NAPA RIVER RUTHERFORD REACH RESTORATION PROJECT
2012 MONITORING REPORT

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Introduction

The purpose of this document is to report on the Project status and results of the Monitoring Program for the Napa River Rutherford Reach Restoration Project (the Project) conducted through July 2012. 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 4, encompassing Reaches 1-4, between the Zinfandel Lane and Rutherford Cross Road Bridges, and Reach 8 midway between the Rutherford and Oakville Cross Roads. Final design and permitting of Phase 5, Reaches 5, 6, 7 and 9 commenced in fall 2012. Construction of Phase 5 is planned for 2014.

Project Setting

The Napa River Rutherford Reach Restoration Project is being implemented along 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 funded by landowner assessments 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' 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 Napa County Flood Control and Water Conservation District 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 purposes of monitoring Project success, restoration goals are organized into four categories:

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

These goals are described in detail below:

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 amount 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 bank full (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

The pre-restoration condition of aquatic habitat within the Rutherford Reach in 2009 consisted of long runs and glides, with fewer deep pools, and occasional riffles. Pool depths typically exceeded 3 feet and occasionally reached a maximum depth of approximately 9 feet. When present, cover in the pools consisted 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 were present in runs and riffles compared to pools. Cover in these habitats consisted of undercut banks, overhead cover from riparian vegetation, and instream woody material. The predominant substrate in the reach was gravel and sand-sized particles, although more sand than gravel was commonly present. Median 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 was 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); a 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) bank full 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) bank full 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

Regarding the pre-restoration condition of riparian habitat in 2009, the species composition and the width and extent of the riparian corridor varied considerably throughout the Rutherford Reach depending on channel width, bank steepness, and adjacent land uses. In general, Reaches 1, 2, 3, and 5 supported the largest intact stands of mature riparian vegetation. Valley oak (Quercus lobata), coast live oak (Quercus agrifolia), and California walnut (Juglans hindsii) were the dominant species in these reaches. Reaches 3, 5, 6 and 7, where the wider channel permits development of bars and inset floodplain benches, supported extensive stands of Fremont cottonwood (Populous fremontii), white alder (Alnus rhombifolia), red willow (Salix laevigata), arroyo willow (Salix lasiolepis), yellow willow (Salix lutea), and sandbar willow (Salix exigua). Overstory vegetation was 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) were also found within the project area. The width of the riparian corridor (including vegetated areas along both banks) was greatest in Reach 1 (600 to 800 feet). The riparian corridor in Reaches 3, 5, 6, and 7 was also relatively wide, ranging from 250 to 400 feet in width. Reaches 2, 4, 8, and 9, which are confined by levees or adjacent land use, supported narrow bands of riparian vegetation (150 feet or less).

In many portions of the Rutherford Reach, the riparian understory was 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) were also pervasive throughout the project area. However, other areas supported 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 was not unusual to find areas dominated by native overstory and understory species. These areas of high native diversity were 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 was 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; establish a minimum 50' buffer to reduce disturbance to native wildlife and encourage migration; 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; 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; stabilize exposed soils using a hydromulch consisting of a native (or sterile) seed mix.

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 habitat 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

The Preliminary Design for the Project was 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 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 of the planned six construction phases. 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.

Phase 1a

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

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

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 18,000 - 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 3a

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 was completed 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 was Siteworks. The revegetation contractor was SMP Services.

Phase 3b

Phase 3b: Reach 4 west bank construction was completed in summer 2012, between river stations 12,000 and 16,000 on the Emmolo, Caymus (Mee prior to 2013), and Round Pond West properties, completing restoration construction on all properties between the Zinfandel Lane and Rutherford Cross Road Bridges, or 52% of the Project. The construction contractor was Team Ghilotti, Inc. The revegetation contractor was SMP Services.

Phase 4a

Phase 4a: Reach 8 north construction was planned for completion in summer 2012, between river stations 5,800 and 7,800 on the Sawyer (Foley Johnson), Sequoia Grove, and Wilsey properties, located midway between the Rutherford Cross Road and Oakville Cross Road Bridges. All planned work was completed as scheduled with the exception of work on the Foley-Johnson property due to a delay caused by PG&E relocation of a power pole within the grading footprint. This work is scheduled for completion in 2013. Construction of Phase 4a: Reach 8 north brings the project to 60% completion. The construction contractor was Siteworks. The revegetation contractor was Hanford ARC.

The restoration elements constructed in each construction phase (through Phase 4A) are summarized in the following section and in **Appendix C. Restoration Elements**.

Restoration Actions and Treatment Elements

Restoration actions and treatments are summarized below according to the specific project goals that they address:

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 Element Construction Summary 2009-2012

During the first four years of restoration construction from 2009-2012, 7,125 linear feet of inset floodplain benches, with a surface area of 12.3 acres, were constructed in Reaches 1,2,3,4 and 8. A total of 914 linear feet, with a surface area of 0.8 acres, of side channels were created: 325 feet at Bench 3 in Reach 3, and 589 feet at Bench 1 in Reach 8. In Reaches 2-4, 13,435 linear feet of berms and bank stabilizations areas were setback from the stream to widen the river channel. Riparian restoration planting covered 21.1 acres including constructed benches, bank stabilization areas and widened riparian corridors where berms were setback. Fifty-two (52) instream habitat structures, including large woody debris and boulder clusters, were installed through 2011 and assessed for habitat function in 2012.

Phase1a, Reaches 1-2 East Bank Restoration Elements

Graded Structures

Phase 1a was constructed in 2009 on the east bank of Reaches 1-2. 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 bank full 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 bank full 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. Fifteen total bench logs were installed to slow channel flow velocities and prevent erosion of the newly graded terraces until vegetation become established to provide root strength and roughness: Eight (8) bench logs were installed on the Guggenhime bench, and seven (7) bench logs were installed on the Quintessa bench.

Restored Riparian Habitat

2.49 acres of riparian habitat were restored in Phase 1a, Reaches 1-2 East Bank.

Phase1b, Reaches 1-2 West Bank Restoration Elements

Graded Structures

Phase 1b was constructed in 2010 on the west bank of Reaches 1-2. 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 on the Ranch Winery/Sutter Home property and functions as high flow backwater habitat. The first bank full 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 edge water habitat. The second bank full 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 bank full 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 edge water habitat.

Instream Habitat Structures

Eighteen (18)instream habitat structures were installed in Phase 1b, Reaches 1-2 West Bank, including twelve (12) bench logs placed perpendicular to the channel to slow flow velocity and curb surface erosion of the instream benches, three (3) spider logs, two (2) toe log structures, and one (1) boulder cluster. Five (5) bench logs were installed in the Ranch Winery/Sutter Home alcove, and one (1) on the Ranch Winery/Sutter Home terrace bench; three (3) bench logs were installed on the Frogs Leap bench, and three (3) 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, three (3) spider log structures of triangular stacks of cabled together logs were anchored to the channel bed at right (west) bank river station 22,000, and left (east) bank river stations 21,900, and 21,670. Two (2) 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 19,475-19,400 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

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

Phase 2, Reach 3 Restoration Elements

Graded Structures

Phase 2 was constructed in 2010 on both banks of Reach 3. Graded restoration elements in Phase 2: Reach 3 includes 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 325 linear feet 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. Bench 2 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 edge water 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 edge water 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 edge water habitat.

Instream Habitat Structures

Seven (7) instream habitat structures were installed in Phase 2, Reach 3, including two (2) terrace logs on the Carpy-Conolly property, and five (5) root wad structures keyed into trenches in the upstream and/or downstream end of the graded benches in Reach 3 with root wads extending into the channel. The root wad 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. Four (4) root wads were installed on the right (west) bank at river stations 17,700, 17,425, 17,350, 17,225, and 16,900 on Benches 1-3, and one (1) root wad was installed at left (east) bank river station 16,125 at the downstream end of Bench 5. 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

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

Phase 3a, Reach 4 East Bank Restoration Elements

Graded Structures

Phase 3a was constructed in 2011 on the east bank of Reach 4. Graded restoration elements in Phase 3a: Reach 4 East Bank include: four (4) instream benches and two (2) bank stabilization areas. Bench 7 spans 265 linear feet between left (east) bank river stations 15,840 – 15,575 on the Carpy-Conolly property. Bench 7 functions as edge water habitat. Bank Stabilization Area 1 spans 150 linear feet between left (east) bank river stations 14,450 – 14,300 on the Carpy-Conolly property. Bank Stabilization Area 1 functions as edge water habitat. Bank Stabilization Area 2 spans 75 linear feet between left (east) bank river stations 13,900-13,825 on the Honig property at the base of the confluence separating the Carpy-Conolly and Honig properties. Bank Stabilization Area 2 functions as high flow refugia. Bench 11 spans 230 linear feet between left (east) bank river stations 13,680 – 13,450 on the Honig property. Bench 11 functions as edge water habitat. Bench 13 spans 425 linear feet between left (east) bank river stations 13,150 – 12,725 on the Honig property. Bench 13 functions as a secondary channel. Bench 14 spans 190 linear feet between left (east) bank river stations 12,580 – 12,390 on the Round Pond east bank property. Bench 14 functions as an edge water habitat.

Instream Habitat Structures

Twelve (12) instream habitat structures were installed in Phase 3, Reach 4 east bank,: three (3) roots wads embedded in created instream benches, five(5) low profile log instream structures, and four (4) instream boulder clusters. The three (3) root wads, which have the trunk embedded in the bank and the root wad in the channel, were installed on the left (east) bank at river stations 13,070 on Bench 11, 12,800 on Bench 13, and 12,420 on Bench 14. The five (5) low profile logs, which have the root wad embedded in the bank and the canopy in the channel, were installed on the left (east) bank at river stations 13,650 and 13,590 on Bench 11, 12,990 and 12,850 on Bench 13, and 12,550 on Bench 14. The four (4) boulder clusters were installed in the river channel at river stations 13,050, 12,950, 12,825 and 12,400.

Restored Riparian Habitat

5.0 acres of riparian habitat were restored in Phase 3a: Reach 4 East Bank.

Phase 3b, Reach 4 West Bank Restoration Elements

Graded Structures

Phase 3b was constructed in 2012 on the west bank of Reach 4. Graded restoration elements in Phase 3a: Reach 4 West Bank include: five (5) instream benches and one (1) bank stabilization area. Bench 6 spans 325 linear feet between right (west) bank river stations 16,125-15,800 on the Emmolo property. Bench 6 functions as edge water habitat. Bench 8 spans 200 linear feet between right (west) bank river stations 15,275-15,075 on the Emmolo property. Bench 8 functions as edge water habitat. Bench 9 spans 70 linear feet between right (west) bank river stations 14,085-14,015 on the Caymus (Mee prior to 2013) property. Bench 9 functions as edge water habitat. Bench 10 spans 415 linear feet between right (west) bank river stations 13,915-13,500 on the Caymus (Mee prior to 2013) property. Bench 10 functions as edge water habitat. Bench 12 spans 200 linear feet between right (west) bank river stations 13,300-13,100 on the Round Pond west bank property. Bench 12 functions as edge water habitat. Bank Stabilization Area 3 spans 260 linear feet between right (west) bank river stations 12,800-12,540 on the Round Pond west bank property. Bank Stabilization Area 3 functions to protect the Colinas Farming Shop building and as edge water habitat.

Instream Habitat Structures
Instream habitat structures installed in Phase 3b Reach 4 west will be reported in the next Annual Monitoring Report.

Restored Riparian Habitat
5.2 acres of riparian habitat were restored in Phase 3a: Reach 4 West Bank.

Phase 4a, 8 North Bank Restoration Elements

Graded Structures
Phase 4a was constructed in 2012 on both sides of the channel at the north end of Reach 8. Graded restoration elements in Phase 4a: Reach 8 north include: one (1) instream bench, one (1) linear wetland secondary channel, and two (2) bank stabilization areas. Bench 1 spans 600 linear feet between left (east) bank river stations 7,100-6,500 on the Wilsey property. The bench contains a 589 feet long constructed linear wetland. The bench and wetland function as a secondary channel, backwater, and wetland habitat. Construction of Bank Stabilization Area 1 on the Foley (Sawyer prior to 2012) property planned for 2012 between right (west) bank stations 7,625-7,300 was postponed until 2013 to accommodate the relocation of a PG&E power pole. Bank Stabilization Area 2 spans 300 linear feet between right (west) bank river stations 6,825-6,525 on the Sequoia Grove property. Bank Stabilization Area 2 functions as edge water habitat. Bank Stabilization Area 3 spans separate nodes along 600 linear feet between left (east) bank river stations 6,400-5,800 feet on the Wilsey property.

Instream Habitat Structures
Instream habitat structures installed in Phase 4a Reach 8 north will be reported in the next Annual Monitoring Report.

Restored Riparian Habitat
2.7 acres of riparian habitat were restored in Phase 3b: Reach 4 West Bank.

Monitoring Approach

The Monitoring Program framework links project objectives to proposed monitoring elements based on the understanding of process-based relationships between existing conditions and restoration techniques aimed at achieving desired outcomes. 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. Each desired outcome has defined specific performance indicators and standards. Project success will be evaluated by quantifying progress towards meeting performance standards over the life of the project. The monitoring components and schedule is described first and then existing conditions, restoration treatments, desired outcomes, monitoring indicators, and performance standards by monitoring category are addressed.

The Monitoring Program has four 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 of the performance of the instream habitat structures at representative seasonal flows; 3) repeat detailed channel transect and longitudinal profile surveys are conducted pre-construction and following significant flow events to capture long term habitat response, and, 4) phased vegetation surveys. These field survey elements are complemented with 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.

A Before/After Control/Impact (BACI) approach is being applied 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 similarly organized into the four categories of study to address progress towards meeting stated project goals with related parameters for measurement as described below:

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/or 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 bank full 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 bank full 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 bank full 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
- A 40% increase in seasonal refugia cover

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, and 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 the thirteen individual monitoring studies are provided in **Appendix D**. 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 – 2012.

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 in Reaches 1-3, and surveyed velocities on instream benches installed on the east bank of Reach 4 in winter 2012. 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 bank full 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.

Performance Standard

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.

Progress Towards Standard

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. 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 2012, 4,543 feet of channel banks were mapped as eroding or unstable throughout the Rutherford Reach. This constitutes 9% of the channel bank length in the Rutherford Reach. This is a reduction of 69% compared to the 2009 baseline with 40% of the 4.5 mile Rutherford Reach Restoration Project complete.

A minimum further reduction of 843 linear feet in total eroding bank length is required to meet the project goal of 75% reduction of eroding banks since 2009. Continued implementation of Project construction through Reach 9 is expected to result in reduction of eroding stream banks exceeding the Project goal.

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).

Performance Standard

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.

Progress Towards Standard

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 1-3, and 4a in Reaches 1-4, and Reach 8 north, which constitutes 60% of the 4.5 mile Project Reach, from 2009-2012 reduced fine sediment source loading by an estimated 10,154 metric tons/year for the next 20 years, or 53% of the total TMDL target reduction for the Napa River watershed from mainstem channel incision and bank erosion sources.

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.

Performance Standard

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.

Progress Towards Standard

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 (pre-Project) longitudinal profile thalweg survey of the entire Rutherford Reach was completed in 2006, 2009 and 2010. Trends in channel bed incision rates will be evaluated once the longitudinal surveys have been reoccupied 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. Comparison of the pre- and post- 2005 flood surveys provides insufficient data to draw any definitive conclusions regarding the ongoing rate of channel incision, largely because the 2004 segments did not extend over the entire 4.5 mile reach. Comparison of the pre-project longitudinal profile with a longitudinal profile conducted after project completion, and following future channel forming flood flows, should provide a better indication of whether channel incision is continuing throughout the reach.

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.

Surveys at monitoring transects are before and after the construction of each phase. 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.

Performance Standard

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

- Positive trends in increases in bank full channel width to depth ratios

Progress Towards Standard

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 monitoring cross sections surveyed in 2004 were reoccupied and resurveyed following the flood from 2008-2009 to measure changes in channel geomorphology resulting from the 2005 New Year's Flood, which was the highest magnitude flood on record for the Rutherford Reach. 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 3 in 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 in 2012, Cross sections will be surveyed prior to construction in the remaining reaches 5,6,7 and 9 in-2013.

Widening of the channel as a result of construction of instream benches, bank stabilization areas and setback berms is increasing the bank full channel width to depth ratio in restored reaches. Trends in bed and bank erosion rates, and in increases in bank full channel width to depth ratios, will be analyzed once the monitoring cross sections have been reoccupied following restoration construction and the pre- and post- construction transects are compared.

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 location of the survey is adjusted to capture the grain size distribution at the new location of the riffle crest for a more accurate comparison.

Performance Standard

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).

Progress Towards Standard

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

Pebble counts have been conducted at monitoring cross sections prior to construction in Phase 1-4, in Reaches 1-4, 7 and 8, and substrate was mapped along the longitudinal profile of the Rutherford Reach in 2009 and 2010. In 2011, pebble counts were resurveyed at six of the fourteen monitoring locations in Reaches 1-4 upstream of the Rutherford Cross Road. Also in 2011, downstream of the Rutherford Cross Road, in Reaches 5-9, where no restoration had yet taken place, two of the eleven existing sample sites were resampled. In 2001 four new pebble count locations were surveyed as a baseline prior to restoration construction in Reach 8.

18,300 cfs Annual Peak Flood Flow 2005

Particle counts taken before and after the 2005 flood in 2004 and 2005, and again in 2008 and 2009, showed no discernible trend in median particle size D50 in the narrow reach upstream of the Rutherford Cross Road in Reaches 1-4. Downstream of the Rutherford Cross Road, in Reach 5-9, the D50 generally increased, indicating a slight coursing of the stream channel. Comparison of the D84 particle size, which is utilized to model sediment transport, pre- and post- flood, show an overall coarsening of the channel in all reaches.

Pre- and Post-Restoration

Comparison of pebble counts taken at monitoring cross sections in 2009 and 2011 pre- and post-construction of Phase 2: Reach 3 in 2010 demonstrate that a new gravel bar formed at river station 16,300 on the east bank opposite Carpy-Conolly Bench 5. The gravel bar that was sampled in 2009 at station 16,422 prior to construction of Carpy-Conolly Bench 4, at east bank river stations 16,725-16,475, and Carpy-Conolly Bench 5, at east bank river stations 16,350-16,100, no longer existed in 2011. It is likely that the widening of the channel at Bench 5 slowed velocities sufficiently to cause the gravel that was mobilized from the bar between the two benches 122 feet upstream, where the channel width was unchanged, to deposit as a new bar. Sampling of the new downstream bar in 2011, which set up on the opposite west bank, shows that the median grain size increased from D50=16mm to D50=32mm, and the D84 increased from 32mm to 45mm following the 2011 peak flow event of 7,330 cfs. Significantly, not only did the gravel bed coarsen from 2009, but the percentage of fines in the new bar decreased from 17% to 1% of the sample. The reduction of fines in the gravel might be attributed to the fact that sand and finer sediments can now escape the incised low flow channel and deposit on the restored benches at relatively low flows (less than a 10 year recurrence interval). The sandbar, which accumulated on the new Carpy-Conolly Bench 5 adjacent to the bar, provides further evidence of this hypothesis that instream bench creation in serving to reduce the percent of fines in spawning gravel.

The gravel bar at station 13,050 also coarsened and contained a lower percentage of fines following construction of Phase 3: Reach 4 East Bank Honig Bench 13 between stations 13,150-12,725 in 2011. Following the peak flow event of 7,330 in 2011, comparison of pebble counts from 2010 and 2011 show a coarsening of the bar at station 13,050, with an increase in the D50 from 11mm to 22mm, and an increase in the D84 from 32mm to 45mm. The percentage of fines in gravel on the bar decreased markedly from 30% to 2%. Like Bench 5 upstream, Honig Bench 13 had also accumulated sand.

Pebble counts in taken in 2009 and 2011 in other restored and untreated locations show no conclusive trend in the coarsening of the channel in the overall Project reach. In addition, while the sampled bars in Reaches 1-4 showed a reduction of percent fines where the channel had been widened as part of restoration, an unrestored section of channel downstream of the Rutherford Cross Road at station 7,700 also showed a decreased in fines from 39% to 12%. The widening of the channel at restoration sites may be a contributing factor to the formation of bars, the coarsening of the channel, and the reduction of fines in the gravel bars, however, the degree to which has not yet been determined.

Particle counts taken in 2008-2012 will be compared against particle counts taken following construction to assess the effect of widening the channel in Reaches 1-4 which were restored from 2009-2012, as well as in the northern section of Reach 8, which was restored in 2012. These reaches will have undergone a minimum peak flow of 9,628 cfs in the winter of 2012-2013.

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.

Performance Standard

The desired outcomes for spawning gravel permeability include:

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

Progress Towards Standard

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 RCD is conducting permeability studies as well as scour chain studies again in the Rutherford Reach in the winter of 2012-2013. Spawning gravel permeability 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.

According to staff of ESA PWA, gravel deposits can generally be characterized as being "forced" or "free". In the first case, "forced bars" are locked in position by some structural element within the river corridor or by a relatively wide expansion. The second case, "free bars" are transient features that represent an inability of the flow field to effectively route sediment through the course of sediment and water loading to the river corridor.

The ESA PWA Basis of Design for the Project relies on the findings by staff members that locally wide channel areas fix riffle crest locations. For the Napa River, we can hypothesize that bench widening may increase riffle persistence at those locations. However, different benches have varying relative widths so it remains to be seen if any of the benches are wide enough to create forced bars and in the process persistent riffles.

ESA PWA staff also observed that in Reaches 5-9 downstream of the Rutherford Cross Road there is more sediment being deposited in the areas where the floodway width is wider, as would be expected. White also observed many of the pool and riffle locations in these depositional areas to be forced by local scale objects such as large wood, exposed roots, and boulder clusters (rip-rap). He expects to see increased sediment deposition where benches are created to widen the channel, with the number of riffle crest (and corresponding pool) occurrences being more related to the number of forcing elements in the stream.

Tessera Consulting and staff from the Napa County Resource Conservation District and California Land Stewardship Institute noted that a number of the riffle crests in the Oakville to Oak Knoll Reach mapped in October 2012 downstream were bedrock controlled. By contrast, very few riffle crests in the Rutherford Reach can be attributed to bedrock control, and are limited to Reach 3 upstream of the Rutherford Cross Road.

Performance Standard

The desired outcome for increased complexity in channel morphology includes:

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

Progress Towards Standard

Jones & Stokes mapped a total of 155 gravel bars in the 4.5 mile Rutherford Reach in 2004, 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, a map of the distribution of riffle crests mapped in 2009-2010 in concert with the survey of the longitudinal profile, and GPS points of riffle crests mapped coincident with the annual river surveys conducted in 2011-2012. 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 multiple riffle crest mapping surveys.

Riffle crest distribution was first mapped during the Annual Stream Maintenance and Monitoring Survey in June 2011 using a GPS. The riffle crests will continue to be mapped with GPS annually each June as a cost effective means of providing a continuous data set of riffle distribution until the longitudinal profile is resurveyed. These data sets can be compared against the 2008/2009 baseline study, as well as against high points in the 2009/2010 and subsequent longitudinal thalweg profiles to evaluate changes in riffle crest frequency and distribution. Starting in June 2011 we standardized the riffle crest GPS mapping protocol to consistently record the topographic high points in the stream thalweg profile, using professional judgment as to whether the high point constitutes an apex of a gravel bar and whether the fisheries biologist believes that it is a likely locations to be used as salmonid spawning location. We use the gage at Pope Street Bridge upstream to record the base flow at the time of mapping. The riffle crest mapping data from June 2012 can be augmented by the mapping of riffle crests in the Oakville to Oak Knoll Reach, which the Napa County Resource Conservation District staff conducted in concert with the California Land Stewardship Institute in October 2012.

Of the 155 bars mapped in 2004, 40% were located in Reaches 1-4, and 60% of the bars were located in Reaches 5-9. Each of these river reach segments is 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. Subsequent riffle crest mapping from 2009-2012 is consistent with this finding.

From 2010 to 2012 riffle crest density has been decreasing in the overall Project Reach, however, riffles have been created or augmented in restored Reaches 1-4. There remains a consistently lower concentration of riffle crests in Reach 4 relative to the remainder of the Project Reach, however, the channel widening in Reach 3 precipitated formation of a new gravel bar in association with Carpy-Conolly Benches 4 and 5, and the widening in Reach 4 precipitated formation of a new bar in association with Honig Bench 13 (See Section VI. Pebble Counts). The channel widening at Reach 3 Caymus Bench 3 has also caused augmentation of an existing bar.

The detailed long profile in 2009-2010 mapped 101 riffle crests, for a project density of 21 riffle crests per mile along the Rutherford Reach. In 2011, the density of riffle crests mapped with GPS during the annual survey was 14 riffle crests per mile, and in 2012 that density decreased to 13 riffle crests per mile. The density of riffle crests in treated Reaches 1-3 decreased from 2011-2012, however the newly formed riffle crest increased the density of riffle crests in treated Reach 4. We hypothesis that the large 80 year flood of 2005 delivered a lot of gravel, which has been being redistributed throughout the Rutherford Reach, but that the decreasing number of riffles may indicate that no significant pulse of supply has taken place since that flood. Examination of the riffle crests plots suggest that a pulse of gravel is traveling through the Project Reach in that, from June 2011-2012, riffle crest density decreased in Reaches 1-4 from 46 to 37 riffle crests per mile, while riffle density increased in downstream Reaches 6-8 from 63 to 74 riffle crests per mile.

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.

Performance Standard

The desired outcome for residual pool depth includes:

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

Progress Towards Standard

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 was 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 were surveyed for the first time in June 2011 in Reaches 1-2. The residual pool depths associated with low profile log structures, which were first installed in 2011 in Reach 4, were surveyed for the first time in June 2012. Residual pool depths were not measured at bench logs installed on created terraces above the bank full channel. The following table summarizes measured residual pool depth associated with LWD structures in 2011 and 2012.

Residual Pool Depth Measurements 2011-2012

River Station	Bank	Type	Label	Residual Pool Depth (Feet) 2011 3.4-27.0 cfs	Residual Pool Depth (Feet) 2012 6.4-7.1 cfs
22000	Right	Spider Log	WD-22200-R	1.44	NM
21900	Left	Spider Log	WD-21900-L	4.44	NM
21850	Right	Toe Log	WD-21850-R	1.88	NM
21670	Left	Spider Log	WD-21670-L	2.48	NM
19475	Left	Toe Log	WD-19475-R	NM	NM
17700	Right	Root Wad	WD-17700-R	0.16	NM
17425	Right	Root Wad	WD-17425-R	2.16	NM
17225	Right	Root Wad	WD-17225-R	NM	NM
16900	Right	Root Wad	WD-16900-R	NA	NM
16125	Left	Root Wad	WD-16125-L	NA	2.56
13650	Left	Low Profile Log	WD-13650-L	NA	1.25
13590	Left	Low Profile Log	WD-13590-L	NA	1.58
13070	Left	Root Wad	WD-13070-L	NA	0.03
12850	Left	Low Profile Log	WD-12850-L	NA	NM
12800	Left	Root Wad	WD-12800-L	NA	1.30
12550	Left	Low Profile Log	WD-12550-L	NA	NM
12420	Left	Root Wad	WD-12420-L	NA	1.93
12990	Left	Low Profile Log	WD-10990-L	NA	NM

NM-Not Measured

NA-Not Applicable / Not Yet Installed

Stream flow measured at the USGS Gage approximately 1100 feet upstream from the Zinfandel Lane Bridge at the upstream end of the Rutherford Reach.

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.

Performance Standard

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

- A 75% persistence of installed instream habitat enhancement structures.
- A 40% increase in seasonal refugia cover

Progress Towards Standard

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

Installed Instream Habitat Structures

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 any structure.

Large Woody Debris (Installed and Naturally Occurring)

The trend in naturally recurring LWD was downward from 2010 to 2012 ranging from 186 to 142 occurrences. The installation of 55 instream structures from 2009-2011 increased the total number of overall LWD occurrences to 194 in 2012. In 2012, the installed habitat structures in reaches 1-4 provided an increase in seasonal refugia cover of 37 % over what would have been provided that year by naturally occurring LWD.

From 2010-2012, the largest concentration of naturally occurring LWD was mapped 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, where the east bank is hardened with a concrete wall. 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. In 2010, 2011, and 2012, LWD concentrations in Reach 7 were 81/mile, 73/mile and 34/mile respectively, while in Reach 8 concentrations were 59/mile, 40/mile and 34/mile in 2010, 2011, and 2012 respectively.

A LWD jam that has persisted from 2009-2012 is located at station 19,390, 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. Construction of the benches reduced the constraint imposed by the jam on the channel, and has precluded the need to remove the jam to reduce bank erosion. The jam has thinned since 2009 but a piece of live downed wood continues to sprout and grow across the channel.

Over the long term, the adopted management strategy to preserve naturally occurring LWD and the further addition of LWD through continued project implementation is expected to result in meeting overall Project goals.

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.

Performance Standard

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 bank full benches.

Progress Towards Standard

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 2009-2011, one alcove and 10 instream benches were constructed in Reaches 1-4 (of 9 Total Project Reaches). Results from the velocity monitoring studies conducted by RCD staff during one winter event each in 2011 and 2012 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 all instream bank full 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

Vegetation installed in riparian restoration areas will be monitored the first three establishment years by the contractor that installed the plants in each phase of the Project. 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.

Performance Standard

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

Progress Towards Standard

See **Appendix D. Study XII. Vegetation Establishment Surveys** for the results from the vegetation establishment surveys, which were first reported in the 2012 Monitoring Report.

Revegetation of Reaches 1 and 2 began following restoration construction in 2009-2010, and in Reach 3 in 2010. Summary results of the vegetation surveys show that direct count survival of installed woody and herbaceous vegetation in Reaches 1 through 2 was greater than 85% after 2-3 years, which is consistent with Project goals and performance standards for vegetation survivorship. Survivorship for Reach 3, however, was 52% or greater after 2 years. Observed reasons for low survivorship and adaptive measures to increase survivorship at Reach 3 east bank are detailed in section 4.2 of **Appendix D. Study XII Vegetation Establishment Surveys**.

Vegetation area mapping currently indicates that combined vegetative cover (herbaceous and woody) at restored sites in Reaches 1-3 is approximately 67%, while un-vegetated ground comprises 33% of the cover type. Additionally, results indicate that approximately 18% of the cover in restored areas is comprised of non-native species while the remaining 82% cover is native. While this metric is not yet consistent with the Project goal/performance standard of greater than 90% native cover, it is expected to be achieved over the long-term life of the Project (20 years).

Line intercept transects surveys at any given restoration site indicate that approximately 74%-84% of installed vegetation is between 0-3’ in height while the remaining 16%-26% is approximately 3-15’ high. This range in vegetation size class is generally considered typical of a newly planted site (< 3 years) and is expect to increase at a normal trajectory under typical growing conditions.

In conclusion, with site specific and general monitoring taking place at regular occurrences and informing adaptive management decisions at restoration sites, it is expected that the Project goals and performance measures will be achieved over the life of the Project.

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 has 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.

Performance Standard

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).

Progress Towards Standard

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 1-4, Reaches 1-4, and 8. Landowners who have undergone restoration construction since 2009 have continued to allow access for Project.

All 30 landowners included in the Channel Maintenance Assessment District receive annual reports of channel survey findings, and requests for channel maintenance. 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 Flood Control District.

Landowner Advisory Committee Meetings are held twice times per year. The meetings have had in-person representation of approximately one third of the 30 properties included in the Maintenance Assessment District. Each Annual Maintenance Work plan proposed by the District based on the annual maintenance and monitoring survey and landowner requests has been approved by a majority vote of the attending landowners 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.

Database Tracking

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. Napa County also uploads project data to Wetland Tracker for each Project phase at the following website: http://www.californiawetlands.net/tracker/. Each year, Napa County completes and submits the State Water Resources Control Board Annual Sediment Load Reduction Form, including BMPs implemented. Additionally, background information, monitoring reports and data can also be viewed on the Napa County Watershed Information Center Conservancy: http://www.napawatersheds.org/app_folders/view/3577.

Conclusion

To date, monitoring results indicate that Project restoration actions are meeting or are on target to meet the Project goals outlined in Project permits and monitoring documents. The goal of reducing excessive fine sediment loads is being met annually by both the stabilization and re-vegetation of eroding stream banks and by the removal of large sources of fine sediment from unstable stream banks within the active channel. Long term monitoring will indicate whether the goal of reducing channel incision and bank erosion in order to decrease sediment load is being met. Preliminary results indicate that channel complexity has also increased by widening and reconfiguring the active channel, as evidenced by the creation of new gravel bars, and augmentation of existing bars. Preliminary monitoring results demonstrate that installed instream structures are promoting pool scour and creating associated cover for salmonids. Recruitment of gravel with a low percentage of fine sediment is also providing suitable spawning habitat. Velocity monitoring has begun to demonstrate that areas that have been graded to create slow water rearing habitat for salmonids are functioning as designed. Long term monitoring will continue to document and support the emerging trend of persistent large woody debris structures, both naturally recruited and installed structures, as well as the relative percentage of installed structures versus naturally recruited LWD. Monitoring is also designed to demonstrate if gravel is continuing to be recruited and maintained as a result of the Project and if bar density is increasing within the Project reach.

Riparian habitat continues to be enhanced and expanded in the short term as a result of the Project through implementing restoration actions such as the removal of non-native invasive plant species and the creation of vineyard setbacks followed by subsequent replanting with native over and understory species throughout the Project reach. Short term revegetation monitoring has demonstrated that restoration plantings are successfully establishing and naturally recruiting within the Project reach. Continued adaptive management of the restored areas funded by the Channel Maintenance Assessment will ensure non-native plants and installed native vegetation is managed and monitored for success over the long term resulting in a more resilient native riparian corridor. Stakeholder participation has been robust. Continued outreach by Napa County will ensure that this private-public partnership serves as a model for protecting and managing natural resources in coordination with the productive uses of property.

This Monitoring Report will be updated annually with results from studies conducted per the Project permits and the Monitoring Plan.

Appendices

NAPA RIVER RUTHERFORD REACH RESTORATION PROJECT

2011-2012 MONITORING REPORT

Appendices
Monitoring Studies and Project Summaries

February 2013

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A. Regulatory Permit Summary

Regulatory Permit Summary

Permitting Agency	Agency Contact	Permit Number	Permit Expiration
Permits Obtained for Entire Project			
U.S. Army Corps of Engineers (Corps), San Francisco District 1455 Market Street San Francisco CA 94103-1398	Sahrye Cohen	2008-00366N Covers entire project	July 20, 2019 Extension may be granted if requested at least one month before expiration
U.S. Fish and Wildlife Service (USFWS or Service), Sacramento Office 2800 Cottage Way, Room W-2605 Sacramento CA 95825-1846	Ben Solvesky	81420-2009-F-0266-1 Biological Opinion for entire project: California freshwater shrimp California red-legged frog	Expires upon completion of the project
NOAA-NMFS, Southwest Region 325 Sonoma Avenue, Room 325 Santa Rosa CA 95404-6515	Joshua Fuller	Tracking Number 2008/08010 Biological Opinion for entire project: Central California Coast steelhead	2019
Permits Obtained by Implementation Phase			
San Francisco Bay Regional Water Quality Control Board (RWQCB) 1515 Clay Street, Suite 1400 Oakland CA 94612	Ann Riley	Phase 1: Reaches 1 and 2 Site No. 02-28-C0338 CIWQS Place No. 735511	2019
		Phase 2: Reach 3 Site No. 02-28-C0338 CIWQS Place No. 735511	2020
		Phase 3: Reach 4 Site No. 02-28-C0377 CIWQS Place No. 763994	2021
		Phase 4: Reach 8 CIWQS Place No. 7780033	2022
California Department of Fish and Game (DFG), Bay Delta Region PO Box 47 Yountville CA 94599 7329 Silverado Trail Napa CA 94558	Suzanne Gilmore	Phase 1: Reaches 1 and 2Notification No. 1600-2009-0206-3	December 31, 2013
		Phase 2: Reach 3 Notification No. 1600-2010-0021-R3	December 31, 2014
		Phase 3: Reach 4 Notification No. 1600-2011-0036-R3	December 31, 2014

B. Restoration Reaches, Phases, and Construction Schedule

Restoration Reaches, Phases, and Construction Schedule

The Rutherford Reach of the Napa River spans between river stations 0 and 24,857, starting at the Oakville Cross Road Bridge and extending upstream to the Zinfandel Lane Bridge. As of the writing of this document, the anticipated schedule for the construction of the Napa River Rutherford Reach Restoration Project is as follows:

Construction Phase	Reaches	River Stations	Year
Zinfandel Lane Bridge	**Upstream Limit Project Reach**	**24,857**	
Phase 1-East Bank	Reach 1 and 2	24,857 – 21,875 - 18,000	2009
Phase 1-West Bank	Reach 1 and 2	24,857 – 21,875 - 18,000	2010
Phase 2	Reach 3	18,000 - 16,000	2010
Phase 3A-East Bank	Reach 4	16,000 - 12,000	2011
Phase 3B-West Bank	Reach 4	16,000 - 12,000	2012
Rutherford Cross Road Bridge	**Middle of Project Reach**	**12,000**	
Phase 4A-North	Reach 8	7,800 - 5,800	2012
Phase 4BC-South	Reach 8	6,400 - 3,400	2013
Phase 5	Reach 9	3,400 - 0	2014
Phase 6	Reach 5	12,000 - 11,000	2014
Phase 6	Reach 6	11,000 – 9,200	2014
Phase 6	Reach 7	9,200 - 7,800	2014
Oakville Cross Road Bridge	**Downstream Limit Project Reach**	**0**	

C. Restoration Elements

Napa River Rutherford Reach Restoration Elements Summary

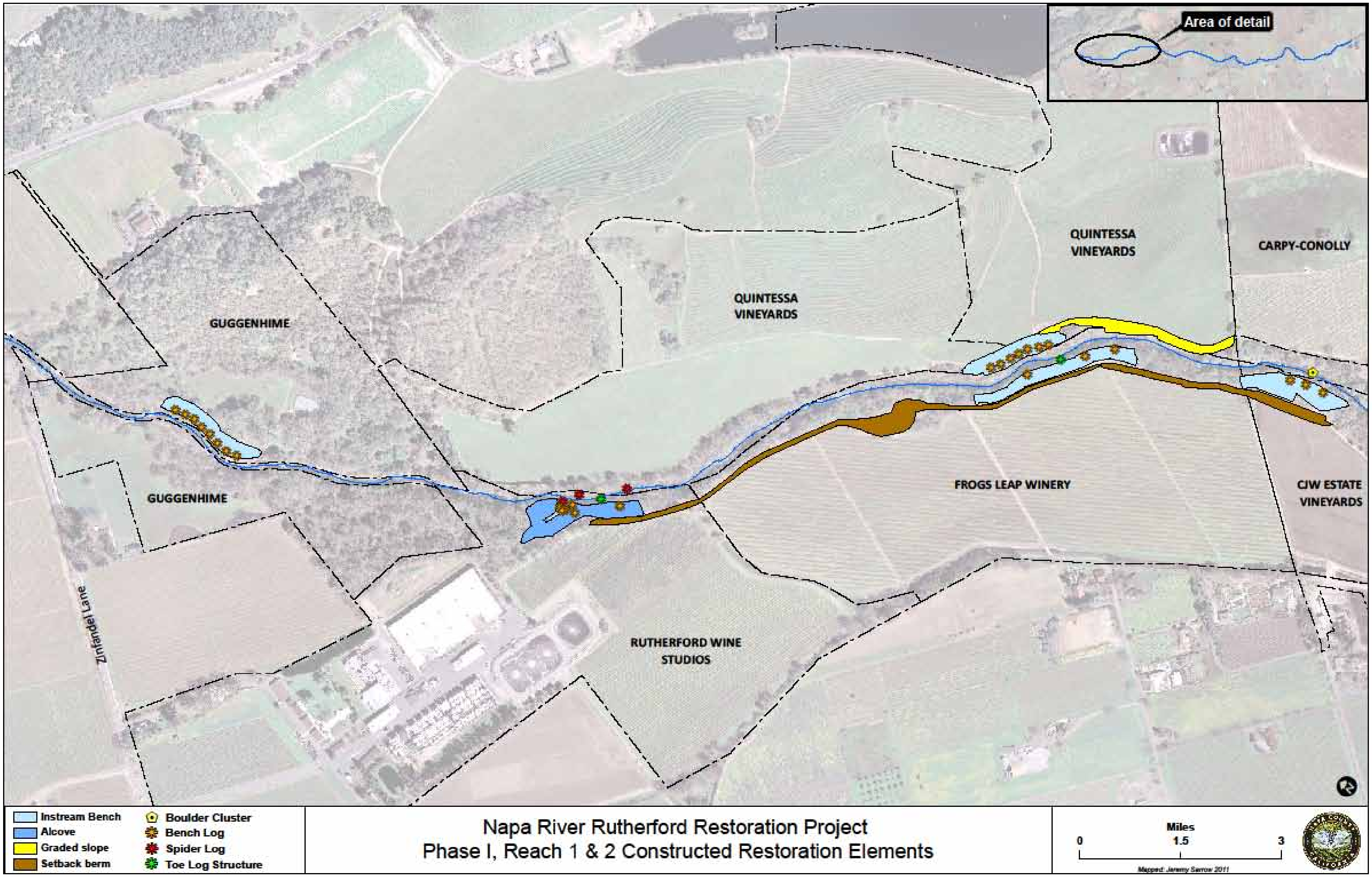
Construction Years: River Reaches (of 9 Total Reachs):		2009 Reach 1	2009- 2010 Reach 2	2010-2011 Reach 3	2010-2012 Reach 4	2012* Reach 8 North	2009-2012 Total
River Stations (Feet upstream from Oakville Cross Road)		**24,857-21,875**	**21,875-18,000**	**18,000-16,000**	**16,000-12,000**	**7,800-5,800**	**24,857-5,800**
Length of inset floodplain benches constructed	Linear Feet	518	2,160	982	3,010	505	**7,175**
Area of inset floodplain benches constructed	Acres	0.8	3.1	1.7	5.6	1.2	**12.3**
Length of side channels and/or alcoves created or reconnected	Linear Feet	325	0	0	0	589	**914**
Area of side channels and/or alcoves created or reconnected	Acres	0.7	0.0	0.0	0.0	0.1	**0.8**
Length of set back berms and bank stabilization areas constructed	Linear Feet	-	3,565	1,205	8,665	-	**13,435**
Number of Instream Habitat Structures Installed: Large Woody Debris (LWD) & Boulder Clusters (BC)	Number	15	18	4	15	19	**71**
Riparian Area Replanted** (BSSR + Widened Riparian Area + Instream Bench)	Acres	1.5	4.5	2.2	10.2	2.7	**21.1**

January 31,2013.

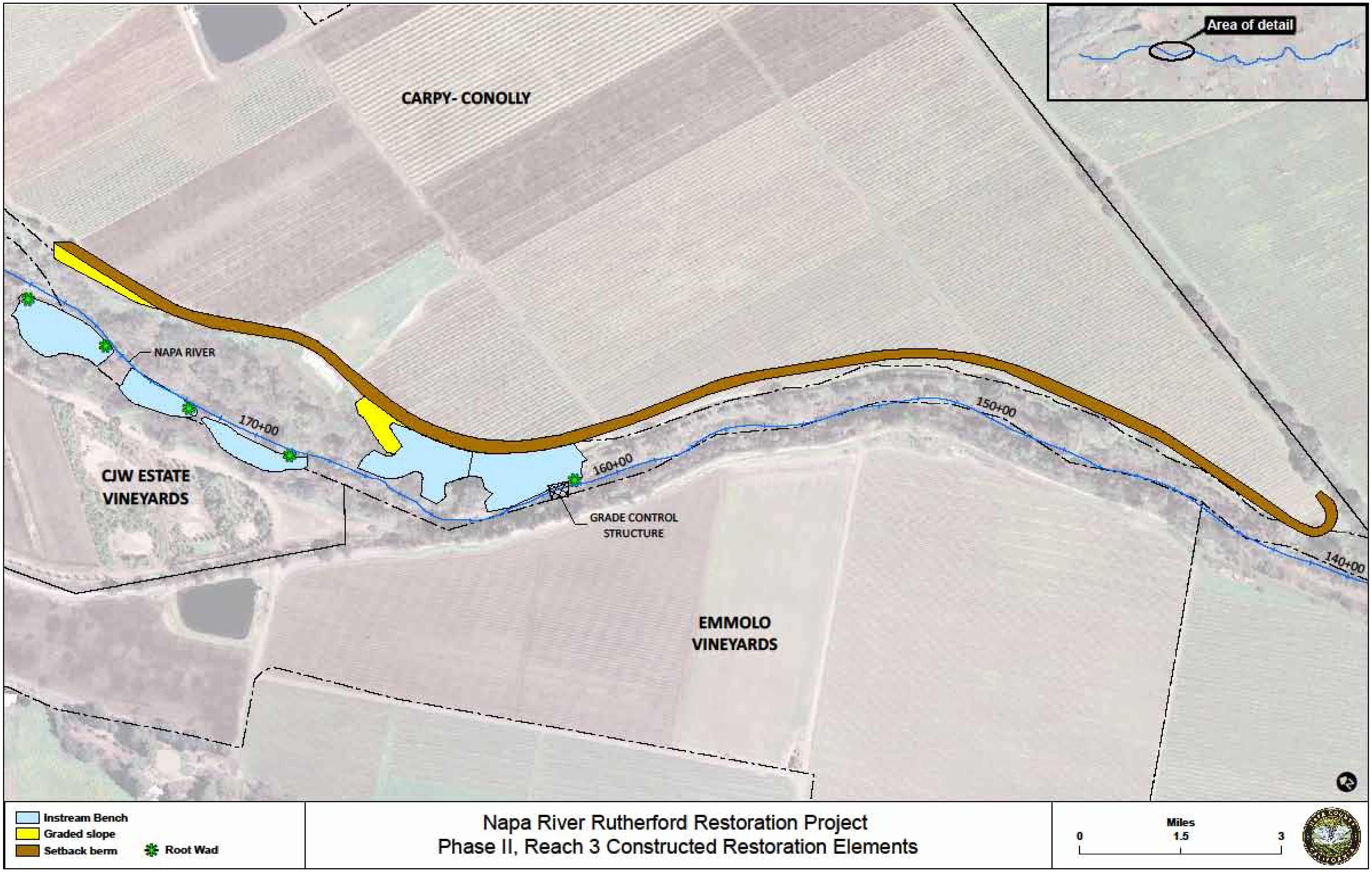
*2009-2011 data calculated from 2012 air photos and as as-built surveys; 2012 data estimated from construction specifications.

**Riparian area replanted with container and plug stock only; does not include graded areas that were hydroseeded only.

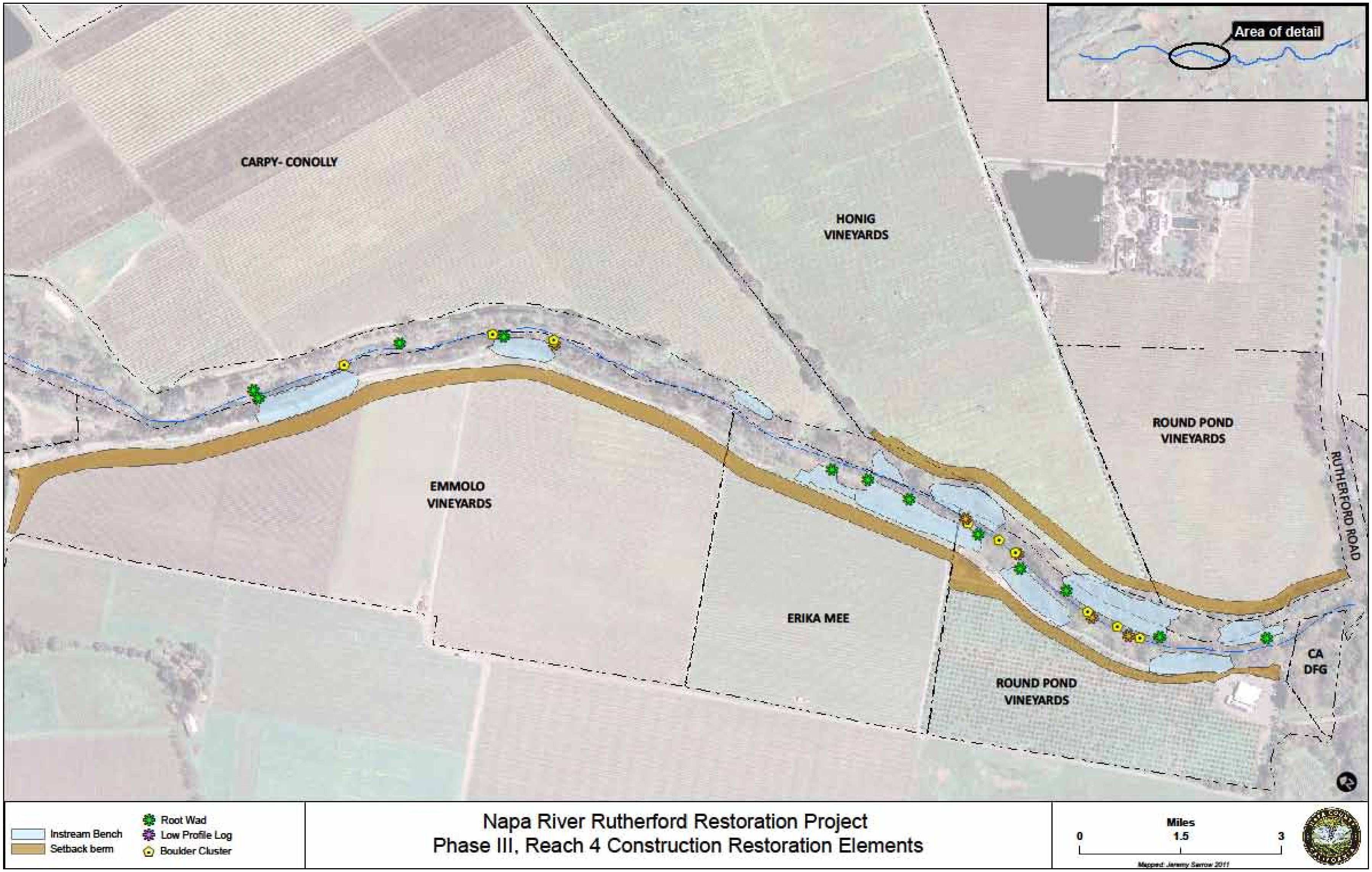
Source: Jeremy Sarrow, Napa County Flood Control and Water Conservation District; Gretchen Hayes, Tessera Sciences; ESA PWA.



