NAPA RIVER RUTHERFORD REACH RESTORATION PROJECT
ANNUAL MONITORING REPORT- 2014

Prepared April 2015 by:

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1. Introduction

The purpose of this document is to report on the results of surveys performed through December 2014 related to the Monitoring Program for the Napa River Rutherford Reach Restoration Project (Project). Napa County, in partnership with the Napa County Resource Conservation District (RCD), conducts the monitoring program in accordance with the various Project permits and as defined in the Monitoring Plan (*Tessera 2012/Napa County-RCD 2015*) approved for the Project. The current Monitoring Plan and associated Annual Monitoring Reports can be accessed online at the Napa County Watershed Information Center and Conservancy (WICC) document repository for the Rutherford Reach Restoration Project: http://www.napawatersheds.org/app_folders/view/5502. The Monitoring Plan outlines the 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 and schedules used to evaluate project effectiveness monitoring parameters.

1.1 Project Description

The Napa River Rutherford Reach Restoration Project is a landowner-initiated project being implemented along a 4.5-mile reach (comprised of approximately 40 parcels owned by 30 different entities) of the mainstem Napa River south of the City of St. Helena between Zinfandel Lane and the Oakville Cross Road. 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 and property loss. A suite of restoration approaches have been utilized to achieve the goal and objectives, including: setting back earthen berms from the top of the river bank; creating vegetated buffers between the river and adjacent land uses; creating backwater habitat to provide high-flow refugia for native fish; installing instream structures to improve aquatic habitat; removing non-native invasive and Pierce's disease host plants; planting native understory species; and installing biotechnical bank stabilization to stabilize actively eroding banks.

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 Pierce's Disease host plant removal; and, repairing (as needed) instream habitat structures and other constructed instream restoration features. This work is conducted 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.

1.2 Project Status and Implementation

As of October 2014, restoration construction for the entire Project, Reaches 1-9, has been completed and the Project is now in the maintenance and monitoring phase. Implementation of the project will be fully complete by the end of 2017, following three years of vegetation establishment and maintenance in Reaches 5-9. Beginning in 2018, long-term monitoring and maintenance of the channel will be conducted under a Maintenance Assessment District (MAD) established for the Project which is funded by landowners with riverfront property between Zinfandel Lane and the Oakville Cross Road.

For monitoring purposes, the 4.5 mile Project reach has been divided into reaches numbered from 1 to 9 starting from the Zinfandel Lane Bridge and ending at Oakville Cross Road and into construction contract phases numbering 1 through 5. Final Designs for all construction phases are available at the Napa County WICC website: http://www.napawatersheds.org/app_folders/view/3577. See **Table 1** below for a list of construction schedules, Project reaches, river stationing and construction phases by year.

Table 1: Construction Phases, Reaches, River Stationing and Construction Year

Final Design & Construction Phase	River Reach	River Station	Construction Year
Zinfandel Lane Bridge	Upstream Project Limit	24,857	-
Phase 1-East Bank	Reach 1 and 2	24,857 – 21,875	2009
Phase 1-West Bank	Reach 1 and 2	24,857 – 21,875	2010
Phase 2	Reach 3	21,875 - 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
Phase 4A	Reach 8 North	7,800 - 5,800	2012 - 2013
Phase 4BC	Reach 8 South	6,400 - 3,400	2013
Phase 5	Reach 6	11,000 – 9,200	2014
Phase 5	Reach 7	9,200 - 7,800	2014
Phase 5	Reach 9	3,400 - 0	2014
Oakville Cross Road Bridge	Downstream Project Limit	0	-

1.3 Restoration Site Descriptions and Elements by Construction Phase and Reach

The restoration elements constructed in each construction phase (1-5) are summarized in the following sections and are illustrated in **Figures 1-5** below. Restoration elements, including graded structures, setback 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.

As a result of construction and completion of the Project in 2014, 26 floodplain benches measuring a total of 8,580 linear feet with a surface area of 16.8 acres, were constructed in Reaches 1-9. A total of 6 side channel, wetland and alcove features were built totaling 3,054 linear feet, with a surface area of 4.6 acres including the secondary channels constructed at the Round Pond and Wilsey Properties and the backwater alcove features constructed at Rutherford Wine Studios and Cakebread properties. 13 bank stabilization areas were constructed totaling 3,818 linear feet approximately14,303 linear feet of setback berms were created in order to widen the distance between agricultural activities and the river channel.

Invasive species have been removed or managed, and riparian vegetation has been replanted on 30.5 acres including constructed benches, bank stabilization areas and widened riparian corridors where berms were setback. One hundred and forty seven (147) instream habitat structures, including (108) large woody debris structures and thirty nine (39) boulder clusters, have been installed and assessed as a result of the Project; see **Table 2** below.

Table 2: Constructed Restoration Elements by Project Reach

River Reaches (9 Total):		Reach 1	Reach 2	Reach 3	Reach 4	Reach 8 North	Reach 8 South	Reach 5,6,7,9	Total
Floodplain Benches:	Number	1	4	5	9	1	3	3	26
	Linear Feet	750	1,975	1,265	2,320	11	1450.0	809.0	8,580
	Acres	0.8	3.1	1.7	5.6	1.2	3.2	1.3	16.8
Tributary Alcoves, Created Linear Wetlands, Side Channels, Swales, Culvert outlet:	Number	1	-	-	-	1	1	3	6
	Linear Feet	350	-	-	-	589	565.0	1550.0	3054
	Acres	0.7	-	-	-	0.1	2.1	1.7	4.6
Bank Stabilization Areas:	Number	-	1	-	3	3	3	3	13
	Linear Feet	-	800	-	485	1,225	605.0	703.0	3,818
Setback Berms/Riparian Area:	Linear Feet	-	3,565	1,205	8,665	-	615.0	253	14,303
	Acres	-	-	-	-	-	0.3	0.6	1
Instream Habitat Structures: Large Woody Debris & Boulder Clusters:	Number	15	18	7	26	21	43	17	147
Riparian Area Replanted (Riparian Areas + Bank Stabilization Areas + Instream Benches):	Acres	1.5	4.5	2.2	10.2	2.3	5.6	4.2	30.5

Phase 1a, Reaches 1-2 East Bank

Phase 1a was constructed in 2009 on the east bank of Reaches 1-2. Graded restoration elements included: 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 2009 thalweg, and functions as a bankfull terrace. The second bench spans 600 linear feet between river stations 20,000-19,400 on the Quintessa property, at an average elevation of 160 feet, which is an approximately 10 feet above the level of the 2009 thalweg riffle crests, and function ns as a bankfull terrace. The top of bank grading spans 800 feet between river stations 19,400 and 18,600, at an elevation of 165 feet, approximately 16 feet above the level of the thalweg upslope above the exposed bedrock outcrop. 1.5acres of riparian habitat were planted and restored in Phase 1a, Reaches 1-2 East Bank.

Instream habitat structures included bench logs placed perpendicular to the channel to slow flow velocity and curb surface erosion of the instream benches. Fifteen (15) total bench logs were installed to slow channel water velocities and prevent erosion: Eight (8) bench logs were installed on the Guggenhime bench, and seven (7) bench logs were installed on the Quintessa bench, **Figure 1**.

Phase 1b, Reaches 1-2 West Bank

Phase 1b was constructed in 2010 on the west bank of Reach 1-2. Graded restoration elements included: 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 2009 thalweg elevation on the Ranch Winery/Sutter Home property and functions as high flow backwater habitat. The first bankfull bench extends downstream from the alcove and spans 800 linear feet between river stations 21,900 – 21,625 on the Ranch Winery/Sutter Home property at elevation 165 feet, which averages 14 feet above the level of the 2009 thalweg riffle crests, and functions as edge water habitat. The second bankfull bench spans 600 linear feet between river stations 19,900 - 19,100 on the Frogs Leap property at elevation of 159 feet, which averages 13 feet above the level of the 2009 thalweg riffle crests. The third bankfull bench spans 575 linear feet between river stations 18,600 – 18,025 on the Caymus property at elevation of 157 feet, which averages 13 feet above the level of the 2009 thalweg riffle crests, and functions as edgewater habitat. 4.5 acres of riparian habitat were restored in Phase 1b, Reaches 1-2 West Bank.

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 water 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 anchored 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, **Figure 1**.

Phase 2, Reach 3 Restoration Elements

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 2009 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 2009 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 2009 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 2009 thalweg riffle crests. Bench 3 functions as edgewater habitat. The fourth bench spans 250 linear feet between left (east) bank river stations 16,725 – 16,475 on the Carpy-Conolly property, at an average elevation of 144 feet, which averages 3 feet above the level of the 2009 thalweg riffle crests. Bench 4 functions as edgewater habitat. The fifth bench spans 250 linear feet between left (east) bank river stations 16,350 – 16,100 on the Carpy-Conolly property, at an average elevation of 143 feet, which averages 4 feet above the level of the 2009 thalweg riffle crests Bench 5 functions as edgewater habitat. 2.2 acres of riparian habitat were restored in Phase 2, Reach 3.

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 stations 16,180-16,150 to preclude against channel incision and undermining of restored elements upstream, **Figure 2**.

Phase 3a, Reach 4 East Bank Restoration Elements

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 and functions as edgewater habitat. Bank Stabilization Area 1 spans 150 linear feet between left (east) bank river stations 14,450 - 14,300 on the Carpy-Conolly property and functions as edgewater 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 and function as high flow refugia. Bench 11 spans 230 linear feet between left (east) bank river stations 13,680 – 13,450 on the Honig property and functions as edgewater 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 and functions as an edgewater habitat. 5.0 acres of riparian habitat were restored in Phase 3a: Reach 4 East Bank

Twelve (12) instream habitat structures were installed in Phase 3, Reach 4 east bank,: three (3) root 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 trunk 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, **Figure 2.**

Phase 3b, Reach 4 West Bank Restoration Elements

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. and functions as edgewater habitat. Bench 8 spans 200 linear feet between right (west) bank river stations 15,275-15,075 on the Emmolo property and functions as edgewater 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 and functions as edgewater 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 edgewater habitat. Bench 12 spans 200 linear feet between right (west) bank river stations 13,300-13,100 on the Round Pond west bank property and functions as edgewater 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 and 3 functions to protect the Colinas Farming Shop building and as edgewater habitat. 5.2 acres of riparian habitat were restored in Phase 3a: Reach 4 West Bank.

Fourteen (14) instream habitat structures were installed in Phase 3b, Reach 4 west bank in 2012: six (6) root wads embedded in created instream benches, two (2) low profile log instream structures, five (5) instream boulder clusters, and one (1) boulder field. The six (6) root wads, which have the trunk embedded in the bank and the root wad in the channel, were installed on the right (west) bank at river stations 16,050 on Bench 6, 15,250 on Bench 8, 14,060 on Bench 9, 13,670 on Bench 10, 13,500 on Bench 10, and 13,290 on Bench 12.The two (2) low profile logs, which have the root wad embedded in the bank and the trunk in the channel, were installed on the right (west) bank at river stations 15,925 on Bench 6, and 13,210 on Bench 12.The five (5) boulder clusters were installed in the river channel at river stations 16,000, 15,910, 15,790, 15,275and 13,190. The boulder field was installed at station 13,980 upstream of the Honig east bank tributary confluence. The boulder field replaced a planned grade control structure starting at upstream river station 13,980, between floodplain Benches 9 and 10 upstream of the confluence with the return drainage on the east bank. The design plan was modified to accommodate site constraints and preservation of existing willows at the base of the channel bank, **Figure 2.**

Phase 4a, Reach 8 North Restoration Elements

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 foot 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 commenced in 2012 between right (west) bank stations 7,625-7,300, and was completed in 2013 following the delayed 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 and functions as edgewater 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.

From 2012 to 2013, twenty-five (25) instream habitat structures were installed in Phase 4, Reach 8 north; including thirteen (13) boulder clusters and twelve (12) wood structures. In 2012, twenty-one (21) instream habitat structures were installed in Phase 4, Reach 8 north; including ten (10) boulder clusters and eleven (11) wood structures. Five (5) boulder clusters were installed on the gravel bar along the base of Bank Stabilization Area 2 at river stations 6,760, 6,740, 6,710, 6,690, and 6,660. Five (5) boulder clusters were installed along the left edge of the channel at the outside of the meander bend along Bank Stabilization Area 3 at river stations 6,200, 6,160, 5,985, 5,905 and 5,875. One (1) wood structure was integrated into the boulder cluster at river station 6,690 at the base of Bank Stabilization Area 2. 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 along Bank Stabilization Area 3 at river stations 6,180, 6,100 and 5,880. In 2013, (4) instream structures were installed at Bank Stabilization Area 1 at Foley Johnson (previously Sawyer): three (3) boulder clusters at stations 7,530, 7,460 and 7,410; and (1) root wad at station 7,512, **Figure 3.**

Ritz-Carlton Hotel Mitigation Restoration Elements

The linear wetland mitigation area included in the 589 feet long secondary channel constructed on Reach 8A North, Bench 1, which spans 600 linear feet between left (east) bank river stations 7,100-6,500 on the Wilsey property. The bench and wetland function as a secondary channel, backwater, and wetland habitat. 2.3 acres of riparian habitat were restored in Phase 4a: Reach 8 north.

One (1) large wood structure was installed mid-way up the west bank of the mainstem Napa River at station 7,090 to deflect flows into the upstream end of the linear wetland secondary channel. Instream habitat structures installed along the linear wetland secondary channel include six (6) wood structures installed to direct flows along the newly graded secondary channel; three (3) log weirs at river stations 6,880, 6,610 and 6,530; two (2) low profile logs at river stations 6,740 and 6,670; and one (1) root wad at the downstream end of the secondary channel near the confluence with the mainstem at station 6,515, **Figure 3.**

Phase 4bc, Reach 8 South Restoration Elements

Phase 4bc was constructed in 2013 on both sides of the channel at the south end of Reach 8. Graded restoration elements in Phase 4bc: Reach 8 South include: three (3) instream benches, one (1) tributary alcove, and three (3) bank stabilization areas. Bench 1 spans 600 linear feet between right (west) bank river stations 6,300 – 5,700on the Davis (Frostfire) property. The base elevation of the backwater alcove on Bench 1 is 118 feet, which is the average level of the 2013 thalweg riffle crests. On the Laird property on the left (east) bank, Bench 2 spans 500linear feet between river stations 5,350-4,850. Bench 2 was originally designed to function as edgewater habitat; however, due to the presence of a Swainson's hawk nest, the design was modified to retain the oak tree on an island and the revised design functions as a backwater alcove and high flow bypass channel around the island. The high flow channel elevation crests at 143 feet, which is approximately 26 feet above the level of the 2013 thalweg at the upstream end of the bench. The slope grades down to an elevation of 119 feet, which is one foot above the level of 2013 thalweg at the downstream end of the bench. Downstream on the Laird property, Bench 3 spans 350 linear feet between east bank river stations 4,250-3,900 at an average elevation of 119 feet, which averages 4 feet above the level of the thalweg riffle crests and functions as edgewater habitat.

Bank Stabilization Area 1 spans 100 linear feet between right (west) bank river stations 5,450 – 5,350 on the Frostfire (Davis) and AJM Vineyards (McDowell) properties adjacent to Glos Lane and was constructed to stabilize a steep sandy slope and preserve a heritage oak tree where a significant stand of Arundo was eradicated. Bank Stabilization Area 2 spans 225 linear feet between right (west) bank river stations 5,350-5,125 on the Cakebread property, between AJM Vineyards and the Glos house. Bank Stabilization Area 3 spans 250linear feet between right (west) bank river stations 4,550-4,300 on the Glos property. Bank Stabilization Area 3 functions as edgewater habitat at an elevation of 121 feet, which averages 5 feet above the level of the thalweg riffle crests. Bank Stabilization Area 3 also replaces an area where Arundo had been eradicated. Additional bank stabilization was completed where Arundo had previously been eradicated on the east bank between Benches 2-3 on the Laird property. 5.6 acres of riparian habitat were restored in Phase 4bc: Reach 8 south. Two (2) 50 feet long buried rock grade

control structure were installed in the channel between river stations 5,770 – 5,720 and 5,375 – 5,350 to preclude channel incision.

