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Shasta West Watershed Management Plan



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***Prepared by the
Western Shasta Resource Conservation District
In cooperation with the
Shasta West Technical Advisory Committee
and the
Shasta West Watershed Group***

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EXECUTIVE SUMMARY

Overview

The Western Shasta Resource Conservation District (WSRCD) is a special district of the State of California that was formed in 1957 to work with willing landowners to conserve and enhance the natural resources of western Shasta County. The WSRCD was awarded two grants, funded through the State of California Department of Water Resources Under the Clean Drinking Water, Coastal and Beach Protection Act of 2002 Water Code Section 79500 et seq, to develop a Watershed Assessment (WA) and the Watershed Management Plan (WMP) for the Shasta West watershed area (Map 2). The Shasta West Watershed Group (SWWG) and Technical Advisory Committee (TAC) were specifically formed to guide and provide input for the development of the WA and WMP.

This document is intended to be used by any stakeholder, agency, business, community watershed group, landowner or interested party within the boundaries of the watershed. It is imperative that private landowners are an integral part of any and all watershed management strategies. Education, outreach, collaboration, and cooperation with private landowners and other stakeholders will be paramount throughout the implementation of this plan.

Mission Statement

The mission of the Shasta West Watershed Group is to provide long-term protection and maintenance of the unique qualities and character of the watershed, it's seasonal and annual creeks, its rural open space, it's diversity of plants and animals, and the intrinsic values of native plants, animals, birds and fish.

Goals and Proposed Actions

1. **Goal:** Restore and protect the elements of biodiversity and ecological processes within the Shasta West Watershed.

Proposed Actions: Manage invasive species; support local sources for native seeds and planting materials; oak woodland management; modification or removal of fish passage barriers to improve fish migration; fuel reduction to

minimize or avoid the occurrence of catastrophic fire; regulate illegal dumping; and reduce impacts caused by development and trespassing.

An example is the project at Jenny Creek for removal or amelioration of out flow pipes and for creation of spawning beds on city property near former water treatment plant. This would include gravel injections, and removal of Himalayan blackberry, vinca and Ailanthus species from confluence to Mary Lake. Another example is the fuel reductions project in the area between old Shasta and Redding.

- 2. Goal:** Restore and protect native species and biotic communities within the Shasta West Watershed.

Proposed Actions: Conduct Shasta West Watershed flora and fauna inventories to determine baseline conditions; manage invasive species; work with willing landowners to implement projects for restoration/protection of aquatic and terrestrial habitats such as riparian zones, oak woodlands, and vernal pools; and modify or remove structures that inhibit fish and wildlife migration.

An example is the Canyon Creek Channel Improvement Project: This creek was rerouted into a constructed man-made channel above Highway 273. This resulted in a lack of pools and riffles, incorrect placement of large concrete boulders, and limited natural vegetation and seepage from nearby properties. This project would redesign the channel, seek to restore the pools and riffles, remove concrete boulders, plant native plants, and introduce fines or encourage sealing materials where needed to prevent water seepage.

- 3. Goal:** Maintain and/or improve the hydrologic functions of priority streams through combining flood control requirements, ecological restoration, and water quality protection in the Shasta West Watershed.

Proposed Actions: Collaborate with the City of Redding and Shasta County to promote the adoption of the Ahwahnee Water Principles; reduce urban runoff and improve runoff water quality; provide information and outreach to promote Best Management Practices for animal and livestock keeping; work with the appropriate entities to develop programs to modify flood control structures; and facilitate implementation of projects to improve stream and floodplain functions such as sediment routing and riparian succession.

An example is the Swasey Sediment Dam that captures sediment from the Middle Creek Watershed and is instrumental in keeping fine sediment from settling in spawning beds of rainbow trout, steelhead and Chinook salmon and area fish habitat. Periodic cleanouts of the sediment dam by the Resource Conservation District have occurred since 1990.

4. **Goal:** Increase public knowledge and understanding of biodiversity elements, ecological and hydrological processes, ecological restoration techniques, native species, and human impacts in the Shasta West Watershed through inventory/monitoring and outreach/education programs sponsored by the Shasta West Watershed Group.

Proposed Actions: Develop simultaneous inventory/monitoring and education/outreach programs that will attract volunteers and ultimately contribute to the knowledge base and understanding of the natural resources and ecological processes within the Shasta West Watershed.

An example is ongoing education conducted by WSRCD working with watershed and other area groups and watershed education programs in local area schools that teaches 3rd through 5th grade students what a watershed is and steps to protect it.

5. **Goal:** Reduce the potential for loss of life and property to wildfires.

Proposed Actions: Collaborate with the Shasta West Fire Safe Council to utilize the *Shasta West Watershed Strategic Fuels Management Plan* (WSRCD, 2003), and the *City of Redding Hazard Mitigation Plan* (City of Redding, 2005) to implement fuelbreaks and fire safe best management practices throughout the watershed.

Fuelbreaks have been implemented in these areas: Hwy 299 between Redding and Old Shasta, Rock Creek Road, Swasey Drive, Lower Springs Road, Iron Mountain Mine Road, and Benson Drive (just completed). These fuelbreaks will require regular maintenance. Additional fuelbreaks are needed in this area.

6. **Goal:** Clean up the indiscriminant dumping throughout the watershed by leading efforts to reduce illegal dumping.

Proposed Actions: Collaborate with the City of Redding and Shasta County to establish a program to make the proper disposal of unwanted items more convenient for residents. Work with landowners to control access to their property to prohibit illegal dumping; organize and lead efforts to clean up creeks and other target areas throughout the watershed, and continue to participate in Redding's Adopt-a-Street program.

An example is the partnership between the City of Redding, WSRCD, and various local service groups to conduct annual creek cleanups on Lower Clear Creek and other local creeks, including those in the Shasta West Watersheds.

7. **Goal:** Ensure that public access from recreation and education will not negatively impact private lands and commerce.

Proposed Actions: Assist in identifying opportunities for obtaining voluntary public access from willing landowners; collaborate with the City of Redding, Shasta County, and willing private landowners to expand compatible open space recreation opportunities; promote the use of and expansion of existing trail systems, and encourage use of existing public OHV areas and trails.

8. **Goal:** Implement management actions to rehabilitate, restore, and protect the natural processes and biota in the Shasta West Watershed.

Proposed Actions: Competitively pursue grant funding to focus efforts on identifying, prioritizing, and implementing on-the-ground management actions and data collection projects.

An example is upcoming efforts recently funded to control invasive non-native plant species such as Tree of Heaven (*Ailanthus*), Spanish, Scotch and French broom, and Himalayan blackberry from the Highway 299 west corridor.

A critically important value of this plan is this: the WMP recommends a number of projects, including possible partners for those projects, and identifies potential funding sources. Increasingly, partner agencies and funding sources want to see that such a plan has been developed before they get involved or agree to fund a project. So this plan provides such a foundation.

More details about the project examples in this summary are available in the full WMP below, which is also available on CD from the WSRCD.

INTRODUCTION

Background

A watershed approach to resource management recognizes that the health of the watershed is directly related to the health and well-being of the dependant wildlife species, regional economies, and local communities. The citizens of California have long recognized the importance of healthy watersheds and have supported management on a watershed basis through approval of statewide bonds.

The Shasta West Watershed Group (SWWG) originally began in 1994 when erosion control problems were identified by local residents. Shasta West covers the area west of the Sacramento River in Redding that includes downtown Redding and the drainages of Rock Creek, Middle Creek, Salt Creek, Jenny Creek, Canyon Creek, Olney Creek, Oregon Gulch and Linden Channel. A Watershed Assessment (WA) was completed in 2005 and funds were provided by the Department of Water Resources in 2006 to develop the Watershed Management Plan (WMP.) Several fuels reduction projects have taken place through funding from the National Park Service (NPS), Bureau of Land Management (BLM), and CAL FIRE. Additional projects include erosion studies that were conducted on Middle Creek in the early 1990's; and the modification of two fish barriers located on Salt and Olney Creeks through grant funding received through the Cantara Trustee Council.

Major benefits anticipated from the WMP include expanded capacity of the SWWG for education and outreach throughout the area, increased collaboration between agencies responsible for resource management and, throughout the watershed, promotion of individual landowner projects that tie into grant funded projects to restore, enhance, and protect the watershed.

Area Description

The Shasta West Watershed is over 30,000 acres (approximately 46 square miles.) Just under half of this area is within the City of Redding. Shasta State Historic Park, located six miles west of Redding, consists of 19 acres and includes the historic town of Shasta. Approximately 700 acres in the northwest portion of the watershed lies within the eastern boundary of Whiskeytown National Recreation Area.

The climate of the area is Mediterranean with summers that are hot and dry and winters that tend to be cool and wet. Temperatures average 62°F and range from

an average of 55°F in the winter to 98°F in the summer. Extended periods of temperatures exceeding 100° are not uncommon during the summer months. Precipitation occurs mostly during the winter and spring months, and averages 33.3 inches annually.

The Shasta West Watershed contains eight major tributaries, all of which drain into the Sacramento River. Rock Creek flows from west to east, originating in the steep terrain east of Whiskeytown Lake. Middle Creek flows from south to north until it reaches the town of Old Shasta where it turns east to the Sacramento River. Salt Creek flows from southwest to northeast, originating in the gently rolling terrain near the intersection of Swasey and Lower Springs Roads. Jenny Creek flows from southwest to northeast through a heavily developed area of west Redding. Canyon Creek flows from northwest to southeast through a heavily developed area of west Redding. Oregon Gulch flows from west to east through a moderately developed area of southwest Redding. Olney Creek flows from west to east through relatively undeveloped areas east of Highway 273 and through moderately developed areas between Highway 273 and the Sacramento River. Maps showing this watershed area are on the report cover and on page 8.

Photo 1. Rock Creek



The watershed supports diverse vegetation communities and various fish and wildlife species. Significant biological resources include riparian communities, seasonal wetlands, vernal pools, stream and pond habitats, and the organisms that occupy these habitats. Many special-status plant and animal species and designated critical habitat are found throughout the watershed. Special-status

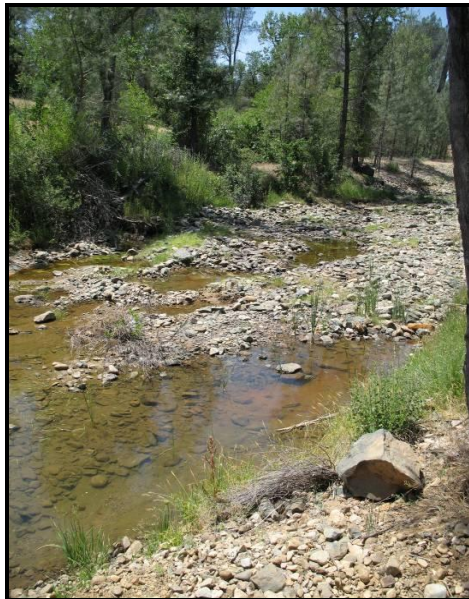
species include the spring and fall-run Chinook salmon, Central Valley steelhead, vernal-pool fairy shrimp, and tadpole shrimp.

The majority of the recorded significant archeological and historical sites in the watershed are historic resources associated with mining activities. With urban development, cultural resources such as Native American heritage sites are at risk of being lost or damaged.

In general, the eastern half of the watershed is incorporated into the City of Redding. Although much of the watershed is urbanized, 35.1 percent (10,264 acres) remains open space, public land, and parks. This is the result of strong open space policies combined with federal land retention on steep slopes and along streams in Redding (4,059 acres of designated greenway) within Shasta County. The watershed includes several land use features that help define the area as a cultural center to the region. Key elements include downtown Redding, Turtle Bay Exploration Park, and the Sacramento River Trail which is over 18 miles long and runs through the center of Redding.

The watershed also contains regional services used by residents throughout Shasta County and neighboring counties. These include hospitals and medical support offices, federal and state government regional field offices, the Shasta County Courthouse, Redding City Hall, and the Redding Convention Center. These facilities form a hub for regional services in the Shasta West Watershed.

Photo 2. Olney Creek



The watershed is experiencing the impacts of urbanization such as increased stormwater runoff, loss of key habitat, pollution, and decreases in water quality. Urbanization is expected to continue, despite periodic declines in local real estate markets.

