NAPA RIVER RUTHERFORD REACH RESTORATION PROJECT

2011 MONITORING REPORT

August 31, 2011

Monitoring Team:

Tessera Consulting
6549 Willowview Court
Livermore, CA 94551
Contact: Gretchen E. Hayes
(925) 455-4489

Napa County
Flood Control and Water Conservation District
804 First Street
Napa, CA 94559
Contact: Jeremy Sarrow
(707) 259-8600

Napa County Resource Conservation District
1303 Jefferson St.
Suite 500 B
Napa, CA 94558
Contact: Leigh Sharp
(707) 252-4188 x110

Table of Contents

Introduction

The purpose of this document is to report on the results of the Monitoring Program for the Napa River Rutherford Reach Restoration Project (Project) conducted through March 31, 2011. Napa County has conducted the monitoring program in accordance with the various Project permits as defined in the approved ***Monitoring Plan for the Rutherford Reach Restoration of the Napa River*** (2009, Rev 1/2011), which can be accessed online at:

http://www.napawatersheds.org/files/managed/Document/4585/RDRT-Phase%203-MP-Draft%20110111.pdf

The Monitoring Plan outlines a comprehensive monitoring framework and defines protocols for evaluating environmental parameters that provide measures of long term restoration effectiveness. Refer to the Monitoring Plan for specific field protocols, schedules, and field data sheets used to evaluate monitoring parameters.

This document is intended for review by resource agencies, the public, and members of the Rutherford Dust Restoration Team, which includes local landowners and/or their representatives, Napa County, and the Napa County Resource Conservation (RCD).

Regulatory Compliance

The California Environmental Quality Act (CEQA) review was completed for the Project in 2008. The Project Initial Study/Mitigated Negative Notice of Determination is on file (State Clearing House No. 2008082086).

The regulatory permits acquired for the entire 4.5 mile Rutherford Reach Restoration Project include:

- USACE CWA 404 Permit (No. 2008-00366N), with construction phase reviews for updated wetland delineations and cultural resources.
- Project Biological Assessment: NMFS and USFWS biological opinions
- California Natural Diversity Database Record Search
- County Grading and Floodplain Management permit: the project has been determined to be in compliance with County grading and floodplain management ordinances through completion and submittal to FEMA of a Conditional Letter of Map Revision (CLOMR) in 2008.

The regulatory permits which are issued by restoration implementation (construction) phase include:

- RWQCB 401 Water Quality Certifications
- CDFG 1602 Streambed Alternation Permits

See **Appendix A. Regulatory Permit Summary** for detailed tables of information on existing Project permits and regulatory contact information

As of this report submittal, the Project has acquired all required permits to implement construction in Phases 1 through 3, encompassing Reaches 1-4, between the Zinfandel Lane and Rutherford Cross Road Bridges. Permit applications with the RWQCB and CDFG are in process to implement construction in Reach 8.

Project Setting

The Napa River Rutherford Reach Restoration Project is comprised of a 4.5-mile reach of the mainstem Napa River south of the City of Saint Helena between Zinfandel Lane and the Oakville Cross Road. This reach is comprised of approximately 40 parcels owned and managed by 29 different private entities. Historic changes in land use and management in the Napa River watershed have resulted in confinement of the river into a narrow channel, loss of riparian and wetland habitats, accelerated channel incision and bank erosion, and ongoing channel degradation. Properties along the Rutherford Reach have been subject to bank instability and failure leading to the loss of land, excessive sedimentation in the river and costly repairs.

The Napa River Rutherford Reach Restoration is a landowner-initiated project that aims to reduce existing bank erosion and enhance riparian and aquatic habitats using a suite of approaches, including: setting back earthen berms from the top of the river bank; creating vegetated buffers between the river and adjacent land uses; excavating and planting inset floodplain benches (1.5- to 2-year flood recurrence interval); creating backwater habitat to provide high-flow refugia for native fish; removing non-native invasive and Pierce's disease host species (e.g., Himalayan blackberry, periwinkle, giant reed, tree-of-heaven); planting native understory species; installing biotechnical bank stabilization to stabilize actively eroding banks; and, installing instream structures to improve aquatic habitat. The project also includes an annual maintenance program to proactively address debris, bank erosion, and inputs of fine sediments and to maintain the functions of the restoration features. Maintenance activities include: debris removal; downed tree stabilization/relocation; in-channel vegetation management; planting native vegetation; invasive and Pierces's Disease host plant removal; and, repairing (as needed) instream habitat structures and other constructed instream restoration features. All of this work is conducted on private land along the Project reach under the supervision of the County in concert with landowners and their representatives.

The Napa River is presently subject to a Clean Water Act Total Maximum Daily Load (TMDL) action due to excessive quantities of fine sediment degrading local water quality and beneficial uses. While sediment is a naturally-occurring input to the Napa River system, excessive amounts are considered a pollutant, and thus sediment load reductions mentioned in this report amount to 'pollutant reductions' in TMDL terms. The Rutherford Reach Restoration Project serves to support the TMDL objective of reducing fine sediment loads and as a result has been designated a regional priority by the San Francisco Bay Regional Water Quality Control Board responsible for TMDL development and implementation.

Restoration Goals and Objectives

For the purposed of monitoring Project success, restoration goals are organized into four main categories:

- Sediment Load Reductions and Increased Channel Morphology Complexity
- Aquatic Habitat Enhancement
- Riparian Habitat Enhancement
- Ongoing Stakeholder Participation

Sediment Load Reductions and Increased Channel Morphology Complexity

Existing (Pre-Project) Conditions

Changes in land use and land cover types, construction of earthen berms, and filling of historic distributary channels has resulted in increased flow volumes and velocities within the Rutherford Reach leading to channel incision, and streambank erosion and failure. In addition, inputs of fine sediments to the channel from eroding streambanks and other sources within the watershed has led to a reduction in the quality and quantity of instream habitat for salmonids and other native fish in the Rutherford Reach.

Desired Outcomes

The desired outcomes for this category focus on reducing contributions of fine sediment to the Napa River by reducing rates of channel bank erosion and bed incision and creating a more stable long term channel configuration.

The goals/desired outcomes for reducing fine sediment loads due to accelerated rates of channel bed and bank erosion and for improving channel morphology are as follows.

- Decrease the total surface area of eroding streambanks.
- Reduce rates of bank retreat and stabilize severely eroding banks.
- Reduce rates of channel incision.
- Re-establish geomorphic and hydrologic processes to support a continuous and diverse native riparian corridor.
- Rehabilitate natural river/floodplain interactions where possible.
- Increase and enhance riverine, riparian, and floodplain habitat value and complexity, particularly to support increased quality and quantity of habitat for Chinook salmon, Steelhead trout and California freshwater shrimp.
- Create inset bankfull (1.5 year flood elevation) and mid-level terraces.
- Create sustainable geometries for setback channel banks and berms.
- Minimize the need for ongoing channel stabilization and maintenance work.

Aquatic Habitat Enhancement

Existing (Pre-Project) Conditions

Aquatic habitat within the Rutherford Reach consists of long runs and glides, with fewer deep pools, and occasional riffles. Pool depths typically exceed 3 feet and occasionally reach a maximum depth of approximately 9 feet. When present, cover in the pools consist of deep water,

undercut banks, instream woody material, and overhead cover in the form of low growing riparian vegetation. In general, less cover and fewer cover types are present in runs and riffles compared to pools. Cover in these habitats consists of undercut banks, overhead cover from riparian vegetation, and instream woody material. The predominant substrate in the reach is gravels and sand-sized particles, although more sand than gravel is commonly present. Finer substrates, such as clay- and silt-sized particles, are generally absent. Average particle size (D_{50}) on the bars and riffles sampled in 2005 varied from approximately 8mm to 50mm, with an average of 23mm. In comparison, preferred spawning habitat for Chinook salmon typically consists of bed material ranging from 25 to 102 mm in size. In summary, the diversity and abundance of native fish (including salmonids) in the Rutherford Reach is limited by a combination of factors including: the lack of winter and spring high flow refugia (low velocity flow areas); lack of suitable fall and winter spawning habitat (riffles and coarse gravel), lack of habitat complexity (pool, riffle, glide variability); high percentage of predatory fish habitat (deep pools and glides); and lack of instream and overhead cover.

