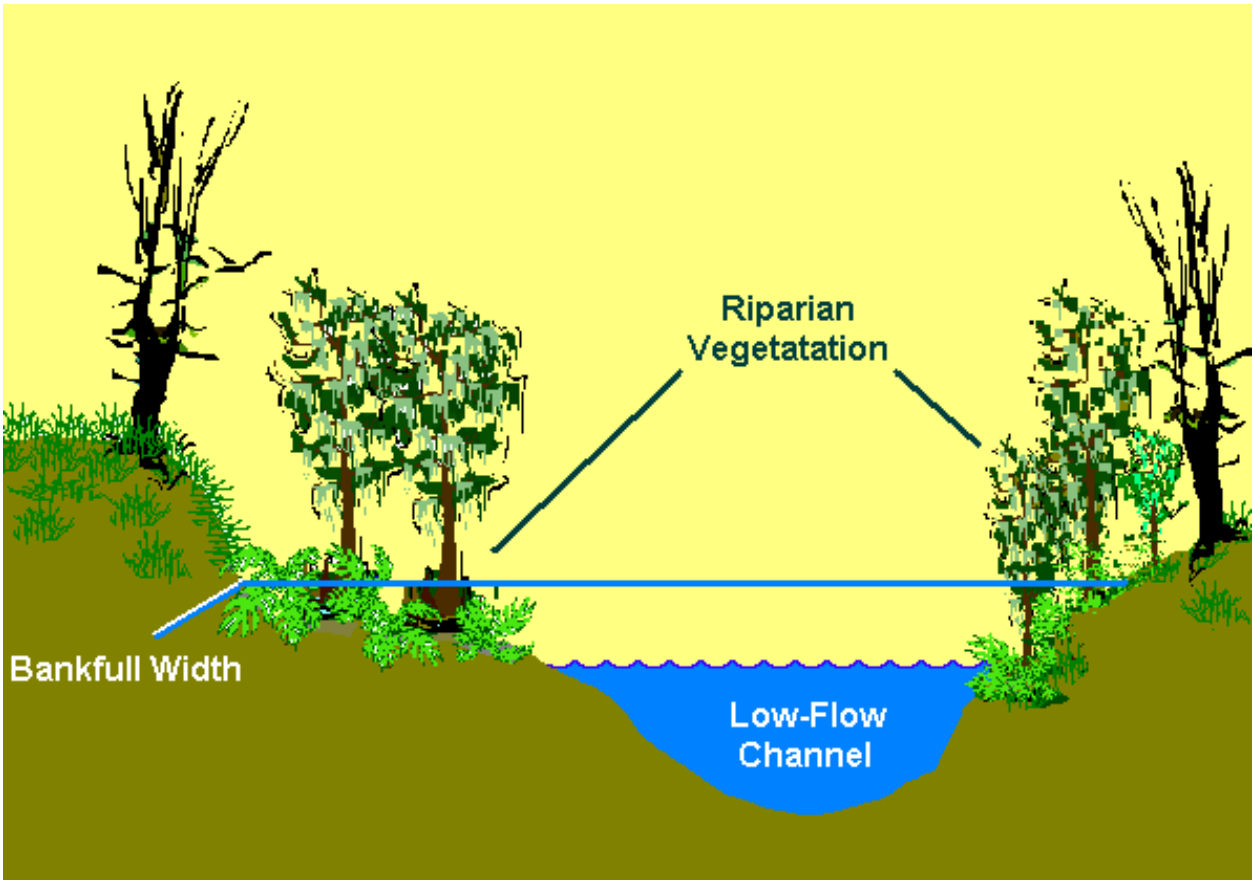
APPENDIX A

Potential Riparian Encroachment Example

Appendix A Potential Riparian Encroachment Example

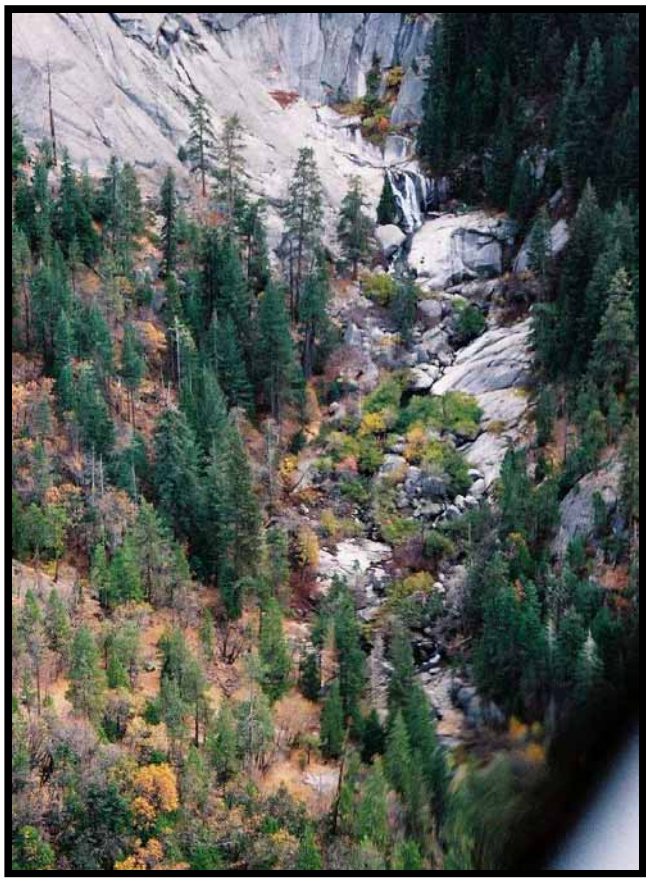


APPENDIX B

Representative Photographs of Riparian Vegetation Communities

Appendix B. Representative Photographs of Riparian Vegetation Communities

White Alder Riparian Scrub



White Alder Riparian Scrub

Appendix B. Representative Photographs of Riparian Vegetation Communities

White Alder/Montane Riparian Scrub

White Alder/Montane Riparian Scrub

Appendix B. Representative Photographs of Riparian Vegetation Communities

Montane Riparian Scrub

Montane Riparian Scrub

Appendix B. Representative Photographs of Riparian Vegetation Communities

Montane Black Cottonwood Forest

Montane Black Cottonwood Forest

Appendix B. Representative Photographs of Riparian Vegetation Communities

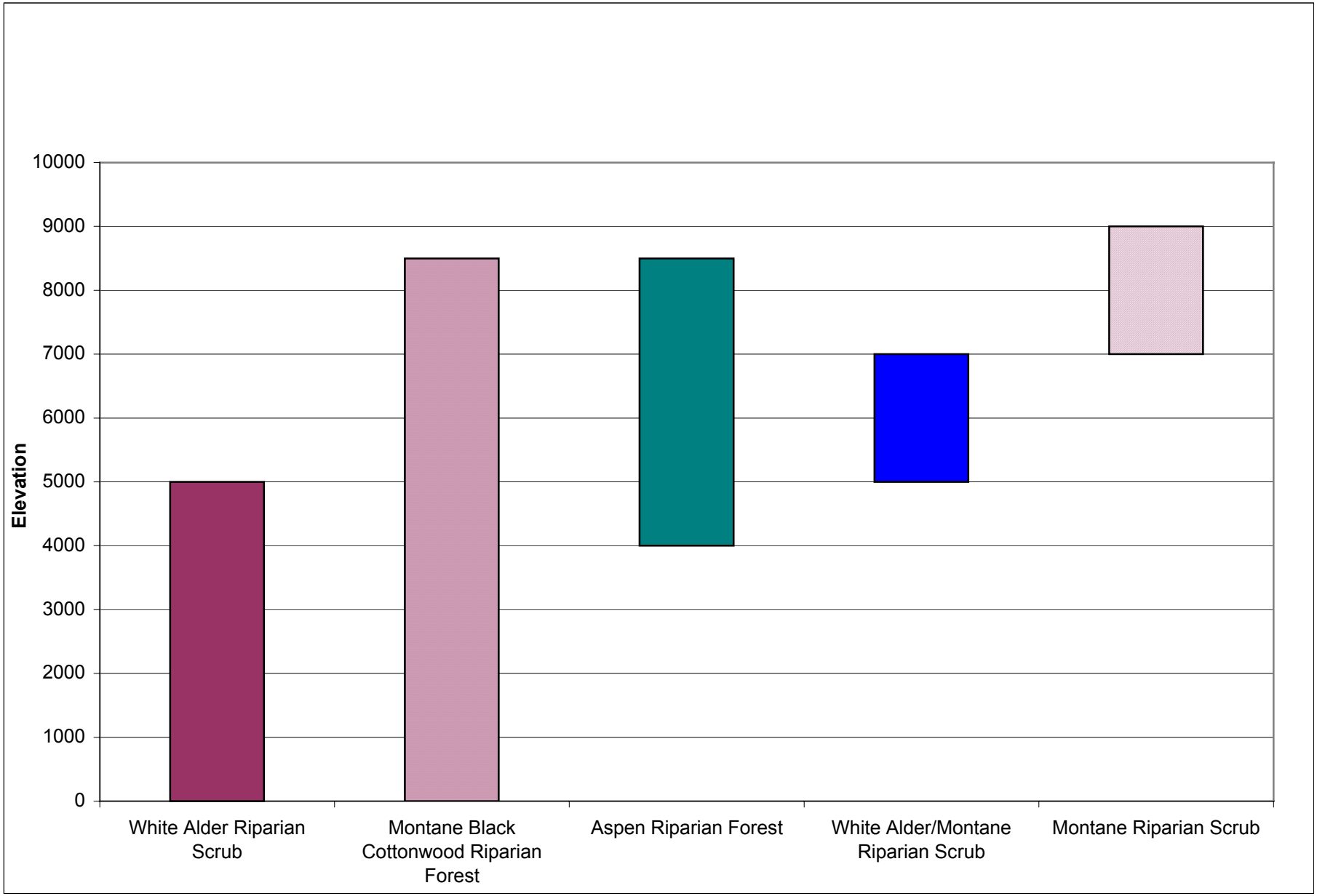
Aspen Riparian Forest

Aspen Riparian Forest

APPENDIX C

Riparian Vegetation Communities Present within the Big Creek ALP Project Area by Elevation

Appendix C. Riparian Vegetation Communities Identified in the Big Creek ALP Project Area by Elevation



APPENDIX D

Dominant Species Typically Found in the Riparian Communities Identified within the Project Area

Appendix D. Dominant Species Typically Found in the Riparian Communities Identified within the Project Area

WILLOW

Willows (*Salix* spp.) grow predominately in wet habitats near watercourses and quickly colonize newly formed sandbars. Willows reduce erosion by retaining soil in their matted root systems. Willows do not tolerate shade and are poor competitors (Uchytil 1989). There are 30 species of willow that are native to California and species commonly hybridize (Stuart and Sawyer 2001). Willows typically require seasonal flooding for regeneration. Seed dispersal is timed with early spring flooding so that seeds may germinate on freshly deposited, moist alluvium (Jones and Stokes 1983, Brothers 1985, Uchytil 1989). The water table in healthy willow stands is generally within at least 10 feet of the ground surface (Lines and Bilhorn 1996). Although most willow species require periodic flooding and high water tables, some species can survive on rocky slopes and uplands. Ten willow species were identified in the Big Creek ALP study area during special-status plant surveys in 2002. Specific information on hydrologic requirements were not available for all species, but willows, in general, require high water tables (within 10 feet of ground surface) and seasonal flooding in coincidence with seed dispersal, for seedling establishment and to maintain health and vigor (Jones and Stokes 1983, Lines and Bilhorn 1996). It is anticipated that the requirements for these species are very similar to the requirements for other willow species in the area that grow in similar habitats.

Narrowleaf willow (*Salix exigua*) typically occurs in riparian areas in narrow bands on the immediate edges of lakes, ponds, marshes, alluvial terraces, streams, and rivers in moist, sandy soils from 0 to 8,000 feet in elevation (Stuart and Sawyer 2001, USDA-FS 2003). Narrowleaf willow also occurs on moist, well-drained benches and bottomlands (Brunsfeld and Johnson 1985). This is a facultative wetland species (i.e., a species that usually occurs in wetlands but occasionally occurs in non-wetlands; USFWS 1996). This species is intolerant of shade and thrives at water edges where periodic flooding deposits sand and cobble and often removes would-be competitors (USDA-FS 2003). This willow species can survive severe annual flooding and is often found below the high water mark. However, trees must have some portion of their crown above water for part of the summer in order to survive (Shelford 1954). Narrowleaf willow reproduces vegetatively by root sprouts (Argus 1973), and also by sprouting of broken stem pieces that are transported and deposited by floodwaters (Zasada 1986). Narrowleaf willow also reproduces by seeds, which are produced in large numbers and dispersed by wind and water (Mozingo 1987). Seeds remain viable for only about a week, so it is important that they reach suitable habitat quickly in order to germinate (Ware and Penfound 1949). Freshly deposited alluvium is the ideal substrate for establishment of narrowleaf willow because it provides constant moisture and is generally free of overstory trees that would shade out seedlings (Hansen at al. 1988). Alterations in the timing and intensity of high

Appendix D. Dominant Species Typically Found in the Riparian Communities Identified within the Project Area (continued)

flows can interfere with regeneration of narrowleaf willow (Ware and Penfound 1949, Stromberg et al. 1991). Narrowleaf willow helps stabilize streambanks and prevent erosion (Hansen et al. 1988).