Map 1. Shasta County, California



Map 2. Shasta West Map



ISSUES

This section outlines the principal issues and concerns regarding overall watershed conditions, and provides management objectives and actions to address those issues (Addendum B, Index to Issues/Management Objectives/Management Actions). The issues are based on the Shasta West Watershed Assessment, stakeholder input, and other information provided by the SWWG and TAC members. Although watershed issues are discussed independently, it should be noted that management actions impacting watershed health are highly interrelated (e.g. water quantity/water quality, stream channel stability/aquatic habitat, vegetation management/habitat, etc.) and may appear in more than one section.

WATER QUALITY AND HYDROLOGY

Existing Conditions

Water Quality

- Sediment problems in Middle Creek were identified in the 1993 *Middle Creek Erosion and Sediment Control Study*, but no long term solutions to address the problem of sediment delivery to the Sacramento River have been implemented.
- Best Management Practices (BMPs) for water quality are known, but are not widely utilized.

Photo 3. Oregon Gulch



- Improper refuse disposal in the western limits of the watershed needs to

- be addressed.
- The water quality shows signs of being impacted by stormwater runoff in all streams in this watershed.
 - Existing water quality data is not readily accessible for resource planning.
 - Issues resulting from activities such as illegal Off Highway Vehicle (OHV) use and improper waste disposal should be addressed particularly in the western portion of the watershed.
 - Visual observations used to assess stream health during the development of the Shasta West Watershed Assessment need to be supplemented by more extensive field surveys.
 - Water quality concerns regarding OHV trails include increased erosion and sediment into nearby surface waters.
 - Improperly managed animal and livestock enclosures can discharge sediment, nutrients, and bacteria.
 - Increased polluted stormwater runoff increases the need for and cost of water treatment.
 - Invasive plants are contributing to decreased water quantity and quality.
 - The City of Redding and Shasta County have only recently adopted setback standards in riparian zones for new construction.

Hydrology

- Many of the Shasta West streams flow through urban areas and have been modified from their original conditions.
- The capacity of stream channels to convey high flows during storms has been reduced by historic and new developments encroaching into riparian zones and floodplains, while at the same time; the amount of urban runoff and associated flash runoff events have escalated due to increased impervious areas such as streets and parking lots.
- Increased flows during flood events have caused accelerated erosion within stream channels and onto floodplains in the area.
- The potential for chemical and organic pollutants increases as development increases.

Photo 4. Channeled Lower Reach of Canyon Creek.**Photo 5. Channel Constriction on Jenny Creek**

Management Objectives

- Implement focused monitoring on key water quality parameters to define baseline conditions and assess the need for improved management practices and/or rehabilitation.
- Develop and implement a continuing, long term watershed monitoring program to allow water quality/quantity decisions to be made on a data driven, scientific basis.
- Develop a Monitoring Coordination Strategy to coordinate SWMG ambient water quality/quantity monitoring with other monitoring efforts in order to maximize overall knowledge of Shasta West Watershed conditions.
- Establish a process and a center for data storage, data analysis, and public distribution of water quality and quantity and other watershed monitoring information.
- On all projects, assist in implementing Best Management Practices (BMPs) for controlling erosion to improve water quality in the Shasta West Watershed.

Management Actions

- Survey the watershed using physical surveys or remote sensing to establish baseline geomorphic information and basic data such as stream

- channel slope, stream channel types and composition.
- Classify streams according to the Montgomery Buffington stream classification system to develop basic knowledge of stream behavior, hydraulic and sediment relations, and to provide a consistent and reproducible frame of reference for communication by natural resource planners working with the Shasta West streams in a variety of disciplines.
 - Work with agencies and landowners to develop a stream monitoring program that includes installing and monitoring stream gauges on priority streams in the watershed in order to determine flow regimes.
 - Survey sub-surface stream sections to produce GIS layers and work with the City and County planners to investigate opportunities for stream daylighting.
 - For a future update of the Shasta West Watershed Assessment, work with the City of Redding to obtain data from the city's hydrology model and FEMA flood mapping models for streams in the watershed.
 - Work with agencies to develop a water quality monitoring program to gather baseline data for the priority streams in the watershed.
 - Work with agencies, landowners and organizations to assess and develop long term solutions for a sediment reduction program for the Middle Creek sub-watershed.
 - After collecting baseline water quality data for priority streams identified in a water quality monitoring program, assess the effects of stormwater runoff and non-point source pollution upon streams in the watershed.
 - Collaborate with DWR to convert water quality data that is in hardcopy format into an easily accessible electronic format.
 - Collaborate with agencies to research and update Best Management Practices regarding development and permeability issues.
 - Collaborate with agencies and landowners to monitor key OHV use areas to determine the effects upon water quality.
 - Provide expertise and services for riparian vegetation management to minimize flood risk.
 - Work with DWR to develop a groundwater monitoring grid in the event that future demand for GW resources in the watershed increases.
 - Collaborate with landowners and agencies to perform a stream function analysis on the priority streams in the watershed to determine overall stream health.
 - Collaborate with Anderson Cottonwood Irrigation District (ACID) to investigate the effects of the ACID canal on ecosystem and stream conditions in the watershed.
 - Encourage the City of Redding and Shasta County to incorporate the Ahwahnee Water Principles into their General Plans.
 - Provide information and outreach to promote better livestock and animal keeping practices.

VEGETATION AND SPECIAL STATUS PLANTS

Existing Conditions

- Knowledge of native species composition is lacking and urban development is increasing in riparian areas and wetlands of the watershed resulting in a reduction of biodiversity.
- Invasive species are replacing native communities in riparian areas and have become a major issue in the watershed, with a special concern for the spread of A-rated noxious weeds.
- Urban developers entering the Wildland Urban Interface (WUI) need to be educated about the effects of urban sprawl on the spread of non-native species.
- The effects of suburban and semi-rural development on native vegetative communities are unknown.
- Oak woodlands are the dominant vegetative community in the watershed, accounting for 30 to 40 percent of the area.
- Historical copper smelting has changed the biodiversity in the watershed.
- Scattered foothill, ponderosa, and knobcone pines are interspersed throughout dense brush in the western portions of the watershed; thickets of Manzanita that are practically impenetrable dominate the terrain between Middle and Rock Creeks.
- Utilization of the California Land Cover Mapping and Monitoring Program, a statewide cooperative effort focused on mapping and monitoring California's vegetation and land cover, during development of the WA was insufficient for assessing riparian vegetation and wetland areas in the watershed and the accuracy of imagery was uncertain for differentiating the variety of hardwood types.

Management Objectives

- Conduct vegetation inventories to identify and monitor existing conditions and trends.
- Increase knowledge of the sensitive botanical and wildlife species in the watershed.
- Protect existing riparian corridors and encourage the rehabilitation of degraded riparian areas.
- Quantify, locate and develop management strategies for non-native plant and animal species.
- Conserve existing oak woodlands and support projects that enhance oak woodland health.
- Utilize fuel management to increase wildlife habitat quantity and quality while helping to protect natural resources throughout the watershed.

Management Actions

- Work with the Shasta County Planning Department and other agencies to perform an invasive weed inventory and develop a GIS database
- Map known invasive occurrences and control actions for CDFA and CallIPC A-listed weeds to track and estimate the rate of spread in the watershed.
- Utilize invasive mapping data in conjunction with data from adjacent watersheds to gain knowledge on the spread of invasive weeds in the region.
- Collaborate with agencies and organizations involved in the control of invasive plants to coordinate weed control efforts.
- Acquire and analyze recent color aerial photographs for the watershed, verified by field investigation in order to assess the extent and quality of the valley foothill riparian California Wildlife Habitat Relationship (CWHR) System* vegetation community and address uncertainty from the California Land Cover Mapping & Monitoring Program* (LCMMP) mapping in regard to the various hardwoods and deciduous tree life forms.

* The CWHR habitat classification scheme has been developed to support the CWHR System, a wildlife information system and predictive model for California's regularly-occurring birds, mammals, reptiles and amphibians. When first published in 1988, the classification scheme had 53 habitats. These habitats -- except the non-vegetated Barren habitat -- are described in detail in the CWHR publication entitled:

A Guide to Wildlife Habitats of California. 1988

Edited by Kenneth E. Mayer and William F. Laudenslayer, Jr.
State of California, Resources Agency,
Department of Fish and Game, Sacramento.

* The California Land Cover Mapping & Monitoring Program (LCMMP) is a collaborative effort of the US Forest Service and CDF to map and assess changes in California's vegetation. This effort provides monitoring data for regional assessment across ownerships and vegetation types. We also identify the cause of changes using current fire perimeter data, USFS harvest/plantation data and fieldwork. By revisiting each project area on a five year schedule, it is possible to detect trends and conversion rates of vegetation.

- Obtain historical and current aerial photographs and conduct a time-series analysis of aerial photographs in order to assess fragmentation of native

- vegetation communities. This type of analysis could also produce a rate of habitat fragmentation for the watershed.
- Work with landowners and agencies to encourage the retention of riparian buffer zones to (1) maintain and/or enhance native riparian habitat, (2) benefit fish, wildlife, and native plant species, (3) provide buffering benefits to reduce the effects of stormwater runoff, siltation, and chemicals entering the watercourse and (4) to reduce potential damage from flooding.
 - Work with landowners to further analyze floristic surveys already conducted along Salt and Canyon Creeks. Consider undertaking similar surveys along other priority streams.
 - Work with landowners to survey wetlands and identify their interaction with streams and adjoining plant communities.
 - Collaborate with agencies to explore mechanisms for retaining and regenerating oak species; pursue available funding for oak management; and promote the development of an oak woodlands management plan for Shasta West.
 - Work with agencies to further the investigation of the long-term effects of copper smelting on the soil and vegetative conditions in the watershed.

FISH & WILDLIFE

Existing Conditions

- Current information on wildlife species is based mainly on CWHR modeling; no survey data was collected for the WA to confirm the occurrence of various wildlife species in the watershed.
- The watershed has suitable habitat to support as many as 50 native fish species; however the quantity and quality of salmon spawning and rearing habitat is largely unknown, particularly in the upper reaches of the watershed.
- The watershed may support 200 to 300 species of terrestrial vertebrates, thousands of species of insects, and other various invertebrates. Neo-tropical songbirds, such as vireos, particularly favor oak woodlands and associated riparian habitats for nesting when they return to the watershed in summer.
- Native habitat is being reduced and fragmented by urban development and existing riparian corridors and habitats are under urban development pressures.
- Vegetation typing and LCMMP imagery is insufficient for assessing the quality and quantity of wildlife habitats, stressing the need for better mapping of terrestrial habitats combined with the pattern and rate of urban/semi-rural development.

Photo 6. Juvenile Mortality in Rock Creek

- There is a need to review BMPs to evaluate their ability to provide wildlife habitat parameters and species needs.
- The rate and pattern of urban and semi-rural development and its effects on wildlife habitat and populations have not been fully explored; however deer population and health are effected by rural development, and Mountain Lion occurrences within the watershed will increasingly lead to conflicts with residents as they occupy urban-interface habitat throughout the watershed
- In particular, the impact of wildlife movement barriers, animals killed by vehicles, and urban animal predation on watershed wildlife and populations is unclear.

Management Objectives

- Conduct vegetation inventories to better understand existing conditions and trends.
- Increase knowledge of the sensitive botanical and wildlife species in the watershed.
- Protect existing riparian and terrestrial corridors and encourage the rehabilitation of degraded riparian corridors.
- Quantify, locate and develop management strategies for non-native plant and animal species.
- Conserve existing oak woodlands and support projects that enhance oak woodland health.
- Use fire prevention and fuels management practices that increase or improve wildlife habitat.

