Elk River Recovery Assessment to Restore Beneficial Uses and Abate Nuisance Flooding Conditions, Elk River, Humboldt County, CA

July 24, 2012

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Introduction

Elk River is impaired by fine sediment that originated primarily from discharge of waste associated with industrial timber harvest activities during the 1988-1997 time period. Impairments include fine sediment with turbidity and channel deposits degrading fisheries habitat, domestic and agricultural supply. Nuisance flooding conditions have resulted from reduced channel capacity associated with stored instream sediment deposits in the Middle Reach of the watershed. Development of the Elk River Sediment Total Maximum Daily Load (TMDL) is underway, along with numerous early implementation efforts. The reduction in channel capacity due to the instream sediment deposits is so severe in the Middle Reach of the watershed that the increased flood frequency and magnitude constitutes a nuisance condition that poses health and safety risks to residents. This nuisance condition must be addressed by the TMDL implementation program.

Direct recovery actions in the Middle Reach of Elk River, combined with sediment load reduction in the watershed, may be necessary to restore ecosystem functions, abate nuisance flood conditions, and recover beneficial uses. The primary objective of any direct recovery action in the middle reach would be to contain bankfull flows (1.5-2 year recurrence interval), while minimizing any impacts to upstream and downstream reaches, infrastructure, and land uses. Evaluation of the anticipated effects of sediment reduction measures and direct recovery actions is required to inform development of an appropriate and effective approach that integrates actions throughout the affected river channel.

Proposal

This proposal requests $401,437 from the Cleanup and Abatement Account (CAA) to conduct the Elk River Recovery Assessment (Recovery Assessment). The Recovery Assessment is a system-

wide analysis of the fate and transport of sediment, including legacy sediment now stored instream; an assessment of the effect on sediment fate and transport from a suite of sediment removal and restoration activities; and the development of an implementation framework that addresses the instream sediment deposits and will lead to recovery of ecosystem functions and beneficial uses in Middle Reach of Elk River. The Elk River Recovery Assessment has broad support from watershed stakeholders who are contributing cost-shares and in-kind support. The duration of the project is from fall 2012 through spring 2014. The project will:

- Document existing channel morphology and sediment conditions reach-wide (18.5 miles from the top of the Middle Reach Elk River downstream to Humboldt Bay, Figure 1);
- Develop, calibrate, and validate a reach-wide hydrodynamic and sediment transport model;
- Conduct analyses to assess the trajectory of the system under (1) existing sediment loads, (2) reduced sediment loads, and (3) a suite of broad recovery actions in combination with reduced sediment loads;
- Establish a robust monitoring network to track long-term system recovery;
- Prioritize a suite of direct recovery actions independently and in conjunction with sediment reduction measures already being designed and/or implemented; and
- Obtain peer review from a pre-established Technical Advisory Committee.

Background

Elk River was included on the Clean Water Act Section 303(d) List of impaired waters in 1998 on the basis of excessive sedimentation. Accelerated timber harvest and road construction activities, beginning in 1986, followed by large storm events in 1995–1998, caused unprecedented discharges of sediment and organic debris and resulted in major geomorphic changes in the Middle Reach of Elk River, near the confluence of North Fork and South Fork. The channel filling degraded salmonid habitat by filling pools and burying spawning gravels and large wood. There has been a coincident increase in the frequency and magnitude of flooding, affecting the safety and livelihood of residents in the Middle Reach of Elk River. Records indicate that stored instream deposits have reduced channel conveyance capacity in the upper Mainstem Elk River by 60% and the North Fork Elk River now overtops its banks an average of four times per year. The instream deposits are largely a result of discharges of waste from non-point source activities (timber harvest activities) from 1988-1997. In 1998, mechanical removal of instream sediment deposits was considered too environmentally damaging by Regional Water Board staff[1]. However, the impacted geomorphic and hydraulic conditions have resulted in lower conveyance capacity, lower flow velocities, and ongoing sediment deposition that exacerbated nuisance flooding conditions in the Middle Reach of Elk River[2]. Residents now experience flooding conditions on an average of four times per year.

In 2004, the Regional Water Board received a petition from 64 affected Elk River residents requesting cleanup (dredging) of the instream sediment deposits to abate the nuisance flooding

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[1] Based upon findings in sediment source inventory reports and treatment workplans submitted by Pacific Watershed Associates on behalf of Pacific Lumber Company.

