Placer County Water Agency
Middle Fork American River Hydroelectric Project
(FERC No. 2079)

DRAFT

PROPOSED 2006 GEOMORPHOLOGY AND RIPARIAN HABITAT CHARACTERIZATION STUDY PLAN

Prepared for:

Placer County Water Agency
144 Ferguson Road
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May 5, 2006

Placer County Water Agency

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May 5, 2006
File No. 01030A

SUBJECT: Middle Fork American River Hydroelectric Project Relicensing - Draft Proposed 2006 Geomorphology and Riparian Habitat Characterization Study Plan

Dear Resource Agency Representatives –

Attached for your review and comment is the Draft Proposed 2006 Geomorphology and Riparian Habitat Characterization Study Plan. Any comments that can be provided by May 24 will be included in the Comments/Response Table for discussion at the June 1 meeting. The Proposed Aquatic Study Plan will be forwarded to you by early next week.

You can access the report on our MFP Relicensing website at http://relicensing.pcwa.net under Documentation/Draft Documents.

If you have any questions, please call me at (530) 823-4889.

Sincerely,

Mal Toy
Director of Resource Development

MT:bb

Enclosure

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05/05/2006 03:53 PM MST

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Subject: PCWA - MFP Draft Proposed Geomorphology and Riparian Habitat Characterization Study Plan

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If you have any questions, please contact me at (530) 823-4889.

On behalf of Mal Toy,

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Geo-Rip Phase II Study Plan.| Tables 1-3.pdf Appendices A-F.pd

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

This plan describes Placer County Water Agency's (PCWA's) proposed approach for conducting Phase 2 of the Geomorphology and Riparian Habitat Mapping Studies associated with the relicensing of the Middle Fork American River Project (MFP or Project). The technical approaches proposed in this plan build upon information developed during 2005 (Phase 1) and represent a refinement of the methods presented in PCWA's 2005-2006 Existing Environment Study Plan Package dated June 17, 2005.

2.0 STUDY OBJECTIVES

The purpose of the Phase 1 and 2 studies is to develop information regarding the geomorphic and riparian conditions in the river reaches downstream of the MFP dams and reservoirs. Information developed as part of these studies will be used as a basis for designing and implementing future, more focused technical studies that are designed to evaluate Project effects, and to provide the information needed to develop appropriate protection, mitigation, and enhancement (PM&E) measures.

3.0 GENERAL APPROACH

During Phase 1, information on geomorphic and riparian resources was developed using existing data sources and by conducting qualitative field surveys. The geomorphology studies focused on characterizing current geomorphic conditions, including mapping stream reaches based on the Rosgen Level I and Montgomery-Buffington stream classification systems, identifying potential sediment sources, and comparing historical and recent aerial photography along the study streams in the vicinity of the MFP. The riparian studies focused on developing qualitative information on riparian resources, including identifying, mapping, and describing the riparian habitat along the study streams. The Phase 1 study activities also provided information regarding the accessibility of the study stream reaches.

The Phase 2 geomorphology studies will focus on collecting additional information on current geomorphic conditions of the study streams using the methodology defined by Rosgen (1996) under Level II Morphological Description and Level III Assessment of Stream Condition and Departure from Potential. The Phase 2 studies provide a quantitative assessment of channel classification and conditions. In combination, these analyses are intended to provide a thorough description of channel condition and stability, and to identify stream reaches that are relatively more sensitive to alterations of the flow and sediment regime. The Level III analysis results in a description of stream stability, potential, and function.

The focus of the Phase 2 riparian studies is to collect additional qualitative and quantitative riparian data at each of the Rosgen Level II and III study sites to further characterize and assess the condition of the riparian resources in the study streams. These data, when combined with the information collected during the geomorphology studies, can be used to evaluate the condition of the riparian resources in relation to the life history strategies of the dominant species and fluvial geomorphic processes.

The Phase 2 geomorphology and riparian studies are coordinated to allow for future more detailed analysis of physical processes in the study streams and their related effects on geomorphic and riparian conditions.

4.0 STUDY METHODOLOGY

The following activities will be completed during 2006 as part of the Phase 2 geomorphology and riparian studies:

- Select study reaches and quantitative study sites in consultation with the resource agencies.
- Conduct quantitative Phase 2 studies at agreed upon study sites.
- Assess potential watershed and land use activities that may influence the morphology of the rivers and streams associated with the MFP.
- Map mass wasting and streambank erosion sites downstream of Ralston Afterbay, using methods agreed upon with the resource agencies.
- Evaluate potential reference reaches, addressing objectives determined in consultation with the resource agencies.
- Prepare a report documenting the Phase 2 study results.

The methods associated with each of these activities are described in the following subsections.

4.1 SELECTION OF STUDY REACHES AND QUANTITATIVE STUDY SITES

PCWA proposes to use a three-step process to select sites for quantitative study, as follows:

1. Identify study reaches that are potential candidates for quantitative studies based on the Phase 1 study results and access conditions.
2. Inspect candidate study reaches and select and flag potential quantitative study sites.
3. Visit potential study sites with the resource agencies to obtain agreement on quantitative study sites and transect placement.

The selection process is further explained in the following.

4.1.1 Step 1 - Identify Potential Study Reaches

The first step in the selection process involves the preliminary selection of potential study reaches. PCWA proposes to use a stratified sampling approach to identify

candidate reaches for quantitative studies. In this approach, stream reaches are first stratified by geomorphic type (Rosgen Level I classification), as mapped during the Phase 1 geomorphology study. The Level I stream reaches are further stratified by accessibility. PCWA does not propose to conduct quantitative studies in stream reaches that are unsafe to access.

Figure 1 shows the study reaches that were identified as potential candidates for quantitative studies based on geomorphic information developed during Phase 1 and on accessibility, as determined in the field and using United States Geological Survey (USGS) topographic maps, aerial photography and aerial video.

Table 1 shows the study reaches that were identified as potential candidates for quantitative studies, by river and river mile. As indicated, 43 stream reaches were initially evaluated as candidates for quantitative studies. Of these, ten were determined to be inaccessible and are therefore not proposed for further study. A total of 33 stream reaches are known to be accessible and/or may be accessible. Prior to conducting Phase 2 studies, accessibility will be verified in the field. Phase 2 studies will not be conducted on reaches that are determined to be inaccessible.

4.1.2 Step 2 - Inspect Candidate Study Reaches and Select and Flag Potential Quantitative Study Sites

A team consisting of geomorphologists and riparian ecologists will conduct a field trip to each of the candidate study reaches to evaluate access conditions and to select potential quantitative study sites. Each potential quantification study site will contain two to three cross-section transects (depending upon how many can be surveyed in a day) extending across the valley floor to each canyon wall. The quantitative study sites and transects will be located to best represent the range of geomorphic and riparian conditions within the stream reach. The endpoints of the proposed transects will be flagged and recorded with a Global Positioning System (GPS).

4.1.3 Step 3 - Final Selection

Once the potential quantification study sites and transects have been identified, and prior to any data collection, PCWA will coordinate and conduct a field trip to visit the sites with the resource agencies and other interested parties. Final selection of the quantification study sites and transects will be completed in the field in consultation with the resource agencies. The endpoints of all approved study transects will be marked with flagging during the field visit.

