Riparian Habitat Mapping, Monitoring, and Mitigation Plan

FINAL

Technical Implementation and Planning Approach Report

SAN JOAQUIN RIVER
RESTORATION PROGRAM

July 29, 2013

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Table of Contents

Tables

Appendices

List of Abbreviations and Acronyms

DEM	Digital elevation model
DFW	California Department of Fish and Wildlife (formerly California Department of Fish and Game)
DWR	California Department of Water Resources
ELT	Executive Leadership Team
FWA	Friant Water Authority
Implementing Agencies	Reclamation, USFWS, NMFS, DWR, and DFW
NMFS	National Marine Fisheries Service
NRDC	Natural Resources Defense Council
PDT	Project Delivery Team
PM	Project Manager
PMP	Project Management Plan
Project	Planning and development of the Riparian Habitat Mapping, Monitoring, and Mitigation Plan
Reclamation	United States Bureau of Reclamation
Restoration Area	Riparian and wetland habitats in the 150-mile area, from Friant Dam to the confluence with the Merced River
RHMMMP	Riparian Habitat Mapping, Monitoring, and Mitigation Plan
Settlement	Stipulation of Settlement in *Natural Resources Defense Council, et al. v. Kirk Rodgers, et al., United States District Court, Eastern District of California, No. CIV. S-88-1658-LKK/GGH*
Settling Parties	NRDC, FWA, U.S. Departments of the Interior and Commerce
SJRRP	San Joaquin River Restoration Project
SJRRP Flows	Interim Flows and Restoration Flows
SJRRS Act	San Joaquin River Restoration Settlement Act
SWS	Stillwater Sciences
USFWS	United States Fish and Wildlife Service

Chapter 1. Introduction

1.1 Background

After more than 18 years of litigation known as Natural Resources Defense Council (NRDC), et al., v. Kirk Rodgers, et al., the NRDC, Friant Water Authority (FWA), and the U.S. Departments of the Interior and Commerce (Settling Parties), reached agreement on the terms and conditions of the San Joaquin River Settlement (Settlement), which was subsequently approved by the Court in 2006. The San Joaquin River Restoration Program (SJRRP) is a direct result of the Settlement. The SJRRP is a comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of the Merced River and restore a self-sustaining Chinook salmon fishery in the river while reducing or avoiding adverse water supply impacts from Interim and Restoration flows. The anticipated benefits and potential impacts associated with the implementation of the SJRRP were analyzed in the *San Joaquin River Restoration Program Environmental Impact Statement/Report* (PEIS/R).

In order to implement the Settlement, a comprehensive strategy for the conservation of listed and sensitive species and habitats was prepared in the form of the Conservation Strategy, in coordination with the Implementing Agencies. The Conservation Strategy's purpose is to serve as a tool built into the PEIS/R project description to minimize and avoid potential impacts to sensitive species and habitats. The Conservation Strategy consists of avoidance, minimization, monitoring and management measures that would result in a net benefit for riparian and wetland habitats in the 150-mile Restoration Area, from Friant Dam to the confluence with the Merced River.

One of the specific Conservation Measures, RHSNC-2(a), states that a "Riparian Habitat Mitigation and Monitoring Plan for the SJRRP will be developed and implemented in coordination with the California Department of Fish and Wildlife (DFW)[1]. Credits for increased acreage or improved ecological function [of] riparian and wetland habitats resulting from the implementation of the SJRRP actions will be applied as compensatory mitigation before additional compensatory measures are required." The intent of riparian monitoring and mapping is to document and track the changes in riparian vegetation over time, and to develop a crediting mechanism that would benefit future SJRRP activities. While Conservation Measure RHSNC-2(a) does not specify the regulations toward which riparian habitat creation/enhancement credits would be applied, it is assumed that such credits would be appropriate for mitigating impacts under National Environmental Policy Act (NEPA), California Environmental Quality Act (CEQA), and Section 1600 of the California Fish and Game Code, but not necessarily under the federal or California Endangered Species Acts (ESA and CESA, respectively), or for impacts to occupied habitat for species that are otherwise protected.

[1] Prior to January 1, 2013, DFW was known as the California Department of Fish and Game (DFG). This report uses the agency's current name except when citing documents or resources published under the previous name.

The Riparian Habitat Mapping, Monitoring, and Mitigation Plan (RHMMMP) Project (Project) will implement Conservation Strategy RHSNC-2(a).

1.2 Technical Implementation and Planning Approach Report

This Technical Implementation and Planning Approach Report (TIPAR) describes the methods that will be utilized to gather data, prepare results, and present findings to the SJRRP as a part of the Project. The TIPAR specifically needs to:

- Detail the methodology for obtaining existing information needed to establish a baseline understanding of vegetation in the Restoration Area.
- Identify data needs and provide recommendations for obtaining such data, including field methods, locations, and schedule.
- Present an approach for assessing vegetation change in the Restoration Area both initially and at appropriate annual intervals.

A first administrative draft of this TIPAR will be submitted to the Implementing Agencies for review and comment. After addressing the Implementing Agencies' comments, a second draft of the TIPAR will be submitted to the Implementing Agencies for final review and comment. After addressing these final comments, a final TIPAR will be delivered in both electronic and hard copy to the Implementing Agencies.

1.3 Project Tasks

Contractually, the Project tasks include: (1) Development of the Technical Implementation and Planning Approach Report; (2) Field Verification Surveys; and (3) Development of the Riparian Habitat Mapping, Monitoring, and Mitigation Plan. For the purposes of this TIPAR, however, the Project tasks are broken down into the technical elements necessary to execute the Project and the ultimate contents of the RHMMP. These include:

1. Mapping riparian vegetation conditions that have developed since the initiation of Interim Flows by updating the previous vegetation mapping conducted by Moise and Hendrickson (2002).
2. Comparing current vegetation conditions with pre-Interim Flow baseline conditions to develop an initial estimate of the riparian habitat created by the SJRRP to-date.
3. Developing a mitigation framework for crediting riparian habitat creation under the Interim and Restoration Flows that can be used by individual SJRRP activities before additional compensatory measures are required.
4. Developing methods to both update the estimate of riparian habitat created by the SJRRP and to monitor the performance of riparian habitat mitigation credits.
5. Developing recommendations for riparian habitat management that can be implemented under the SJRRP to increase the benefits and effectiveness of the Interim and Restoration Flows and other SJRRP actions.