Forty-three (43) instream habitat structures were installed in Phase 4bc, Reach 8 South in 2013: eleven (11) boulder clusters, and thirty-one (32) large wood structures. One (1) root wad structure was placed at river station 4,523; two (2) in the channel at river stations 5,770 and 5,344; Eleven (11) single root wad snags, some with an adjacent boulders, are located at river stations 6,163, 6,150, 6,108, 5,244, 5,243, 4,067, 4,054, 3,397, 3,367, 3,345, 3,326; and nineteen (19) root wad structures at river stations: 5,247, 5,094, 4,960, 4,293, 4,204, , 4,187, 3,999, 3,958, 3,500, 3,474, 3,400, 3,355, 3,333, 3,322 and 3,252, **Figure 3.**

Phase 5, Reaches 5, 6, 7 and 9

Phase 5: Reaches 6, 7 and 9 was constructed in 2014 on both sides of the channel and included the following graded restoration elements: three (3) instream benches, one (1) secondary channel, three (3) bank stabilization areas and one swale. The secondary channel built on the Round Pond property between river stations 10,400 to 9,100 and spans 1,251linear feet. The bank stabilization area and swale on the Peju, St. Supery and Foley Johnson properties on the west side between river stations 9,375 and 7,925 span 168 and 375 feet respectively. Construction at Reach 9 occurred between river stations 3,200 and 650, and took place on east and west sides of the river. The bank stabilization area on the Laird property spans 275 feet, the bank stabilization area and instream bench on United span 52 and 316 feet, the instream bench on Swanson measures 148 linear feet and the Opus One instream bench spans 168 feet.

Seventeen (17) instream habitat structures were installed in Phase 5, Reaches 6, 7, and 9 in 2014: eleven (11) root wads were embedded in created instream benches bank stabilization areas, and six (6) instream boulder clusters. Three of the root wads were installed just upstream of the secondary channel inlet on the left bank at river station 10,450 and one was installed on the west bank at river station 93,25 at bank stabilization area 1 with a boulder cluster. Three root wads were installed on the east bank at bank stabilization area 2, river station 29,55 to 29-25, along with two boulder clusters, two root wads were installed on Bench 1, east bank, at river station 22,20 and 20,20, and one root wad was installed at bench 3 west bank, river station 870 and another on bench 2, east bank, at river station 850. Three boulder clusters were also installed in the channel between bench 2 and 3 at river station 800, 765 and 730 respectively, **Figure 4 and 5.**

Figure 1: Constructed Restoration Elements Reaches 1 and 2

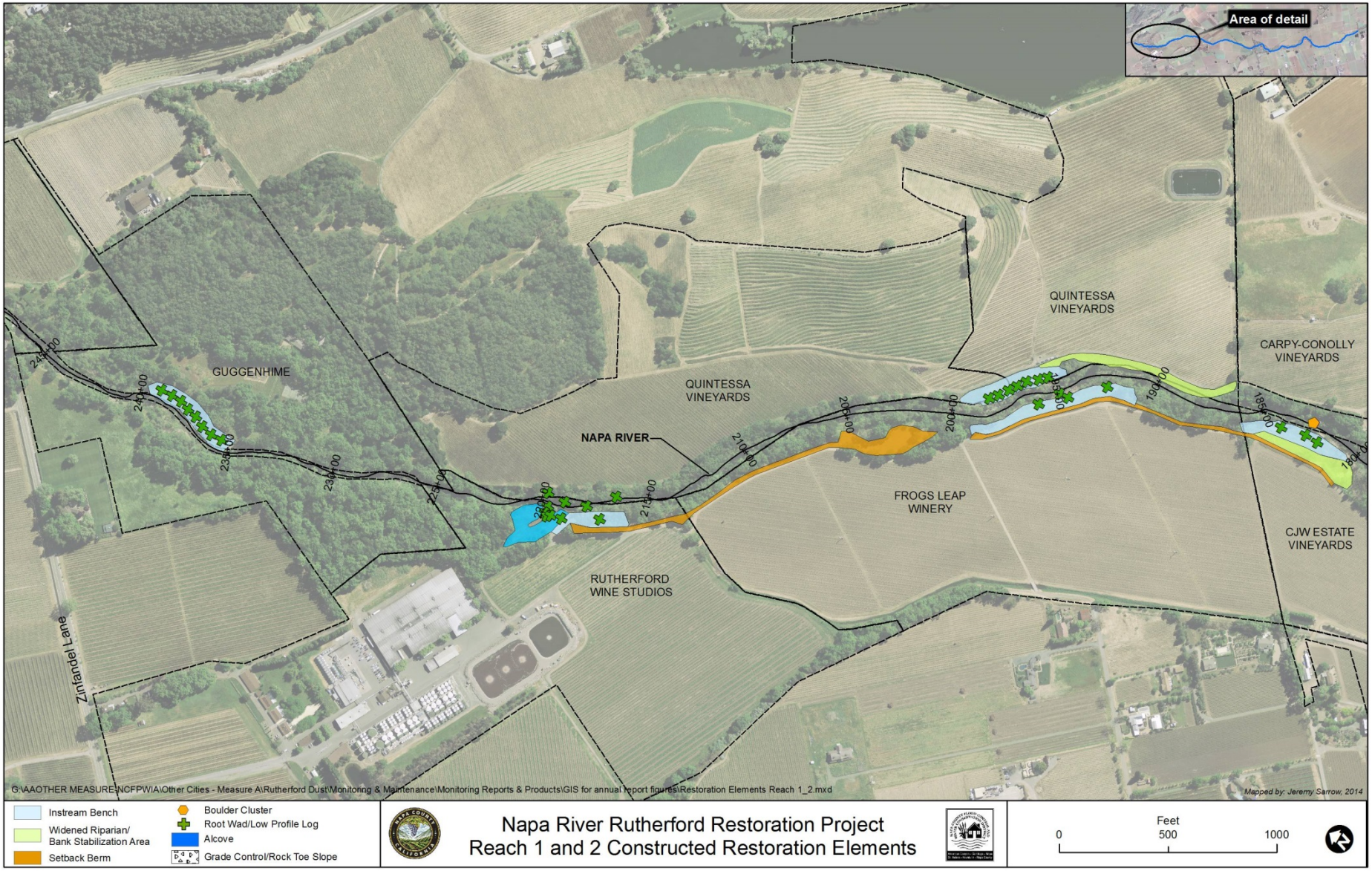


Figure 2: Constructed Restoration Elements Reaches 3 and 4

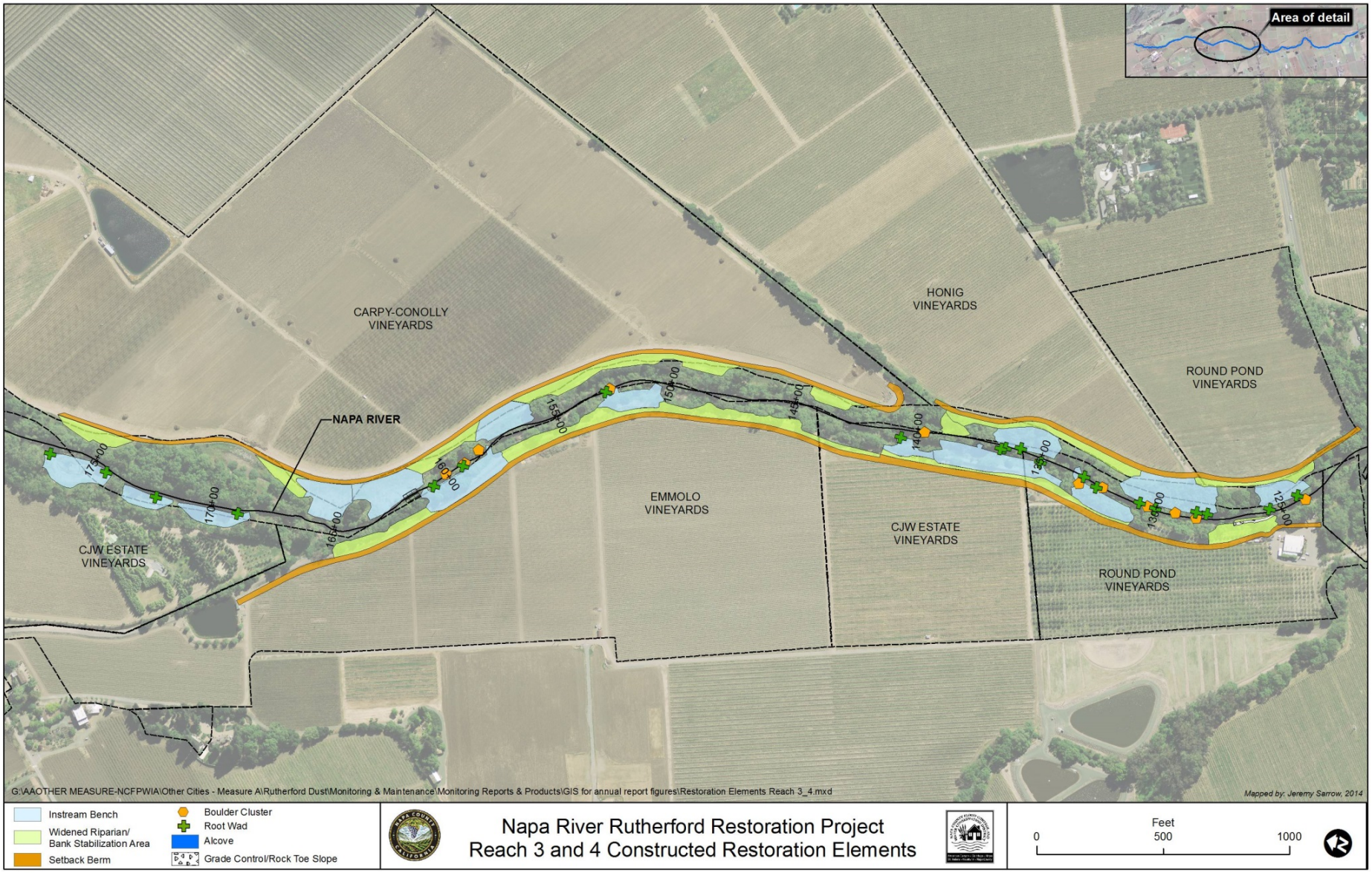


Figure 3: Constructed Restoration Elements Reach 8 North/South

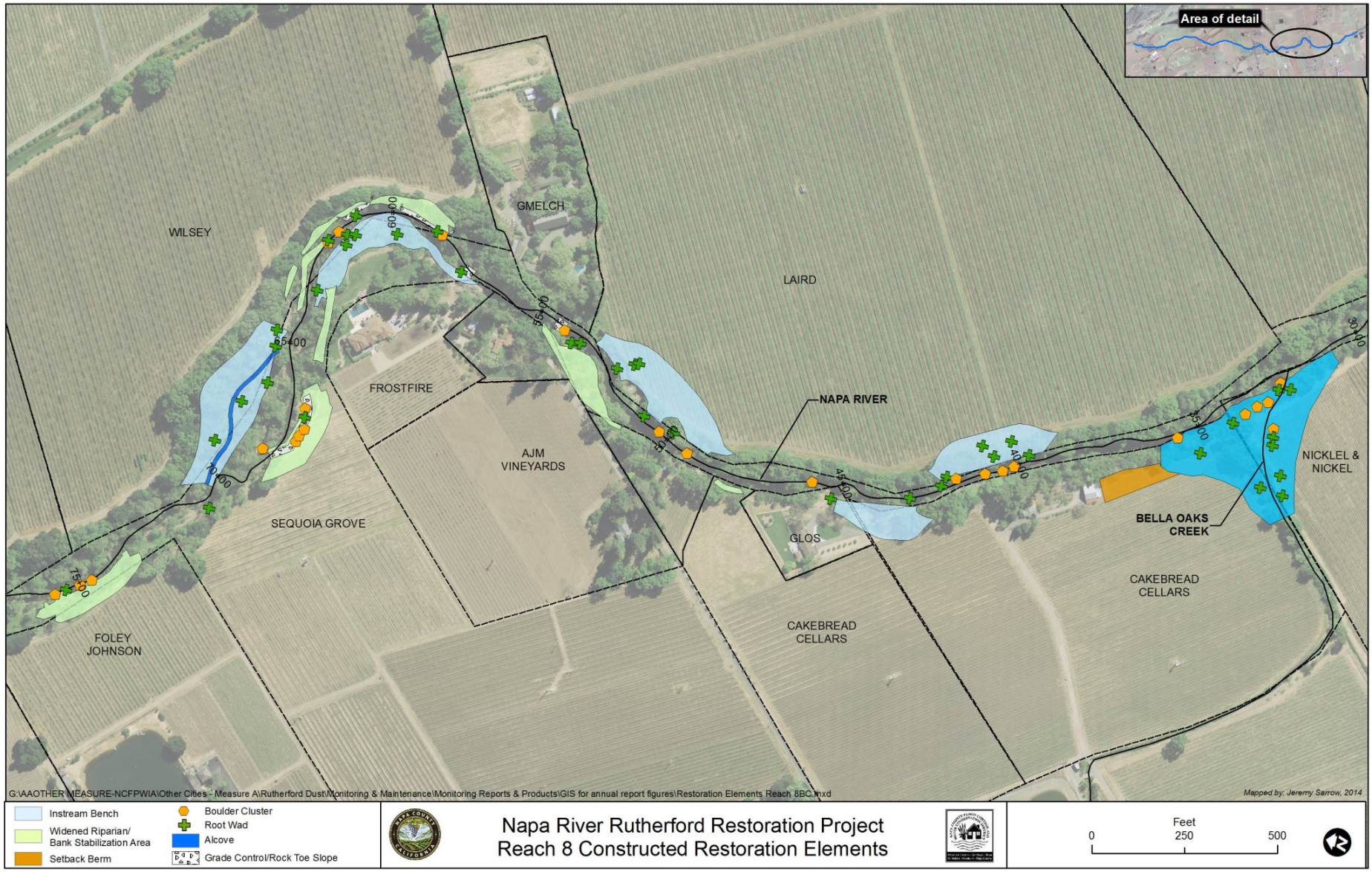
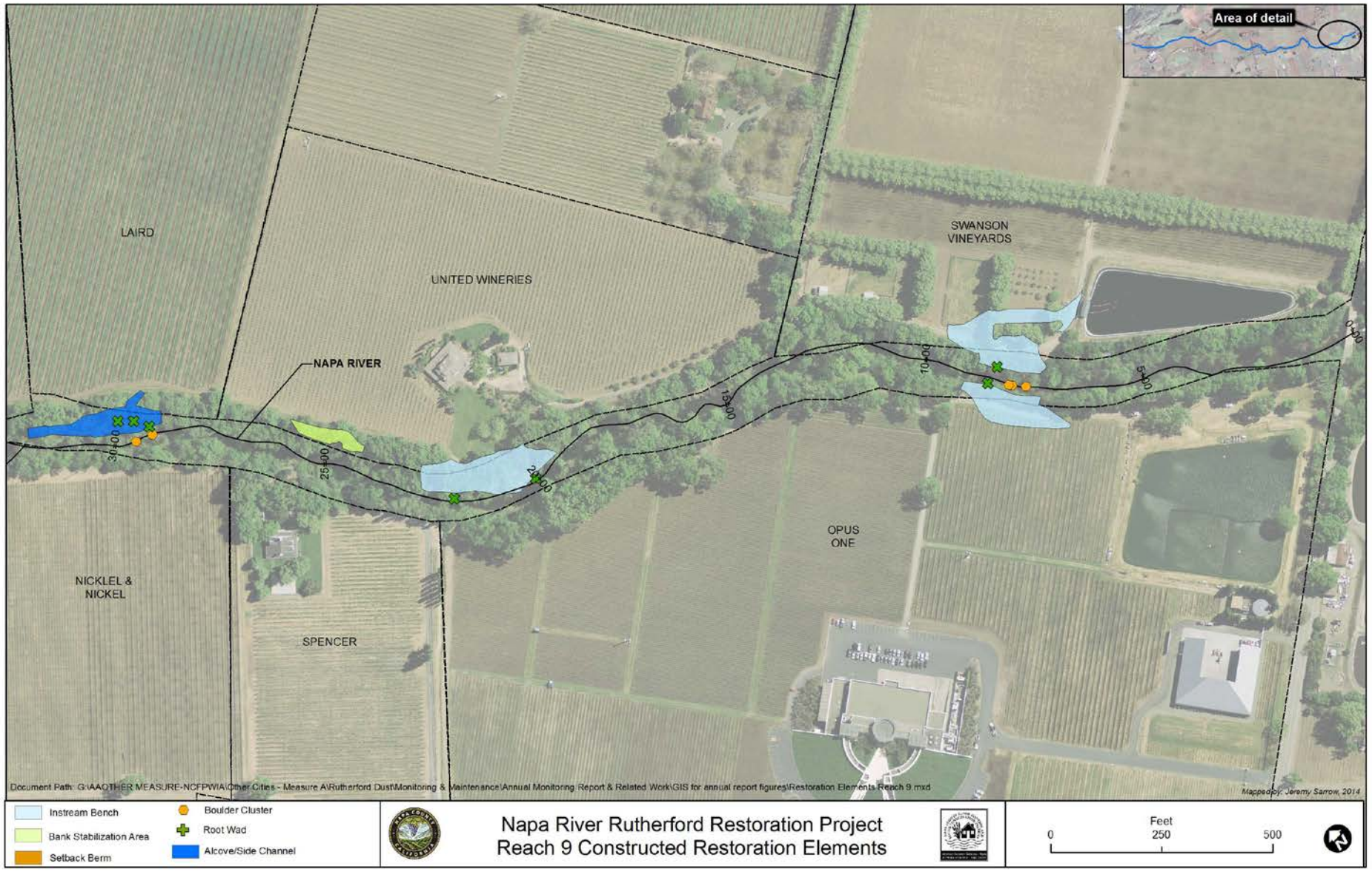


Figure 4: Constructed Restoration Elements Reaches 5, 6, and 7

Figure 5: Constructed Restoration Elements Reach 9



2.0 Restoration Goals and Objectives

Restoration goals and objectives defined for the Project in the monitoring plan and in various regulatory permits include the following general categories:

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

2.1 Sediment Load Reductions and Increased Channel Morphology Complexity

Existing (Pre-Project) Conditions

Changes in land use, construction of earthen berms, and filling of historic channels has resulted in increased flow volumes and velocities within the Napa River leading to channel incision, streambank erosion and failure. In addition, inputs of fine sediments to the channel from eroding stream banks 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 Project reach.

