Ryan Creek Migration Barrier Replacement Project

California Department of Fish and Wildlife Grant Award #P0910515

FINAL REPORT
October 15, 2013

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Project Start and End Dates: June 01, 2011 through December 20, 2013

Summary

Ryan Creek is a tributary to Outlet Creek in the Willits area of Mendocino County, California. The project is located at 39°28'45.87"N, 123°21'40.79"W (T19N, R14W, Section 24, MDBM on the USGS Willits 7.5-Minute Quadrangle Map) and is accessible by taking Highway 101 north out of Willits approximately 5 miles, turning right onto Ryan Creek Road. The private driveway that accesses the crossing is located 500 feet upstream. There is a gate on the driveway.

This project is part of a comprehensive series of restoration projects on Ryan Creek that began in 2007 with a design grant from the California Coastal Conservancy. That grant contributed to designs to remove or modify four salmonid barrier structures and to place large wood habitat in the stream. The barriers, beginning downstream and moving upstream, consisted of a complete barrier on Ryan Creek Road, a Mendocino County road; an undersized partial culvert barrier under Highway 101; and a complete barrier on a private driveway 300' upstream of Highway 101 (this project). The fourth barrier is on the North Fork of Ryan Creek and remains the only project that has not moved beyond the conceptual design phase. An initial design for this project site was completed in 2009 and revised in 2013 based on the 2012 preliminary design completed for the Caltrans crossing (located downstream of this project).

The crossing constructed under this grant was the last barrier on this creek. In 2011 a downstream migration barrier structure (on Ryan Creek Road, a Mendocino County maintained road) was removed and replaced with a full stream simulation bridge. Large wood structures were installed on ~800' of the stream between the County road and the Highway 101 stream crossing concurrent with that County road migration barrier removal project.

Construction on this project began in August 2013 and was completed in September 2013 with post construction surveying and plantings being done in December 2013. The private driveway is owned by Clarence Rhine of Willits, CA.

Ryan Creek is a tributary to Outlet Creek which is a major tributary to the Eel River. Outlet Creek and Ryan Creek are one of the few headwater tributaries of the Eel River that support coho salmon. The drainage area for the main stem of Ryan Creek is ~1.1 square miles, with at least 7,092 feet (1.34 miles) of useable, inaccessible spawning and rearing habitat upstream of the project crossing.

The project restored access to high quality spawning and rearing habitat and restored fairly natural hydraulic function and watershed processes in an important coastal watershed for the following federally listed species that are all currently at the project site:

California Coast Chinook Salmon (*Oncorhynchus tshawytscha*) – Threatened
Southern Oregon/Northern California Coast Coho Salmon (*Oncorhynchus kisutch*) – Threatened
Northern California Coast Steelhead (*Oncorhynchus mykiss*) – Threatened
Pacific Lamprey (*Lampetra tridentata*) – Unlisted but in serious decline

Objectives included:

- Provide full fish and flood/debris passage at the Ryan Creek private crossing consistent with NOAA/NFMS Fish Passage Criteria;
- Improve stream conveyance;
- Eliminate the potential for approximately 3,600 cubic yards of road prism fill from delivering to Ryan Creek and connected downstream watersheds, including the Outlet Creek and the Eel River;
- Reconnect downstream watersheds areas consistent with the 2004 Upper Main Eel River and Tributaries (including Tomki Creek, Outlet Creek and Lake Pillsbury) Total Maximum Daily Loads for Temperature and Sediment (EPA, Region IX);

- Decrease the potential for upstream headcutting if the road should fail;
- Improve the flow capacity at the Rhine Driveway crossings
- Reintroduce large wood routing in the stream;
- Restore natural stream function upstream of the crossing and restore the site using native vegetation

This project encompassed all of the preparatory work to replace the migration barrier, completion of supplemental permit and design analysis, purchasing the crossing structure (multi-plate arch culvert), developing the staging area for the project, construction of the project, pre and post-project photo monitoring documentation and monitoring reports, and rehabilitation of the project site. The costs presented in this report are for all work and expenses incurred through December 31st, 2013.

This project is part of a larger cooperative effort by Mendocino County and the Five Counties Salmonid Conservation Program (5C) to protect, maintain and restore anadromous salmonid habitat and water quality while also enhancing public infrastructure. More information on those efforts can be obtained at www.5counties,org.

Rhine Driveway Project before with 5' corrugate metal culvert looking downstream (left) and restored channel with 14' wide multi-plate arch culvert (right).

Rhine Driveway Project before with 5' corrugate metal culvert looking upstream (left) and restored channel with 14' wide multi-plate arch culvert (right).

See attached project location map.