4.2 DATA COLLECTION AT QUANTITATIVE STUDY SITES

The following describes the Phase 2 data collection methods proposed at each quantitative study site. The geomorphology methods are described first, followed by the riparian habitat mapping methods.

4.2.1 Geomorphology Studies

The Phase 2 geomorphology studies will consist of the following components:

- Rosgen Level II Analysis
- Calibration of Bankfull Stage to Known Streamflows
- Rosgen Level III Analysis
- Data Reduction and Development of Work Products

Each of these components is described in the following.

4.2.1.1 Rosgen Level II Analysis

A Rosgen Level II morphological description (Rosgen 1966) will be completed at each of the proposed quantification study sites. The Rosgen Level II stream classification is based on detailed field measurements. This differs from the Level I classification, which is based on valley form and channel dimensions observable on maps, aerial photos, or visual ground inspection. The Level II classification is based on more rigorous, quantitative, and measured parameters. As such, the Level II assessment allows for:

- Refinement of Level I stream type classifications, and
- Quantitative morphological delineation of stream types.

The Level II classification hierarchy is shown in Appendix A. Level II classification is based on field measurements of five primary morphometric parameters:

- Entrenchment ratio (floodprone width divided by the bankfull width; Wfp/Wbf)
- Width-to-depth ratio (bankfull width divided by the average bankfull depth; Wbf/Dbf)
- Sinuosity (ratio of stream distance to valley distance)
- Water surface slope
- Bed particle size

These morphometric parameters will be measured at each approved quantification study site. Measurements will be taken at two to three transects per quantification study site, depending upon how many can be surveyed in one day. The endpoints of all approved study transects will be marked with rebar and recorded with GPS. Standard procedures will be used to identify bankfull width using field indicators and to measure bankfull width, flood prone width, and slope, as outlined in Harrelson et al. (1994) and Rosgen (1996). A quantification study site will be at least 10 bankfull widths in length.

For mapping purposes, a Level II classified stream reach will have a minimum length of 0.2 mile.

A pebble count will be performed at each approved quantification study site based on procedures developed by Wolman (1954) and Rosgen (1996). Additional pebble counts are proposed at 36 sites within the study reaches where Phase 1 studies identified a transition in dominant bed material within a stream reach (Table 2). The locations of particle size transitions were identified during the Level I field and aerial reconnaissance surveys conducted in 2005. These additional pebble count measurements will provide a complete, quantitative assessment for the Level II classification.

4.2.1.2 Calibration of Bankfull Stage to Known Streamflows

Prior to data collection at the Level II quantification study site, bankfull elevation will first be calibrated by the field crews at available gaging station locations with long-term flow records, using procedures described by Rosgen (1996). This calibration procedure assists with distinguishing bankfull elevation from other elevations, which is an important key to channel classification. Ten gaging stations have sufficiently long and recent records to support field calibration (Table 3). Field determined bankfull stage elevations and associated bankfull channel dimensions will be calibrated to known recurrence interval discharges at the gaging stations. This calibration first requires calculating annual flood flow frequency at gaged stations prior to conducting field work. Flood flow frequency analysis will be developed using the USGS Bulletin 17B, Guidelines for Determining Flood Flow Frequency (USGS 1982).

4.2.1.3 Rosgen Level III Analysis

A Rosgen Level III assessment of stream condition and departure from potential analysis (Rosgen 1966) will also be completed at each of the proposed quantification study sites. The Level III analysis provides a description of channel morphological stability and function. Stream stability is morphologically defined as the ability of the channel to maintain its dimension, pattern, and profile so that it is neither aggrading nor degrading. An objective of the Level III analysis is to determine the extent to which the present-day channel condition matches its functional stream potential, based on quantifiable morphological characteristics. Stream classification forms the basis for assessing the degree to which existing conditions differ from an accepted range of morphological values.

There are three approaches for determining the degree of departure for an existing stream condition from its full functional potential (Rosgen 1996):

- Comparing existing stream condition to a geomorphological database for similar stream types;

- Comparing the same stream reach over different time periods, usually through the use of historical aerial photography, ground photography, or by comparison to historic data; and

- Comparing river condition at different points in space (i.e., upstream and downstream of project facilities or to a reference stream).

Level III parameters will be collected at all approved Level II quantification study sites using a combination of field surveys, with supporting data from aerial surveys, aerial photography, and topographic maps. The Level III data collection will be performed concurrent with the Level II data collection. Information from the riparian vegetation mapping will be integrated into the Level III assessment. This information will be used to help identify the relative responsiveness of stream reaches to bank erosion or slope instability.

The following parameters are to be collected at each quantification study site:

- Deposition patterns
- Meander patterns
- Stream order
- Steambank erosion potential
- Description of the extent and relative influence of large woody debris on channel morphology
- Channel stability rating

Deposition patterns essentially categorize bar features. Rosgen (1996) has identified eight depositional pattern types that will be used to classify bar features at each quantification study sites. Meander patterns will be classified based on a categorization system described by Rosgen (1996), that distinguishes eight types. Stream order will be determined based on the system developed by Strahler (1964), that is a method for organizing and comparing channels of different size within the watershed stream network. Stream order will be determined from USGS topographic maps, not from field data.

Streambank erosion potential will be determined based on a method developed by Rosgen (1996), that classifies reaches into categories of relative bank erosion potential (i.e., very low, low, moderate, high, very high, and extreme). Measured criteria include streambank height to bankfull stage, ratio of riparian vegetation rooting depth to streambank height, degree of root density, bank angle, and degree of bank surface protection. The bank erodibility rating guide developed by Rosgen (1996) is provided in Appendix B.

A large woody debris inventory to be performed during the Phase 2 Aquatic Habitat Characterization Study will provide most of the information needed to describe the influence of large woody debris on channel morphology. However, the geomorphology study will describe the relative extent of woody debris in the channel based on field

observations at each quantification study site. The extent of large woody debris will be categorized according to Rosgen (1996). In addition, the observed geomorphic function(s) of large woody debris will be described.

Channel stability ratings provide an index that describes the potential for changes in the sediment supply or flow regime to have effected the vertical and lateral stability of a channel. The rating system provides an indication of channel stability, but is not a quantitative measure of actual hydraulic conditions that cause the transport of bedload material, result in scour or deposition, or erode banks. Channel stability will be rated using the Pfankuch (1975) method as modified by Rosgen (1996). The stability ratings are based on field observations and measurements that result in categories ranging from poor to excellent stability. The parameters evaluated in the stability rating system are provided in the attached form (Appendix C). Channel stability ratings will be performed at each of the selected quantification study sites.

4.2.1.4 Data Reduction and Work Products

The work products for Phase 2 of the geomorphology study will consist of Level II stream reach classifications delineated on a base map or aerial photographs. For each quantification study site, data associated with each of the Level II parameters will be shown in a tabular format. Transect locations will be photo-documented and monumented with rebar pins, and GPS coordinates recorded so that they can be relocated for future use, if necessary. Transects and longitudinal profiles will be graphically plotted, with bankfull and floodprone widths identified. Pebble counts will be graphically plotted as cumulative particle size distribution curves and frequency histograms.