Goals and desired outcomes

The desired goals for this category focus on reducing fine sediment input into the Napa River by reducing rates of channel bank erosion and bed incision and creating a more stable long term channel configuration. Specific objectives include:

- Decrease the total amount of eroding stream banks.
- Reduce rates of bank retreat and stabilize severely eroding banks.
- Reduce rates of channel incision.
- Re-establish geomorphic and hydrologic processes to reconnect the river channel to floodplain areas.
- 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.
- Create inset bankfull (1.5 year flood elevation) and mid-level terraces.
- Minimize the need for ongoing channel stabilization and maintenance work.

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

- Increased Riparian Buffer Width
- Setback Berms and Replacement
- Channel Reconfiguration, bank stabilization and creation of secondary channels
- Grade Control Boulders and Weirs

2.2 Aquatic Habitat Enhancement

(Pre-Project) Conditions

The pre-restoration condition of aquatic habitat within the Project Reach 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 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. The predominant substrate in the reach was gravel and sand-sized particles. 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.

Goal and desired outcomes

The goals/desired outcomes for aquatic habitat in the Project reach include:

- Protect existing high value riparian habitat 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.
- 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 and Spawning Habitat

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

Annual Steelhead 0-1+ and Spring Chinook Juvenile Rearing Habitat

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

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

- Large Woody Debris Structures
- Plant Material: Native Willow Cuttings, Off-Bench Branch Cover, Branch Bundles
- Constructed Riffles
- Backwater Alcoves on Created Instream Benches and Secondary Channels
- Graded Instream Benches on Alternating Banks

2.3 Riparian Habitat Enhancement

(Pre-Project) Conditions

Pre-Project condition of riparian habitat varies considerably throughout the Project 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 hindisi*) were the dominant species in these reaches. Reaches 3, 5, 6 and 7 supported stands of Fremont cottonwood (*Populus fremontii*), white alder (*Alnus rhombifolia*), red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*). 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 throughout 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*). 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*) and California rose (*Rosa californica*).

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. 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, increase plant diversity and structure to improve quality for resident and migrant wildlife.

Absent significant change in the geomorphic regime the riparian community will continue to decline as older trees die and recruitment is impaired due to numerous factors (lack of suitable surfaces for colonization, competition with invasive plant species, etc.). Creation of inset flood terraces and bank setback increases the area suitable for riparian recruitment. In particular 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.

Goals and Desired Outcomes

The goals/desired outcomes for enhancing riparian habitat include:

- Protect existing high value riparian habitat where possible.
- Expand the native riparian buffer width and extent.
- Remove invasive non-native vegetation and replanting with native vegetation.
- Re-establish geomorphic and hydrologic processes to support a continuous and diverse native riparian corridor.

Restoration treatments to improve riparian habitat include:

- Revegetation and maintenance of restored 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 plant species

2.4 Stakeholder Participation

(Pre-Project) Conditions

The preliminary design for the Project was completed for all 30 properties in the Rutherford Reach in 2008. Participation in the Project is determined by individual landowners in separate final design and construction phases.

Goals and 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.
- Rehabilitate the river in a way that facilitates permitting agency approval.

Elements to maintain stakeholder participation include:

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

3.0 Monitoring Approach, Indicators and Performance Standards

Monitoring links the Project objectives to proposed monitoring elements based on process-based relationships between existing conditions and restoration techniques aimed at achieving desired outcomes. Each desired outcome has specific performance indicators and standards. Project success will be evaluated by quantifying progress towards meeting performance standards over the life of the Project. See the Monitoring Plan for details describing monitoring activities, frequency and protocols.

Project monitoring has four components: 1) an Annual Survey of the entire 4.5 mile reach; 2) seasonal evaluation of the performance of the instream habitat structures at representative seasonal flows; 3) repeat channel transect and longitudinal profile surveys conducted pre-construction and following significant flow events to capture long term habitat response, and, 4) phased vegetation surveys. Surveys are complemented with photo-monitoring at defined stations and surveys of stakeholder participation. Refer to the *Monitoring Plan* prepared for the Project for a detailed description of the protocols and see **Table 3** below for a summary of the Monitoring Indicators, Protocols and Performance Standards.

As mentioned previously, for monitoring purposes, the 4.5 mile Project has been defined by 9 reaches as well as a stream stationing system based on linear footage. The Project spans between river stations 0 and 24,857 feet, starting at the Oakville Cross Road Bridge and extending upstream to the Zinfandel Lane Bridge.

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). The monitoring program is designed to evaluate the success of the Project at meeting the objectives of reducing excessive channel bank and bed erosion, enhancing aquatic and riparian habitat, protecting property and maintaining stakeholder participation.

Table 3. Monitoring Indicators, Protocol Summary and Performance Standards

Indicator	Monitoring Protocol	Performance Standard
Sediment Load Reduction and Channel Morphology		
Length/surface area of eroding banks (LxH or % L)	Eroding Streambank Survey and Sediment Source Reduction Calculations	75% reduction in length or surface area of actively eroding banks
Rate of bed deposition and scour relative to cross sections (L or Vol/T)	Cross Section and Thalweg Surveys	Positive trends in reductions of bed and bank erosion rates
Bankfull width to depth ratio at representative treatment cross-sections	Cross Section Surveys, Stream Flow Measurement	Positive trends in increases in bankfull channel width to depth ratios
Aquatic Habitat Enhancement		
Channel substrate size distribution (median size frequency distribution, % fine sediment)	Pebble Counts, Spawning Gravel Permeability (Napa RCD)	Statistically significant increase in riffle median grain size (D50 mm) and reduction in riffle substrate percentage of fines (<2mm)
Riffle length and frequency	Channel Morphology Survey: Riffle, Glide, Pool Distribution Mapping	30% increase in riffle length or riffle frequency
Residual pool depth	Residual Pool Depth Survey at Installed Instream Habitat Structures	25% increase in residual pool depth in treated locations
Large woody debris structure persistence (# years, % persisting)	Large Woody Debris Survey	Persistence (75%) of installed instream habitat enhancement structures
Flow velocities in constructed high-flow refugia areas (v)	Seasonal Salmonid Habitat Velocity Surveys	Creation of high flow refugia with (velocities less than 6 fps) for flows 500 cfs and above at constructed alcoves and instream bankfull benches

Indicator	Monitoring Protocol	Performance Standard
Riparian Habitat Enhancement		
Area successfully treated (acres)	Area Mapping Percent Cover and Composition Survey	A minimum 20 acres over the life of the Rutherford Reach project (acres)
Plant survival at revegetation sites (%)	Vegetation Establishment Surveys and Direct Count Plant Survival and Vigor Survey	80% survival of native plants at revegetation sites at years 3, 5 and 10 post installation
Percent native vegetative cover: Absence/presence natural recruitment	Area Mapping Percent Cover and Composition an Line Intercept Surveys	Greater than 90% native cover (less than 10% total non-native) and evidence of natural recruitment by year 5 at revegetation sites
Stakeholder Participation		
Landowner Participation in the Restoration Project	Records of Landowner Access Agreements	90% landowner participation in the project.
Landowner adaptive monitoring and management	Records of Landowner Maintenance Requests	Ongoing access for team (Napa County Flood District and the Napa County Resource Conservation District)
Landowner Advisory Committee participation	Landowner Advisory Committee Meetings Attendance Records	Continued landowner leadership and attendance at Landowner Advisory Committee (LAC) meetings

4.0 Results and Discussion

4.1 Instream Flow Measurements

Tracking and analyzing streamflow in the Napa River Rutherford Restoration Reach is key to identifying channel-forming flows and evaluating changes in stream geometry, bank condition, and sediment load, as well as guiding monitoring activities. Channel-forming flows are flow events that are sufficiently large to move all the mass and sizes of alluvial sediment supplied to the channel, and include a range of intermediate high flows. The most effective channel-forming flow is often associated with the bankfull discharge, which is in turn often associated with a 1.5-year recurrence interval. Although only a rule of thumb, the 1.5-year peak flow is used in this monitoring effort as a threshold to define a channel-forming flow.

Streamflow in the project reach is measured at USGS Station 11456000 NAPA R NR ST HELENA, located at Pope Street Bridge, approximately 2.1 miles upstream of the Project. Real-time and historical stage and flow data for the station are available at waterdata.usgs.gov. The difference in upstream watershed area between the station and the top of the project reach is approximately 5.5%, and similar increases in streamflow can be expected. No significant tributaries enter the river between the station and the top of the project reach. One named tributary, Bale Slough, enters the river along the project reach and by

the downstream limit of the Project the watershed area has increased by approximately 25%, and similar increases in streamflow can be expected.

Station 11456000 has been in operation since 1929 and USGS provides peak flow statistics at streamstatsags.cr.usgs.gov. The calculated peak flows for the 1-, 2-, 5-, 10-, 25-, 50- and 100-year floods are summarized in **Table 4**. USGS does not provide a peak flow statistic for the 1.5-year flood, but it is estimated for the purposes of this monitoring effort at 4,800 cfs.

Table 4. Peak flow statistics for USGS Station 11456000.

Peak Flood	Discharge (cfs)
Mean Annual	3,160
2-Year	5,980
5-Year	10,300
10-Year	13,100
25-Year	16,400
50-Year	18,700
100-Year	20,700

The last rare flooding event occurred on December 31, 2005, prior to construction of the project, when a peak flow of 18,300 cfs was recorded at Station 11456000, making it an approximate 50-year flood. Since that time, all peak flow events have been below 10,000 cfs, or less than 5-year recurrence interval events. Flow events with peak discharges greater than the 1.5-year flood that have occurred since initiation of construction in 2009 are listed in **Table 5.** These events can be expected to have significantly altered the streambed, promoted further erosion of eroding streambank areas, and tested the stability of graded restoration areas.

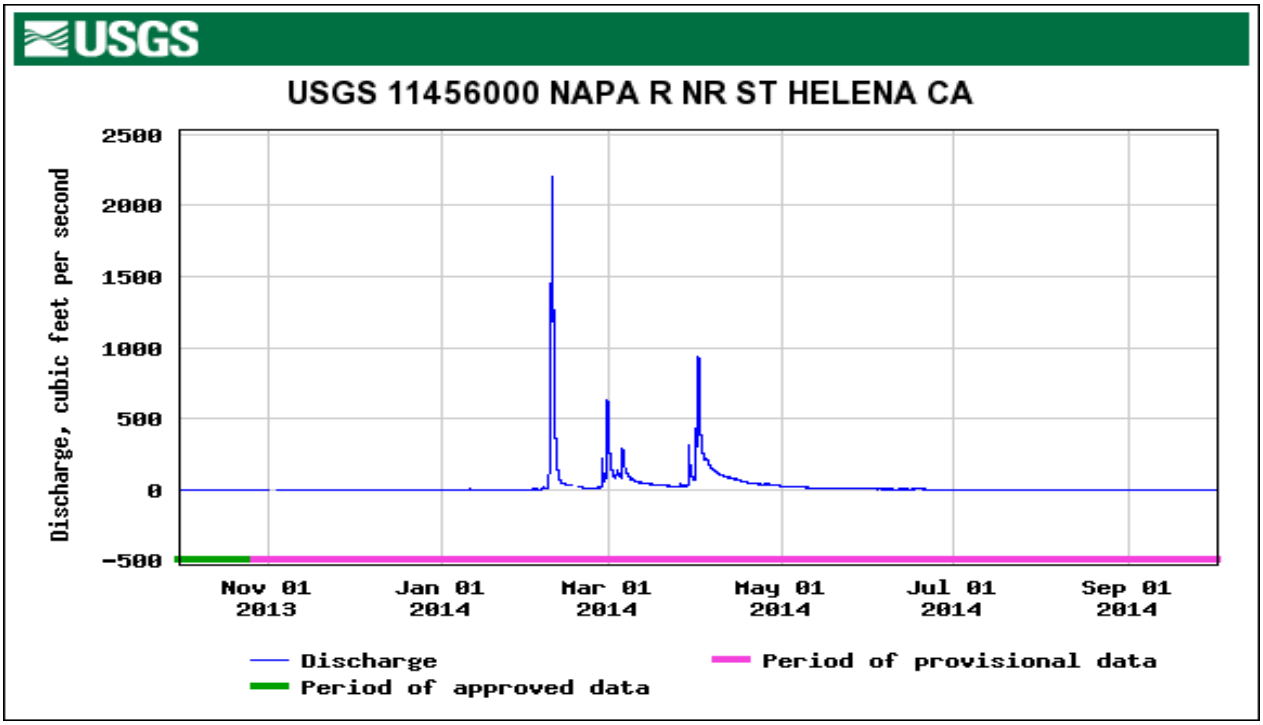
Table 5. High-flow events and peak discharges greater than 1.5-year flood since initiation of Project construction.

Water Year	Date	Peak Discharge (cfs)
2010-11	Mar 20, 2011	7,330
2010-11	Mar 24, 2011	4,830
2012-13	Dec 2, 2012	9,260
2012-13	Dec 23, 2012	9,690
2014-15	Dec 11, 2014	7,720*

**Value remains flagged as provisional by USGS at the time of this writing.*

During the 2013-14 water year (October 1, 2013 through September 30, 2014), measureable streamflow began at Station 11456000 in early December and continued at low-flow conditions until early February when a series of small storm systems produced stream flow in the reach during the period of February through April. The peak flow of the season occurred on February 9, 2014, and was measured to be 2,200 cfs, well below the mean annual peak flood. Following the last significant storm of the season in early April, flows in the river receded until the channel finally dried up in late June. A plot of streamflow measured at Station 11456000 during the 2013-14 water year is included as **Figure 6**.

Figure 6. 2013-2014 streamflow, Napa River Rutherford Restoration Reach, USGS Station 11456000.



The 2014 calendar year also includes the start of the 2014-15 water year, and measureable flows in the reach began in late November. On December 11, 2014, a major winter storm produced a peak flow of 7,720 cfs in the reach, between a 2-year and a 5-year peak flood. RCD observed this peak at select locations to be quite high in the channel, although flooding is not known to have occurred anywhere in the reach. More information on this event and the entire 2014-15 streamflow season will be presented in the 2014-15 monitoring report.

The Napa River tends to flow perennially through the project reach in wet years, and dry up completely for long subreaches during the summer months in dry years. Dry-season streamflow data for Station 11456000, including mean monthly discharge statistics, can be found at waterdata.usgs.gov.

4.2 Eroding Streambank Survey

An annual eroding stream bank survey is conducted along the entire length of the bankfull channel every year in order to evaluate the extent of any stream bank erosion within the Project area and to assess effects on fine sediment loading. During the dry season, the team walks the entire project reach in the downstream direction and maps the start and end of erosion areas on each bank. For each erosion area, the length and average height of the erosion is estimated and it is noted whether the erosion affects the whole bank, the top of bank, or the base of bank. In addition, it is noted whether the erosion is due to undercutting or a lack of vegetation. Project restoration efforts addressed eroding stream banks through grading over steepened banks to a more stable profile and biotechnical stream bank stabilization features such as brush mats. Additional information regarding monitoring protocols

and performance targets is in the *Monitoring Plan for the Rutherford Reach Restoration of the Napa River* which can be found at www.napawatersheds.org.