Yellow willow (*Salix lutea*) occurs along stream and river edges, meadows, moist ditches, and moist alluvial terraces from 5,000 to 9,500 feet in sandy clay, and sandy, or rocky soils (Hansen et al. 1988, Stuart and Sawyer 2001, Argus 2002). Yellow willow almost always occurs in wetlands under natural conditions (USFWS 1996). This species reproduces primarily by seeds, which are produced in mass quantities and dispersed by wind and water (USDA-FS 2003). Seeds remain viable for only a few days and usually germinate within 12 to 24 hours of reaching a suitable substrate (USDA-FS 2003). Yellow willow does not produce root sprouts, but broken pieces of stems or roots often sprout new plants after being transported and deposited by floodwaters (Argus 1973). Yellow willow requires periodic flooding to maintain stand vigor. It is likely that the hydrologic requirements for this species are similar to those of narrowleaf willow and therefore, alterations in the timing and intensity of high flows could interfere with regeneration of yellow willow. This is a valuable species for stabilizing streambanks and preventing erosion (USDA-FS 2003).

Lemmon's willow (*Salix lemmonii*) occurs on streams or rivers on low gradient floodplains, usually within lodgepole pine (*Pinus contorta* ssp. *murrayana*) or Douglas fir (*Pseudotsuga menziesii*) forests or mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) from 5,000 to 10,000 feet in elevation (Uchytil 1989). It commonly inhabits relatively dry portions of riparian zones. This species almost always occurs in wetlands under natural conditions (USFWS 1996). Reproduction is primarily by seeds that are dispersed by wind and water from spring to early summer. Seeds germinate within 24 hours if they reach a moist site (Uchytil 1989). It is likely that the hydrologic requirements for this species are similar to those of narrowleaf willow and therefore, alterations in the timing and intensity of high flows could interfere with regeneration of Lemmon's willow. Lemmon's willow resprouts from the root crown after fire or cutting but does not sprout from lateral roots. Broken stems and roots that are transported and deposited by floodwaters may also resprout (Zasada 1986).

Scouler's willow (*Salix scouleriana*) occurs in dry to moist coniferous forests, lake and river edges, meadows, and springs from 0 to 10,000 feet in elevatation in sandy, silty-clay, or gravelly igneous rock substrates (Hickman 1993, Argus 2002, Stuart and Sawyer 2001). Scouler's willow occurs in drier habitats than most willows and can establish on dry, rocky slopes at high elevations (Chan and Wong 1989). Scouler's willow is more commonly found upland of riparian zones and in transitional zones between riparian and upland than in riparian zones (USDA-FS 2003). Its wetland indicator status is facultative (i.e., it is equally likely

Appendix D. Dominant Species Typically Found in the Riparian Communities Identified within the Project Area (continued)

to occur in wetlands or non-wetlands; USFWS 1996). This species tolerates a broad range of soil moisture and occurs on moderately to well-drained soils (USDA-FS 2003). Scouler's willow reproduces by seed and by root sprouts. Seeds are dispersed by wind and water in late spring. Moist mineral soil is required for germination and establishment of seedlings. The seeds, which remain viable for only a few days, germinate quickly when deposited on suitable substrate (Zasada 1986). Streamflow alteration is not likely to significantly affect this species since it can persist in dry habitats.

Jepson's willow (*Salix jepsonii*) occurs along the margins of montane and subalpine streams, lakes, and wet meadows from 3,500 to 11,500 feet in gravelly, rocky, or bouldery, granitic substrates (Stuart and Sawyer 2001, Argus 2002). Jepson's willow is an obligate wetland plant (i.e., it almost always occurs in wetlands under natural conditions; USFWS 1996). It is likely that the hydrologic requirements for this species are similar to those for yellow willow since these species are both obligate wetland plants and occur in similar habitats. Jepson's willow is often found in association with yellow willow in the Project area.

Shining willow (*Salix lucida*) occurs on lake shores, stream edges, seeps, springs, wet meadows, and other wet habitats from 0 to 10,500 feet, in silty, sandy to gravelly alluvium (Stuart and Sawyer 2001, Argus 2002). This is a facultative wetland species (i.e., it usually occurs in wetlands but occasionally occurs in non-wetlands; USFWS 1996). Hydrologic requirements for this species are likely similar to those of narrowleaf willow since these species are both facultative wetland species and they occur in similar habitats in the Project area. However, shining willow was commonly associated with Jepson's willow and Lemmon's willow in the Project area but was not observed growing in association with narrowleaf willow.

Sierra willow (*Salix eastwoodiae*) occurs in subalpine, alpine, and riparian zones, and talus slopes from 5,000 to 10,000 feet in granite substrates (Stuart and Sawyer 2001, Argus 2002). This species almost always occurs in wetlands under natural conditions (USFWS 1996). Based on its habitat within the Project area and its wetland indicator status, it is anticipated that Sierra willow has similar hydrologic requirements to Lemmon's willow.

Arroyo willow (*Salix lasiolepis*) occurs on the shores of rivers, streams, marshes, meadows, springs, and rocky bluffs from 0 to 9,000 feet in elevation in silty, sandy, gravelly, or rocky substrates (Stuart and Sawyer 2001, Argus 2002). This species is usually found in wetlands but occasionally occurs in non-wetlands (USFWS 1996). Arroyo willow tolerates drier areas that are higher in elevation than the streambank (McBride and Strahan 1984). Due to its adaptation to

Appendix D. Dominant Species Typically Found in the Riparian Communities Identified within the Project Area (continued)

higher areas of the floodplain, this species is not likely to be significantly affected by streamflow alteration. Arroyo willow was observed growing with Lemmon's willow, Jepson's willow, and shining willow.

Gray-leaf Sierra willow (*Salix orestera*) occurs in subalpine meadows, slopes, lakes, and streams on granite substrates from 7,000 to 13,000 feet in elevation (Argus 2002). This species is usually found in wetlands but occasionally occurs in non-wetlands (USFWS 1996). Although this species has a different wetland indicator status, it is likely that gray-leaf willow has similar hydrologic requirements to yellow willow based on its habitat within the Project area. Gray-leaf willow was observed in association with yellow willow, Jepson's willow, arroyo willow, and shining willow.

Strap-leaf willow (*Salix ligulifolia*) occurs on the banks and floodplains of rivers and streams in sandy-clay or gravelly soils from 0 to 10,000 feet in elevation (Argus 2002). This species is equally likely to occur in wetlands or non-wetlands (USFWS 1996). It is not anticipated that this species would be significantly affected by alteration of stream flows since it is able to persist in non-wetland habitats.

DOGWOOD

Dogwood (*Cornus* spp.) species in California typically grow on moist slopes or in riparian areas. Dogwoods have shallow root systems and may not be well adapted to drought conditions (Croker et al. 1998).

Mountain dogwood (*Cornus nuttallii*) is found on moist slopes and in riparian areas in coniferous forests from 0 to 6,500 feet in elevation (Stuart and Sawyer 2001). This species usually occurs in non-wetlands and is occasionally found in wetlands (USFWS 1996). Mountain dogwood is shade tolerant and is commonly found beneath large conifers such as sugar pine (*Pinus lambertiana*), ponderosa pine (*Pinus ponderosa*), and incense cedar (*Calocedrus decurrens*; Paruk 1997). This species grows best in deep, well-drained soils that are relatively stone free and have a rich humus layer. Seeds germinate in fall in a variety of substrates. Mountain dogwood cannot survive standing water (USDA-FS 2003). Since this is predominately an upland species, stream flow alteration is not likely to affect it.

Red osier dogwood (*Cornus sericea*) occurs in riparian areas, wet meadows, swamps, and moist forests from 0 to 9,000 feet in elevation and grows best under open to partially closed canopies (Stuart and Sawyer 2001, USDA-FS 2003). This species is usually found in wetlands but occasionally occurs in non-wetlands (USFWS 1996). Red osier dogwood can tolerate flooding but does not require it (USDA-FS 2003). Although mature plants can survive root

Appendix D. Dominant Species Typically Found in the Riparian Communities Identified within the Project Area (continued)

submergence through most of the growing season, seeds will only germinate above water level (USDA-FS 2003). This species grows in a variety of soils but prefers rich, moist soils. Seeds are dispersed primarily by songbirds but are also dispersed by other animals (USDA-FS 2003). Natural regeneration of this species occurs both sexually from seeds and asexually from stolon formation, layering, and root and trunk sprouts (USDA-FS 2003).

ALDER

Alders (*Alnus* spp.) typically grow in cool, moist woodlands and forests near streams or rivers (Stuart and Sawyer 2001). Most species of alder prefer rich, moist, but well-drained soils with high water tables. Some species can tolerate stagnant water as well. Alders often colonize flood-scoured stream banks and form tangled thickets which stabilize the soil (Krastinic et. al. 2000). Alders have nitrogen fixing bacteria associated with their roots that increase soil fertility (Krastinic 2000). If the streambed becomes incised or migrates to the point where alder roots can no longer reach the water, alders will eventually be replaced by species better adapted to floodplain environments (McBride and Strahan 1984).

White alder (*Alnus rhombifolia*) occurs in riparian woodlands and forests from 300 to 7,900 feet in elevation along permanent streams and lakes (Stuart and Sawyer 2001). White alder generally occurs in finer sediments than willows or cottonwoods (McBride and Strahan 1984). This species usually occurs in wetlands but is occasionally found in non-wetlands (USFWS 1988). White alder regenerates both from seed and from root and trunk sprouts (USDA-FS 2003). On river sediments in California, layering has been found to be the most common mode of reproduction for this species but layering stops as terracing occurs and the banks become higher and drier (McBride and Strahan 1984). Seeds of white alder are dispersed primarily by wind but are also carried by water. Seeds germinate on sunny, wet mineral sites exposed by receding flood waters, and seedlings appear to establish only in continuously moist substrates (Brothers 1985). White alder is restricted to streams that flow year round and occurs primarily in the flood zone, becoming more sparse farther away from the stream (Brothers 1985). Floodplain terrace building as a result of unusually high floodwaters can raise the ground surface to a point where it becomes too dry for white alder layering to occur or for seeds to germinate (McBride and Strahan 1984). This species is important in bank stabilization and erosion control.

Mountain alder (*Alnus incana* ssp. *tenuifolia*) occurs along streams and in and around montane to upper montane meadows from 4,000 to 8,000 feet in elevation. This species almost always occurs in wetlands under natural conditions (USFWS 1996, Stuart and Sawyer 2001). This species occurs

Appendix D. Dominant Species Typically Found in the Riparian Communities Identified within the Project Area (continued)

primarily on sites that are seasonally flooded and requires a water table within 3 feet of the ground surface. Mountain alder is confined mostly to rivers, stream borders, overflow channels, and mountain springs or seeps and is found in broad floodplains only occasionally (Roberts 1984). This species can withstand severe runoff and stabilizes streambanks, reducing erosion (USDA-FS 2003). Regeneration occurs from prolific seed production and from rhizomes or root sprouts (Brothers 1985). Fruits are dispersed by wind and water in fall and winter (USDA-FS 2003).

COTTONWOOD

Cottonwoods (*Populus* spp.) typically grow in moist woodlands and forests in riparian areas. These are pioneer species and also prevent streambank erosion, like willows and alders (USDA-FS 2003). Cottonwoods are often used as indicators of surface water because the water table must be within at least 10 feet from the ground surface to maintain healthy cottonwood stands (Lines and Bilhorn 1996, Stuart and Sawyer 2001). Cottonwoods rely on periodic flooding in both spring and winter to persist (Fenner et al. 1985) in valley alluvial systems. Cottonwoods require fresh, moist alluvial sediments for seed germination (Jones and Stokes 1983, Fenner et al. 1985). Seed dispersal is timed during the high flows of early spring so that germination will occur just as spring flood waters are receding to expose the ideal substrate (Fenner et al. 1985). Following germination, cottonwood seedlings require a continuously moist substrate for survival (Scott et al. 1996). Because cottonwoods have evolved with flow regime and fluvial processes, changes in the natural timing and magnitude of high flows may interrupt the regenerative processes of cottonwoods (Anderson et al. 1984, Fenner et al. 1985, Bradley and Smith 1986). Cottonwood habitat is reduced by restriction of stream channels and reduction of overbank flooding (EDAW 1999). Cottonwoods can adapt to periods of drought but long-term maintenance depends on the ability to reach the alluvial groundwater table, which requires adequate stream flows (EDAW 1999).

Fremont cottonwood (*Populus fremontii* ssp. *fremontii*) occurs in riparian woodlands from 0 to 6,500 feet in elevation. This species is intolerant of shade and establishes on bare, moist soil near streams (Stuart and Sawyer 2001). Gravelly sand is the ideal substrate for this species (Jones and Stokes 1983). This species is equally likely to occur in wetlands or non-wetlands in California (USFWS 1996). Although mature Fremont cottonwood trees may persist in upland habitats, they require a water table within at least 10-15 feet of the ground surface, and seedling establishment requires freshly deposited, exposed alluvium left by receding floodwaters (Jones and Stokes 1983, Fenner et al. 1985, Bradley and Smith 1986, Lines and Bilhorn 1996). In California, seeds are generally dispersed from April to May (Taylor 2000). Seeds remain viable for one to five

Appendix D. Dominant Species Typically Found in the Riparian Communities Identified within the Project Area (continued)

weeks after dispersal. Therefore, it is critical that moist, exposed alluvium is present within this time period. Seeds are dispersed primarily by wind but also by water (Taylor 2000). Seed viability is lost if the appropriate microhabitat is not available within two or three days of the seed being wetted (Braatne et al. 1996). Seedlings require a water table within 3 feet of the ground surface for the first year in order to survive and they cannot tolerate water loss of more than an inch per day (Stromberg et al. 1991). Asexual reproduction occurs from root sprouting, stump sprouting, and sprouting from stem buds when stems come in contact with moist alluvium (Taylor 2000). Regeneration is strongly dependent on annual runoff regime (Brothers 1984). Changes in the natural timing and flow of watercourses may reduce the recruitment and vigor of Fremont cottonwood stands (Fenner et al. 1985, Bradley and Smith 1986). Fremont cottonwood can survive inundation and siltation (Braatne et al. 1996).

Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*) is found in riparian woodlands and alluvial bottomlands from 0 to 10,000 feet in elevation (Hickman 1993, Stuart and Sawyer 2001). This species usually occurs in wetlands but is occasionally found in non-wetlands (USFWS 1996). This species is intolerant of shade and requires disturbance, such as flooding, to remove conifers that would shade them out (Stuart and Sawyer 2001). Although black cottonwood can tolerate inundation, stagnant standing water and fine sediments tend to inhibit growth of this species, whereas fast running floodwater that is high in oxygen tends to increase growth (Paruk 1997). Black cottonwood has been reported as tolerant of short-duration flooding and tolerant of frequent and prolonged flooding, but the water table is nearly always close to the surface in areas dominated by black cottonwood (USDA-FS 2003). Seeds of black cottonwood are dispersed by wind and water beginning in mid-summer (Braatne et al. 1996). If flows are too high, the seeds can be carried too long and will lose viability (Braatne et al. 1996). Seedlings require as much as 0.5 inches of moisture per day for the first month following germination in order to survive (Braatne et al. 1996). Inundation and sediment deposition aids in seedling establishment because it eliminates competitors (Braatne et al. 1996). Although flooding helps black cottonwood seedlings to establish, ice jams and turbulent melting during spring runoff can scour seedlings established in previous years (USDA-FS 2003). Seedling establishment is highly dependent on flow magnitude following seed deposition (Malanson and Butler 1991). As in Fremont cottonwood, seed dispersal of black cottonwood coincides with high flows of spring, changes in the timing and magnitude of natural flows can interfere with regeneration of black cottonwood (Malanson and Butler 1991, Braatne et al. 1996). In mature stands of black cottonwood, root sprouting is the most common form of regeneration (USDA-FS 2003).

Appendix D. Dominant Species Typically Found in the Riparian Communities Identified within the Project Area (continued)

OTHER SPECIES

Quaking aspen (*Populus tremuloides*) is often found in or near montane and subalpine meadows and streams from 6,000 to 10,000 feet in California, but it occurs in a wide variety of habitats, including moist upland woods to dry mountainsides (Hickman 1993, Stuart and Sawyer 2001, USDA-FS 2003). Quaking aspen is equally likely to occur in wetlands or non-wetlands (USFWS 1996). This species does not tolerate shade, standing water, or waterlogged soils (Perala 1990). Stems that survive flooding in the short-term often develop fungal infections after prolonged flooding (Davidson et al. 1959). Quaking aspen reproduces from seed and, more commonly, from root sprouts (USDA-FS 2003). Prolific root sprouting occurs following removal of the parent tree but usually only sprouts that occur in canopy gaps survive (USDA-FS 2003). Seedling establishment is most successful on moist mineral soils with good drainage, moderate temperatures, and absence of competing vegetation. Because quaking aspen is adapted to upland habitats, streamflow alteration is not likely to significantly affect this species.

Bigleaf maple (*Acer macrophyllum*) is commonly found along streambanks and in moist canyons within mixed coniferous forests but can also occur on dry, rocky slopes and a variety of other habitats from 0 to 5,000 feet in elevation (Hickman 1993, Stuart and Sawyer 2001). In southern California, bigleaf maple is usually restricted to canyons and riparian areas (Brothers 1985). Bigleaf maple is equally likely to occur in wetlands or non-wetlands (USFWS 1996). Bigleaf maple achieves its most vigorous growth in deep alluvial soils near streams. This species is flood tolerant and grows well in floodplain habitats (USDA-FS 2003). This species has low to moderate shade tolerance. Reproduction is primarily by seed but sprouting from the root crown of top-killed trees is also prevalent (Haeussler and Coates 1986). Seeds are dispersed primarily by wind starting in late fall (Haeussler and Coates 1986). The seeds, which remain viable for only a few months and then begin to decay, germinate in winter (Fried et al. 1988). Moisture stress, predation, and light intensity are the primary factors influencing survival of seedlings (Haeussler and Coates 1986, Fried et al. 1988). Seedlings often remain stunted under closed forest canopies and only begin to flourish when the canopy is opened by disturbance (Fried et al. 1988). Seedlings do not usually survive more than a few years under dense canopy cover (Fried et al 1988). Because big leaf maple is adapted to upland habitats, streamflow alteration is not likely to significantly affect this species.

Oregon ash (*Fraxinus latifolia*) is usually found along streams, seeps, and wet meadows from 0 to 5,500 feet in elevation (Stuart and Sawyer 2001). This species usually occurs in wetlands but is occasionally found in non-wetlands (USFWS 1996). Oregon ash is tolerant of intermediate shade levels and grows

Appendix D. Dominant Species Typically Found in the Riparian Communities Identified within the Project Area (continued)

best in frequently flooded habitats (Haard 1996, Stuart and Sawyer 2001). Although this species tolerates flooding, it does not require it, and established trees can survive summers without water (OSU 2003, WSU 2003). Oregon ash can survive standing water only in winter, when it is dormant, and early in the growing season (WSU 2003).

Western azalea (*Rhododendron occidentale*) occurs in moist coniferous forests from 0 to 7,500 feet in elevation, often along streams, wet meadows, and seeps (Hickman 1993, Stuart and Sawyer 2001). This species is equally likely to occur in wetlands or non-wetlands (USFWS 1996).

APPENDIX E

Historical Aerial Photography for Review

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Huntington Lake	1944	Unknown	51	7	160	Y	Dam 1	1:15,840	Black & White
Huntington Lake	1944	Unknown	51	7	161	Y	Dam 2 & Dam 3	1:15,840	Black & White
Huntington Lake	1944	Unknown	52	8	23	Y	South mid-West of Lake	1:15,840	Black & White
Huntington Lake	1944	Unknown	52	8	22		North mid - West of Lake	1:15,840	Black & White
Huntington Lake	1944	Unknown	52A	18	76	Below site - N Above site - Y	Mid-east of Lake	1:15,840	Black & White
Huntington Lake	1944	Unknown	53	18	45	Y	Northeast of Lake	1:15,840	Black & White
Huntington Lake	1944	Unknown	53	18	44	Y	Southeast of of Lake	1:15,840	Black & White
Vermillion Valley- Before the dam was built	1944	Unknown	58	12	125	Y		1:15,840	Black & White
Vermillion Valley- Before the dam was built	1944	Unknown	59	14	25	Y		1:15,840	Black & White
Vermillion Valley- Before the dam was built	1944	Unknown	60	15	11	Y		1:15,840	Black & White
Warm Creekeek Diversion	1944	Unknown	57	12	82	Y		1:15,840	Black & White
Powerhouse 1 & Dam 4	1944	Unknown	51	7	159	Y		1:15,840	Black & White
Powerhouse 2 & Dam 5	1944	Unknown	50	7	143	Y		1:15,840	Black & White
Mammoth Pool Conveyance System	1944	Unknown	48	7	81	Y	Mammoth Pool Dam	1:15,840	Black & White
Mammoth Pool Conveyance System	1944	Unknown	48	7	83	Y	Rock Creek Diversion	1:15,840	Black & White
Mammoth Pool Conveyance System	1944	Unknown	48	7	85	Y	Clearwater Diversion	1:15,840	Black & White
Mammoth Pool- Before the dam was built	1944	Unknown	49	7	108	Y	Daulton Creek	1:15,840	Black & White
Mammoth Pool- Before the dam was built	1944	Unknown	49	7	109	Y	Logan Meadow	1:15,840	Black & White
Mammoth Pool- Before the dam was built	1944	Unknown	49	7	110	Y	Miller Meadow	1:15,840	Black & White
Mammoth Pool- Before the dam was built	1944	Unknown	50	7	133	Y	Fuller Buttes	1:15,840	Black & White
Tunnel #3	1944	Unknown	49	7	106	Y	Dam 6 & Powerhouse 8	1:15,840	Black & White
Tunnel #3	1944	Unknown	48	7	88	Y	Mid-tunnel	1:15,840	Black & White
Tunnel #3	1944	Unknown	47	7	47	Y	Powerhouse 3 south end tunnel	1:15,840	Black & White

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Florence Lake	1944	Unknown	59	14	30	Y	Florence Lake Dam	1:15,840	Black & White
Florence Lake	1944	Unknown	59	14	29	Y	Southwest of Lake	1:15,840	Black & White
Florence Lake	1944	Unknown	60	15	3	Y	Northeast of Lake	1:15,840	Black & White
Florence Lake	1944	Unknown	60	14	42	Y	Southeast of Lake	1:15,840	Black & White
Ward Tunnel	1944	Unknown	58	14	8	Y	Florence Lake East part of tunnel	1:15,840	Black & White
Ward Tunnel	1944	Unknown	57	12	79	Y	Camp 62	1:15,840	Black & White
Ward Tunnel	1944	Unknown	57	12	79	Y	Bosilla	1:15,840	Black & White
Ward Tunnel	1944	Unknown	56	12	60	Y	Camp 61	1:15,840	Black & White
Ward Tunnel	1944	Unknown	55	12	9	Y	West portion of tunnel	1:15,840	Black & White
Jackass Meadow	1944	Unknown	59	14	30	Y		1:15,840	Black & White
Jackass Meadow	1944	Unknown	60	15	5	Y	North & South side of diversion around Hooper	1:15,840	Black & White
Jackass Meadow	1944	Unknown	59	14	29	Y	Hooper diversion dam	1:15,840	Black & White
Mono-Bear Siphon	1944	Unknown	58	12	128	Y		1:15,840	Black & White
Mono-Bear Siphon	1944	Unknown	58	12	126	Y	North Fork, Mono Diversion	1:15,840	Black & White
Bear Creek	1944	Unknown	59	14	27	Y		1:15,840	Black & White
Bear Creek	1944	Unknown	60	15	8	Y		1:15,840	Black & White
Bear Creek	1944	Unknown	61	15	38	Y		1:15,840	Black & White
Mono Creek	1944	Unknown	58	12	126	Y		1:15,840	Black & White
Tunnel #5	1944	Unknown	49	7	102	Y	North end of tunnel (Shaver Dam)	1:15,840	Black & White
Tunnel #5	1944	Unknown	49	7	101	Y	Mid-tunnel	1:15,840	Black & White
Tunnel #5	1944	Unknown	49	7	100	Y	Shaver Dam, south end	1:15,840	Black & White
Shaver Lake	1944	Unknown	49	7	100	Y	Shaver Dam	1:15,840	Black & White
Shaver Lake	1944	Unknown	50	7	144	Y	Shaver Lake Pt. (Northeast of lake)	1:15,840	Black & White
Shaver Lake	1944	Unknown	50	7	153	Y	South east of lake	1:15,840	Black & White
Shaver Lake	1944	Unknown	49	7	99	Y	Northwest side of lake	1:15,840	Black & White
Shaver Lake	1944	Unknown	48	7	98	Y	Southwest side of lake	1:15,840	Black & White
Redinger	1944	Unknown	45	7	6	Y	Dam 7	1:15,840	Black & White
Redinger	1944	Unknown	44	6	137	Y	Powerhouse 4	1:15,840	Black & White
Balsam Meadow Forebay	1944	Unknown	51	7	157	Y		1:15,840	Black & White

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Huntington-Pitman-Shaver Conduit	1944	Unknown	52	8	23	Y	North most portion-Huntington Lake	1:15,840	Black & White
Huntington-Pitman-Shaver Conduit	1944	Unknown	52	8	25	Y	Tamarack Creek	1:15,840	Black & White
Huntington-Pitman-Shaver Conduit	1944	Unknown	52	8	24	Y	Mid-South Portion	1:15,840	Black & White
Ely Diversion	1944	Unknown	33	1381	85	Y		1:15,840	Black & White
Balsam Diversion	1944	Unknown	34	1381	95	Y		1:15,840	Black & White
Huntington Lake	1970	May through September	26	19	21	Y	Dam 1 of Huntington Lake	1:15,840	Black & White
Huntington Lake	1970	May through September	26	19	22	Y	Dam 2 & Dam 3 of Huntington Lake	1:15,840	Black & White
Huntington Lake	1970	May through September	27	26	17	Y	Southwest side of Lake	1:15,840	Black & White
Huntington Lake	1970	May through September	28	25	145	Y	Southeast side of Lake	1:15,840	Black & White
Huntington Lake	1970	May through September	27	26	16	Y	Northwest side of Lake	1:15,840	Black & White
Huntington Lake	1970	May through September	28	25	144	Y	Northeast side of Lake	1:15,840	Black & White
Huntington Lake	1970	May through September	29	17	66	Y	East side of Lake (Portal Powerhouse)	1:15,840	Black & White
Vermillion Valley Dam	1970	May through September	34	18	118	Y	Vermillian Valley	1:15,840	Black & White
Warm Creek Diversion	1970	May through September	33	18	80	Y	Warm Creek Diversion	1:15,840	Black & White
PH1 & Dam 4	1970	May through September	26	19	19	Y	Same photo for both PH 1 & Dam 4	1:15,840	Black & White
PH2 & Dam 5	1970	May through September	23	13	103	Y	PH 2 & Dam 5	1:15,840	Black & White
Mammoth Pool Conveyance System	1970	May through September	23	13	94	Y	Mammoth Pool Dam	1:15,840	Black & White
Mammoth Pool Conveyance System	1970	May through September	22	12	44	Y	Rock Creek Diversion	1:15,840	Black & White
Mammoth Pool Conveyance System	1970	May through September	22	12	39	Y	Mammoth Pool Powerhouse	1:15,840	Black & White

