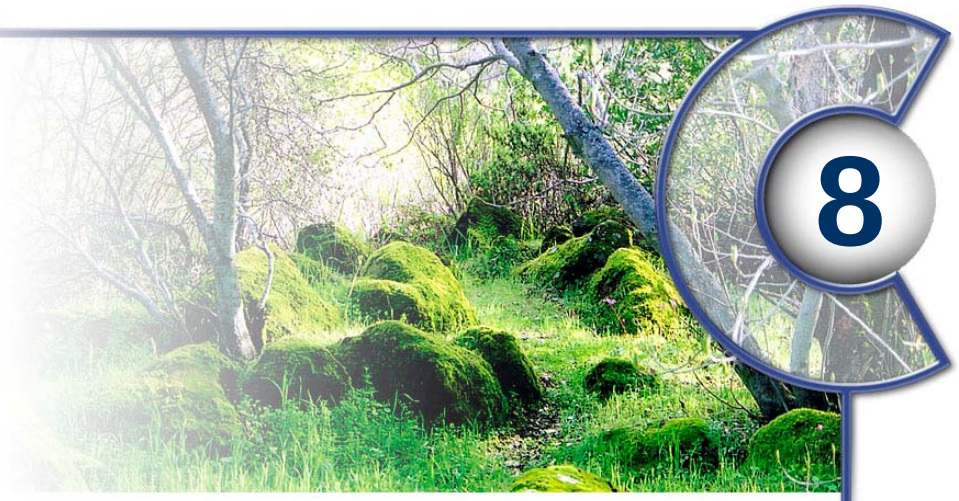


8

Stakeholder Planning

8 STAKEHOLDER PLANNING

8.1 STAKEHOLDERS

A stakeholder is an individual, group, or agency with an interest in Putah Creek. Landowners are the essential stakeholders for any action pertaining to Putah Creek since no actions may occur on private or public land without the consent of the landowner or land manager. Many groups have formed to represent Putah Creek landowners over issues including water rights, resource protection, and management of public lands. Other groups have formed that include landowners and non-landowners to advance public interests through creek cleanups and restoration projects with willing landowners. Several public agencies provide funding for creek enhancement projects because the public has an interest in issues such as weed abatement, flood protection, fish and wildlife conservation, water quality, and solid waste abatement. For purposes of the Putah Creek Watershed Management Action Plan (WMAP), stakeholders are divided into three broad groups: landowners, local organizations, and funding agencies. This section describes the roles and activities of each.

8.1.1 LANDOWNERS

There are over 200 private and public landowners and 275 parcels in the lower Putah Creek watershed, including those portions of Pleasants Creek below Miller Creek and Dry Creek below Highway 128, that are influenced by flows in Putah Creek. Approximately 78% of the land along Putah Creek is privately-owned, primarily in crop and orchard production but also with a growing number of private rural residences. The balance, in public ownership, is held by Yolo and Solano counties, the cities of Davis and Winters, the University of California, Davis (UC Davis), the California Department of Fish and Game, and the U.S. Bureau of Reclamation.

Riparian landowners (i.e., those whose property adjoins and/or includes the creek) own land to the centerline of creek. Riparian parcels cover nearly 14,000 acres with a total riparian corridor of about 1,700 acres. Landowner holdings range in size from 0.13 acre to 640 acres, with an average size of 61 acres. As landowners do not always live on the land they own, it is helpful to understand the different types of landownership that is found along Putah Creek:

- rural residential with private residence and no farm,
- rural residential with a farmer living and working on the land,
- non-residential with the landowner living elsewhere but possibly working the property himself, and
- farmed land with an absentee landowner who may have a lessee working the land.

Lessee interests and authorities may or may not include Putah Creek issues.

8.1.2 LOCAL ORGANIZATIONS

Several local organizations focused on Putah Creek and tributaries have formed in recent years. The following is a brief history of these organizations and why they formed.

PUTAH CREEK COUNCIL

The Putah Creek Council (PCC) is a public interest non-profit organization. PCC was formed in 1988 to increase appreciation for the natural resources of Putah Creek. Early PCC activities included nature walks and the production of a newsletter. In 1990, the effects of the 1987 – 1994 drought began to dramatically affect the aquatic and riparian habitat of the creek, at times resulting in over 20 miles of dry creek bed for extended summer periods. At this point, the PCC began to advocate for more flows in the creek to support the creek's unique collection of native fish, wildlife, and California fauna. In 1991, PCC began legal proceedings to ensure adequate environmental flows. In 1993, the City of Davis and UC Davis joined the litigation, which resulted in a 1996 ruling of the Sacramento Superior Court significantly increasing flows to Putah Creek. The judgment was appealed by Solano County water interests and that began negotiations that led to an historic May 2000 settlement agreement – the Putah Creek Accord. The Accord provides up to 50 percent more water, guarantees minimum flows to downstream compliance points, includes flow pulses to attract historic salmon back up Putah Creek, and also recognizes the need for shared water supply and instream flow reductions during periods of low water storage behind Monticello Dam.

The PCC currently organizes community volunteers in creek enhancement projects including trash cleanup days, invasive weed removal, and native fish and wildlife habitat projects, and provides seminars to the public on creek-related natural resource topics. The PCC's mission is to protect and enhance Putah Creek and its tributaries through advocacy, education, and community-based stewardship. The PCC plans and implements projects on lands of willing landowners in a manner that respects and advances landowner interests, rights, and concerns.

PUTAH CREEK LANDOWNERS ASSOCIATION

The Putah Creek Landowners Association, consisting of 30 riparian landowners, was formed to oppose an attempted adjudication of riparian water rights by Solano County Water Agency. The adjudication was eventually dropped and riparian water allocation has been resolved via individual negotiations in rare instances when riparian water supplies have been overdrawn.

DRY CREEK HOMEOWNERS ASSOCIATION

The Dry Creek Homeowners Association (DCHA) was formed by Valerie Whitworth to address eroding streambanks on Dry Creek on the west side of the City of Winters. The DCHA received two grants from the California Department of Water Resources' (DWR's) Urban Streams Restoration Program and completed several pilot projects on Dry Creek near the confluence with Putah Creek.

LOWER PUTAH CREEK COORDINATING COMMITTEE

The Putah Creek Accord established a new forum, the Lower Putah Creek Coordinating Committee (LPCCC), to oversee implementation of the settlement, hire and supervise the Streamkeeper, and coordinate creek studies and enhancement efforts. The LPCCC is composed of five Yolo and five Solano County-appointed members representing

environmental and water interests, including the cities of Davis, Fairfield, Suisun, Vacaville, Vallejo, and Winters; PCC, UC Davis; a representative of riparian landowners; Solano Irrigation District (SID), Solano County Water Agency (SCWA), and Maine Prairie Water District. The LPCCC administers an annual budget of $160,000 indexed to inflation for fish and wildlife monitoring, vegetation management, and Streamkeeper salary, as well as administering additional funds from grants to protect the resources of Putah Creek. The LPCCC holds its public meetings six times per year, alternating between Davis and Winters, to discuss issues affecting Putah Creek and to provide a forum for resolving disputes within the framework of the Putah Creek Accord.

WINTERS PUTAH CREEK COUNCIL

The Winters PCC was formed as a volunteer organization to guide decisions on Winters Putah Creek Park and help with its planting and maintenance. Activities include cleanups, planting of riparian vegetation, and a forum for discussing issues affecting the park.

PUTAH-CACHE BIOREGION PROJECT

The Putah-Cache Bioregion Project (PCBR) was formed by UC Davis to promote conservation of the Putah Creek and Cache Creek watersheds. Activities include educational events.

PUTAH CREEK DISCOVERY CORRIDOR

This effort was formed by UC Davis to organize public landowners in the Interdam Reach from Monticello Dam to PDD to provide coordinated educational opportunities. Activities include development of a master plan, leading field trips for school-age children, and other related educational opportunities.

YOLO LAND TRUST

The Yolo Land Trust is a land conservation organization founded in 1988 to protect the agricultural and open space lands in Yolo County. The Yolo Land Trust primarily works with individual landowners to purchase and establish conservation easements on private property and may have a role in holding conservation easements along Putah Creek.

SOLANO LAND TRUST

The Solano Land Trust is another land conservation organization formed to conserve agricultural, environmentally sensitive, and open space land in Solano County. The Solano Land Trust has purchased conservation easements along Putah Creek and Pleasants Creek.

FISHING ORGANIZATIONS

Various fishing organizations have participated in the conservation of lower Putah Creek as a blue ribbon trout fishery. They sponsor annual cleanup events and spawning gravel augmentation, and promote measures to stop the spread of New Zealand Mud Snail.

CALIFORNIA AUDUBON

California Audubon promotes conservation and enhancement of bird habitat. The Winters office has organized planting and cleanup events on lower Putah Creek and the Dry Creek watershed.

SOLANO COUNTY RESOURCE CONSERVATION DISTRICT

The Solano County Resource Conservation District has organized landowners on Pleasants Creek to control arundo, an invasive exotic plant, and has managed major cleanup projects to-date, removing eight cars and 1,200 tons of concrete from the banks of Putah Creek and Pleasants Creek tributary.

8.1.3 KEY FUNDING AGENCIES

This section discusses agencies that by virtue of their decisions to fund Putah Creek projects are shaping the future of the Putah Creek watershed. Stakeholders in this category fall into a more regional framework; while they may fund or do work along Putah Creek, their missions and mandates are much broader.

SOLANO COUNTY WATER AGENCY

SCWA administers water from the Solano Project and is fiscal agent of the LPCCC. SCWA serves 300,000 municipal water users and irrigation water for 70,000 acres of agricultural land. Its responsibilities are to ensure water availability for agricultural, municipal, commercial, industrial, and all other beneficial uses; control flood and storm waters using a combination of reservoir storage, diversion, or release for groundwater recharge; promote water conservation; protect life and property from floods; install recreational facilities or landscaping; and generate power for wholesale or agency use.

SOLANO IRRIGATION DISTRICT

SID is an independent special district, a local governmental agency, formed in 1948. SID has entitlements for 151,000 acre feet of agricultural and domestic water for service to many areas in Solano County each year. The District also is the operator of the Solano Project, which delivers Lake Berryessa water to the cities of Fairfield, Suisun City, Vacaville, and Vallejo; Maine Prairie Water District; and the SID agricultural customers. The District owns and operates the hydroelectric power plant at the base of Monticello Dam. SID is a member of the LPCCC and independently funds water conservation programs.

CALFED/CALIFORNIA BAY-DELTA AUTHORITY

The California Bay-Delta Authority (CBDA) oversees the implementation of the CALFED Bay-Delta Program for state and federal agencies working cooperatively to improve the quality and reliability of California's water supplies while restoring the Bay-Delta ecosystem. The CALFED Bay-Delta Program is responsible for developing and implementing a long-term

comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta System. CALFED Ecosystem Restoration and Watershed Programs have funded physical and biological assessments, community outreach, stewardship planning, and educational programs in the Lower Putah Creek watershed.

U.S. FISH AND WILDLIFE SERVICE

The U.S. Fish and Wildlife Service (USFWS) is the federal agency responsible for conservation and enhancement of nonanadromous fish and wildlife resources. The USFWS conducted a reconnaissance study of Putah Creek in 1993 and has provided project grants to landowners in the Putah Creek watershed through the Partners for Wildlife Program.

STATE WATER RESOURCES CONTROL BOARD

State Water Resources Control Board (SWRCB) issues water rights and protects water quality throughout the state. The SWRCB currently funds stewardship planning on Putah Creek as a continuation of a 2001 Proposition 204 project.

CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD

The Central Valley Regional Water Quality Control Board (RWQCB) is the local implementing agency for protecting water quality in the state. The RWQCB administers the CBDA and Proposition 13 projects in the Putah Creek watershed.

WILDLIFE CONSERVATION BOARD

Wildlife Conservation Board (WCB) promotes wildlife conservation throughout the state and currently funds invasive weed control and riparian restoration projects throughout the lower Putah Creek watershed.

INTEGRATED WASTE MANAGEMENT BOARD

Integrated Waste Management Board (WMB) implements solid waste management programs, including trash disposal and recycling, throughout the state. The IWMB Farm and Ranch Cleanup Program provides funding for removal of solid waste on agricultural lands, including several sites in the lower Putah Creek watershed.

8.2 STAKEHOLDER INVOLVEMENT

8.2.1 METHODS

Stakeholders have been involved in Putah Creek stewardship on several occasions since 1992 when the Dry Creek Homeowners Association led by a local landowner, Valerie Whitworth, began implementing bank stabilization projects on the Dry Creek tributary.

Subsequent public comment opportunities arose during the review of the USFWS Putah Creek Reconnaissance Planning Report in 1993. Primary issues identified then were invasive weed

control (particularly arundo, eucalyptus, tamarisk, and tree-of-heaven), water conservation methods (prior to the settlement agreement), scarification of gravel bars, and infilling riparian vegetation to maintain a continuous wildlife migration corridor. Shortly thereafter, the Putah Creek water litigation prompted landowners to organize in opposition to adjudication of riparian water rights.

In 2000, the Solano County Department of Environmental Management received a Proposition 204 grant to organize a Lower Putah Creek Watershed Stewardship Group. Several meetings were held with affected stakeholders, chiefly riparian landowners. This was the first public forum on Putah Creek since the attempted adjudication of water rights by the SCWA. Although water rights were not part of the Stewardship Group's mission, the initial meetings were consumed by discussions of water rights. Eventually, in an attempt to bring closure to that issue, an entire meeting was devoted to the subject with experts from the SWRCB explaining that adjudication was among few mechanisms for resolving water rights disputes. To further shape stakeholder discussion, the facilitator conducted a survey to determine the breadth of issues of concern to stakeholders. Out of this survey, three subcommittees were formed to address landowner issues, remediation and prevention of illegal dumping, and weed control. These were highly productive discussions. Unfortunately, the term of the grant expired before additional meetings could be held and the notes were not compiled into a plan.

The LPCCC continued stakeholder discussions with individual landowners arising out of common interest in solid waste removal, weed control, bank stabilization, and establishment of native vegetation. The LPCCC surveyed landowners informally to determine interests in solid waste removal and weed control, especially control of arundo, for which funds were available. As a result, the LPCCC published a newsletter, "The Flow," to cover news on Putah Creek and opportunities for restoration. The LPCCC toured eroding streambanks on Pleasants Creek with drinking water treatment plant managers to illustrate the cause of source water turbidity.

During this time, the PCC began conducting seminars on a wide range of topics to further inform stakeholders about Putah Creek resources and hosted events for volunteers to engage in cleanup and restoration projects.

The Solano Resource Conservation District contacted landowners individually and held special field days to promote arundo control and bank stabilization in the Pleasants Creek tributary. Most landowners along Pleasants Creek are now working cooperatively to address these issues.

8.2.2 FINDINGS

STAKEHOLDER MEETINGS

1. Public landowners and private riparian landowners engage most productively on common interests such as in the subcommittees (landowner issues, remediation, prevention of illegal dumping, and weed control) that formed under the initial Proposition 204 project.

2. Private landowners reserve the right to determine what is done on their land, but also enjoy meeting other landowners and learning about similarities and differences of issues on different reaches of the creek.

3. It takes time to build trust and familiarity among stakeholders. Early meetings were attended by many people who did not know each other and who began to build trust and familiarity over the course of several meetings.

4. While landowners are generally wary of non-landowners participating in a plan affecting private land management, the public participates in planning for public lands.

5. Only a landowner can agree to take action on their land; no one else can make that decision or take an action for them.

6. The value of working with landowners as a group is to ensure that information is disseminated broadly and evenly first-hand.

7. Landowner views and issues are diverse.

8. Local communities provide input to local government offices that are responsible for managing public lands.

9. The goal of the WMAP should be to present issues (questions) requiring further discussion and to describe opportunities for progress on stakeholder defined issues.

STAKEHOLDER INTERESTS AND CONCERNS

Respect for Private Property

Landowners are concerned with issues of liability, trespass, and privacy. Watershed enhancement projects along Putah Creek must respect these landowner concerns and incorporate measures to minimize problems.

Liability

Landowners are concerned about liability for injury. The terrain is often rugged and there are rattlesnakes, wasps, poison oak, gopher holes, and other hazards. Liability waivers are essential for volunteer projects. The SCWA covers volunteers with workers compensation and holds landowners harmless for LPCCC-sponsored projects for the duration of the project.

Trespass

Landowners are concerned about trespass due to problems with theft, illegal dumping, and property damage. Signage helps to reduce trespass by clearly marking boundaries that are not otherwise apparent.

Privacy

Some landowners have residences on their properties and find uninvited persons to be an invasion upon their privacy.

Illegal Dumping

Illegal dumping includes legacy dump sites and ongoing dumping from rural roads. Laws prohibiting illegal dumping are difficult to enforce in rural areas due the low probability of witnesses. Removal of legacy dumpsites and prevention of illegal dumping can improve water quality and reduce blight. This improves the appearance and value of private property while enhancing the appearance of public viewscapes. Trash reduction also may discourage future dumping, since the existence of trash piles attracts more illegal dumping.

Legacy Dumps

Many legacy dump sites on Putah Creek have yet to be cleaned up. Much progress has been made under the IWMB Farm and Ranch Cleanup Program that provides funding for removal of solid wastes on agricultural lands.

Ongoing Dumping

Cleanup events sponsored by the PCC, Winters Putah Creek Committee, IWMB Farm and Ranch Cleanup Program, and others have cleaned up over a thousand tons of trash. However, some sites continue to experience illegal dumping, especially near Stevensons Bridge and other locations where a public road (especially Putah Creek Road) runs along the top of the bank providing ready access to vehicles.

Deterrence

Signage to deter dumping has proven to be ineffective. Fences and gates are also ineffective barriers except for heavy vehicle barrier gates.

Enforcement

Resources for enforcement of laws prohibiting dumping have been limited because it is difficult to prove who was responsible even if there are articles such as discarded mail that provide names and addresses.

Vegetative Barriers

Illegal dumping is most common in areas where there are gaps in the riparian vegetation suggesting that infilling of vegetation along the top of the bank could provide an effective barrier to dumping. Vegetation provides a three-dimensional, self-repairing barrier that is superior to fences. The IWMB and the LPCCC have funded infilling of vegetation along roads to deter dumping. Vehicle barriers have been effective in preventing dumping from farm

roads. Vegetative barriers offer the best hope of preventing dumping in areas where public roads are adjacent to the top of the bank.

Bank Erosion and Bank Failure

Bank erosion and bank failure are threatening farms, residences, bridges, structures, and riparian woodland in a number of locations along lower Putah Creek and its tributaries.

Pleasants Creek

Bank erosion and bank failure along Pleasants Creek below the Miller Creek confluence has damaged to property and structures along Pleasants Creek, including roads, bridges, and residential property. The bank erosion and failure has accelerated since the construction of Monticello Dam because reduced flows on mainstem Putah Creek have led to steeper water surface gradients on the tributary creeks during high-flow events, therefore resulting in higher velocity flows and more erosion. Rock vanes at Hoskins Ranch deflect flows away from the banks and reduce downstream velocities. Similar rock structures throughout Pleasants Creek could provide a long-term solution to eroding banks. Pleasants Creek is the primary source of sediments in Lake Solano and the main source of turbidity for the Solano Project. Source water protection grants may be available to help stabilize the banks of Pleasants Creek.

Dry Creek

Bank erosion on Dry Creek below Highway 128 has also accelerated since Monticello Dam was built, threatening banks of farms and residences along Dry Creek. Two Urban Streams Restoration Program grants from the DWR have stabilized the banks of Dry Creek behind Russell Blvd in Winters, and a third proposal is under review.

Mainstem Putah Creek

Bank erosion on mainstem Putah Creek is less pronounced than on the tributaries, in part because the channel of mainstem Putah Creek was formed by much higher flows prior to Monticello Dam, leading to excess channel capacity and reduced erosion pressure on the banks. However there are isolated locations of severe erosion, including just downstream of the Dry Creek confluence and just below Road 92F in Yolo County. The LPCCC submitted a proposal to the DWR's Urban Streams Restoration Program to rebuild the banks of Putah Creek and restore the channel to a remnant course that did not threaten to erode the banks and adjacent Putah Creek Road. Funding from the Wildlife Conservation Board to control weeds can also take pressure off of the banks by opening up flows in the center of the channel.

Impediment of Flood Flows

Excess Vegetation

Since the late 1970s when the U.S. Army Corps of Engineers (USACE) ceased to manage vegetation in the Putah Creek channel, vegetation has grown unchecked, increasing water

surface elevations for a given volume of flow (i.e., reducing channel capacity) and raising concern among many landowners that more needs to be done to control excess vegetation in the creek channel, primarily invasive weeds.