1.4 TIPAR Organization

- Chapter 1 provides Project background information, summarizes the purpose and objectives of the TIPAR, and describes the technical tasks that are addressed in the TIPAR.
- Chapter 2 describes Project assumptions about the mitigation framework that will be developed in the RHMMMP, including the nexus for riparian habitat mitigation requirements and the criteria for mitigation credits, and summarizes some of the primary concerns with developing and tracking riparian habitat mitigation credits over time. Although developing the mitigation framework is one of the final tasks of the project and issues related to the framework will be discussed and resolved as the Project progresses and ultimately described in the RHMMMP, assumptions about the framework are presented first in the TIPAR in order to determine the adequacy of the field and analytical methods.
- Chapter 3 describes the existing information sources, field and analytical methods, and reporting structure that will be used to map current vegetation conditions in the Restoration Area and compare the Moise and Hendrickson (2002) baseline (2000) vegetation map with the current vegetation map.
- Chapter 4 describes the long-term riparian habitat monitoring protocol that will be used to track changes in the number of acres and composition of riparian habitat, and monitor the performance of mitigation credits.
- Chapter 5 describes how recommendations to improve the quantity and quality of riparian habitat will be developed in the RHMMMP.
- Chapter 6 provides the schedule for task and overall Project completion.

Chapter 2. Riparian Habitat Mitigation Framework

This chapter describes the current Project assumptions of ways in which impacts to riparian habitat and mitigation credits are likely to be measured, concerns associated with riparian habitat change over time, and levels and types of impacts to riparian habitat that could occur. These assumptions and concerns will be discussed and resolved during the development of the RHMMMP and associated meetings with the Implementing Agencies, but are presented here because they are fundamental to the selection of the data collection methods described in subsequent chapters of the TIPAR.

2.1 Nexus for Mitigation Requirements

The Project assumes that riparian habitat mitigation requirements of the SJRRP will stem from five primary regulatory mechanisms:

1. Avoidance, minimization, and mitigation measures in project-specific NEPA and CEQA documents (e.g., Initial Studies) to address construction-related impacts to riparian habitats that are considered rare natural communities by DFW. DFW identifies rare natural communities on their most recent *List of Vegetation Alliances and Associations* (DFG 2010) and defines them using the *A Manual of California Vegetation, Second Edition* (Sawyer et al. 2009) vegetation classification system.
2. Vegetation-related Avoidance and Minimization Measures in project-specific Streambed Alteration Agreements from DFW.
3. Measures to address project-specific impacts to Essential Fish Habitat that are disclosed in project-specific CEQA documents.
4. Measures from the Conservation Strategy in the PEIS/R that are related to riparian wildlife habitat and are cited in the U.S. Fish and Wildlife Service (USFWS) (2012) *Formal Consultation and Conference Report* and National Marine Fisheries Service (NMFS) (2012) Biological Opinion (BO) for the SJRRP.
5. Mitigation measures in project-specific USFWS Fish and Wildlife Coordination Act Reports (FWCAR) to address construction-related impacts to riparian habitats.

Mitigation requirements and ratios from these agencies for project-specific construction-related impacts to riparian habitat are likely to be variable[2] and will be reported in the RHMMMP.

It is not anticipated that the riparian habitat mitigation framework described in this TIPAR will be used to comply with or address impacts to species that are protected under the ESA, CESA, or to address impacts to occupied habitat for species that are otherwise protected.

[2] For SJRRP actions, DFW has used 3:1 for the removal of trees and shrubs > 4 inches but ≤ 24 inches in diameter at breast height (dbh), and 10:1 for trees and shrubs >24 inches dbh.

2.2 Riparian Habitat Mitigation Credits

Per Conservation Strategy RHSNC-2(a), the Project assumes that riparian habitat has been created by the SJRRP Interim and Restoration Flows, as compared to the 2000 baseline vegetation map by DWR (Moise and Hendrickson 2002), and will be used to mitigate for project-specific construction-related impacts to riparian habitat before additional compensatory mitigation is required. As such, acres of particular riparian vegetation types are assumed to be the primary unit of the mitigation credits (see the next section for more detail). While natural recruitment and/or enhancement will be the primary means by which riparian habitat mitigation credits become available, the Project assumes that acres of riparian habitat used as mitigation credit will be subject to the following criteria:

- Mitigation credits should be the same vegetation type, or on a trajectory to becoming the same vegetation type, as the vegetation impacted, in terms of plant species composition and structure (e.g., shrubland, forest, savannah), and/or of a vegetation type that is rare or otherwise considered desirable to establish and/or maintain in the Restoration Area (Chapter 5 includes more discussion of this topic). The field methods in Chapter 3 have been designed to capture these, as well as several other, vegetation composition parameters.

- Mitigation credits should have the same or better "quality" as the vegetation impacted. For this project, quality is primarily measured by the proportion of nonnative invasive plant cover and the degree of human disturbance, and the field methods in Chapter 3 have been designed to capture these parameters. Other elements of vegetation quality such as percent vegetative cover, structure, and age are encompassed by the vegetation type (as described in the field methods in Chapter 3). In addition to informing mitigation credit value, this distinction between vegetation type and quality is intended to allow for the natural dynamics of riparian systems, in which floods, droughts, and fires influence the characteristics of the vegetation, and to help identify the management actions, such as weed treatment, that may be appropriate to enhance vegetation quality.

- To the extent they are available, mitigation credits should be applied in the same reach of the Restoration Area as the project-specific impact. If the same vegetation type is not available in the same reach, the next closest reach will be used.

- If based on the 2013 riparian habitat map, the same vegetation type is available for mitigation credit in any reach of the Restoration Area, the mitigation ratio is likely to be 1:1 (1 acre of mitigation for every 1 acre of impact). If the same vegetation type is not available for credit in any reach, but is expected to recruit or develop in the next three to five years, the mitigation ratio is likely to be from 3:1 to 5:1, dependent upon the vegetation type and its current quality, to offset the lag in time between the impact and mitigation. Mitigation ratios of 10:1 are expected for impacts to large, mature native trees. If the same vegetation type is not available in any reach, and is not expected to recruit or develop in the next three to five years, active planting of the vegetation type may be necessary at similar 3:1 to 5:1 ratios (see Chapter 5).

- When active planting is required, such efforts should be conducted in the same reach and in the impact area, if appropriate. In some cases, however, active planting will be better

suited outside of the impact area, in areas that are appropriate for habitat establishment and have the physical conditions necessary for successful plant establishment. Active planting locations will be recommended in the RHMMMP, but will ultimately be determined on a case-by-case basis and in coordination with the Implementing Agencies.

- As are other forms of mitigation, naturally recruited riparian habitat used as mitigation credit will be subject to monitoring and performance standards related to allowable levels of nonnative invasive species cover and human disturbance. If performance standards are not met, then remedial actions may be necessary or the credit reassigned to a different area.
- Mitigation credits will need to be accessible (i.e., located on property where permission has been granted for access) in order to verify, monitor, and if necessary, maintain the credit.