Table 1: Detailed Budget Information

PERSONAL SERVICES	CDFG	NOAA	Caltrans	Coastal Conservancy	Total Project Cost
Level of Staff					
Project Coordinator(s)	$4,778			$1,626	$6,404
Benefits	$2,605			$838	$3,443
					$0
Project Director	$1,877			$2,968	$4,844
Benefits	$1,467			$1,979	$3,446
					$0
Field Technician 1	$0			$672	$672
Benefits	$0			$168	$168
TOTAL PERSONAL SERVICES	**$10,727**			**$8,249**	**$18,977**
OPERATING EXPENSES					
PWA Monitoring		$12,102			$12,102
Conduct Vegetation Clearing	$2,500				$2,500
Install Diversion Structure	$3,000				$3,000
Structural Excavation	$4,500				$4,500
Install Temporary Shoring	$10,000				$10,000
Remove & Dispose of CMP culvert	$700				$700
Assemble & Install 18' wide x 10' tall x 100' long multiplate arch culvert	$100,000				$100,000
Install Engineered Streambed Material	$10,500				$10,500
Install Structural Backfill	$26,250				$26,250
Deliver & Place Rock Slope Protection	$3,000				$3,000
Install Rock Base for Driveway	$500				$500
Excavator & Operator	$4,000				$4,000
Loader & Operator	$3,000				$3,000
Grader & Operator	$500				$500
Dump Truck & Operator	$1,000				$1,000
Roller & Operator	$80				$80
Mobilization	$5,000				$5,000
Erosion Control	$0				$0
Purchase LWD	$0				$0
Install LWD	$3,000				$3,000
Environmental & Regulatory Compliance					$0
CDFG 1602 Permit				$1,673	$1,673
Caltrans Encroachment Permit			$500		
Mendocino County Grading Permit				$2,746	
Mendocino County Design Inspection				$1,031	
Aquatic Species Assessment		$4,540			$4,540
Revegetation					$0
Native grass seed	$800				$800
Mulch - certified weed free straw	$150				$150
Riparian tree seedlings	$750				$750
TOTAL OPERATING EXPENSES	**$179,230**	**$16,642**	**$500**	**$5,450**	**$197,545**
SUBTOTAL	**$189,957**	**$16,642**	**$500**	**$13,699**	**$216,521**
Administrative Overhead	**$18,996**	**$1,664**		**$1,370**	$22,030
GRAND TOTAL	**$208,953**	**$18,306**	**$500**	**$15,069**	**$238,551**

Purpose and Need

Five Counties Salmonid Conservation Program (5C)

This project is part of a larger cooperative effort by Mendocino County and the Five Counties Salmonid Conservation Program (5C) to protect, maintain and restore anadromous salmonid habitat and water quality while also enhancing public infrastructure. While a private road rather than a county project, this project represents the 71st salmonid migration barrier removal project that the 5C program and/or its member counties have completed since 1998. The projects have restored more than 146 miles of habitat.

The 5C Program is a non-profit organization formed by the counties of Del Norte, Humboldt, Mendocino, Siskiyou and Trinity. The 5C working cooperatively with the counties and other partners have contributed to over 150 projects in these counties since 2000. Their goal is to formulate strategic land use conservation standards and implement practices to restore fisheries habitat. Developed in 1997 as a result of the listing of coho salmon as Threatened under the federal Endangered Species Act, the 5C Program's migration barrier removal strategy is an essential step toward conservation of the Southern Oregon-Northern California Coast Coho (SONCC) coho salmon. The Ryan Creek project continues 5C efforts, both barrier removal and sediment reduction, aimed at maintaining and restoring salmonid habitat within the Ryan Creek watershed.

Ryan Creek Project Fisheries Benefit

This project was funded from three funding sources to remove a fish barrier at Ryan Creek on the Rhine's private driveway. This project will combine benefits in conjunction with the improved crossing on Ryan Creek Road by Mendocino County and a future project on State Highway 101 to be completed by Caltrans. The size, complexity, and permitting timelines for all three barrier removal projects on Ryan Creek necessitated that barrier removal be completed in consecutive construction seasons as discussed below. A fourth barrier, on a tributary to Ryan Creek (North Fork Ryan Creek), on Highway 101 has not been addressed as of the preparation of this report.

Prior to 2011, the culvert on Ryan Creek Road (Mendocino County) blocked 2.8 miles of upstream habitat in Ryan Creek. The private road crossing blocked 1.34 miles of that habitat and the Highway 101 crossing on the North Fork blocks 1.39 miles of habitat. Ryan Creek is located within the Southern Oregon-Northern California Coast coho ESU, California Coastal Chinook ESU, and the Northern California Steelhead Distinct Population Segment (DPS). The SONCC coho salmon ESU has declined in abundance over the past several decades due to the loss of, and damage or change to, the natural environment. Water diversions for agriculture, flood control, domestic, and hydropower purposes have greatly reduced or eliminated historically accessible habitat and degraded remaining habitat. Loss of habitat complexity has also contributed to the ESU's decline. NOAA's National Marine Fisheries Service, Southwest Regional Office, lists several limiting factors to the SONCC coho, including but not limited to, agricultural operations, dams, road crossings (bridges, culverts, low-water fords), and streambed alteration. Some of the priority recovery actions listed for this ESU include: completing and funding a population-monitoring plan, improving freshwater habitat quantity and quality, improving road construction and road maintenance practices and, removing/upgrading high-priority man-made fish passage barriers. The California Coast Chinook Salmon ESU is the southernmost portion of the species' North American range. Threats include artificial barriers, road crossings (e.g., bridges, culverts, and low-water fords), forestry operations, and streambed alteration.