[2] North Coast Regional Water Quality Control Board. 2009. Draft Elk River Sediment TMDL Staff Report.

conditions and recover beneficial uses of water. The Regional Water Board rejected the petition citing the need for a lead entity and a feasibility study prior to initiating a major channel modification effort. Since then, CalTrout has stepped forward as a ready and willing, viable lead entity. This proposed project, the Elk River Recovery Assessment, will test the response of the system to a suite of direct recovery actions. The Recovery Assessment will result in a peer-reviewed sediment reduction implementation framework that is scientifically defensible and has the best prospect of leading to recovery of beneficial uses, satisfying the Regional Water Board's previous requirement for a feasibility study.

In 2008, a technical advisory committee (TAC) comprised of experts in fluvial geomorphology and river restoration was formed, in part, to evaluate sediment information in Elk River and its adequacy for informing recovery actions[3]. The TAC concluded that existing information about physical processes and aquatic habitat was insufficient to evaluate recovery alternatives. The TAC also concluded that large-scale projects implemented to enhance and stabilize different properties or reaches would require a well-integrated and scientifically-based design effort to ensure that actions achieve the desired effects and avoid unintended consequences in adjacent reaches. Regional Board staff had previously found that such a scientifically-based evaluation would also be necessary for permitting implementation of recovery actions.

The TAC was asked to develop an approach that could lead to the identification of restoration actions to address the channel impairments in the Middle Reach of Elk River. Potential recovery actions could include dredging, new channel construction, off-channel detention basin, levee construction or modification, vegetation management, infrastructure improvements, creation of inset floodplains, high flow channels, and placement of in-stream large woody debris. The approach identified by the TAC includes construction, calibration, and validation of hydrodynamic and sediment transport models suitable for assessing the effects of a range of actions individually, collectively and under a range of flows, sediment loads, and time frames. Such a system's approach is appropriate and necessary given the severity and persistence of the instream deposits, especially in the Middle Reach of Elk River. An ecosystem based approach is also necessary to develop a successful clean-up plan. The TAC's approach was incorporated into funding proposals submitted to Department of Fish and Game's Fisheries Restoration Grant Program in 2009 and 2010, with a significant cost-share from Humboldt Redwood Company (HRC)[4]. While the proposal ranked high regionally, it did not receive funding during the statewide review of projects.

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[3] The TAC was convened by Redwood Community Action Agency (RCAA) with funding support from a Proposition 50 Grant (Agreement No. 06-289-551-0) Humboldt Bay Watershed Sediment Reduction, Monitoring and Salmon Habitat Implementation Program

[4] Of note, when Humboldt Redwood Company (HRC) took over upon bankruptcy of Pacific Lumber Company, they were held liable for penalties levied on Palco for violations of Cleanup and Abatement Orders in Elk River and Freshwater Creek. Regional Water Board Staff attempted to divert some of the penalties toward a supplemental environmental project (SEP) to support the modeling efforts; however other cost shares were not available at that time. As a result, in 2009, HRC paid a civil liability of $330,000 into the cleanup and abatement account.

A pilot modeling effort was conducted by Northern Hydrology and Engineering (NHE) and Stillwater Sciences in a portion of the middle reach of Elk River in 2011/2012 to test the performance of the proposed models and the adequacy of the existing data. The pilot effort found that the models offered reasonable estimates of the observed water surface elevations and scour and fill within the modeled reach, and could provide appropriate and useful tools for assessing recovery actions at a broader scale (NHE and Stillwater, 2012). This request is for CAA funds to expand the modeling to assess the entire Middle Reach of Elk River as well as the Lower Reach down to Humboldt Bay and to identify recovery actions, that in combination with reduction in sediment loads, will lead to a sustainable stream system capable of supporting beneficial uses and abating the current nuisance flooding conditions in the Middle Reach.