Invasive Weeds

Invasive weeds in the riparian corridor increase fire risk, degrade wildlife habitat value, and increase flood risk. Most native riparian vegetation lays flat in high flows or consists of single stem trees that go dormant in the winter, dropping leaves, and offering little resistance to flood flows. Certain invasive weeds, however, especially Himalayan blackberry, arundo, and tamarisk do not lay flat or drop their leaves in most winters and therefore impede flows to a much greater degree than native vegetation. They also slow flow velocities to such a great extent that sediment drops out and builds mounds around arundo clumps and blackberries, further reducing channel capacity and deflecting flows toward streambanks, resulting in increased lateral erosion. A grant from the Wildlife Conservation Board for weed control in the channel offers opportunities to increase wildlife habitat value, increase channel capacity, and reduce fire and flood risk.

Watershed Management Action Planning and Funding

Ongoing stewardship planning and grant awards will provide a way for landowners to learn about funding opportunities and participate in future projects. Current grants awarded to the LPCCC for enhancement of resources along lower Putah Creek include:

< State Wildlife Conservation Board grant for invasive weed control, and fish and wildlife habitat enhancement;

< DWR Urban Streams Restoration Program grant under consideration to rebuild the banks of Putah Creek and restore the channel to reduce streambank erosion and damage to residential property and Putah Creek Road;

< SWRCB stewardship grant to conduct stakeholder meetings to ascertain watershed resource issues and concerns.

< Proposition 13 grant through the RWQCB, SWRCB, and CALFED Bay-Delta Program to provide an update to the lower Putah Creek WMAP, including presentations to stakeholders on findings determined in this WMAP version, and exploration of opportunities for improving watershed resources, based on resource needs and landowner interests, while addressing landowner concerns.

< Integrated Waste Management Board Farm and Ranch Cleanup Grants and Directed Actions provide funding for cleanup of solid wastes dumped by persons other than the landowner or landowner's family. At the request of the landowner, the Streamkeeper documents the dump site with maps and photographs and solicits bids for the cleanup

work. The county resource conservation districts incorporate this information into grant applications and oversee resulting cleanup projects.

9

Key Findings and Watershed Management Questions

9 KEY FINDINGS AND WATERSHED MANAGEMENT QUESTIONS

Chapters 1 through 8 of the Putah Creek WMAP evaluate the historic and present resources of the watershed. This chapter highlights the key findings in those chapters to present an array of possibilities for actions and decisions on Putah Creek in the future. Each section below is arranged to highlight the main resource areas followed by a summary of the primary challenges inherent to the resource. The result is a series of key questions that could be addressed in the course of WMAP updates. Resource-specific questions conclude each resource section. Key questions that highlight the interrelated and complex relationship between resource areas conclude the chapter.

9.1 CULTURAL RESOURCES

Though small in scale relative to the major watersheds of California, Putah Creek has an exceptionally rich cultural history. From the earliest Native Americans who inhabited the watershed for thousands of years to those farming and residing there today, the creek and its tributaries have influenced quality of life for centuries. Traces of historic activities can be found throughout the watershed and range from village sites to homesteads, farms, and bridges.

VALUES AND BENEFITS

As a perennial watercourse, Putah Creek attracted Native and European/American peoples who may have left materials and features on the landscape.

< *Recorded sites*. Numerous archaeological and historical research projects have been conducted within the vicinity of Putah Creek and have recorded Native American and Euro-American sites, features, and artifacts in areas that could be affected by activities associated with habitat restoration activities. Some of these resources have been found to be eligible or potentially eligible for listing on the California Register of Historical Resources (CRHR) and the National Register of Historical Places (NRHP). Sites known to exist along Putah Creek include those listed below.

- ethnographic Native American site of Ku'ndihi,
- prehistoric artifact scatters,
- Native American occupation sites,
- Chambers Farmstead (c. 1860–1945),
- the Yolo-Solano Bridge (1907), and
- Stevensons Bridge (1923).

PROBLEMS AND LIMITATIONS

In addition to protecting recorded sites, as required by law, there may be undiscovered cultural remains in the watershed that could be impacted by future restoration activities.

- *Incomplete knowledge*. It is unknown where other similar prehistoric and historic-era sites, features, and artifacts are located in the area.

- *Effects on projects*. Cultural resource survey data are important to ensure the protection of cultural resources along Putah Creek.

KEY NEEDS AND QUESTIONS

- What are the key goals and objectives for cultural resources along Putah Creek?

- To what extent should additional efforts be made to identify and protect significant cultural resources?

9.2 LAND OWNERSHIP, LAND USE, AND RESOURCE MANAGEMENT PROGRAMS

Land use patterns in the Central Valley over the past 200 years began with the establishment of homesteads, and farming and grazing enterprises that converted native habitats to developed rural uses. More recent urban development has constrained historic rural uses and resulted in additional losses of native habitats, including riparian habitat along creeks and rivers. Moreover, water storage in Lake Berryessa has reduced the scale of riparian vegetation that is supportable compared to historic conditions when flooding was frequent. This regional trend is reflected in changes in land uses along lower Putah Creek, Pleasants Creek, and Dry Creek.

VALUES AND BENEFITS

The following list characterizes current land ownership, land use, and resource management conditions along Putah Creek:

- *Riparian habitat*. Less than 2,000 acres of riparian corridor presently exists along lower Putah Creek and Pleasants Creek, representing less than 0.2% of the total acreage (1,182,336 acres) of Solano and Yolo counties.

- *Adjacent agricultural and native vegetation lands*. The vast majority, about 70%, of lands adjacent to (i.e., bordering) the riparian corridors of lower Putah, Pleasants, and Dry creeks are agricultural lands, nearly all of which are designated as Prime Farmland, Farmland of Statewide Importance, or Farmland of Local Importance. Reaches 1–5 have the highest proportion of adjacent farmland (80–96%) and lowest percentage of adjacent native vegetation (0.4–9%). Reach 6 (the interdam reach) and Reach 7 (Pleasants Creek) have the highest percentages of adjacent native vegetation (71–74%) and the least farmland (23–26%).

- *Urban development*. Urban development accounts for approximately 4% of the land adjacent to the riparian corridors and consists primarily of low-density residential development, commercial, and light industrial uses. The majority of developed land occurs on the north

side of Putah Creek, in Yolo County. The majority of urban development adjacent to the riparian corridor occurs in Winters (in Reach 5 and along Dry Creek).

< *Private and public ownership*. GIS analysis shows that most (78%) of the land within and adjacent to the lower Putah Creek and Pleasants Creek riparian corridors is privately owned (see Table 3-1, Exhibit 3-1). Public lands account for about 21.2% of the corridor and adjacent parcels. Ownership of the remaining 0.8% of land is unknown at this time.

< *Public interest*. The degree of public interest in the various resources present in the lower Putah Creek watershed highlights the need for comprehensive management programs. Interests that may seem divergent can be addressed in plans and programs that recognize and allow for varied uses and objectives within the watershed.

< *Public access*. Public access is available on publicly-owned lands in and near lower Putah Creek and Pleasants Creek. These include (from west to east):

- Bureau of Land Management property,
- Stebbins Cold Canyon Reserve,
- Putah Creek Wildlife Area,
- DFG fishing access sites,
- Lake Solano County Park,
- Winters Putah Creek Park,
- Stevensons Bridge,
- UC Davis Putah Creek Riparian Reserve,
- Davis South Fork Preserve, and
- Yolo Bypass Wildlife Area/Putah Creek Sinks.

PROBLEMS AND LIMITATIONS

< *Complex land use patterns*. The lower Putah Creek watershed has developed complex land use patterns that would benefit from a comprehensive management plan, such as this WMAP, to:

- recognize and incorporate public and private interests in watershed resources;

- present a balanced approach to conserving and enhancing natural resources and functions within the watershed; and

- optimize compatibility of adjacent land uses.

< *Need to protect and restore remaining riparian habitat*. Native riparian communities in the Central Valley provide among the most important habitat for wildlife, including many species that have become rare as natural habitat areas were converted to other uses. As natural habitat continues to dwindle in size regionally, riparian communities require ever more protection and enhancement efforts.

< *Balancing agriculture, urban, and habitat management requirements*. Agricultural and urban uses would benefit from management of resources to reduce risks related to flooding, wildfires, erosion, invasive weeds, and other issues. A functioning watershed management plan integrates resource management requirements of developed uses, including agricultural and urban uses, and continued efforts to protect and enhance important natural habitat.

KEY NEEDS AND QUESTIONS

< What are the key goals and objectives for land use and resource management along Putah Creek?

< There is a need for greater planning and discussion among interested stakeholders to address and accomplish long-term and collaborative maintenance requirements.

< What proportion of the riparian corridor should be restored to native riparian communities, overall and/or by reach?

< What management actions would be beneficial to both the riparian corridor resources and land uses on lands adjacent to the riparian corridor? If/when/where would it be most (or least) beneficial to enhance or restore resources on adjacent lands?

< Agricultural land uses are often incompatible with public access, for example during re-entry intervals after applications of pesticides, or because of problems with pilferage of crops. How can the security of agricultural lands and private property in general be protected or enhanced?

< What method of notifying creekside landowners would be good to use if/when there are pending land use proposals that could affect them?

< How will Williamson Act contracts and non-renewed contracts affect land use planning and conservation in the lower Putah Creek watershed?

9.3 GEOMORPHOLOGY, HYDROLOGY, AND WATER QUALITY

The geomorphology, hydrology, and water quality of Putah Creek reflects the sum of the physical, chemical, and biological properties of the stream and its tributaries and can have direct and dramatic effects on the vitality of aquatic organisms, water-dependent aquatic habitat, human health, recreation, agriculture, and other beneficial uses of the water. The relationships are typically complex, can vary spatially and temporally, and there is a level of uncertainty regarding how different characteristics interrelate.

VALUES AND BENEFITS

While the lower Putah Creek watershed currently enjoys good water quality in general, protecting the beneficial uses of the creek is dependent on ongoing active management of stream flows, regulatory compliance among permitted dischargers, and developing/

maintaining a riparian buffer to protect the creek from nonpoint runoff from adjacent land uses. Lower Putah Creek water is characterized by the following:

< *Flood protection*. The hydrology and geomorphology of the lower Putah Creek watershed has been manipulated and altered to provide flood protection for residents, communities, and agricultural lands in the watershed.

< *Water project development and management*. Development and operation of the Solano Project (Monticello Dam and Lake Berryessa, PDD, Putah South Canal, and the necessary waterways, laterals, and drainage works) meets the water demands of agriculture and municipalities as well as recreation.

< *Geomorphic and hydrologic interrelated processes*. Geomorphic and hydrologic processes influence the form and function of Putah Creek and play a large role in shaping the characteristics, functions, and values of other resources in and adjacent to the riparian corridor including water quality, fisheries, vegetation and wildlife, land uses, and cultural resources.

< *Good water quality*. Putah Creek water quality is generally classified as good and the waterway supports a wide variety of existing and potential designated beneficial uses, including:

- municipal and domestic water supply,
- agricultural water supply,
- primary contact (i.e., swimming) and secondary contact (e.g., canoeing) recreation,
- warm freshwater habitat,
- warmwater fish habitat, for spawning
- wildlife habitat, and
- cold, freshwater habitat for spawning (although not designated an "existing" beneficial use of Putah Creek, lower Putah Creek is associated with a blue-ribbon trout fishery.)

PROBLEMS AND LIMITATIONS

Geomorphology, hydrology, and water quality have been affected over time by the changes in water management, flood control, and land uses throughout the watershed. Flood protection activities and water project development and management have altered natural processes and changed the ecosystem. Historic mining activity in the upper watershed continues to present a lingering water quality problem for the lower watershed. Without additional effort, protecting the beneficial uses of the creeks in the lower Putah Creek watershed will be constrained by the following:

- *Channel process alterations*. Water management measures and other channel modifications in the early 20th century discussed above caused significant changes in natural channel processes. Completion of Monticello Dam and the PDD caused major changes in the lower reaches of Putah Creek including reduction in backwater effects at tributaries (USACE 1995) and reduction natural sediment transport. These changes have resulted in dramatic alterations in natural processes and have led to problems that include erosion and channel incision, especially to tributaries.

- *Limited data*. Routine water quality monitoring data are limited to samples taken by Reclamation in the Putah South Canal terminal reservoir and by UC Davis, upstream and downstream of the university wastewater treatment plant.

- *Remnant mercury mining contamination*. Lower Putah Creek is on the 303(d) list of impaired water bodies for mercury contamination. Studies confirmed the mercury levels in the creek are consistent with remnant mining-derived mercury, together with some level of ongoing movement through Lake Berryessa, constituting the primary source of contamination in lower Putah Creek.

- *Nonpoint sources of polluants*. Nonpoint source loadings that may contribute potential contaminants include mercury discharge sources from the upper watershed, agricultural activities along the lower reaches below PDD, illegal dumping in various locations, and identifiable stormwater discharge outfalls near municipal centers of Winters and Davis.

- *Not all pollutant sources are identifiable*. Identifying a pollutant does not imply that an effective control can be found and/or implemented.

KEY NEEDS AND QUESTIONS

Past channelization of Putah Creek for flood protection and gravel extraction have left large reaches of over-widened channel that cause excessive warming due to exposure of the water surface and low-flow velocities that create long residence time of water in what are now long pools. Future management actions might address funding sources and methods to help restore the natural form and function of these reaches.

- What are the key goals for the hydrology, geomorphology, and water quality of Putah Creek?

- Geomorphic assessments of the Putah Creek system are needed to better understand the effects of past and present actions and fluvial processes on creek resources and to determine beneficial, feasible, and affordable solutions (e.g., rock vanes, biological revetment) to address priority issues of concern, such as erosion and bank instability, as well as to determine opportunities for feasible resource enhancements such as restoration of fisheries, floodplain, and other habitats.

- Many legacy dumpsites remain on Putah Creek causing blight and degradation of water quality through the presence of solid wastes (gross pollutants) in the creek channel. What resources exist for cleaning up these wastes and deterring future dumping?

- The relative effects on water quality from point sources and nonpoint sources can be better quantified with regular monitoring of conventional pollutants at more points along the creek. What are the opportunities to coordinate with landowners in different parts of the watershed to develop a volunteer water quality monitoring program?

9.4 FISHERIES

Fisheries in the lower Putah Creek watershed are comprised of different assemblages and have changed from the period prior to Euro-American settlement to the present. The different fish assemblages are based primarily on the distinctly different aquatic habitats found in mountains, foothills, and valley floors within the watershed. The history of fisheries in Putah Creek from the period prior to Euro-American settlement to the present can be divided into four sections that are based on periods of different human modifications to the creek. Conditions from four periods are described as: (1) prehistoric (prior to mid-1800s: historical distribution of native fishes), (2) Euro-American settlement (late 1800s through 1950s: nonnative fish introductions and alterations to habitat), (3) Solano Project (1960s to Putah Creek Accord (2000): large-scale alterations in natural processes and habitat), and (4) Putah Creek Accord (provisions to manage instream flows to assist in enhancing native fish populations).

VALUES AND BENEFITS

Primary fisheries resource values and benefits of the lower Putah Creek watershed include the presence of special-status and other native and recreationally important nonnative fish species. Additionally, the native fisheries response to the Accord water release schedules has been positive.

- *Diverse historic native fishery*. Historically, a diverse population of native resident and anadromous fish species utilized aquatic habitat in the lower Putah Creek watershed.

- *Special-status fish species*. A total of seven special-status anadromous and resident freshwater fish species occur or have the potential to occur in lower Putah Creek. Special-status anadromous fish species include Central Valley steelhead Evolutionarily Significant Unit (ESU) (*Oncoryhnchus mykiss*), Central Valley fall-/late fall-run chinook salmon ESU (*Oncoryhnchus tshawytscha*), and Pacific lamprey (*Lampetra tridentada*). Special-status freshwater fish species include Sacramento splittail (*Pogonichthys macrolepidotus*), Sacramento-San Joaquin roach (*Lavinia symmetricus* sp. *symmetricus*), hardhead (*Mylopharodon conocephalus*), and Sacramento perch (*Archoplites interruptus*).

- *Present recreational fishery*. Lower Putah Creek supports a recreationally important fishery that is comprised of cold- and warm-water, native and nonnative fish species. The Putah

Creek interdam reach between Monticello Dam and the PDD at Lake Solano is especially well known for quality trout fishing.

< *Fisheries response to Accord water release schedules*. Based on limited initial data and other observations, it appears that the distribution and abundance of native fish in lower Putah Creek may be benefiting by the Accord flow release schedule. Moreover, small chinook salmon spawning runs have returned to the creek.

PROBLEMS AND LIMITATIONS

Problems and limitations affecting fisheries resources associated with the current state of the watershed include habitat modifications, nonnative fish species, invasive aquatic invertebrates, lack of suitable spawning habitat, high water temperatures, and fish passage impediments.

< *Habitat modifications and nonnative species*. Putah Creek is an example of a creek modified by human activities and characterized by a greater diversity and quantity of introduced species than native species (Moyle et al. 2003). General declines in native fishes in Putah Creek reflect a changing ecosystem.

< *Invasive aquatic invertebrates*. Three invasive aquatic invertebrates that may affect or are affecting lower Putah Creek are the Chinese mitten crab (*Eriocheir sinensis*), Asian clam (*Corbicula fluminea*), and New Zealand mud snail (*Potamopyrgus antipodarum*). Invasive aquatic invertebrates are introduced invertebrates that can drastically alter the ecology of a body of water such as a lake, stream, estuary, or entire watershed, and as a result, alter, reduce, or eliminate both native and introduced aquatic flora and fauna. Invasive invertebrates can have negative effects on an ecosystem by modifying the food chain and competition, creating habitat interference, and introducing new diseases.

< *Lack of suitable spawning habitat*. The lack of suitable spawning habitat is a constraint for most native fish species, including salmon. Recent observations of salmon at the concrete pool below the PDD indicated that most or all spawning locations downstream had likely been utilized by the migrating salmon.

< *High water temperatures limiting habitat*. High water temperatures resulting from loss of SRA habitat, flow modifications and geomorphic alterations, and standing water are important limiting factors to native fish production in lower Putah Creek.

< *Fish passage issues*. Chinook salmon, steelhead, and lamprey are all anadromous species that migrate up lower Putah Creek to spawn, and later return to sea. Two structures, the PDD and Monticello Dam, completely block migration into historic spawning and rearing areas in the interdam reach and as far upstream as Berryessa Valley. Several other natural and human-made migration barriers may also impede fish passage including beaver dams, weirs, culverts, and small dams.

KEY NEEDS AND QUESTIONS

< What are the key goals and objectives for the fisheries of Putah Creek?

< Should efforts be made to attempt to restore the native aquatic ecosystem? What are the implications on recreationally important nonnative species?

< Recent changes to flow releases from the PDD have been favorable to native species. What are additional measures that can be designed to restore and enhance native fish in Putah Creek could help improve the larger ecosystem, benefiting both native and introduced game species? Aquatic habitat restoration and enhancement measures designed to benefit native and valued nonnative fish species may include:

- Continued management of flow releases to queue fish migration and spawning; provide adequate passage conditions; protect spawning, egg incubation, and rearing habitat; and manage (i.e., reduce) water temperatures. Should beaver dams be monitored and seasonally breached to facilitate passage and migration of salmon and other anadromous fish?

- Enhancement of spawning habitat through spawning gravel augmentation. What locations in the watershed are most appropriate for effective gravel augmentation projects?

- Improvement of aquatic habitat through the design and implementation of instream (e.g., boulder and rootwad structure) and riparian SRA habitat restoration and enhancement projects. What locations in the watershed would benefit the most from instream and/or riparian habitat restoration and enhancement? What types of specific habitat restoration and enhancement projects (e.g., directed towards specific species and/or life stages) would be most effective and/or are deemed most important?

9.5 VEGETATION AND WILDLIFE

California's existing riparian forests comprise only 5-10% of their original acreage. Yet, these habitats support a disproportionately large percentage of California's flora and fauna. Thus, measures to protect and enhance these ecosystems will have far-reaching benefits to the vegetation and wildlife of the region while helping to safeguard important natural resources and ecosystem services.

VALUES AND BENEFITS

< *Plant Communities*. The dominant plant community types along the lower Putah Creek corridor are mixed riparian forest (60%), disturbed riparian woodland (15%), and valley oak riparian forest (12%). Other community types are riparian scrub, foothill riparian woodland, riverine wetland, open water, ruderal associations, and agricultural crops. Several reaches have major infestations of nonnative invasive weeds, especially Reach 4 upstream of Stevensons Bridge.

