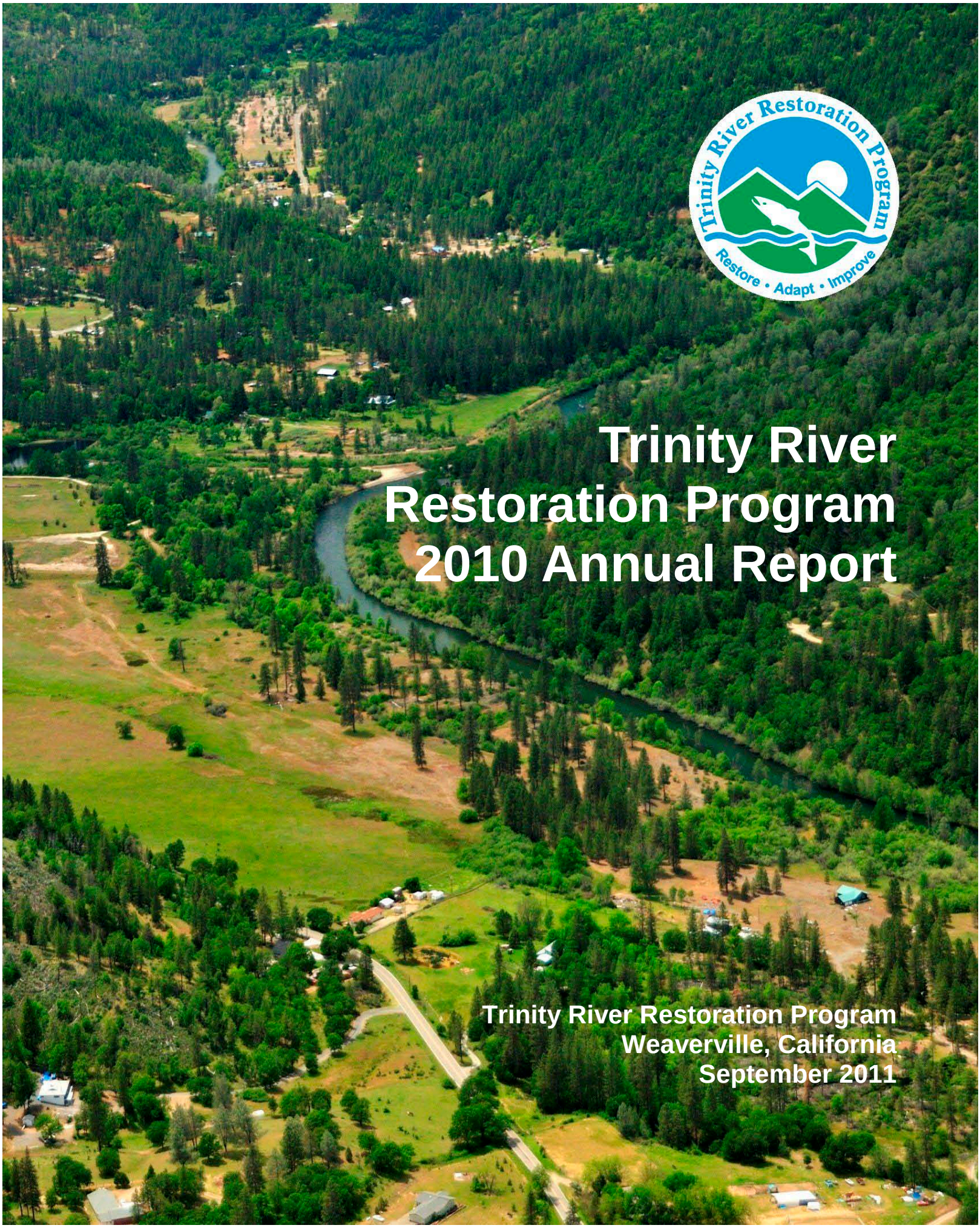

Trinity River Restoration Program 2010 Annual Report

Trinity River Restoration Program
Weaverville, California
September 2011

Trinity River Restoration Program

Thank You

To the Trinity River Restoration Program partners for their contributions to this report.

ON COVER: Aerial view of Lowden Ranch and Trinity House Gulch sites prior to rehabilitation.

ABOVE: The reconstructed sites undergoing a high-flow release in 2011

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Figure 1. Geographic overview of the Trinity River between Lewiston Dam and the North Fork (approximately 40 river miles), located within the Klamath watershed in northern California.

Introduction

Background

The Trinity River Restoration Program (TRRP or the Program) was founded in 2000, based on three comprehensive foundational documents: the Record of Decision (ROD; U.S. Department of the Interior 2000), the Trinity River Environmental Impact Statement (U.S. Fish and Wildlife Service et al. 2000), and the landmark Trinity River Flow Evaluation Final Report prepared by the U.S. Fish and Wildlife Service and the Hoopa Valley Tribe (USFWS and HVT, 1999). The ROD provides a permanent flow allocation for the Trinity River based on five different water-year types varying from critically dry to extremely wet years. The ROD also established the Trinity Management Council (TMC) and stated that the TMC will establish and guide an Adaptive Environmental Assessment and Management (AEAM) program to monitor and evaluate the physical and biological responses to restoration activities. The TMC oversees the refinement of flow schedules and other activities to ensure that the ultimate goal of restoring the fishery resources of the Trinity River is achieved.

Former Secretary of the Interior Bruce Babbitt and Hoopa Valley Tribal Chairman Duane Sherman signing the Record of Decision in 2000

The Program is administered by the Department of the Interior, Bureau of Reclamation and co-managed with the following program partners: the U.S. Fish and Wildlife Service (USFWS), the Hoopa Valley Tribe (HVT), the Yurok Tribe, Trinity County, the California Resources Agency (consisting of California's Department of Water Resources and Department of Fish and Game), the U.S. Forest Service (USFS), and the National Marine Fisheries Service. All serve on the TMC. The Program has a main office located in Weaverville, California, that is staffed by physical, environmental, and biological scientists, technicians, and administrative specialists. Scientists and technical specialists from the program partner agencies and from local governments and organizations participate with Program staff on cooperative planning, design, implementation, and scientific assessment efforts. Program activities include physical habitat modifications to the river, monitoring of river responses, and reviews and recommendations for future modifications or enhancements to current management actions (e.g., flow releases from dams, fishery harvests, hatchery practices).

Record of Decision Activities for the Trinity River

1. Flow Management – a variable flow regime based on five water-year types to mimic natural flows
2. Mechanical Channel Rehabilitation – treatments to reshape the current channel form to allow physical processes to create and maintain fish habitat
3. Sediment Management – augmentation of spawning gravels and reduction in fine sediments
4. Watershed Restoration – a basin-wide program to reduce fine sediment input to the Trinity River
5. Infrastructure Improvements – modification of structures in the floodplain to allow peak flows
6. Adaptive Environmental Assessment and Monitoring – a rigorous program to monitor and improve restoration activities through experience
7. Environmental Compliance and Mitigation – measures to minimize or eliminate short-term impacts

The program partners meet and share management and funding decisions through the TMC. Technical staff from all program partners meets in collaborative working groups and teams to discuss, develop, design and implement Program activities. Other interested parties provide advice and recommendations to the TMC through a stakeholder group known as the Trinity Adaptive Management Working Group. Members of this group represent interests of local citizens groups, Federal agencies, two counties, business interests, conservation groups, and water users from the Central Valley.

Mission

The mission of the Program is to restore fisheries and wildlife to the Trinity River using a set of procedures outlined in the three foundational documents (http://www.trrp.net/?page_id=3175) while still providing beneficial flows to the Central Valley. The river was dammed and most of the flow was diverted to the Sacramento Valley beginning in 1963 as part of the Trinity River Division of the Central Valley Project, a Bureau of Reclamation Federal water development program for California. The diverted water enters the Sacramento River near Redding, California, and provides for a variety of uses such as agriculture, industry, drinking water, recreation, electrical power generation, and habitat. By 1970, it became apparent that the diversion of water was a cause of the declining fisheries in the Trinity River (USFWS and HVT 1999). Federal legislation at that time and in subsequent years has called for a variety of protections to the river, including protection of pre-dam levels of fisheries and of Native American tribal rights for access to Trinity River fish. The studies of the river, culminating in the Record of Decision, concluded that the best option to both continue water deliveries to the Central Valley Project and recover fisheries in the Trinity would require the commitment of approximately one-half the inflow to Trinity Reservoir for instream flows in the Trinity River, as well as a set of physical restoration projects to increase habitat for fish.

Goals

The goals to restore the Trinity River to a healthy alluvial river and to benefit anadromous fisheries are articulated in the founding documents and supported by the TRRP. Implementation activities are the actual restoration efforts on the river; complimentary adaptive environmental assessment

and monitoring activities provide periodic evaluations of the success of the program in meeting habitat and fishery restoration goals. This new learning is incorporated into future planning and design for new restoration activities.

More information on the Trinity River, the TRRP and the Central Valley Project is available through links provided in the References section at the end of this annual report.

The Program in 2010

The Program has passed the decade mark and, during this period, has focused on the first five goals outlined in the ROD. The five goals placed a priority on physical restoration of the river to create attributes of an *alluvial river system* (Figure 2) that are known to enhance habitat for anadromous fish species.

