5. Environmental Consequences

5.1 Introduction

This chapter provides an analysis and evaluation of the environmental consequences of implementing the alternatives described in Chapter 4. These alternatives include:

Alternative A - No Action
Alternative A proposes no changes to the present wildlife and habitat management actions implemented on the Refuge, and no new public use programs would be implemented. This alternative represents the baseline from which other "action" alternatives will be evaluated.

Alternative B - Maximize Habitat Values and Species Protection
New and expanded wildlife and habitat management actions would be implemented under Alternative B to protect, restore, and enhance habitat values for listed and sensitive species on Refuge lands. The wildlife-dependent recreational uses currently occurring on the Refuge (i.e., wildlife observation, photography, environmental education, interpretation) would be managed to minimize disturbance to plants and wildlife, while also providing opportunities for the public to observe and appreciate the native species and natural lands protected within the Refuge. A designated system of trail would be developed that provides both non-motorized multiple trail use opportunities and pedestrian-only trails. Many existing user-created trails would be subject to closure, rehabilitation, or rerouting. No dogs would be permitted on the Otay-Sweetwater Unit. Public uses on the Del Mar Mesa Vernal Pool Unit would be permitted in accordance with the City of San Diego's Carmel Mountain and Del Mar Mesa Preserves Management Plan, and such uses would be limited to the designated trail system.

Alternative C - Expand Opportunities for Wildlife-dependent Recreational Uses
Alternative C proposes to expand the opportunities for wildlife-dependent recreational uses on the Otay-Sweetwater Unit, including providing hunting opportunities in designated locations within this Unit. The wildlife and habitat management activities proposed for the Refuge under Alternative C would remain generally consistent with those described under Alternative B. Additionally, public uses and access on the Del Mar Mesa Vernal Pool Unit would be consistent with those proposals presented in Alternative B. A designated system of trail would be developed that proposes to establish primarily non-motorized multiple use trails. Leashed dogs would be permitted on Refuge trails.

Alternative D (Preferred Alternative) - Optimize Species Protection While Providing Opportunities for Compatible Public Use
Alternative D intends to implement all of the wildlife and habitat management activities described under Alternative B, as well as implement a Feral Pig Monitoring and Eradication Plan to protect refuge resources from damage caused by feral pigs.

Alternative D also proposes to provide a range of compatible public use opportunities that minimize disturbance to sensitive resources. Under this alternative, hunting is proposed on a portion of the Otay Mesa and Lakes management area and the designated trail system would include multiple use and hiking only trails. Leashed dogs would only be permitted on those trails designated for multiple use. Public access on the Del Mar Mesa Vernal Pool Unit would be consistent with the proposals described under Alternative B.

An evaluation of the impacts associated with implementing the various proposals included under Alternatives A, B, C, and D has been conducted for each aspect of the environment described in Chapter 3, including physical, biological, cultural, and socioeconomic resources. The adverse and beneficial effects of each alternative are generally described under several action categories, including wildlife and habitat management (including habitat enhancement and restoration), public use, and where applicable, Refuge operations. Cumulative effects (impacts) on the environment of implementing the four alternatives are presented later in this chapter.

5.2 Effects to the Physical Environment

Topics addressed under the physical environment section include direct and indirect effects to topography, visual quality, geology and soils, geological hazards, paleontological resources, mineral resources, agricultural resources, hydrology/water quality, climate change, air quality, greenhouse gas emissions, and contaminants.

Noise is not addressed in this section because no activities are proposed in proximity to sensitive noise receptors (i.e., residential uses) that would generate noise levels in excess of existing county standards. The potential for activities to generate what might be considered nuisance noise is addressed under land use compatibility in the section titled Effects to the Social and Economic Environment.

The criteria used in this document to determine if a particular impact represents a significant adverse effect are present here for each topic.

- Topography – An adverse topographic effect is considered significant if grading or other land altering activity is proposed in a highly scenic area or would alter a locally or regionally important topographic landmark, or if any proposed activities would substantially alter the existing landform.

- Visual Quality – An adverse visual impact would be considered significant if a proposal would substantially alter the natural landform or block public views to a public resource.

- Geology, Soils, and Geological Hazards – Impacts related to geology and soils would be considered significant if a proposed action would trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion affecting on-site facilities or adjacent facilities, such as roadway embankments and bridge abutments. Impacts would also be considered significant if any proposed structures would be susceptible to geological hazards, such as liquefaction, settlement, ground rupture, or lateral spreading.

- Paleontological Resources – A significant adverse effect related to paleontological resources would occur if a proposed action could directly or indirectly damage a unique paleontological resource or site, or if grading or excavation would disturb the substratum or parent material below the major soil horizon in a paleontologically sensitive area.

- Mineral Resources - A significant adverse effect related to mineral resources would occur if a proposed action resulted in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State, such as proposing incompatible uses on or within the vicinity (generally up to 1,300 feet) of an area classified as MRZ-2; on land classified as MRZ-3; on land underlain by Quaternary alluvium; or on or within the vicinity of areas containing industrial material and gemstone resources.

- Agricultural Resources – A significant adverse effect on agricultural resources would occur if a proposed action would result in the conversion of a substantial amount of Prime Farmland or Farmland of Statewide Importance to non-agricultural use (e.g., commercial, residential, industrial use), or if uses proposed in proximity to existing agricultural areas could result in indirect impacts to the adjacent agricultural activities.

- Hydrology – An adverse hydrologic effect is considered significant if an action would result in increased storm flooding on- or off-site, a net deficit in the aquifer volume, a drop in the local groundwater table, or changes in historical storm flow direction and velocities that would trigger or accelerate slope/bank instability or erosion affecting facilities located both on and off the Refuge.

- Water Quality – Adverse impacts to water quality would be considered significant if the action would violate any water quality standards or waste discharge requirements, substantially increase sedimentation or turbidity in water courses, introduce contaminants (non-point source pollution) into the watershed, or otherwise substantially degrade water quality.

- Climate Change – The predicted effects of climate change on a proposed action would be considered significant if these effects would substantially alter or degrade sensitive habitats and/or habitats that support listed species, migratory birds, or other species of concern. In addition, effects of climate change would be considered significant if Refuge property, such as structures, trails, roads, signage, and other facilities, could be damaged or destroyed due to changing site conditions, including increasingly severe weather.

- Air Quality – Direct adverse effects related to air quality would be considered significant if the action would result in emissions equal to or in excess of the NAAQS; sensitive receptors are exposed to substantial pollutant concentrations, including air toxics such as diesel particulates; or air contaminants are released beyond the boundaries of the Refuge. Significant indirect effects to air quality would occur if a proposed Refuge action results in the degradation of the existing level of service on adjacent roadways.

- Greenhouse Gas Emissions – The Service has not developed a quantitative threshold for determining whether a project's GHG emissions will have a significant effect on the environment, and no statewide threshold has been adopted by the State of California. The California Air Pollution Officers Association (CAPCOA), in its publication "CEQA & Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act" (2008), does explore various options for establishing significance thresholds for GHG emissions. These options include setting the threshold at zero and setting a non-zero level for GHG emissions. Another option involves addressing project effects without establishing a threshold. This could be accomplished through a quantitative or qualitative evaluation of individual projects. Because significance thresholds for GHG emissions have yet to be established, our significance determination is currently based on the specific context of an individual action. To the extent possible, our determination is based on an estimate of the expected GHG emissions and the extent to which efforts are made to reduce expected emissions.

- Contaminants - Adverse effects related to contaminants are considered significant when constituents of concern are present in or could be introduced into the soil, groundwater, or surface water at levels that exceed standard screening levels for assessing ecological risk.

5.2.1 Effects to Topography

5.2.1.1 Alternative A – No Action

Wildlife and Habitat Management

Conducting the wildlife and habitat management activities currently occurring on the Refuge (e.g., monitoring of Federal and State listed, endangered, and threatened species; restoring and enhancing native habitat; removing trash, debris, and illegal encampments; maintaining existing access roads, gates, and fencing; conducting scientific research) would require some soil disturbance, but no substantial alteration of the existing landform would occur. Therefore, continuing to implement these actions would not significantly affect existing site topography or any important topographic features located within the Refuge boundary.

Public Use

Under Alternative A, trail use would continue on the Refuge generally as it is occurring today. There is the potential that some of the user-created trail segments present on the Refuge could be closed and possibly revegetated in an effort to protect sensitive Refuge resources and address user safety. Existing interpretive elements and environmental education programs would utilize the existing trail network; therefore, no new trail construction would occur under this alternative. No other facilities are proposed to accommodate public use. Continuation of the current public use program on the Refuge is not anticipated to significantly affect existing site topography or any important topographic features located within the Refuge boundary.

Refuge Operations

The activities implemented to support Refuge operations under Alternative A result in minor, if any, physical changes to the natural landform. As a result, no significant adverse effects to existing landform are anticipated under Alternative A.

5.2.1.2 Alternative B

Wildlife and Habitat Management

The management activities conducted under Alternative A would also occur under Alternative B. As described under Alternative A, none of these activities would result in adverse effects to topography. In addition, Alternative B calls for expanded habitat restoration and enhancement efforts within the Otay-Sweetwater Unit, which would require some site preparation (e.g., removal of invasive plants, minor soil disturbance). These actions would not result in any substantive changes to the topographic character of the site.

Other proposals, such as increased monitoring of species and habitat and implementation of an IPM Plan would have little, if any, effect on the existing landform, while actions to facilitate the reintroduction of one or more listed species could result in some small changes in the landform to improve habitat quality. These changes would most likely be limited to riparian areas where minor land alteration could be required to improve opportunities for water pooling to support certain life stages for arroyo toad and/or southwestern pond turtle. In some cases, this alteration of landform would be required to correct previous human alteration of the riparian system. Such changes would be minor and once the sites have revegetated, the alterations would be virtually undetectable. No significant adverse effects to existing topographic features are therefore anticipated from the implementation of these activities.

The wildlife and habitat management actions proposed under this alternative would not result in any substantive modifications to highly scenic areas nor would they affect a locally or regionally important topographic landmark. In addition, no grading to implement these actions would result in the substantial alteration of the existing landform by creating manufactured slopes higher than 10 feet or steeper than 2:1 (50 percent).

Public Use

Alternative B proposes to expand current public use programs on the Refuge. The installation of kiosks and interpretive signs to support these programs would have no effect on the area's natural landform. Environmental education and interpretive programs would generally be conducted on designated trails, with limited activities, primarily those related to habitat restoration and enhancement, occurring off trail.

Establishment of a designated, sustainable trail system within the Refuge is intended to reduce the effects to the landform of scaring and erosion that have resulted from the proliferation of user-created trails in the area. Within the Del Mar Mesa Vernal Pool Unit, some trails would be closed, while others would be realigned in an effort to protect listed vernal pool species and sensitive vernal pool habitat. These efforts would be implemented in coordination with the City of San Diego and other Del Mar Mesa Preserve partners. Implementing these actions would result in only minor changes to the existing landform; therefore, no significant adverse effects to site topography in this area are anticipated.

The proposal to realign or close some trails within the Otay-Sweetwater Unit would, in most cases, have little, if any, effect on the natural landform. When an existing trail segment is proposed for realignment to eliminate erosion problems or avoid sensitive habitat areas, the new (realigned) trail segment would be designed and constructed to include appropriate minimum and maximum slopes and follow existing contours, thereby minimizing the initial and long-term effects of trail construction on the existing landform.

There are a few places on the Refuge where user-created trails and/or old ranch roads have become highly eroded, supporting deep ruts. Rehabilitating severely damaged areas may require a combination of earthwork to improve drainage through the area and potentially the import of clean fill to assist in achieving the desired topographic contours. Once the erosion damage has been addressed, the areas would be revegetated with appropriate native species. Implementing this work would benefit the natural landform and improve the visual quality of the area. Other trail closures and realignments within the Otay-Sweetwater area would have similar beneficial effects.

Within the Otay-Sweetwater Unit, several new staging/parking areas are proposed to accommodate Refuge visitors. Potential sites for these new parking areas include the northeast portion of the McGinty Mountain area, the south side of Highway 94 in the Las Montañas area, the south side of Highway 94 to the west of Millar Ranch Road in the Sweetwater River area, and a yet-to-be-determined site off Proctor Valley Road on the Refuge's Hidden Valley property. Each parking lot site has its own topographic characteristics with the north McGinty Mountain site providing the greatest challenge. This site includes a gently sloping, but somewhat eroded, disturbed area at the base of an old truck trail that connects to Sloane Canyon Road just to the southeast of the intersection of Model A Ford Lane and Sloane Canyon Road. Alternatives B, C, and D propose to construction a four to six space parking area at this location. No design for this parking area is currently available and would not be prepared until funds have been identified for site design and construction.

The Refuge proposes to design the parking area in north McGinty Mountain in a manner that would minimize the extent of landform modification (i.e., grading) to the maximum extent practical, but some landform modification and potentially some small retaining walls may be needed to achieve a level surface for the parking area. The site is already disturbed and generally void of vegetation; therefore, the creation of a small, unpaved parking area at this site is not expected to significantly alter the existing topographic character of the area.

The other two locations where new parking areas and access roads would be provided (i.e., south of Highway 94 in the Las Montañas and Sweetwater River areas) are generally flat, requiring minimal landform alteration. As with the McGinty Mountain site, the actual size and layout of these parking areas would be determined when funding for engineering design and construction is identified. Based on the relatively flat topography in these areas, there appears to be limited potential for impacts to the existing landform. In addition, no important topographic landmarks are present within or immediately adjacent these sites. Therefore, no significant adverse effects to topography are anticipated.

Alternative B also proposes coordinating with other agencies to identify a safe trail connection between the north and south sides of Highway 94 at the Sweetwater River. No major adverse modifications to the existing landform are anticipated from providing an undercrossing, at-grade crossing, or overpass to accommodate trail access at this location. There are no regionally important topographic landmarks at this location and construction of a trail crossing here is not expected to degrade or otherwise affect the existing visual quality of the area. However, until a site-specific design and engineering is completed for the project, the full extent of the project construction cannot be determined, therefore, additional analysis in accordance with NEPA would be conducted prior to project implementation.

Refuge Operations

The development of several refuge facilities are proposed under Alternative B, including a visitor contact station and associated visitor-serving facilities on approximately 2.4 acres to the south of Highway 94 and west of Millar Ranch Road in the Sweetwater River area. The proposal for this site would require site grading for a pad to accommodate a trailer or other temporary visitor contact station and public restroom, grading to create a parking area and trailhead, and construction of a trail and potentially a trail bridge to provide access from the parking area to the Sweetwater Loop and River Trail. This area is relatively flat; therefore, no extensive landform alteration is anticipated. The specific design and layout of this site would be developed in the future when funding for the project is identified. At that time, additional analysis of the project's potential effects on site topography would be conducted in compliance with NEPA.

Alternative B also includes proposals to construct a greenhouse/native plant nursery and firefighter/volunteer staff barracks at Rancho Jamul, and to relocate an existing storage building on San Miguel Mountain to Rancho Jamul. The site preparation required to accommodate these facilities would occur in previously disturbed, flat areas of the Rancho Jamul compound and are not expected to impact any natural landforms. Therefore, no adverse effects to topography are anticipated.

Another proposal involves the closure of abandoned mines shafts when discovered, including some located on Mother Miguel Mountain and McGinty Mountain. These closures would involve some minor disturbance at the entrance to the shafts to accommodate the installation of bat-compatible steel gates, when applicable, or to fill the shafts with polyurethane foam. Such disturbances would have virtually no effect on existing area topography.

Maintenance activities proposed under this alternative, including the repair of a small dam in the San Miguel Mountain, removal of water tanks on Mother Miguel Mountain, removal of abandoned pump houses and wells in the Sweetwater River area, and removal or rehabilitation of fencing in the Hidden Valley area, would have no effect of the existing landform.

5.2.1.3 Alternative C

Wildlife and Habitat Management

The effects of implementing the wildlife and habitat management proposals included under Alternative C would be essentially the same as those described under Alternative B. No significant adverse effects to the existing landform on the Refuge are anticipated.

Public Use

The primary differences between Alternatives B and C relate to the types of uses permitted on the Refuge, therefore the effects described under Alternative B related to trails, the construction of parking areas, the implementation of expanded public use programs, and the installation of new kiosks and interpretive signs would apply to the implementation of Alternative C.

A few additional trail corridors are included under this alternative, including a trail that would extend from the western ridge of the Sweetwater River area down to the Sweetwater Loop and River Trail, an interpretive trail on Lot 707, and a trail up to the top of Mother Miguel Mountain. These trail alignments would follow the existing contours of the land to minimize impacts to the landform and ensure a sustainable trail tread. Another 500-foot-long interpretive trail, constructed as a boardwalk, would be installed within the vernal pool restoration site in the San Miguel Mountain area. This area is relatively level, requiring limited ground disturbance. No adverse impacts to the existing landform are anticipated from these trail projects.

Refuge Operations

The construction projects proposed in Alternative B to support Refuge operations are also proposed under Alterative C. In addition, Alternative C proposes relocating the Refuge office from Rancho Jamul to the Sweetwater River area once the transfer of 2.4 acres of Caltrans land to the Refuge is completed. Under Alternative B, this site would accommodate a temporary visitor contact station and various visitor services-related amenities. Many of the uses proposed for this site under Alternative B would also be provided under Alternative C. In addition, Alternative C proposes the construction of an approximately 2,500-square-foot, permanent Refuge office and visitor contact station, along with parking for Refuge staff and Refuge vehicles. Due to the lack of significant topographic relief within the project site, no adverse effects to the existing landform are anticipated. Additional review in accordance with NEPA would occur following the completion of site-specific design and construction plans.

5.2.1.4 Alternative D

Wildlife and Habitat Management

The effects of implementing the wildlife and habitat management proposals included under Alternative D would be essentially the same as those described under Alternative B. No significant adverse effects to the existing landform on the Refuge are anticipated.

Public Use

The primary differences between Alternatives C and D relate to the types of uses permitted on the Refuge, therefore the effects described under Alternative C related to trails, the construction of parking areas, the implementation of expanded public use programs, and the installation of new kiosks and interpretive signs would also apply to the implementation of Alternative D.

Refuge Operations

The construction projects proposed in Alternative C to support Refuge operations, including construction of a refuge office and visitor contact facility in the Sweetwater River management area, are also proposed under Alterative D. Therefore, the potential effects to landform described under Alternative C for these projects would also apply to the implementation of Alternative D.

5.2.2 Effects to Visual Quality

5.2.2.1 Alternative A – No Action

Wildlife and Habitat Management

Current wildlife and habitat management activities that could affect visual quality include the removal of invasive plants, installation of native plants in disturbed or fire damaged areas, the installation or replacement of fencing, access road maintenance, and removal of trash and debris. While activities such as vegetation removal associated with the control of invasive species, including non-native trees and palms, may change the visual character of the affected areas; these impacts are temporary in nature and result in only minor changes to the Refuge's visual quality. Following invasive species control, affected areas would be planted with appropriate native vegetation or allowed to revegetate naturally. These actions serve to mitigate temporary minor impacts to the visual character of the site. Continuation of existing wildlife and habitat management activities, as proposed under Alternative A, would not result in any significant adverse effects to visual quality. Some minor beneficial effects would result from be trash and debris removal and the replacement of weedy and invasive species with native plants.

Public Use

The Refuge is currently crisscrossed with various user-created trails, old truck trails, and utility easements, which are visible from other areas within and outside of the Refuge. Although no designated trail system is proposed under this alternative, there is the potential that some existing user-created trail segments could be closed to protect sensitive Refuge resources. Such actions would have a minor beneficial effect on visual quality, as these disturbed areas would no longer be visible once they are revegetated. No actions are proposed that would block views of significant landmarks on or off the Refuge, and no significant land alteration is proposed that would adversely affect the existing visual quality of the lands preserved within the Refuge.

Refuge Operations

The activities implemented to support Refuge operations under Alternative A result in minor, if any, physical changes that could alter a site's existing visual character. As a result, no significant adverse effects related to visual quality are anticipated under Alternative A.

5.2.2.2 Alternative B

Wildlife and Habitat Management

The management activities conducted under Alternative A would also occur under Alternative B, and as described under Alternative A, would result in only minor changes to the Refuge's visual quality.

Additional management actions proposed under Alternative B, such as expanded habitat restoration and enhancement efforts within the Otay-Sweetwater Unit, would alter the existing visual appearance of a site. Upland areas supporting weedy vegetation may be initially transformed into a barren site that would ultimately become revegetated with primarily native vegetation. In riparian areas, non-native shrubs, reeds, and trees would be removed and ultimately replaced with native plants such as willows, mulefat, or sycamores. Although the visual character of the restored or enhanced areas would be altered, this change is not considered a significant adverse effect. The control of feral pigs, should they enter the Refuge, is not proposed under this alternative, therefore, future impacts to visual quality due to rooting and wallowing in native vegetation could occur, if a feral pig population is established on the Refuge.

Other proposals, such as increasing monitoring of species and habitat and implementing an IPM Plan would have little, if any, effect on the visual character of the Refuge. No significant adverse effects related to visual quality are therefore anticipated from these activities.

Public Use

Establishing a designated trail system for the Refuge, as proposed in Alternative B, would lead to the closure or realignment of many of the user-created trails that crisscross the lands within the Refuge. The proposal to realign or close some trails within the Otay-Sweetwater Unit would have no adverse effect on the existing visual quality of the area. In some cases, the closure and rehabilitation of an area that currently supports a poorly aligned, highly eroded trail would provide minor benefits as the area becomes revegetated and the previously disturbed site ultimately blends into the existing hillside. New trail segments that may be created to replace eroded sections of trails would be aligned to follow existing contours, thereby minimizing the initial and long-term visual effects of the trail.

The new parking areas and associated amenities (e.g., information kiosks, interpretive signs) proposed to accommodate trail users within the McGinty Mountain and Las Montañas area would require the removal of existing vegetation and grading of currently undeveloped areas. These changes would necessarily alter the sites' visual quality. To ensure that no significant adverse impacts to the visual quality of these sites as viewed from the public right-of-way and from within the Refuge would occur, the following measures would be incorporated into the future design of these parking area projects:

- For the parking lot surface, avoid the use of light concrete and asphalt and instead use materials and colors that allow the parking surface to better blend into the existing environment;
- Minimize the removal of native trees and shrubs, revegetate disturbed areas with native plants and, where appropriate, plant native trees and shrubs to soften the view of the parking area and/or structures (e.g., restrooms, contact station, trash receptacles, trailhead kiosk) from the roadway; and

- Should retaining walls be required, plant appropriate native shrubs or other native vegetation in front of the retaining walls to soften their appearance.

The effects to the visual quality of the area by providing a trail crossing at Highway 94 and the Sweetwater River would vary depending upon the final solution. A fair weather undercrossing or at-grade crossing would have minimal effects on the visual quality of the area, while an overcrossing would have high visibility, the overall effects of which would be dependent upon the ultimate design. When funding is identified to address this trail connection problem, additional public input and analysis in accordance with NEPA would be required prior to implementation.

Refuge Operations

The construction of a temporary visitor contact station and other visitor service-related facilities in the Sweetwater River area would alter the existing visual character of the site but would not significantly change the overall character of the views observed along Highway 94, which include a mixture of open native habitat and urban development. View corridors from Highway 94 onto the Refuge would be maintained, and the site design for this Refuge facility would take into consideration views from Highway 94 of the riparian woodlands that parallel the roadway, as well as need to maintain the open rural character of the community. The measures described previously to minimize adverse visual effects from the construction of proposed parking areas would also be implemented at this site. Through appropriate design features, the use of materials and colors that complement the setting, and the strategic use of native plants, the effect of the structures on the visual character of the area can be minimized. Prior to project construction, design and engineering plans would be prepared and additional analysis under NEPA would be required. At that time, the proposed design would be evaluated to ensure that the structure would not result in significant adverse effects to the visual character of the area.