< *Corridor Width*. The width of the riparian corridor (including the open water creek channel) ranges from approximately 110 feet to 840 feet, equating to an average acreage of 16 to 108 acres per river mile. By river mile, Reach 1 contains the smallest amount of riparian acreage (in the Yolo Bypass) while the largest is in Reach 5, particularly in the first mile downstream of the PDD. Pleasants Creek and Reach 1 contain the longest continuous stretches of very narrow corridor.

< *Habitat Quality*. Table 9-1 below summarizes the habitat quality data for all wildlife groups. In general, habitat is of moderate quality for most of the wildlife groups analyzed, lending support to continued and expanded conservation and habitat restoration efforts along Putah Creek. While habitats are clearly in need of enhancement, they are not so highly degraded that conservation and/or restoration efforts would be ecologically or economically infeasible.

Table 9-1
Comparison of Habitat Quality between Functional Groups

Functional Group	High Quality Habitat	Low Quality Habitat
Raptors	East of I-80 (Reaches 1 & 2)	Near I-505 (Reach 4 and 5), At I-80 (Reach 2)
Tree Nesting Birds	Upstream of Stevensons Bridge (Reach 4), Upstream portion of Reach 6	Lake Solano (Reach 6), Downstream of I-505 (Reach 4)
Shrub Nesting Birds	Downstream of Monticello Dam (Reach 6), Downstream of Putah Diversion Dam (Reach 5)	Los Rios Check Dam
Ground Nesting Birds	Upstream portion of Reach 6	Pedrick Road to SR 113 Lake Solano (Reach 6)
Cavity Nesting Birds	None, but many areas of moderate habitat	I-80 to Mace Boulevard (Reach 2), Downstream of Hwy 505 (Reach 4), Lake Solano (Reach 6)
Western Pond Turtles	Downstream of Stevensons Bridge (Reach 3), Downstream of I-80 (Reach 2)	Pleasants Creek (Reach 7)
Corridor Width	Upstream of confluence between Putah Creek and Bypass (Reach 1), Reach 5	Yolo Bypass (Reach 1)
Shaded Riverine Aquatic	Upstream from Lake Solano (Reach 6)	Lake Solano (Reach 6), Pleasants Creek (Reach 7), Yolo Bypass (Reach 1)
Movement Corridor	Middle of Reach 2, Downstream of Putah Diversion Dam (Reach 5)	Lake Solano (Reach 6)
Native Riparian Woodland	Reach 1 (portions); Middle of Reach 4, Reach 6	Upstream of Stevensons Bridge (Reach 4)

< *Sources of colonists*. Restoration would be facilitated by the fact that Putah Creek still supports adequate source wildlife populations that would serve as sources of colonists to restored habitats.

< *Reference sites*. Table 9-1 suggests that certain sites and/or reaches along the creek could be targeted for conservation, management, and/or restoration actions. For example, certain areas of Reaches 5 and 6 have higher-quality habitat than other reaches, especially for shrub- and ground-nesting birds. These areas could be targeted for conservation and habitat enhancement, and used as reference sites to guide restoration actions elsewhere on the creek.

PROBLEMS AND LIMITATIONS

< *Areas of low-quality habitat*. Lake Solano, Pleasants Creek, downstream of I-505, Pedrick Road to Highway 113, and the Yolo Bypass are notable for their low-quality habitat. These areas represent the greatest challenges for maintaining wildlife populations and should be targeted for protection and habitat restoration.

< *Landowner support*. Implementing the recommendations for improving the habitat and wildlife along Putah Creek, such as widening the riparian corridor or manipulating floodplain topography, would be complex, involve dedication of land, and require significant landowner coordination and support.

KEY NEEDS AND QUESTIONS

< What are the key goals and objectives for vegetation and wildlife along Putah Creek?

< What are the key restoration and enhancement measures for plant communities and wildlife habitat. Measures designed to restore and enhance vegetation and wildlife along Putah Creek would help improve the larger ecosystem functions and values? Habitat restoration and enhancement measures designed to benefit plant communities and wildlife may include:

- *Widening the riparian corridor* where it is currently narrow and creating upland woodland buffer strips would create more habitat for upland species like the burrowing owl and Swainson's hawk and insulate the riparian corridor from predators, songbird brood parasites (e.g., brown-headed cowbirds), and physical disturbances, such as wind and pesticide overspray.

- *Increasing habitat heterogeneity and microsite topography* within the floodplain to create more diverse habitats and hydrologic complexity that will support a greater abundance and diversity of organisms. Sensitive biological resources expected to benefit from this measure include song sparrow, western pond turtle, foothill yellow-legged frog, as well as many fish species.

- *Reducing channelization and recontouring streambanks* to increase the floodplain and reduce channel incision. This would raise the water table for riparian plants and promote a wider riparian corridor.

- *Creating instream wetlands* to slow the flow of water, create opportunities for groundwater recharge, and provide habitat for western pond turtle, tricolored blackbird, yellow-breasted chat, and other wetland-associated species.

- *Maintaining instream and bankside woody debris* to provide habitat for juvenile fish and aquatic insects, and basking sites for western pond turtles.

- *Increasing the amount of cobble-sized and smaller instream sediments* to provide habitat for fish and foothill yellow-legged frogs.

- *Increasing vegetative structural complexity and density* of native understory plant species to provide cover and nesting substrates for ground- and shrub-nesting birds, such as song sparrow.

- *Retaining large decadent trees and snags* where safe to do so to provide perching sites for raptors and nesting sites for primary and secondary cavity nesting birds, such as woodpeckers and western bluebirds.

- *Improving connectivity* along the riparian corridor to facilitate wildlife movement, especially near bridges, freeways, and residential development.

- *Reducing the ability of predators, brood parasites, and humans to disturb the riparian corridor* and minimize attractants for predators, such as trash piles and picnic areas.

- *Developing habitat enhancement and restoration actions to benefit sensitive wildlife species* that occur in the Putah Creek corridor.

- *Conducting long-term biological studies* such as bird surveys currently being conducted by the UC Davis Museum of Wildlife and Fish Biology. Also under the auspices of the Museum, surveys for selected terrestrial invertebrates and comprehensive vegetation surveys of the entire lower watershed have commenced in July 2005. Longer-term surveys and monitoring will help verify whether the habitat quality assessment characterizations are borne out in terms of species distribution and abundance.

- *Developing standardized methods for vegetation mapping* of the entire riparian corridor that mesh well with existing assessments would enhance understanding of wildlife habitat. A LiDAR (airborne laser imaging technology) study will provide a surface model of vegetation, as well as ground points by January 2006.

- *Identifying lesser-known invasive weed threats* to the creek. The widespread and ubiquitous invasive weeds have been readily identified. However, some invasive weeds, such as Italian thistle (*Carduus pycnocephalus*), have been overlooked as threats to the Putah Creek ecosystem, although this species has increased its presence over a number of years. Identifying lesser-known threats along the creek could help define actions that can be taken by landowners before the threat becomes a problem.

- *Determining additional research needs for Valley Elderberry Longhorn Beetle (VELB).* Putah Creek was considered for designation as critical habitat for VELB, but was withdrawn because of lack of information on the population in the area. Emphasis should be placed on obtaining the results from UC Davis surveys for this species led by Marcel Holyoak and Teresa Talley, and determining whether additional research or studies are needed to address outstanding issues.

- *Conducting surveys for foothill yellow-legged frog in lower Putah Creek*. Yellow-legged frogs are known to occur in the Cold Canyon tributary, and may stray into areas of suitable habitat in the interdam area of Putah Creek (DFG 2003a, Barry 2000). However, comprehensive surveys to assess the distribution of foothill yellow-legged frogs in the lower Putah Creek watershed have not been conducted. While there may be competition with introduced species, especially bullfrogs (*Rana catesbeiana*), its effects are unknown.

- *Conducting surveys for giant garter snake*. The water in the Putah Creek portion of the Yolo Bypass is slow moving and the riparian vegetation is not well developed, creating potential for giant garter snakes from the Willow Slough population to be found in the Bypass area of lower Putah Creek. Surveys should be undertaken to address this issue.

- *Identifying future vegetation management strategies*. The U.S. Army Corps of Engineers once controlled vegetation in Putah Creek channel with mechanical clearing and burning of vegetation but that program ended in 1977 and there has been no comprehensive plan for vegetation management since that time. How will vegetation be managed in the future?

9.6 INVASIVE WEEDS

KEY FINDINGS

< *Invasive weeds are widely distributed throughout the riparian corridor of lower Putah Creek*. The 20 inventoried species have established over 1,800 infestations that occupy about 128 acres, or 6% of lower Putah Creek's riparian corridor. These infestations are along all reaches and across all geomorphic surfaces (e.g., Arundo at creek bottom to yellow starthistle on the top of bank and terrace) of the channel. Each reach has about 125 to 450 infestations that occupy 8 to 30 acres.

< *Invasive weed infestations alter ecosystem functions along lower Putah Creek*. Invasive weeds alter riparian ecosystem functions including conveyance of floodwaters, transport and storage of sediment, geomorphic processes that sustain channel and floodplain landforms, nutrient cycling and provision of wildlife habitat, and other functions. As invasive weeds displace native vegetation, some important effects include the following.

- **Altered conveyance of floodwaters and sediment.** Establishment of invasive weeds (e.g., Arundo and tamarisk) on or along the channel bed increases roughness and

reduces the channel's ability to convey flood flows. Dense stands of invasive weeds also trap sediments and divert flows against channel banks, decreasing bank stability and sediment transport.

- **Alteration of wildlife habitats.** Many invasive weeds (e.g., Arundo, tree-of-heaven, tamarisk) form dense monocultures that provide less wildlife habitat than the native riparian vegetation they displace. Invasive weeds in the channel also detrimentally affect native fish habitat (e.g., by trapping gravels and other sediment).

- **Altered fire regime.** Native riparian vegetation often hinders the spread of fires. However, invasive weeds, such as eucalyptus, Arundo, and tamarisk, produce volatile oily or dry fuel that increases the frequency, extent, and damage caused by fires.

< *Species differ substantially in the size and number of their infestations*. For the 20 inventoried species, the number of infestations ranged from one to several hundred, and the area infested ranged from fractions of an acre to about 24 acres. However, species can be grouped into three categories.

- **Ubiquitous Weeds.** Five species have established numerous infestations occupying large contiguous areas. They include Eucalyptus (302 infestations occupying 24 acres), Eurasian milfoil (39 infestations occupying 9 acres), Himalayan blackberry (241 infestations occupying 22 acres), perennial pepperweed (143 infestations occupying 18 acres) and yellow starthistle (28 infestations occupying 16 acres). Together, these five species account for half (50%) of the total mapped infestations and 70% of the total area occupied by the infestations.

- **Widespread Weeds.** Three species have established a large number of smaller infestations. They include Arundo (406 infestations occupying 21 acres), tamarisk (393 infestations occupying 10 acres), and tree-of-heaven (123 infestations occupying 5 acres). Together, these species account for 41% of the mapped infestations and 28% of the total area occupied by infestations. Because of their numerous infestations, these species have considerable potential to rapidly expand the area they occupy.

- **Incipient Weeds.** The remaining 12 species are less abundant than both the ubiquitous and widespread species. Together, incipient species currently account for just 9% of infestations and just 2% of the total area occupied by infestations. Several of these species (e.g., fennel) may be in the early stages of a much more extensive invasion of natural vegetation along lower Putah Creek.

< The implementation of any weed management program depends on landowner participation and the availability of funding (and often of volunteer labor).

< Prioritization of weeds and sites for removal efforts is intended to make the best use of limited resources and to maximize environmental benefits. While all invasive species included in the WMAP are considered invasive and important to remove, species were

grouped into three priority levels for control. Prioritization of species in the WMAP considered weed distribution, invasiveness, removal costs, and effects on physical processes, biological communities, and human uses. Level 1 species include those which have incipient or widespread distribution patterns and are either highly invasive in general or known to cause substantial impacts. They include species such as arundo, tamarisk, eucalyptus, fennel, English ivy, and fig. Level 2 species are already ubiquitous (regardless of invasiveness and effects) or are less invasive and cause lesser impacts. Level 2 includes species such as Himalayan blackberry and perennial pepperweed, both ubiquitous and very invasive, as well as tree tobacco and Virginia creeper, which are incipient, but less invasive. Level 3 species are considered to be least invasive and cause relatively low levels of effects. These include species such as almond and catalpa. Regardless of priority level, other factors may warrant control of one or more infestation(s) of weeds even before all Level 1 species are controlled. Examples include infestations that are part of a comprehensive site restoration effort, important infestation damages to address at a particular location, etc.

< *Invasive weeds may still be controlled along lower Putah Creek, and removal efforts could even eradicate some species from the riparian corridor.* Removing the roughly 128 acres of invasive weeds from the riparian corridor, though requiring a large-scale effort, is feasible. Furthermore, the 12 incipient weeds occupy less than 3 acres combined, making it feasible to eradicate these species from lower Putah Creek's riparian corridor.

PROBLEMS AND LIMITATIONS

< *The cost and problems associated with invasive weeds are likely to be considerable if they are not controlled.* While invasive weed infestations may still be controlled along lower Putah Creek, in the absence of removal efforts, the area infested by invasive weeds may increase considerably and the costs of control efforts will increase accordingly.

< *Landowner cooperation*. Many invasive weeds send propagules downstream leading to infestation throughout the creek. Gaining cooperation from landowners and coordinating removal efforts is a key challenge to success.

KEY NEEDS AND QUESTIONS

< *What are the key goals and objectives for invasive weed abatement along lower Putah Creek?*

< *What species and locations of infestations can/should be prioritized?* While invasive weed species have been preliminarily grouped into three priority levels, removal costs have not been well documented for many species; therefore, this attribute was not uniformly used to assign species to priority categories. As species removal costs become better known, species priority levels should be reassessed if those costs are substantially higher or lower than for most other species. For instance, eucalyptus was raised to priority Level 1 due to its high cost of removal, which also increases rapidly as eucalyptus grow. Regardless of priority level, factors such as location of sensitive resources and the pattern and distribution of infestations need to be considered when prioritizing individual infestations for control.

- *What locations offer the greatest potential habitat quality benefit through invasive weed removal combined with other efforts to enhance and restore ecosystems along lower Putah Creek?* Invasive weed removal and other riparian restoration projects should be closely coordinated. Restoration may be necessary after some removal projects to ensure recovery of native riparian vegetation. Conversely, restoration projects may be hindered by competition from invasive weeds, unless invasive weeds are removed prior to restoration. Recommendations from fish, wildlife, and vegetation habitat analyses along with knowledge of the hydrology and geomorphology of the creek should be combined to prioritize locations to remove weeds and restore habitat, when feasible.

- *What are the most cost-effective removal techniques?* While removal techniques exist for many invasive weeds, new and more effective approaches are continually being discovered. Some uncertainties or concerns may exist with regard to different treatment types, such as some herbicides. Also, different techniques are more or less viable or effective in different conditions and based on available resources. Learning from various treatments used will increase efficiencies in removing the weeds and successfully restoring native species habitat.

- *What monitoring and adaptive management protocols will best serve to continually improve treatment approaches, prioritization of species and infestation locations to control, and combinations of habitat restoration to include?* Monitoring of invasive weed distributions and the results of weed removal and restoration projects are integral to a successful program. An adaptive management approach of monitoring, evaluating, and refining approaches, if needed, would enable continual improvements and gains in efficiency in achieving invasive weed abatement and habitat restoration goals and objectives.

- *What can be done to control eucalyptus and how can the trees be disposed of with minimum disturbance or enhancement of the creek channel? Eucalyptus is a significant invasive species on Putah Creek that grows rapidly and is extremely costly to remove, especially as trees reach mature size.*

9.7 STAKEHOLDER PLANNING

A stakeholder is an individual, group, or agency with an interest in Putah Creek. For purposes of the WMAP, stakeholders are divided into three broad groups: landowners, local organizations, and funding agencies. There are over 200 private and public landowners and 264 parcels in the lower Putah Creek watershed, including those portions of Pleasants Creek below Miller Creek and Dry Creek below Highway 128, that are influenced by flows in Putah Creek. Since the early 1990s, many groups have formed to represent Putah Creek landowners over issues including water rights, bank stabilization, and public land management.

VALUES AND BENEFITS

- Landowners are the essential stakeholders for any action pertaining to Putah Creek since no actions may occur on private or public land without the consent of the landowner or land manager.

- Groups have formed that include landowners and non-landowners to advance public interests through creek cleanups and restoration projects with willing landowners.

- Several agencies provide funding for creek enhancement projects because of public interest in issues such as weed abatement, flood protection, fish and wildlife conservation, water quality, and solid waste abatement.

- Stakeholder meetings can be an effective way to ensure information is disseminated broadly and evenly.

- Landowners engage most productively when there is a common, focused interest.

- A series of stakeholder meetings can serve to build trust and familiarity among stakeholders.

PROBLEMS AND LIMITATIONS

- Although some categorize landowners under one umbrella, their views, interests, and concerns are diverse and cannot be presented unilaterally.

- Public participation is welcome and expected when planning for public lands, but the same public participation can at times be viewed warily when plans are developed affecting private land management.

- Key landowner concerns are respect for private property, liability, trespass, and privacy.

- Resource management-related concerns include: illegal dumping, bank erosion and bank failure, impediments to flood flows, and invasive weeds.

KEY NEEDS AND QUESTIONS

- What are the key goals and objectives for stakeholder planning along Putah Creek?

- Many creek improvement projects (e.g., revegetation) take years to accomplish and some carry risk of failure (e.g., in unexpected high flows). How do landowners know that these projects will be maintained or that maintenance costs will not be passed on to landowners?

- Publicly funded projects often require site visits by representatives of funding agencies some of whom have regulatory authorities. What assurances can be offered to landowners that such visits will not result in increased regulation (i.e., from unrelated issues that exist on the same properties)?

- Landowners have expressed concern that watershed enhancement will lead to unwelcome increases in public use of the waterway. How can creek enhancement proceed without increasing public use, the risk of trespass, and associated liabilities?

- Enhanced fish and wildlife habitat on Putah Creek may increase populations of listed species like Swainson's hawk, steelhead trout, and VELB. How can habitat enhancement proceed with assurances that future property uses will not be compromised?

- Eroding streambanks cause loss or degradation of private property. What remedies exist and how can they be funded?

9.8 OVERARCHING, INTERRELATED, AND INSTITUTIONAL NEEDS AND QUESTIONS

- What is the overall vision for Putah Creek to help develop goals and objectives that will guide specific actions on the creek?

- Historically, human activity intended to provide benefits to the region caused unintended consequences that are now being addressed. This awareness raises questions about the effectiveness or utility of current and future management actions. It is important that we use existing knowledge to help determine when and where to actively fix a problem versus allowing long-term natural processes to work without or with minimal intervention.

- Invasive weed removal, trash cleanup, and bank stabilization projects often temporarily or permanently change landscapes. How can these projects proceed with reasonable assurances that the creek channel and adjacent land uses will not be adversely affected?

- The public occasionally uses Putah Creek for recreational boating, likely without sufficient awareness or regard for resource protection (e.g., spreading New Zealand mud snail or wading on salmon or trout redds), adequate knowledge of potential hazards, and basic precautions such as life jackets. How can recreational uses of Putah Creek be managed to protect natural resources and to protect landowners from liability, invasion of privacy, and trespass?

- Illegal dumping and theft (e.g., walnut burls) is often associated with vehicle access either from public roads or private roads (e.g., farm roads). How can vehicle access to the creek channel be controlled?

- Will actions proposed by the WMAP help address or mitigate the effects of local land use changes, such as urbanization, that may affect water quality? If so, how?

- Enhancing spawning habitat for steelhead trout could lead to a self-sustaining population. Since steelhead trout are protected species, how would this affect fishing in the creek?

- Plantings are needed to provide shade over the water, hold streambanks against erosion, and enhance wildlife habitat. How can restoration plantings proceed without reducing flood flows, increasing fire risk, or contributing to debris jams?

- Some weeds currently provide some stability to streambanks even while causing increased erosive pressure on the opposite bank. How can weed removal proceed without increasing the risk of erosion on banks where they are currently growing?

10

Resource Management Actions and Opportunities

10 RESOURCE MANAGEMENT ACTIONS AND OPPORTUNITIES

This chapter provides an overview of past, present, and proposed future projects and implementation requirements to track project actions over time.

10.1 SUMMARY OF PAST, PRESENT, AND PROPOSED FUTURE PROJECTS

Early actions along Putah Creek were based on both resource needs and opportunities. In the 1990s, funding became available for a variety of resource enhancement projects that have benefited the creek. For example, the Dry Creek Homeowner's Association defined a need for bank stabilization and then acquired funding. By 2002, landowners had identified a need to remediate and prevent illegal dumping and control invasive weeds. With landowner support, multi-year grant funds were acquired from funding partners as indicated in Chapter 8. The funds have thus far enabled development of this WMAP, streamlined regulatory and permitting for watershed enhancement actions, and implemented a variety of resource enhancement projects. These projects have continued to engage the community around Putah Creek. Table 10-1 identifies the range of projects and locations that have been or are being implemented along Putah Creek. Future projects will be developed to reflect and address the key findings, issues, and questions identified in Chapter 9, filtered through ongoing stakeholder involvement and contingent upon continued funding and individual landowners' willingness to take actions.

