

Middle Eel River Community Conservation and Restoration Pilot Project

Proposal to the State Water Resources Control Board



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Executive Summary

The Eel River Recovery Project (ERRP) is a 501c3 non-profit corporation that has been organizing in the 3600 square mile Eel River watershed since 2011. We have been assisting volunteer monitors throughout the basin to collect data on fish populations, water temperature and flow, and toxic cyanobacteria since 2012. Our data suggest that loss of stream flow is a major constraint on cold-water fish production and also has ripple impacts on water quality of main Eel River channels downstream. Diminished flow causes stream warming and, along with nutrient enrichment, promotes growth of toxic blue-green algae or cyanobacteria blooms. Stream desiccation has three root causes: changes in forest stands after old-growth logging leading to increased evapotranspiration, aggradation that buries stream beds, and increased rural water use partly in conjunction with cannabis cultivation.

In order to address these problems in two key Eel River tributaries, ERRP is seeking funding for the *Middle Eel River Community Conservation and Restoration Pilot Project* to assist residents of this sub-basin to implement water conservation, to decrease erosion, and to prevent pollution. Much of the initial focus will be on Chamise and Woodman Creeks that are very important tributaries of the middle main Eel River basin, which extends from Dos Rios to Dyerville. Their improvement will increase ecosystem function of this reach that already supports Chinook salmon, green sturgeon, and Pacific lamprey spawning. Although the work during this project will focus on the Chamise and Woodman Creek watersheds, formation of a Middle Eel Watershed Council (MEWC) will allow flexibility to apply for grants in other smaller sub-basins in this region without each having to form their own watershed group.

ERRP has worked closely with residents in both the Chamise and Woodman Creek watersheds and problems with flow have been apparent during water temperature monitoring since 2012. People within these watersheds would like to see the problem reversed through cooperative efforts, but they need additional resources to do so. Roads and erosion are also critical issues in both watersheds, and non-point source pollution from farming activities may also be an issue. This grant will bring substantial technical assistance for water conservation, pollution prevention, and to work to improve watershed hydrology and forest health. Some of the most qualified consultants in the field of watershed restoration, water conservation, farm planning, hydrology, and sediment and erosion control will be able to provide services to land owners so they can start to implement solutions. The end product of the grant will be a *Middle Eel River Watershed Conservation and Restoration Strategy* that could lead to funding for implementation of needed measures, including increased water storage that enables forbearance, road-related erosion control, gully abatement, and forest health implementation.

ERRP intends to facilitate the formation of the MEWC so that local stakeholders can carryout projects that will benefit their neighbors and the environment. By forming a watershed group for a larger geographic area, future service delivery could extend to other smaller sub-basins within the middle main Eel River watershed and membership of the MEWC could be expanded to include members from smaller watersheds in the sub-basin. For the two years this grant is funded, watershed coordinator services will be provided. The plan is for the MEWC to become its own non-profit 501c3 and to then apply for grants for project implementation.

Chamise Creek and Woodman Creek are each very important steelhead and Pacific lamprey spawning and rearing streams and Chinook salmon can now utilize the lower reaches of both streams for spawning in fall. Each of these watersheds has significant Bureau of Land Management ownership (30-40%) and partnerships between local residents and BLM is expected to work on shared objectives like improving forest health, limiting catastrophic fire risk, restoring hydrology and development of recreation potential on public lands. ERRP hopes that this project can serve as a model and be adapted to other basins in main middle Eel River watershed and in other large sub-basin areas within the Eel River basin.

Background

The water sources in question for this project are Chamise Creek and Woodman Creek, each of which have their headwaters in the Coast Range at 2500-3500 feet in elevation. Current water uses are primarily for domestic and agricultural supply. Average rainfall in both watersheds is a maximum of 70-75 inches per year in their upper reaches, declining to 40-55 inches on their eastern boundaries where they join the Eel River, due to the orographic effect. Despite ample average rainfall, both Chamise and Woodman creeks have lost surface flow in recent years, as documented by ERRP monitoring. ERRP has installed water temperature gauges in Chamise Creek annually since 2012, and periodically measured temperatures in upper and lower Woodman Creek. Timelapse cameras have captured images of flow in both watersheds in 2015 as part of another grant, and flow imagery continues to be captured on Chamise Creek (<https://vimeo.com/214843216>). Losing tributary flow has raised concerns about negative impacts to downstream beneficial uses, including supporting ESA-listed steelhead trout and Chinook salmon, water supply for domestic or agricultural purposes, and the potential for Eel River downstream reaches to stagnate and develop toxic cyanobacteria.

Development in these watersheds has been relatively rapid since 1995, and not all water users have water rights, although many have recently filed for them with the State Water Resources Control Board (SWRCB). The key water issue affecting these sub-basins is timing of withdrawal, and new California state law (Proposition 64) requires that diversion from North Coast streams cease after May 15, after which water for domestic and agricultural purposes must be met with stored water during annual “forbearance” periods. The public-private partnership envisioned by this grant would rely on those landowners or lessors who are of means to acquire storage with their own capital, while grants would be sought for those in the basin willing to participate but who lack the means to purchase their own storage. In fact, a significant amount of capital has already been expended by land owners in both watersheds for storage tanks and pond construction.

Over-supply of sediment has the potential to bury streams in both watersheds, as flood debris can cause streams to lose surface flow in late summer and fall. Landslides related to road failures can trigger mass wasting and that can bury stream courses with many feet of sediment. Changes in hillslope hydrology related to previous logging also play a role in flow depletion, as compacted areas like landings and roads reduce infiltration into groundwater. Also, early to mid-seral forests within the watersheds (40-60 years old) yield far less water than the late seral forests they replaced (Stubblefield et al. 2012). Consequently, watershed plans will also include sections on restoring and maintaining forest health. Over-stocked forest conditions promote elevated risk of catastrophic fire, which is also a concern to both communities.

In order to get implementation on the ground in the 3600 square mile Eel River watershed, ERRP needs to organize targeted efforts at the sub-basin scale. Over the last five years ERRP has identified key sub-basins in the Eel River that contain the right components to form successful watershed councils: 1) engaged citizens who have participated in ERRP outreach events, 2) populations of ESA-listed salmonid species, and 3) high potential for organizing success and ecological recovery. Based on previous scoping, ERRP has chosen to focus on the Tenmile, Chamise, and Woodman Creek watersheds. A California Coastal Conservancy grant using Prop 1 funding is allowing ERRP to assist with forming a Tenmile Creek Watershed Council and to help them address water conservation and water supply issues there. This grant would allow ERRP to fulfill strategic goals in two more key watersheds and to form the MEWC to support watershed restoration planning and implementation.