Management Actions

- Work with the City of Redding and Shasta County to explore the use and/or development of incentive programs for landowners to preserve and maintain native habitats through the review and development of BMPs that retain open spaces to accommodate a variety of wildlife species.
- Collaborate with agencies and educate the public on the effects of various forms of recreation on fish and wildlife populations and habitat, including the use of developed educational materials and outreach programs to inform rural residents on the risk of living in Mountain Lion habitat.
- Collaborate with the City of Redding and Shasta County to develop a GIS database that can track urban development and wildlife habitats in the watershed and work with agencies and organizations to develop a wildlife monitoring program.
- Evaluate habitat using the Guild Approach or other comparable scientific method to prioritize habitat restoration and protection efforts after the development of a high quality vegetation map of the watershed. Simply put, a “guild” is defined as a collection of species that occur in the same habitat. The analysis of a guild of species for a particular habitat can provide a valuable community-level assessment. Information gathered could be used to link the habitats of the Shasta West Watershed to other adjacent watershed habitat types.
- Develop educational materials and outreach programs about the function and importance of fish and wildlife species and the idea of biodiversity for the watershed. Included in the materials should be education on the effects of domestic animals such as cats, dogs and exotic pets on biodiversity and the watershed.
- Consult with DFG to identify opportunities for riparian and terrestrial wildlife corridor conservation and restoration.
- Use results of recent fish barrier surveys to evaluate and plan fish passage improvement projects in the Shasta West watershed.

FIRE PREVENTION AND FUELS MANAGEMENT

Existing Conditions

- Dominant fuels in the watershed are at high and severe fire risk, which threatens wildland habitat and urban development with large wildfires.
- Current fuel loading is unacceptably high, and detailed local fuel inventories have been completed in the Shasta West Watershed Strategic Fuels Management Plan (December 2003).
- Lightning related fires make up almost 90 percent of all wildland fires in the Shasta West Watershed.

- Fire exclusion and suppression in the Shasta West Watershed have resulted in a significant increase in fuel loading and potential for catastrophic wildfire.

Management Objectives

- Implement the completed Shasta West Strategic Fuels Management Plan.
- Coordinate efforts in the Shasta West Watershed between communities and resource agencies to reduce the risk of fire.
- Continue to adjust fuels management needs to coincide with the ecological goals of habitat preservation throughout the watershed.
- Develop a watershed fuels inventory to map vegetation cover types and distribution throughout the watershed, including vegetation relative to slope, aspect, elevation and land use.
- Implement shaded fuel break and community fuel reduction projects using a mixture of equipment and handwork, utilizing commercial timber harvest, biomass harvest, chippers, masticators, and other ground based equipment.
- Encourage the use of landscape level fuel reduction projects to modify fire behavior and intensity and continue educating the community on the importance of fuel reduction and the construction and maintenance of fuel breaks.
- Facilitate community implementation discussions at local community locations and educate landowners on the importance of creating at least a 100 feet of defensible space.
- Maintain existing fuel breaks for long-term benefit and protection of life and property.

Management Actions

- Acquire and analyze recent color aerial photographs for the watershed and ground truth them for accuracy.
- Collaborate with agencies involved with fire management to determine the occurrence of dominant vegetation types with high risk of wildfire. All updated information should be presented to the FRAP program for review.
- Work with agencies and landowners to support, fund, and implement the Shasta West Strategic Fuels Management Plan.
- Collaborate with agencies and landowners to perform a thorough fire history study of the watershed.
- Locate historical fire sites, determine burn intervals, and estimate fire intensity to provide insight into native fuel conditions of the watershed and assist resource managers in fuel management that benefits both the urban population and watershed ecology.
- Collaborate with agencies and landowners to encourage fuel management activities which promote wildland and urban protection as well as biodiversity and habitat improvement.

- Advertise and encourage support for the Shasta West Fire Safe Council and the Shasta County Fire Safe program.
- Work with agencies to retain a full time Fire Safe Coordinator to coordinate the Fire Safe program and other related activities.

LAND USE

Existing Conditions

Recreation

- Traditional dispersed recreational activities, such as hunting and fishing, are in decline due to encroaching residential and commercial development, while other activities, such as equestrian and off-highway vehicle (OHV) use, are on the rise.
- Water related recreation activities are increasingly popular.
- Significant opportunities exist to increase recreational uses such as walking, biking, wildlife viewing, and equestrian trails located adjacent to creeks in the area.

Illegal Dumping

- Watercourses and accessible open spaces throughout the Shasta West watershed are being inundated continually by illegal dumping of garbage, cars, development debris, appliances, etc.
- Garbage and litter in the watershed contribute to fish, wildlife and human health and safety problems.

Photo 7. Trash in Linden Channel



Erosion

- Erosion and sedimentation resulting from the unique geology of the Shasta West Watershed were identified as an important issue in the Watershed Assessment.
- Soils within the Shasta West Watershed vary considerably in productivity, depth, and use as one travels from the eastern margin near the Sacramento River to the mountainous soils along the western margin.
- The risk of erosion is greatly compounded by modifications of steep slopes, poorly constructed dirt roads, and recreational uses such as OHV use.
- Sandy, erosion prone soils and fine sediment that gets deposited in streams, may fill pore spaces of stream gravels used by spawning fish and benthic organisms.
- Erosion is impacted by urban stormwater run-off and residential development, which raise the amount of impervious surface and lead to rapid increases in peak flows and in-channel erosion.
- New development, especially during the construction phase, has contributed to increased sediment in area streams, particularly when contractors/vacant landowners have not undertaken or maintained remedial actions as required by various laws and permits to control erosion.
- Invasive plants create changes in sediment deposition and erosion within stream channels and displace native species in disturbed areas, contributing to increased wildfire frequency and intensity.
- High-intensity wildfires damage soils and render them unable to support vegetation which results in increased erosion during high wind and precipitation events.

Development

- Residential development on steep slopes has increased, resulting in the need to promote the use of open space easements as mitigation for developments on steep slopes in excess of 20%.
- Residents of the watershed need to be informed on the effects of illegal refuse disposal in the watershed.
- There is a lack of a consolidated recreation development plan for the watershed.
- The BLM Land Disposal and Acquisition Programs allow selling property for residential development in order to purchase areas of higher habitat value, which can lead to reductions in recreation opportunities and increase development impacts.
- Unknown effects of power transmission lines and the associated footprint and maintenance accesses upon soils, wildlife, fisheries, and urban development.

Management Objectives

- Protect and restore natural undeveloped areas by eliminating indiscriminant and illegal dumping and minimizing soil erosion and sedimentation problems.
- Promote the use of existing public trail systems within the watersheds and, with support from public and willing private landowners, expand the systems to provide for more connectivity between trails and enhance recreational opportunities.
- Work to obtain public access for recreation and education in ways that will not negatively impact private lands and commerce.
- Eliminate OHV trespassing and encourage use of established public OHV areas while educating people about sustainable OHV recreating procedures and practices.
- Support implementation of methods to reduce stormwater runoff such as collection and infiltration of stormwater runoff within the confines of new developments.
- Support modification of existing stormwater management infrastructure and evaluate existing stormwater management facilities to determine their modification potential in order to provide more onsite infiltration, which indirectly improves aquatic habitats.
- Support development of compact, walkable neighborhoods within existing developed areas so as to minimize impervious areas and disruption to natural areas.
- Support implementation of the Shasta Builders Exchange Agree Park green construction program¹ that includes elements such as energy efficiency, materials efficiency, water efficiency, and utilization of infill lots.

Management Actions

- Work with agencies, landowners and users of the watershed to develop a comprehensive recreation use and development plan that incorporates the need for different types of recreation while minimizing negative effects upon the natural resources in the watershed.
- Work with OHV Groups to develop a plan to eliminate trespass use and to encourage use of established public OHV use areas and trails.
- Work with the city and county to assess the effects of illegal refuse disposal and develop and provide education on the effects of illegal trash dumping.
- Collaborate with Cities and Shasta County to establish a program offering opportunities to bring unwanted items to a local landfill.

¹ Shasta Builders Exchange, www.agreepark.com/

- Organize and lead efforts to regularly pick up litter and garbage throughout the watershed by utilizing programs such as Redding's Adopt-a-Street program.
- Perform an erosion potential analysis using newly developed GIS soils layers produced by the NRCS and digital elevation models developed by the USGS and develop or review BMPs for areas identified as having high erosion potential.
- Perform a road inventory and analysis that surveys culverts, stream crossings, road design, construction, and type of road use.
- Work with landowners to control access and improve conditions of dirt roads on private property.
- Encourage adherence to zoning and land use management plans and collaborate with appropriate agencies to review, update, and implement BMPs to protect ecological resources in the watershed.
- Work with power line operators and agencies to control trespass and erosion within power transmission line right of way areas throughout the watershed.
- Support the incorporation of the Ahwahnee Water Principles into the Cities and Shasta County General Plans (Attachment D).
- Inventory existing stormwater infrastructures and modify as needed to allow more storm runoff and landscape watering infiltration onsite while potentially improving aquatic habitat and water quality.
- Support the incorporation of green construction principles² into construction projects (Addendum E).
- Support implementation of the City of Redding's vision to focus growth inward rather than outward expansion and guiding principle to conserve the natural environment and protect environmentally sensitive areas³.
- Encourage landowners with large tracts of undeveloped land to protect natural habitat and open space attributes on their property.

² California Integrated Waste Management Board, www.ciwmb.ca.gov/GreenBuilding/Basics

³ *City of Redding General Plan, Introduction, Goals and Policies*

SUPPORT PROGRAMS

This section identifies the principle support programs for implementation of the Watershed Action Plan (Addendum C, Index to Support Programs /Management Objectives/Management Actions). Although the support programs are discussed separately, many times it is possible to overlap efforts and provide education through the monitoring efforts.

EDUCATION AND OUTREACH

Existing Conditions Summarized

- Education and outreach plays a critical support role in every aspect of watershed health and there is a need for active Watershed Stewardship in the Shasta West Watershed that involves communities, agencies, resource users and organizations.

Photo 8. Classroom education with the Watershed Model.



- With urban development cultural resources such as Native American heritage sites are at risk of being lost or damaged.
- Historical natural resource data from agencies needs to be preserved in order to compare current management practices to historical conditions.
- Resource managers need to identify environmental justice issues in the watershed in regard to environmental laws, regulations and policies.

Management Objectives

- Collaborate with agencies and organizations to locate and preserve historical natural resource data.
- Educate the public about the efforts of the Shasta West Watershed Group to maintain and improve watershed health.
- Promote and facilitate watershed management education and outreach opportunities to increase the public's understanding and awareness of the many valuable functions of watersheds; the detrimental impacts to them; and the need to restore and protect them.
- Educate stakeholders about Best Management Practices in relation to common land use practices.

Management Actions

- Develop a public outreach and education plan (see appendix).
- Work with agencies and landowners to promote and support educational and volunteer initiatives that enhance public awareness and increase direct participation in watershed stewardship.
- Encourage residents and resource users to become active stewards in their everyday activities and through volunteer involvement. To help coordinate these activities, work to fund a full time watershed coordinator.
- Collaborate with agencies and organizations such as the Northeast Information Center, Shasta Historical Society and the Wintu Tribe to perform comprehensive cultural resource surveys and document newly discovered resources.
- Work to bring the documentation into a centralized and consolidated database of cultural resources that would aid future urban development in locating and protecting cultural heritage.