The following limiting factors, and their level of threat to this DPS, were identified in the 2006 *Pacific Coastal Salmonid Restoration Fund Report to Congress*: channel structure and complexity (moderate threat), riparian areas & LWD recruitment (moderate threat), water quality (moderate threat), and fish passage (high threat). Several priority recovery actions are needed for the California Coast Chinook Salmon ESU, including the following: "improving freshwater habitat quantity and quality; protecting and restoring habitat complexity and connectivity from the upper watershed to the ocean; conducting focused freshwater habitat restoration in salmon streams (e.g., erosion control, bank stabilization, riparian protection and restoration, and reintroduction of large woody debris); improving county and city planning, regulations (e.g., riparian and grading ordinances), and county road maintenance programs, like those

implemented under the 5C Program. Northern California Steelhead face a wider array of threats than salmon, including loss of habitat critical to juvenile and smolt survival (loss of side channel and stream complexity), as well as threats from water impoundments and diversions. Road crossings (e.g., bridges, culverts, and low-water fords), streambed alteration, and water pollution are additional threats. Priority recovery actions needed include: improving freshwater habitat quantity and quality; conducting focused freshwater habitat restoration in anadromous salmonid streams (e.g., erosion control, bank stabilization, riparian protection and restoration, and reintroduction of large woody debris); and removing high-priority fish passage barriers"[1].

Outlet Creek has one of the longest migrating populations of coho salmon in California is found in the upper tributaries of Outlet Creek. Coho salmon have recently been observed in the tributaries to Little Lake Valley including Ryan, Willits, Baechtel, Broaddus, and Mill Creeks. The 2004 Recovery Strategy for California Coho Salmon lists several problems facing coho in the Outlet Creek HSA including "above optimum summer water temperatures, quantity and quality of pools, limited escape cover, sedimentation resulting from stream-bank failure and the road system, limited shade canopy, and barriers to fish migration." Coho salmon were found immediately below the crossing on private driveway crossing addressed in this project – see fish removal results below.

Ryan Creek Project
This project has restored access to high quality spawning and rearing habitat and restored fairly natural hydraulic function and watershed processes in an important coastal watershed for the federally listed species. Before removal in 2013, the 5' metal culvert on Ryan Creek at the Rhine Driveway, effectively blocked access to approximately 1.34 miles of anadromous fishery habitat. The 5' metal culvert with 5' overflow culvert with an approximate 1.5' jump was replaced with a 14' x 12' multi-plate arch.

Commencing August 12th, the 5' diameter corrugated metal pipe (CMP) culvert was removed and replaced with an 100 foot long 14-foot span corrugated metal multi-plate arch, implementing a full stream simulation design through the road crossing. The old culvert created a 1.5' jump at the outlet that did not allow for full fish passage. Both existing culverts were partially rusted through and had begun to collapse in several places. Also, the undersized crossing reduced passage of bedload and debris associated with the high flows. The full stream simulation design complies with the *NMFS Guidelines for Salmonid Passage at Stream Crossings* (September 2001 as amended), allowing for the 100-year flood flows and associated bedload and debris to pass safely through replacement structures. This treatment minimized the potential for future culvert failures in larger storms (<100 year storms). The pre-existing culvert at the Rhine Driveway overtopped on relatively small storms, due in part to a backwatering effect caused by the State Highway 101 crossing immediately downstream, with a significant loss of hydraulic efficiency (creek flows are above the culvert inlet and half-way up the upstream fill face) at the 10-year flow. The new crossings reduce potential maintenance costs associated with storm flows and culvert plugging, and eliminate the potential for delivery of approximately 3,600 cubic yards of road fill material into the downstream reaches of Outlet Creek and the Eel River.

Objectives included:
- Provide full fish and flood/debris passage at the Ryan Creek private crossing consistent with NOAA/NFMS Fish Passage Criteria;
- Improve stream conveyance;
- Eliminate the potential for approximately 3,600 cubic yards of road prism fill from delivering to Ryan Creek and connected downstream watersheds, including the Outlet Creek and the Eel River;
- Reconnect downstream watersheds areas consistent with the 2004 Upper Main Eel River and Tributaries (including Tomki Creek, Outlet Creek and Lake Pillsbury) Total Maximum Daily Loads for Temperature and Sediment (EPA, Region IX);
- Decrease the potential for upstream headcutting if the road should fail;
- Improve the flow capacity at the Rhine Driveway crossings
- Reintroduce large wood routing in the stream;

[1] http://swr.nmfs.noaa.gov/recovery/Salm_Steel.htm

- Restore natural stream function upstream of the crossing and restore the site using native vegetation

All objectives were met.

Background information:

Ryan Creek is located in the Southern Subbasin of the Outlet Creek Hydrologic Subarea (HSA), within the Middle-Upper Main Eel Recovery Unit (2004 *Recovery Strategy for California Coho Salmon* and *Outlet Creek Basin Draft Watershed Plan Assessmen*t - Coastal Watershed Planning and Assessment Program*;* CWPAP). Outlet Creek is one of the headwaters of the Eel River, the third largest river system in California. The Outlet Creek Basin drains an area of 160 square miles of Northern California's Coast Range and both historically and currently, Chinook and coho salmon and winter-run steelhead trout inhabit the Basin. Ryan Creek is tributary to Outlet Creek, and consists of approximately five stream miles. It flows west, entering Outlet Creek about 16.3 miles upstream from the Eel River confluence. Outlet Creek consists of ~18 stream miles, flowing northeasterly and entering the Eel River at river mile 126, seven miles above Dos Rios. Tributaries to Outlet Creek, such as Ryan Creek, are considered to be higher quality habitat than Outlet Creek itself. The surrounding area is vegetated by coniferous and hardwood forests in a steep terrain ranging from 1,400 to 2,200 feet in elevation.

