APPENDIX G: RIPARIAN APPENDICES

Appendix G1. Information on Non-native Invasive Plant Species within the Planning Area

Appendix G2. Wetlands management on the San Luis National Wildlife Refuge Complex

APPENDIX G1: Information on Non-native Invasive Plant Species within the Planning Area

Through funding by the San Joaquin River Riparian Habitat Restoration Program and based on the 2000 CDWR vegetation maps, the San Joaquin River Parkway and Conservation Trust prioritized nonnative species for control as part of their current nonnative invasive plant species management efforts for Reaches 1 through 5. Based on each plant's listing with California Exotic Pest Plant Council (CalEPPC), proximity to the active channel, potential for floodway impedance, relative ease of control, and relative cost of removal, the Parkway Trust identified the following species for high-priority control: scarlet wisteria, tree-of-heaven, giant reed, pampas grass, tamarisk, edible fig, and Himalayan blackberry. These species, as well as nonnative annual grasses, parrot's feather, and water hyacinth, are discussed in detail in below, because they are documented as aggressive invaders that displace native plants and disrupt natural habitats (CalEPPC 1999).

Scarlet wisteria
Scarlet wisteria is likely the most serious invasive plant in the San Joaquin riparian corridor. Also known as "rattlebox," the plant forms dense colonies in disturbed areas and on sand and gravel bars, where it displaces native willow scrub. It is a deciduous shrub or small tree, up to four meters tall. The seed pods, which when open have four oblong "wings," may be dispersed by water. A native of South America, it produces abundant seeds, can reproduce rapidly, and since it may grow along watercourses, its buoyant pods may spread great distances. This plant may invade moist areas where there are long, hot summers. It can survive a hard freeze, but probably not for more than two or three days (CalEPPC 1999). It is most likely to spread to wildland areas adjacent to or downstream from ornamental plantings where it can grow into dense thickets. At present, scarlet wisteria is found primarily in Reach 1A, but extends to RM 242 in Reach 1B (CDWR 2000). There have been partially successful attempts to eradicate scarlet wisteria along the San Joaquin River, and close observation will be required to keep control of invasions of the species in the future (CDWR 2000).

Tree-of-heaven
Tree-of-heaven is an aggressive invader of Central Valley river systems. Also known as ailanthus, the plant was introduced from Asia as a landscape tree (and as a symbol of good luck at the entrances to mines). This tree has fast-growing stems and roots, and mature trees can reach 80 feet or more in height and have smooth stems with pale gray bark (Bossard 2000). Seeds are produced on female trees in late summer to early fall in flat twisted papery structures called samaras, which may remain on the trees for long periods of time (Bossard 2000). All parts of the tree, especially the flowers, have a strong odor, which some have likened to peanuts or cashews (CalEPPC 1999). Tree-of-heaven is a prolific seed producer, grows rapidly, and can out-compete native vegetation. Once established, it can quickly take over a site and form an impenetrable thicket. These trees also produce toxins that prevent the establishment of other plant species. The root system is aggressive enough to cause damage to sewers and foundations (Bossard 2000). The species is extremely tolerant of wildfires and re-sprouts vigorously afterward. Along roadsides and fields in the river corridor, tree-of-heaven has invaded former valley oak woodlands in several areas. It has formed dense, spreading stands consisting of large older trees with many sapling root sprouts, forming a spreading invasion front. Three acres of tree-of-heaven were mapped in Reach 1A and ½ acre each in Reaches 1B and Reach 2 (CDWR 2000).

Giant reed
Giant reed is a highly aggressive, naturalized landscape plant that invades riparian zones by establishing dense monospecific clonal stands. Giant reed is a tall perennial grass that can grow to

over 20 feet in height. Fleshy creeping rootstocks form compact masses and allow the emergence of fibrous roots, which can penetrate deeply into the soil (Bossard 2000). This species is drought and fire-tolerant (its foliage is highly flammable), and re-sprouts vigorously after fire by quickly exploiting released nutrients. Giant reed is also very shade-tolerant, establishing under full canopy and exposing the dominant trees to increased fire threat. The long fibrous interconnecting root mats of giant reed form a framework for debris dams, especially in areas behind bridges, culverts, and other structures that can lead to damage (Bossard 2000). The species does not propagate by seed (all individuals in the U.S. are sterile), and establishment occurs exclusively by vegetative propagules—most often by rhizomes that wash downstream from eroded banks. Most commonly, the plant establishes in disturbed areas such as roads, revetted banks, and bridge abutments where native vegetation has been cleared. Giant reed is a strong competitor in systems with increased nutrient supply, and run-off of fertilizer into stream systems may be an important factor aiding its dominance in many California riparian areas.