PLAN PARTICIPANTS

The *Shasta West Management Action Plan* was developed using a consensus approach in ten meetings of the Technical Advisory Committee, a review by the Shasta West Watershed Group, and feedback from two public workshops

Category	Agency, Etc.	Representative ⁴
Shasta County	Shasta County	Dan Wayne (SCRTPA)
Cities	Redding	Chris Glover (City Parks), Randall Smith (Redding Planning Commissioner/Rotary)
State Agencies	Western Shasta RCD	David DeMar, Kelli Neher, James Moller, Mike O'Leary, Jack Bramhall, Shiloe Braxton, Mary Mitchell, Paulette Cobb, Susan Weaver
	Regional Water Quality Control Board	Guy Chatelat
	Ca. Department of Fish and Game	Eda Eggeman, Patricia Bratcher, Dale Morrison
	CA State Parks	Pat Gilbert
	Ca. Department of Water Resources	Margie Graham
Federal Agencies	US Fish and Wildlife Service	Brenda Olson,
	Natural Resource Conservation Service	Melinda Graves
	Whiskeytown National Recreation Area	Jennifer Gibson
	Bureau of Land Management	Gary Diridoni
Private	Shasta West Watershed Group and Landowners	Beth Doolittle-Norby, Toby Bodeen, Derek Yorton, Diana Smith, Jane McKenna, Darin Bond, Michele Driggs, Bob Madison, Marnie and David Yorton, Priscilla Benson, Marci Fernandes, Kathy Hill, Susan Weale, Leonard Schwaub, Gary Loomis, Emily Young, Marion Schmirz, Claodia Yerion, Evelyn Winegarden, Stacy Halpenny, Rick Christ, Luis Ames, Mike Goodwin, Tom Stone, Kent Went, Kathleen Zalesng, Mark Cox, Mary Rose, Elin Klaseen, Diane Panosian, Jim and Jeanie White, Ray and Peg Minton, Nancy Pernell, Bob Browne, Celeste Browne, Sylvia Holochrist, Clifford (Illegible), Joyce Earing, Ethel Cain, Justin Wolff, Jim White, Gail Rich

⁴ Many representatives are on both the Shasta West Shasta West Watershed Group and TAC

ADDENDA

ADDENDUM A: DECISION TREE

ADDENDUM B: INDEX TO MANAGEMENT ISSUES /OBJECTIVES/ACTIONS

ADDENDUM C: INDEX TO SUPPORT PROGRAMS /MANAGEMENT ISSUES /OBJECTIVES/ACTIONS

ADDENDUM D: AHWAHNEE WATER PRINCIPLES

ADDENDUM E: GREEN CONSTRUCTION PRINCIPLES

ADDENDUM B

Index to Issues/Management Objectives/Management Actions			
Issues	Management Objectives	Management Actions	Shasta West Watershed Assessment ¹
Water Quality	➤ Implement focused monitoring on key water quality parameters and assess the need for improved management practices and/or rehabilitation.	➤ Survey the watershed using physical surveys or remote sensing to establish baseline geomorphic information and basic data such as stream channel slope, stream channel types and composition.	3-14
	➤ Develop and implement a continuing, long term watershed monitoring program to allow water quality and quantity decisions to be made on a data driven, scientific basis.	➤ Classify streams according to the Rosgen stream classification system to develop basic knowledge of stream behavior, hydraulic and sediment relations, and to provide a consistent and reproducible frame of reference for communication by natural resource planners working with the Shasta West streams in a variety of disciplines.	3-14
	➤ Develop a Monitoring Coordination Strategy to coordinate SWMG ambient water quality/quantity monitoring with other monitoring efforts in order to maximize overall knowledge of Shasta West Watershed conditions.	➤ Work with agencies and landowners to develop a stream monitoring program that includes installing and monitoring stream gauges on priority streams in the watershed in order to determine flow regimes.	3-14
	➤ Establish a process and a center for data storage, data analysis, and public distribution of water quality and quantity and other watershed monitoring information.	➤ Survey sub-surface stream sections to produce GIS layers and work with the City and County planners to investigate opportunities for stream daylighting.	3-14
	➤ Assist in implementing Best Management Practice (BMP) projects in order to demonstrate and evaluate their effectiveness to improve water quality in the Shasta West Watershed.	➤ For a future update of the Shasta West Watershed Assessment, work with the City of Redding to obtain data from the city's hydrology model and FEMA flood mapping models for streams in the	3-14

¹ Shasta West Watershed Assessment, section and page reference.

Index to Issues/Management Objectives/Management Actions			
Issues	Management Objectives	Management Actions	Shasta West Watershed Assessment¹
		watershed.	4-21
		➤ Work with agencies to develop a water quality monitoring program to gather baseline data for the priority streams in the watershed.	4-21
		➤ Work with agencies, landowners and organizations to assess and develop long term solutions for a sediment reduction program for the Middle Creek sub-watershed.	4-21
		➤ After collecting baseline water quality data for priority streams identified in a water quality monitoring program, assess the effects of stormwater runoff and non-point source pollution upon streams in the watershed.	4-22
		➤ Collaborate with DWR to process water quality data that is in hardcopy format into an easily accessible electronic format.	4-22
		➤ Collaborate with agencies to research and update Best Management Practices regarding development and permeability issues.	4-22
		➤ Collaborate with agencies and landowners to monitor key OHV use areas to determine the effects upon water quality.	4-22
		➤ Work with landowners and agencies to implement a groundwater monitoring program to determine the level of ground water and the recharge rate to the underground aquifers.	4-22
		➤ Collaborate with landowners and agencies to perform a stream function analysis on the priority streams in the watershed to determine overall stream health.	3-14

Index to Issues/Management Objectives/Management Actions			
Issues	Management Objectives	Management Actions	Shasta West Watershed Assessment₁
		<ul style="list-style-type: none"> ➤ Collaborate with Anderson Cottonwood Irrigation District (ACID) to investigate the effects of the ACID canal on ecosystem and stream conditions in the watershed. ➤ Encourage the City of Redding and Shasta County to incorporate the Ahwahnee Water Principles into their General Plans. 	TAC

Index to Issues/Management Objectives/Management Actions			
Issues	Management Objectives	Management Actions	Shasta West Watershed Assessment 1
Botany	<ul style="list-style-type: none"> ➤ Conduct vegetation inventories to better understand existing conditions and trends. ➤ Increase knowledge of the sensitive botanical and wildlife species in the watershed. ➤ Protect existing riparian corridors and encourage the rehabilitation of degraded riparian areas. ➤ Quantify, locate and develop management strategies for non-native plant and animal species. ➤ Conserve existing oak woodlands and support projects that enhance oak woodland health. ➤ Utilize fuel management to increase wildlife habitat quantity and quality while helping to protect natural resources throughout the watershed. 	<ul style="list-style-type: none"> ➤ Work with the Shasta County Planning Department and other agencies to perform an invasive weed inventory and develop a GIS database. 	5-24
		<ul style="list-style-type: none"> ➤ Map known invasive occurrences and control actions for CDFR and CallIPC A-listed weeds to track and estimate the rate of spread in the watershed. 	5-24
		<ul style="list-style-type: none"> ➤ Utilized invasive mapping data in conjunction with data from adjacent watersheds to gain knowledge on the spread of invasive weeds in the region. 	5-24
		<ul style="list-style-type: none"> ➤ Collaborate with agencies and organizations involved in the control of invasive plants to coordinate weed control efforts. 	5-24
		<ul style="list-style-type: none"> ➤ Acquire and analyze recent color aerial photographs for the watershed, verified by field investigation in order to assess the extent and quality of the valley foothill riparian CWHR vegetation community and address uncertainty from the LCMMP mapping in regard to the various hardwoods and deciduous tree life forms. 	5-24
		<ul style="list-style-type: none"> ➤ Obtain historical and current aerial photographs and conduct a time-series analysis of aerial photographs in order to assess fragmentation of native vegetation communities. This type of analysis could also produce a rate of habitat fragmentation for the watershed. 	5-24
		<ul style="list-style-type: none"> ➤ Work with landowners and agencies to encourage the retention of riparian buffer zones to 	5-24

Index to Issues/Management Objectives/Management Actions			
Issues	Management Objectives	Management Actions	Shasta West Watershed Assessment 1
		<p>(1) maintain and/or enhance native riparian habitat, (2) benefit fish, wildlife, and native plant species, (3) provide buffering benefits to reduce the effects of stormwater runoff, siltation, and chemicals entering the watercourse and (4) to reduce potential damage from flooding.</p> <ul style="list-style-type: none"> ➤ Work with landowners to further analyze floristic surveys already conducted along Salt and Canyon Creeks. Consider undertaking similar surveys along other priority streams. ➤ Work with landowners to survey wetlands and identify their interaction with streams and adjoining plant communities. ➤ Collaborate with agencies to explore mechanisms for retaining and regenerating oak species. Pursue available funding for oak management. ➤ Work with agencies to further the investigation of the long-term effects of copper smelting on the soil and vegetative conditions in the watershed. 	<p>5-24</p> <p>5-24</p> <p>5-24</p> <p>5-24</p>
Fish & Wildlife Habitats	<ul style="list-style-type: none"> ➤ Conduct vegetation inventories to better understand existing conditions and trends. ➤ Increase knowledge of the sensitive botanical and wildlife species in the watershed. ➤ Protect existing riparian and terrestrial corridors and encourage the rehabilitation of 	<ul style="list-style-type: none"> ➤ Work with the City of Redding and Shasta County to explore the use and/or development of incentive programs for landowners to preserve and maintain native habitats through the review and development of BMPs that retain open spaces to accommodate a variety of wildlife species. 	6-30

Index to Issues/Management Objectives/Management Actions			
Issues	Management Objectives	Management Actions	Shasta West Watershed Assessment 1
	<p>degraded riparian corridors.</p> <ul style="list-style-type: none"> ➤ Quantify, locate and develop management strategies for non-native plant and animal species. ➤ Conserve existing oak woodlands and support projects that enhance oak woodland health. ➤ Utilize fuel management to increase wildlife habitat quantity and quality. 	<ul style="list-style-type: none"> ➤ Collaborate with agencies and educate the public on the effects of various forms of recreation on fish and wildlife populations and habitat, including the use of developed educational materials and outreach programs to inform rural residents on the risk of living in Mountain Lion habitat. ➤ Collaborate with the City of Redding and Shasta County to develop a GIS database that can track urban development and wildlife habitats in the watershed and work with agencies and organizations to develop a wildlife monitoring program. ➤ After the development of a high quality vegetation map of the watershed, evaluate habitat using the Guild Approach or other comparable scientific method to prioritize habitat restoration and protection efforts. Information gathered could be used to link the habitats of the Shasta West Watershed to other adjacent watershed habitat types. ➤ Develop educational materials and outreach programs about the function and importance of fish and wildlife species and the idea of biodiversity for the watershed. Included in the materials should be education on the effects of domestic animals such as cats, dogs and exotic pets on biodiversity and the watershed. <p>Consult with DFG to identify opportunities for riparian and terrestrial wildlife corridor conservation and restoration.</p>	<p>6-30</p> <p>6-31</p> <p>6-31</p> <p>6-31</p> <p>TAC</p>

Index to Issues/Management Objectives/Management Actions			
Issues	Management Objectives	Management Actions	Shasta West Watershed Assessment 1
Fire Prevention and Fuels Management	➤ Implement the completed Shasta West Strategic Fuels Management Plan.	➤ Acquire and analyze recent color aerial photographs for the watershed and ground truth them for accuracy.	8-35
	➤ Coordinate efforts in the Shasta West Watershed between communities and resource agencies to reduce the risk of fire.	➤ Collaborate with agencies involved with fire management to determine the occurrence of dominant vegetation types with high risk of wildfire. All updated information should be presented to the FRAP program for review.	8-35
	➤ Update fuel mapping throughout the watershed.	➤ Work with agencies and landowners to support, fund, and implement the Shasta West Strategic Fuels Management Plan.	8-35
	➤ Continue to adjust fuels management needs to coincide with the ecological goals of habitat preservation throughout the watershed.	➤ Collaborate with agencies and landowners to perform a thorough fire history study of the watershed.	8-35
	➤ Develop a watershed fuels inventory to map vegetation cover types and distribution throughout the watershed, including vegetation relative to slope, aspect, elevation and land use.	➤ Locate historical fire sites, determine burn intervals, and estimate fire intensity to provide insight into native fuel conditions of the watershed and assist resource managers in fuel management that benefits both the urban population and watershed ecology.	8-35
	➤ Implement shaded fuel break and community fuel reduction projects using a mixture of equipment and handwork, utilizing commercial timber harvest, biomass harvest, chippers, masticators, and other ground based equipment.	➤ Collaborate with agencies and landowners to encourage fuel management activities which promote wildland and urban protection as well as biodiversity and habitat improvement.	8-35
	➤ Encourage the use of landscape level fuel reduction projects to modify fire behavior and intensity and continue educating the community on the importance of fuel reduction and the construction and maintenance of fuel breaks.	➤ Advertise and encourage support for the Shasta West Fire Safe Council and the Shasta County Fire Safe program.	8-35
	➤ Facilitate community implementation discussions at local community locations and educate landowners on the	➤ Work with agencies to retain a full time Fire Safe Coordinator to coordinate the Fire Safe program and other related activities.	8-35