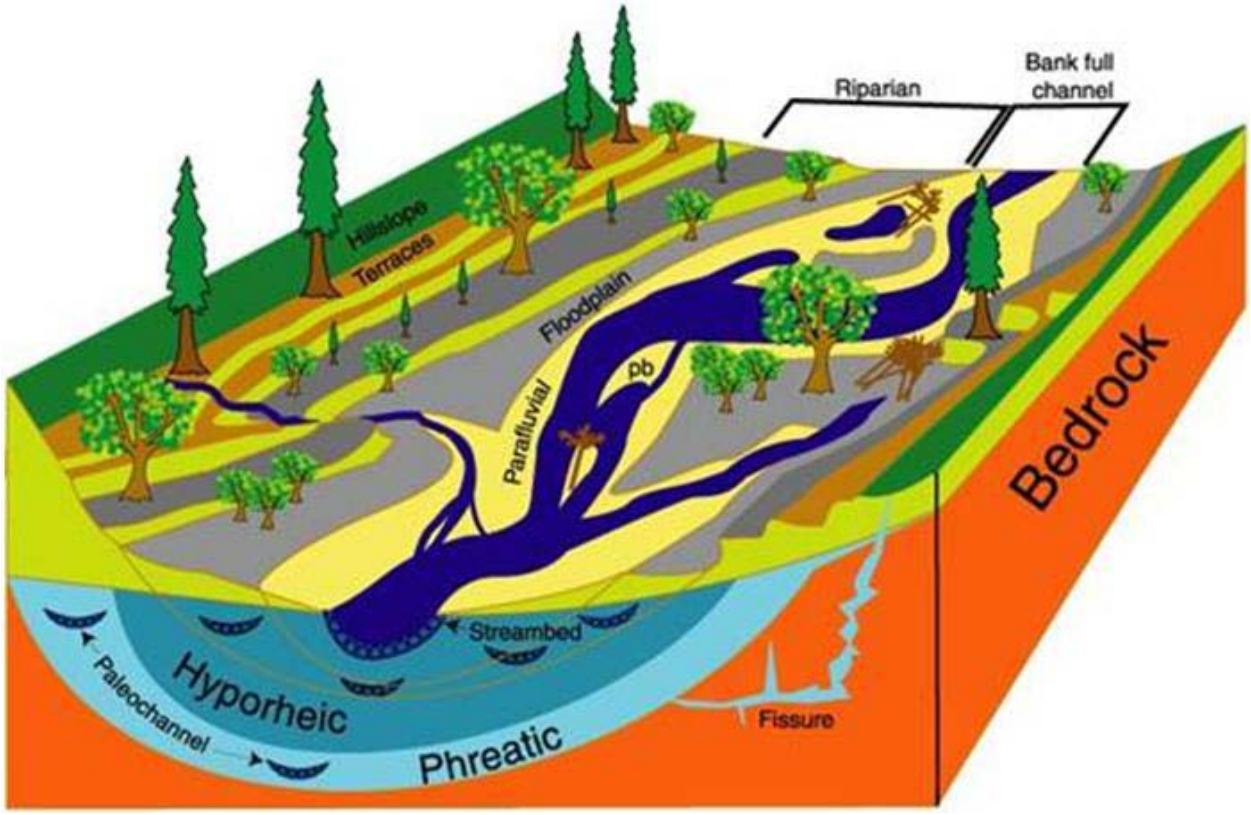

Figure 2. Conceptual view of an alluvial river (a river with bed and banks made up of mobile materials). Alluvial rivers are shaped by the magnitude and frequency of the flows and floods, and the ability of these floods to erode, deposit, and transport sediment. Alluvial rivers can assume a number of forms based on the properties of their banks, the flows they experience, the local riparian ecology, and the amount, size, and type of sediment that they carry. (Source: Stanford and Lorang, 2005, used by permission.)

2010 was considered a normal water year. The incorporation of inter-annual (between year) differences in water years into planning for intra-annual (within year) program flow scheduling has provided variability in scheduled flows over the past decade with the purpose of achieving dynamic conditions in the managed river.

The 2010 annual report describes activities to restore river function and anadromous fisheries through a suite of activities, as prescribed by the ROD, which include a variety of physical rehabilitation, sediment management, and watershed projects by the broad partnership that co-manages the TRRP. The information accumulated from 10 years of restoration activities has led to a new understanding of the river's physical and ecological conditions and how it responds to changes. This understanding can now be incorporated into future designs, planning, evaluations and adaptation of management actions. This report provides concise summaries of major program activities with our partners, as well as citations, references, and contacts for readers who desire more information. Accomplishments are organized by the seven Program goals (ROD priorities) and are provided as short, technical sections with updates on annual results and significant findings.

Funding and Expenditures

Program funding has mostly varied between $10 million and $15 million per year since 2002, but full funding for adequate implementation of all ROD activities is considered to be $16.4 million per year. Funding in excess of full Program funds was received in 2010, in part due to the passage of the American Recovery and Reinvestment Act (ARRA). The Program received a total of $16.66 million, as shown in the table below.

Fiscal Year 2010 Funding (in millions of dollars)	
BUREAU OF RECLAMATION	
Water & Water-Related Fund	7.45
CVPIA* Restoration Fund	1.75
ARRA Fund	5.08
CALFED** Fund	0.20
U.S. FISH AND WILDLIFE SERVICE	
FY 2010 Appropriations	2.18
TOTAL	16.66

*Central Valley Project Improvement Act
**CALFED Bay-Delta Program

Most of the funding supported physical modifications to the river and the associated watershed, modifications to floodplain infrastructure, and the monitoring of physical and biological responses. Other partner agencies contribute in-kind services to support Program activities.

The Program budget allocations for administration, implementation, and science and monitoring were about $2.7 million, $9.3 million, and $4.7 million, respectively.

Activities and Accomplishments

Flow Management

Restoration flows are intended to:

- Clean spawning gravels,
- Build gravel/cobble bars,
- Scour sand out of pools,
- Provide adequate temperature and habitat conditions for fish and wildlife at different life stages,
- Control riparian vegetation, and
- Perform many other ecological functions.

Restoration high flow, spring 2010

In order to mimic some of the inter-annual variation that is naturally found within the Trinity Basin, the ROD defines five water-year types along with the a minimum volume of water to be released into the Trinity River for each (Table 1). An annual flow release recommendation is developed through a collaborative process. The TMC makes the final flow recommendation, which is then forwarded to the Bureau of Reclamation, Central Valley Operations office.

The 2010 water year was classified as a "normal" water-year type. The corresponding water allocation for restoration releases is 647,000 acre-feet (0.8 km^3). The actual flow releases from Lewiston Dam for the 2010 water year are shown in Figure 3.

Table 1. Annual water volumes for in-stream flow releases, probability of occurrence, and annual basin runoff thresholds

Water Year Type	Restoration Water Allocation[1]	Annual Basin Runoff Above Lewiston Gage[1]	Probability of Occurrence[2]
Extremely Wet	815	>2,000	12 years out of 100
Wet	701	1,350 to 2,000	28 years out of 100
Normal	647	1,025 to 1,350	20 years out of 100
Dry	453	650 to 1,025	28 years out of 100
Critically Dry	369	<650	12 years out of 100
Average (weighted by probability of occurrence)	594.6		

[1] In thousands of acre-feet (1 acre-foot ≈ 1.23 million cubic meters).
[2] Probability based on data from years 1912 to 1994.

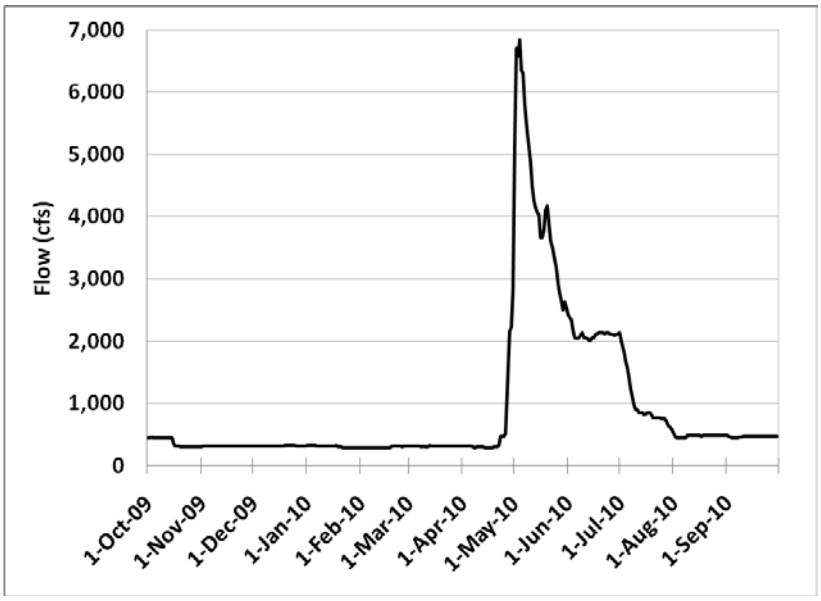

Figure 3. Actual flow releases from Lewiston Dam to the Trinity River for water year 2010. Daily average data from gage # 11525500 – Trinity River at Lewiston, CA, operated by the U.S. Geological Survey.

The summer base flow was 450 cubic feet per second (cfs) (12.7 m^3/s)[1] and winter base flow was 300 cfs (8.5 m^3/s). The spring high flow releases are timed to correspond with the natural snowmelt runoff. Releases above 2,500 cfs are intended to reconfigure the channel, scour riparian vegetation, build gravel bars, and flush sand. Releases below 2,500 cfs (70.8 m^3/s) are intended to control water temperatures and

[1] Metric conversions in this document are rounded to avoid implying a greater degree of precision than the original measurement supports. For instance, although 12.742 m^3/s would be a more accurate equivalent of 450 cfs, that would imply precision to within a thousandth of a cubic meter, which is not supported by the original measurement.

promote riparian growth on floodplain surfaces. Taken as a whole, these actions should improve habitat abundance and quality.

Mechanical Channel Rehabilitation

The second element of the Program's restoration strategy directs the creation of a dynamic alluvial channel exhibiting all the characteristics of the pre-dam river, within the geomorphic bounds of the river and limited flow releases. Finished projects are intended to work in conjunction with restoration flows, which are expected to:

- Promote alternate bar sequences and low velocity habitat for salmonid fry,
- Increase habitat complexity to provide life history habitats for anadromous fishes, and
- Allow the river to maintain itself as an alluvial system in both treated and untreated areas.

The ROD calls for 47 channel rehabilitation projects in the upper 40 miles (64 km) of river below Lewiston Dam. Through adaptive management and monitoring, projects now include construction of natural riverine features such as floodplains, point bars, forced meanders, mid-channel islands, side channels, alcoves, and other features of natural alluvial systems.