Desired Outcomes

The goals/desired outcomes for aquatic habitat quality on the Napa River Rutherford Reach are as follows:

Overall

- Protect existing high value riparian corridor habitat patches wherever possible.
- Re-establish geomorphic and hydrologic processes to support a continuous and diverse native riparian corridor.
- Increase and enhance riverine, riparian, and floodplain habitat value and complexity, particularly to support increased quality and quantity of habitat for Chinook salmon, Steelhead trout and California freshwater shrimp.
- Increase habitat velocity flow complexity by increasing variability in pool, riffle and glide habitats.
- Decrease percentage of deep pool and glide habitats that function as predatory fish habitat, and increase percentage of shallow pool and riffle habitat.

Steelhead and Chinook Rearing Habitat

- Increase summer rearing habitat and cover by inducing lateral pool scour associated with installed habitat structures (LWD).
- Increase and establish of high flow (>500 cfs) low velocity (<6 fps) bankfull refugia areas to increase fall and winter rearing habitat for 0-1+ Steelhead, and immigrating/emigrating salmonids.

Steelhead and Chinook Spawning Habitat

- Increase of suitable fall and winter spawning habitat by increasing the frequency and length of riffle habitat, and increasing the recruitment of coarser spawning gravel by inducing sorting of bed and bar material, resulting in increased deposition of spawning-sized sediments and decreases in percentages of fines covering riffle crests / pool tails.
- Increase fall and winter spawning habitat and cover by inducing lateral pool scour associated with installed habitat structures (LWD).

Annual Steelhead 0-1+ Rearing

- Increase and establish of high flow (>500 cfs) low velocity (<6 fps) bankfull refugia areas to increase spring rearing habitat for 0+ Steelhead, and immigrating/emigrating salmonids.
- Increase quantity of high velocity feeding lanes, by creating relatively high velocity riffle habitat, and breaking up low velocity flat-water pool habitat. Induce local velocity accelerations and complexity and channel flow constrictions with installed habitat structures (LWD/Boulders).
- Enhance and encourage coarse sediment trapping for establishing riffle habitat and subsequent invertebrate production (i.e., create fish food habitat).

Spring Chinook Juvenile Rearing

- Increase and establish spring flow backwater pool habitat areas to increase spring rearing habitat for juvenile Chinook, and immigrating/emigrating salmonids.
- Increase summer rearing habitat by enhancing pool habitat complexity, depth, and shelter/canopy cover.

Riparian Habitat Enhancement

Existing (Pre-Project) Conditions

The species composition and the width and extent of the riparian corridor vary considerably throughout the Rutherford Reach depending on channel width, bank steepness, and adjacent land uses. In general, Reaches 1, 2, 3, and 5 support the largest intact stands of mature riparian vegetation. Valley oak (Quercus lobata), coast live oak (Quercus agrifolia), and California walnut (Juglans hindisi) are the dominant species in these reaches. Reaches 3, 5, 6 and 7, where the wider channel permits development of bars and inset floodplain benches, support extensive stands of Fremont cottonwood (Populus fremontii), white alder (Alnus rhombifolia), red willow (Salix laevigata), arroyo willow (Salix lasiolepis), yellow willow (Salix lutea), and sandbar willow (Salix exigua). Overstory vegetation is relatively sparse in Reach 4 consisting of small stands or individual valley and coast live oaks. California bay (Umbellularia californica), blue elderberry (Sambucus mexicana), and California buckeye (Aesculus californica) are also found within the project area. The width of the riparian corridor (including vegetated areas along both banks) is greatest in Reach 1 (600 to 800 feet). The riparian corridor in Reaches 3, 5, 6, and 7 is also relatively wide, ranging from 250 to 400 feet in width. Reaches 2, 4, 8, and 9, which are confined by levees and adjacent land use, support narrow bands of riparian vegetation (150 feet or less).

In many portions of the Rutherford Reach, the riparian understory is dominated by non-native species including Himalayan blackberry (Rubus discolor), periwinkle (Vinca major), and wild grape (Vitis sp.). Other non-native invasive species such as giant reed (Arundo donax) are also pervasive throughout the project area. However, other areas support substantial patches of native understory species including snowberry (Symphoricarpos albus), Santa Barbara sedge (Carex barbarae), creeping wild rye (Leymus triticoides), and California rose (Rosa californica). In these reaches, it is not unusual to find areas dominated by native overstory and understory species. These areas of high native diversity are primarily a result of invasive species removal and

revegetation projects implemented by local landowners to control Pierce's disease, and by the District to control giant reed.

In general, the extent and diversity of riparian habitat found within the project area is limited by the morphology of the channel. In most reaches the confined nature of the channel prevents the establishment of inset floodplain benches and bars that would enable recruitment and establishment of riparian species. Additionally, channel incision has increased channel capacity and decreased the frequency of overtopping leading to the development of a more xeric mix of plant species (e.g., oaks) along the top of the river bank.

Relevant design criteria include: establish planting zones based on water surface elevations and distance from channel (VW-3); establish a minimum 50' buffer to reduce disturbance to native wildlife and encourage migration (VW-4); fill existing canopy gaps < 25' in length (VW-5); increase plant diversity and structure to improve quality for resident and migrant wildlife, especially riparian-dependent birds (VW-7); obtain all plant material from Napa River watershed (VW-10); salvage native plant material for transplanting onto newly excavated benches and slopes (VW-11); irrigate all newly established plant material (VW-13); stabilize exposed soils using a hydromulch consisting of a native (or sterile) seed mix (VW-14).

Interruption of historic patterns of disturbance due to flooding has reduced riparian corridor width and interrupted succession processes critical to recruitment and survival of native riparian vegetation species and communities. Absent significant change in the geomorphic regime (outside the scope of this project), the riparian community will continue to decline as older trees die and recruitment is impaired due to numerous factors (lack of suitable geomorphic surfaces for colonization, competition with invasive plan species, seed/seedling predation by introduced species, etc). Artificial creation of inset flood terraces and bank setback and grading increases the area suitable for riparian recruitment. In particular in terms of created flood terraces, designing terraces for inundation at approximately the two-year return interval event creates new disturbance zones where future recruitment may be self-sustaining, assuming invasives continue to be controlled as part of project maintenance.

Desired Outcomes

- The goals/desired outcomes for enhancing riparian habiat are as follows:
- Protect existing high value riparian corridor habitat patches wherever possible.
- Expand the native riparian buffer width and extent.
- Remove invasive non-native vegetation and replanting with native vegetation that will not promote Pierce's disease in vineyards.
- Re-establish geomorphic and hydrologic processes to support a continuous and diverse native riparian corridor.

Stakeholder Participation

Existing Conditions

Whereas the Preliminary Design for the Project has been completed for all 28 properties in the Rutherford Reach, participation in the Project is determined by individual landowners in separate final design and construction phases.

Desired Outcomes

- Ongoing access granted for team members, including Napa County Flood District and the Napa County Resource Conservation District, and contractors.
- Minimize piecemeal efforts at channel stabilization and berm construction on the part of landowners.
- Continued landowner leadership, as evidenced via the Landowner Advisory Committee.
- Remove invasive non-native vegetation and replanting with native vegetation that will not promote Pierce's disease in vineyards.
- Work closely with landowners to address their interests with regard to adjacent farmland and property.
- Rehabilitate the river in a way that facilitates permitting agency approval.

