

Integrated Weed Management Plan
For the
Battle Creek Watershed
Manton, California
2012-2016



(Photo Courtesy Kathy Bishop Battle Creek Watershed Conservancy)

Prepared for the
Battle Creek Watershed Conservancy
by the
Tehama County Resource Conservation District
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Acknowledgements

This document was created for the Board and staff of the Battle Creek Watershed Conservancy in order to inform these stakeholders and to provide direction towards improving conditions within the Battle Creek watershed related to invasive plants.

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The Integrated Weed Management Plan for the Battle Creek Watershed was written to incorporate the following documents:

***Tehama County Resource Conservation District Noxious Weed Inventory & Management
Report for the Battle Creek Watershed Conservancy 2002***

Battle Creek Watershed Community Strategy: Battle Creek Watershed Conservancy 2007

Bureau of Land Management Manual 9015 – Integrated Weed Management 1992

Lassen National Forest Land Resource Management Plans 1992

Lassen Volcanic National Park Weed Management Plan 2008

Manton Community Fire Plan: Manton Fire Safe Council 2005

Tehama East Community Wildfire Protection Plan 2008

Sierra Nevada Forest Plan Amendment 2004

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Introduction

The role of a weed management plan is to provide a conceptual framework and recommendations for actions to prevent introduction and to control the spread of invasive plant species. Whether as large as an entire state or as small as an urban backyard, any plan should be tailored to the landscape it is intended to address. Every manager has goals for the land they manage even if it is as simple as maintaining landscapes in their current condition. More often, goals are related to the intended use of the land, such as recreation, economic productivity, or ecosystem benefits.

Weed management plans are one tool for achieving the vegetation goals for landscapes, and it is essential to identify what those goals are. This planning document describes the Battle Creek Watershed and the invasive plant issues currently facing the area's landowners and other stakeholders. The document goes on to describe the land management goals developed by various stakeholder groups and the invasive plants that impact these goals. The plan then describes potential solutions to the invasive plant problem and strategies for implementation of recommended measures.

Characteristics of Invasive Species

In general, successful exotic (weed) species have a number of common characteristics that allow their rapid development in disturbed or otherwise impacted sites. These include:

- Their native habitat and the reception area are similar in climate, plant life forms, and soil.
- These plants have a generalized seed dispersal mechanism (wind, water, or animal) allowing seeds to be carried to the "reception" area and spread.
- They are successful in areas where few native species reproduce successfully by seed.
- They have rapid growth, flower early, and produce large numbers of seeds.
- They have a wide range of phenotypic "plasticity."
- These plants demonstrate "polymorphism" which allows some seeds to germinate immediately and others to germinate much later.
- Their seeds have the ability to establish within a wide range of photoperiods and temperature conditions.

In addition, weeds are non-native, invasive terrestrial plants that sometimes interfere with land management objectives. Examples of interference include weeds impeding desirable native plants from thriving and producing food for wildlife, trails become impassable due to overgrowth of thorny vegetation, and invasive plants in flood relief channels capturing excessive amounts of sediment which prevent flood waters from escaping. Section 1 of this plan describes the goals of various public and private entities that manage lands within the Battle Creek watershed. Section 2 describes current conditions within the entire watershed area and how invasive plant species may be preventing attainment of these management goals. In Section 3 the planning document contains a framework for setting

priorities and for identifying effective management actions and for future decision making and course correction. Finally, the plan presents specific management strategies for individual plant species.

Throughout the array of landscapes within the Battle Creek Watershed, invasive plants have varying degrees of negative impacts on native ecosystems. Noxious plants displace native species, changing plant community structure and reducing the value of habitat for wildlife. These plants may disrupt physical ecosystem processes such as fire regimes, sedimentation and erosion, light availability, and nutrient cycling. This increase in the distribution and dominance of exotic species has led to competition and displacement of native plants, along with the disruption of properly functioning ecological systems through alteration of ecosystem cycles, hybridization with native species, promoting other non-native or undesirable species, and reducing biological diversity.

Unique sites and plant communities have become particularly vulnerable to the invasion of exotic species. Systems limited by water and nutrients, such as arid lands, riparian areas, and springs, play an integral role in flora and fauna composition and are the primary sites for disturbance by agriculture, ranching, and urbanization. The disruption of the area's geomorphological and hydrological processes by land-use practices affects the diversity of the physical environment. Communities that have a high frequency of disturbance or that are adjacent to disturbed land, such as grasslands, riparian areas, waterways, roadsides, sand dunes, and some forests, are highly susceptible to the establishment of exotic species. Resource extraction and housing developments are common disturbances which can alter inter-species competition, predator-prey relationships, and physical stresses by increasing levels of certain resources.

Watershed Description, Current Conditions and Land Management Objectives

Within Battle Creek Watershed

The area addressed by this integrated weed management plan includes the entire Battle Creek Watershed. The 350 miles of streams within the Battle Creek system drains an area of approximately 370 square miles in central Northern California. This watershed includes the southern slopes of the Latour Buttes, the western slope of Mt. Lassen (10,400 feet), and mountains south of the Mineral community. Battle Creek and its tributaries then cascade down through basalt canyons and foothills to the confluence with the Sacramento River near Cottonwood, at an elevation of 335 feet. As noted in the Battle Creek Watershed Assessment (2002), the Battle Creek watershed is unique due to its volcanic origin, geology, and year-round plentiful cold stream flows. Battle Creek and its tributaries have long been noted for their ability to support a productive assemblage of anadromous and resident fishes. The "2007 Battle Creek Watershed Community Strategy" mentions that approximately 250 miles of Battle Creek's two forks and their tributaries are fish bearing with 87 miles historically accessible to anadromous fishes such as Chinook salmon and steelhead. The terrestrial wildlife habitats within the watershed include mountaine, mixed conifer and pine forest, oak woodlands, oak savannas, riparian woodlands, freshwater wetland habitat, and willow scrub. These ecosystems house migratory waterfowl, large mammals, songbirds, raptors, furbearers, reptiles, and amphibians.

Land use within the Battle Creek watershed ranges in intensity from light commercial and rural residential development, including the communities of Manton, Shingletown, and Viola, to undeveloped wilderness areas within Lassen Volcanic National Park and the Lassen National Forest. Activities on watershed lands are predominated by large scale industrial timber harvesting which is regulated by the State Board of Forestry, Regional Water Quality Control Board, and California Department of Fish and Wildlife. Other significant activities within the watershed include livestock grazing, agricultural production in the form of orchards and vineyards, and recreational activities on public and private lands. Approximately one quarter of the Battle Creek watershed is under Federal ownership and managed by the Lassen National Forest (51,621 acres), Lassen Volcanic National Park (11,440 acres), and the Bureau of Land Management (8,537 acres). Other significant landowners and land management entities within the watershed include Sierra Pacific Industries, which owns and manages approximately 70,000 acres of timberland, and The Nature Conservancy, with 1,810 acres under its management. In addition to those stakeholders who manage large land holdings, numerous small private landowners are found throughout the watershed. Many of these individuals were represented in this planning process by the Battle Creek Watershed Conservancy. As a result, the perspective and opinions of public and private land management entities of all sizes have been represented in this planning document.

In August of 2012, the Battle Creek watershed was significantly impacted by the 27,676-acre Ponderosa Fire which burned across the canyon of Battle Creek's South Fork. The fire then headed north and east, crossing Digger Creek and Rock Creek, which are tributaries of Battle Creek's North Fork, and continued up Shingletown ridge. Within Battle Creek's South Fork Canyon and along Shingletown ridge, much of the forest and riparian vegetation was removed on slopes ranging from 20% to 100%. With such a high level of disturbance across an extensive area, plant invasions can occur at varying levels of severity depending upon:

- the amount of habitat disturbance that has occurred,
- the burned area's proximity to previously invaded sites,
- the number and means available for propagules to spread, and
- the extent to which resource levels have been altered and ecologic processes disrupted.

Invasive potential is highest when propagules of invasive plants are likely to reach new areas that offer the combination of soil nutrients, sunlight, and moisture that are necessary to establish and compete with native plants for these resources. In vegetation types where there is frequent natural disturbance, native vegetation is often able to recover quickly (i.e., by resprouting or establishing from seed), and therefore high resource availability following disturbance may not be a factor in invasive plant populations becoming established. In other vegetation types, plant resource availability, particularly soil nutrients, can affect whether invasive plants become established. Following a fire, such resources can be increased directly (i.e., postfire fertilization) or indirectly from the sudden reduced competition for nutrients after vegetation is removed. Established populations of invasive plants can affect the supply of resources available. For example, some invasive plants might limit the growth of other species through competition or inhibition of nutrient uptake. Processes that reduce plant resource availability, such as postfire recovery of vegetation, can reduce invasion potential. As vegetation recovers, resource uptake increases. Propagules can be introduced deliberately (i.e., added to postfire seeding mixes) or accidentally (i.e., contaminant species in postfire seeding mixes or straw mulch). Plant propagule numbers can be reduced

by seed predators (i.e., mice, squirrels, and many birds) or diseases that reduce the reproductive rates of invasive plants.

Figure 1. Battle Creek Watershed



Figure 2. Tributaries and Parcels Located Within the Battle Creek Watershed

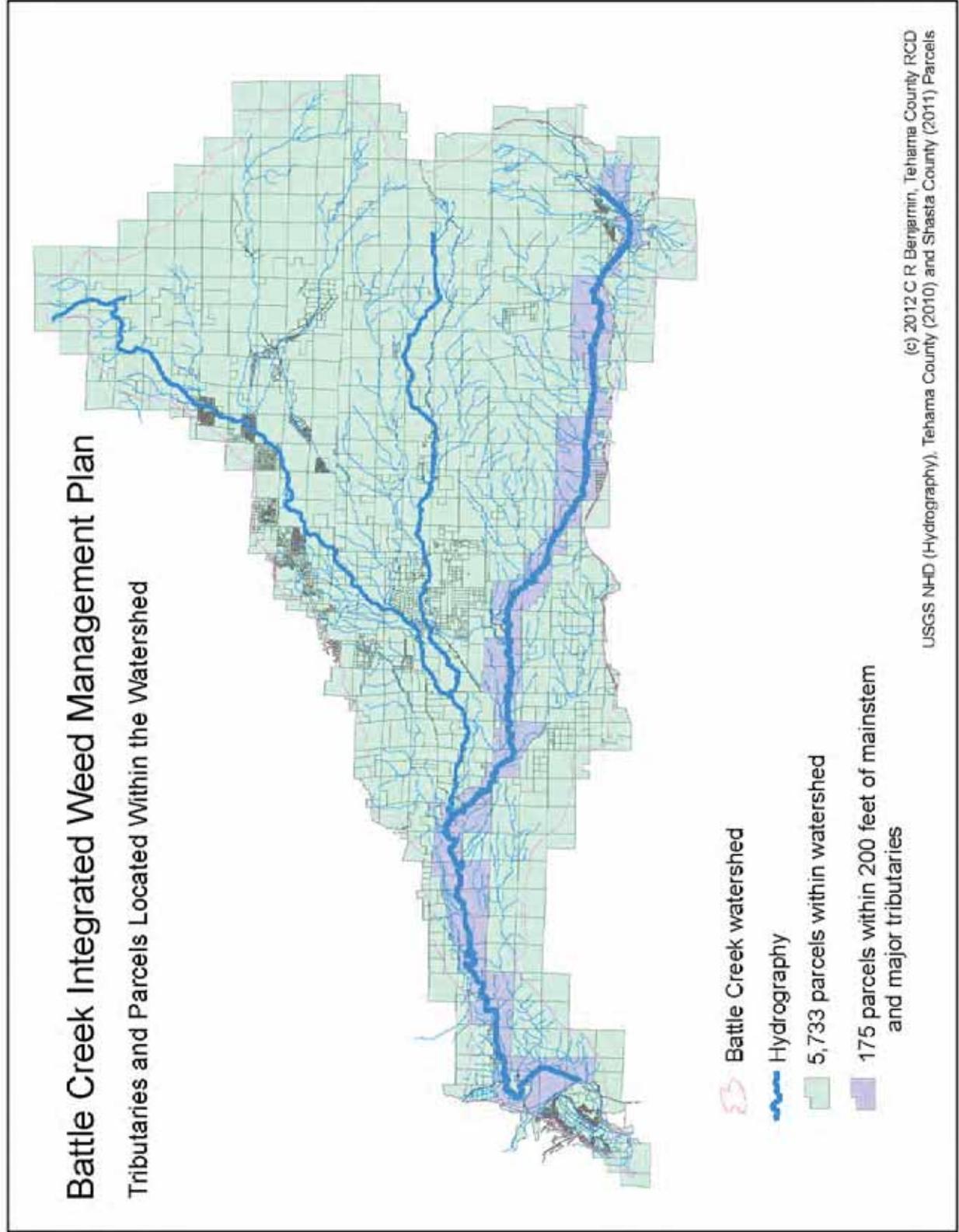
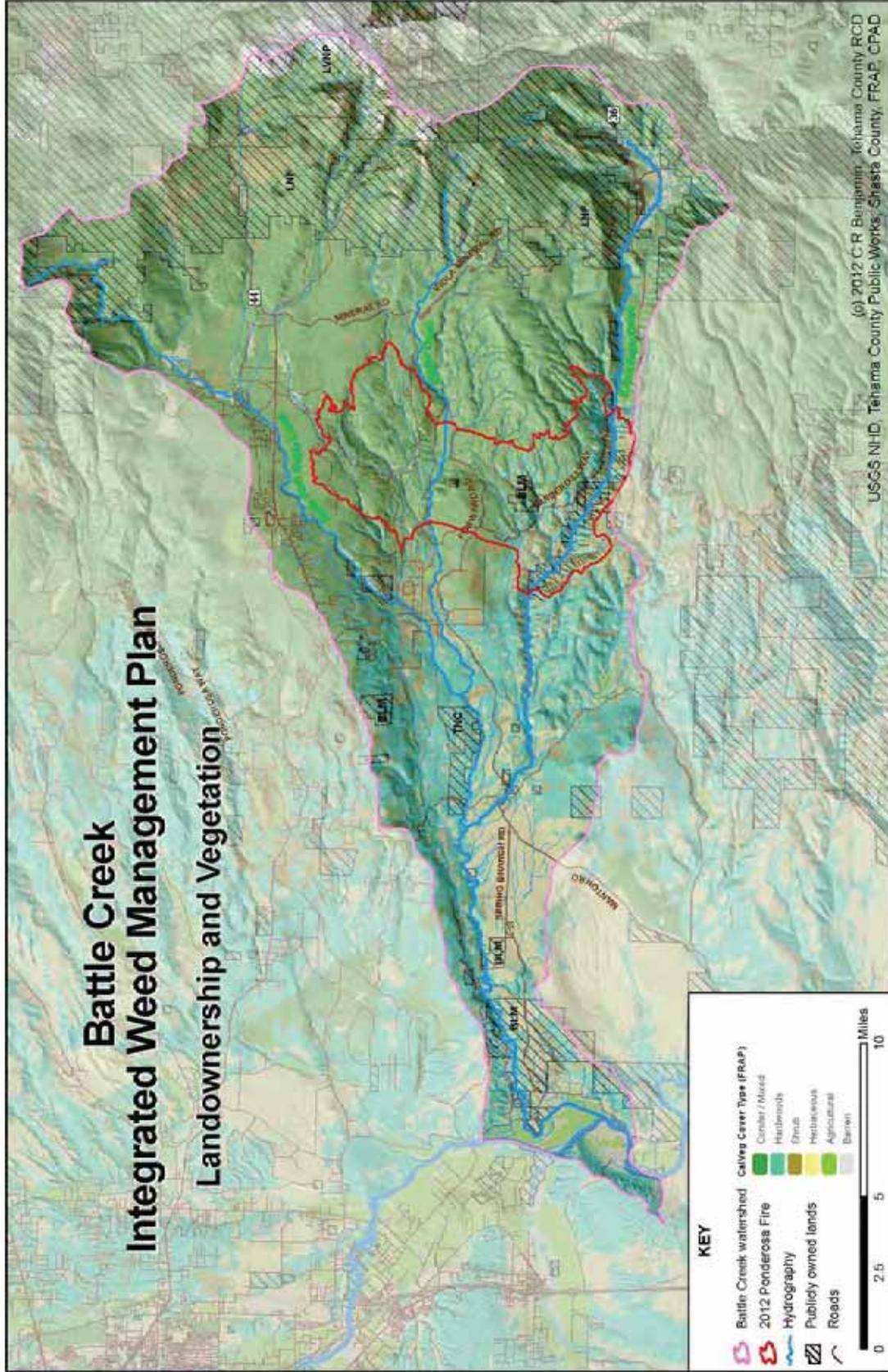


Figure 3. Landowners, Vegetation and Ponderosa Fire Area Within the Battle Creek Watershed



How Invasive Weeds Interfere with the Natural Processes and Land Management Goals

Found Within the Battle Creek Watershed

The proper ecological functioning of the various landscapes found within the Battle Creek Watershed has an integral role in that system's flora and fauna composition. A number of areas are desirable for developed activity and are primary sites for disturbance related to agriculture, ranching, recreation areas, and urbanization. The disruption of geomorphologic and hydrological processes by land use practices affects the diversity of the physical and biological environment. Ecosystems with a high frequency of disturbance and/or which are adjacent to disturbed land such as grasslands, riparian areas, waterways, roadsides, sand dunes, and some forests, are highly susceptible to the establishment of exotic species. Resource extraction and housing developments are also common forms of disturbances. In addition, disturbance may alter inter-species competition, predator-prey relationships, and physical stresses by increasing levels of certain resources. In essence, the "invader" has an advantage over more sensitive species when these factors are present. The disturbance history of a community will often determine the distribution of a species. The increasing rate in which native plants are being displaced by exotic species is of concern to many of the stakeholders found within the Battle Creek watershed including individual landowners along with members of the Battle Creek Watershed Conservancy, the Battle Creek Watershed Working Group, and the Manton Fire Safe Council.

In addition to the proper functioning of natural systems within a watershed, invasive plants can impact the management goals for these lands, whether the goals are to maintain naturally functioning ecosystems or to utilize lands for more intensive purposes. The production of timber and forage, the operation of water distribution systems, management of fire and fuels, and the health and proper management of recreation lands can all be impacted by the occurrence and development of invasive species. The effects of the most troublesome weeds within the primary plant communities of the Battle Creek Watershed are described below.

Riparian Areas

Riparian area weeds currently found within the Battle Creek watershed include Himalayan blackberry (*Rubus armeniacus Focke*), pampas grass (*Cortaderia selloana*), giant reed (*Arundo donax*), yellow star thistle (*Centaurea solstitialis*), Spanish broom (*Spartium junceum*), Scotch broom (*Cytisus scoparius*), and French broom (*Genista monspessulana*). These species can alter plant community composition and structure if allowed to spread. In time they could dominate the canopy layer and form mono-specific stands as has occurred within portions of the Battle Creek Watershed and other riparian areas of Northern California. These changes have been noted to impact natural hydrogeomorphological processes which can have a negative impact on stream bank stability and structure of riparian plant communities resulting in significant decreases in habitat quality. In addition, the high flammability of brooms, pampas grass, and *Arundo* pose a wildfire threat to the health of both riparian and upland vegetation.

As noted in the 2007 *Battle Creek Watershed Community Strategy*, the most important weeds that modify both forested and non-forested riparian communities are Himalayan blackberries, pampas grass, and

yellow star thistle. The effects of these species on riparian areas are not fully understood. The non-native Himalayan blackberry may outcompete and/or hybridize with the native California blackberry (*Rubus ursinus*). At the same time, these invasive plants could benefit some species of wildlife by providing additional food and shelter. The Himalayan blackberry may reduce the recruitment of other riparian plants. Both Pampas grass and *Arundo* infest and sometimes dominate former riparian forest sites. Broom species negatively impact riparian corridors by significantly increasing the risk of wildfire and resultant deterioration of aquatic habitat and water quality conditions. In addition to information provided by local landowners, a formal noxious plant survey was conducted in 2002 within the watershed of Battle Creek's South Fork by the Tehama County Resource Conservation District. The results of this effort reported the extensive presence of Himalayan blackberry, Scotch broom, and Klamath Weed along Battle Creek's South Fork, Ripley Creek, the Cross County Canal, South Inskip Canal, and the Union Canal.

Uplands and Grasslands

A large portion of the project area consists of grasslands and open woodlands. The 2002 Survey mentioned above was also conducted on various large and small upland parcels within the Battle Creek watershed. These surveys, together with discussions held with participating landowners, indicated that the most invasive species found within upland portions of the survey area included medusahead and yellow star thistle. These plants were reported to reduce forage value and impact livestock health. Their large scale distribution throughout the state makes effective control problematic, and thus they are not classified as controllable or "A Rated" by the California Department of Food and Agriculture. As a result, there are currently no organized large scale State efforts to contain, control or eradicate their occurrence within the State.

Trails and Roads

Weeds that interfere with road and trail usage include Himalayan blackberry and yellow star thistle. Himalayan blackberry obstructs movement along trails and can overrun an area if left unchecked. Yellow star thistle, with its spiny flower heads, can be an obstruction and annoyance on dirt roads and trails and may also become a fire hazard once the annual stems die. It can also colonize grasslands and waterfowl nesting habitat from adjacent trails and levees, where it is spread by passing automobiles and other equipment.

Land Management Goals for Lands within the Battle Creek Watershed

Battle Creek Watershed Conservancy

The Battle Creek watershed consists of both public and private land. In 1997 the Battle Creek Watershed Conservancy (BCWC) was formed in order to provide representation for private landowners, stakeholders, and residents of the watershed. Its purpose was to look beyond efforts to simply "fix" the creek and to consider the long-term health of the entire watershed. The BCWC's collaboration led to development and member support of the 2007 "*Battle Creek Community Strategy*" which was created with the goal of aiding in the preservation of the watershed's environmental and economic resources

through responsible stewardship, liaison, cooperation, and education. When the strategy was released after stakeholder review, it became that group's framework for future watershed restoration and education activities throughout the entire Battle Creek Watershed.

Given its large area and its array of landscapes, land uses, landowners, and land managers, a multitude of goals have been established for lands within the Battle Creek watershed. The strategies that were developed through the community input process represent the goals of participating landowners, land managers, and agency personnel. The strategies focus on the restoration of Chinook salmon runs in the Battle Creek system and the establishment of a fully functioning watershed. In creating these strategies, an overarching goal for the watershed was developed:

“To preserve the environmental and economic resources of the Battle Creek watershed through responsible stewardship, liaison, cooperation, and education.”

Among the major concerns identified in the 2007 strategy document was the pace with which various invasive species are spreading throughout the watershed. The Battle Creek Watershed Community Strategy goes on to state that these plants pose a threat to ranching and the riparian corridors within the watershed. In the pursuit of achieving this overall goal for the Battle Creek watershed, strategies were created which apply to all resource improvement and protection measures to be implemented including the control of invasive plant species.

- Encourage pre-fire management prescriptions to reduce wildfire impacts to natural resources and assets.
- Promote land and water stewardship through outreach and education.
- Seek to protect in-basin water rights and support appropriate beneficial water use policies.
- Strive to maintain and restore natural processes and functions throughout the watershed.
- Support Best Management Practices in the continuation of existing upland land uses, such as livestock grazing, farming, wildlife habitats, open space, and other uses in support of local sustainable economies.
- Support forestland management practices which sustain healthy forest lands in the upper watershed and which, in turn, support local sustainable communities.
- Improve and maintain water quality throughout the Battle Creek watershed.
- Seek to delineate, improve, and maintain riparian corridors along Battle Creek and its tributaries.
- Support land use planning that supports sustainable communities and land uses throughout the Battle Creek watershed.

- Work to restore and maintain suitable habitat conditions for Chinook salmon and steelhead, and other aquatic resources of the Battle Creek watershed.
- Seek to identify and protect critical holding, spawning, and rearing habitats and anadromous fish resources.
- Encourage commercial outdoor recreational opportunities which support local sustainable economies and which operate within the constraints of adequate resource management protections.
- Monitor plans and activities of organizations outside the watershed and evaluate policies with regard to their local effects and implications.

Based upon information obtained from a 2011 survey sent to landowners and to public and private land management entities along with preliminary survey work conducted by the Tehama County Resource Conservation District, a number of significant invasive plant species were identified and the need for their control discussed in the strategy document. These included yellow star thistle (*Centaurea solstitialis*), Klamath Weed (*Hypericum perforatum*), Spanish Broom (*Spartium junceum*), Scotch Broom (*Cytisus scoparius*), French Broom (*Genista monspessulana*), medusahead (*Taeniatherum caput-medusae*), Himalayan blackberry (*Rubus armeniacus*), Giant Reed (*Arundo donax*), Tree of Heaven (*Ailanthus altissima*), perennial pepperweed (*Lepidium latifolium* L.), and Pampas Grass (*Cortaderia selloana*).

In accomplishing the weed management objectives developed through this integrated planning process, numerous public land management goals, objectives, and priorities were considered, along with those of private landowners as expressed in the *Battle Creek Community Strategy*. These public and private goals were then integrated into an implementation strategy and a coordinated, watershed wide work program developed through landowner and agency participation. Combined, the implementation strategy and work program address each participating entity's needs and specific invasives problems. A number of Federal land management agencies have established ongoing programs for monitoring, assessment, and continual control of invasive plants. As described in the implementation measures shown later in this planning document, these objectives have been incorporated into control strategies for invasive plant sites found outside agency boundaries.

Lassen National Forest

The *2004 Sierra Nevada Forest Plan Amendment* updates a number of National Forest Land Resource Management Plans (LRMP), including the Lassen National Forest's 1992 planning document. The overriding goal for managing invasive species established in the Lassen National Forest's 1992 plan is to "reduce impacts of forest pests on all resources to acceptable levels through integrated pest management." To accomplish this, Forest wide invasive control efforts have been developed that will address this issue in the following order of priority:

Priority 1. Prevent the introduction of new invaders

Priority 2. Conduct early treatment of new infestations

Priority 3. Contain and control established infestations

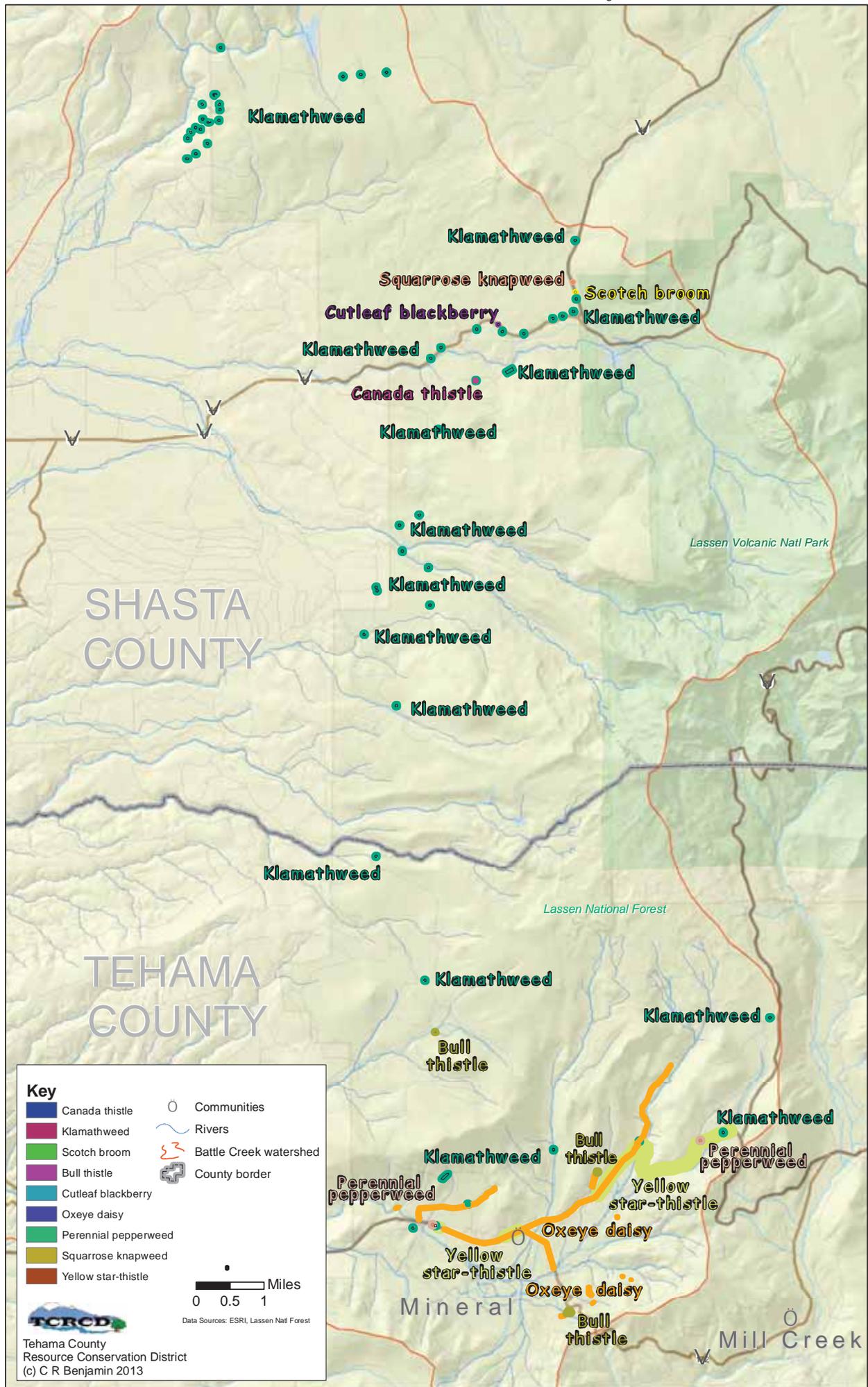
Among the revisions in the framework were forest-wide standards and guidelines for noxious weed management. The document also provides specific measures to be taken by National Forest personnel to implement Forest Service Manual direction regarding noxious weeds along with a list of Best Management Practices that can be used as appropriate to carry out the weed standards and guidelines. As currently practiced, a project-level noxious weed risk assessment serves as the primary mechanism for prescribing weed prevention measures. These assessments are a standard component of the project planning process for ground-disturbing or site-altering activities. The risk assessment may be as simple as a one-page form documenting little or no risk posed by a project, or a more complex plan with contract provisions when risk is determined to be moderate to high. The risk assessment demonstrates the need for and appropriateness of requiring contractors and permittees to take preventive measures, such as cleaning heavy equipment or obtaining certified weed-free mulch for erosion control.