Napa River Rutherford Restoration Project
Phase I, Reach 1 & 2 Constructed Restoration Elements



Napa River Rutherford Restoration Project
Phase II, Reach 3 Constructed Restoration Elements



Napa River Rutherford Restoration Project
Phase III, Reach 4 Construction Restoration Elements

Restoration Elements: Graded Habitat Features: Cumulative Channel Length Restored

Year	Design Phase	Subreach	Designer	Upstream River Station	Downstream River Station	Channel Length by Phase	Channel Length Cumulative	Project Completion
	Graded Structure	**Parcel**	**Bank**	(feet)	(feet)	(feet)	(feet)	(%)
2009	**Phase 1a**	**Reaches 1-2 East Bank**	**ICF JAS, RSA**	**24,857**	**18,000**	**6,857**	**6,857**	**28%**
	Bench	Guggenhime	Left / East	23,950	23,450			
	Bench	Quintessa	Left / East	20,000	19,400			
	Bank Stabilization	Quintessa	Left / East	19,400	18,600			
2010	**Phase 1b**	**Reaches 1-2 West Bank**	**ICF JAS, NHC**	**24,857**	**18,000**	**6,857**	**6,857**	**28%**
	Alcove	Ranch /Sutter Home	Right / West	22,225	21,875			
	Bench	Ranch /Sutter Home	Right / West	21,875	21,625			
	Bench	Frogs Leap	Right / West	19,900	19,100			
	Bench	Caymus	Right / West	18,600	18,025			
2010	**Phase 2**	**Reach 3**	**ESA PWA**	**18,600**	**16,000**	**2,600**	**8,857**	**36%**
	Bench 1	Caymus	Right / West	17,700	17,425			
	Bench 2	Caymus	Right / West	17,350	17,160			
	Bench 3	Caymus	Right / West	17,150	16,850			
	Bench 4	Carpy Conolly	Left / East	16,725	16,475			
	Bench 5	Carpy Conolly	Left / East	16,350	16,100			
2011	**Phase 3a**	**Reach 4 East Bank**	**ESA PWA**	**16,000**	**12,000**	**4,000**	**12,857**	**52%**
	Bench 7	Carpy Conolly	Left / East	15,840	15,575			
	Bank Stabilization 1	Carpy Conolly	Left / East	14,450	14,300			
	Bank Stabilization 2	Honig	Left / East	13,900	13,825			
	Bench 11	Honig	Left / East	13,680	13,450			
	Bench 13	Honig	Left / East	13,150	12,725			
	Bench 14	Round Pond East	Left / East	12,580	12,390			

Restoration Elements: Graded Habitat Features: Cumulative Restored Channel Length

Year	Design Phase	Subreach	Designer	Upstream River Station	Downstream River Station	Channel Length by Phase	Channel Length Cumulative	Project Completion
	Graded Structure	Parcel	Bank	(feet)	(feet)	(feet)	(feet)	(%)
2012	**Phase 3b**	**Reach 4 West Bank**	**ESA PWA**	**16,000**	**12,000**	**4,000**	**12,857**	**52%**
	Bench 6	Emmolo	Right / West	16,125	15,800			
	Bench 8	Emmolo	Right / West	15,275	15,075			
	Bench 9	Mee	Right / West	14,085	14,015			
	Bench 10	Mee	Right / West	13,915	13,500			
	Bench 12	Round Pond West	Right / West	13,300	13,100			
	Bank Stabilization 3	Round Pond West	Right / West	12,800	12,540			
	Phase 4a	**Reach 8 North**	**ESA PWA**	**7,800**	**5,800**	**2,000**	**14,857**	**60%**
	Tributary	Foley Sawyer	Right / West	7,725				
	Bank Stabilization 1	Foley Sawyer	Right / West	7,625	7,300			
	Bank Stabilization 2	Sequoia Grove	Right / West	6,825	6,525			
	Bench 1	Wilsey	Left / East	7,100	6,500			
	Bank Stablization 3	Wilsey	Left / East	6,400	5,800			
2013 (Est.)	**Phase 4b-4c**	**Reach 8 South**	**ESA PWA**	**6,400**	**2,725**	**3,675**	**17,932**	**72%**
	Bench 2	Frostfire Davis	Right / West	6,400	5,900			
	Bench 3	Laird	Left / East	5,350	4,850			
	Bank Stablization 4	AJM McDowell	Right / West	5,250	4,950			
	Bank Stablization 5	Glos	Right / West	4,850	4,750			
	Bench 4	Laird	Left / East	4,300	3,850			
	Tributary Alcove	Cakebread	Right / West	3,615	3,400			
	Tributary Alcove	Nickel & Nickel	Right / West	3,400	3,050			
2014 (TBD)	**Phase 5**	**Reach 9**	**ESA PWA**	**2,725**	**-**	**2,725**	**20,657**	**83%**
2015 (TBD)	**Phase 6**	**Reaches 5,6,7**	**ESA PWA**	**12,000**	**7,800**	**4,200**	**24,857**	**100%**
2016 (TBD)	**TOTAL PROJECT**	**Reaches 1 - 9**		**24,857**	**0**	**24,857**	**24,857**	**100%**

Restoration Elements: Graded Habitat Features: Cumulative Treated Bank Length

Year	Design Phase	Subreach	Treated Bank Length by Phase	Total Bank Length by Phase	Completed Phases / Constructed Reaches		
					Treated Bank Length Cumulative	Total Bank Length Cumulative	Total Treated Bank length Cumulative
	Graded Structure	Parcel	(feet)	(feet)	(feet)	(feet)	(%)
2009	**Phase 1a**	**Reaches 1-2 East Bank**	**1,900**	**13,714**	**1,900**	**13,714**	**14%**
	Bench	Guggenhime	500				
	Bench	Quintessa	600				
	Bank Stabilization	Quintessa	800				
2010	**Phase 1b**	**Reaches 1-2 West Bank**	**1,975**	**13,714**	**3,875**	**13,714**	**28%**
	Alcove	Ranch /Sutter Home	350				
	Bench	Ranch /Sutter Home	250				
	Bench	Frogs Leap	800				
	Bench	Caymus	575				
2010	**Phase 2**	**Reach 3**	**1,265**	**5,200**	**5,140**	**17,714**	**29%**
	Bench 1	Caymus	275				
	Bench 2	Caymus	190				
	Bench 3	Caymus	300				
	Bench 4	Carpy Conolly	250				
	Bench 5	Carpy Conolly	250				
2011	**Phase 3a**	**Reach 4 East Bank**	**1,335**	**8,000**	**6,475**	**25,714**	**25%**
	Bench 7	Carpy Conolly	265				
	Bank Stabilization 1	Carpy Conolly	150				
	Bank Stabilization 2	Honig	75				
	Bench 11	Honig	230				
	Bench 13	Honig	425				
	Bench 14	Round Pond East	190				

Restoration Elements: Graded Habitat Features: Cumulative Treated Bank Length

Year	Design Phase	Subreach	Treated Bank Length by Phase	Total Bank Length by Phase	Completed Phases / Constructed Reaches		
					Treated Bank Length Cumulative	Total Bank Length Cumulative	Total Treated Bank length Cumulative
	Graded Structure	Parcel	(feet)	(feet)	(feet)	(feet)	(%)
2012	**Phase 3b**	**Reach 4 West Bank**	**1,470**	**4,024**	**7,945**	**25,714**	**31%**
	Bench 6	Emmolo	325				
	Bench 8	Emmolo	200				
	Bench 9	Mee	70				
	Bench 10	Mee	415				
	Bench 12	Round Pond West	200				
	Bank Stabilization 3	Round Pond West	260				
	Phase 4a	**Reach 8 North**	**1,825**	**4,000**	**9,770**	**29,714**	**33%**
	Tributary	Foley Sawyer					
	Bank Stabilization 1	Foley Sawyer	325				
	Bank Stabilization 2	Sequoia Grove	300				
	Bench 1	Wilsey	600				
	Bank Stablization 3	Wilsey	600				
2013 (Est.)	**Phase 4b-4c**	**Reach 8 South**	**2,415**	**7,350**	**13,445**	**35,864**	**37%**
	Bench 2	Frostfire Davis	500				
	Bench 3	Laird	500				
	Bank Stablization 4	AJM McDowell	300				
	Bank Stablization 5	Glos	100				
	Bench 4	Laird	450				
	Tributary Alcove	Cakebread	215				
	Tributary Alcove	Nickel & Nickel	350				
2014 (TBD)	**Phase 5**	**Reach 9**	**TBD**	**5,450**	**16,170**	**41,314**	**39%**
2015 (TBD)	**Phase 6**	**Reaches 5,6,7**	**TBD**	**8,400**	**20,370**	**49,714**	**41%**
2016 (TBD)	**TOTAL PROJECT**	**Reaches 1 - 9**	**TBD**	**49,714**	**20,370**	**49,714**	**41%**

Restoration Elements: Instream Habitat Structures

River Station	Installation	Year Installed	Phase	Subreach	Parcel	Bank	Restoration Label	Configuration
23,920	Bench Log	2009	1a	1	Guggenhime	Left / East	WD-23920-L	Single > 18"
23,880	Bench Log	2009	1a	1	Guggenhime	Left / East	WD-23880-L	Single > 18"
23,830	Bench Log	2009	1a	1	Guggenhime	Left / East	WD-23830-L	Single > 18"
23,780	Bench Log	2009	1a	1	Guggenhime	Left / East	WD-23780-L	Single > 18"
23,730	Bench Log	2009	1a	1	Guggenhime	Left / East	WD-23730-L	Single > 18"
23,680	Bench Log	2009	1a	1	Guggenhime	Left / East	WD-23680-L	Single > 18"
23,620	Bench Log	2009	1a	1	Guggenhime	Left / East	WD-23620-L	Single > 18"
23,560	Bench Log	2009	1a	1	Guggenhime	Left / East	WD-23560-L	Single > 18"
22,010	Bench Log	2010	1b	1	Ranch Winery	Right / West	WD-22010-R	Single > 18"
22,000	Spider Log	2010	1b	1	Ranch Winery	Right / West	WD-22000-R	Accumulation 2 < 9
21,950	Bench Log	2010	1b	1	Ranch Winery	Right / West	WD-21950-R	Single > 18"
21,930	Bench Log	2010	1b	1	Ranch Winery	Right / West	WD-21930-R	Single > 18"
21,910	Bench Log	2010	1b	1	Ranch Winery	Right / West	WD-21910-R	Single > 18"
21,905	Bench Log	2010	1b	1	Ranch Winery	Right / West	WD-21905-R	Single > 18"
21,900	Spider Log	2010	1b	1	Quintessa	Left / East	WD-21900-L	Single > 18"
21,850	Toe Log	2010	1b	2	Ranch Winery	Right / West	WD-21850-R	Jam > 10
21,710	Bench Log	2010	1b	2	Ranch Winery	Right / West	WD-21710-R	Single > 18"
21,670	Spider Log	2010	1a	2	Quintessa	Left / East	WD-21670-L	Accumulation 2 < 9

Restoration Elements: Instream Habitat Structures (Continued)

River Station	Installation	Year Installed	Phase	Subreach	Parcel	Bank	Restoration Label	Configuration
19,780	Bench Log	2009	1a	2	Quintessa	Left / East	WD-19780-L	Single > 18"
19,730	Bench Log	2009	1a	2	Quintessa	Left / East	WD-19730-L	Single > 18"
19,685	Bench Log	2009	1a	2	Quintessa	Left / East	WD-19685-L	Single > 18"
19,650	Bench Log	2009	1a	2	Quintessa	Left / East	WD-19650-L	Single > 18"
19,650	Bench Log	2010	1a	2	Frogs Leap	Right / West	WD-19650-R	Single > 18"
19,610	Bench Log	2009	1a	2	Quintessa	Left / East	WD-19610-L	Single > 18"
19,560	Bench Log	2009	1a	2	Quintessa	Left / East	WD-19560-L	Single > 18"
19,505	Bench Log	2009	1a	2	Quintessa	Left / East	WD-19505-L	Single > 18"
19,475	Toe Log	2010	1b	2	Frogs Leap	Right / West	WD-19475-R	Single > 18"
19,440	Bench Log	2010	1b	2	Frogs Leap	Right / West	WD-19440-R	Single > 18"
19,200	Bench Log	2010	1b	2	Frogs Leap	Right / West	WD-19200-R	Single > 18"
18,350	Bench Log	2010	1b	2	Frogs Leap	Right / West	WD-18350-R	Single > 18"
18,260	Bench Log	2010	1b	2	Frogs Leap	Right / West	WD-18260-R	Single > 18"
18,250	Boulder Cluster	2010	1b	2	Frogs Leap	Mid	BC-18250-M	Boulder Cluster
18,200	Bench Log	2010	1b	2	Frogs Leap	Right / West	WD-18200-R	Single > 18"

Restoration Elements: Instream Habitat Structures (Continued)

River Station	Installation	Year Installed	Phase	Subreach	Parcel	Bank	Restoration Label	Configuration
17,700	Root Wad	2010	2	3	Caymus	Right / West	WD-17700-R	Single > 18"
17,425	Root Wad	2010	2	3	Caymus	Right / West	WD-17425-R	Single > 18"
17,225	Root Wad	2010	2	3	Caymus	Right / West	WD-17225-R	Single > 18"
16,900	Root Wad	2010	2	3	Caymus	Right / West	WD-16900-R	Single > 18"
16,440	Terrace Log	2010	2	4	Carpy-Conolly	Left / East	WD-16440-L	Single > 18"
16,400	Terrace Log	2010	2	4	Carpy-Conolly	Left / East	WD-16400-L	Single > 18"
16,125	Root Wad	2010	2	4	Carpy-Conolly	Left / East	WD-16125-L	Single > 18"
13,650	Low Profile Log	2011	3a	4	Honig	Left / East	WD-13650-L	Single > 18"
13,590	Low Profile Log	2011	3a	4	Honig	Left / East	WD-13590-L	Single > 18"
13,070	Root Wad	2011	3a	4	Honig	Left / East	WD-13070-L	Accumulation 2 < 9
13,050	Boulder Cluster	2011	3a	4	Honig	Left / East	BC-13050-L	Boulder Cluster (4)
12,990	Low Profile Log	2011	3a	4	Honig	Left / East	WD-12990-L	Single > 18"
12,950	Boulder Cluster	2011	3a	4	Honig	Mid	BC-12950-M	Boulder Cluster (4)
12,850	Low Profile Log	2011	3a	4	Honig	Left / East	WD-12850-L	Single > 18"
12,825	Boulder Cluster	2011	3a	4	Honig	Mid	BC-12825-M	Boulder Cluster (5)
12,800	Root Wad	2011	3a	4	Honig	Left / East	WD-12800-L	Accumulation 2 < 9
12,550	Low Profile Log	2011	3a	4	Round Pond E	Left / East	WD-12550-L	Single > 18"
12,420	Root Wad	2011	3a	4	Round Pond E	Left / East	WD-12420-L	Accumulation 2 < 9
12,400	Boulder Cluster	2011	3a	4	Round Pond E	Left / East	BC-12400-L	Boulder Cluster (3)

D. Monitoring Studies

Monitoring Parameter Protocols, References, and Frequency by Category Table

Sediment Load Reductions and Channel Morphology

Monitoring Parameter	Protocols	Reference Sources	Frequency
Sediment Delivery to the Channel: Length and Height (Surface Area) of Actively Eroding Banks (Failing graded slopes, mass wasting, slumps, flows, etc)	Mapping and Measurement of Height and Length of Actively Eroding Streambanks, Photodocumentation	Gerstein and Harris (2005) Harrelson et al. (1994) Nossaman et al. (2007)	Annually
Channel Adjustment / Incision: Bed Deposition or Scour in Control Versus Treated Reaches	Cross Section Transects, Local Longitudinal Thalweg Survey, Photodocumentation	Flosi et al / CDFG. (1998) Gerstein (2005) Harrelson et al (1994) Gerstein (2005) Harrelson et al (1994)	Pre-and Post-Construction, and/or Post Significant Channel Forming Event
Bankfull Width to Depth Ratio: Entrenchment	Cross Section Transects	Fitzpatrick et al (1998) Rosgen (1996)	Pre-and Post-Construction, and/or Post Significant Channel Forming Event
Flood Stage / High Water Mark	Cross Section Transects	Fitzpatrick et al (1998)	Pre-and Post-Construction, and/or Post Significant Channel Forming Event
Bank Stability *(Rates of Widening at reference vs. restored cross sections)*	Cross Section Transects	Gerstein and Harris (2005) Nossaman et al. (2007)	Pre-and Post-Construction, and/or Post Significant Channel Forming Event
Channel Planform Network (Primary and Secondary Channels)	Photodocumentation of Constructed Alcoves Air Photo Analysis (As Available)	Fitzpatrick et al (1998)	Post Significant Channel Forming Event; As Available

Aquatic Habitat

Monitoring Parameter	Reference Sources	Protocols	Frequency
Large Woody Debris Logs and Jams (>12 inch diameter, or clump of >4 pieces)	Gerstein (2005) Flosi et al / CDFG. (1998)	Mapping and Categorization of LWD by geomorphic unit, salmonid habitat function, and risk to bank stability; Photodocumentation	Annually
Channel Geomorphic Heterogeneity: Riffle Habitat Frequency and Distribution		Mapping of Riffle Crests with GPS	Annually
Installed Habitat Structure (LWD/Boulder/Other) Affect on Increasing Pool Depth and Habitat Complexity	Lisle (1987)	Measurement of Residual Pool Depth at Locations of Installed Habitat Structures (LWD/Boulder/Other)	Annually
Installed Habitat Structure Persistence (LWD/Boulder/Other)	Lisle (1987)	Evaluation of Persistence and Status at Locations of Installed Habitat Structures	Annually
Areas requiring trash removal		Mapping, Photodocumentation	Annually
Channel Geomorphic Heterogeneity: Riffle, Pool and Glide Habitat Distribution	Flosi et al / CDFG (1998) Gerstein (2005) Harrelson et al. (1994); USDA R-5s Bulletin Number One	Cross Section Transects, Local Longitudinal Thalweg Survey or Habitat Unit Mapping at Locations of Installed Structures.	Pre-and Post-Construction, and Post Significant Channel Forming Event
Spawning Gravel Recruitment: Channel Substrate Size Distribution / Riffle Median Grain Size (D50)	Bunte & Abt (2001) Cover et al (2008) Fitzpatrick et al (1998) USDA (2003) Wolman (1954)	Modified Wolman Pebble Count, and/or Grid Pebble Count at Riffle Crests near Cross Section Transects	Pre-and Post-Construction, and Post Significant Channel Forming Event
Area of Low Velocity High Flow Refugia Within Bankfull at Constructed Alcoves and Bankfull Benches	USDA (2003) Gerstein (2005) Flosi et al / CDFG. (1998) Fisheries Biologist Expert Opinion	Habitat Unit Mapping and/or Sketch of River Flow Pattern; Description of Restoration Feature Affect on River Flow Pattern and Relative Velocity; Photodocumentation; Velocity Flow Measurements in Constructed High Flow Refugia Habitat	Representational Seasonal River Flow Stages (Winter and Spring)

Riparian Habitat

Monitoring Parameter	Protocols	Reference Sources	Frequency
Areas requiring weed control, including infestations of Pierce's disease host species	Mapping, Photodocumentation, Land Owner Request Forms	Harris (1999, 2005) Herrick et al (2005 a) Interagency Technical Reference (1996)	Annually
Areas requiring trash removal	Mapping, Photodocumentation		Annually
Riparian Vegetation Buffer Width	Cross Section Transects, Vegetation Surveys Air Photo Analysis (As Available)	Harris (1999, 2005)	Pre-and Post-Construction, and/or Post Significant Channel Forming Event
Riparian Vegetation Buffer Width for first five years after planting	As Built Surveys Air Photo Analysis (As Available)	Harris (1999, 2005)	Post Construction
Number of Pierce Disease Host Plant Infestations for first five years after planting	Area Mapping Vegetation Survey; Direct Count Vegetation Survey; Photodocumentation	Herrick et al (2005 a) Interagency Technical Reference (1996)	Establishment Years, 1,2,3 by contractor; Years 5 and 7 by Maintenance Assessment District
Restoration Planting Survival (80% in first five years after planting)	Cross Section Transect Vegetation Survey; Direct Count Vegetation Survey; Photodocumentation	Nossaman et al. (2007) Harris (1999, 2005) Gaffney (2008)	Establishment Years, 1,2,3 by contractor; Years 5 and 7 by Maintenance Assessment District

Stakeholder Participation

Monitoring Parameter	Protocols	Reference Sources	Frequency
Landowner participation in adaptive monitoring and management	Landowner maintenance requests and access agreements	FISRWP (2001)	As Events Occur
Landowner Advisory Committee (LAC) participation	Meeting minutes; Surveys of participation; Opinion surveys of effectiveness	FISRWP (2001)	As Events Occur

Monitoring Parameter Protocols, References, and Category by Frequency Table

Annual Stream Reach Survey

Monitoring Parameter	Protocols	Reference Sources	Category
Sediment Delivery to the Channel: Length and Height (Surface Area) of Actively Eroding Banks (Failing graded slopes, mass wasting, slumps, flows, etc)	Mapping and Measurement of Height and Length of Actively Eroding Streambanks, Photodocumentation	Gerstein and Harris (2005) Harrelson et al. (1994) Nossaman et al. (2007)	Sediment Load Reductions & Channel Morphology
Large Woody Debris Logs and Jams (>12 inch diameter, or clump of >4 pieces)	Mapping and Categorization of LWD by geomorphic unit, salmonid habitat function, and risk to bank stability; Photodocumentation	Gerstein (2005) Flosi et al / CDFG. (1998)	Aquatic Habitat Quality
Channel Geomorphic Heterogeneity: Riffle Habitat Frequency and Distribution	Mapping of Riffle Crests with GPS		Aquatic Habitat Quality
Installed Habitat Structure (LWD/Boulder/Other) Affect on Increasing Pool Depth and Habitat Complexity: Residual Pool Depth (Change in Pool Storage of Fines)	Measurement of Residual Pool Depth at Locations of Installed Habitat Structures (LWD/Boulder/Other)	Lisle (1987)	Aquatic Habitat Quality
Installed Habitat Structure Persistence (LWD/Boulder/Other)	Evaluation of Persistence and Status at Locations of Installed Habitat Structures	Lisle (1987)	Aquatic Habitat Quality
Areas requiring weed control, including infestations of Pierce's disease host species	Mapping, Photodocumentation, Land Owner Request Forms	Harris (1999, 2005) Herrick et al (2005 a) Interagency Technical Reference (1996)	Riparian / Floodplain Habitat Quality
Areas requiring trash removal	Mapping, Photodocumentation		Aquatic & Riparian Habitat Quality

Repeat Channel Transect Surveys and Local Longitudinal Profiles

Monitoring Parameter	Protocols	Reference Sources	Category
Channel Adjustment: Bed Deposition or Scour in Control Versus Treated Reaches	Cross Section Transects, Local Longitudinal Thalweg Survey, Photodocumentation	Flosi et al / CDFG. (1998) Gerstein (2005) Harrelson et al (1994) Gerstein (2005) Harrelson et al (1994)	Sediment Load Reductions & Channel Morphology
Bankfull Width to Depth Ratio: Entrenchment	Cross Section Transects	Fitzpatrick et al (1998) Rosgen (1996)	Sediment Load Reductions & Channel Morphology
Flood Stage / High Water Mark	Cross Section Transects	Fitzpatrick et al (1998)	Sediment Load Reductions & Channel Morphology
Bank Stability *(Rates of Widening at reference vs. restored cross sections)*	Cross Section Transects	Gerstein and Harris (2005) Nossaman et al. (2007)	Sediment Load Reductions & Channel Morphology
Channel Planform Network (Primary and Secondary Channels)	Photodocumentation of Constructed Alcoves, Local Longitudinal Thalweg Profile; Velocity Profile; Photodocumentation Air Photo Analysis (As Available)	Fitzpatrick et al (1998)	Sediment Load Reductions & Channel Morphology
Channel Geomorphic Heterogeneity: Riffle, Pool and Glide Habitat Distribution	Cross Section Transects, Local Longitudinal Thalweg Survey or Habitat Unit Mapping at Locations of Installed Structures.	Flosi et al / CDFG (1998) Gerstein (2005) Harrelson et al. (1994); USDA R-5s Bulletin Number One	Pre-and Post-Construction, and Post Significant Channel Forming Event
Spawning Gravel Recruitment: Channel Substrate Size Distribution / Riffle Median Grain Size (D50)	Modified Wolman Pebble Count, and/or Grid Pebble Count at Riffle Crests near Cross Section Transects	Bunte & Abt (2001) Cover et al (2008) Fitzpatrick et al (1998) USDA (2003) Wolman (1954)	Aquatic Habitat Quality
Riparian Vegetation Buffer Width	Cross Section Transects, Vegetation Surveys Air Photo Analysis (As Available)	Harris (1999, 2005)	Riparian / Floodplain Habitat Quality

Seasonal Aquatic Habitat Surveys of Constructed Alcoves and Bankfull Instream Benches

Monitoring Parameter	Protocols	Reference Sources	Category
Area of Low Velocity High Flow Refugia Within Bankfull at Constructed Alcoves and Bankfull Benches	Habitat Unit Mapping and/or Sketch of River Flow Pattern; Narrative Description of Restoration Feature Affect on River Flow Pattern and Relative Velocity; Photodocumentation; Velocity Flow Measurements in Accessible Areas of High Flow Refugia Habitat in Constructed Alcoves and Bankfull Benches	USDA (2003) Gerstein (2005) Flosi et al / CDFG. (1998) Fisheries Biologist Expert Opinion	Aquatic Habitat Quality

Phased Vegetation Establishment Years 1,2,3,5 and 7

Monitoring Parameter	Protocols	Reference Sources	Category
Riparian Vegetation Buffer Width for first five years after planting	As built survey; Air Photo Analysis (As Available)	Harris (1999, 2005)	Riparian / Floodplain Habitat Quality
Number of Pierce Disease Host Plant Infestations for first five years after planting	Area Mapping Vegetation Survey; Direct Count Vegetation Survey; Photodocumentation	Herrick et al (2005 a) Interagency Technical Reference (1996)	Riparian / Floodplain Habitat Quality
Restoration Planting Survival (80% in first five years after planting)	Cross Section Transect Vegetation Survey; Direct Count Vegetation Survey; Photodocumentation	Nossaman et al. (2007) Harris (1999, 2005) Gaffney (2008)	Riparian / Floodplain Habitat Quality

As Air Photos Become Available

Monitoring Parameter	Protocols	Reference Sources	Category
Channel Planform Network (Primary and Secondary Channels)	Photodocumentation of Constructed Alcoves Air Photo Analysis	Fitzpatrick et al (1998)	Stream Channel Geometry, Capacity, & Stability
Riparian Vegetation Buffer Width	Cross Section Transects, Vegetation Surveys Air Photo Analysis	Harris (1999, 2005)	Riparian / Floodplain Habitat Quality

As Events Occur

Monitoring Parameter	Protocols	Reference Sources	Category
Landowner participation in adaptive monitoring and management	Landowner maintenance requests and access agreements	FISRWP (2001)	Stakeholder Participation
Landowner Advisory Committee (LAC) participation	Meeting minutes; Surveys of participation; Opinion surveys of effectiveness	FISRWP (2001)	Stakeholder Participation

I. Stream Flow Measurements

Stream Flow Measurements

Annual Survey Results

2010

Peak discharge in the winter of 2010 following the first season of project construction in 2009 in Phase 1a, Reaches 1-2 east bank was 2,800 cfs on January 20, 2010; which is between a 1.25 year recurrence interval flood. The bankfull instream benches on the Guggenhime and Quintessa properties inundated at the 1.25 year recurrence interval flood.

2011

Peak discharge in water year 2011 following the second season of project construction in 2010 in Phase 1b, Reaches 1-2 west bank, and Phase 2, Reach 3, occurred on March 20, 2011 and was 4,080 cfs, which is between a 1.5 year and 2 year recurrence interval flood. The benches constructed in 2009 in Phase 1a Reaches 1-2, and all of the benches constructed in 2010 in Phase 1b, Reaches 1-2, and Phase 2, Reach 3, were inundated several times during the winter of 2011.

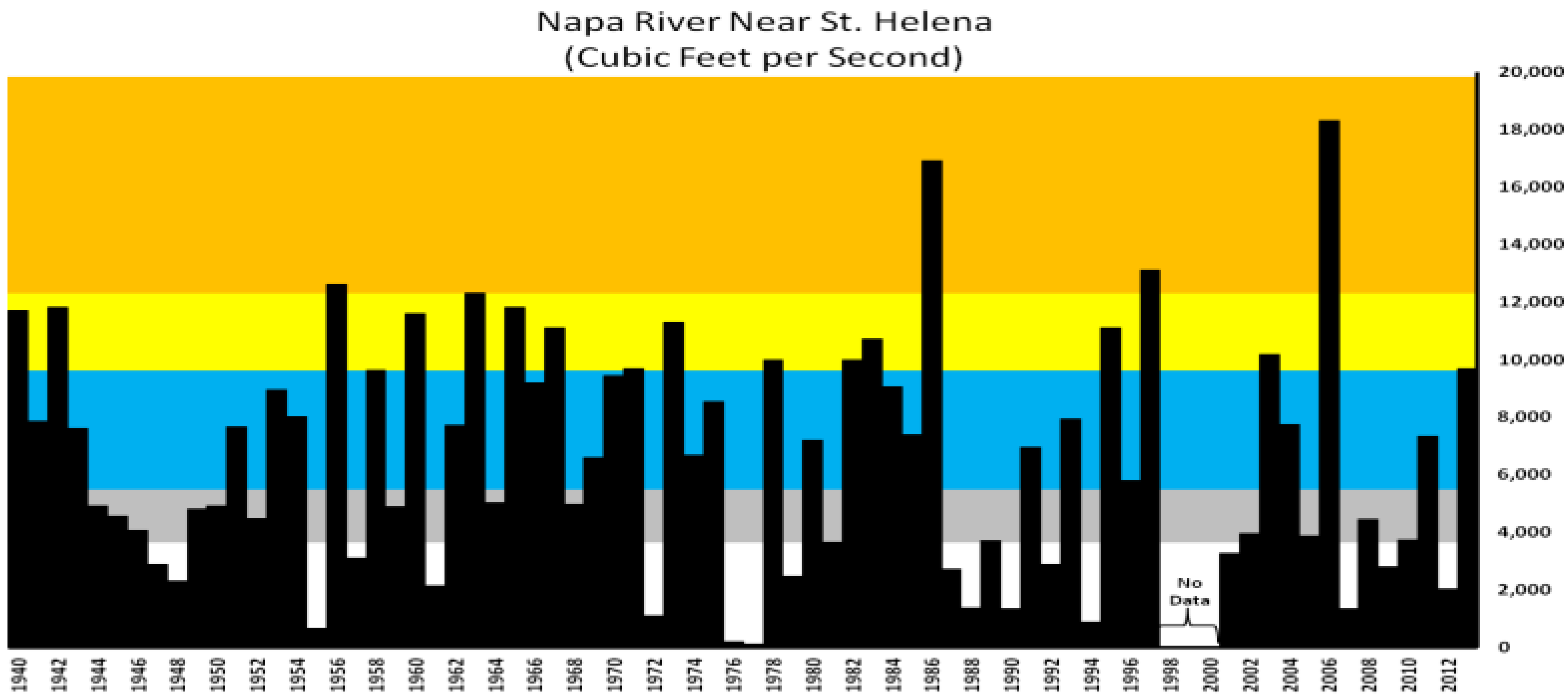
2012

Peak discharge in water year 2012 following the third season of project construction in 2011 in Phase 3, Reach 4 east bank, occurred on March 14, 2012 and was 2,050 cfs, which is less than a 1.25 year recurrence interval flood. Seasonal rains did not commence in water year 2012 until January 2012 inhibiting Chinook salmon from swimming upstream to spawn during the usual November to December timeframe. During this drought year, the benches constructed in 2010 in Phase 3a Reach 4 east bank each were inundated, whereas the benches in Phase 1a on Guggenhime, Quintessa, and Frog's Leap were not.

2013

In December 2012, two flow events came within a foot of overtopping the channel banks in the Rutherford Reach. The December 2, 2012 flow peaked at 9,260 cfs followed three weeks later by a 9,698 cfs peak flow event on December 23, 2012. The recurrence interval for flows of this magnitude is usually only once every 5-8 years on average. These storm flows ranked 21st and 18th largest, respectively, in magnitude among all annual peak flows for the Napa River Near St. Helena gage during the 83 years on record from 1929 - 2012. The newly constructed features in Reach 4 West and Reach 8 North held up well following the first storm, requiring only minor maintenance of erosion control matting and coir logs. Re-vegetation of Reach 4 West and Reach 8 North had not yet taken place at the time of the storm events. Lack of established vegetation cover, saturated soils, and the larger storm flow that occurred three weeks later on December 23, 2012, caused some localized slope failure in Reach 8 which required re-grading and stabilization. Erosion control measures were also reinstalled throughout the Project.

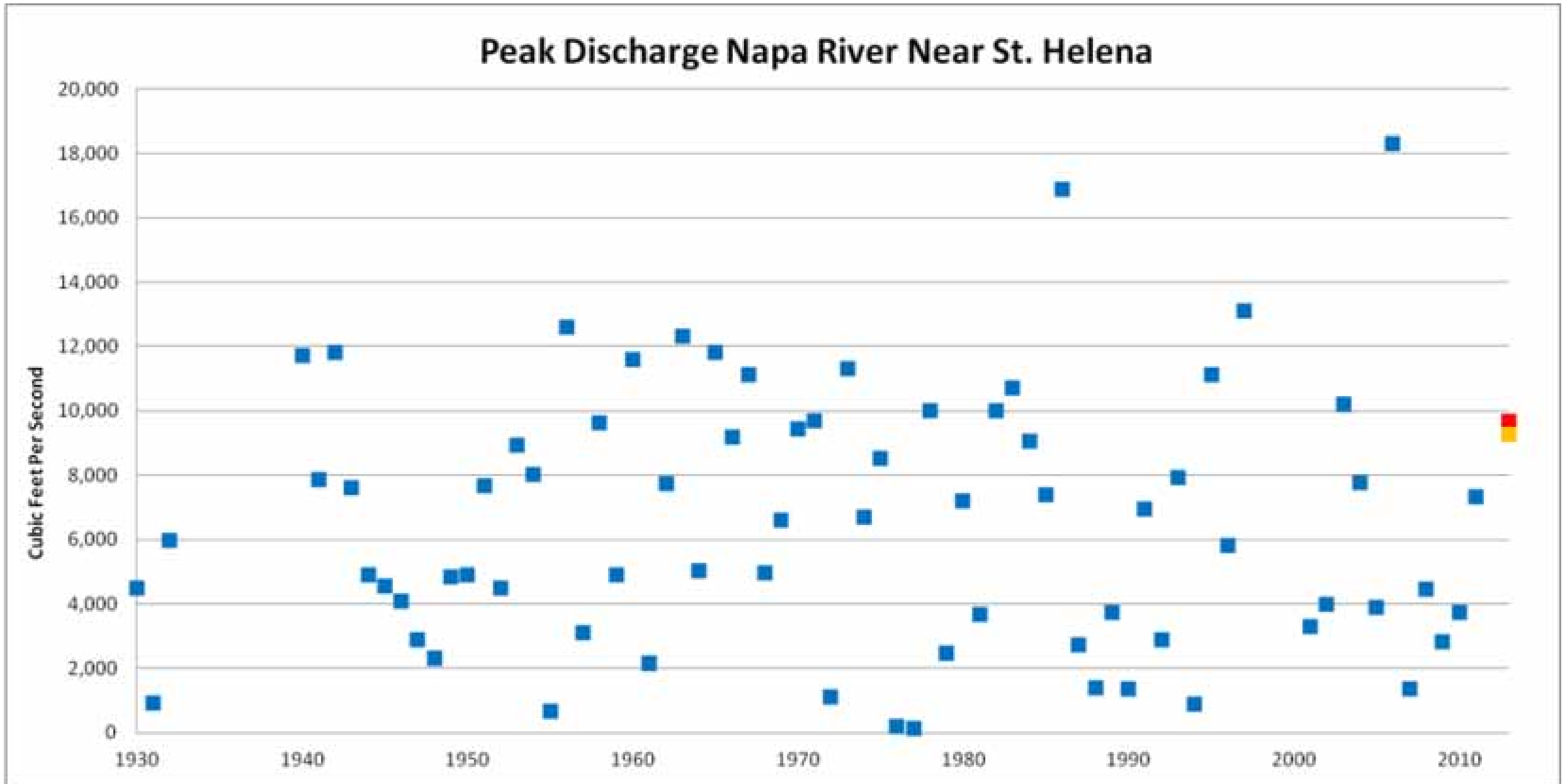
Annual Peak Flows



Hydrologic Unit Code 18050002 Latitude 38°30'41", Longitude 122°27'17" NAD27
Drainage Area 78.8 square miles Gage Datum 193.21 feet above NGVD29

Recurrence Interval and Corresponding Discharge

Discharge Interval	Cubic Feet per Second	Frequency
$Q_{1.25}$	2,870 cfs	Recurs Annually
$Q_{1.5}$	3,843 cfs	Typical Channel Forming Flow
Q_2	5,790 cfs	Recurs About Every 2 Years
Q_5	10,100 cfs	Recurs About Once in 5 Years **Flow near top of channel banks in Rutherford Reach**
Q_{10}	13,000 cfs	Recurs About Once in 10 Years **Overbank Flow in Rutherford Reach**



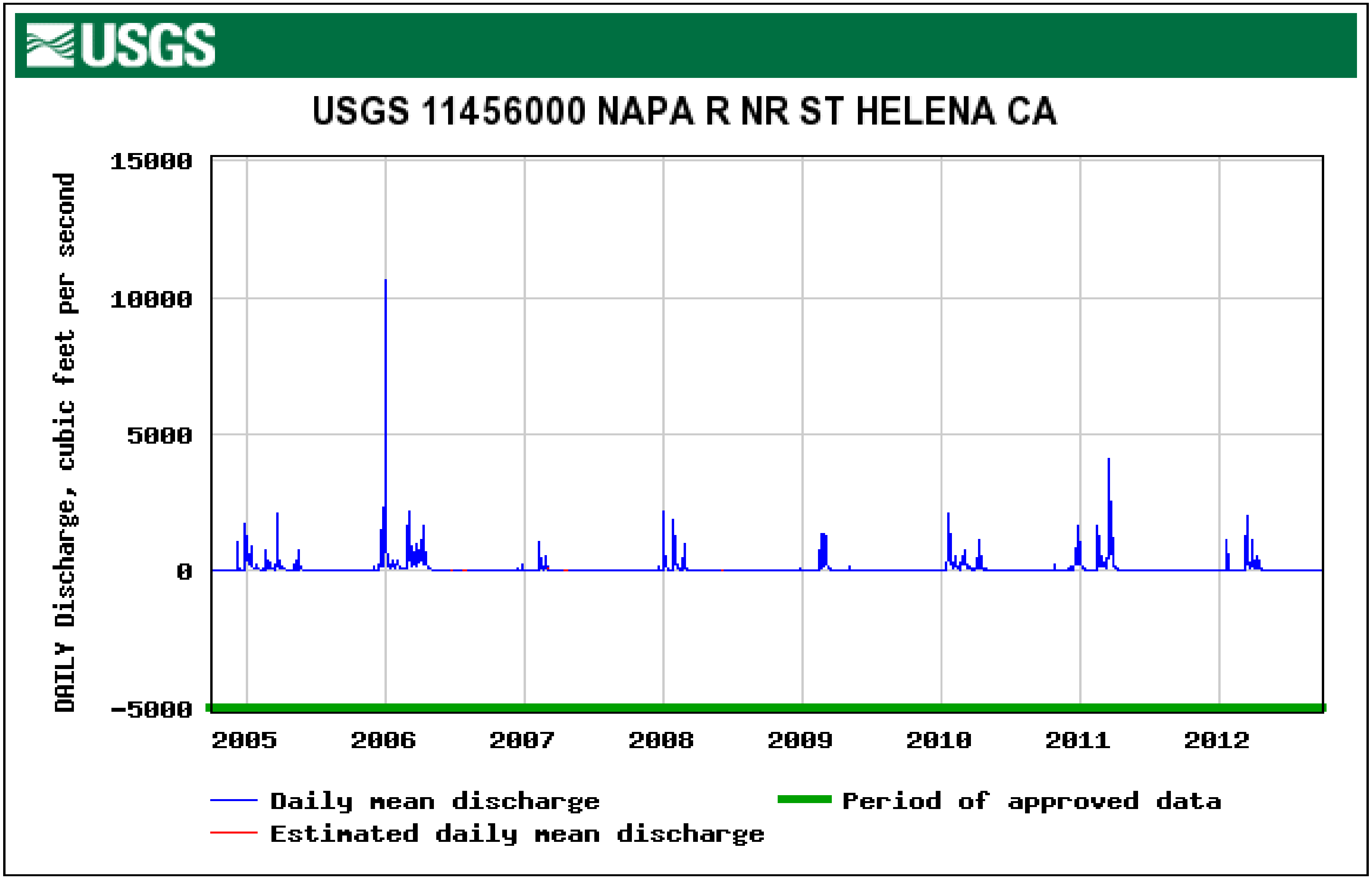
Q_{100}	21,000 cfs	Recurs About Once in a 100 Years **Disastrous Flooding**

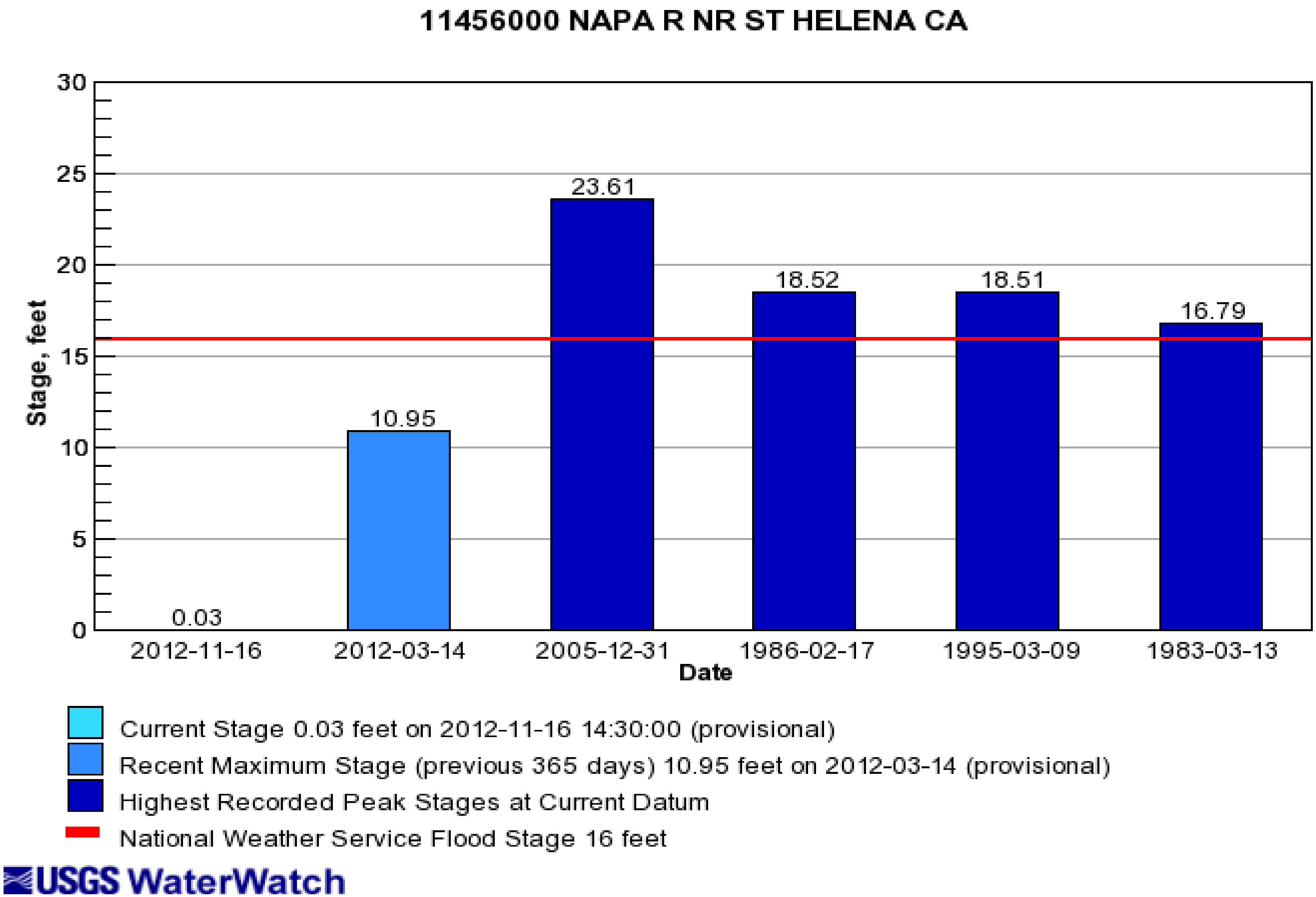
Water Year	Peak Discharge (cfs)	Peak Discharge Date	Gage Height (feet)
2004	7,760	December 29, 2003	14.92
2005	3,890	March 22, 2005	10.80
2006	18,300	December 31, 2005	23.61
2007	1,350	December 26, 2006	6.87
2008	4,460	January 04, 2008	14.08
2009	2,800	February 22, 2009	11.06
2010	3,740	January 20, 2010	12.99
2011	7,330	March 20, 2011	14.99
2012	2,050	March 14, 2012	10.95
2013 Preliminary	9,698	December 23, 2012	16.90

12/23/2012

12/2/2012

2013 Preliminary	9,260	December 2, 2012	16.60





11456000 NAPA R NR ST HELENA CA
30
25
20
15
10
5
0
Stage, feet
23.61
18.52
18.51
16.79
10.95
0.03
2012-11-16
2012-03-14
2005-12-31
1986-02-17
1995-03-09
1983-03-13
Date
Current Stage 0.03 feet on 2012-11-16 14:30:00 (provisional)
Recent Maximum Stage (previous 365 days) 10.95 feet on 2012-03-14 (provisional)
Highest Recorded Peak Stages at Current Datum
National Weather Service Flood Stage 16 feet
USGS WaterWatch

RIVER FLOOD STAGE (FEET) AND ASSOCIATED IMPACTS: Napa River at St. Helena

16.0 Feet	Flood Stage. Minor flooding begins to affect the entire reach including the lowest areas of towns along the reach. Rural areas including many secondary roads affected. Primary roads begin to flood.
18.0 Feet	Moderate flooding of the lower portions of towns along the entire reach. Crop losses and erosion of land becoming widespread. Most secondary and many primary roads inundated.
19.0 Feet	Major flooding throughout the upper Napa Valley with most roads inundated making travel extremely difficult. Moderate to severe damage to all towns along the reach.
20.0 Feet	Disastrous flooding across upper Napa Valley with travel essentially impossible. Extreme damage to all towns along the reach.

High Water Mark and Water Surface Elevations for Velocity Monitoring of High Flow Refugia

2011

	Discharge Napa River Near St. Helena at Pope Street Bridge (cfs)	Water Surface Elevation (ft NAVD88)					
		Sutter Alcove	Frogs Leap Bench 1	Caymus Bench 0	Caymus Bench 1	Caymus Bench 2	Caymus Bench 3
River Station		21950	19680	18300	17500	17290	17050
HWM 2/16/2011	2,930		160.31	157.22	155.94	155.36	154.74
WSEL 2/16/2011 10:36	1,150	159.96					
WSEL 2/16/2011 11:03	1,120		156.13				
WSEL 2/16/2011 11:22	1,100			152.40			
WSEL 2/16/2011 11:42	1,070				150.18		
WSEL 2/16/2011 12:11	1,030						149.20
HWM 2/17/2011	3,160	165.38	160.92	157.89	156.81	156.30	155.75
WSEL 2/23/2011	228	155.52	151.61	148.34	145.49	145.52	144.76

2012

	Discharge Napa River Near St. Helena at Pope Street Bridge* (cfs)	Water Surface Elevation (ft NAVD88)					
		Bench 14: Round Pond	Bench 13: Honig	Bench 11: Honig	BSA 2: Honig	BSA 1: Carpy-Conolly	Bench 7: Carpy-Conolly
River Station		12400	12900	13600	13850	14400	15700
WSEL 1/23/2012 09:40	2,040	143.20					
WSEL 1/23/2012 10:00	2,060		143.99				
WSEL 1/23/2012 10:40	2,100			144.95			
WSEL 1/23/2012 10:50	2,100				145.73		
WSEL 1/23/2012 11:17	2,050					146.87	
WSEL 1/23/2012 11:30	1,970						149.81

*Provisional data provided by USGS, subject to revision

II. Eroding Streambank Survey

Eroding Streambanks

Annual Results

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. The target goal is to reduce the length of eroding banks in the entire Rutherford Reach (Reaches 1-9) by 75%, in comparison to the baseline survey measured in 2009. Eroding bank length is mapped annually under the channel monitoring survey conducted by Napa County each June. In 2009, 14,674 feet of channel banks were eroding, or 30% of the channel bank length in the Rutherford Reach. A 75% reduction in eroding bank length by 2017 would require that no more than 7.5% of the channel bank length in the Rutherford Reach was eroding, or that no more than 3,700 total linear feet of the 49,714 feet of left (east) and right (west) banks are eroding to meet the sediment source reduction goal of the Project.