The Level III information will be presented in tabular format, spatially designated on maps, or presented in narrative format, as appropriate. Channel reaches most susceptible to disturbance and those relatively more geomorphically resilient reaches will be identified and ranked. Potentially disturbed or altered reaches will be identified, and the nature of the likely channel alteration will be described. The results of the 2006 studies, including GIS maps, aerial videos, and other products, will be cross-referenced with the results from the 2005 studies. All updates will be identified in the 2006 report. All raw data, analysis files, and Geographic Information System (GIS) shape files will be provided to the resource agencies. Maps will be provided in the report and on CD.

4.2.2 Riparian Studies

The Phase 2 riparian studies will focus on collecting both quantitative and qualitative data at each agency-approved quantitative study site. The information will be used to refine the description of the composition, distribution, and age class structure of the riparian habitat, including regeneration and encroachment, developed during the Phase 1 studies. Riparian data collection at all the Phase 2 quantitative study sites, unless specified, include the following activities:

- Photo Documentation

- Vegetation Transect Composition and Structure
- Stream Bank Composition
- Data Reduction and Work Products

Each of these activities is discussed in the following.

4.2.2.1 Photo Documentation

Photo documentation will provide a visual record of the conditions of the riparian community and surrounding land uses. Permanent photo points will be established during the 2006 studies at each transect location. Each point will be marked with a stake or rebar that is clearly visible from the photographer's location. In addition, the location of each point will be recorded with GPS coordinates so that it can be relocated for future use, if necessary. The photographs will be stored electronically in a photolog with pertinent information including date, time, number, and environmental information (such as recent high flows, etc). The datasheet for documenting the photo points is provided in Appendix D.

4.2.2.2 Vegetation Transect Composition and Structure

Quantitative data will be collected at each quantitative study site using the line-intercept method and with plots distributed along transects established perpendicular to the channel. Riparian data will be collected along transects within each quantification study site. The width of the riparian corridor will be measured at all transects. Vegetation will be sampled from the low flow water's edge to the valley walls or hillslope, and will include bars if present.

At all reaches, quantitative and qualitative information on the riparian community will be collected, as described in the 2005-2006 Existing Environment Study Package (PCWA 2005). The datasheets are provided in Appendix D.

Composition

Data collected using the line-intercept method will be used to characterize the species distributions, cover of litter, woody debris, woody vegetation[1], and conifers, and substrate particle size within the riparian corridor (Canfield 1941; Winward 2000). Community composition (dominant ground, shrub, and tree species present), is obtained by walking along the transect tape and measuring and recording the length of each dominant species or community type that intersects the tape along the transect. In addition, the length of areas of bare ground, leaf litter, large woody debris, and different substrate size classes will be recorded along each transect. The lengths of the vegetation and other corridor attributes are then related to the width of the entire riparian corridor to determine the proportion of each within the corridor.

[1] All cover measurements will be made with a densiometer.

Structure

Data will be collected in plots placed at changes in elevations and shifts in dominant species characteristics along each transect to evaluate possible changes or shifts in riparian characteristics, including age class and densities, in relation to potential differences in flow connectivity and hydroperiod. Data will be collected in two plot sizes at each plot location. Herbaceous and other cover data will be collected within 1 m^2 plots along transects. Shrub and tree data will be collected within 5 x 2 m plots along transects.

Plot-transect data collection will be used to collect quantitative data, including:

- Shrub and Tree Layers (5 x 2 m plots):
  - Canopy coverage class (%)
  - Total number of stems (class)
  - Stem count per individual or species (class)[2]
  - Tree diameter (diameter at breast height)
  - Dominant species relative decadence (%)
  - Dominant species coverage (%)
  - Total plot decadence (%)

- Ground Layer (1 x 1 m plots)
  - Dominant species coverage (%)
  - Total canopy coverage
  - Ground layer canopy coverage
  - Shrub layer canopy coverage
  - Tree layer canopy coverage

Other pertinent information will be recorded as observed in the field, including: substrate, channel encroachment, large woody debris within the riparian corridor, bank instability, and evidence of recreational and other land use activities (e.g. fishing trails, vegetation trampling or clipping, horses or cattle present). Evidence of unusual stress or mortality, and/or evidence of wildlife use, will also be noted. In addition, noxious weed and special-status plant species will be documented if encountered during field surveys.

[2] Many observers have difficulty differentiating willow and mountain alder individuals, particularly mature individuals. Stems per individual will not be assessed if this occurs; rather stems per area (densities) will be determined. Seedlings or young individuals will be identified as this information is important for assessing regeneration. In addition, when stem densities are high, the accuracy of the counting tends to decrease. To minimize this error in the field, stem densities have been grouped. The groupings are finer at lower densities and are broader as densities increase.

The total plot number along each transect will vary depending on the width of the riparian corridor. However, plots will be established to sample at least 5% of the total transect length, with a minimum of 4 5 x 2 plots and 6 1 x 1 plots per transect, as feasible based on the width of the valley bottom. A plot will always be established at the water's edge, and plots will also be established on bar features, if present along the transect.

In reaches with poorly developed and narrow floodplains in which only 1 or 2 plots would be placed along the transect, additional plots will be established parallel to the channel to evaluate a minimum of 4 5 x 2 plots and 6 1 x 1 plots per transect.

4.2.2.3 Stream Bank Composition

Stream bank composition and cover will be characterized at each quantification study site using a modified greenline method[3] (minimum of 100m long)[4] (Winward 2000; Coles-Ritchie et al. 2004). At least one surveyed transect will intercept the greenline. Data on community composition and dominant species (dominant ground, shrub, and tree species present), bare ground, leaf litter, and large woody debris will be collected following a procedure similar to that described above for the line-intercept method, with the exception that the information will be collected parallel to the channel rather than perpendicular to it. The lengths of the vegetation and other corridor attributes are then related to the length of the greenline to determine the proportion of each along the stream bank. In addition, the number of seedlings of woody species (riparian and upland, if present) along a 6-foot wide belt along the greenline will also be tallied.

Other observational information, such as channel encroachment, other land uses, substrate, evidence of unusual stress or mortality, and/or evidence of wildlife use, will also be noted. A sample datasheet is provided in Appendix D.

Age Class Structure

During the 2005 riparian studies, lines of seemingly similarly aged white alder and/or cottonwoods were observed along certain reaches of the Rubicon River and the Middle Fork American River[5]. During the 2006 field studies, a study of tree ages will be completed within a sub-sample of these reaches including:

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[3] The greenline is defined as: '*The first perennial vegetation that forms a lineal grouping of community types on or near the water's edge. Most often it occurs at or slightly below the bankfull stage' (Winward 2000).*

[4] In addition to vegetation composition data, this sampling procedure provides information on bank stability.