The installation of new structures (i.e., a greenhouse/native plant nursery, firefighter/volunteer staff barracks, a relocated storage building) in proximity to the existing office facilities at Rancho Jamul would not significantly alter the existing visual character of the site, which already includes a variety of buildings and other structures. The proposal to close old mine shafts located on the Otay-Sweetwater Unit and the removal of water tanks, pumphouses, and fencing would have little, if any, effect on visual quality.

5.2.2.3 Alternative C

Wildlife and Habitat Management

The effects of implementing the wildlife and habitat management proposals included under Alternative C would be essentially the same as those described under Alternative B.

Public Use

The analysis of potential effects to visual quality from implementing the public use proposals include under Alternative C would be essentially the same as those described for Alternative B. The incorporation of the measures presented in Alternative B into future parking lot design and layout would minimize the potential for adverse effects to visual quality. Through proper alignment of the trails proposed for Lot 707, the western slopes of the Sweetwater River area, and Mother Miguel Mountain, visual impacts from trail construction would be minimized. No visual impacts are anticipated from the installation of an interpretive boardwalk trail at the restored vernal pool site on the Otay-Sweetwater Unit.

Refuge Operations

The construction projects proposed in Alternative B to support Refuge operations are also proposed under Alterative C; therefore, the potential effects to the visual quality of the affected areas would be the same as those described under Alternative B. In addition, the measures proposed to minimize the visual impacts of the visitor service-related facilities along Highway 94 in the Sweetwater River area would minimize the potential for visual impacts related to the construction of a permanent Refuge office, visitor contact station, and staff parking area.

5.2.2.4 Alternative D

Wildlife and Habitat Management

The effects of implementing the wildlife and habitat management proposals included under Alternative D would generally be the same as those described under Alternative B. However, under Alternative D, the Refuge would implement a Feral Pig Monitoring and Eradication Plan. One component of this plan, as described in Appendix E, is to strategically place temporary traps on the Refuge, if pigs are determined to be present. The number of traps would be limited, relatively small in size, and would not block viewsheds. Various types of traps including cage traps, box traps, and/or corral traps would be utilized in areas frequented by pigs (see Appendix E). Traps would be installed in a manner that would avoid any degradation to the visual character of the site. To the extent practicable, traps would be placed in areas not visible from public trails or the public right-of-way, and would be removed as soon as they were no longer required. In most cases, traps would remain in use for no more than 30 days.

Controlling feral pigs as soon as they are identified on the Refuge will minimize the potential for them to disperse further onto the Refuge, avoiding adverse effects to visual quality associated with vegetation and soil disturbance from pig activity and reducing the need for temporary tramps that could be visible from some trails.

Public Use

The primary differences between Alternatives C and D relate to the types of uses permitted on the Refuge, therefore the potential effects to visual quality and the measures presented to minimize these effects, as described under Alternative C, would also apply to the implementation of Alternative D.

Refuge Operations

The construction projects proposed in Alternative C to support Refuge operations, including construction of a refuge office and visitor contact facility in the Sweetwater River management area, are also proposed under Alterative D. Therefore, the potential effects and recommended measures to minimize such effects to visual quality under Alternative C would also apply to the implementation of Alternative D.

5.2.3 Effects to Geology, Soils, and Geological Hazards

5.2.3.1 Alternative A – No Action

Wildlife and Habitat Management

Conducting the wildlife and habitat management activities currently occurring on the Refuge would not result in adverse effects to geology or soils. None of the management activities

proposed under this alternative (e.g., species monitoring, trash and debris removal, fence relocation, invasive plant control, maintenance of access roads and gates) would trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion, thus affecting on-site facilities or adjacent facilities, such as roadway embankments and bridge abutments and pilings. Neither would Alternative A make the Refuge and its facilities any more susceptible to geological hazards, such as liquefaction, settlement, ground rupture, or lateral spreading.

In some areas of the Refuge where invasive species control is implemented, the underlying soils may be prone to erosion, therefore, best management practices (BMPs), such as the temporary installation of fiber rolls or silt fencing, would be implemented to minimize runoff through these denuded areas. Once native vegetation has become established, these BMPs would no longer be necessary. Through the implementation of appropriate BMPs, significant adverse effects related to geology or soils would be avoided.

Public Use

The many rock outcrops present on the Refuge's steeper slopes represent a potential rock fall threat to Refuge visitors, particularly those visitors who wander off the trail and disturb highly erosive soils beneath the rock outcrops. Another potential soil-related trail impact is erosion. Various areas within the Refuge are overlain with highly erosive soils. Off-trail activity can break up cryptobiotic soil crust and lead to erosion in these sensitive soil areas, while off-trail travel in vernal pools when they are wet can alter and erode the microtopography on which the pools rely. In many cases, user-created trails follow the fall line of the slope rather than following the existing topographic contours of the site. As a result, water follows down the center of the trail, damaging the trail tread and making navigation of the trail difficult for users, and thus encouraging users to widen the trail or create a network of braided trails. Corrective measures such as water bars and drainage cuts can reduce but not eliminate these erosion hazards. To eliminate such problems would require rerouting and/or closure of the non-sustainable trail segment.

In addition to the existing trails on the Refuge, the other public use facilities currently present on the Refuge are limited to a parking area and kiosk in the McGinty Mountain area, and an informational kiosk, interpretive signs, and a trail bridge in the Sweetwater River area. The existing parking lot occurs on soils with a moderate to high potential for erosion; therefore, periodic monitoring of the site is conducted to determine if corrective measures, such as augmentation of the existing gravel surface, are needed to avoid erosion and downstream sedimentation due to the presence of water or from continued vehicle travel.

Refuge Operations

The activities implemented to support Refuge operations under Alternative A result in minor, if any, physical changes; therefore, no adverse effects associated with the geological or soil conditions on the Refuge would result from the continuation of current Refuge operations.

5.2.3.2 Alternative B

Wildlife and Habitat Management

The management activities conducted under Alternative A would also occur under Alternative B. As described under Alternative A, none of these activities would trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion, nor would they make the

Refuge and its facilities any more susceptible to geological hazards, such as liquefaction, settlement, ground rupture, or lateral spreading.

The expanded habitat restoration and enhancement activities proposed in Alternative B would require some site preparation (e.g., removal of invasive plants, minor soil disturbance) that could expose moderate to highly erosive soils to the forces of wind and runoff. However, as described under Alternative A, the implementation of appropriate BMPs would minimize runoff and the potential for erosion from these sites.

Another action proposed under Alternative B that is affected to some extent by the types of soils that overlay the site is the implementation of an IPM Plan—in particular, the use of herbicides. To ensure maximum effectiveness, while minimizing the amount of chemical being applied to a site, it is important to consider the types of soils present in an area proposed for treatment. Some active ingredients respond differently depending upon the soil type (sandy soils versus clay soils) and soil permeability. For example, some products bind with clay soils; therefore, higher application rates may be necessary in clay soil environments to ensure that adequate amounts of the herbicide are available for uptake by the targeted invasive plants. To minimize the amount of product applied to a site, chemicals being considered for use in a specific area will be evaluated based on volatility, mobility in soil, and water solubility.

The control of feral pigs, should they enter the Refuge, is not proposed under this alternative, therefore, there is a potential under this alternative for future erosion and sedimentation due to soil disturbance associated with pig rooting and wallowing.

Public Use

To minimize the potential for impacts related to rock fall, in addition to requiring all trail users to stay on designated trails, periodic monitoring (every few years) of potential rock fall areas would be conducted to identify any potential hazards that may warrant the closure of a particular trail segment. Additionally, monitoring would occur following a severe rainstorm event or a wildfire that exposes large rock crops to increased erosional forces.

Under Alternative B, a designated trail system would be established for the Refuge and specific trail alignments would be described in a step-down trail plan for the Otay-Sweetwater Unit. The types of soils present on the Refuge will influence trail discussions, including trail closures, trail realignments, and trail rehabilitation. The McGinty Mountain area, the southern portion of the Las Montañas area, the northern portion of the Sweetwater River area, and the Hidden Valley portion of the San Miguel Mountain area are overlain with Cieneba and Vista series soils, both with erosion hazards that range from moderate on flatter areas to very high on steep slopes. The eastern slopes of the Sweetwater River area and a major portion of the San Miguel Mountain area are overlain with San Miguel-Exchequer rocky silt loams that demonstrate runoff potential of medium to rapid depending upon the slope and an erosion hazard of moderate to very high.

Another factor to be considered in determining trail sustainability is the presence of clay soils. Linne clay loam and Diablo clay soils are present within the San Miguel Mountain area. When wet, these soils can hold water, resulting in soggy trail treads. Use of these wet trails can create large holes in the trail that exacerbates the problem the next time it rains, or users may create new pathways around the wet trail, damaging native habitat on either side of the trail. Clay soils are very slippery when wet and may present a safety hazard to hikers, or at least make the hike less pleasant.

To address these soil-related problems, as well as the erosion hazards associated with the vast majority of the soils on the Otay-Sweetwater Unit, trail layout and design would incorporate measures to ensure a sustainable trail; one that will not result in excessive erosion caused by water flow or use. Sustainable trail practices that would be implemented as part of trail rehabilitation, trail realignment, or new trail construction would include but are not limited to adequately outsloped tread, sustainable grades, frequent grade reversals, erosion resistance, special treatments in areas where soil is prone to retaining moisture, and rolling contours (Hesselbarth et al. 2007). These and other practices would be described in detail in the step-down trail plan for the Otay-Sweetwater Unit.

The site of the proposed parking lot at the north end of McGinty Mountain, adjacent to Sloane Canyon Road, is overlay with Cieneba very rocky, coarse sandy loam, having a high to very high potential for erosion. To avoid adverse effects related to erosion and downstream siltation, the grade and drainage within of the parking lot, as well as the slopes and anticipated drainage patterns of the slopes adjacent to the parking lot would be taken into consideration during site design. In addition, BMPs would be implemented to control erosion during and after construction. Temporary measures to control runoff and sedimentation during construction could include the use of fiber rolls, detention basins, and/or silt fencing. Post construction BMPs would involve long-term measures to minimize the potential for erosion due to use and seasonal rains. These long-term measures would include sustainable grading practices, the use of appropriate permeable surface materials, revegetating the undeveloped portions of the site with appropriate native vegetation, and providing for proper drainage through the site.

The soils that overlay the area to the south of Highway 94 in the Las Montañas area have varying degrees of erodibility, with the Ramona and Vista soil series characterized by a slight to moderate potential for erosion and Cieneba soil series having a high to very high potential for erosion. Based on the existing topography in the area, it is likely that the parking lot would be located within the area overlain by Ramona sandy loam, which has a lower potential for erosion than the areas to the east. Nevertheless, to avoid adverse effects related to erosion, the implementation of BMPs to address temporary and long-term erosion control would be incorporated in to the project design.

Another parking area is proposed under Alternative B for the area south of Highway 94 and west of Millar Ranch Road. The soils in this area, Visalia sandy loam, two to five percent slopes, have a moderate potential for erosion. To minimize the potential for adverse effects, the BMPs described previously for the Las Montañas and McGinty Mountain areas would also be incorporated into the future design and engineering plans for this parking area, as well as the larger construction site that will include a temporary visitor contact station, restrooms, and trail staging area.

Soil and erosion-related issues associated with a trail connection across Highway 94 at the Sweetwater River would vary depending upon which option is ultimately selected for crossing. An at-grade crossing is likely to be influenced the least by soil and erosion issues, while a fair weather crossing would require further geotechnical analysis and the implementation of both short-term and long-term BMPs to minimize the potential for silt entering the adjacent floodway. The construction of an overcrossing would require additional geotechnical analysis and the implementation of BMPs during project construction. Prior to the construction of a trail connection in this area, additional public input and analysis in accordance with NEPA would be required.

Alternative B proposes to expand current public use programs and facilities on the Refuge. Within the Del Mar Mesa Vernal Pool Unit, some trails would be closed, while others would be realigned in an effort to protect listed vernal pool species and sensitive vernal pool habitat. These efforts would be implemented in coordination with the City of San Diego and other Del Mar Mesa Preserve partners. Implementing these actions would improve conditions on the trail and reduce the potential for erosion. No other impacts related to geology or soils are anticipated in this portion of the Refuge.

Refuge Operations

Potential impacts related to erosion on construction sites for the greenhouse/native plant nursery, firefighter/volunteer staff barracks, and relocated storage building at Rancho Jamul is relatively low and would be further minimized through the implementation of short-term BMPs to control erosion during construction and long-term BMPs, primarily revegetation of disturbed areas. BMPs would also be implemented during proposed dam repair and pump house demolition. No erosion issues are anticipated during operations associated with well or mineshaft closures.

With respect to geologic and soil hazards, the lands within the Refuge do not include significant areas of expansive soils, landslide prone soils, or areas prone to liquefaction (County of San Diego 2007a); therefore, structures and parking lots proposed for the Otay-Sweetwater Unit would not be subject to such hazards.

5.2.3.3 Alternative C

Wildlife and Habitat Management

The effects related to geology and soils of implementing the wildlife and habitat management proposals included under Alternative C would be essentially the same as those described under Alternative B. Restoration and enhancement projects incorporate the use of short and long-term BMPs into the project design to minimize the potential for erosion and downstream sedimentation. Therefore, the implementation of this alternative would not trigger or accelerate substantial slope instability, subsidence, ground failure, or erosion, nor would they make the Refuge and its facilities any more susceptible to geological hazards, such as liquefaction, settlement, ground rupture, or lateral spreading. The types of soils present within a proposed invasive plant species control site would be evaluated prior to herbicide application as described under Alternative B.

Public Use

The effects of implementing the public use proposals included under Alternative C would be generally the same as those described under Alternative B. However, some additional trail projects are proposed under Alternative C, including a trail on the western slopes of the Sweetwater River area, an interpretive trail on Lot 707, a trail to the top of Mother Miguel Mountain, and an interpretive boardwalk trail at the vernal pool site in the San Miguel Mountain area. The western slopes of the Sweetwater River area to the south of Highway 94 are overlain with Friant rocky fine sandy loam soils, which demonstrate rapid to very rapid runoff velocities with a high to very high potential for erosion (Bowman et al. 1973). The area where a trail is proposed on Mother Miguel Mountain is overlain with San Miguel-Exchequer rocky silt loams, which have runoff potential of medium to rapid depending upon the slope and an erosion hazard of moderate to very high. To minimize the potential for erosion and siltation, BMPs, as presented in Section 6.9.3 (Conservation Measures) of the draft CCP/EA, would be implemented during construction and adherence to sustainable trail design standards would be

followed during both trail layout and construction. The only potential geologic hazard in these areas is the potential for rock fall on Mother Miguel Mountain. Periodic monitoring of site conditions, as described under Alternative A, would occur in this area following trail construction.

Refuge Operations

The construction projects proposed in Alternative B to support Refuge operations are also proposed under Alterative C. As described under Alternative B, no geologic hazards are present in the areas proposed for future construction projects; therefore, no adverse effects related to geologic hazards are anticipated and the implementation of BMPs during and after construction would avoid any adverse effects related to soil erosion.

5.2.3.4 Alternative D

Wildlife and Habitat Management

The effects related to geology and soils of implementing the wildlife and habitat management proposals included under Alternative D would be generally the same as those described under Alternative C. The BMPs described under Alternative B would also be implemented under Alternative D. The proposal to monitor for and control as necessary feral pigs that may enter the Refuge will provide greater benefits to the environment with respect to minimizing the potential for soil disturbance and erosion than the other action alternatives.

Public Use

The effects of implementing the public use proposals included under Alternative D would be generally the same as those described under Alternative C. However, the interpretive trail on Lot 707 and the trail to the top of Mother Miguel Mountain would not be constructed under this alternative.

Refuge Operations

The construction projects proposed in Alternative B to support Refuge operations are also proposed under Alterative D. As described under Alternative B, no geologic hazards are present in the areas proposed for future construction projects; therefore, no adverse effects related to geologic hazards are anticipated and the implementation of BMPs during and after construction would avoid any adverse effects related to soil erosion.

5.2.4 Effects to Paleontological Resources

5.2.4.1 Alternatives A, B, C, and D

Although there is the potential for paleontological resources to be present within the Sweetwater River and San Miguel Mountain areas of the Otay-Sweetwater Unit and within the Del Mar Mesa Vernal Pool Unit, the nature of the action proposed under Alternatives A, B, C, or D, which are generally limited to habitat conservation and compatible public uses, would result in a minor amount of excavation on the Refuge. Therefore, no adverse effects to subsurface paleontological resources are anticipated. Protection of these resources, should they be inadvertently discovered, would occur in compliance with all applicable policies and regulations. In addition, the regulations that prohibit the collection of paleontological resources on Federal lands managed by the Service would be enforced on the Refuge.

5.2.5 Effects to Mineral Resources

5.2.5.1 Alternatives A, B, C, and D

Portions of the Otay-Sweetwater Unit include areas where adequate information indicates that significant deposits of aggregate resources are present or are likely to be present (see Figure 3-10). These areas occur primarily within the Sweetwater River floodplain. Within the acquisition boundary of the Refuge, approximately 33 acres, including some lands already incorporated into the Refuge, are classified as MRZ-2 (areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood exists for their presence). Within the Refuge, these areas are generally located upstream of the Sweetwater Reservoir. The potential for impacts to the reservoir in terms of water quality and increased siltation makes it unlikely that these resources would be available for extraction even if they were not located within the Refuge.

Other areas within the acquisition boundary of the Otay-Sweetwater Unit have been classified as MRZ-3 (areas where significant aggregate resources are potentially present). Approximately 3,000 acres within the acquisition boundary have been classified as MRZ-3, and these areas are distributed in approximately four general locations within the acquisition boundary: north of Dehesa Road, south of the Las Montañas area, east of Brown Field, and northeast of Brown Field. It is unlikely that all 3,000 acres classified as MRZ-3 would be acquired for inclusion in the Refuge; however, if they were to be acquired, these parcels would represent less than three percent of the total area (about 97,000 acres) within the county that are classified as MRZ-3. In addition, approximately 24,000 acres within the county and outside the Refuge acquisition boundary are designated MRZ-2. As a result, the Refuge and the activities proposed for implementation within the Refuge would not represent a significant reduction in aggregate resources available for commercial use in the county. In addition, the Refuge would not result in the irrevocable loss of aggregate resources, as they would continue to be preserved on Refuge property.

Although there is evidence of past mining activity on the Refuge for minerals other than aggregate material, most of the evidence seems to indicate that mining was generally exploratory in nature or of limited scale. Only Peg Leg Mine seems to have been in production for an extended time. Alternatives B, C and D all propose to close old mining shafts when they are located. This activity, as well as the other activities proposed in the CCP under the various alternatives, would not result in any adverse effects to the region's mineral resources.

5.2.6 Effects to Agricultural Resources

5.2.6.1 Alternatives A, B, C, and D

The effects to agricultural resources from implementing any of the management alternatives considered for San Diego NWR would be the same. In all cases, the majority of the lands within the Refuge would be maintained to protect native habitat, sensitive species, and the general diversity of the native species present on the Refuge. Under any of the alternatives, the lands within the Refuge would not be used or made available for agricultural purposes. Although the majority of the lands within the Refuge have been identified as having value for grazing, these areas do not support soils that are classified as prime farmland or farmland of statewide importance (County of San Diego 2007b).

The California Department of Conservation (2000) does identify areas within the McGinty Mountain area and the Sweetwater River area as Farmland of Local Importance. In addition, portions of the non-contiguous mitigation parcels recently added to southwestern end of the San

Miguel Mountain area are identified as Farmland of Local Importance. These parcels are not however of adequate size to support agriculture and all are located immediately adjacent to urban development.

In the case of the McGinty Mountain area, only a small portion of the area classified as Farmland of Local Importance actually supports soils that are considered candidates for classification as Prime Farmland or Farmland of Statewide Importance soil candidates (County of San Diego 2007b). In addition, this portion of the Refuge, although located within the San Diego County Water Authority service boundary, contains no waterlines or water meters. Preserving this portion of the Refuge to support important biological resources would therefore not represent a significant adverse effect to agricultural resources, because this action would not result in the conversion of Prime Farmland or Farmland of Statewide Importance to non-agricultural use.

The Sweetwater River area includes several areas overlain with soils that are candidates for Prime Farmland or Farmland of Statewide Importance, and the locations of these soils generally coincide with the areas on the Refuge that have been classified by the California Department of Conservation (2010b) as Farmland of Local Importance. As indicated in Figure 3-10, the areas classified as Farmland of Local Importance are relatively narrow and occur along major riparian corridors (i.e., Sweetwater River, Steele Canyon Creek) within the Refuge. The configuration of these areas (i.e., long and narrow) along with the lack of any infrastructure to support irrigation severely limits the value of this area for agricultural use. Similar situations exist on lands included within the Refuge acquisition boundary, and in these cases, the value for agricultural use is also considered relatively low. None of the lands included within the Refuge boundary or within the acquisition boundary are classified as Prime Farmland or Farmland of Statewide Importance.

The implementation of the CCP under any of the alternatives would not result in any irrevocable loss of important farmland. Further, the management actions and public uses proposed under any of the alternatives would have no effect on any existing or future agricultural activities occurring in proximity to the Refuge, therefore no direct or indirect impacts to agricultural resources are anticipated.

5.2.7 Effects to Hydrology

5.2.7.1 Alternative A – No Action

Wildlife and Habitat Management

The management activities occurring on the Refuge, involving trash, debris, and homeless camp cleanups; invasive species control; and maintenance of access roads, fencing, and signage have limited effect on the natural flows within the Sweetwater River, Steele Canyon Creek, and other drainages on the Refuge. In addition, these activities have little influence on stormwater flow and velocity within the Refuge. Current habitat enhancement and restoration projects involve only minimal alteration of the existing soil and therefore do not result in any significant increases in stormwater runoff volumes or velocities. Trash and debris cleanups and removal of invasive plant material that are implemented within major drainages and along the floodplain of the Sweetwater River would improve, to some extent, the hydrological conditions within the drainages in which this work is conducted. The overall effect on the watershed would however be minimal.

Public Use

Wildlife-dependent recreational uses occurring on the Refuge have limited impact on hydrology within or outside of the Refuge. Existing user-created trails however can have adverse effects on hydrology, particularly if the trail alignment follows the fall line of the slope. Trails created on the fall line allow stormwater to flow down the trail at higher velocities and volumes than would occur under natural slope conditions. The result is changes in the existing hydrology on the slope and increased erosion along the trail, as well as at the bottom of the slope where the water flows into existing drainages. Such impacts are localized and can be most effectively addressed through trail closure and slope rehabilitation. Other temporary measures such as minor realignments, installation of water bars, or changes in cross slope can reduce but would not eliminate the impacts. Other facilities on the Refuge, including the parking lot at Jamul Drive and the multiple use trail bridge that crosses the Sweetwater River, do not result in any impacts to the hydrology on the site.

Hydrologic hazards include flooding, mudslides, and river scour and deposition that could affect existing trails, particularly user-created trails that follow existing drainages and/or are constructed parallel to the fall line. Although most visitors would not be on the trails during a significant rain event, poorly laid out trails could create hazards to trail users associated with flash flooding and/or mud or rock slides.