Considerable portions of both Chamise Creek and Woodman Creek’s steep headwater areas are owned and managed by the U.S. BLM Arcata Office. These areas of intact or recovered forest land are vital in helping maintain baseflows in summer. ERRP has a close working relationship with BLM and would like to recruit land owners in these watersheds to assist the agency as volunteers in maintaining forest health to lower catastrophic

fire risk and maintain and improve hydrologic functions. Landowners could then take knowledge gained in volunteer stewardship activities on BLM land and apply lessons learned on their own properties.

This project will help protect and improve habitat for ESA-listed Chinook salmon and steelhead trout. Chinook are part of the California Coastal population and the Northern Mountain Interior Diversity Strata (NMFS 2015). They may spawn in the lowest reaches of Chamise Creek and passage for spawning Chinook was re-established for the first time in 100 years in Woodman Creek as a result of removal of the railroad dike in 2018. Steelhead that spawn in Woodman and Chamise creeks are part of the Northern California Distinct Population Segment, Lower Interior Diversity Strata and are targeted for recovery by NMFS (2015). The Eel River is also listed as impaired for sediment and temperature and this project will help abate both problems, which is a priority of the U.S. Environmental Protection Agency (2006) Total Maximum Daily Load requirements.

Project Justification

This project is consistent with the goals and objectives of a number of federal, state and locally generated plans described below:

- 1) NMFS (2015) Multi-species Recovery Plan: This document deals with both Eel River Chinook salmon and steelhead trout and ERRP is focused on increasing flows and decreasing water temperature and sediment, which are all objectives of the plan.
- 2) BLM (2016) Northwest California Integrated Resource Management Plan: The priority for BLM's Arcata Office is recreation and restoration and they manage lands in both Chamise and Woodman Creek. Restoring flow, reducing water temperature and decreasing sediment yield is expected as a result of this project would be in line with their objectives. BLM (2016) notes that the patch of forest in the headwaters of Woodman Creek is late seral and classifies as Late Seral Reserve under the NW Forest Plan (FEMAT 1994). Reducing fire risk helps ensure that late seral conditions on BLM are retained.
- 3) Eel River Watershed Improvement Group (ERWIG 2000) Development of Watershed Groups Throughout the Eel River Basin: This document recommended that the Woodman Creek Road Association was a cooperative model and the potential kernel for a watershed group in this important fish-producing sub-basin.
- 4) North Coast Regional Water Quality Control Board (NCRWQCB 2011) Basin Plan: The NCRWQCB periodically issues guidelines for water quality in Region 1, which is the area within the State stretching from Santa Rose to Oregon. The water temperatures in Chamise and Woodman creeks are higher than recommended as is the middle main Eel River. Therefore, if flows increase and water temperatures cool, this project could help widen compliance with the Basin Plan.
- 5) U.S. Environmental Protection Agency (2006) - Middle Main Eel River TMDL: This document calls for reduction of water temperatures and sediment yield from middle main Eel River tributaries, including Woodman and Chamise creeks. Therefore, this project helps with TMDL compliance. They note temperature as a problem in both streams and recommend riparian improvements. This latter subject will be considered by watershed councils as they weigh priorities.
- 6) California Natural Resources Agency (CNRA 2014, 2016) California Water Action Plan: "The California Water Action Plan – originally released by the administration of Governor Brown in January 2014 – is a roadmap for the first five years of the state's journey toward sustainable water management" (CNRA 2016). This project aligns with almost all the goals of the program, including:

- Reliability, Restoration and Resilience
- Make Conservation a California Way of Life
- Protect and Restore Important Ecosystems
- Manage and Prepare for Dry Periods
- Expand Water Storage Capacity and Improve Groundwater Management
- Increase Flood Protection

7) Mendocino Fire Chief's Association (2016) - Mendocino County Community Wildfire Protection Plan: This plan recommends fuels management in the Woodman Creek project as desirable and the forest health objectives of this project would reduce fire risk in Woodman and Chamise creek basins.

8) California Department of Fish and Game – Stream Inventory Report Woodman Creek (1998a) and White Rock Creek (1998b). The recommendations of these documents is to install continuous recording temperature devices for 3-5 years in Woodman Creek and White Rock Creek at various locations. This project would begin the accomplishment of the latter, and we will also promote sediment reduction, which is another of the report's objectives. Like the U.S. EPA (2006), this report suggests improving canopy to help reduced water temperatures.