More specifically, the Lassen National Forest LRMP and the Sierra Nevada Strategy list the following forest-wide objectives in terms of preventing, controlling, and eradicating invasive plant species.

- *Use an integrated pest management (IPM) approach to managing pests during the planning and implementation of all activities that influence vegetation. Consider a full range of pest management alternatives for each project. Select treatment methods through an environmental analysis process that considers the environmental effects, treatment efficacy, and cost effectiveness of each alternative. Determine monitoring and enforcement plans during this site-specific process. Also use pest detection, surveillance, evaluation, prevention, suppression, and post-action evaluation as integral components of this IPM approach.*
- *Inform forest users, local agencies, special use permittees, groups, and organizations in communities near national forests about noxious weed prevention and management.*
- *As part of project planning, conduct a noxious weed risk assessment to determine risks for weed spread (high, moderate, or low) associated with different types of proposed management activities. Refer to weed prevention practices in the Regional Noxious Weed Management Strategy to develop mitigation measures for high and moderate risk activities.*
- *When recommended in project-level noxious weed risk assessments, consider requiring off-road equipment and vehicles (both Forest Service and contracted) used for project implementation to be weed free. Refer to weed prevention practices in the Regional Noxious Weed Management Strategy.*

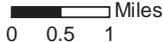
- *Minimize weed spread by incorporating weed prevention and control measures into ongoing management or maintenance activities that involve ground disturbance or the possibility of spreading weeds. Refer to weed prevention practices in the Regional Noxious Weed Management Strategy.*
- *Conduct follow-up inspections of ground disturbing activities to ensure adherence to the Regional Noxious Weed Management Strategy.*
- *Encourage use of certified weed free hay and straw. Cooperate with other agencies and the public in developing a certification program for weed free hay and straw. Phase in the program as certified weed free hay and straw becomes available. This standard and guideline applies to pack and saddle stock used by the public, livestock permittees, outfitter guide permittees, and local, State, and Federal agencies.*
- *Include weed prevention measures, as necessary, when amending or re-issuing permits (including, but not limited to, livestock grazing, special uses, and pack stock operator permits).*
- *Include weed prevention measures and weed control treatments in mining plans of operation and reclamation plans. Refer to weed prevention practices in the Regional Noxious Weed Management Strategy. Monitor for weeds, as appropriate, for 2 years after project implementation (assuming no weed introductions have occurred).*
- *Conduct a risk analysis for weed spread associated with burned area emergency rehabilitation (BAER) treatments. The BAER team is responsible for conducting this analysis. Monitor and treat weed infestations for 3 years after the fire.*
- *Consult with Native Americans to determine priority areas for weed prevention and control where traditional gathering areas are threatened by weed infestations.*
- *Complete noxious weed inventories, based on regional protocol. Review and update these inventories on an annual basis.*
- *As outlined in the Regional Noxious Weed Management Strategy, when new, small weed infestations are detected, emphasize eradication of these infestations while providing for the safety of field personnel.*
- *Routinely monitor noxious weed control projects to determine success and to evaluate the need for follow-up treatments or different control methods. Monitor known weed infestations, as appropriate, to determine changes in weed population density and rate of spread.*

Surveys conducted by Forest Service personnel resulted in the identification of five major species of invasive plants within those portions of the Battle Creek Watershed located inside the boundaries of Lassen National Forest. These included oxeye daisy (*Leucanthemum vulgare*), Klamath Weed (*Hypericum perforatum*), yellow star thistle (*Centaurea solstitialis*), bull thistle (*Cirsium vulgare*) and Perennial pepperweed (*Lepidium latifolium*). These invasive plants became a primary focus of the control and eradication measures developed in this integrated weed management plan.



Key

 Canada thistle	 Communities
 Klamathweed	 Rivers
 Scotch broom	 Battle Creek watershed
 Bull thistle	 County border
 Cutleaf blackberry	
 Oxeye daisy	
 Perennial pepperweed	
 Squarrose knapweed	
 Yellow star-thistle	

 Miles
 0 0.5 1
 Data Sources: ESRI, Lassen Natl Forest


 Tehama County
 Resource Conservation District
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Lassen Volcanic National Park

In March 2008, Lassen Volcanic National Park (LVNP) personnel released its weed management plan and environmental assessment. Through this planning process it was recognized that the increase in distribution and dominance of exotic species has led to competition with native species and the disruption of ecosystems. The LVNP has implemented a plan to manage invasive and native plant species within the National Park boundaries. Although the LVNP has a relatively low number of exotic species compared to other National Parks in California, most infested sites are within habitats having very high native biological diversity (riparian areas and meadows), and there is considerable potential for further spread. Currently, no native species are considered “weedy.” Some, such as cattail and white fir (*Typha* spp. and *Abies concolor*), have the potential to negatively impact rare plants and desired vegetation communities. The LVNP is in a position to proactively manage current noxious plant infestations, prevent large infestations from occurring, and reduce the risk of new invasions.

As stated in the Lassen Volcanic National Park Weed Management Plan, the purposes of Park planning efforts are to:

- *Decrease weed plant cover and increase native plant cover*
- *Document and standardize best management practices to more effectively meet goals and objectives*
- *Provide options or tools to managers in reducing the threat to natural and cultural Resources*
- *Use monitoring to more effectively implement and adapt management practices*
- *Determine the minimum tool/treatment or combinations of treatments that support Wilderness Values to restore functioning native plant communities*
- *Develop a document that will meet required federal and state environmental compliance*
- *Develop a document that will provide future direction for weed-related projects that fall under its scope*
- *Restore native plant communities and wildlife habitat to reduce the park resources dedicated to weed removal*

During development of the Lassen Volcanic National Park Weed Management Plan and Environmental Assessment, a number of invasive plant species were identified which do not currently exist within the Park but have a high potential for spread and are anticipated to be a potential problem in the future. Included were squarrose knapweed (*Centaurea virgata*) and spotted knapweed (*Centaurea stoebe*). Currently, bull thistle (*Cirsium vulgare*) and woolly mullein (*Verbascum thapsus*) are considered to be the most widespread weeds within Park boundaries and are targets for control efforts. Intermediate wheatgrass (*Elytrigia intermedia ssp. intermedia*) and smooth brome (*Bromus inermis*), which is not rated

in California, are also found within the Park. These species are the main targets of the Park's current weed treatment activities. In addition, oxeye daisy (*Leucanthemum vulgare*), dalmation toadflax (*Linaria genistifolia ssp. dalmatica*), St. John's wort (*Hypericum perforatum*), foxglove (*Digitalis purpurea*), and chicory (*Chicorium intybus*) are targets of treatment efforts at the Park headquarters in Mineral. Yellow salsify (*Tragopogon dubium*) is widely distributed but not abundant in disturbed areas. Other exotic species such as dandelion (*Taraxacum officinale*) and self-heal (*Prunella vulgaris*) are found in moist or disturbed areas of the Park but are not currently targeted for treatment. Canada thistle (*Cirsium arvense*) is found near the southwest Park entrance.

Figure 5 – Map 1 of 6
Infestation Areas within the Lassen Volcanic National Park

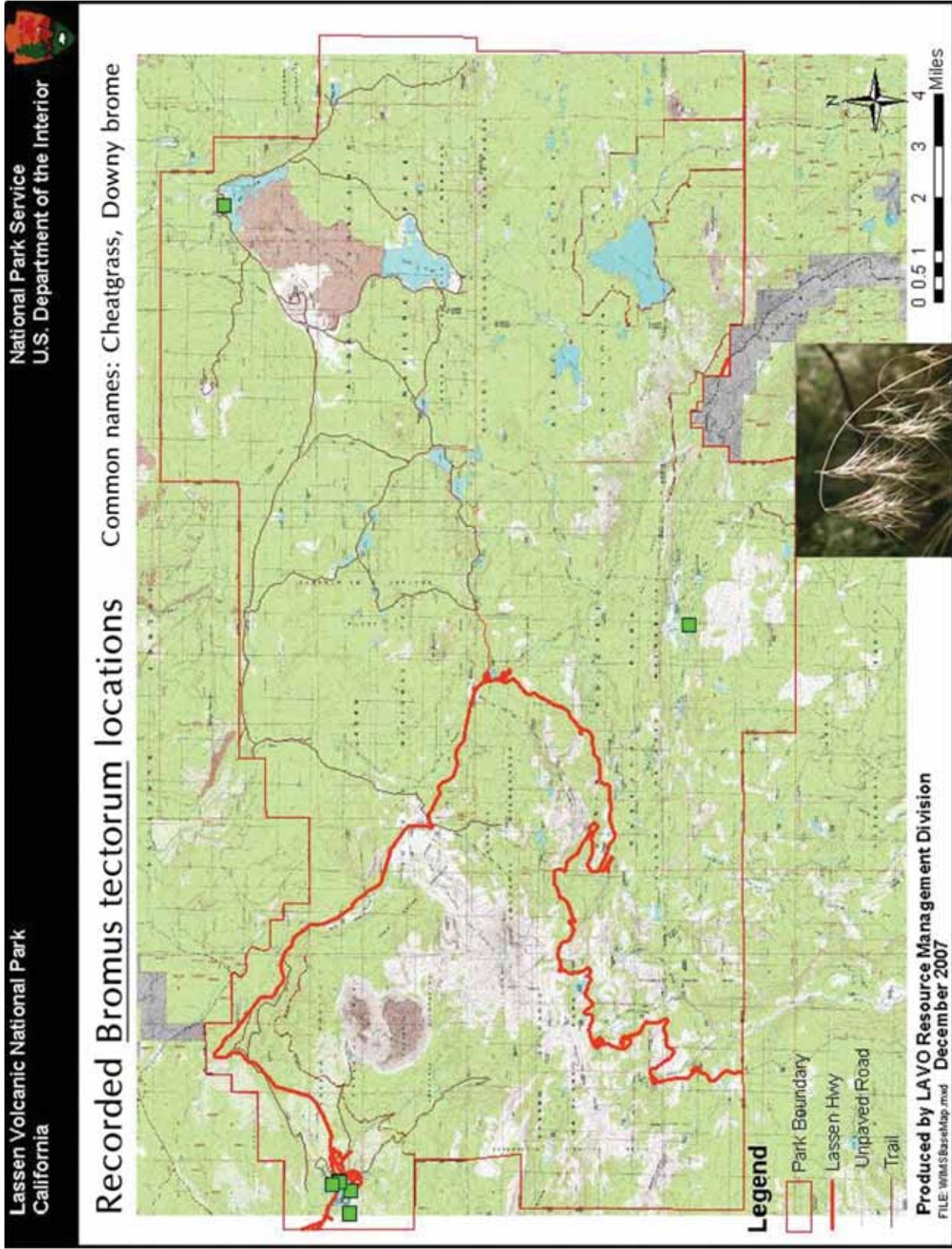


Figure 5 – Map 2 of 6
Infestation Areas within the Lassen Volcanic National Park

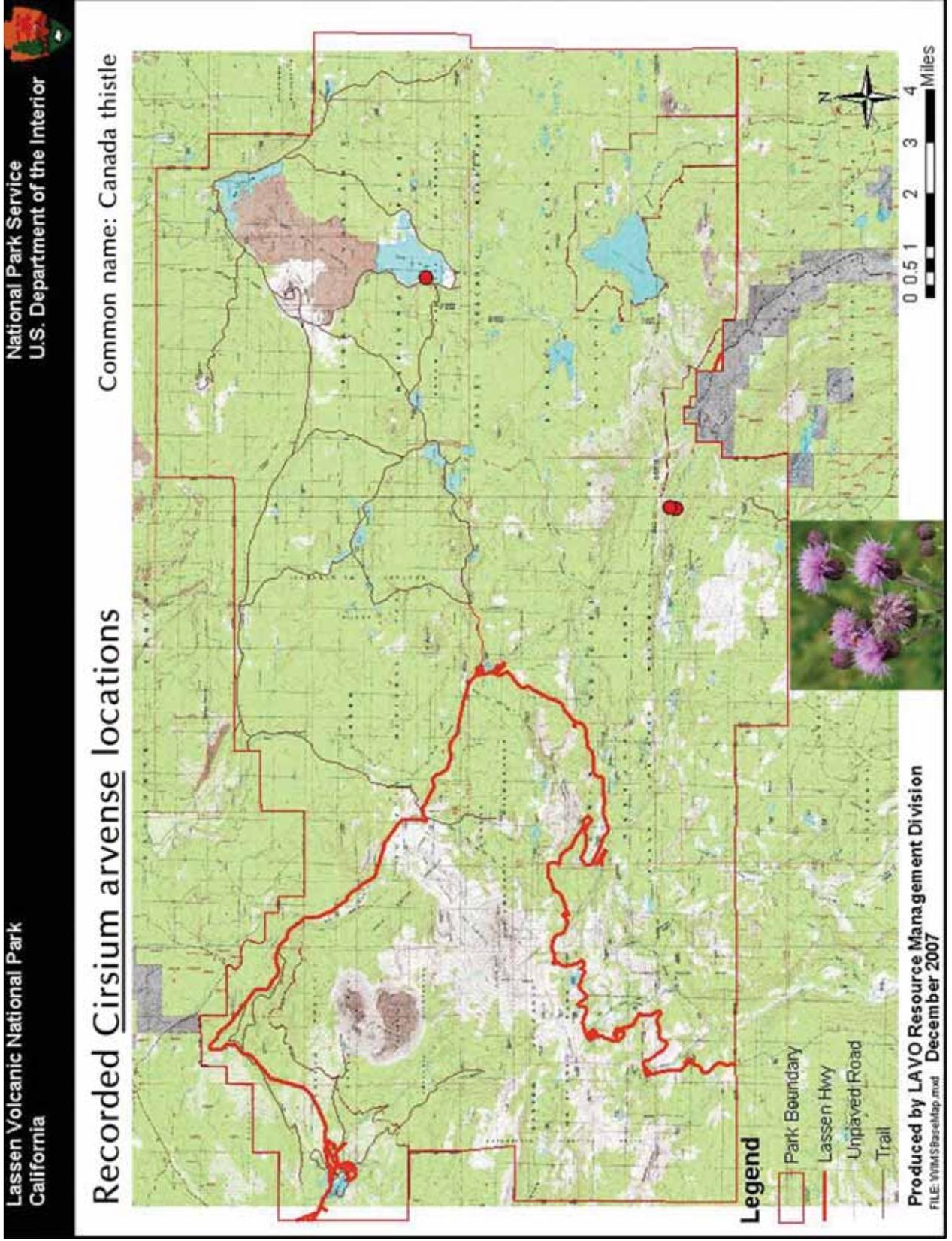


Figure 5 – Map 3 of 6
Infestation Areas within the Lassen Volcanic National Park

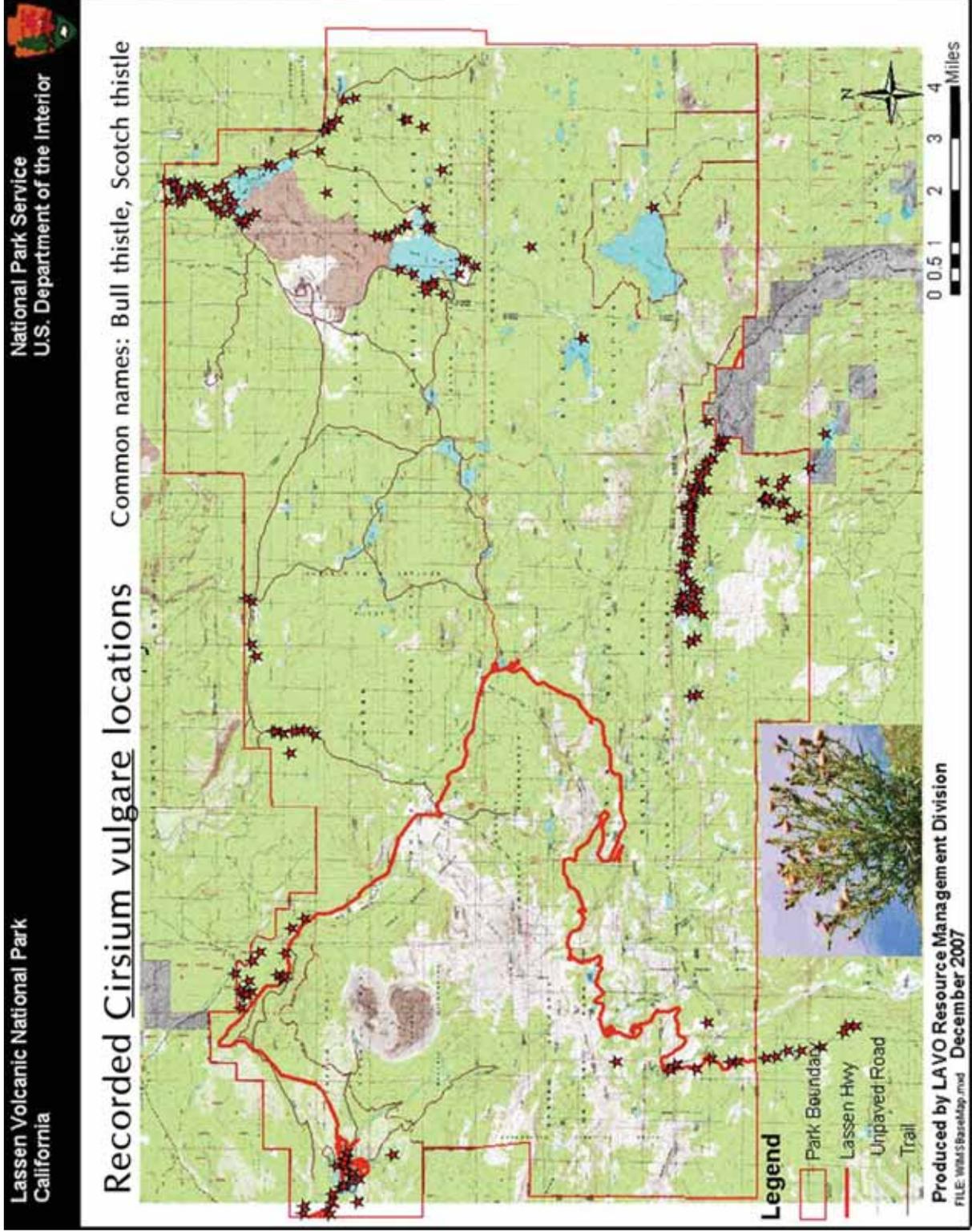


Figure 5 – Map 4 of 6
Infestation Areas within the Lassen Volcanic National Park

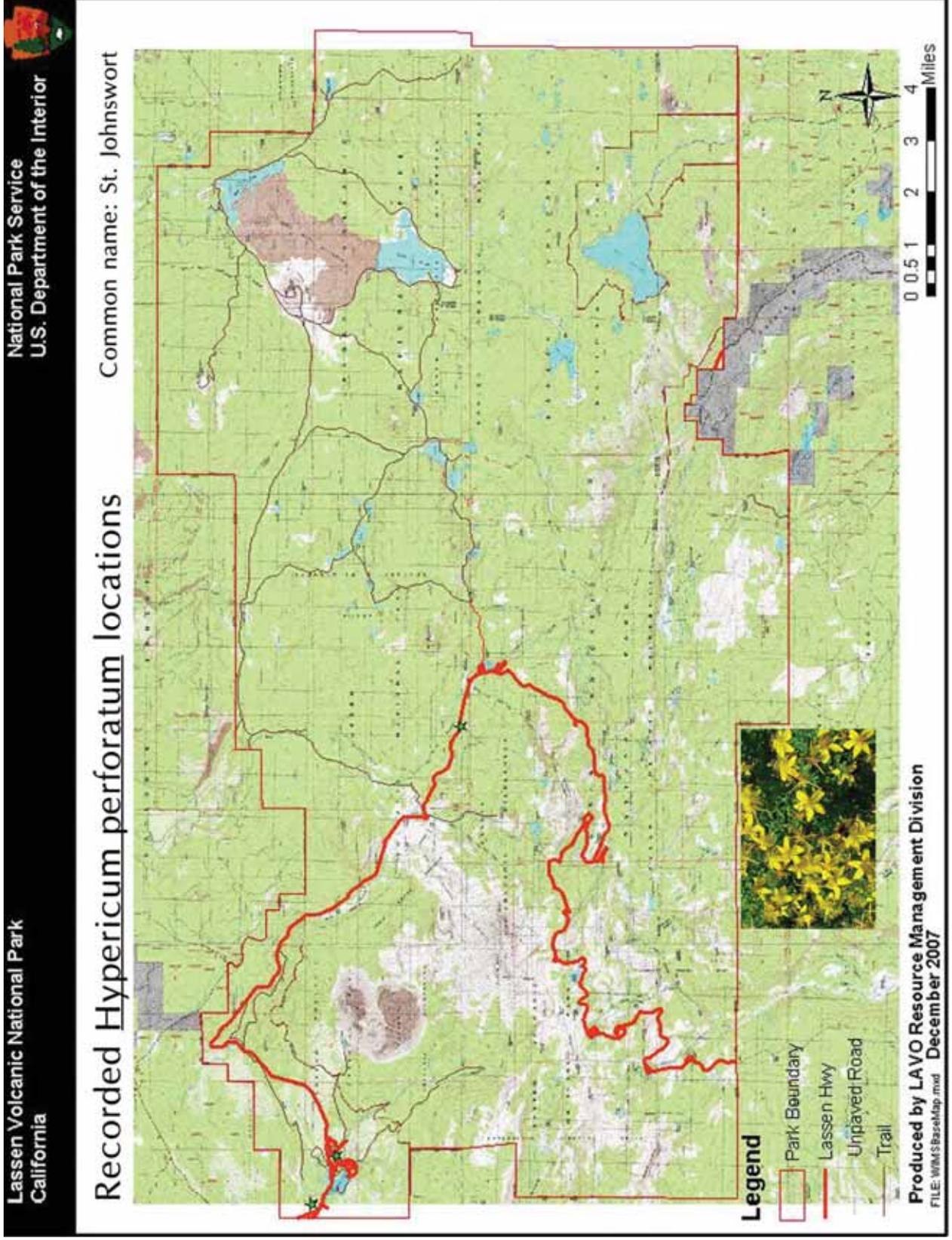


Figure 5 – Map 5 of 6
Infestation Areas within the Lassen Volcanic National Park

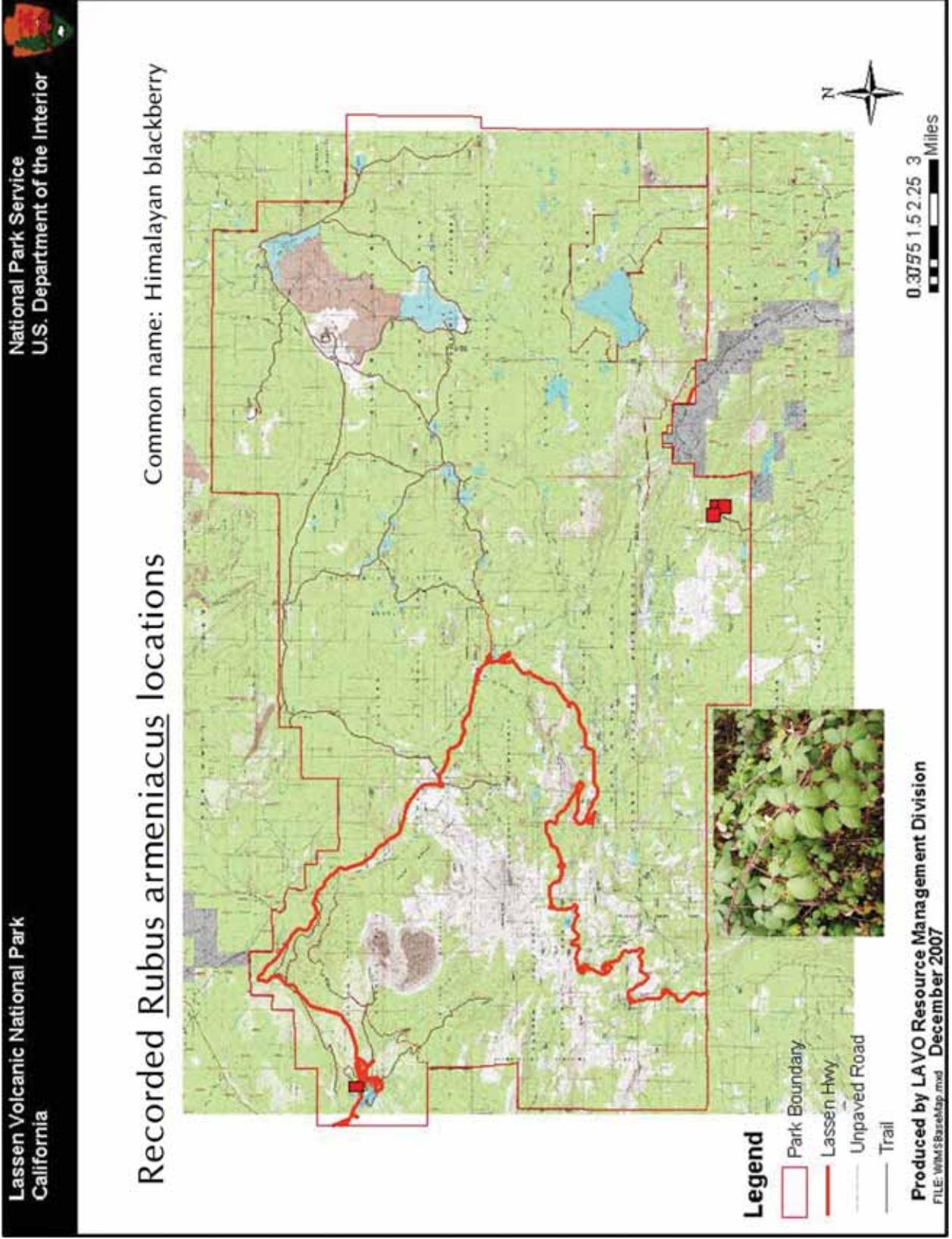
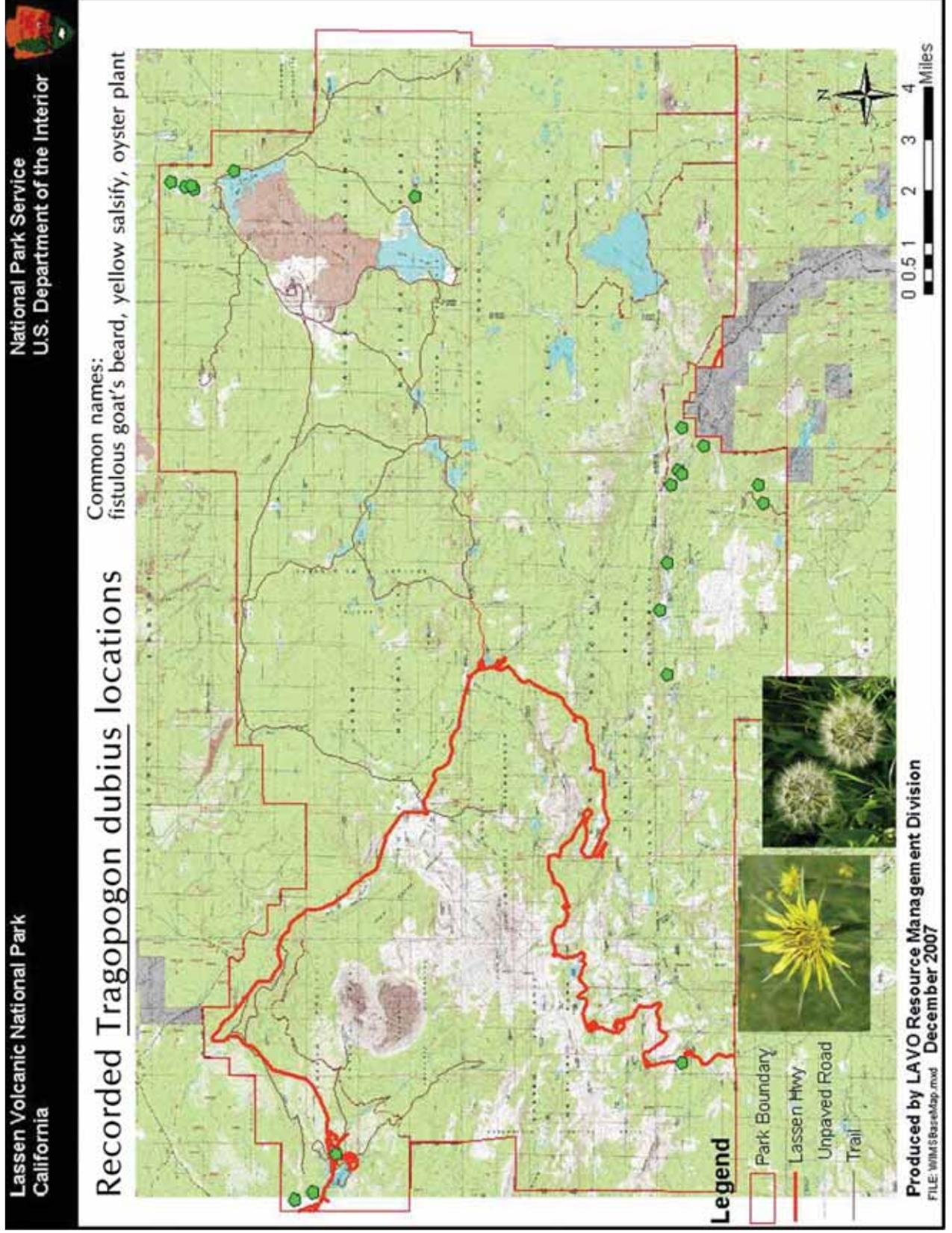


Figure 5 – Map 6 of 6
Infestation Areas within the Lassen Volcanic National Park



Bureau of Land Management

Within the Battle Creek watershed are found 24,537 acres of grasslands, oak woodlands and riparian habitat managed by the Bureau of Land Management, including the 16,000-acre Bend Area of Critical Environmental Concern and various small parcels located between the watershed's timberline and the Sacramento River. *BLM Manual 9015 – Integrated Weed Management* sets forth policy related to the management and coordination of noxious weed activities executed by agency personnel on lands under its jurisdiction. This portion of the BLM operations manual states that the agency's objectives with regards to integrated pest management is to proactively control and manage infestations and the spread of noxious weeds using a science based approach.