Within the Del Mar Mesa Vernal Pool Unit, site hydrology is important at two scales: the larger landscape scale associated with the canyon and mesa topography and the much smaller microrelief scale associated with the mimamound and vernal pool topography present on the mesa. The microdrainages that form in these areas of the mesa facilitate the filling of the vernal pools during the winter rains. Even minor disruption of these drainage patterns can adversely affect the quality of the vernal pool habitat. Trail use and unauthorized trail construction within this portion of the Refuge can affect hydrological processes both at the landscape scale and at the microrelief scale.

Refuge Operations

The activities implemented to support Refuge operations under Alternative A result in minor, if any, impacts to the existing hydrology on the Refuge or at Rancho Jamul; therefore, no adverse effects related to hydrology would result from the continuation of current Refuge operations.

5.2.7.2 Alternative B

Wildlife and Habitat Management

The effects to hydrology of expanding the existing management actions on the Refuge to address listed species protection and recovery, as well as maintenance of habitat and native plant and wildlife diversity, would be similar to those described under Alternative A. Although there are proposals to improve habitat quality within the Sweetwater River and some of its tributaries, these actions (i.e., removing invasive shrubs and trees, restoring native vegetation, managing some vegetation to mimic a natural flood regime) would not significantly alter the existing hydrologic conditions within the Refuge.

Public Use

The construction of some trail segments and the closure of others in accordance with the designated trail system proposed under Alternative B would not impact site hydrology, however, future trail bridges could impede water flow if not properly designed. To ensure that

trail bridges do not impact water flows, particularly during flood events, the siting, structural design, and elevation of a proposed trail bridges would take into consideration the hydrology and flood flow elevation of the affected stream or river. The same would apply to any future proposal to construct a fair weather trail undercrossing below Highway 94 at the Sweetwater River. The design and construction of such a facility would have to take into consideration hydrologic conditions occurring under the bridge to ensure that no adverse effects to the bridge or facilities located up or down stream of the undercrossing, particularly during a flood event. Additional environmental review and analysis would be required if and when preliminary design and engineering plans are prepared for such an undercrossing.

The design and construction of new parking areas would be designed to avoid any obstructions to both seasonal low flow volumes and higher stormwater flows.

To avoid impacts to facilities and users associated with hydrologic hazards, the siting of trails, bridges, staging areas, interpretive elements, and a visitor contact station and associated visitor-serving facilities must take into consideration the potential for flood hazards, mud or rockslides, and river scour and deposition. The majority of the impacts related to these hazards can be avoided by providing adequate buffers between existing floodways and proposed facilities, aligning new trails perpendicular to the fall line and within the limits of the maximum sustainable grade, and minimizing alterations to the existing floodway that could affect downstream river scour or deposition. In some instances, it may also be necessary to close temporarily one or more trails during and immediately after a significant storm event to protect visitors from potential hazards.

Where appropriate, additional hydrological analysis would be conducted as part of construction design to ensure that no significant adverse effects to the proposed facility and/or to up or downstream properties would result from project implementation.

Refuge Operations

Construction of Refuge support facilities at Rancho Jamul would not result in any impacts related to hydrology. The proposal to implement repairs to the existing Saddle Road Dam and address the existing seepage problem on the outside of the dam face would require consideration of the existing hydrologic conditions in the vicinity of the dam. The proposed repair work would be expected to benefit hydrologic conditions downstream and minimize the potential for future dam failure. Proposed mineshaft closures would have minimal, if any, effects on hydrology.

5.2.7.3 Alternative C

Wildlife and Habitat Management

The effects to hydrology of implementing the wildlife and habitat management actions described under Alternative C would be the same as those described under Alternative B.

Public Use

The effects to hydrology of implementing the public use proposals described under Alternative C would be similar to those described under Alternative B. With respect to the proposal to construct a boardwalk through a portion of the Shinohara vernal pool site, the design for the facility will take into account the need to protect the microhydrology of the site, which supports the vernal pool habitat. The boardwalk would be constructed using a pin foundation system or

a similar product that does not require any grading on the site. This will ensure that no adverse effects to hydrology would result from the implementation of this project.

Refuge Operations
The effects to hydrology of implementing the Refuge operations proposed under Alternative C would be the same as those described under Alternative B.

5.2.7.4 Alternative D

Wildlife and Habitat Management
The effects to hydrology of implementing the wildlife and habitat management actions described under Alternative D would be the same as those described under Alternative B.

Public Use
The effects to hydrology of implementing the public use proposals described under Alternative D would be similar to those described under Alternative C.

Refuge Operations
The effects to hydrology of implementing the Refuge operations proposed under Alternative D would be the same as those described under Alternative B.

5.2.8 Effects to Water Quality

5.2.8.1 Alternative A – No Action

Wildlife and Habitat Management
Best management practices (BMPs) (e.g., installation of fiber rolls, silt fencing) are currently implemented by Refuge staff during maintenance activities such as access road repairs and fencing removal and replacement, as well as around areas undergoing preparation for native habitat restoration. These BMPs are intended to minimize erosion and sedimentation into adjacent wetlands. The continued implementation of these types of measures would minimize or avoid water quality impacts within the Sweetwater River, Steele Canyon Creek, and other smaller drainages, as well as downstream reservoirs and ultimately San Diego Bay.

Erosion control has also been used on the Refuge following loss of vegetation due to wildland fire. Depending upon the severity and extent of a fire, various erosion control methods have been and will continue to be implemented to minimize erosion from burn areas into adjacent drainages. These measures include the installation of fiber rolls, silt fencing, check dams, or water bars to reduce the potential for siltation due to erosion during storm events and, as appropriate, reseeding with native species to minimize the time that barren soils are exposed to wind and water erosion. The specific measures to be implemented following a wildland fire event are determined based on a rapid evaluation of the effects of the fire on the physical characteristics of the burn site, such as the extent of any remaining vegetation cover, size of the burn area, steepness of the slopes, soil types present, and proximity to major drainages.

Pest Management
The control of invasive plant species on the Refuge involves mechanical removal and the periodic application of herbicides. Although mechanical removal has the potential to expose soils to wind and water erosion, these activities are generally limited to the use of hand tools and/or are focused on individual plant removal rather than the removal of large areas of

vegetation. Therefore, the continuation of mechanical control methods is not expected to impact water quality within adjacent wetland areas.

Because the Service uses insecticides, herbicides, and fungicides on refuges, a formal pesticide use review process is employed to ensure that all chemical pesticides approved for use have been reviewed for their potential impacts to groundwater, surface water, and terrestrial and aquatic non-target vegetation and wildlife, including threatened and endangered species. This process involves the preparation and approval of a Pesticide Use Proposal (PUP). The Service maintains a database (Pesticide Use Proposal System [PUPS]) that contains a list of all pesticides approved for use on each Refuge, as well as details regarding target pests, products applied, application dates, rates, methods, number of applications, site description, sensitive habitats, and BMPs employed to avoid impacts to Refuge resources. Pesticides approved for use must be shown to pose the lowest toxicity-related threat to non-target terrestrial and aquatic ecosystems while addressing the specific pest control objectives. The pesticides approved for use on the San Diego NWR are described in Chapter 4.

The use of herbicides to control invasive plants could also pose several environmental risks, including water contamination and persistence in the environment (Bossard et al. 2000). The potential for such risks under this alternative is considered minimal due to the types and limited quantities of herbicides used on the Refuge, combined with the requirements for review and approval of all products used on the Refuge through the PUPS and the requirement that all applications of approved pesticide products be conducted in accordance with the specifications on the project label. Products currently used on the Refuge to control invasive plants include Telar XP, with the active ingredient chlorsulfuron; Fusilade DX, with the active ingredient fluazifop; and Makaze, Prosecutor, Roundup, Roundup Pro, and Rodeo all of which contain the active ingredient glyphoste. Table 5-1 presents information regarding the basic hazards and environmental fate of these herbicides.

Potential impacts to water quality from the use of herbicides can occur because of product drift during application. Several factors influence drift, including spray droplet size, wind and air stability, humidity and temperature, physical properties of herbicides and their formulations, and the method of application. Accidental drift is most likely to happen when the chemical is applied by broadcast method, particularly via a boom. Drift is less likely to occur when other methods are used such as basal bark, cut stump, or wick application.

There is also the potential for surface water contamination when herbicides are applied intentionally or accidentally near wetland areas or when soil-applied herbicides are carried away in runoff to surface waters. To minimize such impacts, decisions as to which herbicide should be used in a particular area are determined based on site and weather conditions, soil type, depth of water table, presence of water sources, and guidance provided via the PUPS approval process. Application schedules are designed to avoid impacts to water quality while remaining consistent with the objective of the vegetation treatment program.

To ensure that adverse effects to water quality related to the application of pesticides will not occur, Refuge staff will adhere to all label directions (e.g., application methods and rates; proper cleaning, storage, and disposal of application equipment and herbicide products), Service regulations, and guidance provided through the PUPS approval process.

Table 5-1
Environmental Fate of Herbicides Presently Used on the Refuge (Alt. A)
(Factors Specific to Air and Water Quality)

Active Ingredient	Application Details	Solubility in Water	Basic Hazard Identification
Chlorsulfuron	Applied at very low application rates, and apply only one application per growing season, implement measures to control spray drift	Very high at pH 7; decreases to medium at pH 5	Potential for off target movement and non-target effects via runoff, leaching (half-life in water is one month); high mobility in soils with affinity for dry, light sandy soils that can move by wind or water (half-life in soil averages 40 days)
Fluazifop	Runoff potential reduced by avoiding application when rainfall could occur within 48 hours	None	Non-volatile but may increase with temperature, soil moisture; not water soluble, high runoff potential of several months after application; binds strongly to soils, low soil mobility (half-life in soil averages 15 days)
Glyphosate	Application should not occur during a temperature inversion, as drift potential is high	Very High	Non-volatile; runoff, leaching potential (half-life in water 35-63 days); low mobility in soil (half-life in soil averages 25–47 days, range 2–130 days)

Public Use

Many of the user-created trails within the Refuge do not meet the definition of a sustainable trail and, as a result, contribute to moderate to severe erosional issues on the Refuge. User-created trails, sometimes referred to as social trails, generally do not follow the existing contours of the hillsides and instead follow the fall line of the slope or are created in the flat terrain at the bottom of the slopes. Both of these situations result in problems that ultimately contribute to increased siltation in downstream drainages. As water flows down the slope, it will follow the path of least resistance; this is the fall line. Trails that follow the fall line tend to channel stormwater and often develop deep gullies due to the erosional forces of high velocity stormwater. This is a particular concern because many of the soils present on the steeper slopes within the Otay-Sweetwater Unit are described as having a high erosion hazard. Trail users, including bikers, hikers, and equestrians who attempt to maneuver down these steep trails, can exacerbate erosional problems on a trail. Braking tires, sliding feet, and heavy horse hooves can loosen disturbed soil making the gullies deeper or causing additional disturbance outside the boundaries of the trail by traveling off the trail to avoid the gullies.

Trail widening and trail braiding, which often occur along eroded trail segments, result in further exposure of soils, increasing the extent of erosion associated with trail use in a particular area. In the same way, trails created in flat areas can collect water, causing muddy situations that trail users avoid by creating new pathways around the problem. The result is two to three new trail treads that will likely also be subject to water collection over time. During heavy rainstorms, silt from these muddy areas can flow into adjacent waterways, increasing turbidity and degrading downstream water quality.

Measures that could be implemented to reduce or eliminate these impacts to water quality include closing and rehabilitating some trails and/or rerouting unsustainable trail segments. Less severe problems may be addressed through corrective measures such as establishing an appropriate outslope, constructing knicks or rolling grade dips to allow water to move off the trail, or armoring in flat, wet areas can reduce the potential for erosion.

The existing parking lot in the McGinty Mountain area consists of a pervious surface that minimizes the potential for sheet flow and increased storm water velocities across the site. No adverse impacts to water quality have been identified in this portion of the Refuge.

Another potential impact to water quality related to trail use is the accumulation of horse and dog waste on the trail and in staging areas. The phosphorous, nutrients, and potential forms of bacteria, including fecal coliform, present in horse urine and/or manure and dog waste, can all be detrimental to water quality.

Dog waste carries bacteria, viruses, and parasites that can threaten the health of humans and wildlife, and generally contains nutrients that promote weed and algae growth. On average, dogs produce 5×10^9 fecal coliform bacteria per animal per day (Horsley and Witten, Inc. 1996), some of which are *Escherichia coli (E. coli)*. Dogs can also carry *Salmonella* and *Giardia*. When a pet owner fails to properly clean up and dispose of their pet's waste, which includes roughly 40 percent of pet owners in America, the feces can be picked up by stormwater runoff and washed into nearby wetland areas. Once in the water, coliform bacteria and parasites can be released, and the decaying pet waste can consume oxygen and sometimes release ammonia, leading to degraded water quality and impacts to the health of aquatic organisms.

Horse manure and urine can also poses a threat to ground or surface water quality; however, the risk from trail horse activity is considered low (Westendorf 2011). The nitrogen present in horse urine is highly volatile and quickly converts to ammonia gas. Nutrients in horse feces are primarily organic matter containing nitrogen that is slowly converted to ammonium or nitrate over several years. Nitrate does have the potential to leach into the ground but the process is slow. This slow leaching process combined with relatively low numbers of horses on the trail results in a very low potential for groundwater contamination.

The traces of phosphorus and potassium found in horse urine are not considered a threat to groundwater contamination, but because these constituents bind to soil particles, there is the potential for the contaminated sediments to erode into surface water bodies, particularly when trails are located in proximity to streams or other drainages.

A number of pathogenic microorganisms have been identified in horse manure; however, for the most part, these organisms are usually present in insignificant levels. Studies conducted by the National Animal Health Service found *Salmonella* in 0.02 percent of the horses in the northern region of the United States (1 in 500 horses shedding *Salmonella*). Research conducted at the University of California found insignificant amounts of *E. coli* in adult horse intestines (Westendorf 2011). *Cryptosporidium* and *Giardia* are also present at low levels in horses. One study found 0.33 percent of horses were carrying *Cryptosporidium parvum* and 0.66 percent of horses carrying *Giardia* (Westendorf 2011). Vegetated buffer strips demonstrated some ability to remove *Cryptosporidium* oocysts from runoff before deposition in a water source. The success of the removal process varied depending upon soil type, soil density, and percent slope (Atwill et al. 2002).

Ongoing equestrian use on some Refuge trails is not expected to result in significant impacts to water quality on the Refuge or downstream within the Sweetwater Reservoir. Impacts related to dog waste on the Refuge are currently a concern, with demonstrating a need for additional user education and compliance with waste removal requirements.

Refuge Operations

The activities implemented to support Refuge operations under Alternative A result in minor, if any, impacts to the existing water quality on the Refuge or at Rancho Jamul.

5.2.8.2 Alternative B

Wildlife and Habitat Management

The BMPs described under Alternative A for actions related to wildlife and habitat management, including actions taken after fires, would also be implemented, as appropriate, when conducting the additional wildlife and habitat management actions proposed under Alternative B. The implementation of these BMPs would minimize or avoid water quality impacts within the Sweetwater River, Steele Canyon Creek, and other smaller drainages, as well as downstream reservoirs and ultimately San Diego Bay.

The control of feral pigs, should they enter the Refuge, is not proposed under this alternative, therefore, there is a potential under this alternative for future impacts to water quality associated with pig activity on Refuge lands. Specifically, feral pigs typically feed by digging or rooting through the upper soil layer. This disturbance can be extensive and frequently occurs in riparian areas (USDA Forest Service 2013). The result of this activity is displaced soils and vegetation, leaving large areas of bare ground vulnerable to erosion. The correlation between soil erosion and the presence of feral pigs in a watershed is supported in the scientific literature (Browning 2008).

In California, feral pigs are a documented source of coliform bacteria in watersheds (USDA Forest Service 2013). The foraging and wallowing behavior of pigs can markedly increase water turbidity, but more importantly, feral pigs can introduce infectious waterborne organisms into the watershed. Important protozoan parasite pathogens, such as Giardia, Cryptosporidium, Balantidium, and Entamoeba are often present in the feces of feral pigs. In a study conducted in California, it is suggested "that given the propensity for feral pigs to focus their activity in riparian areas, feral pigs may serve as a source of protozoal contamination for surface water" (Atwill et al. 1997). The presence of feral pigs on the Refuge could affect water quality within the Sweetwater River, Sweetwater Reservoir, and Otay Lakes.

Pest Management

Under Alternative B, pesticide use on the Refuge would be addressed through the IPM Plan presented in Appendix D. The herbicides described under Alternative A would also be considered for use under Alternative B, along with several additional products. The basic hazards and environmental fate of the herbicides proposed for use under Alternative B are presented in Table 5-2. Integrated pest management not only involves the selective use of pesticides, it also incorporates the following additional strategies: prevention, mechanical, physical, and cultural methods for controlling pest, biological control, and habitat maintenance, enhancement, and restoration. The effects of these non-pesticide IPM strategies (e.g., the physical removal of invasive plants with hand tools, possible future use of biological controls, restoration of native species in disturbed areas) to address pest species on the Refuge would have potential effects to water quality similar to those described under Alternative A.

Table 5-2
Environmental Fate of Herbicides Proposed For Use on the Refuge (Alt. B)
(Factors Specific to Air and Water Quality)

Active Ingredient	Application Details	Solubility in Water	Basic Hazard Identification
Chlorsulfuron	Applied at very low application rates, and apply only one application per growing season, implement measures to control spray drift	Very high at pH 7; decreases to medium at pH 5	Limited volatility; potential for off target movement and non-target effects via runoff, leaching (half-life in water, one month); high mobility in soils with affinity for dry, light sandy soils that can move by wind or water (half-life in soil averages 40 days)
Oryzalin	Do not apply directly to water or where soils have rapid to very rapid permeability	Slightly	Limited volatility; low water solubility (half-life in water, 8-40 days); moderate soil mobility (half-life in soil averages 20 days); leach potential
Fluazifop-P-butyl	Runoff potential reduced by avoiding application when rainfall could occur within 48 hours	None	Non-volatile, but may increase with temperature, soil moisture; not water soluble, high runoff potential of several months after application; binds strongly to soils, low soil mobility (half-life in soil averages 15 days)
Glyphosate (containing surfactant)	Do not apply directly to water, do not apply when winds exceed 10 miles per hour or when inversion conditions exist	Very High	Non-volatile; runoff, leaching potential (half-life in water 12 days to 10 weeks); immobile in soil (half-life in soil, 1 to 174 days)
Glyphosate (mixed with water or nonionic surfactant)	Application should not occur during a temperature inversion, as drift potential is high	Very High	Non-volatile; runoff, leaching potential (half-life in water 12 days to 10 weeks); immobile in soil (half-life in soil ranges from 1 to 174 days)
Triclopyr (ester)	Highly volatile, apply at cool temperatures and no wind	Medium	Insoluble and persistent in water; very high mobility in soil (average half-life in soil, 30-90 days; in anaerobic soils, half-life is considerably longer (1,600-1,300 days)
Clethodim	Do not apply when conditions are favorable for drift (drought, high temperatures, low relative humidity), especially when sensitive plants are located nearby	Highly dependent on pH	Non-volatile; highly persistent in the aquatic environment; slight soil mobility, but not a threat to groundwater; low persistence in most soils (half-life in soil is about 3 days)
Aminopyralid	Highly volatile, apply at cool temperatures, low wind speed and no inversion conditions	High	Low volatility; low potential for groundwater contamination

Pesticides considered for use on the Refuge are evaluated through the PUPS process using scientific information and analyses that is documented in Chemical Profiles of the IPM (Appendix D, Attachment B). These profiles, which are described in detail in the draft IPM Plan, provide quantitative assessment/screening tools and threshold values to evaluate potential effects to water, soil, and air. PUPs are approved where the Chemical Profiles provide scientific evidence that potential impacts to the Refuge's physical environment are likely to be only minor, temporary, or localized in nature.

A number of BMPs intended to protect water quality would be implemented on the Refuge as part of the pesticide application process. Some of these BMPs are presented here.

- To avoid spills, spray tanks will not be left unattended during filling.
- To ensure the greatest efficacy of the product and minimize the need for reapplication, water quality parameters (e.g., pH, hardness) will be considered when specified on the pesticide label.
- All pesticide spills will be addressed immediately using procedures identified in the Complex's Emergency Action Plan - Incidental or Emergency Chemical Spills.
- Refuge staff will use low impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, Thinvert system applications) rather than broadcast foliar applications (e.g., boom sprayer, large tank wand applications), wherever practical.
- Equipment will be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.
- Spray applications will not be conducted on days with a greater than 30 percent forecast for rain within six hours, except for pesticides that are rapidly rain fast (e.g., glyphosate in 1 hour) to minimize or eliminate potential runoff.

A complete list of the BMPs to be implemented for pesticide use on the Refuge is provided in the IPM Plan (Appendix D).

In some cases (as described in the Environmental Fate discussion found in the IPM Plan [Appendix D]), product specific BMPs must be implemented to ensure that impacts to water quality are not significant. For example, to minimize the potential for groundwater quality degradation caused by leaching and/or surface runoff, a pesticide with a soil half-life or aquatic persistence half-life of more than 100 days would only be approved for use on the Refuge if one or more of the following BMPs are implemented: 1) limiting application of a particular product to one application per site per year; 2) not using a particular product on coarse-textured soils where the groundwater table is less than 10 feet below the surface and the average annual precipitation is greater than 12 inches; and/or 3) not using a particular product on steep slopes if substantial rainfall is expected within 24 hours or the ground is already saturated. The same BMPs are required if the soil or aquatic dissipation time (i.e., the time required for 50 percent of the deposited pesticide to degrade and move from a treated site) for a proposed product is greater than 100 days.

The potential for a pesticide to move to groundwater is another factor that is considered in the PUPs approval process. This potential is determined using the Groundwater Ubiquity Score (GUS) (refer to Appendix D for more information about GUS). Where GUS is greater than 4.0, a PUP will only be approved with additional BMPs implemented specifically to protect water quality. These are the same BMPs described previously for soil half-life and dissipation time.

Based on scientific information and analyses documented in the Chemical Profiles in the IPM plan, pesticides allowed for use on Refuge lands would be relatively low risk to surface and groundwater quality due to low toxicity levels or short persistence in the environment, and/or the implementation of general and pesticide specific BMPs. Information regarding the risks to water quality of particular pesticides is provided on the product labels and is available in the

Pesticide Properties Database (PPDB 2009) developed by the Agriculture & Environment Research Unit of the University of Hertfordshire and found online at http://sitem.herts.ac.uk/aeru/footprint/en/index.htm.

The potential impacts, if any, to water quality from the application of these pesticides in accordance with the directions on the label and the general BMPs described in Appendix D would be minor, temporary, or localized in nature.

Public Use

Future actions associated with the provision of public uses on the Refuge under Alternative B include establishment of a designated trail system, the closure and/or rerouting of trails that represent an adverse effect to sensitive habitats and species or were created without regard for topography and water movement, and the development of new visitor services facilities (e.g., parking lots, staging areas, refuge offices). Water quality impacts associated with these types of actions would be avoided or minimized through sensitive project design and the implementation of temporary and long-term BMPs. These BMPs could include but are not limited to the use of silt fencing, straw wattles, and filter fabric to prevent the introduction of exposed soils into adjacent wetland areas; proper maintenance and fueling of construction vehicles to avoid spills and tracking of dirt onto public roadways; and appropriate erosion control techniques following construction to minimize the potential for erosion while the desired vegetation becomes established. With the implementation of appropriate BMPs, which are further addressed in Section 6.9.3 of the draft CCP/EA, no adverse effects related to water quality would occur under Alternative B.