Project Location

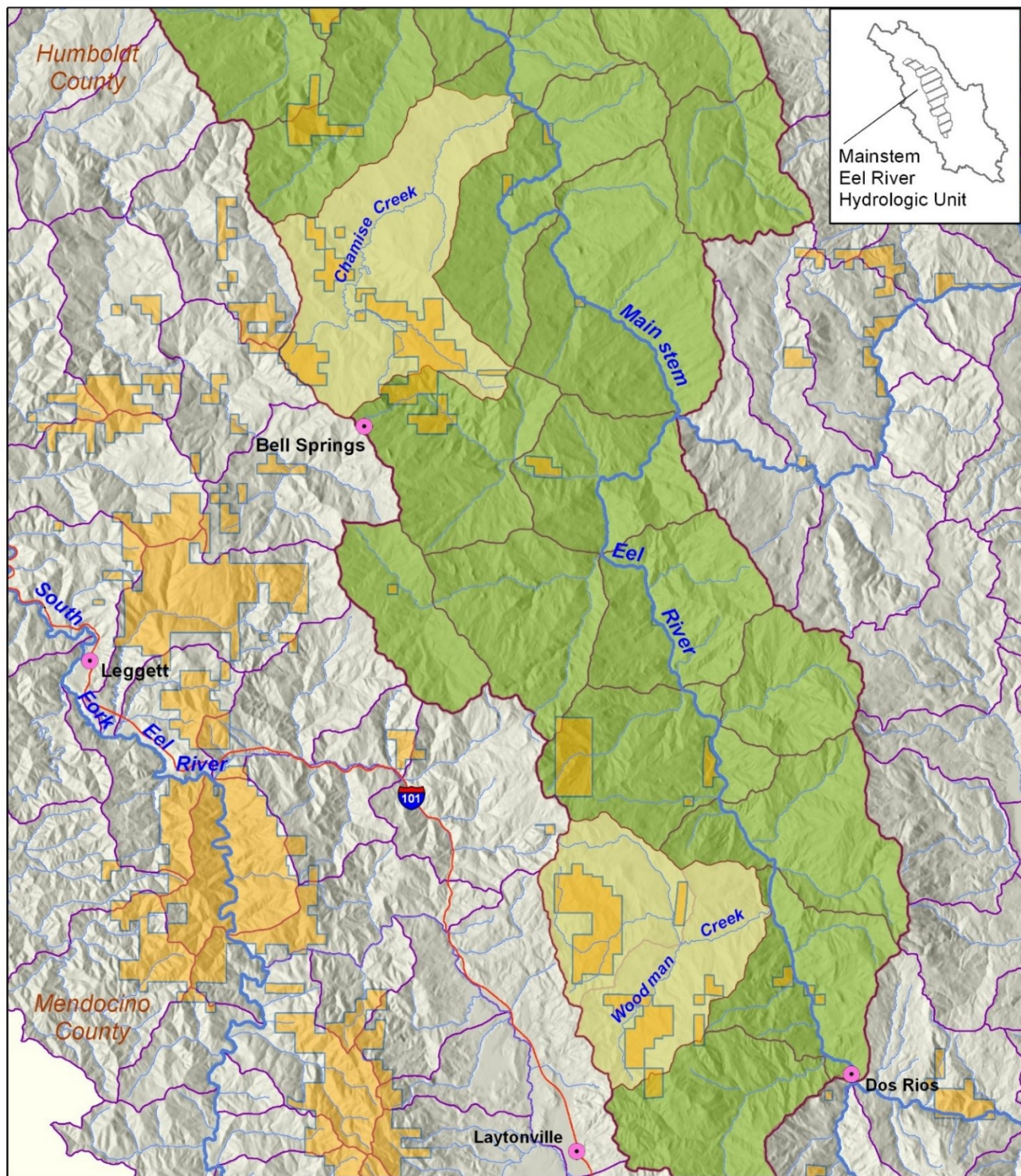
The Woodman Creek watershed is a tributary to the middle main Eel River basin, with its mouth approximately five miles downstream of the town of Dos Rios in Mendocino County. The middle main Eel extends from Dos Rios downstream to Dyerville, and Chamise Creek joins the main Eel above the town of Alderpoint in Humboldt County. Figure 1 shows the location of the basins in the middle main Eel sub-basin, which is the same as the U.S. Geologic Survey Mainstem Eel River Hydrologic Unit. Figure 2 shows the Woodman Creek watershed, and Figure 3 the Chamise Creek watershed.

Goals and Objectives

There are three goals for this project: 1) form consensus driven watershed council for the Middle Eel River basin, 2) create a *Middle Eel River Conservation and Restoration Strategy* that includes plans for implementation of specific measures for the Chamise and Woodman Creek basins for water conservation, road erosion control and pollution prevention, and 3) get as much work implemented as possible by private land owners in response to educational efforts under this grant. The objective is to bring in as much resources as possible with subsequent grants to assist watershed residents with carrying out needed projects.

Work Plan

This project will be carried out by skilled contractors, most of whom have extensive experience working in the Eel River basin and within the Chamise and Woodman creek watersheds. ERRP (2016) conducted extensive outreach and provided technical assistance under the SWRCB grant in 2015-2016, so contacts have been made and the level of enthusiasm in the watersheds suggests that many people are willing to participate. ERRP has a team of motivated contractors who all have skill sets and experience that give this project a high chance of succeeding. Team personnel and their area of focus is displayed in Figure 4. Sub-tasks that constitute the outline of a *Middle Eel River Community Conservation and Restoration Pilot Project Work Plan* are available as Table 1.



Location of Chamise and Woodman Creek Watersheds, as part of the Mainstem Eel River Hydrologic Unit within the Eel River Basin

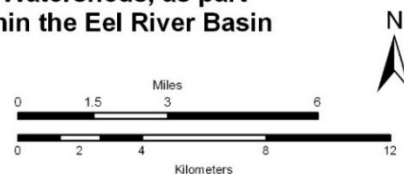
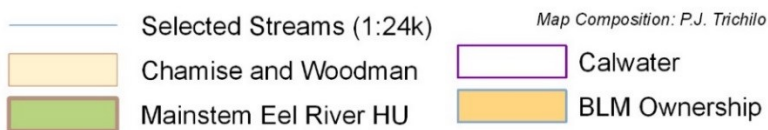


Figure 1. Location of Middle Main Eel River HUC and Chamise and Woodman Creek watershed locations.