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Tunnel #3	1970	May through September	23	26	82	Y	Dam 6 & Dam 8	1:15,840	Black & White
Tunnel #3	1970	May through September	22	12	36	Y	Upper mid-portion of Tunnel	1:15,840	Black & White
Tunnel #3	1970	May through September	21	12	87	Y	Bottom mid-portion of Tunnel	1:15,840	Black & White
Tunnel #3	1970	May through September	21	12	88	Y	Powerhouse #3	1:15,840	Black & White
Florence Lake Dam	1970	May through September	35	23	67	Y	Florence Dam & Point where Ward Tunnel Begins	1:15,840	Black & White
Florence Lake Dam	1970	May through September	36	23	44	Y	North Florence Lake	1:15,840	Black & White
Ward Tunnel	1970	May through September	35	23	67	Y	Florence Lake where Ward Tunnel begins	1:15,840	Black & White
Ward Tunnel	1970	May through September	34	18	124	Y	East Portion of Tunnel	1:15,840	Black & White
Ward Tunnel	1970	May through September	33/34	27	70	Y	Ward Tunnel at Camp 62	1:15,840	Black & White
Ward Tunnel	1970	May through September	33	18	75	Y	Bosillio	1:15,840	Black & White
Ward Tunnel	1970	May through September	32	18	22	Y	Camp 61 & Portal Forebay	1:15,840	Black & White
Ward Tunnel	1970	May through September	31	17	138	Y	Kaiser Pass	1:15,840	Black & White
Ward Tunnel	1970	May through September	30	25	126	Y	West portion	1:15,840	Black & White
Jackass Meadow	1970	May through September	36	23	17	Y	Jackass Meadow	1:15,840	Black & White
Jackass Meadow	1970	May through September	36	23	18	Y	N & S Hooper diversion	1:15,840	Black & White
Jackass Meadow	1970	May through September	36	23	19	Y	Hooper diversion dam	1:15,840	Black & White
Mono-Bear Sipon	1970	May through September	33/34	27	71	Y	Lower-Bear siphon	1:15,840	Black & White
Mono-Bear Sipon	1970	May through September	34	18	122	Y	Mid-Bear siphon	1:15,840	Black & White

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Mono-Bear Sipon	1970	May through September	34	18	121	Y	Upper-Bear siphon	1:15,840	Black & White
Mono-Bear Sipon	1970	May through September	35	23	63	Y	South Fork of Mono-Bear Siphon	1:15,840	Black & White
Mono-Bear Sipon	1970	May through September	36	23	21	Y	Bear Diversion	1:15,840	Black & White
Mono-Bear Sipon	1970	May through September	35	23	61	Y	North Fork & Mono diversion	1:15,840	Black & White
Tunnel 5	1970	May through September	24	19	99	Y	South End (Shaver Dam) of Tunnel 5	1:15,840	Black & White
Tunnel 5	1970	May through September	24	19	100	Y	North End of Tunnel 5	1:15,840	Black & White
Shaver Lake	1970	May through September	24	19	99	Y	North Section of Shaver Lake	1:15,840	Black & White
Shaver Lake	1970	May through September	24	19	97	Y	Shaver Lake Point	1:15,840	Black & White
Shaver Lake	1970	May through September	24	19	97	Y	Middle of Shaver Lake	1:15,840	Black & White
Shaver Lake	1970	May through September	24	19	95	Y	South Shaver Lake	1:15,840	Black & White
Shaver Lake	1970	May through September	23	26	75	Y	West Shaver Lake	1:15,840	Black & White
Redinger	1970	May through September	18	12	52	Y	Dam 7	1:15,840	Black & White
Redinger	1970	May through September	17	12	167	Y	Powerhouse 4	1:15,840	Black & White
Balsam Meadow Forebay	1970	May through September	26	19	16	Y		1:15,840	Black & White
Hunnigntion-Pitman-Shaver Conduit	1970	May through September	27	26	13	Y	North end-Huntington Lake	1:15,840	Black & White
Hunnigntion-Pitman-Shaver Conduit	1970	May through September	27	26	12	Y	Conduit at Pitman Creek	1:15,840	Black & White
Hunnigntion-Pitman-Shaver Conduit	1970	May through September	27	26	11	Y		1:15,840	Black & White
Hunnigntion-Pitman-Shaver Conduit	1970	May through September	26	19	18	Y		1:15,840	Black & White
Hunnigntion-Pitman-Shaver Conduit	1970	May through September	26	19	16	Y	South end-Stevensons Creek	1:15,840	Black & White

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Ely Diversion & Balsom Diversion	1970	May through September	25	19	67	Y		1:15,840	Black & White
Mammoth Pool	1970	May through September	23	13	96	Y	Mammoth Pool Dam	1:15,840	Black & White
Mammoth Pool	1970	May through September	23	13	98	Y	Fuller Meadow	1:15,840	Black & White
Mammoth Pool	1970	May through September	24	19	118	Y	North most end	1:15,840	Black & White
Huntington Lake	1976	May through September	26	5	200	Y	Dam 1, 2 & 3 West portion of Lake	1:5840	Color
Huntington Lake	1976	May through September	27	5	224	Y	Mid Northwest portion of lake	1:5840	Color
Huntington Lake	1976	May through September	27	5	223	Y	Mid Southwest portion of lake	1:5840	Color
Huntington Lake	1976	May through September	28	6	5	Y	Mid Northeast portion of lake	1:5840	Color
Huntington Lake	1976	May through September	28	6	4	Y	Mid Southeast portion of lake	1:5840	Color
Huntington Lake	1976	May through September	29	6	31	Y	East most portion of lake (Portal Powerhouse)	1:5840	Color
Vermillion Valley	1976	May through September	34	7	184	Y	Dam 1, 2 & 3 West portion of lake	1:5840	Color
Vermillion Valley	1976	May through September	33	7	73	Y	Diversion	1:5840	Color
Powerhouse 1 & Dam 4	1976	May through September	26	5	202	Y		1:5840	Color
Powerhouse 2 & Dam 5	1976	May through September	24	3	80	Y		1:5840	Color
Mammoth Pool Conveyance System	1976	May through September	23	13	25	Y	Mammoth Pool Dam	1:5840	Color
Mammoth Pool Conveyance System	1976	May through September	23	3	23	Y	Rock Creek Diversion	1:5840	Color
Mammoth Pool Conveyance System	1976	May through September	23	3	16	Y	Mammoth Pool Powerhouse	1:5840	Color
Mammoth Pool	1976	May through September	23	13	25	Y	Mammoth Pool Dam	1:5840	Color

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Mammoth Pool	1976	May through September	23	13	27	Y	Fuller Meadow	1:5840	Color
Mammoth Pool	1976	May through September	24	5	32	Y	Mill Creek	1:5840	Color
Mammoth Pool	1976	May through September	25	3	39	Y	North most end of Pool	1:5840	Color
Tunnel #3	1976	May through September	23	3	15	Y	Dam 6 & Powerhouse 8- uppermost portion of tunnel	1:5840	Color
Tunnel #3	1976	May through September	22	2	200	Y	Mid-upper portion of tunnel	1:5840	Color
Tunnel #3	1976	May through September	22	2	201	Y	Mid-lower portion of tunnel	1:5840	Color
Tunnel #3	1976	May through September	21	4	204	Y	Powerhouse #3	1:5840	Color
Florence Lake	1976	May through September	35	7	202	Y	Florence Lake Dam & point where Ward tunnel begins	1:5840	Color
Florence Lake	1976	May through September	39	9	132	Y	North side of Lake	1:5840	Color
Florence Lake	1976	May through September	36	9	134	Y	South side of Lake	1:5840	Color
Florence Lake	1976	May through September	37	2	167	Y	East side of Lake	1:5840	Color
Ward Tunnel	1976	May through September	34	7	177	Y	Tunnel at Camp 62	1:5840	Color
Ward Tunnel	1976	May through September	33	7	68	Y	Bolsillo	1:5840	Color
Ward Tunnel	1976	May through September	32	7	115	Y	Portal Forebay	1:5840	Color
Ward Tunnel	1976	May through September	31	7	22	Y	Kaiser Meadow	1:5840	Color
Ward Tunnel	1976	May through September	30	6	84	Y	West of Kaiser	1:5840	Color
Ward Tunnel	1976	May through September	29	6	32	Y	Shaver Lake- Portal Powerhouse- West Portion	1:5840	Color

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Jackass Meadow	1976	May through September	36	9	131	Y	Meadow	1:5840	Color
Jackass Meadow	1976	May through September	36	9	130	Y	North & South diversion	1:5840	Color
Jackass Meadow	1976	May through September	36	9	129	Y	Hooper Diversion Dam	1:5840	Color
Mono-Bear Siphon	1976	May through September	34	7	178	Y	Lower Mono-Bear Siphon	1:5840	Color
Mono-Bear Siphon	1976	May through September	34	7	180	Y	Mid Siphon	1:5840	Color
Mono-Bear Siphon	1976	May through September	34	7	181	Y	Upper & North Fork	1:5840	Color
Mono-Bear Siphon	1976	May through September	35	7	197	Y	S. Fork & Bear Diversion Dam	1:5840	Color
Mono-Bear Siphon	1976	May through September	35	7	182	Y	N. Fork & Mono Creek Diversion Dam	1:5840	Color
Tunnel #5	1976	May through September	24	3	80	Y	North end	1:5840	Color
Huntington Lake	1981	Unknown	35	3181	48	Y	Dam 1	1:12,000	Color
Huntington Lake	1981	Unknown	35	3181	49	Y	Dam 2 & Dam 3	1:12,000	Color
Huntington Lake	1981	Unknown	36	1481	45	Y	Mid-North West	1:12,000	Color
Huntington Lake	1981	Unknown	36	1481	46	Y	Mid-South West	1:12,000	Color
Huntington Lake	1981	Unknown	37	3081	115	Y	Mid-North East	1:12,000	Color
Huntington Lake	1981	Unknown	37	3081	116	Y	Mid-South East	1:12,000	Color
Huntington Lake	1981	Unknown	38	1281	15	Y	East most Portion	1:12,000	Color
Huntington Lake	1981	Unknown	35	1281	14	Y	Portal Powerhouse	1:12,000	Color
Vermillion Valley- Not photographed		Unknown						1:12,000	Color
Warm Creek- Not photographed		Unknown						1:12,000	Color
Powerhouse #1 & Dam 4	1981	Unknown	35	1381	125	Y		1:12,000	Color
Powerhouse #2 & Dam 5	1981	Unknown	34	1381	92	Y		1:12,000	Color
Mammoth Pool Conveyance System	1981	Unknown	31	681	11	Y	Mammoth Pool Dam	1:12,000	Color
Mammoth Pool Conveyance System	1981	Unknown	30	681	64	Y	Clearwater Creek Diversion	1:12,000	Color

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Mammoth Pool Conveyance System	1981	Unknown	30	681	63	Y	Mammoth Pool Powerhouse	1:12,000	Color
Mammoth Pool	1981	Unknown	31	681	11	Y	Mammoth Pool Dam	1:12,000	Color
Mammoth Pool	1981	Unknown	31	681	9	Y	Fuller Meadow	1:12,000	Color
Mammoth Pool	1981	Unknown	32	1381	39	Y	Mill Creek	1:12,000	Color
Mammoth Pool	1981	Unknown	33	1081	99	Y	North most end of pool	1:12,000	Color
Tunnel #3	1981	Unknown	30	681	62	Y	Powerhouse #8 & Dam 6 North most portion	1:12,000	Color
Tunnel #3	1981	Unknown	30	681	60	Y	Mid-North portion of Tunnel	1:12,000	Color
Tunnel #3	1981	Unknown	29	3381	78	Y	Mid-Tunnel	1:12,000	Color
Tunnel #3	1981	Unknown	28	581	88	Y	South most portion of Tunnel	1:12,000	Color
Florence Lake- Not photographed		Unknown						1:12,000	Color
Ward Tunnel-Eastside Not photographed	1981	Unknown	43	2881	31	Y	Portal Forebay	1:12,000	Color
Ward Tunnel-Eastside Not photographed	1981	Unknown	43	2881	32	Y	Camp 61 Creek	1:12,000	Color
Ward Tunnel-Eastside Not photographed	1981	Unknown	41	3281	95	Y	Kaiser Pass	1:12,000	Color
Ward Tunnel-Eastside Not photographed	1981	Unknown	40	3281	45	Y	West portion of Ward Tunnel	1:12,000	Color
Ward Tunnel-Eastside Not photographed	1981	Unknown	39	1281	42	Y	Huntington Lake- Portal Powerhouse	1:12,000	Color
Jackass Meadow- Not photographed		Unknown						1:12,000	Color
Mono-Bear Siphon		Unknown						1:12,000	Color
Tunnel 5	1981	Unknown	31	680	23	Y	North end	1:12,000	Color
Tunnel 5	1981	Unknown	32	1381	55	Y		1:12,000	Color
Tunnel 5	1981	Unknown	32	1381	56	Y	Ely Station	1:12,000	Color
Tunnel 5	1981	Unknown	32	1381	58	Y	South end-Shaver Lake	1:12,000	Color
Shaver Lake	1981	Unknown	32	1381	58	Y	North portion of Shaver Lake	1:12,000	Color
Shaver Lake	1981	Unknown	32	1381	59	Y	Shaver Lake Point	1:12,000	Color
Shaver Lake	1981	Unknown	32	1381	61	Y	Mid-Shaver Lake	1:12,000	Color
Shaver Lake	1981	Unknown	32	1381	62	Y	South Shaver Lake	1:12,000	Color