Project Implementation

The 4.5 mile project reach has been defined by a stream stationing system based on linear footage upstream from the Oakville Cross Road Bridge. The Rutherford Reach of the Napa River spans between river stations 0 and 24,857 feet, starting at the Oakville Cross Road Bridge and extending upstream to the Zinfandel Lane Bridge. The project reach has been divided into subreaches numbered from 1 to 9 starting from the Zinfandel Lane Bridge.

The Rutherford Reach Restoration Project is being constructed in phases contingent on available funding and landowner/District priorities with a target completion date of 2017. The Conceptual Design for the Rutherford Reach was completed in 2002, followed by the Preliminary Design in 2008. Final Designs are completed for each construction phase. A copy of the preliminary design and final designs for each phase are available at the Watershed Information Center and Conservancy (WICC) of Napa County website at http://www.napawatersheds.org/app_folders/view/3577.

For each phase, the consulting engineer refines the preliminary design to a final design suitable for construction, based on more detailed topographic data, specific site conditions such as vegetation, current science, and consultations with landowners and permitting agency staff. Regulatory agency approval of the final design and remaining permits are obtained for each phase of construction implementation. Construction is overseen by a Project Team that includes the Napa County Program Manager, Napa County Department of Public Works Construction Managers, the Rutherford Dust Restoration Team Landowner Advisory Committee (LAC), with the benefit from input of a Project Strategy Team that includes technical experts and representatives from interested resource agencies.

See **Appendix B. Restoration Reaches, Phases, and Construction Schedule** for detailed tables of the locations of river reaches, and the timing and location of construction phases.

Implementation construction began in 2009 with Phase 1a East Bank.

Phase 1a East Bank design was completed by ICF Jones & Stokes, with engineering subcontractors Riechers Spence & Associates, Inc. Phase 1a: Reaches 1 and 2 East Bank construction took place in the summer of 2009. Phase 1a East Bank spans 6,254 feet, between river stations 24,857 - 18,600, on the Guggenhime and Quintessa properties. The construction contractor was Siteworks, and the revegetation contractor was Martinez Landscaping.

Phase 1b design was completed by ICF Jones & Stokes, with engineering subcontractors and Northwest Hydraulic Consultants, with consultation input from Prunuske Chatham Inc. Phase 1b: Reaches 1 and 2 west bank construction took place in the summer of 2010. Phase 1b west bank spans 6,254 feet, between river stations 24,857 - 18,600, on the Ranch Winery/Sutter Home, Frogs Leap and Caymus properties. The construction contractor was Siteworks, with subcontractor Martinez Landscaping. The revegetation contractor was SMP Services.

Phase 2, Reach 3 final design was completed by ESA PWA (formerly Phil Williams Associates, Inc), with design sub-consultation by Restoration Resources and Cramer Fish Sciences. Phase 2: Reach 3 took place in the summer of 2010. Phase 2 spans 2,000 feet in the channel between river stations 18,600 - 16,000 on the Caymus property on the right (west) bank, and the Carpy-Conolly property on the left (east) bank. Phase 2 spans an additional 2,000 feet along the top of left (east) bank where the levee was setback on the Carpy-Conolly property, between river stations 16,000-14,000. The construction contractor was Team Ghilotti, Inc., with subcontractors, Atlas Tree Service and Prunuske Chatham. The revegetation contractor was SMP Services.

Phase 3 final design was completed by ESA PWA (formerly Phil Williams Associates, Inc), with design sub-consultation by Restoration Resources and Cramer Fish Sciences.

Phase 3a: Reach 4 East Bank is occurring in summer 2011. Phase 3 spans 4,000 feet between river stations 16,000 and 12,000 on the Carpy-Conolly, Honig and Round Pond East properties, completing left (east) bank construction between the Zinfandel Lane and Rutherford Cross Road Bridges. The construction contractor is Siteworks. The revegetation contractor will be chosen in August 2011.

Phase 3b: Reach 4 west bank construction will take place in summer 2012, between river stations 12,000 and 16,000 on the Emmolo, Mee, and Round Pond West properties, completing restoration construction on all properties between the Zinfandel Lane and Rutherford Cross Road Bridges. The construction contractor will be chosen in June 2012. The revegetation contractor will be chosen in August 2012.

The restoration elements constructed in each construction phase (through Phase 3) are summarized in the following section.

Restoration Treatment Elements

Restoration treatments are enumerated below by four main categories.

Sediment Load Reductions and Increased Channel Morphology Complexity

Restoration treatments to reduce sediment load and stabilize channel morphology include:

- Increased Riparian Buffer Width
- Setback Berms and Replacement
- Channel Reconfiguration
- Bank Stabilization
- Grade Control Boulders and Weirs

Aquatic Habitat Enhancement

Restoration treatments installed in-channel to improve aquatic habitat include:

- Large Woody Debris, Spider Logs, Low Profile Logs, and Toe Log-Boulder Structures
- Plant Material: Native Willow Cuttings, Off-Bench Branch Cover, Branch Bundles
- Constructed Riffles
- Backwater Alcoves on Created Instream Benches and Historic Secondary Channels
- Graded Instream Benches on Alternating Banks

Riparian Habitat Enhancement

Restoration treatments to improve riparian habitat include:

- Revegetation and Maintenance of Graded Areas with Native Under and Over Story Species
- Vegetation of Widened Riparian Corridor with Native Under and Over Story Species
- Removal and Management of Invasive Non-Native Species and Pierce Disease Host Plants

Stakeholder Participation

Methods to maintain stakeholder participation include:

- Conduct Landowner Advisory Committee Meetings
- Conduct Informational Outreach
- Manage Channel Maintenance and Monitoring Program

See **Appendix C. Restoration Elements** for figures and tables of restoration elements and locations in each Phase of construction. Restoration elements, including graded structures, setback agricultural berms, and instream structures are depicted on aerial photos by construction phase. Tables list restoration feature by type, river station location, designer and year constructed by phase. Restoration elements are graphed on the longitudinal profile survey to illustrate location in relation to channel morphology and elevation above the thalweg.

Phase1a, Reaches 1-2 East Bank Restoration Elements

Graded Structures

Graded restoration elements in Phase 1a, Reaches 1-2 East Bank include: two (2) instream benches and a cut slope to stabilize the top of an eroding bedrock bank. The first bench spans 500 linear feet between river stations 23,950 – 23,450 on the Guggenhime property, at an average elevation of 168 feet, which is an approximately 10 feet above the level of the thalweg, and functions as a bankfull terrace. The second bench spans 600 linear feet between river stations 20,000-19,400 on the Quintessa property, at an average elevation of 160 feet, which is an approximately 10 feet above the level of the thalweg riffle crests, and function ns as a bankfull terrace. The top of bank grading spans 800 feet between river stations 19,400 and 18,600, at an elevation of 165 feet, approximately 16 feet above the level of the thalweg upslope above the exposed bedrock outcrop.

Instream Habitat Structures

Instream habitat structures included bench logs placed perpendicular to the channel to slow flow velocity and curb surface erosion of the instream benches. Eight (8) bench logs were installed on the Guggenhime bench, and seven (7) bench logs were installed on the Quintessa bench.

Restored Riparian Habitat

2.5 acres of riparian habitat were restored in Phase 1b, Reaches 1-2 West Bank.