The development of any new trails on the Refuge, as well as trail rehabilitation and/or realignment projects, would occur in accordance with sustainable trail practices, such as those implemented by the California Department of Parks and Recreation. Guidance for developing sustainable trails is addressed in Section 6.9.3 of the draft CCP/EA.

The potential for impacts to water quality from larger projects, such as the provision of visitor-serving facilities on the 2.4-acre Caltrans site near Millar Ranch Road, would be further reduced by the implementation of a Storm Water Pollution Prevention Plan (SWPPP). A SWPPP is required by the State of California as part of the California NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities for all construction projects on the Refuge, including restoration projects, that disturb one or more acres of land surface.

Potential impacts to water quality due to the presence of horses on the Refuge would be reduced, to some extent, by the closure of user-created trails located within the riparian zone of the Sweetwater River and the realignment of certain trails currently located too close to the Sweetwater River corridor. In addition, equestrian-related water quality BMPs developed in response to NPDES permits issued by the Santa Ana and San Diego Regional Water Quality Control Board (Task Force 2004) would be implemented as applicable for the proposed trail system and within trail staging areas. Design of these staging areas will take into consideration site drainage and will include facilities necessary to ensure proper containment and disposal of horse manure. Equestrians would also be asked to implement additional BMPs to reduce opportunities for *Cryptosporidium parvum* and fecal coliforms to enter the watershed. These include establishing a volunteer manure cleanup program on the Refuge and not allowing horses to eliminate in or adjacent to watercourses. According to Adda Quinn of EnviroHorse, equestrians are being educated not to allow their animals to eliminate during stream crossings and to avoid stopping in the watercourse while making a crossing. The

construction of the Sweetwater Loop and River Trail bridge has substantially reduced the number of horses entering the river floodway.

Under Alternative B, no dogs would be permitted on the Refuge, which would reduce the concerns related to water quality impacts from dog feces.

Should a fair weather undercrossing be proposed for construction under Highway 94 at the Sweetwater River, a range of BMPs would be required during and after construction to protect water quality. These BMPs include many already presented in this document, as well as limitation on where and how construction vehicles can be fueled and serviced, how soil can be stockpiled during construction, requirements for spill response kits to be on-site at all times during construction, and the possible use of coffer dams to separate the construction site from the floodway. The implementation of specific BMPs, which would be identified during subsequent site-specific engineering and NEPA analysis, would be included as part of the scope of work. Adherence to these requirements would minimize the potential for impacts to water quality during and following construction.

Refuge Operations

The same BMPs described previously for the construction of public use facilities would also be implemented during the construction of the proposed visitor contact station, the Refuge support facilities proposed at Rancho Jamul, the repair of the Saddle Road Dam, and closure of mind shafts. In addition, when required, a Storm Water Pollution Prevention Plan (SWPPP) will be implemented during construction. These actions would minimize the potential for adverse effects to water quality on and downstream of the Refuge.

5.2.8.3 Alternative C

Wildlife and Habitat Management

Proposals for wildlife and habitat management under Alternative C would be essentially the same as those described under Alternative B, and the same BMPs would be implemented to minimize the potential for adverse effects to water quality.

Pest Management

The analysis of potential effects to water quality from the implementation of the IPM Plan would be the same under this alternative as described previously for Alternative B.

Public Use

The primary difference between Alternatives B and C that relate to water quality include an increase in the number of trails that will be open to multiple uses, which results in the potential for additional horses to be present on the Refuge. In addition, leashed dogs and hunting dogs would be permitted on the Refuge under this alternative. As a result, the impact analysis described under Alternative A with respect to horse manure and dog waste would also be relevant under Alternative C. With respect to dogs, Alternative C allows dogs to be present on the Refuge. Leashed dogs would be permitted on trails provided users collect and properly dispose of dog waste. If dog waste is allowed to accumulate at trailheads or along the trails, the ability to bring leashed dogs onto the Refuge could be revoked without notice. Dogs would also be permitted to accompany hunters in accordance with Refuge-specific regulations. Hunting dogs, which would be present on the Refuge in limited numbers, would be required to be under voice control at all times. Assuming trail users and hunters adhere to Refuge regulations related to dogs, the effects to water quality would be minimal. If noncompliance

results in the accumulation of waste, potentially impacting water quality within the Refuge watercourses, dog walking would no longer be permitted on the Refuge.

Refuge Operations
The effects to water quality of implementing the Refuge operations proposed under Alternative C would be the same as those described under Alternative B.

5.2.8.4 Alternative D

Wildlife and Habitat Management
Proposals for wildlife and habitat management under Alternative D would be generally the same as those described under Alternative B, and BMPs would be implemented to minimize the potential for adverse effects to water quality.

A potential benefit to water quality under this alternative is the proposal to implement a Feral Pig Monitoring and Eradication Plan. Although feral pigs were not known to occur on the Refuge as of January 2014, should they disperse from their current locations onto the Refuge, their activities could result in adverse effects to water quality, as described under Alternative B. The prompt control of feral pigs on refuge lands in accordance with the proposed Feral Pig Monitoring and Eradication Plan would minimize or avoid such impacts.

To avoid any potential for sedimentation or other water quality-related impacts from the implementation of the Feral Pig Monitoring and Eradication Plan, corral style traps would not be installed within wetlands, the ordinary high water mark, or the bed and bank of any drainage. In addition, no pig carcasses will be left within the ordinary high water mark or within the bed and bank of any drainage or wetland.

Pest Management
The analysis of potential effects to water quality from the implementation of the IPM Plan would be the same under this alternative as described previously for Alternative B.

Public Use
The effects to water quality under Alternative D would be similar to those described under Alternative C; however, dogs would only be permitted on multiple use trails and in the designated hunting area on the Otay Mesa and Lakes area. Assuming visitors adhere to Refuge regulations related to dogs, the effects of this alternative as they relate to water quality would be similar to those described under Alternative A. The measure addressed under Alternative C to reduce the potential effects to water quality from horse activity on the Refuge would also be implemented under Alternative D.

Refuge Operations
The effects to water quality of implementing the Refuge operations proposed under Alternative D would be the same as those described under Alternative B.

5.2.9 Effects from Climate Change

5.2.9.1 Alternatives A, B, C, and D
According to Ackerly (2012), "climate change per se is a pervasive feature of earth history," however, "the pace of change currently forecast for the next 100 years is virtually unparalleled in its speed, magnitude, and global extent. If the rate of change exceeds the pace of biological

response, especially the capacity of populations to migrate or undergo adaptive evolutionary change, impacts on species distributions, community structure, and ecosystem function may be profound. Projecting the magnitude and distribution of these impacts poses a considerable challenge, requiring integration of theory and observation from a range of disciplines, including paleoecology, ecophysiology, population biology, and biogeography."

As discussed in Chapter 3, world climate is changing as a result of the accumulation of carbon dioxide and other greenhouse gases in the atmosphere (USFWS 2010h, Cayan 2009). These changes in climate are expected to affect mean average temperature, extreme temperatures, duration of extreme temperature events, average rainfall, amount of rainfall versus snowfall, increases in severe storm events, sea levels, and other associated climatic factors. Global average temperature increases of 0.74 degrees Celsius (°C) are already documented, and temperature increases in some areas are projected to exceed 3.0°C over the next decade. In California, the surface air temperature has risen about 1°F over the last 100 years (Cayan 2009), and there is general consensus that temperatures in southwestern California will increase in most months by about 2°C over the next 100 years (PRBO Conservation Science 2011).

Regional climate models have also projected a significant increase in extreme temperature events in coastal southern California, as well as increases in prolonged hot spells. In addition, some models project even higher summer temperatures in the areas of southern California located outside the influence of the coastal zone (Cayan 2009). Although there appears to be general consensus that temperatures will increase in most months in southern California, there is no consensus regarding the projected effects of climate change on precipitation patterns in southern California. Some models predict a decrease in mean annual rainfall, while others suggest little, if any, change over current conditions (PRBO Conservation Science 2011).

Observations made across the country indicate that climate change is affecting wildlife, plants, and habitat quality. In southwestern California, chaparral and coastal sage scrub vegetation is projected to decrease, while areas of non-native grasslands are projected to increase. This change will have a significant impact on the range of species that depend on scrub habitat for survival, including a number of listed bird, plant, and insect species. This change in vegetation type, along with increased temperatures and possibly increases in periods of drought, would also be expected to result in increased fire frequency, which would further exacerbate the conversion of native habitats to non-native grassland.

Climate change is considered a major threat to biodiversity at the global and local level (Dawson et al. 2011, Gardali et al. 2012); however, we have only just begun to assess the full extent of this threat. According to Dawson et al. (2011), "Assessing the biodiversity consequences of climate change is complicated by uncertainties about the degree, rate, and nature of projected climate change, the likelihood of novel and disappearing climates, the diversity of individual-species responses to a broad suite of interacting climate variables, and interactions of climate-change effects with other biotic factors (e.g., competition, trophic relationships) and stressors (land use, invasive species, pathogens, pollutants)." To address this threat, it is important to understand the various aspects of a species' vulnerability (e.g., exposure, sensitivity, adaptive capacity) to climate change. With this information, it may be possible to adapt management actions to address these vulnerabilities and to take advantage of a species' adaptive capacities.

Magness et al. (2011) used this approach to examine the vulnerability of the reserve units within the NWRS and then suggested a suite of management approaches that would capitalize on local conditions to facilitate adaptation and help spread ecological risk across the NWRS network. These management approaches ranged from retrospective strategies (e.g., maintaining historic

conditions) for refuges with slow rates of environmental change to prospective approaches that would facilitate ecological transitions consistent with future climatic conditions.

The Service has developed a draft National Fish, Wildlife and Plants Climate Adaptation Strategy (public review draft dated January 2012) to address the effects of climate change, conserve ecosystems, and make these ecosystems more resilient. The seven goals of this Strategy include:

Goal 1: Conserve habitat to support healthy fish, wildlife, and plant populations and ecosystem functions in a changing climate.

Goal 2: Manage species and habitats to protect ecosystem functions and provide sustainable cultural, subsistence, recreational, and commercial use in a changing climate.

Goal 3: Enhance capacity for effective management in a changing climate.

Goal 4: Support adaptive management in a changing climate through integrated observation and monitoring and use of decision support tools.

Goal 5: Increase knowledge and information on impacts and responses of fish, wildlife, and plants to a changing climate.

Goal 6: Increase awareness and motivate action to safeguard fish, wildlife, and plants in a changing climate.

Goal 7: Reduce non-climate stressors to help fish, wildlife, plants, and ecosystems adapt to a changing climate.

The wildlife and habitat management actions currently being implemented, as well as those proposed in Alternatives B, C, and D, are consistent with these goals. Expanded monitoring proposals included in Alternatives B, C, and D would provide additional data about existing habitat quality and species distribution and abundance, allowing biologists to identify changes over time and adapt management actions accordingly.

5.2.10 Effects to Air Quality

5.2.10.1 Alternative A – No Action

Wildlife and Habitat Management

Current wildlife and habitat management activities on the Refuge require the use of motorized vehicles for access to the six management areas within the Refuge. The staff on the Refuge consists of a full-time Refuge Manager, Refuge Operations Specialist and Wildlife Biologist. The Refuge also relies on contractors, other agency staff, and researchers to assist in management activities such as habitat and endangered species monitoring, invasive species control, habitat restoration, research, and general species surveys. Refuge staff generate approximately 80 vehicle trips to and from the Refuge office per week and an additional 20 to 30 trips per week associated with traveling to and from various parts of the Refuge. Trips generated by other entities working on the Refuge are variable, with some occurring seasonally and others only occurring during the duration of a particular project. The sum of these trips contributes extremely low levels of emissions, and the pollutions generated are

considered negligible in the context of the larger air basin regulated by the San Diego Air Pollution Control District.

The wildlife and habitat management activities occurring on the Refuge result in limited exposure of soils to wind erosion; therefore, the contribution of particulate matter from the operation and management of the Refuge to the larger air basin is also negligible.

Pest Management

As described previously in the water quality section, herbicides are used on the Refuge to control invasive plants. Herbicides and pesticides in general can volatilize from soil and plant surfaces and move from the treated area into the atmosphere. The potential for a pesticide to volatilize is determined by the pesticide's vapor pressure. As indicated in Table 5-2, the only product used on the Refuge at this time with high volatility is Pathfinder II (active ingredient triclopyr). This product, along with the other products used on the Refuge, are applied at such low volumes on the Refuge that even volatile products quickly become diluted in the atmosphere, minimizing the effect on local air quality. In addition, Pathfinder II is permitted to be applied only once a year on the Refuge.

The potential for adverse air quality impacts from the use of these products is further reduced through compliance with all Federal, State, and local pesticide use laws and regulations, as well as Department of the Interior (DOI), Service, and NWRS pesticide-related policies. This includes compliance with the FIFRA, which requires all pesticides to be applied at the rates and with the application equipment specified on the pesticide label.

Based on the analysis provided previously, the implementation of the habitat and pest management proposals included under Alternative A are not expected to result in any significant adverse effects to air quality.

Public Use

The public use program currently conducted on the Refuge generates vehicular emissions because of visitors traveling to and from various parts of the Refuge to use the trails, observe wildlife and plants, or attend special events. The total number of trips generated from these visits to the Refuge is unknown. Based on the estimate of 22,000 visitors to the Refuge in 2011, a worst-case scenario would be that visitors traveled to and from the Refuge in a car by themselves, generating 44,000 trips per year. The total number of trips is likely lower, as many users travel to the Refuge in groups of two or more, some travel via bicycle and others walk onto the Refuge from nearby homes. In the context of the emissions generated throughout the air basin, even if the total number of trips generated by visitors to the Refuge was 50,000 trips per year, the emissions from these trips, which represents fewer trips that those occurring along Highway 94 in one day, are negligible. Therefore, continuation of the current public use programs on the Refuge would not result in any significant adverse effects to air quality.

Refuge Operations

The potential effects to air quality as they relate to current Refuge operations would be the same as those addressed previously under Wildlife and Habitat Management and Public Use.

5.2.10.2 Alternative B

Wildlife and Habitat Management

Each of the wildlife and habitat management activities conducted under Alternative A would also occur under Alternative B. As described in Alternative A, none of these activities would result in adverse effects to air quality. The additional management activities included within Alternative B such as habitat restoration and enhancement, expanded monitoring and research, and the construction of new visitor-serving facilities in various locations on the Refuge, as well as operation-related facilities at Rancho Jamul (e.g., native plant nursery, staff barracks, storage facility) would all generate new vehicle trips and associated emissions. Some trips, such as those associated with new construction and research projects, would be temporary, while others would result in long-term increases in miles driven, such as increases in staffing.

This alternative proposes to increase the number of staff members by seven, resulting in approximately 140 new trips per week. This increase in trips is still relatively low and, in the context of the emissions generated throughout the air basin would be inconsequential.

Construction projects that require vegetation removal and grading could result in temporary, localized adverse impacts to air quality related to fugitive dust and tailpipe emissions generated by construction equipment (e.g., graders, tractors, dump trucks). The effects to air quality of implementing the individual projects would not generate dust or emissions in excess of current air quality standards. Additionally, these projects would be implemented at different times as funding sources are identified, so emissions from construction would be spread over many years.

To reduce the generation of emissions is the maximum extent practicable, the measures presented here would be included in all construction specifications for projects implemented on the Refuge.

- The load of all haul vehicles shall be covered to reduce fugitive dust generated during the transport of materials and any stockpiled material shall be covered to reduce the production of dust.

- To prevent visible dust emissions from leaving the project site boundary, measures including but not limited to, watering prior to and during any earth movement, watering exposed soil three times per day, as applicable, installing wind fencing when conditions warrant, covering excavated materials to prevent erosion, and stopping work during high wind conditions, shall be implemented.

- Construction equipment and vehicles shall not track dirt and dust onto public roads, and all equipment and tires shall be washed or swept prior to leaving the project site.

- All equipment used on the site shall meet San Diego APCD standards.

Through the implementation of these measures, short-term emissions generated during construction and/or site preparation would not adversely affect regional air quality. In addition, the emissions from these activities are not expected to exceed San Diego APCD thresholds and Federal de minimis levels.

Pest Management

As described under Alternative A, some pesticides can volatilize from soil and plant surfaces and move from the treated area into the atmosphere. An integrated approach to pest management is proposed under Alterative B that would include the use of herbicides to control invasive plant species. Several additional products are proposed for use on the Refuge, as presented in Table 5-2; however, only Pathfinder II is characterized as volatile. Other products may be approved in the future that are also characterized as volatile, but as described under Alternative A, herbicide use the Refuge occurs at low volumes, and the number of applications per year is limited. As a result, there is little, if any, potential for air quality impacts, when herbicides are applied in accordance with label requirements; all Federal, State, and local pesticide use laws and regulations; and DOI, Service, and NWRS pesticide-related policies. This includes compliance with FIFRA, which requires all pesticides to be applied at the rates and with the application equipment specified on the pesticide label.

The draft IPM Plan (Appendix D) includes a number of BMPs that would be implemented in association with pesticide use of the Refuge to further minimize potential effects to air quality. A summary of these BMPs is presented here.

- Low impact herbicide application techniques (e.g., spot treatment, cut stump, oil basal, Thinvert system applications) will be used to the extent practicable.
- Low volume rather than high volume foliar applications will be used when low impact methods will not provide adequate and/or uniform application rates.
- Applicators will use and adjust spray equipment to apply the coarsest droplet size spectrum with optimal coverage of the target species while reducing drift.
- Applicators will use drift reduction technologies such as low-drift nozzles.
- Spray applications will be made at the lowest height for uniform coverage of target pests to minimize or eliminate potential drift.
- If windy conditions frequently occur during afternoons, spraying (especially boom treatments) will be conducted during early morning hours.
- Spraying will occur during low (average less than 7 mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically less than 85 ^{o}F).
- Applicators will avoid spraying during inversion conditions (often associated with calm and very low wind conditions) that can cause large-scale herbicide drift to non-target areas.
- Equipment will be calibrated regularly to ensure that the proper rate of pesticide is applied to the target area or species.

A complete list of the BMPs to be implemented on the Refuge during pesticide application is provided in the draft IPM Plan (Appendix D).

The implementation of the BMPs presented in the IPM Plan will ensure that localized and regional air quality impacts related to herbicide use will be minimized, avoiding any adverse effects to air quality.

Public Use

Alternative B includes a number of public use proposals not considered under Alternative A, including trail closures and realignments, construction of new parking areas and a visitor contact station. These facilities would generate additional long-term visitor trips to the Refuge, as well as short-term construction related emissions.

Vehicular emissions generated by new visitors to the Refuge would, however, continue to represent relatively low numbers when considered in the context of the larger San Diego air basin. To reduce total emissions generated from public use activities, carpooling to Refuge events will be encouraged, and, to the extent possible, special events will be schedule outside of peak traffic periods to avoid incremental increases in existing traffic congestion in the region, a contributing factor to degraded air quality.

Refuge Operations

Construction projects proposed under Alternative B that relate to Refuge operations (e.g., barracks, plant nursery, Refuge office/visitor contact station) would be subject to the air quality BMPs described previously. The implementation of these measures would minimize the extent of the air emissions generated by ongoing management activities on the Refuge.

5.2.10.3 Alternative C

Wildlife and Habitat Management

The wildlife and habitat management activities proposed under Alternative C and the measures proposed to minimize the potential for impacts to air quality from implementing these activities would be essentially the same as those described under Alternative B.

Pest Management

The analysis of potential effects to air quality from the implementation of the IPM Plan would be the same under this alternative as described previously for Alternative B.

Public Use

Although public uses would be expanded to some extent under Alternative C, the increase in the number of visitors to the Refuge and the potential for additional construction activity as a result of this expansion of use would be minor in the context of the larger San Diego air basin. Therefore, the implementation of the public uses proposed under Alternative C would have the same effect on air quality as those described for Alternative B.

Refuge Operations

Moving the Refuge office from Rancho Jamul to the Sweetwater River area would reduce the number and length of vehicle trips associated with Refuge operations and management, resulting in some benefits, albeit minor, to air quality. The effects to air quality of implementing the other refuge operation actions described under Alternative C would similar to those described under Alternative B.

5.2.10.4 Alternative D

Wildlife and Habitat Management
The wildlife and habitat management activities proposed under Alternative D and the measures proposed to minimize the potential for impacts to air quality from implementing these activities would be essentially the same as those described under Alternative B.

Pest Management
The analysis of potential effects to air quality from the implementation of the IPM Plan would be the same under this alternative as described previously for Alternative B.

Public Use
Public uses proposed under Alternative D would be similar to those proposed under Alternative B. Therefore, the implementation of the public uses proposed under Alternative D would have the same effect on air quality as those described for Alternative B.

Refuge Operations
The effects to air quality of implementing the refuge operation actions described under Alternative D would similar to those described under Alternative B.

5.2.11 Effects Related to Greenhouse Gas Emissions

5.2.11.1 Alternative A, B, C, and D
The scientific community overwhelmingly agrees that the earth's climate is becoming warmer and that human activity is contributing to this change. Unlike other environmental impacts, climate change is a global phenomenon in which large and small GHG generators throughout the earth contribute to the impact. Therefore, although many GHG sources are individually too small to make any noticeable difference to climate change, the number of small sources around the world combine to produce a very substantial portion of total GHG emissions (CAPCOA 2008).

On February 18, 2010, the White House Council on Environmental Quality (CEQ) issued draft guidance on when and how Federal agencies should analyze the environmental effects of climate change and GHG emissions when they describe the environmental impacts of a proposed action under NEPA. Within this draft guidance, CEQ suggests that Federal agencies consider during the scoping process whether a quantitative and qualitative analysis of GHG emissions from a proposed action would provide meaningful information to decision makers and the public. CEQ proposes that direct emissions of 25,000 metric tons or more of CO_2-equivalent GHG emissions on an annual basis should be considered the indicator that a quantitative and qualitative assessment may be warranted. This level of GHG emissions is not, however, intended to be an indicator of a threshold of significant direct or indirect effects. Further, CEQ does not propose to make this guidance applicable to Federal land and resource management actions and is instead seeking public comment on the appropriate means for assessing the GHG emissions of Federal land and resource management decisions.

At the State level, various options are being considered for setting a threshold for GHG emissions in California, including zero and non-zero levels, while another option involves addressing project effects without establishing a threshold. The latter could be accomplished through a quantitative or qualitative evaluation of individual projects.

GHG emissions are reported in metric tons of CO_2 equivalent emissions, which represent a single metric that embodies all GHGs, including CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Because these GHGs all have varying heat-trapping abilities and atmospheric lifetimes, a global warming potential (GWP) value has been assigned to each GHG to facilitate comparison among GHGs, with the GWP representing the heat-trapping impact of a GHG relative to CO_2, which has a GWP of 1.0 (CEQ 2012).

Under any of the alternatives, activities associated with wildlife and habitat management, public use, and Refuge operations would result in the generation of GHGs. Alternatives B and C would result in slightly higher emissions than Alternative A due to an increase in the number of staff members proposed (an increase from 3.0 to 9.5 full-time equivalents, or FTEs), limited expansion of opportunities for wildlife-dependent recreational uses, and small and moderate scale construction projects to support visitor services and Refuge operations. The emission associated with the construction projects would be temporary and limited in duration.