In order to facilitate the application of mitigation credits meeting these criteria, the Project assumes that mitigation credits will be defined according to a nested classification based on vegetation layer (tree, shrub, herbaceous), vegetation type (dominant or characteristic species), vegetation height (as a proxy for age), and canopy cover (as a measure of the type of habitat provided). In addition, there are a number of vegetation quality and landscape parameters that will likely be used to further define mitigation credit types, including:

- Percent cover of nonnative invasive plant species
- Degree of human impact
- Connectivity to high quality habitat
- Proximity to sources of impacts

The field and analysis methods described in Chapters 3 and 4 have been selected in order to incorporate these parameters and identify the mitigation credit types that are available.

2.3 Mitigation Credit Application and Tracking Issues

A number of issues and constraints are anticipated to be encountered during the development of the RHMMMP. As no existing mitigation crediting scheme analogous to the SJRRP RHMMMP has been identified, it is anticipated that these issues will be resolved during the development of the RHMMMP and in discussion with the Implementing Agencies. These issues and constraints include, but are not limited to:

- Defining agreed-upon mitigation ratios for various impacts related to riparian habitat
- Accounting for changes in vegetation composition, structure, and quality over time
- Addressing uncertainty related to flooding, fires, and/or unanticipated human impacts
- Double-counting credit in the same place for multiple mitigation requirements (e.g., measures to address both USFWS BO, FWCAR, and NMFS Essential Fish Habitat)
- Accounting for practicalities, such as levee, dam, and canal maintenance, changes between Interim and Restoration Flows, and other hard to categorize implementation challenges
- Identifying appropriate performance standards for mitigation credits

- Ensuring mitigation credits are protected in perpetuity (recommendations for how this can be done will be included in the RHMMMP)

In addition, an SJRRP-wide mechanism for tracking project-related impacts, available credits, and assignment of credits will likely need to be developed and maintained. Such a mechanism would likely need to take the structure of a relational database that can be linked to GIS (e.g., Microsoft Access) and that would include:

- Baseline (2000) vegetation types and quality
- Changes in vegetation over time/availability of mitigation credits based on monitoring
- Ability to track credit type, credit owner, associated project and regulatory nexus, and initiation year
- Mitigation monitoring results (e.g., changes in quality or type that could lead to required adaptive management actions)

Chapter 3. Riparian Vegetation Map

3.1 Approach and Objectives

Current (i.e., 2013) vegetation in the Restoration Area will be mapped in order to document riparian vegetation response to the Interim Flows, which began on October 1, 2009. The map of current conditions will be compared with the 2000 baseline vegetation map in GIS to calculate the changes in riparian vegetation as a result of four years of Interim Flow water releases and provide an inventory of available riparian habitat mitigation credits.

3.2 Existing Information Sources

Stillwater Sciences will acquire relevant existing data, as available, to assist in creating the vegetation map. Of particular interest are existing vegetation maps, soils information, plot sample data, geologic maps, and ancillary imagery. The following information sources will be used to map current vegetation conditions and calculate the change in riparian habitat.

- Most recent aerial imagery of the Restoration Area
- CNPS (California Native Plant Society)/DFG. 2011. Protocol for Combined Vegetation Rapid Assessment and Releve Sampling Field Form. CNPS, Sacramento, CA. Available at: http://www.cnps.org/cnps/vegetation/pdf/protocol-combined.pdf
- DFG (California Department of Fish and Game). 2008. Legislative Analyst's Office Supplemental Report of the 2007 Budget Act: FY 2007-08, Item 3600-001-0001 Department of Fish and Game. Vegetation Mapping Standard for the State of California. 12 pp.
- GIC (Geographical Information Center, California State University Chico). 2009. Central Valley Riparian Mapping Project. Prepared for the California Department of Water Resources, Central Valley Flood Protection Program, Sacramento, CA.
- Moise, G. W. and B. Hendrickson. 2002. Riparian Vegetation of the San Joaquin River. Technical Information Record SJD-02-1. California Department of Water Resources, San Joaquin District, Environmental Services Section, Fresno, CA.
- Reclamation. 2008. SJRRP Target Riparian Plant Species Mapping and Field Reconnaissance Survey. Scope of Work, June 17, 2008. U.S. Bureau of Reclamation, Sacramento, CA.
- Reclamation. 2011. Mendota Pool Bypass and Reach 2B Improvements Project, Technical Memorandum on Environmental Field Survey Results (Subject to Revision). Prepared for the San Joaquin River Restoration Program, Sacramento, CA.
- Reclamation. 2012. Vegetation Response to Interim Flows in the San Joaquin River. Annual Report 2012. U.S. Bureau of Reclamation, Technical Service Center, Denver, CO.

- Reclamation. 2012. Reach 4B, Eastside Bypass, and Mariposa Bypass Channel and Structural Improvements Project, Final Environmental Field Survey Report. Prepared for the San Joaquin River Restoration Program, Sacramento, CA.
- Reclamation. 2012. Field Survey Methods and Results—Supplement #1, Expanded Vegetation Map, Expanded Wildlife Habitat Assessment, and Swainson's Hawk Survey for the Arroyo Canal Fish Screen and Sack Dam Fish Passage Project. Prepared for the San Joaquin River Restoration Program, Sacramento, CA.
- San Joaquin River Partnership. 2012. San Joaquin River Restoration Program Invasive Vegetation Monitoring and Management Annual Report. Prepared for the U.S. Bureau of Reclamation, San Joaquin River Restoration Program's Grant Agreement #R11AP20088 San Joaquin River Weed Management and Jobs Creation Project.
- SJRRP digital elevation model (DEM)

All of these information sources have either already been acquired, or will be acquired from Reclamation in the spring of 2013. Other than a comparison with 2000 vegetation conditions, the project does not include an analysis of historical vegetation conditions, or a comparison between current and pre-2000 vegetation conditions. Therefore, the following existing information that was listed in the project's Project Work Statement (PWS) is not anticipated to be required by the project: historical aerial photo imagery, historical land information, and anecdotal evidence from landowners or SJRRP staff.

3.3 Field and Analytical Methods

3.3.1 Reconnaissance

A three-day on-site reconnaissance of the Restoration Area will be conducted. The primary goals of the visit will be to correlate vegetation communities on the ground with vegetation features visible in aerial photographs and to better understand the relationship between vegetation cover and environmental conditions in the Restoration Area. In addition, the visit will help the team determine if there are any areas that require special attention due to the presence of unique vegetation types or environmental conditions.

Prior to the reconnaissance, the required equipment will be gathered (e.g., a laser rangefinder, compass, high resolution GPS, binoculars, and camera), and field base maps and data sheets will be prepared. A field base map of public access points that are well distributed along the length of the Restoration Area and that appear to support dominant vegetation types will be prepared. A target of four to five locations of each dominant vegetation type will be included for each of the five reaches, although access and time constraints may limit the ability to achieve this target. In addition, the 2000 vegetation map will be printed and uploaded to a hand-held GPS. Reconnaissance data sheets will be designed to record information on site conditions, dominant plant species, stand structure (e.g., mature vs. young trees, shrub, herbaceous), and vegetation class, as described in Section 2.2 above. Finally, a draft riparian habitat monitoring data sheet, described under Section 4.3, will be prepared in order to perform a preliminary assessment of its format and content.