[5] This has been observed on numerous regulated and non-regulated streams (Auble et al. 1994; Braatne et al. 1996; Scott et al. 1997; Mahoney and Rood 1998; Roberts et al. 2002; Rood et al. 2003; Merigliano 2005) and has been attributed to the life history strategies of the species and specific years with successful recruitment during a year with a relatively high flow event, favorable high flow recession limb, and low mortality from drought or erosion/abrasion during subsequent years.

- Middle Fork American River, French Meadows to Ralston Afterbay: RM 29.1-27.7 or 27.7-26.1
- Middle Fork American River, Downstream of Ralston Afterbay: RM 24.4-10.8
- Middle Fork American River, Downstream of Ralston Afterbay: RM 9.6-0.0
- Rubicon River: RM 21.0-19.7 or 19.7-17.6[6]
- Rubicon River: RM 3.3-3.7 or 3.3-2.1

Tree increment cores will be collected and dated at selected reaches with the even-aged stands of cottonwoods or alders, following methods similar to those described in Maeglin 1979; Phipps 1985. A minimum of 20 and maximum of 40 trees will be sampled. The sampled trees will intersect at least one surveyed transect. If more than one line of trees of similar ages is observed within the reach, then additional lines will be sampled. The trees will be aged in the lab and the ages of the individuals will be related, in general, to the hydrologic regime at the time of seedling establishment and subsequent years.

4.2.2.4 Data Reduction and Work Products

Work products resulting from the Phase 2 riparian studies will include GIS maps showing the location and extent of riparian vegetation along the channels. The vegetation community type mapping will be overlaid on the Level II channel classification. Information collected on the location of invasive or special status species will also be incorporated on GIS base maps. Quantitative and qualitative data collected at each study site will be summarized by study stream, and will include text descriptions, tables, graphs, figures, photographs, and maps, as appropriate in Microsoft Excel or other formats. The results of the 2006 studies, including GIS maps, aerial videos, and other products, will be cross-referenced with the results from the 2005 studies. All updates will be identified in the 2006 report. All raw data, analysis files, and GIS shape files will be provided to the resource agencies. Maps will be provided in the report and on CD.

4.3 WATERSHED AND LAND USE ACTIVITIES

The geomorphic and riparian resources along the study streams and rivers may be affected by a variety of factors, including historic and recent land and water uses and naturally-occurring events such as fires and floods. General information regarding historic and recent land and water uses and naturally-occurring events will be developed and evaluated as part of the Phase 2 riparian and geomorphology studies. This effort will focus on information that provides perspective and context regarding the Project setting and possible sediment sources and land use activities that may influence stream morphology and riparian habitat. PCWA does not propose to develop quantitative information regarding these topics as part of the 2005-2006 Existing

[6] The specific reach will be determined during the field verification of the quantification study sites and transect locations.

Environment Studies. This information will be further developed during subsequent phases of the relicensing process and provided to the resource agencies in the Pre-Application Document (PAD).

4.4 SEDIMENT RECRUITMENT DOWNSTREAM FROM RALSTON AFTERBAY

The location and relative abundance of sediment recruitment to channels from hillslope mass-wasting and bank erosion processes downstream of Ralston Afterbay will be evaluated. This assessment will focus on the inner gorge area of the Middle Fork American River, between Ralston Afterbay and the confluence with the North Fork American River, and the North Fork American River from the Middle Fork confluence to the high water mark of Folsom Reservoir. Sediment sources located between the active stream channel and the tops of the valley walls (e.g., up to the ridgeline) will be identified. Mass-wasting and significant bank erosion sites will be mapped. Aerial reconnaissance, ground survey, and aerial photography will be used to identify the sediment recruitment sources.

4.5 POTENTIAL COMPARISON STREAMS

It may be necessary to compare specific geomorphic and riparian resource attributes on the study streams to those upstream of Project diversions if suitable, or on other unregulated streams and rivers. The best comparison streams are preferably those unimpaired by water diversions, but within the same watershed, and with similar and well-defined historic and current land use activities. Streams with an existing hydrologic record are also preferable in order to understand how regulated flows may be influencing geomorphic conditions and riparian resources.

PCWA proposes to consult with the resource agencies regarding the selection of possible reference reaches, study goals and objectives as they relate to the selection of reference reaches, study methodologies, and evaluation criteria. PCWA plans to begin these discussions as the resource agencies are reviewing the Phase 2 study plans.

5.0 REPORTING

A report-describing Phase 2 of the geomorphology and riparian habitat studies will be prepared. The report will provide a description of the study objectives, methods, and results and will include documentation regarding the study reach selection process. All work products described in this plan will be incorporated into the report, with text descriptions, tables, graphs, and photographs, as appropriate. In addition, for perspective, the report will include a discussion of recent climatic and hydrologic conditions prior to and during the period of study.

The results of the 2006 studies, including GIS maps, aerial videos, and other products, will be cross-referenced with the results from the 2005 studies. All updates will be identified in the 2006 report. All study measurement sites will be identified on a base map to be included with the report. All data will be provided in raw format on an accompanying CD.

6.0 AGENCY CONSULTATION AND NEXT STEPS

This study plan presents PCWA's proposed approach for conducting Phase 2 of the Geomorphology and Riparian Habitat Mapping Studies. PCWA recognizes that it is important to obtain agreement on these approaches with the resource agencies prior to proceeding with the studies. The following are key decisions that must be made prior to implementing the work outlined in this study plan.

- Obtain agreement on overall study approaches and quantitative methods described in this plan; and

- Obtain agreement on the number and location of quantification study sites and transects.

In addition, PCWA plans to consult with the resource agencies regarding:

- The selection of potential comparison reaches, including study goals, objectives and methods;

- The collection and evaluation of data and information regarding general watershed conditions that may influence stream morphology and riparian habitat; and

- The approach to be used to map mass-wasting sites downstream of Ralston Afterbay.

PCWA plans to discuss these topics with the resource agencies during a meeting scheduled for June 1, 2006, with the goal of obtaining concurrence on the study approaches and methods outlined in this plan during the meeting. With agreement from the agencies, PCWA will proceed with Step 2 of the study plan, which involves conducting a field trip to further assess the proposed study reaches and identify and flag potential quantitative study sites. Upon completion of Step 2, PCWA will schedule a field trip with the resource agencies to select the quantitative study sites and transect locations. Upon agency approval of the quantitative study sites, PCWA will begin the Rosen Level II and III surveys and riparian vegetation surveys.

PCWA will develop a schedule showing the dates during which fieldwork is expected to be conducted and will provide the resource agencies with monthly updates throughout the 2006 field season. The field schedule will be provided to specific individuals identified by the resource agencies. PCWA will coordinate with these individuals as the field schedule evolves and specific field dates are identified and refined. PCWA encourages and looks forward to participation by the resource agencies in the fieldwork.

7.0 SCHEDULE MILESTONES

The 2006 studies (Phase 2) will be carried out in accordance with the following schedule.