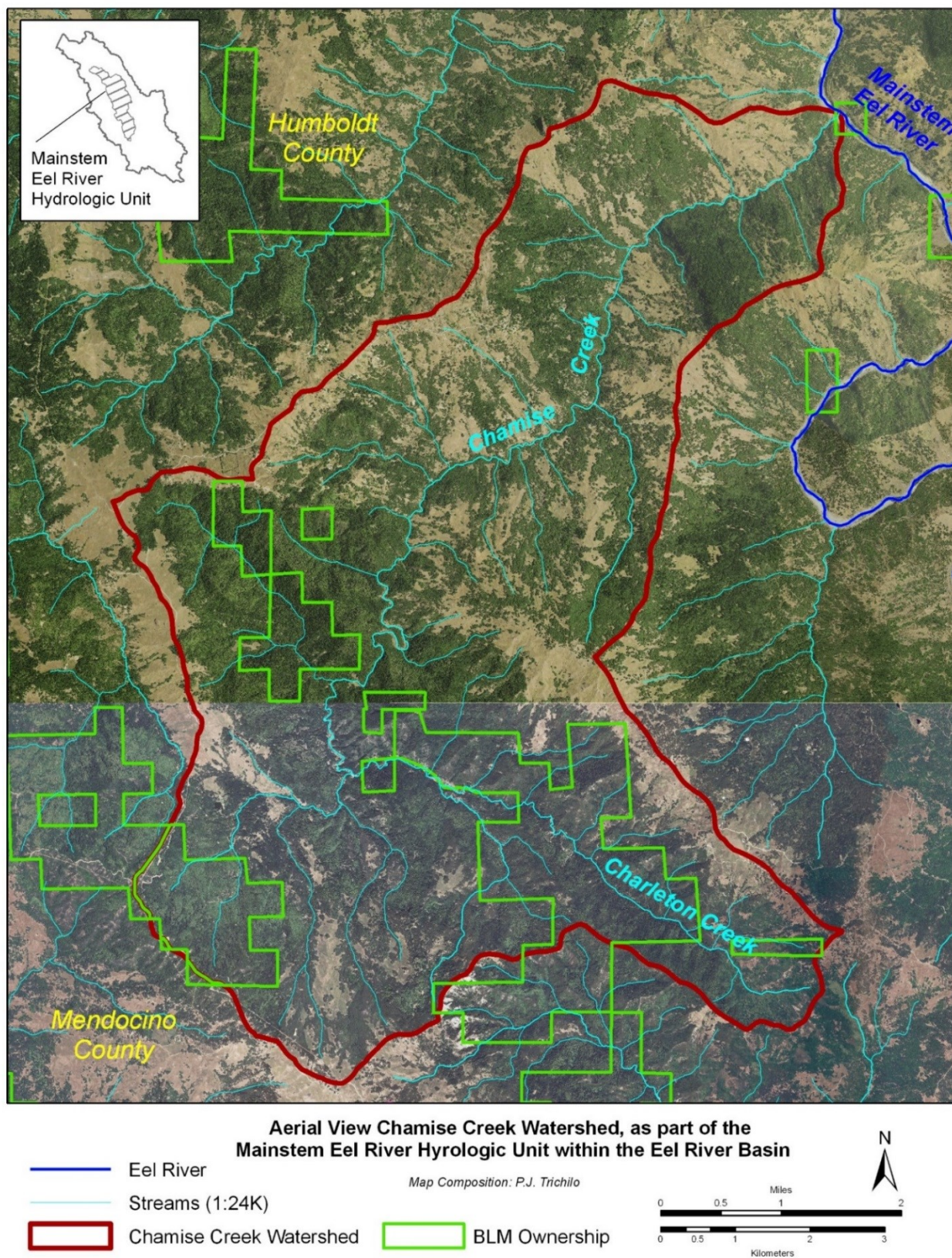
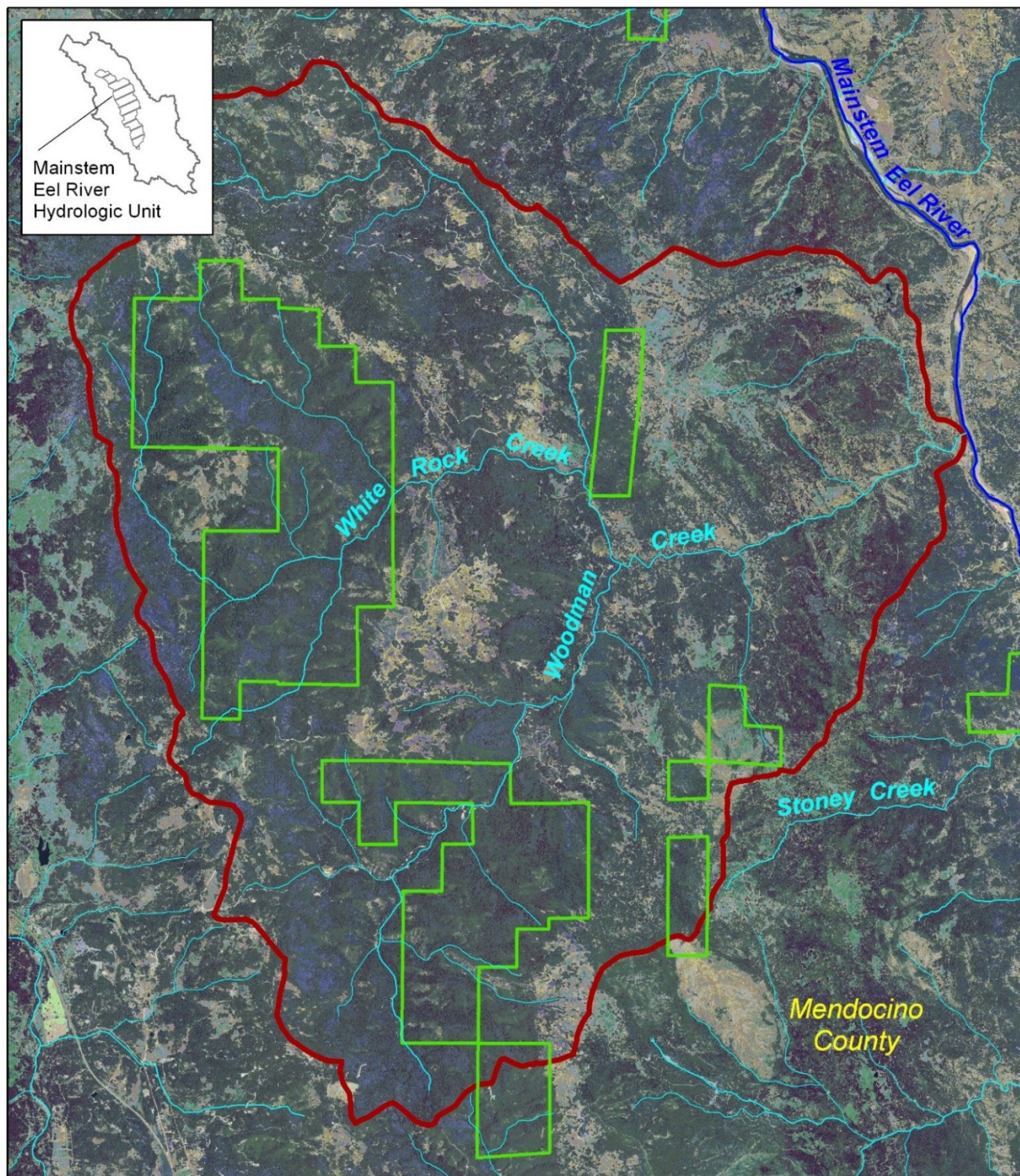


Figure 2.

Chamise Creek watershed with 1:24,000 hydrography layer.



**Aerial View Woodman Creek Watershed, as part of the
Mainstem Eel River Hydrologic Unit within the Eel River Basin**

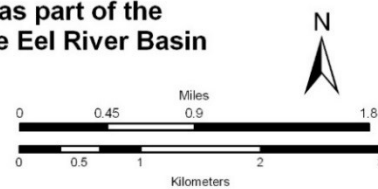


Figure 3. Woodman Creek watershed with 1:24000 hydrography.

Table 1. Sub-tasks defining performance of the Chamise and Woodman Creek Community Conservation and Restoration Pilot Project grant.