During the 3-day reconnaissance, publically accessible areas throughout the Restoration Area, including all five reaches, will be visited, targeting the locations identified on the access field map. At each site, GPS points will be taken and field observations will be recorded. At each location, the previously identified vegetation type will be identified and the following information will be recorded: (1) dominant canopy species (using binoculars if necessary), (2) GPS position of location, (3) distance and (4) bearing to the target canopy using a laser rangefinder and compass, respectively. The target canopy position and boundaries will also be hand-drawn on the field maps. During the reconnaissance, the riparian habitat monitoring field data sheets will be tested to determine the practicality of gathering the information (time, clarity, repeatability) and to assess how well these metrics reflect on-the-ground interpretations of site quality.

3.3.2 Preliminary Riparian Vegetation Map

Field notations, data, and hand-drawn field maps from the reconnaissance will be transcribed, organized, and incorporated into a GIS database so that the exact location and attributes associated with each field recorded canopy type are included. This information will be used to update the DWR (2002) vegetation units that will provide a preliminary vegetation map of post-Interim Flow conditions for the Restoration Area.

The most recent aerial imagery available will be reviewed, and the DWR (2002) vegetation units will be refined and modified using heads-up digitizing techniques to more accurately reflect the conditions in the aerial imagery. Modification of vegetation units will be limited to the area inundated under 8,000 cfs. This area equates to the DWR (2002) vegetation mapping extent in most cases. The exceptions are the bluffs and hills in Reach 1A and some of the left bank floodplain in Reach 5. These areas outside of the 8,000 cfs inundation area will not be updated, as Interim and Restoration Flows will not be regularly affecting these areas.

All riparian vegetation types will be delineated using a 0.50 acre minimum mapping unit and classified using groups of ecologically-related alliances and alliances where feasible, according to the second edition of *A Manual of California Vegetation* (Sawyer et al. 2009). Where the photographic signature is unclear, the vegetation unit will be flagged for further investigation during the accuracy assessment.

3.3.3 Accuracy Assessment

Once the preliminary vegetation map is complete, a field accuracy assessment will be performed according to DFW protocols in order to ensure that the final vegetation map meets the state vegetation mapping minimum accuracy requirement of 80% (Meidinger et al. 2003, CDFG 2008) and to improve the final vegetation map.

Accuracy assessment (AA) points will be pre-selected using a stratified random sampling design. The five Restoration Area reaches will be stratified into accessible and non-accessible areas based on the areas where landowners have granted access for the survey, and the areas inundated under 2,000 cfs and between 2,000 cfs and 8,000 cfs. Within accessible portions of the area inundated under 2,000 cfs, seven AA points per major vegetation type will be selected in each reach. Within accessible portions of the area inundated between 2,000 cfs and 8,000 cfs, one AA point per major vegetation type will be selected in each reach. Agricultural fields, urban areas, and open water areas will be excluded from the random sampling process.

Although more in-depth field data will be collected during the three-week AA survey than during the reconnaissance field visit, many survey methods will be the same. Field equipment will be gathered (e.g., laser rangefinder, compass, high resolution GPS loaded with selected AA site points, binoculars, and camera) and field base maps and data sheets will be prepared. The AA points and vegetation polygon boundaries will be printed on field base maps with an aerial photograph background to help guide field crews. Although field base maps will show draft vegetation polygon outlines, they will not be labeled with draft vegetation classes to preclude bias during the AA survey (Meidinger et al. 2003, CDFG 2008).

GPS units and the field base maps will be used to navigate to each pre-selected AA point, with the goal of sampling as many of the randomly selected AA points as possible. It is anticipated that 200 to 300 AA points will be visited. At each point, a vegetation survey will be conducted to record the canopy cover for each stratum as well as plant species and phenology of the dominant vegetation, based on a stream-lined version of the CNPS rapid assessment form (Appendix A). Areas most representative of the polygon within which the target AA point occurs will be sampled, according to the CNPS rapid assessment protocol (CNPS 2010). A vegetation classification field key will be used to identify the vegetation type according the second edition of the *Manual of California Vegetation* (Sawyer et al. 2009). Other information collected, as summarized in the sample draft data sheet provided in Appendix A, will include a short list of dominant species by vegetation strata, stand structure (e.g., height categories, herbaceous cover, total vegetation cover), human disturbance categories, and weed cover codes based on ratings listed by the California Invasive Plants Council (http://www.cal-ipc.org/ip/inventory/index.php). A photograph will be taken at each AA point to provide visual documentation of the site.

Byusing the CNPS rapid assessment protocol, the following vegetation parameters will be documented: (1) species composition (i.e., a list of dominant and unusual species), which will provide an indication of species diversity; (2) percent surface cover (i.e., cover of water, bare ground, boulders, litter, etc.), which will provide an indication of vegetation density; (3) percent cover of vegetation in all relevant strata (i.e., herb, shrub, and tree), and tree, shrub, and herb height, all of which will provide an indication of vegetation structure; and (4) invasive species and types and intensities of human disturbance, which will provide an indication of vegetation condition and quality. The quantity of vegetation types will be provided in the riparian vegetation map. These vegetation parameters can be measured and documented relatively quickly, quantified and used in statistical analyses, and together provide a thorough depiction of the condition of various vegetation types. Exhaustive species lists, which would be needed to calculate species richness, and stem density and size measurements which could be used to quantify recruitment rates, are too time consuming to be collected at AA points, but could be components of the pilot projects or long-term monitoring recommendations described in Chapter 5.

3.3.4 Final Riparian Vegetation Map

Back in the office, AA point data will be downloaded from the GPS units into an Access database. All vegetation and species data will be manually entered into this database and a thorough quality assessment/quality check (QA/QC) will be performed on the data prior to analysis. Nomenclature standards and other data management procedures will be the same as for the classification plot data (see Vegetation Classification and Description section). Digital photographs will be archived into folders which are labeled by date. AA point data will be

intersected with the map polygon data. The vegetation alliance class assigned to each AA point in the field will be compared to the preliminary map class code for that polygon. Per protocol, if any of the field-determined classes agree with the labeled map class for a given polygon, the point will be considered correct (Meidinger et al. 2003, CDFG 2008). Each AA point mismatch (disagreement between field call and polygon label) will be evaluated for the type of error (true or false). Sources of "false" error include GPS or positional errors, edge error, and inclusions (small patches of vegetation within larger map polygons). Mismatches will be reviewed when a false error is identified and will be either determined to be a match, mismatch, or will be discarded. All other mismatches will be deemed true errors. Errors will be assessed using 'fuzzy logic' in which the degree of error is assigned based on accuracy of alliance, alliance group (e.g. willows vs. non-willows, hardwood vs. conifer, etc.), height class, and dominant vegetation strata (Gopal and Woodcock. 1994, Woodcock and Gopal. 2000, DFW 2013a).