Phase 2 Schedule

Date	Milestone
May – June 2006	Consultation with resource agencies regarding Phase 2 study plan
June – July 2006	Conduct field inspection to identify and flag potential Phase 2 quantification study sites
July 2006	Conduct site visit with agencies and stakeholders to select Phase 2 quantification study sites and transects
July - Oct 2006	Conduct Phase 2 studies, including data tabulation, reduction and preliminary analysis
Sept – Nov 2006	Continue data reduction and analysis
Nov - Dec 2006	Report preparation
Jan 2007	Distribute report to resource agencies for review and comment

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TABLES

Table 1. Phase 2 Study Site Locations.

River	RM Reach to Establish Quantification Site[1]	Level 1 Rosgen Type	RM Access Points	Type of Access	Access Rating[2]	Location and Access Description-Notes
Middle Fork American River						
Between Interbay and French Meadows Reservoir						
	44.2-47.2	A	45.8	4-wheel drive	Accessible	Near French Meadows Reservoir
	42.0-44.2	B	45.8	4-wheel drive	Inaccessible	Need at least 1.6 mile hike
	39.7-42.0	A	45.8	4-wheel drive	Inaccessible	3.8-mile channel hike
	39.7-37.4	Fb or A	35.9	Car	Inaccessible	0.5-mile channel hike
	37.4-36.5	A	35.9	Car	Inaccessible	access at Interbay via car, but channel inaccessible over at least 0.6-mile channel walk
	36.5-36.0	Fb or G	35.9	Car	Accessible	Interbay dam and reservoir
Ralston Afterbay and Interbay						
	36.0-35.6	N/A				Ralston-Interbay reach
	33.4-35.6	Fb or B	35, 35.6	Hike, car	Difficult/Unknown	Ralston-Interbay reach
	29.1-33.4	Fb	29.4	Helicopter	Accessible	Ralston-Interbay reach
	27.7-29.1	F or B	29.4	Helicopter	Accessible	Ralston-Interbay reach
	26.1-27.7	Fb or B	26.1, 27.7	4-wheel drive	Accessible	Afterbay
	25.7-26.1	Fb	26.1	4-wheel drive	Accessible	0.4-mile reach just above Ralston Afterbay
	24.7-25.7	N/A				Ralston Afterbay 0.4-mile reach just above Ralston Afterbay
Below Ralston Afterbay						
	10.8-24.7	F		Hike, boat, helicopter	Accessible	Upstream Otter Creek and major tributaries
	9.6-10.8	For B	10.4, 10.8	Car, boat, helicopter	Accessible	Ruck-A-Chucky rapids
	0.0-9.6	F	9.3	Car, hike, boat, helicopter	Accessible	All F-type
Long Canyon						
Long Canyon Creek						
	7.0-11.4	B	8.6	Car	Accessible	Ramsey Crossing
	0.0-7.0	A	6.8, 3.4	Hike	Accessible	RM 6.8 upper boundary of A-type; hike downstream. RM 3.4 on Rubicon, hike upstream
North Fork Long Canyon Creek						
	0.0-3.1	B	1.4, 2.6, 3.1	Car	Accessible	
South Fork Long Canyon Creek						
	0.0-3.3	B	0.4, 1.8, 3.3	Hike, 4-wheel drive	Accessible	

Table 1. Phase 2 Study Site Locations.

River	RM Reach to Establish Quantification Site[1]	Level 1 Rosgen Type	RM Access Points	Type of Access	Access Rating[2]	Location and Access Description-Notes
Duncan Creek						
	7.9-8.6	B or G	8.7	Car	Accessible	Duncan Diversion access point
	5.0-7.9	B	5.9, 7.4	Car	Accessible	Access at RM 5.9 unknown
	4.0-5.0	B or G	5.9	4-wheel drive. hike	Difficult/Unknown	
	3.1-4.0	G	3.2	4-wheel drive. hike	Inaccessible	
	1.0-3.1	B	3.2	4-wheel drive. hike	Inaccessible	
	0.0-1.0	A	0.1	4-wheel drive. hike	Inaccessible	Access from Red Star Ridge Road
Rubicon River						
	30.3-27.5	B	28.7, 30.3	Hike, 4-wheel drive, helicopter	Accessible	RM 30.3 is dam access point. Trail at RM 28.7 is 700 feet descent over 1.5-miles
	27.5-24.7	F or B	25.0, 25.3	Hike, helicopter	Accessible	Trail access at RM 25.0 is 900-feet descent over 0.8-mile
	24.7-24.2	G	25	Hike	Inaccessible	Cannot walk channel from access point
	24.2-23.4	F	25	Hike	Inaccessible	Cannot walk channel from access point
	23.4-22.5	F or G	22.6	Hike	Accessible	Trail hike 1.5-mile from Road 2 bridge
	22.5-21.9	G	21.2	4-wheel drive	Inaccessible	Channel walk 0.7-mile upstream
	21.9-19.7	F	21.2	4-wheel drive	Accessible	Must channel walk 0.5-mile downstream
	19.7-17.6	F or G	20.25	Hike	Accessible	Confirm access
	17.6-14.6	G	14.3	Helicopter	Difficult/Unknown	Must hike at least 0.3-mile upstream
	14.6-13.5	F or G	14.3	Helicopter	Difficult/Unknown	No other channel access
	13.5-8.7	G	9.5	Helicopter	Difficult/Unknown	No other channel access
	8.7-6.1	F or G	8	Helicopter	Difficult/Unknown	Questionable LZ for Duke
	6.1-5.6	G	5.3	4-wheel drive, hike	Difficult/Unknown	2.5-mile trail hike, then channel walk upstream about 0.3 or more miles
	5.6-4.4	F	5.3	4-wheel drive, hike	Difficult/Unknown	2.5-mile trail hike, then channel walk upstream about 0.3 or more miles
	4.4-3.7	G	3.4	4-wheel drive	Accessible	Hike upstream 0.3-mile or more
	3.7-3.3	F	3.4	4-wheel drive	Accessible	
	3.3-2.1	F or G	3.1, 3.4	4-wheel drive	Accessible	Hike up or downstream about 0.2-mile
	2.1-0.8	F	0.5	Car	Difficult/Unknown	Hike channel upstream 0.3-mile or more
	0.8-0.3	G	0.5	Car	Accessible	No channel hike necessary

[1]Reaches are defined by breaks in Rosgen Level I channel classification

[2]Reaches in blue text indicate accessibility is unknown (accessibility will be determined during field inspections). Reaches in red text are inaccessible

Table 2. Additional Pebble Count Sites for Level II Classification.