The relative differences between the alternatives can be described qualitatively, but quantifying the amount of GHG emissions generated from these types of uses is difficult. According to the USEPA Greenhouse Gas Equivalencies Calculator (USEPA 2011b), the use of 115 gallons of gasoline and the consumption of 1,500 kilowatt-hours of electricity each generate one metric ton of CO_2 equivalent. Currently, the office facility at Rancho Jamul, which accommodates Refuge, CDFW, and BLM staff, consumes approximately 60,000 kilowatt-hours of electricity annually, or 41.4 metric tons of CO_2 equivalent. Only a slight increase in energy consumption at this location would be expected should staff levels increase by 5.75 FTEs since much of the energy consumed is the result of heating and cooling the existing facility. The consumption of gas by additional staff traveling to and from work would represent an estimated 30 metric tons of CO_2 equivalent annually. Even with the implementation of the various construction projects proposed under Alternatives B, C, or D, the GHG emissions would not begin to approach the 25,000 metric tons or more of CO_2 equivalent annually that CEQ suggests would warrant analysis to determine significance.

Nevertheless, the Service has a mandate to reduce the total GHG emissions generated from the operation and maintenance of the Refuge. Therefore, as vehicles are replaced, new vehicles will be selected that have better fuel economy; wherever possible, tasks requiring off-Refuge travel will be combined to reduce the total number of miles driven by Refuge staff; office equipment, including light fixtures, will be evaluated and replaced as necessary with "Energy Star" qualified products; power management features on all computers and monitors will be activated, laptop power cords will be unplugged when not in use; and all equipment and lights will be turned off at the end of the day. Future structures, such as a Refuge office, visitor contact station, or green house would also incorporate the use of solar panels to minimize GHG emissions from the Refuge.

Based on this analysis, GHG emissions anticipated to result from the implementation of any of the alternatives are not expected to represent a significant direct or indirect impact on the environment under any of the alternatives.

5.2.12 Effects Related to Contaminants

5.2.12.1 Alternative A, B, C, and D

Under any alternative, evaluation of potential sources of environmental contaminants on the Refuge would continue to be overseen by the Service's Contaminants Program at the Carlsbad Fish and Wildlife Office to ensure that potential contaminants issues are appropriately addressed

as part of the Refuge's overall management plan and do not result in any significant adverse effects to Refuge resources, Refuge visitors, or Refuge personnel.

Alternative D includes a proposal to control feral pigs on the Refuge, which will require disposal of pig carcasses, particularly when pigs are dispatched within corral traps. In most cases, pig carcasses will be transported off the Refuge. Transport and disposal would occur in accordance with applicable laws and regulations. Because the intent is to identify and dispatch pigs as soon as they are identified on the Refuge, the number of carcasses to be removed is expected to be small. If a pig is shot in a very remote location, the carcass may be left in place, where it would provide food for a range of native species (e.g., vultures, mountain lion, coyote, bobcat). Animal carcasses are not considered hazardous waste by the U.S. EPA; therefore, if a carcass must be left in remote locations, it would not result in any impacts related to contaminants.

5.3 Effects to Habitat and Vegetation Resources

The effects to the habitats and vegetation supported on the San Diego NWR associated with implementing the no action and three action alternatives are described in this section. Potential impacts to these resources are characterized here as direct and indirect effects. Direct impacts would involve the removal of native vegetation in preparation for construction projects, while indirect impacts would involve changes to habitat or vegetation that are incidental to the implementation of an action.

An adverse effect to habitat or vegetation resources would be considered significant if:

- A substantial portion of native habitat would be removed or otherwise modified to accommodate a proposed action, and/or

- An action would result in the direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of a sensitive or narrow endemic plant species.

The potential effects to habitats and native vegetation are described here for each of the three alternatives.

5.3.1 Alternative A – No Action

Wildlife and Habitat Management

Continuation of current wildlife and habitat management activities (e.g., conducting surveys and implementing monitoring protocols, mechanically removing invasive plants, conducting Refuge cleanups to remove trash, debris, and illegal camps, maintaining access roads, fencing, and signage), as proposed under Alternative A, could result in some temporary impacts to native habitat from trampling or minor vegetation clearing. These impacts would be limited in scope and would not result in any significant adverse impacts to native vegetation.

To reduce illegal off-road activity on various Refuge parcels, a combination of fencing, signage, public outreach, and law enforcement are implemented. The effectiveness of these actions is sometimes limited given the size and fragmented nature of the Refuge. To increase the effectiveness of these measures, particularly with respect to control of off-road vehicle use, the Refuge works in partnership with land managers of adjoining parcels to share patrol responsibilities and add fencing and other deterrents along major roads where historically

vehicles were crossing other properties to access the Refuge. This practice has been fairly successful in the Proctor Valley area.

Beneficial effects to native vegetation from these activities would include reductions in human disturbance from unauthorized use of the Refuge for habitation or dumping, elimination of competition for nutrients and water once invasive weeds are removed, and avoidance of impacts to vegetation from unauthorized trespass or off-road vehicle activity following installation of fencing and signage.

Pest Management

Under Alternative A, invasive plant removal involves both mechanical and chemical control methods, with much of the control focused on non-native grasses and invasive, non-native annual plants. Additional control of perennial non-native invasive plant species also occurs to a lesser extent within existing riparian and other wetland areas on the Refuge. When mechanical control methods are implemented, the unintentional removal of native plant species is minimized by ensuring that all participants in the removal process are familiar with various species present in the control area, ensuring that only the species intended for control is removed from the site.

When chemical control is proposed, the area where an herbicide is to be applied is surveyed prior to any application to determine the extent of native vegetation present in the area and to identify and record the presence of any sensitive plant species. Areas to be avoided are flagged or otherwise delineated to ensure protection of sensitive species. Next, the herbicides that have been approved for use on the Refuge through the PUPS are reviewed to determine the potential effect of each herbicide on native vegetation in the event that unintentional pesticide drift should occur. The product with the least potential for impact to native vegetation, while also providing effective control of the pest species, is selected.

When applying a pesticide, application equipment is selected that will provide site-specific delivery to target pests while minimizing or eliminating direct or indirect (e.g., drift) exposure to non-target areas. Where possible, target-specific equipment (e.g., backpack sprayer, wiper) are used to treat target pests. Other target-specific equipment to apply pesticides could include use of a hand wand attached to an ATV sprayer, soaked wicks or paintbrushes for wiping invasive vegetation, and lances, hatchets, or syringes for direct injection into stems. Following these procedures, as well as the application requirements provided on the product label, will minimize the potential for impacts. No significant adverse effects to habitat and native vegetation are anticipated as a result of herbicide use. The use of these produces does provide benefits to native habitat as the control of non-native vegetation in combination with the revegetation of native plants results in improved habitat quality particularly in riparian corridors and burn areas where the initial growth following a fire includes a significant number of invasive plant species.

Public Use

The primary impacts to native vegetation on the Refuge from public use activities include continued expansion of the user-created trail system and off-trail activities such as cross country hiking and riding, illegal fishing, geocaching, and general “exploring.” All of these activities result in the trampling of vegetation, the removal of vegetation, particularly shrub species, soil compaction, and general degradation of habitat quality.

Wildlife-dependent recreational uses occurring on the Refuge can also result in off-trail activity, causing trampling of vegetation and damage to shrubs. These uses are generally

conducted from existing trails such as the Sweetwater Loop and River Trail and the trail located to the west of Par Four Drive. Some off-trail activity associated with these uses does occur, but this activity is limited and does not appear to have a significant adverse effect on the native vegetation.

Under current conditions, the primary public use on the Refuge, both on the Otay-Sweetwater Unit and the Del Mar Mesa Vernal Pool Unit, is trail use. Trails are used by hikers, runners, mountain bikers, equestrians, and dog walkers. Although some wildlife-dependent recreational uses are occurring on the trails, it appears that the majority of the visitors are present for general trail use. Under Alternative A, these activities would continue with no designated system of trails. Of the more than 200 linear miles of trails, pathways, access roads, and old ranch roads present throughout the Refuge, only two of the trails, the Sweetwater Loop and River Trail and a trail located to the north of Highway 94 in the Sweetwater River area, have been addressed in previous NEPA documents. Trail use and unauthorized trail construction have, over the years, resulted in substantial changes to the natural landscape, including the removal of native vegetation. Trail use on the Refuge has had both direct and indirect impacts on native vegetation. These impacts include:

- temporary and/or permanent loss of vegetation due to intentional removal to clear impediments to travel;
- incidental destruction of vegetation caused by repeated foot, bicycle, horse, and motor vehicle traffic;
- destruction of vernal pool basins and trampling of vernal pool plants from feet, hooves, and tires traveling through the ponds;
- compaction of soil in native grasslands and forblands;
- shrub and tree root exposure;
- introduction of weeds into wildlife habitat; and
- changes in localized drainage patterns due to erosion and associated deposition within or adjacent to poorly laid out trails.

These impacts could be avoided and possibly reversed through the creation of a designated trail system and the closure of trails that extend into sensitive habitat areas and/or are poorly aligned and are experiencing extensive erosion, rutting, and braiding.

Refuge Operations

Refuge operations occurring at Rancho Jamul have no effect on native vegetation.

Establishment of eight fuel modification zones on the Refuge has resulted in the unmitigated replacement of approximately 30 acres of native vegetation and wildlife habitat with exotic annual weeds that are annually disced, mowed, or otherwise destroyed. Under Alternative A, suppression of native vegetation in fuel modification zones would continue. Other activities related to Refuge operations would have effects similar to those described under Wildlife and Habitat Management.

5.3.2 Alternative B

Wildlife and Habitat Management

The primary difference between Alternative A and Alternative B with respect to effects on native vegetation is that Alternative B includes a number of restoration and enhancement proposals, as described in Chapter 4, that would result in added benefits for native vegetation.

Areas dominated by non-native plants would be replaced with appropriate native vegetation (e.g., native grassland species, coastal sage scrub vegetation), some recent burn areas would be replanted with native species, and invasive species would be controlled in sensitive habitat areas, including the vernal pool habitat on the Shinohara parcel.

The proposal to manage some portions of the Refuge's riparian habitat in a manner that would mimic a natural disturbance regime would require habitat manipulation, such as cutting back some willows and mulefat to provide greater structural diversity and to provide openings in the tree canopy, within portions of the existing riparian vegetation. These actions would facilitate the development of young willow and mulefat shrubs, as well as the growth of important understory plants, all of which support the nesting and foraging needs of the federally endangered least Bell's vireo. Although these actions would result in improvement of habitat quality for some species (including the vireo) that are dependent on early-successional riparian vegetation, the effects would have to be weighed carefully against potential adverse impacts to habitat quality for species that rely on late-successional riparian forests (e.g., yellow-billed cuckoo, warbling vireo [*Vireo gilvus*], Bullock's oriole [*Icterus bullockii*], Swainson's hawk [*Buteo swainsoni*] and possibly Swainson's thrush [*Catharus ustulatus*]).

Other actions proposed under Alternative B include the removal of cattle and goats from the Refuge when observed and the future control of wild pigs from the Refuge, should their range extend onto Refuge land. Without the implementation of proposed eradication and/or control methods, these species would damage or destroy Refuge vegetation, reduce reproductive success of seed bearing plants, and impact important soil structure, all of which could result in significant adverse impacts to the native habitats and plants species present on the Refuge.

As this alternative does not include a proposal to eradicate feral pigs should they be identified on the Refuge, there is the potential for future adverse effects to Refuge vegetation from feral pig activity. Native flora could be subject to trampling and removal as feral pigs root and wallow within vegetated areas, particularly in wet areas and oak woodlands. Studies have shown that foraging by feral pigs reduces oak regeneration (Sweitzer and Van Vuren 2002, 2008), and Cushman et al. (2004) hypothesized that vegetation changes due to pig rooting and wallowing provide greater opportunities for non-native grass colonization. This could lead to the conversion of native vegetation to non-native grasslands, reducing the habitat quality for a range of wildlife species.

Pest Management

Potential effects to native vegetation, sensitive plant species, and overall habitat quality from implementation of the draft IPM Plan would generally be minor, temporary, or localized in nature. Mechanical and/or physical control of invasive plant species could result in the inadvertent removal of native vegetation. To minimize the potential for such impacts, those conducting physical control would be trained to distinguish native vegetation from non-native vegetation, and any control being conducted in proximity to listed plant species would be supervised by individuals trained to recognize all growth stages of the species.

The IPM Plan also addresses the selective use of pesticides to eradicate, control, or contain pest species in order to achieve resource management objectives. Based on scientific information and analyses documented in "Chemical Profiles" in the IPM Plan, the pesticides currently being considered for use on the Refuge, as well as those that may be considered in the future, are evaluated to ensure that their use would represent relatively low risk to non-target species. Where there is the potential for risk to non-target plants from the use of a specific herbicide, BMPs related to proper application of each product, precautions to be taken

during mixing, and various steps to be taken to avoid overspray or drift (refer to Appendix D for a complete listing of BMPs for pesticide use) would be implemented to ensure that adverse effects to non-target vegetation is minimized and/or avoided.

Table 5-3 outlines the ecological risk of the pesticides currently proposed for use under Alternative B. Three of the herbicides presented in Table 5-3—Surflan AS (active ingredient oryzalin), Telar XP (active ingredient chlorsulfuron), and Pathfinder II (active ingredient triclopyr)—represent a risk to non-target plant species via spray drift, runoff, or accumulation in the soil. Aquatic plant toxicity in chlorsulfron ranges from non-toxic to highly toxic, with five non-target plant incidents reported in the USEPA EIIS database related to chlorsulfuron. These reports document cases of reduced reproductive effects as a result of sublethal exposure to this herbicide (USEPA 2005).

Based on the results of various field, greenhouse, and laboratory studies, several researchers have concluded that small quantities of chlorsulfuron applied at label rates may result in high risk to non-target plants growing near the application site. The primary effect is a change in plant reproduction without altering vegetative growth. To minimize the potential for impacts to non-target native plants, the chemical profile prepared for this herbicide includes a specific BMP that restricts the use of this product to ground application only, with wide area applications prohibited and only spot treatment of targeted species permitted on the Refuge. Care should be taken if this product is used in proximity to vernal pool habitat and other wetland areas. For all herbicide applications, the potential for impacts to non-target plants would be minimized by adherence to the BMPs outlined under the sections on air quality and water quality previously, which address spray drift and runoff. In addition, adherence to product label directions and implementation of general and product specific BMPs (as presented in the chemical profiles) would reduce potential adverse effects to below a level of significance.

Public Use

Under Alternative B, wildlife-dependent recreational uses including wildlife observation, photography, environmental education, and interpretation would be accommodated primarily using a designate system of trails. All activities would for the most part be confined to this trail system, leaving large blocks of native habitat closed to public access. Providing opportunities for these uses on a designated system of trails rather than on the proliferation of user-created trails that currently exist on the Refuge would be expected to reduce ongoing off-trail activity and the continued creation of unauthorized trails on the Refuge. Although attempts to reduce off-trail activities would be encouraged through a public outreach and education program, it is likely that some impacts (e.g., trampling, shrub damage, removal of flowers) to native vegetation in proximity to existing trails would continue to occur. These impacts would be limited in scope and are not expected to result in significant adverse effects to the native vegetation.

The construction of new parking areas in the McGinty Mountain and Las Montañas areas and the construction of a temporary visitor contact station, restrooms, parking area, and access route to the Sweetwater Loop and River Trail would require the removal of a combination of non-native and native vegetation. The extent of native habitat removal is expected to be minimal; however, until a site design specific to the site has been prepared, these impacts cannot be quantified. To minimize the extent of impact, the 2.4-acre parcel would be surveyed, and those areas with the least potential for impacts to native vegetation would be identified. Based on this information, a site design can be developed that avoids to the extent feasible existing sensitive habitat areas.

Table 5-3
Ecological Risks of Pesticides Proposed for Use under the Integrated Pest Management Plan

Product Name	Active Ingredient	Ecological Risk to Plants	Toxicity to Birds	Toxicity to Mammals	Toxicity to Fish/Aquatic Invertebrates	Toxicity to Honeybees	Other Ecological Risks
Makaze **Prosecutor**	Glyphosate	Non-selective, but harmless to most plants once in the soil	Practically nontoxic	Low toxicity	Practically nontoxic	Practically nontoxic	Surfactants may be highly toxic to aquatic organisms
AquaNeat	Glyphosate	Non-selective but harmless to most plants once in the soil	Practically nontoxic	Low toxicity	Slightly to moderately nontoxic	Practically nontoxic	None identified
Fusilade DX	Fluazifop-P-butyl	Selective for grasses	Slightly to practically nontoxic	Slightly to practically nontoxic	Highly toxic	Very low toxicity	Shown to inhibit fungal growth at high doses (Tu et al. 2001)
Telar XP	Chlorsulfuron	Risk to non-target plants, minimize spray drift	Practically nontoxic	Practically nontoxic	Practically nontoxic	Practically nontoxic (also for beetles)	Aquatic plant toxicity ranges from nontoxic to very highly toxic
Milestone, VM	Aminopyralid	Potential for non-target effects; more toxic to dicots than monocots	Very low toxicity	Practically nontoxic	Practically nontoxic	Practically nontoxic	Slightly toxic to aquatic vascular plants

Table 5-3
Ecological Risks of Pesticides Proposed for Use under the Integrated Pest Management Plan

Product Name	Active Ingredient	Ecological Risk to Plants	Toxicity to Birds	Toxicity to Mammals	Toxicity to Fish/Aquatic Invertebrates	Toxicity to Honeybees	Other Ecological Risks
Surflan AS	Oryzalin	Risk to acute to non-target plants, minimize spray drift and avoid runoff from treated areas	Slightly toxic to practically non-toxic	Practically nontoxic	Highly toxic	Nontoxic	Poses a risk to endangered aquatic species in shallow water adjacent to treated areas
Pathfinder II	Triclopyr tiethylaminer (ester formulation)	Triclopyr soil residues can cause damage to non-target plants via root uptake	Slightly toxic	Slightly toxic; there is the potential for long-term exposure to species that eat fruit or foliage of treated plants	Highly toxic	Practically nontoxic	Very persistent in evergreen foliage and twigs; inhibits growth of some species of fungi (Tu et al. 2001)
Envoy Plus	Clethodim	Selectively toxic to plants, affecting only grass species	Practically nontoxic	Slightly toxic	Slightly toxic	Practically nontoxic	None identified

Whenever possible, sites supporting non-native vegetation would be selected over sites supporting native habitat. The general areas being considered for these facilities are not known to support listed or sensitive species, but if sensitive plants were located in the area, the facilities would be sited in such as manner as to avoid impacts to these species. Any loss of sensitive native vegetation would be mitigated through the revegetation of like species on highly disturbed sites within the Refuge at a 1:1 replacement ratio.

A designated trail system is proposed for the Otay-Sweetwater Unit, and specific trail alignments for the routes included with the trail system would be developed with user involvement in a step-down trail plan. All trail alignments would be designed to be sustainable and to avoid short- and long-term significant adverse impacts to sensitive habitat and listed and sensitive plant species. To achieve a sustainable trail system, it may be necessary to reroute some or all of an existing trail or to incorporate trail design changes to adjust grades or outslope, and incorporate other corrective measures such as rolling grade dips and knicks. These actions may result in the removal of some native vegetation; however, where a trail is being realigned, mitigation for the loss of vegetation within the new alignment would be provided by reestablishing native habitat within the old trail alignment. Loss of vegetation to implement improvements to an existing trail would be minimal; in most cases, such improvements would eliminate long-term erosion along the trail that has led to trail widening and/or the creation of braided trails. Once the improvements are made, widened or braided sections of trail can be recontoured and planted with native vegetation.

Within the Del Mar Mesa Vernal Pool Unit, the designated trail alignments on Refuge would be consistent with the proposal currently being considered by the City of San Diego for the larger Del Mar Mesa Preserve. These alignments have been designed to minimize impacts to native vegetation and sensitive plant species, particularly listed species that are restricted to specialized vernal pool habitat.

Throughout the Refuge, areas of sensitive habitat would be monitored and signs of off-trail activity or the development of new user-created trails would be addressed through signage, fencing, trail rehabilitation, or other measures intended to discourage continued activity at a particular location.

Refuge Operations

Support facilities proposed for construction at Rancho Jamul would be constructed in an area that has a long history of human disturbance and does not support native vegetation. As a result, no impacts to native habitat or sensitive plant species are anticipated. Alternative B also addresses the need to close abandoned mines shafts and wells, repair Saddle Road Dam, remove tanks at the old dairy near Mother Miguel Mountain, and remove a well and pump house from the vicinity of Jamacha Road. All of these activities would likely result in some trampling of native vegetation to access and implement actions. These effects would be short term and limited in nature. In other cases, some native vegetation may have to be removed to implement repairs. In cases where an area is denuded of vegetation, appropriate native species would be planted or seeded in the disturbed area to mitigate the impacts and to ensure that the disturbed area does not become infested with invasive, non-native vegetation. The implementation of these measures would minimize the potential for significant adverse effects to native vegetation.

Under alternative B, fuel breaks would be maintained (i.e., native vegetation would be prevented from regenerating in approximately 30 acres of exotic annual weeds).

5.3.3 Alternative C

Wildlife and Habitat Management

The wildlife and habitat management proposals included under Alternative C would be essentially the same as those proposed in Alternative B.

Pest Management

The potential effects to habitat quality and individual plant species from the implementation of the IPM Plan would be the same under this alternative as described for Alternative B.

Public Use

The public uses proposed under Alternative B would also be permitted under Alternative C. Therefore, the impacts associated with these uses would be generally the same as those described previously for Alternative B. Two additional trail corridors are included in the designated trail system under Alternative C, one leading up to Mother Miguel Mountain and the other providing access from the western ridge in the Sweetwater River management area down to the Sweetwater Loop and River Trail. The impacts of developing trails in these areas would be similar to the discussion provide in Alternative B. Alternative C also proposes to open a portion of the Refuge to hunting, which would have some effect on existing vegetation as described here.

Alternative C includes a proposal to open a portion of the McGinty Mountain area, the southern portion of the Las Montañas area, and the southwest portion of the Otay Mesa and Lakes area to hunting. The specific details of the hunting program would be developed during step-down planning. For the McGinty Mountain and Las Montañas areas, the hunt program would be limited in terms of specific areas open to hunting and the number of days within a hunt season in which hunting would be permitted. In addition, the number of hunters allowed within these areas would be limited to ensure a quality hunt for all participants. Hunting on the designated portion of the Otay Mesa and Lakes area would be generally consistent with State hunting regulations as they apply to State Ecological Reserves.

Hunting would be conducted on foot by individuals or small groups, often accompanied by a hunting dog. Since hunting is not limited to designated trails, direct impacts to vegetation could occur from trampling. However, because hunters tend to travel in dispersed patterns over wide areas rather than utilizing the same pathway over and over again, the effects of trampling would be limited and short term. In addition, hunting in most of the designated hunt areas would be a seasonal activity, generally occurring in the fall and winter months when limited growth, particularly of forbs, is occurring. As a result, impacts to Refuge vegetation by hunters would be expected to be minimal and insignificant. All prospective hunters will be required to attend a training session before they can hunt on the Refuge. As part of this training session, the need to protect habitat quality within the hunting area will be addressed.