A new side channel at the Trinity House Gulch site was one of the projects funded by the American Recovery and Reinvestment Act.

Three major projects funded by ARRA were completed during the 2010 construction season: Lowden Ranch, Trinity House Gulch, and Reading Creek. Work at the three project sites treated more than 2 miles (3.2 km) of mainstem river length and restored approximately 20 acres (8.1 hectares) of new floodplain. A total of 181,000 cubic yards (138,400 m^3) of excavated material was sorted and redistributed within the site to build floodplains, side channels, forced meanders, and split-flow features; 29,000 cubic yards (22,200 m^3) of fill was placed in the form of coarse sediment point bars and islands; and more than 400 trees were used to construct large wood structures for geomorphic and habitat development.

Sediment Management and Watershed Restoration

The third and fourth elements of the Program's restoration strategy relate to management of coarse and fine sediments.

As these sediments compose both the bed and banks of the river channel, managing their supplies is key to developing complex channel topography and diverse physical aquatic habitat.

Coarse Sediment

Gravel being placed in the river at a high-flow injection site near the mouth of Grass Valley Creek during the 2010 spring flow release.

Coarse sediment augmentation is intended to replace the loss of gravel behind the dams and increase the availability and quality of physical habitat by promoting the processes of scour and fill that maintain bars, pools, spawning beds, and other elements of channel complexity. Progress toward these goals is assessed by measuring coarse sediment transport, by estimating sediment fluxes, and by a variety of geomorphic mapping and surveying activities.

A total of 14,500 cubic yards (11,090 m^3) of coarse sediment was introduced into the river in FY2010, including 11,400 cubic yards (8,720 m^3) placed as constructed gravel bars at three rehabilitation sites and 3,100 cubic yards (2,370 m^3) introduced as high-flow injections at two locations near Lewiston. Such additions are designed based on analyses indicating that beneficial changes to the bed sediment composition can be best achieved by adding an average of approximately 7,000 cubic yards (5,350 m^3) of coarse sediment per year to the upper river (Gaeuman 2008). Future augmentation plans include repeated gravel additions at four long-term augmentation sites near Lewiston, as well as the construction of several large bars at rehabilitation sites currently in the design phase.

The Program monitors the effects of gravel augmentation on pool depths and water surface elevations near gravel augmentation sites and in sensitive areas downstream.

Fine Sediment

The Program teamed with the Trinity County Resource Conservation District and local stakeholders to complete or initiate eight priority watershed projects using $360,700 from the Program and $275,000 in matching funds. These projects were designed to reduce fine sediment inputs to the Trinity River by preventing sediment production and delivery to tributary streams. Project work in 2010 included road upgrades in the Democrat Gulch, China Gulch, Phillips Gulch, Soldier Creek, and Bierce Creek watersheds; an erosion control project in the area burned by the Coffin Fire; and planning and design

for riverine sediment control projects along Indian Creek and Sidney Gulch.

Infrastructure Modification and Improvements

The fifth element of the restoration strategy is to upgrade bridges and other public and privately owned structures to withstand higher ROD flows. As of 2010, upgrades to bridges and private properties were substantially complete. Minor upgrades may be needed in the future as a result of changes to the river from mechanical channel rehabilitation or from high-flow events.

Floodplain Mapping

The project to remap the 100-year floodplain is progressing well. Trinity County, a private contractor (Waterworks), and the Department of Water Resources are continuing efforts to revise the Federal Emergency Management Agency's flood maps. A contract modification was issued for work to continue through December 2012.

Adaptive Environmental Assessment and Management

The Trinity River, like other alluvial river systems, is complex and dynamic. Our understanding of the Trinity River and how it will respond to restoration actions is continually improving. Adaptive Environmental Assessment and Management, the sixth element of the Trinity River restoration strategy, is a systematic approach for improving future management decisions by learning from outcomes of past actions. This section includes a description of significant achievements on various AEAM fronts.

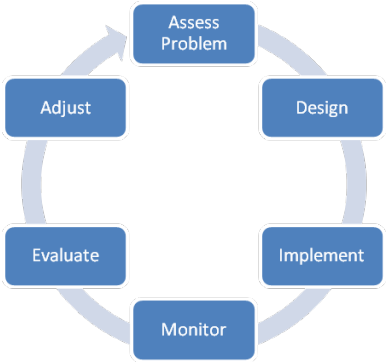

Diagram illustrating the steps of the adaptive management process.

Sediment Workshop

In August 2010, the Program hosted a sediment workshop attended by physical scientists from partner organizations, as well as external experts. The purpose of the workshop was to examine the high-flow-release magnitude and duration objectives and to recommend potential experiments using high-flow releases and coarse sediment augmentation to build bars and to test whether these actions could create desired channel

complexity. The concept that emerged from the workshop is that large bars are deposited during the highest magnitude flows, and topographic complexity is created as the flows decline. The workshop culminated in a recommendation to conduct a "Build and Carve" adaptive management experiment to test the concept. The purpose of the proposed experiment would be to increase understanding of the maximum bar growth and channel complexity response possible under the ROD restoration actions.

Sediment Transport Monitoring

Sediment transport monitoring during peak flows.

Sediment transport measurements made at four locations along the mainstem Trinity River during the May 2-6, 2010, peak flow release represent the seventh consecutive year of this ongoing monitoring program, making this one of the most comprehensive datasets of its kind in existence. Sediment transport information is used to assess numerous aspects of river management, including coarse sediment augmentation, fine sediment source control, and flow scheduling. Results of sediment monitoring demonstrate that the Program is meeting its stated objective of increasing coarse sediment storage and decreasing the amount of fine sediment to promote channel complexity and habitat. Recent studies indicate that the quantity of gravel stored in the Lewiston area continues to increase (Wilcock 2010; Gaeuman 2011). By the end of 2010, coarse sediment storage through the first 20 miles (32 km) downstream from Lewiston Dam had attained a level similar to or greater than the amount that existed at the time of dam closure. Less than 700 tons (635 metric tons) of coarse sediment passed the most downstream sediment monitoring station at Douglas City, whereas nearly 18,000 tons (16,300 metric tons) entered the reaches upstream, mostly from gravel augmentation. Meanwhile, storage of fine bed sediments (i.e., the sand and very fine gravels that can clog spawning beds and fill pools) continues to decrease in the upper river. The most recent sediment budget report (Gaeuman 2011) estimates that the total quantity of fine bed material stored upstream from Douglas City decreased by more than 25,000 tons (22,700 metric tons) from 2004 through 2010.

Scour chain recovery at the mid-Valdor Gulch monitoring site. The chain was recovered under 2.4 in. (6 cm) of fresh substrate and recorded 2.0 in. (5 cm) of scour in response to the WY 2010 peak ROD release.

Bed Mobility and Scour Monitoring

Bed scour and bed mobility were monitored using a combination of painted tracer rocks, scour chains, and topographic surveys at nine sites during the May 2010 spring release as a part of the Interdisciplinary Habitat Assessment

Project. Results showed that the 2010 flow release was largely successful in meeting bed mobility management objectives for the normal water year type identified in Chapter 8 of USFWS and HVT (1999).

Riparian Vegetation

Prior to construction of Trinity and Lewiston Dams, large floods on the Trinity River constrained riparian vegetation. Since flow regulation began, vegetation has encroached and stabilized the river channel, restricting riverine ecological processes. However, abundant riparian vegetation is known to be good for salmonids, birds and other wildlife. This contrast is at the heart of the Program's complex management of vegetation. The goal of the Program's revegetation is no net loss of riparian cover within 10 years, and riparian cover placed more appropriately for the development of healthy functioning riparian areas.

Willow planting at Sawmill about 1 year after planting (taken April 2011).

At the Sawmill Rehabilitation Project site, constructed in late 2009, existing vegetation was retained when possible and large wood was brought in to increase habitat complexity. Native species were planted to increase diversity, with woody riparian species (e.g., cottonwoods, as well as arroyo, red, and shiny willows) primarily on floodplains, and wetland and riparian understory species (e.g., sedges, rushes) along the low-water edge and in wetland areas.

Riparian vegetation monitoring included vegetation mapping at 12 channel rehabilitation sites that were completed between 2005 and 2010, and system-wide evaluations at 11 other sites. Vegetation measures included: structural complexity, extent, species richness, age diversity, and riparian woody regeneration within different flow zones. System-wide, riparian vegetation responded uniformly where narrowleaf willow dominated within the 300- to 2,000-cfs (8.5- to 57-m^3/s) flow zones. As of 2010, restoration flows appear to inhibit hardwood seedling establishment along the 450-cfs (12.7-m^3/s) water surface. Few willows, alders, or cottonwoods have reestablished there, and these hardwoods also have not been detected on constructed floodplain surfaces.

Where removal of vegetation left root materials behind, restoration flows have been insufficient to prevent regrowth from root sprouts (particularly for willows). It is unlikely that such regrowth from root sprouts will be scoured from the low

water's edge. Since root sprouts may ultimately exert more influence than seedlings in controlling geomorphic channel processes, grubbing roots is highly recommended for future rehabilitation efforts. While the vegetation is young and has not yet caused the channel to simplify, it will be important to monitor areas of woody plant regrowth along the summer water's edge to determine whether the short-term gain of juvenile rearing habitat is sufficient to mitigate the threat of vegetative re-encroachment, subsequent channel simplification, and the lack of periodic flooding.

Fisheries

Juvenile Salmonid Outmigrant Abundance

Chinook salmon fry.

To estimate abundance of naturally produced age-0 Chinook salmon outmigrating from the upper Trinity River, the HVT Fisheries Department conducted sampling at Pear Tree Bar, located approximately 39 miles (63 km) downstream of Lewiston Dam. A second site located near Willow Creek, operated by the Yurok Tribal Fishery and the USFWS, was used to monitor annual age-0 Chinook production, and to assess Program performance objectives for outmigrating juvenile Chinook salmon, juvenile coho salmon and steelhead smolts.

Yearling coho salmon hiding under wood near Lewiston Dam.