Stream	Pebble Count Reach (RM)	Accessibility	Dominant Particle Size[a]	Level I Type
Middle Fork American	34.8-35.6	Difficult/Unknown	2	Fb or B
Middle Fork American	33-33.4	Accessible	2/3	Fb
Middle Fork American	22 – 20.3	Accessible	2	F
Middle Fork American	20.3 – 19.4	Accessible	1/2	F
Middle Fork American	19.4 – 17.2	Accessible	2/3	F
Middle Fork American	17.2 – 16.6	Accessible	4	F
Middle Fork American	16.6 – 14.5	Accessible	3	F
Middle Fork American	14.5 – 12.4	Accessible	3/4	F
Middle Fork American	12.1 – 10.8	Accessible	5	F
Middle Fork American	8.5 – 7.4	Accessible	2/3	F
Middle Fork American	7.4 – 2	Accessible	3/4	F
Middle Fork American	2 – 1.7	Accessible	2	F
Middle Fork American	1.7 – 1	Accessible	3	F
Middle Fork American	1 - 0	Accessible	3/4	F
Long Canyon	10.5 - 9	Accessible	2/3/4	B
Long Canyon	9 – 8.3	Accessible	2/3	B
Long Canyon	6.7 – 6.4	Accessible	1/2/3/4	A
Long Canyon	6.4 – 6.2	Accessible	1 / 2	A
Long Canyon	1 - 0	Accessible	2/3	A
No. Fork Long Canyon	2.6 – 1.9	Accessible	2/3	B
No. Fork Long Canyon	1.9 – 1.75	Accessible	3/4	B
No. Fork Long Canyon	1.6 – 1.4	Accessible	2/3	B
No. Fork Long Canyon	1.4 – 0.3	Accessible	N.D.	B
No. Fork Long Canyon	0.3 – 0.0	Accessible	1/2	B
So. Fork Long Canyon	3.1 – 1.8	Accessible	2/3/4	B
So. Fork Long Canyon	1.6 – 1.2	Accessible	1/2/3/4	B
So. Fork Long Canyon	1.2 – 1	Accessible	2	B
So. Fork Long Canyon	1.0 – 0.1	Accessible	2/3/4	B
Rubicon River	8.7 – 9.0	Difficult/Unknown	1/2	G
Rubicon River	9.4 – 13.5	Difficult/Unknown	2/3	G
Rubicon River	14.6 – 15	Difficult/Unknown	2	G
Rubicon River	15.2 – 17.6	Difficult/Unknown	2/3	G
Rubicon River	21 – 21.9	Accessible	2	F
Rubicon River	24.7 – 25.6	Accessible	2/3	F or B
Duncan Creek	5.0 – 4.5	Difficult/Unknown	2/3	B or G
Duncan Creek	8.7 – 8.3	Difficult/Unknown	1/2	B or G

[a]Dominant particle size estimated from Level I surveys in 2005.
Particle size key (Rosgen, 1966): 1 = bedrock, 2 = boulder, 3 = cobble, 4 = gravel, 5 = sand

Table 3. Level II Bankfull Calibration Sites at USGS Gaging Stations

Location	USGS Gage	Period of Flow Record
Middle Fork American River		
French Meadows	11427500	1951-2004
Above Middle Fork Powerhouse Near Foresthill	11427600	1965-2004
Below Interbay Dam Near Foresthill	11427770	1965-2002
Near Foresthill	11433300	1958-2004
Near Auburn[1]	11433500	1911-1986
Rubicon River		
Below Hell Hole Dam	11428800	1965-2004
Near Georgetown (below So Fork Rubicon)	11431000	1910-1964
Near Foresthill[1]	11433200	1958-1984
Duncan Creek		
Duncan Canyon Near French Meadows	11427700	1960-2004
Duncan Canyon Below Diversion Dam Near French Meadows	11427750	1964-2004
Long Canyon Creek		
Near French Meadows[1]	11433100	1960-1992
South Fork Long Canyon Creek		
Release Below Diversion Tunnel Near Volcanoville	11433065	1988-2003
North Fork Long Canyon Creek		
Release Below Diversion Tunnel Near Volcanoville	11433085	1988-2004

[1] These gaging stations have been discontinued for a relatively long period of time so that they are unlikely to be useful for field calibration, due to shifts in the rating curve or lack of known, stable elevation points such as that defined by a staff gage.

FIGURES

Placeholder for Figures

Non-Internet Public Information

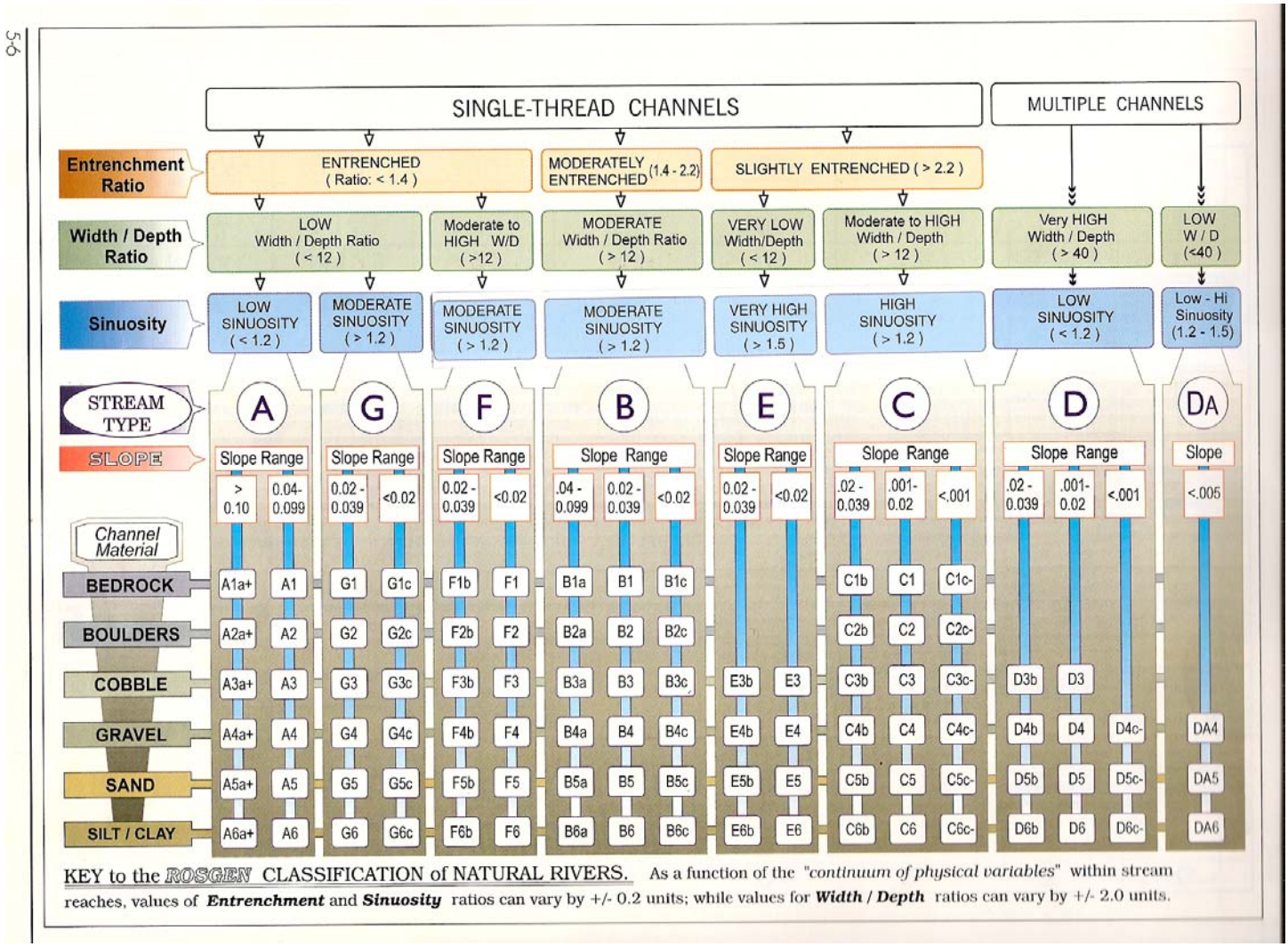
These Figures have been removed in accordance with the Federal Energy Regulatory Commission (FERC) regulations at 18 CFR Section 388.112.