Manual 9015 also states that it is the BLM's policy to undertake integrated noxious weed management activities and implement programs to:

- Promote and facilitate cooperation and coordination among other Federal and State agencies and county weed control departments, private organizations, and individuals in planning and implementing integrated pest management approaches to confine or reduce the rate of spread, manage, and control noxious weeds.
- Promote and facilitate continuing research and technology developments to manage noxious weeds utilizing integrated weed management approaches.
- Protect, enhance, and wisely use terrestrial and aquatic ecosystems.
- Provide technical, managerial, educational, and other assistance programs to land managers, operators, and other users that will encourage the adoption and use of conservation and prevention integrated weed management practices to manage and confine or reduce the rate of spread of noxious weeds.
- Promote and facilitate the development of use-oriented management strategies that reduces the long-term dependence on noxious weed control programs.
- Provide land and aquatic resource inventories compatible among agencies to identify and classify noxious weeds and noxious weed infestations.

This portion of the BLM manual establishes that the agency will manage noxious weeds and other undesirable plants found on lands under their jurisdiction in an integrated manner. It also states that agency personnel will ensure that the organization's environmental controls and objectives for threatened, endangered, proposed, and sensitive species, including applicable laws and regulations, are followed. These directives are incorporated into that agency's land management planning documents as well. In conjunction with the BLM's environmental analysis process, any projects that alter plant communities are to be analyzed in order to determine the risk of introducing noxious weeds. BLM personnel are directed to determine factors that favor initial establishment and spread of noxious weeds when considering alternative control or treatment measures. They are also directed to design management practices or prescriptions that will reduce the need for future treatments.

Lands under Lassen National Forest and Lassen Volcanic National Park management are generally upstream from those managed by the Bureau of Land Management and private entities. Variations in the types and intensities of uses on public and private lands result in varying rates of introduction for new invasive species and reintroduction of those noxious species that had been previously controlled or eliminated. Consequently, it is of the utmost importance that public and private landowners throughout the various reaches of the Battle Creek watershed communicate with one another regarding newly established infestations or previously unreported species of noxious plants found upslope that have not migrated to lower elevations. It will also be important for upstream and downstream landowners to communicate what is being done on their lands to control or eradicate newly occurring infestations.

Overview of Weed Management Planning

During the early stages of development, the Battle Creek Integrated Weed Management Plan's technical advisory committee decided to take an adaptive approach to setting coordinated weed management goals as well as the active control or eradication of noxious plant species. This process of setting priorities and developing implementation measures uses lessons from previous experience to mold future efforts. The overall process of developing an adaptive management strategy includes the following steps:

1. Establish management goals for lands within the watershed.
2. Identify the weeds interfering with these goals and assign priorities based on their impacts.
3. Determine effective control options. Assess the likely effects on both target and non-target species.
4. If necessary, adjust the weed priorities.
5. Develop and implement the management plan.
6. Monitor and assess the impacts of the management actions.
7. Evaluate the effectiveness of developed methods as measured against the site goals and use this information to refine the control priorities, methods, and goals.
8. Learn what is practical, effective, and realistic.
9. Return to step one...

Through past management experience of various watershed stakeholders, it has been observed that some weeds found throughout the Battle Creek watershed are tenacious and harmful while others may restrict themselves to recently disturbed locations. Attempting to control all non-native species present can be overwhelming, unnecessary, expensive, and ultimately unsuccessful. In developing weed control measures for the Battle Creek watershed, this plan took an integrated pest management (IPM) approach in

developing implementation measures. These measures considered a full range of weed control practices, including the environmental impacts that would result from either implementation or ignoring infestations. Considering that the spread of invasive plants crosses all property boundaries and governmental jurisdictions, the IPM approach developed through this planning process calls for the promotion of cooperation between all stakeholders, both public and private, as well as for continual project monitoring and surveillance.

The implementation strategy and prioritization process developed through this planning process is built upon several principles, the most fundamental being the active prevention of infestations by new invaders. To accomplish this, it is critical that watershed stakeholders fully understand the factors that favor initial infestation as they develop site specific measures for control and eradication. Land use practices such as requirements related to grazing, construction, and permitting need to be developed in a manner that will aid in the control of invasives infestations and reduce the necessity for future treatments or dependence on noxious weed control programs. As part of project planning, noxious weed risk assessments should be conducted in order to determine the risk for weed spread associated with different types of management activities. It is also highly recommended that monitoring of noxious plants become a part of ongoing land management practices on both large and small parcels located throughout the watershed.

It has been observed by resource specialists and land managers that infestations by noxious plants are an indication of problems related to the proper functioning of ecosystem components. In essence, noxious plants would not be able to make a foothold in a healthy, properly functioning ecosystem. Consequently, another fundamental principle developed in this weed plan is for watershed lands to be managed in a manner that promotes the overall health and proper functioning of ecosystems and target species as well as for an increase in native plant cover. This compares with managing against weed species and a decrease in noxious plant cover. To that end, those invasive species identified and discussed in this planning document were considered to represent the greatest threat to the various ecosystems found within the watershed and had the greatest potential to spread quickly and dominate native plant cover. A set of priorities for control or elimination should then be established for each species.

The implementation strategies and specific treatment measures developed through this planning process also focused on the early treatment of new infestations and the control of established infestations in order to keep small weed problems from becoming large, expensive, and very difficult to control. Criteria for species treatment options also included minimizing overall negative environmental impacts by leaving weed infestations unchecked if such lack of attention would result in less unwanted impact than some treatment action. Recommendations for active control treatments were avoided during those periods of time when native or migratory nesting birds and various listed species could be harmed. Higher priorities were given to infestations most likely to be controlled with available technology and resources. Species which have no significant presence in the Battle Creek watershed but have the potential to become a major infestation were also considered. Our weed management plan includes regular monitoring by landowners for the most aggressive potential new colonizers in order to quickly detect and eliminate these plants if they do appear.

Project Prioritizing According to Plant Severity Classification

Setting priorities ensures that limited resources available for non-native plant management are spent effectively. In setting control and eradication priorities, those plants with the greatest impact on specific sites or watershed resources were given the highest consideration. No control actions were considered in instances where the target plant was so widely distributed throughout the watershed and surrounding area that effective control would be problematic, excessively expensive for the level of tangible control obtained, or have a very low chance of success in achieving control objectives. An assumption was made that landowners would address these widely spread noxious species on a parcel by parcel basis as they actively managed their farms, ranches, and timberland. Control actions were not considered if a particular noxious species appeared limited in its distribution or showed little if any indication of spreading. Taking no action was also considered where the negative impacts to watershed resources from treatments would be greater than the level of resource improvement achieved through control or eradication.

In this planning process, the first step in developing a control strategy was to determine the level of threat posed by the identified non-native species. This information was obtained from the California Department of Food and Agriculture (CDFA), the California Invasive Plant Council (Cal-IPC), and other organizations focused on noxious plant control. Significantly, Cal-IPC develops a list of invasive plant species occurring in California, an assessment of potential invasiveness, and other basic information. The Cal IPC rating system was used in rating invasive plants in terms of their impact on the resources found within the Battle Creek watershed. This rating system was used because it focuses on conditions endemic to California such as climate and habitat. The Cal IPC system also provides a uniform methodology for categorizing invasive plants and a clear explanation of the process used for their evaluation and categorization.

Definitions for the Cal IPC rating system are shown below:

- **High Priority Cal IPC A Rate Plants** – *These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate through high rates of dispersal and establishment. Most are widely distributed ecologically.*
- **Moderate Priority Cal-IPC B Rate Plants** – *These species have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate through high rates of dispersal, although establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.*
- **Low Priority Cal-IPC C Rated Plants**– *These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.*

High Priority Cal IPC A Rated Plants

Brooms

French broom (*Genista monspessulana*), Spanish broom (*Spartium junceum*) and Scotch broom (*Cytisus scoparius*) are found throughout the Battle Creek watershed planning area. These noxious plants are often found mixed with desirable native species, especially along stream channels. In some locations brooms make up 100% of the streamside brush component. These plants propagate rapidly by seed, particularly within riparian areas, with large plants producing roughly 75,000 seeds. Brooms grow rapidly and form dense stands that are inaccessible and unpalatable to wildlife. The dense stems make regeneration of most native species difficult if not impossible once broom stands have been established. Brooms also pose a significant fire hazard to riparian areas and other ecosystems. As the plant grows, the inner stems die back, providing a highly flammable fuel which can facilitate the transfer of fire from surface fuels to the overstory component. An intact overstory canopy provides thermal protection to the aquatic environment by maintaining water temperature at levels that are conducive to anadromous species. Broom also poses a significant threat of wildfire to populated areas. Soil disturbance can cause new seedlings to sprout or become deeply buried in the soil where germination can occur.

Yellow Star Thistle (*Centaurea solstitialis* L.)

Yellow star thistle threatens large expanses of open areas such as grasslands and oak savannas. Due to its degenerative effect on these landscapes, this plant is currently diminishing habitat, reducing wildlife and cattle forage, and generally decreasing native plant and animal diversity within the watershed. Dense infestations also threaten natural ecosystems and nature reserves by fragmenting sensitive plant and animal habitat. Severe infestations of yellow star thistle can form near-monotypic stands, dramatically impacting plant diversity. It has been suggested that the invasion of California grasslands by yellow star thistle may be caused in part by fire suppression and reductions in fire frequency in these ecosystems. Grazing patterns in Northern California can also accelerate development and expansion of infested areas. Throughout much of the North State, cattle are grazed until late spring, reducing the amount of grasses and other vegetation that will compete with star thistle. Cattle are then often moved to higher elevation grazing sites during the late spring and summer months at about the same time star thistle begins to develop and produce seeds. Once present, heavy infestations of yellow star thistle may change an area's fire regime by altering fuel characteristics at a given site. This may keep the community perpetually off-balance and not allow the re-establishment of native species.

Medusahead *Taeniatherum caput-medusae* (L.) Nevski

Medusahead is an extremely widespread winter annual that typically invades disturbed sites, grasslands, and openings in chaparral and oak woodlands. The plant continues to expand its range in California, and it is estimated that medusahead occupies more than one million acres of annual dominated grassland, oak woodland, and chaparral communities in the state. Due to the extent of its infestations within California and the poor probability of controlling its spread, the plant has been given a low priority rating for treatment by State and local resource agencies. Medusahead is native to the Mediterranean region of Europe and is well adapted to the semi-arid climate predominant in the western United States. It germinates in the fall, which is followed by rapid root development during the winter and seed maturation in late spring to summer.

This aggressive non-native annual grass causes severe undesirable effects throughout western rangelands. It has the ability to outcompete grasses and forbs while changing the condition and nature of grassland ecosystems over a substantial area. It not only increases fire frequency within an area, but it can also lead to substantial litter accumulation that can suppress the establishment of native or other more desirable species. Medusahead consists of very high silica content (>10% dry weight), which can reduce forage by as much as 75 to 80% in infested rangelands. High silica content in plant tissues can also reduce the rate of tissue decomposition and can lead to 2 to 5 inches of litter build-up that may remain intact for two or more years. The thatch layer does not impact medusahead germination and establishment, but it does often exclude other species, leading to monotypic stands. Accumulated medusahead litter increases the frequency of wildfires, thus eliminating the native shrub component from infested communities.

Himalayan Blackberry (*Rubus armeniacus* Focke)

At the present time, Himalayan blackberry is encroaching into riparian areas along natural stream courses, manmade water conveyance infrastructure, springs, and storage ponds. It is also developing extensive infestations within open areas such as irrigated grazing lands and oak woodlands. Due to its extent throughout the watershed, it is unlikely that Himalayan blackberry can be eradicated. Both native and exotic varieties of the plant are found within the watershed, and there is considerable difficulty in identifying between the two due to hybridization. The habitat benefits provided by the non-native variety such as cover and forage is often offset by negative impacts attributable to the plant's developing a monoculture along riparian corridors. Simple investigations conducted by professionals and volunteers could help determine if the various blackberry populations are spreading and their impacts on the recruitment of valued riparian species.

Perennial Pepperweed (*Lepidium latifolium*)

Perennial pepperweed is a perennial herb (family Brassicaceae) found in moist or seasonally wet sites throughout California. The plant is an aggressive invader of interior wetlands and streamside areas. It is also associated with sites that are seasonally very dry. Perennial pepperweed grows very aggressively and can form dense stands that exclude other plants, including natives. The plant reproduces both by seed and vegetatively from its roots and small root fragments. Seeds and root fragments are spread easily by flooding or stream flow, soil movement, and seeds sticking to tires, shoes, or animals, making continued dispersion difficult to avoid. Perennial pepperweed is a state-listed, high priority noxious weed in California and other western states. Riparian ecosystems where this weed has spread are often not in good ecological condition prior to invasion due to overgrazing. Consequently, the plant is an indicator of watershed problems attributable to poor land management. Once perennial pepper weed becomes established in riparian areas, it follows irrigation canals and ditches to agricultural fields. In mountainous areas, the plant invades native hay meadows which are often the primary source of winter forage for the range livestock industry. During the late spring, these areas are often important nesting habitats for waterfowl and shore birds. The development of perennial pepperweed can negatively impact native vegetation used for nesting and protection.

Pampas Grass (*Cortaderia selloana*)

Pampas grass was introduced as an ornamental plant and has now spread to wildland areas, where it can dominate ecosystems while providing little habitat value for local wildlife species. Surveys have identified areas where these plants are found and indicate that the development of infestations are currently in a manageable state. Spot control of pampas grass has been demonstrated to work well with the plant's growth characteristics.

Giant Reed (*Arundo donax*)

Arundo donax is currently a Cal IPC A rated invasive species and a major invader to a number of low elevation tributaries along the Sacramento River. It is found just upstream and downstream from Battle Creek's confluence with the Sacramento River mainstem. Several stands were also noted in moist areas adjacent to Manton Road near the community of Manton. This plant has the ability to germinate via portions of stalk or other plant parts migrating downstream during flood events and becoming lodged in sand bars or other wet areas where they can develop into large monocultures. Given the close proximity of this plant to the mouth of Battle Creek, there is a significant potential for it to become established and significantly impact that portion of the Battle Creek watershed immediately adjacent to the Sacramento River.

Moderate Priority Cal IPC B Rated Plants

Klamath Weed (*Hypericum perforatum*)

Hypericum perforatum, also known as St. John's wort, is an annual herb/forb that is poisonous to livestock. It is partially controlled by the Klamath weed beetle, an imported insect. The large bushy plant prefers dry, sandy, or gravelly soils in open sunlit areas. It can be found in pastures, foothill woodlands, waste places, and along roadsides. It may dominate a site as an unproductive monoculture. Klamath weed spreads by seed and by creeping horizontal stems that root when they touch the ground. It can be toxic to light-colored livestock when consumed in large quantities.

Bull Thistle (*Cirsium vulgare*)

Bull thistle is widespread throughout the Battle Creek watershed from its highest elevations to its lower reaches. It is most common near the edge of freshwater marshes, meadows, and mesic forest openings in mountainous areas below 7,000 feet. Bull thistle is most troublesome in recently or repeatedly disturbed areas such as pastures, overgrazed rangelands, recently burned forests and forest clearcuts, along roads, ditches, and fence lines. Even small-scale disturbances such as gopher mounds can promote bull thistle establishment and survival. It can also colonize areas in relatively undisturbed grasslands, meadows, and forest openings.

The plant reproduces by seed, and individuals set seed only once before dying. Large plants may produce tens of thousands of wind-dispersed seeds. Bull thistle invades a site and expands its area by competing with and displacing natives, including forage species favored by native ungulates such as deer and elk. In addition to outcompeting native plant species for water, nutrients, and space, the presence of bull thistle in

hay decreases feed value and lowers market price. In pastures and irrigated rangeland it may interfere sufficiently with livestock grazing so that live-weight gain is significantly reduced. Bull thistle often dominates recently clear-cut forests and has been noted to reduce growth in Ponderosa pine saplings. The plant also colonizes and maintains high population densities for up to six years in clear cuts within mixed evergreen forests.

Canada Thistle *Cirsium arvense* (L.) Scop

Canada thistle is a persistent perennial that grows vigorously and forms dense colonies, spreading by roots growing horizontally that give rise to aerial shoots. Plants generally grow one to four feet tall but on occasion may grow to more than six feet in height and branching freely. Stems are smooth, mostly without spiny wings, green, and glabrous. Flower heads are numerous, small, and almost spineless. Flowers are purplish lavender or less commonly white. The plant is common throughout Northern California and grows on a variety of soil types. It does well on deep, well aerated, moist, loamy soils but is known to also grow in sandy soils and dry sites. It may also grow on stream banks, in meadows, and in wet ditches. However, the plant will not survive in saturated soil.

Canada thistle is intolerant of shade, requiring good light conditions for aggressive growth, and can infest many habitats such as cultivated fields, roadsides, pastures and rangeland, railway embankments, and lawns. It is a major pest within streamside grasslands and can invade moist prairies. This invasive plant is considered a noxious weed in California, and once established it is a fierce competitor for nutrients and water needed by crops or native vegetation. It produces allelopathic chemicals that assist in displacing competing plant species. It has been reported to accumulate nitrates that cause poisoning in animals. The spiny leaves scratch animal skin, sometimes causing infection or, at a minimum, restricting animal grazing in heavily infested areas.

Squarrose knapweed (*Centaurea virgata* Lam. var. *squarrosa* (Willd.) Boiss.)

Centaurea virgata ssp. *squarrosa* is a perennial plant that favors disturbed open sites throughout the Battle Creek watershed, including degraded rangeland, logged areas, grasslands, and roadsides. Its seed dispersal is enhanced by soil and water movement and by clinging to humans and animals. This variety of knapweed has a Moderate rating by CalIPC and is a noxious weed in other western states. Squarrose knapweed competes with forage species on rangeland and reduces forage production for livestock and wildlife. The plant's flower heads function like burs clinging to passing animals. Sheep wool is perfect for catching and holding the bur-like heads, but other animals may carry the seeds as well. Seeds are also dispersed by vehicles, trains, and all types of equipment.

The plant is highly competitive and invades disturbed areas, degrading desirable plant communities. There is evidence that spotted knapweed produces allelopathic chemicals that inhibit the growth of other plants and destroy their ability to compete for limited soil moisture and nutrients. This allows the plant to form dense monocultures. Although spotted knapweed is usually found in disturbed areas, once a plant

colony is established, it may invade adjacent areas that are relatively undisturbed or otherwise in good condition. Seed dispersal and reproduction can be limited by mowing or mechanical removal of plants before seed-set.

Ox-eye daisy (*Leucanthemum vulgare*)

Ox-eye daisy is a prostrate herb with stems that sprout laterally from a creeping rootstock. When in flower, the plant's height ranges from one to three feet. The white-petaled flower-like inflorescences have yellow centers. Leaves are dark green on both sides, one to two inches long, smooth, and pinnately lobed or toothed. The number of flower stalks ranges from one to forty per plant. Locally, the Ox-eye daisy is found within both the Cascade and northern Sierra Nevada range from sea level to alpine mountain meadows up to 7,000 feet in elevation. This plant is a common weed of disturbed areas such as roadsides, fields, pastures, and former homesteads. It readily spreads into wild lands and is found in a variety of plant communities including, prairie, scrub, wet meadows, riparian forests, and open-canopy forests. It thrives in a wide range of conditions and in full sun to semi-shade. Plants are shallowly rooted to 3" to 5" deep. It tolerates a wide range of soil moisture conditions, but does particularly well in soils that are heavy and damp.

Ox-eye Daisy displaces native plant species by growing so densely that it excludes other vegetation. It is not known to be used as forage by animals in California. The plant is a host for several viral diseases affecting crops, including the yellow dwarf virus of potatoes. It is difficult to control or eradicate because of its large seedbank, long viability of seed, and an ability to resprout if not completely removed. Ox-eye daisy is capable of reproduction the first summer after it becomes established regardless of plant size. Plants that are one inch in diameter have been observed bearing a single flower. Stem growth is prostrate and creeping until development of erect flowering stalks 1 to 3 feet tall. Flowering commences generally in May and continues until late August. Seed production is prolific when water is adequate. Most Ox-eye daisy seeds remain viable for twenty years in the soil and can remain viable after passing through digestive tracts of animals. Seeds germinate continuously as long as there is adequate moisture. Plant growth slows during periods of flowering and low water availability.

Dalmatian toadflax (*Linaria dalmatica* (L.))

This herbaceous perennial was originally introduced as an ornamental. It can be found in disturbed open sites, fields, pastures, degraded rangelands, roadsides, and within fields of agronomic and perennial crops. Infestations often form large colonies, displacing desirable vegetation. The plant is a short-lived, creeping perennial herbaceous species in the figwort family. It aggressively invades disturbed communities including roadsides, graded abandoned lots and fields, clear cuts, rangelands, and riparian communities, displacing native and desirable species. Although cattle avoid grazing the plant, Dalmatian toadflax contains a poisonous glucoside harmful to cattle if consumed in large quantities. Sheep and goats, however, can graze this species without any harm from the glucoside.

Low Priority Cal IPC C Rated Plants

Woolly Mullein (*Verbascum thapsus* L.)

Woolly mullein has a limited rating by Cal IPC even though it occurs throughout California. It is particularly abundant in dry valleys on the eastern side of the Sierra Nevada and the southern Cascades at elevations up to 8,000 feet. High population densities are found in moist meadows and creek drainages. This plant prefers disturbed habitats with little other vegetation, especially on dry, gravelly soils. It is common along roadsides, rights-of-way, river banks, forest cuts, meadows, pastures, and waste areas. It is an early colonizer and may be the first plant to colonize bare soil.

Foxglove (*Digitalis purpurea*)

Foxglove also has a Limited Rating by Cal IPC. It is an erect, knee-high to head-high herbaceous perennial found in the foothills of the Battle Creek watershed infesting moist meadows and roadsides. All parts of the plant are toxic. It readily colonizes areas of soil disturbance, forming dense patches that displace natural vegetation. This plant has been identified in various portions of Lassen Volcanic National Park within or adjacent to the Battle Creek Watershed.

Non-Cal IPC Rated Invasive Plants

The following plants are considered invasive by various land management entities within the Battle Creek Watershed but are not rated by Cal IPC.

Chicory (*Cichorium intybus*)

Chicory is a common roadside weed and has been found along roads within the western half of the Lassen Volcanic National Park. Sightings have also been noted at the Park's Headquarters in Mineral. The plant blooms after living through one winter and prefers being near hot rocks or other debris in the soils, which is one reason it thrives best along roadsides.

Yellow salsify (*Tragopogon dubius* Scop.)

Yellow salsify is widely distributed in disturbed areas of Lassen Park but not in abundance. The plant is reproductive generally from April to September throughout its range. Given a seed source and a canopy opening, yellow salsify is a potential inhabitant of nearly any vegetation or community type. Within Lassen Park, the plant can be found at disturbed sites such as roadsides and clear cuts but also in less impacted areas such as open forests and woodlands, shrublands, and grasslands. On Federal lands southeast of the Battle Creek watershed, yellow salsify was the most abundant nonnative seven years after mixed-conifer forests were logged or logged and burned. Long-distance seed dispersal from disturbed sites into relatively open, undisturbed sites is common. It has been noted that abundance of this plant decreases from disturbed sites to the forest interior. While often frequent in disturbed or open habitats, yellow salsify rarely occupies much of the total vegetation cover, regardless of the habitat type or disturbance regime. Yellow salsify is often considered an indicator or invader of heavily grazed sites in the West.

Dandelion (*Taraxacum officinale*)

Within the Battle Creek watershed, dandelion usually occurs in non-wetland areas but can survive in those conditions. It is found at elevations up to 10,827 feet. Within Lassen Volcanic National Park, the plant is found within moist or disturbed areas but is not currently targeted for treatment by the National Park Service.

Self-Heal (*Prunella vulgaris* var. *lanceolata*)

Like dandelion, self-heal is found in moist or disturbed areas of the Lassen Park and is another invasive that is not targeted for treatment.

Intermediate Wheatgrass *Thinopyrum intermedium*

Intermediate wheatgrass has been located in the southwest corner of the Lassen National Park near the former ski slope and is one of the main eradication targets for Park Service treatment activities. Although this infestation is not within the Battle Creek watershed, the ability of this plant to spread into that area resulted in its being included in the Battle Creek Integrated Weed Management Plan. Intermediate wheatgrass is a highly competitive, noxious agricultural weed of cool temperate regions. It can significantly reduce crop yields and contaminate seed grain crops, reducing the value of the harvest. Intermediate wheatgrass occupies disturbed places, cultivated fields, and mountain meadows such as Brokeoff Meadows in the easternmost portion of the Battle Creek watershed. It grows on most soil types, including acidic, alkaline, and saline soils to an elevation of 6,000 feet.

Smooth Brome *Bromus inermis* Leyss.

Smooth brome is an exotic, aggressively spreading, cool-season grass that grows from 1 to 3 feet tall. The blooming period occurs during early to midsummer. The root system is fibrous and produces abundant rhizomes, and dense colonies of plants are often formed. This robust grass prefers mesic conditions, full or partial sun, and a fertile loam or clay-loam. Habitats include pastures, fallow fields, and grassy areas along roads, degraded meadows, little-mowed areas of city parks, and waste areas. The seeds of brome grasses are attractive to upland game birds and some sparrows. Their foliage is eaten by rabbits and hoofed herbivores, including elk, deer, and livestock. Unlike other brome grasses, the spikelets of smooth brome lack awns that can injure the mouthparts and gastrointestinal tract of hoofed herbivores. Dense colonies of smooth brome provide cover for small rodents, and it is possible that they eat both the seeds and foliage. Smooth brome is found in the southwest corner of the Park and is another main target of the Park's weed treatment activities.

Project Related Environmental Analysis and Permitting

State of California Environmental Permitting Process and Mitigation Measures

Large invasive plant control projects result in an array of positive environmental impacts. Negative impacts can also occur if insufficient environmental analysis is conducted, resulting in the development of inadequate or damaging project work scopes and mitigation measures. County Departments of Agriculture (CDA) are responsible for controlling the use of herbicides on private lands in order to assure that these chemical compounds are used in a proper, safe, and effective manner. An important component of this control and enforcement program focuses on the training and certification of pest control workers, along with ensuring safe working conditions and safe use of proper protective equipment by employees who work with or around pesticides. To accomplish this, CDA's require that if herbicides are to be applied on commercial agricultural, timber, and rangeland, a State Certified Applicator holding a Qualified Applicators License or Certificate must apply these materials. In addition, the grower must register in the county where work will occur. The same is true if a State certified Pest Control Advisor develops recommendations for herbicide use and provides these to a licensed applicator. In addition, the CDA's require that those applying such materials certify their use and amount through the submission of a County use report prepared by the Qualified Applicator.

If project work of any kind occurs near water, a Department of Fish and Game Streamside Alteration Permit (1600 Permit) would be required. A State Water Resources Control Board (SWRCB) permit may be required if such work entails excavation in wetlands, herbicides applied into water, or if there is a chance for chemical drift to carry toxins away from target plants and into the surrounding environment. A SWRCB permit would also be required if there were a chance for herbicides to wash into surface water due to natural or manmade flows. Recently, invasives control work became more complicated, as pesticides and herbicides are regulated by and must be in compliance with the National Pollution Discharge Elimination System (NPDES) administered by the U.S. Environmental Protection Agency (EPA). Within California, the SWRCB administers these regulations on behalf of the EPA. In the past, various pesticides were exempt, because when applied according to directions they were not considered "pollution." These chemicals have been reevaluated, and anything that is not absorbed by the target plant and falls onto another plant in its initial form or degenerates into a secondary component is now considered a pollutant, which requires an NPDES permit.