In February 2012, Regional Water Board co-sponsored an Elk River Restoration Summit[5] and presented an approach to identify recovery actions. There was significant support for this proposed assessment strategy by the attending landowners, permitting agencies and funders. However, participants recognized that funding the Recovery Assessment through state and federal grants would be difficult because the necessary project costs exceed funding amounts typically awarded through planning grants, and the project does not qualify for money earmarked specifically for implementation. As such, the CAA was identified as the best option for funding the Recovery Assessment. The resulting implementation actions will be readily translated into project proposals for implementation funding from State and Federal sources, with anticipated landowner partnerships and cost shares. In addition to private landowner funding contributions, State and Federal funding sources are likely to include California Department of Fish and Game's Fisheries Restoration Grant Program, US Fish and Wildlife Service (USFWS) Partners Program, the Nation Oceanic and Atmospheric Association Restoration Center, US EPA 319(h), USFWS North American Wetlands Conservation Act, and Natural Resources Conservation Service.

The Recovery Assessment builds on an existing rigorous monitoring network maintained by landowners in the Upper and Middle Reaches of Elk River. Data collection in the Lower Reach is currently limited, as it has not been the focus of Regional Water Board regulatory efforts. However, to ensure that recovery actions are appropriately identified and evaluated, the Recovery Assessment includes geomorphic and water quality data collection. These new locations will be included in the long-term network ensuring a robust monitoring program to track TMDL effectiveness and evaluate the success of recovery actions.

The project team is uniquely qualified to conduct the Elk River Recovery Assessment. Additionally, they are of good value, as all parties have a local presence, minimizing the need for project-related travel costs. All have maintained excellent working relationships with stakeholders, demonstrating integrity and objectivity in a watershed that has long been divided via the timber wars and scientific disagreement. This team has continually worked toward solutions and civil scientifically-based discourse. The Elk River Recovery Assessment has broad support from watershed stakeholders, including affected residents, HRC, and permitting agencies.

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[5] The Restoration Summit was co-sponsored by Regional Water Board staff and RCAA with funding support from a Proposition 50 Grant (Agreement No. 06-289-551-0) and Department of Conservation.

CalTrout is non-profit agency with the organizational capacity to be a viable lead in implementation of recovery action in Elk River. They have an excellent track record with the Regional Water Board and a demonstrated ability to work with landowners, large and small. Their expertise in fisheries recovery is crucial to ensuring that the recovery actions result in improved ecosystem fisheries enhancement as well as abatement of nuisance flooding. CalTrout is ready to take the results of the Recovery Assessment and craft an implementation strategy, then pursue funding via implementation grants.

Over the past decade Northern Hydrology and Engineering (NHE) has assisted the Regional Water Board with technical evaluations of hydraulic and flooding conditions in Elk River (Anderson, 2001; Patenaude, 2004; NHE and Stillwater, 2012), including significant cost share via informal consultations with Regional Water Board staff on the approach to identify recovery actions. Their unique knowledge of Elk River hydrodynamics and sediment transport, data collection and evaluation, and the available modeling tools and their application to Elk River make NHE uniquely qualified to conduct the Recovery Assessment. The experience of conducting the pilot modeling serves to reduce the up-front costs associated with conducting the Recovery Assessment. Additionally, NHE has an excellent track record of tackling difficult permitting issues, resulting in site specific designs that ensure environmental protection.

Stillwater Sciences has led scientific evaluations of the unique geologic and geomorphic processes in Elk River (Stallman, 2004; Stillwater, 2005). They have extensive experience in working with the LiDAR data from the watershed, a fundamental Elk River topographic data set. Stillwater has consistently and effectively served a support role to Regional Water Board staff in developing a strategy for recovery of Elk River via sediment production and fate analyses.

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The proposed project satisfies a number of the CAA Program Preferences:

- *Emergency Cleanup Projects – Public Safety (Strategic Goals 1, 2, 3, and 4)*
  The nuisance flooding constitutes a significant health and safety risk to residents within the Middle Reach of Elk River.
- *Cleanup and/or abatement of 2006-listed water bodies that will help to implement a Total Maximum Daily Load (TMDL). (Strategic Goal 1)*
  The TMDL implementation program must address the instream deposits to ensure recovery of beneficial uses and abatement of nuisance conditions. The assessment described herein will identify necessary implementation actions to ensure the system recovers.
- *Cleanup and/or abatement of non-point source legacy pollutants when the source(s) of the pollution have been mitigated. (Strategic Goals 1, 2, 3, and 4)*
  The instream deposits are as a result of past discharges of sediment from industrial timber harvest activities. Sediment reduction measures have been underway in Upper Elk River since 1997. Currently a regulatory framework is in place to identify and treat existing sources of sediment and avoid creation of new sources. The TMDL implementation framework proposes refinements to the existing program on an aggressive timeframe to further reduce the management loads to meet water quality standards.