Task #	Task Item	Description
A1	Kickoff Outreach	Announcement of project kickoff in northern Mendocino and southern Humboldt newspapers, public radio stations, ERRP website, social media and posters on watershed bulletin boards
A2	Public Meetings	Public meetings to be held in Laytonville ERRP office for Woodman Creek residents, at the Heartwood Institute in the Chamise Creek basin, and in Blocksburg.
A3	Form Watershed Council	Form MEWC at first stakeholder meeting and devise Mission Statement
A4	Watershed Survey	Create and send survey similar to the one developed for Tenmile Creek project that gathers data and identifies clients .
A5	Create Database	Tabulate results from surveys and track cooperators in project database.
A6	Follow-up	Make contact with non-responding land owners by phone and additional direct mail to increase participation.
A7	Meetings/Field Trips	Meet quarterly to go over critical issues and host field trips to model farms or demonstration sites.
A8	MCWA Incorporation	The MEWC will become an IRS approved 501c3 by Year-2 of the project
B-1	Water Rights, Permitting & Conservation	Hollie Hall consulting services to land owners in the Woodman and Chamise Creek watersheds on water rights, permitting, and conservation
B-2	Basin Water Conservation Planning	Develop Chamise and Woodman Creek water conservation plans, including targets for additional storage, a plan for forbearance, and grants to pursue for implementation
B-3	Farm Planning	Village Ecosystems provides technical assistance on improving hydrology, reducing winter runoff and related sediment pollution, greywater systems and other agricultural “best practices”
C-1	Collect Flow Data	Thomas Gast and Associates Environmental Consultants (TGAEC) will collect flow data at two locations in Chamise and Woodman creeks from April – October 2020-2021
C-2	Historic Flow	TGAEC calculates changes in current flow versus historic
C-3	Current Storage	Calculate an estimate of how much water storage in tanks and ponds currently exists in Chamise Creek and Woodman Creek watersheds
C-4	Additional Flow & Storage Needed	Calculate the quantity of water needed to make creeks perennial and additional water storage needed to achieve forbearance
C-5	Conservation Plans	Create a community water conservation strategy for both the Chamise and Woodman creek watersheds and include in final report.

Task #	Task Item	Description
D-1	Road Air Photo Analysis	Analyze aerial photos to see extent of roads, landslides associated with roads and prioritize where resources are needed
D-2	Outreach & Training	PWA will provide land management and environmental protection training to land owners and the Watershed Coordinator.
D-3	Road Inventory	Inventory and assessment of approximately 20 mi of private and shared use roads in the Chamise Creek watershed
D-4	Transportation Plan Development	Develop Chamise Creek watershed transportation plan identifying prioritize road upgrading or road decommissioning.
D-5	Erosion Sources & Fish Passage	Maps and a report will be created describing significant sediment sources and fish passage barriers at road crossings
D-6	Data Entry & Analysis	PWA databases help quantify sediment sources to prioritize erosion control related to roads and to calculate proper culvert size.
D-7	Final Roads & Erosion Report	Prepare final plan-of-action for erosion and sediment control including estimated implementation costs
E-1	Assimilate Fish and Watershed Reports	Acquire and transfer to electronic form all CDFW, SWRCB, BLM, U.S. EPA, MCRCD, and academic reports and data about Chamise and Woodman creeks
E-2	Aquatic Monitoring	Deploy six water temperature gauges each in Chamise and Woodman creeks and in strategic Middle Eel tributaries. Establish photo points and characterize fish communities at all sites.
E-3	Timelapse Cameras	Install three timelapse cameras each in Chasmise and Woodman Creek to capture flow imagery for movies
F-1	GIS	Create maps for watershed planning purposes and for illustrations in watershed plans
G-1	Outreach	Create brochures, videos, slide shows and web content to increase awareness of land owners and encourage working on solutions immediately Middle Eel basin-wide.
H-1	Fiscal Services	Contractor disbursements, database management, fiscal control
H-2	Monthly Reports	Report monthly to substantiate invoices
H-3	Quarterly Reports	Quarterly progress reports will summarize major milestones
H-4	Prepare Plan Draft	Prepare draft <i>Middle Eel River Conservation and Restoration Strategy</i> and circulate for review
H-5	Publish Final Plan	Publish final <i>Middle Eel River Conservation and Restoration Strategy</i> and promote findings in press and on-line.
H-6	Publish Final Project Report	Documentation of grant completion and satisfactory performance