The impact many invasives control projects have on listed species may require preparation of a CEQA document in the form of either an exemption or an Initial Study/Mitigated Negative Declaration, along with the permits mentioned above. CEQA applies to all "projects" carried out or approved by a state or local public agency. Unless formally exempt from State requirements, noxious plant eradication projects must be analyzed for their impact on watershed resources attributable to the techniques used and the overall impact project results would have on current environmental conditions. Mitigation measures are normally required to be developed that reduce impacts from project work to a less than significant level or that modify project workscopes so that impacts would not occur during implementation. Typically, if a public agency is executing the project, that agency is the Lead Agency for the purposes of CEQA. The issuance of a 1600 Streambed Alteration Agreement by the California Department of Fish & Wildlife (DFW) or the SWRCB's requirement of a permit also require that an invasives control project be

classified as a “project” subject to compliance with CEQA. On non-DFW initiated projects, the agency acts as a CEQA Responsible Agency when issuing a 1600 Agreement and relies on the CEQA document prepared by the Lead Agency. Under CEQA, adherence to Mitigation Measures developed in an Initial Study/Mitigated Negative Declaration document is assured through the preparation of a Mitigation Monitoring and Reporting Plan which establishes how Mitigation Measures will be monitored and which party will be responsible for monitoring activities.

Federal Environmental Permitting Process

Impact analysis and the development of modified work scopes that minimize the environmental effects of projects on federally managed lands or any project using Federal funds would be conducted through a National Environmental Quality Act (NEPA) process. If Federal funds were expended on private lands for activities classified as a “Project” under CEQA, both the CEQA and NEPA processes would need to be initiated. On January 14, 2011, the White House Council on Environmental Quality (“CEQ”) finalized new guidance on the use, documentation, and enforcement of mitigation measures under NEPA which imposes no substantive requirement to mitigate a project’s adverse environmental impacts. When a Federal action would have significant adverse impacts, however, the Lead Agency must prepare an Environmental Impact Statement (“EIS”) which analyzes, among other subjects, the “means to mitigate” those impacts. A project applicant can incorporate mitigation measures into its project design in order to avoid triggering NEPA’s EIS requirements, resulting in a Finding of No Significant Impact (“FONSI”). The new Guidance endorses the use of these “mitigated FONSI[s]” when accompanied by “enforceable mitigation measures.” Importantly, failure to document and monitor mitigation may undermine the integrity of the NEPA review. Consequently, steps can be taken in order to ensure that mitigation commitments are expressly stated and adhered to. Individual agencies generally supplement this general standard with their own procedures that make relevant funding, permitting, or other agency approvals conditional upon performance of mitigation commitments.

Mitigation Measures

Regardless of whether project work is to be completed by a public or private entity, in all cases site specific mitigation measures or changes to project work scopes must be developed in order to fully protect environmental resources, within both the immediate project site and the surrounding area. The following general mitigation measures have been developed in order to minimize the impacts of project work on public and private lands. These measures would apply to most projects envisioned for the Battle Creek watershed.

Mitigation Measures Related to the Protection of Biological Resources

- No herbicides will be allowed to enter the wetted stream or in channel ponds that have not been registered for aquatic use.
- Any List 1, List 2, or List 3 Sensitive Plants found within the project area will be protected with a

25-foot avoidance zone during execution of project work. Personnel specifically trained in the identification of List 1, List 2, and List 3 species or a professional botanist will be required to evaluate potential habitat for these species prior to implementation of work within the project area. These evaluations will occur during the listed plant's blooming period. Personnel conducting the evaluations will also evaluate potential findings of any such plants within treatment areas during the execution of project work. If project work is not completed during the originally proposed time frame, evaluations will be made during the following year's blooming period. Qualifications for personnel who will make evaluations of sites include those found in the California Department of Fish and Wildlife's 2009 document entitled "**Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities**" (see Appendix E). If any such plants are found within treatment areas, they will be flagged, and project work will be excluded from those sites.

- List 3 plant species are those which are considered sensitive and for which no specific protection measures are required. Although no formal surveys will be made, if List 3 plants are found during project work, the Project Manager shall be notified and the plants shall be flagged for avoidance.

- To reduce wildlife disturbance, the Project Manager shall direct crews to avoid spraying of all wildlife observed in the treatment areas. Areas not sprayed due to the presence of wildlife may be sprayed once wildlife has left the treatment area. Areas with suspected occupied nesting or denning habitats shall also be avoided and not treated. Only manual plant removal methods or herbicides will be used in these areas until wildlife has left the project site. The Project Manager shall demonstrate compliance with this measure through the submission of annual reports to the California Department of Fish and Wildlife's Northern Region Lake and Streambed Alteration Agreement Program no later than December 31 of each year that the project is implemented.

- In order to protect any species covered by the Migratory Bird Treaty Act (MBTA), no project work will occur from March 1 to August 31, unless the following is implemented:
 - A survey is conducted and it is determined that there are no occupied nests within the proposed activity area.
 - If an occupied nest is found, then a biologist or a person with knowledge of, and ability to recognize, species protected by the MBTA will determine if the birds present are those protected by the MBTA.
 - If an MBTA species is located, then no activities will occur within 100 feet of the nest during the breeding season.

- USFWS 1999 guidelines will be followed if the Valley Elderberry Longhorn Beetle or elderberry plants are encountered during implementation of the project. All elderberry bushes will be flagged for avoidance prior to implementation.

- If an elderberry bush is entangled with a target noxious weed whose stems are numerous and cannot be individually sprayed up close to a cut, that noxious weed will be removed mechanically and the cut stump swabbed with herbicide.
- Motorized equipment shall avoid adjacent vernal pool and wetland habitats while entering and exiting the floodplain.
- All applications of herbicide shall be done under the supervision of a licensed applicator in accordance with applicable, federal, state, and local laws or guidelines. All applicators will be trained to safely handle and apply herbicides per State of California Regulations as well as those of the County Department of Agriculture. All directions on the herbicide label will be followed.
- Mixing sites shall be located only in areas devoid of vegetation, and where there is no potential of a spill reaching vegetation, streams, or any pooled water. No mixing shall occur in any storm water inlet.
- In order to increase applicator accuracy and to avoid missed vegetation, overspray, and personal exposure to herbicides, a suitable stain or dye will be incorporated into the herbicide prior to application.

Mitigation Measures Related to the Protection of Cultural Resources

- An individual knowledgeable in identifying cultural resources shall inspect the project site prior to all ground disturbing activities in order to assure that archeological, prehistoric, historic, or paleontological resource sites along the path of the fuel break or within 30 feet beyond the project boundary have been flagged and that equipment operators and others working in the project areas are informed about their locations. Such individuals may be a Registered Professional Forester with CalFire archeological certification, a professional archeologist, or other individual with appropriate training as determined by a professional archeologist.
- Within areas of ground or vegetation disturbing activities, if project work appears to expose any previously unknown archeological, prehistoric, historic, or paleontological resource sites along the path of project work or within 30 feet beyond the project boundary, the site will be avoided. Work may continue elsewhere within the overall project area. Exposed cultural or paleontological resources will be appropriately flagged in order to immediately establish an exclusion buffer of at

least 100 feet. A professional archeologist will examine the site, evaluate found objects, and make a finding of their significance. The archeologist will also develop recommendations for the permanent protection of objects and site treatments as necessary. Identified sites will be permanently protected through avoidance. These sites will be made off limits to both personnel and equipment. A professional archeologist will determine an appropriate permanent flagged exclusion zone once the site has been adequately assessed for significance.

- If during the execution of project work human remains are found, the Project Manager will halt work at that location until a professional archaeologist visits the site in order to assess their significance, process the remains, and immediately contact the County Coroner. If the remains are determined by the County coroner to be Native American, the Native American Heritage Commission (NAHC) and Native American groups, at the discretion of the professional archeologist, will be notified within 24 hours, and the guidelines of the NAHC will be adhered to in the treatment and disposition of the remains. Findings of significance will be prepared and submitted to appropriate agencies at the discretion of the professional archeologist. Project work may continue on other non-impacted portions of the project area.

Mitigation Measures Related to Hazards and Hazardous Materials

- All workers involved with herbicide applications will wear appropriate protective clothing and related safety equipment (masks gloves etc) as per the guidelines of the California Department of Industrial Relations Division of Occupational Safety and Health and those of the manufacturer.
- Clean soap and water will be readily available on site for the purpose of emergency washing. Wash stations will be located away from any natural waterway to avoid contamination of waterways and ponds in the area.
- Prior to and during herbicide application, signs will be posted along access points to minimize potential exposure by the public. Signs will be posted at least 24 hours prior to and 48 hours after application, advising the public to avoid entry into treated areas, thus assuring public safety.
- Landowners and residents will be informed in writing as to the date when herbicides will be applied on particular properties. This notification will provide information regarding the chemicals to be used and the mitigation measures to be developed to reduce environmental impacts and will recommend that all persons and animals stay out of treatment areas for a specified period of time.
- No herbicide applications will take place when wind velocities exceeding ten (10) miles per hour occur. Wind speeds will be monitored hourly. If rain is forecast within 24 hours from the application period, implementation would be postponed.

- Gasoline will at no time be transported across a live stream or wet crossing other than in the fuel tank of operating equipment.
- The Project Manager will select fuel storage, refueling, and maintenance areas for equipment on flat sites that are away from dry or wet waterways and areas that could potentially flow into a stream in the event of an accidental spill. Fuel containment equipment (i.e., absorbent sheets and waddles) will be made available and used at refueling and maintenance areas. Equipment will be stored and maintained within properly cleared areas.
- Contractors and/or landowners providing operations equipment (e.g., quads, chainsaws, and other fuel equipment) shall make daily written inspections for leaks, correcting and repairing any such leaks prior to resuming their use. The written daily inspections will be submitted to the Project Manager along with evidence of any repairs required and completed before returning equipment to project work sites.
- Contractors and/or landowners providing equipment will also provide adequate fire protection equipment. This will include a water wagon located at equipment operation areas, as well as fire extinguishers attached to all mechanized equipment. In addition, fire fighting hand tools will be made available at all areas where equipment is operated. The Project Manager and all contractors and/or landowners providing equipment shall comply with all applicable fire safe standards as found in Public Resources Code Division 4, Chapter 6 (PRC's 4427, 4428, 4429, 4431, 4442, list not all-inclusive).
- Only appropriately licensed applicators who are trained in wildfire prevention and suppression will be used in the execution of project work.
- All motorized equipment shall have approved spark arrestors.

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Appendix A

Management Strategies for Individual Plant Species

Eradication and Control Methods

Listed below are the control and monitoring programs recommended for those invasive plants found within the Battle Creek watershed that have a High or Moderate Cal IPC rating. Plants with a low rating have been recommended for monitoring rather than project work. If continual monitoring efforts indicate a rapid spread of these plants, consideration could be given to developing active eradication efforts using either those techniques and strategies listed below or others developed for a yet unidentified species. It is anticipated that the implementation of this weed management plan will occur over approximately a 5 year period. The five major treatment techniques developed for noxious plants within the Battle Creek watershed are described below.

Chemical

Garlon 3A (triclopyr), Rodeo (glyphosate) and Polaris (Imazaphyr) are proposed for use on noxious plants found within the Battle Creek watershed. A surfactant as recommended on herbicide labels would be used. Rodeo and Polaris would be treated with purple dye and Garlon with blue dye to indicate the type of material used and the level of herbicide coverage. Generally, applications using a cut-and-daub method or foliar application are recommended. Garlon 3A, Polaris, and Rodeo herbicides are aquatic formulations and are EPA-registered for application in and around bodies of water. This is an important consideration given that many of the most critical and impactful infestations within the watershed occur along streams, springs, ditches, and other wet areas. These formulations were chosen to provide enhanced protection to anadromous fish and other aquatic resources. Using this method, invasive plants are cut with loppers or saws and hauled off and burned in designated burn piles located where seeds or other reproductive plant parts could not enter streams, watercourses, or other areas where distribution could occur. Herbicides such as triclopyr or Imazaphyr are applied directly to freshly cut stems or stumps by hand, using small squirt bottles or application wands within 20 minutes of cutting. Applications should concentrate the chemical on the cambium layer adjacent to the bark. Herbicide application to the stump from close proximity would minimize the amount of herbicide applied and reduce drift onto non-target vegetation. In most instances, a nonionic surfactant would need to be used in order to increase chemical impact to target plants.

Target vegetation that sprouts after initial treatment would be re-treated by applying herbicide directly to foliage at close range using application wands to prevent drift. The initial application would be done in the spring, summer, or early fall. Re-treatments would occur during the same time period approximately one year after initial treatments were completed. Timing would be adjusted for best results, depending on the chemical and target species. All application would be directed by a licensed pest advisor, and a licensed applicator would be used to conduct treatments in compliance with pesticide regulations specified on the herbicide labels. Subsequent applications to control specimens that sprout or are missed the first round would occur as needed during a five year period. Project design standards would need to be developed and employed as a means of avoiding applications to non-target vegetation or drift into stream courses. Such standards would be in addition to and incorporated into the list of more general

Mitigation Measures described in the section entitled “**Project Related Environmental Analysis and Permitting.**”

Manual Labor

Manual labor generally consists of physically pulling, digging, and pruning the target species.

Animals

Animals such as goats, sheep, or in limited situations cattle can be used for grazing to control and eradicate various weed species. It is important that the compatibility of particular types of livestock with plants being treated be determined in order to prevent animal health issues and ineffective treatment of target plants.

Mechanical

A masticator, mower, or a dozer with brush rake, sub-soiled rippers, or a straight shank ripper are options for those species that can be successfully controlled through the simple removal of surface and root system vegetative material.

Fire

As a tool, fire must be used very judiciously due to safety concerns near homes and other developed area. In addition, the seeds of some noxious plants germinate in the presence of fire and thus exacerbate their development, and a number of species develop from root systems and consequently may not be killed by fire. With the removal of overstory vegetation, such plants will continue to grow, sometimes at an accelerated rate due to increased sunlight, as can recently germinated seeds. Fire can be used to successfully reduce the volume of cut or otherwise removed invasive plant material in a cost effective manner, thus preparing a site for future herbicide or animal treatments. Burning can also be used to reduce standing vegetation prior to the application of herbicides or used to kill root systems.

Inventory, Monitoring, Education

Noxious plant species should be mapped and monitored at least once a year regardless of whether eradication efforts have been initiated or not. Annual or multi-annual post treatment monitoring would indicate where follow up treatments are needed, would verify the efficacy of treatment techniques, and would indicate whether native plants have been adversely affected by treatments. In addition, ongoing monitoring would aid in determining if various noxious species are expanding their range within the watershed or if new infestations are occurring.

Specific Weed Control Plans

French Broom (*Genista monspessulana*)/ Spanish Broom(*Spartium junceum*) / Scotch Broom (*Cytisus scoparius*)

Priority: High

Current Distribution

All three broom species are found throughout the Battle Creek watershed, particularly along streams, ditches, and other aquatic sites. French broom is especially prevalent along stream channels.

Measurable Objectives and Goal

Goal: Locate any established plants and eradicate

(1) Continue a yearly surveillance for new invasion.

Control Options

Effective broom removal techniques depend upon climate, topography, age, size of the infestation, and importance of its impact on non-target species. In addition, the type, quantity, and duration of resources available to remove and control broom at an infestation site must be considered. All methods require appropriate timing and follow-up monitoring. Due to their large seed banks, monitoring of removal sites is essential in order to locate and kill new seedlings. Location and retreatment of resprouts is also necessary. Sites should be examined once a year, when the seed germination period ends in late spring, for a period of five to ten years, and for every two years thereafter.

Manual/Mechanical Removal

When using hand removal or mechanical methods, it has been found that the most reliable approach is to start operations on small infestations at sites that have many desirable species that will reseed naturally. Desirable species should be given some assistance by hand weeding brooms. Areas having an intermediate degree of infestation would be treated next, with large areas with dense population treated last using other techniques such as prescribed burning or herbicides to replace hand pulling. Pulling with weed wrenches is effective for broom removal in small infestations or where an inexpensive, long-duration labor source is dedicated to broom removal. The weed wrench removes the entire mature shrub, eliminating resprouting. However, the resultant soil disturbance tends to increase depth of the seed bank and prolong the need for monitoring. Wrench removal is labor-intensive but can be used on slopes. It also allows targeting of broom plants while minimizing impact on neighboring species. Brush hogs, which twist off above-ground plant material, can be used for broom removal. Although less labor-intensive than weed wrenches, they damage neighboring species and cannot be used on steep slopes. The twisting action is more destructive to tissues that initiate resprouting than is clean cutting. Depending on the season of brush hog removal, resprouting can still be a problem. Saw cutting has been successfully used if the following four steps were completed: (1) cut shrubs at or below ground level in late July or August, after broom has gone to seed and soil moisture is at a seasonal low; (2) move cut broom plants to sites appropriate for disposal or burn in spring after plants dry (use tarps to avoid spreading mature seed to uninfested areas while moving sawed broom); (3) the following summer, after grasses are dry and have dispersed their seed, destroy new French broom seedlings by mowing as low to the ground as possible

with a heavy-duty brush cutter with a four-pointed metal blade; and (4) repeat for the next five or six seasons or until the seed bank is exhausted. Timing and height of cutting are critical in using this technique.

Mulching

Deep (10cm) wood bark mulch has been found to significantly decreased seedling emergence of broom. This suggests that mulching could be used to suppress regrowth from the seed bank after removal of mature shrubs.

Prescribed Burning

Using fire to remove uncut broom in late spring or early summer has been successful in some areas of California. Reburning of the removal site is usually necessary two and four years after the initial burn. Reburnings are most effective in killing resprouts and seedlings if there is either naturally occurring or reseeded grasses to carry the fire. Complete, 100% mortality has been achieved on some sites with the use of propane torches to remove broom seedlings up to 20 cm in height that emerge from the seed bank after removal of adult brooms. The torch is set so it is hot but not flaming, and it is passed over the French broom seedlings. The heat does not cause the seedling to burn, but within a day the seedling is wilted and dead. This is done at the end of the rainy season when seedlings are up but there is no fire danger. Flame throwers have also been used to spot-treat road edges or small areas with seedlings emerged from the seed bank after removal of mature brooms.

Grazing

Heavy grazing by goats for four or five years during the growing season has been reported as effective in New Zealand and has been tried at a few sites in California. The disadvantage is that goats are not selective, and native species that may start to revegetate the area are also eaten.

Chemical Treatments

A solution of 2% Garlon 3A sprayed on foliage until wet has been used to treat mature French broom shrubs. Adding ½% surfactant has been found to improved effectiveness. The foliar spray does impact non-target species, however, and resprouting often occurs. A solution of 5% glyphosate and oil has been found to be effective in killing broom along with triclopyr ester (25 percent), in Hasten® or Penevator® oil (75 percent) in one spot, low-volume basal bark application with a wick. Dye should be added to the herbicide solution to help avoid missing stems. It is often necessary to spot only the main stem with 2 or 3 drops of herbicide, within 8 cm of the ground surface, in order to obtain a 99 percent kill of the eight-year-old broom plants. Killing mature shrubs may not be effective in eliminating an infestation if it is within a well developed seed bank. This application technique does not impact non-target species, but it is time-consuming if the site is large. Both of these chemical methods should be used during periods of active growth after flower formation and seed set but before seed dehisces.

Another very effective technique entails a combination of treatments that begin with an early July low-volume basal bark application of triclopyr ester (such as Garlon®) (25 percent) in Hasten or Penevator oil (75 percent) and a purple dye in a low-volume basal bark application (2-3 drops in one spot <8 cm from the soil surface) with a squirt bottle on mature dense stands of broom. After four weeks all broom shrubs are normally killed and are then cut down, left on site, and burned. This flushes the seed from the seed bank by increasing germination rate with the next rains. In some instances, broom seed banks within burned plots were reduced to less than 5 percent of their original size three years after prescribed burns.

Seed banks of unburned plots otherwise treated in the same manner were reduced to 15.5 percent of their original size. During the next two years in July under this scenario, seedlings in plots are treated with either 2 percent glyphosate (as Roundup®, label-recommended strength) or cut with a four-blade gasoline powered brush cutter. Glyphosate is applied with a backpack sprayer, and non-target vegetation is avoided.

Treatment Schedule

Herbicide treatments

Late Spring/Early Summer

Manual & Mechanical

Prior to flowering.

Animals

May – July

Centaurea Solstitialis (yellow star thistle)

Priority: High

Current Distribution

Yellow star thistle can be found throughout the project area from its uppermost elevation to the Sacramento River.

Measurable Objectives and Goal

Goal: Control and eradication of current infestation.

- (1) Continue monitoring for future infestations.

Control Options

Control of yellow star thistle cannot be accomplished with a single treatment or in a single year. Effective management requires control of the current population and suppression of seed production combined with establishment of competitive desirable vegetation.

Chemical Treatments

Small plants can be treated with an application a 2% solution of Rodeo plus a ½% R-11 surfactant and purple dye, sprayed to wet the plant. An application of glyphosate is a very effective method of controlling star thistle plants in the bolting, spiny, and early flowering stages.

Mechanical

Mowing can be used to manage yellow star thistle provided it is well timed and used on plants with a high branching pattern. Mowing early in the growth stage can result in increased light penetration and rapid regrowth of the weed. Mowing should be done when the mower can reach most of the plant. This option may need to be done a few times a year over multiple years.

Animals

Grazing is effective in reducing yellow star thistle seed production. Sheep, goats, or cattle eat yellow star thistle before spines form on the plant. Goats will eat star thistle even in the spiny stage. When it is abundant, yellow star thistle appears to have an ability to sustain animals several weeks beyond annual grass “dry down.” Intensive grazing in late May and June using large numbers of animals for short duration can reduce plant height, canopy size, and seed production. Overgrazing should be avoided by not allowing more than half the grass forage to be removed. Grazing more than this will reduce the recovery rate of the grasses and the ability to shade out yellow star thistle.

Fire

Burning is best performed at the end of the rainy season when flowers first appear. Yellow star thistle should be green at this time and will require desiccated vegetation to burn. Most annual vegetation other than yellow star thistle, particularly grasses, should have dried and shed their seeds by this time. The foliage of these plants serves as a fuel source to allow a more complete burn. Burning for two or more

consecutive years helps suppress yellow star thistle and deplete the soil seed bank. Burning can also increase the recovery and density of perennial grasses. Post burn activities should include disking the treated area and planting with native grasses. Burning can damage biological control agents, but insects from adjacent areas will readily move back into the site the following year.

Treatment Schedule

Herbicide treatments
Before seed dispersal

Manual & Mechanical
Prior to flowering.

Animals
May – July

Follow up in the spring of following year.

Medusahead (*Taeniatherum caput-medusae*)

Priority: High

Current Distribution

This plant is distributed throughout the grasslands and oak savannas of the Battle Creek watershed.

Measurable Objectives and Goal

Goal: Locate any established plants and eradicate

(1) Continue a yearly surveillance for new invasion.

Control Options

Methods of controlling medusahead have been explored and implemented since the 1950s, but with limited success or inconsistent results. Control programs are often based on the differential phenology of medusahead and desirable forages. In a Mediterranean climate, most range plants fully mature and disperse their seed by early to mid-June. In contrast, medusahead matures about two or more weeks later than most range species, creating a time period when control methods such as prescribed burning can be selectively implemented.

Mechanical

Previous reports indicate that the competitive ability of medusahead in annual grasslands was primarily due to the slow breakdown of its thatch, which is high in silica. It was found that this thatch was the main component responsible for suppressing other competing species. Removing thatch by either tillage or mowing in the fall can reduce the competitiveness of medusahead and provide better than 50% reduction of this plant during the following year. In addition, thatch removal can dramatically improved the efficacy of some herbicides, regardless of whether the removal technique is through burning, tillage, or mowing.

Grazing

In a study designed to determine the effects of grazing on beef production, it was found that two years of intensive grazing significantly reduced medusahead from 45 percent of the total species composition to only 10 percent. While the palatability of medusahead to livestock is low, earlier studies have shown that sheep will graze medusahead in all vegetative stages. As plants matured, sheep preference declined as they selectively avoided medusahead. At high stocking rates, sheep uniformly grazed medusahead-infested grasslands in all vegetative stages. Sheep have intensively grazed medusahead in early spring (March) and/or midspring (April-May) with the cover of annual grasses monitored during the summer. Preliminary results indicate that mid-spring grazing reduced medusahead by greater than 80% with or without an early spring grazing, but early spring grazing alone was ineffective.

Prescribed Burning

Medusahead and other long-awned invasive grasses (e.g., downy brome, ripgut brome, red brome, and barbed goat grass) rely on animal dispersal for seed dissemination. Consequently, the seeds remain attached to the inflorescence longer than most desirable perennial and annual grasses. Medusahead matures several weeks to more than a month later than most annual species, including grasses. This directly exposes seeds to intense heat of fire flame when the senesced vegetation of other species or

medusahead litter provides adequate fire fuel. Effective control of medusahead with prescribed burning (>90%) was demonstrated. In contrast, it has been found that repeated annual burning in mid-summer increased medusahead infestations while decreasing the population of more desirable annual grasses. These inconsistent results suggest that burn timing may be critical to the success of this strategy. Demonstrations and project work in other areas indicate that the best timing for burning medusahead was in late May to early June before seed dispersal and before the seed moisture is below 30 percent. It was also found that prescribed burning conducted in late spring or early summer before seed drop is a very effective treatment. Effectively, 87 percent control has been obtained in medusahead infestations after a single burn and over 99% control after two consecutive burns. This level of control in only two years suggests that seed longevity of medusahead in the soil is relatively short. Despite the potential success of burning, it is not widely accepted because of air quality and liability issues related to urban development in rural areas.

Chemical Control

Currently registered herbicides are not a practical option in most cases since the extensive application of herbicides is difficult in rough terrain and selective herbicides are not yet registered in California for control of specific annual grasses. Of the currently registered compounds, glyphosate can be an effective control method when applied in early spring to young medusahead plants. This chemical material is non-selective, however, and can damage desirable broadleaf or grass vegetation, including native perennial grasses. Although not yet registered in California, imazapic has proven to be very effective on medusahead and other annual grasses. Imazapic is an imidazolinone herbicide registered for use in other states for the management of noxious annual grasses in rangelands, grasslands, and wildlands. It has been shown that this new herbicide controls most invasive annual grasses in California without significantly injuring seedlings of many native perennial grass or broadleaf species. These results also indicate that imazapic can become tied up in the thatch layer, thus reducing its availability to germinating and developing medusahead seedlings. In some areas of California, imazapic provided nearly complete control of medusahead in plots cleared of all thatch, but provided no significant control compared to untreated plots when the thatch was still present. Consequently, it would be difficult for land managers to accurately determine the proper rate to apply if they have some level of thatch within their application site.

Integrated Approaches

Although the timely use of consecutive prescribed burns can be a very effective tool for medusahead control, this option is not always available to land managers. Other strategies for the selective control of medusahead could include a combination of burning and herbicide applications. Tests have shown that in some areas two consecutive years of prescribed burning (May or June), two consecutive years of imazapic, a first year burning followed by a second year imazapic treatment, or a first year imazapic treatment followed by a second year burning, averaged a reduction in the medusahead cover of the untreated site of between 45 percent and 71 percent. As previously described, a single year of burning gave 86 to 98 percent control, and after a second year burn, the control was almost 100 percent. In comparison, the combination of a late spring burn (which removed the thatch) followed by a fall imazapic treatment nearly always gave 100 percent control of medusahead the following year. These results indicate that it is possible to achieve nearly complete control of this annual grass in a single season using a combination of prescribed burning and imazapic.

Treatment Schedule

Herbicide treatments: June – October

Manual & Mechanical: Anytime of the year, ideally before seed reproduction.

Spring of following year: Complete herbicide follow-up to ensure successful eradication has been achieved.

Himalayan Blackberry (*Rubus armeniacus*)

Priority: High

Current Distribution

Himalayan blackberry is abundant along stream channels, canals, and damp areas throughout the Battle Creek watershed.

Measurable Objectives and Goal

Goal: Control current infestation initially along Battle Creek's north and south fork channels, Digger Creek, and Rock Creek channels, and later along canals and throughout the watershed.

- (1) Continue monitoring for future infestations.

Control Options

Chemical

An initial application would consist of a 5% solution of Rodeo. The glyphosate herbicide would be mixed with ½% surfactant R-11 and a purple highlight dye. The application should be sprayed until wet. Timing of this application is most effective when the plants are flowering. A second treatment the following year would need to be completed.

Grazing

Goats and sheep can be used as a control method.

Manual removal

This would require manual labor, targeting specific areas for removal, control, or maintenance of the Himalayan blackberry.

Mechanical

Heavy equipment such as back-hoes or a small dozer with brush rake or steel ripper shanks could be used. A masticator could also be used for control purposes.

Treatment Schedule

Herbicide

The initial application should be done during the flowering stage of the plant. This should be monitored to insure proper timing.

Animal

Anytime except during dominant stage and fruit bearing stage.

Perennial Pepperweed (*Lepidium latifolium* L.)

Priority: High

Current Distribution

Perennial pepperweed is currently found within the watershed of Battle Creek's South Fork in the vicinity of Mineral.

Measurable Objectives and Goal

Goal: Control current infestation initially along Battle Creek's South Fork and various canals throughout the watershed.

Continue monitoring for future infestations.

Control Options

Established perennial pepperweed populations are difficult to control and require multiple years of intensive management. Suppressing the extensive root system is critical for successful control. A management program should include prevention, monitoring, and treatment of small satellite populations before plants develop extensive roots. If large populations exist, management should be focused on containing the infestation and preventing further spread to surrounding areas.

Prevention

Techniques that prevent perennial pepperweed establishment save time and resources in the future. Perennial pepperweed root fragments or seeds have been found in straw, hay bales, mulch, and crop seed. Consequently, it is important to assure that these items are free of weed seed and propagules before applying them to an area. Periodic surveys of property lines, roadsides, waterways, and riparian corridors help detect new infestations before they become well established. If construction or soil disturbance occur in infested areas, it is important to assure that root fragments and seed are not transported to other sites by equipment or personnel. Always clean vehicles, machinery, and clothing after visiting infested areas. If livestock graze perennial pepperweed, hold animals in closely monitored paddocks for several days to allow seed to pass through their digestive system before transporting the livestock to new areas.