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Shaver Lake	1981	Unknown	31	1381	30	Y	West Shaver Lake	1:12,000	Color
S.J. Railroad from Big Creek to El Prado	1981	Unknown	35	1381	126	Y	Big Creek	1:12,000	Color
S.J. Railroad from Big Creek to El Prado	1981	Unknown	33	1381	86	Y	Camp Sierra	1:12,000	Color
S.J. Railroad from Big Creek to El Prado	1981	Unknown	31	681	24	Y		1:12,000	Color
S.J. Railroad from Big Creek to El Prado	1981	Unknown	30	681	59	Y		1:12,000	Color
S.J. Railroad from Big Creek to El Prado	1981	Unknown	29	3381	76	Y	Mill Creek	1:12,000	Color
S.J. Railroad from Big Creek to El Prado	1981	Unknown	29	3381	77	Y	Mathew Mill	1:12,000	Color
S.J. Railroad from Big Creek to El Prado	1981	Unknown	28	581	95	Y	Musick Creek	1:12,000	Color
S.J. Railroad from Big Creek to El Prado	1981	Unknown	28	581	98	Y	Pine Ride	1:12,000	Color
S.J. Railroad from Big Creek to El Prado	1981	Unknown	28	581	100	Y	Mountain Station Rest	1:12,000	Color
Redinger	1981	Unknown	22	1381	19	Y	Powerhouse 4	1:12,000	Color
Balsam Meadow Forebay	1981	Unknown	22	1381	97	Y		1:12,000	Color
Huntington- Pitman - Shaver Conduit	1981	Unknown	35	3181	49	Y	North end- Huntington Lake	1:12,000	Color
Huntington- Pitman - Shaver Conduit	1981	Unknown	36	1481	47	Y	Grouse Creek	1:12,000	Color
Huntington- Pitman - Shaver Conduit	1981	Unknown	36	1481	50	Y	Pitman Creek	1:12,000	Color
Huntington- Pitman - Shaver Conduit	1981	Unknown	35	1381	123	Y	Near Tamarack Mtn.	1:12,000	Color
Huntington- Pitman - Shaver Conduit	1981	Unknown	35	1381	121	Y	South end- Stevensons Creek	1:12,000	Color
Ely Diversion	1981	Unknown	33	1381	85	Y		1:12,000	Color
Balsam Diversion	1981	Unknown	34	1381	95	Y		1:12,000	Color
Huntington Lake	1992	Unknown	35	591	115	Y	Dam 1	1:12,000	Color
Huntington Lake	1992	Unknown	35	591	116	Y	Dam 2 & Dam 3	1:12,000	Color
Huntington Lake	1992	Unknown	36	591	88	Y	Mid-West of lake	1:12,000	Color
Huntington Lake	1992	Unknown	37	591	61		Mid-East of lake	1:12,000	Color

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Huntington Lake	1992	Unknown	38	591	28		East of Lake	1:12,000	Color
Huntington Lake	1992	Unknown	38	591	27		Portal Powerhouse	1:12,000	Color
Vermillion Valley	1992	Unknown	46	391	181		Vermillion Dam	1:12,000	Color
Vermillion Valley	1992	Unknown	48	391	79		Mid-East Lake Edison	1:12,000	Color
Vermillion Valley	1993	Unknown	49	1091	13		East Lake Edison- not taken in 1992	1:12,000	Color
Warm Creek Diversion	1992	Unknown	45	491	14			1:12,000	Color
Powerhouse #1 & Dam 4	1993	Unknown	34	1291	152			1:12,000	Color
Powerhouse #2 & Dam 5	1991	Unknown	31	291	152			1:12,000	Color
Mammoth Pool Conveyance System	1991	Unknown	30	291	99		Upper most portion of Conveyance System	1:12,000	Color
Mammoth Pool Conveyance System	1991	Unknown	30	291	99		Shake Flat	1:12,000	Color
Mammoth Pool Conveyance System	1991	Unknown	30	291	105		Rock Creek Diversion	1:12,000	Color
Mammoth Pool Conveyance System	1991	Unknown	30	291	109		Clearwater Diversion	1:12,000	Color
Mammoth Pool Conveyance System	1991	Unknown	30	291	110		Mammoth Pool Powerhouse	1:12,000	Color
Mammoth Pool	1991	Unknown	31	291	165		Mammoth Pool Dam	1:12,000	Color
Mammoth Pool	1991	Unknown	30	291	98		Logan Meadow	1:12,000	Color
Mammoth Pool	1991	Unknown	31	291	168		Fuller Meadow	1:12,000	Color
Mammoth Pool	1993	Unknown	32	1291	98		Kaiser Pass Creek	1:12,000	Color
Mammoth Pool	1993	Unknown	32	1291	100		Mill Creek	1:12,000	Color
Mammoth Pool	1993	Unknown	33	1291	92		North most portion of pool	1:12,000	Color
Tunnel #5	1993	Unknown	32	1291	176		Mid-tunnel	1:12,000	Color
Tunnel #5	1993	Unknown	32	1291	178		Shaver Lake Dam- South end of tunnel	1:12,000	Color
Shaver Lake	1993	Unknown	32	1291	178		Shaver Lake Dam	1:12,000	Color
Shaver Lake	1993	Unknown	32	1291	179		Shaver Lake Point	1:12,000	Color
Shaver Lake	1993	Unknown	31	291	145		North east portion of lake	1:12,000	Color
Shaver Lake	1993	Unknown	31	291	143		South east portion of lake	1:12,000	Color
Shaver Lake	1993	Unknown	32	291	177		Mid lake	1:12,000	Color
Shaver Lake	1993	Unknown	32	1291	120		West portion of lake	1:12,000	Color
Florence Lake	1992	Unknown	47	391	167		Florence Lake Dam- where Ward Tunnel begins	1:12,000	Color

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Florence Lake	1992	Unknown	47	391	93		North side of lake	1:12,000	Color
Florence Lake	1992	Unknown	47	391	95		South side of lake	1:12,000	Color
Florence Lake	1992	Unknown	49	391	63		East side of lake	1:12,000	Color
Tunnel #3	1991	Unknown	30	291	111		Dam 6 & Powerhouse 8- upper most portion tunnel	1:12,000	Color
Tunnel #3	1991	Unknown	30	291	113			1:12,000	Color
Tunnel #3	1991	Unknown	29	291	71		Stevenson Creek	1:12,000	Color
Tunnel #3	1991	Unknown	27	191	55		Powerhouse #3- lower most portion of tunnel	1:12,000	Color
Ward Tunnel	1992	Unknown	47	391	189		Florence Lake Dam- East most portion of tunnel	1:12,000	Color
Ward Tunnel	1992	Unknown	45	491	7		Camp 62	1:12,000	Color
Ward Tunnel	1992	Unknown	44	491	24		Bosillo	1:12,000	Color
Ward Tunnel	1992	Unknown	43	491	84		Portal Forebay	1:12,000	Color
Ward Tunnel	1992	Unknown	41	491	168		Kaiser Meadow	1:12,000	Color
Ward Tunnel	1992	Unknown	40	491	146		West of Kaiser Meadow	1:12,000	Color
Ward Tunnel	1992	Unknown	39	491	209		Shaver Dam - West most portion of tunnel	1:12,000	Color
Redinger	1991	Unknown	24	191	137		Dam 7	1:12,000	Color
Balsam Meadow Forebay	1993	Unknown	34	1291	147			1:12,000	Color
Huntington-Pitman-Shaver Conduit	1992	Unknown	35	591	115		Huntington Lake- North end of Conduit	1:12,000	Color
Huntington-Pitman-Shaver Conduit	1992	Unknown	36	591	90		Grouse Creek	1:12,000	Color
Huntington-Pitman-Shaver Conduit	1992	Unknown	36	591	92		Pitman Creek	1:12,000	Color
Huntington-Pitman-Shaver Conduit	1992	Unknown	35	591	110		Near Tamarack Mtn.	1:12,000	Color
Huntington-Pitman-Shaver Conduit	1992	Unknown	35	591	108		South end- Stevenson Creek	1:12,000	Color
Ely Diversion	1993	Unknown	33	1291	113			1:12,000	Color
Balsam Diversion	1993	Unknown	34	1291	50			1:12,000	Color
Huntington Lake	1996	Unknown	40	796	223	Y	Dam 1	1:12,000	Color Negative
Huntington Lake	1996	Unknown	40	769	222	Y	Dam 2 & 3	1:12,000	Color Negative

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Huntington Lake	1996	Unknown	41	896	13	Y	South mid-West Portion of Lake	1:12,000	Color Negative
Huntington Lake	1996	Unknown	41	897	14	Y	North mid-West Portion of Lake	1:12,000	Color Negative
Huntington Lake	1996	Unknown	42	896	42	Y	Mid-East Portion of Lake	1:12,000	Color Negative
Huntington Lake	1996	Unknown	43	896	58	Y	East most Portion of Lake Portal Powerhouse	1:12,000	Color Negative
Vermillion Valley	1996	Unknown	50	1396	18	Y	Vermillion Valley Dam	1:12,000	Color Negative
Vermillion Valley	1996	Unknown	51	1696	131	Y	West Lake Edision	1:12,000	Color Negative
Vermillion Valley	1996	Unknown	52	1796	18	Y	Mid-Lake Edison	1:12,000	Color Negative
Vermillion Valley	1996	Unknown	52	1796	19	Y	Mid-Lake Edison	1:12,000	Color Negative
Vermillion Valley	1996	Unknown	53	1796	91	Y	Mid-East Portion of Lake	1:12,000	Color Negative
Vermillion Valley	1996	Unknown	54	1796	20	Y	East Lake Edison	1:12,000	Color Negative
Warm Creek	1996	Unknown	49	1196	71	Y	Warm Creek Diversion	1:12,000	Color Negative
Powerhouse #1 & Dam 4	1996	Unknown	39	696	175	Y		1:12,000	Color Negative
Powerhouse #2 & Dam 5	1996	Unknown	36	996	5			1:12,000	Color Negative
Mammoth Pool Conveyance System	1996	Unknown	35	996	41		Mammoth Pool	1:12,000	Color Negative
Mammoth Pool Conveyance System	1996	Unknown	35	996	42		Sake Flat Creek	1:12,000	Color Negative
Mammoth Pool Conveyance System	1996	Unknown	35	996	46		Rock Creek Diversion	1:12,000	Color Negative
Mammoth Pool Conveyance System	1996	Unknown	35	996	50		Clearwater Creek Diversion	1:12,000	Color Negative
Mammoth Pool Conveyance System	1996	Unknown	35	996	52		Mammoth Pool Powerhouse	1:12,000	Color Negative
Mammoth Pool	1996	Unknown	36	996	19		Mammoth Pool Dam- South most portion of pool	1:12,000	Color Negative
Mammoth Pool	1996	Unknown	35	996	41		Logan Meadow	1:12,000	Color Negative
Mammoth Pool	1996	Unknown	37	996	103		Kaiser Creek	1:12,000	Color Negative
Mammoth Pool	1996	Unknown	37	996	104		Mill Creek	1:12,000	Color Negative
Mammoth Pool	1996	Unknown	37	996	106			1:12,000	Color Negative
Mammoth Pool	1996	Unknown	37	996	116		Northmost portion of pool	1:12,000	Color Negative