The draft map will be updated based on the AA results, improved aerial imagery resolution (compared to the baseline 2000 imagery), and topography, including where necessary, revised interpretation of polygon classification and/or boundaries. Summary statistics of acreage per vegetation type and quality will be reported along with the final map and results from the AA. A cross-walk table of the classification schemes used to create the 2000 and 2013 vegetation maps of the Restoration Area will be developed in order to identify changes in vegetation over time. The 2000 vegetation map will be overlaid onto the updated 2013 map in GIS in order to query the extent and distribution of vegetation type changes using the cross-walk table. Increases in native riparian vegetation extent and/or quality indicated through this query will be considered potentially available credits created to-date from the Interim Flows. Some of the potential credits will have been verified during the AA surveys and will be identified as such. Potential credits that were not verified during the AA surveys due to access or time restrictions are anticipated to require some additional level of field verification prior to application of the credit in response to project-specific analyses and mitigation needs.

If appropriate, the nonnative invasive species mapping being conducted by San Joaquin Parkway and Conservation Trust/River Partners will be incorporated into the final riparian vegetation map.

Additional ancillary sources (e.g., existing vegetation maps, supplemental photography, topographic map products such as relative elevation or height above river, soil types, etc.), if appropriate, will be incorporated into the process as well.

3.4 Reporting

In addition to this TIPAR, two reports will be produced as a part of this project: (1) a Field Survey Report that describes the methods and results of the riparian vegetation mapping task; and (2) the RHMMMP that will use the riparian vegetation mapping as the basis for developing and describing a riparian vegetation mitigation and monitoring framework, as well as provide recommendations for actions that can be undertaken by the SJRRP to further enhance the quality and quantity of riparian vegetation. The Field Survey Report will document the methods used and findings from the riparian habitat mapping field reconnaissance and AA. A map of the AA points visited in the field will be provided, along with a table of the number of AA points per vegetation type and reach. The Field Survey Report will also describe the vegetation types in the

Restoration Area based on the 2013 riparian habitat map (e.g., name, dominant species, human disturbance factors, assessment of susceptibility to change under restoration flows) and a summary description of the major changes in vegetation between the 2000 and 2013 vegetation maps. The draft Field Survey Report will be submitted for review by Reclamation and the Implementing Agencies. Comments will be addressed and a final field survey report will be delivered in both electronic and hard copy. Data forms will be scanned and provided as an appendix to the Field Survey Report. All mapping related GIS files and metadata will be burned onto a DVD, and included as an appendix to the Field Survey Report.

The vegetation descriptions and map will also be included as a chapter of the RHMMMP. The RHMMMP will also include a detailed comparison of the changes in vegetation between the 2000 and 2013 vegetation maps, as well as a coarse analysis of the conditions responsible for those changes. For example, a narrative regarding the continuity, or lack thereof, of Interim Flows in different reaches/areas of the Restoration Area will be provided in the RHMMMP.

Chapter 4. Riparian Habitat Monitoring

4.1 Approach and Objectives

Based on the Conservation Measure RHSNC-2(a), it is assumed that riparian habitat will be monitored for two distinct, yet related purposes: First, the vegetation map described in Chapter 3 will need to be updated periodically to re-assess mitigation credit availability. The proposed approach for these updates is to repeat much of the methodology described in Chapter 3, and to compare the updated results with the most recent previous map to identify changes in vegetation composition and distribution.

Secondly, areas used as mitigation credit will need to be monitored to assess the mitigation "performance." Similar to more traditional mitigation monitoring, the proposed approach for this monitoring will be to identify and quantify changes in the quality of mitigation credit areas to determine if and when any remedial actions are required to maintain or improve the credit value. This monitoring also provides an opportunity to monitor the physical processes that shape vegetation conditions, and to identify when broader measures, such as active planting or land management, may be necessary to increase the diversity, extent, and quality of native vegetation types in the Restoration Area. Mitigation monitoring details, such as monitor qualifications, frequency and timing, and performance standards, will be described in the RHMMMP and determined in cooperation with the Implementing Agencies.

4.2 Existing Information Sources

The following information sources will be used to update the riparian vegetation map and to monitor mitigation areas.

- Most recent aerial imagery of the Restoration Area
- Most recent riparian vegetation map
- CNPS (California Native Plant Society)/DFG. 2011. Protocol for Combined Vegetation Rapid Assessment and Releve Sampling Field Form. CNPS, Sacramento, CA. Available at: http://www.cnps.org/cnps/vegetation/pdf/protocol-combined.pdf
- DFG (California Department of Fish and Game). 2008. Legislative Analyst's Office Supplemental Report of the 2007 Budget Act: FY 2007-08, Item 3600-001-0001 Department of Fish and Game. Vegetation Mapping Standard for the State of California. 12 pp.
- Reclamation. 2012. Vegetation Response to Interim Flows in the San Joaquin River. Annual Report 2012. U.S. Bureau of Reclamation, Technical Service Center, Denver, CO.

4.3 Field and Analytical Methods

4.3.1 Riparian Habitat Map Updates

The riparian habitat map will be updated in order to reassess the availability and condition of mitigation credits utilizing methods described in Chapter 3, with the exception of the reconnaissance visit. The riparian habitat map should be updated approximately every two to five years, as needed to inform the mitigation needs of individual SJRRP actions, until riparian habitat mitigation credits are no longer needed (i.e., the mitigation requirements of individual SJRRP actions have been met). At a minimum, the map should be updated after three to five years of full Restoration Flows, and/or between three and five years after a Riparian Recruitment Flow is provided (Riparian Recruitment Flows are higher-magnitude Restoration Flows that would be released when the water year type allows and timed to facilitate the recruitment of riparian vegetation).

The most recent previous riparian habitat map will be overlain on the most recently acquired aerial photography of the Restoration Area, and the boundaries of vegetation units will be revised using heads-up digitizing techniques. As with the original 2013 riparian habitat map (see Chapter 3), all riparian vegetation types will be delineated using a 0.50 acre minimum mapping unit. Vegetation units will be classified using the most recent edition of A Manual of California Vegetation (i.e., Sawyer et al. 2009 or a subsequent print or online edition). Riparian vegetation will also be attributed with height, cover density, and human disturbance modifiers, as part of the habitat quality information. Where the photo signature is unclear, the vegetation unit will be flagged for further investigation during the accuracy assessment. If available and appropriate, subsequent nonnative invasive species maps by San Joaquin Parkway and Conservation Trust/River Partners will be incorporated into the updated riparian vegetation map.