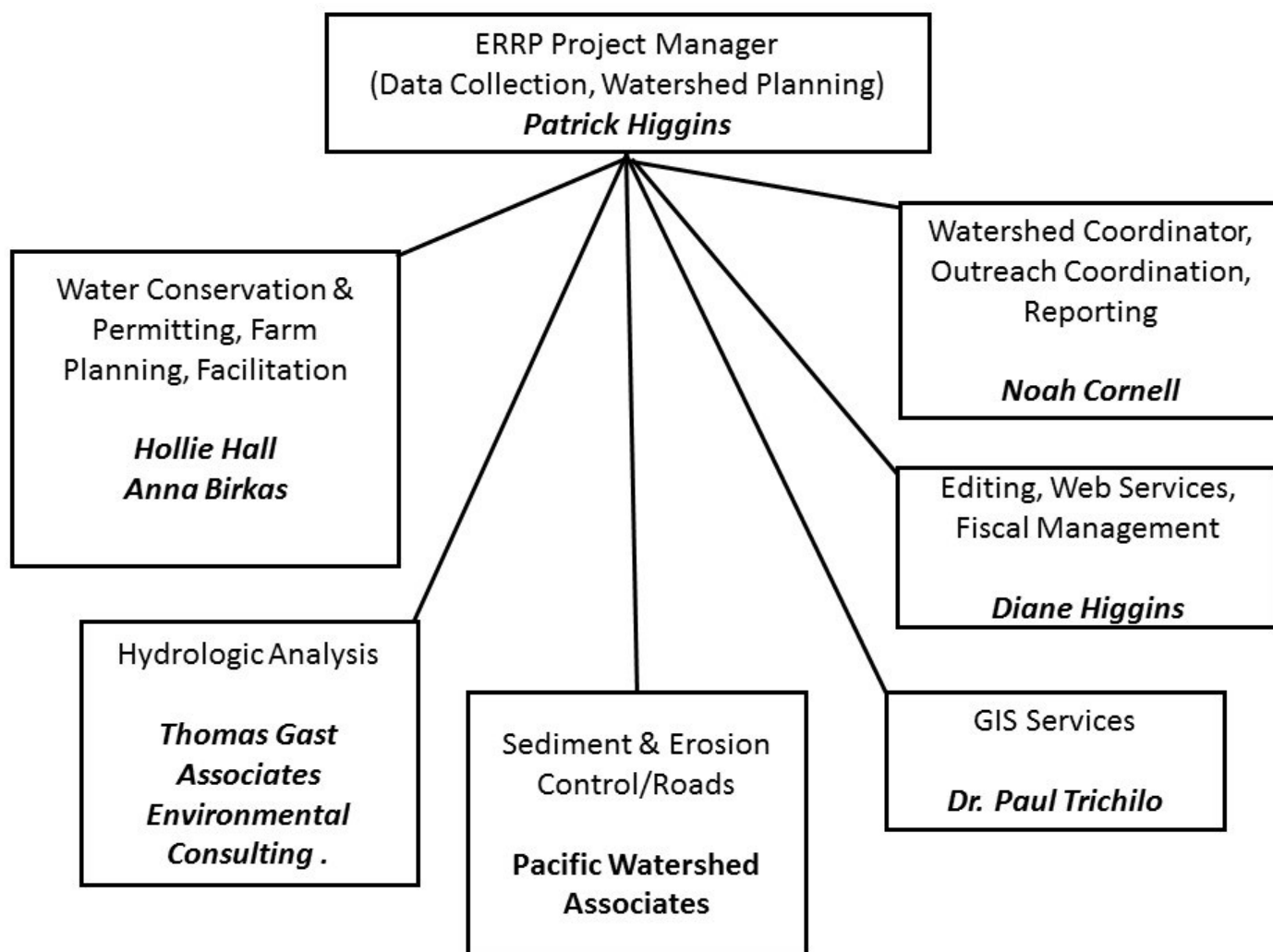


Figure 4. Flow diagram of contract personnel and their assignments.

Task A. Watershed Council Development: ERRP is currently managing a team of contractors in assisting with water conservation and pollution prevention planning in the Tenmile Creek basin with a grant funded by the California Coastal Conservancy utilizing Proposition 1 funds, which involves formation of the Tenmile Creek Watershed Council. The same contractors that are assisting with that project will help formation of the Middle Eel Watershed Council. ERRP Managing Director Patrick Higgins will be assisted by contractors Noah Cornell, Hollie Hall, and Anna Birkas who all have extensive experience working with residents of both the Chamise and Woodman Creek watersheds in implementing agricultural best management practices. Established relationships will help win trust and provide a foundation for organizing. Scoping meetings for this contract will take place in the Chamise Creek watershed at the Heartwood Institute, at the ERRP office in Laytonville that is proximate to Woodman Creek, and in Blocksburg that is also within the Middle Eel watershed to invite wider participation. Press outreach, posters, social media, and direct mail will be used to get the community involved and to maximize participation in formation of the MEWC and the project itself.

- A-1) Kickoff Outreach: Announce the project kickoff in northern Mendocino and southern Humboldt newspapers, public radio stations, ERRP website, social media and posters on watershed bulletin boards.

- A-2) Public Meetings: Hold public scoping meetings at the Heartwood Institute in Chamise Creek, the ERRP office in Laytonville that is convenient for Woodman Creek land owners, and in Blocksburg in the lower Middle Eel River watershed. The project will be explained, potential watershed council members recruited, and awareness of about the potential for bringing in resources for conservation and restoration.
- A-3) Form Watershed Council: Set meeting for formation of the MEWC and supply contract staff to record minutes. Form Board of MEWC and create a Mission Statement.
- A-4) Watershed Survey: Design and send a water use and land use practice survey form that offers services in the Chamise and Woodman Creek watersheds to all land owners.
- A-5) Create Outreach/Cooperator Database: Create a master database that captures survey results and land owner cooperation.
- A-6) Follow Up Contacts: Contact all land owners not yet participating in the Chamise and Woodman Creek watersheds by phone or through a second direct mail solicitation for participation.
- A-7) MEWC Meetings/Field Trips: ERRP contractors will meet with the MEWC quarterly throughout the project to track progress and to participate in the planning process. MEWC and ERRP may also host field trips to model farms or demonstration sites so that landowners can learn and share ideas about solutions.
- A-8) MEWC Incorporation - In the second year of the project, the MEWC will acquire grant funds for the purpose of applying for incorporation and will become an IRS 501c3 corporation so that it can bring resources into the Middle Eel River watershed for restoration and conservation.

Task B Community Water Conservation Planning and Best Practices Consultation: Camp-Shremmer (2014) provides a methodology for technology transfer of the successful community water conservation project in the upper Mattole River to other North Coast watersheds like the Eel River. A non-profit group, the Sanctuary Forest, was able to help residents organize, acquire water storage capacity through grants, and then implement a community plan that requires “forbearance” from stream diversion in late summer and fall (McKee and Formosa 2012). ERRP currently has a similar project in the Tenmile Creek watershed (Higgins 2019). Best management practices will also be promoted that encourage increasing water infiltration into the landscape and reducing winter run-off that causes erosion. Regenerative cannabis farming will be promoted that utilizes living soils, drip irrigation, bioswales and buffer strips to prevent pollution.

- B-1) Water Rights, Permitting & Conservation Consultation: Hollie Hall will provide technical assistance about water conservation, water rights and water permitting during farm visits and at public meetings. She will encourage installation of water meters and calculation of water budgets during visits with land owners and help them understand their water rights and about the process of water permitting. Conservation measures will be encouraged, such as installation of over-flow valves for storage tanks so more water remains in the stream.
- B-2) Basin Water Conservation Planning: Hollie Hall will also work with the MEWC and stakeholders to devise water conservation plans for Woodman and Chamise creeks, including targets for additional storage, a plan for forbearance, and grants to pursue for implementation
- B-3) Farm Planning/Best Practices Consultation: Anna Birkas will provide technical assistance on water conservation, increasing infiltration, reducing winter runoff and related sediment pollution, installing greywater systems, and other aspects of agricultural “best practices” to participating land owners and at public meetings, and MCWC meetings.

Task C – Current and Historic Flow/Needed Additional Storage – This project will study the hydrology and flow of the Chamise and Woodman Creek watersheds. Thomas Gast and Associates Environmental Consultants (TGAEC) will measure flow from April through October at two locations in each watershed for two years. If funding is going to be acquired for water storage and water conservation implementation, then there needs to be baseline flow data to test whether measure are working. Historic flows will be estimated, amount of water needed to restore surface flows, and the amount of water storage needed to allow forbearance in both Chamise and Woodman Creek watersheds. Funding mechanisms to subsidize additional storage will be identified and detailed in the watershed strategy so implementation funding can be sought in the future.