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. By the fourth annual maintenance survey in 2012, following completion of construction of Phases 1, 2 and 3a, in Reaches 1, 2, 3, and Reach 4 East bank upstream of the Rutherford Cross Road, eroding bank length had been reduced to 4,543 linear feet. With the Rutherford Reach Project nearly half completed, eroding bank length had achieved a reduction of 69% compared to the 2009 baseline. Achieving the 75% reduction of eroding bank length with the completion of the project is probably. It is noteworthy that between 2009-2012 no storm event reached the 5 year recurrence interval magnitude. Mapped eroding banks may increase after larger channel forming flow events.

2009

The baseline survey conducted in June 2009 mapped 14,674 linear feet of eroding banks throughout the Rutherford Reach: 8,538 linear feet on the left (east) bank, and 6,136 feet on the right (west) bank. Eroding bank sections ranged from 20 to 35 feet high. The longest contiguous sections of eroding bank on the right (west) bank spanned 140 feet between stations 21,500 - 21,360 (20 feet high) on the Guggenhime property; and 1,470 feet between stations 5,475 – 4,005 (20 feet high) on the Laird property, and on the left bank spanned 680 feet between stations 12,690 – 12,010 (35 feet high) on the Round Pond West property; and spanned a nearly contiguous stretch of 1,450 feet over three sections between stations 2,680 – 1,230 (feet high) on the Opus One property. The most rapidly eroding section of the river spanned 270 feet between right (east) bank river stations 6900 – 6,630 on the Sequoia Grove property. According to air photo analysis, and field observations since 2004, the 20 foot high bank at Sequoia Grove has been retreating at an average rate of 2 feet per year. This section of the channel is devoid of riparian vegetation buffer and is a high priority for restoration, to curb fine sediment delivery to the stream channel, and because rapid bank collapse is migrating downstream and threatening a residential home on the adjacent Frostfire/Davis (previously Mueller) property.

2010

In June 2010, 9.032 linear feet of eroding banks were mapped throughout the Rutherford Reach: 3,822 linear feet on the left (east) bank, and 5,210 feet on the right (west) bank constituting 18% of the channel bank length in the Rutherford Reach. This constitutes a reduction of 38% compared to the 2009 baseline. Eroding bank sections ranged from 10 to 30 feet high. Hardened banks, including rip rap and concrete, were mapped throughout the Rutherford Reach in 2010, and amounted to 4,813 linear feet of stream bank: . 1,260 linear feet on the left (east) bank, and 5,210 linear feet on the right (west) bank constituting 18% of the channel bank length in the Rutherford Reach. Some of the hardened banks will be removed during the course of future restoration construction, with the exception of the bank revetments installed to protect the bridges at Zinfandel Lane, the Rutherford Cross and the Oakville Cross Roads.

2011

In June 2011, 4,751 linear feet of eroding banks were mapped throughout the Rutherford Reach: 2,238 linear feet on the left (east) bank, and 2,513 linear feet on the right (west) bank constituting 10% of the channel bank length in the Rutherford Reach. This constitutes a reduction of 68% compared to the 2009 baseline.

2012

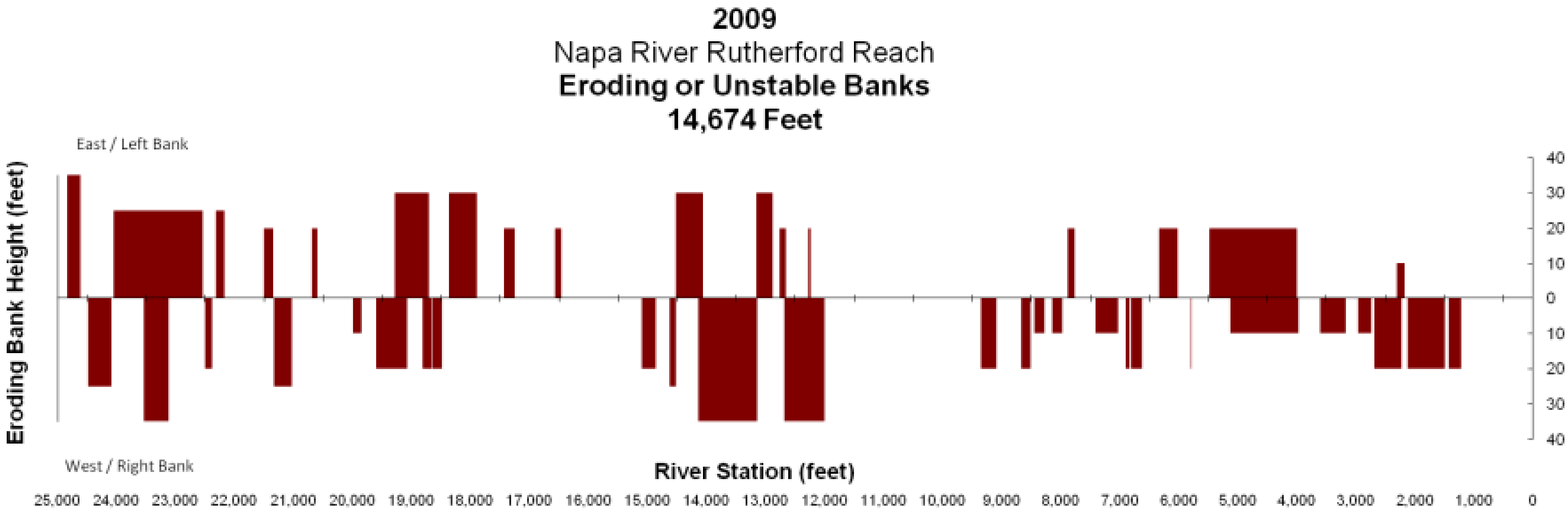
In June 2012, 4,543 linear feet of eroding banks were mapped throughout the Rutherford Reach: 1,696 linear feet on the left (east) bank, and 2,847 linear feet on the right (west) bank constituting 9% of the channel bank length in the Rutherford Reach. This constitutes a reduction of 69% compared to the 2009 baseline with 40% of the Rutherford Reach restoration complete.

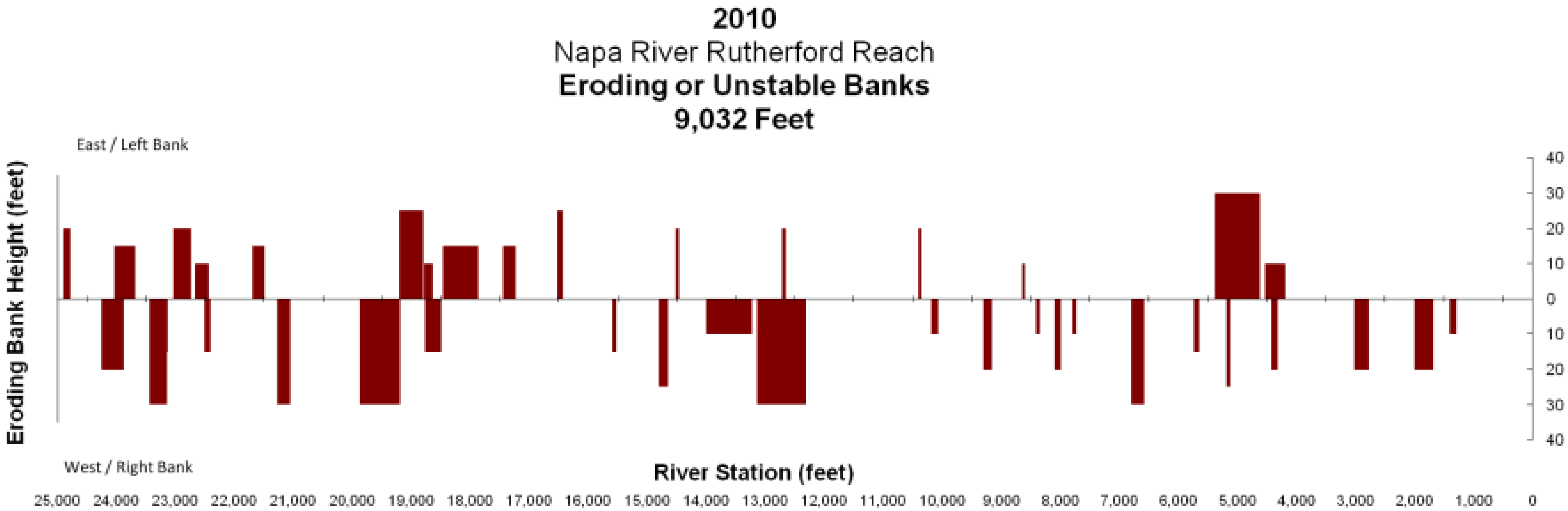
Eroding Streambanks Table

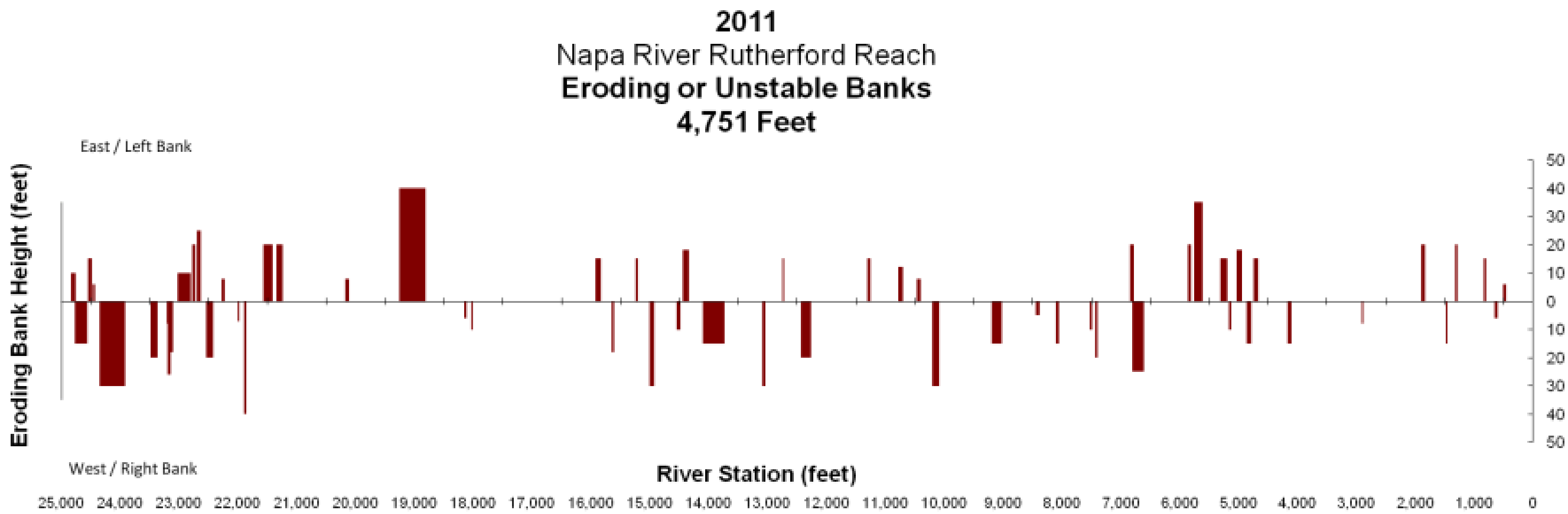
	Unstable or Potentially Unstable Banks (Linear Feet)			
Annual Summer Survey	**2009**	**2010**	**2011**	**2012**
Rutherford Reach	14,674	9,032	4,751	4,543

Hardened Banks (Linear Feet)
2010
4,813

Eroding Streambanks Charts






2011
Napa River Rutherford Reach
Eroding or Unstable Banks
4,751 Feet
East / Left Bank
West / Right Bank
Eroding Bank Height (feet)
River Station (feet)
50
40
30
20
10
0
10
20
30
40
50
25,000
24,000
23,000
22,000
21,000
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
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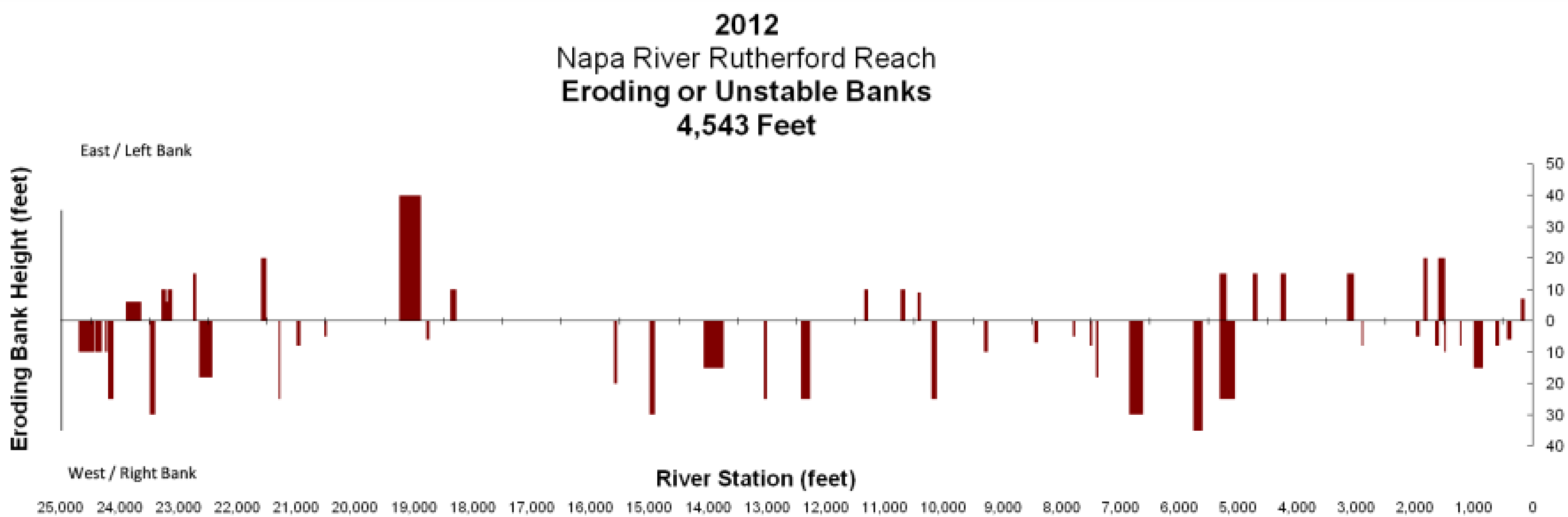
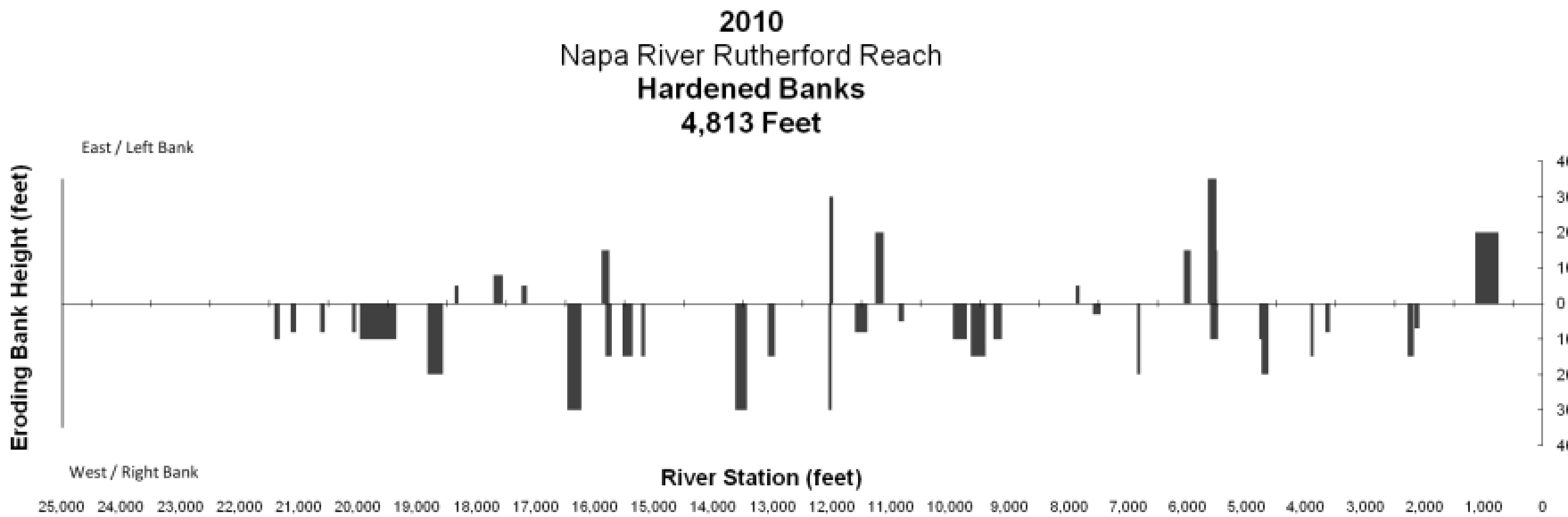
2,000
1,000
0


2012
Napa River Rutherford Reach
Eroding or Unstable Banks
4,543 Feet
East / Left Bank
West / Right Bank
Eroding Bank Height (feet)
River Station (feet)
50
40
30
20
10
0
10
20
30
40
25,000
24,000
23,000
22,000
21,000
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0

Hardened Streambanks Chart



III. Sediment Source Reduction Calculations

SEDIMENT SOURCE REDUCTION

Annual Results Summary

2010

Implementation of Phases 1-2 combined, in 36% of the 4.5 mile Project reach, reduced fine sediment loading by 5,337 metric tons/year for twenty years, or 28% of the total target reduction for the Napa River watershed from mainstem channel incision and bank erosion sources.

2011

Implementation of Phases 1-3A combined, in 52% of the 4.5 mile Project reach, reduced fine sediment loading by 7,498 metric tons/year for twenty years, or 39% of the total target reduction for the Napa River watershed from mainstem channel incision and bank erosion sources.

2012

Implementation of Phases 1-4A combined, in 60% of the 4.5 mile Project reach, reduced fine sediment loading by 10,154 metric tons/year for twenty years, or 53% of the total target reduction for the Napa River watershed from mainstem channel incision and bank erosion sources.

Annual Sediment Source Reduction Summary Table: Part 1 of 2

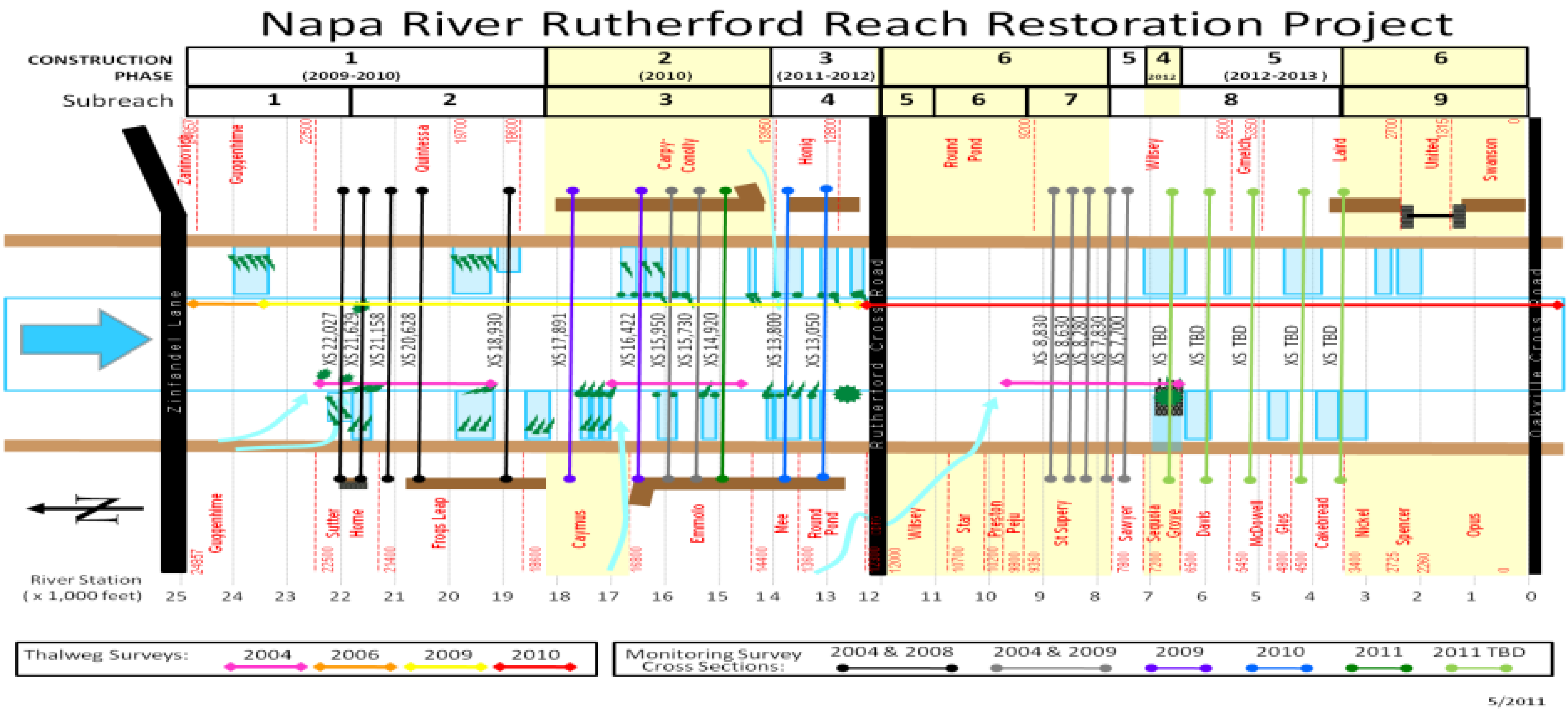
As of 12/04/2012 Assuming Sandy Clay Loams	RWQCB GRTS Reporting Year	Percent of RDRT Project Complete	Phase Upstream Station	Phase Downstream Station	Drainage Area (square miles)	Linear Feet	Miles	Cubic Yards Cut from Channel Banks	Cubic Meters Cut from Channel Banks
PHASE 1A: Reaches 1-2 East Bank	**2009**	**25%**	**24,857**	**18,600**	**83**	**6,257**	**1.19**	**16,801**	**12,845**
PHASE 1B: Reaches 1-2 West Bank	2010		24,857	18,600	83	6,257	1.19	48,041	36,730
Phase 1a - East Bank - 2009	2009		24,857	18,600	83	6,257	1.19	16,801	12,845
Phase 1b - West Bank - 2010	2010		24,857	18,600	83	6,257	1.19	31,240	23,885
PHASE 2: Reach 3	2010		18,600	16,000	85	2,600	0.49	18,639	14,251
PHASES 1 -2: Reaches 1-3	**2010**	**36%**	**24,857**	**16,000**	**85**	**8,857**	**1.68**	**66,680**	**50,981**
PHASE 3A: Reach 4 East Bank	2011		16,000	12,000	86	4,000	0.76	26,049	19,916
PHASES 1 -3A: Reaches 1-3, 4 East	**2011**	**52%**	**24,857**	**12,000**	**86**	**12,857**	**2.44**	**92,729**	**70,896**
PHASE 3B: Reach 4 West Bank	2012		16,000	12,000	86	4,000	0.76	29,360	22,447
PHASE 4A : Reach 8 North	2012		7,800	5,800	95	2,000	0.38	9,412	7,196
PHASES 3B,4A: Reaches 4 West, 8 North	**2012**		**0**	**0**	**95**	**6,000**	**1.14**	**38,772**	**29,643**
PHASES 1-4A	**2012**	**60%**	**24,857**	**5,800**	**95**	**19,057**	**2.81**	**131,501**	**100,540**

Annual Sediment Source Reduction Summary Table: Part 2 of 2

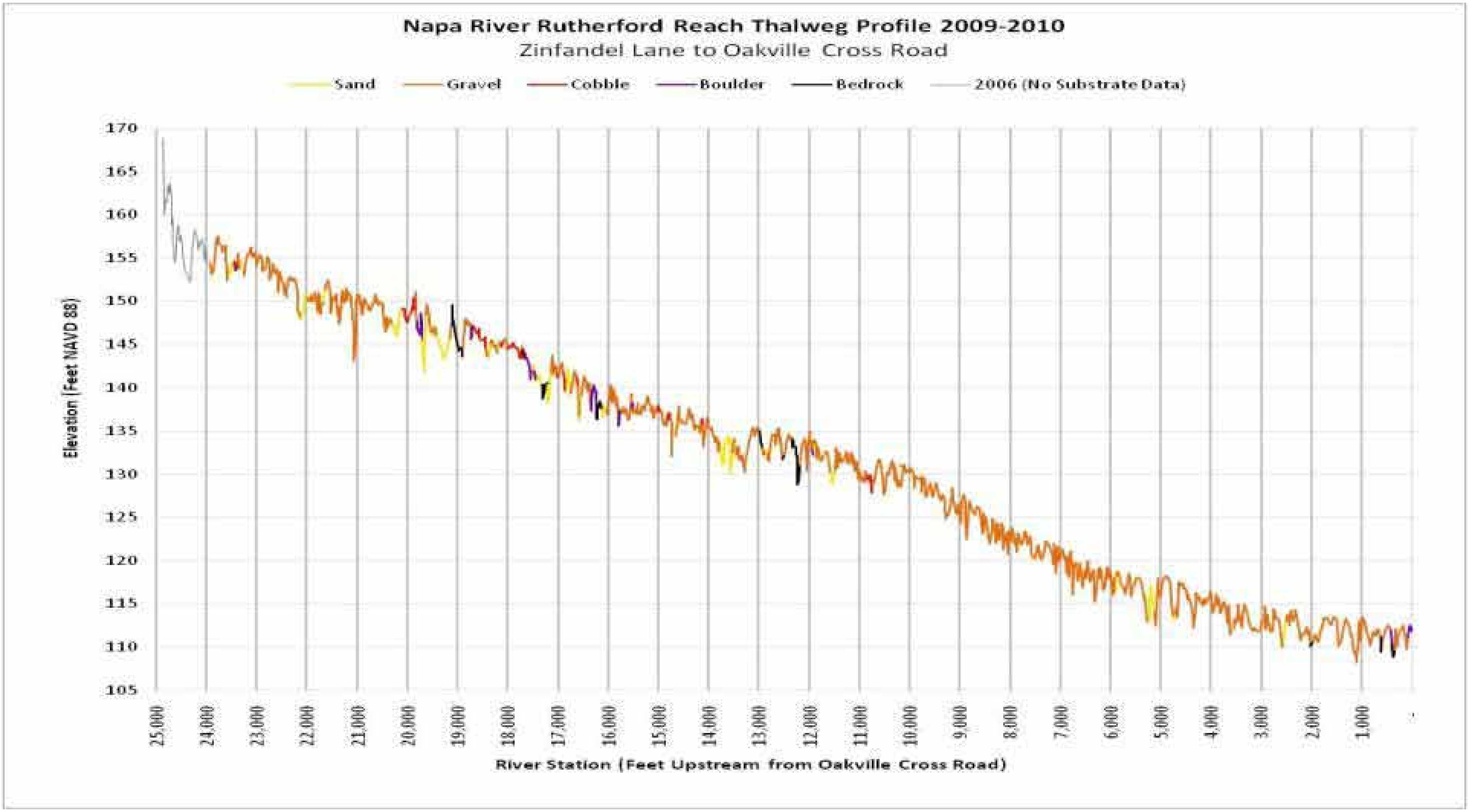
As of 12/04/2012			**Slight Lateral Recession Rate + Removed Sediment Source**		**Moderate Lateral Recession Rate + Removed Sediment Source**	
Assuming Sandy Clay Loams	RWQCB GRTS Reporting Year	Metric Tons/ Year (over 20 years) Reduced Sedimentation due to Cut from Channel Banks	Metric Tons/Mile/ Year (over 20 years) Reduction in Yearly Bank Erosion Rates (Assuming 200 tons/ mile/year)	TOTAL ANNUAL REDUCTION IN SEDIMENT DELIVERY TO THE CHANNEL (Metric tons/year)	Metric Tons/Mile/ Year (over 20 years) Reduction in Yearly Bank Erosion Rates (Assuming 750 tons/ mile/year)	TOTAL ANNUAL REDUCTION IN SEDIMENT DELIVERY TO THE CHANNEL (Metric tons/year)
PHASE 1A: Reaches 1-2 East Bank	**2009**	**1,028**	**237**	**1,265**	**889**	**1,916**
PHASE 1B: Reaches 1-2 West Bank	2010	2,938	237	3,175	889	3,827
Phase 1a - East Bank - 2009	2009	1,028	770,717	-	889	772,634
Phase 1b - West Bank - 2010	2010	1,911	1,433,082	-	889	1,435,881
PHASE 2: Reach 3	2010	1,140	98	1,239	369	1,509
PHASES 1 -2: Reaches 1-3	**2010**	**4,078**	**335**	**4,414**	**1,258**	**5,337**
PHASE 3A: Reach 4 East Bank	2011	1,593	152	1,745	568	2,161
PHASES 1 -3A: Reaches 1-3, 4 East	**2011**	**5,672**	**487**	**6,159**	**1,826**	**7,498**
PHASE 3B: Reach 4 West Bank	2012	1,796	Included in 3A	1,796	Included in 3A	1,796
PHASE 4A : Reach 8 North	2012	576	76	651	284	860
PHASES 3B,4A: Reaches 4 West, 8 North	**2012**	**2,371**	**227**	**2,599**	**852**	**3,224**
PHASES 1-4A	**2012**	**8,043**	**563**	**8,606**	**2,110**	**10,154**

IV. Longitudinal Profile Thalweg Surveys

Longitudinal Profile Thalweg Survey Location Schematic

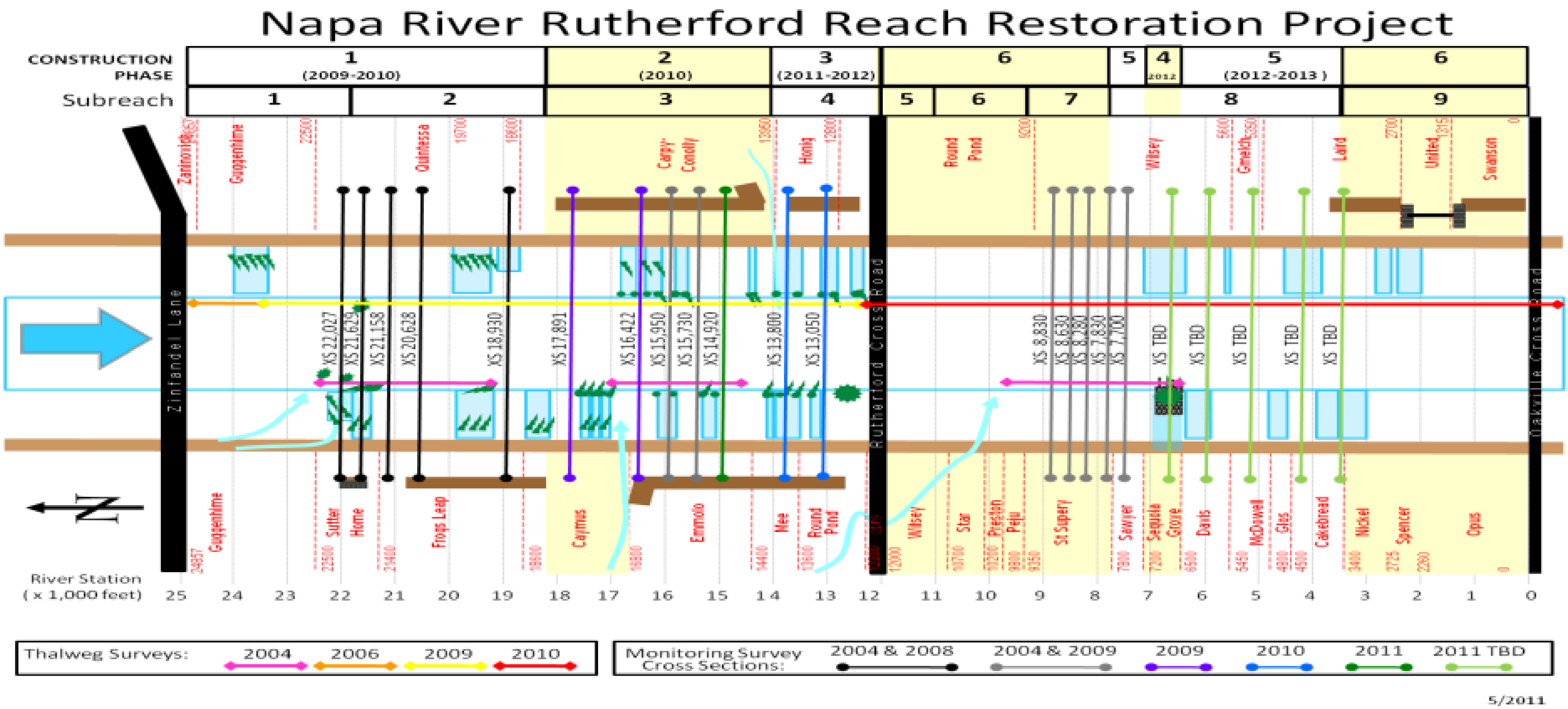


Longitudinal Profile Thalweg Survey



V. Channel Transect Surveys

Cross Section Transect Survey Location Schematic

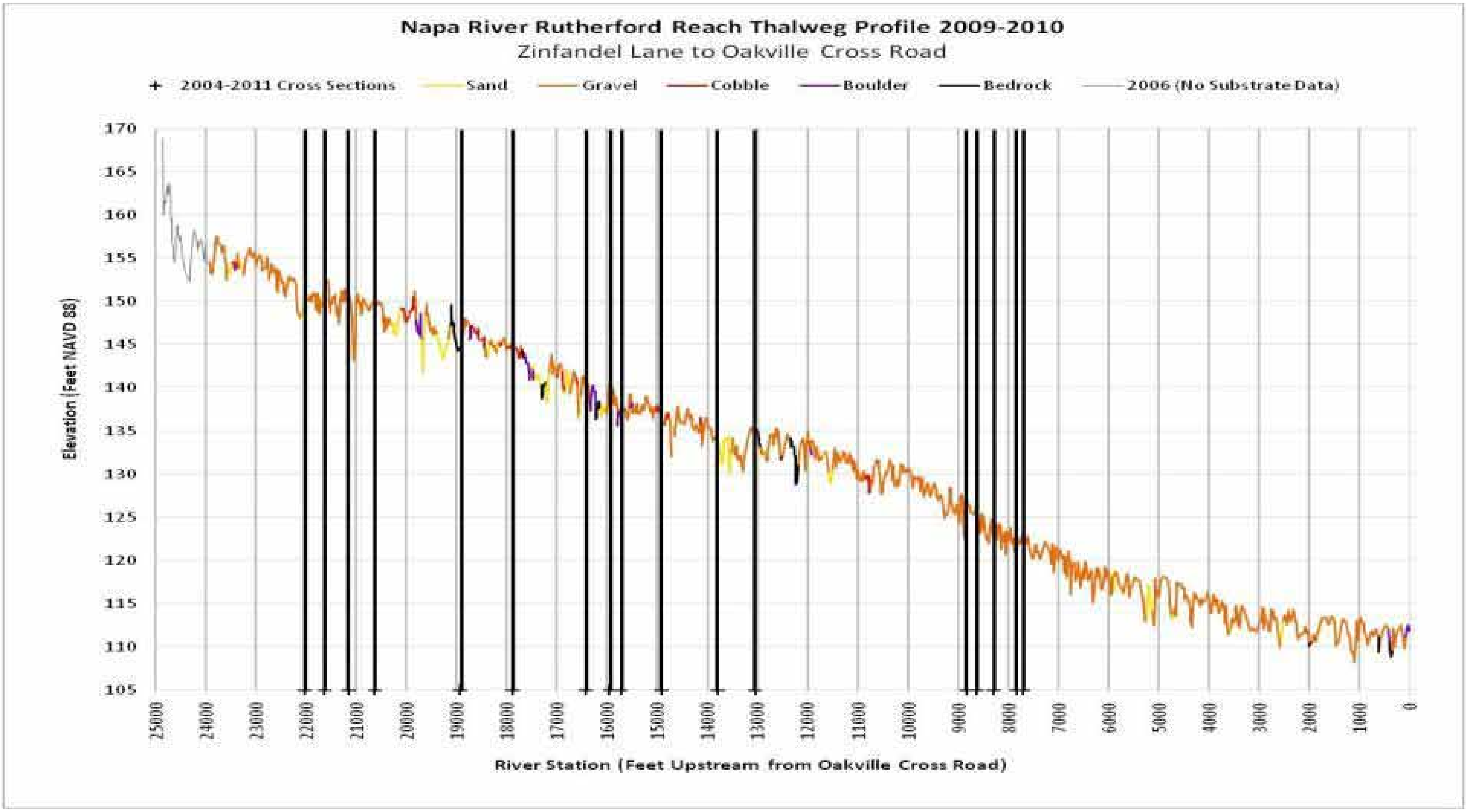


Monitoring Cross Section Location Table

CROSS SECTION IDENTIFIATION TABLE			Through	May 2011											
River Station	**Years Surveyed**	**Left (East) Bank Property**	**Left (East) Bank Pin - Top of Bank**		**Left (East) Bank Pin Mid Bank**		**Left (East) Bank Pin Base of Bank**		**Right (West) Bank Property**	**Right (West) Bank Pin Top of Bank**		**Right (West) Bank Pin Mid Bank**		**Right (West) Bank Pin Base of Bank**	
			Latitude	Longitude	Latitude	Longitude	Latitude	Longitude		Latitude	Longitude	Latitude	Longitude	Latitude	Longitude
0	**ZINFANDEL**														
22,027	2008, 2005 DT	Quintessa	38.4882342	-122.423606	-	-			Ranch Winery/Sutter Hon	38.487937	-122.423980	-	-		
21,629	2008, 2004	Quintessa			-	-			Ranch Winery/Sutter Hon	38.486979	-122.423331	-	-		
21,158	2008, 2004	Quintessa			-	-			Frogs Leap	38.486175	-122.422023	-	-		
20,628	2008, 2004	Quintessa			-	-			Frogs Leap	38.485420	-122.420577	-	-		
18,930	2008, 2007 DT	Quintessa	38.4818830	-122.416987	-	-	38.481877	-122.417078	Frogs Leap	38.481869	-122.417449	-	-		
17,891	2009	Carpy-Conolly	38.4790661	-122.416118	-	-	38.479141	-122.416500	Caymus	38.479287	-122.417046	38.479188	-122.416710	38.479173	-122.416650
16,422	2009	Carpy-Conolly	38.4753112	-122.416464	-	-	38.475231	-122.416627	Emmolo			-	-		
15,950	2009, 2004	Carpy-Conolly	38.4744460	-122.415476	-	-	38.474376	-122.415622	Emmolo	38.474242	-122.415901	-	-	38.474337	-122.415706
15,730	2009, 2004	Carpy-Conolly	38.4740120	-122.414825	-	-	38.473898	-122.414992	Emmolo	38.473772	-122.415180	-	-	38.473871	-122.415035
14,920	2011	Carpy-Conolly	38.4719700	-122.413419	38.471981	-122.413620	38.471986	-122.413686	Emmolo	38.472002	-122.413976	-	-	38.471990	-122.413768
13,845	2009 Long Profile	Honig	38.4690985	-122.413237	-	-	-	-		-	-	-	-	-	-
13,800	2010	Honig	38.4690410	-122.413207	-	-	38.469007	-122.413447	Mee	38.468965	-122.413733	-	-	38.468992	-122.413554
13,050	2010	Round Pond E	38.4669420	-122.413530	-	-	38.466919	-122.413721	Round Pond West	38.466846	-122.414295	38.466879	-122.414023	38.466900	-122.413878
12,060	2010 Long Profile	Round Pond E	38.4650540	-122.411736	-	-	-	-		-	-	-	-	-	-
12,000	**JTHERFORD XRD**														
8,830	2009, 2004	Wilsey	38.4580900	-122.408580	-	-	38.458030	-122.408730	St Supery	38.457690	-122.409980	-	-	38.457940	-122.409070
8,630	2009, 2004	Wilsey	38.4576800	-122.408430	-	-	38.457450	-122.408740	St Supery	38.457240	-122.409700	38.457430	-122.408970	38.457470	-122.408890
8,280	2009, 2004	Wilsey	38.4568900	-122.408280	-	-	38.456570	-122.408760	St Supery	38.456480	-122.408810	-	-	38.456570	-122.408780
7,830	2009, 2004	Wilsey	38.4556989	-122.407548	-	-			St Supery	38.455546	-122.408214	-	-		
7,700	2009, 2004	Wilsey	38.4554775	-122.407285	-	-			Sawyer	38.455139	-122.407950	-	-		
0	**OAKVILLE XRD**														
															Data Needed
															(-)No Pin

Monitoring Cross Section Map

Monitoring Cross Sections on Longitudinal Profile

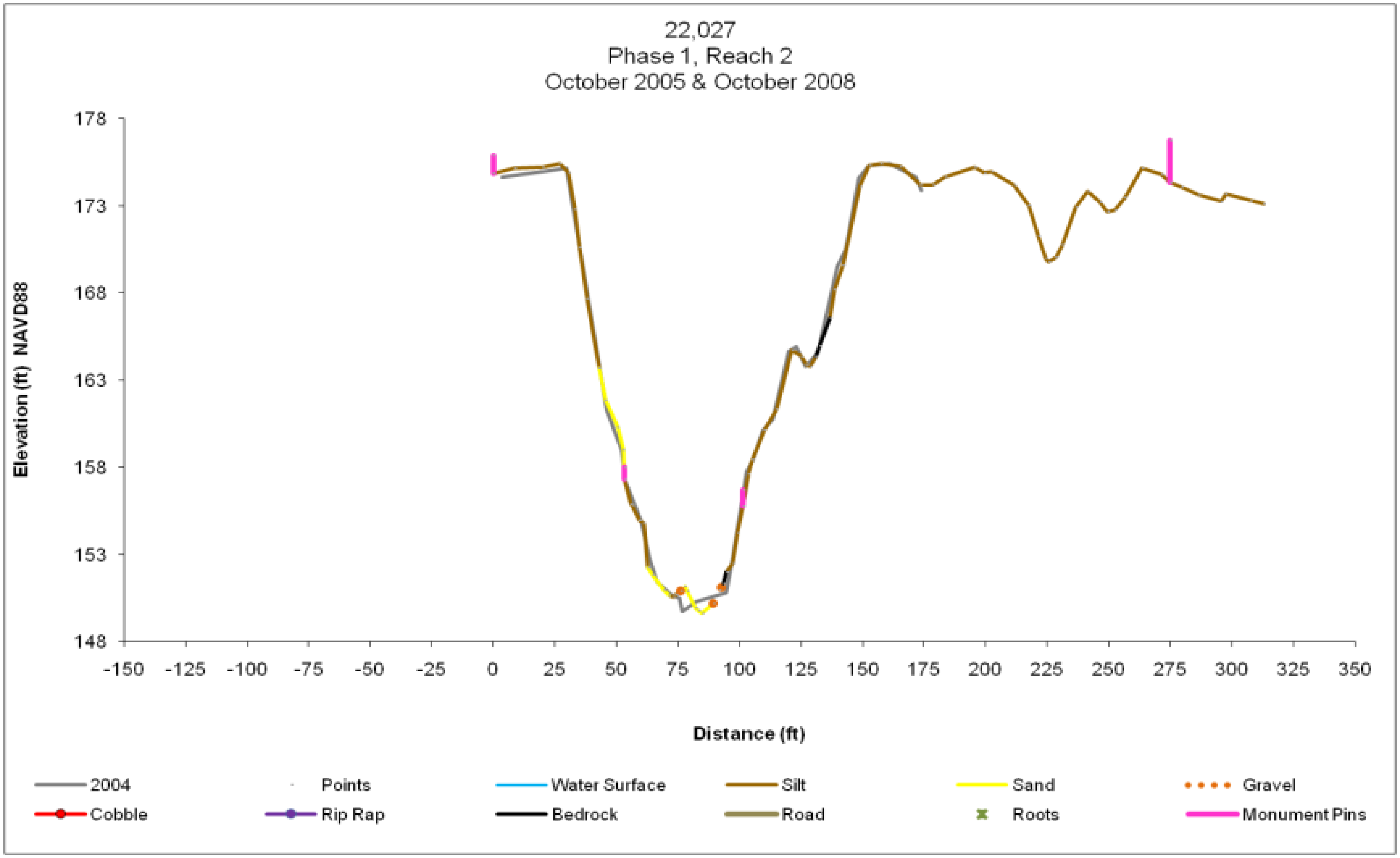


Monitoring Cross Section Substrate Key

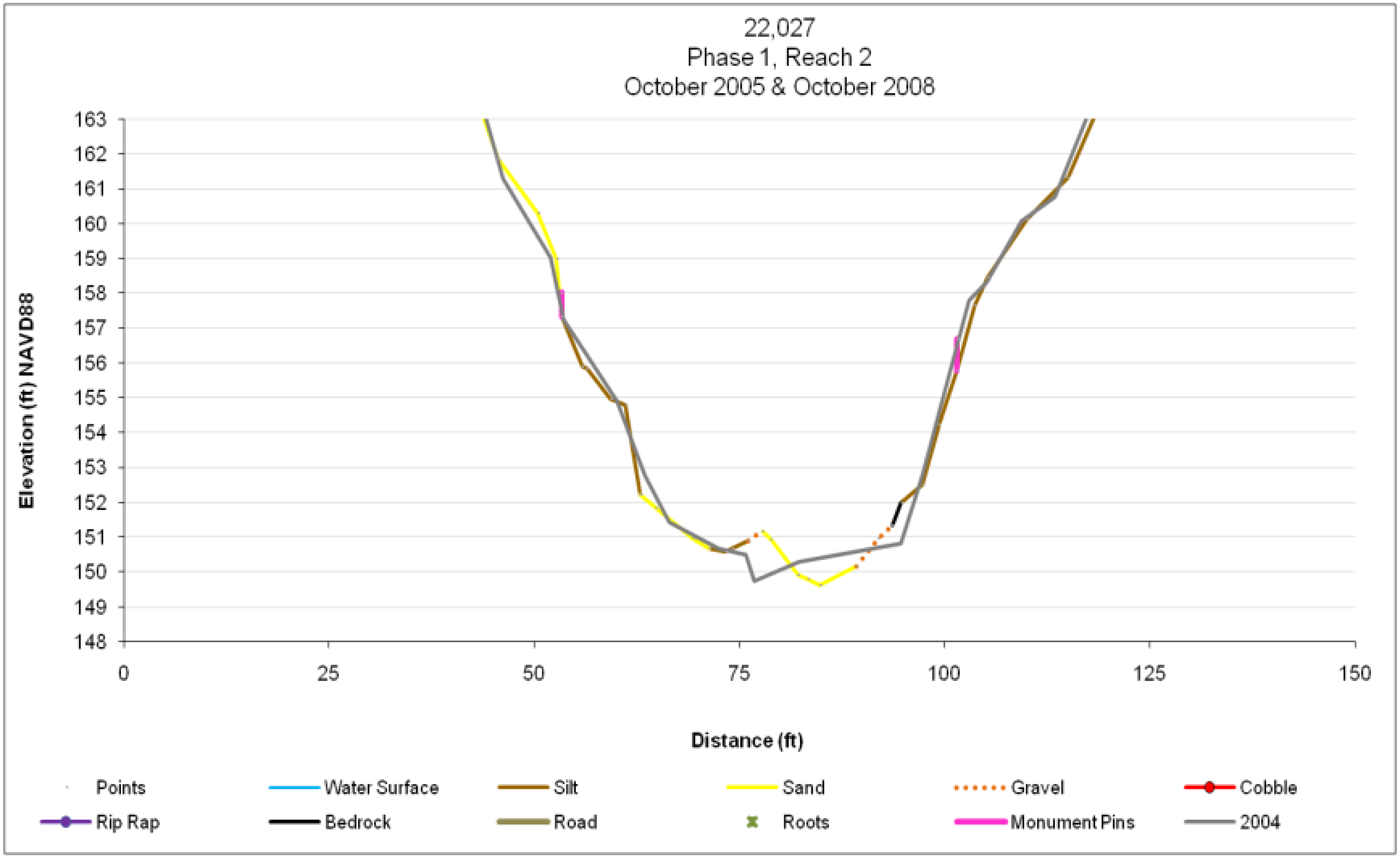
The distribution of substrate size classes along the cross section and longitudinal transects is indicated by coloring the cross section plot according to relative gravel size determined by eye during the survey.

brown	silt, soil	(<.062mm median diameter)
yellow	sand	(.062-2 mm median diameter)
orange	gravel	(2-64 mm median diameter)
red	cobble	(>64 mm median diameter)
purple	Boulder / Rip Rap	(>128 mm median diameter)
grey	bedrock	
Black	rip rap or hardened banks	
green	roots	