Once the draft revised riparian habitat map is complete, a streamlined one-week field accuracy assessment will be conducted according to DFW protocols (Meidinger et al. 2003, DFG 2008). The same methods described in Chapter 3 will be used, but at fewer sites. Fewer sites should be adequate, assuming only a few years will have passed since the last riparian habitat map was developed.

Back in the office, the vegetation alliance assigned to each accuracy assessment point in the field will be compared to the preliminary map class code for that polygon, and analyzed per the methods described in Chapter 3. The map will be updated based on the accuracy assessment results and summary statistics of vegetation type acreage and quality will be reported along with the final map.

The updated riparian habitat map will be overlaid with the previous riparian habitat map and queried in GIS for changes in vegetation type and quality in order to identify any changes in the amount of type of available riparian habitat mitigation credits.

4.3.2 Mitigation Monitoring

Once an area of riparian habitat is identified as a mitigation credit, its status as such will be recorded in GIS and the extent and quality of riparian vegetation will be regularly monitored to ensure the sites, and therefore mitigation credits, are sustained. Mitigation monitoring details, such as monitor qualifications, frequency and timing, and performance standards, will be

described in the RHMMMP and determined in cooperation with the Implementing Agencies. As such, only a conceptual-level description of data collection and analysis methods below is provided here. Additional transect-based monitoring, that could be conducted to better understand the trajectory of vegetation change in the Restoration Area and the processes and conditions controlling that change, is discussed in Chapter 5.

Each mitigation site would be monitored periodically. Monitoring would likely be more frequent (e.g., every year or every other year) in the first three to six years after a mitigation credit has been assigned. Afterwards, monitoring may only be necessary every five years, until it can be determined that the mitigation credit is meeting the performance standards or on a trajectory toward meeting the performance standards. Mitigation monitoring would likely be transect- or plot-based, with the same transects or plots revisited during each monitoring effort. Appropriate performance standards for SJRRP riparian mitigation, which will be primarily based on natural recruitment, could be: (1) that the credit is continuing to be or is on a trajectory toward becoming the vegetation type for which the credit was assigned; (2) that trees and shrubs are increasing in size; (3) that nonnative plant cover does not exceed allowable levels; and (4) that human disturbances are not reducing the value of the mitigation credit. The ultimately selected performance standards will need to be carefully considered and selected to ensure that changes in vegetation as a result of natural and beneficial processes, such as floods and vegetation succession, do not devalue a mitigation credit. If performance standards are not met, then management actions, such as weed treatment or off-road vehicle deterrence, would be taken or the credit would be reassigned to a different available area.

4.4 Reporting

4.4.1 Riparian Habitat Map Updates

As described in Chapter 3, riparian habitat map updates will be accompanied by a concise Field Survey Report that document the results of the accuracy assessment, describe the changes in the map, and provide summary statistics of the changes in vegetation types, human and natural disturbance levels, and acreages, as the basis for updating the status of available riparian habitat mitigation credits.

4.4.2 Mitigation Monitoring

A Mitigation Monitoring Report would be provided that documents the methods used and findings from the riparian habitat mitigation monitoring, including a summary of changes in riparian vegetation observed at the monitoring sites and changes in associated mitigation credit. Findings from the long-term transect monitoring sites will also be reported, including an analysis of trends and indications of linkages between physical factors and riparian vegetation. In particular, evidence of linkages between vegetation and flow regime and between vegetation and management practices will be described.

The draft Mitigation Monitoring Report will be submitted for review by Reclamation and the Implementing Agencies. Comments will be addressed and a final Mitigation Monitoring Report will be delivered in both electronic and hard copy. Data forms will be scanned and provided as an appendix to the Mitigation Monitoring Report. All mapping related GIS files and metadata will be copied onto a DVD and included as an appendix to the Mitigation Monitoring Report.

Chapter 5. Riparian Habitat Recommendations

5.1 Approach and Objectives

In addition to documenting riparian habitat creation in response to Interim and Restoration Flows, the RHMMMP will provide recommendations for pro-active steps to enhance riparian habitat conditions in the Restoration Area. Such recommendations will be related to:

- Priority mitigation areas
- Areas suitable for active planting, should it be necessary
- Long-term management actions
- Pilot projects
- Private-public partnerships
- Property transfers

Permitting requirements for implementing any of the management recommendations will also be provided.

5.2 Existing Information Sources

The following information sources will be used to develop riparian habitat management recommendations in the RHMMMP.

- Riparian habitat map developed as described in Chapter 3
- SJRRP hydraulic modeling results, digital elevation model (DEM), and DEM-derived layers, such as relative elevation or inundation maps, if available. If LiDAR data is available in time for use during the project, it would be used to generate a higher resolution DEM.
- Parcel map(s)
- NRCS (Natural Resources Conservation Service). 1962. Soil Survey of Madera Area, California.
- NRCS (Natural Resources Conservation Service). 1971. Soil Survey, Eastern Fresno Area, California.
- NRCS (Natural Resources Conservation Service). 1998. Soil Survey of Fresno County, California, Western Part.
- DFW. 2013. California Natural Diversity Database (CNDDB). Rarefind Version 3.1.1. Electronic database. California Department of Fish and Game, Sacramento, California.

- Reclamation. 2008. SJRRP Target Riparian Plant Species Mapping and Field Reconnaissance Survey. Scope of Work, June 17, 2008. U.S. Bureau of Reclamation, Sacramento, CA.

- Reclamation. 2008. SJRRP Target Riparian Plant Species Mapping and Field Reconnaissance Survey. Scope of Work, June 17, 2008. U.S. Bureau of Reclamation, Sacramento, CA.

- Reclamation. 2012. Vegetation Response to Interim Flows in the San Joaquin River. Annual Report 2012. U.S. Bureau of Reclamation, Technical Service Center, Denver, CO.
- San Joaquin River Partnership. 2012. San Joaquin River Restoration Program Invasive Vegetation Monitoring and Management Annual Report. Prepared for the U.S. Bureau of Reclamation, San Joaquin River Restoration Program's Grant Agreement #R11AP20088 San Joaquin River Weed Management and Jobs Creation Project.

5.3 Methods

GIS analysis of existing spatial data sets will be the primary method used to develop recommendations for the RHMMMP. Priority mitigation areas and areas suitable for active planting will be identified using landscape ecology metrics, such as patch size, proximity to other large intact riparian vegetation, and proximity to stressors, such as sources of human disturbance, nonnative invasive plants, etc. Riparian habitat that is considered to be most relevant to the mitigation program (e.g., rare natural communities) will be identified during the GIS analysis. The parcels associated with these areas, presence of nonnative invasive plants (from Reclamation's 2008 effort and/or the San Joaquin Parkway and Conservation Trust/River Partners current efforts), adjacent habitat types (from the vegetation map), and adjacent land uses (as determined by photointerpretation) will be assessed using GIS to create a list and map of priority mitigation and active planting areas based on their ability to provide new or enhanced riparian habitat.