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Tunnel #3	1996	Unknown	34	996	53		Powerhouse 8 & Dam 6- North most portion	1:12,000	Color Negative
Tunnel #3	1996	Unknown	34	996	54		Mid-upper portion	1:12,000	Color Negative
Tunnel #3	1996	Unknown	33	396	182		Stevensons Creek	1:12,000	Color Negative
Tunnel #3	1996	Unknown	33	396	166		Mid-lower most portion	1:12,000	Color Negative
Tunnel #3	1996	Unknown	66	396	135		Powerhouse 8 & Dam 6- Powerhouse 3 - South most portion of tunnel	1:12,000	Color Negative
Florence Lake	1996	Unknown	52	1796	174		Florence Lake Dam & point where Ward Tunnel begins West Portion	1:12,000	Color Negative
Florence Lake	1996	Unknown	53	1796	103		North side of lake	1:12,000	Color Negative
Florence Lake	1996	Unknown	53	1796	105		South side of lake	1:12,000	Color Negative
Florence Lake	1996	Unknown	54	1796	35		East Side of lake	1:12,000	Color Negative
Ward Tunnel	1996	Unknown	52	1796	174	Y	Florence Dam - East most portion of tunnel	1:12,000	Color Negative
Ward Tunnel	1996	Unknown	51	1696	123	Y		1:12,000	Color Negative
Ward Tunnel	1996	Unknown	50	1396	125	Y	Camp 62	1:12,000	Color Negative
Ward Tunnel	1996	Unknown	49	1196	77	Y	Bolsillo	1:12,000	Color Negative
Ward Tunnel	1996	Unknown	49	1196	141	Y	Portal Forebay	1:12,000	Color Negative
Ward Tunnel	1996	Unknown	47	1396	47	Y		1:12,000	Color Negative
Ward Tunnel	1996	Unknown	46	1396	31	Y	Kaiser Meadow	1:12,000	Color Negative
Ward Tunnel	1996	Unknown	45	1296	211	Y		1:12,000	Color Negative
Ward Tunnel	1996	Unknown	43	896	58	Y	Portal Powerhouse- West most portion of tunnel	1:12,000	Color Negative
Jackass Meadow	1996	Unknown	53	1796	100		North & South Diversion	1:12,000	Color Negative
Jackass Meadow	1996	Unknown	53	1796	99		Hooper Dam Diversion	1:12,000	Color Negative
Mono-Bear Siphon	1996	Unknown	50	1396	126		Lower Mono-Bear Siphon	1:12,000	Color Negative
Mono-Bear Siphon	1996	Unknown	50	1396	127		Mid Siphon	1:12,000	Color Negative
Mono-Bear Siphon	1996	Unknown	51	1696	127		Upper portion of Siphon	1:12,000	Color Negative
Mono-Bear Siphon	1996	Unknown	51	1696	129		North Fork & Mono Diversion	1:12,000	Color Negative
Mono-Bear Siphon	1996	Unknown	52	1796	179		South Fork	1:12,000	Color Negative
Mono-Bear Siphon	1996	Unknown	52	1796	180		Bear Diversion	1:12,000	Color Negative
Tunnel #5	1996	Unknown	37	596	213	Y	South end- Shaver lake	1:12,000	Color Negative

Appendix E. Historical Aerial Photography Information for Review in the Project Vicinity (continued)

Area	Year	Date Photographed	Flight Line	Roll #	Photo #	Stereo Pair (Y/N)	Area of Photo	Scale	Film Type
Tunnel #5	1996	Unknown	37	596	212		Mid-tunnel	1:12,000	Color Negative
Tunnel #5	1996	Unknown	37	596	210		North end tunnel	1:12,000	Color Negative
Shaver Lake	1996	Unknown	37	596	213		Shaver Dam	1:12,000	Color Negative
Shaver Lake	1996	Unknown	37	596	215		Shaver Lake Pt.	1:12,000	Color Negative
Shaver Lake	1996	Unknown	37	596	216		Mid-South portion of lake	1:12,000	Color Negative
Shaver Lake	1996	Unknown	37	596	218		South portion of lake	1:12,000	Color Negative
Shaver Lake	1996	Unknown	38	696	189		West portion of lake	1:12,000	Color Negative
Shaver Lake	1996	Unknown	38	696	12		East portion of lake	1:12,000	Color Negative
S.J. Railroad from Big Creek to El Prado	1996	Unknown	39	696	175		Big Creek- North most portion	1:12,000	Color Negative
S.J. Railroad from Big Creek to El Prado	1996	Unknown	36	596	195			1:12,000	Color Negative
S.J. Railroad from Big Creek to El Prado	1996	Unknown	35	996	57		Stevenson Creek	1:12,000	Color Negative
S.J. Railroad from Big Creek to El Prado	1996	Unknown	34	396	185		Mill Creek	1:12,000	Color Negative
S.J. Railroad from Big Creek to El Prado	1996	Unknown	32	396	137		Sugar Loaf	1:12,000	Color Negative
S.J. Railroad from Big Creek to El Prado	1996	Unknown	31	396	116		Italian Creek	1:12,000	Color Negative
S.J. Railroad from Big Creek to El Prado	1996	Unknown	29	396	72		Ball Mill Creek	1:12,000	Color Negative
S.J. Railroad from Big Creek to El Prado	1996	Unknown	28	396	63		Auberry-Southern most portion photographed	1:12,000	Color Negative
Redinger	1996	Unknown	29	396	77		Dam 7	1:12,000	Color Negative
Redinger	1996	Unknown	27	396	31		Powerhouse 4	1:12,000	Color Negative
Balsam Meadow Forebay	1996	Unknown	40	796	223			1:12,000	Color Negative
Huntington-Pitman-Shaver Conduit	1996	Unknown	40	796	223		Huntington Lake- North end	1:12,000	Color Negative
Huntington-Pitman-Shaver Conduit	1996	Unknown	41	996	17		Pitman Creek	1:12,000	Color Negative
Huntington-Pitman-Shaver Conduit	1996	Unknown	40	696	208		Near Tamarack Mountain	1:12,000	Color Negative
Huntington-Pitman-Shaver Conduit	1996	Unknown	40	696	206		Stevenson Creek	1:12,000	Color Negative
Ely Diversion	1996	Unknown	38	696	169			1:12,000	Color Negative
Balsam Diversion	1996	Unknown	39	696	177			1:12,000	Color Negative

APPENDIX F

Preliminary Riparian Data

Appendix F. Preliminary Riparian Data

Stream	Description	Station to Station[1]		Rosgen Reach Type	Riparian Present	Percent Riparian	Species Composition	Continuous/ Discontinuous	Approximate Area	Age Classes Present	Comments
		D/S RM	U/S RM		*Yes/No*	Cover		C/D	(square feet)		
Riparian on Bars											
Ross Creek	Project Reach	0.70 - 0.87	0.87	A1a+	*No*						
	Above Diversion	0.87	1.2	A1a+	*No*						
Rock Creek	Project Reach	0.38	0.48	A1a+	*No*						
	Above Diversion	0.48	0.65	A2	*No*						
Big Creek	Project Reach	1.2	1.7	A1/A2	*Yes*	50	blackberry, alder, herbs	D	1000	seedling, young	Blackberry (*Rubus discolor*) dominating bar vegetation.
	NA	1.7	1.9	Dam 5 Impoundment	*No*						
	Project Reach	1.9	2	A2	*No*						
	Project Reach	2	2.2	B2	*Yes*	75	blackberry, alder, aspen, herbs	C	100 4000	seedling, young, mature	Dense blackberry (*Rubus discolor*) cover with mature alder and aspen rooted in boulder.
	Project Reach	7.85	7.95	A1a+	*No*						
	Project Reach	7.95	8.27	B2	*No*						
	Project Reach	8.27	8.6	B5	*Yes*	90	alder, herbs	C	200	seedling, young	
	Project Reach	8.6	8.85	B2/B5	*No*						
	Project Reach	8.85	9.35	A1/A2	*No*						
	Project Reach	9.35	9.6	A2/B2	*No*						
	Project Reach	9.6	9.77	G5	*No*						
	Project Reach	9.77	9.9	A1a+/A2a+	*No*						
Adit 8	Project Reach	0.5	0.53	A2a+	*No*						
	Project Reach	0.53	0.6	A4a+	*No*						
	Project Reach	0.6	0.7	A2a+/A4a+	*No*						
	Project Reach	0.7	0.96	A1a+/A2a+	*No*						
	Above Diversion	0.96	1.06	A1a+	*No*						
	Above Diversion	1.06	1.3	A1a+/A2a+	*No*						
Ely Creek	Project Reach	0.54	0.58	B2/B3	*No*						
	Project Reach	0.58	0.98	A1a+/A2a+	*No*						
	Above Diversion	0.98	1.3	A1a+/A2a+	*No*						
	Above Diversion	1.3	1.4	B5/G5 (B1)	*Yes*	25-39	herbs	C	75	seedling	Grass on mid channel bars in pools, sand substrate.
	Above Diversion	1.4	1.5	G5/G3	*Yes*	60-100	herbs	C	75	seedling	Grass, ferns, herbs on all bars in unit.
Balsam Creek	Project Reach	0	0.7	A1a+/A2a+	*Yes*	60	herbs	C	120	seedling	Active sand bar associated with boulder.
	Above Diversion	0.7	0.75	A1a+	*No*						
	Above Diversion	0.75	0.85	B2/B3	*No*						
	Above Diversion	0.85	1.2	A1a+	*No*						
	Above Diversion	1.2	2.5	A1a+	*No*						
Pitman Creek	Project Reach	1.43	1.52	B1	*No*						
	Above Diversion	1.52	2.02	B1/B3/B4	*No*						

Appendix F. Preliminary Riparian Data (continued)

Stream	Description	Station to Station[1]		Rosgen Reach Type	Riparian Present	Percent Riparian	Species Composition	Continuous/ Discontinuous	Approximate Area	Age Classes Present	Comments
		D/S RM	U/S RM		*Yes/No*	Cover		C/D	(square feet)		
Riparian on Bars (continued)											
Bear Creek	Project Reach	1.39	1.43	A2 with B inclusions	*No*						
	Above Diversion	1.43	1.82	A1a+	*No*						
	Above Diversion	1.82	2	B1/B2	*No*						
	Above Diversion	2	2.1	B2/B3	*No*						
Hooper Creek	Project Reach	0	0.04	A2a+	*No*						
	Project Reach	0.04	0.21	B3	*No*						
	Project Reach	0.21	0.62	A1a+/A2a+	*No*						There is a 5' x 6' discontinuous patch with about 15% cover of herb seedlings - Not a real factor
	Above Diversion	0.62	0.95	A1a+/A2a+	*No*						
	Above Diversion	0.95	1.6	A1a+/A2a+	*No*						
Tombstone Creek	Project Reach	0	0.1	E6	*No*						
	Project Reach	0.1	0.55	E5	*No*						
	Project Reach	0.55	0.62	B2/B5	*No*						
	Project Reach	0.62	0.98	A1a+/A2a+	*No*						
	Above Diversion	0.98	1.12	A1a+/A2a+	*No*						
	Above Diversion	1.12	1.22	A2/A4/A5	*No*						
	Above Diversion	1.22	1.6	A1a+/A2a+	*No*						
South Slide Creek	Project Reach	0	0.27	A2a+	*No*						
	Project Reach	0.27	0.32	A1a+	*No*						
	Above Diversion	0.32	0.5	A1a+/A2a+	*No*						
North Slide Creek	Project Reach	0	0.29	A2a+	*No*						
	Above Diversion	0.29	0.5	A1a+/A2a+	*No*						
Mono Creek	Project Reach	5.29	5.68	B2	*No*						
(below diversion)	Project Reach	5.68	5.79	A2	*No*						
	Above Diversion	5.79	5.96	Impoundment							
	Above Diversion	5.96	6.3	B2	*Yes*	50	alder	C	150	seedling, young	Bars vary in size, one large bar.
Bolsillo Creek	Project Reach	0	0.1	A1a+	*No*						
	Project Reach	0.1	0.2	E5	*No*						
	Project Reach	0.2	0.65	A1a+/A2a+	*No*						
	Project Reach	0.65	0.8	B2/B5	*No*						
	Project Reach	0.8	0.9	A2a+	*No*						
	Project Reach	0.9	1.02	A2/B2	*No*						
	Project Reach	1.02	1.32	G2/G5	*No*						
	Project Reach	1.32	1.55	B2/B3/B5	*No*						
	Project Reach	1.55	1.57	A2a+	*No*						
	Above Diversion	1.57	1.58	A2a+	*No*						
	Above Diversion	1.58	1.65	G2/G5	*No*						
	Above Diversion	1.65	1.69	B4/B5	*Yes*	10	herbs	D	50	seedling	
	Above Diversion	1.69	1.75	B2/B3	*No*						
	Above Diversion	1.75	2.2	A2a+	*No*						

Appendix F. Preliminary Riparian Data (continued)