Ryan Creek flows into Outlet Creek approximately one-half mile below the Mendocino County Road crossing on Ryan Creek Road (#301C). The crossing addressed in this project is located ~ 900 feet upstream of the County road crossing and 300 feet upstream of the State Highway 101 on a private driveway owned by Clarence Rhine of Willits, CA. The drainage area is ~1.1 square miles, with at least 7,092 feet (1.34 miles) of useable, mostly inaccessible spawning and rearing habitat upstream of the crossing. To summarize, there are four major barriers to fish passage in the Ryan Creek watershed – the county road crossing, the State Highway 101 crossing, the crossing addressed in this project and another Highway 101 culvert crossing at Milepost 52.36 on the North Fork of Ryan Creek. The Mendocino County Road crossing on Ryan Creek was upgraded in the summer of 2011. The design firm of Prunuske Chatham, Inc. (PCI) was hired to complete the design for the Rhine driveway site in April 2007. The PCI design called for an 18' wide by 9' arch to be embedded. 5C Program consulted with Mendocino Country DOT engineer Howard Dashiell during project permitting and implementation.

The Eel River is California's third largest river system, and was historically the third largest producer of salmon and steelhead. It also hosts populations of green sturgeon, lamprey eel, and the southernmost population of coastal cutthroat trout. However, like many river systems, the Eel River has suffered the combined effects of poor road design and construction, inappropriate logging and grazing practices, hydroelectric development, excessive water diversions and over-fishing. Coastal salmon population estimates for the Eel River are difficult to obtain. However, the California Department of Fish and Game (CDFG) estimated an annual spawning escapement of 82,000 steelhead in the Eel River in 1964, though this number dropped to about 20,000 fish in the late 1980s (CDFG 1997). Excepting the barriers to migration, Ryan Creek habitat is in excellent condition. It provides "excellent habitat for state and federally listed anadromous fish, including: Chinook salmon, coho salmon and steelhead." Surveys by the CDFG dating to the early 1970s document the presence of steelhead, Coho salmon, Chinook salmon, and lamprey eel at the County barrier. Projects that provide unimpeded fish passage in the Eel River watershed have been identified as a high priority in the CDFG's 2004 *Recovery Strategy for California Coho Salmon*. Outlet Creek, of which Ryan Creek is a tributary, is also identified as one of the highest priority coho watersheds in the *Recovery Strategy*, due in part to the fact that it has one of the longest migrating populations of coho salmon within California. It is also noteworthy that a recent FERC decision on the Eel River will amplify the benefits of small habitat restoration projects like this one. Following a protracted and controversial relicensing proceeding at the Potter Valley Project (P-77), a hydroelectric facility on the Upper Eel River, the National Marine Fisheries Service issued, on November 26, 2002, a final biological opinion ensuring significantly increased flows below the Cape Horn Dam. Cape Horn Dam is a diversion facility located approximately 33 miles above Dos Rios and 26 miles above the confluence of Outlet Creek with the Eel River. Prior to the improved flow regime resulting from the Biological Opinion,

most migrating salmonids remained trapped during low flow periods near Outlet Creek at Dos Rios and nearby riffles, at least 33 miles below the diversion. As a result, many of the tributaries between the diversion and Dos Rios, such as Outlet Creek, were rendered inaccessible to migrating fish. Ryan Creek has been indirectly affected by the operations of the Potter Valley Project. However, with the newly required flow regime, there is now a far higher likelihood that enhancement and restoration projects below the Ryan Creek project area will benefit salmon more effectively, due to the fact that the increased flows will better enable those populations to access high quality habitat streams like Ryan Creek at the appropriate times.

The State Highway crossing was visually assessed during the Caltrans District 1 Inventory to Fish Passage Barriers and ranked as the #8 priority in the District (the NF site ranked as #2 and given the proximity, both crossings were programmed into a current design grant that the 5C Program had from the State Coastal Conservancy in 2005). Project design work started in July 2005 and continued through April 2007. The private driveway crossing was visually examined during a 2006 site visit with the design consultant and the Technical Advisory Team for this project, including Marcin Whitman & Scott Harris (CDFG), Tom Daugherty (NMFS), Lucy Kostrzewa & Tim Ash (Caltrans), Michael Bowen (Coastal Conservancy) and Christine Jordan (5C). Design work for Prunuske Chatham to scope out a replacement or retrofit option for this crossing was approved under the same Conservancy design grant. A FishXing assessment was completed on both the State Highway crossing and private driveway crossing by Prunuske Chatham and in summary, the State Highway crossing is 48% passable for adult salmonids and 5% passable for juveniles. The private driveway crossing addressed in this project is 12% passable for adults and 0% passable for juveniles. The State Highway crossing is a 5-foot diameter, 125-foot long corrugated metal pipe set at grade with minimal slope. It has a concrete apron invert. The private driveway crossing consists of two 5-foot diameter corrugated metal pipes under a 25-foot embankment. One culvert is 40% crushed in the middle and the other is starting to rust through on the bottom. The northern pipe is 102-feet long, set slightly lower in elevation than the southern pipe receives the natural flow from upstream. This culvert is perched approximately 1.5 feet above the pool below. The driveway slope is approximately 20% and increases to roughly 30%. The project design is to replace the existing corrugated metal pipes with another culvert structure as a re-route of the driveway is not feasible, nor is a bridge due to the driveway slope and embankment fill. The poor condition of the existing culverts precludes a retrofit option.