10.2 PROJECT IMPLEMENTATION REQUIREMENTS

All projects must be implemented in accordance with regulatory requirements. A streamlined regulatory and permitting program has been developed for the lower Putah Creek watershed by the LPCCC. The program enables landowners who wish to participate in grant-funded resource enhancement projects on their property to initiate projects with little or no additional regulatory delays, thus saving time and enabling more funds to be spent on implemention. A detailed overview of future project permitting and regulatory requirements can be found in Appendix H, "Permitting and Regulatory Compliance," and Appendix I, "Restoration and Enhancement Project Requirement Summaries."

Table 10-1
Summary Table of Past, Present, and Proposed Future Projects along Putah Creek

Location	Action Item/Issue	Time Value	Needs/Resources	Funding	Lead/Partners	Timeframe[1]	Results
All	Arundo Removal	High	Permits; Landowner Authorization	CBDA	LPCCC	2002 to 05/2007	60 gross acres cleared to date
All	Solid Waste Removal and Prevention	Med	Permits; Landowner Authorization	IWMB	LPCCC RCDs PCC WPCC	Ongoing	1,500 tons of waste removed to date (1995 to 2005); volunteer cleanups 2–3 times per year
All	Eucalyptus Removal	High	Permits; Landowner Authorization	CBDA WCB City of Winters	LPCCC	2005 to 08/2007	South bank of Winters Putah Creek Park and Yolo Housing cleared to date
All	Tamarisk Removal	Med	Permits; Landowner Authorization	WCB	LPCCC, landowners	2003 to 2007	Control campaign on UCD lands; individual clumps removed by landowners
All	Bank Stabilization	High	Permits; Landowner Authorization; Geomorphic; Assessment	DWR WCB CBDA USFWS	LPCCC Solano RCD	2002 to 08/2007	Hoskins Ranch on Pleasants Creek; Dry Creek – Putah Creek Confluence; Dry Creek
Hasbrook-Kilkenny, YHA, 505	Spawning Habitat Enhancement	Med	Permits; Landowner Authorization; Geomorphic Assessment	CBDA WCB USFWS	LPCCC	2003 to 08/2007; new projects are proposed	200 cubic yards added at Yolo Housing
All	Blackberry Removal	Med	Permits; Landowner Authorization	WCB	LPCCC	2005 to 08/2007	16 acres removed at Wimmer 2 acres removed at YHA 2 acres controlled at Pickerel

Table 10-1
Summary Table of Past, Present, and Proposed Future Projects along Putah Creek

Location	Action Item/Issue	Time Value	Needs/Resources	Funding	Lead/Partners	Timeframe[1]	Results
All	Native Plant Restoration	Med	Landowner Authorization	WCB CBDA	LPCCC RCDs Audubon UCD Cities of Winters, Davis	Ongoing	4 acres at Winters Putah Creek Park Stevenson's Bridge, Hoskins Ranch, Morales, Mertz, McNamara, UCD, Wimmer City of Davis
Dry Creek – Putah Creek Confluence	Channel Realignment	High	Permits; Landowner Authorization	DWR WCB Solano Transportation	LPCCC, Solano Transportation	2005–2007	Design channel completed, flow diverted
Winters Putah Creek Park	Remove Percolation Dam; Construct Lower Trail	Med	Permits	California Resources Agency	LPCCC	2007–2008	
All	Floodplain Restoration	Med	Permits	Unknown	LPCCC	Undetermined	

[1] End dates are based on project grant funding periods and dates may be subject to change.

List of Acronyms:

CBDA = California Bay-Delta Authority
DWR = California Department of Water Resources
IWMB = State Integrated Waste Management Board
LPCCC = Lower Putah Creek Coordinating Committee
PCC = Putah Creek Council
RCD = Resource Conservation District
UCD = University of California, Davis
USFWS = U.S. Fish and Wildlife Service
WCB = State Wildlife Conservation Board
WPCC = Winters Putah Creek Committee

11

Recommendations for Future Plan Development

11 RECOMMENDATIONS FOR FUTURE PLAN DEVELOPMENT

Key elements for future plan development are:

- obtain stakeholder review of Phase 1 WMAP findings and involvement in establishing watershed enhancement goals, objectives, and recommended project actions;
- develop and implement a mechanism for tracking past, present, and future watershed enhancement actions; and
- identify planning, funding, and labor resources that will help facilitate future watershed enhancement actions under consideration.

11.1 STAKEHOLDER INVOLVEMENT AND DEVELOPMENT OF WATERSHED GOALS, OBJECTIVES, AND PROJECT ACTIONS

The success of a watershed plan is dependent on the interests and level of involvement of the stakeholders. Therefore, the next step for the WMAP is to present the data from Phase 1 to the stakeholders to further document their interests and concerns, as well as to define current opportunities and constraints regarding watershed enhancement actions. This will enable LPCCC to blend stakeholder knowledge and needs with the technical information compiled in Phase 1 to create a set of stakeholder-based goals and objectives for the watershed and a list of project ideas that can be implemented over the next 5 years. To assist in watershed planning meetings with stakeholders, an abbreviated version of the WMAP may be prepared to facilitate awareness and discussion of key issues, interests, and concerns. A graphical overview ("mental map") of Putah Creek's history, issues, and solutions may also be helpful in this regard.

Stakeholder meetings should be focused on key topics. Topics may include a review of past efforts and input by previous stakeholder meetings, specific resource areas, and existing watershed enhancement projects and programs underway. The meetings can then focus on developing goals and objectives for watershed enhancement and determining project ideas within each topic. Specific meetings should review invasive weeds and other issues and plan for future collaborative projects with willing landowners. The decision to participate in a project, or not, always remains the choice of each individual landowner, so implementing projects on private lands requires individual landowner approval. However, any goals, objectives, decisions, or actions resulting from meetings would be based on the open discussion of technical knowledge, stakeholder interests, and the funding challenges for these types of projects. As more landowners enroll in particular types of projects (e.g., trash and invasive plant removal), there will be greater benefit to the watershed.

11.2 TRACKING OF PAST, PRESENT, AND PLANNED FUTURE PROJECTS

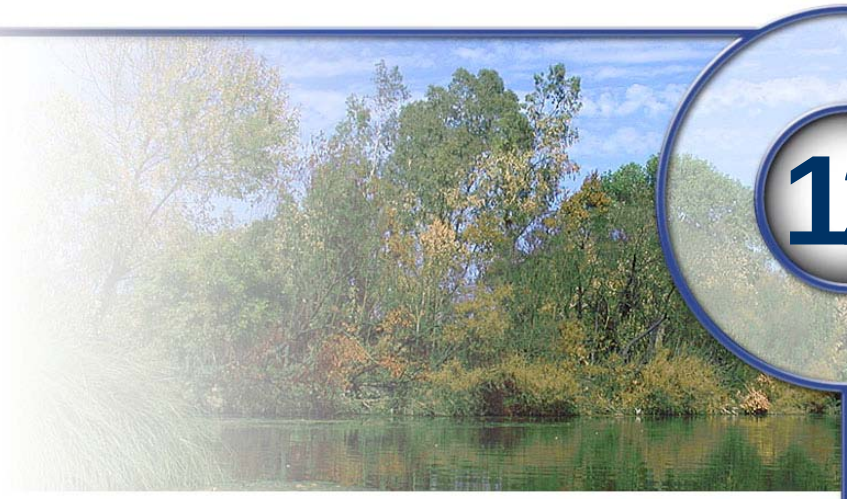
One of the key functions of the WMAP will be to establish a mechanism for tracking past, present, and planned future projects. Collecting and tracking data over time, and having it easily accessible to stakeholders and agencies, is part of an overall adaptive management

strategy for the lower Putah Creek watershed. Chapter 10, "Resource Management Actions and Opportunities," is the first step in this direction. As projects are added and reports collected, the tracked data will facilitate periodic review and refinement of watershed priorities and actions and measure progress against watershed goals and objectives. The LPCCC watershed portal (http://www.watershedportals.org/lpccc) already provides a calendar/journal of events and an open source geographical database is under development. The geographical database could be used to track current and proposed projects.

11.3 WATERSHED ENHANCEMENT RESOURCES

Another need that can be satisfied in Phase II of the WMAP is a collection of resources that will facilitate project implementation and WMAP development over time. Potential resources to include are:

- weed abatement plan for Putah Creek,
- plant palette for Putah Creek restoration and enhancement projects,
- list of plant nurseries that grow and/or stock California native plants,
- list of plants to avoid in landscaping or other projects on or along Putah Creek, and
- funding sources for specific types of actions (e.g., trash abatement).



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12.2 PERSONAL COMMUNICATIONS

Crain, Patrick K. Staff Research Associate, Department of Wildlife, Fish, and Conservation Biology, University of California, Davis. Various e-mail, telephone and in-person communications with EDAW staff Ron Unger between October, 2003 and June, 2004; and communications with Rich Marovich, Putah Creek Streamkeeper.

Engilis, Andy. Museum Curator, Museum of Wildlife and Fish Biology, Department of Wildlife, Fish, and Conservation Biology, University of California, Davis. Telephone conversation with Linda Leeman of EDAW. September 24, 2004.

Fulks, Andrew. University of California Davis Putah Creek Riparian Reserve. Manager. August 12 and 25, 2003–personal communication with Connie Gallippi at EDAW.

Honer, Karen. City of Winters, Public Works. Director. September 24, 2003–personal communication with Connie Gallippi of EDAW.

Marovich, Rich. LPCCC Putah Creek Streamkeeper. Various e-mail, telephone, and in-person communications with EDAW staff Connie Gallippi, Jeanine Hinde, and Ron Unger in 2003 and 2004. Specific correspondence includes: email to Ron Unger on December 10, 2003 regarding the recent run of fall-run chinook salmon in lower Putah Creek; telephone conversation with Connie Gallippi of EDAW on land use issues including resource management programs, public access, habitat values, and wildfire management on August 6, 2003.

Moore, Rick. 2003. Yolo County Planning Department. February 27, 2003–e-mail correspondence with Mahala Young of EDAW regarding rural waste pickup issues and trash cleanup events.

Moyle, Dr. Peter B. Professor of Fish Biology at the University of California, Davis. Davis, CA. Various e-mail, telephone and in-person communications with EDAW staff Bob Solecki and Ron Unger between May 2003 and June 2004; communications with Rich Marovich; and Dr. Moyle's presentation on the fishes of Putah Creek at the Putah Creek Council Public Speakers Series meeting on April 22, 2003; and email on December 10, 2003 to Rich Marovich regarding salmon run.

Ng, Michele. Department of Water Resources. September 23, 2003–personal communication with Putah Creek Council on.

PCC. 2003. Putah Creek Council e-mail announcements of salmon observations on lower Putah Creek between October and December 2003.

Ramos, Carl. 2003–personal communication with Brian Ludwig of EDAW regarding the historic context of the Putah Creek watershed and vicinity; July 18, 2003–e-mail regarding early gold mining in Putah Creek.

Salamunovich, Tim. 1999. Fish Biologist, Thomas R. Payne & Associates, Arcata, CA. E-mail orrespondence with Peter Moyle of UC Davis Department of Wildlife, Fish, and Conservation Biology, regarding lamprey sitings. Also, map indicating lamprey spawning locations on May 12, 1999.

Salamunovich, Tim. 2003. Fish Biologist, Thomas R. Payne and Associates, Arcata, CA. E-mail correspondence with Patrick Crain of UC Davis Department of Wildlife, Fish, and Conservation Biology, and Tom Pate of Solano County Water Agency. October 20, 2003.

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Stevens, Michelle. Department of Water Resources Restoration. Wetlands ecologist. November 3, 2003–personal communication via email with Connie Gallippi of EDAW.

Truan, Melanie Allen, PhD., Director, Biomonitoring and Research, Museum of Wildlife and Fish Biology, Department of Wildlife, Fish and Conservation Biology, University of California, Davis. Telephone conversation with Ron Unger of EDAW on October 20, 2004. Email communication with Ron Unger, Linda Leeman and Deborah North of EDAW providing review of Chapter 6 and contents of Table 6-2.

13

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APPENDIX **A**

LOCATIONS OF LANDMARKS IN THE LOWER PUTAH CREEK WATERSHED

Appendix A
LOCATIONS OF LANDMARKS IN THE LOWER PUTAH CREEK WATERSHED

Landmark	Feature	Acres	Fish Sampling Site	River Mile	Approx. Miles From PDD	Approx. Km from PDD
Lower Putah Creek						
Monticello Dam	dam forming Lake Berryessa; upper end of study area		--	29.5	-6.6	-11
Highway 128	bridge		--	29.0	-6.1	-10
Stebbins Cold Canyon Reserve/Putah Creek Wildlife Area/BLM	UC Natural Reserve System preserve (576 ac); CDFG Wildlife Area (670 ac); BLM land (365 ac); education, research, public use for nature observation	1,611	--	29.4 to 27.5	-6.5 to -4.6	-10 to -7
Fishing Access Sites	5 sites owned by CDFG, managed by Yolo County Parks Dept.		--	28.5 to 24.7	-5.6 to -1.8	-9 to -3
Pleasants Valley Road	bridge		--	24.4	-1.5	-2
Pleasants Creek	confluence with Putah Creek		--	23.9	-1.0	-2
Lake Solano County Park	public multi-purpose recreation park	60	--	23.9 to 23.6	-1.0 to -0.7	-2 to -1
Lake Solano	reservoir; recreation, irrigation, drinking water			25.4 to 22.9	-2.5 to 0.0	-4 to 0
Putah Diversion Dam (PDD)	dam forming Lake Solano		Site 1	22.9	0.0	0
Dry Creek	confluence with Putah Creek		Site 2	20.5	2.5	4
County Road 89 (Railroad Avenue)	bridges		--	20.0	2.9	5
Winters Putah Creek Park	City of Winters property; public multi-purpose creekside park, fishing access		--	20.0 to 19.0	2.9 to 3.9	5 to 6
Interstate 505 (I-505)	bridge		Site 3	19.1	3.8	6
Yolo Housing Authority	Yolo County property, north side		Site 4	18.2	4.7	8
Hasbrook-Kilkenny	private property		Site 5	17.6	5.4	9
Vickery	private property		Site 6	16.3	6.6	11
Jordan	private property		Site 7	15.3	7.6	12
Russell Ranch	UC Davis property, north side	1,711	Site 8	13.9	9.0	15
Stevensons Bridge	bridge		Site 9	13.0	9.9	16

Appendix A
LOCATIONS OF LANDMARKS IN THE LOWER PUTAH CREEK WATERSHED

Landmark	Feature	Acres	Fish Sampling Site	River Mile	Approx. Miles From PDD	Approx. Km from PDD
Olander	private property		Site 10	12.4	10.6	17
Pedrick Road	bridge		Site 11	10.2	12.7	20
UC Davis Putah Creek Riparian Reserve	UC Davis property; north side; research, education, some public use		--	10.7 to 6.3	12.2 to 16.6	20 to 27
Above Alpha Phi Omega (APO)	1 km upstream of APO picnic area		Site 12	9.8	13.1	21
APO Picnic Area	UC Davis Riparian Reserve fire ring and picnic site		Site 13	9.4	13.5	22
I-80	bridge		--	8.3	14.6	24
S.P. Railroad	railroad bridge		--	7.7	15.2	25
Old Davis Road	bridge		Site 14	7.5	15.5	25
Mace Boulevard	bridge		Site 15	4.2	18.7	30
South Fork Preserve	City of Davis property; north and south side, conservation, public use (north side) for nature observation	110	--	4.0 to 3.5	18.9 to 19.4	30 to 31
Los Rios	City of Davis property and easements; conservation, farming		--	2.8 to 1.4	20.1 to 21.5	32 to 35
Road 106A	earthen seasonal bridge		Site 16	1.2	21.8	35
Yolo Bypass West Levee	north levee bend point adjacent to Putah Creek; river mile (RM) 0.0		--	0.0	22.9	37
Yolo Bypass Wildlife Area/Putah Creek Sinks	California Dept. of Fish and Game Wildlife Area; Yolo Bypass is floodway for Sacramento River	15,830	--	0.6 to -3.2	22.3 to 26.1	36 to 42
Los Rios Check Dam	CDFG managed check dam; lower end of study area		Site 17	-2.0	24.9	40
East Toe Drain of Yolo Bypass	Bypass channel confluence with Toe Drain connecting to Sacramento-San Joaquin Delta		--	-3.2	26.1	42
Pleasants Creek						
Putah Creek confluence	confluence at Lake Solano		--	Pl 0.0	--	--

APPENDIX **B**

PUTAH CREEK RESOURCE ASSESSMENT
WILDLIFE HABITAT EVALUATION FORM

INSTRUCTIONS TO ACCOMPANY THE PUTAH CREEK RESOURCE ASSESSMENT WILDLIFE HABITAT EVALUATION FORM

Wildlife habitat will be evaluated on Putah Creek by estimating quality based on a checklist of habitat elements (criteria) for groups of species that have similar habitat requirements. Optimal habitat should have all criteria present and classified as good. Moderate quality habitat may have two or three criteria classified as good or fair. Low quality habitat may only have one criterion classified as good or fair. Overall habitat quality determinations will vary depending on the value of the criteria.

A form will be completed at approximately 0.5 mile intervals along lower Putah Creek from the Monticello Dam to the Putah Sinks and for Pleasants Creek. The area encompassed at each sampling point will vary based on access and visibility, but will generally be a zone approximately 300–500 feet long, and at a minimum 100 feet.

Nesting Landbirds

Nesting birds are divided into four categories based on the nest position. The three following criteria can be evaluated once for all groups of landbirds. The fourth criterion, which refers to nest substrate availability, is to be evaluated for each group separately.

Criteria:

- **StrucCom**–Structural complexity (herbaceous, shrub, canopy layers present, resulting in high plant species diversity)
- **RipWidth**–The width of the riparian corridor
- **LowPred**–Lower apparent density of predators/disturbance or attractants for predators, e.g., cats near residential areas; trash piles, picnic areas which may attract rats, raccoons, etc.

Ground/Low Nesters (0–4'):

Includes such species as song sparrow, Lazuli bunting, spotted towhee, and California towhee.

Criteria:

- **NestSub**–Suitable substrate for nesting, i.e., vegetation density relative to the nest position to provide concealment

Shrub Nesters (4–10')

Includes such species as bushtit and black-headed grosbeak.

Criteria:

- **NestSub**-Suitable substrate for nesting, i.e., vegetation density relative to the nest position to provide concealment.

Tree Nesters (>10')

Includes such species as western wood-pewee, yellow-billed magpie, and Bullock's oriole.

Criteria:

- **NestSub**-Suitable substrate for nesting, i.e., vegetation density relative to the nest position to provide concealment.

Cavity Nesters

Includes such species as American kestrel, western bluebird, ash-throated flycatcher, and tree swallow.

Criteria:

- **Snags**-presence of snags in which nesting cavities are present or can be created.

Raptors

Some of the raptors, which nest on Putah Creek, include red-shouldered hawk, red-tailed hawk, Swainson's hawk, and great-horned owl.

Criteria:

- **NestTree**–Tall/mature trees for nests (valley oak, cottonwood, willow, sycamore, walnut preferred by Swainson's hawks).
- **ForageHab**–Open fields or pastures for foraging adjacent to the nesting habitat.
- **LowDistrb**–Low amount of disturbance in the area.

Herpetofauna

The most likely native herpetofauna to occur on Putah Creek is northwestern pond turtle.

Criteria:

- **SlowWat**–Slack or slow moving water.
- **AerialBask**–Aerial basking areas (e.g., logs, rocks, exposed bank).
- **SubVeg**–Dense submergent vegetation (e.g., pondweed, ditch grass) for basking and feeding; and/or short emergent vegetation for hatchlings.
- **UplandNest**–Upland nesting sites (up to 400 meters from aquatic habitat) with high clay or silt fraction substrate on an unshaded slope usually less than 25° and often south-facing.

Shaded Riverine Aquatic

Shaded riverine aquatic (SRA) cover is in the interface of riparian vegetation and riverine habitat. The productive interaction and synergism of terrestrial and aquatic habitat types associated with SRA cover results in a valuable cover for fish and other aquatic organisms, providing a variety of micro-habitats with various flows, depths, cover, and food production. Instream cover such as vegetative debris provides a food source and spawning substrate for a variety of aquatic species.