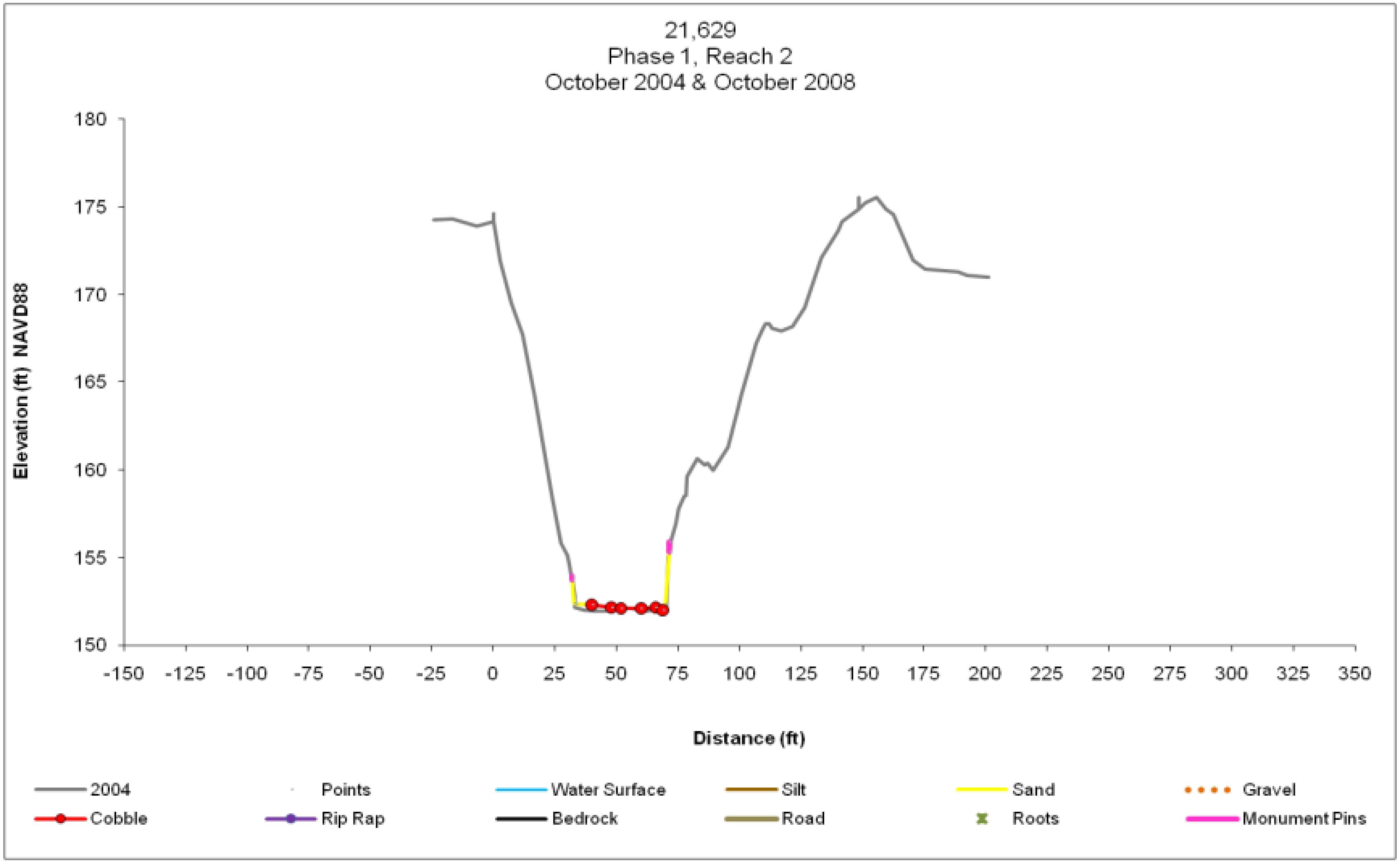
Monitoring Cross Section 22,027



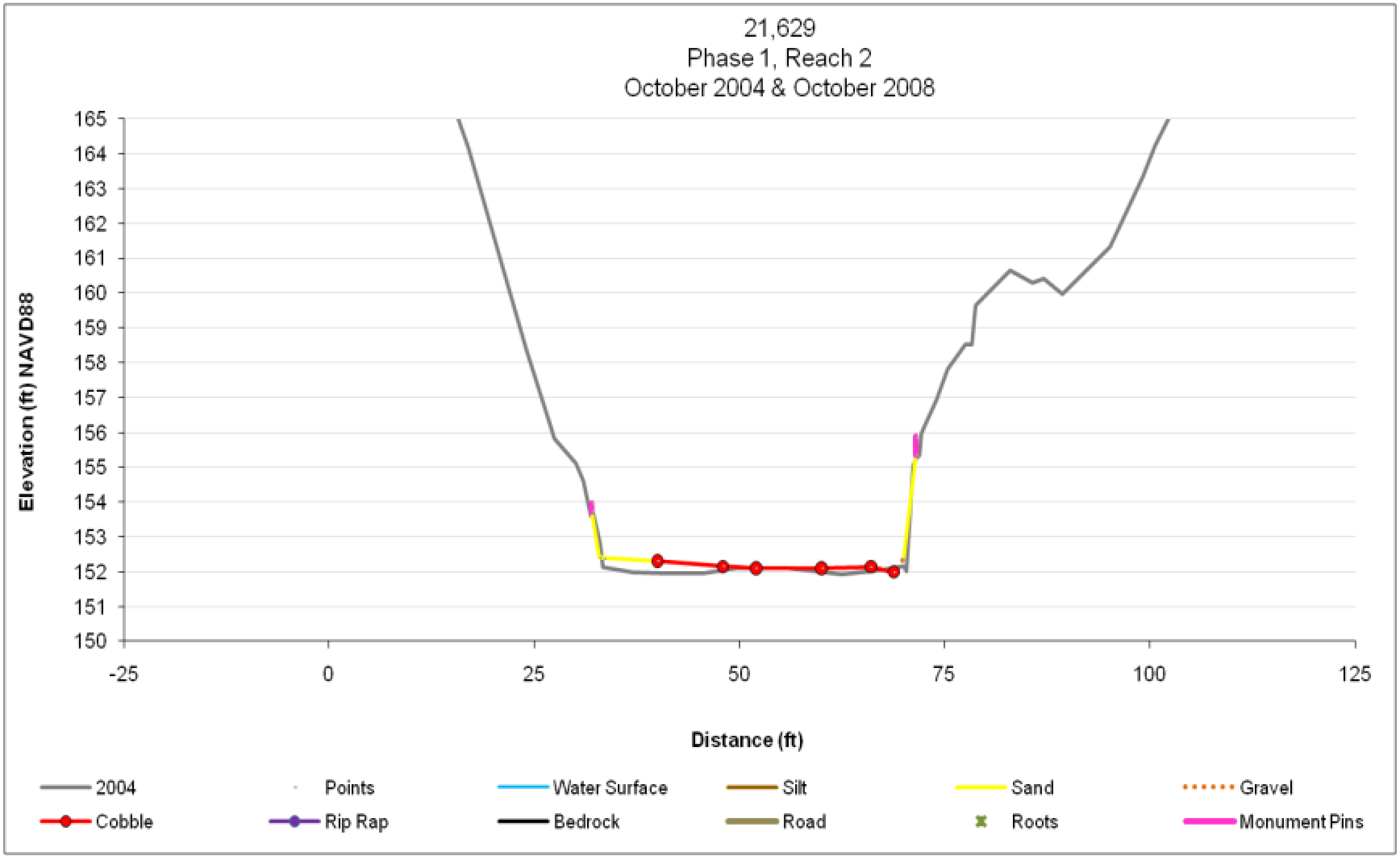
Monitoring Cross Section 22,027 (Channel Bed)



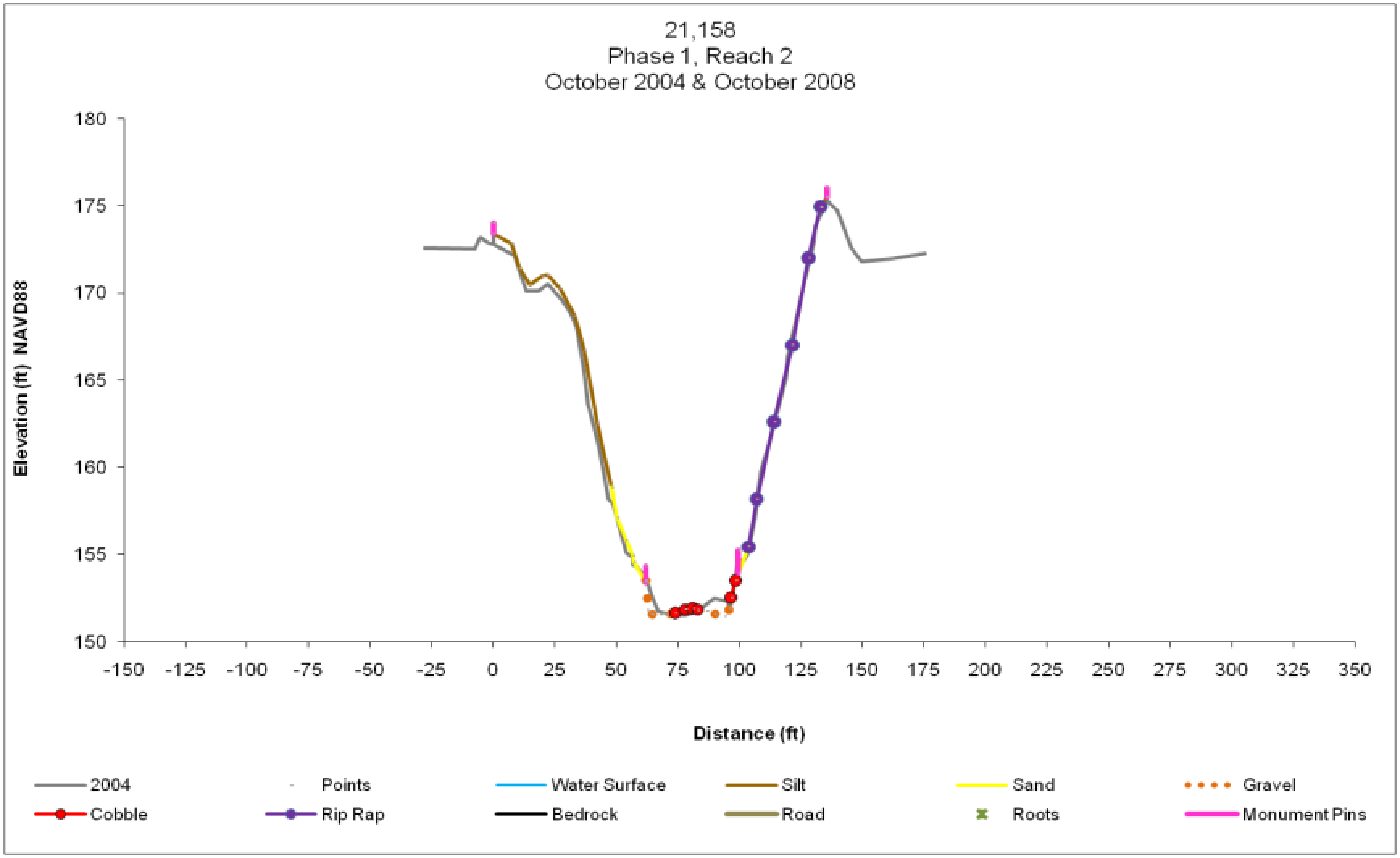
Monitoring Cross Section 21,629



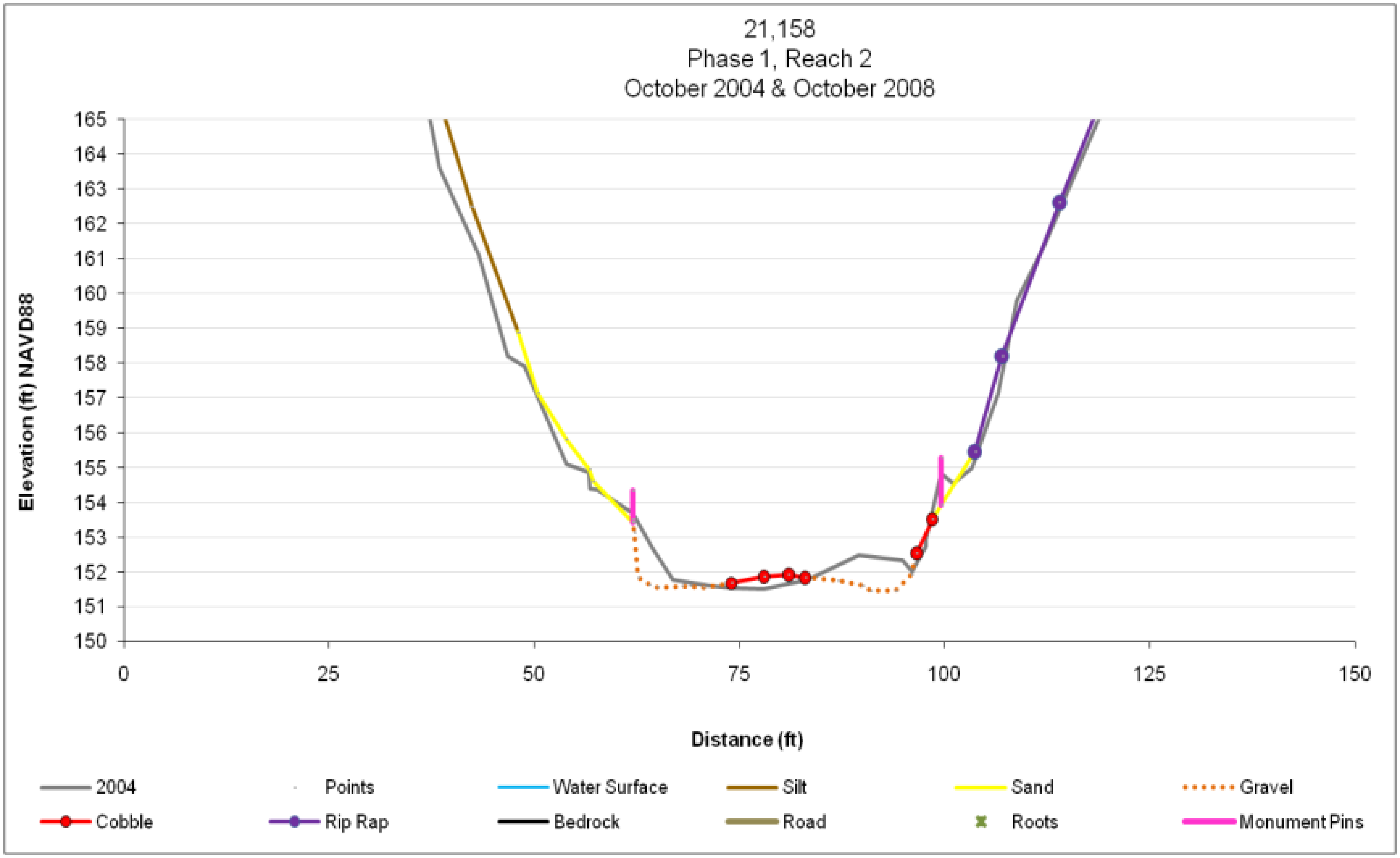
Monitoring Cross Section 21,629 (Channel Bed)



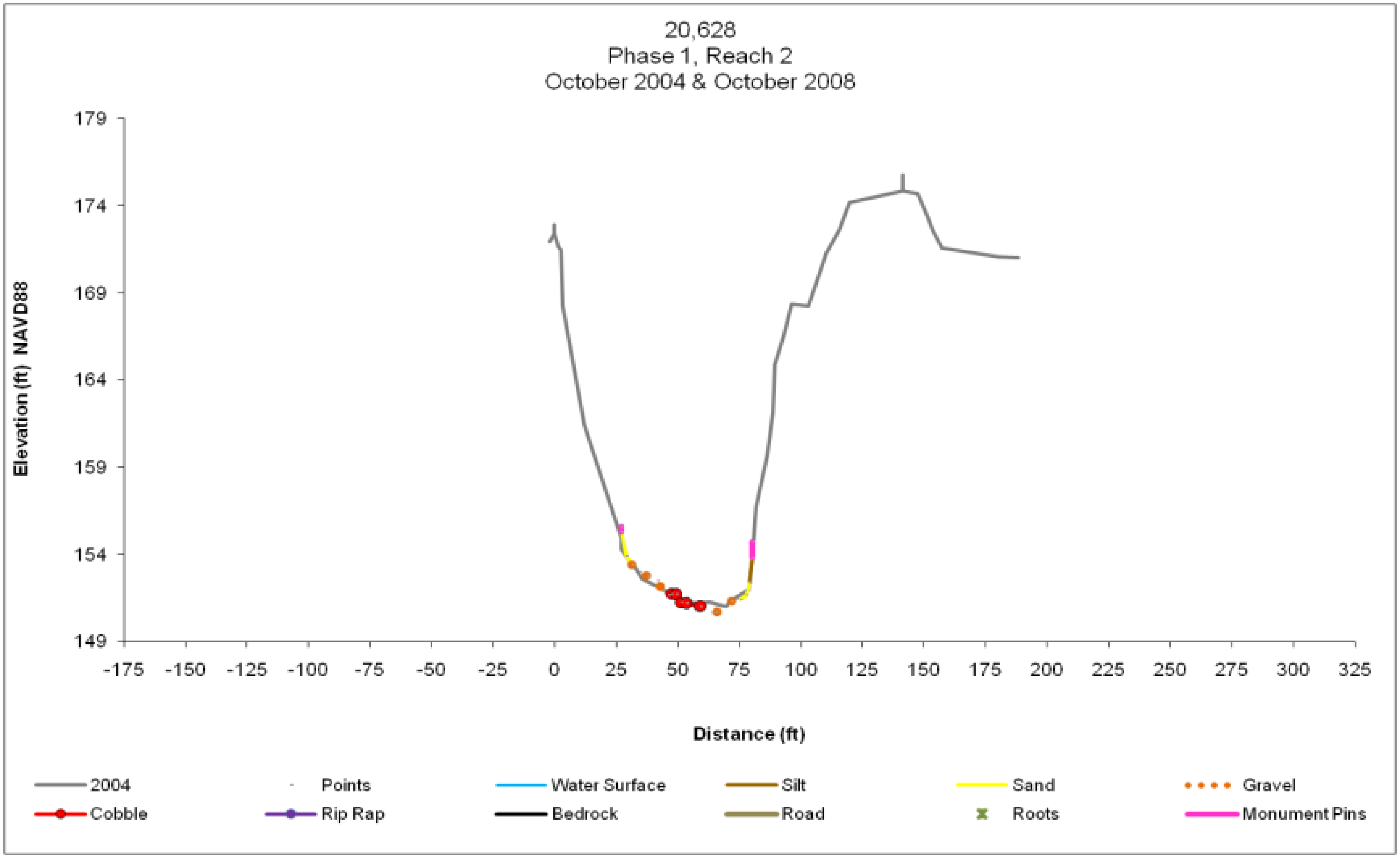
Monitoring Cross Section 21,158



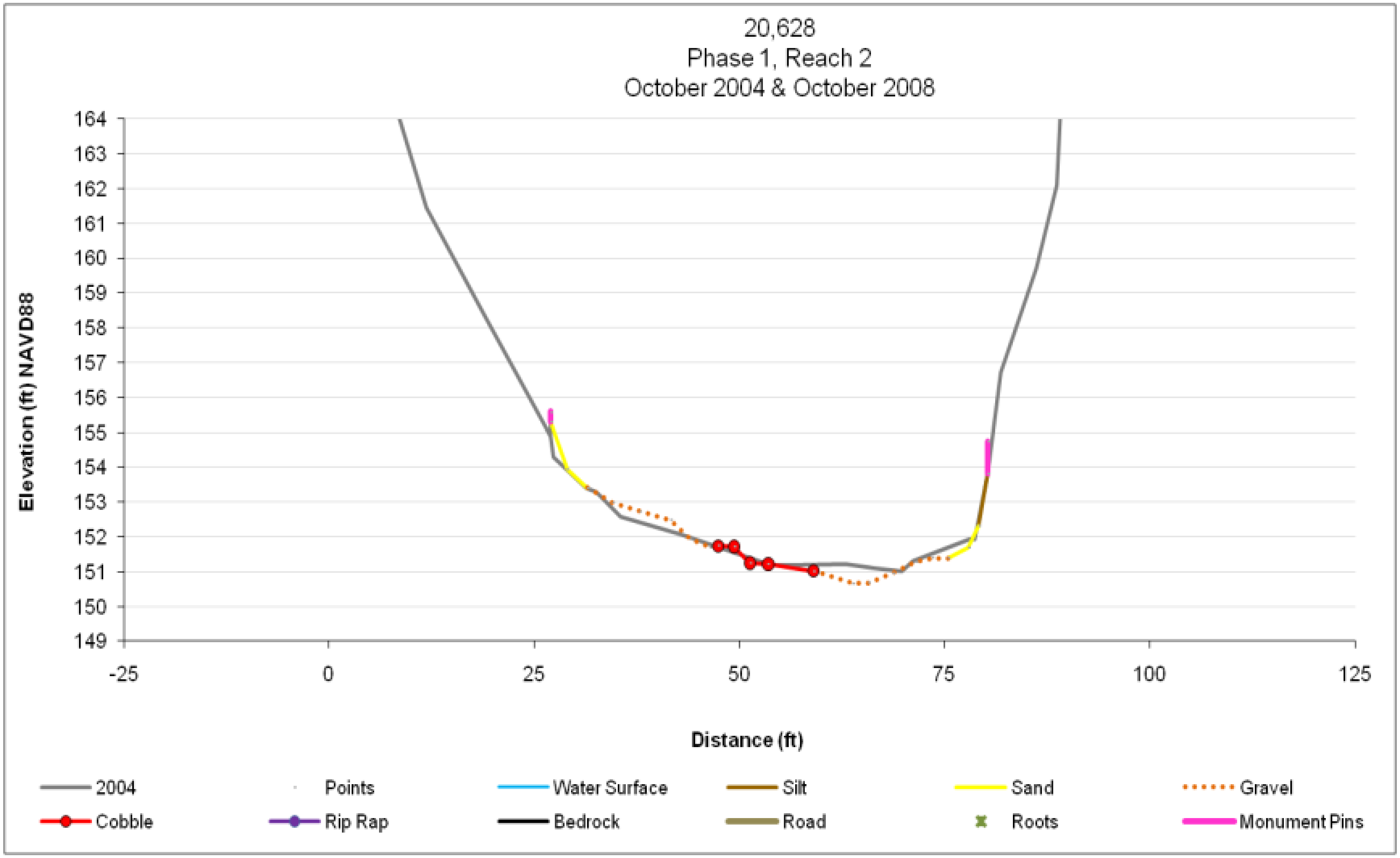
Monitoring Cross Section 21,158 (Channel Bed)



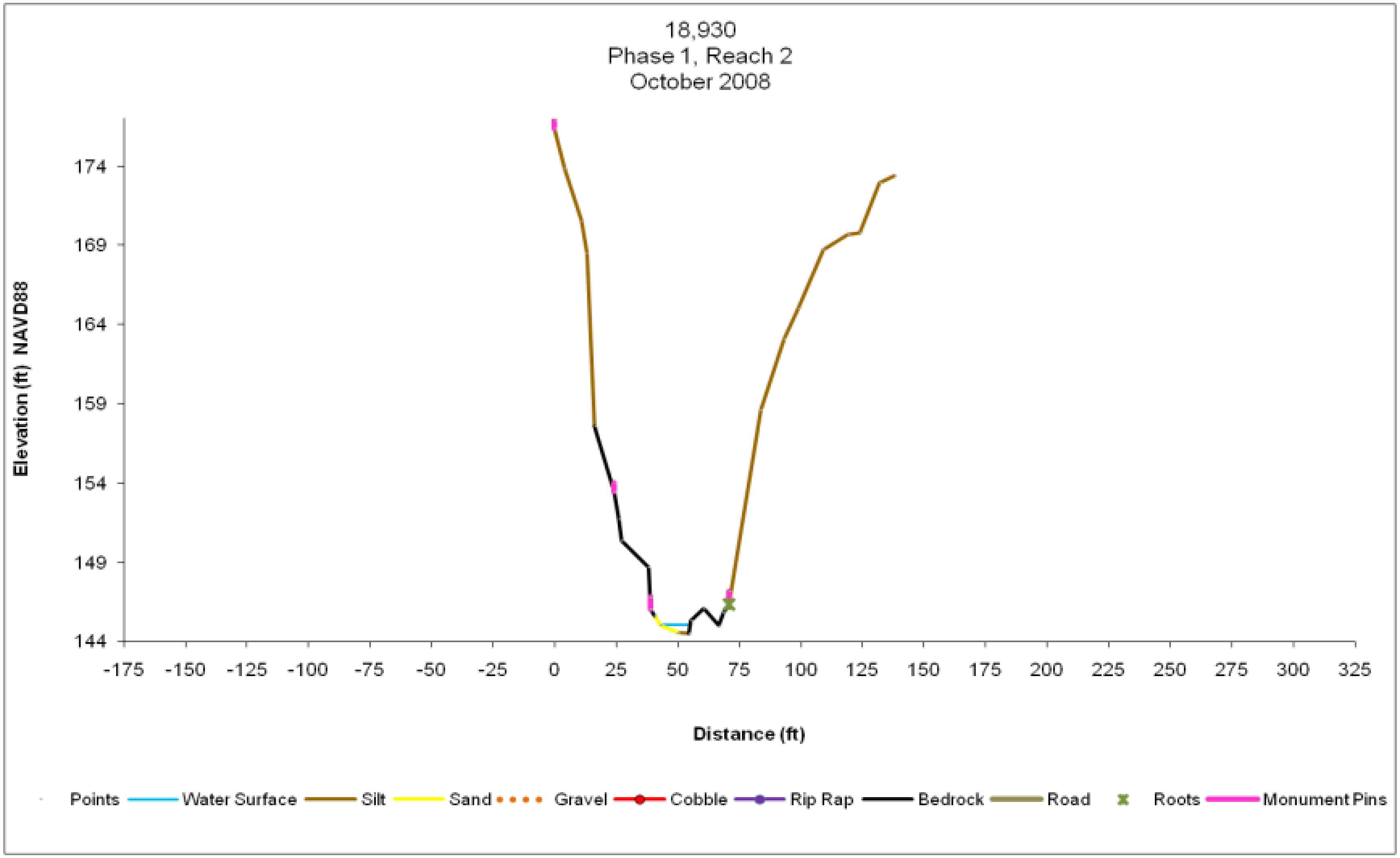
Monitoring Cross Section 20,628



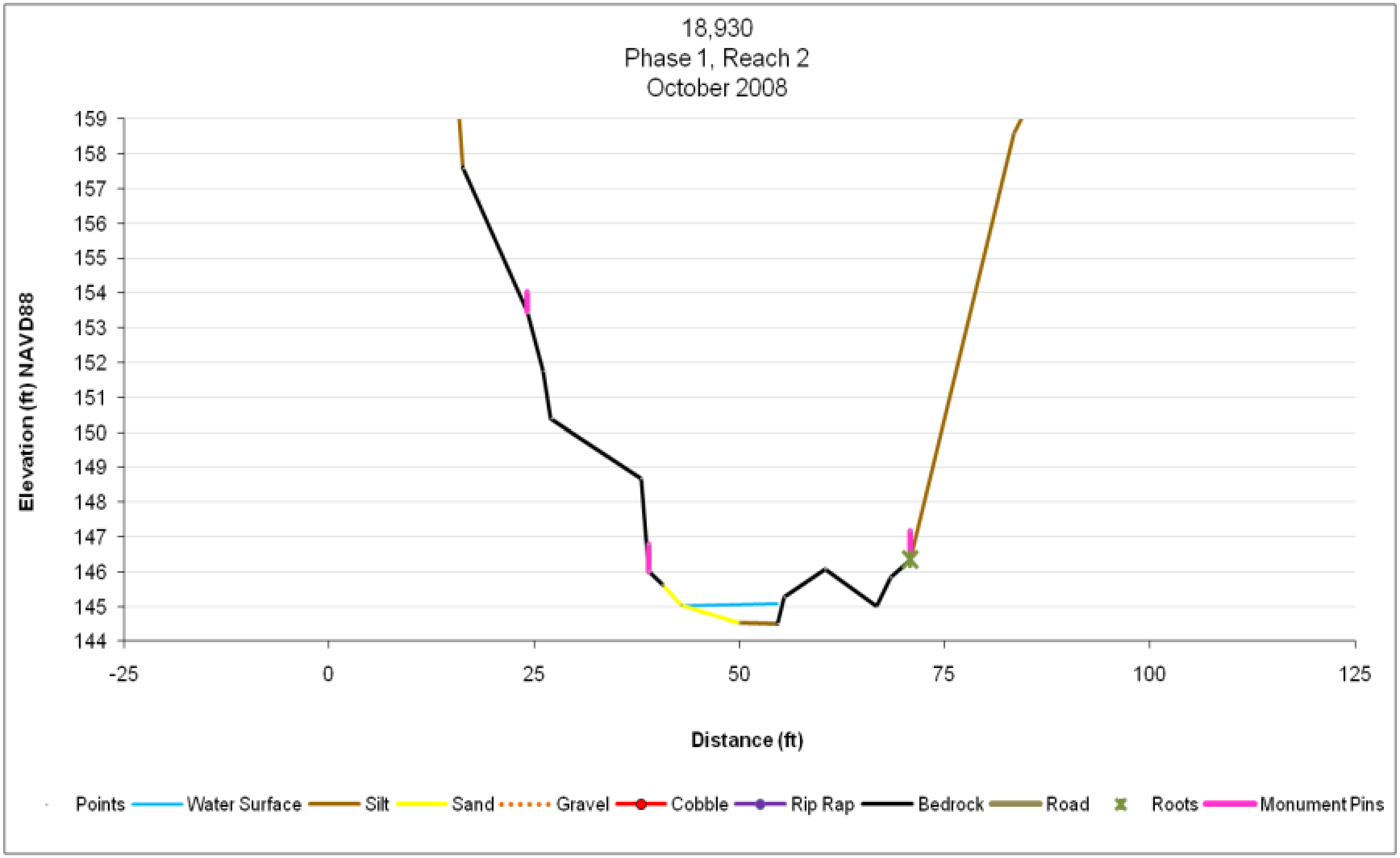
Monitoring Cross Section 20,628 (Channel Bed)



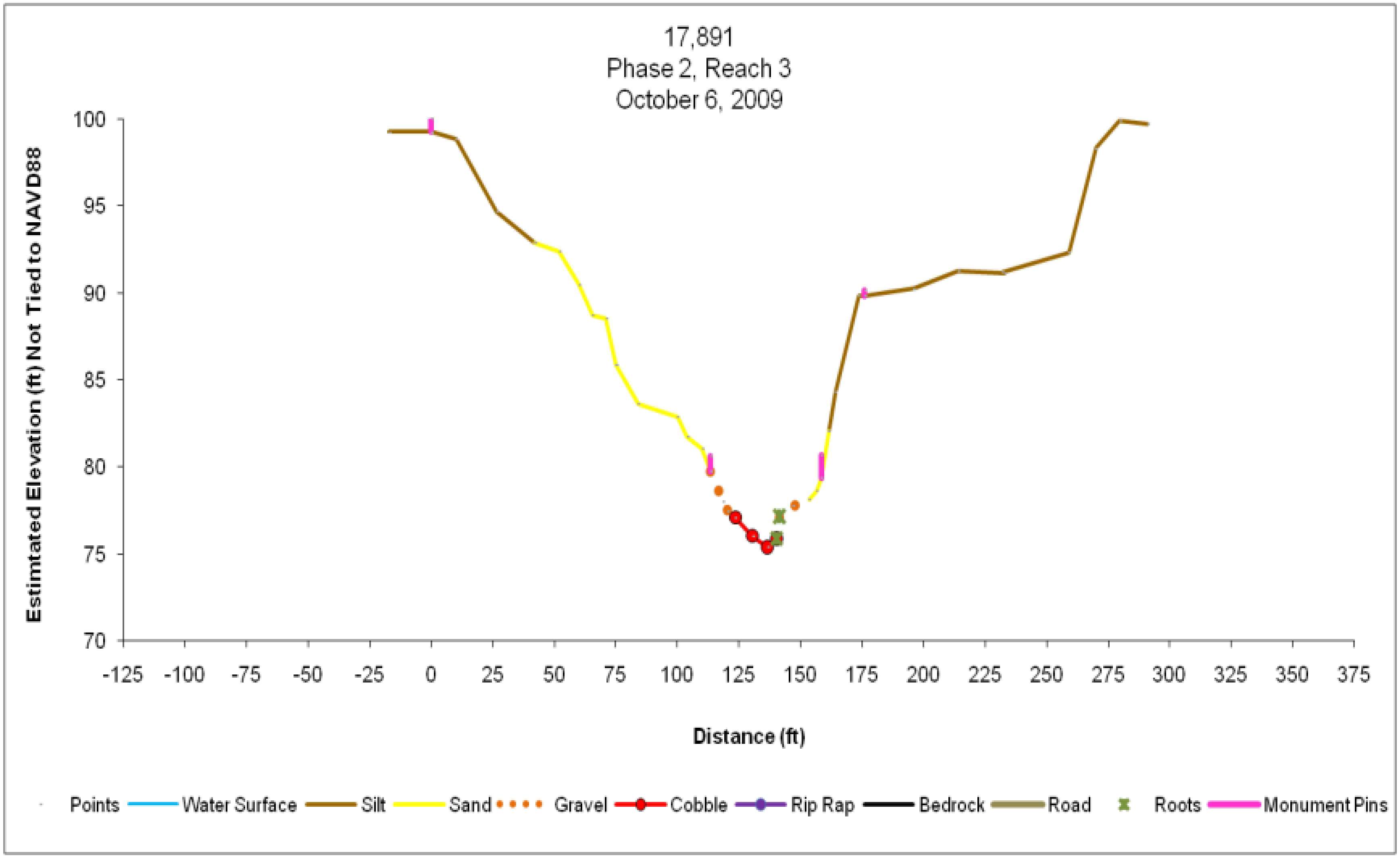
Monitoring Cross Section 18,930



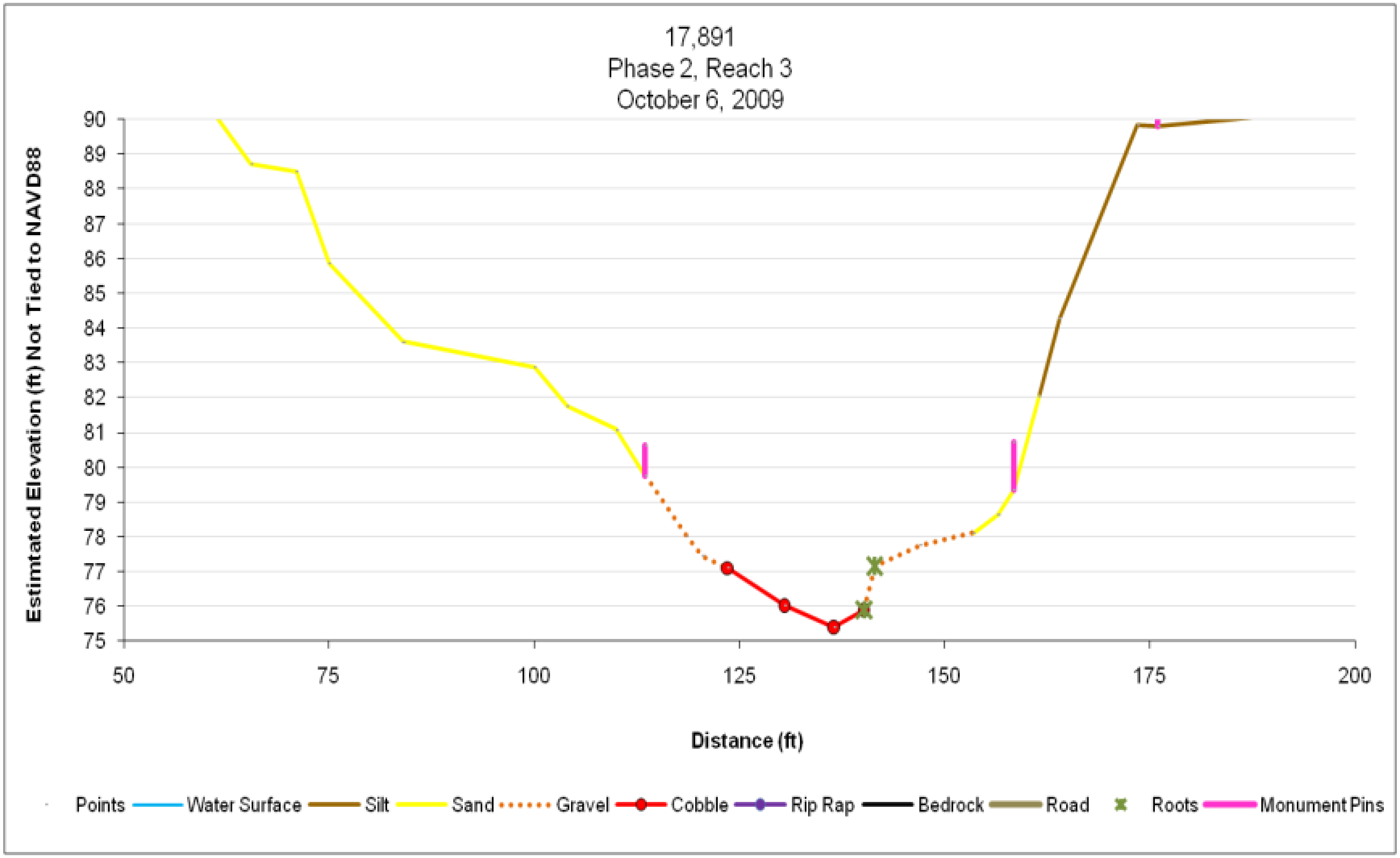
Monitoring Cross Section 18,930 (Channel Bed)



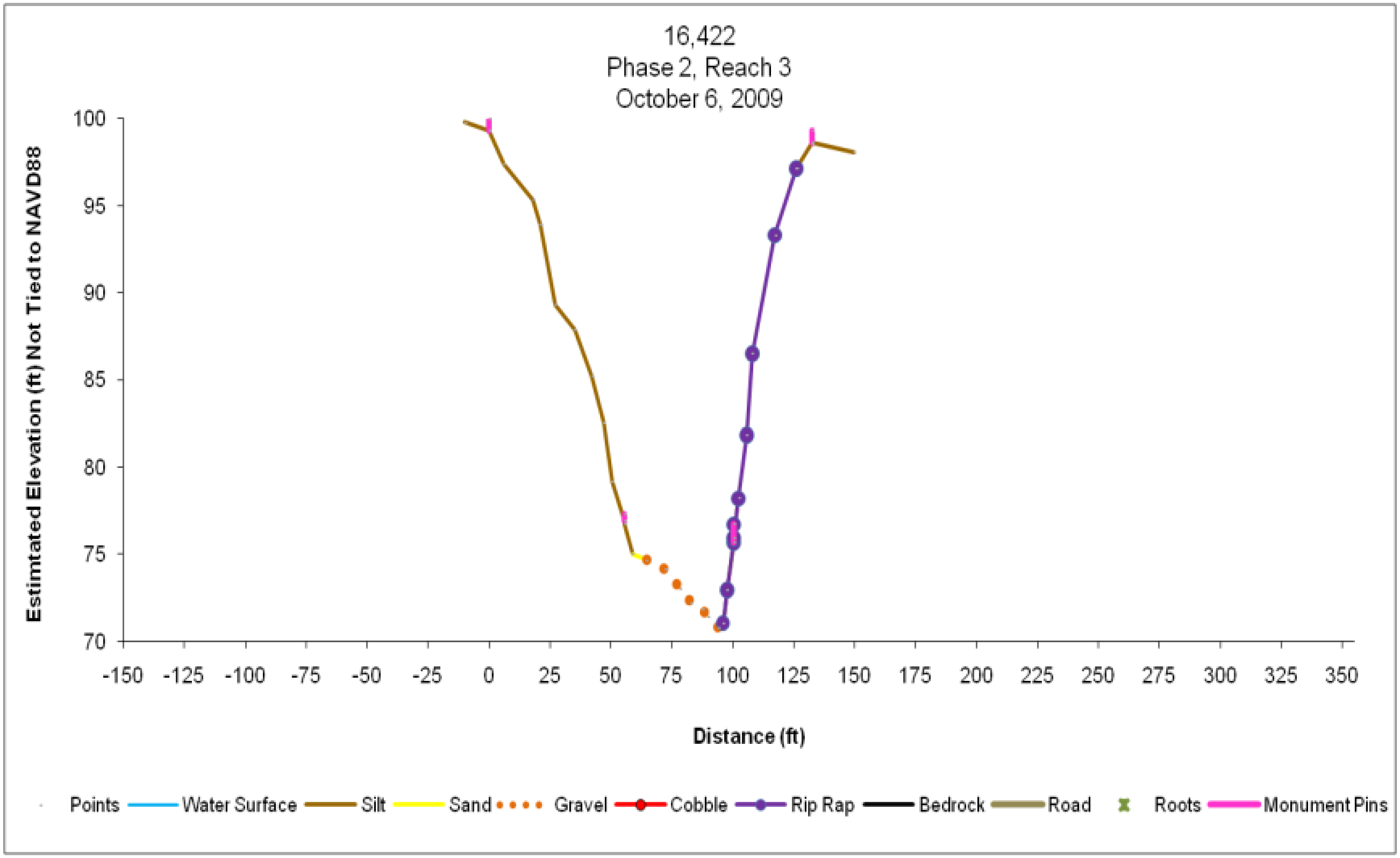
Monitoring Cross Section 17,891



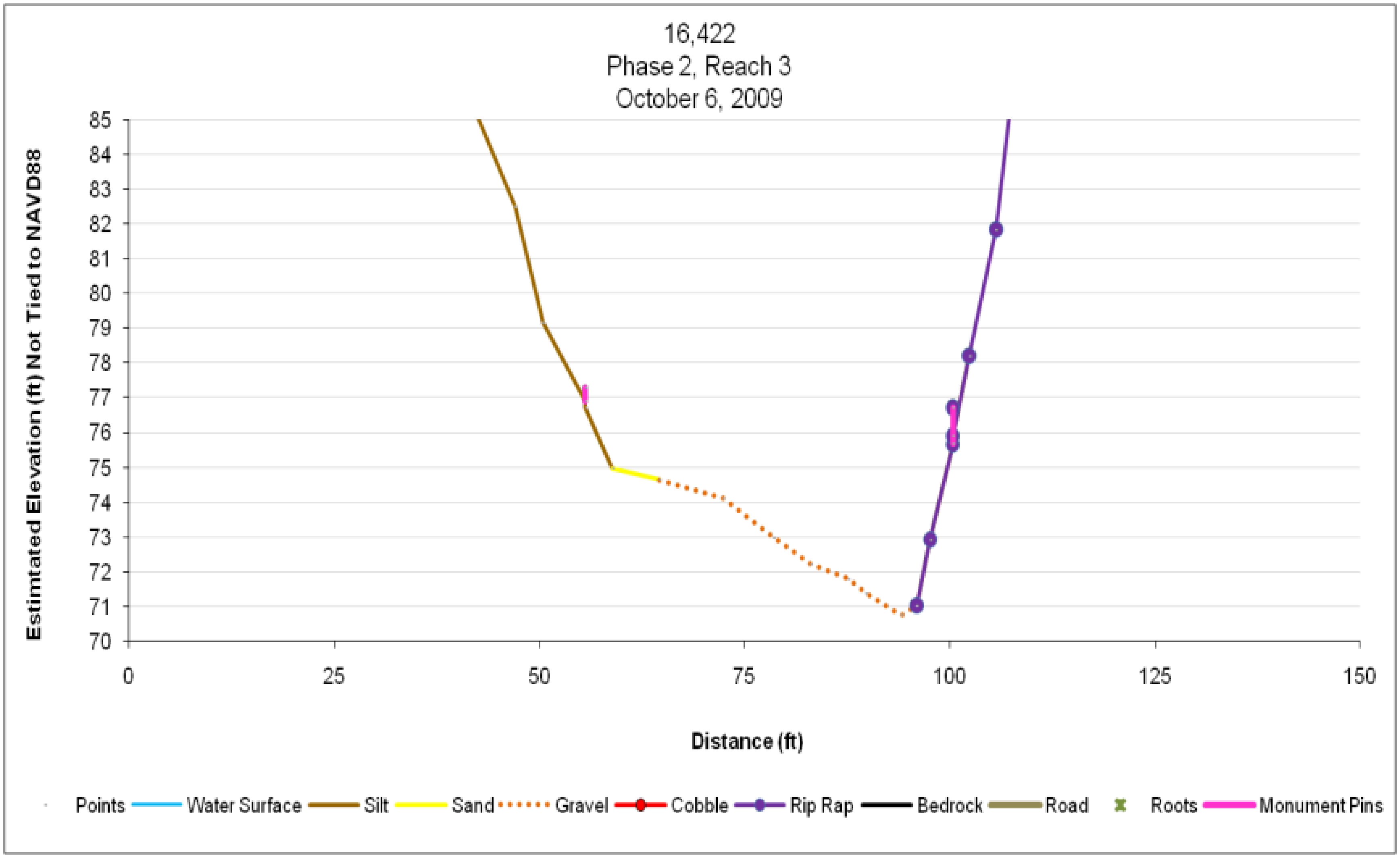
Monitoring Cross Section 17,891 (Channel Bed)



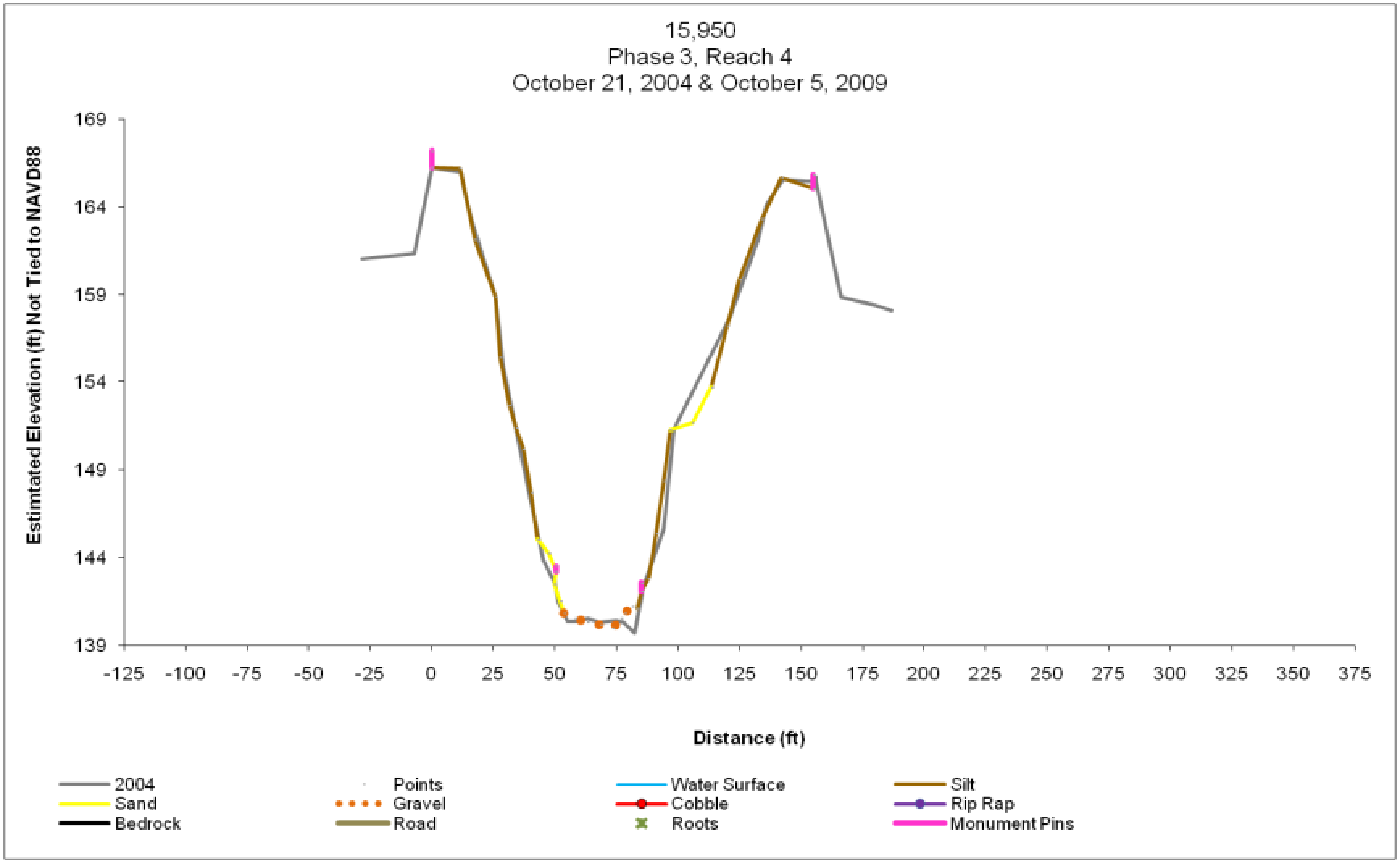
Monitoring Cross Section 16,422



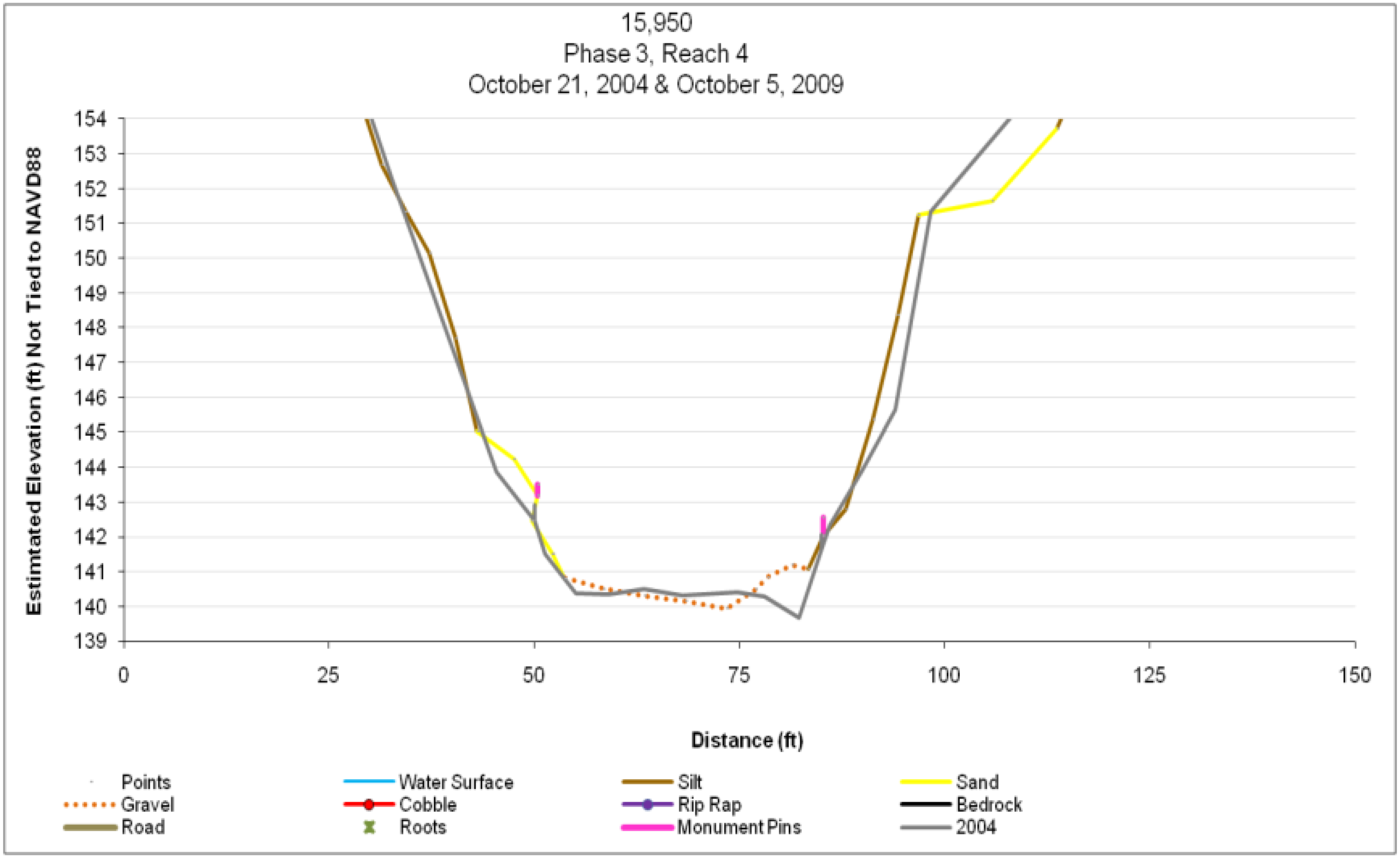
Monitoring Cross Section 16,422 (Channel Bed)