A summary of long-term management actions that can be used to expand and/or enhance riparian habitat in the Restoration Area will be developed based on field conditions, restoration ecology literature, emerging research on the relationships between riparian vegetation types and flood dynamics (e.g., Guilloy et al. 2011, Cech, in progress) and GIS analysis. Such actions will include supplemental planting, invasive species management, and other actions to help increase and improve riparian vegetation without interfering with local land management practices. Areas suitable for such actions will be identified in GIS using overlays of vegetation type, flood inundation, and soils to anticipate what vegetation is likely to naturally recruit, what vegetation types are likely to be in need of supplemental planting, and inundation and soil conditions conducive to horticultural restoration.

Recommendations for pilot projects, such as using focused, intensive monitoring to test new or uncertain active restoration methods or natural recruitment responses to altered flows, will be proposed. This will include recommendations for monitoring vegetation response to Riparian Recruitment Flows. Such projects are likely to focus on priority areas/reaches, and aim to address process-vegetation type issues and uncertainties, and weed treatment uncertainties. GIS

will be used to identify parcels and ecological conditions conducive to such projects. For example, a subset of mitigation sites could be selected for more intensive monitoring using permanent transects. In these areas, permanent transects, established perpendicular to the channel bank, could be sampled using line intercept (woody species) and point intercept (herbaceous species) methods (Elzinga et al. 1998), and information on physical conditions could be collected. This could include measurements of soil texture, soil pH and salinity, surface and ground water levels.

Private-public partnerships, such as agreements with adjacent property owners, or other actions to increase SJRRP efficiency and to benefit both Reclamation and landowners will be recommended. Areas that are appropriate for such partnerships will be identified using spatially explicit information on parcel ownership, access, location, associated land rights, and nodes of high-quality vegetation.

Property transfers, such as easements, land purchases, or other methods to protect mitigation credits in perpetuity and/or to encourage a more continuous and higher quality riparian corridor in the Restoration Area, will be recommended. Recommendations will be based primarily on the goal of protecting and/or expanding nodes of high quality habitat and those areas where mitigation credits are likely to become established.

Permitting requirements for implementing any of the management recommendations will also be provided. This will include a table of actions (e.g., weed treatment), the triggers for a permit (e.g., removal and disturbance of streamside vegetation), if there are any, and a brief description of the steps required for permit acquisition and compliance.

5.4 Reporting

All recommendations, and their corresponding maps, as well as a description of potential permit needs will be included as chapters in the RHMMMP.

Chapter 6. Schedule

The overall schedule for the Project and major milestones are provided below in Table 1.

Table 1.
Project Schedule and Milestones

TASK	DATE	
	START	COMPLETION
Project Start	September 2012	
TIPAR	Nov 2012	Apr 2013
First admin draft TIPAR	11/15/2012	3/18/2013
SJRRP Staff review	3/18/2013	4/2/2013
Second admin draft TIPAR	4/2/2013	4/5/2013
Implementing Agency review	4/8/2013	6/18/2013
Final TIPAR	6/19/2013	7/19/2013
Field Surveys	Apr 2013	Jul 2013
Site Access	4/8/2013	5/10/2013
Reconnaissance Visit	5/13/2013	5/15/2013
Field Surveys	6/10/2013	6/28/2013
Field Survey Report	Jul 2013	Oct 2013
Draft Field Survey Report	7/1/2013	9/15/2013
SJRRP Staff review	9/15/2013	9/30/2013
Final Field Survey Report	9/30/2013	10/30/2013
Field Survey Data	9/15/2013	10/30/2013
RHMMP	Nov 2013	Apr 2014
First admin draft RHMMMP	11/1/2013	1/1/2014
SJRRP Staff review	1/1/2014	1/15/2014
Second admin draft RHMMMP	1/15/2014	2/14/2014
Settling Parties review	2/14/2014	3/1/2014
Final RHMMMP	3/1/2014	3/28/2014
End of Project	September 2014	

Chapter 7. Literature Cited

Cech, J. In progress. Juvenile Chinook salmon use of sandbar willows in a large-scale, simulated floodplain: Microhabitat selection and energetics. Chapter in: Salmon: Physiology, Behavior & Diet and Ecological Importance.

CNPS/DFG (California Native Plant Society/Department of Fish and Game). 2011. Protocol for combined vegetation rapid assessment and releve sampling field form. May 13, 2011. Available at: http://www.cnps.org/cnps/vegetation/pdf/protocol-combined.pdf

DFG (California Department of Fish and Game). 2008. Legislative Analyst's Office Supplemental Report of the 2007 Budget Act: FY 2007-08, Item 3600-001-0001 Department of Fish and Game. Vegetation Mapping Standard for the State of California. 12 pp.

DFG (California Department of Fish and Game). 2010. List of California terrestrial natural communities. Website. http://www.dfg.ca.gov/biogeodata/vegcamp/pdfs/natcomlist.pdf

DFW (California Department of Fish and Wildlife). 2013a. Accuracy Assessment of the East Sacramento Valley Natural Vegetation Map. Prepared by the Vegetation Classification and Mapping Program for Strategic Growth Council and California Department of Water Resources Central Valley Flood Protection Program.

DFW (California Department of Fish and Wildlife). 2013b. California Natural Diversity Database (CNDDB). Rarefind Version 3.1.1. Electronic database. California Department of Fish and Wildlife, Sacramento, California.

DFW (California Department of Fish and Wildlife). 2013c. Natural diversity database. January 2013. Special vascular plants, bryophytes, and lichens list. Quarterly publication.

Elzinga, C. L., D. W. Salzer, and J. W. Willoughby. 1998. Measuring and monitoring plant populations. BLM Technical Reference 1730-1.

Gopal, S. and C. Woodcock. 1994. Theory and methods for accuracy assessment of thematic maps using fuzzy sets. Photogramm Eng Remote Sens 60:181–188.

Guilloy, H., E. González, E. Muller, F. Hughes, and N. Barsoum. 2011. Abrupt drops in water table level influence the development of Populus nigra and Salix alba seedlings of different ages. Wetlands. 31:1249–1261

Meidinger, D.V. 2003. Protocol for accuracy assessment of ecosystem maps. Technical Report 011. B.C. Ministry of Forestry, Victoria, British Columbia. Moise, G. W. and B. Hendrickson. 2002. Riparian Vegetation of the San Joaquin River. Technical Information Record SJD-02-1. California Department of Water Resources, San Joaquin District, Environmental Services Section, Fresno, CA.

NMFS (NOAA National Marine Fisheries Service). 2012. Biological Opinion, File No. 151422SWR2010SA00360 (2011/05814); Formal consultation for the San Joaquin River

Restoration Program. Prepared for the U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, California by the Southwest Region, National Marine Fisheries Service, Long Beach, California.