Stream	Description	Station to Station[1]		Rosgen Reach Type	Riparian Present	Percent Riparian	Species Composition	Continuous/ Discontinuous	Approximate Area	Age Classes Present	Comments
		D/S RM	U/S RM		*Yes/No*	Cover		C/D	(square feet)		
Riparian on Bars (continued)											
Camp 62 Creek	Project Reach	0	0.12	A2a+	*No*						
	Project Reach	0.12	0.79	B2/B3	*Yes*	5	willow	D	400	seedling	One willow on large cobble bar.
	Project Reach	0.79	1.06	A2	*Yes*	5	willow, herbs	D	150	seedling	
	Project Reach	1.06	1.2	B2/B3	*No*						
	Project Reach	1.2	1.35	A2a+	*No*						
	Above Diversion	1.35	1.85	A2a+	*No*						
North Fork Stevenson Creek	Project Reach	3.11	3.25	B1/B2	*Yes*	40	willow, herbs	C	180	seedling	Boulder/cobble bar
	Project Reach	3.25	3.34	A2a+	*No*						
	Project Reach	3.34	3.45	A1a+	*No*						
	Project Reach	3.45	3.55	A2a+	*No*						
	Above Diversion	3.55	3.63	A2a+	*Yes*	80	herbs	D	80	seedling	Sand bar downstream of large woody debris.
	Above Diversion	3.63	3.8	A1a+	*No*						
	Above Diversion	3.8	3.9	B2	*No*						
	Above Diversion	3.9	3.97	C5	*No*						
	Above Diversion	3.97	4.05	B5	*No*						
Stevenson Creek	Project Reach	2.2	2.5	B1/B3/B4	*No*						
	Project Reach	3.85	3.9	A1a+	*No*						
	Project Reach	3.9	3.98	B1	*No*						
	Project Reach	3.98	4.08	B5	*Yes*	100	alder, herbs	C	210	seedling	
	Project Reach	4.08	4.3	B3/B5	*No*						
	Shaver Lake above Station 4.3 - No data for Stevenson Creek above Shaver										
Crater Diversion Channel	Project Reach	0.65	0.72	B2/B5	*No*						
	Project Reach	0.72	0.8	G2	*No*						
	Project Reach	0.8	0.85	B2	*No*						
	Project Reach	0.85	0.88	A2a+	*No*						
	Project Reach	0.88	0.98	G2	*No*						
	Project Reach	0.98	1.1	A1a+/A2a+	*No*						
	Project Reach	1.1	1.13	G1	*No*						
	Project Reach	1.13	1.24	A1a+	*No*						
	Project Reach	1.24	1.3	A4/A5	*No*						
	Project Reach	1.3	1.6	A1a+	*Yes*	100	conifer, alder, herbs	C	240	seedling, young, mature	
	Project Reach	1.6	1.7	A1a+/A2a+	*No*						
	Project Reach	1.7	1.78	A1/A5	*Yes*	75	herbs	C	90	seedling	
	Project Reach	1.78	1.9	B1/B2	*Yes*	80	alder, herbs	C	150	seedling	
	Project Reach	1.9	1.98	B4/B5	*Yes*	100	conifer, alder, herbs	C	1000	seedling, young, mature	Several mature, dying conifers present.
	Project Reach	1.98	2.07	A2a+	*No*						
	Project Reach	2.07	2.1	B3/B5	*No*						
	Project Reach	2.1	2.15	G2	*No*						
	Project Reach	2.15	2.2	A2	*No*						

Appendix F. Preliminary Riparian Data (continued)

Stream	Description	Station to Station[1]		Rosgen Reach Type	Riparian Present	Percent Riparian	Species Composition	Continuous/ Discontinuous	Approximate Area	Age Classes Present	Comments
		D/S RM	U/S RM		*Yes/No*	Cover		C/D	(square feet)		
Riparian on Bars (continued)											
Chinquapin Creek	Project Reach	0	0.1	A2	*Yes*	20	alder, herbs	D	60	seedling, young	
	Project Reach	0.1	0.14	B3/B4	*No*						
	Project Reach	0.14	0.19	G2/G4	*No*						
	Project Reach	0.19	0.38	A2a+	*No*						
	Project Reach	0.38	0.5	B3	*No*						
	Project Reach	0.5	0.9	A2a+	*No*						
	Above Diversion	0.9	1.4	A2a+	*No*						
Crater Creek	Project	0	0.17	B4/B5	*Yes*	40-59	herbs	C	28	seedling	
	Project	0.17	0.37	E5/DA5	*No*						
	Project	0.37	0.48	C5(B5)	*Yes*	40-59	herbs	C	36	seedling	Grass clumps on bars, sand substrate.
	Project	0.48	0.53+	A2a+	*Yes*	40-59	herbs	C	45	seedling	
	Project	1.39	1.59	A2a+	*No*						
	Project	1.59	1.72	A2a+(A1a+)	*No*						
	Project	1.72	1.88	B5	*No*						
	Project	1.88	1.95	B2/B3	*No*						
	Project	1.95	2.21	A1a+/A2a+	*No*						
	Project	2.21	3.04	A2a+ with A2/B2 inclusions	*No*						
	Reference	3.04	3.18	A2a+	*No*						
	Reference	3.18	3.38	B2	*No*						
	Reference	3.38	3.45	C4/C5	*No*						
	Reference	3.45	3.51	A2a+	*Yes*	60-100	willow, herbs	C	NA	seedling, young	Sand/gravel point bar.

[1]Data collected in the field may be slightly upstream or downstream from the river mile stations indicated in this datasheet and mapped on the topographic map due to the accuracy of the equipment and because of differences in terrain and timing of data collection.

Appendix F. Preliminary Riparian Data (continued)

Stream	Description	Station to Station[1]		Rosgen Reach Type	Riparian Present	Riparian Width[2]	Dominant Woody Species[3]	Dominant Herb Species[3]	Approximate Length[4]	Density	Age Classes Present	Substrate	Comments
		D/S RM	U/S RM		Yes/No	(feet)							
Riparian on Banks													
Ross Creek	Project Reach	0.7	0.87	A1a+	Yes	2	willow, shrubs	herbs	10% unit	Low	seedling, young	NA	Ross Creek diversion located at Station 0.87.
	Above Diversion	0.87	1.2	A1a+	Yes	2	willow, shrubs	herbs	5% unit	Low	seedling, young	NA	There are a few willow clumps on the banks and below the diversion.
Rock Creek	Project Reach	0.38	0.48	A1a+	Yes	<5	alder, willow	herbs	10% unit	Low	seedling, young	NA	Rock Creek diversion located at Station 0.48. Riparian is low density and sporadic.
	Above Diversion	0.48	0.65	A2	Yes	5-10	alder, willow, sycamore	herbs	unit	Mod.	seedling, young, mature	NA	
Big Creek	Project Reach	1.2	1.7	A1/A2	Yes	5-10	alder, willow, blackberry	herbs	75% unit	Mod.	seedling, young, mature	NA	
	NA	1.7	1.9	Dam 5 Impoundment	Yes	10	alder, willow, blackberry	None	50% unit	Mod.	seedling, young	NA	
	Project Reach	1.9	2	A2	Yes	10	alder, willow, blackberry	herbs	unit	Low-Mod.	seedling, young, mature	NA	
	Project Reach	8.6	8.85	B2/B5	Yes	15	alder, willow	herbs	80% unit	High	seedling, young	NA	
	Project Reach	9.35	9.6	A2/B2	Yes	15-20	alder, willow	herbs	unit	High	seedling, young	NA	
	Project Reach	9.6	9.77	G5	Yes	15	alder, willow	herbs	unit	High	seedling, young, mature	NA	
	Project Reach	9.77	9.9	A1a+/A2a+	Yes	2	alder, willow	herbs	40% unit	Low	seedling	NA	Most of the riparian vegetation is grass.
Adit 8	Project Reach	0.5	0.53	A2a+	Yes	15	ALRH, ACMA, RUPA, RULE	HEMI, WOFI, CIAL	150 ft.	NA	seedling, young, mature	sand	Canyon Road located at Station 0.53.
	Project Reach	0.53	0.6	A4a+	Yes	15	ALRH, ACMA, RUPA, RULE	HEMI, WOFI, gramiNoides	200 ft.	NA	young, mature	sand	
	Project Reach	0.6	0.7	A2a+/A4a+	Yes	20	ALRH, SALU, ACMA, RUPA, RULE	WOFI, CIAL, ARDO, gramiNoides	250 ft.	NA	seedling, young	sand	
	Project Reach	0.7	0.96	A1a+/A2a+	Yes	15-20	ALRH, CONU, RUPA, ACMA	ADBI, HEMI, WOFI, ASHA	250 ft.	NA	seedling, young	sand	
	Above Diversion	0.96	1.06	A1a+	Yes	5	ACMA, SASC, RINE, RUPA	HEMI, ARDO	500 ft.	NA	seedling, young	sand	Adit 8 project structure located at Station 0.96.

Appendix F. Preliminary Riparian Data (continued)

Stream	Description	Station to Station[1]		Rosgen Reach Type	Riparian Present	Riparian Width[2]	Dominant Woody Species[3]	Dominant Herb Species[3]	Approximate Length[4]	Density	Age Classes Present	Substrate	Comments
		D/S RM	U/S RM		Yes/No	(feet)							
Riparian on Banks (continued)													
Ely Creek	Project Reach	0.53	0.58	B2/B3	Yes	2	conifer, alder, willow	herbs	75% unit	NA	young, mature	cobble sand	
	Project Reach	0.58	0.98	A1a+/A2a+	Yes	3	conifer, alder	herbs	25% unit	NA	seedling, young, mature	cobble boulder	
	Above Diversion	0.98	1.3	A1a+/A2a+	Yes	5	alder, willow, shrubs	herbs	40% unit	NA	seedling, young, mature	cobble sand	Ely Creek diversion located at Station 0.98.
	Above Diversion	1.3	1.4	B5/G5 (B1)	Yes	10	alder, willow	herbs	unit	NA	seedling, young, mature	boulder/cobble/ sand	There are many mature trees in the floodplain.
	Above Diversion	1.4	1.5	G5/G3	Yes	5-10	alder	herbs	unit	NA	seedling, young, mature	sand	Grass on bars and banks, large woody debris present, sporadic mature alder on floodplain.
Balsam Creek	Project Reach	0	0.7	A1a+/A2a+	Yes	2-5	alder, willow	herbs	unit	Low-Mod.	seedling, mature	NA	Riparian vegetation is mostly very low density and sporadic.
	Above Diversion	0.7	0.75	A1a+	Yes	<5	alder, willow	herbs	<10% unit	Low	seedling, young, mature	NA	Balsam Creek diversion located at Station 0.70, riparian vegetation is discontinuous.
	Above Diversion	0.75	0.85	B2/B3	Yes	2	None	herbs	<10% unit	Low	seedling	NA	Very sporadic herbaceous vegetation.
	Above Diversion	0.85	1.2	A1a+	Yes	2-3	alder	herbs	<10% unit	Low	seedling	NA	Very sporadic herbaceous vegetation.
Pitman Creek	Project Reach	1.43	1.52	B1	Yes	5	willow, shrubs	herbs	15% unit	Low (sporadic)	seedling	NA	Pitman Creek diversion located at Station 1.52.
	Above Diversion	1.52	2.02	B1/B3/B4	Yes	10-25	SAJE, SALE, SPDE, LOIN	EPAN, AGEX	500 ft.	NA	seedling, young	sand	Lodgepole pine occurs intermittently along bank.
Bear Creek	Project Reach	1.39	1.43	A2 with B inclusions	Yes	10-May	alder, willow	herbs	unit	Low - Mod.	seedling, young	NA	
	Project Reach	1.43	1.57	B2	Yes	5-10	alder, willow	None	unit	Low - Mod.	seedling, young	bedrock boulder	Bear Creek Dam at Station 1.57.
	Above Diversion	1.82	2	B1/B2	Yes	5-10	alder	None	unit	Low - Mod.	seedling, young	NA	Low density vegetation where bedrock is present, moderate density on sand.
	Above Diversion	2	2.1	B2/B3	Yes	10	alder	herbs	unit	Mod.	seedling, young	NA	Evidence of recent flow in floodplain area.
Hooper Creek	Project Reach	0	0.04	A2a+	Yes	5-10	alder	herbs	50% unit	Low	seedling, young	NA	
	Project Reach	0.04	0.21	B3	Yes	5	alder	herbs	unit	Low-Mod.	seedling, young	NA	
	Project Reach	0.21	0.62	A1a+/A2a+	Yes	9	conifer, alder	herbs	unit	Mod.-High	seedling, young, mature	NA	

Appendix F. Preliminary Riparian Data (continued)

Stream	Description	Station to Station[1]		Rosgen Reach Type	Riparian Present	Riparian Width[2]	Dominant Woody Species[3]	Dominant Herb Species[3]	Approximate Length[4]	Density	Age Classes Present	Substrate	Comments
		D/S RM	U/S RM		Yes/No	(feet)							
Riparian on Banks (continued)													
Tombstone Creek	Project Reach	0	0.1	E6	Yes	10	None	herbs	unit	High	seedling	NA	
	Project Reach	0.1	0.98	A1a+/A2a+	Yes	10+	ALIN, POTR, RUPA, SALE, Ribes sp.	ARDO, THFE, ATFE, Grasses	200 ft.	NA	seedling, young, mature	sand	Large woody debris present, some bitter cherry along riparian edge; evidence of channel avulsion in broader floodplain.
	Above Diversion	0.98	1.12	A1a+/A2a+	Yes	10	ALIN, POTR, RUPA, SALE, Ribes sp.	None	250 ft.	NA	seedling, young, mature	sand	Tombstone Creek diversion located at Station 0.98.
	Above Diversion	1.12	1.22	A2/A4/A5	Yes	10	ALIN, POTR, SALE	EQAR, CASP	unit	NA	seedling, young, mature	sand	Some white fir saplings present along banks.
	Above Diversion	1.22	1.6	A1a+/A2a+	Yes	15	ALIN, POTR, SALE, SAJE	MIGU, ERPE, EPAN, SETR	unit	NA	seedling, young, mature		
South Slide Creek	Project Reach	0	0.27	A2a+	Yes	10-30	alder, willow, aspen	herbs	unit	Mod. - High	seedling, young, mature	NA	
	Project Reach	0.27	0.32	A1a+	Yes	30	alder, willow, aspen	herbs	unit	Low-High	seedling, young	NA	South Slide Creek diversion located at Station 0.32.
	Above Diversion	0.32	0.5	A1a+/A2a+	Yes	15+	alder	None	unit	High	young	NA	Very dense riparian cover.
North Slide Creek	Project Reach	0	0.29	A2a+	Yes	5-15	alder, willow, aspen, thimbleberry, Ribes	herbs	unit	Mod. - High	seedling, young	NA	North Slide Creek diversion located at Station 0.29
	Above Diversion	0.29	0.5	A1a+/A2a+	Yes	5	alder	None	unit	High	young	NA	Very dense riparian cover along channel margin.
Mono Creek	Project Reach	5.29	5.68	B2	Yes	10	alder, willow	herbs	unit	Mod.	seedling, young	NA	Willow and alder in boulders on channel margin, some grasses.
(below diversion)	Project Reach	5.68	5.79	A2	Yes	5	willow (few alder)	few herbs	25% unit	Low-Mod.	seedling, young	NA	Sparse riparian on steep banks.
	Above Diversion	5.79	5.96	Impoundment									
	Above Diversion	5.96	6.3	B2	Yes	10	conifer, alder	NA	85%unit	Mod.-High	seedling, young	NA	Riparian vegetation is fairly dense.
Bolsillo Creek	Project Reach	0	0.1	A1a+	Yes	5-20	alder	herbs	unit	Mod.-High	seedling, young	NA	
	Project Reach	0.1	0.2	E5	Yes	20	alder, cottonwood, shrubs	herbs	unit	High	seedling, young	NA	
	Project Reach	0.2	0.65	A1a+/A2a+	Yes	1-20	alder, shrubs	herbs	unit	Low-High	seedling, young	NA	
	Above Diversion	1.57	1.58	A2a+	Yes	10	alder	herbs	unit	Mod.	seedling, young	NA	