The target goal of the Project is to reduce actively eroding stream banks throughout the entire Project reach by 75%. During the baseline survey in 2009, 14,674 feet of channel banks were mapped as eroding, or 30% of the channel bank length in the Rutherford Reach. In 2013, 5,200 feet of channel banks were mapped as eroding or unstable throughout the Rutherford Reach. This constitutes 15% of the channel bank length in the Rutherford Reach. This is a reduction of 65% compared to the 2009 baseline. In 2014, 1,840 feet of channel banks were mapped as eroding or unstable throughout the Rutherford Reach, this is a reduction of 87% compared to the 2009 baseline. The results of the surveys from 2009-2014 are summarized in **Table 6** below. See **Appendix A** for figures depicting the location and extent of eroding stream banks mapped during the 2014 survey.

As expected, the total linear length of eroding stream banks has steadily decreased as construction of the Project has progressed. Based on the 2014 survey results, the Project has already realized its goal, of 75% with an 87% reduction in active stream bank erosion through the entire Project reach.

Table 6. Results of eroding banks surveys, 2009-2014.

Survey	Total Linear Length of Eroding Banks (ft.)	Reduction Relative to 2009 Baseline (%)
2009	14,674	-
2010	9,000	39
2011	4,800	67
2012	4,400	70
2013	5,200	65
2014	1,840	87

4.3 Sediment Source Reduction Calculations

The stated TMDL for the Napa River 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 sediment delivery achieved through cessation of bank erosion that was proceeding at an average moderate rate of 750 metric tons/mile/year over the length of the unrestored channel. Sediment removed is assumed to be sandy clay loam with a bulk density of 1.6 metric tons/cubic meter.

Following the completion of the Project in the fall of 2014, construction of Phases 1-5 in Reaches 1-9 (100% of the 4.5 mile Project Reach), the cumulative amount of fine sediment reduction as a result of Project construction grading activities is of 257,260 metric tons. Further an estimated 16,394 metric tons/year will be reduced in the Napa River watershed over the next 20 years, or 87% of the total TMDL target reduction for the Napa River watershed from mainstem channel incision and bank erosion sources. See **Table 7** below for sediment reduction volume data by Project construction phase and reach as a result of restoration Project implementation.

Table 7. Annual Sediment Source Reduction by Construction Phase and Reach

Sediment Source Reduction Estimates by Construction Phase and Reach	Percent Complete	Sediment Removed (Metric Tons)	Sediment Removed (Metric Tons/Year /20 Years)	Reduction in Channel Bank Erosion Rates			
				MODERATE RATE 750 Metric Tons/ Mile/Year	Metric Tons/ Year	Year	%
PHASE 1A: Reaches 1-2 East	**25%**	**20,552**	**1,028**	**237**	**1,916**	**2009**	**10%**
PHASE 1: Reaches 1-2		58,768	2,938	237	3,827	2010	20%
PHASE 2: Reach 3		22,801	1,140	98	1,509	2010	8%
PHASE 1B: Reaches 1-2 West; PHASE 2: Reach 3		61,016	3,051	335	4,309	2010	23%
PHASES 1 -2: Reaches 1-3	**36%**	**81,569**	**4,078**	**335**	**5,337**	**2010**	**28%**
PHASE 3A: Reach 4 East		31,865	1,593	152	2,161	2011	11%
PHASES 1 -3A: Reaches 1-3, 4 East	**52%**	**113,434**	**5,672**	**487**	**7,498**	**2011**	**39%**
PHASE 3B: Reach 4 West		39,694	1,985	Included in 3A	1,985	2012	10%
PHASE 4A: Reach 8 North		11,514	576	76	860	2012	5%
PHASE 3B: Reach 4 West; PHASE 4A: Reach 8 North		51,208	2,560	76	3,414	2012	18%
PHASES 1-4A	**60%**	**164,642**	**8,232**	**563**	**10,342**	**2012**	**54%**
PHASE 4BC: Reach 8 South		66,774	3,339	192	4,060	2013	21%
PHASES 1-4: Reaches 1-4, 8	**72%**	**231,417**	**11,571**	**679**	**14,118**	**2013**	**74%**
PHASE 5N: Reaches 5, 6,7		11,255	563	159	1,159	2014	6%
PHASE 5S: Reach 9		14,588	729	103	1,116	2014	6%
PHASE 5: Reaches 5,6,7,9		**25,843**	**1,419**	**262**	**2,276**	**2014**	**13%**
TOTAL PROJECT (2009-2014) PHASES 1-5: Reaches 1-9	***100%***	***257,260***	***13,118***	***942***	***16,394***	***2014***	***87%***

4.4 Longitudinal Profile Thalweg Surveys

Thalweg surveys were not completed in 2014; the next thalweg survey for the entire Project reach is scheduled for 2016. The following section is a discussion of the results related to previous thalweg surveys; see monitoring report appendices from previous years for supporting data.

The baseline pre-Project longitudinal thalweg survey was completed in 2009/2010. A subsequent survey was completed in fall 2013 following completion of restoration in the upstream half of the Project in Reaches 1-4, and in Reach 8 North. The 2013 survey of the Project reach was completed following restoration construction in Reaches 1-4, Reach 8 North, and the completion of the fish barrier removal at the Zinfandel Lane Bridge. Thalweg surveys are to be conducted periodically, approximately once every five years, to evaluate changes in channel bed morphology in the Project reach. Comparison of the pre-Project 2009/2010 thalweg survey with the 1972 FEMA channel profile shows that the channel elevation remained essentially unchanged at upstream and downstream limits of the Project reach at the Zinfandel Lane and Oakville Cross Road Bridges, at 169 feet and 112 feet, respectively. Over this 37 year time period, the channel elevation decreased approximately one foot under the Rutherford Cross Road Bridge at the midpoint of the Project reach. The degree of channel incision varied greatly along the Project reach between the relatively fixed points of elevation at the three bridges. In the most confined channel sections upstream of the Rutherford Cross Road Bridge, in Project Reaches 1-4, the channel incised up to sixteen (16) feet, which equates to a maximum average rate of 0.4 feet per year.

Comparison of the 2013 and 2009/2010 surveys reveals that the elevation of the channel has remained unchanged at the downstream end of the Project at Oakville Cross Road Bridge. At the upstream limit of the Project, the thalweg elevation decreased to 163 feet at the Zinfandel Lane Bridge, where the bridge apron was lowered by 6 feet to restore fish passage in 2011. Elevation differences varied by less than a foot under the Rutherford Cross Road Bridge.

In addition to remaining stable at the Zinfandel Lane, Rutherford Cross Road, and Oakville Cross Road Bridges, the channel elevation remained steady at various riffle crests in both restored and control sections. There are several other locations where the channel thalweg elevation remained stable with negligible change, most notably at the bedrock grade control at station 19,104 at the east bank stabilization area on Quintessa. There is a beaver dam at this location that has persisted for several years and the number of beaver dams is increasing annually. At least three have persisted at other riffle crests where the channel elevation has remained stable for between 2009-2103. This indicates either that the beaver's select relatively stable sites to construct the dams, or that the beaver dams are helping to stabilize the channel locations where they are constructed.

Aggradation and incision of the channel bed occurred between points that remained fixed in elevation along the entire Project reach following the December 2012 floods. Gravel has deposited locally in sections of the channel where flow velocities have been reduced through channel widening at instream benches, alcoves and created secondary channels. The length of the existing riffle in Reach 2 increased, extending downstream to the widened area of the channel at the constructed alcove in Reach 2. Channel bed load has also deposited where channel roughness has been increased.

While the elevation of the channel bed has remained unchanged at the limits of the Project reach, the baseline elevation of some points in the channel has been locally reduced. Whereas the majority of the deepest pools in 2009/2010 were impassable and the distance to the maximum depth was estimated, in the historic drought year of 2013, most every pool was passable, and in fact some of the most persistent pools were completely dry. Thalweg elevations from the 2013 survey are therefore more reliable, but do not necessarily indicate that incision occurred at all of the coincident pool locations.

In general, a relatively high degree of channel scour occurred in between areas that had been widened to create floodplain benches in Reach 4. Prior to restoration, Reach 4 was the most narrow and confined section of the Project, and was characterized by a long, homogenous glide pool. Now relatively deeper pools separate longer and well-defined riffles, which were created by gravel deposition at benches. Historically low flow conditions allowed for a complete survey of Reach 8 at 9 at the downstream end of the project, portions of which were also previously impassable due to the depth of pools. Reoccupation of known points in the channel, indicate that the channel scoured locally up to eight feet in Reach 9, creating deep pools in previous riffle crest locations. These observations indicate that the channel bed is still subject to scour between fixed points of elevation. This may support the hypothesis that the channel has excess carrying capacity in relation to the bed load supply.

Some of these areas of local pool scour may be related to local reductions in bed load due to aggradation of the channel bed immediately upstream. For example, the aggradation area at Benches 10 and 11 in Reach 4 is followed immediately downstream scour pool. The channel aggraded along the length of Reaches 6, 7 and 8 from the confluence of Bale Slough to the downstream end of the newly constructed secondary channel. Channel adjustments in Reach 9 may be due to reduced amounts of bed load from upstream due to aggradation in of Reach 8. While the channel bed elevation remained relatively the same through the downstream half of Reach 8, the channel experienced down cutting from the Bella Oaks tributary confluence downstream through Reach 9. This may be related to an increase in carrying capacity provided by the discharge from Bella Oaks.

Although local areas of the channel are scouring, increased channel instability is unlikely to ensue if the natural and installed grade control structures continue to function to prevent channel incision from propagating upstream. Following the 2012 storms, the installed grade control in Reach 4 at Bench 5 was not exposed or undermined due to channel. This indicates that the installed structure is thus far functioning similarly to the natural bedrock grade control structure upstream in Reach 2 at the Quintessa Bank Stabilization Area to preclude upstream migration of channel Knick points. Aggradation of the boulder field installed in Reach 4 between Benches 4-5 immediately upstream of the scour pool associated with the confluence of the Honig ditch on the east bank suggests that channel stability and roughness has been sufficiently increased to preclude headward migration channel incision. Future storm flow events will serve to demonstrate whether the grade control structures installed in Reach 8BC South 2013 will also function as designed to hold the channel elevation, prevent channel incision, and preclude the isolation of newly created instream benches above the channel thalweg.

4.5 Channel Transect Surveys

Cross section surveys were not completed in 2014; the next cross section survey for the entire Project reach is scheduled for 2015. The following section is a discussion of the results related to previous cross section surveys; see monitoring report appendices from previous years for supporting data.

In 2013, licensed surveyors re-surveyed cross sections at all of the long term monitoring locations, and at additional locations previously surveyed in 2005 and 2007 to conduct hydraulic modeling and to create the baseline maps in support of the restoration design, in Reaches 1-4 of the Project between the Zinfandel Lane Bridge and the Rutherford Cross Road.

The bankfull channel width to depth ratio has been directly increased along 25% of the Project reach, where the channel banks have been graded to construct 9,285 linear feet of inset floodplain benches and alcoves, and 3,235 linear feet of bank stabilization areas. Through 2013, 12,520 linear feet of channel banks have been stabilized with slope grading, constituting 35% of the total channel bank length in restored reaches.

4.6 Pebble Counts

Pebble count surveys were not conducted in 2014, pebble counts for the entire Project reach will take place in 2015 at the same time cross section data is collected. The following section is a discussion of the results related to previous pebble counts; see monitor report appendices from previous years for supporting data.

In fall 2013, the particle size distribution was sampled at thirty one (31) riffle crests at monitoring cross sections throughout the Project reach. Comparison of this data with previous pebble counts allows assessment of channel substrate changes subsequent to the 18,300 cfs flood of 2005, and the peak flow events of 9,628 cfs and 9,260 cfs in December 2012, in restored and unrestored sections of the Project. The 2013 data reflects the effects of the December flow events on restored areas in Reaches 1-4 between Zinfandel Lane and the Rutherford Cross Road, as well as in Reach 8 North.

Pre- and Post-Restoration

The widening of the channel at restoration sites is contributing to the formation of gravel bars, the coarsening of the channel, and the reduction of percent fines in spawning riffle crests. Pebble counts conducted at riffle crests located adjacent to constructed inset floodplain benches show a bimodal distribution of particle size distribution. Pebble count data showing that median grain size on the floodplains is lower, and that the percentage of fine sediment is higher relevant to that in the adjacent low flow channel validates the field observation that sand is depositing differentially on the benches.

December 2012 Storm Flows

No definitive conclusions can be made regarding effect of restoration on changes in particle size based on a comparison of particle counts at sampled at locations in restored and unwidened sections of the channel from before and after the December 2012 storm events. The overall trend indicates that the median particle size at the majority of riffles sampled in the restored upstream half of the Project became finer since they were last sampled from 2008-2011. Conversely, the median particle size at the majority of riffles sampled in the downstream half of the Project stayed the same or became finer since

they were last sampled from 2008-2011. No difference in median grain size was measured between the gravel recruited in the secondary channel and along the base of the bank stabilization area at Sequoia Grove.

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 pebble counts taken in 2013, however, show an overall coarsening of the channel bed at 8 of the 10 locations surveyed in 2004. Of the two locations where the D50 particle size decreased relative to 2004, station 17,891 was located in a control reach, and station 15,950 was located at a restored bench. In the widened section of the channel, the particle size distribution was bimodal. Whereas the overall cross section was relatively finer compared to 2004 (D50 = 11 vs D50 = 16), the gravel in the riffle was coarser (D50 = 22 vs D50 = 16), and the sediment deposits on the newly constructed adjacent floodplain bench were much finer (D50= vs D50=16).

4.7 Channel Morphology/Riffle Survey

The Project reach has experienced great simplification in channel morphology due to channel incision, with long sections of homogenous glides, and a reduction in the frequency and spatial extent of riffle spawning habitat. Restoration efforts aim to increase riffle length and frequency through a variety of treatments as outlined in the Monitoring Plan (www.napawatersheds.org). The performance standard for the Project is a 30% increase in riffle length or riffle frequency in treated locations. As part of the annual channel survey, riffle crest mapping has been performed since 2011. The monitoring team identifies each riffle crest visually in the field and records its location with a GPS device. The points are then mapped and river stationing for each crest is assigned.

Monitoring methods have been evolving over the course of the construction phase of the Project, and as a result the monitoring team has determined that the results of the 2011 and 2012 riffle crest mapping efforts are not-comparable with data collected more recently. The monitoring team has used the 2013 riffle crest survey data as a baseline for assessing performance against the standard

Four treated areas that were completed prior to the recent annual survey were identified and listed in **Table 8**. Two additional treatment areas (river station 1,900 – 2,350 and 650 – 1,000) were completed in 2014, subsequent to the 2014 annual survey, and will be addressed in future monitoring reports. Riffle crest counts from the 2013 and 2014 surveys are summarized in **Table 8** below. Based on comparison of 2014 riffle crest data to the baseline, a 12% increase in riffle frequency has been observed in restoration treatment areas to date.

Table 8. Restoration treatment areas and riffle crest counts, 2013-2014.

Treated Area	River Station (ft)	Riffle Crest Count		Percent Change
		2013	2014	
1	23,300 – 24,100	2	4	+100%
2	21,500 – 22,200	2	3	+50%
3	12,300 – 20,000	18	20	+11%
4	2,800 – 7,700	20	20	0%
Total		42	47	+12%

4.8 Large Woody Debris and Boulder Cluster Surveys

As part of the annual channel survey naturally recruited and installed large wood debris (LWD), and boulder clusters, have been monitored since 2009. Naturally recruited LWD is monitored for year-to-year comparison to track trends in location, quantity, size, and function. Installed LWD and boulder clusters are assessed to verify their persistence, functionality (summer and winter refugia) and to assess potential damage or maintenance needs. For purposes of the survey, naturally recruited LWD is defined as piece of wood located in channel below top of bank that is at least 6 feet in length and 18 inches in diameter. For each occurrence, it is noted whether the LWD or boulder cluster is performing any of the following functions: spawning gravel recruitment, hydraulic constriction, pool scour, summer refugia, winter high-flow refugia, or bank stability. Some occurrences provide multiple functions, and some are not currently providing any of the listed functions.

The stated performance standard for LWD is a 75% persistence of installed instream structures and a 40% increase in seasonal refugia or cover.