Cultural Control

Establishing and maintaining competitive perennial vegetation can dramatically slow the introduction and spread of perennial pepperweed. Vigorous sod-forming grasses, alfalfa, or cropping systems with annual tillage can help prevent perennial pepperweed introduction and establishment in agricultural areas. Closely spaced plantings of herbaceous perennials, shade trees, and/or fabric or plastic mulches can help prevent introduction in ornamentals.

Hand Pulling and Tillage

Seedlings are easily controlled by hand-pulling or tillage, but these techniques do not control established plants because shoots quickly resprout from vast root reserves. Root segments as small as 1 inch are capable of producing new shoots.

Mowing and Burning

Mowing and burning are not effective at reducing perennial pepperweed stands but are helpful at removing accumulated thatch. Perennial pepperweed thatch burns best in winter or spring under dry conditions before initiation of spring growth. Mowing breaks old stems into small fragments and helps prevent shading of favorable species. However, mowing also stimulates perennial pepperweed plants to resprout and produce new growth. Combining mowing with herbicides has been shown to be an effective control strategy. For best results, plants should be mowed at the bolting or flower bud stage and herbicides applied to resprouting shoots once they have reached the flower bud stage.

Revegetation

Establishing desirable or native vegetation in disturbed areas is crucial to managing perennial pepperweed and preventing future weed problems. Perennial pepperweed is very competitive. Consequently, seeding or transplanting of desirable vegetation should occur once dense pepperweed stands have been controlled. Choose vigorous, fast-growing plant species that are adapted to the site. Perennial grasses are a good choice for natural areas and pastures. Grasses are tolerant to some selective herbicides used for perennial pepperweed control and over time form thick sod that prevent future weed establishment. In pastures, promote grass expansion and vigor with fertilization and grazing management.

Chemical Control

Several postemergent herbicides control perennial pepperweed; however, repeat applications are usually necessary for several years to treat resprouting shoots and seedlings. Extended control with herbicides is greatly enhanced by establishing competitive vegetation at the site. In areas with a dense buildup of thatch, mow or burn old shoots before applying herbicides. Timing of herbicide application is critical. Herbicides work best when applied at the flower bud stage and is least effective at the rosette or early bolting stage. Plant phenology differs between location and year. As a result, infested areas should be regularly observed in the spring and herbicides applied when flower buds appear. If herbicide cannot be applied at the flower bud stage, mow plants and apply the herbicide to regrowth. With seedlings, apply herbicides as soon as possible to prevent plants from producing new lateral shoots from the root. Herbicide choice depends on label restrictions, land use objectives, and cost. Table 1 provides a summary of effective herbicide choices.

Table 1.

Summary of Herbicides Available to Control Perennial Pepperweed in Rangeland, Pasture, Rights-of-Way, and Crop Situations. (Most products NOT for Home Gardens and Landscape)

Herbicide (trade name)	Site	Rate*	Efficacy	Comments
chlorsulfuron (Telar)	rangeland, pasture, noncrop areas	0.75-1.5 oz a.i.	Most effective herbicide; provides 1-3 years of over 90% control.	Has soil residual activity. Selectively controls many broadleaf plants. Do not apply near sensitive crops or water. Add a nonionic surfactant.
glyphosate (Roundup, Rodeo, Aquamaster, and others)	rangeland, pasture, crops, ditches, aquatic sites, wetlands, riparian areas, noncrop areas	2-3 lb a.e.	Variable results. Provides between 40-85% control 1 year after treatment. Repeat applications needed to control established stands.	Nonselective. If thatch is dense, mow and apply to resprouting plants. Good treatment if reseeding shortly after application. Add a nonionic surfactant.
imazapyr (Raptor)	alfalfa, "Clearfield" crops (see label)	0.047 lb a.i.	Provides good season-long suppression. One application per year needed to control established plants.	Has soil residual activity. Apply to spring rosettes in crops. Controls several broadleaf and annual grass species. Add methylated seed oil and nitrogen fertilizer.
imazapyr (Stalker, Arsenal, Chopper)	noncrop areas, fence rows, highway rights-of-way	4-6 oz a.e.	Provides between 85-95% control 1 year after treatment.	Has soil residual activity. Nonselective at rates applied. Controls most grasses and some broadleaf plants. Do not use in rangeland or pasture.
imazethapyr (Pursuit)	alfalfa, edible legumes (see label)	0.095 lb a.i.	Provides season-long suppression in alfalfa. Repeat applications needed to control established plants.	Has soil residual activity. Apply to fall or spring rosettes in crops. Add methylated seed oil and nitrogen fertilizer for postemergent control.
<i>a.i. = active ingredient; a.e. = acid equivalent</i>				

Cortaderia selloana (*pampas grass*)

Priority: High

Current Distribution

See 2011 survey map in appendix.

Measurable Objectives and Goal

Goal: Locate any established plants and eradicate

- (1) Continue a yearly surveillance for new invasion.

Control Options

Chemical

Small plants can be treated with an application of 1 ½ to 2% solution of Rodeo plus a ½% R-11 surfactant and purple dye; spray until wet. Larger plants may require removal of the upper portion of their crown, leaving at least 50% of the crown or leaf surface for a foliar application. All material should be placed in a plastic bag and disposed of or burned on site.

Manual

Removing plants through manual labor can be accomplished by utilizing a number of tools and methods. The most important consideration is reaching the root crown and removing the entire root wad in order to prevent resprouting. All material should be placed in a plastic bag and disposed of or burned on site.

Mechanical

Heavy equipment such as backhoes or bobcats can be used to remove large plants. All material should be placed in a plastic bag for disposal or burned on site. The greatest obstacle in controlling and eradicating pampas grass is its prolific seed reproduction capacity and plants growing outside the project area. After the removal of plants, there will be a long period of time when a large, in-place seed source allows the recruitment of new seedlings. This situation necessitates ongoing efforts to maintain a landscape free of pampas grass.

***Arundo donax* (Giant Reed)**

Priority: High

Current Distribution

Arundo Donax is found near the mouth of Battle Creek as well as upstream and downstream along the Sacramento River's mainstem.

Measurable Objectives and Goal

Goal: Control current infestation near the mouth of Battle Creek's mainstem. Coordinate with other public and private entities along the Sacramento River in order to develop an overall strategy and work plan to eradicate scattered infestations, particularly those on lands controlled by the Bureau of Land Management within that agency's Bend Area of Critical Environmental Concern.

Continue monitoring for future infestations.

Control Methods

A suite of methods is needed to control *A. donax* depending upon the presence or absence of native plants, the size of the stand, the amount of biomass which must be dealt with, and the terrain and season. The key to effective treatment of established *Arundo* is killing the root mass. This requires treatment of the plant with a systemic herbicide at appropriate times of the year to ensure translocation to the roots. Only one herbicide is currently labeled for wetlands use by the EPA: Rodeo®, a tradename formulation of glyphosate produced by Monsanto Corporation. Glyphosate is a broad-spectrum herbicide which can be used on *A. donax*, *Tamarix ramosissima* (saltcedar), and most other monocots and dicots. Other herbicides might also be used as labels and conditions allow. Monocot-specific chemicals, such as Fusilade-DX® (fluazapop-butyl) and Post® (Sethoxidan), might be particularly useful for treating *A. donax* in stands with a substantial component of native dicots; however, neither is currently labeled for wetlands use.

The most effective treatment on *A. donax* is the foliar application of a 2% to 5% solution of Rodeo applied post-flowering and pre-dormancy at a rate of 0.5 to 1 L/hectare. During this period of time, usually mid-August to early November, the plants are actively translocating nutrients to the root mass in preparation for winter dormancy, which results in effective translocation of herbicide to the roots. Comparison trials indicate that foliar application during the appropriate season results in almost 100 percent control, compared with only 5 to 50 percent control using cut-stem treatment. Two to three weeks after foliar treatment, the leaves and stalks of *Arundo* become brown and soften, creating an additional advantage in dealing with the biomass: cut green stems might take root if left on damp soil and are very difficult to cut and chip. Treated stems have little or no potential for rooting and are brittle. This material may be left intact on the ground or chipped *in situ* for mulch.

Cut-stem treatment requires more time and man-power than foliar spraying and requires careful timing. Cut stems must be treated with concentrated herbicide within one to two minutes in order to ensure tissue uptake. This treatment is most effective during post-flowering. The chief advantage of the cut-stem treatment is that it requires less herbicide that can be surgically applied to the stem. Due to its reduced

efficacy and the labor required for this type of application, it is often as or more expensive than foliar spraying except on very small, isolated patches or individual plants.

A popular approach to dealing with *Arundo* has been to cut the stalks and remove the biomass, wait three to six weeks for the plants to grow to about one meter tall, and then apply a foliar spray of herbicide solution. The chief advantage of this approach is that less herbicide must be applied to treat the fresh growth compared with tall, established plants and that coverage is often better due to the shorter and more uniform height of plants. Cutting the stems may, however, result in plants returning to growth-phase, drawing nutrients from the root mass. As a result, there is less translocation of herbicide to the roots and less root-kill. Therefore, many follow-up treatments must sometimes be made, which negates any initial savings in herbicide and greatly increases manpower costs.

Pure stands (>80% canopy cover) of *A. donax* are most efficiently treated by aerial application of an herbicide concentrate, usually by helicopter. Such application can treat at least 50 hectares per day. Special spray apparatus produces extremely fine droplets (400 microns) of concentrated herbicide which actually reduces herbicide use, minimizes overspray, and results in greater kill.

In areas where helicopter access is impossible, where *A. donax* makes up the understory, where patches are too small to make aerial application financially efficient, or where weeds are mixed with native plants (<80% cover), herbicides must be applied by hand. Street vehicles with 400-liter spray tanks are a good alternative where road access is available; however, small 4-wheel drive vehicles equipped with 60-liter sprayers have been a preferred approach in situations where the streambed is not so rocky as to prevent access. Twenty-liter backpack sprayers are another alternative where the vegetation is too dense or the landscape too rugged for vehicles to be effective.

Methods for vegetation removal include use of prescribed fire, heavy machinery (e.g. bulldozers), handcutting by chainsaw or brush cutter, hydro-ax, chipper, biomass burning, or removal by vehicle. Removal of the biomass should only be done where the weed cover is so dense as to prevent recovery by native vegetation after treatment or where cut vegetation might create a debris-dam hazard during flood events. Prescribed fire, or burning piles of stacked biomass, is the most cost-effective way of removing biomass as long as it does not threaten native vegetation or other resources. Chipping is more costly in terms of equipment and labor, and cut, dried chips pose no threat for regeneration or for forming debris dams. Hauling of biomass by vehicle is extremely expensive and should only be done as a last resort. Most landfills will not accept *A. donax*, and those that do will only accept *A. donax* if cut into short lengths and bagged, making labor costs very high. The use of heavy machinery such the hydro-ax is extremely expensive. The machines are very slow as a hydro-ax can only cut about 3 to 4 acres per day.

Klamath Weed (aka. St. Johns wort) (*Hypericum perforatum*)

Priority-High

Measurable Objectives and Goal

Goal: Control current infestation on the U.S. Park Service property along with several small scattered clumps in the vicinity of Mineral and other locations identified and mapped by the Tehama County RCD.

- (1) Continue monitoring for future infestations.

Control Options

The most cost-effective and practical control techniques to use will depend on the scale of the St. John's wort infestation and the topography of the infested land. All techniques should aim to remove the weed and replace it with introduced or native pastures.

Prevention of Spread

Preventing the invasion of St John's wort is the cheapest and most effective way of controlling the plant. Land managers need to have an ability to identify the weed and regularly check for it in October or November along boundary fences, roadsides, stock routes, or reserves adjoining properties under their management. When found, the plant needs to be removed immediately in order to prevent spread. If purchasing livestock from areas contaminated with St. John's wort, they should be held in a small paddock for five weeks before releasing the herd. This will allow seed on or inside the animal to be released. Later, paddocks containing cattle should be inspected and treated for infestations. If paddocks are infested, stock movement should be minimized between infested and clean areas. Vehicles moving between these areas should be cleaned. Only certified seed and fodder should be used. If purchasing fodder, information about its source should be obtained. When feeding livestock, restrict feeding sites to flat, arable areas, as these allow easy access and the opportunity to use a variety of control options. In addition, feeding should occur in paddocks where there is a strong perennial grass pasture, as this will provide good competition against establishing weeds. Feeding areas should be regularly inspected and treated for new infestations. Establishing a competitive perennial pasture using grasses such as phalaris, especially along boundaries of infested paddocks, can create a buffer against further spread of St. John's wort.

Burning

Burning checks the growth of St. John's wort and destroys seeds on the plant but can sometimes have a more detrimental effect on the associated pasture than on the St. John's wort.

Hand-weeding

Hand-weeding, either by pulling plants or digging them out using a hoe or shovel, is not an effective method of controlling St. John's wort as the plant can reproduce from buds produced on its roots. Consequently, new plants will grow unless the entire root structure is removed.

Herbicides

Herbicides registered for control of St. John's wort include fluroxypyr, triclopyr plus picloram, and glyphosate. Applied during flowering, fluroxypyr will selectively remove St. John's wort while minimizing damage to grasses or clovers. Triclopyr plus picloram will kill all legumes, and glyphosate will kill or severely damage all species growing with the weed.

Spot-spraying

Spot-spraying is an appropriate control strategy to use on isolated St. John's wort infestations. Triclopyr plus picloram and glyphosate are both registered for the control of St. John's wort using spot-spraying equipment. Spot-spraying is best executed when St. John's wort is in flower (November to January). At that time, the plant can easily be seen and is most sensitive to herbicides. Spraying operations should occur when the St. John's wort reaches the 50% open flower stage and finish before it advances to the 50% green capsule stage. Avoid spraying plants when the flowers have turned brown. Best results are obtained when spot-spraying when foliage is thoroughly wetted with herbicide. Do not spray St. John's wort that has been defoliated by insects, is being grazed, or is moisture stressed, as herbicide effectiveness is reduced under these circumstances.

Boom-spraying

Fluroxypyr, triclopyr plus picloram, and glyphosate are all registered for the control of St. John's wort using boom-spray equipment. Boom-spraying St. John's wort should be carried out from bud to full flowering (November to early January). Patches of St. John's wort can be treated with fluroxypyr or triclopyr plus picloram using a small boom. Research indicates that two boom-spray applications of fluroxypyr or triclopyr plus picloram one year apart at flowering can result in 100 percent kill of the weed. Boom-spraying medium St. John's wort infestations can be effective if the existing pasture can be salvaged. A chemical such as fluroxypyr will selectively remove St. John's wort in the pasture while minimizing damage to clovers or grasses. If the existing pasture cannot be salvaged, boom-spraying with glyphosate in November/December as part of a pasture resowing program is another option.

Rotary wiper

A rotary wiper can be effective for treating patches of St. John's wort. Using this equipment, the plant is treated at full flower with 1 L glyphosate per 20 L water (plus 200 mL wetting agent) by wiping the top two-thirds of the plants one way. It is important to graze any associated useful plants to below the wiper height before treatment.

Chemical

Chemical options for St. John's wort: According to NSW DPI's "Noxious and Environmental Weed Control Handbook 4th Edition", treatments include:

Chemical options	Rate: Spot/Boom	Comments
Triclopyr 600 g/L + picloram 600 g/L eg Grazon DS®	500 ml in 100 L of water Boom rate: 2.0 – 4.0 L per hectare:	Late spring to early summer, during flowering to early seed set. Boom: Apply November to January, use higher rate on dense infestations.
Triclopyr 300 g/L + picloram 100 g/L + Aminopyralid 8 g/L Grazon Extra®	500 ml in 100 L of water Boom rate: 2.0 – 4.0 L per hectare:	Foliar application from late spring to early summer, during flowering to early seed set. Apply November to January, use higher rate on dense infestations.
Fluroxypyr 200 g/L eg Starane®	500 mL per 100 L water 3.0 L/ha	Spring to midsummer application. Boom appln. Observe withholding period.
Fluroxypyr 333 g/L Starane Advanced®	300 mL per 100 L water 1.8 L/ha	Foliar application from flowering to seed set. Observe withholding period. Observe withholding period.
Fluroxypyr 333 g/L eg Starane Advanced®	1.8 L/ha	Apply from bud to full bloom. Some regrowth will occur. Treat regrowth the following season for best results. Use at least 200 L water/ha.
Glyphosate 360 g/L Various trade names	3.0 L per hectare	Apply November to May, flowering to post flowering. (Suitable isolated plants only)
Metsulfuron methyl 600 g/L eg Brushoff® + glyphosate 360 g/L various trade names	10 g metsulfuron methyl PLUS 200 ml glyphosate per 100 L water	Spray to wet, but not to cause run-off.

Pasture Competition

Competition from perennial pastures is essential for the long-term control of St. John's wort. Pasture competition prevents the germination and establishment of St. John's wort seedlings by reducing space, light, moisture, and nutrient availability. Maintaining pasture cover in the autumn is particularly effective in reducing germinating St. John's wort seedlings, which are highly susceptible to competition early in their life cycle. In light to medium St. John's wort infestations (where the existing pasture can be salvaged), pasture competition can be improved by appropriate grazing management such as allowing pastures to occasionally set seed and resting paddocks, as well as by fertilizing regularly and controlling pests. On fertile soils, medium to heavy St. John's wort infestations (where the existing pasture cannot be salvaged) can be controlled by sowing a perennial pasture.

Cropping and Pasture Sowing on Arable Land

On arable land, St. John's wort can be controlled by cultivation and cropping to remove the plant and reduce seed reserves before sowing a perennial pasture. For example:

- Year 1 – Boom-spray with glyphosate in November/December to obtain an initial kill, or plough in summer to expose and dry out the roots of the St. John's wort.
- Year 2 – Cultivate to prepare a seedbed, and sow a winter cereal crop in autumn. Repeat plowing or glyphosate herbicide application in the summer.

- Year 3 – Sow a second cereal crop in autumn, and repeat plowing or glyphosate herbicide application in summer, before sowing a perennial pasture in the following autumn.

Perennial grass pastures are the most competitive for St. John's wort control. As pasture varieties and sowing requirements vary, professional advice should be obtained for site specific recommendations.

Pasture Sowing on Non-Arable Land

Infestations of St. John's wort on non-arable fertile upland sites can often be controlled by replacing it with a direct-drilled or aerially sown perennial pasture. The direct-drilling/aerial sowing technique involves spraying glyphosate in November to January, and again after the autumn break to control annual weeds before sowing the pasture mix. New pastures should be allowed to set seed in the year of establishment, and any reinfesting St. John's wort can be controlled by spot-spraying.

Grazing Management

Grazing St. John's wort offers a cost-effective, long-term control method in all situations, and it is often the only practical method for steep, inaccessible upland areas. Care needs to be taken in order to avoid poisoning when grazing St. John's wort. Superfine or fine-wool adult Merino wethers or dry, non-pregnant ewes with at least four months' wool growth are recommended for grazing of St. John's wort infestations. Animals with this wool type and amount of wool growth have the most protection against sunlight and are also effective defoliators of St. John's wort. Cattle can also be used, either exclusively or to supplement the role of sheep. Cattle are less effective defoliators of St. John's wort than sheep since they do not graze as closely as sheep. However, they are more tolerant of hypericin. Fully colored (pigmented) cattle, either 100% black or red, will be the most tolerant. Cattle can be put onto St. John's wort pastures sometimes six weeks earlier than sheep, and the pasture can be used to knock down heavy infestations and open it up for subsequent grazing by sheep. Cattle can also remain on St. John's wort pastures much longer than sheep in spring.

Timing of grazing

St. John's wort should only be grazed when the hypericin levels in the plant are low. For broad-leaf infestations, start grazing (with sheep) in early May and continue through to mid-October. For narrow-leaf infestations, start grazing (with sheep) in early July, and continue through mid-September. Variations in yearly climatic conditions can influence these recommended grazing periods. For example, the grazing period may be extended for a few weeks during years in which dry conditions occur but are reduced during wet years as hypericin levels become elevated during wet conditions. During these safer grazing periods, the flowering stems which are high in hypericin are dead. At the base of each plant, however, are many soft, green, prostrate-growing shoots. These shoots are low in hypericin, and by eating them stock will significantly depress the weed's ability to re-grow the following season. Grazing these shoots will also allow competing vegetation to progressively outgrow them. The reduction in St. John's wort density in pastures following successive years of grazing decreases the potential daily hypericin intake of grazing livestock, thus allowing for the safe grazing period to begin earlier in autumn and continue longer through spring. Grazing intensively during the spring can also delay the growth of hypericin-rich flower stems for several months and thereby extend the safe grazing period. In the spring, it is important to make sure that livestock are moved off St. John's wort pastures before the new season's flowering stems reach a height of 5–10 cm as poisonous levels of hypericin can rapidly develop.

Grazing Methods

Several shorter periods of grazing using high stocking rates have been found to be more effective than one long period using a lower stocking rate. Higher stocking rates allow livestock to defoliate St. John's wort, and shorter grazing periods allow stock to be removed to protect their health and maintain the competitive nature of the pasture. If possible, heavy St. John's wort infestations should be fenced off to reduce the size of the area to be grazed and thereby facilitate this repeated heavy grazing. Grazing must be carried out every year to achieve long-term control. The retention of good tree shade in St. John's wort-infested paddocks is recommended to minimize the effect of sunlight on livestock.

Canadian Thistle (*Cirsium arvense*)/ Bull Thistle aka CIVU (*Cirsium vulgare*)

Priority: Moderate

Current Distribution

Both Canadian thistle and bull thistle have been located on public and private lands throughout the Battle Creek watershed largely within marshy areas, meadows, and mesic forest openings at elevations below 7000 feet. The densest infestations have been found in recently or repeatedly disturbed sites such as pastures, overgrazed rangeland, recently burned forest and forest clear cuts, and along roads, ditches, and fences.

Control Options

Chemical Control

Herbicides are not recommended for use on exotic thistles in high quality natural areas. Chemical control is most effective when plants are in the rosette stage and least effective when thistles are flowering. It is most effective when applied 10-14 days before bolting of the flowering stems. A solution of 3% Glyphosate and 1% oil or Imazapyr at a low application rate has been shown to provide good late-season control but is more expensive and cannot be used near water or during certain seasons of the year.

Mechanical Control

Eliminating seed production is the most effective mechanical control technique. Thistles mowed in bud or early bloom stage will produce new branches from buds in the axils of the basal leaves. Close mowing or cutting twice per season will usually prevent seed production. This can be done at any time during the growing season, although cutting is easier when the thistles are smaller. Mowing once flowering has begun may result in the spread of viable seeds with the mower. For effective selective control, plants should be cut with a sharp shovel at 1 to 2" inches below the soil surface before flowering. Competition with native vegetation decreases seedling establishment. A buffer strip between the preserved area and external sources of exotic thistles should be maintained to prevent invasion.

Treatment Schedule

Studies in Yosemite National Park have shown that pulling bolting thistles increases disturbance to the seed bank and results in higher regeneration of the plant. The disturbed area is smaller if the bolting plant is clipped at the base, preferably below the basal leaves. Sometimes this is not possible, but clipping at the soil surface or just below works fairly well.

Rosettes: Clipping rosettes often results in a fair amount of disturbance. As a result, all of them should be pulled and left to dry.

Bolted: If bull thistle has bolted, the seed head (if there is one) must be clipped, bagged, and disposed of. The thistle itself should be clipped below the basal leaves and left to dry in the sun. If the plant is budding or flowering, it is very important to clip, bag, and carry out the seed heads.

Disposal: The clipped and pulled plants need to be piled on top of a log, rock, or bare area, making sure that no roots are in contact with the soil in order to increase desiccation. It also reduces missing rosettes because they are covered by clipped stalks. Bull thistle flowers can potentially continue to bloom after they are clipped from the plant, so it is important to remove all flowers, including tight buds.

Remember: Branches easily tear the larger plastic bags, so it's best to double bag and be cognizant of it. Also, be aware of holes from the prickles on the flowers. Sometimes when working with thistles a large paper bag is best for collecting heads that have not gone to seed.

(*Centaurea virgata*) Squarrose knapweed and (*Centaurea stoebe*) Spotted knapweed

Priority: Medium

Current Distribution

Recent surveys show infestations of Squarros knapweed near the community of Old Station, in the vicinity of Lake Almanor and in an area of timberland along State Route 44 just outside the eastern boundary of Lassen Volcanic National Park,

Measurable Objectives and Goal

Goal: Control current infestations within Lassen National Forest lands, private property near Lake Alamnor and Mineral along with several small scattered clumps in other locations mapped by the Tehama County RCD and the Lassen National Forest.

Continue monitoring for future infestations.

Control Options

Prevention

Both these species of knapweeds reproduce by seed, so it is important that the spread of seed be controlled as much as possible. Vehicles and equipment operating within infested areas can effectively spread seeds. Consequently, avoiding areas of infestation and thoroughly cleaning equipment is critically important. Livestock should not be grazed during flowering and seeding of the weeds. Moving cattle from muddy, weed infested fields to uninfested areas should be avoided as seeds clinging to muddy hooves and hides will spread the infestation. In addition, the use of certified weed free hay will reduce the potential for seed spread. Squarrose knapweed closely resembles diffuse knapweed, so it is important to frequently monitor rangelands and other properties for invasive weeds in order to detect their presence early before they become well established. Monitoring should occur on at least a yearly or quarterly basis during the growing season. It is important to detect and eradicate weed introductions early, minimize soil disturbance, and contain neighboring infestations quickly. It is essential to control outlying plants before attacking larger populations.

Mechanical Control

Hand pulling knapweed is ineffective as stout taproots resprout when broken off. Grubbing or digging the roots of individual plants or small infestations with a shovel may be effective if most of the taproot is removed. Roots should be cut at least eight inches below the soil surface in order to prevent the formation of new shoots.

Cultural Control

If desirable perennial grasses are abundant enough to provide competitive stress in knapweed stands, a careful application of a broadleaf herbicide that does not harm grasses may allow the grasses to effectively exclude the weeds. If timed correctly, precipitation or irrigation (where available) encourage growth of competitive grasses over knapweed.

Chemical Control

Control of knapweed with herbicides appears to be more effective if used in combination with other control methods. Annual treatments for several years will be needed because plants often regrow after chemical application. In addition, seed from previous years ensure an available seed source to reestablish the infestation unless they are controlled as they germinate. Establishing a competitive crop or a sod of perennial grass will enhance control of regrowth and deter the establishment of new seedlings. Glyphosate kills knapweed plants but will also destroy competitive grasses. When using glyphosate, apply to actively growing plants in the bud stage at a rate of 3 lb ae/A. Seed a locally adapted perennial grass in the fall and at least ten days after the application. Apply Tordon® (picloram) to knapweed plants in late spring before or during flower stem elongation at a rate of 0.25 to 0.5 lb ae/A. This will provide some control and will not damage perennial grasses. Treatment of plants in the bud stage may not prevent seed production in the year of application, but seed germination will be noticeably reduced. Tordon® is a restricted-use herbicide that must be applied by, or its application supervised by, a certified pesticide applicator. Stinger® (clopyralid) or Transline® (clopyralid) can be applied to knapweeds up to the bud stage of growth. The best results will be obtained if actively growing weeds are treated. The recommended rate of application for knapweeds is 0.25 to 0.5 lb ae/A.

Treatment Schedule

Herbicide treatments: June – October

Manual & Mechanical: Anytime of the year, ideally before seed reproduction.

Spring of following year: Complete follow up treatments to ensure successful eradication has been achieved.

(*Leucanthemum vulgare*) Oxeye daisy

Priority: Moderate

Current Distribution

Ox-eye has been identified near Mineral just east of Battle Creek's South Fork near Highway 36.

Measurable Objectives and Goal

Goal: Control current infestation on municipality owned 25 acre parcel and individual scattered clumps.

Continue monitoring for future infestations.

Control Options

An important consideration in the control of Ox-eye Daisy is that the plant's seeds remain viable in soil for at least two years. The first step in its control is to develop a containment strategy. Removal methods will depend upon environmental variables and the type of plant community infested. Primary methods of dispersal besides seed drop should be identified. If plants are growing along trails, shoes and hooves picking up seeds in wet soil may disperse them. People also pick the bright flowerheads from which ripe seeds may fall as they hike through the region. Information about the daisies should be posted to alert wildland users. Small outlying populations should be treated first.

Complete eradication of a large, well established, and geographically widespread population of Ox-eye daisies can be difficult because of their small size and abundant seed production. Prolific seed set and the ability of rhizomes to resprout make successful removal dependent on appropriately timed treatment and persistent follow-up. Removal sites should be inspected before plants have set a new crop of seed in June. If the infestation is small, it may be difficult to locate the previous year's removal site. These areas should be mapped and marked with colored flagging or pin flags, especially if follow-up will be done by someone else. If plants are mulched, the mulch will serve as an effective indication of the location of the infestation. It is much easier to locate daisies after flowering begins, which is typically by mid-June in coastal California populations.

Manual Methods

A combination of hand removal and mulching can be used to control Ox-eye daisy. If the infestation is small (less than 0.25 acres) or widely scattered, hand removal may be efficient. Using a small hand pick, chip around the base of the plant several inches deep to loosen it. Lift the entire plant out intact without leaving any stem pieces (rhizomes) behind. Check for rhizome fragments, since an entire plant can regenerate from them. A round-point shovel is effective for scooping out whole plants. If the soil is flat and compacted, a sharp garden spade can also be used to scrape the plant out of the soil. A hula hoe is also handy for scraping away abundant masses of seedlings or small plants.