Criteria:

- **OverVegHi**–Riparian vegetation that overhangs and shades the water in the creek from taller shrubs and trees.
- **OverVegLo**–Riparian vegetation that overhangs and shades the water in the creek from herbaceous or lower-growing plants, e.g., sedges.
- **NatBank**–Banks composed of natural substrates that support riparian vegetation rather than concrete levees or rip-rap.
- **VegDebris**–Presence of vegetative debris such as logs, branches, and leaves.

Wildlife Corridor/Mammal Movement

A wildlife movement corridor is a linear habitat whose primary wildlife function is to connect two or more significant habitat areas. The following criteria are considered to facilitate movement for a variety of mobile species, such as large and mid-sized mammals.

Criteria:

- **Cover**–Vegetative cover.
- **Connectivity**–The reach should connect to other reaches that contain suitable habitat, without major (>50 meters) gaps in vegetation or obstacles to travel along the corridor.
- **LowDistrb**–Low amount of disturbance in the area.

Putah Creek Resource Assessment
Wildlife Habitat Evaluation

Date :_____ **Surveyor Names:_____**

Zone Description		
Sample Point Number:		**Aerial Photo #s:**
Zone Length (approx.):	**Location Description** *(Downstream and upstream landmarks, driving instructions)***:**	
Channel width (approx. range):		
Riparian corridor width (approx. range):		

Plant Communities	
Plant communities: **(name and % of total area)** *use Sawyer-Keeler-Wolf classification and series, e.g., cottonwood riparian, riparian scrub, valley oak riparian, etc.*	

Vegetation Structure
For each layer, identify dominant species

Ground Layer (herbaceous/litter)	**Low (< 5m)**	**Sub-canopy**	**Canopy**
Species	Species	Species	Species

Wildlife Observed *(list all species or sign observed)*

Habitat Quality for Wildlife Groups

Based on the criteria listed for each group, classify the overall quality of habitat. Optimal habitat should have all criteria present and classified as good. Moderate quality habitat may have two or three criteria classified as good or fair. Low quality habitat may only have one criterion classified as good or fair. Overall habitat quality determinations will vary depending on the value of the criteria. See instruction sheet for more information.

Nesting Landbirds (General)

Criteria:

	Good	Fair	Poor		Good	Fair	Poor
StrucCom	☐	☐	☐	*RipWidth*	☐	☐	☐
LowPred	☐	☐	☐				

Restoration opportunities:_____

_____

Notes:_____

_____

Ground/Low Nesting Birds (0–4')

☐ Optimal ☐ Moderate ☐ Low ☐ Absent

Criteria:

	Good	Fair	Poor
NestSub	☐	☐	☐

Restoration opportunities:_____

Raptors

☐ Optimal ☐ Moderate ☐ Low ☐ Absent

Criteria:

	Good	Fair	Poor		Good	Fair	Poor
NestTree	☐	☐	☐	*ForageHab*	☐	☐	☐
LowDistrb	☐	☐	☐				

Restoration opportunities:_____

_____

Notes:_____

_____

_____

Shrub Nesting Birds (4-10')

☐ Optimal ☐ Moderate ☐ Low ☐ Absent

Criteria:

	Good	Fair	Poor
NestSub	☐	☐	☐

Restoration opportunities:_____

_____

Notes:_____

_____

Herpetofauna

☐ Optimal ☐ Moderate ☐ Low ☐ Absent

Criteria:

	Good	Fair	Poor		Good	Fair	Poor
SlowWat	☐	☐	☐	*AerialBask*	☐	☐	☐
SubVeg	☐	☐	☐	*UplandNest*	☐	☐	☐

Restoration opportunities:_____

_____

Notes:_____

_____

Tree Nesting Birds (>10')

☐ Optimal ☐ Moderate ☐ Low ☐ Absent

Criteria:

	Good	Fair	Poor
NestSub	☐	☐	☐

Restoration opportunities:_____

_____

Notes:_____

_____

Shaded Riverine Aquatic (SRA)

☐ Optimal ☐ Moderate ☐ Low ☐ Absent

Criteria:

	Good	Fair	Poor		Good	Fair	Poor
OverVegHi	☐	☐	☐	*VegDebris*	☐	☐	☐
OverVegLo	☐	☐	☐	*CutBank*	☐	☐	☐
NatBank	☐	☐	☐				

Restoration opportunities:_____

_____

Notes:_____

_____

Cavity Nesting Birds

☐ Optimal ☐ Moderate ☐ Low ☐ Absent

Criteria:

	Good	Fair	Poor
Snags	☐	☐	☐

Restoration opportunities:_____

_____

Notes:_____

_____

Wildlife Corridor/Mammal Movement

☐ Optimal ☐ Moderate ☐ Low ☐ Absent

Criteria:

	Good	Fair	Poor		Good	Fair	Poor
Cover	☐	☐	☐	*Connectivity*	☐	☐	☐
LowDistrb	☐	☐	☐				

Restoration opportunities:_____

_____

Notes:_____

_____

General Notes

APPENDIX C

PUTAH CREEK INVASIVE WEED INVENTORY

PUTAH CREEK INVASIVE WEED INVENTORY

Date:					Surveyors:						Location/Reach:							
Map #	Weed ID (e.g., LELA1)	Mapped (Y) / Lat-Long	Size of Poly/Pt (if < 50 ft long/wide)		ARDO form? (Y/N)	Trees			Shrubs		% Weed cover in polygon (within its canopy)	Weed Position*	Describe erosion caused by this infestation, if any	Recruits (this weed)[1]	Recruit Species (use acronym)[1]			Notes
			Length (ft)	Width (ft)		# <6" DBH	# 6–24" DBH	# >24" DBH	#	Avg. Height				(N)one (F)ew (M)any	None	Few	Many	

* Weed Position: LFC =Low flow (main) channel; B=bar; HFC=High flow channel; LB=Lower bank; UB=Upper bank; T=Top of bank terrace

[1] Recruits: Complete this section only for sites with access. Complete within all infestation polygons greater than about 100 square meters (e.g., > 10m x 10m). If infestation observations (points or polygons) are too numerous to record recruitment data for each observation then characterize recruitment throughout the entire site, by specific weed infestation type (use "weed characterization form, by site/reach").

Weed ID Code	*Scientific Name*	Common Name	Notes
AIAL	*Ailanthus altissima*	Tree of Heaven	
EUC	*Eucalyptus* spp.	Eucalyptus	
ROPS	*Robinia pseudo-acacia*	Black locust	
FICA	*Ficus carica*	Fig	
SCMO	*Schinus molle*	Peruvian peppertree, California peppertree	
ARDO	*Arundo donax*	Giant reed	
TAM*	*Tamarix* spp.	Tamarisk, salt cedar	Also labelled as TARA, but ID not confirmed
LELA	*Lepidium latifolium*	Perennial pepperweed	
CESO	*Centaurea solstitialis*	Yellow starthistle	
PAQU	*Parthenocissus quinquefolia*	Virginia creeper	
HEHE	*Hedera helix*	English ivy	
MYR	*Myriophyllum* sp.	Parrot's feather, watermilfoil	
CAT	*Catalpa* sp.	Catalpa	
RUDI	*Rubus discolor*	Himalayan blackberry	
EICR	*Eichornia crassipes*	Water hyacinth	
SIMA	*Silybum marianum*	milk thistle	
FOVU	*Foeniculum vulgare*	fennel	
NIGL	*Nicotiana glauca*	tree tobacco	

APPENDIX **D**

LOWER PUTAH CREEK PLANT INVENTORY

LOWER PUTAH CREEK PLANT INVENTORY

Scientific Name	Common Name	Family
Acer macrophyllum	Big leaf maple	Aceraceae
Acer negundo	Box elder	Aceraceae
Adenostoma fasciculatum	Chamise	Rosaceae
Achillea millefolium	Yarrow	Asteraceae
Achyrachaena mollis	Blow-wives	Asteraceae
*Aegilops triuncialis**	Barbed goatgrass	Poaceae
Aesculus californica	California buckeye	Hippocastanaceae
*Ailanthus altissima**	Tree-of-Heaven	Simaroubaceae
Alnus rhombifolia	White alder	Betulaceae
*Althea rosea**	Holly hock	Malvaceae
*Amaranthus retroflexus**	Redroot pigweed	Amaranthaceae
Ambrosia psilostachya	Western ragweed	Asteraceae
Ammannia coccinea	Red ammania	Lythraceae
Amsinckia menziesii var. *intermedia*	Common fiddleneck	Boraginaceae
*Anagallis arvensis**	Scarlet pimpernel	Primulaceae
*Anthriscus caucalis**	Bur-chervil	Apiaceae
Apocynum cannabinum	Indian hemp	Apocynaceae
Arctostaphylos manzanita	Common manzanita	Ericaceae
Aristolochia californica	California pipevine	Aristolochiaceae
Artemisia douglasiana	Mugwort	Asteraceae
Artemisia dracunculus	Wild tarragon	Asteraceae
*Arundo donax**	Giant reed	Poaceae
Atriplex patula	Fat-hen	Chenopodiaceae
*Atriplex rosea**	Redscale	Chenopodiaceae
*Avena fatua**	Wild oat	Poaceae
Azolla filiculoides	Mosquito fern	Azollaceae
Baccharis pilularis	Coyote bush	Asteraceae
Baccharis salicifolia	Mulefat	Asteraceae
Bidens frondosa	Stick-tight	Asteraceae
*Brassica nigra**	Black mustard	Brassicaceae
*Bromus catharticus**	Rescuegrass	Poaceae
*Bromus diandrus**	Ripgut brome	Poaceae
*Bromus hordeaceus**	Soft chess	Poaceae
Bromus madritensis ssp. *rubens**	Red brome	Poaceae
Calystegia sp.	Morning-glory	Convolvulaceae
*Cardaria draba**	Hoary cress	Brassicaceae
*Carduus pynocephalus**	Italian thistle	Asteraceae
Carex obnupta	Slough sedge	Cyperaceae
Carex sp.	Sedge	Cyperaceae

* = non-native species

LOWER PUTAH CREEK PLANT INVENTORY

Scientific Name	Common Name	Family
Catalpa sp.*	Catalpa	Bignoniaceae
Ceanothus cuneatus	Buckbrush	Rhamnaceae
*Centaurea solstitalis**	Yellow star-thistle	Asteraceae
Cephalanthus occidentalis	Button bush	Rubiaceae
Cercis occidentalis	Redbud	Fabaceae
*Chamomilla suaveolens**	Pineapple weed	Asteraceae
*Chenopodium album**	White goosefoot	Chenopodiaceae
*Cichorium intybus**	Chicory	Asteraceae
*Cirsium arvense**	Canada thistle	Asteraceae
Clarkia sp.	Clarkia	Onagraceae
Claytonia perfoliata	Miner's lettuce	Portulacaceae
Clematis ligusticifolia	Virgin's bower	Ranunculaceae
*Conium maculatum**	Poison hemlock	Apiaceae
*Convolvulus arvensis**	Field bindweed	Convolvulaceae
*Conyza canadensis**	Canadian horseweed	Asteraceae
Cornus sericea	American dogwood	Cornaceae
*Cortaderia jubata**	Andean pampas grass	Poaceae
Cotula coronopifolia	Brass buttons	Asteraceae
Crassula connata	Pygmy weed	Crassulaceae
*Crypsis schoenoides**	Swampgrass	Poaceae
Cuscuta sp.	Dodder	Cuscutaceae
*Cynodon dactylon**	Bermuda grass	Poaceae
*Cynosurus echinatus**	Dogtail grass	Poaceae
Cyperus eragrostis	Umbrella sedge	Cyperaceae
Cyperus esculentus	Yellow nutsedge	Cyperaceae
Cyperus rotundus	Purple nutsedge	Cyperaceae
*Datura wrightii**	Jimsonweed	Solanaceae
*Daucus carota**	Queen Anne's lace	Apiaceae
Elodea sp. *(or Egeria* sp.*)*	Waterweed	Hydrocharitaceae
Elymus glaucus	Blue wildrye	Poaceae
Epilobium brachycarpum	Tall annual willow-herb	Onagraceae
Epilobium canum	California fuchsia	Onagraceae
Epilobium ciliatum	Slender willow-herb	Onagraceae
Equisetum arvense	Common horsetail	Equisetaceae
Equisetum sp.	Horsetail	Equisetaceae
Eremocarpus setigerus	Turkey mullein	Euphorbiaceae
Eriodictyon californicum	Yerba Santa	Hydrophyllaceae
*Erodium botrys**	Storkbill filaree	Geraniaceae
*Erodium cicutarium**	Redstem filaree	Geraniaceae

* = non-native species

LOWER PUTAH CREEK PLANT INVENTORY

Scientific Name	Common Name	Family
*Erodium moschatum**	Greenstem filaree	Geraniaceae
Eschscholzia californica	California poppy	Papaveraceae
*Eucalyptus globulus**	Blue gum	Myrtaceae
*Eucalyptus camaldulensis**	Red gum	Myrtaceae
Euphorbia sp.	Spurge	Euphorbiaceae
Euthamnia occidentalis	Western goldenrod	Asteraceae
*Ficus carica**	Edible fig	Moraceae
*Filago gallica**	Narrow-leaved filago	Asteraceae
*Foeniculum vulgare**	Fennel	Apiaceae
Fraxinus latifolia	Oregon ash	Oleaceae
*Galium aparine**	Common bedstraw	Rubiaceae
Glycyrrhiza lepidota	Wild licorice	Fabaceae
Gnaphalium canescens	Everlasting cudweed	Asteraceae
Grindelia sp.	Gum plant	Asteraceae
*Hedera helix**	English ivy	Araliaceae
Helianthus annuus	Common sunflower	Asteraceae
Heliotropium curassavicum	Heliotrope	Boraginaceae
Hemizonia fitchii	Fitch's spikeweed	Asteraceae
Heteromeles arbutifolia	Toyon	Rosaceae
*Hirschfelia incana**	Shortpod mustard	Brassicaceae
Hoita macrostachya	Leather root	Fabaceae
Hordeum murinum ssp. *leporinum**	Foxtail	Poaceae
*Hypochaeris glabra**	Smooth cat's ear	Asteraceae
Juglans californica	California black walnut	Juglandaceae
*Juglans regia**	English walnut	Juglandaceae
Juncus balticus	Baltic rush	Juncaceae
Juncus effuses	Common rush	Juncaceae
*Kickxia elatine**	Sharp-leaved fluellin	Scrophulariaceae
*Lactuca serriola**	Prickly lettuce	Asteraceae
Lathyrus sp.	Sweet pea	Fabaceae
Leersia oryzoides	Rice cutgrass	Poaceae
Lemna sp.	Duckweed	Lemnaceae
*Leontodon taraxacoides**	Lesser hawkbit	Asteraceae
*Lepidium latifolium **	Perennial pepperweed	Brassicaceae
*Leucanthemum vulgare**	Ox-eye daisy	Asteraceae
Leymus triticoides	Creeping wildrye	Poaceae
Linaria sp.	Toadflax	Scrophulariaceae
*Liquidambar styraciflua**	Liquidambar, sweet gum	Hamamelidaceae
*Lolium multiflorum**	Italian ryegrass	Poaceae

* = non-native species

LOWER PUTAH CREEK PLANT INVENTORY

Scientific Name	Common Name	Family
*Lotus corniculatus**	Bird's foot trefoil	Fabaceae
Lotus purshianus	Spanish clover	Fabaceae
Lotus sp.	Lotus	Fabaceae
Ludwigia peploides	Floating water-primrose	Onagraceae
Lupinus albifrons	Silver lupine	Fabaceae
Lupinus bicolor	Miniature lupine	Fabaceae
Lupinus microcarpus	Chick lupine	Fabaceae
Lupinus succulentus	Succulent lupine	Fabaceae
Lycopus americanus	Water horehound	Lamiaceae
*Maclura pomifera**	Osage orange	Moraceae
*Malva parviflora**	Cheeseweed	Malvaceae
Malvella leprosa	Alkali mallow	Malvaceae
Marah sp.	Manroot	Cucurbitaceae
*Marrubium vulgare**	Horehound	Lamiaceae
Marsilea vestita	Hairy waterclover	Marsileaceae
*Medicago polymorpha**	California burclover	Fabaceae
*Melia azedarach**	China berry	Meliaceae
*Melilotus alba**	White sweetclover	Fabaceae
*Melilotus indica**	Indian sweetclover	Fabaceae
Mentha arvensis	Field mint	Lamiaceae
Mimulus aurantiacus	Sticky monkeyflower	Scrophulariaceae
Morus sp.*	Mulberry	Moraceae
Myriophyllum sp.	Water milfoil	Haloragaceae
*Nicotiana glauca**	Tree tobacco	Solanaceae
*Olea europaea**	Olive	Oleaceae
Opuntia sp.	Prickly pear	Cactaceae
Panicum capillare	Witchgrass	Poaceae
*Parthenocissus quinquefolia**	Virginia creeper	Vitaceae
*Paspalum dilatatum**	Dalllis grass	Poaceae
*Paspalum distichum**	Knotgrass	Poaceae
*Petrorhagia dubia**	Pinkgrass	Caryophyllaceae
*Phalaris aquatica**	Harding grass	Poaceae
Phalaris arundinacea	Reed canary grass	Poaceae
*Phalaris minor**	Littleseed canary grass	Poaceae
Phoradendron villosum	Oak mistletoe	Viscaceae
Phyla nodiflora	Common lippia	Verbenaceae
Pinus sabiniana	Foothill pine	Pinaceae
*Plantago major**	Common plantain	Plantaginaceae
Platanus racemosa	California sycamore	Platanaceae

* = non-native species

LOWER PUTAH CREEK PLANT INVENTORY

Scientific Name	Common Name	Family
*Poa pratensis**	Kentucky bluegrass	Poaceae
Polygonum arenastrum	Common knotweed	Polygonaceae
Polygonum hydropiperoides	Swamp smartweed	Polygonaceae
Polygonum lapathifolium	Willow weed	Polygonaceae
*Polygonum persicaria**	Lady's thumb	Polygonaceae
Polygonum punctatum	Common water smartweed	Polygonaceae
*Polypogon monspeliensis**	Rabbitfoot grass	Poaceae
Populus fremontii	Fremont cottonwood	Salicaceae
*Potamogeton crispus**	Curly pondweed	Potamogetonaceae
Prunus dulcis (=P. amygdalus)*	Domestic almond	Rosaceae
Prunus sp.	Cherry	Rosaceae
Prunus virginiana var. *demissa*	Western choke cherry	Rosaceae
Psilocarphus brevissimus	Woolly marbles	Asteraceae
Quercus chrysolepis	Canyon live oak	Fagaceae
Quercus douglasii	Blue oak	Fagaceae
Quercus lobata	Valley oak	Fagaceae
Quercus wislizenii	Interior live oak	Fagaceae
*Raphanus sativus**	Wild radish	Brassicaceae
Rhamnus californica	California coffee berry	Rhamnaceae
Rhus trilobata	Skunkbush	Anacardiaceae
*Robinia pseudo-acacia**	Black locust	Fabaceae
Rosa californica	California rose	Rosaceae
*Rubus discolor**	Himalayan blackberry	Rosaceae
Rubus ursinus	California blackberry	Rosaceae
*Rumex crispus**	Curly dock	Polygonaceae
Rumex salicifolius	Willow dock	Polygonaceae
Salix exigua	Sand bar willow	Salicaceae
Salix gooddingii	Goodding's willow	Salicaceae
Salix laevigata	Red willow	Salicaceae
Salix lasiolepis	Arroyo willow	Salicaceae
Sambucus mexicana	Blue elderberry	Caprifoliaceae
Sanicula crassicaulis	Western sanicle	Apiaceae
*Schinus molle**	Peruvian peppertree	Anacardiaceae
Scirpus acutus	Common tule	Cyperaceae
Scrophularia californica	California figwort	Scrophulariaceae
*Senecio vulgaris**	Common groundsel	Asteraceae
*Silybum marianum**	Milk thistle	Asteraceae
Solanum americanum	Common nightshade	Solanaceae
*Solanum elaegnifolium**	Horse-nettle	Solanaceae

* = non-native species

LOWER PUTAH CREEK PLANT INVENTORY

Scientific Name	Common Name	Family
*Sonchus asper**	Prickly sow-thistle	Asteraceae
*Sonchus oleraceus**	Common sow-thistle	Asteraceae
*Sorghum halepense**	Johnson grass	Poaceae
*Spergularia rubra**	Sand spurry	Caryophyllaceae
*Stellaria media**	Chickweed	Caryophyllaceae
Symphoricarpos albus var. *laevigatus*	Upright snowberry	Caprifoliaceae
*Taeniatherum caput-medusae**	Medusahead grass	Poaceae
*Tamarix aphylla**	Athel tamarisk	Tamaricaceae
*Tamarix chinensis**	Five-stamen tamarisk	Tamaricaceae
*Tamarix parviflora**	Four-stamen tamarisk	Tamaricaceae
*Taraxacum officinale**	Common dandelion	Asteraceae
Toxicodendron diversilobum	Poison oak	Anacardiaceae
*Tribulus terrestris**	Puncture vine	Zygophyllaceae
*Trifolium hirtum**	Rose clover	Fabaceae
*Trifolium incarnatum**	Crimson clover	Fabaceae
Typha angustifolia	Narrow-leaf cattail	Typhaceae
Umbellularia californica	California bay laurel	Lauraceae
Urtica dioica	Stinging nettle	Urticaceae
*Verbascum thapsus**	Woolly mullein	Scrophulariaceae
Vicia Americana	American vetch	Fabaceae
*Vicia sativa**	Common vetch	Fabaceae
*Vicia villosa**	Hairy vetch	Fabaceae
*Vinca major**	Periwinkle	Apocynaceae
Vitis californica	California grape	Vitaceae
*Vulpia myuros**	Rattail fescue	Poaceae
Xanthium strumarium	Cocklebur	Asteraceae
*Zelkova serrata**	Sawtooth zelkova	Ulmaceae

* = non-native species

APPENDIX **E**

LOWER PUTAH CREEK AVIAN SPECIES

LOWER PUTAH CREEK AVIAN SPECIES

Sources included Sutter & Dawson 1986, Cole et al. 1990, Truan 2002, compiled by Truan (2003).