- C-1) Collect Flow Data: TGAEC will collect flow data at two locations within the Chamise Creek watershed and at two locations on Woodman Creek between April and October during 2020-2021.
- C-2) Calculate Historic Flows: TGAEC will use the U.S. EPA VELMA model (Visualizing Ecosystem Land Management Assessments) to calculate the likely range of historic flow of Chamise and Woodman creeks. This model is being used in the Tenmile Creek watershed in cooperation with Humboldt State University and it will be ideal for use in this project.
- C-3) Calculate Current Water Storage: TGAEC and Hollie Hall will work together to estimate existing water storage in tanks and ponds in both the Chamise and Woodman Creek watersheds by using surveys circulated to land owners, aerial photos of impoundments, field measurements of depths and volumes during pond assessments and through an assessment of potential pond/groundwater interactions.
- C-4) Additional Flow and Water Storage Needed: The difference between historic flow as calculated by TGAEC and current flow is equal to the quantity of water needed to restore flow to the targeted creeks. This would also be equal to the amount of storage needed by land owners that would allow them to not draw surface water from Chamise or Woodman Creek in summer and fall.

C-5) Community Conservation Plans: A community water conservation plan will be created for the Chamise and Woodman Creek watersheds and included in the *Middle Eel River Watershed Conservation and Restoration Strategy*. This will include a listing of all sources for grant assistance for augmenting storage and implementing water conservation and dates of expected Request for Proposals.

Task D – Chamise Creek Watershed Road and Erosion Assessment and Planning – The Woodman Creek Road Association has been working with the Mendocino County Resource Conservation District (MCRCD) to acquire funding for road assessments and implementation of road improvements and erosion control. Similar services are needed in the Chamise Creek watershed, which is in Humboldt County, but there have been no projects previously. Pacific Watershed Associates (PWA) is the contractor to ERRP under this grant that will render services related to road erosion assessment and planning. Their work plan is comprised of the sub-tasks listed below.

D-1) Road/Landslide Air Photo Analysis: Conduct an air photo analysis to document channel disturbances, road and skid trail locations, and road construction and road abandonment locations. Landslides and large gullies associated with the road network will also be identified. The aerial photo analysis will be crucial to determining the location and actual miles of constructed roads, as well as the erosion and channel response to historic road construction activities. All visible landslides and large gullies will be located and field-verified during the subsequent field inventories where access is available. The analysis is also critical in verifying the locations of old abandoned roads that are good candidates for future road decommissioning before

they fail and further impact streams in the watershed. This will also establish baseline data for monitoring of community efforts to coordinate watershed restoration efforts.

D-2) Outreach and Training: PWA will work with the Watershed Coordinator and participating community members to provide land management and environmental protection training. This training will be conducted in coordination with the grander effort outlined in this proposal. An emphasis of this component of the project will be to build internal capacity within the Chamise Creek watershed so that the community can independently manage their watershed for enhanced environmental protection.

D-3) Road Inventory: This erosion prevention planning project will result in the inventory and assessment of approximately 20 mi of private and shared use roads in the Chamise Creek watershed, which ultimately drains to the Eel River near Harris, CA. The objective of this component of the proposed project is to conduct an on-the-ground assessment required to produce a detailed erosion prevention and erosion control action plan that protects and improves habitat for salmonids by preventing controllable erosion and sedimentation from the road system. Fish passage barriers, if they exist, will be identified and analyzed. In addition, sediment sources that will deliver sediment to a stream channel will be inventoried and considered for potential treatment. Sources of erosion that will not deliver sediment to a stream will not be considered for remediation but will be mapped and identified for future maintenance activities. This component of the project will consist of three main work tasks: 1) a field inventory, including necessary QA/QC, of fish passage barriers and upland road related sediment sources; 2) data entry and analysis; and 3) preparation of a prioritized plan-of-action and estimated implementation costs for erosion prevention and erosion control treatments.

D-4) Transportation Plan Development: Based on the air photo analysis, and the community's future management plans, the PWA project manager and the local watershed coordinator will develop a preliminary long term transportation plan. It is anticipated that preliminary determinations for some portion of the inventoried features and roads will be unknown until the field inventory is completed, the degree of erosion risk is identified, and individual landowners are consulted. An emphasis for this component of the project will be to identify shared use roads and County maintained roads that can be immediately assessed.

D-5) Erosion Source and Fish Passage: Prepare base maps, field data form, and conduct a systematic field inventory of approximately 20 mi of maintained and abandoned roads to delineate all features which are currently delivering sediment or pose a risk of sediment delivery to the Chamise Creek stream network. For each identified feature of erosion and sediment delivery, a data form will be filled out that includes information such as: the nature and magnitude of existing and potential erosion problems, the likelihood of erosion or slope failure, the recommended treatment immediacy, the volume of future erosion, the percentage of delivery to the stream system, and recommended treatments to eliminate or significantly reduce the risk of future sediment delivery. A tape and clinometer survey will also be completed at all stream crossings to develop reproducible estimates of the potential sediment delivery volumes, and for calculating end-haul volumes and stream crossing geometries and volumes for road upgrading and road decommissioning projects. PWA technicians under supervision by the project manager and project manager will map features on base maps created and informed from the results of the aerial photograph analysis.

Most of PWA's upslope erosion inventory efforts will be focused on the road system since that is where preventable erosion is most likely to occur. They will also identify fish passage barriers, possible work sites on major skid trails, stream banks, and channel side slopes along or near the road system. During the assessment, PWA considers a range of possible road treatments including everything from upgrading through seasonal closure to full decommissioning. A host of potential treatments are available to "stormproof" roads and prevent erosion and PWA will work with the community and watershed coordinator to evaluate which treatments are

appropriate given the projected management plan for each individual road and watershed area. Features which do not pose a risk of future sediment delivery may be mapped as road maintenance sites on the base maps, but no additional data will be collected.

D-6) Data Entry and Analysis: The PWA Road computer program will be utilized by the PWA project manager and PWA technical staff to calculate stream crossing fill volumes using the survey data collected in the field. This proprietary software, developed by PWA, provides accurate and reproducible estimates of the potential volume of erosion and sediment delivery at a stream crossing feature. Drainage area calculations will be performed at most of the larger stream crossing features in order to determine the appropriate culvert size or drainage structure for the 100-year return interval flood flow. The fill volumes, as well as the entire PWA data form, will be entered into a Microsoft Access database for analysis and permanent storage by PWA technicians and the PWA project manager.