Mechanical Methods

Shallow cultivation of less than six inches has been found to have little effect and is likely to spread roots. Cultivation greater than six inches in summer exposes roots to desiccation. Subsequent shallower

cultivations kills seedlings. This technique opens the soil to infestation by other weeds and must be combined with dense revegetation with desirable seed.

Mulching

Due to the fact that Ox-eye daisy is a prostrate plant except for its flower stalks, heavily mulching large infestations with mature and certified weed free rice straw has been found to be a successful treatment option. One negative aspect of mulching with manure is that it can contain an array of invasive plant seeds which can be spread once mulch has been applied. Straw should be applied during the fall at the onset of the growing season. One bale will cover approximately 100 square feet. The site should be monitored in early spring. If any live plants are found under the straw or if any light can reach the soil, then another thick layer should be applied before flowering begins in May. If the infested area has a lot of woody plants, they can make it difficult to mulch thickly, and lopping or brush cutting may need to be completed first.

It is also important to determine if the plants are seedlings or adults. When mulch is adequately applied, first time seedlings should not grow through it. Humans or animals passing through the area may disturb the mulch. Where mulch is thinning, it should be re-applied, especially if there is a month or more of wet weather to come or if the site is a wet habitat. Once a mature population is removed from the area, a crop of seedlings will take their place. Therefore, the length of time the area should remain mulched depends on the size of the seedbank and longevity of Ox-eye daisy seeds in it. Along edges that are difficult to mulch, spot removal can be done by hand.

Grazing

Intensive cattle grazing programs are an effective control for Ox-eye daisy. Although cattle tend to avoid it because of its high acidity, under high stocking densities in an intensive grazing system, cattle have been found to eat this species.

Chemical Treatments

Picloram, imazapyr, sulfometuron methyl, and dicamba are effective at label concentration when applied in the early flowering stages, but these herbicides persist in the soil. Ox-eye daisy is moderately resistant to MCPA, 2, 4-D, and dicamba, but these chemical materials may damage non-target species.

(*Linaria genistifolia* ssp. *dalmatica*) Dalmation toadflax

Priority: Medium

Current Distribution

Dalmation toadflax is most often found in disturbed open sites, fields, pastures, degraded rangelands, roadsides, and in agronomic and perennial crops. Infestations often form large colonies, displacing desirable vegetation. This plant has been found just west of Mineral within the Lassen Volcanic National Park Headquarters compound along Highway 36.

Measurable Objectives and Goal

Goal: Locate any established plants and eradicate

- (1) Continue a yearly surveillance for new invasion.

Control Options

Preventing the establishment of Dalmatian toadflax populations is the most time efficient and cost effective way of controlling this species. Farmland, rangeland, and outdoor recreation equipment can transport seeds and should be cleaned thoroughly before moving from infested areas to uninfested areas. Livestock can also transport seed. Cattle should be held in corrals for six days and sheep for 11 days before moving from an infested area to an uninfested area in order for viable seeds to pass through their systems. Dalmation toadflax is most vulnerable at the seedling stage, and these should be immediately removed. Once the root system is established, this species is extremely competitive for water and resources and is difficult to control or eradicate. Management of Dalmatian toadflax should focus on both the prevention of seed formation and the prevention of vegetative spread, as both factors are equally important in establishing populations.

Physical/Mechanical/Cultural

Pulling small infestations of Dalmatian toadflax by hand can be an effective way of control, especially if established in sandy or moist soil. Pulling must continue for 5-6 years in order to remove all root fragments, and lateral roots should be followed and removed from the soil. The site should be revisited for 10 to 15 years to assure the removal of seedlings produced from dormant seeds. Mowing and burning are ineffective at controlling toadflax as this does not affect the root stocks or the buried seeds. Cultivation can effectively eradicate these species when it is repeated every 7 to 10 days over a 2 year period. Machinery needs to be well cleaned in order to prevent the spread of root fragments to uninfested areas. Well adapted species can be highly competitive with toadflax seedlings. A combination of toadflax control measures with seeding of various species having different phenologies and rooting systems (shallow, intermediate, and deep rooted species) can effectively outcompete germinating Dalmatian toadflax seedlings. Care must be taken to not overgraze areas, as this has been shown to increase the spread of toadflax infestations. Since animals typically do not graze toadflax, the plants become more competitive and abundant than the grazed species depending upon the animal. It has been shown that sheep can help suppress stands of Dalmatian toadflax and limit seed production.

Herbicides

Herbicides used exclusively and in combination with seeding of competitive species can control Dalmatian toadflax. Most herbicide treatments are recommended at the flowering stage with seeding of desirable competitive species the following spring. Herbicide control of Dalmatian toadflax can vary because of the large genetic variation within the species, its ability to grow in a variety of climates, and because of the waxy covering on its leaves and stems. Even when herbicide treatment appears successful, follow-up should occur every 3-4 years for as long as 12 years in order to eradicate the species. Use lower recommended rates when plants are growing in sandy soils.

Table 3. Herbicide options for management of Dalmatian toadflax

Herbicide	Active Ingredient	Rate of Herbicide	Timing of application	Comments
Tordon 22K*	picloram	1-2 qt/A	Flowering or in the fall; especially effective after first hard frost	<ul style="list-style-type: none"> • Residual herbicide • Selective • Retreatment for several years may be required. • Best control occurs when area re-seeded with competitive grasses
Telar	chlorsulfuron	2-3 oz/A + 0.25% (v/v) non-ionic surfactant	Flowering to fall	<ul style="list-style-type: none"> • Residual herbicide • Selective • Persistent in high pH soils • Retreatment for several years may be required.
Many compounds	glyphosate ¹	3-4 lbs ai/acre	Early bloom	<ul style="list-style-type: none"> • Nonselective • Will suppress in current year, but abundant regrowth will occur the following year.
Banvel, Clarity, Vanquish	dicamba	2-4 qt/acre	Pre-bloom to flowering stage	<ul style="list-style-type: none"> • Residual herbicide • Selective • Retreatment for several years may be required.

Treatment Schedule

Herbicide treatments: June – October

Manual & Mechanical: Anytime of the year, ideally before seed reproduction.

Spring of following year: Do a follow-up to ensure successful eradication has been achieved.

Appendix B

Formally Listed Species Found Within the Battle Creek Watershed

Depending upon the area to be treated (such as sensitive riparian areas) and the technique to be used, those invasive control projects that are not exempt from the provisions of the California Environmental Quality Act or the Federal National Environmental Quality Act must adhere to these sets of regulation. It is anticipated that such non-exempt efforts would require a CEQA Initial Study/Mitigated Negative Declaration document, a NEPA Environmental Assessment, or both if public and private lands are involved or if Federal and State dollars are used. A major component of both these environmental analysis processes is the requirement for an analysis of impacts to State and Federally listed species. To make these processes more efficient and effective when designing or implementing project proposals, the California Department of Fish and Wildlife's Natural Diversity Database was reviewed during February and March of 2012 in order to identify special status Federal and State listed species found within the Battle Creek watershed. The Cal Fish database, a species list generated from the California Wildlife Habitat Relationship System database Version 8.2 (2008), and numerous other references were also reviewed in order to determine the possible occurrence of listed terrestrial, amphibian, aquatic, and anadromous species. With listed species information already gathered, stakeholders within the Battle Creek watershed who are implementing project work can more efficiently develop effective work scopes and mitigation measures that protect listed and other species. The following results relate to species listed as Endangered, Threatened, or Sensitive Species (List 1, List 2 and List 3).

1 = Federal Endangered

2 = Federal Threatened

3 = California Endangered

4 = California Threatened

5 = California Fully Protected

6 = California Protected

7 = California Species of Special Concern

8 = Federally Proposed Endangered

9 = Federally Proposed Threatened

10 = Federal Candidate

11 = BLM Sensitive

12 = USFS Sensitive

13 = CDF Sensitive

14 = Harvest

Mammals

AMERICAN BADGER (*Taxidea taxus*) ^{7,14:} This species is found throughout California with the exception of the North Coast area. It is most abundant in drier open stages of most shrub, forest, and herbaceous habitats having friable soils suitable for the development of new burrows. Old burrows are

frequently used as well. Young are born in burrows dug in relatively dry, often sandy soil, usually in areas with sparse overstory cover. Suitable habitat for badgers is characterized by herbaceous, shrub, and open stages of most habitats with dry, friable soils. Badgers mate in summer and early fall. Gestation period varies from 183-265 days with birthing occurring during March and April.

AMERICAN MARTEN (*Martes Americana*):^{7,12} Optimal habitats for *Martes Americana* include various mixed evergreen forests having more than 40% crown closure with large trees and snags which provide cavities for nesting and denning. Important habitats include subalpine conifer and mixed conifer stands. The American marten forages on the ground and in trees, snags, logs, and rocky areas. Individuals may travel up to 15 miles during hunting. Cavities in large trees, snags, stumps, logs, burrows, caves and crevices in rocky areas are used for dens as well as cover. Nests are located in cavities and lined with leaves, grass, mosses, or other vegetation. Habitat with limited human use is important. Martens require a variety of different-aged stands, particularly old-growth conifers and snags which provide abundant cavities. Small clearings, meadows, and riparian areas provide foraging habitats, particularly during snow-free periods. Breeding occurs in the summer and litters are born in March and April, some as late as June. Extensive even-aged forest management and removal of mature mixed conifer stands within Eastern Tehama County have been detrimental to the viability of this species's local population. Numerous sightings of this species however, have been made within old growth forest stands of the Lassen Volcanic National Park.

BLACK-TAILED JACKRABBIT (*Lepus californicus*)^{1,3,14} This species is common throughout the state, except at the highest elevations. It is abundant at lower elevations in early stages of forest development as well as within chaparral habitats where shrubs are used for cover. The Black-Tailed Jackrabbit prefers grasses and forbs but will eat almost any vegetation that occurs in the area, up to about 20" above the ground. Young are born beneath vegetation that provides some overhead cover. Intermediate canopy stages of shrub habitats, open shrub/herbaceous and tree/herbaceous edges provide suitable habitat. *Lepus californicus* breeds throughout the year, with the greatest number of births occurring from April through May.

BROAD FOOTED MOLE (*Scapanus latimanus*)⁷ This mole species is largely subterranean, requiring friable soil for burrowing. It is common to most of California. Within Eastern Tehama County, optimal habitat includes annual and perennial grassland, pastures, montane and valley foothill riparian, and aspen. The species is also found in a variety of open forest habitats. Its elevational range extends up to 9,840'. The Broad Footed Mole feeds just below ground surface by burrowing and detects some prey by vibrations in the soil. It may feed at deeper levels when conditions are dry or cold. Nests are made of grass and leaves in an additional tunnel greater than 1 foot in depth. During the wet season, this species moves away from flooded areas and into chaparral or other dry habitats. Breeding occurs from February to May.

CALIFORNIA VOLE (*Microtus californicus*):^{1, 3, 7, 11} The California Vole, is on the federal Endangered Species List. It is classified as endangered in California. Non-native plants and animals introduced into its environment have contributed to the decline of this vole species. Exotic plants have replaced various species needed for its survival. *Microtus californicus* has suffered from having to compete with the House Mouse and other non-natives animals. The Vole's major reproductive season is September through December, or several months after autumn rains and it terminates with desiccation of vegetation, usually in June. In some years, there may be a minor reproductive period in autumn with sporadic pregnancies the rest of the year. California Vole habitat within Eastern Tehama County includes grassy meadows suitable for burrowing. This species feeds on grasses and other green vegetation when available. During the winter it eats mostly roots and other underground parts of plants. Like most other voles, this species considerably alters its habitat with burrows, runways and cuttings. Its main predators are hawks, owls, weasels, and snakes.

DUSTY FOOTED WOOD RAT (*Neotoma fuscipes*):^{1, 7} The presence of Dusky-footed Woodrat is usually noticed by large houses built from sticks, twigs, cacti, horse and cow manure, plant materials and man-made debris. These houses are above ground, frequently beneath a rock outcrop, in a rock pile or partially under a shrub. Dwellings help protect the woodrat from seasonal temperature extremes and predators. The Dusky-footed Woodrat breeds throughout the year with usually more than one litter produced per year. The wood rat eats primarily woody plants including leaves, flowers, nuts and berries and it has been shown to forage above ground.

MOUNTAIN LION (*Felis concolor*):⁷ Mountain lions inhabit an array of landscapes within Eastern Tehama County including chaparral, foothill oak woodlands and conifer forests. These areas contain woody vegetation, deer and solitude which are some of this species' primary life requirements. Areas too small to accommodate the species home range which can be 100 miles or more, cannot support Lion populations unless they are connected to one another by suitable corridors of vegetation that provide a large enough accessible area in the aggregate. As the Mountain Lions preferred prey, deer require open and closed vegetation types in order to maintain sufficient herd sizes. Mountain lions will also prey on beaver, porcupines, rabbits, skunks, and other small mammals, birds, and fish. Females breed at two or three years of age, then every 18 to 20 months thereafter. Young may be born at any time of the year.

NORTHERN FLYING SQUIRREL (*Glaucomys sabrinus*):^{7, 12} This year round resident of Eastern Tehama County inhabits dense, mature conifer stands containing large trees and snags that are intermixed with various riparian species. The Northern Flying Squirrel inhabits elevations ranging between 5,000' and 8,000'. This species forages in trees and on the forest floor. It uses cavities in mature trees, snags or logs for cover and nesting. Some nests are constructed on tree branches using twigs and leaves. Breeding occurs in March followed by a 37 to 40 day gestation period.

NORTHERN RIVER OTTER (*Lontra Canadensis*):^{7, 11} Within Eastern Tehama County, the Northern River Otter is a year round resident of rivers, large streams, lakes and wetlands. *Lontra Canadensis* is most abundant at foothill elevations. Preferred cover is provided by thickets, tall wetland plants, hollow logs, stumps, snags, burrows and other cavities. Nests are normally created in burrows and cavities within banks, rocks, trees, stumps, in hollow logs, thickets, or on platforms made of wetland plants associated with a large, permanent water source. In California most young are born during March and April.

PACIFIC FISHER (*Martes pennanti (pacifica)* DPS):^{7, 10} The Pacific fisher (*Martes pennanti*) is a specialized forest carnivore that is associated with closed-canopy, late-succession forests throughout its range. The easternmost third of the Battle Creek watershed contains mixed conifer forests; both old growth stands of large mixed conifer species and second growth stands of smaller trees. Within the mid elevations of the watershed, stands of Ponderosa Pine and Sugar Pine containing pockets of open chaparral are found. Both these ecotypes are considered suitable habitat for the Pacific Fisher.

RINGTAIL (*Bassariscus astutus*):⁵ The ringtail occurs in various riparian, forest and shrub habitats at elevations ranging from sea level to 8,800'. For diurnal rest sites, ringtails use trees as well as rock outcropping. Its principal habitat requirements related to den sites include boulders or in hollows of trees within areas containing sufficient food which includes rodents and other small animals. Ringtails are primarily carnivorous and prey mainly on rodents (woodrats and mice) and rabbits. They will also take substantial amounts of birds and eggs, reptiles, invertebrates, fruits (berries of madrone, manzanita, cascara, cacti and mistletoe), seeds acorns and some carrion. Foraging habitats include rocks and in trees, near water. In summer and fall, the ringtail's diet consists primarily of insects, while birds, mammals, and carrion are eaten in the spring and winter. Breeding occurs from February to June with a peak in March through April. Litters are born in May or June. Dens can include a hollow tree, rock pile, a crevice in a cliff, or abandoned burrows or woodrat nests.

SIERRA NEVADA RED FOX (*Vulpes vulpes nector*):^{4,12} The subspecies *V. v. nector* is found in the Cascades within a variety of habitats including wet meadows, mixed conifers, Ponderosa pine and Lodgepole pine stands, aspen, montane chaparral, montane riparian and montane hardwood-conifer. Most sightings of the species have been above 7,000'. The lowest elevations sightings have occurred at approximately 3900'. *V.v. nector* hunts in meadows, fell-fields, grasslands, wetlands, and other open habitats. Dens are developed in dense vegetation and rocky areas along with rock outcrops, hollow logs, stumps and burrows located in deep, loose soil. Edge areas are utilized extensively. Mating takes place in late winter (January through March). After a gestation period of 52 days, young are born in early spring (March-through May).

SIERRA NEVADA SNOWSHOE HARE (*Lepus americanus tahoensis*):⁷ This species of hare is found primarily in montane riparian habitats with thickets of alders and willows as well as in stands of young conifers interspersed with chaparral. The early seral stages of mixed conifer, subalpine conifer, red fir, Jeffrey pine, lodgepole pine, and aspen are likely habitats, primarily along edges and especially

near meadows. Summer food consists of grasses, forbs, sedges, and low shrubs. Needles and bark of conifers as well as leaves and green twigs of willow and alder are eaten in the winter. Dense cover is preferred, either in understory thickets of montane riparian habitats or in shrubby understories of young conifers. The species' breeding period is from mid to late February until June or July. Nesting areas are developed by lining a shallow depression under a shrub, log or in slash using grass, fur, or needles. The Snowshoe Hare prefers edges, heterogeneous habitats and areas with dense understory particularly in riparian zones. It is also found in areas with young firs having branches that droop to ground as well as in patches of ceanothus and Manzanita within or bordering fir or pine forests.

PALLID BAT (*Antrozous pallidus*):^{7, 11, 12} The Pallid Bat generally inhabits shrublands, woodlands, grasslands and occasionally cottonwood-riparian zones within those habitats. It is most common in areas having rocky outcroppings particularly near water. During summer this species usually roosts in rock crevices, rock piles, tree cavities, shallow caves, and abandoned mines. The pallid bat is sensitive to human disturbance. Recreational activities may impact roosting bats sometimes resulting in the abandonment of young and roosts.

SPOTTED BAT (*Euderma maculatum*):^{7, 11} Within Northern California, the spotted bat occupies a number of habitats including grasslands and mixed conifer forests. The species' elevation range extends from below sea level to 10,000 feet. The Spotted Bat feeds in flight over water and at ground level. Roosting and nesting preference is for rock crevices and cliffs. Mating season is in autumn and most births occur before mid-June.

TOWNSEND'S BIG-EARED BAT (*Corynorhinus townsendii*):^{7,11,12} *C. townsendii* occurs primarily in oak woodlands and lower to mid-elevation mixed coniferous-deciduous forests of the inner coast ranges as well as the Sierra Nevada and Cascade foothills. Its distribution tends to be geomorphically determined, by the availability of caves or cave-like roosting habitat. Population concentrations occur in areas with substantial surface exposures of cavity-forming rock.

WESTERN MASTIFF BAT (*Eumops perotis*):^{7, 11} The Western Mastiff Bat occurs in semi-arid to arid habitats, including conifer and deciduous woodlands, annual and perennial grasslands as well as chaparral. Suitable habitat consists of extensive open areas with abundant roost locations provided by crevices in rock outcrops. Crevices in cliff faces and trees are required for roosting. When roosting in rock crevices, *Eumops perotis* needs vertical faces to drop off and take flight. This species feeds on insects in flight from ground to tree-level. Nursery roosts normally include tight rock crevices at least 35" deep and 2" wide. Breeding occurs most frequently in early spring (March), parturition may occur from early April through August or September.

WESTERN RED BAT (*Lasiurus blossevillii*):^{7, 12} This species of medium-sized bat is born from late spring to early summer. It roosts in the foliage of large shrubs and trees, usually sheltering on the underside of overhanging leaves. Roosting habitat is found in woodland borders and rivers. Roost sites have been found in edge habitats adjacent to riparian zones. Roost trees are typically large diameter cottonwoods and willows. Foraging occurs in and amongst vegetation and this species forages regularly over the same territory. Foraging has been noted in habitats such as oak woodland, low elevation conifer forests and along riparian corridors. This species may forage in habitats adjacent to streams and rivers that do not provide roosting habitat. Other requirements include undisturbed foliage roost sites that provide protection from predators along with structurally diverse vegetation that support a variety of insect prey habitat. It is found to be less abundant in low and middle elevations of mixed conifer forests. The western red bat was ranked in the top five species of conservation concern as less than 6% of relatively intact old growth, riparian forest remains

YUMA MYOTIS (*Myotis yumanensis*):⁷ *Myotis yumanensis* is common and widespread in California. It is found in a wide variety of habitats ranging from sea level to 11,000' but it is uncommon to rare above 8,000'. Optimal habitats are open forests and woodlands with sources of water over which to feed. This species usually feeds over water sources such as ponds, streams, and stock tanks. Yuma myotis roosts in buildings, mines, caves, or crevices and has also been seen roosting in abandoned swallow nests and under bridges. Maternity colonies of several thousand females and young may be found in buildings, caves, mines, and under bridges. Warm, dark sites are preferred. If temperatures exceed 40°C, bats seek cooler locations, and individuals roost farther apart. Yuma Myotis is nocturnal and hibernates. It makes local or short migrations to suitable hibernacula. This species emerges soon after sunset in many areas. Yuma myotis like other California bats, mates in the fall and its season of birth lasts from late May to mid-June with a peak in early June. Prey includes moths, midges, flies, termites, ants, homopterans, and caddisflies. It requires a significant water source. As a result, distribution is closely tied to bodies of water which it uses as foraging sites and sources of drinking water. Open forests and woodlands provide optimal habitat.

VAGRANT SHREW (*Sorex vagrans*):⁷ The vagrant shrew is common in the Cascades and Sierra Nevada from the Oregon border to Northern Inyo Co. Optimal habitats are valley foothill and montane riparian, aspen, wet meadows, stream banks, annual and perennial grasslands, as well as emergent wetlands at elevations ranging from sea level to 12,000 feet. All of these landscapes are found within the Battle Creek watershed. *Sorex vagrans* forages under litter on moist surfaces, underground and in moist accumulations of dead plant material. It makes a nest of dry grass, moss or other materials under logs, roots, or dense vegetation. Most young are born from March to May. There may be a second peak of births in August and September.

WESTERN SPOTTED SKUNK (*Spilogale gracilis*):^{7, 14} This skunk occupies a variety of habitats including rocky bluffs, cliffs, hollow logs, brush-bordered canyon streams or stream beds. They feed on a variety of food sources from an array of habitat types including bird eggs, young rabbits, mice, and

arthropods such as grasshoppers and scorpions. Breeding occurs in September and October with young born in late April.

WOLVERINE (*Gulo gulo*):^{4, 5, 12} This species is rarely seen in Eastern Tehama County although sightings have occurred in eastern Shasta County and Siskiyou County. Preferred habitats include Douglas-fir and mixed conifer stands along with red fir, lodgepole, wet meadow and montane riparian areas. Most sightings within Northern California have occurred at elevations ranging from 1,600' to 4,800'. *Gulo gulo* forages in open to sparse tree habitats on ground, in trees, burrows, among rocks, in or under snow and sometimes in shallow water. *Gulo gulo* prefers areas with low human disturbance. Caves, hollows in cliffs, logs, rock outcrops and dense forest stands are used for cover. The Wolverine's mating season is from May to July. Young are born from January through April.

CALIFORNIA WOLVERINE (*Gulo gulo luteus*):⁴ This species is believed to be extirpated from Lassen Volcanic National Park and typically avoids developed areas. Surveys for *Gulo gulo luteus* has occurred throughout the State over the past 10 years with no confirmed sightings.

Birds

BALD EAGLE (*Haliaeetus leucocephalus*):^{3, 5} *Haliaeetus leucocephalus* requires large bodies of water or free flowing rivers with abundant fish. Snags, stoutly limbed or broken-topped trees and large rocks are used as streamside hunting perches. It roosts in dense, sheltered and remote conifer stands containing large old-growth or dominant live trees having open branchwork. Nesting occurs most frequently in stands with less than 40% canopy and having some foliage to shade the nest. Stick platform nests are generally built on the largest tree in a stand usually between 50' and 200' above the forest floor just below the crown. Nests are usually located near a permanent water source. In California, it has been determined that 87% of nest sites are within 1 mile of water. The Bald eagle's breeding period is between February and July with peak activity between March and June. Nesting normally does not occur if human disturbance is evident. In addition, the mixed conifer forest within the area consist of small second growth stands containing extensive fir thickets.

GOLDEN EAGLE (*Aquila chrysaetos*):^{5,11,13} This California fully protected species' habitat within the Northern interior consists of rolling foothills and mountain terrain, wide arid plateaus deeply cut by streams and canyons, open mountain slopes, cliffs and rock outcrops. The Golden Eagle requires open terrain for hunting including grasslands, savannahs, early successional stage forests and shrub land habitats. Cover generally takes the form of secluded cliffs with overhanging ledges as well as large trees used for cover. Nesting sites are normally located on cliffs of all heights and in large trees in open areas. Breeding occurs from late January through August and peaks between March and July.

GRASSHOPPER SPARROW (*Ammodramus savannarum*):⁷ The Grasshopper Sparrow occurs in dry, dense, grasslands, especially those containing a mix of native grasses and forbs growing on hillsides or mesas. Tall forbs and scattered shrubs are used for singing perches. The Grasshopper Sparrow feeds primarily on insects, especially Orthoptera, other invertebrates as well as grass and forb seeds. Foraging occurs by scratching in soil and ground litter within the low foliage of relatively dense grasslands. A thick cover of grasses and forbs is essential for its concealment. Nesting material consists of grasses and forbs in slight ground depressions hidden at the base of overhanging clumps of grasses and forbs. It uses scattered shrubs for singing perches. This species breeding period is from early April to mid-July, with a peak in May and June

SAGE SPARROW (*Amphispiza belli*):^{2,7} Habitat for this species of sparrow adheres closely to chamise dominated landscapes. As a ground-foraging omnivore during breeding season and ground gleaning granivore during non-breeding season, the Sage Sparrow generally prefers semi-open habitats with evenly spaced shrubs 3 to 8" high rather than tall old chaparral. In addition to adult and larval insects, spiders, seeds and small fruits, this species feeds on succulent vegetation that develops after wildfires. Shrub height and structure is believed to be more important to nest site choice than species as the Sage Sparrow prefers taller shrub species with large canopies. Nest shrub height averages between 3' and 4' above the soil surface and nests are placed in the densest part of nest site vegetation.

The occurrence of Sage Sparrow is reduced near edges with permanent human development. Disturbances that reduce shrub cover such as frequent fire; mechanical disruption, livestock grazing, and off-highway vehicle use appear to have negative effects on Sage Sparrows although there may often be a time-lag between the disturbance and any effects due to site-fidelity. The invasion of exotic weeds can cause increased fire frequency resulting in complete loss of shrub cover and a reductions in Sage Sparrow populations. On the other hand, long-term fire suppression in California chaparral may allow shrubs to grow higher and thicker than what is preferred by this species. *Amphispiza belli* may prefer recently burned chaparral because it has a low, open shrub structure. With the removal of tall dense chaparral stands, semi open foraging habitats will be increased.

SONG SPARROW (*Melospiza melodia*):⁷ The song Sparrow is common resident throughout California with the exception of higher mountains and southern deserts. During all seasons, this species prefers riparian emergent wetland, and wet meadow habitats. It breeds in riparian thickets of willows, shrubs, vines, tall herbs and in emergent vegetation. During the winter, Song Sparrows may be found far from water in open habitats with thickets of shrubs or tall herbs avoiding densely wooded habitats except along forest edges. It usually forages on the ground or in low vegetation, under cover of dense thickets or wetland vegetation sometimes a short distance from cover. Males typically sing from exposed perches at moderate heights in shrubs, tall herbs, or low trees. The Song Sparrow nests in shrubs, thickets, emergent vegetation and small trees usually within 4 'of ground level. It will also nest on the ground hidden under low, dense vegetation, usually near water, in emergent vegetation, or in other moist sites. Nesting season usually begins in April. Breeding occurs in dense riparian thickets, emergent wetlands and other moist situations.

GREATER SANDHILL CRANE (*Grus canadensis*):⁴ This species is found in wetland habitats such as meadows, pastures, grain fields, bogs, fens, marshes and fields. There have been sightings in Kings Creek Meadow, Cameron Meadow, Spencer Meadow, Snag Lake, Horseshoe Lake, and Warner Valley in Lassen Volcanic National Park although no reproduction has been confirmed. Most sightings of this species are in the fall when they are seen flying over Lassen Volcanic National Park during migration.

LITTLE WILLOW FLYCATCHER (*Empidonax traillii brewsteri*):³ This species nests in dense willow thickets in montane meadows and along streams. Records indicate this species historically bred in Sulfur Creek Meadows and around Snag Lake in Lassen Volcanic National Park. This species is currently found in the Warner Valley area of the park where a breeding pair was discovered in 2004.

GREAT GRAY OWL (*Strix nebulosa*):³ The traditional range of *Strix nebulosa* is from Plumas County south through the Sierra Nevada range although individuals have been found in northwestern California and the Warner Mountains. The Great Gray Owl breeds in old growth red fir, mixed conifer or lodge pole pine habitats normally in the vicinity of wet meadows. This owl uses small trees and snags within wet meadows or at their edges. Nesting occurs in broken topped snags 24" in diameter and greater. Peak egg laying period is generally from March through May.

SHORT EARED OWL (*Asio flammeus*):⁷ Short-eared Owls inhabit open spaces such as grasslands, prairie, agricultural fields, mountain meadows and alpine tundra. Nests are located on ridges and mounds within dry sites supporting vegetation that conceal incubating females. Suitable nesting habitat is characterized by herbaceous vegetation that is tall and dense enough to conceal incubating females and for daytime cover. Breeding habitat must have sufficient ground cover to conceal nests and nearby sources of small mammals for food. Communal roosts occur in old growth fields, along thick hedgerows, in overgrown rubble in abandoned fields or in clumps of dense conifers. These owls tend to roost in trees only when snow covers the ground. Foraging habitat is similar to nesting habitat and includes grasslands, prairies, marshlands and seasonal wetlands. Although communal roosts occur in clumps of dense conifers, optimal habitat requires numerous open areas. Breeding habitat must have sufficient ground cover to provide sources of small mammals for food.