Phase1b, Reaches 1-2 West Bank Restoration Elements

Graded Structures

Graded restoration elements in Phase 1b, Reaches 1-2 West Bank include: one (1) tributary alcove, and three (3) instream benches on the right (west) bank. The alcove spans 325 linear feet between stations 22,225 – 21,900, and begins at the thalweg elevation. The first bankfull bench extends downstream from the alcove, and spans 800 linear feet between river stations 21,900 – 21,625 on the Ranch Winery/Sutter Home property at elevation 165 feet, which averages 14 feet above the level of the thalweg riffle crests, and functions as edgewater habitat. The second bankfull bench spans 600 linear feet between river stations 19,900 - 19,100 on the Frogs Leap property at elevation of 159 feet, which averages 13 feet above the level of the thalweg riffle crests. The third bankfull bench spans 575 linear feet between river stations 18,600 – 18,025 on the Caymus property at elevation of 157 feet, which averages 13 feet above the level of the thalweg riffle crests, and functions as edgewater habitat.

Instream Habitat Structures

Instream habitat structures in Phase 1b, Reaches 1-2 West Bank include bench logs placed perpendicular to the channel to slow flow velocity and curb surface erosion of the instream benches. Six (6) bench logs were installed in the Ranch Winery/Sutter Home alcove, and three on the Ranch Winery/Sutter Home bench; three bench logs were installed on the Frogs Leap, and three bench logs were installed on the Caymus bench. Instream habitat structures were first installed in the low flow channel in 2011. In Phase 1 b: Reaches 1 and 2, spider log structures of triangular stacks of cabled together logs were anchored to the channel bed at right (west) bank river station 22,100, and left (east) bank river stations 21,900, and 21,700. Two linear toe log structures were installed consisting of a linear assemblage of triangular log structures, cabled together, and cabled to boulders to anchor

them in place along the base of the channel bank. The first structure spans 50 feet between right (west) bank river stations 21,850 – 21,800 on the Ranch Winery/ Sutter Home property. This toe log structure is 14 feet below the graded bench surface, with the area between containing undisturbed riparian vegetation. The second toe log structure spans 75 linear feet between right (west) bank river stations 21,850 – 21,800 on the Frogs Leap property. This structure is located 12 feet below the graded bench surface, with only a pre-existing riparian tree remaining between the bench and the log structure after grading.

Restored Riparian Habitat

5.6acres of riparian habitat were restored in Phase 1b, Reaches 1-2 West Bank.

Phase 2, Reach 3 Restoration Elements

Graded Structures

Graded restoration elements in Phase 2: Reach 3 include five (5) instream benches. The first bench spans 275 linear feet between right (west) bank river stations 17,700 – 17,425 on the Caymus property, at an average elevation of 147 feet. Bench 1 functions as a secondary channel with a mid channel bar and starts approximately 2 feet above the level of the thalweg at the upstream end of the bench, and ends at the channel grade where it renters the channel at the downstream end of the bench approximately 6 feet above the level of the thalweg riffle crests. The second bench spans 190 linear feet between right (west) bank river stations 17,350 – 17,160 on the Caymus property, at an average elevation of 146 to 145 feet, which averages 5 feet above the level of the thalweg riffle crests. Bench 2 functions as a backwater alcove. The third bench spans 300 linear feet between right (west) bank river stations 17,150 – 16,850 on the Caymus property, at an average elevation of 147 feet, which averages 4.5 feet above the level of the thalweg riffle crests. Bench 3 functions as edgewater habitat. The fourth bench spans 250 linear feet between left (east) bank river stations 16,725 – 16,475 on the Carpy-Conolly property, at an average elevation of 144 feet, which averages 3 feet above the level of the thalweg riffle crests. Bench 4 functions as edgewater habitat. The fifth bench spans 250 linear feet between left (east) bank river stations 16,350 – 16,100 on the Carpy-Conolly property, at an average elevation of 143 feet, which averages 4 feet above the level of the thalweg riffle crests Bench 5 functions as edgewater habitat.

Instream Habitat Structures

Instream habitat structures installed in Phase 2: Reach 3 include eight (8) root wad structures keyed into trenches in the upstream and/or downstream end of the graded benches with root wads extending into the channel. The structures are ballasted with 4 ton boulders, buried, and further stabilized with the addition of willow brush mattresses and gravel, which are then anchored with erosion control fabric. A total eight root wads were installed: Five root wads were installed at right (west) bank river stations 17,700, 17,425, 17,350, 17175 and 16,900 extending from Benches 1-3, and three root wads were installed at left (east) bank river stations extending from Benches 4-5 at river stations 16,670, 16,650, and 16,100. A 30 foot long buried rock grade control structure was installed in the channel between river stations16,180-16,150 to preclude against channel incision and undermining of restored elements upstream.

Restored Riparian Habitat

5.04 acres of riparian habitat were restored in Phase 2, Reach 3.

Phase 3a, Reach 4 East Bank Restoration Elements

Graded Structures
Graded restoration elements in Phase 3a: Reach 4 East Bank will include: four (4) instream benches and two (2) bank stabilization areas.

Instream Habitat Structures
Instream habitat structures in Phase 3a: Reach 4 East Bank will include: four (4) roots wads embedded in created instream benches, six (6) low profile log instream structures, and five (5) instream boulder clusters, and one (1) roughened channel structure.

Restored Riparian Habitat
4.2 acres of riparian habitat will be restored in Phase 3a: Reach 4 East Bank.

Phase 3b, Reach 4 West Bank Restoration Elements

Graded Structures
Graded restoration elements in Phase 3b: Reach 4 West Bank will include: five (5) instream benches and one (1) bank stabilization area.

Instream Habitat Structures
Instream habitat structures in Phase 3b: Reach 4 West Bank will include: seven (7) root wads embedded in created instream benches, one (1) low profile log instream structure, and two (2) instream boulder clusters.

Restored Riparian Habitat
Eight (8) acres of riparian habitat will be restored in Phase 3b: Reach 4 West Bank.

Monitoring Approach

The Monitoring Program framework links project objectives to proposed monitoring elements based on our understanding of process-based relationships between existing conditions and restoration techniques aimed at achieving desired outcomes. For each desired outcome we have defined specific performance indicators and standards. Project success will be evaluated by quantifying progress towards meeting performance standards over the life of the project. We first describe the monitoring components and schedule. We then address existing conditions, restoration treatments, desired outcomes, monitoring indicators, and performance standards by monitoring category. See **Appendix D. Monitoring Studies** for summary tables describing monitoring activities and monitoring frequency organized by resource category, and for monitoring protocols organized by frequency.

The Monitoring Program has four main components: 1) an Annual Survey of the entire 4.5 mile reach, which is aimed at capturing both critical monitoring parameters and channel maintenance needs using rapid assessment formats; 2) seasonal evaluation and photomonitoring of the performance of the instream habitat structures at representative seasonal flows; 3) repeat detailed channel transect and longitudinal profile surveys be conducted pre-construction and following

significant flow events to capture long term habitat response, and, 4) phased vegetation surveys. These monitoring field survey elements are complemented with basic photo-monitoring at defined stations, detailed monitoring of revegetation sites conducted in phases as project areas are planted, and surveys of stakeholder participation. Refer to the Monitoring Protocols in the ***Monitoring Plan*** for a detailed description of the protocols that are to be conducted in each monitoring component.

We are employing a Before/After Control/Impact (BACI) approach for long term measuring change of geomorphic, aquatic and riparian habitat parameters (Roni 2005; Gerstein & Harris, 2005). Monitoring parameters have been chosen to measure changes in targeted resource categories in response to stream enhancements. Detailed Transects complement the Annual Survey and are designed to balance the frequency and resolution of data collection in the most meaningful and yet cost-effective manner possible.