As of 2014, 139 of the 147 installed large woody debris and instream habitat structures (boulder clusters), or 94%, have persisted since installation well exceeding the target of 75% persistence. Additionally, the percent of LWD categorized as providing summer refugia (cover) and/or winter high flow refugia by installed LWD structures was 21% and 24% in 2014. Of the 87 naturally recruited LWD occurrences surveyed in 2014 approximately 48% were categorized as providing summer refugia and 27% provided winter refugia; **Table 9** below.

Table 9. LWD/Instream Structure Persistence and Refugia Categorization

Survey Type	Total Installed LWD and Boulder Clusters as of 2014	Total Surveyed 2014*	Percent
Persistence of Installed LWD	147	139	94%
Summer refugia (cover)		32	21%
Winter (High flow) refugia		35	24%
Survey Type	**Total Naturally Recruited LWD Survey in 2014**	**Total Surveyed 2014***	
Summer refugia (cover)	87	42	48%
Winter (High flow) refugia		24	27%

*LWD not categorized as summer or winter refugia during 2014 survey were categorized as "other' functional type (hydraulic constriction, pool scour, etc.). See appendices for additional details.

Also, as shown in table A1 of **Appendix A**, the number of accumulations and jams has remained stable and the number of single occurrences varies greatly from year to year. The differences do not appear to correlate with large flow events. Bed form association has remained stable, with the most variation stemming from how "perched" LWD is accounted for. LWD size and function has also remained stable with most of the variation observed attributed to evolving survey methods. See **Appendix A** (and previous year's survey reports) for tables and figures summarizing the data collected regarding large woody debris.

4.9 Instream Habitat Structure and Residual Pool Depth Surveys

Instream habitat structures include graded habitat features as well as LWD and/or boulder configurations that were installed during construction to enhance aquatic habitat. LWD structures and boulders have been installed primarily to induce pool scour and create greater heterogeneity along the streambed. Forty graded habitat features, 108 LWD structures, and 39 boulder structures have been installed during restoration. The locations of instream habitat structures are shown on the 2014 restoration monitoring maps; **Figures 1-5,** Section 1**.**

The performance standard for these structures aims to achieve a "25% increase in residual pool depth in treated locations". Residual pool depth is a standardized way of measuring depth independently of variations caused by discharge. The residual depth for each structure was calculated from the difference between the maximum depth of the pool associated with the feature and the downstream riffle crest.

Residual pool depth was measured at structures for comparison in 2013 and again in 2014 during the annual maintenance survey. Only structures that were intended to perform pool scour were included in this assessment. In 2013, a total of 14 installed boulder structures and 20 installed LWD structures were found to be providing pool scour and the residual pool depth for each structure was measured. In 2014, we were able to re-measure 12 of the original 14 boulder structures and 18 of the original 20 LWD structures and calculate average residual pool depths for comparison (**Table 10**)**.**

The average residual pool depth associated with the 12 installed boulder structures was 1.9 feet in 2013 and 2.4 feet in 2014, representing an increase of 26%. The average residual pool depth associated with the 18 installed LWD structures was the same in both years at 2.5 feet. It should be noted that bed scour is particularly irregular in terms of timing and magnitude, and it is strongly dependent on seasonal flow patterns. Therefore, comparisons over such a short time period (one-year) are limited to showing short-term trends and outcomes.

Table 10. Summarized residual pool depths for installed habitat structures in 2013 and 2014

Structure Type	2013 Average Residual Pool Depth (ft.)	2014 Average Residual Pool Depth (ft.)	Percent Change
Boulder Cluster	1.9	2.4	26% Increase
LWD	2.5	2.5	No change

Each year, the RCD performs two assessments of installed structures: one during a winter high-flow event to evaluate graded habitat features and high-flow structures, and one during spring baseflows to evaluate LWD and boulder structures in the low-flow channel. During the high-flow assessment, RCD sketches flow patterns in graded areas and measures water velocity at select locations to evaluate whether the feature has successfully decreased velocities and created slow- and slack-water habitat. The RCD also collects photographs and surveys high-water marks. During the low-flow assessment, RCD sketches flow patterns and measures water velocity around low-flow installed structures to evaluate whether the structures are functioning as intended. Low-flow structures are also assessed on an annual basis during the maintenance survey. During this survey, the function, persistence, and condition of the structures are evaluated, and the residual pool depth is measured for structures providing pool scour.

Instream habitat structures are categorized by type and each designed to provide a specific function. Structures installed as part of this project and the functions they are intended to provide are listed in **Table 11.**

Table 11. Types, channel locations, and intended functions of installed instream habitat structures.

Instream Habitat Structure Type	Channel Location	Intended Functions
Graded habitat features (bench cuts, alcoves, secondary channels)	Off-channel	High-flow refugia
High-flow LWD structures (bench logs, log weirs, snags)	Bank, terrace	High-flow refugia
Low-flow LWD structures (root wads, low-profile logs, spider logs, toe logs)	Low-flow channel	Hydraulic constriction, pool scour, summer refugia
Boulder structures (boulders, boulder clusters, grade-control riffles)	Low-flow channel	Hydraulic constriction, pool scour, summer refugia

At the time of this writing, the RCD has assessed all structures associated with restoration construction in Phases 1a, 1b, 2, 3a, 3b, 4a, and 4bc. The results of previous assessments can be found in the restoration monitoring reports (www.napawatersheds.org). Structures associated with the final construction phase (Phase 5) will be assessed in 2015, and reported under separate a cover in 2015.

4.10 Vegetation Establishment Surveys

Vegetation establishment surveys are conducted the first three years following plant installation and thereafter during years 5 and 10 post installation. The target restoration goals and success criteria for vegetation establishment include:

- A minimum of 20 acres of riparian habitat established over the life the Project (20 years)
- A minimum of 80% of native plants installed shall survive/establish at the re-vegetation sites within 3 years after being installed, and at years 5 and 10, and will be in good health
- Greater than 90% native cover will exist at any given planting site over the *life* of the Project and evidence of natural recruitment will be documented after year 5 at any given re-vegetation

site

As a result of completing construction for the Project in the fall of 2014, 30.5 acres of native riparian plants have been install in restored areas encompassing all 9 Project reaches, exceeding the minimum target of 20 acres of riparian restoration. Summary results from vegetation monitoring through 2014 of the 30.5 acres, including direct count, percent vegetative cover, line intercept transect surveys and invasive plant management is presented herein.

Direct count and photo documentation

During the fall of 2014, District and contractor staff conducted annual direct count vegetation surveys of the restoration sites in Reaches 4 and 8; the location of these sites is shown in **Figure B1** of **Appendix B.** Reaches 1-3 were installed in 2009 and 2010, therefore direct count surveys for reaches 1- 3 were not conducted in 2014 and will not be conducted again until 2015 (year 5 post installation). All planted areas in reaches 4 and 8 were surveyed to determine percent survivorship and qualitative health of installed vegetation. **Table 12** below presents the cumulative direct count and qualitative health assessment for reaches 1-4 and 8; for additional detailed information regarding percent survivorship and health by a given species at each planted area in reaches 4 and 8 see tables B1 and B2 in **Appendix B**. Direct count vegetation data reported is listed by survey reach and year and includes the initial quantity of each species planted; the quantity live plants (including natural recruitment) at the time of the survey; the percent survival; and the general health of the vegetation. Re-vegetation contractors were responsible for plant establishment and monitoring in Reaches 1-3 from 2009-2010 as well as Reach 4 in 2012-2014 and Reach 8 in 2013-2014.

Survey data for reaches 1 and 2, survey year 2013, indicates overall survivorship was 81% or greater while overall survivorship for Reach 3 was 49% for survey year 2013. Reaches 1-3 were installed in 2009 and 2010 and therefore direct count surveys for reaches 1- 3 will not be conducted again until 2015 (year 5 post installation). Overall survivorship for Reach 4 was 92% for survey year 2014. When including natural recruitment, overall survivorship for Reach 8 was 101% for survey year 2014. Direct count surveys for reaches 4 and 8 will be conducted again in 2015. Several issues have arisen in Reach 3, east bank, that contributed to the low overall survivorship including low viability of seed material planted, inconsistent water availability during critical late summer irrigation months (particularly during the period of drought in 2013) and a high population of field mice in the area burrowing beneath installed plant material and consuming roots. Representative photos of the survey sites are shown in **Appendix B.**

Table 12: Direct Count/Survivorship Surveys Reaches 1-4 and 8

	2013			2014			
Survey Area	**Quantity Installed**	**Quantity Alive**	**% Survival**	**Quantity Installed**	**Quantity Alive**	**% Survival**	**Health**
Reach 1-2	1603	1293	81%	N/A	N/A	N/A	Good
Reach 3*	1404	683	49%	N/A	N/A	N/A	Poor
Reach 4	2898	2506	86%	2898	2658	92%	Good
Reach 8	N/A	N/A	N/A	1816	1829	101%	Excellent

*The District is currently assessing how to best adaptively manage Reach 3 such that 80% or greater survival will be attained over time.

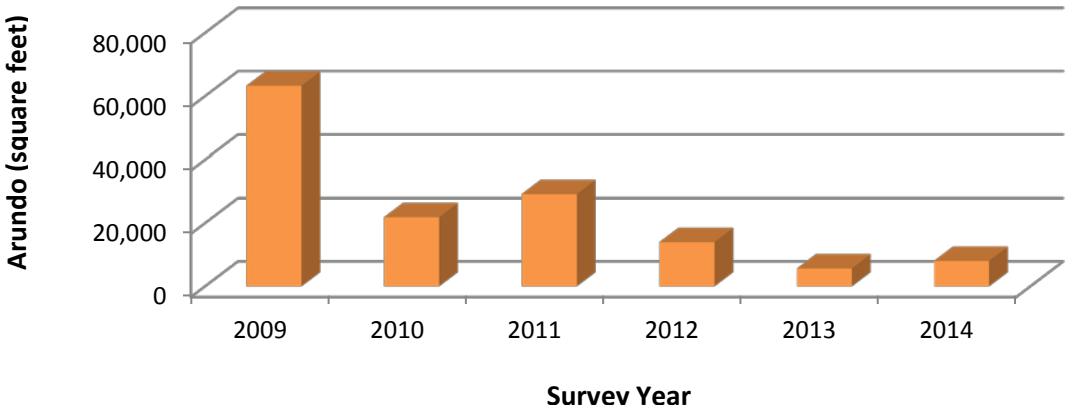
Invasive plant management

A total of 410,581 square feet (9.4 acres) of invasive and Pierce host's plants (*Arundo*, *Vinca*, grape, Himalayan blackberry and Mugwart) were ultimately treated by District staff and contractors during the summer and fall of 2014; the largest amount treated to date. Species such as fennel, poison hemlock, etc. were observed during the June survey but not treated as a result of land owners requests to prioritize the maintenance funds use for only treatment of invasive plants that are considered Pierce host's species as well giant reed which is not a Pierce host. **Table 13** shows the total area of invasive and Pierce host plants treated by species since the inception of the Project in 2009. Previous and ongoing efforts related to the Project designed to manage and remove giant reed (*Arundo*) have been successful in significantly reducing the amount of giant reed in the entire Project area. **Chart 1** below depicts the general decline of Arundo throughout the Project area. Currently, only small or re-sprouting patches of giant reed require treatment under the Maintenance Assessment District. Areas of invasive plants that were treated in 2014 that had the potential to cause streambank erosion were replanted with willow stakes and broad cast seeded with native species during the winter and spring of 2014 and 2015.

Table 13: Invasive/Pierce host plant species Mapped and Treated, 2009-2014

	Species Treated						
Survey Year	**Giant Reed**	**Himalayan Blackberry**	**Periwinkle (*Vinca sp.*)**	**Mugwart**	**CA Grape**	**Other Species (Sesbania, Tree of Heaven, etc.)**	**Total Area Treated (Sqft)**
2009	73,180	-	-	-	-	-	73,180
2010	23,599	952	17,389	-	-	86	42,026
2011	30,749	35,809	9,163	-	7,447	49,138	132,306
2012	14,502	2,668	6,951	20,330	-	17,636	62,087
2013	5,662	42,688	1,901	143,959	5,070	17,903	217,183
2014	8,075	206,182	2,620	169,155	23,753	796	410,581
Total Treated to Date:							937,393 (21.5 acres)

Chart 1: Arundo mapped and treated (2009-2014)



Line intercept transect surveys

Line intercept transects have been established at 19 locations in reaches 1 - 4 and reach 8. Representative photos of the sites are shown in **Appendix B**. The transect lines established thus far range from 42 to 111 feet in length. **Figure B1** in **Appendix B** shows the name and location of each transect line surveyed. **Chart 2** below presents the average relative percent cover, by ground cover type, for all transects lines in Reaches 1- 4 and reach 8 for survey years 2012-2014. As one can see from **Chart 2** the general trend in ground cover is a shift from un-vegetated to herbaceous with a gradual increase of shrub and tree cover types each consecutive year; this is to be expected as sites mature and shrubs and trees grow large and provide more cover and structure at a given restoration site. The increase of herbaceous cover in 2013 followed by a slight decline in 2014 is likely due to the addition of several new transects at sites at locations that were planted and established for less than a year prior to the 2014 survey.

Chart 2: Average percent cover by ground cover type for line transect surveys (2012-2014)

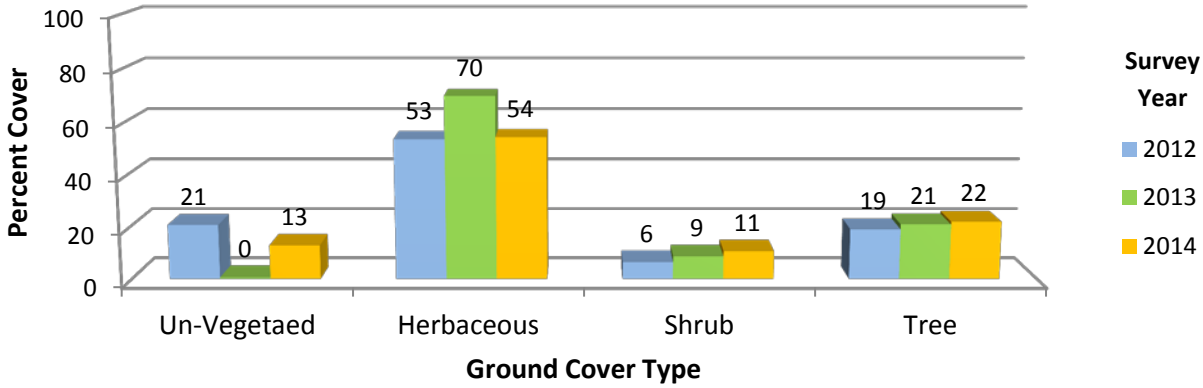
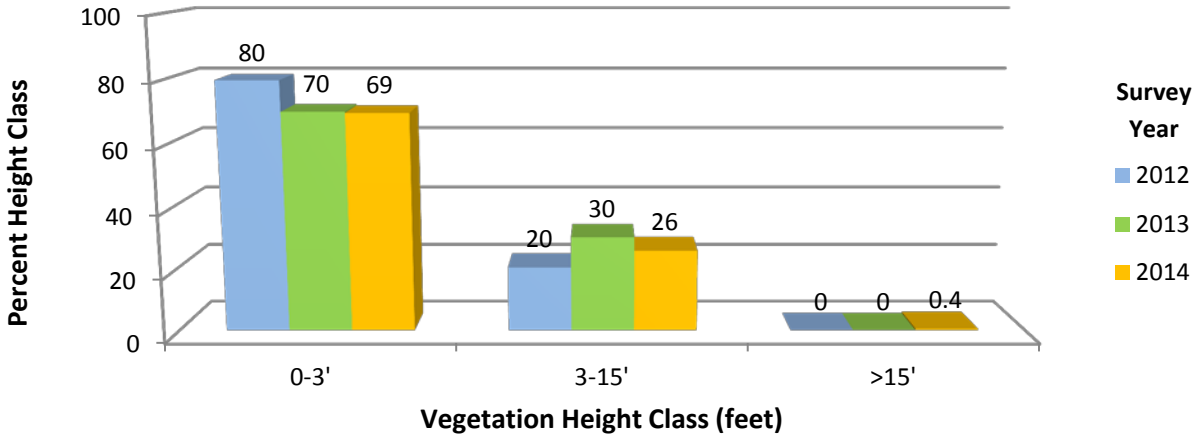


Chart 3, below, presents the average percent for a given height class for each transect line surveyed from 2012 through 2014. Approximately 69% of the vegetation measured in 2014 at a given transect ranged between 0 and 3 feet tall while approximately 26% of the vegetation measured in 2014 ranged between 3 and 15 feet in height. In 2014 several trees (cottonwoods) measured along a transect (CAY2) in reach 3 were 15 feet in height or greater providing data for the next height class and documenting maturation of the over story canopy within Project restoration areas. This represents a milestone in the average vegetation height measured from previous survey years and is indicative of successful plant establishment providing mature riparian habitat within the Project. Representative photos of the sites are shown in **Appendix B.**

Chart 3: Average height class herbaceous and woody vegetation for line transect surveys (2012-2014)



The results of the surveys indicate there is generally a positive trend for vegetation establishment, in terms of both vegetative cover and average height measured at newly constructed restoration areas. Survival of installed woody and herbaceous vegetation in reaches 1-2, 4 and 8 is greater than 80%, which is consistent with the Project goals and performance standards for vegetation survivorship; however survivorship for Reach 3 remains low, 49%-56%. The reasons for low survivorship on reach 3 east bank are mentioned above and in previous reports. The District is currently adaptively managing these sites by adding soil amendments (mycorrhizae, etc.), increasing moisture retention at planting basins through the use of mulch and increasing the watering duration so that this area will attain 80% or greater over time. Results from line intercept surveys indicate that transects sites are covered with approximately 54% herbaceous cover, 22% tree cover type and 11% woody shrub cover and the remaining 13% is either un-vegetated or leaf litter at any given transect. Further, in 2014 approximately 69% of installed vegetation measured is between 0 and 3' in height, 26% is approximately 3 to 15' high and several trees measured above 15' for the first time since surveys began (2009). Both of these measurements, increase in coverage and average height, represent positive trends in vegetation establishment at restored sites providing greater habitat value. The installed vegetation is expected to increase at a normal trajectory under typical growing conditions.