Index to Issues/Management Objectives/Management Actions			
Issues	Management Objectives	Management Actions	Shasta West Watershed Assessment 1
	<p>importance of creating at least a 100 feet of defensible space.</p> <ul style="list-style-type: none"> ➤ Maintain existing fuel breaks for long-term benefit and protection of life and property. 		
<p>Land Use: Recreation, Illegal Dumping, Erosion, and Development</p>	<ul style="list-style-type: none"> ➤ Protect and restore natural undeveloped areas by eliminating indiscriminant and illegal dumping and minimizing soil erosion and sedimentation problems resulting from development and historic features. 	<ul style="list-style-type: none"> ➤ Work with agencies, landowners and users of the watershed to develop a comprehensive recreation use and development plan that incorporates the need for different types of recreation while minimizing negative effects upon the natural resources in the watershed. 	7-22
	<ul style="list-style-type: none"> ➤ Promote the use of existing public trail systems within the watersheds and, with support from public and willing private landowners, expand the systems to provide for more connectivity between trails and enhance recreational opportunities. 	<ul style="list-style-type: none"> ➤ Collaborate with local universities and agencies to perform an economic survey of the value of wildland habitat in the watershed in order to determine the habitat value. 	7-22
	<ul style="list-style-type: none"> ➤ Work to obtain public access for recreation and education in ways that will not negatively impact private lands and commerce. 	<ul style="list-style-type: none"> ➤ Work with OHV Groups to develop a plan to eliminate trespass use and to encourage use of established public OHV use areas and trails. 	4-22
	<ul style="list-style-type: none"> ➤ Eliminate OHV trespassing and encourage use of established public OHV areas while educating people about sustainable OHV recreating procedures and practices. 	<ul style="list-style-type: none"> ➤ Work with the city and county to assess the effects of illegal refuse disposal and develop and provide education on the effects of illegal trash dumping. 	7-21
	<ul style="list-style-type: none"> ➤ Support implementation of methods to reduce stormwater runoff such as collection and infiltration of stormwater runoff within the confines of new developments. 	<ul style="list-style-type: none"> ➤ Collaborate with Cities and Shasta County to establish a program offering opportunities to bring unwanted items to a local landfill. 	TAC
	<ul style="list-style-type: none"> ➤ Evaluate existing stormwater management facilities to determine the potential for 	<ul style="list-style-type: none"> ➤ Organize and lead efforts to regularly pick up litter and garbage throughout the watershed by utilizing programs such as Redding’s Adopt-a-Street program. 	TAC
		<ul style="list-style-type: none"> ➤ Perform an erosion potential analysis by comparing the newly developed GIS soils layers 	2-9

Index to Issues/Management Objectives/Management Actions			
Issues	Management Objectives	Management Actions	Shasta West Watershed Assessment 1
	<p>modifying the facilities to provide more onsite infiltration and to improve aquatic habitat.</p> <ul style="list-style-type: none"> ➤ Support modification of existing stormwater management infrastructure to provide more onsite infiltration and to improve aquatic habitat. ➤ Support development of compact, walkable development within existing developed areas so as to minimize impervious areas and disruption to natural areas. ➤ Support implementation of the Shasta Builders Exchange Agree Park green construction program² that includes elements such as energy efficiency, materials efficiency, water efficiency, and utilization of infill lots. 	<p>produced by the NRCS and combine it with a topographic slope layer generated by 30 meter digital elevation models developed by the USGS. Using the map as a guide, develop or review BMPs for areas identified as having high erosion potential.</p> <ul style="list-style-type: none"> ➤ Perform a road inventory and analysis that surveys culverts, stream crossings, road design, construction, and type of road use. ➤ Work with landowners to control access and improve conditions of dirt roads on private property. ➤ Encourage adherence to zoning and land use management plans and collaborate with appropriate agencies to review and update BMPs to protect ecological resources in the watershed. ➤ Work with power line operators and agencies to assess power transmission line effects upon the watershed. ➤ Support the incorporation of the Ahwahnee Water Principles into the Cities and Shasta County General Plans (Attachment D). ➤ Inventory existing stormwater infrastructures and modify as needed to allow more storm runoff and landscape watering infiltration onsite while improving aquatic habitat and water quality. ➤ Support the incorporation of green construction principles³ into construction projects (Addendum 	<p>2-9</p> <p>TAC</p> <p>7-21</p> <p>7-21</p> <p>TAC</p> <p>TAC</p> <p>TAC</p>

² Shasta Builders Exchange, www.agreepark.com/

³ California Integrated Waste Management Board, www.ciwmb.ca.gov/GreenBuilding/Basics

ADDENDUM C

Index to Support Programs/Management Objectives/Management Actions		
Management Objectives	Management Actions	Reference¹
<ul style="list-style-type: none"> ➤ Educate the public about the efforts of the Watershed Group to maintain and improve watershed health. ➤ Promote and facilitation of watershed management education and outreach opportunities to increase the public's understanding and awareness of the many valuable functions of watersheds and the need to restore and protect them. ➤ Educate stakeholders about Best Management Practices in relation to common land use practices. 	<ul style="list-style-type: none"> ➤ Develop a public outreach and education program (see appendix). 	<p>TAC</p>

¹ Source of Management Action

ADDENDUM D: AHWAHNEE WATER PRINCIPLES

Preamble

Cities and counties are facing major challenges with water contamination, stormwater runoff, flood damage liability, and concerns about whether there will be enough reliable water for current residents as well as for new development. These issues impact city and county budgets and taxpayers. Fortunately there are a number of stewardship actions that cities and counties can take that reduce costs and improve the reliability and quality of our water resources.

The Water Principles below complement the Ahwahnee Principles for Resource-Efficient Communities that were developed in 1991. Many cities and counties are already using them to improve the vitality and prosperity of their communities.

Community Principles

- Community design should be compact, mixed use, walkable and transit-oriented so that automobile-generated urban runoff pollutants are minimized and the open lands that absorb water are preserved to the maximum extent possible. (See the Ahwahnee Principles for Resource-Efficient Communities)
- Natural resources such as wetlands, flood plains, recharge zones, riparian areas, open space, and native habitats should be identified, preserved and restored as valued assets for flood protection, water quality improvement, groundwater recharge, habitat, and overall long-term water resource sustainability.
- Water holding areas such as creek beds, recessed athletic fields, ponds, cisterns, and other features that serve to recharge groundwater, reduce runoff, improve water quality and decrease flooding should be incorporated into the urban landscape.
- All aspects of landscaping from the selection of plants to soil preparation and the installation of irrigation systems should be designed to reduce water demand, retain runoff, decrease flooding, and recharge groundwater.
- Permeable surfaces should be used for hardscape. Impervious surfaces such as driveways, streets, and parking lots should be minimized so that land is available to absorb stormwater, reduce polluted urban runoff, recharge groundwater and reduce flooding.
- Dual plumbing that allows gray water from showers, sinks, and washers to be reused for landscape irrigation should be included in the infrastructure of new development.
- Community design should maximize the use of recycled water for appropriate applications including outdoor irrigation, toilet flushing, and commercial and industrial processes. Purple pipe should be installed in all

- new construction and remodeled buildings in anticipation of the future availability of recycled water.
- Urban water conservation technologies such as low-flow toilets, efficient clothes washers, and more efficient water-using industrial equipment should be incorporated in all new construction and retrofitted in remodeled buildings.
 - Ground water treatment and brackish water desalination should be pursued when necessary to maximize locally available, drought-proof water supplies.

Implementation Principles

1. Water quantity agencies should be consulted early in the land use decision-making process regarding technology, demographics and growth projections.
2. City and county officials, the watershed council, LAFCO, special districts and other stakeholders sharing watersheds should collaborate to take advantage of the benefits and synergies of water resource planning at a watershed level.
3. The best, multi-benefit and integrated strategies and projects should be identified and implemented before less integrated proposals, unless urgency demands otherwise.
4. From start to finish, projects and programs should involve the public, build relationships, and increase the sharing of and access to information.
5. Plans, programs, projects and policies should be monitored and evaluated to determine if the expected results are achieved and to improve future practices.

Authors: Celeste Cantu, Martha Davis, Jennifer Hosterman, Susan Lien Longville, Jeff Loux, John Lowrie, Jonas Minton, Mary Nichols, Virginia Porter, Al Wanger, Robert Wilkinson, Kevin Wolf

Editor: Judy Corbett

(Adopted in 2005)

ADDENDUM E: GREEN CONSTRUCTION BASICS¹

What Makes a Building Green?

A green building, also known as a sustainable building, is a structure that is designed, built, renovated, operated, or reused in an ecological and resource-efficient manner. Green buildings are designed to meet certain objectives such as protecting occupant health; improving employee productivity; using energy, water, and other resources more efficiently; and reducing the overall impact to the environment.

What Are the Economic Benefits of Green Buildings?

A green building may cost more up front, but saves through lower operating costs over the life of the building. The green building approach applies a project life cycle cost analysis for determining the appropriate up-front expenditure. This analytical method calculates costs over the useful life of the asset.

These and other cost savings can only be fully realized when they are incorporated at the project's conceptual design phase with the assistance of an integrated team of professionals. The integrated systems approach ensures that the building is designed as one system rather than a collection of stand-alone systems.

Some benefits, such as improving occupant health, comfort, productivity, reducing pollution and landfill waste are not easily quantified. Consequently, they are not adequately considered in cost analysis. For this reason, consider setting aside a small portion of the building budget to cover differential costs associated with less tangible green building benefits or to cover the cost of researching and analyzing green building options.

Even with a tight budget, many green building measures can be incorporated with minimal or zero increased up-front costs and they can yield enormous savings (Environmental Building News, 1999).

What Are the Elements of Green Buildings?

Siting

- Start by selecting a site well suited to take advantage of mass transit.
- Protect and retain existing landscaping and natural features. Select plants that have low water and pesticide needs, and generate

¹ www.ciwmb.ca.gov/GreenBuilding/Basics.htm#Elements

minimum plant trimmings. Use compost and mulches. This will save water and time.

- Recycled content paving materials, furnishings, and mulches help close the recycling loop.

Energy Efficiency

Most buildings can reach energy efficiency levels far beyond California Title 24 standards, yet most only strive to meet the standard. It is reasonable to strive for 40 percent less energy than Title 24 standards. The following strategies contribute to this goal.

- Use passive design strategies to dramatically affect building energy performance. These measures include building shape and orientation, passive solar design, and the use of natural lighting.
- Develop strategies to provide natural lighting. Studies have shown that it has a positive impact on productivity and well being.
- Install high-efficiency lighting systems with advanced lighting controls. Include motion sensors tied to dimmable lighting controls. Task lighting reduces general overhead light levels.
- Use a properly sized and energy-efficient heat/cooling system in conjunction with a thermally efficient building shell. Maximize light colors for roofing and wall finish materials; install high R-value wall and ceiling insulation; and use minimal glass on east and west exposures.
- Minimize the electric loads from lighting, equipment, and appliances.
- Consider alternative energy sources such as photovoltaic and fuel cells that are now available in new products and applications. Renewable energy sources provide a great symbol of emerging technologies for the future.
- Optimize the design of electrical and mechanical systems and building shell through utilization of computer modeling.

Materials Efficiency

- Select sustainable construction materials and products by evaluating several characteristics such as reused and recycled content, zero or low off gassing of harmful air emissions, zero or low toxicity, sustainably harvested materials, high recyclability, durability, longevity, and local production. Such products promote resource conservation and efficiency. Using recycled-content products also helps develop markets for recycled materials that are being diverted from California's landfills, as mandated by the Integrated Waste Management Act.
- Use dimensional planning and other material efficiency strategies. These strategies reduce the amount of building materials needed and cut construction costs. For example, design rooms on 4-foot multiples to conform to standard-sized wallboard and plywood sheets.

- Reuse and recycle construction and demolition materials. For example, using inert demolition materials as a base course for a parking lot keeps materials out of landfills and costs less.
- Require plans for managing materials through deconstruction, demolition, and construction.
- Design with adequate space to facilitate recycling collection and to incorporate a solid waste management program that prevents waste generation.