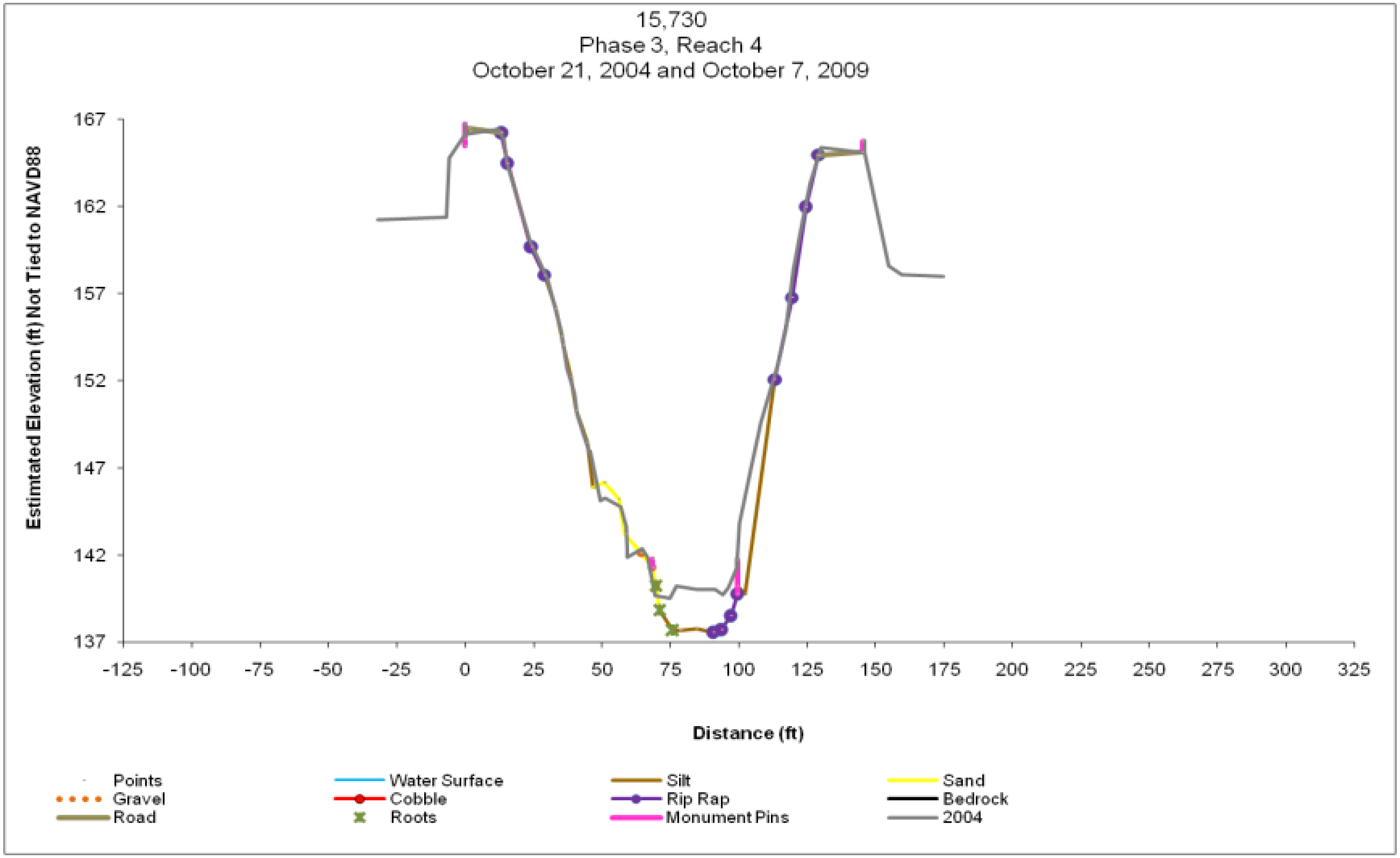
Monitoring Cross Section 15,950



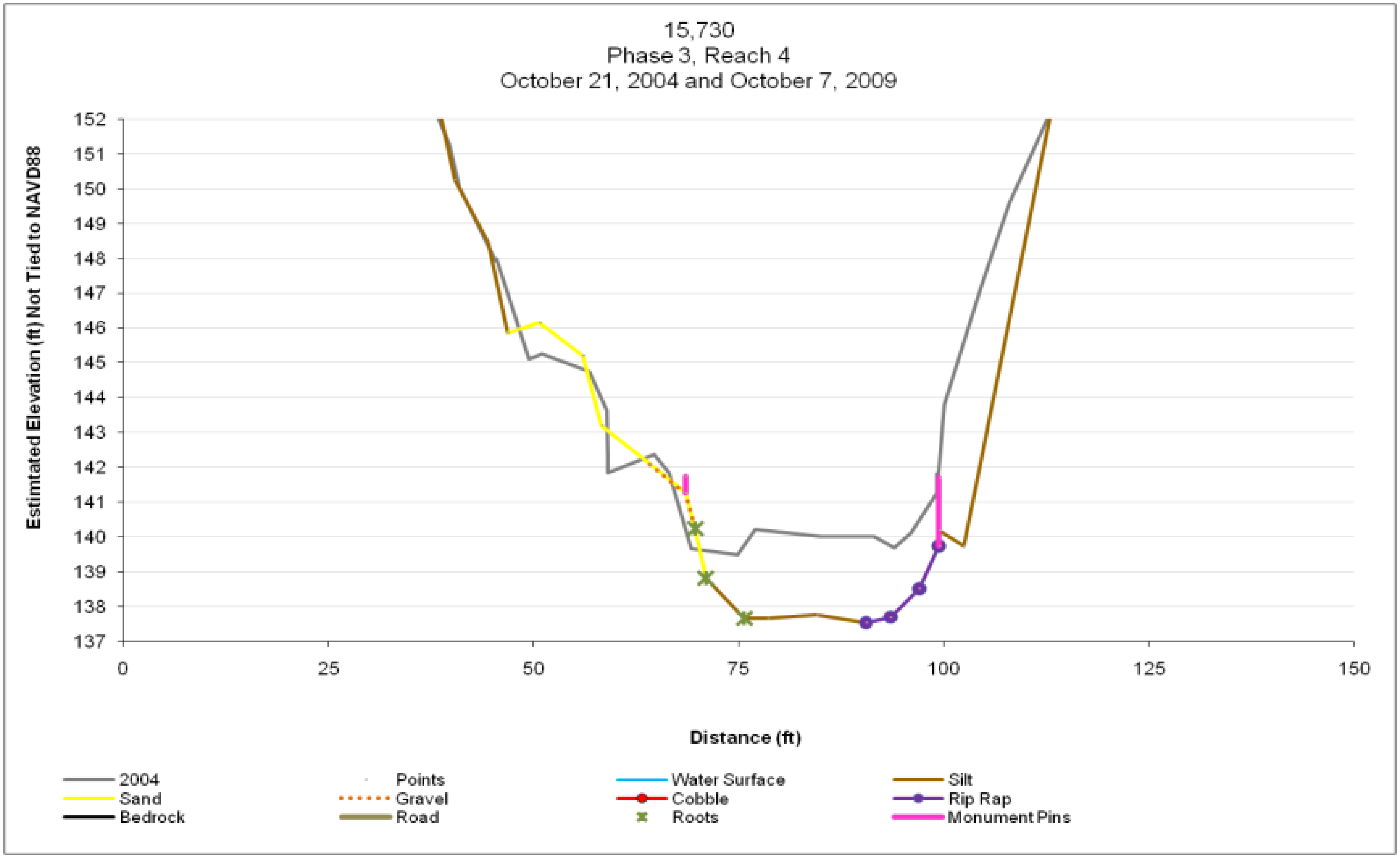
Monitoring Cross Section 15,950 (Channel Bed)



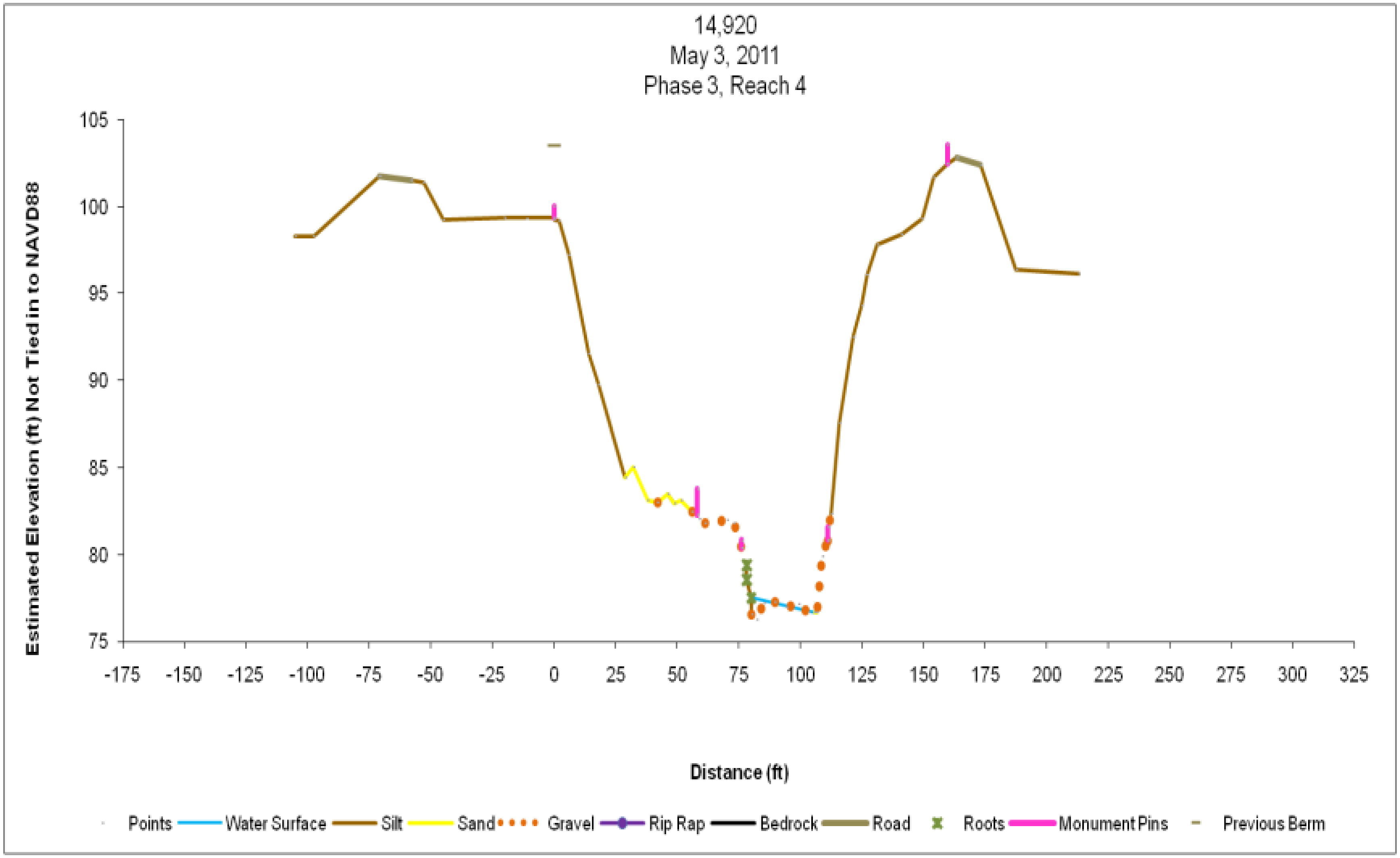
Monitoring Cross Section 15,730



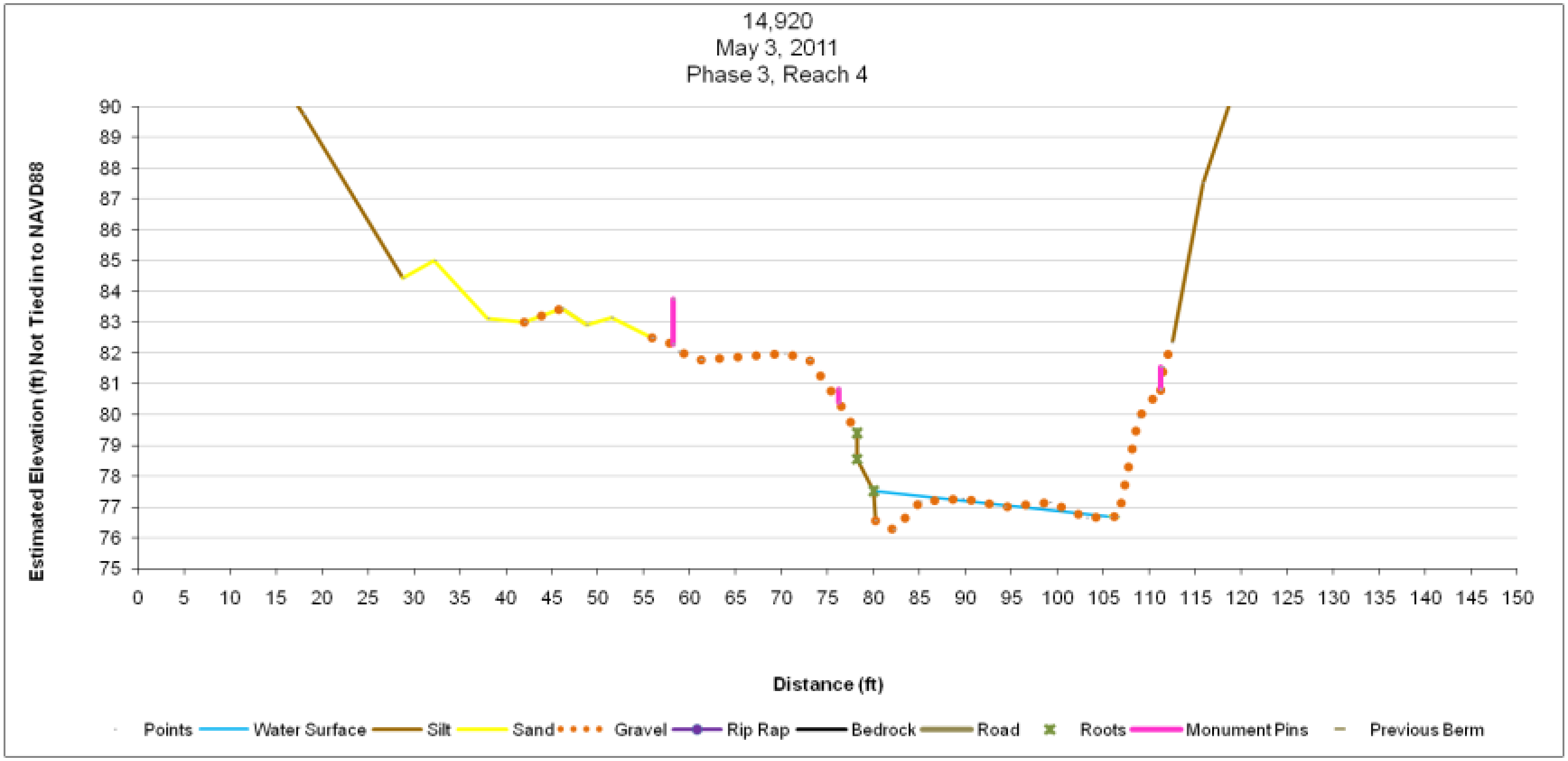
Monitoring Cross Section 15,730 (Channel Bed)



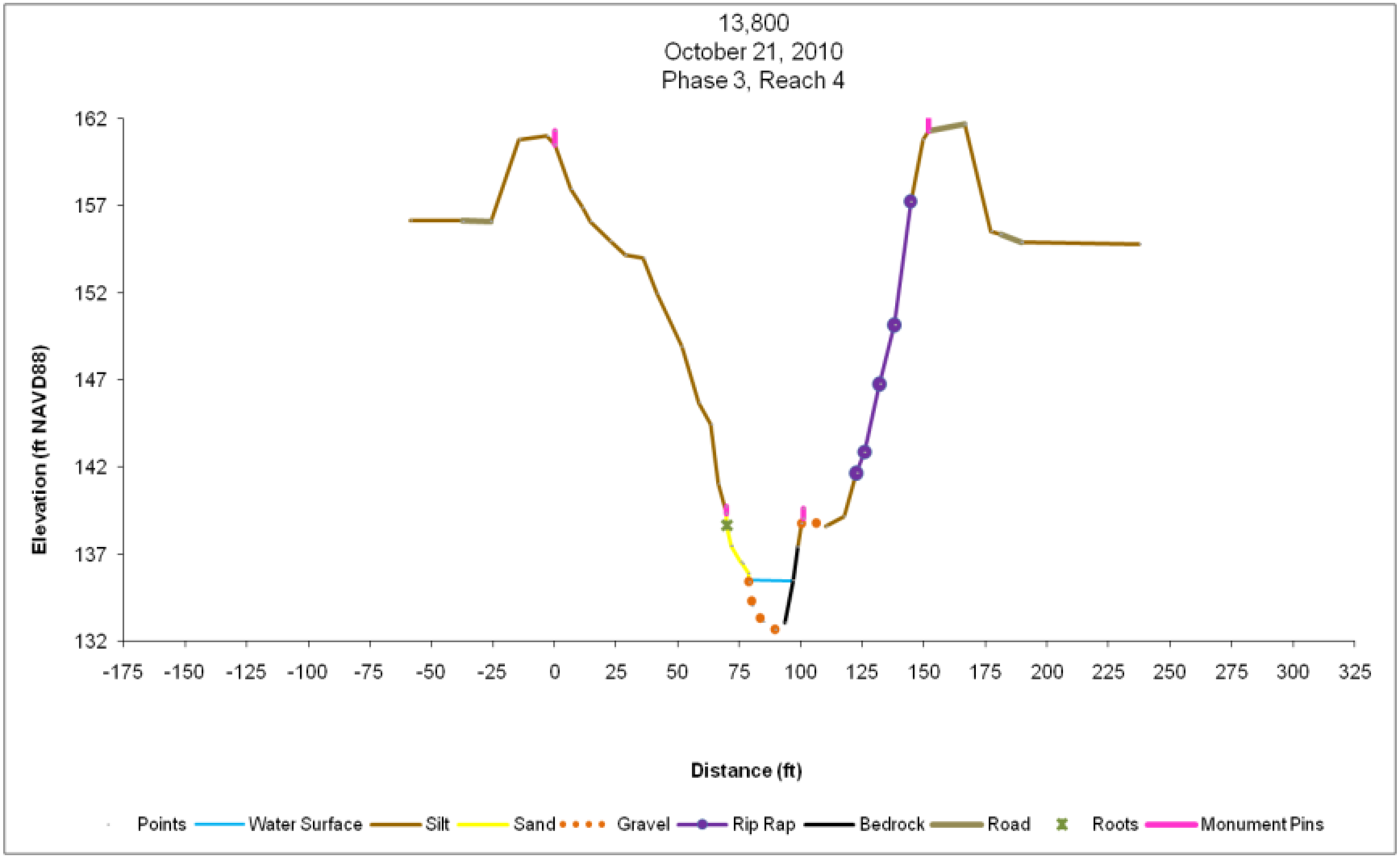
Monitoring Cross Section 14,920



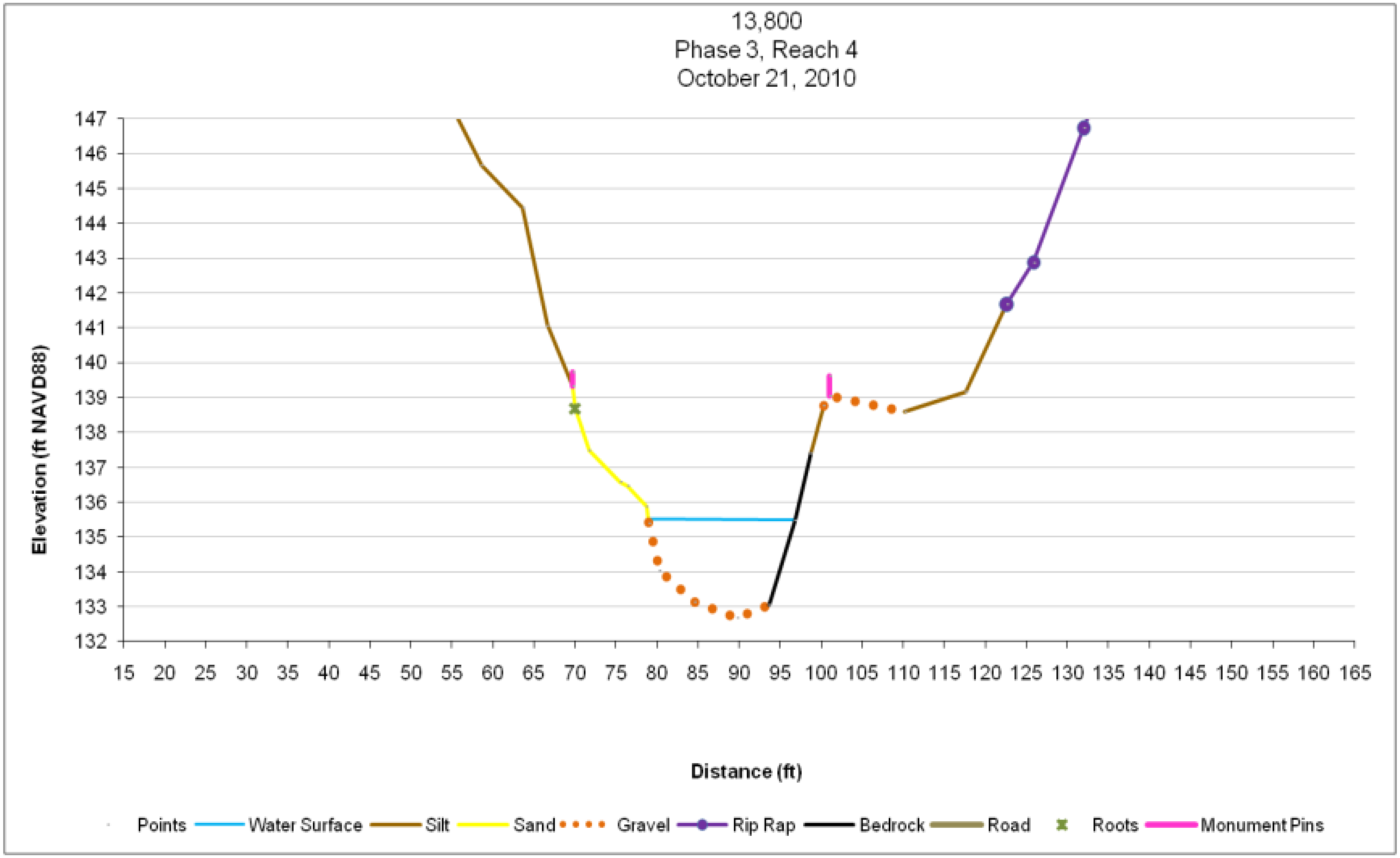
Monitoring Cross Section 14,920 (Channel Bed)



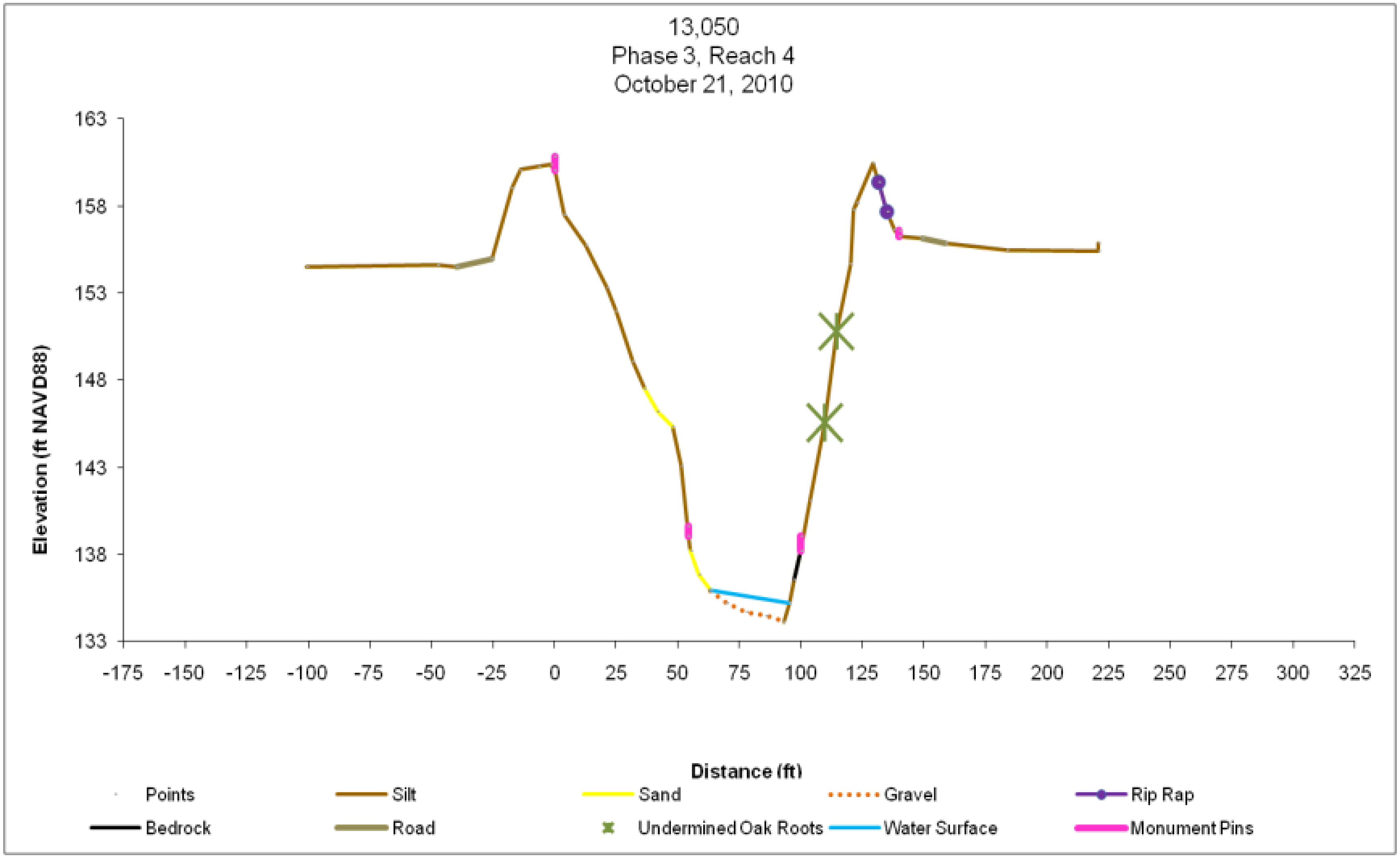
Monitoring Cross Section 13,800



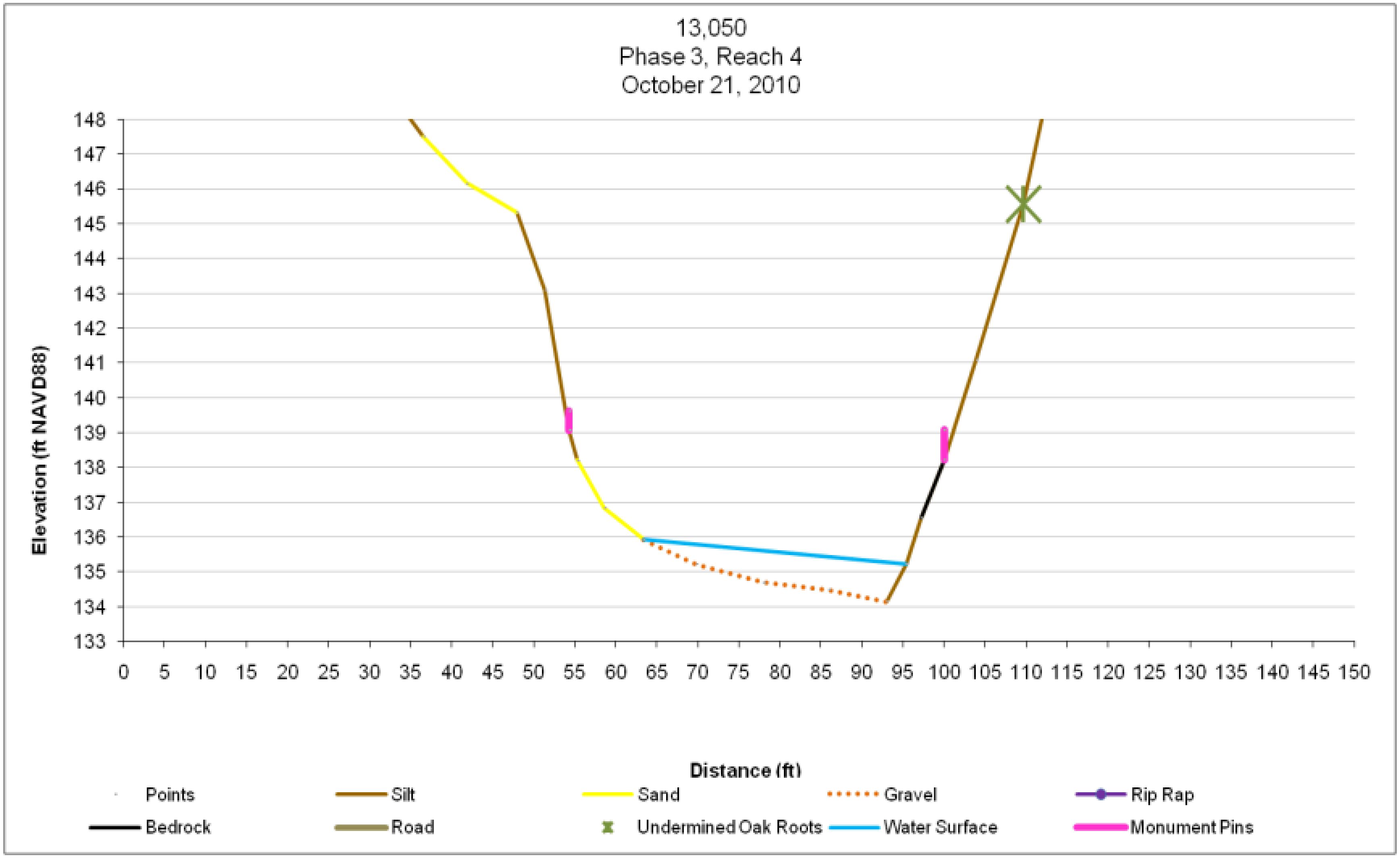
Monitoring Cross Section 13,800 (Channel Bed)



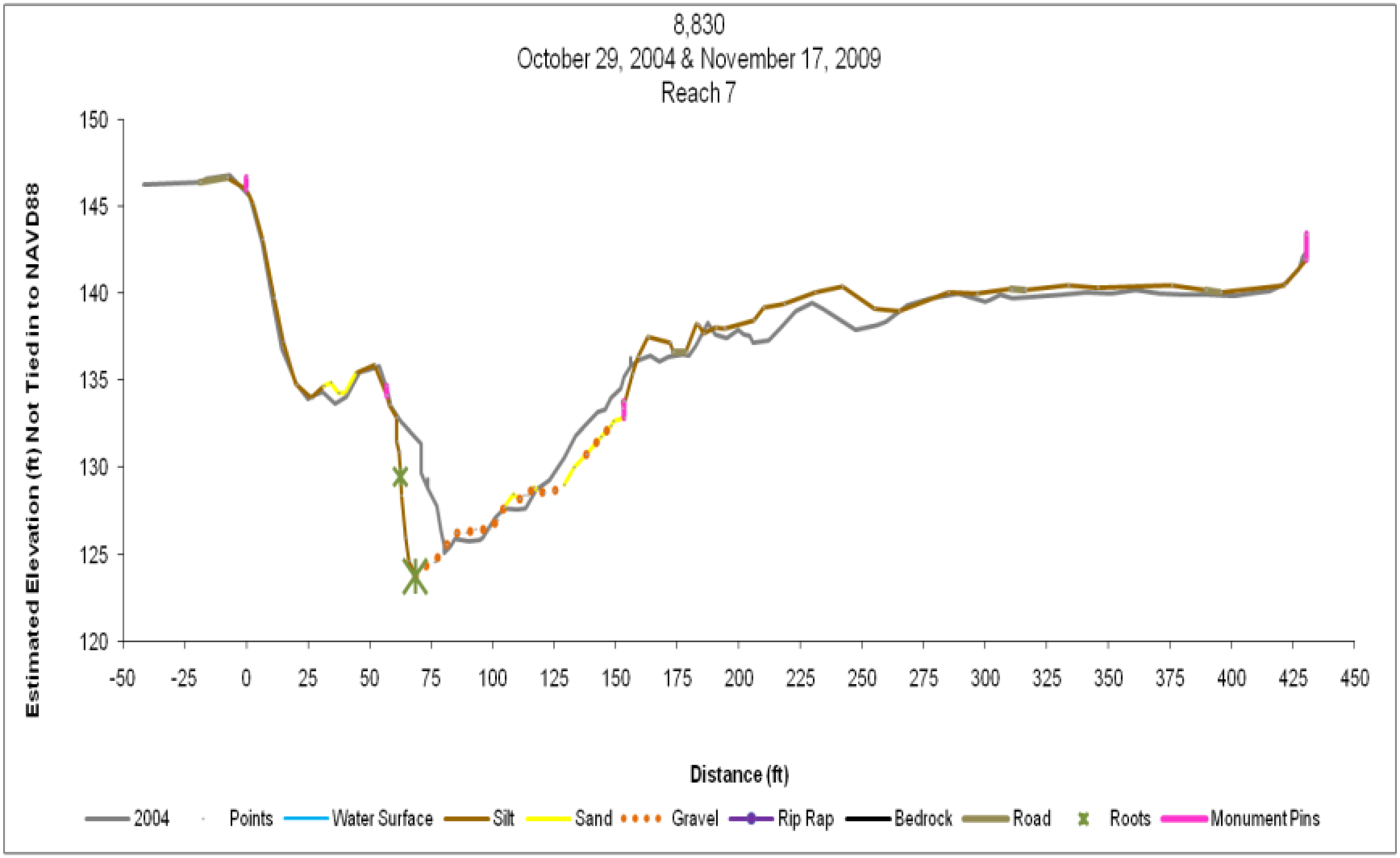
Monitoring Cross Section 13,050



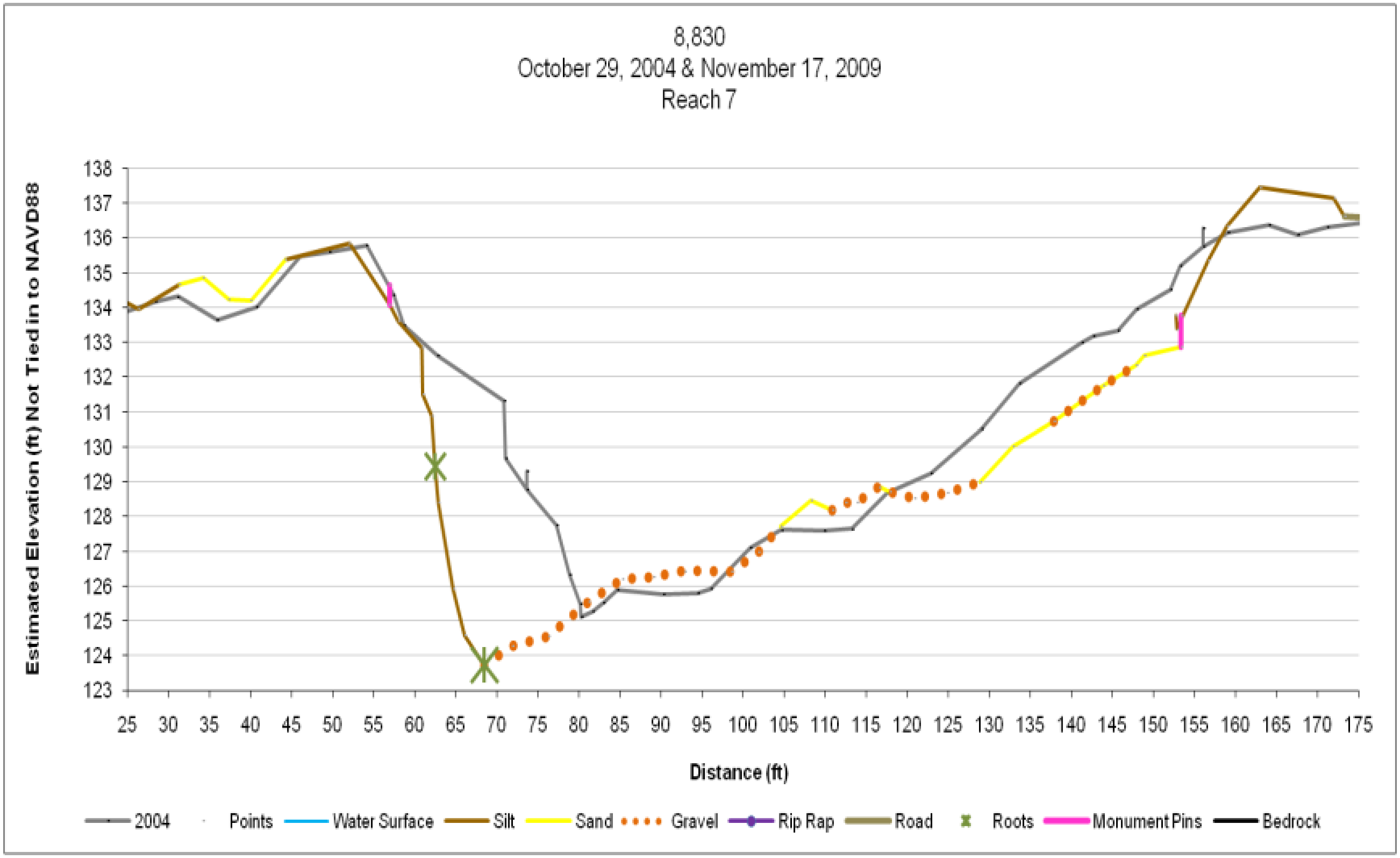
Monitoring Cross Section 13,050 (Channel Bed)



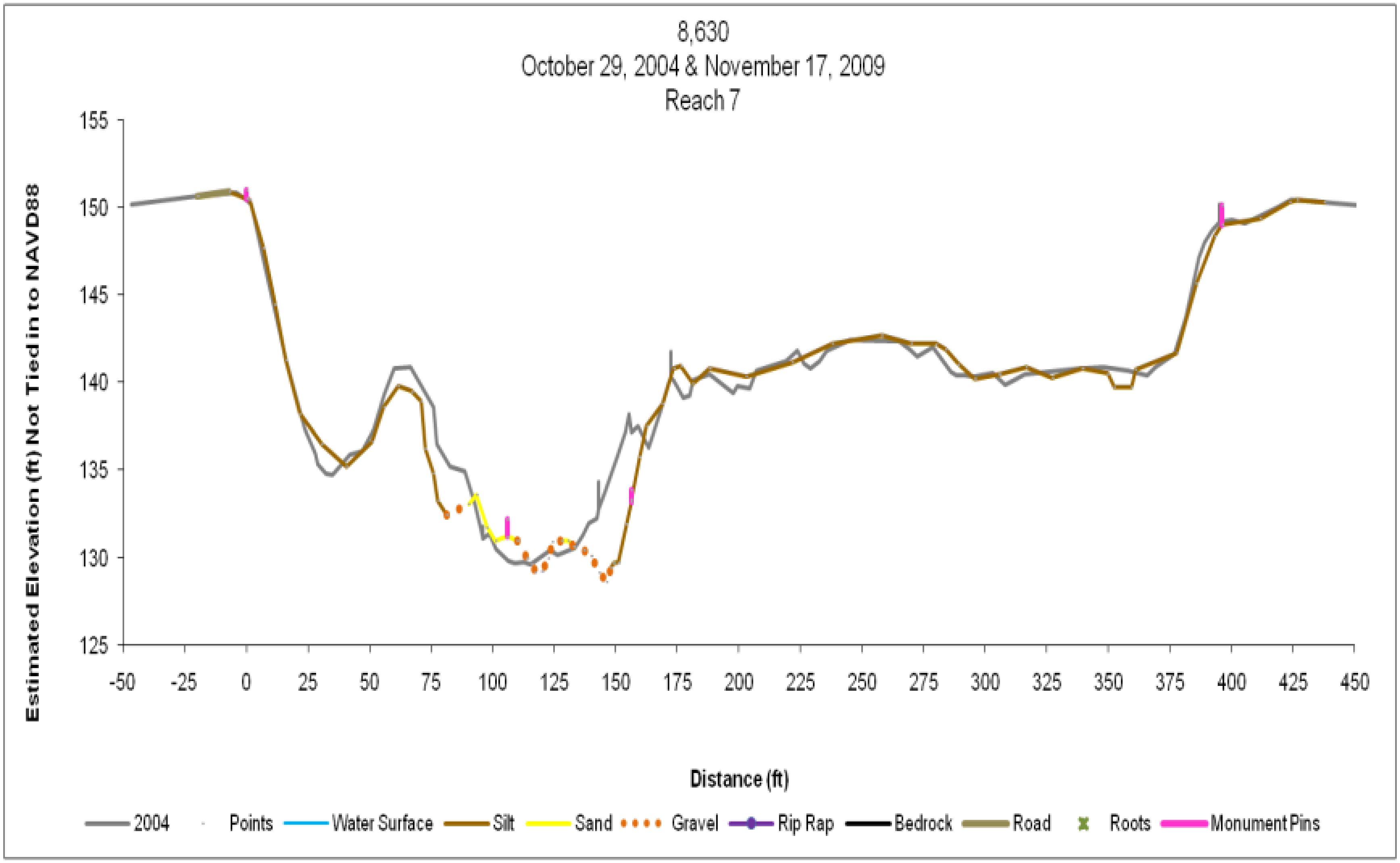
Monitoring Cross Section 8,830



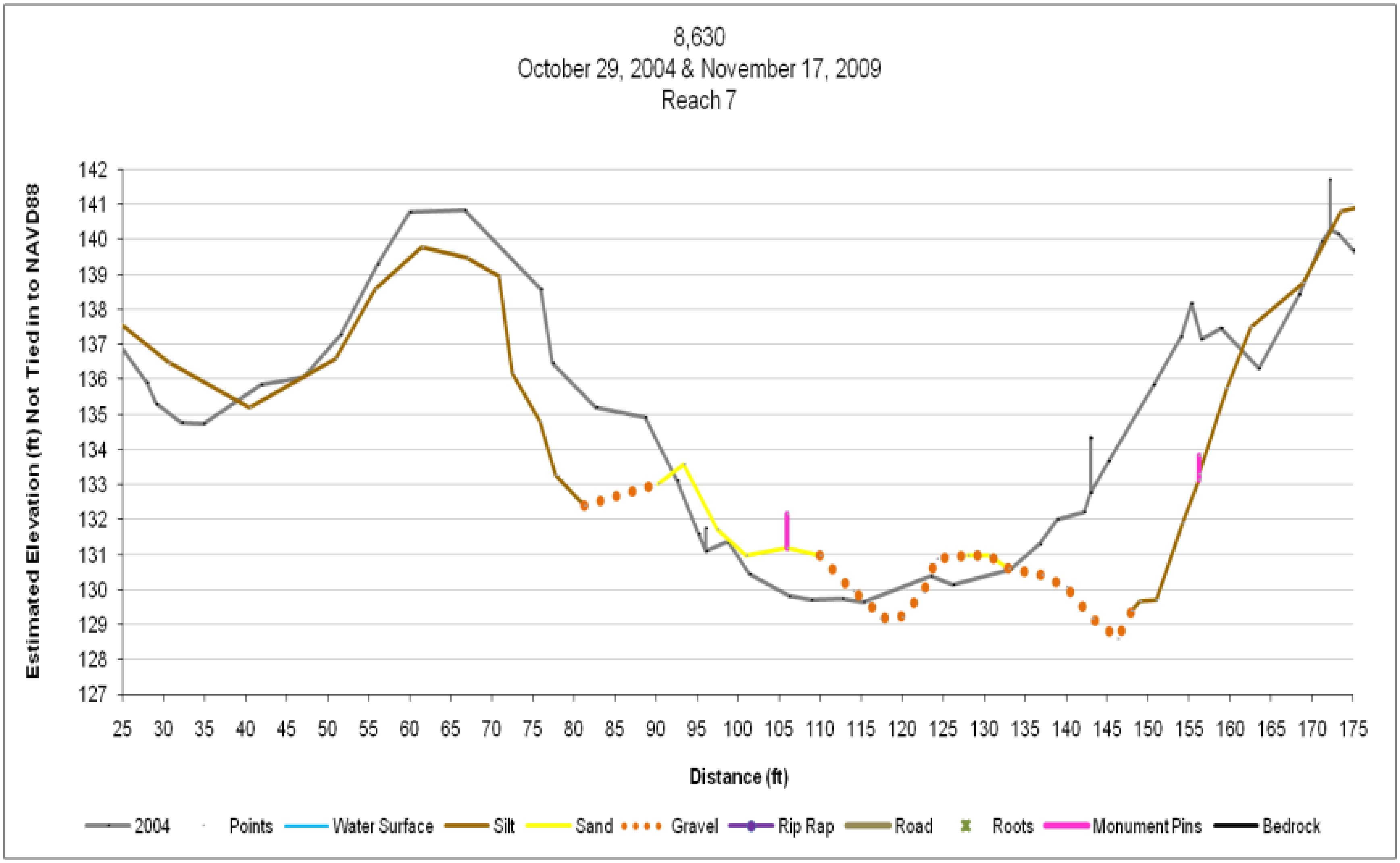
Monitoring Cross Section 8,830 (Channel Bed)