Appendix F. Preliminary Riparian Data (continued)

Stream	Description	Station to Station[1]		Rosgen Reach Type	Riparian Present	Riparian Width[2]	Dominant Woody Species[3]	Dominant Herb Species[3]	Approximate Length[4]	Density	Age Classes Present	Substrate	Comments
		D/S RM	U/S RM		Yes/No	(feet)							
Riparian on Banks (continued)													
Bolsillo Creek (continued)	Above Diversion	1.58	1.65	G2/G5	Yes	10	alder	herbs	unit	Mod.	seedling, young	NA	Vegetation overhanging channel and stabilizing bank.
	Above Diversion	1.65	1.69	B4/B5	Yes	10	alder	herbs	unit	Mod.	seedling, young	NA	
	Above Diversion	1.69	1.75	B2/B3	Yes	5	alder	herbs	unit	Low	seedling, young	NA	
	Above Diversion	1.75	2.2	A2a+	Yes	5-30	alder	herbs	unit	Low-High	seedling, young	NA	Riparian vegetation overhangs channel somewhat.
Camp 62 Creek	Project Reach	0	0.12	A2a+	Yes	5-10	alder, willow	None	unit	Mod.-High	young	NA	Bedrock restricted to left bank.
	Project Reach	0.12	0.35	B2	Yes	10	alder, willow	herbs	unit	Mod.-High	seedling, young		
	Project Reach	0.35	0.55	A2a+	Yes	5	alder, willow	herbs	unit	Low-Mod.	seedling, young	NA	
	Project Reach	0.55	0.79	B2/B3	Yes	5	conifer, alder, willow, shrubs	herbs	unit	Low-Mod.	seedling, young, mature	NA	Vegetation is a mixed bag.
	Project Reach	0.79	1.06	A2	Yes	15	alder	None	unit	High	seedling, young, mature	NA	
	Project Reach	1.06	1.2	B2/B3	Yes	5	conifer, alder, willow	None	unit	Mod.-High	seedling, young, mature	NA	
	Project Reach	1.2	1.35	A2a+									Diversion located at Station 1.35.
	Above Diversion	1.35	1.85	A2a+	Yes	10	ALIN, SAJE, RUPA, COSE, Ribes spp.	CAVE, TOPAPA, SETR, ERPE, THFE	NA	NA	seedling, young, mature	sand	Heavy woody debris, some scour (heavy in spots), banks undercut and unstable in some spots, channel braided.
North Fork Stevenson Creek	Project Reach	3.11	3.25	B1/B2	Yes	2	willow	herbs	5% unit	Low	seedling,	NA	Very sparse riparian cover.
	Project Reach	3.25	3.34	A2a+	Yes	3	alder, willow, shrubs	herbs	10% unit	Low	seedling, young	NA	Scattered patches of mixed vegetation.
	Above Diversion	3.55	3.63	A2a+	Yes	5-10	alder, willow	ferns	unit	Mod.-High	seedling	NA	Continuous riparian corridor, dense in some areas.
	Above Diversion	3.63	3.8	A1a+	Yes	5	alder, willow	ferns	unit	Low	seedling	NA	Thin, discontinuous riparian along channel.
	Above Diversion	3.8	3.9	B2	Yes	5-10	alder, willow	ferns	unit	Mod.-High	seedling	NA	Continuous riparian corridor along channel.
	Above Diversion	3.9	3.97	C5	Yes	25-30	alder, willow	herbs	unit	Mod.-High	seedling, young	NA	Continuous riparian corridor along channel and within full bank area, vegetation is primarily herbaceous in floodplain.
	Above Diversion	3.97	4.05	B5	Yes	10-15	alder, willow	herbs	unit	Mod.	seedling, young	NA	Continuous riparian corridor along channel and within full bank area, vegetation is primarily herbaceous in floodplain.

Appendix F. Preliminary Riparian Data (continued)

Stream	Description	Station to Station[1]		Rosgen Reach Type	Riparian Present	Riparian Width[2]	Dominant Woody Species[3]	Dominant Herb Species[3]	Approximate Length[4]	Density	Age Classes Present	Substrate	Comments
		D/S RM	U/S RM		Yes/No	(feet)							
Riparian on Banks (continued)													
Stevenson Creek	Project Reach	3.85	3.9	A1a+	Yes	15-25	alder, willow	herbs	unit	High	seedling, young	NA	Riparian width includes mixed shrub/herbaceous in floodplain.
	Project Reach	3.9	3.98	B1	Yes	15-25	alder, willow	herbs	90% unit	High	seedling, young	NA	Riparian width includes mixed shrub/herbaceous in floodplain.
	Project Reach	3.98	4.08	B5	Yes	20-30	conifer, alder, willow	herbs	unit	Mod.-High	seedling, young, mature	NA	Riparian width includes mixed shrub/herbaceous in floodplain.
	Project Reach	4.08	4.3	B3/B5	Yes	5-10	alders, willows	few herbs	unit	Mod.-High	seedling, young	NA	Shaver Lake Dam at Station 4.30.
	Shaver Lake above Station 4.3 - No data for Stevenson Creek above Shaver												
Crater Diversion Channel	Project Reach	0.8	0.85	B2	Yes	<5	alder	herbs	unit	Low (sporadic)	seedling, young	NA	Sporadic riparian in bedrock joints.
	Project Reach	0.85	0.88	A2a+	Yes	<5	conifer, alder	herbs	unit	Low	seedling	sand	
	Project Reach	0.88	0.98	G2	Yes	<5	alder	herbs	50% unit	Low	seedling, young, mature	NA	Riparian only on right bank, left bank is bedrock.
	Project Reach	0.98	1.1	A1a+/A2a+	Yes	<5	alder, willow	herbs	70% unit	Low	seedling, young	NA	Thin band of conifers along banks where bedrock is present.
	Project Reach	1.1	1.13	G1	Yes	<5	alder	herbs	30-40% unit	Low (sporadic)	seedling, young	bedrock boulder	Discontinuous, spreading riparian vegetation in bedrock joints and boulder matrix.
	Project Reach	1.13	1.24	A1a+	Yes	<5	alder	herbs	30-40% unit	Low (sporadic)	Seedling, young	NA	Conifers along channel banks with sporadic alder and herbs.
	Project Reach	1.24	1.3	A4/A5	Yes	<5	conifer, alder	herbs	75% unit	Low (sporadic)	seedling, young, mature	NA	Mature conifer along margin, alder seedlings and young alder within sand matrix.
	Project Reach	1.3	1.6	A1a+	Yes	10-20	conifer, alder	herbs	unit	Mod.	seedling, young, mature	NA	
Chinquapin Creek	Project Reach	0	0.1	A2	Yes	10	alder	herbs	unit	High	seedling, young	NA	
	Project Reach	0.1	0.14	B3/B4	Yes	15	alder	None	unit	Mod.	seedling, young	NA	
	Project Reach	0.14	0.19	G2/G4	Yes	5-10	alder	herbs	unit	Low-Mod.	seedling, young	NA	
	Project Reach	0.19	0.35	A2a+	Yes	15	alder	herbs	unit	Mod.-High	seedling, young	NA	Alder overhangs channel significantly.
	Project Reach	0.35	0.5	B3	Yes	15	alder	None	unit	Mod.	seedling, young	NA	
	Project Reach	0.5	0.9	A2a+	Yes	5	alder	herbs	intermittent	Low	seedling, young	NA	Riparian is intermittent.

Appendix F. Preliminary Riparian Data (continued)

Stream	Description	Station to Station[1]		Rosgen Reach Type	Riparian Present	Riparian Width[2]	Dominant Woody Species[3]	Dominant Herb Species[3]	Approximate Length[4]	Density	Age Classes Present	Substrate	Comments
		D/S RM	U/S RM		Yes/No	(feet)							
Riparian on Banks (continued)													
Crater Creek	Project	0	0.17	B4/B5	Yes	5	alder	herbs	40% unit	High	seedling, young	sand	Grasses within bankfull width, alder at and above bankfull width.
	Project	0.17	0.32	E5/DA5	Yes	12	willow	herbs	80% unit	NA	seedling, young	sand	Meadow along channel, willows at bankfull and floodplain.
	Project	0.32	0.42	C5(B5)	Yes	15	willow	herbs	90% unit	NA	seedling, young	sand	
	Project	0.42	0.47+	A2a+	Yes	5	ALIN, POTR, POBA	herbs	10% unit	NA	seedling, young, mature	sand	Large woody debris from aspen and cottonwood.
	Project	1.31	1.44	A2a+	Yes	2	willow	None	<5% unit	very low	seedling, young	NA	A few willows on bedrock/boulder in trench above bankfull.
	Project	1.44	1.51	A2a+(A1a+)	Yes	2	willow, shrubs	None	10% unit	Low	seedling, young	NA	Some mature cottonwoods here.
	Project	1.51	1.77	B5	Yes	3	willow	herbs	50% unit	Low-Mod.	seedling, young	NA	Aspen in floodplain.
	Project	1.77	1.82	B2/B3	Yes	5	shrubs	herbs	70% unit	Mod.	seedling, young	NA	Mixed shrubs and willow present.
	Project	1.82	2.1	A1a+/A2a+	Yes	4	alder, willow, shrubs	None	80% unit	Mod.	seedling, young	NA	Willows in floodplain at relict bankfull.
	Project	2.1	2.87	A2a+ with A2/B2 inclusions	Yes	5	alder, willow	herbs	90% unit	Mod-High	seedling, young	NA	
	Reference	2.87	3	A2a+	Yes	20	SAJE, SALU, ALIN, COSE, LOIN	EPAN	NA	NA	seedling, young, mature	sand/large bldr	
	Reference	3	3.22	B2	Yes	12	SAJE, LOIN	SPCA, SETR, EPAN, MECI	NA	NA	seedling, young	sand/large bldr	
	Reference	3.22	3.29	C4/C5	Yes	5	SAJE, LOIN, RIMO	JUNE, LUPO, SETR, SPCA	NA	NA	seedling, young	sand/large bldr	
	Reference	3.29	3.34	A2a+	Yes	4	SAJE	CAVE, SETR, POPR,PEPA	NA	NA	seedling, young	sand/cobble	

[1]Data collected in the field may be slightly upstream or downstream from the river mile stations indicated in this datasheet and mapped on the topographic map due to the accuracy of the equipment and because of differences in terrain and timing of data collection.

[2]Data was collected on either side of the channel (left bank or right bank), therefore, the width of the riparian vegetation given is for one side of the channel with the exception of Adit 8, Pitman from river mile 1.52 to 2.02, and Tombstone from river mile 0.62 to 1.6.

[3]General species categories (I.e. willow, alder, etc.) were recorded in the field. When possible, plant species were recorded using four-letter acronyms as follows:

ACMA	*Acer macrophyllum*	CASP	*Carex* sp.	HEMI	*Heuchera micrantha*	SAJE	*Salix jepsonii*
ADBI	*AdeNocaulon bicolor*	CAVE	*Carex vesicaria* var. *vesicaria*	LOIN	*Lonicera involucrata var. involucrata*	SALE	*Salex lemmonii*
AGEX	*Agrostis exarata*	CIAL	*Circaea alpina* ssp. *pacifica*	MIGU	*Mimulus guttatus*	SALU	*Salix lucida* ssp. *lasiandra*
ALIN	*Alnus incana* ssp. t*enuifolia*	CONU	*Cornus nuttallii*	POTR	*Populus tremuloides*	SETR	*Senecio triangularis*
ALRH	*Alnus rhombifolia*	COSE	*Cornus sericea*	RULE	*Rubus leucodermis*	SPDE	*Spiraea densiflora*
ARDO	*Artemisisa douglasiana*	EPAN	*Epilobium angustifolium*	RUPA	*Rubus parviflorus*	THFE	*Thalictrum fendleri*
ASHA	*Asarum hartwegii*	EQAR	*Equisetum arvense*	RINE	*Ribes nevadense*	TOPAPA	*Torreyochloa pallida var. pauciflora*
ATFE	*Athyrium felix-femina var. cyclosorum*	ERPE	*Erigeron peregrinus*	SASC	*Salix scouleriana*	WOFI	*Woodwardia fimbriata*

[4]A unit equals 20 to 30 bankfull widths.