- *Cleanup and/or abatement of contaminated site when the viable responsible party has not been identified (Strategic Goals 1, 2, 3, and 4)*
  Two of the primary landowners responsible for the source of legacy pollutants are no longer in business: Pacific Lumber Company and Elk River Timber Company. Successful and expeditious assessment and cleanup requires a collaborative approach to restoration with broad stakeholder buy-in as represented by the proposed project. Penalties associated with historic waste discharge violations have been paid into the Cleanup and Abatement Account and may be reasonably applied to the proposed project, in lieu of pursuing litigation of cleanup and abatement requirements.
- *Projects that promote habitat restoration through non-profit organizations that collaborate with the Regional Water Boards and encourage public outreach and education. (Strategic Goals 1, 2, 3, and 4)*
  The funds are requested for CalTrout (a non-profit), in coordination with the Regional Water Board, to receive a grant or contract to promote habitat restoration, abate nuisance conditions, and rebuild collaborative working relations among landowners and residents in the Elk River watershed.

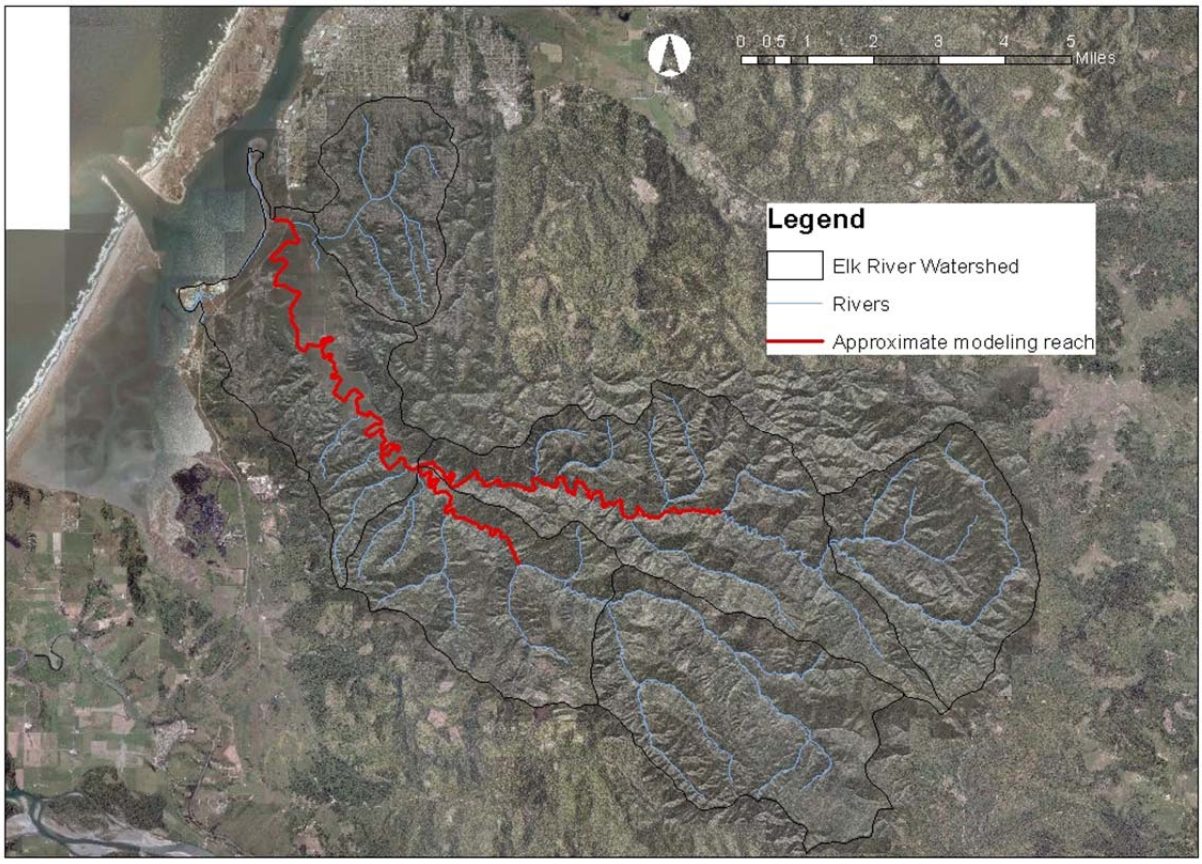

Figure 1: Map of Elk River watershed with modeling reach identified.