Giant reed is the second-most prevalent nonnative invasive plant species in the San Joaquin riparian corridor (CDWR 2000). During their vegetation mapping, CDWR found that giant reed clumps provided little wildlife habitat and that no other plant species grew within the clumps. Approximately 41 acres of giant reed were mapped in Reaches 1 and 2, where it is most abundant between Friant Dam and Highway 99 (CDWR 2000). Smaller amounts (1/4 acre or less) were mapped in Reaches 3 and 5 (CDWR 2000).

Pampas grass

Pampas grass is extremely opportunistic in colonizing disturbed areas, especially where road construction or erosion creates bare patches of earth. Once established, mature plants are very competitive. They can grow from small fluffy seeds to eight-foot-tall plants with blooms within a single season (Bossard 2000). Mature plants have long stalks with plume-like “tussocks” on the uppermost portions of the stalk. Seedlings usually become established in spring and require sandy soils, ample moisture, and light. Seedling survival is low in shaded areas or in competition with grasses or sedges. Pampas grass can tolerate winter frost, warmer summer temperatures, intense sunlight, and moderate drought. This accounts for its success as an ornamental in the hotter and drier inland areas of California (CalEPPC 1999). It can be found in moist soils along the American River near Sacramento, but is rarely invasive in dry inland habitats. The extremely sharp leaves act as barriers to animal movement and have been known to cut the skin of mule deer and other wildlife attempting to pass through them (CalEPPC 1999). Pampas grass is native to Argentina, Brazil and Uruguay, where it grows in relatively damp soils along river margins (CalEPPC 1999). Pampas grass does not appear to be widespread along the San Joaquin River corridor at this time. Occurrences were documented in Reaches 1A and 1B (CDWR 2000).

Tamarisk

Tamarisk is an invasive tree-like shrub, which can quickly become established in riparian areas. Individual plants can produce 500,000 tiny seeds per year and can grow 3–4 meters in one growing season under favorable conditions (Bossard 2000). Seed germination can occur within twenty-four hours in warm moist soil. While tamarisk can survive and even thrive on saline soils, the plant also increases soil salinities and inhibits native plant species growth and germination. Dense tamarisk groves use far more water than native riparian plants and are capable of quick re-establishment after fires (Bossard 2000). Tamarisk recruitment and establishment mirrors that of willows and cottonwood species, requiring open, fine-grained bars to be adequately moist during the brief seed release and viability period. Tamarisk invasions are a problem on many of the tributaries to the San Joaquin River, although it has no yet become widespread in the study area (CDWR 2000).

Edible fig
Edible fig is an agricultural and landscape plant with broad leaves and sweet, wasp-pollinated fruit, that can form dense monospecific thickets up to 25 feet high. Leaves are rough to the touch and are two to eight inches wide and two to ten inches long (Bossard 2000). This species forms a significant component of the mixed riparian forest understory, usually on the upland edge of the riparian zone at higher bank elevations. Edible fig tolerates shade and well-drained soils, and occurs as a major cover on dredger tailings, gravel bars, roadsides, and other disturbed landscapes. If not controlled, edible fig trees could crowd out native trees and understory shrubs characteristic of California's riparian forests (Bossard 2000). Edible fig has been documented in Reach 1 (CDWR 2000).