4.11 Ritz-Carlton Hotel Mitigation Monitoring

The linear wetland constructed in Phase 4A, Reach 8North to satisfy the Ritz-Carlton Hotel mitigation requirements is functioning as designed. The linear wetland is incorporated into the 589 feet long secondary channel constructed on Bench 1, which spans 600 linear feet between left (east) bank river stations 7,100-6,500 on the Wilsey property. The bench and wetland function as a secondary channel, backwater and wetland habitat.

The effectiveness monitoring studies for the overall Project include the results of any sites sampled at the linear wetland mitigation site. Although monitoring study results are not reported separately for the linear wetland mitigation site, a summary of the restoration elements, and any adaptive management measures taken specifically to maintain those features, are included in the applicable report sections on eroding banks, instream habitat structures and vegetation establishment.

The long term monitoring cross section established at river station 6,750 includes data on channel substrate and topography at the linear wetland site. For example, the pebble count study conducted at river station 6,750 documents the median size of the gravel recruited and the percentage of fines deposited at the sample site in the secondary channel.

The 2013 longitudinal profile thalweg survey study includes a plot of the elevation of the linear wetland following gravel recruitment and channel change caused by the December 2012 storm flows a month following the completion of construction. See **Appendix B and C** for photographs documenting the status of the mitigation wetland and vegetation establishment.

4.12 Stakeholder Participation Documentation

The Napa River Rutherford Restoration Project is a landowner-initiated project. The leadership of the landowner advisory committee (LAC) and the active participation of landowners at these and other meetings have been central to the success of the restoration Project. Maintaining landowner buy-in and active participation remains a key element of Project viability. Documentation of participation levels demonstrates the success of community engagement with the Project.

Thirty (30) property owners own forty one (41) parcels with river front property along the Rutherford Reach in Rutherford and Oakville. All 30 landowners who allowed for the creation of the Preliminary Design granted access for completion of the Final Design of the Project on their properties. Temporary Construction Easements and Maintenance Access Agreements have been signed or agreed to by 100 % of the landowners participating in the restoration Project in Phases 1-5, Reaches 1-9. Landowners who have undergone restoration construction since 2009 have continued to allow access for Project maintenance.

All 30 landowners included in the Maintenance Assessment District (MAD) 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 documented and reported in a separate annual Project maintenance report produced by the Napa County Flood Control District. These reports can be accessed online at the Napa

County Watershed Information Center and Conservancy (WICC) in the Rutherford Reach Restoration Project document repository (http://www.napawatersheds.org/app_folders/view/5501).

From 2009 – 2011, the LAC convened three times a year. Landowners voted in 2012 to meet twice a year: once in July to review and comment on the results of the maintenance survey and work plan; and a second time in March to review and comment on the work done the budget, and the prioritization of channel maintenance activities. Attendance at each LAC meeting has ranged between six (6) to fifteen (15) people, representing of 20-50% of the properties in the MAD **Table 14** below. The Napa County MAD representative is available via email and phone throughout the year, and has communication with all of the landowners in the MAD on a regular basis.

Table 14: Landowner Advisory Committee (LAC) Meeting Attendance

Meeting Date	Landowner Attendees	Properties Represented (of 30)	Percent of Properties Represented
6/18/2009	No Record	No Record	No Record
11/13/2009	No Record	No Record	No Record
4/10/2010	No Record	No Record	No Record
12/7/2010	No Record	No Record	No Record
4/22/2011	6	9	30%
8/2/2011	10	9	30%
12/6/2011	7	10	33%
4/12/2012	9	10	33%
7/24/2012	11	8	27%
4/9/2013	8	7	23%
7/25/2013	6	8	27%
4/10/2014	11	15	50%
7/17/2014	6	8	27%
3/24/2015	11	9	30%

4.13 Photo Monitoring

Photo monitoring is conducted concurrently with the annual stream survey and at select locations pre- and post-construction annually. 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 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 are assessed and incorporated in the spatial database (GIS). Results of annual photomonitoring for the entire Project area (Reaches 1 through 9) conducted in 2014 (and in the spring of 2015 in some instances) at established locations are located in **Appendix C.**

4.14 Complementary Monitoring

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

TMDL Studies

The Napa River Sediment TMDL Monitoring Program: Summary Report of Pilot Implementation (September 2013), prepared by Stillwater Sciences for the Napa RCD and the State Water Quality Control Board, presents the findings from studies to assess whether numeric targets for the attainment of water quality set forth by the State Water Board in the Sediment TMDL Plan are being met in the Napa River watershed. The report presents findings on spawning gravel embedednesss and scour chain surveys from previously sampled sites in the Rutherford Reach, along with other locations on the mainstem Napa River. Pebble count data from these studies augmented the monitoring data collected for the Project. 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 were reported in **Appendix D. Study V of the 2012 Monitoring Report.** This report is available online: www.naparcd.org/documents/NapaTMDLPilotMon_TechMemo_2013_FINAL_30SEP2013.pdf.

Salmonid Monitoring

The Napa RCD conducts annual salmonid spawning, rearing and outmigration surveys 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 the Wetland Tracker for each Project phase at the following website: 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.

5.0 Conclusions

Following the completion of the Project in the fall of 2014, construction of Phases 1-5 in Reaches 1-9 (100% of the 4.5 mile Project Reach), the cumulative amount of fine sediment reduction as a result of Project construction grading activities is of 257,260 metric tons. Further an estimated 16,394 metric tons/year will be reduced in the Napa River watershed over the next 20 years, or 87% of the total TMDL target reduction for the Napa River watershed from mainstem channel incision and bank erosion sources.

Monitoring results to date indicate that habitat restoration is meeting, or is on target to meet, Project habitat creation goals. As of writing this report, aquatic and terrestrial habitat has been improved with the addition of 147 instream habitat structures installed along the 4.5 mile Project reach. Creation of inset floodplain benches has resulted in the addition of creating 16.8 acres of low stream flow velocity areas providing refuge for rearing salmonids. An additional 4.6 acres of complex instream/off channel habitat has also been created associated with the construction of 2 tributary alcoves and 2 secondary/side channels.

Over 30.5 acres of riparian habitat has been expanded and enhanced to date. A total of 410,581 square feet (9.4 acres) of invasive and Pierce host's plants (*Arundo*, *Vinca*, grape, Himalayan blackberry and Mugwart) were removed in 2014; the largest amount treated to date and approximately 21.5 acres of invasive plants have been managed since Project inception (2009).

The Project has achieved widespread participation of the property owners within the Project reach. Direct landowner participation in the channel maintenance and monitoring program continues to be robust. Utilizing this successful private-public partnership as a model, Napa County is expanding its efforts to partner with additional property owners throughout the watershed to manage riparian resources while protecting the productive uses of private property.

5.1 Recommendations

Additional time and surveys are needed to further evaluate and provide better resolution regarding long term change and full achievement of performance standards. The success of instream habitat improvements will ultimately be determined by the rebound of fisheries populations in the watershed.

Specific recommendations relative vegetation establishment in reach 3, east bank, includes adaptively managing the site by continuing to add soil amendments (mycorrhizae, etc.), increasing moisture retention at planting basins through the use of mulch and increasing the watering duration such that this area will attain 80% vegetation cover over time.

6.0 References

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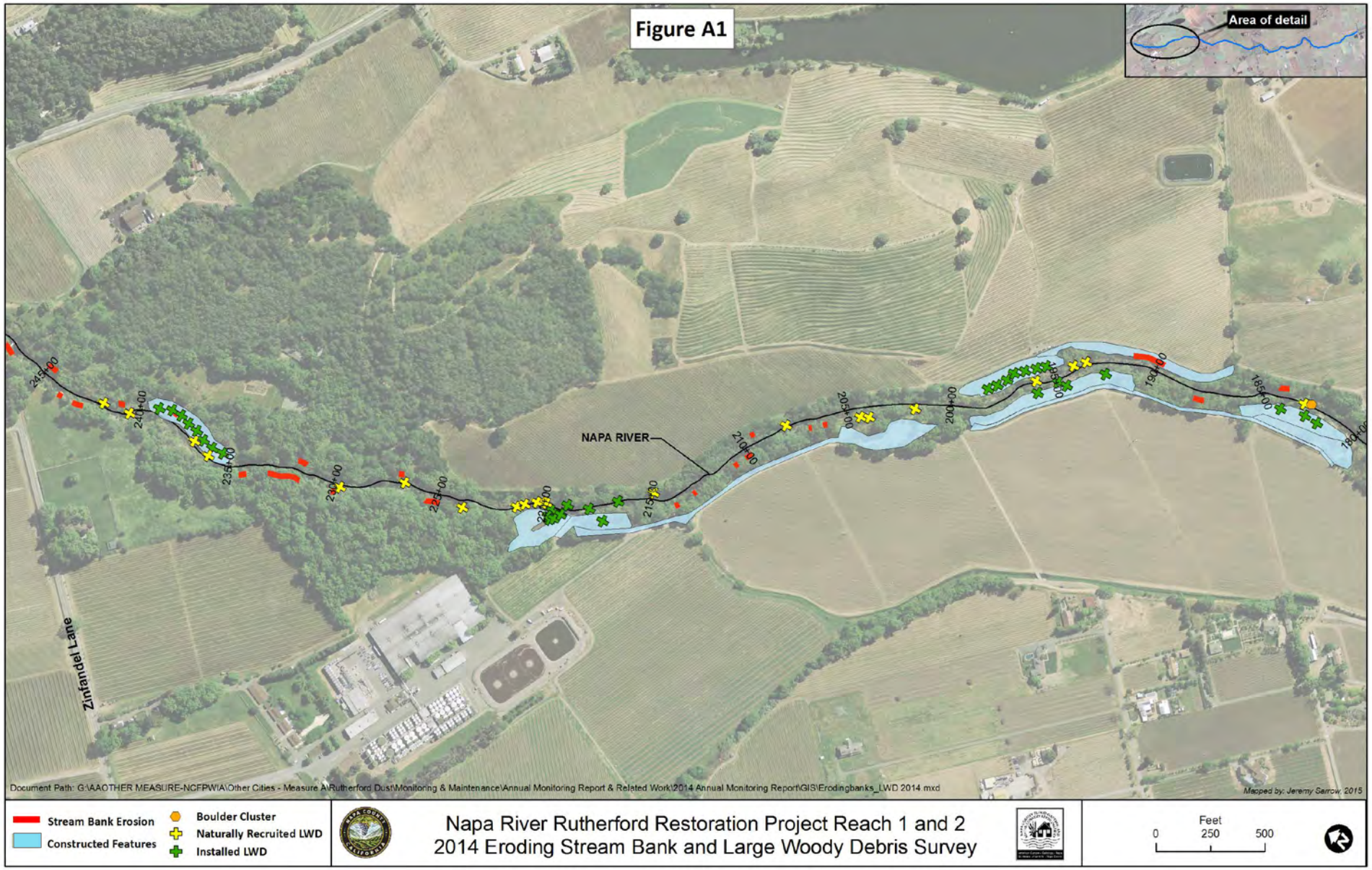
Appendix A
Eroding Stream Bank and Large Woody Debris (LWD) Survey Figures and Tables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Area of detail
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Zinfandel Lane
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240+00
235+00
230+00
225+00
220+00
215+00
210+00
205+00
200+00
195+00
190+00
185+00
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Maoped by: Jeremy Sarrow, 2015
Stream Bank Erosion
Constructed Features
Boulder Cluster
Naturally Recruited LWD
Installed LWD
Napa River Rutherford Restoration Project Reach 1 and 2
2014 Eroding Stream Bank and Large Woody Debris Survey
Feet
0
250
500

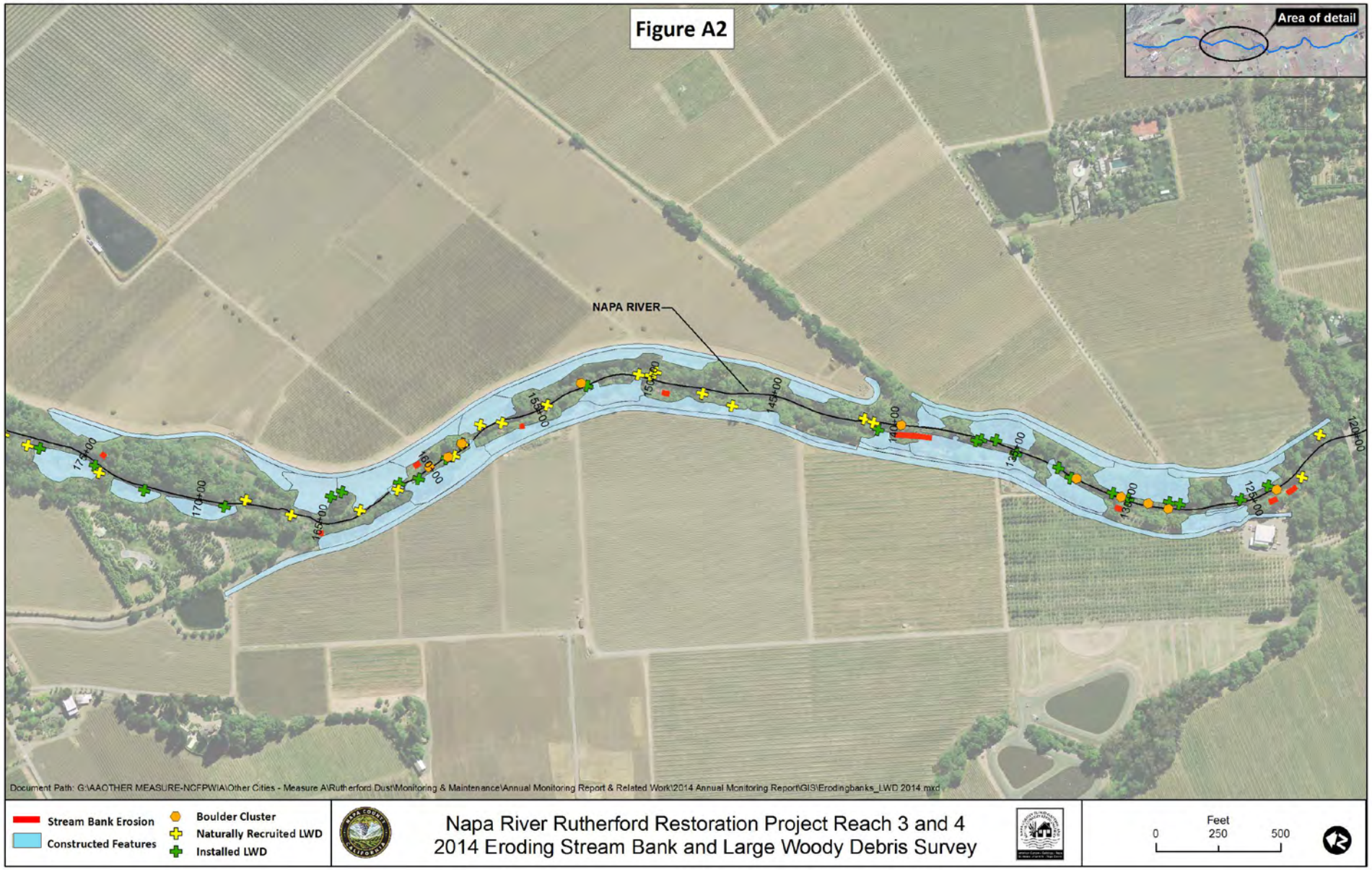
Figure A2
Area of detail
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170+00
165+00
160+00
155+00
150+00
145+00
140+00
135+00
130+00
125+00
120+00
Document Path: G:\AAOTHER MEASURE-NCFPWIA\Other Cities - Measure A\Rutherford Dust\Monitoring & Maintenance\Annual Monitoring Report & Related Work\2014 Annual Monitoring Report\GIS\Erodingbanks_LWD 2014.mxd
Stream Bank Erosion
Constructed Features
Boulder Cluster
Naturally Recruited LWD
Installed LWD
Napa River Rutherford Restoration Project Reach 3 and 4
2014 Eroding Stream Bank and Large Woody Debris Survey
Feet
0
250
500