The PWA project manager and PWA technical staff will perform data analysis, including the generation of data tables summarizing the types of problems by treatment immediacy, future erosion volumes, excavation volumes, sediment saving volumes, etc., as well as develop tables summarizing erosion control treatments for the area. These tables include the types of treatments, material needs (road rock, rip-rap rock, culverts, mulch, etc.), costs for heavy equipment, labor, materials, etc. The database can then be analyzed to evaluate the projected cost-effectiveness of implementing all or a portion of the proposed road and erosion feature treatments, as well as for developing a final report. GIS site maps will be prepared showing the type of erosion or type of proposed treatment, and recommended treatment immediacy for each controllable sediment source identified in the field inventory.

D-7) Final Roads and Erosion Report: Prepare final sediment- and road-related watershed restoration plan-of-action report that summarizes the results of the inventory, including maps, database and GIS files which serve as a flexible, long term planning document for cost-effective erosion control and erosion prevention. Cost-effectiveness is defined as the dollars spent/yd³ of sediment "saved" (prevented) from being delivered to a stream channel. The prioritized plan of action for all correctable or preventable sediment sources can be implemented immediately upon completion of the assessment, once environmental compliance requirements and necessary fundraising are completed. The final report will also include but will not be limited to: (1) miles of assessed road in need of restoration, (2) miles assessed to establish protective measures for salmonids, and (3) number of fish passage barriers assessed. The report will comprise a chapter or an appendix to the *Middle Eel River Watershed Conservation and Restoration Strategy*.

All inventory methods, calculations, prioritization and recommended treatments will follow guidelines and standards described in the "Handbook for Forest, Ranch and Rural Roads: a Guide for Planning, Designing, Constructing, Re-constructing, upgrading, Maintaining and Closing Wildland Roads" [commissioned by the Mendocino County Resources Conservation District (MCRCD), (Weaver et al., 2015)], and the "California Salmonid Stream Habitat Restoration Manual, Chapters 9 and 10" (CDFW, 1998; Weaver and Hagans, 2006).

Task E – Aquatic Monitoring and Volunteer Training - Since all at-risk Pacific salmon species need cold water for survival (McCullough 1998), automated water temperature probes will be deployed at six locations each in the Chamise and Woodman Creek watersheds to check for salmonid suitability. Data collected for this project will be compared with historical water temperatures (Friedrichsen 1998, Asarian et al. 2016). Warming trends may be indicative of flow depletion (Pool and Berman 2000), especially in periods between major floods when channel conditions do not change. Placement of most probes will be to capture ambient stream temperature (Lewis et al 2000), but some will be placed in pools to check for cooling hyporheic influence (Pool and Berman 2000), and to see if they provide good salmonid habitat even if stream reaches are disconnected. Temperature

and fish results will be shared with the MCWC and the public via the ERRP website. Photopoints at each temperature monitoring location will help track channel changes over time and time lapse cameras will be deployed as another way of monitoring flow.

- E-1) Water Temperature: ERRP will place at least 6 Onset Instrument automated temperature probes each in Chamise Creek and Woodman Creek at TGAEC flow gauge locations, other sites previously gauged, and at locations in partnership with local land owners. Gauges will be deployed from May through October in 2020 and 2021 and ERRP will monitor at several other Middle Eel sub-basin tributaries.
- E-2) Fish Community: Fish community structure will be assessed by fisheries biologist and Project Manager Pat Higgins at each flow and temperature monitoring location and photo and video documented. Observations will be compared to CDFG historic records so changes in the fish community can be understood and reported, as well as the location of any coldwater refugia (Bradbury et al. 1995).
- E-3) Photo Monitoring: At each water temperature probe location photos will be taken upstream and downstream on each site visit. Wingscapes timelapse cameras will be deployed at three locations in Chamise Creek and Woodman Creek with photos taken every 30 minutes throughout the year. Photos can be edited into a movie of flow that allows people to see conditions in all seasons.
- E-4) Volunteer Training: ERRP Project Manager Pat Higgins will teach and train Chamise and Woodman Creek watershed volunteers on how to place and retrieve water temperature probes, to take photopoints, and also how to operate time-lapse cameras so that they can sustain monitoring into the future.

Task F – Make Watershed Maps for Planning and Reports – Dr. Paul Trichilo has been preparing maps for watershed analysis, report illustration and for public display since 2011. He is available to make maps with different watershed themes to support analysis of team members in all different aspects of this project.

Task G – Outreach – In order to get land owners to adopt new behaviors that conserve water and avoid pollution, outreach materials are necessary. Direct mail, brochures, videos, slide shows and web content will be generated to increase awareness of land owners and encourage working on solutions immediately Middle Eel basin-wide. The materials will be shared widely and may have benefits in other areas of the Eel River basin not covered by this project as we share information and land owners adopt best practices.

Task H – Project Administration and Reporting – The ERRP has experience in project administration and management which entails the following.

- H-1) Fiscal Services – ERRP will be responsible for disbursements to contractors, evaluation of performance, and fiscal tracking and control. ERRP will interface with grant agency and respond to any requests related to fiscal operation by the contract manager.
- H-2) Monthly Reports – ERRP will generate monthly reports to track expenditures and performance.
- H-3) Quarterly Reports – The quarterly reports will summarize major milestones and track the progress of performance.
- H-4) Draft Conservation and Restoration Plan - A major outcome of this project will be the publication of the *Middle Eel River Conservation and Restoration Strategy*. A draft of this document will be circulated to the grant agency, the MEWC and stakeholders throughout the basin for review and comment.

- H-6) Publish Final Plan – After comments are received, and appropriate changes are made, the final *Middle Eel River Conservation and Restoration Strategy* will be published. The document will be available online and findings will be shared through a final press release and other media outreach.
- H-7) Project Final Report – The last ERRP task for this grant will be to document performance, accomplishments and expenditures and grant funds in a final project report.

Budget

Task	Amount
Task A – Watershed Council Development	\$15,000
Task B – Water Conservation and Best Practices Technical Assistance	\$25,000
Task C – Current and Historic Flow/Needed Additional Storage	\$72,290
Task D - Chamise Creek Road and Erosion Assessment and Planning	\$50,000
Task E – Aquatic Monitoring/Volunteer Training	\$15,000
Task F - Make Watershed Maps for Planning and Reports	\$7,500
Task G – Outreach	\$17,500
Task H- Project Management	\$25,000
Project Administration (10%)	\$22,500
Total Project Budget	\$249,790

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