Himalayan blackberry
Himalayan blackberry is a strong competitor and it rapidly displaces native plant species. Thickets produce such a dense canopy that the lack of light severely limits the growth of other plants (Bossard 2000). It is widespread in disturbed riparian areas on roadsides, revetted banks, cleared fields, and dredger tailings. This species is less common in interior undisturbed riparian forest stands where the native California blackberry is more common, suggesting that invasion of Himalayan blackberry follows routes of disturbance. Himalayan blackberry closely resembles its native counterpart but can be distinguished by its larger and more curved thorns, its reddish (versus bright green) stem, and its leaves commonly arranged as clusters of five (as opposed to three) leaflets. It can grow well on a variety of barren, infertile soil types but prefers disturbed and wet sites. The Himalayan blackberry is often dispersed by mammals and birds, and seeds can be spread by streams and rivers for considerable distances (Bossard 2000). This species does provide some habitat value for wildlife, and tricolored blackbird has been document to use the plant for nesting habitat (Beedy, pers. comm., 2002). Himalayan blackberry was mapped in Reach 1A, but due to the difficulty in distinguishing it from the native blackberry, it was not singled out for mapping (CDWR 2000). CDWR (2000) wrote that most of the blackberry along the river appears to be Himalayan blackberry, particularly in riparian scrub habitats where it lines the banks of the channelized river for long stretches.

Annual grasses
Several non-native grass species that pose a significant threat of invasion to riparian wildlands include slender wild oat, common wild oat, rip-gut brome, soft chess brome, red brome, cheat grass, foxtail barley, annual ryegrass, rabbitsfoot grass, rat-tail fescue, and annual fescue. Prior to the late 1800s, native grasslands and oak woodlands (which contained a native grass understory) covered approximately 25 percent of California's land area (Holland and Keil 1995). Native grassland species were primarily perennial bunchgrasses such as purple needle grass, California oatgrass, deergrass, pine bluegrass, blue wild-rye and various squirreltails, fescues, and melic grasses. These grasses dominated the Central Valley and coastal grasslands from the end of the last ice age until the arrival of Spanish colonists in the seventeenth century.

Beginning in the Mission period and continuing throughout the nineteenth and twentieth centuries, non-native grass species were transported to California from the Mediterranean region in packing, ballast, grain shipments, hay, and livestock. The combination of overgrazing by introduced domestic cattle, sheep, and horses, suppression of the natural wildfire regime, and intensive land conversion to agriculture greatly altered the ecology of the Central Valley grasslands and shifted the competitive advantage from native bunchgrasses to introduced annual species. Ecosystem nitrogen inputs also tend to favor Mediterranean grasses over native species. Today, Central Valley grasslands are dominated by annual, non-native species, primarily from the

Mediterranean region. Eradication of the non-native species listed above is not feasible except in small areas that are isolated from potential non-native seed sources and where aggressive management, including seeding and controlled burning, is implemented.

Parrot's feather
Parrot's feather is an aggressive invasive aquatic plant that forms dense mats of intertwined brownish stems (rhizomes) in water. Mats can clog waterways by entirely covering the surface of the water and causing flooding of the channel (Bossard 2000). Infestations can shade out algae in the water column and create optimal habitat for mosquitoes. Stems can grow to be over six feet long. Parrot's feather leaves are bright green, oblong, deeply cut, and feathery looking. Native to South America, the plant spreads extremely easily. Stems are very brittle and fragment easily. These fragments can produce new plants, which can be spread by boats, trailers, waterfowl, and other wildlife. This species is a serious problem in irrigation and drainage canals and can block irrigation pumps and water intakes (Bossard 2000). One limiting factor of parrot's feather's ability to spread is that it cannot tolerate severe cold and will not invade areas with severe winters (Bossard 2000). Parrot's feather was documented in Reach 3 during the CDWR (2000) vegetation mapping and was observed by Stillwater Sciences in Reach 1 by Lane's Bridge (M. Hayden, S. Khandwala, B. Orr, pers. obs., 2002).

Water hyacinth
Like parrot's feather, water hyacinth is a very aggressive species that can quickly overtake native aquatic vegetation. Native to the Amazon River, water hyacinth is universally regarded as one of the world's most serious weeds. It is a floating aquatic plant with bright green, waxy leaves and violet flowers that have yellow strips on the petals. The plant forms mats on the water surface and can quickly dominate a waterway or aquatic system. Spongy leaf stems act as floats for the plant. Abundant seed production and germination, fragmentation of daughter plants, and rapid leaf production help water hyacinth to displace native aquatic plants used for food or shelter by wildlife species (Bossard 2000). Water hyacinth changes water quality beneath the mats by lowering pH, dissolved oxygen, and light levels, and it creates ideal breeding sites for mosquitoes. Water hyacinth was not mapped during the CDWR (2000) vegetation mapping. Evidently, water hyacinth was widely distributed in the San Joaquin River prior to 1997, but was washed out of the upper reaches of the river during high flows that year (S. Weaver, pers. comm., 2003). Stillwater Sciences, however, observed water hyacinth in the lower reaches of the river during field surveys (Z. Diggory, A. Keith, B. Orr, pers. obs., 2002).