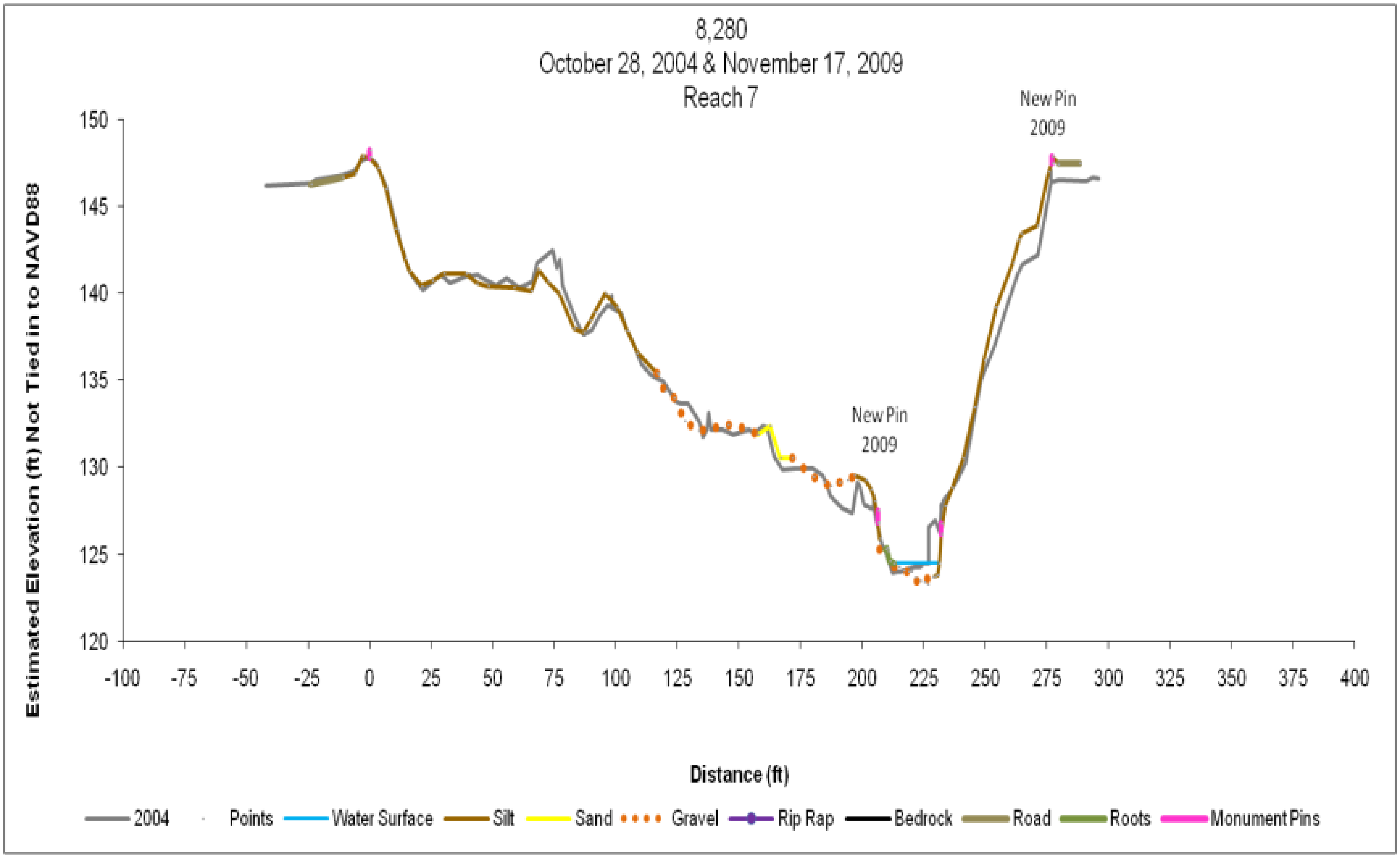
Monitoring Cross Section 8,630



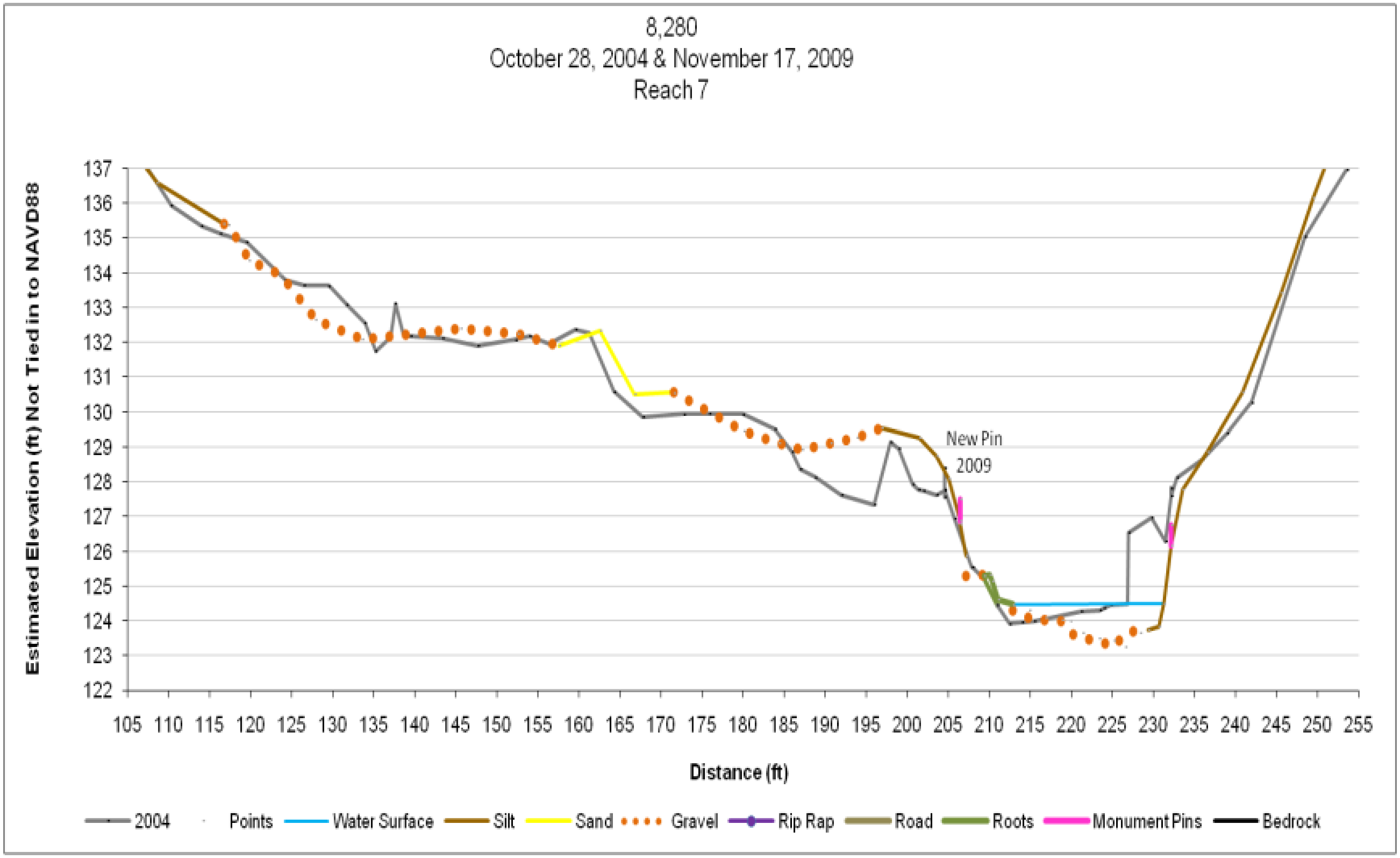
Monitoring Cross Section 8,630 (Channel Bed)



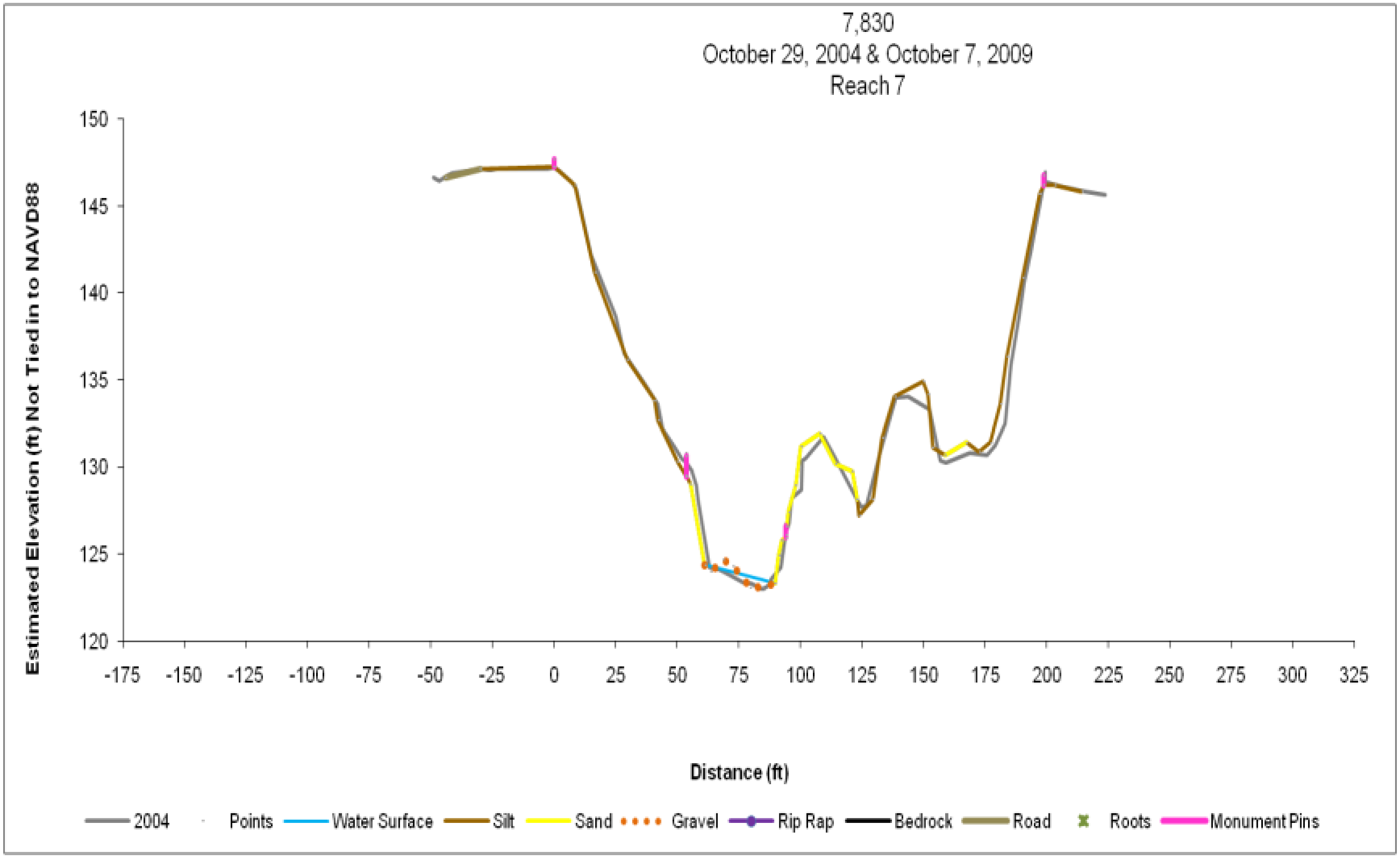
Monitoring Cross Section 8,280



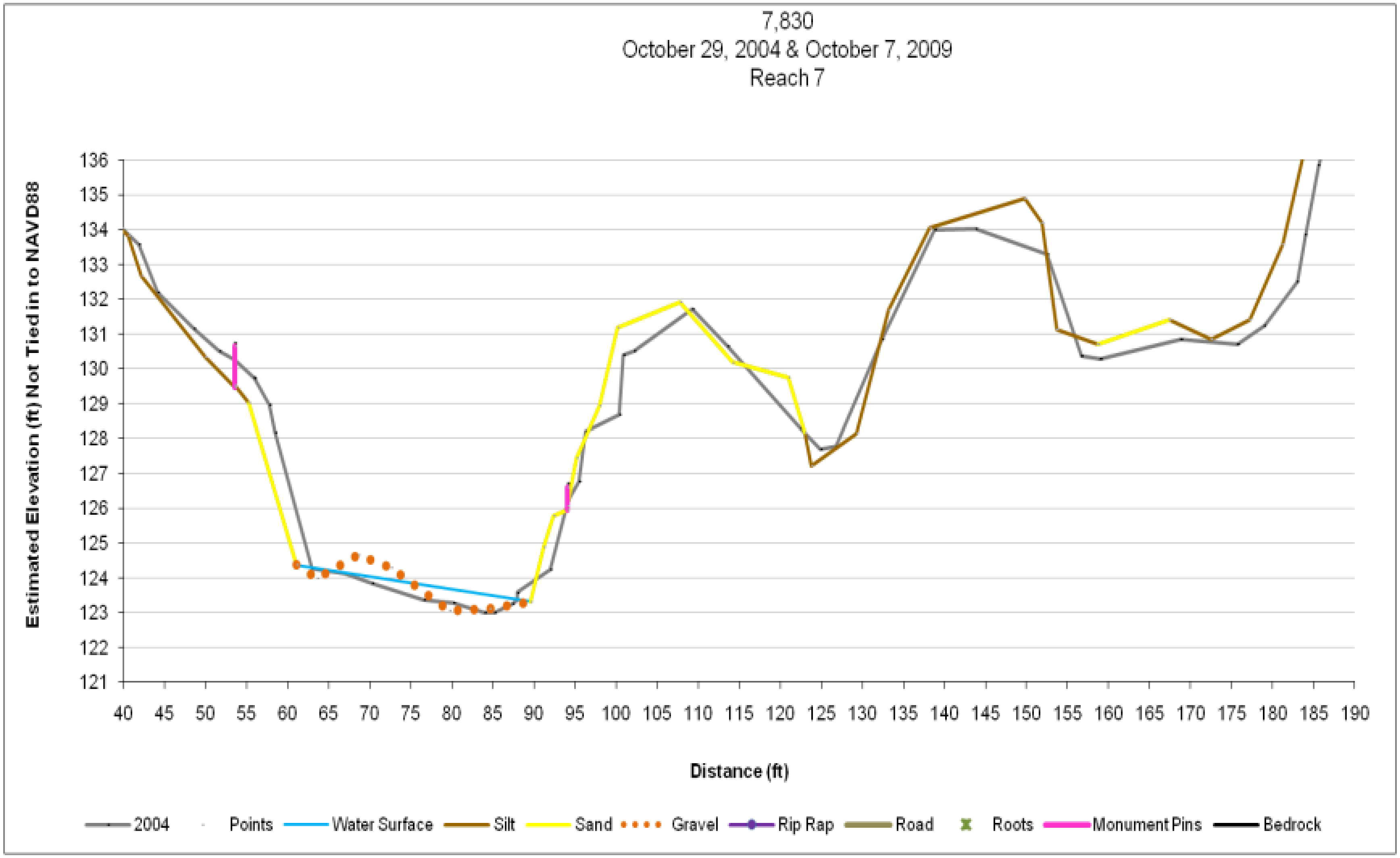
Monitoring Cross Section 8,280 (Channel Bed)



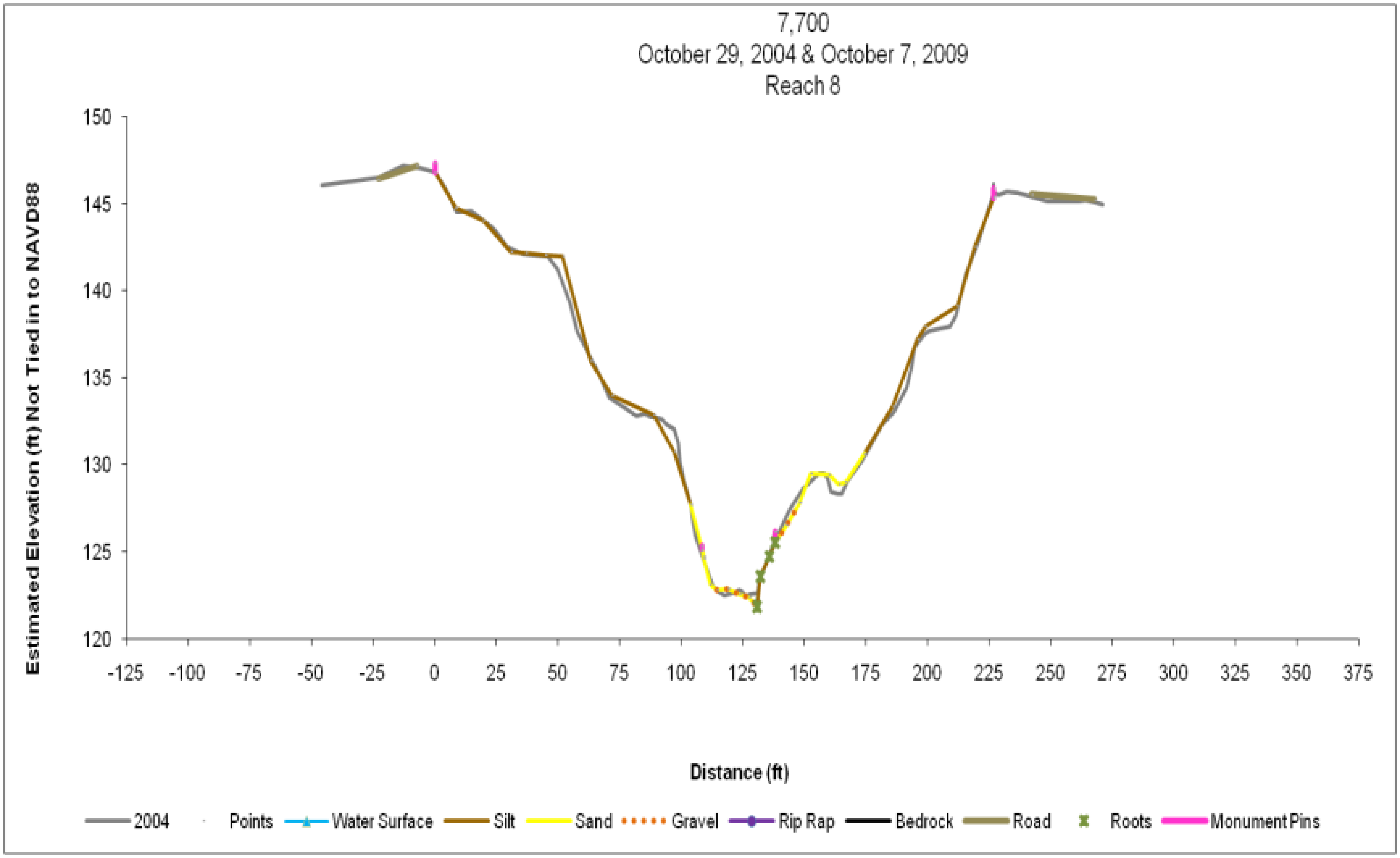
Monitoring Cross Section 7,830



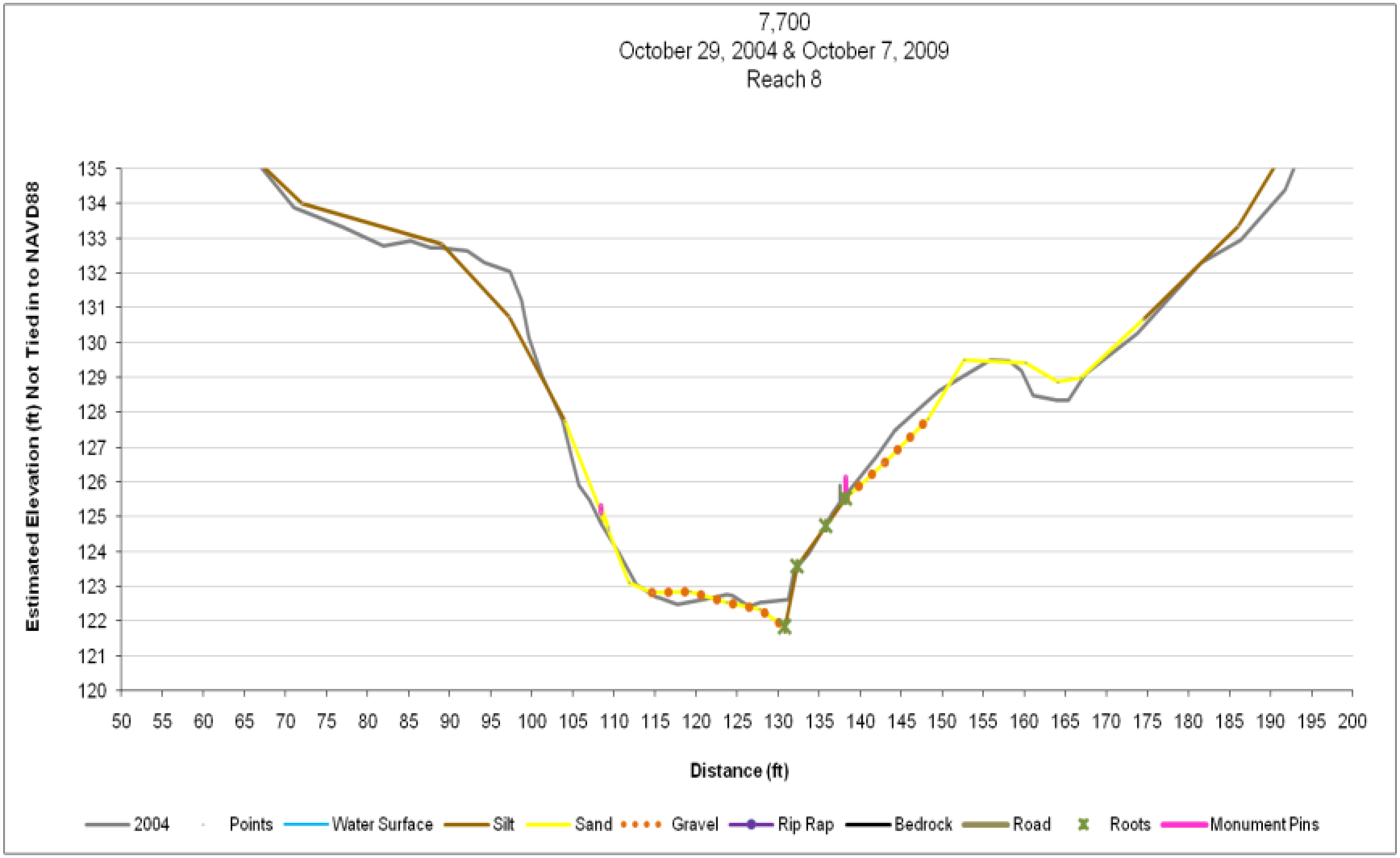
Monitoring Cross Section 7,830 (Channel Bed)



Monitoring Cross Section 7,700



Monitoring Cross Section 7,700 (Channel Bed)



VI. Pebble Counts

Pebble Counts

Pebble counts are taken concurrently with survey cross sections, which are located on riffle crests. Cross sections surveyed pre- and post-restoration construction, and are located in control and graded portions of each restoration reach. In addition to being used for hydraulic modeling for sediment transport, long term trends in particle count data can demonstrate transport of sediment through the system in response to flow events, and channel alterations, such as widening due to restoration.

18,300 cfs Annual Peak Flood Flow 2005

Particle counts taken before and after the 2005 flood in 2004 and 2005, and again in 2008 and 2009, showed no discernible trend in median particle size D50 in the narrow reach upstream of the Rutherford Cross Road in Reaches 1-4. Downstream of the Rutherford Cross Road, in Reach 5-9, the D50 generally increased, indicating a slight coursing of the stream channel. Comparison of the D84 particle size, which is utilized to model sediment transport, pre- and post- flood, show an overall coarsening of the channel in all reaches.

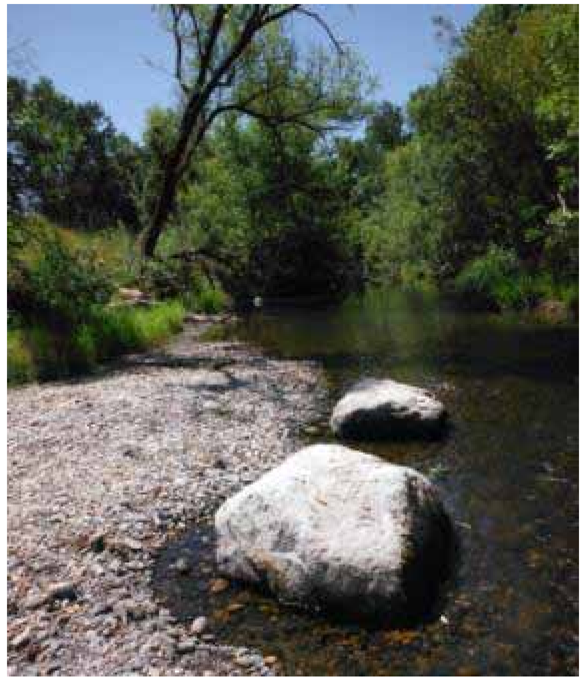
Pre- and Post-Restoration

The widening of the channel at restoration sites appears to be a contributing factor to the formation of bars, the coarsening of the channel, and the reduction of fines in the gravel bars in restored reaches. Comparison of pebble counts taken at monitoring cross sections in 2009 and 2011 pre- and post- construction of Phase 2: Reach 3 in 2010 demonstrate that a new gravel bar formed at river station 16,300 on the east bank opposite Carpy-Conolly Bench 5. The gravel bar that was sampled in 2009 at station 16,422 prior to construction of Carpy-Conolly Bench 4, constructed from east bank river stations 16,725-16,475, and Carpy-Conolly Bench 5, constructed from east bank river stations 16,350-16,100, no longer existed in 2011. It is likely that the widening of the channel at Bench 5 slowed velocities sufficiently to cause the gravel that was mobilized from the bar between the two benches 122 feet upstream, where the channel width was unchanged, to deposit as a new bar.

16,200-16,300 New Gravel Bar 2011

Sampling of the new downstream bar in 2011, which set up on the opposite west bank, shows that the median grain size increased from D50=16mm to D50=32mm, and the D84 increased from 32mm to 45mm following the 2011 peak flow event of 7,330 cfs. Significantly, not only did the gravel bed coarsen from 2009, but the percentage of fines in the new bar decreased from 17% to 1% of the sample. The reduction of fines in the gravel might be attributed to the fact that sand and finer sediments can now escape the incised low flow channel and deposit on the restored benches at relatively low flows (less than a 10 year recurrence interval). The sandbar, which accumulated on the new east bank Carpy-Conolly Bench 5, provides further evidence of this hypothesis that instream bench creation in serving to reduce the percent of fines in spawning gravel.

13,050 Glide Pre-Restoration 2011



13,050 Bar Post-East Bank Bench Construction 2012

A new gravel bar also formed at station 13,050 on the east bank in 2012 following construction of Phase 3: Reach 4 East Bank Honig Bench 13 between stations 13,150-12,725 in 2011. The gravel in the bar was coarser and contained a lower percentage of fines than the gravel which existed previously in the glide that existed in the reach prior to restoration of the bench. Following the peak flow event of 7,330 in 2011, comparison of pebble counts from 2010 and 2011 show a coarsening of the bar at station 13,050, with an increase in the D50 from 11mm to 22mm, and an increase in the D84 from 32mm to 45mm. The percentage of fines in gravel on the bar decreased markedly from 30% to 2%. Like Bench 5 upstream, the new Honig Bench 13 on the east bank had also accumulated sand.

Pebble counts in taken in 2009 and 2011 in other restored and untreated locations show no conclusive trend in the coarsening of the channel in the overall Project reach. In addition, while the sampled bars in Reaches 1-4 showed a reduction of percent fines where the channel had been widened as part of restoration, an unrestored section of channel downstream of the Rutherford Cross Road at station 7,700 also showed a decreased in fines from 39% to 12%. This decrease to one third of the previous percentage of fines is, however, not as dramatic as the reduction of fines of by 99% in the sampled bars associated with new benches in the restored reaches.

Particle counts taken in 2008-2012 will be compared against particle counts taken following construction to assess the effect of widening the channel in Reaches 1-4 which were restored from 2009-2012, as well as in the northern section of Reach 8, which was restored in 2012. These reaches will have undergone a minimum peak flow of 9,628 cfs in the winter of 2012-2013.

Median Particle Size (D50) on Riffles

Reaches 1-4

Particle Size Classes

	PROJECT REACH	1 & 2					3					4					
	RIVER STATION	**22,027**	**21,629**	**21,158**	**20,628**	**18,930**	**17,891**	**17,120**	**17,000**	**16,422**	**16,300**	**15,950**	**15,730**	**14,920**	**13,800**	**13,050**	**12,060**
2004	2004		8	16	16							16	8				
2005-03-22	3,890 cfs																
	2005	ND				ND	45		16								16
2005-12-31	18,300 cfs																
2006-12-26	1,350 cfs																
2008-01-4	4,460 cfs																
	2008	11	22	11	22	22											
2009-02-22	2,800 cfs																
	2009						45			16		22	4				
CHANGE POST 2005 FLOOD			Coarser	Finer	Coarser		Same					Coarser	Finer				
2010-01-20	3,740 cfs																
	2010														ND	11	
2011-03-20	7,330 cfs																
	2011	No Bar	22	32	16			32		No Bar	32	16		16		22	
CHANGE			Same	Coarser	Finer			Coarser		Coarser		Finer				Coarser	
2012-03-14	2,050 Cfs																
	2012																
2012-12-2	9,260 Cfs																
2012-12-23	9,698 Cfs																

Restoration Construction
Peak Discharge
ND: XS Survey or Pebble Count but no D50 Pebble Count Data

Median Particle Size (D50) on Riffles

Reaches 5-9

Particle Size Classes

	PROJECT REACH	5	6	7				8							9	
	RIVER STATION	**11,800**	**9,500**	**8,830**	**8,630**	**8,280**	**7,830**	**7,700**	**7,300**	**6,750**	**6,050**	**5,050**	**4,450**	**3,450**	**2,850**	**1,250**
	2004			16	8	8	8	8								
2005-03-22	3,890 cfs															
	2005	16	16						22			16			11	8
2005-12-31	18,300 cfs															
2006-12-26	1,350 cfs															
2008-01-4	4,460 cfs															
	2008															
2009-02-22	2,800 cfs															
	2009			11	16	16	22	8								
CHANGE POST 2005 FLOOD				Finer	Coarser	Coarser	Coarser	Same								
2010-01-20	3,740 cfs															
	2010															
2011-03-20	7,330 cfs															
	2011			11				16		11	16		16	16		
				Same				Coarser								
2012-03-14	2,050 Cfs															
	2012															
2012-12-2	9,260 Cfs															
2012-12-23	9,698 Cfs															

Restoration Construction
Peak Discharge
ND: XS Survey or Pebble Count but no D50 Pebble Count Data

Particle Size (D84) on Riffles

Reaches 1-4

Particle Size Classes

	PROJECT REACH	1 & 2					3					4					
	RIVER STATION	**22,027**	**21,629**	**21,158**	**20,628**	**18,930**	**17,891**	**17,120**	**17,000**	**16,422**	**16,300**	**15,950**	**15,730**	**14,920**	**13,800**	**13,050**	**12,060**
2004	2004		32	32	32							32	32				
2005-03-22	3,890 cfs																
	2005	ND				ND	ND		ND								ND
2005-12-31	18,300 cfs																
2006-12-26	1,350 cfs																
2008-01-4	4,460 cfs																
	2008	32	45	45	45	45											
2009-02-22	2,800 cfs																
	2009						90			32		45	11				
CHANGE POST 2005 FLOOD			Coarser	Coarser	Coarser							Coarser	Finer				
2010-01-20	3,740 cfs																
	2010														ND	32	
2011-03-20	7,330 cfs																
	2011	No Bar	45	45	32			45		No Bar	45	32		32		45	
CHANGE			Same	Same	Finer					Coarser		Finer				Coarser	
2012-03-14	2,050 Cfs																
	2012																
2012-12-2	9,260 Cfs																
2012-12-23	9,698 Cfs																

Restoration Construction
Peak Discharge
ND: XS Survey or Pebble Count but no D84 Pebble Count Data

Particle Size (D84) on Riffles

Reaches 5-9

Particle Size Classes

	PROJECT REACH	5	6	7				8							9	
	RIVER STATION	**11,800**	**9,500**	**8,830**	**8,630**	**8,280**	**7,830**	**7,700**	**7,300**	**6,750**	**6,050**	**5,050**	**4,450**	**3,450**	**2,850**	**1,250**
	2004			32	32	16	16	16								
2005-03-22	3,890 cfs															
	2005	ND	ND						ND			ND			ND	ND
2005-12-31	18,300 cfs															
2006-12-26	1,350 cfs															
2008-01-4	4,460 cfs															
	2008															
2009-02-22	2,800 cfs															
	2009			32	32	32	45	22								
CHANGE POST 2005 FLOOD				Same	Same	Coarser	Coarser	Coarser								
2010-01-20	3,740 cfs															
	2010															
2011-03-20	7,330 cfs															
	2011			32				32		32	45		32	32		
				Same				Coarser								
2012-03-14	2,050 Cfs															
	2012															
2012-12-2	9,260 Cfs															
2012-12-23	9,698 Cfs															

Restoration Construction
Peak Discharge
ND: XS Survey or Pebble Count but no D84 Pebble Count Data

Percent Fines (<2mm) on Riffles

Reaches 1-4

Percent Fines

PROJECT REACH		1 & 2					3					4					
RIVER STATION		**22,027**	**21,629**	**21,158**	**20,628**	**18,930**	**17,891**	**17,120**	**17,000**	**16,422**	**16,300**	**15,950**	**15,730**	**14,920**	**13,800**	**13,050**	**12,060**
2004	2004		ND	ND	ND							ND	ND				
2005-03-22	3,890 cfs																
	2005	ND				ND	ND		ND								ND
2005-12-31	18,300 cfs																
2006-12-26	1,350 cfs																
2008-01-4	4,460 cfs																
	2008	22	16	23	11	12											
2009-02-22	2,800 cfs																
	2009						8			17		15	42				
2010-01-20	3,740 cfs																
	2010														ND	30	
2011-03-20	7,330 cfs																
	2011	No Bar	6	3	23			2		No Bar	1	17		4		2	
CHANGE			< %Fines	< %Fines	>%Fines					< %Fines		>%Fines				< %Fines	
2012-03-14	2,050 Cfs																
	2012																
2012-12-2	9,260 Cfs																
2012-12-23	9,698 Cfs																

Restoration Construction
Peak Discharge
ND: XS Survey or Pebble Count but no <2mm Pebble Count Data

Percent Fines (<2mm) on Riffles

Reaches 5-9

Percent Fines

	PROJECT REACH	5	6	7				8							9	
	RIVER STATION	**11,800**	**9,500**	**8,830**	**8,630**	**8,280**	**7,830**	**7,700**	**7,300**	**6,750**	**6,050**	**5,050**	**4,450**	**3,450**	**2,850**	**1,250**
	2004			ND	ND	ND	ND	ND								
2005-03-22	3,890 cfs															
	2005	ND	ND						ND			ND			ND	ND
2005-12-31	18,300 cfs															
2006-12-26	1,350 cfs															
2008-01-4	4,460 cfs															
	2008															
2009-02-22	2,800 cfs															
	2009			21	18	16	20	39								
2010-01-20	3,740 cfs															
	2010															
2011-03-20	7,330 cfs															
	2011			21				12		27	13		6	14		
				Same				< %Fines								
2012-03-14	2,050 Cfs															
	2012															
2012-12-2	9,260 Cfs															
2012-12-23	9,698 Cfs															

Restoration Construction
Peak Discharge
ND: XS Survey or Pebble Count but no <2mm Pebble Count Data

Median Particle Size (D50) on Riffles

Reaches 1-4

Measured Diameter (mm)

	PROJECT REACH	**1 & 2**					**3**					**4**					
	RIVER STATION	**22,027**	**21,629**	**21,158**	**20,628**	**18,930**	**17,891**	**17,120**	**17,000**	**16,422**	**16,300**	**15,950**	**15,730**	**14,920**	**13,800**	**13,050**	**12,060**
2004	2004		8	16	16							16	8				
2005-03-22	3,890 cfs																
	2005	ND				ND	50		19								21
2005-12-31	18,300 cfs																
2006-12-26	1,350 cfs																
2008-01-4	4,460 cfs																
	2008	15	25	11	25	30											
2009-02-22	2,800 cfs																
	2009						50			21		26	5				
CHANGE POST 2005 FLOOD			Coarser	Finer	Coarser		Same					Coarser	Finer				
2010-01-20	3,740 cfs																
	2010														ND	14	
2011-03-20	7,330 cfs																
	2011	No Bar	26	34	16			38		No Bar	35	21		20		30	
CHANGE			Coarser	Coarser	Finer			Coarser		Coarser		Finer				Coarser	
2012-03-14	2,050 Cfs																
	2012																
2012-12-2	9,260 Cfs																
2012-12-23	9,698 Cfs																

Restoration Construction
Peak Discharge
ND: XS Survey or Pebble Count but no D50 Pebble Count Data

Median Particle Size (D50) on Riffles

Reaches 4-9

Measured Diameter (mm)

	PROJECT REACH	**5**	**6**	**7**				**8**							**9**	
	RIVER STATION	**11,800**	**9,500**	**8,830**	**8,630**	**8,280**	**7,830**	**7,700**	**7,300**	**6,750**	**6,050**	**5,050**	**4,450**	**3,450**	**2,850**	**1,250**
	2004			16	8	8	8	8								
2005-03-22	3,890 cfs															
	2005	18	19						23			20			12	8
2005-12-31	18,300 cfs															
2006-12-26	1,350 cfs															
2008-01-4	4,460 cfs															
	2008															
2009-02-22	2,800 cfs															
	2009			14	21	19	25	10								
CHANGE POST 2005 FLOOD				Finer	Coarser	Coarser	Coarser	Same								
2010-01-20	3,740 cfs															
	2010															
2011-03-20	7,330 cfs															
	2011			14				19		14	20		21	16		
				Same				Coarser								
2012-03-14	2,050 Cfs															
	2012															
2012-12-2	9,260 Cfs															
2012-12-23	9,698 Cfs															

Restoration Construction
Peak Discharge
ND: XS Survey or Pebble Count but no D50 Pebble Count Data

Particle Size (D84) on Riffles

Reaches 1-4

Measured Diameter (mm)

	PROJECT REACH	**1 & 2**					**3**					**4**					
	RIVER STATION	**22,027**	**21,629**	**21,158**	**20,628**	**18,930**	**17,891**	**17,120**	**17,000**	**16,422**	**16,300**	**15,950**	**15,730**	**14,920**	**13,800**	**13,050**	**12,060**
2004	2004		32	32	32							32	32				
2005-03-22	3,890 cfs																
	2005	ND				ND	ND		ND								ND
2005-12-31	18,300 cfs																
2006-12-26	1,350 cfs																
2008-01-4	4,460 cfs																
	2008	36	47	37	48	50											
2009-02-22	2,800 cfs																
	2009						115			44		50	15				
CHANGE POST 2005 FLOOD			Coarser	Coarser	Coarser							Coarser	Finer				
2010-01-20	3,740 cfs																
	2010														ND	35	
2011-03-20	7,330 cfs																
	2011	No Bar	48	62	44			60		No Bar	55	40		38		54	
CHANGE			Coarser	Coarser	Finer					Coarser		Finer				Coarser	
2012-03-14	2,050 Cfs																
	2012																
2012-12-2	9,260 Cfs																
2012-12-23	9,698 Cfs																

Restoration Construction
Peak Discharge
ND: XS Survey or Pebble Count but no D84 Pebble Count Data

Particle Size (D84) on Riffles

Reaches 4-9

Measured Diameter (mm)

	PROJECT REACH	5	6	7				8							9	
	RIVER STATION	**11,800**	**9,500**	**8,830**	**8,630**	**8,280**	**7,830**	**7,700**	**7,300**	**6,750**	**6,050**	**5,050**	**4,450**	**3,450**	**2,850**	**1,250**
	2004			32	32	16	16	16								
2005-03-22	3,890 cfs															
	2005	ND	ND						ND			ND			ND	ND
2005-12-31	18,300 cfs															
2006-12-26	1,350 cfs															
2008-01-4	4,460 cfs															
	2008															
2009-02-22	2,800 cfs															
	2009			36	40	34	49	26								
CHANGE POST 2005 FLOOD				Coarser	Coarser	Coarser	Coarser	Coarser								
2010-01-20	3,740 cfs															
	2010															
2011-03-20	7,330 cfs															
	2011			36				34		36	45		37	34		
2012-03-14	2,050 Cfs															
	2012															
2012-12-2	9,260 Cfs															
2012-12-23	9,698 Cfs															

Restoration Construction
Peak Discharge
ND: XS Survey or Pebble Count but no D84 Pebble Count Data

VII. Spawning Gravel Permeability

Spawning Gravel Permeability

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 are given in the table below.

DATE	River Station	MEDIAN A (cm/hr)	MEDIAN B (cm/hr)	SITE PERMEABILITY (cm/hr)	SURVIVAL INDEX	D50 (mm)	D84 (mm)	RANK
11/23/2004	21,629	3000	1581	2290.5	33%	8	32	poor
11/23/2004	21,158	2544	3936	3240.0	38%	16	32	fair
11/23/2004	20,628	11618	6967	9292.5	53%	16	32	good
11/30/2004	15,950	6794	3183	4988.5	44%	16	32	fair
11/30/2004	15,730	5112	5304	5208.0	45%	8	32	fair
11/30/2004	8,830	2465	3171	2818.0	36%	16	32	fair
12/1/2004	8,630	2518	1640	2079.0	31%	8	32	poor
12/1/2004	8,280	1288	1636	1462.0	26%	8	16	poor
12/1/2004	7,830	2058	4351	3204.5	38%	8	16	fair
12/1/2004	7,700	2809	2755	2782.0	35%	8	16	poor

Aggregated gravel permeability results with calculated survival rates and qualitative ranking. Sites are listed in downstream order.

VIII. Channel Morphology Survey

Riffle Length and Frequency

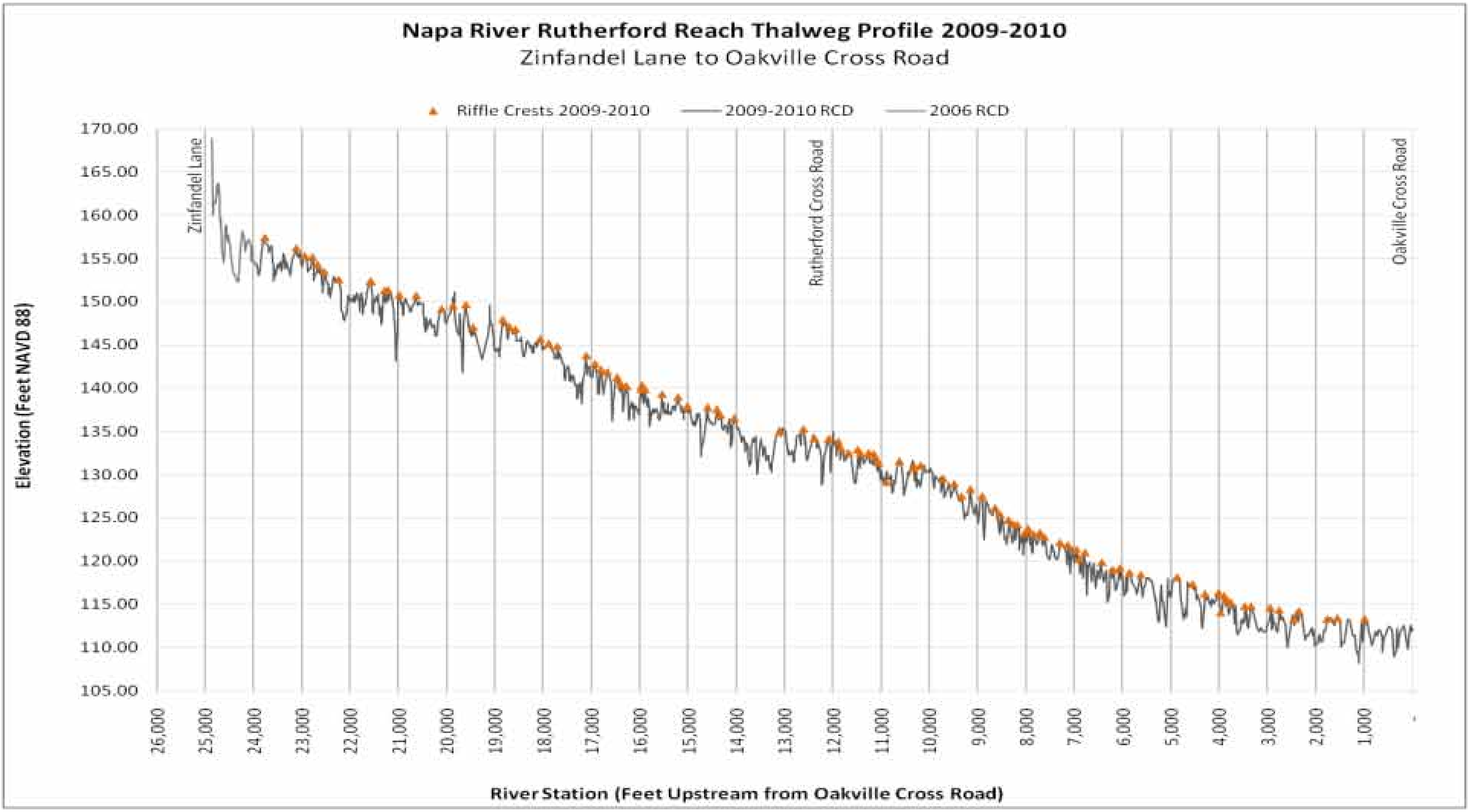
Jones & Stokes mapped a total of 155 gravel bars in the 4.5 mile Rutherford Reach in 2005, which are depicted in the Field Assessments Maps in the *Final Basis of Design Report for the Napa River Rutherford Reach Restoration* Project (Jones & Stokes, October 2008), and enumerated by reach in the table below. As of the writing of this report, only the baseline distribution and extent of gravel bars have been mapped.

Number of Gravel Bars per Subreach (Jones & Stokes, 2005 survey, 2008 Report)

Reach	Bars Mapped	Bar Types
1	17	Lateral; Lateral Point
2	17	Lateral; Lateral Point; Mid-Channel
3	7	Lateral; Lateral Point; Mid-Channel
4	20	Lateral; Mid-Channel
5	5	Lateral; Lateral Point; High Bar/Terrace
6	24	Lateral; Lateral Point; Mid-Channel; High Bar / Terrace
7	17	Lateral; Lateral Point; Mid-Channel; High Bar / Terrace
8	32	Lateral; Lateral Point; Mid-Channel; High Bar / Terrace
9	16	Lateral; Lateral Point; Mid-Channel

Riffle Crest Distribution

The longitudinal thalweg survey completed in 2009-2010 documents the channel geometry of the Rutherford Reach, including riffles, pools and glides.



Bar and Riffle Crest Distribution 2009-2012

The performance standard for the project is a 30% increase in riffle length or riffle frequency in treated locations. The 2009-2010 survey constitutes the baseline against which to evaluate progress towards meeting the standard. During the long profile surveys conducted in 2009-2010, 101 riffle crests were mapped throughout the Rutherford Reach. A 30% increase in riffle frequency would equal 131 riffle crests, or an increase in density from 21 riffle crests per mile for the Rutherford Reach to 27 riffle crests per mile, following the completion of the 4.5 mile project, and at least one channel forming 5 year recurrence interval event.

The longitudinal thalweg survey completed in 2009-2010 documents the channel geometry of the Rutherford Reach, including pools riffles and glides. At the same time as the thalweg was surveyed, all riffle crests were mapped with a GPS. Starting in June 2011, riffle crests are mapped as part of the annual stream survey with GPS to track the changes in riffle crest distribution and density along the project reach. Riffle crests are determined based on geomorphic attributes such as association with point bars, and relatively high stream flow velocity, as well as by the determination of the fisheries biologist that the riffle crest presents a potential spawning location, or is located at an observed spawning location from the previous spawning season.

2009 - 2010

During the long profile surveys conducted in 2009-2010, 101 riffle crests were mapped throughout the Rutherford Reach. This constitutes a density of 21 riffle crests per mile for the Project. The 101 total riffle crests were distributed by project reach as follows: Reach 1: 7%; Reach 2: 13%; Reach 3: 6%; Reach 4: 16%; Reach 5: 7%; Reach 6: 14%; Reach 7: 9%; Reach 8: 21%; Reach 9: 8%. Normalizing riffle crest density by mile for each reach shows that the shortest Reach 5, the reference reach where the channel spreads out immediately downstream of the Rutherford Cross Road, has the highest density of riffle crests at 53 per mile. By contrast, Reach 1 immediately downstream of the Zinfandel Lane Bridge has the lowest density at only 5 riffle crests per mile. Riffle crest density in Reaches 2, 3 and 4 in the narrow berm lined channel upstream of the Rutherford Cross Road were similar ranging from 18-21 riffle crests per mile. Downstream of the Rutherford Cross Road in Reaches 6 and 7, where a secondary channel runs parallel to the wide channel, riffle crest densities were 34 and 37 riffle crests per mile respectively. Densities then decreased in the Reaches and 9 to 25 per mile and 12 per mile respectively.

2011

In June 2011, 65 were mapped throughout the Rutherford Reach. This constitutes a density of 14 riffle crests per mile for the entire Project reach. The overall decrease in riffles compared to 2010-2011 could be attributed to a change mapping protocol from being concurrent with the detailed long profile survey, versus the rapid channel maintenance survey. The decrease could also be attributed to a lack of gravel input, and instead a redistribution of the large influx of gravel that occurred during the 2005 flood event, following which no peak annual storm flows reached a 5 year recurrence interval magnitude

Examining riffle crest distribution by restored reach instead of by the entire project reach, shows that with the exception of Reach 1, all other Reaches 2-9 demonstrated a decrease in the total number of riffle crests compared to the same Reach the previous year. By contrast, when examining riffle crest density in individual reaches as a percent of the riffle crests in the total Project Reach, riffle crest density increased from 2010 to 2011 in treated Reaches 1-3, and in untreated Reach 8: Reach 1, from 7 to 17%; Reach 2, from 13 to 14%; Reach 3, from 6 to 8%; Reach 8 from 21 to 25%. Untreated Reaches 4, 5 and 6 experienced a decrease in riffle crest density compared to the previous year, and Reaches 7 and 9 remained unchanged. The widening of the channel in Reaches 1-3 with inset floodplain benches, likely contributed to the accumulation of gravel and the corresponding increase in the density of riffle crests by reducing flow velocities. The increased complexity in channel hydraulics associated with the spacing the benches on alternate sides of the channel likely forced variable sorting of existing gravel bars as well as formation of new bars creating a greater number of riffle crests. For example, the gravel bar in Reach 3 at Caymus Bench 3 approximately doubled in width in the year following construction. Although a riffle crest was not formed, an incipient gravel bar formed along the bank opposite of Carpy-Conolly Benches 4 and 5 at the downstream end of Reach 3.