LOGGERHEAD SHRIKE: (*Lanius ludovicianus*):^{1,7} Shrikes require open land with lookout perches for hunting, preferring areas with short vegetation such as pastures, lawns and freshly-plowed fields. Preference is also given to sites with a variety of vegetation types and land uses. *Lanius ludovicianus* nests in dense, brushy vegetation either in hedgerows or isolated trees adjacent to feeding areas and roadsides. The amount of cover provided is more important than the type of plant in terms of nest site criterion. The nest is usually well hidden and located on top of an existing nest.

NORTHERN GOSHAWK (Accipiter gentilis):^{7, 13} *Accipiter gentilis* occupies dense middle and high elevation old growth conifer forests. The species nests near riparian areas and open meadows containing water and that are interspersed within the densest portions of forested areas. It also utilizes large live trees with diameters of 11” and greater for nesting and breeding sites during the period of April through mid June.

OLIVE-SIDED FLYCATCHER: (Contopus cooperi):⁷ This species is a summer resident in a wide variety of forest and woodland habitats below 9,000’ throughout California. It is most numerous in montane conifer forests where tall trees overlook canyons, meadows, lakes or other open terrain. Preferred nesting habitats include mixed conifer, montane hardwood-conifer, Douglas-fir, red fir, and Lodgepole pine forests. This species feeds on flying insects over forest canopy or adjacent meadows, clearings, or shrub-covered slopes. *Contopus cooperi* requires large, tall trees for nesting, roosting sites, singing posts and hunting perches. Nests are most often created in an open cup of grasses, mosses, lichens, rootlets, or pine needles placed in a conifer 5’-70’ above ground on a horizontal limb. The species peak egg laying period is in June.

PEREGRINE FALCON (Falco peregrinus):⁸ This fully protected species requires riparian areas and wetlands near cliff ledges that are typically used for cover breeding and nesting purposes. *Falco peregrinus* also requires large tree snags for perches. This species' breeding period is from March to late August.

PRAIRE FALCON (Falco mexicanus): *DFG Watch List, USFWS Birds of Conservation Concern* The Prairie Falcon has a body length of 15 - 20 inches, a 3 ½ foot wingspan, and weighs 1 - 2 pounds. This species inhabit hills, canyons, and mountains of arid grasslands and shrub-steppes throughout the Western United States. The primary food of Prairie Falcons is small mammals, especially ground squirrels. They will however hunt birds, reptiles and insects. *Falco mexicanus* actively searches for prey during flight, catching prey on or close to the ground after a low angled swoop from above. Typically, Prairie Falcons nest on a cliff face using a ledge, cavity, crevice or an abandoned nest of eagles, hawks or ravens. Prairie Falcons lay 3 - 6 eggs with an incubation time of about 34 days. Young falcons leave the nest 5 - 6 weeks after hatching

PURPLE MARTIN (Progne subis):⁷ The Purple Martin is a summer resident in a variety of wooded, low-elevation habitats including valley foothill and montane hardwood along with valley foothill and montane hardwood-conifer. Coniferous habitats, such as Ponderosa pine and Douglas-fir are also used along with riparian areas. This species inhabits open forests, woodlands and riparian areas during its breeding season. *Progne subis* often nests in tall, old trees near water bodies or in old woodpecker cavities. Nests are also found in tall, old, isolated trees or in open old-growth, multi-layered, forests containing snags. The Purple Martin forages over riparian areas and woodlands. It nests from April into August with peak activity in June.

RUFOUS-CROWNED SPARROW (*Aimophila ruficeps*):⁷ A common resident of sparse mixed chaparral, this species frequents steep, often rocky hillsides with grass and forb patches as well as grassy slopes without shrubs, if rock outcrops are present. *Aimophila ruficeps* ground forages in herbage and in litter beneath shrubs and live oak stands. Nests are built on the ground concealed at the base of grass tussocks, shrubs or occasionally in a large shrub. The species breeds from mid-March to mid-June with a peak in May.

RUFOUS HUMMINGBIRD (*Selasphorus rufus*): *USFWS Birds of Conservation Concern* This species of hummingbird generally prefers cool environments having habitat such as secondary succession communities and openings as well as forested and brushy habitats. It typically nests in second growth and mature forests. *Selasphorus rufus* is found within Lassen Volcanic National Park during its spring and fall migration, most often in open meadow areas where they forage on wildflower nectar.

SPOTTED TOWHEE (*Pipilo crissalis*): ⁷**CALIFORNIA TOWHEE (*Pipilo crissalis Vigors*):**^{2,3} The Spotted Towhee and the California Towhee live in chaparral and other tangled, shrubby, and dry habitats at elevations ranging from 2,680' to 6,200'. California Towhees hop or run on the ground but tend to stay close to the protection of low shrubs and trees. The towhee breeds in relatively small and sometimes isolated patches of dense thickets of willows along stream sides, springs and seeps. Foraging normally occurs in adjacent arid uplands.

VAUX'S SWIFT (*Chaetura vauxi*): ⁷ *DFG Species of Special Concern* The Vaux Swift requires hollow trees and snags for nesting and roosting. It shows an apparent preference for foraging over rivers and lakes. This species has been documented in Lassen Volcanic National Park.

WILLOW FLYCATCHER (*Empidonax traillii*):^{1, 3, 12} Willow flycatcher breeding habitat occurs within and adjacent to forested habitats. The species has historically nested throughout much of California where mesic willow thickets are found. *Empidonax traillii* has specific habitat requirements typically consisting of riparian habitat often dominated by willows (*salix* spp), and/or alder (*Alnus* spp). In addition, permanent water, often in the form of low gradient watercourses, ponds, lakes, wet meadows, marshes, and seeps within and adjacent to forested landscapes are also required elements of its habitat. Loss, fragmentation and modification of riparian breeding habitat are thought to have resulted in a decline of Willow Flycatcher numbers. Large scale losses of wetlands have occurred, especially those associated with riverine systems in both valley and montane habitats.

YELLOW WARBLER (*Dendroica petechia*):⁷ Yellow Warblers generally occupy riparian vegetation along streams and in wet meadows. Throughout these areas they are found in willows, cottonwoods and other species of riparian shrubs or trees. Yellow Warblers also breed in xeric montane shrub fields and occasionally in the shrubby understory of mixed-conifer forest. This species appears to adapt its foraging

to variation in local vegetation structure. Its diet consists largely of animal matter including ants, bees, wasps, caterpillars, beetles, true bugs, flies, and spiders.

YELLOW-BRESTED CHAT (*Icteria virens*):⁷ Nesting Yellow-breasted Chats occupy early successional riparian habitats with a well-developed shrub layer and an open canopy. Vegetation structure rather than age appears to be the important factor in nest-site selection. Nesting habitat is usually restricted to the narrow border of streams, creeks, sloughs and rivers and seldom forms extensive tracts. Blackberry (*Rubus* spp.), wild grape (*Vitis* spp.), willow, and other plants that form dense thickets and tangles are frequently selected as nesting strata. The nest is typically placed within 3' of the ground but may be placed within trees 7' or taller. Cottonwoods (*Populus* spp.) and alders (*Alnus* spp.), are often used as song perches. Adult chats feed predominantly on insects, spiders, wild fruits and berries. Adults feed nestlings primarily soft-bodied insects (orthopterans and larval lepidopterans).

Insects

VALLEY ELDERBERRY LONGHORN BEETLE (*Desmocerus californicus dimorphus*):² *Desmocerus californicus dimorphus* (VELB) is endemic to California and occurs below 2,900' in elevation. The Valley Elderberry Longhorn Beetle is listed as federally threatened although it is likely to be de-listed. It ranges in the Central Valley from Redding to Bakersfield. The species is nearly always found on or close to its host plant, elderberry (*Sambucus* species). Although elderberry occasionally occurs outside riparian areas, those supporting the greatest beetle densities are generally located in areas where the shrub is abundant and interspersed among dense riparian forest species, including Fremont cottonwood (*Populus fremontii*), box elder (*Acer negundo*), California sycamore (*Platanus racemosa*), California walnut (*Juglans californica*), white alder (*Alnus rhombifolia*), willow (*Salix* spp.), button willow (*Cephalanthus occidentalis*), Oregon ash (*Fraxinus latifolia*), wild grape (*Vitis californica*), California hibiscus (*Hibiscus californica*), and poison oak (*Toxicodendron diversilobum*). Habitat occupied by VELB tends to form and exist in riparian corridors and on the level open areas of periodically flooded river and stream terraces and floodplains. This geomorphic setting has historically been desirable for agricultural, urban, or industrial development. As a result, a considerable amount of VELB habitat has been converted for use as developable land. Non-native invasive plant species such as black locust (*Robinia pseudoacacia*), giant reed (*Arundo donax*), red sesbania (*Sesbania punicea*), Himalaya blackberry (*Rubus armeniacus*), tree of heaven (*Ailanthus altissima*), Spanish broom (*Spartium junceum*), Russian olive (*Eleagnus angustifolia*), edible fig (*Ficus carica*), and Chinese tallowtree (*Sapium sebiferum*), may have significant indirect impacts on VELB by impacting elderberry shrub vigor and recruitment. It is also predicted that ripgut brome (*Bromus diandrus*), foxtail barley (*Hordeum murinum*), *Lolium multiflorum*, and yellow star thistle (*Centaurea solstitialis*) may increase seedling mortality through competition for light and water or through increased fire return intervals.

Isolated elderberry shrubs separated from contiguous habitat are not typically considered to provide viable habitat for VELB. Potential VELB habitat is defined as stands of elderberry shrubs that are adjacent to or contiguous with, riparian forest, floodplains, or relict elderberry savannah. Adults are

active from March to June, feeding and mating. Females lay their eggs on the bark. Larvae hatch and burrow into the stems. The larval stage may last 2 years, after which the larvae enter the pupal stage and transform into adults. Adults have been observed feeding on the leafy foliage of the elderberry plant. It appears that in order to serve as habitat, the shrubs must have stems that are 1.0 inch or greater in diameter at ground level. Use of the plants by the Beetle is rarely apparent. Frequently, the only exterior evidence of the shrub's use is an exit hole, a small oval created by the larva just before the pupal stage.

Fish

CENTRAL VALLEY SPRING RUN CHINOOK SALMON (*Oncorhynchus tshawytscha*) and Steelhead trout (*Oncorhynchus mykiss irideus*): Central Valley Spring-Run Chinook Salmon, as shown on the CNDDDB is listed as a State and Federal Threatened Species. Per the National Marine Fisheries Service's "*Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead. Sacramento Protected Resources Division*" dated October 2009; *Oncorhynchus mykiss irideus* is present in Battle Creek and has had an historical presence in this stream. In addition, Battle Creek has been determined to be a location warranting restoration of steelhead. Four runs of Chinook salmon are found in the Sacramento River as it passes through the planning area including a winter run (peak run in March); spring run (peak run in July); fall run (peak run in October); and late fall run (peak run in December). The Sacramento River is also home to hatchery-origin steelhead rearing in the river throughout the year.

Amphibians

CALIFORNIA NEWT (*Taricha torosa*):⁷ The California Newt can be found in Northern California from sea level to above 6,000 feet. This population lives in moist forests as a terrestrial, non-breeding *eft*. They can also be found in aquatic zones as a breeding aquatic *newt*. During the late summer and fall months, this species has a terrestrial existence, hiding under logs and in rock crevices. After the first winter rains, the terrestrial *efts* will migrate to water for breeding. Once in the water, they will transform into an aquatic newt utilizing small and large pools. The California Newt is somewhat resistant to predation due to their toxicity.

CALIFORNIA RED LEGGED FROG (*Rana aurora draytonii*):⁷ The California Red Legged Frog is highly aquatic with little movement away from streamside habitat during the dry season. Individuals found in interior areas of California tend to hibernate in burrows during winter months as well as for temporary retreat during periods of activity. It inhabits elevations from sea level to about 5,000 feet. Nearly all of its known occurrences are from below 3,500 feet. California Red Legged Frogs spend most of their lives in and near sheltered backwaters of ponds, marshes, springs, streams and reservoirs with

dense stands of overhanging willows and an intermixed fringe of cattails as such areas are considered optimal habitat.

FOOTHILL YELLOW LEGGED FROG (*Rana boylil*):^{7, 11, 12} This aquatic species requires shallow, flowing water found in small to moderate-sized streams with at least some cobble-sized substrate. Such habitat is best suited to oviposition and in providing significant refuge habitat for larvae and postmetamorphs. Foothill yellow-legged frogs are infrequent or absent in those habitats where introduced aquatic predators such as fishes and bullfrogs are found.

CASCADES FROG (*Rana cascadae*):⁷ In California, Cascades frog distribution is associated with montane and sub-alpine landscapes and inhabit lakes and meadows. Numerous amphibian studies have shown this species to be declining throughout the Cascade and Sierra Nevada ranges. Sightings of the frog have been made inside Lassen Volcanic National Park. *Rana cascadae* occupies aquatic and riparian habitats within mountain meadows, streams, ponds and lakes located above 3,000' in a highly fragmented "island" distribution. The Cascade Frog has a breeding period of May to August.

PACIFIC TAILED FROG (*Ascaphus truei*):⁴ The Pacific Tailed Frog is classified as a California Species of Special Concern in the upper Sacramento River system. *A. truei* normally consists of permanent streams having relatively low water temperatures. Intermittent streams are most often found to provide unsuitable habitat for this species. Tailed frogs are most often found in forested assemblages dominated by old growth stands of Douglas fir, redwood, Ponderosa pine and western hemlock which possess the habitat structure most likely to create the low temperature and clear water conditions required by this species.

SHASTA CRAYFISH (*Pacifastacus fortis*):^{1,2} This species has only been identified in Shasta County at lower elevation waters outside of Lassen Volcanic National Park. There they inhabit cool, clear, spring-fed lakes, rivers and streams. Most individuals are found in still, moderately flowing waters.

CONSERVANCY FAIRY SHRIMP (*Branchinecta conservation*):¹ This species is found in vernal pools within the Central Valley of California. A number of these pools are found within the Battle Creek Watershed on plateaus north of State Route 36E and along Manton Road.

VERNAL POOL FAIRY SHRIMP (*Branchinecta lynchi*):² *Branchinecta lynchi* is listed as a Federally Threatened species throughout its range. This species inhabits vernal pools or similar ephemeral wetlands and grassed or mud bottomed pools or basalt flow depression pools in unplowed grasslands which are found within the mid and lower portions of the Battle Creek watershed. Although it occurs most often in vernal pools it also inhabits a variety of natural and artificial seasonal wetland habitats, such as alkali

pools, ephemeral drainages, stock ponds, roadside ditches, vernal swales and rock outcrop pools. Regardless of the habitat, the wetlands in which this species is found are normally small and shallow; however it occasionally inhabits large (479,000 sq ft) and deep (4") habitats. The pools vary in size from over 25 acres to less than 1,000 square feet. It occurs at temperatures between 6 and 20 degrees C in soft and poorly buffered waters. Eggs are dropped from the brooding female to the benthos. The eggs hatch when the vernal pools and swales fill with rainwater and the immature stages rapidly develop into adults which have been collected from early December to early May.

VERNAL POOL TADPOLE SHRIMP (*Lepidurus packardii*)² This large tadpole shrimp is listed as Endangered and is found in a variety of natural and artificial, seasonally ponded habitat types including, vernal pools, swales, ephemeral drainages, stock ponds, reservoirs, ditches, backhoe pits and ruts caused by vehicular activities. Like the fairy shrimp, wetland habitat in which this species can be found vary in size from very small to very large and exhibit extremes in depth and volume. Adults are omnivorous, foraging on detritus, vegetation and other aquatic invertebrates when available. Early instar stages are most likely obligate filter feeders which later increase active prey consumption.

NORTHWESTERN POND TURTLE (*Clemmys marmorata marmorata*):^{7,11,12} This species uses slow streams, ponds, lakes, wetlands and associated uplands from sea level to 6,000 feet. The Northwest Pond Turtle has been documented historically in Lassen Volcanic National Park within the Manzanita Lake, and Reflection Lake areas.

WESTERN POND TURTLE (*Actinemys mamorata*):^{7, 11, 12} The Western Pond Turtle is listed as a Species of Special Concern throughout Northern California. This species require some slack or slow water aquatic habitat and as a result is uncommon within high gradient streams. The steepness of steam gradients within a significant portion of the Battle Creek watershed result in water temperatures, current velocities, and food source limitations which reduce the species local distribution. Appropriate habitat can be found within the mid and lower elevation portions of the watershed. Habitat quality seems to vary with the availability of aerial and aquatic basking sites. Hatchlings (i.e. individuals through their first year of activity) require shallow water habitat with relatively dense submergent or short emergent vegetation in which to forage. Western Pond Turtles also require an upland oviposition site in the vicinity of the aquatic site. Suitable oviposition sites must have the proper thermal and hydric environment for incubation of the eggs.

WESTERN SPADEFOOT TOAD (*Spea hammondi*):⁷ Western spadefoot toads require two distinct habitat components to complete their life cycle and these normally need to be in close proximity. Included are aquatic habitat for breeding and a terrestrial habitat for feeding and estivation. Western spadefoot toads are mostly terrestrial using upland habitats to feed and burrow in for their long dry-season dormancy. Current research on amphibian conservation suggests that average terrestrial habitat use is within 368 meters (1,207 feet) of aquatic habitats. Western spadefoot toads lay their eggs in a variety of permanent and temporary wetlands including rivers, creeks, pools in intermittent streams, vernal pools,

and temporary rain pools as well as stock ponds. This species reproduces in water when temperatures are between (48°F and 86°F) and water must be present for more than three weeks for metamorphosis to be completed. Optimal habitat used for reproduction must be free of native and nonnative predators such as fishes, bullfrogs, and crayfishes. Western spadefoot toads select areas with sandy or gravelly soil with open vegetation and short grasses. Examples of vegetation communities where this species may occur include valley and foothill grasslands, open chaparral and pine-oak woodlands.

Reptiles

CALIFORNIA MOUNTAIN KING SNAKE (*Lampropeltis zonata*):^{7, 12} California Mountain Kingsnakes are found within mountainous areas throughout their range. This snake inhabits moist woods from sea level to extremely high elevations. In the southern portion of their range, the Kingsnake prefers coniferous forests and woodlands above 3,000 feet. This species appears to prefer rocky areas but also is found beneath logs and under bark. *Lampropeltis zonata* prefers southwestern facing slopes and often retreats under rocks. It will eat lizards, snakes, birds and their eggs along with small mammals. Eggs are laid in June and July.

COMMON GARTER SNAKE (*Thamnophis sirtalis*):^{1,3,5,7} The Common Garter Snakes is very widespread, highly adaptable and can survive extreme environmental conditions. They are found in a wide variety of habitats, including meadows, marshes, woodlands, and hillsides. They tend to prefer moist, grassy environments and are often found near water such as near the edges of ponds, lakes, and streams. These snakes begin mating in the spring as soon as they emerge from hibernation. Gestation is usually two to three months. Most females in the northern part of their range give birth to from 4 to 80 young between late July and October

GOPHER SNAKE (*Pituophis catenifer*):⁷ Gopher Snakes emerge in late March or early April and are typically one of the first snakes to be found active away from overwintering sites. Young start to appear in late August or early September. Activity continues into late October depending on location and weather conditions. Gopher Snakes are primarily a species of dry habitat types such as Ponderosa pine forests. They spend a great deal of time below the surface in animal burrows and often utilize roads and other open areas for basking in the late afternoon and early evening.

STRIPED RACER (*Masticophis lateralis*):^{2, 4} The Striped Racer also known as the California whipsnake is found the length of the Sierra Nevada as well as the Southern portion of the Cascades. It is also found within the northern portion of the Central Valley. This specie's habitat elevation ranges from sea level to 6,020'. Preferred habitats include mixed chaparral, chemise-redshank chaparral, valley-foothill riparian, valley-foothill hardwood and hardwood-conifer along with various coniferous habitats. It forages actively on the surface and occasionally climbs in shrubby vegetation or small trees. During periods of inactivity individuals seek cover under surface objects or in crevices of rock outcrops.

Masticophis lateralis prefers open-canopy stands with woody debris and rock outcrops on south facing slopes.

RUBBER BOA (*Charina bottae*):^{4, 12} The Rubber Boa occurs throughout California at elevations ranging from sea level to 9,040'. The species is found in a variety of montane forest habitats including Ponderosa pine, hardwood, hardwood-conifer, Douglas fir, mixed conifer and riparian, montane chaparral as well as wet meadow habitats. It is usually found in the vicinity of streams, wet meadows or within or under surface objects with good moisture-retaining properties such as rotting logs. Young are born in loose, well aerated soil, under surface objects, or within rotting logs. Breeding occurs from April to June. Young are born alive from late summer to late November.

Plants

BIG-SCALE BALSAMROOT (*Balsamorhiza macrolepis* var. *macrolepis*):^{1b.2} This species of balsamroot has a Heritage Rank of G3G4T2/S2.2 and a Rare Plant Rank of 1B.2. The plant is found generally within grasslands and foothill woodlands. It occurs within various land cover types including purple needle grass grasslands, serpentine bunchgrass grasslands, mixed serpentine chaparral, mixed oak woodlands and forests along with ponderosa pine forests and woodlands between 150 feet and 4,500 feet in elevation.

BOGGS LAKE HEDGE-HYSSOP (*Gratiola heterosepala*):^{3,1B.2} Boggs Lake hedge-hyssop is an annual herb belonging to the figwort family. Its preferred habitat includes vernal pools, reservoir edges, and other muddy clay soils. It is threatened by agriculture, urban development, vehicles, grazing and trampling. The range of Boggs Lake hedge-hyssop includes the Sacramento Valley, the central Sierra Nevada foothills, the interior North Coast Range, the Modoc Plateau, and southern Oregon. It is a very small herb with a main stem 1 to 4 inches tall. The flower is tubular with five lobes. The upper three are white and separated while the lower two are yellow and fused.

BROAD-NERVED HUMP MOSS (*Meesia uliginosa*):^{2.2} *Meesia uliginosa* is strongly tied to montane fens within the Sierra Nevada bioregion usually at elevations between 5,900 to 9,200 feet. The vast majority of the California occurrences are found in sites that meet the definition of a fen.

BUTTE COUNTY FRITILLARY (*Fritillaria eastwoodiae*):^{3.2} This plant is currently a California Rare Plant Rank List 3. Evidence to date suggests that this is a local endemic with limited habitat occurrences.

CASCADE ALPINE CAMPION (*Silene suksdorfii*):^{2,3} *Silene suksdorfii* is a member of the Caryophyllaceae family of which there are approximately 500 species of varying habits with characteristic five petalled flowers and the greatly inflated calyces. It grows in full sun in a well drained medium on the open rocks. It is found in alpine zones of the Cascade Mountains.

CRYPTANTHA CRINITA (*Silky crypantha*):^{1B,2} In addition to alluvial soils of ephemeral creek beds or permanent creek banks on the valley floor, Silky crypantha is found above 3,000' in upland habitats of open gray pine and blue oak woodland coupled with montane chaparral habitat.

GOLDEN ALPINE DRABA (*Draba Aureola*):^{1B,3} *Draba Aureola* is found on scree and talus consisting of volcanic substrates at elevations ranging from 6,000' to 6,500'.

HALL'S RUPERTIA (*Rupertia Hallii*):^{1B,2} This somewhat endangered species is found in oak woodlands and lower mountain coniferous forests having gentle slopes and woodland openings. The species can sometimes be found within disturbed sites such as roadsides and timber harvest areas.

LITTLE HULSEA (*Hulsea nana*):^{2,3} Little Hulsea is a species of flowering plant in the daisy family also know by the common name dwarf alpinegold. It is native to western North America from Washington to northern California, where it grows in the talus of volcanic mountains and plateaus. This is a compact perennial herb producing clumps of hairy foliage and stout stems up to 20 centimeters tall. The leaves are 2 to 6 centimeters long and have lobed edges and many glandular hairs. The stem usually bears a single robust flower head with layers of hairy to woolly phyllaries. The center of the head is packed with golden disc florets and the circumference is lined with golden ray florets each about a centimeter long.

OBTUSE STARWORT (*Stellaria obtusa*):^{4,3} This perennial rhizomatous herb is found on mesic sites and along shaded edges of creeks or on talus slopes within Lower montaine coniferous forests, Upper mountain coniferous forests and Riparian woodlands at elevations ranging between 4,920' and 7,000' feet. It grows in a prostrate manner and the plants blooming period is between May and early September.

LASSEN PEAK COPPER MOSS (*Haplodontium Tehamense*):^{1B,3} This species is endemic to Lassen Peak, Lassen Volcanic National Park and the area immediately surrounding the park's boundaries.

LASSEN PEAK SMELOWSKIA (*Smelowskia Ovalis Congesta*):^{1B,2} Lassen Peak Smelowskia is found on scree and talus consisting of volcanic substrates at elevations ranging from 8,000' to 10,500'.

LONG-STIPED CAMPION (*Silene Occidentalis Longistipitata*)^{1B.2} This perennial herb species grows in chaparral and conifer forest habitats.

MINGAN MOONWORT (*Botrychium minganense*):^{2.2} The habitat of *B. minganense* varies widely from dense forests to open meadow and from summer-dry meadows to permanently saturated fens and seeps. When growing in meadows, plants may stand in open sun or under dense herbaceous cover. The species is often found in association with old (>10 year) disturbances such as logging roads and road shoulders. It may be locally abundant and sometimes is the only moonwort present at a particular site. It sometimes occurs with other *Botrychium* species as scattered individuals.

NODDING VANILLA GRASS (*Hierochloa odorata*)^{2.3} This widely distributed grass grows in undisturbed clay and mucky soils that are neutral to slightly alkaline. The plant requires constant and high moisture supply. These types of sites are found in meadows at higher elevations of the Battle Creek watershed especially within Lassen Volcanic National Park.

NORTHERN SPLEENWORT (*Asplenium septentrionale*)^{2.3} This species of fern is also known by the common name of forked spleenwort. It is native to western North America, Europe, and Asia, where it grows in rocky areas. *Asplenium septentrionale* grows in tufts from rock cracks and looks very much like a grass. It has flat leaves which may be simple or forked and are green in color, sometimes with reddish tinting at its base.

PYROLA-LEAVED BUCKWHEAT (*Eriogonum pyrolifolium* var. *pyrolifolium*)^{2.3} This small woody, low growing perennial blooms in late summer and can reach a maximum height and width of about 20 centimeters including its inflorescence. Clusters of flowers appear on stalks which may be erect or bend to the ground. The species is found in rocky outcrops, pumice and sand ridges at subalpine and alpine elevations throughout the Cascade Range.

RAYLESS MOUNTAIN RAGWORT (*Packera Indecora*):^{2.2} Rayless mountain ragwort inhabits rocky or gravelly areas as well as high, wooded ridges, thicket margins or swamps where they are associated with alder. The species also grows in the humus-filled crevices of basaltic outcrops as well as old disturbance opening or meadows on hummocky sites in fibrous organic soil.

SCALLOPED MOONWORT (*Botrychium crenulatum*):^{2.2} *Botrychium crenulatum* is one of the most hydrophyllic of *Botrychiums*. It usually grows in saturated soils of seeps and along the stabilized margins of small streams, often among dense herbaceous vegetation. It also occurs occasionally in seasonally wet

roadside ditches and drainage ways. This species is usually found in partly shaded to heavily shaded sites at mid to high elevations.

UPSWEPT MOONWORT (*Botrychium ascendens*):^{2,3} This perennial fern is found on moist soils near spring head areas, aquatic sites and wetlands at elevations ranging from 8,890' to 11,550'.

RED BLUFF DWARF RUSH (*Juncus leiospermus* var. *leiospermus*):^{1B,1} Red Bluff dwarf rush is a California endemic annual herb that inhabits the edges of vernal pools in valley grasslands, chaparral and foothill woodlands. This species of rush is threatened by development, grazing, vehicles, industrial forestry and agricultural conversion. It usually grows to 3 inches tall, often turning reddish-brown upon maturity.

SLENDER ORCUTT GRASS (*Orcuttia tenuis*):^{1, 3,1B,1} Slender orcutt grass is a California endemic annual herb inhabiting vernal pools and other moist areas with clay soils in valley grasslands, coniferous forests or sagebrush scrub. This annual grass is threatened by agriculture, residential development, grazing, vehicles, recreational activities, logging, fire, trampling, and non-native plants. Slender orcutt grass is found in the Cascades, Sierra Nevada foothills, inner North Coast Ranges, and Modoc Plateau between 100 and 5,700 feet in elevation. This annual grass is covered with sticky, aromatic secretions with a tuft of short basal leaves. The total height is usually from 3 to 6 inches tall.

SNOW FLEABANE DAISY (*Erigeron nivalis*):^{2,3} This biennial, perennial herb grows in volcanic rocks and meadows within the Cascade Range at elevations ranging between 8,858' to 9,514'.

SQUARESTEM PHLOX (*Phlox muscoides*):^{2,3} A perennial herb, Squarestem Phlox is found in open rocky areas throughout the Cascade Range at elevations between 4,590' to 8,850'.

TALIS COLLOMIA (*Collomia Larsenii*):^{2,2} Talus Collomia grows in high exposed mountainside talus. It is a perennial herb forming a clump in volcanic rocks.