Scope of Work
Work is currently scheduled to begin on this project in the fall of 2012 with completion scheduled for the spring of 2014. The proposed schedule will be adjusted, depending on the timeframe necessary to secure funding and initiate a contract.

Task 1 - Project Team Project Management
Task Lead: Cal Trout
Projected Completion Date: February 2014

Project management will consist of managing the overall project. At a minimum, project management activities will include:

- Contract and subcontract development
- Budget tracking and reporting,
- Invoicing and required progress reports,
- Facilitation of project team and technical advisory committee meetings,
- Landowner contact and outreach as needed, and
- Meeting deliverable and time-frame schedules.

Task 1 Cost = $22,500

Task 2 – Update and Revise Existing Data
Task Participants: Jack Lewis and Northern Hydrology and Engineering
Projected Completion Date: October 2012

This task is primarily associated with updating and revising discharge and suspended sediment concentration (SSC) estimates on the North Fork and South Fork Elk River based upon refinements to stage-discharge relationships and storm-based regressions of turbidity and SSC. These revised discharge and SSC estimates will ultimately be used to develop upstream boundary conditions for the hydrodynamic and sediment transport model. The revised and updated discharge and SSC data will rely on existing Humboldt Redwood Company and/or Salmon Forever data. Specific work products include:

A. Continuous discharge record for North Fork and South Fork Elk River for Water Year 2003 to 2012.
B. Continuous SSC record for North Fork and South Fork Elk River for Water Year 2003 to 2012.

Task 2 Cost = $34,668

Task 3 – Implement In-Channel Data Collection
Task Participants: Northern Hydrology & Engineering, Stillwater Sciences and USFS Redwood Sciences Laboratory.
Projected Completion Date: A-F: December 2012, G: August 2013

Task 3 involves collecting in-stream channel data for defining existing conditions of the project reach. Data collection efforts will focus on filling in gaps in channel topography, including: surveying a thalweg profile and cross sections (as required), collecting and analyzing bed, bank and floodplain sediment samples to define particle size distributions within the project reach, identifying and mapping hydraulic and geomorphic controls in the reach, mapping dominant riparian and floodplain vegetation to characterize bank and overbank roughness elements, and assessing the abundance, quality, and distribution of salmonid habitat. This data collection effort will be done at the spatial resolution necessary to adequately support the grid scale of the proposed hydrodynamic and sediment transport (HST) model. Deliverables for this task include at a minimum:

A. Surveyed thalweg profile of the proposed project reach.
B. Establishment of a cross-section network within the entire project reach for defining existing conditions and post-project monitoring.
C. Surveyed cross-sections of the project reach to adequately define the existing channel bed conditions at the appropriate scale for the HST model.
D. Mapping key geomorphic features of the project reach, such as bed and bank composition, roughness elements, bank slumps, large debris jams, and general bed and bank vegetation features.
E. Collecting and analyzing approximately 50 bed, bank and floodplain sediment samples for particle size distribution of the project reach.
F. Analyzing and mapping the dominant bank and floodplain vegetation for the HST model.
G. Resurvey cross-sections following one winter season to define 1-year sedimentation patterns within the project reach.
H. Assess salmonid habitat availability and habitat impairment resulting from sediment transport and deposition.