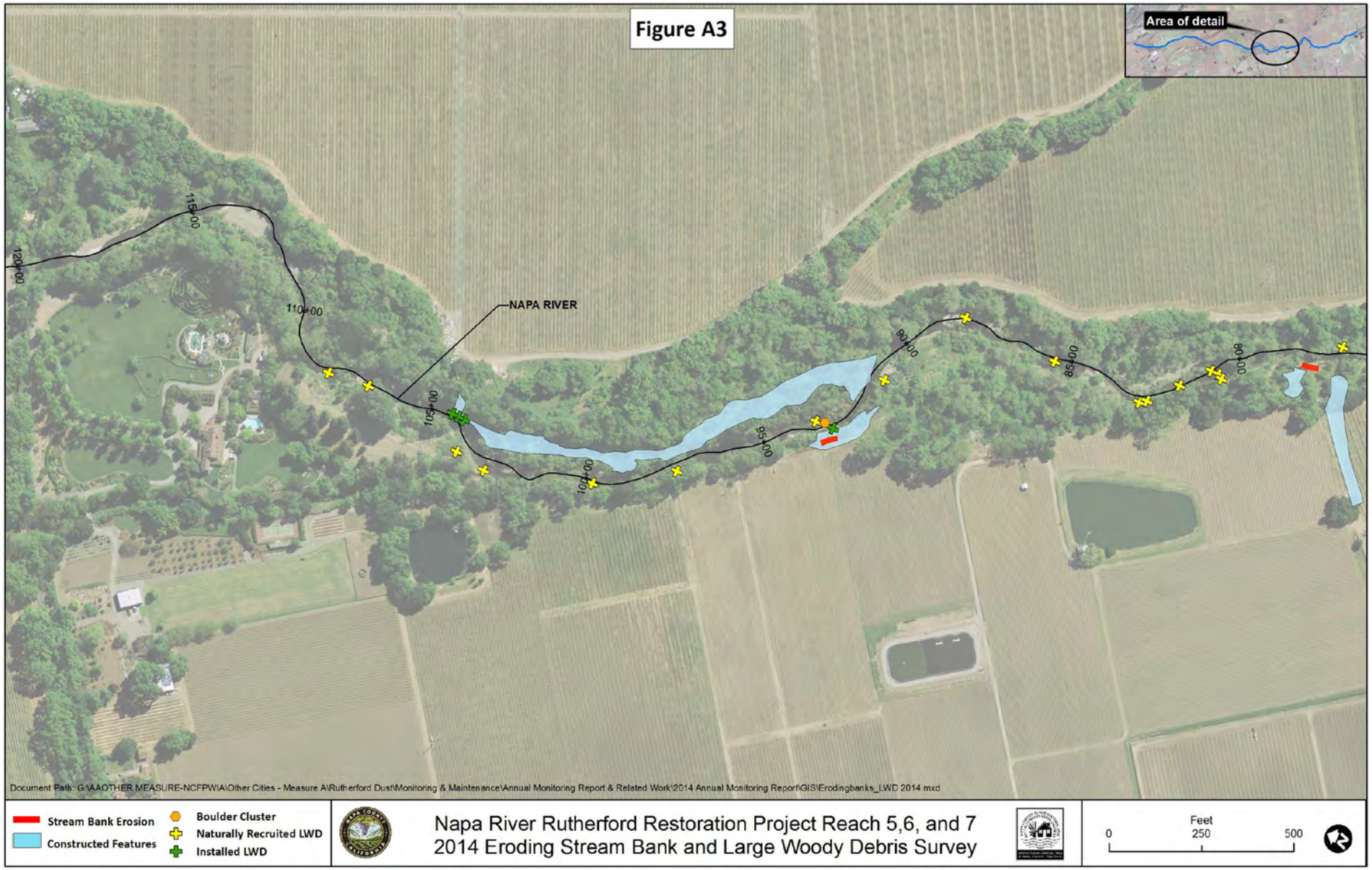
Figure A3
Area of detail
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120+00
115+00
110+00
105+00
100+00
95+00
90+00
85+00
80+00
Document Path: G:\AAOTHER MEASURE-NCFPWIA\Other Cities - Measure A\Rutherford Dust\Monitoring & Maintenance\Annual Monitoring Report & Related Work\2014 Annual Monitoring Report\GIS\Erodingbanks_LWD 2014.mxd
Stream Bank Erosion
Constructed Features
Boulder Cluster
Naturally Recruited LWD
Installed LWD
Napa River Rutherford Restoration Project Reach 5,6, and 7
2014 Eroding Stream Bank and Large Woody Debris Survey
Feet
0
250
500

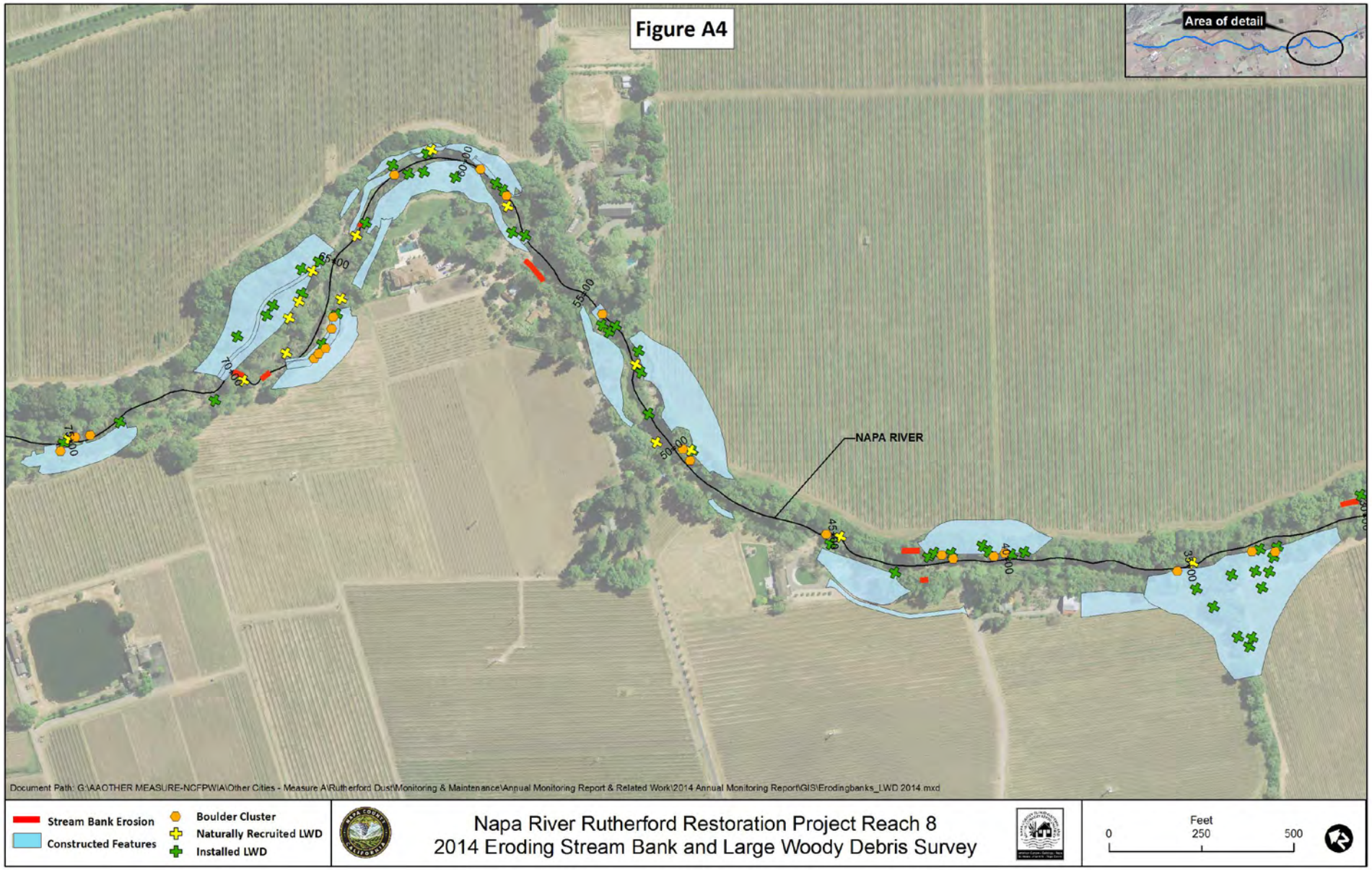
Figure A4
Area of detail
NAPA RIVER
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70+00
65+00
60+00
55+00
50+00
45+00
40+00
35+00
Document Path: G:\AAOTHER MEASURE-NCFPWIA\Other Cities - Measure A\Rutherford Dust\Monitoring & Maintenance\Annual Monitoring Report & Related Work\2014 Annual Monitoring Report\GIS\Erodingbanks_LWD 2014.mxd
Stream Bank Erosion
Constructed Features
Boulder Cluster
Naturally Recruited LWD
Installed LWD
Napa River Rutherford Restoration Project Reach 8
2014 Eroding Stream Bank and Large Woody Debris Survey
Feet
0
250
500

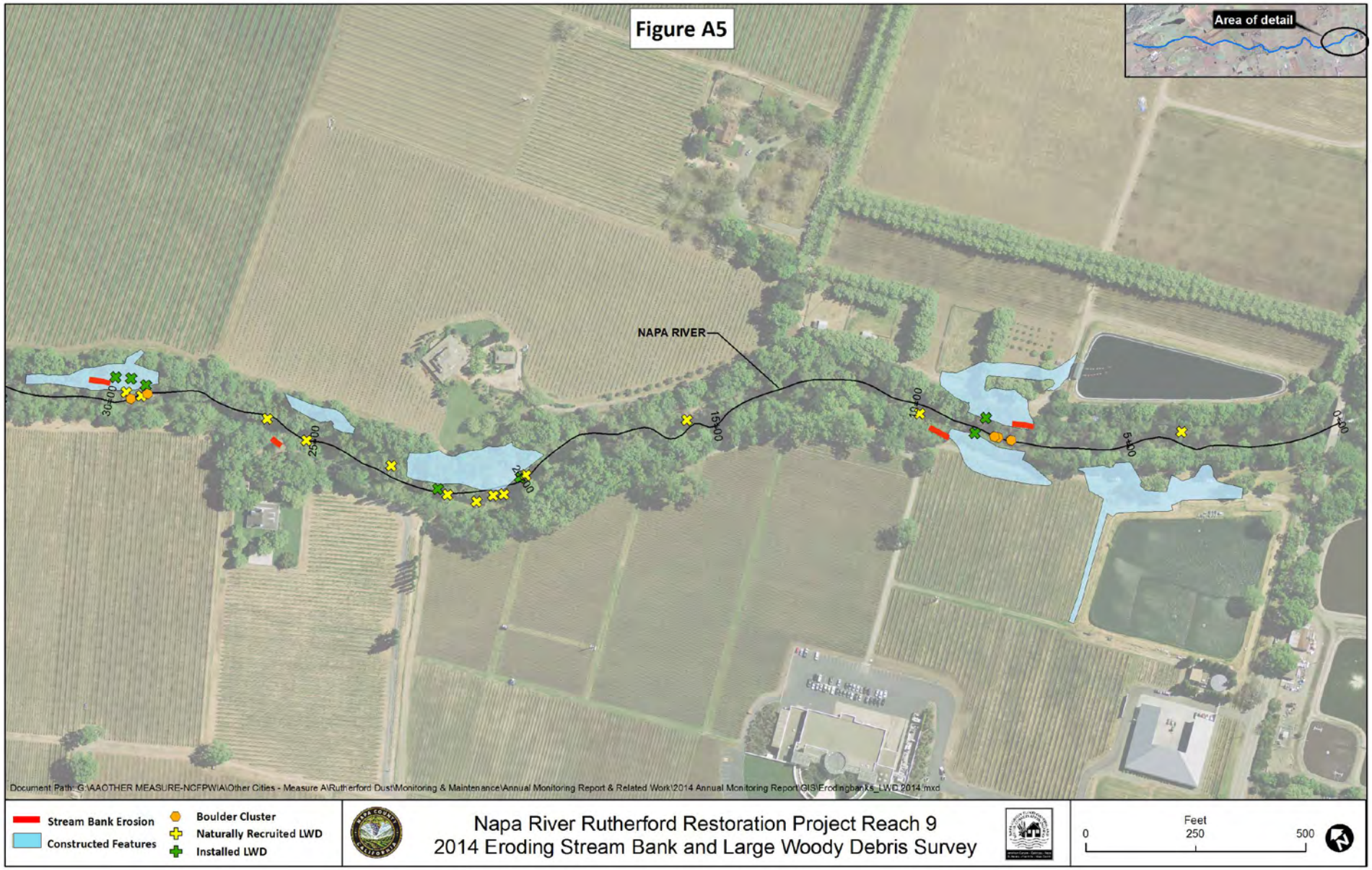
Figure A5
Area of detail
NAPA RIVER
30+00
25+00
20+00
15+00
10+00
5+00
0+00
Document Path: G:\AAOTHER MEASURE-NCFPWIA\Other Cities - Measure A\Rutherford Dust\Monitoring & Maintenance\Annual Monitoring Report & Related Work\2014 Annual Monitoring Report\GIS\Erodingbanks_LWD 2014.mxd
Stream Bank Erosion
Constructed Features
Boulder Cluster
Naturally Recruited LWD
Installed LWD
Napa River Rutherford Restoration Project Reach 9
2014 Eroding Stream Bank and Large Woody Debris Survey
Feet
0
250
500

Table A1: Results of naturally-recruited LWD surveys, 2009-2014.