The Monitoring Program is designed to evaluate the success of the Rutherford Reach Restoration Project at meeting the objectives of reducing excessive channel bank and bed erosion, enhancing aquatic and riparian habitat, protecting property and maintaining stakeholder participation.

The Monitoring Program is organized into four categories of study with related parameters for measurement:

- Sediment Load Reductions and Increased Channel Morphology Complexity
- Aquatic Habitat Enhancement
- Riparian Habitat Enhancement
- Ongoing Stakeholder Participation

Sediment Load Reductions and Increased Channel Morphology Complexity

The monitoring approach to assess reduction in sediment loads to the channel is to evaluate changes in basic stream channel geometry, bank condition, and resultant sediment loads in treated and untreated river reaches.

Performance Indicators

Performance indicators for sediment load reductions and channel morphology are listed below (units in parentheses):

- Length and surface area of actively eroding streambanks over the project reach (LxH or %L)
- Rates of bed deposition and scour at representative cross-sections (L or Vol/T)
- Bankfull width to depth ratio (W/D) at representative treatment cross-sections

Performance Standards

The performance standard for reducing sediment loads and improving channel morphology is:

- A 75% reduction in the length, or surface area, of actively eroding streambanks in the entire project reach.
- Positive trends in reductions in reductions in bed and bank erosion rates
- Positive trends in increases in bankfull channel width to depth ratios

Monitoring Protocols

Monitoring protocols for reducing sediment loads and improving channel morphology include:

- Stream Flow Measurements
- Eroding Streambank Survey
- Sediment Source Reduction Calculations
- Longitudinal Thalweg Surveys
- Cross Section Surveys

Aquatic Habitat Enhancement

The monitoring approach to assess enhancement of aquatic habitat is to evaluate changes in aquatic habitat quantity and quality associated with installed instream structures, including those aspects of active channel morphology that drive the creation and maintenance of habitat complexity.

Performance Indicators

Progress toward the goals/desired outcomes for aquatic habitat quality improvements will be based on (units in parentheses):

- Channel substrate size distribution (median statistic values for size frequency distribution, % fine sediment)
- Riffle length and frequency
- Residual pool depth
- Large woody debris structure persistence (# years, % persisting)
- Riparian/overhead cover (%)
- Area of high-flow refugia in constructed alcoves and bankfull instream benches (A)
- Flow velocities in constructed high-flow refugia areas (v)

Performance Standards

The performance standards for aquatic habitat quality are:

- A statistically significant increase in riffle median grain size (D50 mm)
- A statistically significant reduction in riffle substrate percentage of fines (<2mm)
- A 30% increase in riffle length or riffle frequency in treated locations
- A 25% increase in residual pool depth in treated locations
- A 75% persistence of installed instream habitat enhancement structures
- Creation of high flow refugia with (velocities less that 6 fps) for flows 500 cfs and above at constructed alcoves and instream bankfull benches
- A 40% increase in seasonal refugia cover

Monitoring Protocols

- Pebble Counts
- Spawning Gravel Permeability Studies by Napa RCD
- Channel Morphology Survey: Riffle, Glide, Pool Distribution Mapping
- Residual Pool Depth Survey associated with Installed Instream Habitat Structures

- Large Woody Debris Survey
- Seasonal Salmonid Habitat Velocity Surveys

Riparian Habitat Enhancement

The monitoring approach to assess enhancement of aquatic habitat is to evaluate increases in riparian habitat quantity and quality and planting survival in treated reaches, including the reduction in invasive plant species.

Performance Indicators

Progress toward the goals/desired outcomes for riparian habitat quality improvements will be based on (units in parentheses):

- Area successfully treated (acres)
- Plant survival at revegetation sites (%)
- Percent native vegetative cover: Absence/presence natural recruitment (no units)

Performance Standards

The performance standards for riparian habitat quality are:

- A minimum 20 acres over the life of the Rutherford Reach project (acres)
- An 80% survival of native plants at revegetation sites
- Greater than 90% native cover (less than 10% total non-native)
- Evidence of successful natural recruitment by year 5 at revegetation sites

Monitoring Protocols

- Vegetation Establishment Surveys
- Direct Count Plant Survival and Vigor Survey
- Area Mapping Percent Cover and Composition Survey
- Cross Section Transect Line Intercept Survey

Stakeholder Participation

The monitoring approach to assess stakeholder participation is to evaluate the success of stakeholder coordination in maintaining meaningful levels of participation.

Performance Indicators

The performance standards for stakeholder participation are:

- Landowner Participation in the Restoration Project
- Landowner adaptive monitoring and management
- Landowner Advisory Committee participation
- Performance Standards
- Continuation of at least 90% landowner participation in the project.
- Continued landowner leadership, as evidenced via the Landowner Advisory Committee (LAC) and willingness to fill offices (Chair, Vice-Chair, Secretary).
- Ongoing access granted for team members, including Napa County Flood District and the Napa County Resource Conservation District.

Monitoring Protocols

- Records of Landowner Access Agreements
- Records of Landowner Maintenance Requests
- Landowner Advisory Committee Meetings Attendance Records

Summary of Monitoring Studies

Data, figures and tables from individual monitoring studies are provided in **Appendices F-T**. This section summarizes findings to date and progress towards desired outcomes indicated by each monitoring study listed below.

I. Stream Flow Measurements
II. Eroding Streambank Survey
III. Sediment Source Reduction Calculations
IV. Longitudinal Thalweg Surveys
V. Cross Section Surveys
VI. Pebble Counts
VII. Spawning Gravel Permeability Measurements
VIII. Channel Morphology Survey: Riffle, Glide, Pool Distribution Mapping
IX. Residual Pool Depth Survey at Installed Instream Habitat Structures
X. Large Woody Debris Survey
XI. Seasonal Salmonid Habitat Velocity Surveys
XII. Vegetation Establishment Surveys
    - Direct Count Plant Survival and Vigor Survey
    - Area Mapping Percent Cover and Composition Survey
    - Cross Section Transect Line Intercept Survey
XIII. Stakeholder Participation Documentation

I. Stream Flow Measurements

See **Appendix D. Study I. Stream Flow Data** for a table and figure depicting the annual peak flows experienced in the Rutherford Reach from water years 2004 – 2011.

The channel flow capacity of the Rutherford Reach averages less than a ten year recurrence interval flood event. A 10 year recurrence interval flood discharge is 13,000 cfs and 100 year recurrence interval flood discharge is 21,000 cfs. At a peak discharge of 18,300 cfs, the New Year's Flood of December 31, 2005 was the largest recorded flood on the Napa River Rutherford Reach. Ten monitoring cross sections surveyed in 2004 were reoccupied and resurveyed following the flood from 2008-2009 to measure changes in channel geomorphology. See the section on **Channel Transect Surveys** below for a further discussion and **Appendix D. Study V. Channel Transect Surveys** for graphed comparisons of channel change.

Instream benches were first constructed in 2009. All instream benches were inundated at least once in the first winter following construction. The Napa County RCD first surveyed stream flow velocities on instream benches in winter 2011. The results of the velocity study are presented in the section on **Seasonal Salmonid Habitat Surveys** below and in **Appendix D. Study XI.** High water mark and water surface elevation levels were surveyed in at the velocity measurement locations, and tabulated against the discharge and stage height at the stream gage at the Pope Street Bridge upstream to provide baseline data to establish a stage discharge rating curve for the Rutherford Reach.