The McGinty Mountain area does include sites that support listed plant species; therefore, the specific boundaries of the hunt area to be designed during step-down planning, would not include or would otherwise exclude access (e.g., through the installation of fencing or signage) to these sensitive locations. Information about the need to avoid these areas would be provided as part of required training classes.

Leashed dogs would be permitted on Refuge trails under this alternative. If dogs are leashed and their activities are confined to the trail, no adverse effects to vegetation are anticipated. If,

however, leash regulations are not adhered to by users, impacts to vegetation are likely to occur. If such impacts are identified, the right to bring dogs onto the Refuge could be suspended to protect sensitive Refuge resources.

Also proposed under this alternative are two interpretive trails, one on Lot 707 and the other, an interpretive boardwalk trail, at the vernal pool restoration site on the San Miguel Mountain area. The Lot 707 trail would extend through an old olive grove that has experience some natural recruitment by coastal sage scrub species. No significant loss of native vegetation is anticipated. If the trail becomes part of an environmental education program, existing native habitat would likely be enhanced and new areas of native habitat established as part of that program. The interpretive boardwalk would be designed to avoid impacts to sensitive vernal pool habitat, while providing important information to the public about the need to protect and restore rare vernal pool habitat.

Refuge Operations

The facilities and actions related to refuge operations that were described under Alternative B would also be implemented under Alternative C. Therefore, the impacts associated with these uses would be the same as those described previously for Alternative B.

5.3.4 Alternative D

Wildlife and Habitat Management

The wildlife and habitat management proposals included under Alternative D include all those proposals addressed under Alternative B, as well as a proposal to monitoring for and control, when present, feral pigs. The implementation of the Feral Pig Monitoring and Eradication Plan would provide benefits to sensitive habitats and vegetation not provided by the other alternatives. The prompt control of feral pigs on Refuge lands, as proposed under this alternative, would minimize or avoid such impacts.

Trampling of some vegetation by marksmen and their dogs may occur in areas of trapping and feral pig herding. These impacts are expected to be minor and transitory, however, trapping and herding would be avoided in areas that support sensitive plant species. Vegetation surveys would be conducted prior to trap placement, and the selection of trapping sites would be coordinated with the Refuge biologist to ensure that impacts to native vegetation are minimized. Packstock, which may be used on a limited basis in support of project activities, would be fed weed-free feed to minimize introduction of noxious weeds. None of the actions associated with feral pig control are likely to adversely affect native vegetation or measurably increase noxious weeds.

Pest Management

The potential effects to habitat quality and individual plant species from the implementation of the IPM Plan would be the same under this alternative as described for Alternative B.

Public Use

For the most part, the public uses proposed under Alternative C would also be permitted under Alternative D. The primary differences are that hunting would only be permitted on a portion of the Otay Mesa and Lake area and the Lot 707 and Mother Miguel Mountain trails would not be included in the designated trail plan. The potential impacts to vegetation and sensitive plant species would however be generally the same as those described under Alternative C.

Leashed dogs would be permitted on all multiple use trails under this alternative. Provided dogs are leashed and their activities are confined to the trail, no adverse effects to vegetation are anticipated. If, however, impacts are identified due to off-trail activity by unleashed dogs, the right to bring dogs onto the Refuge could be suspended to protect sensitive Refuge resources.

Refuge Operations

The facilities and actions related to refuge operations that were described under Alternative B would also be implemented under Alternative D. Therefore, the impacts associated with these uses would be the same as those described previously for Alternative B.

5.4 Effects to Wildlife

The effects to wildlife from implementing the various alternatives are described in this section. Once again, potential impacts to these resources are characterized here by evaluating direct and indirect effects. Direct impacts involve the primary effect of implementing an action, such as the flushing of a bird from its nest because of wildlife observation activities. Indirect impacts include habitat modifications that result in a change in abundance or breeding success of a species (or group of species), such as removing shrubs and other vegetation in important butterfly habitat.

An effect to wildlife would be considered significant if:

- An action would result in a substantial reduction in the total acreage available on the Refuge to support native wildlife species or would substantially degrade the quality of available habitat supporting native wildlife species. (For migratory songbirds, a substantial reduction in habitat acreage resulting in a significant adverse impact would be defined as a reduction of five percent or more of the available acreage for these species within the Refuge.)

- An action would result in a substantial adverse effect, either directly or through habitat modifications, on any wildlife species identified as a sensitive or special status species in local or regional plans, policies, regulations, by CDFW or the Service, or any avian species identified as a Bird of Conservation Concern.

- There would be a permanent loss (adverse effect) or gain (beneficial effect) of occupied sensitive species habitat or the direct mortality (adverse effect) of individuals of sensitive species due to the proposed action.

- An action would substantially interfere with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of wildlife breeding sites for sensitive or special status species or any other species of conservation concern.

5.4.1 Alternative A – No Action

Wildlife and Habitat Management

Under Alternative A, current wildlife and habitat management activities—invasive plant control; trash and debris removal; road, fence/gate, and sign maintenance and replacement; environmental contaminants coordination; habitat enhancement and restoration; and species

surveys and protocol monitoring—would continue on the Refuge. Implementing these activities could result in some impacts to wildlife, including temporary disturbance related to noise and human activity and direct loss of individuals due to trampling, inadvertent damage to nests or burrows, or other causes. However, none of the maintenance or management actions that could be implemented under Alternative A would result in a substantial reduction in the quantity or quality of available habitat to support the Refuge's native wildlife species. Further, the removal of invasive vegetation in riparian areas would include the restoration of native species following invasive vegetation removal to ensure appropriate vegetative structure for breeding migratory songbirds.

To minimize the potential for direct and indirect impacts to wildlife, care would be taken to avoid entering sensitive habitat areas whenever possible. When entry is required, it would be timed to avoid the sensitive life stages such as breeding seasons, dispersal periods, or hibernation, unless the objective of the monitoring or research is to investigate specific species during this time. Monitoring activities that must occur within sensitive habitat during the breeding season will only be conducted by qualified personnel to avoid any unintentional impacts to listed or sensitive species. Deleterious effects to wildlife associated with its management will be mitigated by the benefits of management in manipulating populations of target species. The knowledge gained in monitoring and research will mitigate associated impacts by better informing and directing current and future management efforts.

Pest Management

Mechanical and chemical control of invasive weedy plants is conducted in various locations throughout the Refuge as described in Chapter 4. This activity can result in disturbance to wildlife; however, to minimize the potential for adverse effects, control of invasive plants is not conducted in proximity to known nesting areas during the nesting season, and applications of pesticides are generally limited to one to three applications per year. When conducting control, a site reconnaissance occurs prior to work to ensure that the potential for direct effects to wildlife is minimized.

The herbicides currently used on the Refuge include products with active ingredients glyphosate, fluazifop-P-butyl, or chlorsulfuron. The risk to wildlife of using these products includes indirect exposure to mammals and birds from eating contaminated prey or vegetation and direct exposure of skin or eyes to product residue or if vapors or particulates are inhaled. However, as indicated in Table 5-3, none of the products used on the Refuge represent a significant threat to birds, mammals, or honeybees. Fluazifop-B-butyl can, however, be highly toxic to fish and aquatic invertebrates and has been shown to inhibit fungal growth. The surfactants used with glyphosate can be highly toxic to aquatic organisms. As a result, care must be taken when using these products adjacent to vernal pools and other wetlands. Understanding the ecological risks of these products is important when selecting a specific product to control invasive species in sensitive habitat areas. This, combined with BMPs to prevent spray drift, minimize the risk for runoff into adjacent wetland and other habitat areas, and avoid spills, will reduce the potential for adverse effects to wildlife to below a level of significance.

Public Use

Wildlife-dependent Recreational Uses. Wildlife and plant observation, photography, environmental education, and interpretation can result in direct and indirect impacts to wildlife. Nature observation and photography can involve close approaches to pursue identification or to get that perfect photograph. This can result in off-trail activity, causing trampling of wildlife habitat and disturbance to birds, reptiles, and small mammals. If this

activity occurs during the nesting season, it can result in damage or loss of active nests. Activities associated with environmental education and interpretation can result in off-trail activities leading to the same effects. At present, the extent to which this disturbance from wildlife-dependent use is occurring does not substantially interfere with the movement of wildlife species and has not impeded the use of breeding sites for sensitive species. Therefore, these impacts are not considered significant.

The implementation of a public outreach program that encourages visitors to stay on the trails could further reduce the potential for impacts to wildlife. Deleterious effects to wildlife caused by wildlife-dependent recreation can be reduced when the public understands the value of the resources being protected in off trail areas. People who come to the Refuge to view and appreciate wildlife and nature are more likely to support (e.g., financially, civically, or politically) wildlife conservation on and off the Refuge. They may also be moved to consume fewer resources (e.g., land, energy, water) that affect wildlife or may avoid actions (e.g., lighting fireworks in "vacant" land, littering) that have a detrimental effect on wildlife and habitat.

Trails. Existing trails on the Refuge are used by walkers, runners, mountain bikers, equestrians, and dog walkers. Although some wildlife-dependent recreational uses are occurring on the trails, it appears that the majority of the visitors are present for general trail use rather than wildlife-dependent activities. Under Alternative A, these activities would continue with no designated system of trails, although they are subject to closure or rerouting. Because the majority of the trails being used on the Refuge were created without consideration of the sensitivity of the resources they dissect, there is the potential for long-term disturbance to wildlife resources. Without a designated trail system, there is also the potential for off-trail activity and the continued proliferation of trails, resulting in additional disturbance and loss and fragmentation of wildlife habitat.

A number of studies have been conducted to evaluate the effects of recreational activities on wildlife. Potential impacts related to trails include the direct loss of habitat and wildlife, as well as indirect impacts associated with the habitat edges created when a trail traverses otherwise continuous habitat. In reviewing studies related to the influence of recreational trails on bird communities, Delong and Schmidt (2000) report findings that suggest that both the physical presence of a trail and human disturbance associated with the trail can affect bird abundance, species composition, and nest predation in the immediate vicinity of a trail. Miller et al. (1998) studied the influence of multiple use trails on breeding bird communities in forest and mixed-grass prairie ecosystems and found that species composition was altered in areas that included trail use, with generalist species more abundant near the trails and other species displaced away from trails. Other observed effects included few nests located near trails and an increased rate of nest predation for nests located in proximity to trails. The causes for these effects may include disturbance from human activity on the trail and/or the physical interruption in continuity of the habitat-by-habitat edge created by the presence of the trail. Studies indicate that many interior species avoid habitat edges or are present at lower densities in these edge areas (Kroodsma 1984, Van Horn et al. 1995). The results of a study conducted by Holmes and Geupel (2005) of the effects of trails on breeding birds in chaparral habitat indicated that fragmentation of chaparral habitat results in a negative effect on the density of some shrub-nesting bird species. From this, one could conclude that the number of trails extending through native habitat could degrade the overall quality of the habitat, particularly for some bird species.

Other studies of recreation effects on wildlife have found that that mammals exhibit both spatial and temporal displacement from recreational trails (George and Crooks 2006), and that smaller mammals flush from humans who are at a further distance away than do larger mammals (Taylor and Knight 2003). Lenth et al. (2008) observed that mule deer were less active for a distance of up to 165 feet (50 meters) along recreational trails. The distance was even greater in areas where leashed dogs were permitted on the trails.

Domestic dogs, which are currently present on Refuge trails, can also have a negative effect on wildlife species that are likely to perceive dogs as predators (George and Crooks 2006, Lenth et al. 2008). The presence of dogs in habitat management areas can alter patterns of habitat utilization for mule deer, small mammals (including rabbits), bobcats (Lenth et al. 2008), and birds (Banks and Bryant 2007).

The Refuge's location within and adjacent to urban/suburban development makes it attractive to the members of the public interested in recreation. While we acknowledge deleterious effects to wildlife from the presence of humans as noted by the references cited previously, closing all access to the Refuge would reduce the human communities' support for the Refuge's overall conservation program, including land acquisition, species monitoring, and habitat restoration and management. By making education and interpretation of the Refuge's biological diversity an important component of everyday Refuge work, some deleterious effects associated with allowing the public onto the Refuge could be reduced. However, the way in which the public interacts with the resources on the Refuge must be examined to ensure compatibility with Refuge purposes. The current state of the trail network on the Refuge is such that public outreach and public support for the Refuge can produce only minimal reductions in impacts to wildlife. Through proper trail planning and the development of a designated system of sustainable trails, as proposed in Alternatives B, C, and D, impacts to wildlife would be reduced over current conditions. Fragmentation of habitat would be reduced and impacts to sensitive habitat areas would be minimized. The establishment of clearly defined trails with appropriate signage is also likely to reduce off-trail activity throughout the Refuge.

Research. Research conducted on the Refuge can also result in impacts to wildlife, primarily in the form of disturbance, but occasionally, direct take of an individual animal may be necessary to conduct research important to the conservation of the population. To ensure that no significant adverse effects to wildlife result from research projects conducted on the Refuge, all proposals for research are reviewed and approved by the Refuge Manager. In addition, the Refuge Manager prepares a Special Use Permit for all approved research projects with project specific conditions that must be adhered to while conducting activities on the Refuge. These specific conditions are intended to protect sensitive resources and minimize the effects of the research on all Refuge resources.

Refuge Operations

Refuge operations occurring at Rancho Jamul have little, if any, effect on wildlife. Other activities related to current Refuge operations (e.g., law enforcement, sign and fence maintenance, trash and debris cleanup) would have effects similar to those described under Wildlife and Habitat Management.

5.4.2 Alternative B

Wildlife and Habitat Management

In addition to the continuation of the wildlife and habitat management actions described under Alternative A, Alternative B proposes to expand these actions to address other habitats and species. These actions (described in Chapter 4), which would involve new habitat restoration and enhancement projects and listed species surveys and monitoring, would likely result in temporary impacts to wildlife in the form of disturbance and minor alterations in existing vegetative cover. The potential for impacts would be similar to those described under Alternative A. To avoid any significant adverse effects to listed species, these activities would be avoided to the extent feasible in periods and locations when sensitive wildlife species are particularly vulnerable (e.g., the nesting season for birds, hibernation for bats, within patches of *Plantago erecta* in early spring for Quino checkerspot butterfly larvae). Any temporary effects to wildlife that may result from the implementation of these activities would be outweighed by the overall benefits that these actions would provide (e.g., improved habitat quality to support wildlife, better understanding of species distribution and population size).

Pest Management

Under Alternative B, the control of pests on the Refuge would be conducted in accordance with the IPM Plan prepared for the San Diego NWR (Appendix D). Herbicide use currently being implemented on the Refuge, described in Alternative A, would continue under this alternative. Additional products may also be approved for use on the Refuge in the future through the PUP approval process. Under the IPM Plan, the potential effects to Refuge resources from the proposed site-, time-, and target-specific use of current and potentially future pesticides on the Refuge would be evaluated using scientific information and analyses documented in Chemical Profiles of the IPM Plan (Appendix D). These profiles provide quantitative assessment/ screening tools and threshold values to evaluate potential effects to species groups (e.g., birds, mammals, fish). A PUP (including appropriate BMPs) would be approved where the Chemical Profile provides scientific evidence that potential impacts to biological resources are likely to be only minor, temporary, or localized in nature. Along with the selective use of pesticides, the IPM Plan proposes other appropriate strategies (i.e., biological, physical, mechanical, cultural methods) to eradicate, control, or contain pest species to achieve resource management objectives. Based on scientific information and analyses documented in Chemical Profiles, pesticides allowed for use on the Refuge would be of relatively low risk to non-target organisms (refer to Table 5-3), due to their low toxicity or short-term persistence in the environment. Thus, no adverse effects to wildlife from pesticide application are anticipated.

The IPM Plan also addresses the potential future control of invasive aquatic species, including fish, invertebrates, and herpotofauna, and although not covered by the IPM Plan, Alternative B also addresses the potential need in the future to control and/or remove wild turkeys and feral pigs from the Refuge. Control of these organisms is proposed and deemed necessary to support the recovery and conservation of federally listed and MSCP-covered species present on the Refuge. The size of an infestation, its pervasiveness, its potential impact, and management difficulty will determine whether the goal is eradication or containment. For instance, the relatively confined populations of African clawed frog will be targeted for eradication. In contrast, the current goal for the ubiquitous mosquito fish and crayfish is containment via best management practices. Full control may be warranted if listed species such as arroyo toad or California red-legged frog are introduced or detected on the Refuge. Other non-native species, particularly invasive aquatic species, not currently described as

target species, may also be considered for treatment if the species poses a threat to listed or MSCP-covered species.

Biologists at the Western Ecological Research Center, U.S. Geological Survey, Biological Resources Division have been investigating control methods for bass, bullfrogs, green sunfish, and crayfish in the Sweetwater River upstream of the Refuge within Sloane Canyon. Their control efforts have been under way for several years, and the results of these efforts will provide information regarding methodology, cost, and effectiveness. This information is expected to enhance the Refuge's efforts to manage aquatic invasive animals.

The most effective methods for eliminating largemouth bass and potentially other exotic fish species from Refuge wetland areas are water manipulation and fish pesticides (piscicides) such as rotenone, which effectively kills bass. However, prior to using pesticides to control invasive fish, a Chemical Profile must be prepared and the proposed pesticides approved for use on the Refuge through the PUP process, as described in Chapter 4. Trapping or netting may work for some species but are ineffective on bass, as bass typically avoid active trapping methods. Gill nets and seines have been successful at removing bass in small bodies of water that support only a few bass. Other methods of control that have proved successful are electroshocking, spearing, and rod and reel fishing.

Although there is not a substantial need for the control of feral cats or dogs on the Refuge at present, control may be required in the future and, if so, it would be conducted in accordance with Service policy. At present, feral cat populations on the Refuge appear to be controlled by native predators. However, in many urban areas throughout the United States, including San Diego, people concerned for the welfare of cats and unaware of their impacts on wildlife support "colonies" of feral cats by regularly providing them with food. Sometimes such colonies are the focus of "trap, neuter, and release" programs to reduce proliferation of feral cats, but these programs leave cats in the wildlife habitat and are ineffective at reducing their impacts to wildlife. In the event that such a colony is established on the Refuge, the colony will be removed in coordination with an approved shelter facility operated by a cooperating local unit of government, a humane society, or a veterinary care facility.

Alternative B also proposes the potential for controlling brown-headed cowbirds should the need arise. The control of cowbird populations in San Diego County and various locations throughout the U.S. has proved to be an effective management tool used by local, State, and Federal agencies to reduce impacts to listed bird species from cowbird brood parasitism (Griffith and Griffith 2000, Kus and Whitfield 2005).

The Sweetwater Authority has for several years been implementing brown-headed cowbird control in the vicinity of the Sweetwater Reservoir in accordance with the following:

- Sweetwater Reservoir Habitat Management Program: USFWS Biological Opinion 1-6-93-F-42 and CDFG Memorandum of Understanding No. 2081-1994-088-5; and,
- Urban Runoff Diversion System Phase II (URDS II): USFWS Biological Opinion 1-6-95-F-41 and CDFG Addendum to Memorandum of Understanding 2081-1994-088-5.

Three traps are operated by the Sweetwater Authority from mid-March through mid-July using the equipment and methodology developed by Griffith Wildlife Biology (1994). One of these traps is located along the Sweetwater River within the Refuge. Cowbirds are not frequently observed during vireo monitoring. In 2011, the level of parasitism was well below the threshold at which parasitism would cause the local population of least Bell's vireos to

decline. It is reasonable to assume that cowbird trapping conducted by Sweetwater Authority is effectively reducing the frequency of cowbird parasitism on vireos on the Refuge. However, if Sweetwater Authority's cowbird trapping program were to stop, the high edge to area ratio, proximity to urban areas, and proximity of the riparian habitat on the Refuge to livestock would once again make listed bird populations vulnerable to cowbird parasitism and associated declines. Should the Sweetwater Authority's trapping program be suspended, the Refuge could initiate short-term or intermittent cowbird control modeled after the current program but with only two traps, one at Bright Valley Farms and one at the lower end of the Sweetwater River near the Sweetwater Reservoir on Refuge land. A long-term, annual trapping program may not be necessary to achieve effective cowbird control. After cowbird populations have been reduced by trapping, trapping may be suspended. The determination of when to stop or reinitiate the trapping program would be made based on the result of annual monitoring.

If brown-headed cowbird control were to be implemented by the Refuge, it would occur in association with the following management efforts, which are intended to support listed and sensitive bird species:

- ongoing monitoring of listed bird species (including nest monitoring to document rates of parasitism);
- improving habitat quality to benefit specific listed species; and
- restricting public access in nesting areas to minimize the loss of vegetation and to reduce the potential for disturbance, particularly during the breeding season.

Alternative B does not include a proposal to eradicate feral pigs should they be identified on the Refuge, therefore, if feral pigs become established on the Refuge, there is the potential that the Refuge's native wildlife could be adversely affected. Negative impacts associated with feral pigs could include predation on or consumption of native animal species, direct or indirect competition with wildlife for food and habitat, disruption of natural food webs, and/or the transmission of diseases (CBI 2009). Pigs are also known to destroy nests and disturb or consume eggs and offspring of ground-nesting birds.

Studies have shown that pigs compete with native species for limited forage items (Ilse and Hellgren 1995, Laurance 1997). In one study, feral pigs were found to actively seek out and consume acorn hoards collected by small animals (Focardi et al. 2000). Their consumption of acorns, which can adversely affect oak regeneration, also indirectly impact the vertebrate and invertebrate species present in oak woodland habitat (Garrison and Standiford 1996).

Public Use

Hunting and Fishing. The Refuge would remain closed to hunting and fishing under this alternative, therefore, no effects to wildlife resources from these uses would occur under Alternative B.

Other Wildlife-dependent Recreational Uses. The impacts to wildlife from activities related to wildlife observation, photography, environmental education, and interpretation, as proposed for the Refuge under Alternative B, would be similar to those described under Alternative A. However, because these uses would be confined primarily to the designated trail system, and the number of trails proposed to remain open under Alternative B would decrease over

existing conditions, the potential for disturbance to wildlife would be reduced over time as some trails are closed and returned to native habitat.

Trails. Under Alternative B, a designated system of trails would be established on the Refuge that would result in a reduction in the total number of trails traversing the Refuge. One of the intents of this proposal is to reduce disturbance in and adjacent to sensitive habitat areas.

Refuge biologists would participate in the identification of specific trail alignments to assist in determining which areas can best support public use, while minimizing impacts to sensitive Refuge resources. Establishing appropriate trail alignments would include, but not be limited to, consideration of the proximity of trails to sensitive wildlife habitat such as riparian areas, wetlands, and habitats occupied by listed species and the effects of the alignment on habitat connectivity. The consolidation of trails throughout the Refuge would reduce the fragmentation of large interior blocks of habitat, maintaining undisturbed areas for breeding birds, as well as mule deer and other mammals that tend to avoid areas of frequent human use. Although disturbance to wildlife, as described for trails under Alternative A, cannot be avoided, the proposal to establish a designated trail system that takes into account the needs of the Refuge's wildlife would benefit Refuge resources over current conditions. No dogs would be permitted on the Refuge under Alternative B; therefore, the disturbance to wildlife from the presence of dogs, as described under Alternative A, would be substantially reduced under Alternative B.