Water Efficiency

- Design for dual plumbing to use recycled water for toilet flushing or a gray water system that recovers rainwater or other nonpotable water for site irrigation.
- Minimize wastewater by using ultra low-flush toilets, low-flow shower heads, and other water conserving fixtures.
- Use recirculating systems for centralized hot water distribution.
- Install point-of-use hot water heating systems for more distant locations.
- Use a water budget approach that schedules irrigation using the California Irrigation Management Information System data for landscaping.
- Meter the landscape separately from buildings. Use micro-irrigation (which excludes sprinklers and high-pressure sprayers) to supply water in non turf areas.
- Use state-of-the-art irrigation controllers and self-closing nozzles on hoses.

APPENDICES – Potential Projects

APPENDIX A: SUPPORT PROGRAMS

APPENDIX B: FISH AND WILDLIFE HABITAT

APPENDIX C: ILLEGAL DUMPING

APPENDIX D: EROSION

APPENDIX A

SUPPORT PROGRAMS

EDUCATION AND OUTREACH FRAMEWORK

Background: The *Shasta West Watershed Assessment* identified several public education and awareness actions. In the development of the Watershed Action Plan, the TAC embraced the recommendations put forth in the Watershed Assessment and proposed developing a public outreach and education plan.

Purpose: The purpose of this document is to set the stage for developing a cost-effective public outreach and education program when funds are available. It does not include adequate detail and will not serve as an outreach/education plan. The Shasta West Education and Outreach Plan will be developed by a subcommittee of the Shasta West Watershed Group.

Objectives (as listed in the WMP):

- Educate the public about the efforts of the Watershed Group to maintain and improve watershed health.
- Promote and facilitate watershed management education and outreach opportunities to increase the public's understanding and awareness of the many valuable functions of watersheds, the detrimental impacts, and the need for restoration and protection.
- Educate stakeholders about Best Management Practices in relation to common land use practices.

Components: Develop an outreach and education plan that would include, but not be limited to, the following components:

- Shasta West Watershed Group: Prioritize outreach/education actions based on priority management actions.
- Shasta West Watershed Group: Establish an outreach and education subcommittee to develop a cost-efficient outreach and education program.
- Utilize the subcommittee to accomplish the following:
 1. Determine the goals of the outreach and education program.
 2. Develop a public outreach and education program to be sponsored by the Shasta West Watershed Group that includes but is not limited to:
 - Continue the Shasta West Watershed meetings.
 - Continue classroom, field workshop, and exhibits elements.

- Distribute educational material emphasizing the control/eradication of noxious, invasive plants and highlighting ongoing eradication efforts.
- Promote Adopt-a-Watershed Program in local schools.
- Emphasize the benefits of having increased, healthy populations of native fish and other aquatic species.
- Prepare a guide to reduce surface and ground water pollution.
- Emphasize the benefits of good quality water and adequate quantities of water.
- Conduct programs and activities such as revegetation seminars that emphasize the benefits of good aquatic and terrestrial vegetative management throughout the watersheds.
- Emphasize activities that promote the wisdom and choices for efficient and wise use of water.
- Distribute information that emphasizes the benefits of litter-free watersheds.

Inventory and Monitoring Framework

Background: The *Shasta West Watershed Assessment* identified a comprehensive lack of scientific natural resource baseline data within the watershed. It recommended several actions to collect baseline data and to implement a long-term monitoring program to determine the success of management actions, as well as to track trends in the watershed. The Watershed Assessment also recommended an integrated approach including aerial imagery, remote sensing data, and field data collection/verification.

In the development of the Watershed Management Plan (WMP), the Technical Advisory Committee (TAC) embraced most of the recommendations put forth in the Watershed Assessment. The WMP has proposed a citizen-based inventory and monitoring program be developed and implemented to establish scientific baseline data and to conduct long-term assessment of the success of the management actions and to assess trends.

Purpose: The purpose of this document is to set the stage for developing an integrated cost-effective inventory and monitoring program when funds are available. However, it does not include adequate detail and, therefore, will not serve as an inventory/monitoring plan. The Shasta West Inventory and Monitoring Plan will be developed by a subcommittee of the Shasta West Watershed Group.

Goals: The over arching goals of the Shasta West Inventory and Monitoring Plan are to develop a scientific baseline database and to determine the success of the implemented management actions over time, as well as assess trends of the watershed's natural attributes. Specific goals would be determined by the Shasta West Watershed Group during the development and maintenance of the inventory/monitoring plan.

Components: Development of an integrated inventory/monitoring plan could include but not be limited to the following components:

- Prioritize inventory/monitoring actions based on priority management actions.
- Establish an inventory and monitoring subcommittee to develop a cost-efficient integrated inventory and monitoring program.
- Identify what inventory/monitoring actions are needed to track trends across the landscape over time.
- Utilize the subcommittee to accomplish the following:
 - Establish a citizen-based inventory/monitoring group.
 - Determine the goals of the inventory/monitoring program.
 - Determine the types of monitoring, i.e. water quality and quantity, wildlife (aquatic, terrestrial, avian), vegetation, habitats, etc.)
 - Determine cost-efficient integrated inventory and monitoring processes.
 - Determine monitoring locations.
 - Determine frequency of collecting monitoring data.
 - Assess the inventory/monitoring data.

Inventory Actions: Development of a scientific baseline database could include but not be limited to the following inventory actions:

- Determine the baseline conditions of key water quality and quantity parameters including:
 - Turbidity levels
 - Temperature
 - Dissolved oxygen
 - Water flow
 - Pathogen levels via bacteria monitoring
 - Biological parameters (e.g. macroinvertebrates)
- Map, inventory, and assess riparian and aquatic/water-dependant habitat along Shasta West Creeks and their tributaries.
- Map, inventory and assess terrestrial vegetative communities, with particular emphasis on blue oak woodland.
- Map, inventory and assess the extent of invasive plants and animals.
- Conduct population inventories of resident fish species, particularly Chinook salmon and steelhead.
- Map, inventory, and assess fuels management opportunities.

Monitoring Actions: Long-term monitoring to determine management success could include but not be limited to the following actions:

A. Water Quality and Quantity: Determine the long term trends of key water quality and quantity parameters including:

- Turbidity levels

- Temperature
- Dissolved oxygen
- Water flow
- Pathogen levels via bacteria monitoring

B. Terrestrial, Aquatic, and Invasive Vegetation:

- Determine the long-term trend of terrestrial vegetative communities with particular emphasis on oak woodlands.
- Determine the long-term trend of aquatic/water-dependant communities.
- Determine the long-term success of eradicating of invasive vegetative species.

C. Fish and Wildlife Habitat:

- Determine the long-term trend of the existing habitats for salmonids and other resident native fish and aquatic species.
- Determine the extent/nature of use of creeks and other important tributaries by Chinook salmon and steelhead.
- Determine the long-term success of eradicating feral animals and non-native wildlife.
- Determine the long-term success of restoring and maintaining wildlife migration corridors.
- Determine the long-term success of trial salmonids habitat improvement projects such as gravel injection and riparian vegetation improvement and/or removal.

Cost estimates will be developed when these activities are in planning phase to be implemented.

APPENDIX B

FISH AND WILDLIFE HABITAT

PROJECT: Floodplain Restoration
WATERSHED: Shasta West
PROJECT TYPE: Wetlands, Riparian, and Oak Woodland Restoration
HABITAT/JURISDICTIONAL WATER: Perennial Creek
LANDOWNER: City of Redding



Woodland



Wetland

A. General Description of Project:

Project Purpose: Restore native plant habitat, restore riparian habitat.

Problem: Encroachment of invasive plants, unauthorized OHV use, dead trees and debris remaining from Jones fire.

Solution: Exchange lands to create a single City of Redding owned parcel. Replant riparian/wetland species, restore oak woodlands, create a nature park with trails/benches, stabilize banks, clean out sediment, eliminate OHV use, remove/control invasive plants in waterways and wetlands, leave habitat trees in water courses, remove other debris.

Monitoring: Ensure invasive plant removal, monitor native plant growth, and public use.

Maintenance: Spot spray invasive plants, maintain trails and benches.

Primary Benefit: Improved habitat for wildlife and water fowl, restore the meander of the creek, reduction of sediment into the stream, a natural area for public enjoyment, education, and outreach.

Project Location: To be determined.

Category of Ecosystems Affected: Wetlands, perennial creek, floodplain.

Number of Acres Involved/ lineal feet of project: 20 acres total including about 1,500 feet of the creek, 5 acres of wet area.

Environmental Benefit from Project Implementation: Restoration of riparian, wetland and oak woodland habitat.

B. Project Organization:

Lead Agency / Contact Person: WSRCD/City of Redding.

Other Agencies Significantly Involved in Project Implementation: DFG, NRCS.

Inclusion of Project Priority in Planning Documents: Shasta West Watershed Assessment.

Required Permits and Project Documentation Completed: DFG 1600, RWQCB Certification, Reclamation board permit, NEPA and CEQA documentation, Endangered Species Consultation, Section 404, Section 10, Section 401 and Shasta County grading permit.

C. Project Implementation:

Summary of Project Timeline: 3 years from project implementation to monitoring and maintenance, with each phase completed by the WSRCD or private contractors. Up to 8 years of monitoring and maintenance by the City of Redding or volunteers.

Provision for Ongoing Project Support and Monitoring: Up to 3 years of maintenance and monitoring are included in the budget. Additional monitoring could be requested by the agencies involved.

Note: Both timeline and costs may include project details which have been divided into separate program "components" or "phases" (e.g. general restoration of a large habitat may include the cost of removal of stream flow restrictions either as Phase I of a multiple year project or as Component I of a general restoration project).

D. Work Plan:

Brief chronological summary of major project tasks:

- Task 1: Landowner Entry Permits
- Task 2: Design, Consultant and Specs
- Task 3: Permitting
- Task 4: Implementation and Construction
- Task 5: Reporting
- Task 6: Monitoring
- Task 7: Maintenance

E. Permits:

Temporary Entry permits for landowners	City Grading permit
DFG 1600 Permit	County Encroachment permit, Public Works office
California ESA (Fish & Game)	City Encroachment Permit
SWRCB Storm Water Permit	CALTRANS Encroachment Permit
CRWQCB - CWA section 401 water quality certification	NEPA document.
Central Valley Flood Protection Board	Endangered Species Consultation (NMFS)

Shasta County Grading Permit	ACOE - CWA section 404 & section 10
USA utility location	AQMD (Air Quality Management Board)
ACOE Army Corp of Engineers permits Sections 404, 402, 403, & 10	CEQA document (<u>make sure that copy has been filed with county at least 30 days prior to start of project</u>).
Other	Endangered Species Consultation (USFWS)

F. Budget:

The Budget is estimated to be \$66,000 to \$166,000.

Budget variance depends on engineer's designs and regulatory agencies approval. Upon phase one completion, the project cost will be finalized.

PROJECT: Swasey Sediment Dam Cleanout
WATERSHED: Shasta West
PROJECT TYPE: Fish Habitat Improvement
HABITAT/JURISDICTIONAL WATER: Intermittent Stream
LANDOWNER: Bureau of Land Management

Sediment Buildup at Swasey Dam.



Sediment Removal at Swasey Dam.



A. General Description of Project:

Project Purpose: The Middle Creek watershed supports spawning runs of rainbow trout, steelhead and Chinook salmon. The Swasey Sediment Dam captures sediment from the Middle Creek watershed and is instrumental in keeping fine sediment from settling in spawning beds and area fish habitat. Periodic cleanouts of the sediment dam have occurred since 1990.

Problem: A sieve analysis of the previous cleanout of the sediment dam showed increasing fines, which are harmful to salmon spawning areas within Middle Creek and the Sacramento River. An on-site evaluation in January 2007 showed the dam was 80% full. In order to maintain the protection of salmon spawning areas in this sub-watershed, the dam should be cleaned out on a regular basis. The sediment dam was last cleaned out in 2009.

Solution: Cleanouts are done when the stream flow is temporarily diverted around the basin and the sediment dries out. Heavy equipment is brought in to remove the sediment, which is taken to a local gravel company for reuse.