From January through August, 2010, abundance estimates of Chinook salmon were: 1,575,410 (±326,300) at the upriver site and 3,018,480 (±391,982) at the lower river site. The mean migration rate between the two sites was 8.4 miles (13.5 km) per day (±5.8 miles or 9.4 km per day). The 80-percent population outmigration date for juvenile Chinook salmon at the lower river site was July 12, which missed the outmigrant objective of July 9. The 80-percent population outmigration date objectives for juvenile coho salmon (June 4) and steelhead (May 22) at the Willow Creek trap were met in 2010. Earlier outmigration timing probably enhances fish survival, as it allows them to pass through the lower Trinity River before the temperature increases later in the season.

Juvenile Chinook Salmon Disease Monitoring

Fish disease outbreaks in the lower Klamath River have a detrimental effect on outmigrating juvenile Trinity River salmon and steelhead. From April through August 10, 2010, juvenile Chinook salmon migrating through the lower Klamath River were examined for the incidence of two infectious

diseases caused by parasites. Lab analysis detected *Ceratomyxa shasta* in 19.8 percent (37/187) and *Parvicapsula minibicornis* in 69.5 percent (130/187) of juvenile Chinook salmon tested. Detection of disease organisms does not necessarily mean the fish will succumb to the disease. See final summaries on the USFWS Arcata Office web site: http://www.fws.gov/arcata/fisheries/projectUpdates.html.

Adult Run-Size Estimation

Run-size estimates (escapement and harvest) for Trinity River spring- and fall-run Chinook salmon, coho salmon, and adult fall-run steelhead are made annually above two mainstem Trinity River weir sites at Junction City and Willow Creek (CDFG 2010). Preliminary adult escapement estimates and Program escapement goals are presented in Table 2. Total Trinity River basin escapement is currently estimated for fall Chinook only. Spring Chinook, coho and fall-run steelhead escapement estimates shown in Table 2 do not reflect basin totals. Once escapement estimates are finalized, the numbers of hatchery fish spawning in natural areas will be calculated. (See CDFG 2010 for past years.)

Table 2. Preliminary 2010 Adult Escapement Estimates for Trinity River Salmonids (CDFG 2011a, b)

[Spring Chinook salmon are estimated above Junction City Weir; coho salmon and fall-run steelhead are estimated above Willow Creek Weir; and fall Chinook salmon are a total-basin estimate.]

Species	Natural Escapement		Hatchery Escapement	
	2010 Run	Program Goal	2010 Run	Program Goal
Spring Chinook salmon	5,609	6,000	2,447	3,000
Fall Chinook salmon	22,055	62,000	7,748	9,000
Coho salmon	4,203	1.400	2,477	2,100
Fall steelhead adults	6,613	40,000	2,037	10,000

Adult Fall Run Chinook Salmon Harvest

Estimates of fall-run Chinook adult returns to hatcheries and spawning grounds within the basin, as well as the basin-wide harvest by Tribal and recreational fisheries, are reported in the annual *Klamath River Basin Fall Chinook Salmon Spawner Escapement, In-River Harvest, and Run Size Estimates*, 2010 Run (KRTT 2011; CDFG 2011a,b).

Yurok Tribal fishery and lower Klamath recreational fishery harvest is composed of naturally produced Chinook salmon

The Trinity River Hatchery is on the left bank of the river just downstream from Lewiston Dam.

from the Trinity and Klamath Rivers and their major tributaries. Hatchery contributions to the harvest are from the Trinity River Hatchery and from the Iron Gate Hatchery on the Klamath. Harvest in the Hoopa Tribal fishery consists of fall-run Trinity River Chinook.

The 2010 Yurok Tribal harvest totaled 26,363 adult fall-run Chinook salmon, of which 4,186 were from Iron Gate Hatchery and 2,982 were from Trinity Hatchery. Preliminary estimates indicate that the remaining natural component was composed of 12,535 Klamath and 6,659 Trinity naturals.

The 2010 recreational harvest of fall Chinook salmon in the lower Klamath River, below the confluence with the Trinity River, was 3,194 adults. Preliminary analyses of these data indicate that 139 were Iron Gate Hatchery fall-run Chinook, 392 were Trinity Hatchery fall-run Chinook, and 2,663 were natural fall-run Chinook.

The preliminary estimate for the 2010 HVT tribal harvest of adult fall-run Chinook salmon was 3,810, of which 2,057 were of Trinity Hatchery origin and 1,753 were of natural origin.

The Lower Trinity total sport harvest estimate of 2010 adult fall-run Chinook salmon below Willow Creek Weir was 235, consisting of 68 hatchery and 167 natural-origin Chinook.

Genetic Basis of Maturation and Run Timing of Spring- and Fall-Run Klamath River Chinook Salmon

Genetic stock identification methods allowed verification of stock-specific maturation and run timing of Klamath Basin Chinook salmon *(Oncorhynchus tshawytscha*) across two sampling years (2009 and 2010). The spring run entered the Klamath Estuary first, followed by the Klamath fall run (Iron Gate Hatchery, Bogus Creek, Shasta and Scott Rivers), and then the lower basin fall run (Blue, Terwer, and Horse Linto Creeks). The Trinity and Salmon Rivers fall run entered from May through October. The spring-run fish, by entering as early as May, reside in freshwater up to four months prior to spawning, compared to as little as one month for their fall-run counterparts. Accordingly, upon freshwater entry, the earlier returning fish had the greater fat reserves, but they appeared to be a smaller size at maturity. At spawning, the Trinity River Hatchery spring- and fall-run fish, after travelling the same distances, had the same relative egg size and numbers.

Redd Distribution and Abundance

The mainstem Trinity River is surveyed each fall to determine the distribution of salmon spawning. The distribution of spawning by natural-origin Chinook salmon, and the relative run size of natural versus Trinity River Hatchery origin fish, are expected to change in response to improved fry-rearing habitat conditions created through Program activities. A total of 3,782 redds (Chinook and coho salmon) were mapped from September 14 to December 21, 2010, from Lewiston Dam to Cedar Flat. Using the distribution of 1,741 spawned female carcasses recovered over the same portion, we estimate 2,623 of these redds were constructed by natural-origin Chinook salmon females and 549 were constructed by hatchery-origin Chinook salmon females (Figure 4).

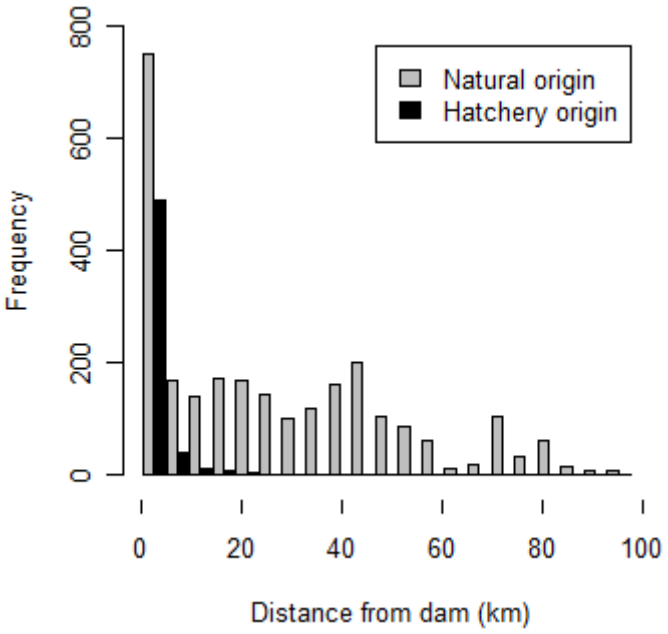

Figure 4. Spatial distributions, starting at Lewiston Dam of mainstem Trinity River redds constructed by natural-origin and hatchery-origin Chinook salmon females, fall 2010.

A total of 238 redds were mapped in the mainstem Trinity River from Hawkins Bar to Weitchpec. Due to storms and water turbidity, the surveying season in this portion of the river was cut short; redds were undoubtedly constructed after the last observations. Fifteen spawned female carcasses were recovered in these lower river reaches, one of which was a hatchery-marked coho salmon, but no hatchery-marked Chinook salmon females were encountered. Based on the makeup of spawned female carcasses in these reaches, an estimated 218 redds were constructed by Chinook salmon, all of natural origin.

Trinity River Hatchery (TRH) Steelhead Straying Assessment

In 2010, rates of straying of adult hatchery steelhead into natural spawning areas were examined. To detect adult hatchery pre-spawned steelhead movements, fish were tagged with passive integrated transponder tags at TRH. Substantial numbers of hatchery steelhead were observed returning to the TRH following initial pre-spawn release. Hatchery steelhead strayed into Deadwood, Rush and Grass Valley Creeks. Evidence suggests that adult TRH steelhead stray into and spawn in the upper mainstem Trinity River and upper tributaries following pre-spawn return to the river at TRH.

Adult Fall Chinook Salmon Disease Monitoring

Monitoring of ich and columnaris levels began in response to the 2002 Klamath River fish kill, which resulted in the death of 33,000 to 67,000 adult Chinook salmon. The primary cause of the Klamath River fish kill was an epizootic outbreak caused by ich and columnaris. In general, healthy fish are resistant to columnaris. Columnaris is observed among adult Chinook salmon in the Klamath River every year to some extent, whereas the outbreak of ich in the Lower Klamath River during 2002 was unprecedented. A total of 102 adult Chinook salmon were sampled in 2010 with only 8 confirmed cases of columnaris observed and not a single incidence of ich.

Fish Habitat Assessment

Channel Rehabilitation Site Assessment—
A post-construction habitat assessment was conducted at the Sawmill Rehabilitation Site by mapping the boundaries of the habitat using the numeric criteria for water depth, velocity and presence of cover or substrate. After construction, total fry and pre-smolt rearing habitat increased 42 and 29 percent, respectively. Optimal habitat increased 96 and 88 percent for fry and pre-smolt, respectively, across the entire site. These increases in both quantity (total habitat) and quality (optimal habitat) were the second largest increases observed since post-construction assessments began in 2008 (Sven Olberston Rehabilitation site was the highest). Also, compared to the previously evaluated sites, the Sawmill site ranked highest in optimal habitat densities and second highest in total habitat densities. (See table below).