II. Eroding Streambank Survey

The Annual Survey is conducted within the entire length of the bankfull channel every year in order to evaluate the status of constructed features and to rapidly assess effects on fine sediment loading, channel morphology, and habitat features. (The Annual Survey also serves the Maintenance Plan objectives by identifying any emerging new areas of management concern along the channel due to debris deposition or bank instability—see *Final Maintenance Plan for the Napa River Rutherford Reach Restoration Project* (Napa County Resource Conservation District, August 2008) for details.) The Annual Stream Reach Survey is conducted each spring prior to the start of the summer construction season. The reduction of eroding bank length in a given construction phase is evaluated for the first time the following June, after one winter stream flow season. Stream maintenance and monitoring surveys commenced in summer 2009 and will continue annually through the 20-year duration of the River Maintenance District. The duration of the monitoring program is designed to coincide with the 20-year extent of the maintenance program.

The desired outcome for eroding banks includes:

- A 75% reduction in the length, or surface area, of actively eroding streambanks in the entire project reach.

See **Appendix D. Study II. Eroding Stream Bank Survey** for figures and tables depicting the location and extent of eroding streambanks mapped during each annual survey.

The target goal is to reduce the surface area of eroding banks in the entire Rutherford Reach (Reaches 1-9) by 75%, which is measured annually under the channel monitoring survey conducted by Napa County each June. Comparison of eroding banks mapped during the first two annual channel maintenance surveys, shows that eroding bank length was reduced in the Rutherford Reach (Reaches 1-9) by 38% from 14,674 to 9,032 feet. Approximately 1,900 feet of this reduction was due to treatment of eroding banks with restoration construction in Phase 1 Reaches 1 and 2 in 2009.

During the baseline survey in 2009, 14,674 feet of channel banks were eroding, or 30% of the channel bank length in the Rutherford Reach. To meet the sediment source reduction goal of the Project, 75% reduction in eroding bank length by 2017 would require that no more than 3,700 total linear feet of the 49,714 feet of left (east) and right (west) banks are eroding, or no more than 7.5% of the channel bank length in the Rutherford Reach. In 2010, 9,032 feet of channel banks were eroding, or 18% of the channel bank length in the Rutherford Reach. This constitutes a reduction of 12% compared to

the 2009 baseline. A minimum further reduction of 11% in total eroding bank length is required to meet the goals of the project.

III. Sediment Source Reduction Calculations

The Total Maximum Daily Load Target (TMDL) is to reduce fine sediment delivery from all Napa River mainstem channel incision and bank erosion sources by 19,000 metric tons/year. To measure the reduction in fine sediment source as result of the Project, the one-time removal of sediment available for delivery to the channel is measured and amortized over the life of the project (20 years). Added to this value is the estimated reduction in average bank erosion rates associated with restored channel (of 750 metric tons/mile/year).

The desired outcome for fine sediment source reduction includes:

- Up to 80% of the total target TMDL sediment load reduction on the mainstem Napa River.

See **Appendix D. Study III Sediment Source Reduction Calculations** for supporting data utilized to calculate the estimated reduction in sediment loading to the mainstem Napa River as a result of restoration Project implementation.

The implementation of Phases 1-2 in 2009 and 2010 reduced fine sediment source loading by 5,337 metric tons/year for the next 20 years, or 28% of the total target reduction for the Napa River watershed from mainstem channel incision and bank erosion sources. It is estimated that implementation of Phase , Reach 4 restoration in 2011 will increase the total reduction in fine sediment source loading to 9,950 metric tons/year, or 52% of the total target sediment load reduction on the Napa River.

IV. Longitudinal Profile Thalweg Surveys

Longitudinal profile thalweg surveys provide detailed topographic data depicting channel morphology, habitat types, and changes in channel slope. Channel surface elevations are surveyed along the thalweg (the lowest flow path of the channel). Points are taken at all riffle crests, pool bottoms, transitions in channel surface substrate (Boulder, cobble, gravel, sand, silt, bedrock). Spacing between intermediate points is generally no more than 10 feet. The baseline longitudinal thalweg survey was completed in 2009, and subsequent surveys will be conducted approximately once every five years used to evaluate changes down the length of the entire Project reach pre-and post- Project. Longitudinal surveys are tied into surveyed elevations from the Project at benchmarks for the cross section transect surveys.

The desired outcomes for channel morphology measured by the longitudinal profile survey include:

- Positive trends in reductions in reductions in channel bed incision rates
- A 30% increase in riffle length or riffle frequency in treated locations.

See Appendix D. Study IV. Longitudinal Profile Thalweg Surveys for a diagram depicting the timing, location, and extent of longitudinal profile surveys conducted in the Rutherford Reach, and for a detailed graph of the thalweg survey and primary channel bed substrate.

Longitudinal thalweg profile surveys were conducted in three sections of the Rutherford Reach in 2004. A baseline longitudinal profile thalweg survey of the entire Rutherford Reach was completed across the years in 2006, 2009 and 2010. Trends in channel bed incision rates will be evaluated once the longitudinal surveys have been reoccupied within five years following restoration construction. Future local longitudinal surveys will be conducted to assess changes in thalweg elevation, channel aggradation and incision, especially with regard to installed instream habitat features, and LWD jams, and in response to channel maintenance actions.

V. Channel Transect Surveys

Transects provide greater resolution for selected habitat and channel morphology parameters at representative project locations and are timed to capture the effects of peak floods (with return intervals of approximately five years and higher). Transects will evaluate changes across the entire channel and adjacent portions of the floodplain by integrating topographic cross-section surveys with habitat mapping conducted concurrently. Transects may, as needed, be complemented with localized longitudinal channel thalweg surveys centered on the transect to measure detailed changes in geomorphic, aquatic, and riparian habitat parameters within the stream channel in response to instream structures. The specific parameters to be evaluated at each transect will be contingent on restoration technique applied. "Treatment" Transects will be complemented with "no treatment" Transects for comparison.

Repeated transect surveys are scheduled before and after the construction of each phase. The cross section transects in each phase will be surveyed pre-construction, and within two years post-construction, thereafter at least once every five years. Cross section transects may be also resurveyed after a significant channel forming flood event, or as deemed necessary by findings during the annual stream reach survey. Transects will be re-occupied and surveyed in the event of a channel changing flood event to re-establish baseline surveys before the construction of a phase, as well as to monitor changes in constructed project reaches. Transects will be re-occupied and surveyed at least once every 5 years in the absence of a channel forming event, unless annual stream surveys indicate minimal change.

The desired outcome in channel morphology as measured by channel cross section surveys includes:

- Positive trends in increases in bankfull channel width to depth ratios

See **Appendix D. Study V. Channel Transect Surveys** for a schematic diagram depicting the timing, location, and extent of cross section transect surveys conducted in the Rutherford Reach. A figure depicts the cross section locations on an aerial photo. A table lists the timing and location of

monitoring cross section surveys. A plot of the cross sections in relation to the longitudinal profile is included. A table provides a key to the particle size distribution illustrated on the longitudinal and cross section plots for silt/soil (brown), sand (yellow), gravel (orange), cobble (red), boulder/rip rap (purple) and bedrock (grey). **Appendix D. Study V.** also contains detailed graphs and photos of the monumented surveyed cross section locations.

Ten cross sections were surveyed in 2004, and subsequently reoccupied in either 2009 or 2010 all prior to construction, which capture the effects of the 2005 New Year's Flood. Ten monitoring cross sections surveyed in 2004 were reoccupied and resurveyed following the flood from 2008-2009 to measure changes in channel geomorphology. In general, cross sections surveyed in confined Reaches 1-4 between the Zinfandel Lane Bridge and the Rutherford Cross Road experienced minimal channel bank erosion and channel migration and some channel incision, whereas the relatively broad, unconfined and shallow channel locations surveyed in Reach 7 downstream of the Rutherford Cross Road experienced some lateral migration and negligible channel incision. The greatest bank erosion was associated with tree throw and scour behind trees which had fallen into the river.