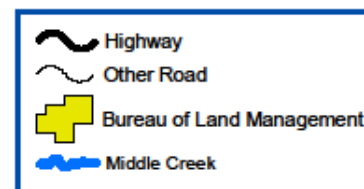
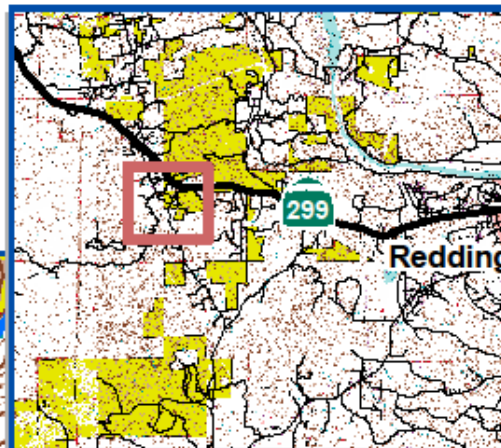
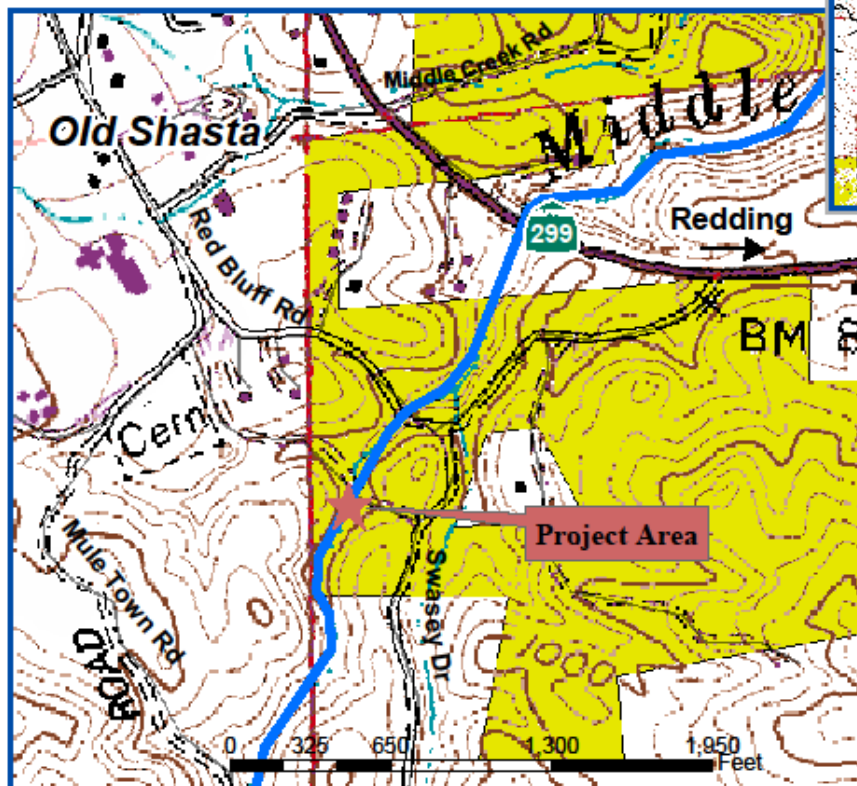
B. Project Organization:

Lead Agency / Contact Person: DFG

Other Agencies Significantly Involved in Project Implementation: City of Redding

Middle Creek Sediment Basin Cleanout

Middle Creek (Shasta West) Watershed,
Shasta County, CA
T32N, R5W, Section 31



Swasey Cleanout



Inclusion of Project Priority in Planning Documents: Shasta West Watershed Assessment

Required Permits and Project Documentation Completed: DFG 1600, RWQCB Certification, CEQA,

C. Project Implementation:

Summary of Project Timeline: From project completion out 3 years monitoring completed by the WSRCD

Note: Both timeline and costs may include project details which have been divided into separate program "components" or "phases" (e.g. general restoration of a large habitat may include the cost of removal of stream flow restrictions either as Phase I of a multiple year project or as Component I of a general restoration project). This separation of program goals into separate elements will ensure maximum project choice for the funder.

Monitoring: Measure sediment depth, walk along the creek and document upstream causes for erosion. Once upstream erosion sources are identified, develop project descriptions to repair the problem and submit the projects into the RCD's Mitigation Library. In the first budget, include technician time to evaluate upstream sediment sources and thereafter evaluate additional stream miles in each grant application.

Maintenance: Revisit the sediment dam every 3 to 5 years. ***If gravel injections are funded for Middle Creek, the sediment dam needs to be monitored for possible sediment removal to protect the new gravel beds.

D. Work Plan:

Project Location: Highway 299 to Swasey Road and Red Bluff Road

Category of Ecosystems Affected: Fisheries, instream habitat

Number of Acres Involved: 0.025 acre

Environmental Benefit from Project Implementation: Improved spawning habitat.

Provision for Ongoing Project Support and Monitoring: Up to 3 years of monitoring should be included in the budget.. Additional monitoring could be requested by the agencies involved.

Criteria for Measuring Project Success: Reduction in turbidity and an increase in the numbers of fish returning to spawn.

Brief chronological summary of major project tasks:

Task 1: Landowner Entry Permits

Task 2: Design, Consultant and Specs

- Task 3: Permitting
- Task 4: Implementation and Construction
- Task 5: Reporting
- Task 6: Monitoring
- Task 7: Maintenance

E. Permits:

Landowner Temporary Entry Permits I	City Grading Permit
DFG 1600 Permit	Shasta County Encroachment Permit, (Public Works office)
California ESA (Fish & Game)	City Encroachment Permit
SWRCB Storm Water Permit	CALTRANS Encroachment Permit
CRWQCB - CWA Section 401 Water Quality Certification	NEPA document.
Central Valley Flood Protection Board	Endangered Species Consultation (NMFS)
Shasta County Grading Permit	ACOE - CWA Section 404 & Section 10
USA utility location	AQMD (Air Quality Management Board)
ACOE Army Corp of Engineers permits Sections 404, 402, 403, & 10	CEQA document (<u>make sure that copy has been filed with county at least 30 days prior to start of project</u>).
Other	Endangered Species Consultation (USFWS)

F. Budget:

BUDGET ESTIMATE: One cleanout of the Swasey Sediment Dam ranges from \$10,850 to \$12,000.

PROJECT: Jenny Creek Spawning Habitat
WATERSHED: Shasta West
PROJECT TYPE: Fish Habitat Improvement
HABITAT/JURISDICTIONAL WATER: Perennial Creek
LANDOWNER: City of Redding

Culvert outflow at the mouth of Jenny Creek.



View of culvert looking downstream.



A. General Description of Project:

Removal or amelioration of outflow pipes and the creation of spawning beds on City of Redding property near the former water treatment plant. Gravel injections, removal of Himalayan blackberry, Vinca and Ailanthus species from confluence with the Sacramento River to Mary Lake.

Project Purpose: Improve instream habitat, allow access to spawning and rearing habitat for anadromous and resident fish and remove/control invasive plant species.

Problem: Man-made obstructions compounded by non-native/invasive plant inundation at the mouth of Jenny Creek have heavily restricted use of the creek by anadromous fish.

Solution: Remove culvert obstructions and/or construct a fish ladder and manage invasive plants to improve fish habitat and allow migration upstream to utilize spawning and rearing habitat.

B. Project Organization:

Lead Agency / Contact Person: DFG

Other Agencies Significantly Involved in Project Implementation: City of Redding

Required Permits and Project Documentation to be Completed: DFG 1600, RWQCB 401 Certification, Reclamation Board permit, NEPA document, CEQA, Endangered Species, ESA, ACOE Section 404, Section 10 and Shasta County Grading Permit.

C. Project Implementation:

Project Location: City of Redding, Hwy 299

Category of Ecosystems Affected: Fisheries, riparian habitat

Number of Acres Involved: 150 lineal feet of creek

Environmental Benefit from Project Implementation: Increased access to spawning habitat, reduction of invasive plants.

Criteria for Measuring Project Success: Increased return of fish for spawning and improved riparian habitat after the control of invasive plants.

Summary of Project Timeline: From initiation to project completion, 5 years, with monitoring and maintenance completed by WSRCD or a private contractor.

Note: Both timeline and costs may include project details which have been divided into separate program "components" or "phases" (e.g. general restoration of a large habitat may include the cost of removal of stream flow restrictions either as Phase I of a multiple year project or as Component I of a general restoration project). This separation of program goals into separate elements will ensure maximum project choice for the funder.

Provision for Ongoing Project Support and Monitoring: Maintenance and monitoring have been included in the budget for up to 5 years. Additional monitoring could be requested by the agencies involved.

D. Work Plan:

Brief chronological summary of major project tasks:

- Task 1: Landowner Temporary Entry Permits
- Task 2: Design, Consultant and Specifications
- Task 3: Permitting
- Task 4: Implementation and Construction
- Task 5: Reporting
- Task 6: Monitoring
- Task 7: Maintenance

PROJECT: Canyon Creek Channel Improvement
WATERSHED: Shasta West
PROJECT TYPE: Man-made creek rehabilitation
HABITAT/JURISDICTIONAL WATER: Ephemeral Stream
LANDOWNER: City of Redding

Man-made channel in Canyon Creek.



Alternate view of Canyon Creek.



A. General Description of Project:

Project Purpose: Redesign and alter the previously constructed man-made channel above Highway 273.

Problem: Lack of pools and riffle, incorrect placement of large concrete boulders, limited natural vegetation.

Solution: Construct pools and riffles, remove concrete boulders, plant native plants, introduce fines or sealing materials where needed to prevent water seepage.

Monitoring: Photograph creek structure and document native plant growth and wildlife use.

Maintenance: Replant any native plants that do not survive.

Primary Benefit: Increase wildlife habitat, reintroduce native plants.

B. Project Organization:

Lead Agency / Contact Person: City of Redding

Other Agencies Significantly Involved in Project Implementation: ACOE, DFG

Project Priority in any Planning Documents: Shasta West Watershed Assessment

Required Permits and Project Documentation to be Completed: DFG 1600, RWQCB 401 Certification, Reclamation Board permit, CEQA, ESA, ACOE Section 404, Section 10, CALTRANS Encroachment Permit and Shasta County grading permit.

C. Project Implementation:

Project Location: Canyon Creek Road, Buenaventura Blvd.

Category of Ecosystems Affected: In-stream habitat, riparian area.

Number of Acres Involved: 2,150 lineal feet of creek starting at the point of natural vegetation and ending at Highway 273.

Environmental Benefit from Project Implementation: Increased aquatic habitat, shaded pools for fish.

Criteria for Measuring Project Success: Increased use by wildlife and fish.

Summary of Project Timeline: From initiation to project completion out 5 years. Monitoring and maintenance completed by the WSRCD or private contractor.

Note: Both timeline and costs may include project details which have been divided into separate program "components" or "phases" (e.g. general restoration of a large habitat may include the cost of removal of stream flow restrictions either as Phase I of a multiple year project or as Component I of a general restoration project). This separation of program goals into separate elements will ensure maximum project choice for the funder.

Provision for Ongoing Project Support and Monitoring: Maintenance and monitoring have been included in the budget for up to 5 years. Additional monitoring could be requested by the agencies involved.

D. Work Plan:

Brief chronological summary of major project tasks:

- Task 1: Landowner Temporary Entry Permits
- Task 2: Design, Consultant and Specifications
- Task 3: Permitting
- Task 4: Implementation and Construction
- Task 5: Reporting
- Task 6: Monitoring
- Task 7: Maintenance

E. Budget:

The Budget is estimated to be \$59,000 to \$157,000.

Budget variance depends on engineer's designs and regulatory agencies approval. Upon phase one completion project cost will be finalized.

PROJECT: Rock Creek Outflow Obstruction
WATERSHED: Shasta West
PROJECT TYPE: Fish Habitat Improvement
HABITAT/JURISDICTIONAL WATER: Intermittent Stream
LANDOWNER: City of Redding

Outflow Obstruction near mouth of Rock Creek.



Rock Creek upstream of confluence.



A. General Description of Project:

Purpose: Repair outflow obstruction.

Problem: Due to natural occurrences a barrier has formed, stopping the migration of anadromous fish up stream from the confluence.

Solution: Bolder structure placed downstream of the barrier will form pools to allow upstream fish migration.

Primary Benefit: Increase spawning habitat for anadromous fish in Rock Creek in the upper Sacramento River area below Keswick dam

Project Location: End of Keswick Dam Road. Take Lake Blvd to Keswick Dam Road to the end of road at the parking lot.