These Figures are considered Non-Internet Public information and can not be posted on the Internet. These Figures are available separately as part of the paper copy distribution.

APPENDIX A

Rosgen (1996) Classification Key For Natural Rivers

Appendix A. Rosgen (1996) Classification Key for Natural Rivers.



APPENDIX B

Bank Erosion Potential Rating

Appendix B. Bank Erosion Potential Rating (Source: Rosgen, 1996).

BANK EROSION POTENTIAL

CRITERIA	VERY LOW		LOW		MODERATE		HIGH		VERY HIGH		EXTREME	
	VALUE	INDEX	VALUE	INDEX	VALUE	INDEX	VALUE	INDEX	VALUE	INDEX	VALUE	INDEX
Bank Ht/Bkf Ht	1.0-1.1	1.0-1.9	1.1-1.19	2.0-3.9	1.2-1.5	4.0-5.9	1.6-2.0	6.0-7.9	2.1-2.8	8.0-9.0	>2.8	10
Root Depth/Bank Ht	1.0-0.9	1.0-1.9	0.89-0.50	2.0-3.9	0.49-0.30	4.0-5.9	0.29-1.15	6.0-7.9	0.14-.05	8.0-9.0	<.05	10
Root Density (%)	80-100	1.0-1.9	55-79	2.0-3.9	30-54	4.0-5.9	15-29	6.0-7.9	5-14	8.0-9.0	<5.0	10
Bank Angle (Degrees)	0-20	1.0-1.9	21-60	2.0-3.9	61-80	4.0-5.9	81-90	6.0-7.9	91-119	8.0-9.0	>119	10
Surface Prot. (%)	80-100	1.0-1.9	55-79	2.0-3.9	30-54	4.0-5.9	15-29	6.0-7.9	10-15	8.0-9.0	<10	10
TOTALS												
		5-9.5		10-19.5		20-29.5		30-39.5		40-45		46-50
Numerical Adjustments												

BANK MATERIALS: BEDROCK: BANK EROSION POTENTIAL ALWAYS VERY LOW
BOULDERS: BANK EROSION POTENTIAL LOW
COBBLE: DECREASE BY ONE CATEGORY UNLESS MIXTURE OF GRAVEL/SAND IS OVER 50%, THEN NO ADJUSTMENT
GRAVEL: ADJUST VALUES UP BY 5-10 POINTS DEPENDING ON COMPOSITION OF SAND
SAND: ADJUST VALUES UP BY 10 POINTS
SILT/CLAY: NO ADJUSTMENT

STRATIFICATION: 5-10 POINTS (UPWARD) DEPENDING ON POSITION OF UNSTABLE LAYERS IN RELATION TO BANKFULL STAGE

APPENDIX C

Channel Stability Rating

Appendix C. Channel Stability Rating (Source: Rosgen, 1996).

CHANNEL STABILITY (PFANKUCH) EVALUATION AND STREAM CLASSIFICATION SUMMARY (LEVEL III)

	Category	POOR	
UPPER BANKS	1 Landform Slope	Bank Slope Gradient 60%+	8
	2 Mass Wasting	Frequent or large causing sediment nearly year long or imminent danger of same.	12
	3 Debris Jam Potential	Moder. to heavy amounts, predom. larger sizes.	8
	4 Vegetative Bank Protection	<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass.	12
LOWER BANKS	5 Channel Capacity	Inadequate. Overbank flows common. W/D ratio >25	4
	6 Bank Rock Content	<20% rock fragments of gravel sizes, 1-3" or less.	8
	7 Obstructions to Flow	Sediment traps full, channel migration occurring.	
	8 Cutting	Almost continuous cuts, some over 24" high. Failure of overhangs frequent.	16
	9 Deposition	Extensive deposits of predom. fine particles. Accelerated bar development.	16
BOTTOM	10 Rock Angularity	Well rounded in all dimensions, surfaces smooth.	4
	11 Brightness	Predom. bright, 65%+ exposed or scoured surfaces.	4
	12 Consolidation of Particles	No packing evident. Loose assortment easily moved.	8
	13 Bottom Size Distribution	Marked distribution change. Stable materials 0-20%.	16
	14 Scouring and Deposition	More than 50% of the bottom in a state of flux or change nearly year long.	24
	15 Aquatic Vegetation	Perennial types scarce or absent. Yellow-green, short term bloom may be present.	4
		TOTAL	

Stream Width _____ x avg. depth _____ x mean velocity _____ = Q _____ cfs

Gauge Ht _____ Reach Gradient _____ Stream Order _____ Sinuosity Ratio _____

Width bkf _____ Depth bkf _____ W/D Ratio _____ Discharge (Q_{bkf}) _____

Drainage Area _____ Valley Gradient _____ Stream Length _____ Valley Length _____

Sinuosity _____ Entrenchment Ratio _____ Length Meander (Lm) _____ Belt Width _____

Sediment Supply
Extreme _____
Very High _____
High _____
Moderate _____
Low _____

Stream Bed Stability
Aggrading _____
Degrading _____
Stable _____

Width/Depth Ratio Condition
Normal _____
High _____
Very High _____

Stream Type [ ]

TOTAL SCORE for Reach E____= G____+ F____+ P____= Pfankuch Rating [ ]

Remarks _____

from table [ ] Reach Condition

CONVERSION OF STABILITY RATING TO REACH CONDITION BY STREAM TYPE*

Stream Type	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	B5	B6
GOOD	38-43	38-43	54-90	60-95	60-95	50-80	38-45	38-45	40-60	40-64	48-68	40-60
FAIR	44-47	44-47	91-129	96-132	96-142	81-110	46-58	46-58	61-78	65-84	69-88	61-78
POOR	48+	48+	130+	133+	143+	111+	59+	59+	79+	85+	89+	79+

Stream Type	C1	C2	C3	C4	C5	C6	D3	D4	D5	D6
GOOD	38-50	38-50	60-85	70-90	70-90	60-85	85-107	85-107	85-107	67-98
FAIR	51-61	51-61	86-105	91-110	91-110	86-105	108-132	108-132	108-132	99-125
POOR	62+	62+	106+	111+	111+	106+	133+	133+	133+	126+

Stream Type	DA3	DA4	DA5	DA6	E3	E4	E5	E6
GOOD	40-63	40-63	40-63	40-63	40-63	50-75	50-75	40-63
FAIR	64-86	64-86	64-86	64-86	64-86	76-96	76-96	64-86
POOR	87+	87+	87+	87+	87+	97+	97+	87+