2012

In June 2012, 62 were mapped throughout the Rutherford Reach. This constitutes a density of 13 riffle crests per mile for the entire Project reach, a slight decrease from the previous year following a drought year with a peak flow below that of a 1.25 year recurrence interval.

The number of riffle crests in the Project was nearly unchanged from 2011; however, the distribution of the riffles became more evenly spaced throughout the majority of the Project Reach. Examining riffle crest distribution by restored reach instead of by the entire project reach, shows that the total number of riffle crests in the first three treated Reaches 1-3 decreased. One riffle crest was added in Reach 4 where restoration of the east bank occurred along the east bank the prior summer. The 9 riffle crests in Reach 4 became more evenly distributed along the length of the reach compared to the 8 riffle crests mapped the prior year. Field observations demonstrated new bar formation associated with the newly constructed Honig Bench 13, near installed boulder clusters. The total number of riffle crests in untreated Reaches 5 through 9 downstream of the Rutherford Cross Road increased slightly by three, with the exception of Reach 9, where one less riffle was mapped than in 2011.

Similarly, when examining riffle crest density in individual reaches as a percent of riffles in the total Project Reach, riffle crest density decreased from 2011 to 2012 in treated Reaches 1-3, and increased slightly in Reach 8: Reach 1, from 7 to 17%; Reach 2, from 13 to 14%; Reach 3, from 6 to 8%; Reach 8 from 21 to 25%. Untreated Reaches 4, 5 and 6 experienced a decrease in riffle crest density compared to the previous year, and Reaches 7 and 9 remained unchanged.

Riffle Crests 2010

Riffle Crests 2011

Riffle Crests 2012

Riffle Crests 2009-2010

2009-2010: 101 Riffle Crests Mapped During Long Profile Thalweg Survey
2009: Reaches 1-4, 2010: Reaches 5-9

Riffle Crests 2011

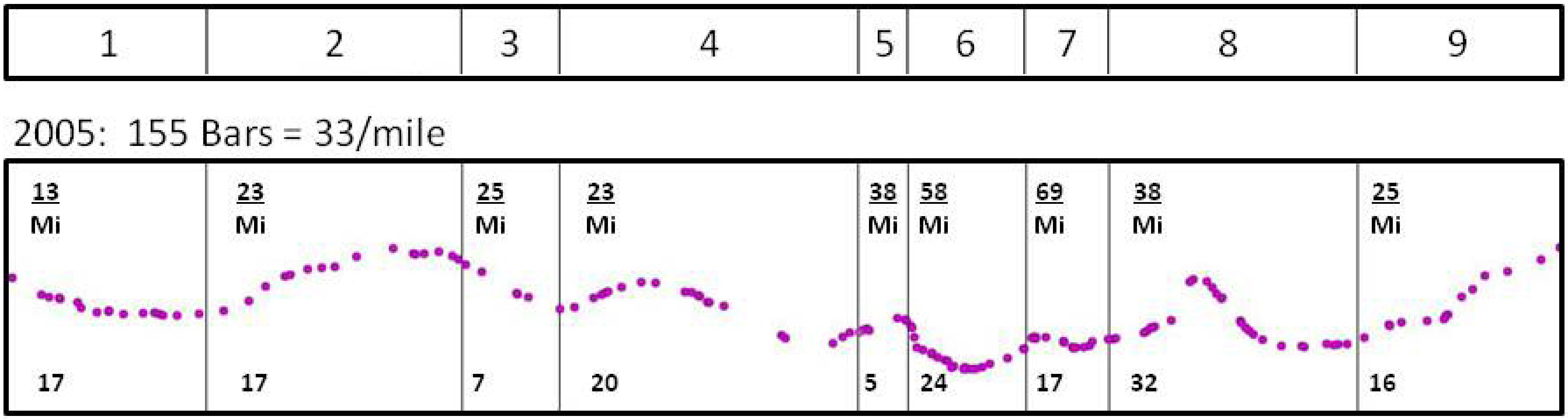
2011: 65 Riffle Crests Mapped During Channel Maintenance Survey with Handheld GPS

Riffle Crests 2012

2012: 62 Riffle Crests Mapped During Channel Maintenance Survey with Handheld GPS

Bars

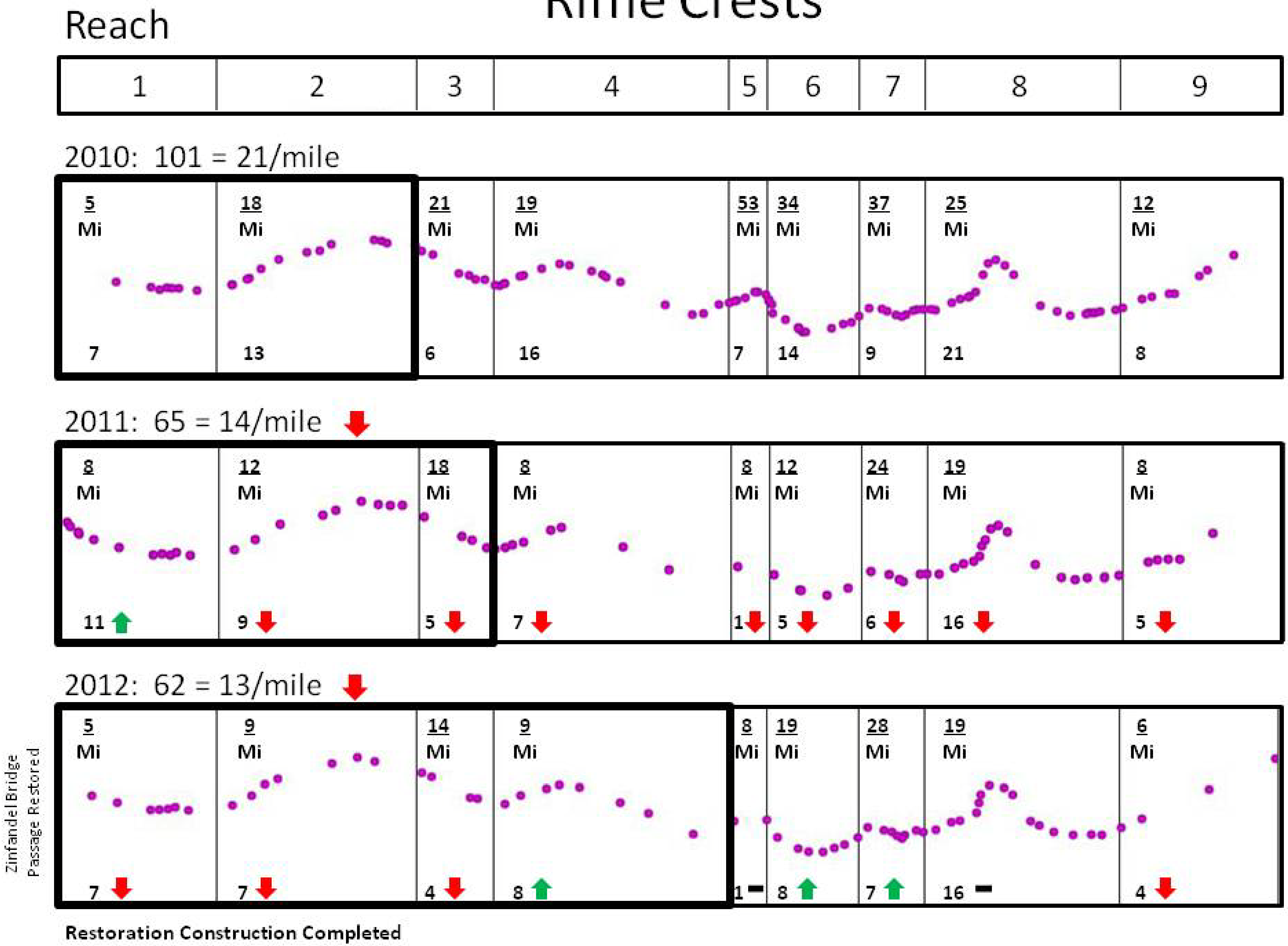
Reach



Source: Jones & Stokes. 2008. *Final Basis of Design Report for the Napa River Rutherford Reach Restoration Project Area, Rutherford, California.* October. San Jose, CA.
Bars mapped via air photos and not verified against in the field along the entire length of the channel.
For comparison with riffle crests mapped during the annual survey in later years, assume one bar equals one riffle crest.

Bars 2005

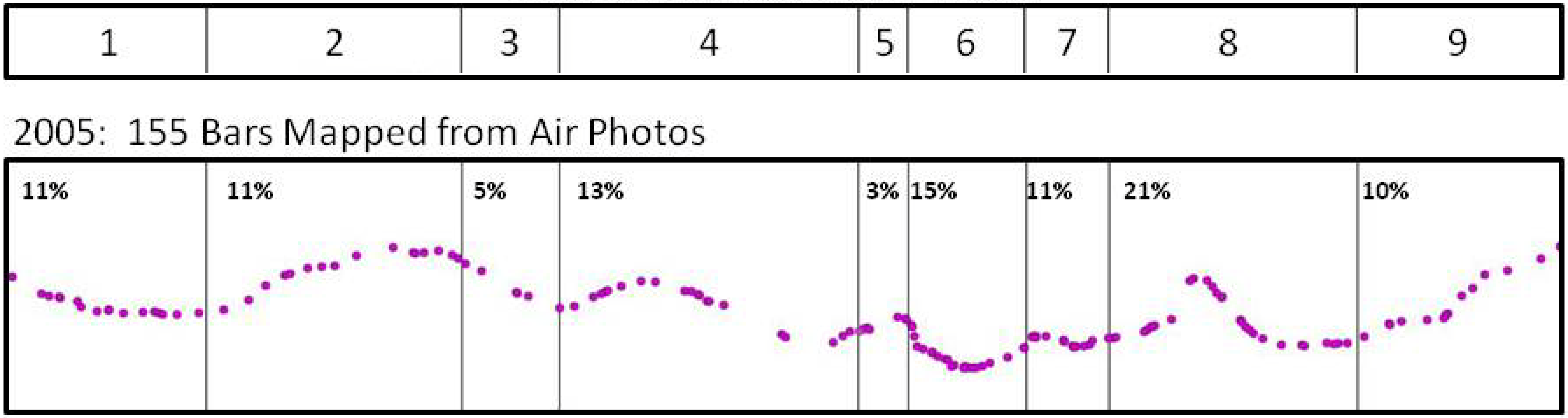
Riffle Crests



Bars

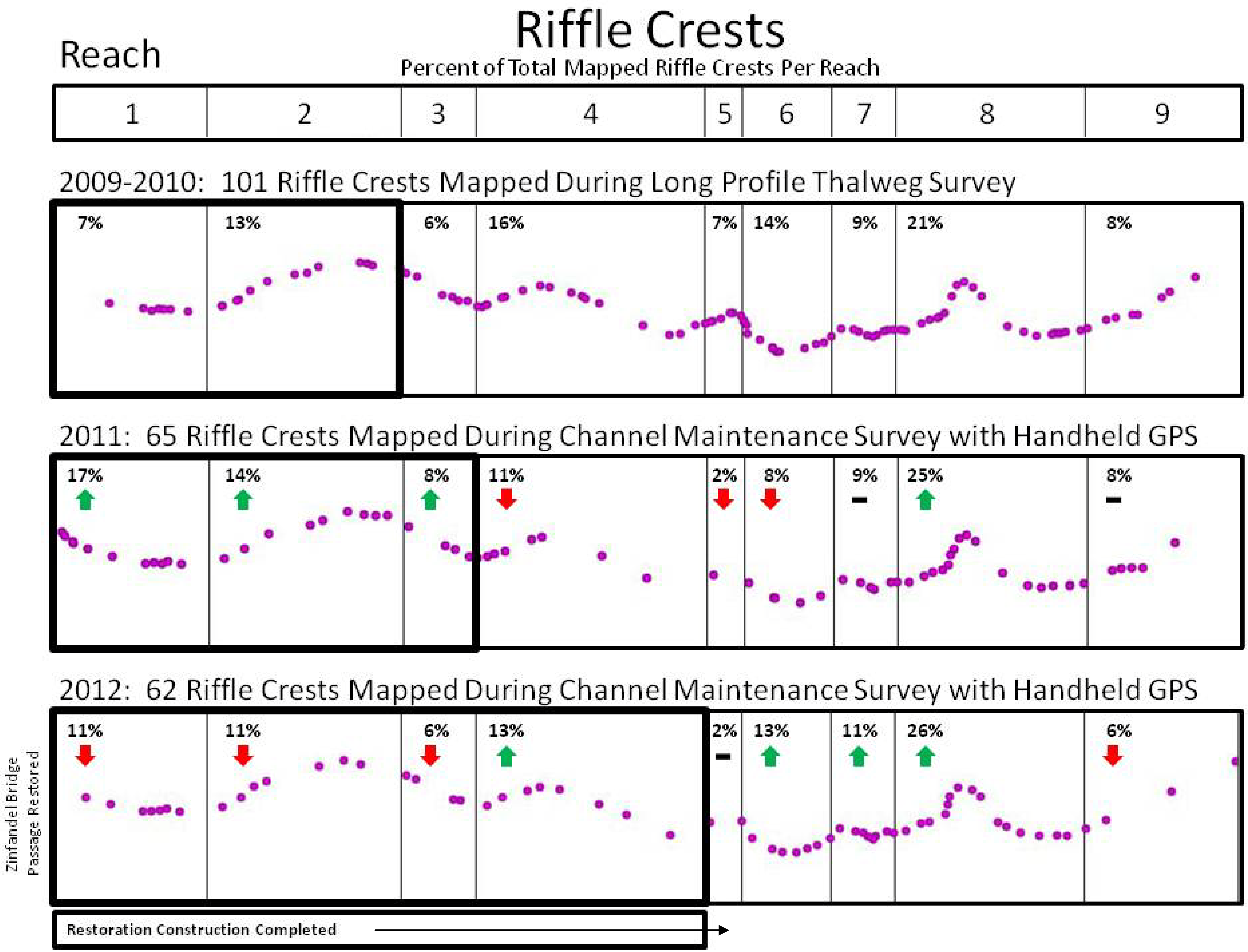
Reach

Percent of Total Mapped Bars Per Reach



Source: Jones & Stokes. 2008. *Final Basis of Design Report for the Napa River Rutherford Reach Restoration Project Area, Rutherford, California.* October. San Jose, CA.
Bars mapped via air photos and not verified against in the field along the entire length of the channel.
For comparison with riffle crests mapped during the annual survey in later years, assume one bar equals one riffle crest.

Bars 2005


Riffle Crests
Reach
Percent of Total Mapped Riffle Crests Per Reach
1
2
3
4
5
6
7
8
9
2009-2010: 101 Riffle Crests Mapped During Long Profile Thalweg Survey
7%
13%
6%
16%
7%
14%
9%
21%
8%
2011: 65 Riffle Crests Mapped During Channel Maintenance Survey with Handheld GPS
17%
14%
8%
11%
2%
8%
9%
25%
8%
2012: 62 Riffle Crests Mapped During Channel Maintenance Survey with Handheld GPS
11%
11%
6%
13%
2%
13%
11%
26%
6%
Zinfandel Bridge Passage Restored
Restoration Construction Completed

IX. Residual Pool Depth Associated with Installed Instream Habitat Structures

Residual Pool Depth Associated with Instream Structures

Annual Survey Results

2011

Residual pool depth, shelter complex, and shelter cover associated with instream structures was measured for the first time in June 2011 during the annual stream survey when those structures, which were first installed in 2010 in Reaches 2-3, had experienced one year of winter flow. Bench logs installed on terraces and high benches were not assessed because they were not in the main flow channel. One boulder cluster was installed in 2010.

2012

Shelter complex, and shelter cover associated with instream structures was measured for the second time in June 2012 for those structures installed in 2010, and for the first time for those structures installed in Reach 4 west in 2011. Bench logs installed on terraces and high benches were not assessed because they were not in the main flow channel. Several more boulder clusters were installed in Phase 3 Reach 4 west. For those structures with two years worth of measurements, no discernible trend in shelter complex or shelter cover rating can be made.

Residual pool depth was measured only at those structures that had been installed in 2011, so no comparison of trends in changes in residual pool depths can yet be made.

River Station	Label	Type	Residual Pool Depth		Shelter Complex		Shelter Cover	
			6/2/2011	6/5-6/2012	6/2/2011	6/5-6/2012	6/2/2011	6/5-6/2012
			20 cfs	6 cfs	20 cfs	6 cfs	20 cfs	6 cfs
22000	WD-22200-R	Spider Log	1.1	NA	1	2	5	20
21900	WD-21900-L	Spider Log	1.4	NA	1	NA	10	NA
21850	WD-21850-R	Toe Log	4.4	NA	2	2	30	25
21670	WD-21670-L	Spider Log	1.9	NA	2	2	30	20
19475	WD-19475-R	Toe Log	2.5	NA	2	NA	40	NA
18250	BC-18250-M	Boulder Cluster	3.4	NA	1	NA	10	NA
17700	WD-17700-R	Root Wad	NA	NA	NA	NA	NA	NA
17425	WD-17425-R	Root Wad	0.2	NA	1	2	25	30
17225	WD-17225-R	Root Wad	2.2	NA	30	2	50	20
16900	WD-16900-R	Root Wad	NA	NA	NA	2	NA	20
16125	WD-16125-L	Root Wad	NA	2.6	3	2	40	40

NA=Not Assessed

River Station	Label	Type	Residual Pool Depth		Shelter Complex		Shelter Cover	
			6/2/2011	6/5-6/2012	6/2/2011	6/5-6/2012	6/2/2011	6/5-6/2012
13650	WD-13650-L	Low Profile Log	-	1.3	-	2	-	10
13590	WD-13590-L	Low Profile Log	-	1.6	-	2	-	20
13070	WD-13070-L	Root Wad	-	NA	-	2	-	20
13050	BC-13050-L	Boulder Cluster	-	NA	-	NA	-	NA
12990	WD-12990-L	Low Profile Log	-	NA	-	NA	-	NA
12950	BC-12930-L	Boulder Cluster	-	2.1	-	NA	-	NA
12850	WD-12850-L	Low Profile Log	-	NA	-	NA	-	NA
12825	BC-12825-L	Boulder Cluster	-	2.9	-	NA	-	NA
12800	WD-12800-L	Root Wad	-	1.3	-	2	-	30
12550	WD-12550-L	Low Profile Log	-	NA	-	NA	-	NA
12420	WD-12420-L	Root Wad	-	1.9	-	2	-	30
12400	BC-12400-L	Boulder Cluster	-	2.1	-	1	-	10

NA=Not Assessed

X. Large Woody Debris Surveys

Annual Large Woody Debris Survey Results

Large Woody Debris (LWD) occurrences greater than one foot in diameter and six feet in length are mapped each June during the annual stream survey. Attributes such as fish habitat and geomorphic functions are recorded for each occurrence. The annual June LWD survey results can be compared to the results of the surveys of the habitat functions of installed structures assessed during a winter and a spring stream flow in the first year following installation, which are provided in the Seasonal Salmonid Habitat Survey Reports in Appendix D. Study IX.

2009

In 2009 154 occurrences of LWD were mapped, with 62% (95) being single pieces, 31% (47) being accumulations of between 2-9 pieces, and the remaining 8% (12) being jams of greater than 10 pieces. All wood was naturally recruited as no restoration installation had yet been installed.

2010

In 2010, 74% (148) of the 201 occurrences of LWD were single pieces, while 24% (49) were accumulations of 2-9 pieces, and the remaining 2% consisted of four (4) jam accumulations of greater than 10 pieces of wood. In 2010, there were about 50% more single pieces of LWD mapped in the channel versus 2009 (148 versus 96), while accumulations of 2-9 pieces remained relatively steady (49 versus 47). Jams of greater than 10 pieces of LWD reduced from 12 to 4 occurrences from 2009 to 2010 indicating that channel flows disseminated and dispersed some of the jams. In 2010, ninety percent (93%) of the debris were naturally recruited while 7% were restoration installations, all consisting of bench logs installed on terraces in Reaches 1-2 east bank, which function to provide bench stability and limited high flow refugia. About one-third of all mapped LWD functioned to provide winter high flow refugia (35%), while 13% of the LWD provided summer low flow refugia. About 6% of all LWD produced hydraulic constriction in the channel to produce increased flow velocities and feeding lane conditions for fish. Fifteen percent (15%) of all LWD caused pool scour; while 32% served to provide bank stability. The majority of LWD were nearly equally split between pools (36%) and terraces (31%), with the remaining 33% associated with other bedforms. Almost all (95%) of the LWD was dead, with 5% rooted and alive.

2011

In 2011, 77% (138) of the 179 occurrences of LWD were single pieces, while 20% (35) were accumulations of 2-9 pieces, and the remaining 3% consisted of five (5) jam accumulations of greater than 10 pieces of wood. One boulder cluster was installed as an instream structure that is evaluated for fish habitat and geomorphic function with the same attributes as installed LWD. In 2011, there were 14 fewer accumulations mapped versus 2010 (35 versus 49) continuing a downward trend in accumulations since 2009. One more jam of greater than 10 pieces of LWD was mapped in 2011 than 2010 (5 versus 4). In 2011, 78% of the LWD were naturally recruited while 22% (40) were restoration installations. About 19% of all mapped LWD functioned to provide winter high flow refugia, nearly half of the percent mapped in 2010: in 2010, 70 occurrences, versus 34 occurrences in 2011. This was true even though 76% of the mapped occurrences providing winter refugia were restoration installations. By contrast the percent of all LWD occurrences providing summer low flow refugia more than doubled from 13% in 2010 to 34% in 2011, from 26 in 2010 to 60 in 2011. Only 10% of all occurrences providing summer refugia were attributed to restoration installations. About 23% of all LWD produced hydraulic constriction in the channel to produce increased flow velocities and feeding lane conditions for fish. Twenty eight percent (28%) of all LWD caused pool scour; while 41% served to provide bank stability.

2012

In 2012, 81% (157) of the 194 occurrences of LWD were single pieces, while 15% (29) were accumulations of 2-9 pieces, and the remaining 2% consisted of three (3) jam accumulations of greater than 10 pieces of wood. Single pieces of wood as a percent of all LWD occurrences have remained relatively steady from 2010-2012, ranging from 74-81%. The percent of accumulations of 2-9 pieces of wood have trended downward between 2009-2012, from 31%, to 24%, to 20%, to 15%. Only 3 jams of greater than 10 pieces of LWD were mapped in 2012. Jams have remained consistently between 2-3% of all LWD occurrences mapped from 2010-2012. The lack of flood flows since 2010 2012 may account for the continuing downward trend in natural wood loading and associated accumulations of large pieces of wood. The percent of LWD mapped attributed to restoration installations has increased each year. In 2012, the 52 LWD and boulder cluster installations installed between 2009-2011 accounted for 27% of all LWD occurrences mapped. In 2012, ninety percent (73%) of the debris were naturally recruited while 27% were restoration installations in Reaches 1-4 upstream of the Rutherford Cross Road. About 15% of all mapped LWD functioned to provide winter high flow refugia, relatively consistent with the previous year. LWD providing summer refugia also remained consistent at 38% of all occurrences versus 34% in 2011. This slight rise in percent of occurrences providing summer refugia can be attributed to installed structures. About 24% of all LWD produced hydraulic constriction in the channel to produce increased flow velocities and feeding lane conditions for fish, also consistent with 2011. . In 2012 (29%) of all LWD caused pool scour versus 28% in 2011. In 2012; 33% served to provide bank stability. The consistency in results from 2011 could be attributed to the lack of change due to lack of channel flow during the preceding drought year.

The limited data set of two years of habitat and geomorphic assessment of installed LWD structures indicates that 6 of the 30, or 20%, of the installed LWD and boulder clusters were performing highly with consistent annual provision of summer refugia for fish, hydraulic constriction of streamflow to produce high velocity feeding lanes, and pool scour to create cover (See table below). This excludes the 22 bench and terrace logs that were installed and are functioning to prevent erosion of the surface of constructed benches and provide winter high flow refugia for fish until vegetation becomes established. Nine installations (30% of the total 30) were underperforming in terms of providing limited fish habitat and geomorphic function (See table below). The boulder cluster installed in 2010 at station 18,250 used undersized rocks that did not affect streamflow. Boulder clusters installed in 2011-2012 increased the rock size to 3-4 tons each in order to increase the effect on channel hydraulics and promote gravel sorting and pool scour. LWD structures that silted in or whose root wads were suspended above the low flow channel also provided limited geomorphic and habitat function. For example, two of the three spider logs installed at stations 22,000 and 21,900 in association with the widening of the channel on the west bank at the alcove became buried. This may be attributed to the dropping out of sediment caused by the lowering of velocities due to the widening of the channel. All other installations provided some fish and geomorphic function as intended.

LWD OCCURRENCES	2009	2010	2011	2012
	154	201	179	194

Nuumber of LWD Occurences

CONFIGURATION	154	201	179	194
Single	95	148	138	157
Accumulation 2 < 9	47	49	35	29
Jam > 10	12	4	5	3
Boulder Cluster	0	0	1	5

RECRUITMENT MECHANISM	154	201	179	194
Restoration	0	15	40	52
Naturally Recruited	154	186	139	142
Flood Deposited	118	182	134	126
Bank Erosion	26	0	0	0
Fallen in Place	10	4	5	16

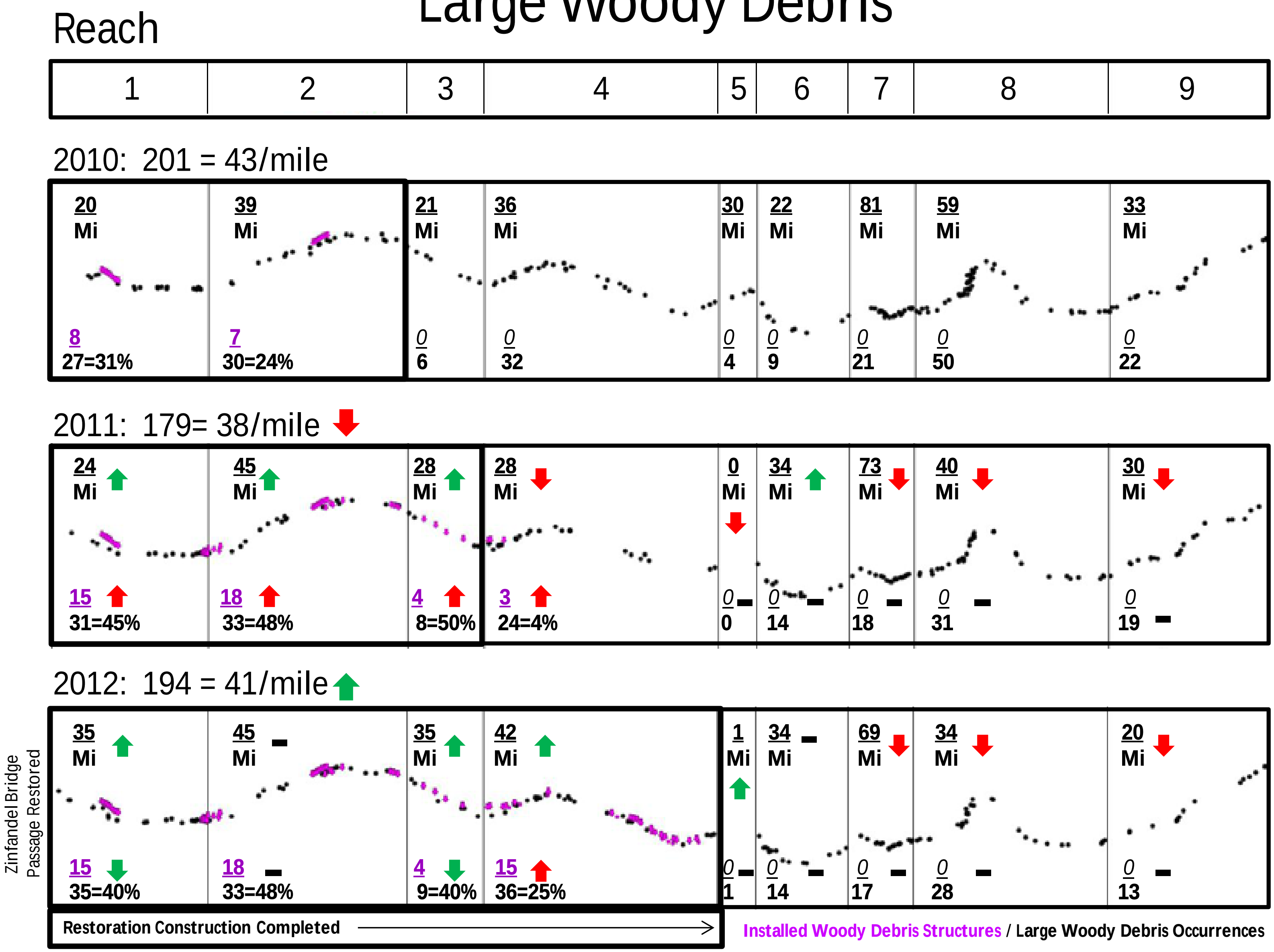
	2009	2010	2011	2012

Percent of All LWD Occurences

CONFIGURATION	100%	100%	100%	100%
Single	62%	74%	77%	81%
Accumulation 2 < 9	31%	24%	20%	15%
Jam > 10	8%	2%	3%	2%
Boulder Cluster	0%	0%	1%	3%

RECRUITMENT MECHANISM	100%	100%	100%	100%
Restoration	0%	7%	22%	27%
Naturally Recruited	100%	93%	78%	73%
Flood Deposited	77%	91%	75%	65%
Bank Erosion	17%	0%	0%	0%
Fallen in Place	6%	2%	3%	8%

Large Woody Debris



ALL LWD OCCURENCES

Number of LWD Occurences

FISH HABITAT FUNCTION	2009	2010	2011	2012
Summer Refugia	NA	26	60	72
Winter High Flow Refugia	NA	70	34	29
Feeding Lane	NA	12	41	47

GEOMORPHIC FUNCTION	2009	2010	2011	2012
Pool Scour	60	30	50	56
Bank Stability	45	64	73	63
Hydraulic Constriction	NA	12	41	47
Perched in Tree or Above Channel	2	8	0	21
Spawning Gravel Recruitment	30	9	NA	NA
Low Terracene Former	11	NA	NA	NA

Percent of All LWD Occurences

FISH HABITAT FUNCTION	2009	2010	2011	2012
Summer Refugia	NA	13%	34%	38%
Winter High Flow Refugia	NA	35%	19%	15%
Feeding Lane	NA	6%	23%	24%

GEOMORPHIC FUNCTION	2009	2010	2011	2012
Pool Scour	39%	15%	28%	29%
Bank Stability	29%	32%	41%	33%
Hydraulic Constriction	NA	6%	23%	24%
Perched in Tree or Above Channel	1%	4%	0%	11%
Spawning Gravel Recruitment	19%	4%	NA	NA
Low Terracene Former	7%	NA	NA	NA

LWD INSTALLATIONS

Number of LWD Installations

FISH HABITAT FUNCTION	2009	2010	2011	2012
Summer Refugia	NA	0	6	9
Winter High Flow Refugia	NA	15	26	8
Feeding Lane	NA	0	3	12

GEOMORPHIC FUNCTION	2009	2010	2011	2012
Pool Scour	NA	0	5	14
Bank Stability	NA	15	31	31
Hydraulic Constriction	NA	0	5	10
Perched in Tree or Above Channel	NA	0	0	0
Spawning Gravel Recruitment	NA	0	NA	NA

LWD INSTALLATIONS

Percent of All LWD Installations

FISH HABITAT FUNCTION	2009	2010	2011	2012
Summer Refugia	NA	0%	15%	17%
Winter High Flow Refugia	NA	100%	65%	15%
Feeding Lane	NA	0%	8%	23%

GEOMORPHIC FUNCTION	2009	2010	2011	2012
Pool Scour	NA	0%	13%	27%
Bank Stability	NA	100%	78%	60%
Hydraulic Constriction	NA	0%	13%	19%
Perched in Tree or Above Channel	NA	0%	0%	0%
Spawning Gravel Recruitment	NA	0%	NA	NA

FISH HABITAT FUNCTION

Number of Occurences	2009	2010	2011	2012
SUMMER REFUGIA	**NA**	**26**	**60**	**72**
Restoration	NA	0	6	9
Naturally Occurring	NA	26	54	63
WINTER HIGH FLOW REFUGIA	**NA**	**70**	**34**	**29**
Restoration	NA	15	26	8
Naturally Occurring	NA	55	8	21
FEEDING LANE	**NA**	**12**	**41**	**47**
Restoration	NA	0	3	12
Naturally Occurring	NA	12	38	35

Percent of All Occurences	2009	2010	2011	2012
SUMMER REFUGIA	**NA**	**26**	**60**	**72**
Restoration	NA	0%	10%	13%
Naturally Occurring	NA	100%	90%	88%
WINTER HIGH FLOW REFUGIA	**NA**	**70**	**34**	**29**
Restoration	NA	21%	76%	28%
Naturally Occurring	NA	79%	24%	72%
FEEDING LANE	**NA**	**12**	**41**	**47**
Restoration	NA	0%	7%	26%
Naturally Occurring	NA	100%	93%	74%

GEOMORPHIC FUNCTION

Number of Occurences	2009	2010	2011	2012
POOL SCOUR	**NA**	**26**	**60**	**72**
Restoration	NA	0	5	14
Naturally Occurring	NA	26	55	58
BANK STABILITY	**45**	**64**	**73**	**63**
Restoration	NA	15	31	31
Naturally Occurring	45	49	42	32
HYDRAULIC CONSTRICTION	**NA**	**12**	**41**	**47**
Restoration	NA	0	5	10
Naturally Occurring	NA	12	36	37
PERCHED	**2**	**8**	**0**	**21**
Restoration	NA	0	0	0
Naturally Occurring	2	8	0	21
GRAVEL RECRUITMENT	**30**	**9**	**NA**	**NA**
Restoration	NA	0	NA	NA
Naturally Occurring	30	9	NA	NA

Percent of All Occurences	2009	2010	2011	2012
POOL SCOUR	**NA**	**26**	**60**	**72**
Restoration	NA	0%	8%	19%
Naturally Occurring	NA	100%	92%	81%
BANK STABILITY	**45**	**64**	**73**	**63**
Restoration	NA	23%	42%	49%
Naturally Occurring	100%	77%	58%	51%
HYDRAULIC CONSTRICTION	**NA**	**12**	**41**	**47**
Restoration	NA	0%	12%	21%
Naturally Occurring	NA	100%	88%	79%
PERCHED	**2**	**8**	**0**	**21**
Restoration	NA	0%	0%	0%
Naturally Occurring	100%	100%	0%	100%
GRAVEL RECRUITMENT	**30**	**9**	**NA**	**NA**
Restoration	NA	0%	NA	NA
Naturally Occurring	100%	100%	NA	NA

LWD STATUS	**2009**	**2010**	**2011**	**2012**
Dead	143	192	171	181
Live	11	9	7	5
Boulder Cluster	0	0	1	5
TOTAL	**154**	**201**	**179**	**191**

BANK EROSION POTENTIAL	**2009**	**2010**	**2011**	**2012**
Yes	7	14	11	2
No	147	187	168	189
TOTAL	**154**	**201**	**179**	**191**

Large Woody Debris and Boulder Cluster Installation
Fish Habitat and Geomorphic Function Summary Table

					Summer Refugia			Winter Refugia			Hydraulic Constriction (Feeding Lane)			Pool Scour			Bank Stability		
River Station	Year Installed	Installation	Restoration Label	Configuration	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
23,920	2009	Bench Log	WD-23920-L	Single > 18"				X	X	X							X	X	
23,880	2009	Bench Log	WD-23880-L	Single > 18"				X	X								X	X	X
23,830	2009	Bench Log	WD-23830-L	Single > 18"				X	X								X	X	X
23,780	2009	Bench Log	WD-23780-L	Single > 18"				X	X								X	X	X
23,730	2009	Bench Log	WD-23730-L	Single > 18"				X	X								X	X	X
23,680	2009	Bench Log	WD-23680-L	Single > 18"				X	X	X							X	X	X
23,620	2009	Bench Log	WD-23620-L	Single > 18"				X	X								X	X	X
23,560	2009	Bench Log	WD-23560-L	Single > 18"				X	X								X	X	X
22,010	2010	Bench Log	WD-22010-R	Single > 18"	-			-	X		-			-			-	X	X
22,000	2010	Spider Log	WD-22000-R	Accumulation 2 < 9	-			-			-			-			-	X	X
21,950	2010	Bench Log	WD-21950-R	Single > 18"	-			-	X		-			-			-	X	X
21,930	2010	Bench Log	WD-21930-R	Single > 18"	-			-	X		-			-			-	X	
21,910	2010	Bench Log	WD-21910-R	Single > 18"	-			-	X		-			-			-	X	
21,905	2010	Bench Log	WD-21905-R	Single > 18"	-			-	X		-			-			-		X
21,900	2010	Spider Log	WD-21900-L	Single > 18"	-			-			-			-			-	X	X
21,850	2010	Toe Log	WD-21850-R	Jam > 10	-	X	X	-			-	X	X	-	X	X	-		
21,710	2010	Bench Log	WD-21710-R	Single > 18"	-			-			-			-			-	X	X
21,670	2010	Spider Log	WD-21670-L	Accumulation 2 < 9	-	X	X	-			-	X	X	-	X	X	-		
19,780	2009	Bench Log	WD-19780-L	Single > 18"				X	X								X	X	X
19,730	2009	Bench Log	WD-19730-L	Single > 18"				X	X								X	X	X
19,685	2009	Bench Log	WD-19685-L	Single > 18"				X	X								X	X	X
19,650	2009	Bench Log	WD-19650-L	Single > 18"				X									X	X	X
19,650	2010	Bench Log	WD-19650-R	Single > 18"	-			-	X		-			-			-	X	X
19,610	2009	Bench Log	WD-19610-L	Single > 18"				X	X								X	X	X
19,560	2009	Bench Log	WD-19560-L	Single > 18"				X	X								X	X	X
19,505	2009	Bench Log	WD-19505-L	Single > 18"				X	X								X	X	X
19,475	2010	Toe Log	WD-19475-R	Single > 18"	-	X	X	-			-	X	X	-			-		
19,440	2010	Bench Log	WD-19440-R	Single > 18"	-			-	X		-			-			-	X	X
19,200	2010	Bench Log	WD-19200-R	Single > 18"	-			-	X		-			-			-	X	X
18,350	2010	Bench Log	WD-18350-R	Single > 18"	-			-			-			-			-	X	X
18,260	2010	Bench Log	WD-18260-R	Single > 18"	-			-			-			-			-	X	X
18,250	2010	Boulder Cluster	BC-18250-M	Boulder Cluster	-			-	X		-			-	X		-		X
18,200	2010	Bench Log	WD-18200-R	Single > 18"	-			-			-			-			-	X	X
17,700	2010	Root Wad	WD-17700-R	Single > 18"	-			-			-			-			-	X	X
17,425	2010	Root Wad	WD-17425-R	Single > 18"	-	X		-			-			-			-	X	
17,225	2010	Root Wad	WD-17225-R	Single > 18"	-	X	X	-			-	X	X	-	X	X	-		
16,900	2010	Root Wad	WD-16900-R	Single > 18"	-			-	X		-			-			-	X	X
16,440	2010	Terrace Log	WD-16440-L	Single > 18"	-			-	X	X									
16,400	2010	Terrace Log	WD-16400-L	Single > 18"	-			-	X	X									
16,125	2010	Root Wad	WD-16125-L	Single > 18"	-	X	X	-			-	X	X	-	X	X	-		

Large Woody Debris and Boulder Cluster Installation
Fish Habitat and Geomorphic Function Summary Table
(Continued)

					Summer Refugia			Winter Refugia			Hydraulic Constriction (Feeding Lane)			Pool Scour			Bank Stability		
River Station	Year Installed	Installation	Restoration Label	Configuration	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
13,650	2011	Low Profile Log	WD-13650-L	Single > 18"	-	-		-	-		-	-		-	-	X	-	-	
13,590	2011	Low Profile Log	WD-13590-L	Single > 18"	-	-	X	-	-		-	-	X	-	-	X	-	-	
13,070	2011	Root Wad	WD-13070-L	Accumulation 2 < 9	-	-	X	-	-		-	-		-	-	X	-	-	
13,050	2011	Boulder Cluster	BC-13050-L	Boulder Cluster (4)	-	-		-	-		-	-	X	-	-	X	-	-	
12,990	2011	Low Profile Log	WD-12990-L	Single > 18"	-	-		-	-		-	-		-	-		-	-	X
12,950	2011	Boulder Cluster	BC-12950-M	Boulder Cluster (4)	-	-		-	-		-	-		-	-	X	-	-	
12,850	2011	Low Profile Log	WD-12850-L	Single > 18"	-	-	X	-	-		-	-		-	-	X	-	-	
12,825	2011	Boulder Cluster	BC-12825-M	Boulder Cluster (5)	-	-		-	-		-	-		-	-	X	-	-	
12,800	2011	Root Wad	WD-12800-L	Accumulation 2 < 9	-	-		-	-		-	-	X	-	-		-	-	
12,550	2011	Low Profile Log	WD-12550-L	Single > 18"	-	-		-	-		-	-		-	-	X	-	-	X
12,420	2011	Root Wad	WD-12420-L	Accumulation 2 < 9	-	-	X	-	-		-	-	X	-	-	X	-	-	
12,400	2011	Boulder Cluster	BC-12400-L	Boulder Cluster (3)	-	-		-	-		-	-	X	-	-	X	-	-	

HIGH PERFORMING INSTALLATIONS

4 of 11 2010 Installations 2 of 12 2011 Installations					Summer Refugia			Hydraulic Constriction (Feeding Lane)			Pool Scour		
River Station	Year Installed	Installation	Restoration Label	Configuration	2010	2011	2012	2010	2011	2012	2010	2011	2012
21,850	2010	Toe Log	WD-21850-R	Jam > 10	-	X	X	-	X	X	-	X	X
21,670	2010	Spider Log	WD-21670-L	Accumulation 2 < 9	-	X	X	-	X	X	-	X	X
17,225	2010	Root Wad	WD-17225-R	Single > 18"	-	X	X	-	X	X	-	X	X
16,125	2010	Root Wad	WD-16125-L	Single > 18"	-	X	X	-	X	X	-	X	X
13,590	2011	Low Profile Log	WD-13590-L	Single > 18"	-	-	X	-	-	X	-	-	X
12,420	2011	Root Wad	WD-12420-L	Accumulation 2 < 9	-	-	X	-	-	X	-	-	X

Excludes 29 bench & terrace log installations in 2009-2011 which provide winter refugia and bank stability

21,850 Toe Log

21,670 Spider Log

17,225 Root Wad

13,590 Low Profile Log

16,125 Root Wad

12,420 Root Wad

UNDERPERFORMING INSTALLATIONS

7 of 11 2010 Installations 2 of 12 2011 Installations					Summer Refugia			Winter Refugia			Hydraulic Constriction (Feeding Lane)			Pool Scour			Bank Stability		
River Station	Year Installed	Installation	Restoration Label	Configuration	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012	2010	2011	2012
22,000	2010	Spider Log	WD-22000-R	Accumulation 2 < 9	-			-			-			-			-	X	X
21,900	2010	Spider Log	WD-21900-L	Single > 18"	-			-			-			-			-	X	X
19,475	2010	Toe Log	WD-19475-R	Single > 18"	-	X		-			-	X		-			-		
18,250	2010	Boulder Cluster	BC-18250-M	Boulder Cluster	-			-	X		-			-	X		-		X
17,700	2010	Root Wad	WD-17700-R	Single > 18"	-			-			-			-			-	X	X
17,425	2010	Root Wad	WD-17425-R	Single > 18"	-	X		-			-			-			-	X	
16,900	2010	Root Wad	WD-16900-R	Single > 18"	-			-	X		-			-			-	X	X
12,990	2011	Low Profile Log	WD-12990-L	Single > 18"	-	-		-	-		-	-		-	-		-	-	X
12,800	2011	Root Wad	WD-12800-L	Accumulation 2 < 9	-	-		-	-		-	-	X	-	-		-	-	

Excludes 29 bench & terrace log installations in 2009-2011 which provide winter refugia and bank stability

22,000 Spider Log at Alcove

21,900 Spider Log

19,475 Toe Log

18,250 Boulder Cluster

17,700 Root Wad

17,425 Root Wad

12,990 Low Profile Log

12,800 Root Wad

WELL PERFORMING INSTALLATIONS

0 of 11 2010 Installations 2 of 12 2011 Installations					Summer Refugia			Pool Scour		
River	Year	Installation	Restoration	Configuration	2010	2011	2012	2010	2011	2012
13,070	2011	Root Wad	WD-13070-L	Accumulation 2 < 9	-	-	X	-	-	X
12,850	2011	Low Profile Log	WD-12850-L	Single > 18"	-	-	X	-	-	X

0 of 11 2010 Installations 2 of 12 2011 Installations					Hydraulic Constriction (Feeding Lane			Pool Scour		
River	Year	Installation	Restoration	Configuration	2010	2011	2012	2010	2011	2012
13,050	2011	Boulder Cluster	BC-13050-L	Boulder Cluster (4)	-	-	X	-	-	X
12,400	2011	Boulder Cluster	BC-12400-L	Boulder Cluster (3)	-	-	X	-	-	X

1 of 11 2010 installations 0 of 12 2011 installations					Summer Refugia			Hydraulic Constriction (Feeding Lane		
River	Year	Installation	Restoration	Configuration	2010	2011	2012	2010	2011	2012
19,475	2010	Toe Log	WD-19475-R	Single > 18"	-	X	X	-	X	X

0 of 11 2010 installations 4 of 12 2011 installations					Pool Scour		
River	Year	Installation	Restoration	Configuration	2010	2011	2012
13,650	2011	Low Profile Log	WD-13650-L	Single > 18"	-	-	X
12,950	2011	Boulder Cluster	BC-12950-M	Boulder Cluster (4)	-	-	X
12,825	2011	Boulder Cluster	BC-12825-M	Boulder Cluster (5)	-	-	X
12,550	2011	Low Profile Log	WD-12550-L	Single > 18"	-	-	X

Large Woody Debris Structure Persistence (# years, % persisting)

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. The maintenance status of Large Woody Debris (LWD) structures was assessed for the first time in June 2011. The performance standard is 75% persistence of installed instream habitat enhancement structures.

2012

As of June 2012, 100% of the large woody debris and boulder clusters installed in 2009-2011 had persisted with no need for maintenance.

In 2012, the survey field team also noted the multi-annual persistence of 18 occurrences (17 single pieces, 1 accumulation 2-9) of naturally occurring LWD. These persistent logs represent 13% of all naturally occurring LWD mapped in 2012. One piece of wood at cross section 8,270 was known to have remained in place at least since 2004.

8,270 Cross Section LWD Persisting from prior to 2004 through 2012

XI. Seasonal Salmonid Habitat Surveys

Seasonal Salmonid Habitat Surveys

2012

At the request of the Napa County Flood Control and Water Conservation District and in accordance with the Monitoring Plan for the Rutherford Reach Restoration of the Napa River, Napa County Resource Conservation District (RCD) completed assessments of recently-installed in-stream restoration features in Reach 4 East bank of the Rutherford Reach Restoration Project on the Napa River. Reach 4 extends from the Rutherford Cross Road at river station 12,000, upstream 4,000 feet to river station 16,000. Restoration construction of the east bank took place in 2011. West bank construction is scheduled for summer 2012. Two assessments were completed: one at a winter flow high enough to inundate new bench cuts, and one at a low spring flow to evaluate new wood and rock habitat structures. The assessments included site sketches of surface flow patterns, collection of photographs, water velocity measurements, water-level elevation surveys, and evaluation of habitat function by a fisheries biologist. In addition, RCD conducted a snorkel survey to assess fish presence throughout the reach.

High-Flow Assessment

On January 23, 2012, Jonathan Koehler, RCD fisheries biologist, and Paul Blank, RCD hydrologist, visited select restoration features in Reach 4 installed in the summer and fall of 2011. These included Bench 7 and Bank Stabilization Area 1 on the Carpy-Conolly property, and Bank Stabilization Area 2, Bench 11, and Bench 13 on the Honig property, and Bench 14 on the Round Pond property. According to data obtained from USGS stream gaging station 11456000, located approximately 2 miles upstream, streamflows peaked 1.5 hours prior to our visit at 2,200 cubic feet per second (cfs). During our visit flows remained quite steady, varying from 1,970 to 2,100 cfs.

Average water velocity was measured at select locations within the newly-installed features using a USGS Price AA current meter with a wading rod and the six-tenths depth method (Table 1). RCD flagged the current water surface elevations (WSEL) for surveying at a later time.

RCD returned to the reach on May 10, 2012 with a theodolite and stadia rod and surveyed the previously-flagged January 23, 2012 WSELs. Water levels were surveyed relative to three existing monuments which had previously been surveyed relative to NAVD88 (Table 1).

Low-Flow Assessment

On May 1, 2012, RCD re-visited the newly-installed fish-habitat restoration features in Reach 4 East. According to data obtained from USGS streamgaging station 11456000, located approximately 2 miles upstream, streamflow was 36 cfs during our visit. Average water velocity was measured at select locations near the newly-installed features using a USGS Price Pygmy current meter with a wading rod and the six-tenths depth method.