Number of Acres Involved: Approximately one acre.

Environmental Benefit from Project Implementation: Increase in spawning and rearing habitat for endangered anadromous fish in the Sacramento River watershed.

Criteria for Measuring Project Success: Fish count above the obstruction once it is removed.

B. Project Organization:

Lead Agency / Contact Person: DFG

Other Agencies Significantly Involved in Project Implementation: City of Redding

Required Permits and Project Documentation to be Completed: DFG 1600, RWQCB 401 Certification, Reclamation Board permit, NEPA document, CEQA, Endangered Species, ESA, ACOE Section 404, Section 10 and Shasta County Grading Permit.

C. Project Implementation:

Summary of Project Timeline: From inception to project completion 5 years. Monitoring and maintenance completed by the WSRCD or a private contractor.

Note: Both timeline and costs may include project details which have been divided into separate program "components" or "phases" (e.g. general restoration of a large habitat may include the cost of removal of stream flow restrictions either as Phase I of a multiple year project or as Component I of a general restoration project). This separation of program goals into separate elements will ensure maximum project choice for the funder.

Provision for Ongoing Project Support and Monitoring: 3 years of maintenance and monitoring have been included in the budget.. Additional monitoring could be requested by the agencies involved.

D. Work Plan:

Brief chronological summary of major project tasks

- Task 1: Landowner Temporary Entry Permits
- Task 2: Design, Consultant and Specifications
- Task 3: Permitting
- Task 4: Implementation and Construction
- Task 5: Reporting
- Task 6: Monitoring
- Task 7: Maintenance

APPENDIX C

ILLEGAL DUMPING

PROJECT: Salt Creek Dumping Site
WATERSHED: Middle Creek Sub-watershed
PROJECT TYPE: Illegally dumped debris and garbage removal
HABITAT/JURISDICTIONAL WATER: Intermittent Stream
LANDOWNER: Bureau of Land Management



A. General Description of Project:

Project Purpose: Remove illegally dumped debris to improve water quality going into Salt Creek.

Problem: During heavy rain events debris and chemicals from illegal dumps can enter the creek and affecting fisheries up and down stream.

Solution: Remove debris, install no dumping and no trespassing signs, and possibly install vehicle barriers to restrict further dumping.

Monitoring: Pre- and post-photo monitoring.

Maintenance: Reconstruction of barriers if needed, possible debris removal.

Primary Benefit: Water quality improvement and watershed restoration by removing contaminants from area.

Project Location: Middle Creek

Category of Ecosystems Affected: Oak woodland

Number of Acres Involved/lineal feet of project: 20 acres

Environmental Benefit from Project Implementation: Water quality improvement from debris removal.

B. Project Organization:

Lead Agency / Contact Person: Bureau of Land Management

Other Agencies Significantly Involved in Project Implementation: Shasta County, Western Shasta RCD

C. Project Implementation:

Summary of Project Timeline: 3 years monitoring and maintenance completed by WSRCD or a private contractor.

Provision for Ongoing Project Support and Monitoring: Maintenance and monitoring have been included in the budget for up to 3 years. Additional monitoring could be requested by the agencies involved.

D. Work Plan:

Brief chronological summary of major project tasks

- Task 1: Landowner Temporary Entry Permits
- Task 2: Design, Consultant and Specifications
- Task 3: Permitting
- Task 4: Implementation and Construction
- Task 5: Reporting
- Task 6: Monitoring
- Task 7: Maintenance

Permits:

No permits are required unless the project disturbs the streambed. Project will require dump fees.

E. Budget:

The Budget is estimated to be \$31,000 to \$41,000.

APPENDIX D: EROSION

PROJECT: Flow Obstruction Improvement
WATERSHED: Shasta West - Any Creek
PROJECT TYPE: Erosion Control
HABITAT/JURISDICTIONAL WATER: Perennial stream
LANDOWNER: Various

Channel Encroachment near bridge on Middle Creek



Choked Channel in Olney Creek.



A. General Description of Project:

Project Location: Various Creeks

Project Purpose: Repairing streambank and abutment damage resulting from channel encroachment by invasive species, such as Giant Reed (*Arundo donax*).

Problem: The growth of *Arundo* has altered the natural flow regime of the creeks, resulting in stream bank erosion and damage to bridge abutments.

Solution: Repair streambank damage and armor bridge abutments.

Monitoring: Project monitoring will be the responsibility of the private road owners.

Maintenance: Bridge maintenance will be the responsibility of the private road owners.

Primary Benefit: Improved stream habitat, protection of existing bridges.

Category of Ecosystems Affected: Fisheries, instream habitat.

Number of Acres Involved: Less than 1 acre.

Environmental Benefit from Project Implementation: Streambank restoration.

B. Project Organization:

Lead Agency / Contact Person: WSRCD

Other Agencies Significantly Involved in Project Implementation: Ca DFG/City of Redding

Required Permits and Project Documentation to be Completed: DFG 1600, RWQCB 401 Certification, Reclamation Board permit, CEQA, ESA, ACOE Section 404, Section 10 and Shasta County Grading Permit.

C. Project Implementation:

Summary of Project Timeline: 1- 2 years for project design, CEQA analysis, permitting, and completion by WSRCD or a contractor.

Note: Both timeline and costs may include project details which have been divided into separate program "components" or "phases" (e.g. general restoration of a large habitat may include the cost of removal of stream flow restrictions either as Phase I of a multiple year project or as Component I of a general restoration project).

D. Work Plan:

Brief chronological summary of major project tasks

- Task 1: Landowner Temporary Entry Permits
- Task 2: Design, Consultant and Specifications
- Task 3: CEQA Analysis/Permitting
- Task 4: Implementation and Construction
- Task 5: Reporting

E. Permits:

Reclamation Board permits.	Temporary Entry permits for landowners
Shasta County Grading Permit	DFG 1600 Permit
City Grading permit	California ESA (Fish & Game)
County Encroachment permit, Public Works office	SWRCB Storm Water Permit
City Encroachment Permit	ACOE Army Corp of Engineers permits. Section 404, 402, 403,& 10
CRWQCB - CWA section 401 Water Quality Certification	ACOE - CWA Section 404 & Section 10
CALTRANS Encroachment Permit	AQMD (Air Quality Management Board)
NEPA document	USA utility location
CEQA document (<u>make sure that copy has been filed with county at least 30 days prior to start of project</u>).	Other
Endangered Species Consultation (NMFS)	
Endangered Species Consultation (USFWS)	

E. Budget:

The Budget is estimated to be \$32,000 to \$60,000. Please review the following tables. Budget variance depends on engineer's designs and regulatory agencies approval, prevailing wage rates, etc.

PROJECT: Erosion
WATERSHED: Shasta West (any Creek)
PROJECT TYPE: Erosion/stream bank restoration/stream diversion
HABITAT/JURISDICTIONAL WATER: Perennial Creek
LANDOWNER: City of Redding



Bank eroding below homes



Possible stream route

a. General Description of Project:

Project Purpose: Stabilize or stop hillside erosion that is threatening a neighborhood.

Problem: Extensive hillside erosion caused by increased stormwater flow from commercial development. **The erosion is threatening a neighborhood.**

Solutions: 1. Armor plate the eroded area through riprap, gabions or stream barbs, or 2. Reroute the creek to an old channel that avoids the hillside. Remove invasive plants to allow water to utilize the natural floodplain during high water events.

Monitoring: Monitor water conveyance during high and regular water events; ensure stream bank stabilization efforts continue to functioning,

Maintenance: Clean debris from the channel to ensure water movement, plant native erosion control plants were needed after high water events.

Primary Benefit: Added protection to homes on the bluff. Reduce sediment deposits into the creek.

Project Location: Redding

Category of Ecosystems Affected: Fisheries, flood plain

Number of Acres Involved, Lineal Feet of Project: 100 lineal feet of erosion

Environmental Benefit from Project Implementation: Reduction of sediment into the creek to improve aquatic habitat.

B. Project Organization:

Lead Agency / Contact Person: WSRCD/City of Redding

Other Agencies Significantly Involved in Project Implementation:

DFG/ACOE/RWQCB

Project Priority in Planning Documents: Shasta West Watershed Assessment
Required Permits and Project Documentation Completed: DFG 1600, RWQCB Certification, Reclamation board permit, NEPA and, CEQA documentation, Endangered Species, ESA, Section 404, Section 10, Section 401 and Shasta County Grading Permit.

C. Project Implementation:

Summary of Project Timeline: Hillside stabilization or stream diversion design, CEQA analysis, permitting 1- 2 years. Maintenance is the responsibility of the City of Redding. Monitoring is by the WSRCD or a private consultant.

Provision for Ongoing Project Support and Monitoring: up to 5 years of monitoring has been included in the budget. Additional monitoring could be requested by the agencies involved.

Note: Both timeline and costs may include project details which have been divided into separate program "components" or "phases" (e.g. general restoration of a large habitat may include the cost of removal of stream flow restrictions either as Phase I of a multiple year project or as Component I of a general restoration project).

D. Work Plan:

Brief chronological summary of major project tasks.

- Task 1: Design, Consultant and Specs
- Task 2: Permitting
- Task 3: Implementation and Construction
- Task 4: Reporting
- Task 5: Monitoring
- Task 6: Maintenance

E. Permits:

CEQA document (<u>make sure that copy has been filed with county at least 30 days prior to start of project</u>).	Temporary Entry permits for landowners
Endangered Species Consultation (NMFS)	DFG 1600 Permit
Endangered Species Consultation (USFWS)	California ESA (Fish & Game)
CALTRANS Encroachment Permit	SWRCB Storm Water Permit

NEPA document.	RWQCB - CWA Section 401 Water Quality Certification
Other	Reclamation Board permits.
City Encroachment Permit	Shasta County Grading Permit
AQMD (Air Quality Management Board)	City Grading Permit
USA utility location	County Encroachment Permit, Public Works office
ACOE Army Corp of Engineers permits. Section 404, 402, 403, & 10	

F. Budget:

1. The Budget is estimated to be \$110,000 to \$120,000 for hillside stabilization/invasive plant removal.

PROJECT MAP

Priority Projects

1. Outreach and Education
2. Inventory and Monitoring
3. Water Quality and Quantity
4. Botanical and Wildlife Resources
5. Fire Prevention and Fuels Management
6. Miscellaneous (i.e. Development,)

Project Cost

1. Outreach and Education
2. Inventory and Monitoring
3. Water Quality and Quantity
4. Botanical and Wildlife Resources
5. Fire Prevention and Fuels Management
6. Miscellaneous (i.e. development, illegal dumping, trespass OHV, etc.)

Potential Funding Sources

1. *Water Quality and Quantity*
 - Ca. Dept. of Water Resources, Prop. 50 for Water Efficiency
 - Ca. Dept. of Water Resources, Prop. 40 for Urban Stream Renewal
 - State Water Resources Control Board
 - The Integrated Regional Water Management Grant Program
 - USDA Natural Resource Conservation Service, Conservation Innovation Grants
 - US EPA, Assessment and Watershed Protection Program
 - NRCS Environmental Quality Incentives Program (EQIP)
2. *Fisheries*
 - USFWS Partners for Fish and Wildlife Program
 - USFWS, Anadromous Fisheries Program
 - NOAA—Five Star Challenge Grants
 - NRCS Wildlife Habitat Incentives Program (WHIP)
3. *Botanical and Wildlife Resources*
 - USFWS, North American Wetlands Conservation Act
 - USFWS, Cooperative Conservation Initiative
 - USFWS, Neotropical Migratory Bird Conservation Fund
 - NRCS Wildlife Habitat Incentives Program (WHIP); Wetland Reserve Program (WRP)
4. *Fire Prevention and Fuels Management*
 - Cal Fire, Forestry Stewardship Program
 - Cal Fire, Vegetation Management Program
 - Cal Fire, California Forest Improvement Program

- USDA NRCS, Environmental Quality Incentives Program
- USDA Forest Service, National Assoc. of State Foresters, State Fire Assistance Program

Support Programs

5. Outreach and Education

- NOAA—Five Star Challenge Grants

6. Inventory and Monitoring

- US EPA, Assessment and Watershed Protection Program

Potential Partners

- Community Cleanup Action Group
- Audubon Society

Key Contacts

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