The construction of facilities to support Refuge visitors (e.g., parking lots, visitor contact station, information kiosks, interpretive sign, photography blind) as proposed under Alternative B would result in both temporary and long-term impacts to wildlife as a result of increased human activity in the affected areas. To minimize the adverse effects of these facilities on wildlife, project sites would be located outside of sensitive habitat areas to the extent feasible; adequate buffers would be provided between visitor facilities and sensitive habitat areas such as riparian corridors and occupied California gnatcatcher habitat; and facilities design would take into consideration the need to minimize noise, lighting, and human access into sensitive habitat areas. In addition, construction proposed near sensitive habitat areas would occur outside of the bird breeding season. The boundaries of all construction sites would be flagged and construction activities would be monitored to ensure that potential impacts to wildlife are minimized. High activity facilities (e.g., restrooms, parking lots, kiosks, the entrance to the visitor contact station) would be sited to provide adequate separation between users and potential riparian bird nesting areas to minimize long-term disturbance impacts.

Research. The potential effects to wildlife of permitting compatible research activities on the Refuge would be the same as those described under Alternative A.

Refuge Operations

The facilities proposed for construction on Rancho Jamul would occur in areas already experiencing moderate levels of human activity, therefore, the temporary increases in activity related to construction and the minor permanent increase in the level of human activity associated with the new facilities would have a limited effect on wildlife.

5.4.3 Alternative C

Wildlife and Habitat Management

Management actions under Alternative C are generally the same as those provided under Alternative B; therefore, the impacts and benefits to wildlife of implementing these actions would be the same as those described under Alternative B.

Pest Management

The potential effects to wildlife from the implementation of the IPM Plan would be the same under this alternative as those described previously for Alternative B.

Public Use

Hunting. The proposal to implement a hunting program within the Refuge, as proposed under Alternative C, would result in direct and indirect impacts to wildlife. These impacts include the direct take of brush rabbits, desert cottontails, dove, and California quail from the McGinty Mountain and Las Montañas areas. In addition, southern mule deer would be hunted on a portion the McGinty Mountain area. In the Otay Mesa and Lakes area, the potential take of rabbits, upland game birds, and southern mule deer could occur. The number of individuals of each species taken annually by hunters would be regulated by CDFW hunting regulations and/or Refuge specific regulations that would be developed as part of a step-down hunt plan.

Hunting could also result in some direct and indirect adverse effects to other wildlife. Direct effects include occasional mortality, wounding, and disturbance of non-target species (DeLong 2002). Hunting can also alter the behavior (i.e., foraging time), population structure, and distribution patterns of wildlife (Owens 1977, White-Robinson 1982, Madsen 1985, Bartelt 1987, Cole and Knight 1990). Human disturbance associated with hunting includes loud noises, such as those produced by shotguns, and rapid movement. This disturbance, especially when repeated over time, can cause some wildlife species to change foraging habits, feed only at night, or relocate. These impacts can be reduced by providing adjacent non-hunting areas where hunting does not occur and where wildlife can feed and rest relatively undisturbed (Havera et al. 1992). Such areas would be provided to the west and south of the proposed 400-acre McGinty Mountain hunt area, to the south and southwest of the proposed 300-acre Las Montañas hunt area, and to the north of the 160-acre Otay Mesa and Lakes area. In addition, the remainder of the Otay-Sweetwater Unit would be closed to hunting, providing extensive sanctuary areas for wildlife.

Recreational hunting would remove individual target animals, but it not expected to negatively affect wildlife populations. This is because wildlife populations on refuges are managed to sustain the proposed hunting program and support other wildlife-dependent priority uses. To manage wildlife populations to support hunting, Refuge often adopt harvest regulations set by the State within Federal framework guidelines. The California Fish and Game Commission, in consultation with CDFW, annually reviews the population censuses to establish season lengths and harvest levels. Refuges utilize this information, along with the results of on-site annual habitat management reviews conducted to evaluate wildlife population levels, habitat conditions, and visitor service activities, to establish Refuge-specific hunting regulations.

The hunting season and bag limits for those species proposed for hunting on the Refuge, as defined by CDFW for the 2013/2014 hunting season, are provided in Table 5-4. Specific bag limits may be lower for some hunt areas on the Refuge and hunting within the specified hunting seasons may be restricted to specific days of the week. Reserving some days during

the week as no hunt days would provide rest periods for wildlife. This approach has been identified as an effective way to minimize hunting-related disturbance to wildlife (Fox and Madsen 1997).

Table 5-4
CDFW Hunting Seasons, Daily Bag Limits, and Possession Limits for 2013/2014

Species	Season	Daily Bag Limit	Possession Limit
California quail	General Season: Third Saturday in October extending through the last Sunday in January	10 quail per day in any combination of species per day	Double the daily bag limit
	Archery Season: Third Saturday in October extending through the last Sunday in January	10 quail per day in any combination of species per day	Double the daily bag limit
Band-tailed pigeon	Third Saturday in December extending for nine consecutive days	2 band-tailed pigeons per day	Double the daily bag limit
Doves (mourning doves, white-winged doves, spotted doves, Eurasian collared-doves)	September 1 - 15 and from the second Saturday in November extending for 45 days	Mourning doves and white-winged doves: 10 doves per day in aggregate	Double the daily bag limit in aggregate
		Spotted doves and Eurasian collared-doves: no limit	Spotted doves, Eurasian collared-doves: no possession limit
Cottontail and brush rabbits	July 1 extending through the last Sunday in January	5 rabbit per day	Ten in possession
Jackrabbit	Open all year	No limit	No limit
Southern mule deer	General Season: Fourth Saturday in October extending for 30 consecutive days	1 buck, forked horn (See California Fish and Game Code, subsection 351(a)) or better per tag	Same as bag limit
	Archery Season: First Saturday in September and extend for 23 consecutive days.	One buck, forked horn or better per tag	Same as bag limit
	San Diego Archery Either-Sex Deer Hunt: First Saturday in September and extend for 44 consecutive days, and reopen on the third Saturday in November and extend through December 31.	One either-sex deer (see California Fish and Game Code subsection 351(c)) per tag	Same as bag limit
	San Diego Muzzleloading Rifle Either-Sex Deer Hunt) Third Saturday in December and extend through December 31	One either-sex deer per tag	Same as bag limit

Reference: California Department of Fish and Wildlife, Regulations for the 2013-2014 Season

The actual harvest levels of each of these species would be determined in consultation with CDFW, and hunting season and specific days in which hunting would be permitted on the Refuge would be defined during the development of a step-down hunt plan. To avoid adverse impacts to these species due to overharvesting, harvest levels would be determined based on existing knowledge of the populations of these species within the region and would be evaluated annually based on estimated annual take and estimated population size.

Resident game species are protected on refuges by both Federal and State laws and regulations to ensure that harvest rates do not negatively affect populations. The potential impacts of hunting on migratory birds and resident upland game birds are discussed and evaluated in documents prepared by CDFW in accordance with the California Environmental Quality Act (CDFG 2001, CDFG 2004a). This process results in periodically updated and publicly reviewed documents. Based on the findings of these documents, the State ensures that game animal hunting in California does not adversely affect its wildlife populations at an unacceptable level (CDFG 2004a).

The migratory bird conventions with Canada and Mexico define "game birds" as those species belonging to the following families: Anatidae (swans, geese, and ducks), Rallidae (rails, gallinules, and coots), Gruidae (cranes), Charadriidae (plovers and lapwings), Haematopodidae (oystercatchers), Recurvirostridae (stilts and avocets), Scolopacidae (sandpipers, phalaropes, and allies), and Columbidae (pigeons and doves). The Migratory Bird Treaty Act, which implements the conventions, grants the Secretary of the Interior the authority to establish hunting seasons for migratory game bird species. In actuality, the Service has determined that hunting is appropriate only for those species for which there is a long tradition of hunting and for which hunting is consistent with their population status and their long-term conservation. Although the Migratory Bird Treaty Act considers some 170 species to be "game birds," less than 60 species are typically hunted each year.

With the responsibility for managing and conserving migratory birds in the United States having been delegated to the Service, the Service develops migratory game bird hunting regulations by establishing the frameworks, or outside limits, for season lengths, bag limits, and areas for migratory game bird hunting. These limits are published annually in the *Federal Register*. In an effort to address the regional differences in hunting conditions, the Nation is administratively divided into four flyways for the primary purpose of managing migratory game birds. The San Diego NWR is located within the Pacific Flyway, and the species addressed within these regulations that is of interest to the Refuge is the mourning dove. NEPA considerations for these regulations are covered by the programmatic document “Final Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Sport Hunting of Migratory Birds (FSES 88– 14),” filed with the Environmental Protection Agency on June 9, 1988.

In 2011, the Service issued the Final Frameworks for Early-Season Migratory Bird Hunting Regulations (76 FR 54052), which established the following framework for mourning doves for California during the 2011–2012 migratory bird hunting seasons: the season may not be more than 60 days, which may be split between two periods, September 1 through September 15 and November 1 through January 15. The daily bag limit is ten mourning and white-winged doves in the aggregate.

CDFW has trustee responsibility for the conservation and management of deer, quail, and other wildlife, including rabbits, bobcat, badger, fox, and nongame mammals, in California. Section 1801 of the Fish and Game Code establishes the overall Wildlife Conservation Policy

for CDFW, which includes the following relevant objectives: perpetuate all species of wildlife for their intrinsic and ecological values, as well as for their direct benefits to all persons; and maintain diversified recreational uses of wildlife, including the sport of hunting, as proper uses of certain designated species of wildlife, subject to regulations consistent with the maintenance of healthy, viable wildlife resources, the public safety, and a quality outdoor experience.

According to the Western Quail Conservation Plan (Zornes and Bishop 2009), breeding bird surveys for California quail within California from 1968 to 2003 indicated a generally stable population trend. Statewide, the take of California quail by hunters, as estimated by California's game-take hunter survey, declined from approximately 1,000,000 in 1992 to approximately 494,000 in 2004 (Zornes and Bishop 2009). A portion of this decline in take is attributed to a 15 percent drop of upland game bird hunters over the same period, as indicated by upland game bird stamp sales. In 2010, the estimated take was 453,773 (CDFG 2010), represent an eight percent decrease over 2004 estimates (accessed at https://www.dfg.ca.gov/wildlife/hunting/uplandgame/reports/surveys.html, 2010 Game Take Hunter Survey Report). There was also a slight decrease (one percent) in the number of upland game bird hunters during the same period. Also contributing to these numbers is a reduction in the total area available for hunting due to the loss of suitable habitat associated with development.

A rough estimate of average, annual harvest during the 2002 through 2004 hunting seasons within Bird Conservation Region 22, which includes San Diego NWR, was 200,000 birds. The Western Quail Conservation Plan concludes that maintaining or enhancing the existing California quail population level in this region is likely to be achieved through the implementation of the recommendations for habitat acquisition and protection and restoration of natural fire regimes that are provided in the Coastal Scrub and Chaparral Conservation Plan (California Partners in Flight 2004). The management strategies proposed for the San Diego NWR, as well as those being implemented on adjacent CDFW Ecological Reserve land, BLM lands, and other preserved lands are consistent with the recommendations presented in the Coastal Scrub and Chaparral Conservation Plan. The protection of significance areas of undisturbed habitat on the Refuge to support California quail, along with ongoing monitoring of quail populations by CDFW and others, would ensure that no adverse effects to existing quail populations on the Refuge or adjoining parcels would occur as a result of opening a portion of the Refuge to hunting.

CDFW also implements a Deer Management Program throughout the State. As part of that program, biologists develop hunting regulations, provide expertise on habitat and population assessments, compile harvest information, conduct and direct research needs, monitor and estimate populations, and respond to various public inquiries related to deer in California. CDFW is currently developing a *Strategic Plan for California Deer* to effectively manage the State's deer population.

CDFW maintains annual Deer Kill Reports (refer to Chapter 3) to track the take of deer throughout the State. The information included in these annual reports comes directly from returned deer tags (reported kill), but the report also includes estimated kill information, which is the reported kill number times a correction factor which is specific for each zone. This zone correction factor is an estimator of the non-reporting rates specific to each zone and takes into account those successful hunters that failed to submit the report card section of the deer tag. The estimated deer kill is considered a more realistic approximation of the actual deer harvest and is used primarily for population modeling and analysis.

In general, where hunting is permitted in the San Diego region (with some exceptions), the 2011 deer hunting season was split between an archery season (September 3, 2011, through September 25, 2011) and a general method season (October 22, 2011, through November 29, 2011). For the 2013/2014 season, the deer hunting season was further split as follows:

- Hunting for forked horn bucks by general method hunting from the fourth Saturday in October extending for 30 consecutive days and by archery hunting from the first Saturday in September extending for 23 consecutive days; and

- Hunting of either-sex deer by archery hunting from the first Saturday in September and extending for 44 consecutive days then reopened on the third Saturday in November and extend through December 31 and by muzzleloading from the third Saturday in December and extend through December 31.

The portion of the county that includes the Refuge is identified by CDFW in the hunting regulations as Zone D-16. In Zone D-16, some areas were only open to hunting on certain days during these periods. Within Zone D-16, 3,000 tags were available, and the take of one buck with a forked horn or better was permitted per tag. For the 2010 season, hunter success was approximately 12 percent, with an estimated total take for the area of 225 bucks. There were also several special hunts in 2011, including the San Diego antlerless deer hunt, a general method hunt in which 300 tags were available; a San Diego muzzleloading rifle hunt, allowing the take of a buck or doe, in which 80 tags were available; and a San Diego archery either sex hunt with a split season, in which 1,000 tags were available. In 2010, hunters involved in the San Diego antlerless deer hunt had a success rate of 20 percent. The success rate for the San Diego muzzle loading rifle hunt and San Diego archery either sex hunt was eight percent and six percent, respectively. CDFW also issues archery only tags, and there is no quota. Hunters with archery only tags may not possess a firearm or crossbow while hunting with this tag. In 2009, only five deer were taken in Zone D-16 by hunters with archery only tags; and statewide, an estimated 286 were taken with these tags. The CDFW recommends participation in the National Bowhunter Education Foundation's archery training course for all persons hunting with archery equipment.

CDFW evaluated the effects of deer hunting in 2004 and concluded the following:

> Sport hunting is a controversial issue. A segment of the public has contended that the loss of a single animal by hunting is a significant impact by virtue of the mortality of the individual. Because the activity of hunting deer will result in the death of individual animals, specific safeguards are included in the proposed action. These safeguards include limited quotas, specified seasons, bag and possession limits, and herd monitoring, which should result in removing deer at a level that is consistent with individual herd performance. Therefore, the proposed actions have been designed to avoid significant adverse effects on the environment.
>
> The removal of individual animals through hunting, together with other natural mortality, from any of the deer herds, should not significantly reduce herd size over the annual cycle. The proposed action is expected to result in maintaining the herd ratio objectives around the approved management plan objectives. The production and survival of young animals within each herd should replace the animals removed by hunting.

Based on the State's analysis, harvesting deer per State regulations should not have a significant adverse impact on the statewide or local deer population.

To minimize hunting related disturbance to listed and sensitive species within the McGinty Mountain and Las Montañas management areas, hunting would not be permitted during the bird breeding season (April 1 through September 15). In addition to minimizing indirect impacts related to disturbance, this restriction would also avoid the potential for nest disturbance or loss due to off-trail activity associated with hunting. Further, to minimize disturbance to target and non-target species, when the step-down hunt plan is prepared, the following management practices would be considered for incorporation into the plan's discussion of hunting within portions of the McGinty Mountain and Las Montañas management areas:

- limit the number of hunters permitted in the area on a given day by implementing a reservation system;
- restrict the type of shot used in these areas to federally approved non-toxic shot;
- maintain large contiguous areas of the Refuge as closed to hunting and other uses to provide adequate sanctuaries for wildlife;
- limit firearms used for hunting to shotguns (prohibit the use of rifles);
- require completion of Refuge-sponsored training related to regulations and protocols for hunting on the Refuge as a prerequisite to applying for a reservation to hunt on the Refuge; and
- require completion of the National Bowhunter Education Foundation's archery training course as a prerequisite for obtaining a reservation to hunt deer on the Refuge.

Within the south coastal area of California, which includes the areas in and around the San Diego NWR (Zone D-16), estimates of the deer population from 1990 through 1996 indicate a fairly stable population with a moderate increase in 1993 and 1994. The estimated population in 1996 was just under 20,000. As part of the development of the step-down hunt plan, Refuge staff will also coordinate with CDFW staff to develop a deer population baseline for the Refuge and implement a long-term annual monitoring plan. Under this proposal, the direct take of deer would occur in the McGinty Mountain and Otay Mesa and Lakes areas.

The proposal to permit hunting on a portion of the Otay Mesa and Lakes area would represent an expansion of an existing hunting area managed on either side of the proposed designated hunt area by CDFW (Otay Mountain Ecological Reserve) and BLM (Otay Mountain Wilderness). Hunting would be permitted in accordance with CDFW's regulations for Ecological Reserves. Based on the habitats present within the area proposed for hunting and limited accessibility (i.e., no motorized vehicle access into the area) to this area, disturbance to wildlife from hunting is expected to be low. In addition, no other uses would be permitted in this area, providing Refuge wildlife with sanctuary areas outside of the designated hunting area. Refuge biologists would periodically monitor this area to ensure that hunting activities are no adversely affecting wildlife. If impacts were identified, steps would be taken to minimize such impacts, including but not limited to, amending the final hunt plan to adjust seasons, permitted hunt days, species to be taken, and/or daily bag limits.

Based on the implementation of all of these measures, no significant impact to the local, regional, or statewide populations of deer, rabbits, quail, dove, or other wildlife permitted to be taken per CDFW regulations beyond the annual cycle is anticipated.

Other Wildlife-dependent Recreational Uses. The impacts to wildlife from activities related to wildlife observation, photography, environmental education, and interpretation, as proposed for the Refuge under Alternative C, would be similar to those described under Alternative A.

However, because these uses would be confined primarily to the designated trail system, and the number of trails proposed to remain open under Alternative C would decrease over existing conditions, the potential for disturbance to wildlife would be reduced over time as some trails are closed and returned to native habitat.

Trails. A designated trail system, as described under Alternative B, is also proposed under Alternative C. However, under this alternative several additional trail routes would be included within the designated trail system (i.e., a trail up to the top of Mother Miguel Mountain, a trail in the Sweetwater River area that connects the western ridge top to the Sweetwater Loop and River Trail, an interpretive trail on Lot 707, an interpretive boardwalk trail in the vernal pool restoration area). The construction and use of these additional routes are not expected to increase the potential for adverse short or long-term effects to wildlife over those addressed under Alternative B. Further, the measures described under Alternative B to minimize potential adverse effects would also be implemented under Alternative C.
Some trails designated for hiking only in Alternative B would be designated for non-motorized multiple use under Alternative C. Increasing the number trails open to multiple use could result in some increase in mortality to reptiles and invertebrates due to trampling. This increase is not expected to be significant, and total mortality would be expected to be lower than existing conditions that support substantially more linear miles of trails being used for multiple use than would be available for use under Alternative C. To minimize the long-term effects of trail use on these species, trails would be periodically monitored for evidence of the direct loss of reptiles and invertebrates throughout the life of the CCP. If warranted by the results of this monitoring effort, one or more trails may be closed to reduce excessive loss of these organisms due to trail use.

One important difference between Alternative B and C is that dogs would be permitted on Refuge trails under Alternative C provided the dog is maintained on a six-foot or shorter leash and all dog waste is cleaned up and properly removed from the site. Dogs would also be permitted on the Refuge in association with hunting in designated hunt areas. In these cases, dogs must be maintained under verbal control and must be leashed when present outside of the designated hunting area. As discussed previously, dogs may affect wildlife in a number of ways: predation, harassment, disturbance, disease, nutrient supplementation by feces, and owners protecting their dogs from wildlife.

With respect to predation, dogs are carnivores and thus have an evolved proclivity to chase wildlife. While centuries of captivity may have, to some degree, reduced domestic dogs' tendency to chase wildlife, and regular feeding may reduce domestic dogs' carnivorous tendencies, some dogs in wildlands actively chase wildlife. Successful predation of wildlife by domestic dogs has been frequently documented, including killing animals ranging from cattle to insects. Domestic dogs are known to kill a wide range of animals of conservation concern, including taxa that occur on the Refuge such as lizards (Koenig et al. 2002) and ungulates, including deer (Lowry 1978, Fuller 1990). Dogs kill birds ranging from domestic fowl to nesting seabirds and fledgling passerines. Dogs are such a widely-recognized threat to wildlife that USFWS regulations (Refuge Manual) allow Refuge personnel to shoot dogs that are chasing wildlife; 50 CFR 28.43 authorizes the disposal of dogs and cats observed in the act of killing, injuring, harassing, or molesting humans or wildlife.

Dog-walkers on the Refuge may also cause the loss of some species, as they may perceive wildlife (e.g., rattlesnakes, coyotes) as a threat to their dogs and may be more likely to kill snakes (including red diamondback rattlesnake, which is a California species of special concern) when they are protecting a dog than they would be if they were alone.

Harassment is intentional disturbance by dogs and is essentially unsuccessful predation. Harassment disrupts normal behavior for the wildlife—ranging from momentary increased vigilance to fleeing in an attempt to escape—and may result in injury, exhaustion, displacement from territory, suspension of foraging, suspension of thermoregulation, or suspension of parental care. Harassment by dogs certainly affects an animal's energetic balance, as it is forced to expend energy, or reduce foraging time, to avoid a predator.

Disturbance is likely the most prevalent deleterious effect of dogs in wildlife habitat but one of the more difficult to demonstrate, since it involves a change in behavior by the wildlife and not necessarily the dog. Disturbance, as addressed here, is a reaction by a wild animal to the perceived threat presented by a dog when the dog is not pursuing, or even necessarily aware of, the wild animal.

Animals have evolved the ability to differentiate potential predators from non-predators. Tinbergen (1951), Lorenz (1939), and Hinde (1954) have demonstrated that animals without previous exposure to predators exhibit anti-predator behaviors (e.g., crouching, alarm calls, mobbing) when confronted with a likeness of a predator and show such behaviors, to a lesser extent or not at all, when confronted with a likeness of an herbivore; this supports the contention that animals can not only tell predators from harmless animals but, to some degree, have an innate ability to do so. Many studies (Miller et al. 2001, Lord et al. 2001, Randler 2006, Lafferty 2001, Mallord et al. 2007, Forrest and Cassady St. Clair 2006, Antos et al. 2007, Sime 1999, Fernandez-Juricic and Telleria 2000, Mitchell et al. 1988) document the fact that dogs disturb wildlife in a variety of ways, habitats, and contexts. The disturbance need not even be visual. Randler (2006) found that broadcasting a barking dog increased vigilance in coots (*Fulica atrata*) more than did broadcast coot alarm calls or chaffinch (*Fringilla coelebs*) song. Refuge personnel have observed wildlife (e.g., shrikes, burrowing owls, Cooper's hawks, rabbits, coyotes, several chaparral/coastal sage scrub bird species) in the presence of dogs on many occasions. At the approach of a dog, animals frequently flush, run, stop foraging, take cover, or otherwise alter their normal behavior as the dog gets closer.

The limited research into the effect of dog disturbance to wildlife suggests that presence of dogs in wildlife conservation areas reduces abundance and diversity of wildlife. Banks and Bryant (2007) conducted a study showing that in the wildlife conservation areas they studied, bird abundance and diversity following the passage of a dog-walker were reduced by 41 percent and 35 percent, respectively, compared to control transects where no dog-walker or a lone pedestrian had passed. Humans walking alone, without dogs, also reduced abundance and diversity but by less than half the amount induced by dogs. They included areas where dogs are frequently walked and areas in which dog walking is prohibited to see whether there was a habituation effect (there was no significant habituation effect). They compared the effect of a single pedestrian, a pedestrian with a dog, and multiple pedestrians without a dog, to determine whether the observed reduction in bird diversity and abundance was due to the presence of two disturbers rather than one or the fact that one of them was a dog. Estimates of bird abundance and diversity were not significantly different between a single human and two humans, without dogs, confirming that birds responded additively to presence of dogs. All of the trials were conducted using leashed dogs.