Fish Diseases

Ich (*Ichthyophthirius mulitifilis*) is a large protozoan that infects fish and other species, including salmon, trout, and frogs, commonly under warm-water conditions. The parasite burrows into the skin, leaving grainy, salt-like lumps that are visible to the naked eye.

Columnaris is an external disease that can be chronic or progress to acute symptoms, including advanced skin and gill necrosis. The disease, caused by *Flavobacterium columnare* bacteria, is associated with mortality in freshwater fishes in high (warm) water temperatures and crowded conditions.

A 2010 assessment of the Sawmill site — reconstructed in 2009 — showed substantial improvement in juvenile salmonid habitat.

Habitat Densities at the Sawmill Site

Habitat type	Life stage	Area of habitat per length of channel	
		ft^2/ft	m^2/m
Optimal	Fry	15.4	4.7
	Pre-smolt	20.3	6.2
Total	Fry	41.0	12.5
	Pre-smolt	51.5	15.7

Restoration Reach Evaluation—
Flow and channel rehabilitation actions are anticipated to create changes in rearing habitat availability through the 40-mile (64-km) restoration reach. Rearing habitat availability was mapped at 32 randomly selected sites in 2009 and 2010 as part of a multiyear study. Total area of rearing habitat within the restoration reach in 2010 was about 3.04 million square feet (282,400 m^2) for fry, and 3.92 million square feet (364,200 m^2) for pre-smolt (Figure 5). No significant change in rearing habitat area was detected for optimal or total restoration reach estimates between 2009 and 2010.

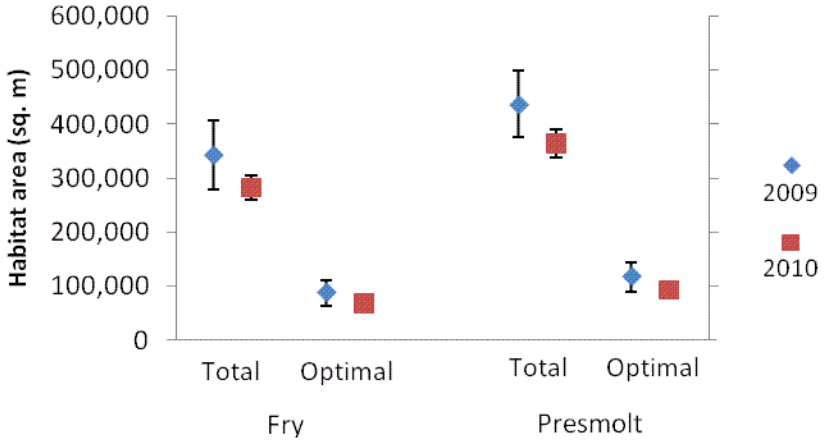

Figure 5. Total and optimal fry and pre-smolt rearing habitat available in 2009 and 2010. Error bars indicate a 95-percent confidence interval.

Data Management

Due to the complexity of the process for conducting adaptive management, data management is essential for progress and learning. As evidenced by the diversity of data presented in the AEAM section, coordination and data sharing are of great importance. A data team was formed for the purpose of coordinating data management; sharing for planning, design and analysis; and other uses across the partnership. The team set a goal to complete a data management plan over the next year that will outline data sharing processes.

Significant improvements were made to the Program's online data portal (ODP) at http://odp.trrp.net. The ODP is a data storage and access system that will provide equal access to Program information products for Program partners, stakeholders, and the public. A prototype of the ODP was completed previously; significant improvements for uploading data and managing the site were made during 2010. By the end of the fiscal year, the document library contained 235 files (now doubled at the time of this writing). Over the next two years, the ODP will be further improved, including features for searchable data packages and an overhaul of the interactive map.

Aerial Photography

High-resolution aerial photography may be the most widely used data across the Program partnership, as it provides context for designing restoration actions, planning scientific investigations, and communicating both within the Program and with the public. The annual collection of aerial photography provides a reliable census of the visual form of the river from a standardized point of view, which enables a variety of analyses of change over time. New orthorectified aerial photography was collected during the summer base flow on August 25, 2010.

To supplement the Program's aerial photography from recent years, georectification was obtained for sets of aerial photography from 1944, 1960, 1965, 1971, 1975, 1980, 1990, and 1997. These older imagery sets provide historic context for current river restoration challenges (Figure 6), and their georectification will enable change analyses over a timeline of more than half a century.

Environmental Compliance and Mitigation

The seventh element of the restoration strategy involves activities that require Program compliance with various environmental laws. (See sidebar.)

Projects performed on public lands managed by the USFS or the Bureau of Land Management must meet additional guidelines (e.g., stipulations of the Northwest Forest Plan and the Aquatic Conservation Strategy).

Applicable Environmental Laws and Authorizations:

- The National Environmental Policy Act (NEPA)
- California Environmental Quality Act (CEQA)
- Endangered Species Act of 1973
- Clean Water Act
- Wild and Scenic Rivers Act
- Executive Order (EO) 11988 for floodplain management
- EO 11990 for the protection of wetlands
- EO 13112 for invasive species
- EO 12898 for environmental justice

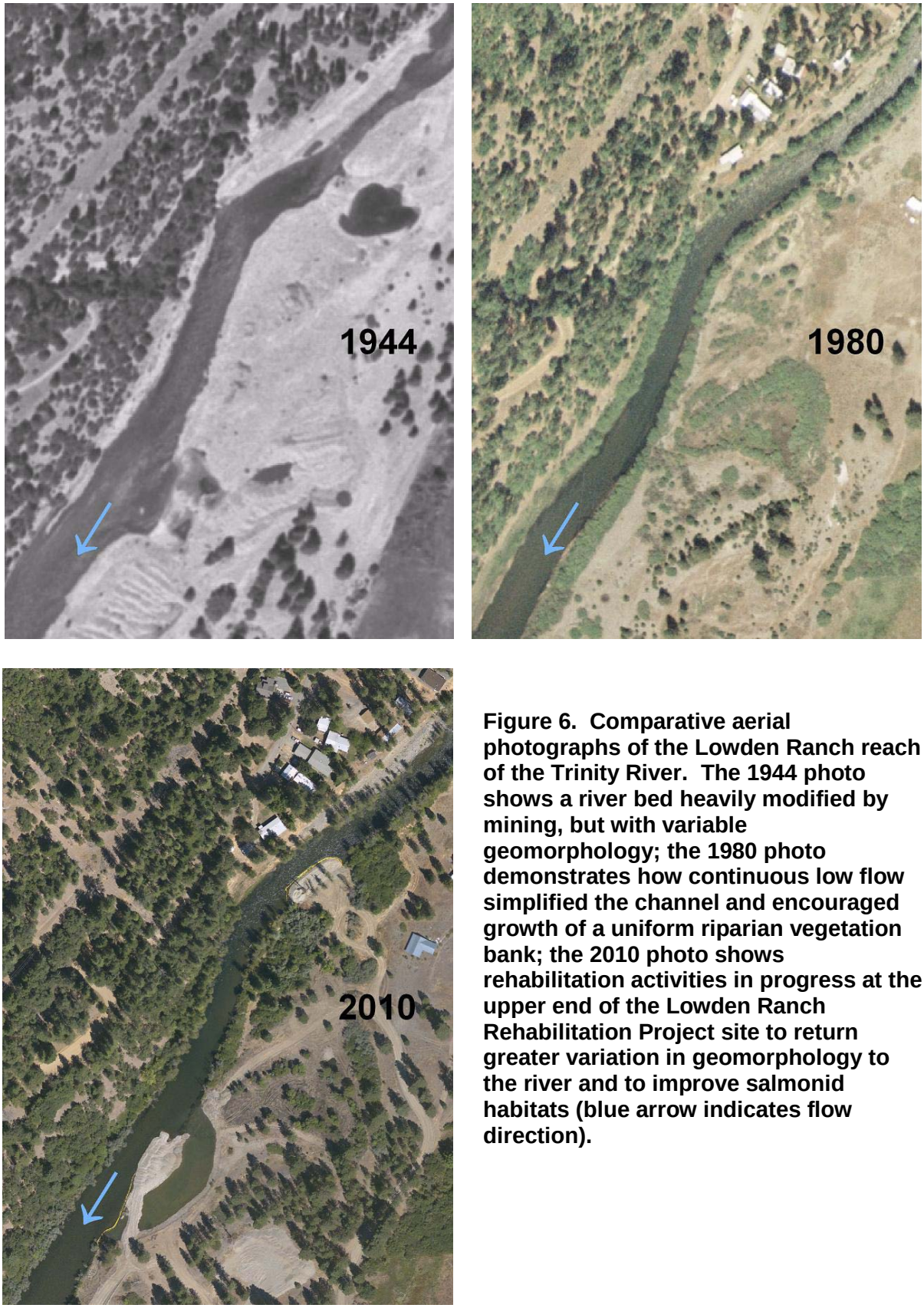

Figure 6. Comparative aerial photographs of the Lowden Ranch reach of the Trinity River. The 1944 photo shows a river bed heavily modified by mining, but with variable geomorphology; the 1980 photo demonstrates how continuous low flow simplified the channel and encouraged growth of a uniform riparian vegetation bank; the 2010 photo shows rehabilitation activities in progress at the upper end of the Lowden Ranch Rehabilitation Project site to return greater variation in geomorphology to the river and to improve salmonid habitats (blue arrow indicates flow direction).

In 2009, the Program, working with staff at the California Regional Water Quality Control Board, North Coast Region, completed the Master Environmental Impact Report (Master EIR) and Environmental Assessment for channel rehabilitation and sediment management activities (NCRWQCB et al. 2009). In 2010, this programmatic EIR streamlined the CEQA, NEPA, and permitting requirements (e.g., Army Corps of Engineers, National Marine Fisheries Service, California Department of Fish and Game, State Water Board, Trinity County, and State Historic Preservation Office) so that construction at Lowden Ranch, Trinity House Gulch, and Reading Creek sites, was able to start earlier than in past years. This allowed the Program to take full advantage of the limited in-river work window, July 15 to September 15, which was established to protect rearing juvenile fish and adult spawners.