Task 3 Cost = $168,886

Task 4 – Implement Water Data Collection
Task Participants: Northern Hydrology and Engineering, Stillwater Sciences, and USFS Redwood Sciences Laboratory.
Projected Completion Date: June 2013

Task 4 consists of collecting stage, velocity and depth integrated SSC data at key locations within the project reach. Conductivity (salinity), temperature and depth (CTD) will also be collected at one location within the Elk River estuary. These data will be used to adjust discharge and SSC data developed in Task 2 for use as downstream boundary conditions for the HST model. Collected data will also be used for calibration/verification of the HST model at internal locations within the modeling domain. The depth integrated SSC samples will be processed for total SSC and particle size distribution. The water data collection effort will be done at the spatial resolution necessary to adequately support the HST modeling effort. Deliverables for this task include at a minimum:

A. Approximately 6-months of CTD data will be collected at a central location in the Elk River estuary.

B. Continuous stage data for 6 to 8-months at approximately 6 to 8 locations within the project reach.

C. Wading discharge measurements, as required, at the stage recording sites.

D. In-channel velocity measurements at 3 to 5 locations within the project reach during 1 to 2 high discharge events.

E. Collection and analysis of approximately 8 depth-integrated SSC samples at about 10 locations within the project reach (80 samples total). The collected SSC samples will be analyzed for total SSC and particle distribution.

Task 4 Cost = $70,555

Task 5 – Hydrodynamic and Sediment Transport (HST) Modeling
Task Participants: Northern Hydrology and Engineering and Stillwater Sciences
Projected Completion Date: November 2013

Task 6 consists of implementing the proposed HST modeling work for this project. The HST model will assess the trajectory of the system (project reach) for (1) existing sediment loads, (2) reduced sediment loads (based upon TMDL loading capacity estimates to be provided by North Coast RWQCB), and (3) reduced sediment loads with broad scale restoration approaches. The HST model grid will be developed at a resolution adequate to assess system trajectory of the entire project reach, and provide a balance with computational efficiency for long-term simulations (e.g. 10+ years). An assessment of the appropriate modeling framework will also be conducted prior to HST model development. Deliverables for this task include at a minimum:

A. The project team will develop a conceptual model of the Elk River project reach.

B. The project team will select the appropriate modeling framework and approach.

C. Data from Tasks 2, 3 and 4 will be used to develop model boundary conditions, which include project reach topography and bathymetry; upstream discharge. SSC, salinity and temperature data for the North Fork and South Fork Elk River and tributaries; downstream water levels, salinity and temperature; bed, bank and floodplain sediment properties; and bank and floodplain vegetation data.

D. HST model grid development and calibration at the appropriate resolution to assess system trajectory.

E. HST model validation and sensitivity analysis of key model parameters.

F. The calibrated and validated HST model will be used to assess trajectory of the project reach for existing sediment loads; reduced sediment loads; and reduced sediment loads with broad scale restoration actions.

Task 5 Cost = $159,828

Task 6 – Reconvene the Technical Advisory Committee (TAC)
Task Participants: Cal Trout, Jack Lewis, Northern Hydrology and Engineering, Stillwater Sciences
Projected Completion Date: Meeting 1: September 2012; Meeting 2: November 2013

The TAC will be reconvened for two meetings. The first meeting will occur at the beginning of the project. The project team will solicit input from the TAC regarding: 1) the long-term desired channel conditions for the Elk River within the project reach, 2) broad recovery actions that will be evaluated, and 3) the data collection plan and proposed modeling approach. The second meeting will occur following completion of Task 5. This meeting will cover HST modeling approach and projected trajectories for: 1) existing sediment loads, 2) reduced sediment loads, and 3) broad recovery actions in combination with reduced sediment loads. Channel sedimentation trajectories under each scenario will be compared to long-term desired conditions. The TAC and project team will jointly assess the potential for achieving desired channel conditions under each scenario in the short and long-term. Deliverables for this task include at a minimum:

A. A description of the long-term desired conditions for the Elk River.
B. Peer review of the modeling approach and results.
C. An assessment of the expected differences between the projected trajectories and the long-term desired conditions under the three scenarios identified: 1) existing sediment loads, 2) reduced sediment loads, 3) broad recovery actions in combination with reduced sediment loads.

<u>Task 6 Cost = $35,240</u>

Task 7 – Prepare HST Modeling Report
Task Participants: Cal Trout, Jack Lewis, Northern Hydrology and Engineering, Stillwater Sciences, USFS Redwood Sciences Laboratory
Projected Completion Date: Draft Report December 2013; Final Report February 2014.