COMMON NAME	Scientific name
Pied-billed Grebe	*Podilymbus podiceps*
Double-crested Cormorant	*Palacrocorax auritus*
American Bittern	*Botaurus lentiginosus*
Great Blue Heron	*Ardea herodias*
Great Egret	*Casmerodius albus*
Snowy Egret	*Egretta thula*
Green Heron	*Butorides virescens*
Black-crowned Night Heron	*Nycticorax nycticorax*
Turkey Vulture	*Carthartes aura*
Greater White-fronted Goose	*Anser albifrons*
Canada Goose	*Branta canadensis*
Wood Duck	*Aix sponsa*
Gadwall	*Anas strepera*
American Widgeon	*Anas americana*
Mallard	*Anas platyrhynchos*
Cinnamon Teal	*Anas cyanoptera*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Lesser Scaup	*Aythya affinis*
Bufflehead	*Bucephala albeola*
Common Goldeneye	*Bucephala clangula*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Ruddy Duck	*Oxyura jamaicensis*
Osprey	*Pandion haliaetus*
White-tailed Kite	*Elanus leucurus*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*
Sharp-shinned Hawk	*Accipiter striatus*

LOWER PUTAH CREEK AVIAN SPECIES

COMMON NAME	Scientific name
Cooper's Hawk	*Accipiter cooperii*
Red-shouldered Hawk	*Buteo lineatus*
Swainson's Hawk	*Buteo swainsoni*
Red-tailed Hawk	*Buteo jamaicensis*
Rough-legged Hawk	*Buteo lagopus*
Golden Eagle	*Aquila chrysaetos*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Prairie Falcon	*Falco mexicanus*
Red Junglefowl	*Gallus gallus*
Ring-necked Pheasant	*Phasianus colchicus*
Common Peafowl	*Pavo cristatus*
Wild Turkey	*Meleagris gallopavo*
California Quail	*Callipepla californica*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Common Moorhen	*Gallinula chloropus*
American Coot	*Fulica americana*
Killdeer	*Charadrius vociferus*
Black-necked Stilt	*Himantopus mexicanus*
American Avocet	*Recurvirostra americana*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Spotted Sandpiper	*Actitis macularia*
Whimbrel	*Numenius phaeopus*
Long-billed Curlew	*Numenius americanus*
Western Sandpiper	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
Ring-billed Gull	*Larus delawarensis*
California Gull	*Larus californicus*
Herring Gull	*Larus argentatus*
Forster's Tern	*Sterna forsteri*
Rock Dove	*Columba livia*
Mourning Dove	*Zenaida macroura*

LOWER PUTAH CREEK AVIAN SPECIES

COMMON NAME	Scientific name
Barn Owl	*Tyto alba*
Western Screech Owl	*Otus kennicottii*
Great Horned Owl	*Bubo virginianus*
Burrowing Owl	*Athene cunicularia*
White-throated Swift	*Aeribaytes saxatalis*
Black-chinned Hummingbird	*Archilochus alexandri*
Anna's Hummingbird	*Calypte anna*
Rufous Hummingbird	*Selasphorus rufus*
Allen's Hummingbird	*Selasphorus sasin*
Belted Kingfisher	*Ceryle alcyon*
Lewis' Woodpecker	*Melanerpes lewis*
Acorn Woodpecker	*Melanerpes formicivorus*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Nuttall's Woodpecker	*Picoides nuttallii*
Downy Woodpecker	*Picoides pubscens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Olive-sided Flycatcher	*Contopus cooperi*
Western Wood-Pewee	*Contopus sordidulus*
Willow Flycatcher	*Empidonax traillii*
Hammond's Flycatcher	*Empidonax hammondii*
Dusky Flycatcher	*Empidonax oberholseri*
Pacific-slope Flycatcher	*Empidonax difficilis*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Western Kingbird	*Tyrannus verticalis*
Loggerhead Shrike	*Lanius ludovicianus*
Cassin's Vireo	*Vireo cassinii*
Hutton's Vireo	*Vireo huttoni*
Warbling Vireo	*Vireo gilvus*
Western Scrub-Jay	*Aphelocoma californica*
Yellow-billed Magpie	*Pica nuttalli*
American Crow	*Corvus brachyrhynchos*
Horned Lark	*Eremophilia alpestris*

LOWER PUTAH CREEK AVIAN SPECIES

COMMON NAME	Scientific name
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Bank Swallow	*Riparia riparia*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Oak Titmouse	*Baeolophus inornatus*
Bushtit	*Psaltriparus minimus*
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinensis*
Brown Creeper	*Certhia americana*
Bewick's Wren	*Thryomanes bewickii*
House Wren	*Troglodytes aedon*
Marsh Wren	*Cistothorus palustris*
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Western Bluebird	*Sialia mexicana*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Varied Thrush	*Ixoreus naevius*
Wrentit	*Chamaea fasciata*
Northern Mockingbird	*Mimus polyglottos*
European Starling	*Sturnus vulgaris*
American Pipit	*Anthus rubescens*
Cedar Waxwing	*Bombycilla cedrorum*
Phainopepla	*Phainopepla nitens*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler (Audubon's)	*Dendroica coronata*
Black-throated Gray Warbler	*Dendroica nigrescens*
Townsend's Warbler	*Dendroica townsendi*
Hermit Warbler	*Dendroica occidentalis*

LOWER PUTAH CREEK AVIAN SPECIES

COMMON NAME	Scientific name
MacGillivray's Warbler	*Oporonis tolmiei*
Common Yellowthroat	*Geothlypis trichas*
Wilson's Warbler	*Wilsonia pusilla*
Western Tanager	*Piranga ludoviciana*
Spotted Towhee	*Pipilo maculatus*
California Towhee	*Pipilo crissalis*
Chipping Sparrow	*Spizella passerina*
Vesper Sparrow	*Pooecetes gramineus*
Lark Sparrow	*Calamopsiza melanocorys*
Savannah Sparrow	*Passerculus sandwichensis*
Grasshopper Sparrow	*Ammodramus savannarum*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
White-crowned Sparrow	*Zonotrichia leucophyrs*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Dark-eyed Junco	*Junco hyemalis*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Guiraca caeulea*
Lazuli Bunting	*Passerina amoena*
Red-winged Blackbird	*Agelaius phoeniceus*
Western Meadowlark	*Sturnella neglecta*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Brown-headed Cowbird	*Molothrus ater*
Hooded Oriole	*Icterus cucullatus*
Bullock's Oriole	*Icterus bullockii*
Purple Finch	*Carpodacus purpureus*
House Finch	*Carpodacus mexicanus*
Pine Siskin	*Carduelis pinus*
Lesser Goldfinch	*Carduelis psaltria*
Lawrence's Goldfinch	*Carduelis lawrencei*
American Goldfinch	*Carduelis tristis*
House Sparrow	*Passer domesticus*

APPENDIX **F**

LOWER PUTAH CREEK FISH SPECIES COLLECTED DURING 1991–2002 SURVEYS

Lower Putah Creek Fish Species Collected During 1991–2002 Surveys

Common Name	*Scientific Name*	*Abbreviation*	*Origin* *Native or Introduced*
American shad	*Alosa sapidissima*	AMS	I
bigscale logperch	*Percina macrolepida*	BSL	I
black bullhead	*Ameiurus melas*	BBH	I
black crappie	*Pomoxis nigromaculatus*	BCR	I
bluegill	*Lepomis machrochirus*	BGS	I
brown bullhead	*Ameiurus nebulosus*	BBH	I
brown trout	*Salmo trutta*	BNT	I
California roach	*Lavinia symmetricus*	RCH	N
channel catfish	*Ictalurus punctatus*	CCF	I
chinook salmon	*Oncorhynchus tshawytscha*	CHN	N
common carp	*Cyprinus carpio*	CRP	I
fathead minnow	*Pimephales promelas*	FHM	I
golden shiner	*Notemigonu scrysoleucus*	GSH	I
goldfish	*Carassius auratus*	GLF	I
green sunfish	*Lepomis cyanellus*	GSF	I
green sunfish X bluegill	*Lepomis* spp.	GXB	I
hitch	*Lavinia exilicauda*	HTC	N
inland silverside	*Menidia beryllina*	ISS	I
largemouth bass	*Micropterus salmoides*	LMB	I
Pacific Lamprey	*Lampetra tridentata*	PLR	N
pumpkinseed	*Lepomis gibbosus*	PMK	I
prickly sculpin	*Cottus asper*	PSC	N
rainbow trout	*Oncorhynchus mykiss*	RBT	N
red shiner	*Cyprinella lutrensis*	RSH	I
redear sunfish	*Lepomis microlophus*	RES	I
redear sunfish X bluegill	*Lepomis* spp	RXB	I
riffle sculpin	*Cottus gulosus*	RSC	N
Sacramento blackfish	*Orthodon microlepidotus*	SBF	N
Sacramento perch	*Archoplites interruptus*	SAP	N
Sacramento pikeminnow	*Ptychochelius grandis*	PKM	N
Sacramento sucker	*Catostomus occidentalis*	SKR	N
smallmouth bass	*Micropterus dolomieu*	SMB	I
striped bass	*Morone saxatilis*	STB	I
threadfin shad	*Dorosoma petenense*	TFS	I
threespine stickleback	*Gasterosteus aculeatus*	SBK	N
tule perch	*Hysterocarpus traski*	TUP	N
warmouth	*Lepomis gulosus*	WRM	I
western mosquitofish	*Gambusia affinis*	MSQ	I
white catfish	*Ameiurus catus*	WCF	I
white crappie	*Pomoxis annularis*	WCR	I
yellowfin goby	*Acanthogobius flavimanus*	YFG	I

Source: LPCCC 2003

APPENDIX G

NEW ZEALAND MUD SNAIL

Fishing Alert

The New Zealand Mud Snail, a tiny non-native snail, was recently discovered in Putah Creek. It was probably transported to Putah Creek on fishing or boating equipment used in Montana. In some areas of Montana, the snail population is 700,000 per square yard. Large populations of the snails have reduced mayfly larvae numbers by 50%. That loss of food is expected to eventually have a dramatic impact on trout populations.

Please help protect California trout populations by preventing the spread of this harmful snail to other waterways:

1. **Wash your boots off completely before leaving the creek.**
2. **Inspect your boots, nets, and other equipment for snails.**
3. **Check under the laces and in the tongue folds of your boots.**
4. **Soak your boots and nets in hot water (130°F) until it cools.**
5. **Allow your boots to dry completely.**
6. **Check boats, kayaks, and canoes for snails.**

EVEN BETTER

Use one pair of boots just for Putah Creek and clean as above.

For additional information, links, and answers to your questions go to:

GRANITE BAY Flycasters www.gbflycasters.org

WildlifeFiles.com

CALIFORNIA TROUT KEEPER OF THE STREAMS www.caltrout.org

Source: Granite Bay Flycasters; California Trout, Inc.; Ken Davis 2003

New Zealand Mud Snail

APPENDIX G

Source: Idaho Dept. of Fish and Game; U.S. Bureau of Reclamation; USFWS; CDFG; Putah Creek Council, 2003

New Zealand Mud Snail Information (side 1)

APPENDIX G

NEW ZEALAND MUDSNAIL (*Potamopyrgus antipodarum*) in CALIFORNIA

WHAT CAN YOU DO?

Reporting Sightings:

- Report potential sightings to david_bergendorf@fws.gov or sellis@dfg.ca.gov or phone **1-888-321-8913**.
- **Please help the aquatic life in California streams and your fellow fishermen by letting them know about this resource pest and its potential impacts on trout and fish habitat.** Please report any fishing activity in closed areas at Lake Solano Park to Park Rangers at (530) 795-2990 and on Putah Creek to California Fish and Game at 1-888-DFG-CALTIP.
- Immature snails are about 1 mm long and often look like sprinkled black pepper.
- Mature snails have a light to dark brown shell and are still tiny, only growing up to 5 mm long.
- NZMS can tolerate a wide range of habitats including reservoirs, rivers, lakes and estuaries. Found in all substrates including gravel, sand, silt, and vegetation.

Clean Your Gear Before Leaving Site or Moving To Another Site!

- See opposite side for gear cleaning recommendations.

Encourage Friends and Fellow Fishermen to Avoid Closed or Infested Areas, and Keep the Mudsnail from Infesting Other California Streams!

KNOWN LOCATIONS IN CALIFORNIA

- 2000: Owens River (Eastern CA); now found in Hot Creek near the fish hatchery.
- October 2003: Putah Creek (Western Central Valley below Monticello Dam) - Fishing Access #3.
- December 2003: Putah Creek - Found between Fishing Access #2 and #3 and between #3 and #4. **Putah Creek and Lake Solano closed to all fishing in interdam reach between Monticello Dam and diversion dam below Lake Solano Park – Closure began December 26, 2003 for 120 days**
- December 2003: Mokelumne River (Central Valley) - above Woodbridge Dam near Lodi.

HOW THEY SPREAD

- It Only Takes One! The snails reproduce without fertilization, bear 20-120 snails per brood (multiple broods per year), and can spread from just one snail.
- Primarily spread through human activities on angling gear, shoes and boats. Can also spread on clothing and animal fur, so please check your dog or other pets before leaving any infested area.
- Snails can survive passing through the gut of a fish and may be spread that way; may hitchhike on birds.
- Can survive for 25+ days in cool, moist places, like waders, mud, boats, the tread of shoes, and so forth.

FAST FACTS

- First discovered in mid-Snake River, Idaho in the 1980s and is spreading rapidly throughout the west.
- Snail densities as high as 750,000 per square meter have been recorded in some areas.
- At high levels, snails consume most available food leaving little for native snails and aquatic insects to feed on. This leads to a reduction or elimination of the native macroinvertebrates, and therefore a reduction in food available for fish and other members of the native aquatic ecosystem.
- The snails have the ability to close off their shell opening allowing them to live for a long time without being in water (25 days if moist).
- NZMS can travel up to 1 meter per hour and have been found over 40 feet from the water. You can pick them up without being near the water!
- Average life span is over one year.

See Opposite Side For More Information And Websites
Updated 1/22/2004

Source: Idaho Dept. of Fish and Game; U.S. Bureau of Reclamation; USFWS; CDFG; Granite Bay Flycasters; California Trout, Inc., 2003

New Zealand Mud Snail Information (side 2)

Department of Fish and Game

NEWS RELEASE FOR IMMEDIATE RELEASE 04:001 January 13, 2004

Contacts: Ed Pert, Chief, DFG Inland Fisheries Division, (916) 445-3616;
Patrick Foy, DFG Information Officer, (916) 358-2938;
Steve Martarano, DFG Office of Public Affairs, (916) 654-5866

DFG Offers Suggestions to Prevent Spread of New Zealand Mud Snails

The California Department of Fish and Game (DFG) urges anglers throughout California to guard against the unintentional spread of the non-native New Zealand Mud Snails (NZMS). Discovery of NZMS has forced the emergency 120-day closure of Putah Creek in Yolo County to allow studies on the infestation and the best course of action.

In late December 2003, the snails were also discovered in the Mokelumme River, another Central Valley waterway that flows from the Sierra Nevada south of Sacramento. DFG announced the discovery after work crews with the East Bay Municipal Utilities District found the snails on equipment downstream from Camanche Reservoir, east of Lodi. Since 2000, the snails have also been found on the Owens River and Hot Creek in the Eastern Sierra.

"It is important for anyone who fishes in California or works in our waterways to take precautions to not transport the NZMS," said Ed Pert, Chief, DFG Inland Fisheries Division. "A major factor in the spread of the NZMS is a lack of awareness by anglers and others in contact with waters infested with NZMS. These snails can survive out of water on wading and fishing gear for extended periods."

Pert said mud snails can survive up to 25 days if they are in a moist environment, such as inside waders, on muddy wader boots, in live wells or in cooling systems at cool temperatures. DFG suggests that anglers treat their gear with at least one of the following methods to prevent spread of NZMS:

- Spray gear with Clorox Formula 409, and then scrub with stiff-bristled brush to remove all visible snails. Follow the procedure with a careful inspection of waders and gear to ensure the removal of all adults. Finish with a tap water rinse. Snails frequently collect between laces and tongue of wading boots and in the boot's felt soles.

- Freeze waders six to eight hours. It is best to leave them in the freezer overnight to ensure complete mortality.

- Drying in air temperature over 112 degrees (50 degrees Celsius) for 24 hours will eliminate all mud snails. Alternatively, place gear in water maintained at 130 degrees for five minutes. Mortality of snails varies by exposure to heat and humidity at different combinations.

- NZMS are not the only aquatic invasive species spread by anglers and boaters. Live bait and the packaging used for some forms of live bait are known to spread other invaders. In addition, invasive aquatic plants and animals are known to hitchhike on boats, their propellers, live wells, and fishing gear. Cleaning all boating equipment is crucial to reducing the impacts from non-native invasive species.

DFG biologists and field staff members who conduct studies in the infested areas have received similar instructions to guard against the spreading of NZMS, Pert said.

DFG warns that the snails in Putah Creek have been collected on the banks, well away from the water's edge. Outdoor enthusiasts and boaters who travel within the riparian areas should also follow the guidelines.

NZMS is a very small snail with the potential of extraordinary population densities - up to approximately a million snails per square meter. Populations in New Zealand are limited naturally by native parasites and predators. In North America, however, there are no natural predators or parasites of the snail and the populations have flourished where introduced. Currently, no method of eradication has been successfully applied to large, open river systems.

Putah Creek began its 120-day closure on Dec. 26, 2003. The Fish and Game Commission ordered the emergency action, which received support from various fly-fishing clubs, to close the popular winter trout fishery from Monticello Dam downstream to, and including, Lake Solano in Yolo County. There are currently no plans to close the Mokelumne River, which is about 40 miles away from Putah Creek.

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Federation of Fly Fishers
(http://www.fedflyfishers.org/Conserve/mudsnailfactsheet.htm)

New Zealand Mud Snails
New Zealand Mud Snail – Fact Sheet

Scientific Name: *Potamopyrgus antipodarum*

Originally found only in New Zealand the New Zealand Mud Snail (NZMS) was first transported to England in 1859. By 1899 it had reached mainland Europe and the 1920's found it throughout all of England. In 1987 NZMS were discovered in Idaho's Snake River. In 1997 surveys showed the snail had spread to all of the major waters in Yellowstone National Park. In recent years it has been found throughout the Columbia River drainage, in many Montana waters and in several California streams.

NZMS have the capability for clonal asexual reproduction. In this type of reproduction a single snail can reproduce with no mate. Thus, a single snail is all that is required to establish a new population.

NZMS reproduce very rapidly. A single snail produces up to 38 live snails twice a year. Each of these reaches reproductive age very quickly and it is possible that a single individual could be responsible for a population of 3,700,000 in two years.

NZMS impact the environment through sheer numbers. Densities of more than 800,000 per square meter have been recorded in several areas. These huge numbers of snail eat much of the available food in the stream. A recent study from Montana State University showed that NZMS can consume up to 50% of the production in a stream.

The impact of NZMS feeding on available food is seen in several ways. The most immediate impact is on populations of native snails that can quickly be pushed out. In fact, in Pole Cat Creek in Grand Teton National Park a unique native snail found only in the creek is facing extinction because of competition from NZMS.