The Coastal Conservancy has invested approximately $102,230 in project design costs for <u>all</u> four crossings in the Ryan Creek watershed since 2004. Caltrans, Mendocino County, and the 5C Program have also contributed approximately $50,000 of additional in-kind time and resources to completing design, permitting, and plan assessment for the Crossings.

Although multiple ownerships can render projects infeasible, it is notable that the 5C Program has obtained landowner permission for the project from all of the project owners at all crossings, notably working in cooperation with Clarence Rhine (current owner of the private crossing) and Mendocino County on the county crossing, but also coordinating with landowners on the SF and NF Caltrans sites. All facility owners and managers agree that the barriers should be remedied as soon as possible.

Project Description

<u>Original Design</u>

The project underwent slight design revisions from January 2013 to April 2013, based on downstream design considerations at the Highway 101 crossing and other factors. The crossing structure dimensions were modified from an 18’ x 9’ multi-plate arch to an equivalent functioning 14’ x 12’ multi-plate arch. The new design was modeled in HecRas and found to meet the same design criteria as the previous structure, but reduced the size of excavation needed. The revised design was submitted to NMFS Santa Rosa (David White) for review for consistency with NMFS Guidelines for Salmonid Passage at Stream Crossings/CDF&W Habitat Restoration Manual criteria on May 14th, 2013. Mr. White conducted a site review with 5C staff on May 14th, 2013 and approved the final design revision on 6/21/2013.

Final Design and Construction

The existing northerly culvert was replaced with a 13-foot 10-inch wide x 12-foot 2-inch tall, 100-foot long embedded multi-plate arch structure, following the stream simulation design. The southerly culvert was left in place and sealed. This design will allow for improved fish passage of all life stages for coho, Chinook, steelhead and Pacific lamprey.

Trees, slash and rootwad material removed through the construction process at the crossing to access the project site were installed for the LWD component upstream and downstream of private crossing or used as erosion control on the fill faces. Removal of any non-native riparian vegetation was completed, including removal of star and bull thistle from the spoils area, as necessary and replanted with native riparian trees and shrubs.

The 5C Program managed all elements of the project, with assistance from contractor Pacific Watershed Associates, subcontractor Garmin Construction and from Howard Dashiell of Mendocino County Department of Transportation (MDOT). The private driveway crossing was completed with coordination with Clarence Rhine. It is not anticipated that debris will build up behind this site, due to the design of passing the 100-year flows and associated bedload and debris. The project was competitively bid out for construction and 5C Project Managers Mark Lancaster and David Colbeck conducted all aspects of construction management, reporting and permit compliance.

Permitting

Between April and August, several unanticipated permitting requirements were added to the project including a Mendocino Grading Permit, an additional Caltrans Encroachment Permit, and payment for the CDF&W 1600 Agreement fee.

Construction Activity Summary

In June, 2013 the Northwest CA RC&DC 5C Program (5C) contracted Pacific Watershed Associates (PWA) to assist in the construction supervision, selection of a General Contractor to construct the project and to provide geologist oversight of slope structural safety and general construction in exposed cut areas. Pacific Watershed Associates was directed to select a contractor based on experience, cost, and availability to complete work in the limited operating period. Garmin Construction of Willits CA was selected in mid-July.

The multi-plate arch structure was ordered from Pacific Corrugate Pipe on July 26th with an anticipated delivery date of August 19th to the work site. on July 30th and 31st the 5C Program staff surveyed the stream channel from Highway 101 to 200' upstream of the construction area, set benchmarks, established photo points, laid out construction controls, and held a pre-construction site review with PWA and Garmin Construction. During that work period 5C staff pulled all Canadian/bull thistles from the construction site. An Agreement between 5C and PWA/Garmin was finalized on August 10th. At the same time, the MDOT agreed to conduct inspections of bolting patterns and torque of the multi-plate and to test compaction of the fill, under an existing Memorandum of Agreement with the 5C.

Aquatic Species Relocation

Fish capture and relocation was coordinated by Ross Taylor and Associates and CDFW biologist Scott Harris. Fish relocation took place over two days and was done concurrent with the stream rerouting. A fish relocation report was submitted to Scott Harris by Ross Taylor on August 15th, 2013. Juvenile coho were found below the project reach but were not present immediately upstream of the crossing. Throughout the construction period, aquatic species found between the block nets were netted and transported downstream of the project reach.

On August 13th RTA conducted pre-project depletion estimates in channel reaches downstream and upstream of the perched culvert. The objective was to determine if there were differences in fish numbers above and below this suspected partial migration barrier. In each reach, two electrofishing passes were made, with fish from the first-pass held until the second-pass was completed. The upper reach was located between the culvert inlet and the exclusion fencing erected for the pre-project fish relocation. The lower reach was located downstream of the lower exclusion fence and was only bounded by the exclusion fence on its upstream end. The upstream reach was 75 feet long, the downstream reach was 82 feet long, and both reaches had three small pools where most of the fish were captured during the electrofishing depletions. The differences in population estimates for the channel reaches downstream and upstream strongly suggest that the private culvert is at least a partial barrier to adult salmon and steelhead, and a complete barrier to juvenile salmonids[2].