The final task is preparation of the HST modeling report which will summarize the above tasks. A draft report will be prepared for review and comment by the North Coast RWQCB, TAC and other identified parties as needed. Following the comment period, a final HST modeling report will be prepared for public distribution. Following is a potential HST modeling report table of contents:

1. Introduction, Background, and Goals and Objectives
2. Discharge and Suspended Sediment Concentrations in Elk River and Tributaries
    a. Existing data
    b. Revised continuous discharge record
    c. Continuous SSC record
3. Project Data Collection
    a. Topographic mapping and surveying
    b. Thalweg profile

   c. Geomorphic mapping
   d. Bed, bank and floodplain sediment samples
   e. Intermediate stage, SSC and velocity measurements
   f. Tidal CTD sampling
   g. Salmonid habitat assessment
4. Geomorphic conditions of existing Elk River channel
5. Develop desired channel condition and broad recovery actions
6. Development of Hydrodynamic and Sediment Transport Model
   a. Conceptual model of project reach
   b. HST model selection
   c. Model grid
   d. Boundary conditions
   e. Calibration of HST model
   f. Validation of HST model
   g. Sensitivity analysis of key HST parameters
   h. Develop reduced SSC scenario
7. Results and Conclusions of Hydrodynamic and Sediment Transport Modeling
   a. Existing sediment loads
   b. Reduced sediment loads
   c. Reduced sediment loads with broad scale restoration actions
8. Recommended recovery actions to restore desired ecosystem and water quality conditions.
9. References
10. Appendices

<u>Task 7 Cost = $91,770</u>

References

Anderson, Jeff. October 2001 *Review of "Elk River Flooding Analysis Summary" by PALCO dated August 6, 2001.* Letter from Jeff Anderson to Adona White North Coast Regional Water Quality Control Board.

Northern Hydrology and Engineering and Stillwater Sciences. 2012. *Elk River Hydrodynamic and Sediment Transport Modeling Pilo t Project.* Prepared for Redwood Community Action Agency, Natural Resource Services.

Patenaude, J.R. August, 2004. *Preliminary Assessment of Flooding in Elk River.* Staff report to the North Coast Regional Water Quality Control Board.

Stallman, J. July 2003. *Strath Terrace Genesis in the North Fork Elk River Valley, North Coastal California.* A Thesis Presented to the Faculty of Humboldt State University in Partial Fulfillment of the Requirements for the Degree of Master of Science in the Environmental Systems Graduate Group, Geology Option.

Stillwater, 2007. *Landslide Hazard in the Elk River Basin, Humboldt County, CA.* Prepared for the North Coast Regional Water Quality Control Board.

Budget

The following budget table includes cost-share estimates that may be adjusted.

Tasks		Project Costs							Funding Requests			
		CT	NHE	SWS	Lewis	RSL	Operating Expenses	Task Total	CAA	HRC	SCC	RCAA
Task 1	Project Management and Outreach	$22,500						$22,500	$22,500			
Task 2	Update and Revise Existing Data		$11,040	$3,500	$20,000		$128	$34,668	$9,668	$10,000	$15,000	$10,000
Task 3	Implement Channel Data Collection	$13,500	$55,340	$73,196		$10,000	$16,850	$168,886	$153,886	$15,000		
Task 4	Implement Water Data Collection		$29,640	$16,692		$16,000	$8,223	$70,555	$55,555	$15,000		
Task 5	Conduct Flow and Sediment Modeling		$126,840	$32,600			$388	$159,828	$159,828			
Task 6	Convene Technical Peer-Review Committee		$19,480	$15,400			$360	$35,240	$0		$35,240	
Task 7	Prepare Implementation Framework Report	$9,000	$43,200	$38,460			$1,110	$91,770	$0		$91,770	
								$583,447				
	TOTAL	$45,000	$285,540	$179,848	$20,000	$26,000	$27,059	$583,447	$401,437	$40,000	$142,010	$10,000

CT= CalTrout; NHE= Northern Hydrology and Engineering; SWS=Stillwater Sciences; Lewis= Jack Lewis; RSL=Redwood Sciences Laboratory; HRC=Humboldt Redwood Company; CAA=Cleanup and Abatement Account; SCC= State Coastal Conservancy; RCAA=Redwood Community Action Agency