The yellow-breasted chat was one of four targeted bird species that showed a positive response to restoration of the riparian habitat.

The Master EIR's mitigation and monitoring program requires that negative impacts to fish and wildlife be mitigated during construction. Consequently, the Program must replace the riparian vegetation which it lawfully removes during project implementation, and must monitor/evaluate the success of replanted riparian vegetation, which many migratory birds rely on for shelter, food, and nesting. In addition, the birds that use riparian vegetation are also monitored to ensure that project implementation is not causing a decline in key species throughout the program restoration reach. The results of 2002–09 riparian bird monitoring along the 40-mile restoration reach found positive abundance trends in four of five targeted riparian bird species: black-headed grosbeak, song sparrow, yellow-breasted chat, and yellow warbler. Tree swallow abundance did not show a trend over the study period (Miller et al. 2010).

Because 2010 work at the Lowden Ranch Rehabilitation Project site was in the midst of very productive western pond turtle habitat, mitigation measures from the Master EIR and the landowner (Bureau of Land Management) both required the Program to protect the population. Consequently, the Program collaborated with Humboldt State University (HSU) to determine the effect of channel rehabilitation projects on turtle populations and to learn at what scale turtle conservation efforts need to focus. In addition, HSU and USFWS researchers were able to find and remove turtles that were in harm's way from rehabilitation site construction. In 2010, researchers captured 73 turtles and made records of their weight, length, and age. (See Figure 7).

Figure 7. An HSU researcher weighs a western pond turtle at the Lowden Ranch Rehabilitation site.

The turtle population was primarily composed of adults, with only 16 percent of turtles less than 10 years old. Among the captured adults, there was a predominance (64 percent) of males reported (Sloan and Marks 2011). Researchers affixed radio transmitters to the shells of 24 turtles and tracked them throughout the year to examine habitat use and movement patterns in the area.

A radio-tagged turtle monitored at Lowden Ranch.

Long-distance terrestrial movements were rare, with turtles spending the majority of their time in the ponds. Nine of the tagged turtles made terrestrial excursions, often between ponds. The study will continue through 2011 to determine if and how quickly turtles might change their movement patterns after construction and in response to the availability of newly created wetland habitats. In addition, more turtles will be collected at other pond areas along the Trinity River mainstem to compare the age and sex distribution with that found at Lowden Ranch.

Replanting Assessments and Wetland Mitigation

As part of its environmental mitigation requirements, the Program has been charged with ensuring a 1:1 replacement of riparian vegetation areas that are impacted during channel rehabilitation site construction. To ensure revegetation success on the often hot and dry Trinity River floodplain, the Program has been updating its techniques since first planting in 2006. During 2010, the Program monitored the 2009 revegetation effort at the Sawmill Rehabilitation Project site in order to

evaluate several techniques and determine their value to enhance the growth or survival of planted riparian vegetation. Two different types of tree shelters (Vexar browse protectors and Ventex browse/weather enclosures), as well as weed mats, were tested on Sawmill cuttings to determine their effect on plant growth and survival (Figure 8).

Figure 8. Ventex tree shelters and weed mats in use at the Sawmill site.

Overall, none of these treatments were found to substantively increase growth or survival of planted poles. Instead, the data indicate a decrease in overall health of the plantings and an increase in overall growth whether the trees were treated with tree shelters and/or weed mats, or not at all. What is more, any of these plant aids can be washed downstream during high-flow events (TCRCD 2011). In 2011, the program will be reviewing past planting projects and, based upon results from all past sites, will make recommendations for future revegetation work.

One of four seasonal wetlands created during the October 2010 wetlands workshop.

Six seasonal wetlands, totaling approximately 2 acres (0.8 hectares), were constructed at the Lowden Ranch site to enhance the site for amphibians and turtles, increase areas for riparian revegetation, and ensure that there is no net loss of wetland acreage through time along the 40-mile restoration reach. Four of these wetlands were created during an October 2010 wetland construction workshop in which the Program assisted the Northwest Chapter of Partners in Amphibian and Reptile Conservation and the USFS's Tom Biebighauser (http://www.wetlandsandstreamrestoration.org/) in teaching wetland creation techniques. Of these wetlands, two capture groundwater and two capture surface runoff, to create hydric conditions. All utilize large wood and slash to create basking surfaces for turtles and shelter from predation. Immediate use

of the wetlands by birds was noted in early monitoring, and the monitoring of these sites has continued in 2011 (Figure 9). Two additional wetlands were created in the Lowden Ranch floodplain (Figure 10) to emulate productive off-channel nursery ponds at the Sawmill site.

Figure 9. Monitoring wildlife use at the recently constructed Lowden Ranch wetland.

Figure 10. Constructed seasonally inundated floodplain wetland at Lowden Ranch site. Coho salmon over-summer in floodplain ponds and grow until they move down-stream, at sizes larger than their mainstem counter-parts, when released from the isolated ponds during high spring flows.

Turbidity

Turbidity, a measure of the cloudiness of water, is typically low in the Trinity River during summer conditions. Permits require avoiding increased turbidity, and protection of the Trinity River's "beneficial uses" (e.g., domestic supply, aesthetic enjoyment, and preservation of fish, wildlife, and other aquatic resources or preserves; as defined in NCRWQCB

2011), while implementing restoration actions like gravel augmentation or mechanical channel rehabilitation.

During the high flows of May 2010, turbidity monitoring during gravel placement showed little impact on water clarity (Figure 11). However, the wash of water over the 2009 constructed Sawmill Rehabilitation Project site caused short-term increases in turbidity, as fines from the site were suspended with each peak in flow and carried downstream. Fluctuating and elevated turbidity persisted for a little over a week during the period of spring flushing flows.

In general, the Program has become adept at isolating summer low-flow channel construction areas from the river so that there is little effect on turbidity.

In 2010, the Program utilized several techniques to minimize turbidity impacts and to stay within permitting requirements. The Program frequently pumped from behind earthen/gravel berms and turbidity curtains (isolated areas) into shoreline detention/filtration basins so that project water quality could be maintained.

The primary difficulty with this isolate and pump technique arises when removing the isolation berms for short periods during reconnection of construction areas with the mainstem river (e.g., during berm and turbidity curtain removal). In these cases, the Program occasionally exceeded permit turbidity control requirements (20 nephelometric turbidity units at 500 feet (150 m) downstream). To minimize turbidity during berm removal, the Program often slowed in-river equipment work (e.g., berm removal) until turbidity dissipated. The Program also utilized turbidity curtains and a flow isolation barrier (water filled dam – Aqua Dam). (See Figures 12 and 13.)

With these additional isolation barriers in place, the Program was able to create slack-water conditions so that turbid water could continue to be pumped onshore as other turbidity barriers were removed. In this way, project water quality was maintained.

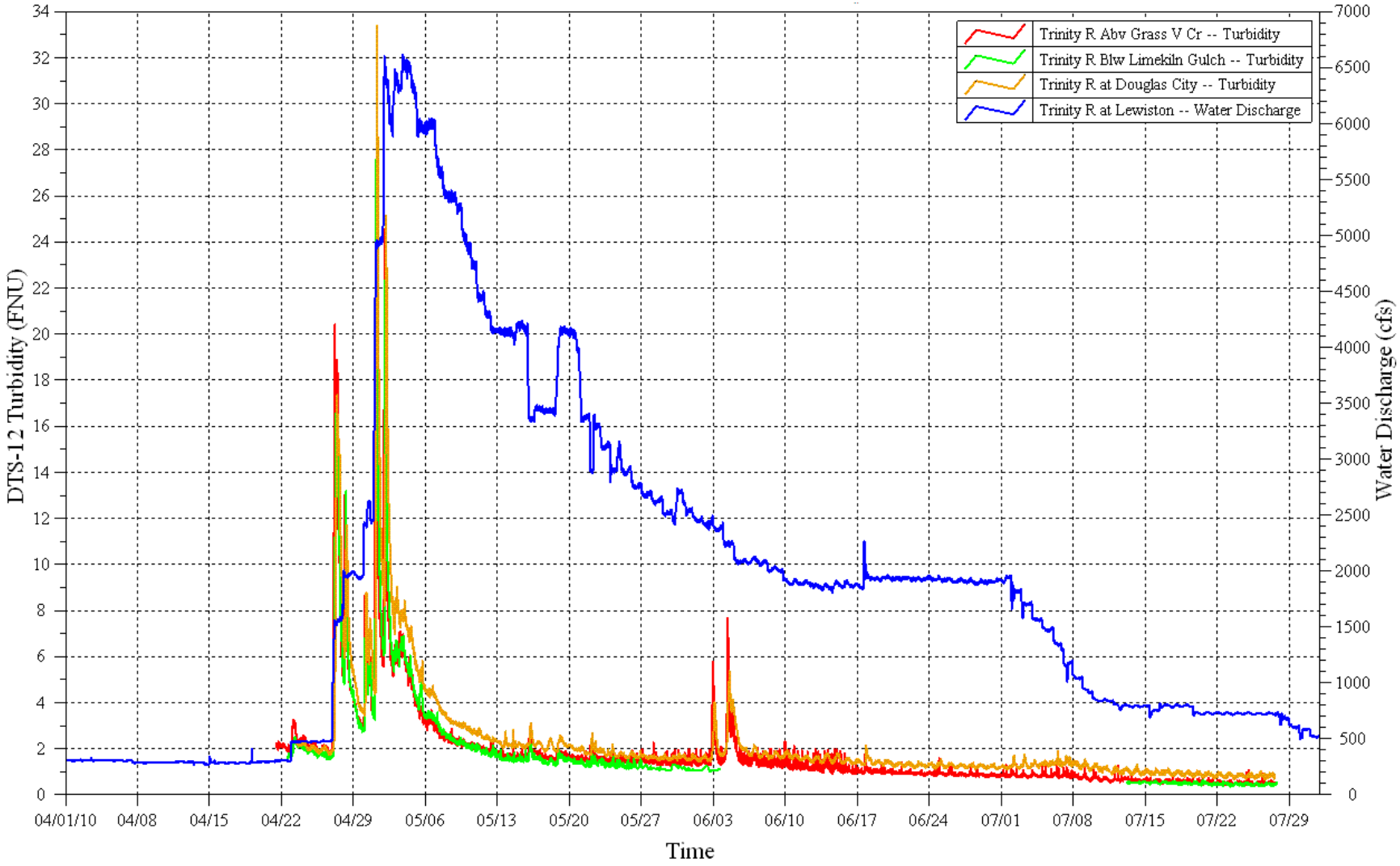

Figure 11. 2010 turbidity measured at monitoring sites above Grass Valley Creek, below Limekiln Gulch, and at Douglas City. All monitoring sites are downstream of the Sawmill Rehabilitation Project site. Spring flows (blue line) are measured below Limekiln Gulch. It is expected that sediment, which left the site during spring high flows, was deposited on downstream floodplain areas where riparian vegetation may colonize the newly placed material. Note: DTS-12 = Forest Technology Systems DTS-12 Turbidity Sensor. FNU = Foramzin Nephelometric Unit. (Unpublished graphic – data used to develop this graphic can be found in Volume 2, The Sediment Computations Report; GMA 2011).