Creek Dewatering and Water Quality Protection

On August 12th and 13th Garmin Construction, PWA, and 5C staff installed fine-meshed block fish exclusion screens to prevent fish and other aquatic dependent species from entering the worksite. Fish exclusion screens were located approximately 50 ft upstream of the culvert inlet and 80 feet downstream of the outlet. The downstream screen was located below the confluence of the bifurcated creek channel flowing through the two culverts. Surface creek flows were rerouted through the existing overflow channel culvert through a 2" fire hose and returned to the main channel, just below the downstream fish exclusion net. A perforated plastic sand bag was placed at the end of the fire hose conveying surface flows through the project to assure that no creek bed scouring occurred at the point of discharge. Two submersible electric pumps, one 2½" gas pump, and an emergency overflow 8" diameter HDPE pipe were installed to convey surface flows around the work area. Power was supplied to the work site from a home adjacent to the Ryan Creek project site.

A diversion dam was constructed downstream of the upper fish exclusion fence and upstream of the construction zone. This structure consisted of a shallow excavation and temporary dam faced with plastic sheeting to collect surface flows in order to pump creek water around the project. A section of flexible plastic pipe was laid through the plastic sheeting to convey any surface flows around the project should a large summertime-storm increase stream flows or should power to the submersible pump be cut off. An oil-trapping absorbent floating boom system was placed across the creek downstream of the water diversion return flow before the start of construction to protect the stream from any accidental oil or petroleum discharge.

A sump hole was dug in the creek at the bottom of the project site to facilitate removal of turbid water with a submersible pump controlled by a float valve to the downstream flood plain. A second sump hole was

[2] Ross Taylor and Associates "Report of Biological Monitoring for Ryan Creek Fish Passage Projects" was submitted to Scott Harris on August 28th, 2013.

dug in the creek bed at the top of the project to remove as much interstitial flow from the excavation site as possible. Turbid water caused by construction activities and interstitial creek flow was collected at the bottom of the construction area and pumped onto the hillside downstream. This water was discharged to the ground in a vegetated flat area approximately 80 feet from the top of the bank. The discharge pipe was relocated periodically (twice a week) to prevent saturation of the ground and potential surface flow returns to the creek. A perforated HDPE flexible pipe was affixed to the end of the discharge pipe to facilitate the dispersal of water across a large area.

During construction of the diversion system, creek flows were interrupted for a short time resulting in the partial dewatering of riffles downstream of the construction site. Pools in the creek remained and water temperatures were not affected. The situation was recognized and surface flows were immediately returned to the creek.

The spoils site was located in a clearing 50' Rhine Driveway from the construction site. Silt fencing was installed at the down slope side of the spoils site to prevent surface runoff and sediment transport in the case of summer storms. Additional sediment control materials, including tarps and silt fencing, were kept on hand should weather (wind or rain) conditions change. During work stoppages, including weekends, construction crewmembers monitored the works site to assure creek flows were maintained through the project and that the spoils site was stable. Straw and silt fencing was installed above the existing culvert at the upstream and downstream edge of the excavation area in order to prevent sediment traveling to the creek during the work stoppage, see below.

Left - Straw mulch and silt fencing was used during extended shut down periods to prevent erosion and delivery of sediment from the excavation site. Right – use of perforated pipe to distribute turbid discharge across the floodplain.

Detour Installation

Access to homes cutoff by construction activities was maintained by opening up a historic forest road at post mile 51.9 of Highway 101. Negotiations between Caltrans, CalFire and the 5C program resulted in the

issuance of an encroachment permit by Caltrans on September 9, 2013 to reopen the road. The delay in approval by Caltrans represented a preventable hardship on property owners directly affected by the project. During the period between the removal of the private drive and final opening up of the forest access road, All-Terrain Vehicles were provided by Garmin Construction to shuttle residents from the forest road berm to their homes. The forest road berm was rebuilt with boulders following completion of the project.

Culvert Removal

Clearing & Grubbing: On August 14th, 2013 Garmin Construction began clearing and grubbing of the road fill. All contractor safety, fire prevention and water quality protection equipment was checked and verified by 5C staff. Approximately 0.25 acres of vegetation was cleared to allow for equipment access and excavation of the existing culvert and roadfill at the crossing, including several small to moderate diameter Douglas-fir, Big leaf maple and White alder trees. The spoils site was cleared by Clarence Rhine prior to project initiation.

Channel Excavation and Construction of Crossing Structure

On August 16th Garmin began excavation of the road fill materials and stopped on August 24th at the top of the existing 5' diameter culvert when it was apparent that the multi-plate arch delivery was going to be delayed until September 3rd. MDOT engineering staff inspected and tested the excavated material for suitability as fill and determined it was appropriate.

Between August 24th and September 3rd work focused on erosion control, maintenance of surface flows and temporary drainage structures for the open channel and spoils site area. During this slowdown period CDFW biologist Harris relocated fish downstream of the fish exclusion nets to the Highway 101 crossing and placed additional exclusion nets at that location.

On September 3rd and 4th the remaining fill, culvert and subgrade excavation was completed. The culvert excavation alignment, grade and embeddedness was confirmed to be in agreement with design specifications. Garmin Construction completed construction of the multi-plate culvert on site. MDOT personnel conducted inspections of bolt installation and torque based on manufacturer recommended specifications. On September 7th the assembled arch (constructed on the road edge) was lowered and set in place. At the same time Garmin Construction placed a slurry grout to the height of the culvert spring line to form a bed and side support for the arch. Sub-grade rock ribbons was installed shortly thereafter.