Survey	2009	2010	2011	2012	2013	2014
Occurrences						
Single	46	60	97	111	90	59
Accumulations (2-9)	23	19	19	24	20	27
Jams (>10)	3	3	3	1	3	1
Total	72	82	119	136	113	87
Bedform Association (%)						
Bank	---	9.8	9.2	3.7	16.8	10.3
Bar	---	15.9	12.6	13.2	9.7	12.6
Pool	---	36.6	37.0	41.9	36.3	35.6
Riffle	---	4.9	10.1	5.9	5.3	9.2
Terrace	---	24.4	29.4	19.1	16.8	12.6
Secondary Channel	---	1.2	1.7	0	1.8	1.1
Perched in Vegetation	---	7.3	---	16.2	13.3	18.4
Size						
Single Piece Length Range (ft)	6-80	8-100	6-95	6-80	6-60	6-80
Single Piece Length Average (ft)	30	25	25	23	23	29
Accumulation Length Range (ft)	10-120	10-100	8-85	8-100	10-200	10-200
Diameter Class (%)						
18-in	25.0	63.4	69.7	68.4	68.1	60.9
24-in	38.9	19.5	16.0	17.6	15.0	26.4
30-in	22.2	3.7	6.7	2.2	5.3	8.0
36-in	6.9	7.3	4.2	5.9	8.0	1.1
42-in	2.8	6.1	2.5	3.7	2.7	2.3
48-in or greater	4.2	0	0.8	2.2	0.9	1.1
Function (%)						
Hydraulic Constriction	---	---	28.6	26.5	18.6	29.9
Pool Scour	---	---	33.6	28.7	28.3	29.9
Gravel Recruitment	---	---	---	---	10.6	1.1
Summer Refugia	---	---	41.2	44.1	42.5	48.3
High-flow Refugia	---	---	6.7	17.6	30.1	27.6
Bank Stability	---	---	28.6	23.5	22.1	5.7
Other	---	---	21.0	17.6	---	---

Appendix B

Vegetation Establishment Survey Figures and Tables

Figure C1: Vegetation establishment direct count, transect survey and photo monitoring locations

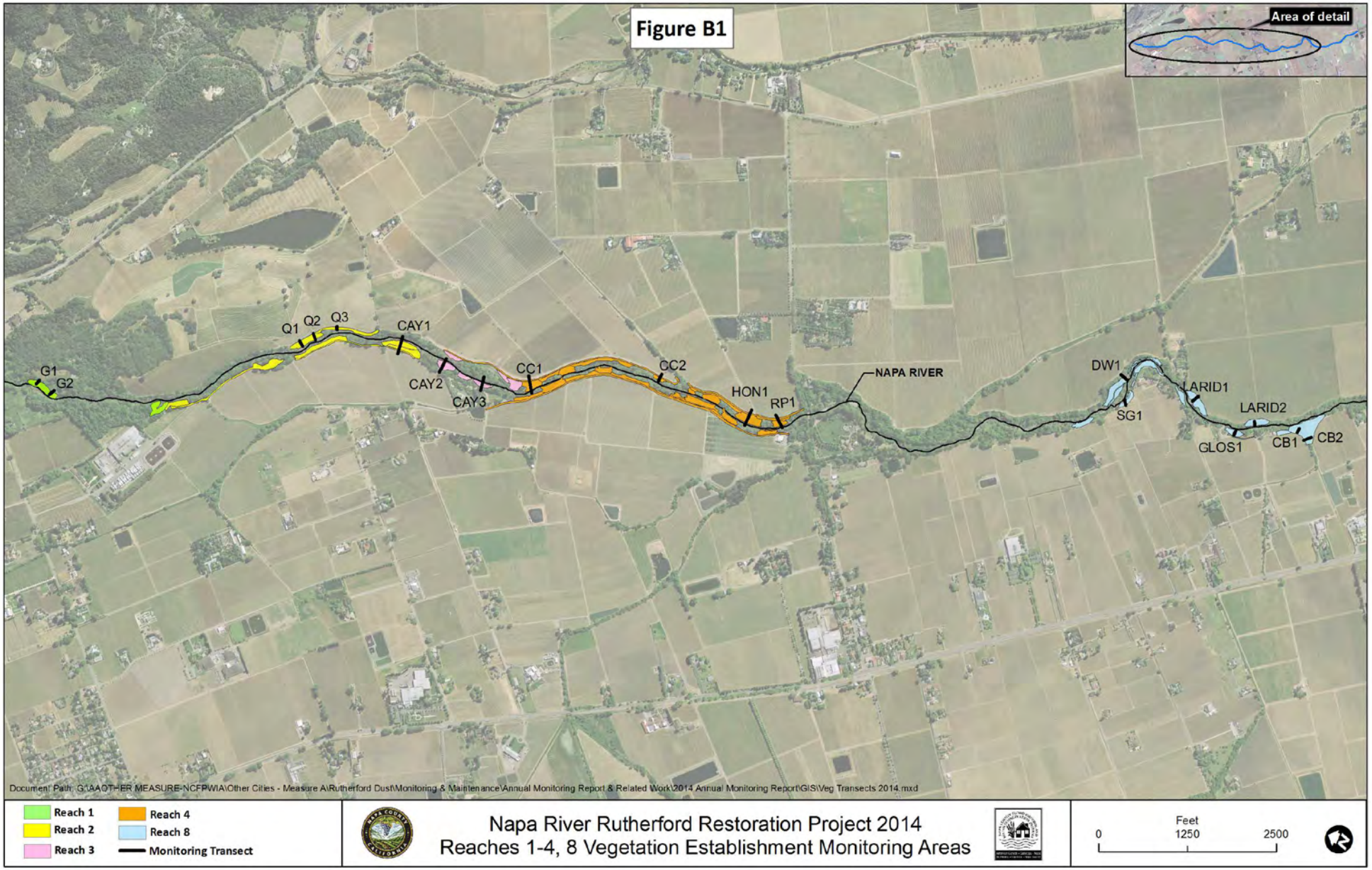

Table B1: Reach 4 Direct Count/Survivorship Survey

	2013			2014			
Common Name	Quantity Required	Quantity Alive	% Survival	Quantity Required	Quantity Alive	% Survival	Health
White Alder	16	15	94%	16	23	144%	Good
Oregon Ash	128	134	105%	128	138	108%	Good
Fremont's Cottonwood	83	22	27%	83	38	46%	Poor
Red Willow	63	25	40%	63	61	97%	Good
Arroyo Willow	58	16	28%	58	93	160%	Good
Yellow Willow	9	6	67%	9	98	1089%	Good
Big Leaf Maple	30	29	97%	30	18	60%	Fair
California Buckeye	126	86	68%	126	70	56%	Poor
Black Walnut	201	139	69%	201	132	66%	Fair
Valley Oak	196	252	129%	196	204	104%	Good
Coast Live Oak	175	202	115%	175	190	109%	Good
Bay Laurel	133	109	82%	133	87	65%	Fair
Blue Oak	73	37	51%	73	67	92%	Good
California Wild Rose	338	345	102%	338	354	105%	Good
Snowberry	338	240	71%	338	258	76%	Fair
Coyote Bush	201	231	115%	201	251	125%	Good
Western Spice Bush	51	53	104%	51	52	102%	Good
Toyon	100	52	52%	100	41	41%	Poor
Deergrass	325	290	89%	325	271	83%	Good
Honeysuckle	254	223	88%	254	212	83%	Good
Total	**2898**	**2506**	**86%**	**2898**	**2658**	**92%**	

*Planted fall 2012, includes original planted stock and naturally recruited species.

Table B2: Reach 8 (including Ritz-Carlton Mitigation Area) Direct Count/Survivorship Surveys

	2014			
Common Name	Quantity Required	Quantity Alive	% Survival	Health
White Alder	174	166	95%	Good
Oregon Ash	100	85	85%	Good
Fremont's Cottonwood	45	177	393%	Good
Red Willow	142	92	65%	Fair
Big Leaf Maple	45	39	87%	Good
California Buckeye	69	111	161%	Good
Black Walnut	104	114	110%	Good
Valley Oak	152	134	88%	Good
Coast Live Oak	142	117	82%	Good
Bay Laurel	30	27	90%	Good
California Wild Rose	251	266	106%	Good
Snowberry	196	199	102%	Good
Coyote Bush	167	119	71%	Fair
Western Spice Bush	10	6	60%	Fair
Toyon	32	31	97%	Good
Deergrass	100	100	100%	Good
Western Redbud	41	38	93%	Good
Honeysuckle	16	8	50%	Poor
Total	**1816**	**1829**	**101%**	

*Planted fall 2013/spring 2014, includes original planted stock and naturally recruited species

Figure B2: Representative photos of direct count and transect monitoring sites

Transect G1 (July 2014)

Transect Q2 (July 2014)

Transect CAY3 (July 2014)

Transect SG1 (July 2014)

Transect GLOS1 (July 2014)

Transect DW1 (July 2014)

Transect LAIRD2 (July 2014)

Transect CB1 (July 2014)

Appendix C

Photo Monitoring

Reaches 1 and 2 East Bank
(Phase 1)

Constructed 2009

Guggenhime
Quintessa

River Station 238+00
Bench: Guggenhime
West Bank to East Bank

River Station 239+00
Bench: Guggenhime, East Bank

June 2011

March 2015

River Station 235+00
Bench: Guggenhime, East Bank

June 2009

October 2009

June 2011

March 2015

River Station 195+50
Benches: Quintessa, East Bank

June 2009

March 2011

March 2015

River Station 19,550

Benches: Quintessa, East Bank to West Bank

September 2009

March 2015

Reaches 1 and 2 West Bank
(Phase 1)

Constructed 2010

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

River Station 219+50

Alcove: The Ranch Winery / Sutter Home, West Bank

September 2009

March 2015

March 2011

LWD, Ranch Winery, March 2015

River Station 198+50
Bench: Frog's Leap, West Bank

July 2010

August 2010

April 2015

River Station 191+00

September 2010 | Frog's Leap Bench from Quintessa Road, East Bank | March 2015

River Station 181+00

Setback Berm: Caymus Bench, West Bank

December 2010

March 2015

Reach 3
(Phase 2)

Constructed 2010

Carpy Conolly and Caymus

River Station 176+50
Bench 1: Caymus, West Bank

September 2009

October 2010

December 2010

March 2015

River Station 172+00
Bench 2: Caymus, West Bank

October 2010

March 2015

December 2010

LWD, Bench 2, March 2015

River Station 168+50

Bench 3: Caymus, Downstream to Upstream

October 2010

March 2015

River Station 164+20
Bench 4: Carpy Conolly, East Bank

September 2010

November 2011

March 2015

River Station 162+00
Carpy Conolly Bench 5, East Bank

September 2011

March 2015

River Station 144+00 Carpy Conolly Bench 6, East Bank

August 2011

March 2015

Reach 4 East Bank
(Phase 3)

2011

Honig
Round Pond East Bank

River Station 135+40
Bench 11: Honig, East Bank

October 2011

March 2012

March 2015

River Station 130+50
Bench 13: Honig, East Bank

August 2011

March 2012

March 2015

River Station 127+50

Bench 13: Honig, East Bank to Upstream

May 2011

October 2011

March 2015

River Station 124+25

Bench 14: Round Pond, East Bank

October 2011

LWD Bench 14, March 2015

March 2015

Reach 4 West Bank
(Phase 3)

Constructed 2012

Emmolo, Caymus and Round Pond

River Station 161+10
Bench 6: Emmolo, West Bank

May 2012

November 2012

March 2015

River Station 157+60
Bench 6: Emmolo, West Bank to Upstream

May 2012

December 2014

August 2012

March 2015

River Station 152+90
Bench 8: Emmolo, West Bank to Downstream

May 2012

November 2012

March 2015

December 2014

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

May 2012

November 2012

March 2015

LWD, Bench 8,
March 2015

River Station 141+00
Bench 9: Caymus, West Bank

August 2012

March 2015

River Station 139+20
Bench 10: Caymus, West Bank to Downstream

August 2012

March 2015

December 2014

River Station 135+60
Bench 10: Caymus, West Bank to Upstream

November 2012

March 2015

December 2014

River Station 133+30
Bench 12: Round Pond West, West Bank to Downstream

August 2012

March 2015

LWD, Bench 12, March 2015

River Station 130+80
Bench 12: Round Pond West, West Bank to Upstream

November 2012

December 2014

March 2015

Boulder Cluster, Reach 4, March 2015

River Station 127+80
Bank Stabilization 3: Round Pond West, West Bank to Downstream

May 2012

November2012

January 2013

December 2012

March 2015

River Station 126+00
Bank Stabilization 3: Round Pond West, West Bank to Upstream

May 2012

November 2012

December 2012

March 2015

Reach 8 North
(Phase 4A)

Constructed 2012

Foley Johnson (Sawyer), Sequoia Grove, Wilsey

Ritz Carlton Hotel Linear Wetland Mitigation
(Part of Secondary Channel on Bench 1 on Wilsey)

Station 73+30
Reach 8 North, West Bank, Foley Johnson (Sawyer) West Bank

May 2012

October 2012

December 2014

March 2015

Ritz Carlton Hotel Linear Wetland Mitigation (Phase 4A)

Constructed 2012

Part of Phase 4a: Reach 8 North Secondary Channel on Bench 1 on Wilsey

River Station 65+50
Bench 1 Secondary Channel: Wilsey, East Bank

August 2012

March 2015

August 2012

March 2015

River Station 65+50
Bench 1: Wilsey, East Bank to Upstream

September 2012

November 2012

December 2012

March 2015

River Station 66+30
Bank Stabilization 2: Sequoia Grove, West Bank

2011

October 2012

November 2012

March 2015

River Station 66+30

Bank Stabilization 2: Sequoia Grove, West Bank to Upstream

May 2012

October 2012

December 2012

March 2015

Reach 8 South
(Phase 4BC)

Constructed 2013

El Encino (Gmelch), Laird, Frostfire (Davis)
AJM Vineyards (McDowell), Glos
Cakebread, Nickel & Nickel

River Station 61 +00
Reach 8 South, Bench 1: Upstream to Downstream

October 2012

March 2015

October 2012

March 2015

River Station 53+00
Reach 8 South, Bank Stabilization 1: Downstream to Upstream

August 2012

March 2015

November 2012

March 2015

River Station 53+00
Reach 8 South, Bench 2: Upstream to Downstream

August 2012

March 2015

November 2012

Boulder Cluster,
Bench 2, March 2015

River Station 44+00
Reach 8 South, Bank Stabilization 3 to Bench 3: Upstream to Downstream

July 2010


November 2012


December 2014


March 2015

River Station 43+00
Reach 8 South, Bank Stabilization 3: Downstream to Upstream


November 2010


February 2013


December 2014


March 2015

River Station 42+00
Reach 8 South, Bench 3: Upstream to Downstream

August 2013

March 2015

December 2014

River Station 40+00
Reach 8 South, Bench 3: Downstream to Upstream

August 2013

March 2015

December 2014

River Station 36+00
Reach 8 South, Bella Oaks Tributary Alcove: Upstream to Downstream

July 2013

November 2013

River Station 36+00
Reach 8 South, Bella Oaks Tributary Alcove: Upstream to Downstream

November 2013

February 2014

River Station 36+00, Reach 8 South, Bella Oaks Tributary Alcove: Upstream to Downstream

August 2013

October 2013

December 2014

March 2015

River Station 34+00, Reach 8 South, Bella Oaks Tributary

August 2013

October 2013

December 2014

March 2015

River Station 31+00, Reach 8 South, Cakebread Alcove: Downstream to Upstream

August 2013

October 2013

December 2014

March 2015

Reach 8 South, Cakebread Alcove Detail

LWD, March 2013

Boulder Cluster, March 2015

Confluence Napa River and Bella Oaks Creek, March 2015

Reach 5, 6 and 7
(Phase 5)
Constructed 2014

Round Pond, Peju,
St. Supery, Foley Johnston

River Station 93+50, Reach 6, Peju-St. Supery Bank Stabilization Area 1, West Bank

July 2014

March 2015

December 2014

River Station 92+00, Reach 6, Peju-St. Supery Bank Stabilization Area 1, West Bank

December 2014

Boulder Cluster, BSSR 1, March 2015

March 2015

LWD Structure, BSSR 1, March 2015

River Station 103+00, Reach 6, Round Pond Secondary Channel Inlet

July 2014

March 2015

December 2014

River Station 104+50, Reach 6, Round Pond Secondary Channel Inlet LWD Structure

December 2014

March 2015

March 2015

River Station 97+00, Reach 6, Round Pond Secondary Channel, Mid-reach

July 2014

March 2015

December 2014

River Station 95+00, Reach 6, Round Pond Secondary Channel, Mid-reach

July 2014

March 2015

December 2014

River Station 91+00, Reach 6, Round Pond Secondary Channel, Outlet

July 2014

March 2015

December 2014

River Station 91+00, Reach 6, Round Pond Secondary Channel, Outlet

July 2014

March 2015

December 2014

Reach 9
(Phase 5)

Constructed 2014

Laird, United
Swanson and Opus One

River Station 29+25, Reach 9, Laird Bank Stabilization Area 2, East Bank

July 2014

December 2014

March 2015

River Station 25+25, Reach 9, United Bank Stabilization Area 3, East Bank

July 2014

March 2015

December 2014

River Station 22+50, Reach 9, United Bench 1, Upstream to Downstream, East Bank

July 2014

December 2014

March 2015

River Station 20+00, Reach 9, United Bench 1, Downstream to Upstream, East Bank

July 2014

March 2015

December 2014

LWD, Bench 1,
March 2015

River Station 9+00, Reach 9, Swanson Bench 2, Upstream to Downstream, East Bank

July 2014

March 2015

December 2014

LWD, Bench 2,
March 2015

River Station 7+50, Reach 9, Swanson Bench 2, Downstream to Upstream, East Bank

July 2014

December 2014

March 2015

River Station 7+50, Reach 9, Opus One Bench 3, Downstream to Upstream, West Bank

July 2014

December 2014

March 2015

River Station 9+00, Reach 9, Opus One Bench 3, Upstream to Downstream, West Bank

July 2014

December 2014

March 2015