Snorkel Survey

On May 17, 2012, Jonathan Koehler and Paul Blank conducted an upstream snorkeling survey of the Rutherford Reach between the Rutherford Cross Road and Zinfandel Lane upstream. According to data obtained from USGS stream gaging station 11456000, located approximately 2 miles upstream, streamflow was 16 cfs during our visit. The survey focused on presence/absence of juvenile salmonids throughout the reach and in the vicinity of each installed feature.

Residual Pool Depth

Following the protocol in the Monitoring Plan for the Rutherford Reach Restoration of the Napa River, RCD measures the residual pool depth associated with installed instream habitat structures as part of the annual channel survey of the 4.5 mile Rutherford Reach each June. The trend in the residual pool depth is used to assess the impact of instream structures on pool structure, including the effectiveness of the structures on causing pool scour, reducing the deposition of fines in pools, and creating habitat complexity. RCD first measured residual pool depth in 2011 at instream habitat structures installed from 2009-2010 in Reaches 1-3, between Rutherford Reach river stations 16,000 – 24,857. Residual pool depth is the difference between maximum pool depth and pool tail depth.

Results

Site sketches and photographs from each assessment are attached. Water velocity measurements are noted on the site sketches. The results of water surface elevation surveying completed during the high-flow assessment are presented in Table 1. Narrative evaluations of the performance of each assessed feature are provided in Table 2.

The results of the snorkel survey showed moderate abundances of juvenile steelhead throughout the reach. No juvenile Chinook salmon were observed during the survey. Juvenile steelhead ranging in length from approximately 80 – 100 mm were observed primarily in swift moving water associated with riffles and runs. No juvenile salmonids were observed in the immediate vicinity of the installed structures. Juvenile salmonids may utilize these structures during the winter, but we could not assess this due to limited visibility and potential danger associated with being in the channel during high flows.

Other fish species observed during the survey included California Roach (Lavinia symmetricus), Sacramento sucker (Catostomus occidentalis), Three-spine stickleback (Gasterosteus aculeatus), Sacramento pike minnow (Ptychocheilus grandis), tule perch (Hysterocarpus traski), and Pacific Lamprey (Entosphenus tridentatus). The adult Pacific lamprey was observed constructing a redd (spawning nest) just upstream of the tributary junction near BSA2: Honig Confluence. All fish species observed were native.

Flow Velocities in Constructed High-Flow Refugia Areas

The performance standard is high flow refugia with velocities less than 6 feet per second (FPS) for flows 500 cfs and above at constructed alcoves and instream bankfull benches, with specific target velocities for salmonid life stages as per the table below.

Target Salmonid Habitat Criteria

Species / Life Stage	*Depth (feet)*	*Substrate*	*Velocity (fps)*
Steelhead Fry	*0.0 – 1.5*	*substrate > sand, organic cover*	*0.0 – 0.5*
Small Juvenile Steelhead	*0.5 – 1.5*	*tennis ball substrate, deeper w/ organic cover*	*0.5 – 1.5*
Large Juvenile Steelhead	*> 1.5*	*N/A*	*1.0 - 2.5*
Adult Spawning	*0.5 – 2.0*	*N/A*	*1.0 - 2.5*
BMI-Riffle	*0.1 – 1.5*	*> golf ball substrate*	*> 1.5*

Source: NOAA/NMFS Criteria for MicroHabitat Mapping on Alameda Creek

High Water Mark and Water Surface Elevation for Velocity Monitoring of High Flow Refugia

2012

	Flow at Pope St* (cfs)	Water Surface Elevation (ft NAVD88)					
		Bench 14: Round Pond	Bench 13: Honig	Bench 11: Honig	BSA 2: Honig	BSA 1: Carpy-Conolly	Bench 7: Carpy-Conolly
River Station		12400-L	12900-L	13600-L	13850-L	14400-L	15700-L
WSEL 1/23/2012 0940	2,040	143.20					
WSEL 1/23/2012 1000	2,060		143.99				
WSEL 1/23/2012 1040	2,100			144.95			
WSEL 1/23/2012 1050	2,100				145.73		
WSEL 1/23/2012 1117	2,050					146.87	
WSEL 1/23/2012 1130	1,970						149.81

Table 1. Water surface elevations at constructed features during January 23, 2012 high-flows.

*Provisional data provided by USGS, subject to revision

Fall and Winter Rearing Habitat for 0-1+ Steelhead, and Immigrating/Emigrating Salmonids

2012

Feature Name	River Station	Feature Type	Assessment	Fisheries Biologist Evaluation
Bench 14: Round Pond	**12500-L**	Bench Cut	High-flow	This bench appears to be functioning very well to provide off-channel refuge habitat for juvenile salmonids during high flow events. Areas of slack water were observed in this feature during a large winter storm event.
Bench 13: Honig	**13000-L**	Bench Cut	High-flow	This bench is functioning very well to provide off-channel refuge habitat for juvenile salmonids during high-flow events. Extensive slow and slack water areas were observed during a large winter storm event. This feature contained a favorable mix of slow resting habitat and swift feeding habitat.
Bench 11: Honig	**13600-L**	Bench Cut	High-flow	This bench is functioning very well to provide off-channel refuge habitat for juvenile salmonids during high-flow events. Extensive slow and slack water areas were observed during a large winter storm event. This feature contained a favorable mix of slow resting habitat and moderate to swift feeding habitat.
BSA 2: Honig	**13850-L**	Bank Stabilization Area	High-flow	This bank stabilization area and tributary channel junction appear to provide high flow refugia in the form of a backwater and partially inundated tree trunks. Water velocities were generally low during a large winter storm event.
BSA 1: Carpy Conolly	**14400-L**	Bank Stabilization Area	High-flow	This bank feature appears to provide high flow refugia, primarily from willows and other riparian vegetation, which were partially inundated at the time of observation. Although water velocities could not be measured in the heavily vegetated area due to limited access, surface currents appeared to be very slow or completely slack throughout most of the feature.
Bench 7: Carpy Conolly	**15700-L**	Bench Cut	High-flow	This bench appears to be functioning very well to provide off-channel refuge habitat for juvenile salmonids during high flow events. Areas of slack water were observed in this feature during a large winter storm event.
BC-12400	**12400**	Boulder	Low-flow	These three boulders appear to provide a relatively small but effective velocity shelter during low to moderate flows. Measured velocities were significantly slower within the

		Cluster		cluster than the surrounding currents. No salmonids were observed around this feature during the snorkel survey. All boulders were covered heavily with filamentous algae.
WD-12410-L	**12410**	Root Wad	Low-flow	This rootwad appears to provide good refuge habitat during low to moderate flows. A deep scour hole has developed immediately around the feature, and water velocities measured just downstream of the rootwad were significantly lower than the surrounding currents. During the snorkel survey, no salmonids were present around this feature, but several other native fish species were observed.
WD-12600-L	**12600**	Root Wad	Low-flow	This rootwad is located at the left edge of a deep (>4 feet) pool and creates a slow backwater habitat. No fish were observed around this feature during the snorkel survey.
WD-12780-L	**12780**	Root Wad	Low-flow	This rootwad appears to provide good refuge habitat during low to moderate flows. A distinct scour hole has developed immediately around the feature, and a sand deposit was observed just downstream of the rootwad. During the snorkel survey, no salmonids were present around this feature, but several other native fish species were observed.
WD-12850-M	**12850**	Root Wad	Low-flow	This rootwad was partially buried in the streambed and did not appear to provide much instream habitat value during the low-flow assessment. No fish were observed around this feature during the snorkel survey.
BC-12850	**12850**	Boulder Cluster	Low-flow	This group of five boulders was completely submerged during our low-flow assessment and snorkel survey. The boulders appear to provide an effective velocity shelter during low to moderate flows. Measured velocities were significantly lower within the cluster than the surrounding currents; however the streambed at this location is relatively flat with little topographic complexity. No salmonids were observed around this feature during the snorkel survey. All boulders were covered heavily with filamentous algae.
BC-12930	**12930**	Boulder Cluster	Low-flow	This group of four boulders was completely submerged during our low-flow assessment and snorkel survey. The boulders appear to provide an effective velocity shelter during low to moderate flows. Measured velocities were lower within the cluster than the surrounding currents. No salmonids were observed around this feature during the snorkel survey. All boulders were covered with a moderate amount of filamentous algae.
WD-13010-M	**13010**	Low-	Low-flow	This log was partially buried in the streambed and did not appear to provide much

		profile Log		instream habitat value during the low-flow assessment. No fish were observed around this feature during the snorkel survey.
BC-13040	**13040**	Boulder Cluster	Low-flow	This group of four boulders appears to provide excellent feeding and resting habitat for juvenile salmonids. Measured water velocities were significantly slower behind each boulder, while swift current habitat was created between the individual stones. Juvenile steelhead (~80-100 mm) was observed around the boulder cluster and in the surrounding riffle habitat during the snorkel survey. In addition, a gravel deposit with favorably-sized salmonid spawning substrate was observed near this boulder cluster, which appeared to be the result of hydraulic sorting.
WD-13080-L	**13080**	Root Wad	Low-flow	This rootwad appears to provide good refuge habitat during moderate to high flows. A relatively shallow scour hole has developed immediately around the feature. During the snorkel survey, no salmonids were present around this feature, but other native fish species were observed.
WD-13650-L	**13650**	Root Wad	Low-flow	This rootwad appears to provide good refuge habitat during low to moderate flows. A distinct scour hole has developed immediately around the feature and a small backwater was present just upstream of the feature at low flow. During the snorkel survey, no salmonids were present around this feature, but other native fish species were observed.

Table 2. Fisheries biologist evaluation of performance of each assessed feature.

XII. Vegetation Establishment Surveys

Vegetation Establishment Surveys

2012

1.0 Introduction

The Napa River Rutherford Reach Restoration Project (Project) is a comprehensive large scale river restoration project spanning 4.5 miles of the Napa River beginning at the south end of St. Helena at the Zinfandel Lane Bridge and ending at the Oakville Cross Road Bridge. The goals of the Project are many but primarily include the restoration of physical and biological processes of the Napa River including expanding and restoring riparian habitat. As part of the Project, revegetation plans and specifications are prepared by a design/ landscape consultant that specifies the quantities and species of plants to be planted post construction. The vegetation plans also specify appropriate planting zones and invasive plant management strategies for the purpose of restoring riparian habitat in disturbed Project areas. Napa County vegetation management specialists review and approve the plans for consistency with known site conditions prior to putting the contract out for bid. This report is prepared by the Napa County Flood Control and Water Conservation District (District) in order to evaluate and monitor restored riparian areas within the Project.

1.1 Site Preparation and Installation Methods

Preparation work post site grading includes the removal of select invasive non-native plant species followed by field marking the planting location of specific plant species with landscaping flags placed by the contractor and project ecologist throughout the Project site according to the species percentages and quantities as specified in the re-vegetation plans. Next, a combination of under and overstory species ranging in size from container stock (1 gallon, treepot or depot), poles (3’-4’ x 1/2”-3” diam.), small plugs and direct seed (1-3 seeds/planting hole depending on species), are installed following excavation of planting holes with a hand or chainsaw augur. Planting holes are amended with fertilizer packets prior to backfilling with native material or compost. Container stock and plugs are generally installed after the first major rain event during the period between October 15th and January 31st.

All planted Project areas are checked weekly during the irrigation season (April to October) and a minimum of once every month during the non-irrigation season (November to February) for the duration of the Project. During the irrigation season, staff check plant condition, weed growth, planting basin stability, and assess soil moisture around each plant to ensure that the plants are receiving sufficient water. Automated drip irrigation is installed for all planted areas within the Project. Watering schedule typically is as follows: For the first- three years irrigation will begin on April 1st. Irrigation will continue until October 15. Plants will be irrigated weekly during the irrigation schedule and in general will receive 10-12 gallons of water per application via drip emitters. The irrigation schedule will be modified if hot dry weather persists into the fall beyond October 15th. In general, the plant will likely not be irrigated after the third year in an effort to have the installed plants adapt to the native precipitation environment.

2.0 Riparian Restoration Goals and Success Criteria

The target restoration goals and success criteria for vegetation establishment as outlined in the body of the main Project Monitoring Report include the following:

- A minimum of 20 acres over the life the Project (acres)
- An 80% survival of native plants installed at re-vegetation sites after the initial contractor maintenance period. The Project will be deemed successful in terms of restoration planting survivorship if, after 3 years, 80% of the plants installed in the initial year are alive and are in good health
- Greater than 90% native cover (less than 10% total non-native) over the life the Project
- Evidence of successful natural recruitment by year 5 at re-vegetation sites

These target goals and success criteria are expected t be achieved over the life of the Project. Continued long-term monitoring will quantify and assess changes in vegetation and other ecological parameters through time to help further determine if the Project is achieving its goals and success criteria by the end of the monitoring period.

3.0 Methods

Below is a brief description of the monitoring methods utilized for the Vegetation Establishment Surveys conducted for the Project. Please refer to the reports listed in the reference section for a more detailed account of specific monitoring protocols and methods outline here.

3.1 Direct count and photo documentation

Direct count of installed plants in restored, planted areas, was conducted in order to determine percent survivorship and vigor/health. As the name implies, this involves the direct survey of each installed plant to determine whether it is dead or alive as well as the general vigor/health of the plant (Harris et al., 2005). For the first three years following plant installation, the contractor is responsible for the initial installation of native plants is responsible for conducting this survey and maintaining the plants such that at the end of the three year contractor maintenance period 80% or greater of installed plants are alive and growing well. District staff was responsible for establishing photo monitoring points at each re-vegetated area and annually photographed each respective site.

3.2 Area mapping/percent vegetative cover, invasive plant management

Each year, District staff map and report the total area of riparian habitat that has been planted in constructed restoration areas; the percentage of vegetative cover [i.e. replanted areas "covered" by herbaceous and/or woody plant species or un-vegetated ground "not covered"] at restored areas; and the total percent of "desirable native vs. targeted non-native invasive species cover in the restored areas (such as Vinca, Arundo, poison hemlock, red sesbania, Himalayan blackberry, etc).

The area mapping method involves the use of GIS and multispectral/multi-band aerial imagery (flown in the spring of 2011 at a resolution of 0.5 foot per pixel) in order to map total area and perform a supervised image classification of vegetative cover. Records of invasive plant species surveyed and treated are logged and reported. District staff then performs field work to "ground truth" these surveyed areas to provide higher data resolution

3.3 Line intercept transect surveys

Line intercept transect surveys and photo documentation of transect sites is conducted per the method outlined by Harris et al (2005). This survey includes establishing several transect lines for a given restoration area and measuring the height class of each plant species intersected by the transect line, categorizing the cover class and percentage of cover along the intercept line (i.e. herbaceous, woody, bare ground, etc.), and photographing each surveyed transect line. Transect lines are perpendicular to the channel in order to capture specific performance of planted species at a given river bank elevation or planting zone.

4.0 Results

The Project has been divided into nine reaches based on geomorphic characteristics, subsequent monitoring areas are also conducted along these reaches and further subdivided as necessary. Direct count surveys, photo documentation, area mapping, and line intercept surveys are conducted annually throughout constructed reaches of the Project.

4.1 Direct count and photo documentation

As of fall 2012, District staff has conducted direct count vegetations surveys of restoration sites in Phases 1-2, Reaches 1-3; the location of these sites is shown in Figure 1. From 2009-2011, in reaches 1-3, approximately 8.25 acres of constructed restored areas were planted with native grasses, shrubs and trees. On the east bank of reaches 1-2, a total of 2.49 acres were surveyed, which were initially planted in 2009. On the west bank of reaches 1-2, a total of 3.56 acres were surveyed, which were initially planted in 2010. In reach 3, a total of 2.2 acres were surveyed, which were initially planted in 2010. Table 1 below presents the cumulative direct count vegetation data for reaches 1-2 starting in 2011; and Table 2 below presents the data for Reach 3. The direct count vegetation data is reported by survey year and includes: the initial quantity of each species; the quantity alive at the time of the survey; the percent survival; and the general health of the plantings. The revegetation contractor was responsible for plant establishment and monitoring in Phases 1-2, Reaches 1-3 from 2009-2012. It should be noted that detailed monitoring information was not collected annually by the contractor responsible for maintaining reaches 1 and 2 east bank, however, District staff surveyed total plant survivorship for these areas in 2011 and 2012. At the end of the three year contractor maintenance period, survivorship was 89% for plants in the restored areas in Reaches 1 and 2 east bank.

Survey data indicate overall survivorship for Reaches 1 and 2 to be 85% or greater for survey years 2011 and 2012, while overall survivorship for Reach 3 was 52% or greater. Several issues arose in Reach 3, east bank that contributed to the lower overall survivorship including direct seed material (acorns, etc) that was not viable when planted, inconsistent water availability from landowners during critical late summer irrigation months and a high population of field mice/voles detected in this area that are burrowing beneath installed plant material and consuming roots. Representative photos of the sites are shown in Figures 3-4, additional photos of these sites can also be viewed in Appendix D. Study V of the Project Monitoring Report.

Table 1: Reach 1-2 Direct Count/Survivorship Survey
(Constructed and re-vegetated in 2009-2010)

	2011			2012		
Common Name	**Qty Planted**	**Qty Alive**	**% Survival**	**Qty Alive***	**% Survival**	**Health**
Coyote brush	60	60	100%	88	147%	Good
CA black walnut	50	56	112%	55	110%	Good
Snowberry	147	147	100%	155	105%	Good
Toyon	9	4	44%	9	100%	Poor
White alder	30	30	100%	30	100%	Good
California wild rose	147	147	100%	140	95%	Good
Western spice bush	241	241	100%	220	91%	Good
Big Leaf Maple	29	29	100%	26	90%	Good
California bay	44	44	100%	39	89%	Good
Oregon Ash	100	91	91%	88	88%	Good
Fremont's cottonwood	136	97	71%	118	87%	Fair
Red willow	136	142	104%	115	85%	Good
Honeysuckle	87	64	74%	64	74%	Fair
Valley oak	90	49	**54%	64	71%	Fair
Arroyo willow	136	95	70%	84	62%	Fair
California buckeye	29	8	**28%	12	41%	Poor
Coast live oak	132	71	**54%	48	36%	Fair
Total	***1603***	***1375***	***86%***	***1355***	***85%***	

*Includes original planted stock, replacement stock and naturally recruited species.

**Acorns/seeds utilized during initial planting demonstrated low viability and thus were replace with larger container stock on the second year.

Table 2: Reach 3 Direct Count/Survivorship Survey
(Constructed and re-vegetated in 2010)

	2011			2012		
Common Name	**Qty Planted**	**Qty Alive**	**% Survival**	**Qty Alive***	**% Survival**	**Health**
Big Leaf Maple	10	5	50%	13	130%	Fair
Oregon Ash	44	32	73%	45	102%	Good
Fremont's Cottonwood	37	16	43%	32	86%	Poor
California Wild Rose	144	121	84%	122	85%	Good
Western Redbud	82	69	84%	68	83%	Good
Twinberry	76	67	88%	59	78%	Good
Western Spice Bush	31	24	77%	23	74%	Good
Black Walnut	65	42	65%	47	72%	Fair
Arroyo Willow	30	8	27%	21	70%	Poor
Coyote Bush	67	36	54%	44	66%	Fair
Snowberry	100	76	76%	64	64%	Good
Bay Laurel	86	76	88%	52	60%	Good
Toyon	59	29	49%	23	39%	Poor
Yellow Willow	28	20	71%	11	39%	Good
Red Willow	24	29	121%	9	38%	Good
Silver Lupine	150	83	55%	57	38%	Fair
Honeysuckle	30	6	20%	9	30%	Poor
White Alder	10	4	40%	2	20%	Poor
Valley Oak	128	14	**11%	25	20%	Poor
Sticky Monkeyflower	57	20	35%	9	16%	Poor
Coast Live Oak	58	0	**0%	2	3%	Poor
Box Elder	13	11	85%	0	0%	Good
California Buckeye	44	0	**0%	0	0%	Poor
Blue Oak	28	0	**0%	0	0%	Poor
California Black Oak	3	0	**0%	0	0%	Poor
Total	***1404***	***788***	***56%***	***737***	***52%***	

*Includes original planted stock, replacement stock and naturally recruited species.

**Acorns/seeds utilized during initial planting demonstrated low viability and thus were replace with larger container stock second on the year. Voles/mice continue to undermine roots on installed plant in reach 3 east bank. District is exploring options to remedy this problem.

4.2 Area mapping/percent cover, invasive plant management

Figure 1 shows the location of each area mapped for percent vegetation cover from 2009-2011, in Reaches 1-3. Approximately 8.25 acres of constructed restored areas were planted with native grasses, shrubs and trees. Results of the supervised classification of the multi-band aerial imagery indicate that approximately 44% of this area is herbaceous vegetation cover, 23% is woody vegetation (shrub and/or tree) cover and the remaining 32% is considered un-vegetated ground; this information is also presented below in Table 3. A strong relationship between the aerial imagery spectral signatures and cover type was evident providing a relatively high confidence level for the supervised classification; a visual example of this relationship is shown Figure 2. In reaches 1 through 3, from 2009 through 2011, 2.18 acres of invasive plant species were mapped and treated. Table 4 below presents the quantity of invasive plants treated and what percentage of a particular species comprised the total amount treated during this period of time. Looking at this table one can derive that approximately 18% of the cover in restored areas were non-native species while the remaining 82% cover is native. Representative photos of the areas are shown in Figures 3-4, additional photos of these areas can also be viewed in Appendix D. Study V of the Project Monitoring Report.

Table 3: Total Riparian Area Planted and Percent Cover.

Cover Type	Total Area Mapped (Acres)	Total Area Mapped (SqFt)	Percent Cover Type
Un-vegetated	2.7	117612.0	33%
Herbaceous (grasses, etc)	3.66	159429.0	44%
Woody (shrub/tree)	1.89	82328.0	23%
Total	***8.25***	***35,9369.0***	***100%***

Table 4: Invasive Plant Species Mapped and Treated, 2009-2012, Reaches 1-3

Common Name	Infested Area Mapped (Acers)	Infested Area Treated (SqFt)	Percent Treated by Species
Red Sesbania	1.13	49,150.70	51.8%
Giant reed	0.42	18,195.34	19.2%
Himalaya Blackberry	0.40	17,391.05	18.3%
CA & Hybrid Grape & Periwinkle	0.17	7,447.93	7.9%
Poison Hemlock	0.06	24,61.97	2.6%
Tree of Heaven	0.004	169.84	0.2%
Total	***2.18***	***94,816.83***	***100%***

4.3 Line intercept transect surveys

Line intercept transects were established at 5 locations in reaches 1 and 2, photo documentation of each transect line was also conducted. The transect lines established range between 42 to 94 feet in length. Figure 1 shows the location of each transect line surveyed. Chart 1 below presents the relative percent cover, by ground cover type, for each transect line surveyed in July 2011. Depending on the transect surveyed, approximately 0%-75% of the ground cover is composed of herbaceous native and non-native grass species, 2%-27% of cover is woody vegetation (shrubs and trees) and the remaining 1%-23% of cover is un-vegetated ground. The exception to this is transect Q3 which is primarily un-vegetated ground due to the underling gravely soils in the immediate area and that lack of sufficient organic material that can support vegetative growth. The District has attempted to plant this area with cottonwood and willow cuttings in augured planting basins with amendments and has achieved a limited amount of success. Chart 2 presents the total percent cover of herbaceous and woody vegetation, by vegetation height class, for each transect line surveyed in July 2011. As would be expected in a newly planted site (< 3 years), the average vegetation height class is 0-3 feet for most surveyed transects. However, transects Q1 and Q2 did have several willows and alders that measured 8' or greater in height. Representative photos of the transect sites are shown in Figure 5.

Chart 1: Relative percent cover by ground cover type for line transect surveys (2011)

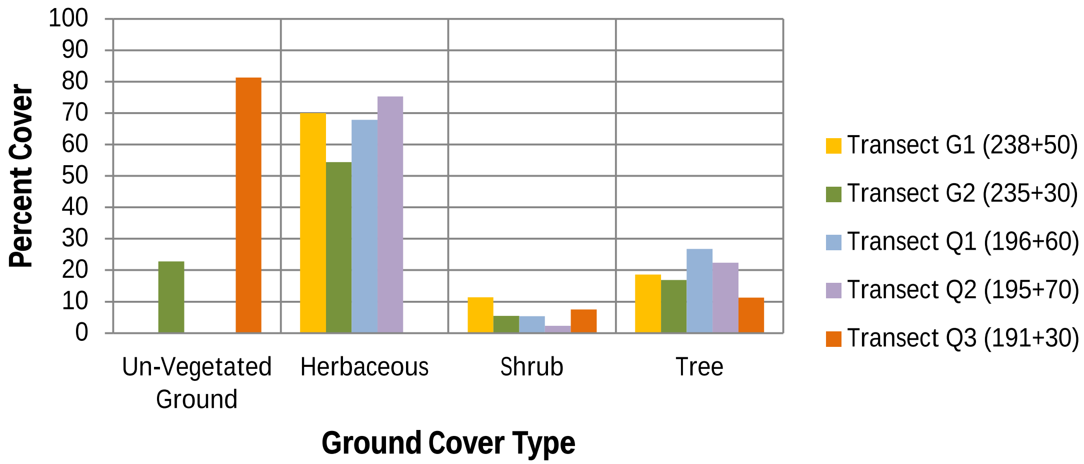
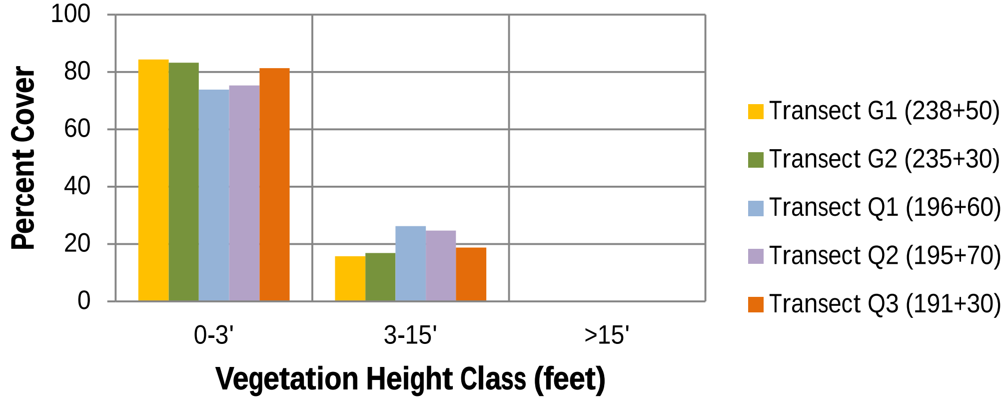


Chart 2: Total percent cover of herbaceous and woody vegetation by height class for line transect surveys (2011)



5.0 Discussion and Conclusion

The results of the surveys indicate there is generally a positive trend for vegetation establishment at newly constructed restoration areas. Survival of installed woody and herbaceous vegetation in reaches 1 through 2 is greater than 85%, which is consistent with Project goals and performance standards for vegetation survivorship; however survivorship for Reach 3 was 52% or greater. The reasons for low survivorship on reach 3 east bank are mentioned in section 4.2 above. The District is currently adaptively managing these sites by attempting to add soil amendments (mycorrhizae, etc.), increase cover and moisture retention at planting basins sites through the use of mulch and increasing the watering duration so that this area will attain 80% or greater over time. Area mapping currently indicates that combined vegetative cover (herbaceous and woody) at restored sites in reaches 1-3 is approximately 67% while un-vegetated ground comprised the remaining 33% cover type. Additionally, results indicate that approximately 18% of the cover in restored areas is comprised of non-native species while the remaining 82% cover is native. While this metric is not yet consistent with the Project goal/performance standard of greater than 90% native cover, it is expected to be achieved over the long-term life of the Project t (20 years). Line intercept transects surveys at any given restoration site indicate that approximately 74%-84% of installed vegetation is between 0-3' in height while the remaining 16%-26% is approximately 3-15' high. This range in vegetation size class is generally considered typical of a newly planted site (< 3 years) and is expect to increase at a normal trajectory under typical growing conditions.

In conclusion, with site specific and general monitoring taking place at regular occurrences and informing adaptive management decisions at restoration sites, it is expected that the Project goals and performance measures will be achieved over the life of the Project.

6.0 References

Harris, R.R., S.D. Kocher, J.M. Gerstein and C. Olson. (2005) *Monitoring the Effectiveness of Riparian Vegetation Restoration*. University of California, Center for Forestry, Berkeley, California.

Hayes, Gretchen E., et al. (2011) *Monitoring Plan for the Napa River Rutherford Reach Restoration Project*, Napa County Flood Control and Water Conservation District, Napa, California, 2009.

Herrick, J.E., J.W. Van Zee, K.M. Havstad, and W.G. Whitford. 2005. *Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems*. USDA-ARS Jornada Experimental Range, Las Cruces, New Mexico.

Figure 1: Study area showing direct count, mapping, transect and photo monitoring locations

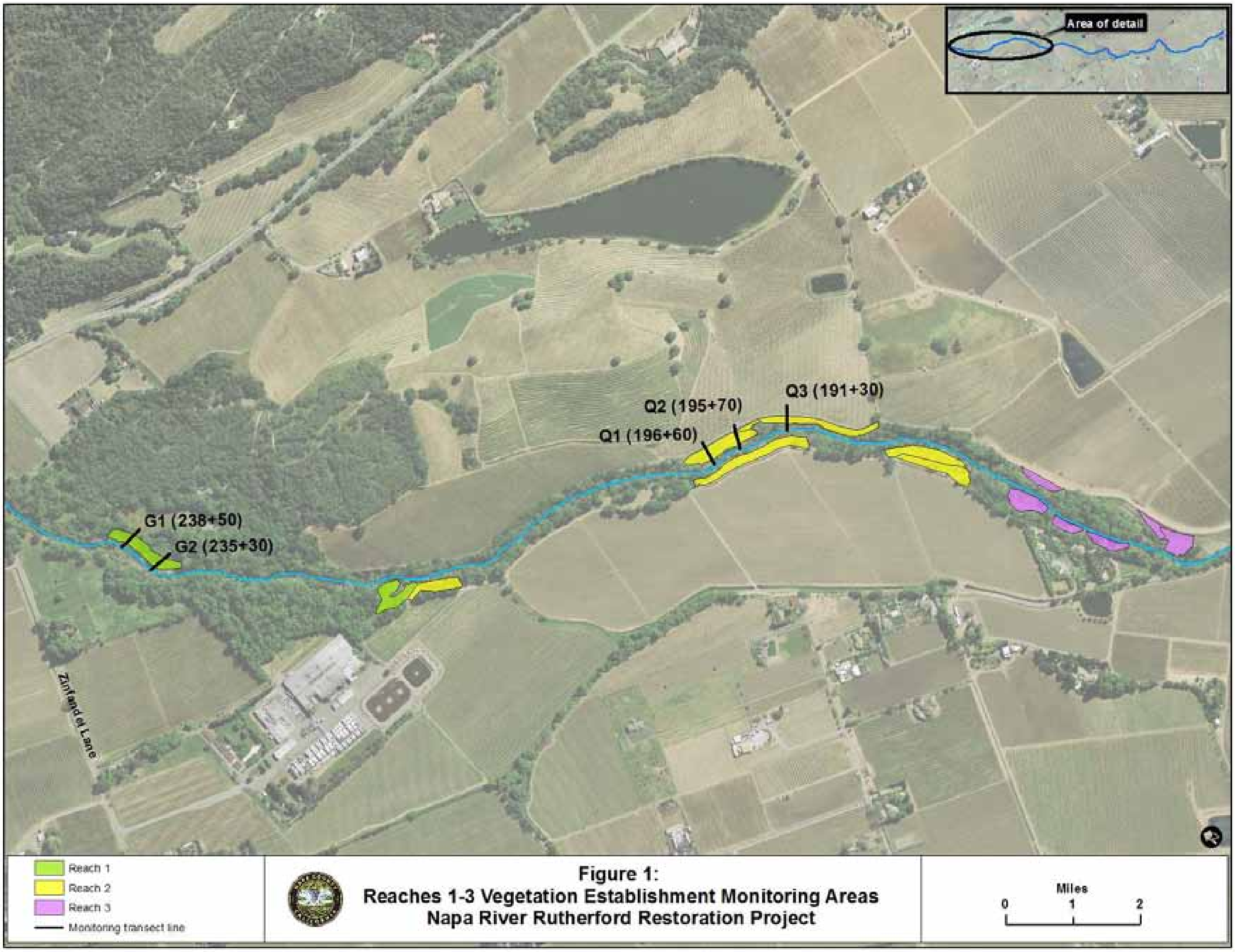


Figure 2: Supervised classification multi-band aerial spectral signatures

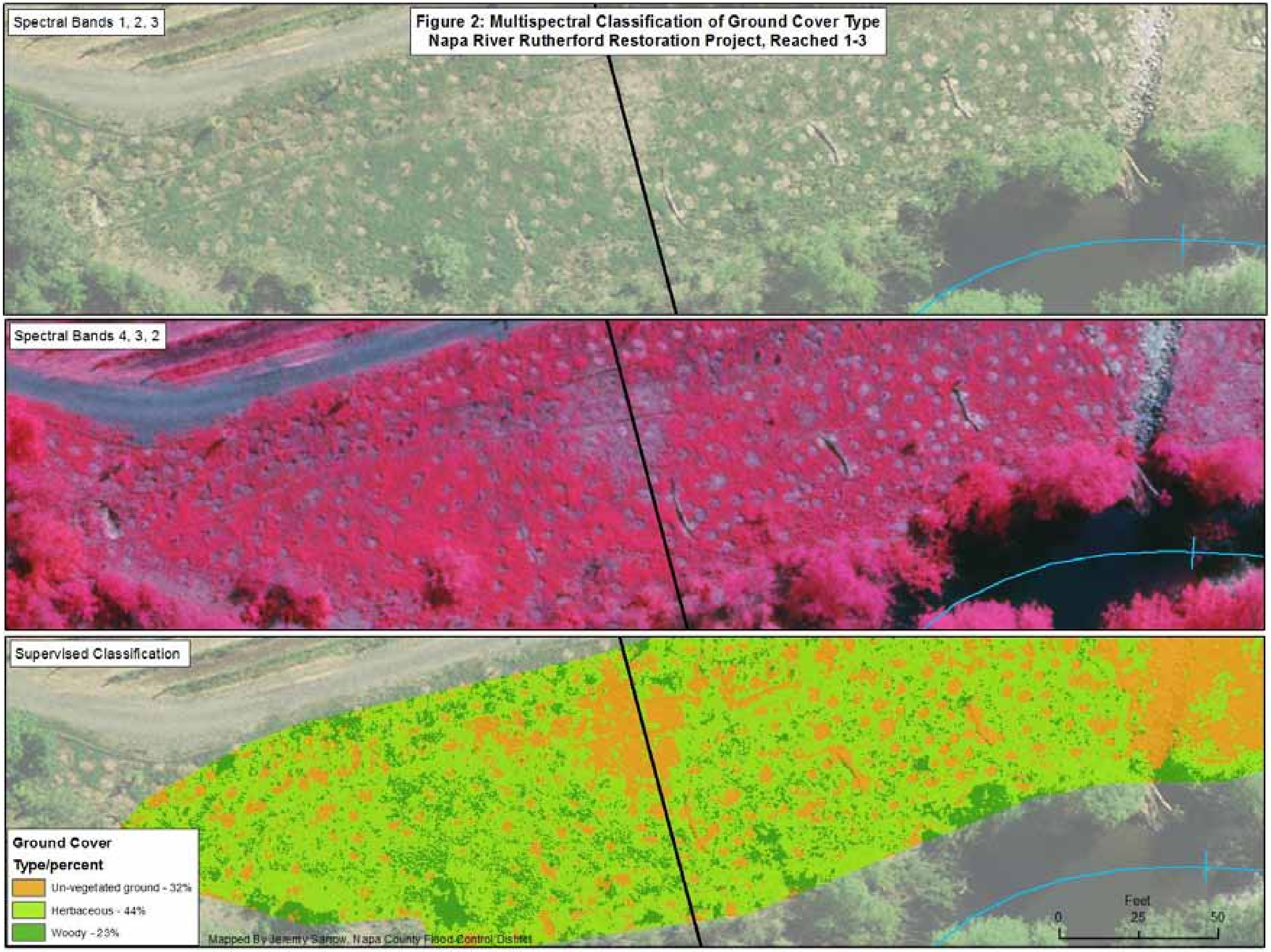


Figure 3: Representative photos of direct count and vegetative cover mapping sites

Guggenhime Bench, Reach 1 (April 2012)

Quintessa Bench 1, Reach 1 (April 2012)

Frogs Leap Bench, Reach 2 (April 2012)

Caymus Bench 1, Reach 2 (April 2012)

Figure 4: Representative photos of direct count and vegetative cover mapping sites

Carpy Conolly Bench 1, Reach 3 (April 2011)

Caymus Bench 2, Reach 3 (April 2012)

Figure 5: Representative photos of line intercept transects

Transect G1/238+50 (July 2012)

Transect Q1/196+60 (July 2012)

Transect Q2/191+30 (July 2012)

XIII. Stakeholder Participation Documentation

Landowner Advisory Committee Meeting Attendance

Meeting Date	Landowner Attendees	Properties Represented (of 30)
6/18/2009	No Record	No Record
11/13/2009	No Record	No Record
4/10/2010	No Record	No Record
12/7/2010	No Record	No Record
4/22/2011	6	9
8/2/2011	10	9
12/6/2011	7	10
4/12/2012	9	10
7/24/2012	11	8

Landowner Channel Maintenance Requests

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 Flood Control and Water Conservation District.

Landowner Access Agreements

Property (30 Total)	Parcel No.	Bank	Phase	Construction Year	Reach									Right of Entry for Final Restoration Design Signed	Temporary Construction Easement Signed	Maintenance Access Agreement Signed
1	030250015000	East	**Zinfandel Bridge**	**NA**	**1**									Yes	2010	Yes
2a	030250016000	West	**NA**	**NA**	**1**									Yes	2009	Yes
2b	30250017000	East	**1a**	**2009**	**1**									Yes	2009	Yes
3	30060025000	West	**1b**	**2010**	**1**	**2**								Yes	2009	Yes
4a	30060049000	East	**1a**	**2009**	**1**	**2**								Yes	2010	Yes
4b	30060059000	East	**1a**	**2009**	**1**	**2**								Yes	2010	Yes
5	30060021000	West	**1b**	**2010**		**2**								Yes	2010	Yes
6a	30230013000	West	**2**	**2010**		**2**	**3**							Yes	2011	Yes
7	30090002000	East	**2**	**2010**			**3**	**4**						Yes	2011	Yes
8	30090003000	East	**3**	**2011**				**4**						Yes	2011	Yes
9a	30140004000	East	**3**	**2011**				**4**						Yes	2011	Yes
10	30230019000	West	**3**	**2012**			**3**	**4**						Yes	2011	Yes
6b	30230004000	West	**3**	**2012**				**4**						Yes	2010	Yes
9b	30230021000	West	**3**	**2012**				**4**						Yes	2012	Yes
11	30230020000	West	**NA**	**NA**				**4**						Yes	NA	Yes
12	30190004000	West	**4**	**2012**								**8**		Yes	2012	Yes
13	30190005000	West	**4**	**2012**								**8**		Yes	2012	Yes
14a	30140019000	East	**4**	**2012**							**7**	**8**		Yes	2012	Yes

Landowner Access Agreements (Continued)

Property (30 Total)	Parcel No.	Bank	Phase	Construction Year	Reach									Right of Entry for Final Restoration Design Signed	Temporary Construction Easement Signed	Maintenance Access Agreement Signed
15a	30190013000	West	**4**	**2013**								**8**		Yes	2012	Yes
15b	30190014000	West	**4**	**2013**								**8**		Yes	2012	Yes
16a	30190012000	West	**4**	**2013**								**8**		Yes	2013	Yes
16b	31010005000	West	**4**	**2013**								**8**		Yes	2013	Yes
17	31010006000	West	**4**	**2013**								**8**		Yes	2013	Yes
18	31010009000	West	**4**	**2013**								**8**		Yes	2013	Yes
19	31010003000	West	**4**	**2013**									**9**	Yes	2013	Yes
20	31030014000	East	**4**	**2013**								**8**		Yes	2013	Yes
21a	31030017000	East	**4**	**2013**								**8**	**9**	Yes	2013	Pending
21b	31030018000	East	**4**	**2013**								**8**	**9**	Yes	2013	Pending
22	031040027000	East	**5**	**2014**									**9**	Yes	2014	Yes
23	031040029000	East	**5**	**2014**									**9**	Yes	2014	Yes
24	031020003000	West	**5**	**2014**									**9**	Yes	2014	Pending
25	031020007000	West	**5**	**2014**									**9**	Yes	2014	Yes
26	030150017000	West	**6**	**2015**						**6**				Yes	2014	Pending
27	030150010000	West	**6**	**2015**						**6**				Yes	2014	Pending
28	030150011000	West	**6**	**2015**						**6**				Yes	2014	Yes
29	030190019000	West	**6**	**2015**							**7**			Yes	2014	Yes
30	030150015000	East	**NA**	**NA**					**5**					NA	NA	Pending
14b	030140014000	East	**NA**	**NA**					**5**	**6**				NA	NA	Pending

XIV. Photomonitoring

Phase 1a
Reaches 1 and 2 East Bank

2009

Guggenhime
Quintessa

River Station 23,800
Bench: Guggenhime
West Bank to East Bank

River Station 23,650
Bench: Guggenhime
Downstream to Upstream

June 2009

June 2011

River Station 23,650
Bench: Guggenhime
West Bank to East Bank

June 2009

June 2011

River Station 23,900
Bench: Guggenhime
East Bank to West Bank

June 2009

October 2009

June 2011

River Station 23,500
Bench: Guggenhime
East Bank to Upstream

June 2009

October 2009

River Station 19,550
Benches: Quintessa & Frogs Leap
East Bank to West Bank

June 2009

September 2009

August 2011

River Station 19,550
Benches: Quintessa & Frogs Leap
East Bank to West Bank

September 2010

March 2011

March 2012

Phase 1b
Reaches 1 and 2 West Bank

2010

The Ranch Winery & Trinchero Family Estates
Frog's Leap
Caymus

21, 950 River Station
Alcove: The Ranch Winery / Sutter Home
West Bank to Upstream

River Station 20,800
Setback Berm: Frog's Leap
West Bank Vineyard to Channel

April 2010

January 2011

River Station 19,850
Bench: Frog's Leap
West Bank to Downstream

July 2010

August 2010

April 2011

May 2011

River Station 19,850
Bench: Frog's Leap
West Bank to Downstream

August 2010

May 2011

River Station 19,100
Frog's Leap Bench from Quintessa Road
East Bank to Upstream West Bank

March 2011

March 2012

River Station 18,100
Setback Berm: Caymus Bench
West Bank to Upstream

April 2010

December 2010

River Station 18,300
Bench: Caymus
West Bank to Upstream

April 2010

December 2010

Phase 2
Reach 3

2010

Carpy Conolly with Pina Vineyard Mgmt
Caymus

River Station 17,650
Bench 1: Caymus
West Bank to Downstream

October 2010

December 2010

River Station 17,625
Bench 1: Caymus
West Bank to Channel

April 14, 2010

January 1, 2011

River Station 17,450
Bench 1: Caymus
Downstream to Upstream West Bank

June 2010

May 2011

River Station 17,450
Bench 1: Caymus
Downstream to Upstream

October 2010

May 2011

River Station 17,200
Bench 2: Caymus
Downstream to Upstream West Bank

October 2010

December 2010

May 2011

River Station 16,850
Bench 3: Caymus
Downstream to Upstream

October 2010

December 2010

River Station 17,130
Bench 3: Caymus
Upstream to Downstream

June 2010

June 2011

River Station 16,900
Caymus Bench 3
Downstream to Upstream

June 2010

June 2011

River Station 16,420
Bench 4: Carpy Conolly
East Bank to Upstream

April 2010

November 2011

River Station 16,600
Bench 4: Carpy Conolly
East Bank to Channel

November 2010

November 2011

River Station 16,125
Bench 5: Carpy Conolly
Downstream to Upstream

June 2010

November 2010

June 2011

River Station 16,200
Carpy Conolly Bench 5
East Bank to Upstream

November 2010

November 2011

Phase 3a
Reach 4 East Bank

2011

Carpy-Conolly
Round Pond
Honig

River Station 13,540
Honig Bench 11
East Bank to Upstream

July 2011

August 2011

November 2011

River Station 13,540

Bench 11: Honig

East Bank to Upstream

November 2011

March 2012

River Station 13,470
Bench 11: Honig
East Bank to Upstream

June 2011

November 2011

March 2012

River Station 13,650
Bench 11: Honig
Channel to East Bank

June 2011

November 2011

River Station 12,900
Berm Bench 13 Berm: Honig
East Bank to Upstream

May 2011

November 2011

River Station 13,050
Bench 13: Honig
East Bank to Downstream

July 2011

August 2011

March 2012

River Station 13,200
Bench 13: Honig
East Bank to Downstream

November 2011

March 2012

River Station 12,750
Bench 13: Honig
East Bank to Upstream

May 2011

November 2011

River Stations13,225 (8-30-11) 13,125 (3-30-12)
Bench 13: Honig Berm
East Bank to Upstream

River Station 13,050
Bench 13: Honig
Channel to East Bank

June 2011

November 2011

River Station 12,760
Bench 13: Honig
Channel to East Bank

June 2011

November 2011

River Station 12,425
Bench 14: Round Pond East
East Bank to Upstream

May 2011

November 2011

River Station 12,490
Bench 14: Round Pond East
East Bank to Channel

May 2011

November 2011

River Station 12,425
Bench 14: Round Pond East
East Bank to Upstream


May 2011


August 2011


March 2012


March 2012

River Station 12,500
Bench 14 Berm: Round Pond East
East Vineyard to Channel

August 2011

November 2011

River Station 12,060
Setback Berm: Round Pond East
East Bank to Upstream

May 2011

March 2012

Phase 3b
Reach 4 West Bank

2012

Emmolo
Mee with Bettinelli Vineyard Management
Round Pond with Colinas Farming

River Station 16,110
Bench 6: Emmolo
West Bank to Downstream

May 2012

November 2012

River Station 15,760
Bench 6: Emmolo
West Bank to Upstream

River Station 15,290
Bench 8: Emmolo
West Bank to Downstream

River Station 15,290
Bench 8: Emmolo
West Bank to Downstream

River Station 15,000
Bench 8: Emmolo
West Bank to Upstream

River Station 14,100
Bench 9: Mee
West Bank to Downstream

August 2012

November 2012

River Station 14,100
Bench 9: Mee
West Bank to Downstream

August 2012

November 2012

River Station 14,050
Bench 9: Mee
West Bank to Downstream

May 2012

November 2012

River Station 13,920
Bench 10: Mee
West Bank to Downstream

May 2012

November 2012

River Station 13,560
Bench 10: Mee
West Bank to Upstream

May 2012

November 2012

River Station 13,330
Bench 12: Round Pond West
West Bank to Downstream

May 2012

November 2012

River Station 13,080
Bench 12: Round Pond West
West Bank to Upstream

River Station 12,780
Bank Stabilization 3: Round Pond West
West Bank to Downstream


May 2012


November2012


January 2013


December 2012


January 2013

River Station 12,600
Bank Stabilization 3: Round Pond West
West Bank to Upstream


May 2012


November 2012


December 2012


January 2013

River Station 13,080
Bench 12: Round Pond West
West Bank to Upstream


May 2012


November 2012


December 2012


January 2013

River Station 12,780
Bank Stabilization 3: Round Pond West
West Bank to Downstream


May 2012


November 2012

River Station 12,660
Bank Stabilization 3: Round Pond West
West Bank to Upstream

May 2012

November 2012

Phase 4a
Reach 8 North

2012

Foley Johnson (Previously Sawyer)
Sequoia Grove
Wilsey

River Station 7,500
Bank Stabilization 1: Foley Johnson (Sawyer)
West Bank

December 2012

December 2012

River Station 6,860

Bank Stabilization 2: Sequoia Grove

West Bank to Downstream

River Station 6,860
Bank Stabilization 2: Sequoia Grove
West Bank to Downstream

River Station 7,100
Bench 1 Secondary Channel Inlet: Wilsey
Channel to Downstream

June 2011

November 2012

January 2013

River Station 7,000
Bench 1 Secondary Channel Inlet: Wilsey
Channel to Downstream

November 2012

January 2013

River Station 7,000
Bench 1 Secondary Channel Inlet: Wilsey
East Bank to Channel

November 2013

December 2012

River Station 6,550
Bench 1: Wilsey
East Bank to Upstream


September 2012


November 2012


December 2012


January 2013

River Station 6,550
Bench 1: Wilsey
East Bank to Upstream

2012 Series

River Station 6,550
Bench 1 Secondary Channel: Wilsey
Downstream End Outlet to Upstream

November 2012

January 2013

River Station 6,500
Bench 1 Secondary Channel: Wilsey
Downstream End Outlet to Downstream

November 2012

January 2013

River Stations 6,310 and 6,025
Bank Stabilization 3: Wilsey
East Bank

November 2012

6,310 to Downstream to Tree at 6,150

January 2013

6,025 to Upstream to Tree at 6,150

River Station 6,630
Bank Stabilization 2: Sequoia Grove
West Bank to Downstream

River Station 6,630
Bank Stabilization 2: Sequoia Grove
West Bank to Downstream

11-2012

12-2012

01-2013

River Station 6,630
Bank Stabilization 2: Sequoia Grove
West Bank to Downstream


May 2012


November 2012


Vicencio, Napa County
December 2012


January 2013

River Station 6,630

Bank Stabilization 2: Sequoia Grove

West Bank to Upstream

May 2012

November 2012

December 2012

January 2013