Streambank Stabilization & Road Construction

Between September 7th and September 15th road fill was placed in lifts. MDOT conducted compaction testing concurrent with fill placement. Fill compaction exceeded 90% in the fill face and 95% on the road surface as per design requirements. Concurrent with fill construction, large wood was placed in the channel (utilizing both small diameter material stockpiled after grubbing activities and rootwads unburied during excavation of the fill) and the streambed material was installed into the channel. Streambed materials consisted of river-run rock that required minimal amendments to achieve the desired streambed mixture. The streambed was installed using a small bulldozer and rented, tracked skid-steer. Jetting occurred over one day using a water truck and re-circulated runoff. Half-ton rock-slope protection was installed upstream and downstream of the new culvert to prevent any scour and increase fill stability. The downstream portion of the channel was re-contoured to reduce the potential for scour on the right bank. The existing overflow culvert was plugged using large rock intermixed with streambed mix. During the entire construction period diversion pumps and fish exclusion netting were checked and maintained as necessary.

Due to the steepness of the road grade and concerns by the landowner, the road was widened as much as possible. The width of fill was limited by the existence of the overflow culvert which was left in place n. The excavated area fill was expanded as wide as possible and the fill face was benched, faced with half-ton and smaller rock, bucket-compacted, faced with small woody debris produced on-site and vegetated. Revegetation of all disturbed areas was completed in fall, 2013.

Equipment used during the period included: 3 excavators, 2 dozers, 2 loaders, 1 dump truck, 1 skid steer, 1 lowboy and tractor, 2 submersible electric water pumps, 1 grout pump, 3 concrete trucks, 1 water truck, numerous air tools, hand tools, saws and similar tools.

After the major construction work at the crossing was completed, the oil-absorbing boom(s), diversion structures and fine-meshed block nets were removed. All excavation work within, or adjacent to, the stream was conducted during the dry period specified in a CDFG 1602 agreement (from June 15-October 15). No fill material was placed within the annual high water mark or in a location that could potentially deliver to the stream. Fugitive dust emissions were moderated by wetting the traveled portion of the disturbed road and did not create a significant adverse impact on air quality during construction.

Water for control of dust during excavation and grading operations was sourced off-site by Garmin Construction. The project plans and specifications included requirements for the contractor to control fugitive dust emissions and follow state laws regarding vehicle emissions. Excavation and removal of the culvert and roadfill, the installation of the new culvert structure and the subsequent natural adjustment of the streambed gradient may have a short-term effect on sediment levels downstream of the project area. Construction activities are subject to water quality limitations imposed by the NCRWQCB specific to turbidity and sediment. Turbidity levels were visually monitored throughout construction. As mandated by the NCRWQCB, the project did not place, discharge, dispose of, or deposit in such a manner as to permit to pass into the waters of the state, any substances or materials, including, but not limited to, soil, silt, bark, slash, sawdust, or petroleum, in quantities deleterious to fish, wildlife, beneficial functions of riparian zones, or the quality and beneficial uses of water within the State. The installation of an oil-trapping absorbent floating boom immediately downstream of the project area as well as revegetation of all disturbed areas ameliorated these impacts

Upon project completion the necessary final erosion controls were implemented at the project sites. All disturbed areas including the new inboard and outboard fill slopes and adjacent streambanks were re-vegetated with native seed species/ riparian tree plantings and mulched with certified weed-free material. The newly excavated streambanks were stabilized as applicable for the project site. No excess spoils materials were produced during this. Spoils storage was in accordance with the Roads Manual BMPs, stored in a manner as not to deliver to a stream (see description above).

Project Monitoring (see attached report)
Photo Monitoring: Photo documentation of pre-project, construction activities and post-project conditions were completed.

Longitudinal Profile/Thalweg Monitoring: Pre-project longitudinal and thalweg surveys have been completed. A Post-project longitudinal profile survey was completed following construction. Similar monitoring will be conducted at the County Road Ryan Creek project site and will tie in to this project's survey.

Biological Monitoring: Ross Taylor and Associates have been contracted to survey the stream for spawning salmonids during the winter of 2013-14.

Other Monitoring: A monitoring plan to assess the physical and biological effectiveness of the project is included in the project design. All monitoring will be conducted by 5C staff & a fishery biologst, and/or CDFW staff biologists. Estimating population response to project implementation is challenging. However, the 5C Program expects a rapid increase in spawning and rearing fish within one year of project

completion. Post-project monitoring for vegetation re-establishment, structural stability, and periodic monitoring for population response at the project site will be part of the monitoring regime for at least two years following construction (through December 2012). It is anticipated that CDFG surveys will continue past 2013.