Reclamation. 2011. SJRRP Water Year 2010 Interim Flows Project Environmental Assessment/ Initial Study, SJRRP Water Year 2011 Interim Flows Project Supplemental Environmental Assessment, SJRRP Water Year 2012 Interim Flows Project Supplemental Environmental Assessment

Reclamation. 2012. San Joaquin River Invasive Vegetation Monitoring and Management EA.

Reclamation and DWR. 2012. SJRRP Final Program Environmental Impact Statement/Program Environmental Impact Report.

Sawyer, J. O., T. Keeler-Wolf, and J. M. Evens. 2009. A manual of California vegetation. Second edition. California Native Plant Society Press, Sacramento, California.

USFWS (U.S. Fish and Wildlife Service). 2012. Formal Consultation and Conference Report under Section 7(a)(2) of the Endangered Species Act for the San Joaquin River Restoration Program. Prepared for the San Joaquin River Restoration Program Mid-Pacific Regional Office of the Bureau of Reclamation, Sacramento, California by the Sacramento Fish and Wildlife Office, Sacramento, California.

Woodcock, C.E. and S. Gopal. 2000. Fuzzy set theory and thematic maps: accuracy assessment and area estimation. International Journal of Geographical Information Science. 14(2)153-172.

Appendix A: CNPS and CDFW Vegetation Rapid Assessment Form – Revised by Stillwater Sciences

Final vegetation type name:	Alliance Association

LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Polygon/Stand #:	Field Tile #:	Date:	Name(s) of surveyors (circle recorder):

GPS wypt #: _____ **GPS name:** _____ **Datum:** _____ **or NAD83.**
Polygon Code: _____ **Subpolygon Code:** _____

GPS within stand? Yes / No If No, cite from waypoint to stand, distance _____ **(meters) & bearing** _____ **(degrees)**
Relative Elevation: **ft / m** **Camera Name/Photograph #'s:**

Stand Size (acres): <1, 1-5, >5 | Plot Size (m^2): 10 / 100 / 400 / 1000 | Plot Shape ___x___ **ft / m or Circle Radius** _____**ft / m**
Steepness, Actual°: _____ **0° 1-5° 5-25° > 25**

Topography[1]: Macro: top upper mid lower bottom | Micro: convex flat concave undulating
Soil Texture code: _____ **| Agriculture** *or* **Residential/Developed** *or* **Upland** *or* **Wetland/Riparian** (circle one)

% Surface cover: (Incl. outcrops) (>60cm diam) (25-60cm) (7.5-25cm) (2mm-7.5cm) (Incl sand, mud)
H20: ____ **BA[3] Stems:** ____ **Litter:** ____ **Bedrock:** ____ **Boulder:** ____ **Stone:** ____ **Cobble:** ____ **Gravel:** ____ **Fines:** ____ **=100%**

Flood evidence: Yes / No (circle one) If yes, describe: _____

Fire evidence: Yes / No (circle one) If yes, describe in Site history section, including date of fire, if known.

Adjacent Disturbances (within 100m) High any grainery, dairy-dense, residential, other

% of Polygon boundary along Natural Lands _____ %

Site history, stand age, comments:

Stand Age: Development stage of oldest plants _____ Development stage of dominant plants

Disturbance code[4] / Intensity (L,M,H): ___/___ ___/___ ___/___ ___/___ ___/___ **"Other"** _____/____

II. HABITAT AND VEGETATION DESCRIPTION

Tree DBH : T1 (<1" dbh), **T2** (1-6" dbh), **T3** (6-11" dbh), **T4** (11-24" dbh), **T5** (>24" dbh), **T6** multi-layered (T3 or T4 layer under T5, >60% cover)
Shrub: S1 seedling (<3 yr. old), **S2** young (<1% dead), **S3** mature (1-25% dead), **S4** decadent (>25% dead)
Herbaceous: H1 (<12" plant ht.), **H2** (>12" ht.) **Desert Riparian Tree/Shrub: 1** (<2ft. stem ht.), **2** (2-10ft. ht.), **3** (10-20ft. ht.), **4** (>20ft. ht.)
% Non Vasc cover: ____ **% Vasc Veg cover:**

% Cover - Conifer tree / Hardwood tree: _____/_____ **Regenerating Tree:** _____ **Shrub:** _____ **Herbaceous:**

Height Class - Conifer tree / Hardwood tree: _____/_____ **Regenerating Tree:** _____ **Shrub:** _____ **Herbaceous:**

Height classes: 01=<1/2m 02=1/2-1m 03=1-2m 04=2-5m 05=5-10m 06=10-15m 07=15-20m 08=20-35m 09=35-50m 10=>50m

Species, Stratum, and % cover. Stratum categories: T=Tree, S = Shrub, H= Herb, E = SEedling, A = SApling, N= Non-vascular.
% cover intervals for reference: <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, 75%.

Strata	Species	% cover	C[5]	Strata	Species	% cover	C

Unusual/invasive species: _____

III. INTERPRETATION OF STAND

Field-assessed vegetation alliance name:

Field-assessed association name (optional):

Adjacent alliances/direction: _____/_____, _____/_

Confidence in alliance identification: L M H Explain:

Phenology (E,P,L): Herb Shrub Tree Other identification or mapping information:

Is poly >1 type: Yes / No If yes, were other types sampled separately? Yes / No

[1] Topography codes
1. Active Floodplain
2. Other Floodplain
3. Channel Bank (Low Flow)
4. Outer Bank (High Flow)
5. Terrace (Retired FP)
6. Isolated Wetland or Oxbow

[2] Soil texture codes
1. Loamy Sand (LS)
2. Sandy Loam (SL)
3. Silt Loam (SiL)
4. Loam (L)
5. Sandy Clay Loam (SCL)
6. Silty Clay Loam (SiCL)
7. Clay Loam (CL)
8. Sandy Clay (SC)
9. Silty Clay (SiC)
10. Clay (C)
11. Sand (S)

[3] BA = Basil Area

[4] Impact codes:
01 Development
02 ORV activity
03 Agriculture
04 Grazing
05 Competition from exotics
06 Logging
07 Insufficient population/stand size
08 Altered flood/tidal regime
09 Mining
10 Hybridization
11 Groundwater pumping
12 Dam/inundation
13 Other
14 Surface water diversion
15 Road/trail construction/maint.
16 Biocides
17 Pollution
18 Unknown
19 Vandalism/dumping/litter

[4] Impact codes (continued):
22 Over collecting/poaching
23 Erosion/runoff
24 Altered thermal regime
25 Landfill
26 Degrading water quality
27 Wood cutting
28 Military operations
29 Recreational use (non ORV)
30 Nest parasitism
31 Non-native predators
32 Rip-rap, bank protection
33 Channelization (human caused)
34 Feral pigs
35 Burros
36 Rills
37 Phytogenic mounding

[5] C = Collected specimen for office ID