Seven new cross sections were surveyed from 2009 - 2011 prior to construction of Phases 2 and 3in Reaches 3and 4. As of May 2011, pre-construction surveys have been conducted at 17 cross section locations chosen for long-term monitoring at river stations in Reaches 1,2,3,4 and 7: 22,027, 21,629, 21,158, 20,628, 18, 930, 17,891, 16,422, 15, 950, 15,730, 14,920, 13,800, 13,050, 8,830, 8,630, 8,280, 7,830, 7,700. Cross sections will be surveyed in Reach 8 prior to construction between 2011 - 2013. Additional cross sections will be added as the project progresses.

Trends in bed and bank erosion rates, and in increases in bankfull channel width to depth ratios, will be evaluated once the monitoring cross sections have been reoccupied within five years following restoration construction, or after a channel forming flood event.

VI. Pebble Counts

To determine the grain size distribution of spawning substrate in the Rutherford Reach, pebble counts are conducted the closest riffle crest to each long term monitoring cross section survey location at the time of the survey. Cross sections are located in control and treatment areas in each construction phase. Most cross sections are originally located at a riffle crest. Migration of the riffle crest away from the monitoring cross section is recorded at the time of the pebble count survey, and the locaotin of the survey is adjusted to capture the grain size distribution at the new location of the riffle crest for a more accurate comparison.

The desired outcomes from the pebble count surveys studies include:

- A statistically significant increase in riffle median grain size (D50 mm).
- A statistically significant reduction in riffle substrate percentage of fines (<2mm).

See Appendix D. Study VI. Pebble Counts for a summary table of pebble counts conducted to date.

As of the writing of this report, pebble counts have been conducted at monitoring cross sections prior to construction in Phase 1, 2 and 3, and substrate was mapped along the longitudinal profile of the

Rutherford Reach in 2009 and 2010, but neither have yet been reoccupied or remapped to evaluate changes in channel substrate size distribution. Changes in riffle median grain sizes and percentage of fines will be evaluated once the monitoring cross sections have been reoccupied within five years following restoration construction, or after a channel forming flood event.

VII. Spawning Gravel Permeability

Spawning gravel permeability studies are complementary monitoring studies to the Project conducted with separate funding sources by the Napa County Resource Conservation District (Napa RCD) at sites throughout the Napa River watershed to characterize the quality of spawning habitat. The Project coordinates with the Napa RCD to obtain data collected at sites within the Rutherford Reach for evaluation of changes over time.

The desired outcomes for spawning gravel permeability include:

- Increased gravel permeability at riffle crests
- Positive trends towards riffle crests with "good" rank

See **Appendix D. Study VII. Spawning Gravel Permeability** for the summarized results of the permeability analysis and the mortality index calculation performed by the Napa County Resource Conservation District for the riffle crest cross sections surveyed in 2004.

In 2004, the Napa RCD collected permeability data at the ten (10) baseline cross section transect survey locations, which were located at riffle crests in the Rutherford Reach. The results of the cross section transect surveys are shown in **Appendix D. Study V,** and the results of the pebble count surveys at these locations are shown in **Appendix D. Study VI**. The results of the permeability and survival index surveys ranked one (1) of the ten (10) cross sections as good, while five (5) were ranked fair, and four (4) were ranked as poor. The Napa Resource Conservation District has recently received funding to conduct permeability studies throughout the Napa River watershed in the next few years. Trends will be measured upon evaluation of the new data.

VIII. Channel Morphology Survey: Riffle, Glide, Pool Distribution Mapping

Mapping of the distribution of riffles, glides and pools provides a way to spatially quantify channel morphology and habitat complexity. Due to ongoing channel incision, the Rutherford Reach has experienced great simplification in channel morphology, with long sections of homogenous glides, and a reduction in the frequency and spatial extent of riffle spawning habitat.

The desired outcome for increased complexity in channel morphology includes:

- A 30% increase in riffle length or riffle frequency in treated locations.

Jones & Stokes mapped a total of 155 gravel bars in the 4.5 mile Rutherford Reach in 2005, which are depicted in the Field Assessments Maps in the Final Basis of Design Report for the Napa River Rutherford Reach Restoration Project (Jones & Stokes, October 2008). See **Appendix D. Study VIII. Channel Morphology Surveys** for a table of the number and types of bars mapped per Reach by Jones & Stokes in 2004, and a map of the distribution of riffle crests mapped in 2009-2010 in concert with the survey of the longitudinal profile. While the distribution of mapped bars and mapped riffle crests are not directly comparable due to differences in protocols, general patterns of riffle density can be discerned from the 2004 and 2008/2009 surveys. A total of 155 bars were mapped in 2004. Forty-four (40%) of the bars were located in Reaches 1-4, and 60% of the bars were located in Reaches 5-9. Each of these river reach segments in comparable in length, indicating that there is a higher density of bars located between the Rutherford Cross Road and Oakville Cross Road Bridges than between the Zinfandel Lane and Rutherford Cross Road Bridges. Spawning redd surveys conducted by the Napa RCD indicate that despite the lower frequency of bars salmon tend to spawn more frequently in Reaches 1-4 because it is the upstream most location accessible on the mainstem Napa River. Restoration efforts were therefore first directed at increasing riffle habitat in these upstream most Reaches of the Rutherford Reach.

Starting in 2011, mapping of riffle crests will commence during the Annual Stream Maintenance and Monitoring Survey in June. This data set will be compared against the 2008/2009 baseline study to evaluate changes in riffle crest frequency and distribution.

IX. Residual Pool Depth Survey Associated with Installed Instream Habitat Structures

Repeated measurements of residual pool depth in the vicinity of installed habitat structures will provide information regarding the effect of the installed structures on increasing channel bed and habitat complexity.

The desired outcome for residual pool depth includes:

- A 25% increase in residual pool depth in treated locations.

See **Appendix D. Study IX. Residual Pool Depth Associated with Installed Instream Habitat Structures** for data collected starting in 2011. Baseline measurements of residual pool depth associated with installed instream habitat structures will be first conducted in 2011 after the first year winter storm flows following the first instream habitat structures installations in 2010.

Instream structures were first installed in the summer of 2010 as part of Phase 1b: Reaches 1-2 West, and Phase 2: Reach 3 construction. Residual pool depth associated with installed LWD, LWD spider log structures, LWD toe log Structures, and boulder clusters will be surveyed for the first time in June 2011.

X. Large Woody Debris Surveys

Seasonal evaluation of constructed instream habitat structures, including installed woody debris (LWD features), boulder clusters, riffle features, constructed alcoves and benches indicate whether the creation of high flow, low velocity, refugia habitat has been achieved as designed.

The desired outcome for installed Large Woody Debris instream structures includes:

- A 75% persistence of installed instream habitat enhancement structures.

See **Appendix D. Study X. Large Woody Debris** Surveys for maps, figures and graphs summarizing the data collected on large woody debris.

Since installation of the first LWD instream structures in 2010, 100% of instream habitat enhancement structures have persisted through winter 2011 with no need for maintenance of the structure.

In 2009 and 2010, the largest concentration of naturally occuring LWD was between river stations 9,000 – 6,000 in Reaches 7 and 8 in the vicinity of large meander bend, where the channel is wide and heavily vegetated and then becomes narrow and highly constrained at a prior bridge crossing location near the end of Glos Lane. This observation concurs with landowner accounts that LWD historically racks in this location and causes local eddy scour of the stream bank at the Sequoia Grove property. Three of the four jams mapped in 2010 were located in this meander bend. The remaining jam is located at station 19390, and spans the channel in Reach 2 at the downstream end of the instream bench restoration locations on the Quintessa and Frog's Leap properties. The Quintessa bench was constructed in 2009, widening the channel upstream of the jam between the time of the 2009 and 2010 LWD surveys. Construction of the bench on the Frog's Leap property in 2010 will further reduce the constraint imposed by the jam on the channel, and may preclude the need to remove the jam.