Stream Type	F1	F2	F3	F4	F5	F6	G1	G2	G3	G4	G5	G6
GOOD	60-85	60-85	85-110	85-110	90-115	80-95	40-60	40-60	85-107	85-107	90-112	85-107
FAIR	86-105	86-105	111-125	111-125	116-130	96-110	61-78	61-78	108-120	108-120	113-125	108-120
POOR	106+	106+	126+	126+	131+	111+	79+	79+	121+	121+	126+	121+

**Generalized relations ... need additional Level IV data to expand data base for validation.*

TABLE 6-7. Channel stability evaluation ... (continued)

6-30

APPENDIX D

Phase 2 Riparian Study Data Sheets

DRAFT
Photo Point Documentation

Stream Name	Date	Time	Photographer	GPS Coordinates	Photo ID	Location of Photographer	Description of Permanent Marker	Description of Photograph

DRAFT
Key for Detailed Riparian Assessment Datasheet

	Ground Layer[4]		Shrub[4]		Tree[4]	
Canopy Cover[1,3] Relative % Cover [2,3]	**Ground Cover**		**Ground Cover**		**Ground Cover**	
	1	<1%	1	<10	1	<10
	2	2-9%	2	10-24%	2	10-24%
	3	10-39%	3	25-39%	3	25-39%
	4	40-59%	4	40-59%	4	40-59%
	5	60-99%	5	60-99%	5	60-99%
	6	100%	6	100%	6	100%
Size Classes[3]	**Shrub**		**Shrub[5]**		**Tree[4]**	
	Levels	**No. Stems**	**Levels**	**dbh**	**Levels**	**dbh**
	1	1	1	Seedlings or sprouts	1 True seedling	S
	2	2-5	2	< 1/2“	2 seedling tree	< 1"
	3	6-10	3	½-1”	3 sapling tree	1" - 3"
	4	11-30	4	1” – 3”	4 sapling tree	3”- 6"
	5	31-60	5	3” – 5”	5 pole tree	6”-9”
	6	60-100	6	>5”	6 pole tree	9”-11”
	7	101-150			7 small tree	11" - 24"
	8	150-200			8 med/large tree	>24
	9	>200				

[1] The amount of area the canopy layer covers within the plot area
[2] Relative cover of each species within the plot area
[3] Record all size classes present for each species recorded. Circle the dominate size class
[4] Mayer and Laudenslayer, 1988
[5] USFWS, 1999

DRAFT Greenline Datasheet

Stream: **GPS Coordinates: Left Bank:____________________Total Transect Length:**
Name: **GPS Coordinates: Right Bank:____________________Total Transect Length:**
Date/Time:

L or R Bank	Attribute[1]		Distance on Transect (m)	Notes[2]
		Start		
		Stop		
		Start		
		Stop		
		Start		
		Stop		
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		Stop		

[1] Species, community type, or attribute (litter, bare ground, substrate, woody debris, dead vegetation).
[2] Fluvial landform, decadence, senescence, grazing, other land use activities.

DRAFT Line-Intercept Datasheet

Stream:	**GPS Coordinates: Transect No._______:___________________**	**Total Width:**
Name:	**GPS Coordinates: Transect No._______:___________________**	**Total Width:**
Date/Time:	**GPS Coordinates: Transect No._______:___________________**	**Total Width:**

Transect No.	Attribute[3]		Distance on Transect (m)	Notes[4]
		Start		
		Stop		
		Start		
		Stop		
		Start		
		Stop		
		Start		
		Stop		
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		Stop		

[3] Species, community type, or attribute (litter, bare ground, substrate, woody debris, dead vegetation).
[4] Fluvial landform, decadence, senescence, grazing, other land use activities.

DRAFT Regeneration Datasheet
Along Greenline Transect

Stream:
Name:
Date/Time:
Stream Bank (circle one): L or R

Young[5]		Seedlings	
Species	**Total Number**	**Species**	**Total Number**

Notes or Other Observations (e.g. land use activities, fluvial landforms, substrate)

[5] Young: <10 stems/individual shrub or dbh <3" for trees

DRAFT

Detailed Riparian Assessment Datasheet

Surveyor(s):	Approximate River Mile Stations:	to
Date:	GPS Coordinates Start:	Finish:
Stream:	Riparian width:	Substrate (dominant and sub-dominant) (plot 1):

1 x 1 m^2 plot

Transect:	Substrate (dominant and sub-dominant) (plot 2):	Substrate (dominant and sub-dominant) (plot 3):

Plot Location:

		Dominant Species	Rel% Cover	Canopy Cover (%)		
Ground Layer				**Shrub Layer**	**Tree Layer**	
Canopy Cover	1					
	2					
	3					
	4					
	5					

Plot Location:

		Dominant Species	Rel% Cover	Canopy Cover		
Ground Layer				**Shrub Layer**	**Tree Layer**	
Canopy Cover	1					
	2					
	3					
	4					
	5					

Plot Location:

		Dominant Species	Rel% Cover	Canopy Cover		
Ground Layer				**Shrub Layer**	**Tree Layer**	
Canopy Cover	1					
	2					
	3					
	4					
	5					

Comments (Identify Plot Number)

Presence of Wildlife/Diagnostic Sign:	Species Present:
Wildlife Habitat Suitability:	
Land Use:	Presence/Qualitative Description of Woody Debris/Piles:
Evidence of Unusual Mortality/Stress:	
Riparian Encroachment:	Other Observations:
Invasive/Exotic Species Presence:	

DRAFT
Detailed Riparian Assessment Datasheet

Surveyor(s):	Approximate River Mile Stations:	to
Date:	GPS Coordinates Start:	Finish:
Sample Segment Name:	Substrate (dominant and sub-dominant) (plot 1):	Substrate (dominant and sub-dominant) (plot 2):

5 x 2 m^2 plot

Transect:

Plot Location:

Shrub	Individual or Species (note I or S for each)	Stem count by size class 1	2	3	4	5	6	7	8	Dominant Species	Rel% Decadence	Rel% Cover
Canopy Cover	1											
	2											
	3											
	4											
	5											
Total Plot Dead	6											
	7											
	8											
	9											
	10											
Tree	Individual (Species)	DBH 1	2	3	4	5	6	7	8	Dominant Species	Rel% Decadence	Rel% Cover
Canopy Cover	1											
	2											
	3											
	4											
	5											
Total Plot Dead	6											
	7											
	8											
	9											
	10											

Plot Location:

Shrub	Individual or Species (note I or S for each)	Stem count by size class 1	2	3	4	5	6	7	8	Dominant Species	Rel% Decadence	Rel% Cover
Canopy Cover	1											
	2											
	3											
	4											
	5											
Total Plot Dead	6											
	7											
	8											
	9											
	10											
Tree	Individual (Species)	DBH 1	2	3	4	5	6	7	8	Dominant Species	Rel% Decadence	Rel% Cover
Canopy Cover	1											
	2											
	3											
	4											
	5											
Total Plot Dead	6											
	7											
	8											
	9											
	10											