Figure 12. Isolating berms are removed as silt curtains and onshore pumping maintain Trinity River mainstem water quality.

Figure 13. Water quality is maintained in river while isolated side channel area is pumped.

Water Temperature Modeling

2010 was a normal water year, during which Trinity Reservoir was drawn down to roughly 1.475 million acre feet (1.819 km^3), roughly 60 percent of capacity.

Low reservoir levels can increase the temperature of water released from the dam and jeopardize the ability to meet downstream water temperature criteria. Temperature modeling of Trinity Reservoir, Lewiston Reservoir, and the Trinity River simulated several 2010 dam release scenarios and their impacts

on temperature compliance in the river. Figure 14 shows model output of these release scenarios.

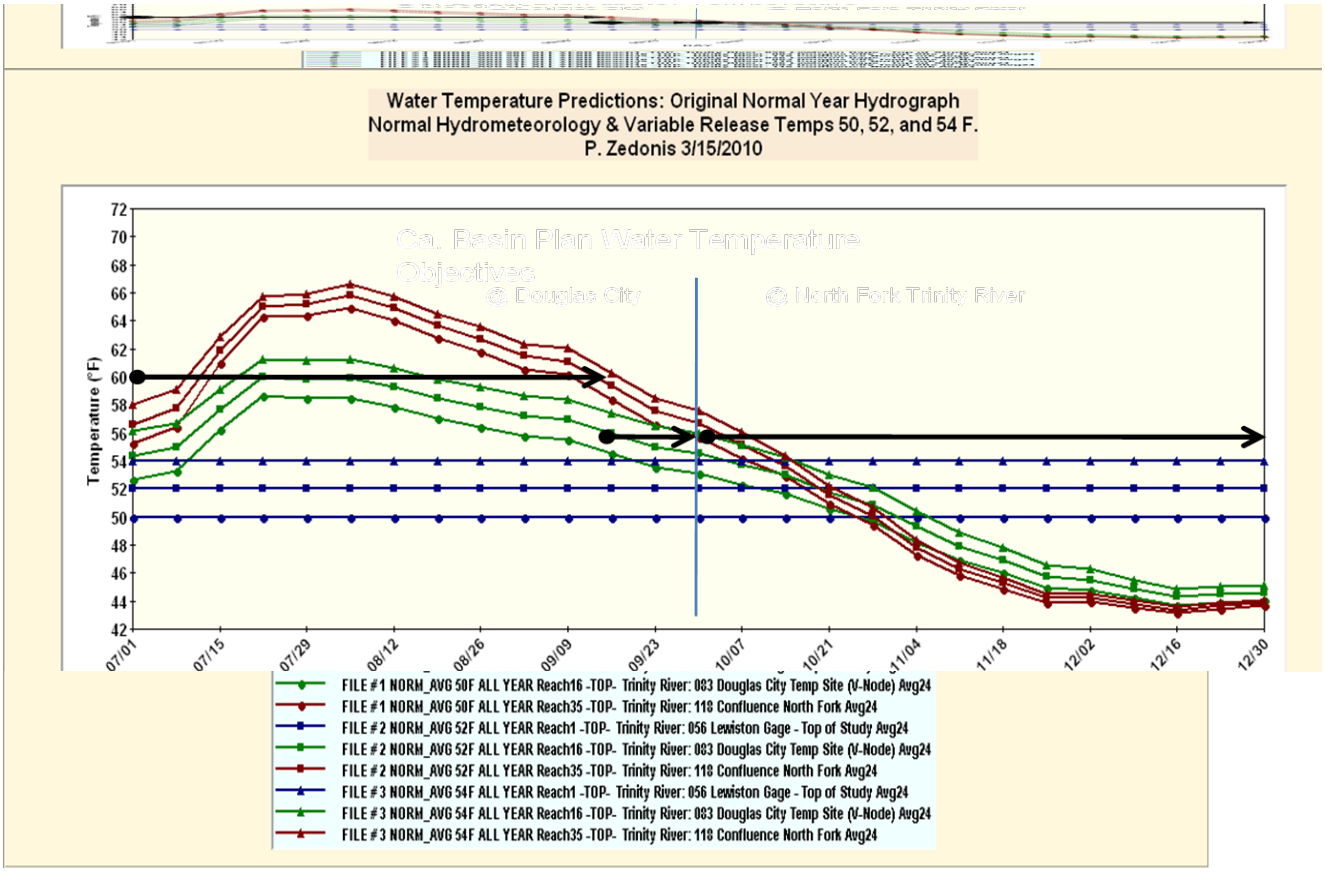

Figure 14. Stream Network Temperature Model predictions of river temperatures (ºF) at Douglas City and above the North Fork Trinity River, July through December 2010. Model runs made in May 2010. Modeling conditions include water release temperatures (50, 52, & 54 °F), the ROD normal year hydrograph, and average hydrometeorology.

Water Temperatures and Compliance

Table 3 lists the ROD Trinity River water temperature targets. The Program, USFWS, and Reclamation actively monitor water temperatures in the Trinity and Lower Klamath Rivers (Scheiff and Zedonis 2010) to understand how dam releases meet those targets. Trinity River temperature is measured at Douglas City and above the confluence with the North Fork Trinity River for regulatory compliance specified in WR 90-5 (SWRCB 1990).

Table 3. Trinity River Temperature Targets by Reach and Date

Source	Target Reach	Dates	Target
Basin Plan for the North Coast Region (NCRWQCB 2011)		***All Years***	
	Lewiston to Douglas City	July 1–September 15	≤60 °F (15.5 °C)
	Lewiston to Douglas City	September 15–30	≤56 °F (13.3 °C)
	Lewiston to North Fork	October 1–December 31	≤56 °F (13.3 °C)
Springtime Objectives of the Record of Decision for the Trinity River EIS/EIR (USFWS et al. 2000)	Lewiston to Weitchpec	***Normal & Wetter Water Years***	
		April 15–May 22	≤55.0 °F (12.8 °C)
		May 23–June 4	≤59.0 °F (15.0 °C)
		June 5–July 9	≤62.5 °F (17.0 °C)
		Dry & Critically Dry Water Years	
		April 15–May 22	≤59.0 °F (15.0 °C)
		May 23–June 4	≤62.5 °F (17.0 °C)
		June 5–June 15	≤68.0 °F (20.0 °C)

Figure 15 shows observed river temperatures between April 15 and December 31, 2010, at Douglas City and above the North Fork. Figure 16 shows temperature compliance in 2010 according to the 2011 temperature performance metric.

Major findings include:

- The North Coast Region Basin Plan (NCRWQCB 2011) Springtime Objectives for emigrating smolts focus on Trinity River temperatures at Weitchpec (Table 3). During the spring and early summer (mid-April to July 9), the water temperature regime of the lower Trinity River at Weitchpec was within the optimal thermal regime for salmonid smolts. (See USFWS and HVT 1999, appendix K.) Water temperatures increased slightly from June 25 to June 29 and, as a result, exceeded the targeted optimal temperature regime (into the marginal regime) for this water year by a maximum of 0.9˚F (0.5˚C). Following this excursion into the marginal regime, water temperatures at Weitchpec decreased to the optimal regime for a period of about 5 days before again increasing to 66.2˚F (19˚C), or 3.6˚F (2.0˚C) above the optimal threshold. The excursions above the optimal regime during late June and early July are probably due to warming air temperatures.