Photo comparisons of LWD that persisted from 2009 to 2010 proved challenging due to changes in photo point perspective, reorientation of the LWD, and variable plant growth. Photo pairs of persistent jams and large pieces of LWD provided in **Appendix D. Study X.** illustrate the thinning and dispersal of LWD accumulations at selected river stations.

XI. Seasonal Salmonid Habitat Surveys

The Rutherford Reach has experienced up to 15 feet of channel incision since the 1970s, simplifying channel geomorphology and associated aquatic habitat, and significantly reducing high flow slow water habitat for salmonids, including special status Steelhead and Chinook salmon. Incision has also drastically reduced the amount of pool tail spawning habitat. A series of alcoves and floodplain flow expansion and contraction features are being installed in the Project reach which are designed to

create flow refugia and complexity at a wide range of flows and salmonid life stages, and to set up the hydraulic conditions for riffle-pool persistence.

The desired outcomes for high flow refugia for salmonids include:

- Creation of high flow refugia with (velocities less that 6 fps) for flows 500 cfs and above at constructed alcoves and instream bankfull benches.
- A 40% increase in seasonal refugia cover.

See **Appendix D. Study XI. Seasonal Salmonid Habitat Surveys** for a summary report of target velocities and water depths for seasonal salmonid habitat, velocity measurements and high water mark surveys at constructed benches, and sketches and photographs of the surveyed locations.

From 2009-2010, one alcove and 10 instream benches were constructed in Reaches 1-3 (of 9 Total Project Reaches). ESA PWA constructed a 2D model to simulate the inundation elevations and associated flow velocities for several of the benches constructed in Reach 3 of the Project. Results from the velocity monitoring conducted by RCD staff during a 1,110 cfs-950 cfs flow event in winter 2011 demonstrate that the target water depths and velocity of less than 6 feet per second (FPS) for flows 500 cfs and above at the constructed alcove and instream bankfull benches are being achieved. The Project demonstrates that even in deeply incised river channels it is feasible to construct slow water refugia and geomorphic conditions for riffle persistence, creating critical habitat for various life stages of salmonids, including rearing habitat for Steelhead fry, small and large juveniles.

XII. Vegetation Establishment Surveys

Re-vegetated riparian areas will be monitored in the first three establishment years by the contractor that installed them in each phase of the Project. Contractors are responsible for monitoring installed vegetation health and vigor, plant survivorship, invasive species management and census of number of planting replaced annually. Thereafter vegetation monitoring and management in restored areas will be done by the Napa County Flood Control and Water Conservation District under the Maintenance Assessment District program. Photomonitoring will be incorporated into the annual stream reach survey, repeated cross section transect surveys, and phased vegetation establishment surveys. Photomonitoring of project progress will be conducted at least once every three years.

The desired outcomes for enhanced riparian habitat include:

- A minimum 20 acres over the life of the Rutherford Reach project (acres)
- An 80% survival of native plants at revegetation sites
- Greater than 90% native cover (less than 10% total non-native)
- Evidence of successful natural recruitment by year 5 at revegetation sites
- A 40% increase in seasonal refugia cover

See **Appendix D. Study XII. Vegetation Establishment Surveys** for the results from the following vegetation establishment surveys starting in the updated 2011 Monitoring Report.

- Direct Count Plant Survival and Vigor Survey
- Area Mapping Percent Cover and Composition Survey
- Transect Line Intercept Surveys

To date approximately 13.1 acres of riparian plantings have been installed throughout reaches 1 - 3 and approximately 18.1 acres or invasive and/or non-native plant species have been treated utilizing a combination or both mechanical and chemical methods. In general, percent survivorship for installed plantings has ranged from 75%-95% depending on specific restored/replanted location. Further details including vegetation health and vigor, plant survivorship, percent cover and invasive species management will be provided in the updated 2011 Monitoring Report as mentioned above.

XIII. Stakeholder Participation Documentation

The Rutherford Dust Restoration project is a landowner-initiated project. The leadership of the Rutherford Dust Restoration Team subcommittee of the Rutherford Dust Society, and the active participation in the Landowner Advisory Committee meetings have been central to the success of the restoration Project. Maintaining Landowner buy-in and active participation will remain a key element of project viability. Through community outreach, this private-public partnership can serve as a model for other communities. Documentation of participation levels will address the success of community engagement as the Project progresses.

The desired outcomes for stakeholder participation include:

- Continuation of at least 90% landowner participation in the Project.
- Continued landowner leadership, as evidenced via the Landowner Advisory Committee (LAC) and willingness to fill offices (Chair, Vice-Chair, and Secretary).

See **Appendix D. Study XIII. Stakeholder Participation Documentation** for a table detailing landowner participation in the Project.

Temporary Construction Easements and 20 year Maintenance Access Agreements have been signed by 100 % of the landowners in Phases 1-3, Reaches 1-4. Landowners who have undergone restoration construction since 2009 have continued to allow access for Project

Records of landowner maintenance requests are maintained by the Napa County Flood Control and Water Conservation District. Annual maintenance activities are reported in a separate Annual Channel Maintenance and Monitoring Report for the Rutherford Reach of the Napa River produced by the Napa County.

Following review and approval of the 30% restoration design plans, nine out of ten landowners in Reach 8have signed a Right of Access for Final Design agreement. In addition, Sequoia Grove has signed a Temporary Construction Easement.

Landowner Advisory Committee Meetings are held three times per year. Average attendance is 15 landowner representatives for the 28 properties participating in the Rutherford Reach Channel Maintenance Special Benefit Zone. Each Annual Maintenance workplans proposed by the District

based on the Annual Maintenance and Monitoring Survey and landowner requests have been passed by a majority vote each year.

Photomonitoring

Photomonitoring is conducted concurrently with the Annual Stream survey and at select locations pre- and post-construction. Photo-monitoring stations are established and re-occupied in the course of monitoring surveys to provide a visual record of progress. Site-specific monitoring of riparian revegetation sites will capture rates of survival and establishment and quantities of native relative to non-native vegetation. As air photos become available, and as the project budget allows, the riparian buffer width and stream network will be assessed and incorporated in the spatial database.

Photo-monitoring data for each phase of construction is published in the final report for each phase of construction. Reports have been completed for Phases 1 and 2, and copies are available at the County. Results of photomonitoring conducted at cross sections are available in **Appendix D. Study V.**

Complementary Monitoring

The project team coordinates with partner agencies responsible for complementary water quality, fish, and wildlife monitoring including the Water Board, RCD, and others and will encourage an active exchange of data and findings.

BMI Studies

Clayton Leal, a graduate student at San Jose State University, is conducting Pre- and Post-construction benthic macro invertebrate studies at selected sites on instream habitat structures installed in Phase 1b Reach 2. His results will be reported as an individual Master's Thesis.

Salmonid Monitoring

The Napa County Resource Conservation District conducts annual salmonid spawning, rearing and outmigration surveys they conduct in the mainstem Napa River with selected sites in the Rutherford Reach. Their annual reports are posted to the WICC website.

Natural Resource Projects Inventory

The Natural Resource Projects Inventory (NRPI) project survey form is completed for each Phase. It can be viewed at the following link: http://www.ice.ucdavis.edu/nrpi/project.asp?ProjectPK=12386

As-Built Drawings

As-Built drawings are available at Napa County Department of Public Works.

Conclusion

This Monitoring Report will be updated annually with results from studies conducted per the Project permits and the Monitoring Plan. To date, monitoring results indicate that the restoration is meeting or is on target to meet Project objectives. The next Annual Monitoring Report will be prepared by February 15, 2012.

Appendices