WESTERN GOBLIN (*Botrychium montanum*):^{2,1} USDA Forest Service and Bureau of Land Management note that *Botrychium montanum* is most closely associated with old growth timber stands. In general it occurs in dark coniferous forests, usually near swamps and streams from 3,300' to 9,800' in elevation.

WOOLLY MEADOWFOAM (*Limnanthes floccosa* ssp. *floccosa*):^{4.2} The California Natural Diversity Data reports *Limnanthes floccosa* ssp. *floccosa* as having a Heritage Rank of G4T4/S3.2 and a Rare Plant Rank of 4.2(Limited distribution Watch List). This fairly endangered California species is found near the wet inner edges of vernal pools found in several locations within the Battle Creek watershed.

Appendix C

Herbicide Use Protocols and Best Management Practices

Herbicide Storage

Herbicide storage facilities should be locked, fireproofed, ventilated, and have proper warning signs posted. Herbicides should be stored separately from all other substances. In addition, each type of herbicide should be stored on separate shelves. Any structure used for storage of herbicides should be posted, and copies of labels, material safety data sheets (MSDS), and inventories should be kept in a locked container outside the storage facility.

Disposal of Herbicides

Only the amount of herbicide required for the treatment area should be mixed to limit the amount of excess herbicide generated during treatment. Small remaining quantities of mixed herbicides and any rinsate from the container or spray equipment could be applied to the treatment area. If herbicides cannot be disposed of in this manner, they should be disposed of according to state laws and regulations.

Herbicide Safety

Procedures for handling herbicides are provided on the herbicide label, and these directions should be followed. Unless the label specifies otherwise, applicators should wear protective goggles or face shields, rubber or neoprene gloves, an impervious cap with a brim and drip guard, long pants, a long-sleeved shirt, and rubber boots during mixing, loading, application, and cleanup. Depending on the formulation of the herbicide, the applicator should use a respirator approved for the type of herbicide being applied. Mixers and loaders should take the additional precaution of wearing an impervious apron. Decontamination kits should be readily available and should include two one-gallon (or more) containers filled with potable water, eyewash kits or eyewash bottles with buffered isotonic eyewash, hand or body soap, paper or other disposable towels, a full Tyvek coverall with foot covers, and a map and directions to the nearest medical facility. Whenever possible, those who apply herbicides should have access (within 15 minutes travel time or at the nearest vehicle access point, whichever is closest) to an eyewash kit and either (a) a shower or large sink or (b) emergency decontamination and first aid kits. When spraying liquids overhead, sleeves should be tucked inside the gloves, and pants should never be tucked inside of rubber boots. Herbicide application equipment should never be worn home or washed in home laundry facilities. Herbicides should never be transported inside the cab or passenger compartment of a vehicle; rather, they should be removed or placed in containers and should never be stored in containers used for food preparation or other food service purposes. Copies of the label and MSDS's should be at the site where herbicides are being applied.

In addition to the safety of the applicator and related personnel, safety of surrounding residents and others in the area not involved with the application of herbicides should be considered. Many herbicide labels specify the re-entry interval or minimum periods before unprotected individuals may enter treated areas or that treated areas should be posted. If the label specifies a reentry period, treated areas should be posted

with signs warning visitors and others not to enter the treated area. The signs should indicate that the area has been treated with an herbicide, what materials were used, and the name and telephone number of a contact person.

Respirator Use

Respirators should meet the standards set by NIOSH and MSHA and be assigned to individual workers for their exclusive use.

Work Area Surveillance

Surveillance of conditions in the work area should be maintained. Look for the degree of employee exposure and stress as well as the combination of work rates, environmental conditions, and physiological burdens of wearing respirators. Changes in operating procedures, temperature, air movement, humidity, and work practices may influence the concentration of a substance in the work area atmosphere. These factors require monitoring of the contaminant concentration. Testing should continue to assure that contaminant exposure has not risen above the maximum protective capability of the respirators. These tests should include personal and area air sampling.

Certified Applicators

Only individuals who are certified/licensed by state and/or local regulations should apply herbicides.

Handling

Herbicide containers and related equipment should be stored in a secure containment area away from people, animals, and food. Containers should be stored closed and inspected periodically. Hazardous waste should be labeled appropriately and include accumulation start dates. The point(s) of contact and threshold size for spills that should be reported shall be verified in advance with the appropriate local agency. This information and other emergency related information should be provided to all applicators and initial responders through a written contingency plan. Directions and contact numbers of the nearest emergency medical treatment facility should be provided to all applicators.

Operating Procedures

All personnel involved in chemical applications should have in their possession a radio, first aid kit, and spill response and decontamination kit. Remove clothing that is contaminated after a spill. Protective clothing and equipment shall be decontaminated, cleaned, laundered, maintained, or replaced as needed to maintain their effectiveness. If personnel clothing becomes wetted with hazardous substances, it should be removed immediately, and the individual should proceed to a shower or a decontamination kit, whichever is closest.

Adequate amounts of water should be consumed to prevent dehydration during hot weather. If personnel experience respiratory difficulties and/or fatigue, they should immediately stop work.

Extreme caution should be taken when handling herbicides. Never open a container at eye level. Never eat, drink, smoke, or use smokeless tobacco when handling herbicides, and wash immediately if contact with an herbicide is made as some formulations can cause irritation, blisters, blindness, and death.

Prior to moving or transporting any container, they should be inspected for leaks. Transport herbicide containers in an upright and secured position to prevent spillage and in the bed of a truck or other off road vehicle, not in the cab. Unless containers can be completely secured (including backpack sprayers containing mixtures), do not use ATVs to transport chemicals.

Read the label for correct application instructions. The application unit should be properly calibrated to deliver the correct amount of product per unit of area. All precautions should be taken to deliver herbicide to only the target species. In order to prevent or reduce drift, the spray boom should be at the lowest setting that will still produce a good pattern. A drift control agent can be added to the herbicide mix.

Keep all pets, people, and livestock away from the area being treated. Do not allow anyone to enter the treated area during the restricted entry interval, which varies based on the herbicide.

Equipment should be rinsed thoroughly following use. Spray tips and strainers should be rinsed and residue removed. Always triple rinse all glass, plastic, and metal herbicide containers. Each time a container is rinsed, it should be one-third full of water before shaking.

Always store herbicides in the original container inside a locked herbicide area. Store any unused portions of herbicides mixtures in a clearly marked and closed container. Include the accumulation start date on the label. Refer to the product label for the shelf life.

Read the label for disposal instructions. Improper disposal of excess herbicide, spray mixture, or rinsate is a violation of the Federal law.

Thoroughly wash any vehicles used in the transportation or application process.

Effectiveness of Application

Pesticides should be selected and Best Management Practices implemented to maximize the effectiveness of treatments on target plants and to minimize potential effects on non-target plants.

Reduced application rates of pesticides should be used wherever possible. Reduced application rates are often more effective than higher application rates because translocation is enhanced prior to loss of physiologic function. Higher rates may burn off leaves and reduce translocation.

Pesticides should be applied as near to the target plant as possible.

Pesticide application should account for meteorological factors such as wind speed, wind direction, inversions, humidity, and precipitation in relation to the presence of sensitive resources near the treatment

area and direction provided on labels. Pesticides should only be applied when meteorological conditions at the treatment site allow for complete and even coverage and prevent drifting of spray onto non-target sensitive resources or areas used by humans. Loss of spray from a treated area increases during high winds or low humidity. Pesticides should also not be applied during periods of dead calm (this could indicate an inversion) or when wind velocity and direction pose a risk of spray drift.

Pesticides should be applied using coarse sprays to minimize the potential for drift. Avoid combinations of pressure and nozzle type that would result in fine particles (mist). Add thickeners if the product label permits.

Pesticides should be applied at the appropriate time based on the pesticide's mode of action. Poor timing of application can reduce the effectiveness of pesticides and can increase the impact on non-target plants. Pesticides should be applied according to application rates specified on the product label.

Pesticides with high volatility should not be used to treat areas located adjacent to sensitive areas because of the potential for unwanted movement of pesticides to these areas.

As needed to protect the efficacy of the pesticide, water should be buffered depending on hardness, pH, and other factors.

Equipment should be maintained and calibrated prior to each application of pesticides. During all applications, droplet size should be controlled to decrease the risk of pesticide drift to non-target species outside the immediate treatment area. Droplet size is controlled by nozzle settings.

Protection of Cultural Resources

Areas that may contain cultural or historic resources and that have not been previously studied should be surveyed. If cultural or historic resources are identified or are known to occur, all surface disturbing activities should be avoided in these areas. (See Mitigation Measures discussed under "Project Related Environmental Analysis and Permitting.") Use of pesticides within the boundaries of the cultural resource or historic resource sites should be restricted. Due to unknown effects, pesticides should not be directly applied to historic structures with limestone grout, hearth features, or cultural resources comprised of organic material, bone, pollen, seeds, and materials made from plant fiber.

Protection of Ground and Surface Water

Pesticides with longer persistence should be applied at lower concentrations and with less frequency to limit the potential for accumulation of pesticides in soils.

In areas where there is the potential to affect surface water or ground water resources, pesticide pH and soil pH should be considered in order to select the pesticide with the lowest leaching potential.

Highly water-soluble pesticides should not be used in areas where there is the potential to affect surface water or ground water resources.

Pesticides with high soil retention should be used in areas where there is potential to affect surface water or ground water resources.

Only pesticides that are registered for use in or near water should be used in those areas.

Only those pesticides that have a low potential toxicity, such as glyphosate (Roundup Pro and Rodeo), should be used within areas near surface waters or in areas with a high leaching potential. Glyphosate is strongly adsorbed into soil, with little potential for leaching to ground water. Microbes in the soil readily and completely degrade it even in low temperatures. It tends to adhere to sediments when released to water and does not accumulate in aquatic life.

Applications of pesticides should be avoided during periods and in areas where seasonal precipitation or excess irrigation water is likely to wash residual pesticides into waterways.

Applications of pesticides within 50 feet of surface water bodies (including streams, rivers, lakes and waterways) should be done by hand equipment to minimize the potential impacts to surface waters.

Appendix E
Protocols for Surveying and Evaluating Impacts to
Special Status Native Plant Populations and Natural Communities

Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities

State of California
CALIFORNIA NATURAL RESOURCES AGENCY
Department of Fish and Game
November 24, 2009¹

INTRODUCTION AND PURPOSE

The conservation of special status native plants and their habitats, as well as natural communities, is integral to maintaining biological diversity. The purpose of these protocols is to facilitate a consistent and systematic approach to the survey and assessment of special status native plants and natural communities so that reliable information is produced and the potential of locating a special status plant species or natural community is maximized. They may also help those who prepare and review environmental documents determine when a botanical survey is needed, how field surveys may be conducted, what information to include in a survey report, and what qualifications to consider for surveyors. The protocols may help avoid delays caused when inadequate biological information is provided during the environmental review process; assist lead, trustee and responsible reviewing agencies to make an informed decision regarding the direct, indirect, and cumulative effects of a proposed development, activity, or action on special status native plants and natural communities; meet California Environmental Quality Act (CEQA)² requirements for adequate disclosure of potential impacts; and conserve public trust resources.

DEPARTMENT OF FISH AND GAME TRUSTEE AND RESPONSIBLE AGENCY MISSION

The mission of the Department of Fish and Game (DFG) is to manage California's diverse wildlife and native plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. DFG has jurisdiction over the conservation, protection, and management of wildlife, native plants, and habitat necessary to maintain biologically sustainable populations (Fish and Game Code §1802). DFG, as trustee agency under CEQA §15386, provides expertise in reviewing and commenting on environmental documents and makes protocols regarding potential negative impacts to those resources held in trust for the people of California.

Certain species are in danger of extinction because their habitats have been severely reduced in acreage, are threatened with destruction or adverse modification, or because of a combination of these and other factors. The California Endangered Species Act (CESA) provides additional protections for such species, including take prohibitions (Fish and Game Code §2050 *et seq.*). As a responsible agency, DFG has the authority to issue permits for the take of species listed under CESA if the take is incidental to an otherwise lawful activity; DFG has determined that the impacts of the take have been minimized and fully mitigated; and, the take would not jeopardize the continued existence of the species (Fish and Game Code §2081). Surveys are one of the preliminary steps to detect a listed or special status plant species or natural community that may be impacted significantly by a project.

DEFINITIONS

Botanical surveys provide information used to determine the potential environmental effects of proposed projects on all special status plants and natural communities as required by law (i.e., CEQA, CESA, and Federal Endangered Species Act (ESA)). Some key terms in this document appear in **bold font** for assistance in use of the document.

For the purposes of this document, **special status plants** include all plant species that meet one or more of the following criteria³:

¹ This document replaces the DFG document entitled "Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened and Endangered Plants and Natural Communities."

² <http://ceres.ca.gov/ceqa/>

³ Adapted from the East Alameda County Conservation Strategy available at http://www.fws.gov/sacramento/EACCS/Documents/080228_Species_Evaluation_EACCS.pdf

- Listed or proposed for listing as threatened or endangered under ESA or candidates for possible future listing as threatened or endangered under the ESA (50 CFR §17.12).
- Listed⁴ or candidates for listing by the State of California as threatened or endangered under CESA (Fish and Game Code §2050 *et seq.*). A species, subspecies, or variety of plant is **endangered** when the prospects of its survival and reproduction in the wild are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, over-exploitation, predation, competition, disease, or other factors (Fish and Game Code §2062). A plant is **threatened** when it is likely to become endangered in the foreseeable future in the absence of special protection and management measures (Fish and Game Code §2067).
- Listed as rare under the California Native Plant Protection Act (Fish and Game Code §1900 *et seq.*). A plant is **rare** when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens (Fish and Game Code §1901).
- Meet the definition of rare or endangered under CEQA §15380(b) and (d). Species that may meet the definition of rare or endangered include the following:
 - ♦ Species considered by the California Native Plant Society (CNPS) to be “rare, threatened or endangered in California” (Lists 1A, 1B and 2);
 - ♦ Species that may warrant consideration on the basis of local significance or recent biological information⁵;
 - ♦ Some species included on the California Natural Diversity Database’s (CNDDB) *Special Plants, Bryophytes, and Lichens List* (California Department of Fish and Game 2008)⁶.
- Considered a **locally significant species**, that is, a species that is not rare from a statewide perspective but is rare or uncommon in a local context such as within a county or region (CEQA §15125 (c)) or is so designated in local or regional plans, policies, or ordinances (CEQA Guidelines, Appendix G). Examples include a species at the outer limits of its known range or a species occurring on an uncommon soil type.

Special status natural communities are communities that are of limited distribution statewide or within a county or region and are often vulnerable to environmental effects of projects. These communities may or may not contain special status species or their habitat. The most current version of the Department’s *List of California Terrestrial Natural Communities*⁷ indicates which natural communities are of special status given the current state of the California classification.

Most types of wetlands and riparian communities are considered special status natural communities due to their limited distribution in California. These natural communities often contain special status plants such as those described above. These protocols may be used in conjunction with protocols formulated by other agencies, for example, those developed by the U.S. Army Corps of Engineers to delineate jurisdictional wetlands⁸ or by the U.S. Fish and Wildlife Service to survey for the presence of special status plants⁹.

⁴ Refer to current online published lists available at: <http://www.dfg.ca.gov/biogeodata>.

⁵ In general, CNPS List 3 plants (plants about which more information is needed) and List 4 plants (plants of limited distribution) may not warrant consideration under CEQA §15380. These plants may be included on special status plant lists such as those developed by counties where they would be addressed under CEQA §15380. List 3 plants may be analyzed under CEQA §15380 if sufficient information is available to assess potential impacts to such plants. Factors such as regional rarity vs. statewide rarity should be considered in determining whether cumulative impacts to a List 4 plant are significant even if individual project impacts are not. List 3 and 4 plants are also included in the California Natural Diversity Database’s (CNDDB) *Special Plants, Bryophytes, and Lichens List*. [Refer to the current online published list available at: <http://www.dfg.ca.gov/biogeodata>.] Data on Lists 3 and 4 plants should be submitted to CNDDB. Such data aids in determining or revising priority ranking.

⁶ Refer to current online published lists available at: <http://www.dfg.ca.gov/biogeodata>.

⁷ <http://www.dfg.ca.gov/biogeodata/vegcamp/pdfs/natcomlist.pdf>. The rare natural communities are asterisked on this list.

⁸ <http://www.wetlands.com/regs/tpge02e.htm>

⁹ U.S. Fish and Wildlife Service Survey Guidelines available at <http://www.fws.gov/sacramento/es/protocol.htm>

BOTANICAL SURVEYS

Conduct botanical surveys prior to the commencement of any activities that may modify vegetation, such as clearing, mowing, or ground-breaking activities. It is appropriate to conduct a botanical field survey when:

- Natural (or naturalized) vegetation occurs on the site, and it is unknown if special status plant species or natural communities occur on the site, and the project has the potential for direct or indirect effects on vegetation; or
- Special status plants or natural communities have historically been identified on the project site; or
- Special status plants or natural communities occur on sites with similar physical and biological properties as the project site.

SURVEY OBJECTIVES

Conduct field surveys in a manner which maximizes the likelihood of locating special status plant species or special status natural communities that may be present. Surveys should be **floristic in nature**, meaning that every plant taxon that occurs on site is identified to the taxonomic level necessary to determine rarity and listing status. "Focused surveys" that are limited to habitats known to support special status species or are restricted to lists of likely potential species are not considered floristic in nature and are not adequate to identify all plant taxa on site to the level necessary to determine rarity and listing status. Include a list of plants and natural communities detected on the site for each botanical survey conducted. More than one field visit may be necessary to adequately capture the floristic diversity of a site. An indication of the prevalence (estimated total numbers, percent cover, density, etc.) of the species and communities on the site is also useful to assess the significance of a particular population.

SURVEY PREPARATION

Before field surveys are conducted, compile relevant botanical information in the general project area to provide a regional context for the investigators. Consult the CNDDDB¹⁰ and BIOS¹¹ for known occurrences of special status plants and natural communities in the project area prior to field surveys. Generally, identify vegetation and habitat types potentially occurring in the project area based on biological and physical properties of the site and surrounding ecoregion¹², unless a larger assessment area is appropriate. Then, develop a list of special status plants with the potential to occur within these vegetation types. This list can serve as a tool for the investigators and facilitate the use of reference sites; however, special status plants on site might not be limited to those on the list. Field surveys and subsequent reporting should be comprehensive and floristic in nature and not restricted to or focused only on this list. Include in the survey report the list of potential special status species and natural communities, and the list of references used to compile the background botanical information for the site.

SURVEY EXTENT

Surveys should be comprehensive over the entire site, including areas that will be directly or indirectly impacted by the project. Adjoining properties should also be surveyed where direct or indirect project effects, such as those from fuel modification or herbicide application, could potentially extend offsite. Pre-project surveys restricted to known CNDDDB rare plant locations may not identify all special status plants and communities present and do not provide a sufficient level of information to determine potential impacts.

FIELD SURVEY METHOD

Conduct surveys using **systematic field techniques** in all habitats of the site to ensure thorough coverage of potential impact areas. The level of effort required per given area and habitat is dependent upon the vegetation and its overall diversity and structural complexity, which determines the distance at which plants can be identified. Conduct surveys by walking over the entire site to ensure thorough coverage, noting all plant taxa

¹⁰ Available at <http://www.dfg.ca.gov/biogeodata/cnddb>

¹¹ <http://www.bios.dfg.ca.gov/>

¹² Ecological Subregions of California, available at <http://www.fs.fed.us/r5/projects/ecoregions/toc.htm>

observed. The level of effort should be sufficient to provide comprehensive reporting. For example, one person-hour per eight acres per survey date is needed for a comprehensive field survey in grassland with medium diversity and moderate terrain¹³, with additional time allocated for species identification.

TIMING AND NUMBER OF VISITS

Conduct surveys in the field at the time of year when species are both evident and identifiable. Usually this is during flowering or fruiting. Space visits throughout the growing season to accurately determine what plants exist on site. Many times this may involve multiple visits to the same site (e.g. in early, mid, and late-season for flowering plants) to capture the floristic diversity at a level necessary to determine if special status plants are present¹⁴. The timing and number of visits are determined by geographic location, the natural communities present, and the weather patterns of the year(s) in which the surveys are conducted.

REFERENCE SITES

When special status plants are known to occur in the type(s) of habitat present in the project area, observe reference sites (nearby accessible occurrences of the plants) to determine whether those species are identifiable at the time of the survey and to obtain a visual image of the target species, associated habitat, and associated natural community.

USE OF EXISTING SURVEYS

For some sites, floristic inventories or special status plant surveys may already exist. Additional surveys may be necessary for the following reasons:

- Surveys are not current¹⁵; or
- Surveys were conducted in natural systems that commonly experience year to year fluctuations such as periods of drought or flooding (e.g. vernal pool habitats or riverine systems); or
- Surveys are not comprehensive in nature; or fire history, land use, physical conditions of the site, or climatic conditions have changed since the last survey was conducted¹⁶; or
- Surveys were conducted in natural systems where special status plants may not be observed if an annual above ground phase is not visible (e.g. flowers from a bulb); or
- Changes in vegetation or species distribution may have occurred since the last survey was conducted, due to habitat alteration, fluctuations in species abundance and/or seed bank dynamics.

NEGATIVE SURVEYS

Adverse conditions may prevent investigators from determining the presence of, or accurately identifying, some species in potential habitat of target species. Disease, drought, predation, or herbivory may preclude the presence or identification of target species in any given year. Discuss such conditions in the report.

The failure to locate a known special status plant occurrence during one field season does not constitute evidence that this plant occurrence no longer exists at this location, particularly if adverse conditions are present. For example, surveys over a number of years may be necessary if the species is an annual plant having a persistent, long-lived seed bank and is known not to germinate every year. Visits to the site in more

¹³ Adapted from U.S. Fish and Wildlife Service kit fox survey guidelines available at www.fws.gov/sacramento/es/documents/kitfox_no_protocol.pdf

¹⁴ U.S. Fish and Wildlife Service Survey Guidelines available at <http://www.fws.gov/sacramento/es/protocol.htm>

¹⁵ Habitats, such as grasslands or desert plant communities that have annual and short-lived perennial plants as major floristic components may require yearly surveys to accurately document baseline conditions for purposes of impact assessment. In forested areas, however, surveys at intervals of five years may adequately represent current conditions. For forested areas, refer to "Guidelines for Conservation of Sensitive Plant Resources Within the Timber Harvest Review Process and During Timber Harvesting Operations", available at <https://r1.dfg.ca.gov/portal/Portals/12/THPBotanicalGuidelinesJuly2005.pdf>

¹⁶ U.S. Fish and Wildlife Service Survey Guidelines available at http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/docs/botanicalinventories.pdf

than one year increase the likelihood of detection of a special status plant especially if conditions change. To further substantiate negative findings for a known occurrence, a visit to a nearby reference site may ensure that the timing of the survey was appropriate.

REPORTING AND DATA COLLECTION

Adequate information about special status plants and natural communities present in a project area will enable reviewing agencies and the public to effectively assess potential impacts to special status plants or natural communities¹⁷ and will guide the development of minimization and mitigation measures. The next section describes necessary information to assess impacts. For comprehensive, systematic surveys where no special status species or natural communities were found, reporting and data collection responsibilities for investigators remain as described below, excluding specific occurrence information.

SPECIAL STATUS PLANT OR NATURAL COMMUNITY OBSERVATIONS

Record the following information for locations of each special status plant or natural community detected during a field survey of a project site.

- A detailed map (1:24,000 or larger) showing locations and boundaries of each special status species occurrence or natural community found as related to the proposed project. Mark occurrences and boundaries as accurately as possible. Locations documented by use of global positioning system (GPS) coordinates must include the datum¹⁸ in which they were collected;
- The site-specific characteristics of occurrences, such as associated species, habitat and microhabitat, structure of vegetation, topographic features, soil type, texture, and soil parent material. If the species is associated with a wetland, provide a description of the direction of flow and integrity of surface or subsurface hydrology and adjacent off-site hydrological influences as appropriate;
- The number of individuals in each special status plant population as counted (if population is small) or estimated (if population is large);
- If applicable, information about the percentage of individuals in each life stage such as seedlings vs. reproductive individuals;
- The number of individuals of the species per unit area, identifying areas of relatively high, medium and low density of the species over the project site; and
- Digital images of the target species and representative habitats to support information and descriptions.

FIELD SURVEY FORMS

When a special status plant or natural community is located, complete and submit to the CNDDDB a California Native Species (or Community) Field Survey Form¹⁹ or equivalent written report, accompanied by a copy of the relevant portion of a 7.5 minute topographic map with the occurrence mapped. Present locations documented by use of GPS coordinates in map and digital form. Data submitted in digital form must include the datum²⁰ in which it was collected. If a potentially undescribed special status natural community is found on the site, document it with a Rapid Assessment or Relevé form²¹ and submit it with the CNDDDB form.

VOUCHER COLLECTION

Voucher specimens provide verifiable documentation of species presence and identification as well as a public record of conditions. This information is vital to all conservation efforts. Collection of voucher specimens should

¹⁷ Refer to current online published lists available at: <http://www.dfg.ca.gov/biogeodata>. For Timber Harvest Plans (THPs) please refer to the "Guidelines for Conservation of Sensitive Plant Resources Within the Timber Harvest Review Process and During Timber Harvesting Operations", available at <https://r1.dfg.ca.gov/portal/Portals/12/THPBotanicalGuidelinesJuly2005.pdf>

¹⁸ NAD83, NAD27 or WGS84

¹⁹ <http://www.dfg.ca.gov/biogeodata>

²⁰ NAD83, NAD27 or WGS84

²¹ http://www.dfg.ca.gov/biogeodata/vegcamp/veg_publications_protocols.asp

be conducted in a manner that is consistent with conservation ethics, and is in accordance with applicable state and federal permit requirements (e.g. incidental take permit, scientific collection permit). Voucher collections of special status species (or suspected special status species) should be made only when such actions would not jeopardize the continued existence of the population or species.

Deposit voucher specimens with an indexed regional herbarium²² no later than 60 days after the collections have been made. Digital imagery can be used to supplement plant identification and document habitat. Record all relevant permittee names and permit numbers on specimen labels. A collecting permit is required prior to the collection of State-listed plant species²³.

BOTANICAL SURVEY REPORTS

Include reports of botanical field surveys containing the following information with project environmental documents:

- **Project and site description**
 - ◆ A description of the proposed project;
 - ◆ A detailed map of the project location and study area that identifies topographic and landscape features and includes a north arrow and bar scale; and,
 - ◆ A written description of the biological setting, including vegetation²⁴ and structure of the vegetation; geological and hydrological characteristics; and land use or management history.
- **Detailed description of survey methodology and results**
 - ◆ Dates of field surveys (indicating which areas were surveyed on which dates), name of field investigator(s), and total person-hours spent on field surveys;
 - ◆ A discussion of how the timing of the surveys affects the comprehensiveness of the survey;
 - ◆ A list of potential special status species or natural communities;
 - ◆ A description of the area surveyed relative to the project area;
 - ◆ References cited, persons contacted, and herbaria visited;
 - ◆ Description of reference site(s), if visited, and phenological development of special status plant(s);
 - ◆ A list of all taxa occurring on the project site. Identify plants to the taxonomic level necessary to determine whether or not they are a special status species;
 - ◆ Any use of existing surveys and a discussion of applicability to this project;
 - ◆ A discussion of the potential for a false negative survey;
 - ◆ Provide detailed data and maps for all special plants detected. Information specified above under the headings "Special Status Plant or Natural Community Observations," and "Field Survey Forms," should be provided for locations of each special status plant detected;
 - ◆ Copies of all California Native Species Field Survey Forms or Natural Community Field Survey Forms should be sent to the CNDDDB and included in the environmental document as an Appendix. It is not necessary to submit entire environmental documents to the CNDDDB; and,
 - ◆ The location of voucher specimens, if collected.

²² For a complete list of indexed herbaria, see: Holmgren, P., N. Holmgren and L. Barnett. 1990. Index Herbariorum, Part 1: Herbaria of the World. New York Botanic Garden, Bronx, New York. 693 pp. Or: <http://www.nybg.org/bsci/ih/ih.html>

²³ Refer to current online published lists available at: <http://www.dfg.ca.gov/biogeodata>.

²⁴ A vegetation map that uses the National Vegetation Classification System (<http://biology.usgs.gov/npsveg/nvcs.html>), for example *A Manual of California Vegetation*, and highlights any special status natural communities. If another vegetation classification system is used, the report should reference the system, provide the reason for its use, and provide a crosswalk to the National Vegetation Classification System.

- **Assessment of potential impacts**

- ♦ A discussion of the significance of special status plant populations in the project area considering nearby populations and total species distribution;
- ♦ A discussion of the significance of special status natural communities in the project area considering nearby occurrences and natural community distribution;
- ♦ A discussion of direct, indirect, and cumulative impacts to the plants and natural communities;
- ♦ A discussion of threats, including those from invasive species, to the plants and natural communities;
- ♦ A discussion of the degree of impact, if any, of the proposed project on unoccupied, potential habitat of the species;
- ♦ A discussion of the immediacy of potential impacts; and,
- ♦ Recommended measures to avoid, minimize, or mitigate impacts.

QUALIFICATIONS

Botanical consultants should possess the following qualifications:

- Knowledge of plant taxonomy and natural community ecology;
- Familiarity with the plants of the area, including special status species;
- Familiarity with natural communities of the area, including special status natural communities;
- Experience conducting floristic field surveys or experience with floristic surveys conducted under the direction of an experienced surveyor;
- Familiarity with the appropriate state and federal statutes related to plants and plant collecting; and,
- Experience with analyzing impacts of development on native plant species and natural communities.

SUGGESTED REFERENCES

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- Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, Inc., New York, NY.
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