References Cited

Bossard, C.C., J.M. Randall, and M.C. Hoshvosky, editors. 2000. Invasive plants of California's wildlands. University of California Press, Berkeley, California.

CDWR (California Department of Water Resources). 2000. Riparian Vegetation of the San Joaquin River. Moise, G.W., and B. Hendrickson, eds. Technical Information Record SJD-02-1. Prepared for San Joaquin River Riparian Habitat Restoration Program, U.S. Bureau of Reclamation, Fresno, California. Prepared by Department of Water Resources, Fresno, California.

CalEPPC (California Exotic Pest Plant Council). 1999. Exotic pest plants of greatest ecological concern in California. Petaluma, California.

Holland, V.L. and D.J. Keil. 1995. California vegetation. Kendall/Hunt Publishing Company, Dubuque, Iowa.

APPENDIX G2: Wetlands management on the San Luis National Wildlife Refuge Complex

The San Luis National Wildlife Refuge manages its freshwater wetland areas to maintain a diversity of resident and migratory species, especially large populations of waterfowl, but also including wading birds, rails, songbirds, and shorebirds (J. Fulton, pers. comm.), and other endangered and sensitive species (Aleutian Canada goose, bald eagle, San Joaquin kit fox, fairy/tadpole shrimp, California tiger salamander, tricolored blackbird, white-faced ibis, Swainson's hawk, etc.) (http://sanluis.fws.gov/mission.htm). Although marsh basins and riparian channels within the Refuge are natural in topography, each year they require maintenance via labor-intensive irrigations and other habitat manipulations, such as artificial flooding, which are described in more detail below (http://sanluis.fws.gov/sanluis_info.htm).

The San Luis and Merced National Wildlife Refuges maintain approximately 6,500 acres of seasonal and permanent/semi-permanent managed wetlands across the approximately 35,000 acres within the Refuges. The objective for the seasonal wetlands is to maintain a hemi-marsh, with 20–30% cover and up to 80% open water (J. Fulton, pers. comm.). This is accomplished through annual water management and a 6–7 year management cycle of discing, mowing, and/or burning to control encroachment when vegetation (especially cattails and tules) has reached 80% cover (J. Fulton, pers. comm.). Because of the focus on more open water habitat for waterfowl, swamp timothy, water or millet and smartweed are the focal plant species (J. Fulton, pers. comm.). Ponds are flooded in the fall to a depth of approximately 2 inches which is sufficient to wet the perimeter of the ponds, and drained in the late winter/early spring, depending on vegetation encroachment and salinization concerns.

The semi-permanent and permanent wetland areas are typically deeper open-water habitats, which limits the amount of encroachment by cattails and tules (J. Fulton, pers. comm.). These areas are still actively managed with water from artificial sources, but over a longer term (e.g., they may drain the areas once every 10 years) than the seasonal wetlands (drained and irrigated annually, and disked every 4 to 6 years) (J. Fulton, pers. comm.).

A complex system of delivery facilities is utilized to distribute 30,000 acre-feet of Central Valley Project Improvement Act water supplies to the refuge (http://sanluis.fws.gov/sanluis_info.htm). During the winter, when the irrigation districts that deliver this water have shut down for maintenance, the Refuge uses well-water to maintain the marsh areas (J. Fulton, pers. comm.). Because the Refuge may then need to supplement its normal supply of Central Valley Project water delivered by canals, with riparian water originating upstream in agricultural areas, there are water quality concerns associated with salinity, boron, selenium, herbicides and pesticides (J. Fulton, pers. comm.). Before the San Luis Drain was placed back into operation in 1996 as the Grassland Bypass the San Luis National Wildlife Refuge was unable to exercise its riparian rights to Salt Slough because agricultural runoff concentrated in Salt Slough caused water quality concerns (the Refuge stopped diverting water from Salt Slough from 1986 to 1996 while the San Luis drain was closed, which left many irrigation districts draining into Salt Slough) (J. Fulton, pers. comm.).