Many organisms besides snails are impacted by NZMS. Many aquatic insects can be impacted as well. Invertebrate studies show marked declines in midge and mayfly populations.

Loss of native snails and other aquatic invertebrates becomes a loss of food to various fish. NZMS provide little if any nutrition to fish that eat them. In fact, a significant percentage of the snails that are eaten pass through the fish alive.

NZMS have no natural enemies in North America. In New Zealand a tiny parasite controls snail numbers, giving hope that future biological control might be possible.

NZMS invasions can only be controlled by preventing the spread of the snail. Once they are established there is no known way to eradicate them. All of the methods of transport have not been identified but it is almost certain that water recreationists are the primary vector of spread.

New discoveries of NZMS are occurring rapidly as biologists and others become trained in looking for them. They are probably found in far more waters than currently identified.

More information on NZMS can be obtained from the Federation of Fly Fishers at 406/222-9369.

APPENDIX H

PERMITTING AND REGULATORY COMPLIANCE

H PERMITTING AND REGULATORY COMPLIANCE

H.1 REGULATORY BACKGROUND

This section summarizes laws and regulations pertaining to land and resource protection and management within the lower Putah Creek watershed. The section includes an overview California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), and other laws and regulations pertaining to the resource areas discussed in this Watershed Management Action Plan (WMAP). However, because of the overlap in laws and regulations, discussions for some resource areas have been combined into the following groups: "water quality, wetlands, and riparian resources," and "fisheries and terrestrial biology." For each resource topic, applicable federal laws are presented first, followed by state laws and, where applicable, local laws and ordinances.

A Categorical Exemption (Cat Ex) under CEQA has been adopted, and several programmatic permits for habitat restoration and watershed enhancement work in the lower Putah Creek watershed have already been obtained. The permits include a programmatic Streambed Alteration Agreement from California Department of Fish and Game (DFG) for work affecting the "bed and bank" of lower Putah Creek and its tributaries, a Nationwide Permit 27 (Restoration) under Section 404 of the Clean Water Act (CWA) from the U.S. Army Corps of Engineers (USACE), and Clean Water Certification pursuant to Section 401 of the CWA from the Central Valley Regional Water Quality Control Board (RWQCB). The Cat Ex and permits are held by the Solano County Water Agency, serving as lead public agency on behalf of the Lower Putah Creek Coordinating Committee (LPCCC). Project and permit requirements specified for the various habitat restoration and watershed enhancement activities have been summarized and are provided as Appendix I of this document.

H.2 CALIFORNIA ENVIRONMENTAL QUALITY ACT

CEQA applies to all discretionary activities that are carried out or approved by California public agencies, including state, regional, county, and local agencies, unless an exemption applies. The main objectives of CEQA are to:

- disclose the decision makers and the public to significant environmental effects of proposed activities,
- identify ways to avoid or reduce environmental damage,
- prevent environmental damage by requiring implementation of feasible alternatives or mitigation measures,
- disclose to the public reasons for agency approval of actions with significant environmental effects,
- foster interagency coordination in the review of projects, and
- enhance public participation in the planning process.

The type of CEQA compliance document prepared for a project depends of the project's potential effect on the environment. A Cat Ex may be prepared if it is determined that the project is exempt from CEQA. If the project will have only minor impacts that can be mitigated to less-than-significant levels, an Initial Study/Mitigated Negative Declaration (IS/ND) is typically adequate. A project resulting in one or more significant effects on the environment typically requires preparation of an Environmental Impact Report (EIR).

H.3 NATIONAL ENVIRONMENTAL POLICY ACT

NEPA requires federal agencies to evaluate the environmental effects of their actions. NEPA applies whenever a federal agency proposes an action, grants a permit, or agrees to fund or otherwise authorize any other entity that could possibly affect environmental resources. Typical NEPA compliance documents include a Cat Ex, Environmental Assessment/Finding of No Significant Impact (EA/FONSI), or Environmental Impact Statement (EIS).

H.4 CULTURAL RESOURCES

H.4.1 FEDERAL LAWS AND REGULATIONS

SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT

Section 106 of the National Historic Preservation Act (NHPA) of 1969 (amended 1970) requires that federal agencies or other public agencies receiving federal support take into account the effects of their actions on properties that may be eligible for or listed on the NRHP, and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on proposed projects and the findings of cultural resource studies. To determine whether an undertaking could affect NRHP eligible properties, all cultural sites that could be affected must be inventoried and evaluated for inclusion on the NRHP. Section 106 of the NHPA would apply if federal agencies were involved in activities on Putah Creek through various permitting processes or by providing federal funding.

NATIVE AMERICAN GRAVES PROTECTION AND REPATRIATION ACT

Native American human remains are also protected under the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 United States Code [USC] 3001 et seq.), which requires federal agencies and certain recipients of federal funds to document Native American human remains and cultural items within their collections, notify Native American groups of their holdings, and provide an opportunity for repatriation of these materials. This act also requires plans for dealing with potential future collections of Native American human remains and associated funerary objects, sacred objects, and objects of cultural patrimony that might be uncovered as a result of development projects overseen or funded by the federal government. In 2001, Assembly Bill (AB) 978 enhanced the reach of NAGPRA and established a state commission with statutory powers to assure that federal and state laws regarding the repatriation of Native American human remains and items of patrimony are fully complied with. In addition, AB 978, as opposed to NAGPRA, includes

nonfederally recognized tribes for repatriation. Like Section 106 of the NHPA, the Native Graves Protection and Repatriation Act would apply if federal agencies become involved in projects along Putah Creek.

H.4.2 STATE LAWS AND REGULATIONS

CEQA

CEQA has a much broader and far reaching environmental regulatory framework than the NHPA, but it also includes cultural resources as an important component of its oversight and management policies. Before discretionary projects are approved, the potential for significant project impacts on archaeological and historical resources must be considered under CEQA (§§21083.2 and 21084.1) and State CEQA Guidelines (California Code of Regulations [CCR] §15064.5).

Similar to the provisions of Section 106, CEQA requires a consideration of the eligibility of cultural resources for potential listing on the CRHR. To be eligible for listing on the CRHR (and the NRHP), cultural resources must possess at least one of the following features:

1. an association with events that have made a significant contribution to the broad patterns of California (or national) history and cultural heritage;

2. an association with the lives of persons important in our past;

3. distinctive characteristics of a type, period, region, or method of construction or represents the work of an important creative individual or possesses high artistic values; or

4. the ability to yield, or likely yield, information important in prehistory or history.

As a matter of policy, public agencies should avoid causing damaging impacts on historic and archeological resources, particularly those that are NRHP/CRHP eligible. When impacts cannot be avoided, they can be mitigated through the following:

< avoiding the sites during construction,
< incorporating the sites into open space,
< capping the resources with chemically stable fill,
< deeding the site into a permanent conservation easement, or
< recovering data (testing and excavation).

CEQA also provides for the protection of Native American human remains (CCR §15064.5[d]) and for the accidental discovery of cultural resources (CCR §15064.5[e]). These are particularly important provisions in that they take into account the possibility that significant resources not noted as a result of previous research efforts may be present within a project area and need to be treated in a way commensurate with CEQA standards.

H.5 LAND USE

H.5.1 FEDERAL LAWS AND REGULATIONS

FEDERAL FARMLAND PROTECTION POLICY ACT

The Natural Resources Conservation Service (NRCS), a federal agency in the U.S. Department of Agriculture (USDA), is the agency primarily responsible for implementing the federal Farmland Protection Policy Act (FPPA). The purpose of the FPPA is to minimize federal contributions to the conversion of farmland to nonagricultural uses by ensuring that federal programs are administered in a manner compatible with state government, local government, and private programs designed to protect farmland. The FPPA established the Farmland Protection Program (FPP) and the Land Evaluation and Site Assessment (LESA) system, which are discussed below in further detail.

NRCS administers the FPP, which is a voluntary program that provides funds to help purchase development rights to keep productive farmland in agricultural uses. The program provides matching funds to state, local, or tribal government entities and nongovernmental organizations with existing farmland protection programs to purchase conservation easements. Participating landowners agree not to convert the land to nonagricultural use and retain all rights to use the property for agriculture. A minimum of 30 years is required for conservation easements, and priority is given to applications with perpetual easements. NRCS provides up to 50% of the fair market easement value (NRCS 2002).

The LESA system helps state and local officials make sound decisions about land use. The system also accurately ranks lands for suitability and inclusion in the FPP. LESA evaluates several factors, including soil potential for agriculture, location, market access, and adjacent land use. These factors are used to rank land parcels for inclusion in the FPP based on local resource evaluation and site considerations (NRCS 2002).

H.5.2 STATE LAWS AND REGULATIONS

CALIFORNIA LAND CONSERVATION ACT (WILLIAMSON ACT)

The Land Conservation Act, administered by the California Department of Conservation (CDC), was enacted when population growth and rising property taxes were recognized as a threat to the viability of valuable farmland in California. John Williamson authored Assembly Bill 2117 in 1965. The bill proposed the development of a contract between landowners and local governments to voluntarily restrict development on property in exchange for lower tax assessments. The originators of the act conceived a strategy for local governments to protect open space and agricultural lands, while integrating long-term planning and growth patterns.

Under a Williamson Act contract, the property owner is guaranteed that the property would be taxed according to its potential agricultural income, as opposed to the maximum valued use of the property, such as for residential development. The State of California passed Article 13, which allows Williamson Act contracts to be used for recreational, scenic, and natural resource

areas, in addition to crop production. Contracts are entered for a 10-year period and can be terminated only by a cancellation or non-renewal.

Cancellation involves an extensive review and approval process, in addition to a payment of fees of up to 12.5% of the property value. Under a non-renewal, a notice is filed by the property owner, after which the 10-year contract expires over time. The non-renewal allows for tax rates to gradually increase over the remainder of the contract, reaching the market value rate by the end of the term (CDC 2001). Subdivision of lands under Williamson Act contracts is limited to a minimum of 10-acre parcels and must incorporate a 200-foot setback from incompatible adjacent uses (CDC 2001).

CALIFORNIA IMPORTANT FARMLAND INVENTORY SYSTEM AND MAPPING AND MONITORING PROGRAM

As discussed above, the LESA system under the FPP is used for ranking land for inclusion in the FPP. The LESA system classifies land based on 10 soil and climatic characteristics. The CDC augmented that program in 1980 by initiating a system of inventorying, mapping, and monitoring of farmland acreage in California. The CDC inventory system was designed to document how much agricultural land in California was being converted to nonagricultural land or transferred into Williamson Act contracts. The CDC classifications in the Important Farmland Inventory System are described below:

- Prime Farmland – Land that has the best combination of features for producing agricultural crops,
- Farmland of Statewide Importance – Land other than Prime Farmland that has a good combination of physical and chemical features for producing agricultural crops,
- Unique Farmland – Land of lesser quality soils used for producing the state's leading agricultural cash crops,
- Farmland of Local Importance – Land that is of importance to the local agricultural economy,
- Grazing Land – Existing vegetation that is suitable for grazing,
- Urban and Built-up Lands – Lands occupied by structures in densities of at least one dwelling unit per 1.5 acres,
- Land Committed to Nonagriculture Use – Vacant areas and existing lands that have a permanent commitment to development but have an existing land use of agriculture or grazing lands, and
- Other Lands – lands that do not meet the criteria of remaining categories (CDC 2001).

Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance are often described together under the term "Important Farmland."

STATE FARMLAND SECURITY ZONES

Farmland Security Zones (FSZs) were established by the CDC with the same intent as Williamson Act contracts. An FSZ must be located in an Agricultural Preserve (area designated as eligible for a Williamson Act contract) and designated as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, or Farmland of Local Importance. Agricultural and open space lands are protected for a minimum of a 20-year term under an FSZ designation and receive an even greater property tax reduction than a Williamson Act valuation. Land protected in an FSZ cannot be annexed by a city or county government or school district (CDC 2001).

An FSZ can be terminated through a non-renewal or cancellation. The non-renewal allows for a rollout process to occur over the remainder of the term of the contract, where the tax rates would gradually rise to the full rate by the end of the 20-year term. A cancellation must be applied for and approved by the director of the CDC, and specific criteria must be met. The cancellation must be in the public interest and consistent with the Williamson Act criteria (CDC 2001). If a cancellation is approved, a payment of fees equal to 25% of the full market value of property must be paid (CDC 2001).

H.6 WATER QUALITY/WETLANDS/RIPARIAN RESOURCES

H.6.1 FEDERAL LAWS AND REGULATIONS

CLEAN WATER ACT SECTION 404

Section 404 of the CWA establishes a requirement to obtain a permit from the USACE prior to initiating any activity that involves any discharge of dredged or fill material into "waters of the United States," including wetlands. Waters of the United States include navigable waters of the United States, interstate waters, all other waters where the use or degradation or destruction of the waters could affect interstate or foreign commerce, tributaries to any of these waters, and wetlands that meet any of these criteria or are adjacent to any of these waters or their tributaries. Wetlands are defined as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and which under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Jurisdictional wetlands must exhibit three wetland delineation criteria: hydrophytic vegetation, hydric soils, and wetland hydrology. Many surface waters and wetlands in California meet the criteria for waters of the United States, including intermittent streams and seasonal wetlands.

The USACE permits fall into the following categories:

< Nationwide permits (NWP) for projects that have only minimal impacts on Waters of the United States (thresholds are established for each Nationwide permit),

- Letters of permission (LOP) for projects with larger impacts (i.e., exceed the NWP thresholds) that have undergone thorough environmental review and coordination with other relevant federal and state agencies, and
- Individual Permits (IP) for projects with larger impacts (i.e., exceed the NWP thresholds) on the environment.

NWPs are considered general permits and as a result have undergone past environmental review (i.e., NEPA). LOPs and IPs trigger the need for additional NEPA review of the project and an analysis of alternatives (i.e., Section 404[b][1] analysis) to determine the practicable alternative that is the least damaging to the environment. Mitigation ensuring a no-net-loss of wetland habitat is typically required by USACE permits with a typical minimum replacement ratio of 1:1 (habitat restored or created to habitat lost). A mitigation and monitoring plan would need to be submitted with the permit application.

CLEAN WATER ACT SECTION 402 - NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT PROGRAM

Section 402 of the federal CWA prohibits the discharge of pollutants through a "point source" into "waters of the United States" without a National Pollutant Discharge Elimination System (NPDES) permit. The program is administered by the U.S. Environmental Protection Agency (EPA) in coordination with the RWQCBs. An NPDES permit issued by these agencies establishes effluent limitations, specifies monitoring and reporting requirements, and contains other provisions to ensure that the discharge does not impair water quality of pose a threat to the health of humans. In essence, the permit translates general requirements of the CWA into specific provisions tailored to the operations of each entity discharging pollutants. The two types of NPDES permits are individual and general permits. An individual permit is specifically tailored to a specific facility, while a general permit covers multiple facilities within a certain category.

One type of general permit that typically applies to construction and restoration programs that encompass more that 0.5 acre of soil disturbance is the General Construction Storm Water Permit. A Storm Water Pollution Prevention Plan (SWPPP) specifying Best Management Practices (BMPs) that will prevent construction pollutants from contacting storm water and contain erosion is required for permit application. The SWPPP also contains a plan for inspection and maintenance of erosion control devices. The applicant files a Notice of Intent (NOI) to seek coverage under the General Construction Storm Water Permit, along with an annual fee and the SWPPP, to the State Water Resources Control Board (SWRCB) in order to comply with the NPDES requirements. Coverage ends by filing a Notice of Termination, once the SWRCB has verified that all conditions of the permit have been met.

Recently, the EPA has focused on the goal of integrating the NPDES program further into the concept of watershed planning. This process involves examining the core functions of the NPDES program and assessing how to adapt the program to better promote community-based water resource management rather than permitting on a source-by-source basis. EPA is gaining insight into the best way to refine the NPDES framework to make decisions based on a

watershed analysis and to engage local leadership in planning and non-point sources, while maintaining a strong baseline individual and general permitting program.

H.6.2 STATE LAWS AND REGULATIONS

PORTER-COLOGNE WATER QUALITY CONTROL ACT

The state Porter-Cologne Water Quality Control Act is California's statutory authority for the protection of water quality. Under the Porter-Cologne Act, California must adopt water quality policies, plans, and objectives that ensure the reasonable protection of beneficial uses of the state. The act requires the nine RWQCBs to adopt water quality control plans and establish water quality objectives, and authorizes the SWQCB and RWQCBs to issue and enforce permits containing requirements for the discharge of waste to surface waters and land.

CALIFORNIA FISH AND GAME CODE SECTION 1602

All diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports fish or wildlife resources is subject to regulation by DFG, pursuant to California Fish and Game Code §§1600–1616. Section 1602 states that it is unlawful for any project to substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake or use any material from the bed, bank or channel of any river, stream, or lake, or deposit or dispose of debris, wastes, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake without first notifying DFG of such activity by applying for a Streambed Alteration Agreement (SAA). The regulatory definition of a stream is a body of water that flows at least periodically or intermittently through a bed or channel having banks and that supports wildlife, fish, or other aquatic life. This includes watercourses having a surface or subsurface flow that support or have supported riparian vegetation. DFG's jurisdiction within altered or artificial waterways is based upon the value of those waterways to fish and wildlife. Mitigation ensuring a no-net-loss of riparian vegetation and associated habitat values is typically required to obtain a SAA. The permit application also requires a fee. Agreements are typically good for 5 years from date of issuance but an agreement can be issued for a longer period of time if requested.

RECLAMATION BOARD ENCROACHMENT PERMIT

The Reclamation Board oversees floodplain management activities for the Sacramento and San Joaquin rivers and their tributaries. Approval of the Reclamation Board is required for projects or uses which encroach into rivers, waterways, and floodways within and adjacent to federal and State authorized flood control projects and within designated floodways adopted by the Board. The Board exercises jurisdiction over the levee section, the waterward area between project levees, a 10-foot-wide strip adjacent to the landward levee toe, an area within 30 feet of the top of the banks on unleveed project channels, and within designated floodways adopted by the Board. Activities outside of these limits that could adversely affect a flood

control project are also under Board jurisdiction. Encroachment permits are required for any activities that involve construction or activities within areas regulated by the Board.

H.6.3. LOCAL LAWS AND REGULATIONS

A flood development permit is required by Yolo County through the Department of Planning and Public Works for any work within a 100-year floodplain that involves building, grading, excavation, filling, or other construction. Solano County has a similar floodplain development review and approval process; however, it is limited to building construction within the floodplain.

H.7 FISHERIES AND TERRESTRIAL BIOLOGICAL RESOURCES

H.7.1 FEDERAL LAWS AND REGULATIONS

FEDERAL ENDANGERED SPECIES ACT

Pursuant to the federal ESA, the National Marine Fisheries Service (NMFS) has authority over projects that may result in take of federally listed anadromous fish species. Similarly, the USFWS has authority over projects that may result in take of federally listed wildlife and plant species. Under the ESA, the definition of "take" is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." USFWS has also interpreted the definition of "harm" to include significant habitat modification that could result in take. If a project has a likelihood that it would result in take of a federally listed species, either an incidental take permit, under Section 10(a) of the ESA, or a federal interagency consultation, under Section 7 of the ESA, is required.

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The Magnuson-Stevens Fishery Conservation and Management Act, as amended (16 U.S.C. 1801), requires that Essential Fish Habitat (EFH) be identified and described in federal fishery management plans (FMPSs). Federal action agencies must consult with NMFS on any activity that they fund, permit, or carry out that may adversely affect EFH. The EFH regulations require that federal action agencies obligated to consult on EFH also provide NMFS with a written assessment of the effects of their action on EFH (50 Code of Federal Regulations [CFR] Section 600.920). NMFS is required to provide EFH conservation and enhancement recommendations to the federal action agency. The statute also requires federal action agencies receiving NMFS EFH Conservation Recommendations to provide a detailed written response to NMFS within 30 days upon receipt detailing how they intend to avoid, mitigate, or offset the impact of the activity on EFH. The Central Valley fall-/late fall-run Chinook salmon EFH that occurs in Putah Creek is covered under this Act.

MIGRATORY BIRD TREATY ACT

The Migratory Bird Treaty Act (MBTA), first enacted in 1918, implements domestically a series of treaties between the United States and Great Britain (on behalf of Canada), Mexico,

Japan, and the former U.S.S.R., which provide for international migratory bird protection, and authorizes the Secretary of the Interior to regulate the taking of migratory birds. The MBTA provides that it shall be unlawful, except as permitted by regulations, "to pursue, take, or kill … any migratory bird, or any part, nest or egg of any such bird, included in the terms of conventions" with certain other countries (16 USC 703). The current list of species protected by the MBTA essentially includes all native birds. Section 3513 of the Fish and Game Code of California provides for adoption of the MBTA's provisions. Neither the MBTA nor this state code provide a statutory or regulatory mechanism for obtaining an incidental take permit for the loss of non-game, migratory birds.