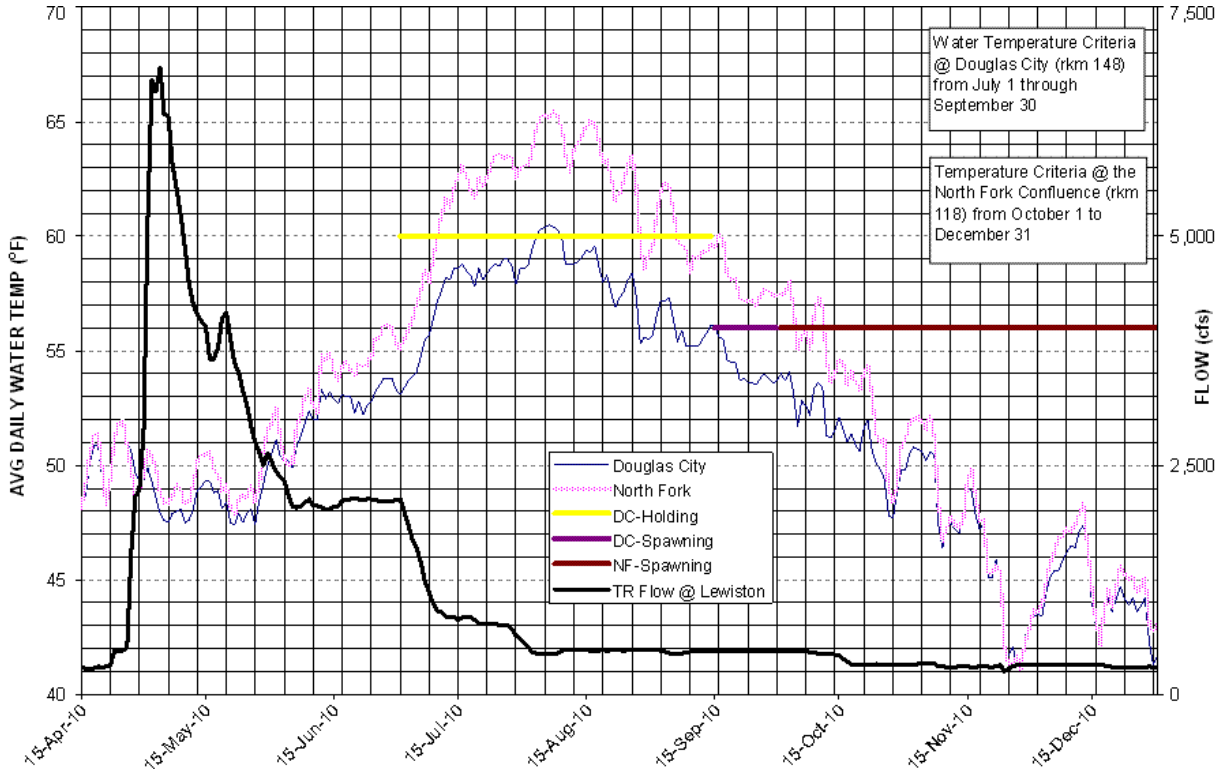

Figure 15. River temperatures (ºF) observed at Douglas City and above the North Fork, along with flows (in cfs) at Lewiston.

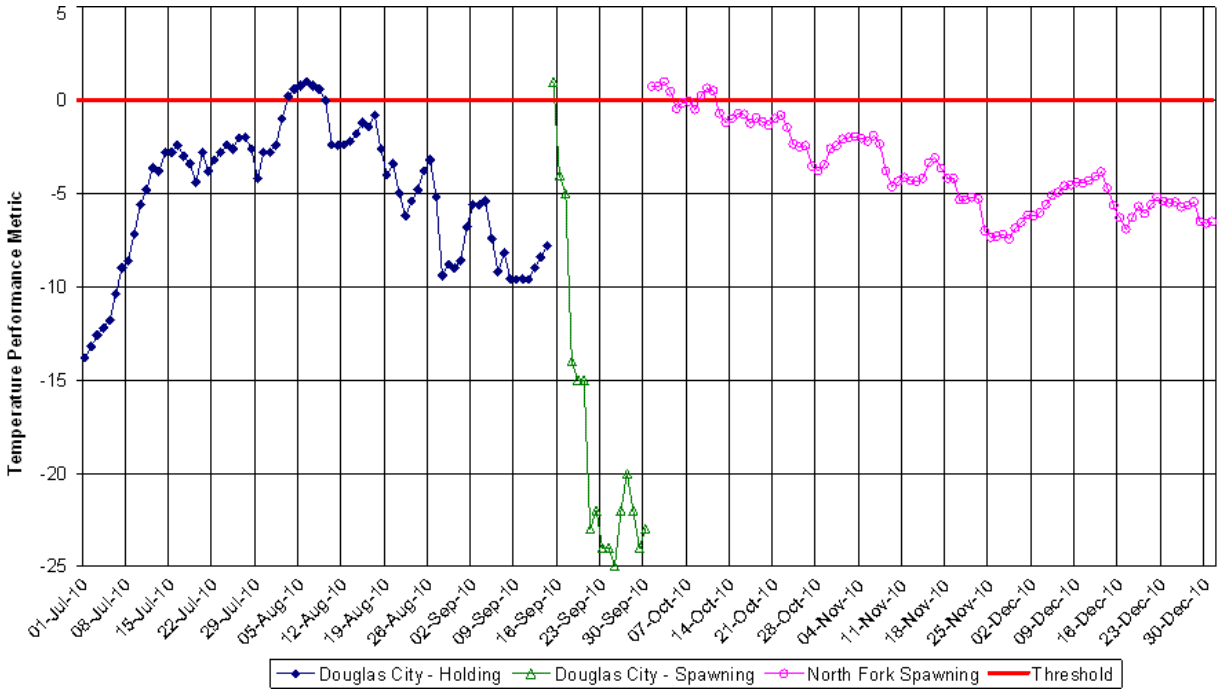

Figure 16. Temperature performance metric (2011) for 2010 at Douglas City and above the North Fork. Values above threshold of '0' indicate exceedance of the target for that period and location. Metric normalized to the maximum exceedance during each period.

- Another factor that likely played a role in exceeding the optimal target was the reduction in flow from Lewiston Dam in late June. (See Figure 15.) This varied from the original flow schedule for a normal water year type wherein a 2,000-cfs release would extend until July 9th.

- Despite not meeting the targets during these times, the prescribed flow did result in increased temperature reductions of the Klamath River, indicating that Lewiston Dam releases initially helped in moderating water temperatures during a time when water temperatures of the Klamath River were increasing. A peak temperature difference between the two rivers of 2.5 ˚F (1.4 °C) was recorded on July 9, a time when water temperatures of both rivers were beginning to increase. The differential resulted in a temperature reduction of 2.5 ˚F (1.4 °C) below the confluence.

- The North Coast Region Basin Plan adult holding temperature target of 60 °F (15.6 °C) at Douglas City was met during 91.8 percent of the period, exceeding the daily mean target by up to 0.5 °F (0.3 °C) for 7 days between August 3 and September 14. The temperature objective of 56 °F (13.3 °C) for spawning at the North Fork Trinity River was met during 92.4% of the period, exceeded by up to 2.0°F (1.1°C) for 7 days between October 1 and October 11. Warm air temperatures and reservoir release water temperatures are the probable causative factors for exceeding temperature targets during this period.

Looking Ahead: 2011 Program Activities

In 2011, the Program will continue to execute the restoration strategy articulated in the Record of Decision (U.S. Department of the Interior 2000), the Trinity River Environmental Impact Statement (USFWS et al. 2000), and the Trinity River Flow Evaluation Report (USFWS and HVT 1999). Planned activities for 2011 include:

- Flow schedule planning and implementation for water year 2011;
- Increased public education and outreach activities (website update, public meetings, articles, etc.);

- Continuation of monitoring and assessment projects with an emphasis on evaluations of restoration activities completed to date;
- Initiation of an independent review of Phase 1 mechanical channel rehabilitation and gravel augmentation work, led by the Program's Scientific Advisory Board. The Phase 1 review will serve as a foundation for Phase 2 planning;
- Completion of five priority watershed projects;
- Construction of the Wheel Gulch Rehabilitation Project site in Junction City, CA;
- High-flow gravel augmentation at Diversion Pool and Lowden Ranch sites;
- Initiation of a process for external review of study plans and reports; and
- Renewal of the technical workgroups.

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Web Sources

- http://www.trrp.net/?page_id=23
  The TRRP website with information on the Trinity River and the Program.
- http://www.trrp.net/?page_id=3175

A chronological list with links to foundational and other pertinent documents.

- http://www.fws.gov/arcata/fisheries/activities/habRestoration/
  Describes the TRRP on the Arcata Fish and Wildlife website.

- http://www.usbr.gov/mp/cvp/
  The Bureau of Reclamation's website on the Central Valley Project.
- http://en.wikipedia.org/wiki/Central_Valley_Project
  A description of the Central Valley Project available on Wikipedia.
- http://www.trrp.net/?page_id=74
  Legislative History on TRRP website
- http://www.fws.gov/arcata/fisheries/reports/technical/Trinity_River_Flow_Evaluation_-_Chapter_1-2.pdf
  Legislative History from Chapter 2 of the Flow Study
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- http://www.fws.gov/arcata/fisheries/reports/tamwg/2011/CharterJanuary142011.pdf
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- http://www.fws.gov/arcata/fisheries/reports/tamwg/Charter & Bylaws/BylawsrevisedMay242011.pdf
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- http://www.trrp.net/?page_id=2291
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The 2010 Annual Report of the Trinity River Restoration Program is available electronically at www.trrp.net and includes web links to reference material and agencies.

Appendix A: Acronyms

AEAM	Adaptive Environmental Assessment and Management
°C	degrees Celsius
CDWR	California Department of Water Resources
CEQA	California Environmental Quality Act
cfs	cubic feet per second
EIR	Environmental Impact Report (required under CEQA)
EIS	Environmental Impact Statement (required under NEPA)
°F	degrees Fahrenheit
HSU	Humboldt State University, Arcata, California
HVT	Hoopa Valley Tribe
km	kilometer(s)
m	meter(s)
NEPA	National Environmental Policy Act
ODP	online data portal
ROD	Record of Decision
TCRCD	Trinity County Resource Conservation District
TMC	Trinity Management Council
TRH	Trinity River Hatchery
TRRP	Trinity River Restoration Program (also “the Program”)
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

On Back Cover:

Constructed Large Wood Jam (logjam) at the Lowden Ranch Rehabilitation Project site just upstream of the confluence with Grass Valley Creek tributary, constructed in the summer of 2010.

Logjams, consisting of accumulations of large woody debris, benefit the Trinity River by altering currents of the river; creating pools, bars, side channels and islands; increasing water elevations that increase floodplain connectivity; and trapping small wood and organic debris moving down the river. Large wood also provides cover for fish, and limits bed and bank erosion, resulting in enhanced water quality. Wood provides nutrients and encourages the growth of macroinvertebrates, which benefit fish. Logjams and wood snags provide wildlife habitat for birds, insects, reptiles, and other species, creating increased biodiversity and biomass on a watershed scale.