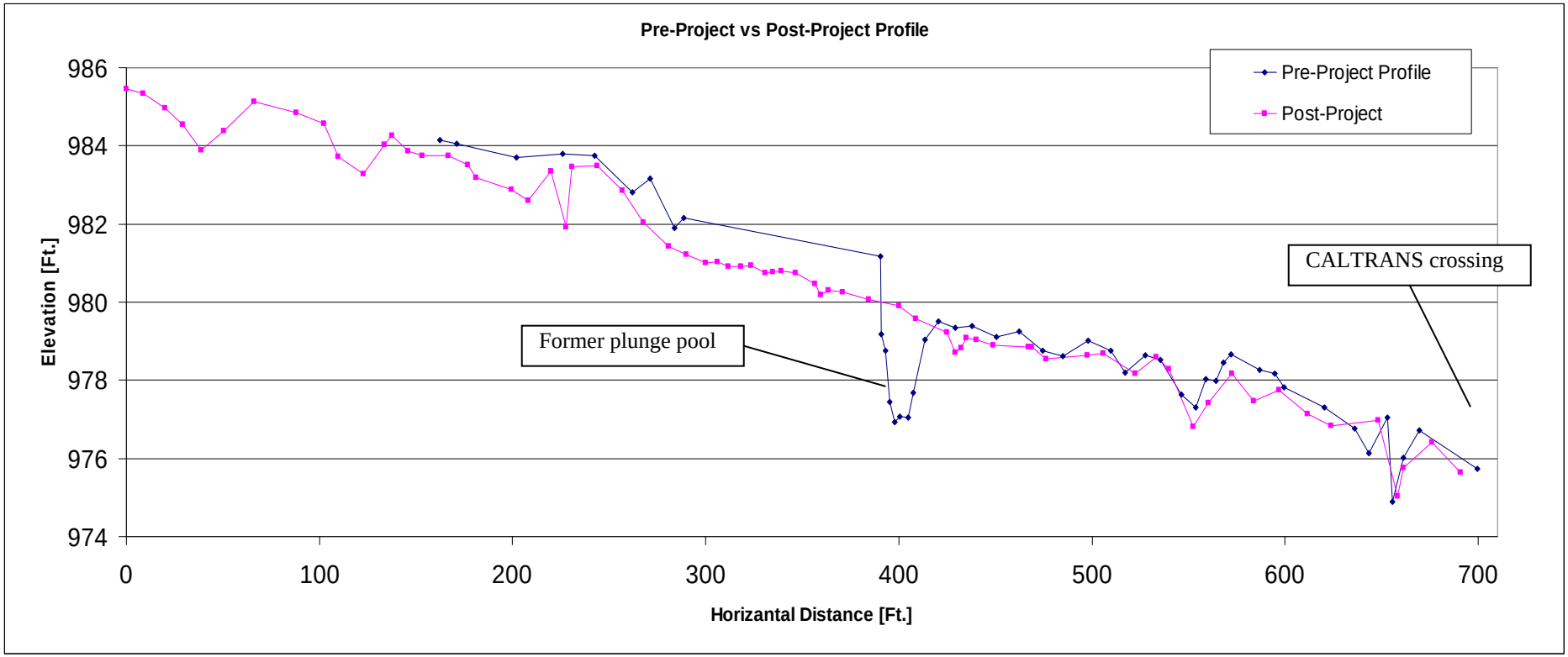
Quantitative Results

A. Stream length treated/assessed/made more accessible (distance in feet): **7,092 feet (1.34 miles)**
B. Instream habitat structures to be installed (number): **0**
C. Fencing length to be installed/repaired (distance in feet): **0**
D. Road length treated/assessed (distance in miles): **0**
E. Stream crossings treated (number): **2**
F. Sediment prevented from entering the stream (volume in cubic yards): **3,600 cubic yards**
G. Trees planted (number): **10: Big Leaf Maple, Oregon Ash, Alder, Redwood at 10-15 foot spacing**
H. Area planted/preserved/assessed (area in acres): **0.25 acres total (area reseeded along riparian zone and the staging area**
I. Public meetings (number): **0. Public meets were not required. One newspaper article was published on August 22, 2013 in the Willits Weekly.**
J. Public meeting attendees (number): **Not applicable**
K. Students trained (number): **0**
L. Juvenile fish produced: **0**
M. Released: **0**
N. Spoils volumes: **0**

Measure Category	**Measure**
Stream crossings treated to improve fish passage (number)	2
Stream length opened for fish passage by improving stream crossings (miles)	1.34 miles
Bridges installed or improved (number)	0
Rocked fords replaced (number)	N/A
Road crossings removed (number)	N/A
Total length of stream made accessible by removing blockages (miles)	1.34 miles
Total blockages/impediments/barriers removed/altered (number)	2
Overall stream length treated (miles, count one side of stream only)	.04
Length of aquatic habitat disturbed (feet)	200
Area (footprint) of instream features installed within bankfull channel (square feet)	3800 ft^2

Refer to attached brief photo log of the construction and project location map.

LONGITUDINAL PROFILE/THALWEG MONITORING



Note: Variations in the pre and post-project are caused, in part, by slight channel adjusted due to trees falling in the creek and associated root wads creating new pools. This tree fall was not caused by project construction as they were located outside of the area of any activity. Also, slight discrepancy exists between the pre-project survey and the post-project survey –specifically with the location of the CalTrans Highway 101 crossing located at the bottom right of the graph. This difference is caused by the horizontal distance between data points varying between each survey. Normally, this is correctable by stretching one graph to correspond to another by matching data points (non-moving, exactly known physical points). However, the post-project survey was completed in the winter under snowy conditions and an inadequate number of matching points were collectable. Because the surveys are of a relatively short distance, this discrepancy is small.