H.7.2 STATE LAWS AND REGULATIONS

CALIFORNIA ENDANGERED SPECIES ACT

Pursuant to the California Endangered Species Act (CESA) and Section 2081 of the Fish and Game Code, a permit from DFG is required for projects that could result in the take of a state-listed Threatened or Endangered species. Under CESA, "take" is defined as an activity that would directly or indirectly kill an individual of a species, but the definition does not include "harm" or "harass," as the federal act does. As a result, the threshold for a take under the CESA is higher than that under the ESA.

CALIFORNIA FISH AND GAME CODE §3503.5 – PROTECTION OF RAPTORS

Section 3503.5 of the Fish and Game Code states that it is unlawful to take, possess, or destroy any raptors (i.e., species in the orders Falconiformes and Strigiformes), including their nests or eggs. Violations include destruction of active raptor nests from tree removal and disturbance to nesting pairs by nearby human activity, which may cause nest abandonment and reproductive failure.

NATURAL COMMUNITY CONSERVATION PLANNING ACT

Under Section 2800 of the Fish and Game Code, the Natural Community Conservation Planning Act (NCCPA) authorizes and encourages conservation planning on a regional scale in California through preparation of Natural Community Conservation Plans (NCCPs). NCCPs address the conservation of natural communities as well as individual species. The NCCPA's focus on regional conservation rather than individual project mitigation is appropriate for complex and extensive programs. Similar regional planning occurs under federal authority through development of Habitat Conservation Plans (HCPs) to protect listed species under the federal ESA. Both Solano and Yolo counties have initiated development of HCPs/NCCP.

The Solano County HCP/NCCP would establish a county-wide comprehensive program for species and habitat protection on undeveloped and agricultural land in response to existing and projected water delivery service needs. The activities of five cities, two water agencies, and a reclamation district will be addressed in the plan. These include urban development; operation and maintenance of irrigation, flood control, and drainage systems; and certain agricultural and habitat management activities associated with the management of habitat

reserves that may be established under the HCP/NCCP. SCWA is the lead agency developing the plan. The report of the independent science advisors was published in fall 2002. A final planning agreement is expected to be available for public review in 2003. The geographic area covered by the draft HCP/NCCP includes a portion of Solano County land along Putah Creek, west of the Putah Diversion Dam (PDD).

Planning efforts are also underway in Yolo County to develop an HCP/NCCP. A grant from USFWS has been awarded to assist in finalizing a county-wide HCP/NCCP. The plan is intended to contribute to balancing well-planned urban development with the preservation of natural and agricultural resources. The funding will also provide additional biological analyses necessary to include western portions of the county, land acquisition planning, the completion of the HCP/NCCP, and environmental review for the county's HCP/NCCP program. Seven listed species are expected to benefit from the plan, including the federally Threatened giant garter snake and valley elderberry longhorn beetle, the federally Endangered palmate-bracted bird's beak, and the State-Threatened Swainson's hawk.

H.7.3 Regional and Local Policies and Ordinances

Sudden Oak Death Syndrome Regulations

The causal pathogen of "sudden oak death" (SOD), *Phytophthora ramorum*, attacks and can kill oaks and other native vegetation in California. Special regulations regarding the pathogen apply in counties in which the occurrence of SOD is confirmed due to the threat of spreading SOD from infected areas to new locations. Occurrence of SOD has been confirmed within Solano County; therefore, special regulations apply. Yolo County is not regulated because the occurrence of SOD has not been confirmed in the County.

Under the Oak Mortality Disease Cooperative Project, a compliance agreement should be obtained from Solano County, prior to project activities involving the removal, transportation, or planting of vegetation material that are potential hosts to SOD. Host species include bigleaf maple (*Acer macrophyllum*), California buckeye (*Aesculus californica*), madrone (*Arbutus menziesii*), tan oak (*Lithocarpus denisflorus*), honeysuckle (*Lonicera hispidula*), coast live oak (*Quercus agrifolia*), black oak (*Quercus kelloggii*), coffeeberry (*Rhamnus californica*), California bay laurel (*Umbellularia californica*), and others.

All people working with regulated vegetation are responsible for knowing if they are working within an infested area. An infested area is an area that is within 1/4 mile of a confirmed SOD occurrence. Putah Creek is currently not known to be an infested area. Host material from within the regulated area (i.e., Solano County) and smaller than 4 inches in diameter should be left on-site (may be chipped or shredded) or disposed of at an approved facility or landfill. If transported, host material smaller than 4 inches diameter should be transported in such a manner that precludes escape of any material (e.g., plastic bags, closed containers) and be accompanied by a copy of the cooperative agreement. Host material larger than 4 inches in diameter may be moved within the regulated area if accompanied by a copy of the cooperative

agreement. In addition, all people working in the field should be educated regarding the host, symptoms, and general distribution of SOD.

H.8 INVASIVE SPECIES

H.8.1 FEDERAL INVASIVE SPECIES LAWS AND REGULATIONS

Executive Order 11312 – Invasive Species (February 3, 1999) directs all federal agencies to prevent and control introductions of invasive non-native species (i.e., pest plants, animals, or other organisms) in a cost-effective and environmentally sound manner to minimize their economic, ecological, and human health impacts. Executive Order 11312 established a national Invasive Species Council composed of federal agencies and departments and a supporting Invasive Species Advisory Committee made up of state, local, and private entities. The Invasive Species Council and Advisory Committee oversee and facilitate implementation of the Executive Order, including preparing a National Invasive Species Management Plan.

A number of other federal laws pertain to noxious and invasive weeds, including the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 as amended (16 U.S.C. 4701 et seq.); Lacey Act as amended (18 U.S.C. 42); Federal Plant Pest Act (7 U.S.C. 150aa et seq); Federal Noxious Weed Act of 1974 as amended by the Food, Agriculture, Conservation and Trade Act of 1990 (Section 1453 "Management of Undesirable Plants on Federal Lands;" U.S.C. 2801 et seq); and the Carlson-Fogey Act of 1968 (Public Law 90-583). The U.S. Department of Agriculture and other federal agencies maintain lists of pest plants of economic or ecological concern.

H.8.2 STATE INVASIVE SPECIES LAWS AND REGULATIONS

A number of state laws and regulations pertain to preventing the spread of non-native invasive species (i.e., pest plants, animals, or other organisms). Section 403 of the California Food and Agricultural Code (FAC) directs the California Department of Agriculture (CDFA) to "prevent the introduction and spread of injurious insect or animal pests, plant diseases, and noxious weeds."

FAC Section 5004 defines a noxious weed as follows: "Noxious weed means any species of plant that is, or is liable to be, troublesome, aggressive, intrusive, detrimental, or destructive to agriculture, silviculture, or important native species, and difficult to control or eradicate, which the director, by regulation, designates to be a noxious weed. In determining whether or not a species shall be designated a noxious weed for the purposes of protecting silviculture or important native plant species, the director shall not make that designation if the designation will be detrimental to agriculture." The state-listed noxious weeds are indicated in Section 4500 of the CCR.

CDFA develops and enforces regulations created to protect California from the importation, cultivation, and spread of plant species that are deemed "noxious" by law. Plant species that have been designated as noxious weeds may be subject to various restrictions including the

statutory provisions for weed-free areas, California Seed Law, and noxious weed management. Management or control activities taken against noxious weeds may both protect California's agricultural industry and important native species.

CALIFORNIA PEST AND NOXIOUS WEED RATINGS

State-listed pests, including noxious weeds, are rated A, B, C, D, or Q based on CDFA's view of the statewide importance of the pest, the likelihood that eradication or control efforts would be successful, and the present distribution of the pest within the state. The ratings guide CDFA, county agricultural commissioners, and others regarding appropriate actions to take. "A" ranked pests are organisms of known economic importance and are subject to state enforced actions involving eradication, quarantine, containment, rejection, or other holding actions. "B" ranked pests are similar to "A" ranked pests, but actions taken to control them are at the discretion of the individual county agricultural commissioner. "B" ranked pests also include organisms subject to state actions and eradication only when found in a nursery. "C" ranked pests include organisms subject to no state enforced action outside of nurseries except to retard spread. "C" ranked pests are controlled at the discretion of the county agricultural commissioners. "Q" ranked pests are organisms or disorders requiring temporary "A" action pending determination of a permanent rating. The organism is suspected to be of economic importance but its status is uncertain because of incomplete identification or inadequate information. "D" ranked organisms include parasites, predators, and organisms of little or no economic importance that require no action.

Eleven invasive weed species were recently determined by CDFA to present a serious threat and are in the process of being added to the list of noxious weed species. They include the following species located within the lower Putah Creek watershed: *Ailanthus altissima* (tree of heaven); *Arundo donax* (giant reed); *Cortaderia jubata* (jubata grass); and *Tamarisk chinensis*, *T. gallica*, *T. parviflora*, and *T. ramosissima* (salt cedar). Additional invasive weeds within the watershed are already designated as state noxious weeds. The status of invasive weeds within the watershed is provided in the Invasive Weeds section in Chapter 7, "Invasive Weeds."

H.9 REFERENCES

Natural Resources Conservation Service (NRCS). 2002. Available <http://www.info.usda.gov/nrcs/ fpcp/fpp.htm>. Accessed May 2002.

California Department of Conservation (CDC). 2001. Division of Land Resource Protection. Williamson Act Program. Available <http://www.Consrv.ca.gov>. Accessed May 6, 2001.

APPENDIX I

RESTORATION AND ENHANCEMENT PROJECT PERMIT REQUIREMENT SUMMARIES

APPENDIX I RESTORATION AND ENHANCEMENT PROJECT PERMIT REQUIREMENT SUMMARIES

These project requirement summaries are intended to be distributed to all personnel or contractors performing any of the lower Putah Creek watershed restoration and enhancement activities listed below under contract or direct written agreement with the Lower Putah Creek Coordinating Committee (LPCCC) and Solano County Water Agency (SCWA), as part of the Lower Putah Creek Restoration and Enhancement project. These summaries were developed as a tool to consolidate information from a variety of sources, including project permits, into easy-to-use guides organized by the type of activity and stream channel zone in which the activity is to take place. Project requirements were specifically summarized from the following documents and permits developed and acquired for this project:

- Protective measures included in the project description in compliance with California Environmental Quality Act (CEQA) and as preparation for the Categorical Exemption (Cat Ex);
- Section 1600 Streambed Alteration Agreement from the California Department of Fish and Game (DFG);
- Clean Water Act Section 404 Nationwide Permit 27 from the U.S. Army Corps of Engineers;
- Clean Water Act Section 401 Clean Water Certification from the Central Valley Regional Water Quality Control Board (RWQCB);
- Informal consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS).

Personnel and contractors performing any of the activities described below are responsible for complying with the requirements of the permits and project protective measures. Copies of those documents are available from the LPCCC.

For ANY work on the project, please familiarize yourself with the *General Restoration and Enhancement Project Requirements for All Ground-Disturbing Activities along Lower Putah Creek* first. Those requirements are organized into the following three stream channel zones in which activities may take place: upland, streambank, and in-stream work. Once familiar with the general requirements, please read the specific project activity requirements summary corresponding to the specific work activity that you will perform for this project. Specific project activities summaries are prepared for the following activities:

- Bank Stabilization
- Fish Habitat Enhancement
- Invasive Weed Removal

GENERAL RESTORATION AND ENHANCEMENT PROJECT REQUIREMENTS FOR ALL GROUND-DISTURBING ACTIVITIES ALONG LOWER PUTAH CREEK

General restoration and enhancement activities covered under this summary of project requirements include those activities involving ground disturbance and the use of heavy equipment such as grading, excavations, vegetation clearing, site preparation, and plant installation for vegetation planting, trash cleanup, and the creation of access roads. Any requirements specific to certain activities, such as invasive weed removal, are listed in the requirement summary for the respective activities, provided below. The following summary is organized by activities which will take place in upland, streambank, and in-stream locations. It is important to note that each zone includes the requirements of the preceeding zone. In other words, upland requirements apply to activities on the streambank as well as in-stream locations. Streambank requirements apply, as well, to activities that will take place in-stream.

UPLANDS

For the purposes of this document, the upland zone is considered to be natural habitat areas, grassland, fallow field, and developed, and other areas extending from the streambank to adjacent developed or agricultural areas. Upland areas are typically on a terrace above the streambank, and the distance from the low flow creek channel varies depending on the location along the creek. Requirements for activities in this zone include:

- Soil, silt, other organic material, petroleum products, or other excavated material shall not be placed where they could enter a water course.
- Prevent erosion, wash-out, and sedimentation by implementing protective measures in disturbed areas.
- Avoid and prevent spills of hazardous materials.
- Contractor (through Solano County Water Agency as the permit holder) shall notify the RWQCB and DFG immediately of any spill of petroleum products or other organic material.
- Areas cleared of native vegetation shall be stabilized and allowed to revegetate naturally.
- Use existing access roads wherever possible.
- Stage equipment in previously disturbed areas such as equipment pads or parking areas.
- No equipment shall be fueled within 500 feet of the stream channel, and no equipment will be parked within 50 feet of the stream bank.
- As soon as work is complete and equipment has been removed (and prior to the next rainy season), stabilize using erosion control methods and revegetate where needed.

- Elderberry shrubs shall be avoided. No ground disturbance shall occur within 20 feet of an elderberry shrub, unless approved by USFWS.
- Avoid construction and use of heavy machinery during the breeding season of raptors (February 1–August 31) and other migratory birds (April 1–August 31), if possible.
- If construction or heavy equipment operation is scheduled during the nesting season of raptors or migratory birds (February 1 to August 31), a focused survey for active nests shall be conducted by a qualified biologist within 15 days prior to the beginning of work. Survey results shall be faxed to Dale Watkins with DFG at (916) 358-2842, Notification Number R2020020357.
- If active nests are found during surveys, establish appropriate buffer (0.25 mile for nesting raptors, 50' for nesting migratory birds) or confer with DFG and USFWS regarding appropriate actions to comply with the Migratory Bird Treaty Act and Fish and Game Code.
- Conduct pre-construction surveys for borrowing owls in accordance with DFG protocols if suitable habitat for this species exists on-site. If no occupied burrows are present, no further avoidance measures are necessary. If occupied borrows are found, establish a 250' buffer around the borrow unless a different buffer size is agreed to with DFG.
- Stay out of established exclusion zones for nesting raptors, burrowing owls, and migratory birds.
- Known cultural resources should be flagged and avoided. If ground disturbing activities are scheduled for an area known to be sensitive, an archaeological monitor shall be present.
- If artifacts (including bones, fossils, arrowheads, pottery) are unearthed, work will stop immediately until the area can be inspected by an archaeologist.

STREAMBANKS

For the purpose of this document, the streambank extends from the open-water to the top of bank and terrace, ending where the upland area begins. The following requirements apply to activities in streambank areas in addition to all conditions specified above for upland area activities:

- A copy of the Streambed Alteration Agreement must be obtained by the contractor and must be available on-site during construction activities.
- Notify DFG within 2 working days of beginning work and within 2 working days of the completion of work. Fax notification to 916/358-2842 attention Dale Watkins, DFG, Notification Number R2-2002-357.
- Avoid or minimize clearing of native riparian vegetation when creating access to the streambank for equipment or conducting work within the riparian corridor.

- Minimize grading of the existing stream bank. Grade access point only where necessary to allow safe passage of vehicles.
- Best Management Practices (BMPs) must be used to preclude increased turbidity and to ensure that road construction does not restrict or impede the passage of normal or expected high flows or cause relocation of the water.
- Wetlands shall be flagged and avoided.

IN-STREAM

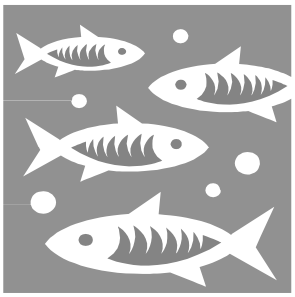
For the purpose of this document, the in-stream zone includes all open water areas. The following requirements apply to activities taking place in-stream, in addition to all requirements specified above for activities in upland and streambank areas:

- Placement of fill in waters of the U.S. shall be avoided whenever possible.
- No litter or construction debris may be left within the stream zone.
- Notify RWQCB in writing (through Solano County Water Agency) of the start of any in-water activity.
- Conduct in-stream work between August 31 and October 31 or whenever Los Rios check dam is removed;
- Time work with awareness of precipitation forecast and likely increases in stream flows;
- Employ BMPs to minimize turbidity and soil erosion during in-stream construction activities. Use materials such as silt fencing to minimize siltation and turbidity.
- Activities should not result in substantial turbidity increases in the watercourse.
- If turbidity increases, monitor per conditions set in CWA Section 401 certification and notify RWQCB if standards stated in the agreement are exceeded.
- Activities should not cause visible oil, grease, or foam in the work area or downstream.
- Discharge of petroleum products or other excavated material to surface waters is prohibited.
- If work in flowing water is unavoidable, divert water around work area and back into stream channel as specified in the Streambed Alteration Agreement.
- Emphasize use of natural materials such as tree trunks, willow cuttings, grass and sedge plugs, and natural gravel from adjacent gravel bars when implementing erosion control measures.

BANK STABILIZATION

Activities included under this category include minor grading and re-sloping, the redistribution of materials on the bed and bank, and the installation of biorevetment such as riparian bush mattress, straw mats, jute mesh, and grass seeding.

- Before beginning work, make sure appropriate surveys for nesting raptors and migratory birds have been conducted and exclusion zones for active nests, elderberries, wetlands, and known cultural resources have been established, as described above in the general requirements.
- Natural bank stabilization shall be installed immediately following weed abatement or other activities, where necessary to minimize erosion.
- If used, biorevetment materials (ex., mats and seeds) shall be placed by hand or by small equipment.
- Seeding may be done by hand or by using a drill seed attachment to a small tractor or similar equipment.



FISH HABITAT ENHANCEMENT

Activities included under this category include the installation of instream structures such as boulders, tree limbs, and spawning gravels, and the planting of vegetation on the streambanks to enhance Shaded Riverine Aquatic (SRA) habitat.

- Before beginning work, make sure appropriate surveys for nesting raptors and migratory birds have been conducted and exclusion zones for active nests, elderberries, wetlands, and known cultural resources have been established, as described above in the general requirements.
- Material (boulders, tree limbs, and clean gravel) will be placed in the streambed by hand or by using small excavators.
- In-stream work shall be conducted during late summer or fall low-flow periods (August to October), while planting of riparian vegetation may take place at any time.
- Some gravel needed for the streambed may be collected from the immediate vicinity of if the gravel is sifted to remove the silt and sand.

INVASIVE WEED ABATEMENT

Activities included under this category include the removal of invasive weeks

Methods to be used include:

- Hand methods (i.e., manual cutting with loppers or chainsaws);
- Herbicide application restricted to weed infestation areas, including use of backpack sprayers, hand bottles, hand-held spray wands connected to suitable spray equipment etc.
- Equipment – use of backhoes or excavators to remove continuous stands of Arundo, tamarisk, or similar invasive weeds where hand removal is not feasible.

Weed removal specific details:

- Before beginning work, make sure appropriate surveys for nesting raptors and migratory birds have been conducted and exclusion zones for active nests, elderberries, wetlands, and known cultural resources have been established as described above in the general requirements.
- Use only focused applications of selective low toxicity (to fish and wildlife) herbicides approved by the Cal Environmental Protection Agency for use over or near waterways, in wildland settings, and adjacent to farms.
- No aircraft application of herbicides will occur between March 15 and August 31 to protect nesting migratory birds.
- Minimize grading of the existing stream bank. Grade access point only where necessary to allow safe passage of vehicles.
- As soon as work is complete and equipment has been removed (and prior to the next rainy season), stabilize using erosion control methods and revegetate where needed.
- Use existing access roads wherever possible.
- Minimize removal of native riparian vegetation.
- Any native riparian tree 3-inches diameter breast height (DBH) or larger removed from fully infested weed stands shall be replaced on-site at a 2:1 ratio.
- When stockpiling cut invasive plant materials, place stockpiles in previously disturbed areas more than 50 feet from flowing water where currents cannot disperse them. Prevent live plant material from entering moving water at any time. Dispose of invasive plant stockpiles in the channel within 4 weeks and within upland areas within 3 months of creation by removal to appropriate upland or by burning.
- Material may be burned in place in accordance with state and local permits providing it does not damage sensitive resources (all appropriate state and local permits must be obtained).

- No burning can occur within 1,000 feet of native riparian or wetland habitat between March 15 and September 15 to protect nesting migratory birds.
- All exposed/disturbed areas larger than 5 acres will be seeded with native and non-native grasses and covered with broadcast straw, jute netting, coconut fiber, etc.