Lenth et al. (2008) also examined distribution of wildlife in conserved habitat that allowed dogs and other habitat areas that did not. They found that mule deer, rabbits, squirrels, and prairie dogs were less dense within 100, 50, 50, and 25 meters of trails, respectively, in areas visited by dogs than in areas where dogs were prohibited. They also observed that bobcat detections were less frequent in areas that allowed dogs.

Mallord et al. (2007) linked population response of a ground-nesting passerine bird—the woodlark (*Lullula arborea*)—to disturbance, primarily by off-leash domestic dogs. They found that density of woodlarks throughout a suitable habitat patch was lower for patches with higher levels of disturbance. They also used a logistic regression model to estimate colonization probability relative to disturbance levels and found that more frequently disturbed areas were less likely to be colonized, with the colonization probability falling under 50 percent when the disturbance rate exceeded eight disturbances per hour.

Off-leash dogs may be more likely to cause disturbance to wildlife than leashed dogs, because they cover more area, are free to go faster (which means they are perceived as more dangerous by wildlife, and they can disturb wildlife in a greater area in a given amount of time), can continue to chase wildlife that flees for a greater distance than the length of the leash, and, if sufficiently distant from their walkers, constitute two sources of disturbance (dog, walker) rather than one (dog and walker together). Off-leash dogs frequently leave the trail. Miller et al. (2001) found that all of the wildlife species they studied (white-tailed deer [*Odocoileus virginianus*], American robin [*Turdus migratorius*], vesper sparrow [*Poocetes gramineus*], and western meadowlark) showed longer flush distances, longer distances moved, and greater alert distances (for deer) when a disturbance (pedestrian, dog, or both) was off-trail as opposed to on-trail.

Compliance with the leash requirement currently in place on the Refuge is far from 100 percent but has not been quantified. When encountering off-leash dogs, Refuge staff inform or remind the public to leash their dog. Signs have been posted at major use areas informing the public that the Refuge is not a leash-free area and that leash regulations will be enforced; signs also offer information on where there are designated leash-free areas in proximity to the Refuge. Refuge law enforcement may also issue citations for non-compliance.

Dogs have the potential to transmit disease to wildlife (and vice-versa). Diseases that dogs can transmit to wildlife include:

- Parvovirus, which affects other canines and was the source for wolf pup mortality in Glacier National Park area in the early 1990s (canines that occur on the Refuge include grey fox and coyote);
- Canine distemper, which nearly wiped out the population of island fox (*Urocyon littoralis*) on Santa Catalina Island and was thought to have been introduced by a domestic dog (another outbreak of this disease, thought to have originated among domestic dogs, caused a large die-off of lions in the Serengeti National Park in Tanzania in the mid-1990s);
- Muscle cysts (*Sarcocystis* spp.), which can affect ungulates like deer and elk (mule deer occur on the Refuge);
- Leptospirosis, a bacterial disease that affects the kidneys and urinary tract of most species of mammals; and
- Parasites such as ticks, tapeworms, and fleas, which are well-known problems in dogs that can be passed to other wildlife.

Some of these pathogens are transmitted through feces that dogs leave on or beside the trail. In areas where dog feces are particularly abundant (e.g., at the end of Par Four Drive), they may have the potential to affect abundance and distribution of plants, including federally endangered species (i.e., San Diego ambrosia) by supplementing soil nutrients to the benefit of the ambrosia's competitors. In general, native coastal sage scrub plant species evolved in relatively nutrient-poor soils. Where supplemental nitrogen is provided by air pollution, it

facilitates the rapid growth and proliferation of exotic annual weeds (Allen et al. 2005). Nitrogen supplementation by dog feces may have a similar effect perhaps more localized effect.

As stated previously, the threshold for significance of a deleterious effect on wildlife includes "a permanent loss . . . of occupied sensitive species habitat or the direct mortality of individuals of sensitive species as a result of a proposed action." It could be argued that a significant deleterious effect—the reduction in bird abundance and diversity that Banks and Bryant (2007) found correlated with dog use of an area—has already occurred on the Refuge due to the frequent presence of dogs on the more heavily visited areas of the Refuge (e.g., the "Interpretive loop"). However, only one short-duration observational study of public use at a portion of the Sweetwater River Trail has been conducted to assess the numbers of dogs (leashed and off-leash) present, and no studies have been conducted to detect changes in populations of bird species.

While the deleterious effect of allowing dogs on the Refuge is currently not quantified, it is reasonable to assume that a deleterious effect to wildlife, particularly with respect to bird abundance and diversity in areas where trails exist or are proposed, would continue under Alternative C. Some of these negative effects would be reduced as a result of the implementation of the designated trail system proposed under Alternative C, which would eliminate trails in many sensitive areas and provide larger areas of undisturbed native habitat.

Negative effects on wildlife would also be reduced by increased efforts of the Refuge to educate dog owners about the need to keep their dog leashed, stay on designated trails, and remove all dog waste. In addition, information about the potential threats to unleashed dogs (e.g., rattlesnakes, ticks) would be provided. If, based on monitoring and other field observations, it is determined that the presence of dogs on the Refuge is having a substantial effect on wildlife in one or more areas, specific trails or the entire Refuge could be closed to dogs without prior notice. Permission to bring dogs onto the Refuge could also be revoked at any time without notice if unleashed dogs or dog waste becomes a chronic problem on the Refuge.

The trail proposals described under Alternative C would provide greater benefits to wildlife than Alternative A but potentially less benefits than Alternative B.

Research. The potential effects to wildlife of permitting compatible research activities on the Refuge would be the same as those described under Alternative A.

Refuge Operations

The facilities proposed for construction on Rancho Jamul would occur in areas already experiencing moderate levels of human activity, therefore, the temporary increases in activity related to construction and the minor permanent increase in the level of human activity associated with the new facilities would have a limited effect on wildlife.

5.4.4 Alternative D

Wildlife and Habitat Management

Management actions under Alternative D are generally the same as those provided under Alternative B; therefore, the impacts to wildlife of implementing these actions would be similar to those described under Alternative B. Alternative D does however include a

proposal to monitor for and control, when present, feral pigs on the Refuge in accordance with Appendix E.

The implementation of actions associated with feral pig control could result in disturbance to wildlife due to monitoring activity, as well as disturbance associated with the presence of marksmen and dogs, the discharge of firearms, and the deployment of helicopters into remote habitat areas. Non-target wildlife could be attracted to traps set up for corralling feral pigs. The traps most likely to be used on the Refuge are open-topped corral style traps, with deer being the most likely non-target wildlife species to be attracted to these traps. Because of the trap design, deer can easily escape by leaping over the perimeter fencing. Smaller wildlife would be able to escape through the paneling. These traps would be open and monitored for several days before setting. If large numbers of non-target wildlife are accessing the bait, the trap may be moved. Despite the features incorporated into the trap design to minimize adverse effects to non-target wildlife, it is possible, but unlikely, that non-target wildlife could be directly impacted by trapping efforts.

To minimize the potential for adverse effects to non-target wildlife:

- feral pig traps would be sited to minimize disturbance to sensitive habitat and the species it supports, and areas identified as sensitive bird nesting habitat would be avoided during the nesting season (March 1 through September 1);
- activities in areas supporting burrows or ground nesting species would be minimized;
- access to the trapping sites would be confined to the extent feasible to existing trails and roads;
- traps, and access to the traps, would not occur in riparian and other wetland habitats and would be sited to avoid any impacts to adjacent wetlands (e.g., ponds, vernal pools, tributary drainages);
- access into areas within the ordinary high water mark or within the bed and bank of any drainage would be minimized;
- traps would be sited so as not to impede the movement of any wildlife species; and
- if fencing is used to protect environmentally sensitive areas from feral pig damage, the fencing would be constructed with openings at ground level so as not to restrict the movement of small wildlife.

Pest Management

The analysis of potential effects to wildlife from the implementation of the IPM Plan would be the same under this alternative as described previously for Alternative B.

Public Use

Hunting. Under Alternative D, hunting would be permitted on approximately 160 acres within the Otay Mesa and Lakes area. The hunting program, which would be further refined during the preparation of a step-down hunt plan, would generally be conducted in accordance with State regulations for Ecological Reserve areas. The wildlife species that could be taken under this proposal are outlined in the Table 5-4. As stated under Alternative C, based on the habitats present within the area proposed for hunting and limited accessibility (i.e., no motorized vehicle access into the area) to this area, disturbance to wildlife from the proposed hunting program is expected to be low. In addition, no other uses would be permitted in this area, providing Refuge wildlife with sanctuary areas outside of the designated hunting area. Refuge biologists would periodically monitor this area to ensure that hunting activities are no adversely affecting wildlife. If impacts were identified, steps would be taken to minimize such impacts, including but not limited to, amending the hunt plan to adjust seasons, permitted hunt

days, species to be taken, and/or daily bag limits. The implementation of these measures would avoid significant impacts to the local, regional, or statewide populations of deer, rabbits, quail, dove.

Other Wildlife-dependent Recreational Uses. The impacts to wildlife from activities related to wildlife observation, photography, environmental education, and interpretation, as proposed for the Refuge under Alternative D, would be similar to those described under Alternative A. However, because these uses would be confined primarily to the designated trail system, and the number of trails proposed to remain open under Alternative D would decrease over existing conditions, the potential for disturbance to wildlife would be reduced over time as some trails are closed and returned to native habitat.

Trails. Based on the similarity of the designated trail systems proposed under Alternatives D and C, the potential impacts to wildlife from trail use would be similar, although some reduction in the level of impact is likely under Alternative D due to the reduction in the number of trails proposed and the provision of additional pedestrian only trails.

The impacts associated with permitting dogs on the Refuge would be similar to those described under Alternative C; however, under Alternative D, dog walking would only be permitted on trails designated for multiple use. Therefore, no dogs would be permitted in the Las Montañas area under this alternative.

Research. The potential effects to wildlife of permitting compatible research activities on the Refuge would be the same as those described under Alternative A.

Refuge Operations

The facilities proposed for construction on Rancho Jamul would occur in areas already experiencing moderate levels of human activity, therefore, the temporary increases in activity related to construction and the minor permanent increase in the level of human activity associated with the new facilities would have a limited effect on wildlife.

5.5 Effects to Federally and State Listed Endangered and Threatened Species and Other Species of Concern

The direct and indirect effects to endangered and threatened species and other species of concern as a result of implementing the various alternatives are described in this section. An adverse effect to these species would be considered significant if:

- An action would result in the direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of a federally or State listed plant species.

- Permanent loss of occupied listed species habitat, substantial loss of foraging or nesting habitat for a listed or special status species, or the direct mortality of individuals of a listed species would occur as a result of a proposed action.

An indirect beneficial impact would occur if an action would result in the creation of substantial new areas of foraging, roosting, or nesting habitat for listed or special status wildlife species or substantial new areas of habitat appropriate to support listed or special status plant species.

Information about the listed species and other species of concern that are known to occur or have the potential to occur on the Refuge is provided in Chapter 3.

5.5.1 Alternative A – No Action

Wildlife and Habitat Management

Activities related to surveying and monitoring of listed and sensitive species can result in temporary disturbance to listed species, particularly if implemented during the nesting season (e.g., least Bell's vireo, which nests from about March 15 to September 15; coastal California gnatcatcher, which nests from about February 15 to August 15). Disturbance to nesting birds can cause adult birds to momentarily leave the nest, putting chicks or eggs at risk of predation. To reduce the potential for disturbance, protocols, such as limiting the number and duration of visits to areas supporting nesting birds, are adhered to when monitoring of nesting birds is deemed necessary. Past experiences have demonstrated that when these protocols are followed, the benefits of the data provided as a result of monitoring outweigh the minor temporary adverse effects that occur during monitoring. There is also the potential for trampling of listed plants and butterfly larvae during surveys; therefore, only qualified individuals are permitted to survey sites when listed or sensitive species are most vulnerable to impacts from human activity.

Other activities such as restoration and enhancement, invasive species removal, trash cleanups, fencing, posting, and fuel break creation/maintenance are scheduled to occur outside of the nesting season to avoid impacts to listed and sensitive bird species. To avoid impacts to sensitive plant species, potential work areas are surveyed prior to implementing any of these activities in an effort to identify and, if necessary, flag areas supporting listed or sensitive species to minimize the potential for inadvertent trampling or removal of any sensitive plants. All activities are limited in areas known to support or have the potential to support sensitive butterfly species (i.e., Quino checkerspot, Hermes copper).

Pest Management

Herbicides currently used on the Refuge to control invasive, weedy species include products with the active ingredient glyphosate, fluazifop-P-butyl, and chlorsulfuron. All applications of these products are made consistent with label requirements and any conditions applied to product use as part of the PUP approval process.

Glyphosate, which is a non-selective herbicide, is described by the USEPA (1993) as "no more than slightly toxic to birds" and "practically non-toxic to fish, aquatic invertebrates, and honeybees." The effects of glyphosate on birds, mammals, fish and invertebrates are considered minimal (USEPA 1993); therefore, no significant adverse effects to listed and sensitive birds, mammals, or terrestrial invertebrates are anticipated. Surfactants, which may be mixed with glyphosate prior to application, may be highly toxic to aquatic organisms, including aquatic invertebrates. In addition, because this product is non-selective, drift during application can harm non-target plants, including listed and sensitive species. To avoid adverse effects to listed and sensitive plant species, as well as to San Diego fairy shrimp, care to avoid drift or runoff must therefore be taken during any application of this product.

Fusilade DX, with the active ingredient fluazifop-P-butyl, is a selective, post-emergent herbicide registered for the control of perennial and annual grass weeds. It is considered by the USEPA to be practically non-toxic to bird and mammal species but highly toxic to fish and aquatic invertebrates; and it has a very low potential for toxicity to honeybees. At unusually

high application rates, fluazifop-p-butyl has been shown to inhibit fungal growth (Tu et al. 2001); however, there is no evidence of significant effects on fungal populations when applied at recommended field rates. As with glyphosate, care to avoid drift or runoff must be taken during any application of this product, particularly if used in the vicinity of vernal pool habitat that supports San Diego fairy shrimp. The potential for drift in the vicinity of native grasses and crytobotic crust should also be avoided.

Chlorsulfuron controls select broadleaf weeds and non-native grasses and is practically non-toxic to birds, mammals, fish, aquatic invertebrates, honeybees, and beetles. Toxicity to aquatic plants can, however, range from non-toxic to very highly toxic; therefore, drift and the potential for runoff into vernal pools following application should be avoided to ensure no adverse effects to sensitive vernal pool plant species will occur. This product also has the potential to affect non-target plant species; therefore, to avoid any adverse effects to listed and sensitive plant species, use of this product is limited to ground application only (i.e., spot treatment of specific plant), and use is limited to less than one acre per treated site.

Control and/or eradication of invasive aquatic organisms within the Sweetwater River and ponds of the Otay-Sweetwater Unit would benefit the recovery of listed and sensitive species such as arroyo toad, California red-legged frog, and southwestern pond turtle if one or more of these species were to be reestablished either intentionally or naturally on the Refuge.

Public Use

Impacts to listed and sensitive species from the implementation of the wildlife-dependent recreational uses currently occurring on the Refuge would be the same as those previously described for Refuge wildlife and vegetation.

Primary impacts to listed and sensitive species result from unauthorized off-trail activity, as well as trails that extend within or immediately adjacent to habitat essential to the recovery of listed species and the protection of sensitive species. Listed and sensitive species, such as the least Bell's vireo, coastal California gnatcatcher, Quino checkerspot butterfly, and Hermes copper butterfly, as well as other sensitive species described in Chapter 3, are all subject to disturbance and habitat fragmentation due to the extent of trails currently present on the Refuge. The presence of dogs on the trail also results in disturbance to sensitive wildlife, as described previously. Off-trail activity also has the potential to adversely affect listed and sensitive plant species, particularly San Diego ambrosia, which grows immediately adjacent to existing trails in the Sweetwater River area. To protect these species, fencing and signage have been installed in areas where sensitive species are known to occur in an effort to keep visitors on existing trails. Additional fencing, signage, and realignment of trails away from areas that support sensitive species would further reduce the potential for adverse effects. Listed vernal pool species on the Otay-Sweetwater Unit are protected by perimeter fencing, while the vernal pools on the Del Mar Mesa Vernal Pool Unit would remain subject to degradation by trail users under Alternative A.

5.5.2 Alternative B

Wildlife and Habitat Management

The expansion of monitoring and survey efforts on the Refuge would be conducted in accordance with the practices and protocols described under Alternative A; therefore, no significant adverse effects to listed and sensitive species are anticipated from these activities.

The other wildlife and habitat management actions proposed under Alternative B, including restoration and enhancement of native habitats and establishment of new populations of listed or sensitive species in appropriate locations within the Refuge, would be conducted outside of the nesting season to avoid disturbance and other potential impacts to nesting birds; would occur only after a survey of the affected site is conducted to ensure that no listed or sensitive species, particularly plants and invertebrates, would be impacted; and would incorporate BMPs to avoid indirect impacts related to off-site erosion and unnecessary ground disturbance that could encourage establishment of non-native invasive plants. The implementation of these measures would minimize the potential for any direct or indirect impacts to listed or sensitive species. Wildlife and habitat management actions included under Alternative B are intended to support native species and habitats and are therefore expected to result in beneficial effects to the listed and sensitive species present on the Refuge.

Alternative B does not include a proposal to eradicate feral pigs should they be identified on the Refuge. Therefore, if feral pigs become established on the Refuge, the listed and sensitive species conserved on the Refuge could be subject to the same adverse effects described above for habitat, vegetation, and wildlife.

Pest Management

Under Alternative B, the control of invasive non-native species would be implemented in accordance with the proposal included in the draft IPM Plan (Appendix D). All pesticides considered for use on the Refuge per the IPM Plan would require review and approval through the PUP process, and chemical profiles would be prepared to assess the potential effect of each pesticide on Refuge-specific species, including listed species. This assessment may result in the identification of product specific BMPs that must be implemented during application and/or requirements for application rates that are lower than those permitted on the product label.

As part of the draft IPM Plan, three additional herbicides have been evaluated for use on the Refuge. The products (presented in Table 5-2) include the active ingredients oryzalin, triclopyr, and clethodim. With respect to listed species, oryzalin can pose a threat to endangered aquatic species in shallow water; therefore, the chemical profile for this product requires that use of this product be limited to one application per year at 1.5 pounds per year acre per year, that a minimum 25-foot buffer zone between all upland treatment sites and the high water mark of the nearest surface water resources be maintained, and that the oryzalin may not be applied to sites upslope to surface water resources with greater than a 10 degree slope. Triclopyr is also considered highly toxic to fish and aquatic invertebrates; therefore, the chemical profile for this product requires that a 25-foot treatment buffer zone from surface water resources must be maintained during application. The potential effects of these products on sensitive vernal pool species would be considered when evaluating potential methods for controlling non-native invasive weeds in proximity to vernal pool habitat.

None of these products poses a significant threat to birds. Although there is the potential for direct exposure to triclopyr through the consumption of the berries or fruits of treated plants, the USEPA considers this product to be only slightly toxic to birds. Additionally, this type of exposure on the Refuge is unlikely, as control of woody invasives is typically conducted by cutting the shrub or tree down and applying the herbicide to the cut stump.

Studies indicate that all of these products are practically non-toxic to non-toxic to honeybees. Information regarding effects to other terrestrial invertebrates is not available; therefore, care should be taken in applying these products in area that support listed or sensitive butterflies.

Triclopyr has also been documented are inhibiting growth of some species of fungi (Tu et al. 2001), but use of this product in upland areas supporting crytobiotic crust is not proposed.

With respect to listed and sensitive plants, all of these products have some potential for damage to non-target plants. However, the implementation of the BMPs described previously in Effects to Water Quality and Effects to Air Quality, as well as the product specific BMPs included in the chemical profiles, would ensure that no adverse effects to listed or sensitive plant species would result from the use of herbicides on the Refuge.

Public Use

Hunting and Fishing. Under Alternative B, the Refuge would remain closed to hunting and fishing.

Other Wildlife-dependent Recreational Uses. Impacts to listed and sensitive species from activities related to wildlife observation, photography, environmental education, and interpretation would be similar to those previously described under Effects to Habitat and Vegetation Resources and Effects to Wildlife. As these uses would be confined primarily to the designated trail system, impacts would more likely be related to noise and disturbance in proximity to the trail, rather than trampling. However, off-trail activity, although not permitted, cannot be fully avoided. To minimize disturbance to sensitive bird species, future trail alignments or realignments would attempt to provide an adequate buffer (i.e., at least 100 feet) between the edge of known nesting areas and the trail tread.

Measures such as fencing and signage would be used in areas where the trail occurs in proximity to sensitive plant species or habitats with the potential to support sensitive butterfly species. Where off-trail activity is more likely to occur due to some feature such as a pond, viewpoint, large rock formation and this off-trail activity could impact sensitive habitat or species, one of several measures would be implemented: 1) realign the trail to provide access to the feature while avoiding sensitive species or habitat areas; 2) realign the trail away from the feature so it is not visible to trail users; or 3) provide fencing along the trail to encourage confining all activities to the designated trail. Appropriate trail alignments, along with measures implemented to discourage off-trial activity, would reduce the potential for significant adverse effects to listed and sensitive species from trail activities related to wildlife observation, photography, environmental education, and interpretation.

Trails. The discussion of impacts and measures to minimize impacts described above would also be applicable to the designated trail system proposed under Alternative B.

Research. The potential effects to sensitive species from the implementation of compatible research activities on the Refuge would be the same as those described under Effects to Habitat and Vegetation Resources and Effects to Wildlife.

Refuge Operations

Proposals related to the construction of parking lots, installation of a kiosk, development of a Refuge visitor contact station, and realignment of trails all have the potential to affect one or more listed or sensitive species. To avoid any adverse direct or indirect impacts to these species, the measures listed here will be implemented as part of all future construction projects proposed on the Refuge.

1. As part of the development of construction plans, specific site designs, or trail realignments, a survey of the potential project site will be conducted to identify the location of any listed, sensitive, or narrow endemic species. If listed species are present within the proposed project footprint, the project will be designed to avoid impacts to the species or an alternative site will be selected.

2. To protect all listed and sensitive avian species, vegetation clearing and construction will be performed generally outside of the nesting and breeding seasons. (For the purposes of implementation, the following general breeding season dates shall be used: January 15 to July 31 for raptor species; March 15 to September 15 for riparian species; and February 15 to August 15 for upland species.) It may be necessary to modify these dates to reflect the species known or expected to occur on a specific site.

3. Every effort will be made to avoid impacts to wetlands; where construction is necessary, such as the construction of a bridge, an evaluation of wetland avoidance options and the identification of specific measures to minimize any impacts will be conducted. For unavoidable impacts, adequate mitigation in the form of wetland creation and/or restoration will be provided.

4. Adequate habitat buffers will be provided when development is proposed in proximity to sensitive habitats such as riparian areas.

5. Trails will be aligned to avoid areas known to support sensitive plant and wildlife species.

6. Areas that support listed or sensitive species and/or sensitive habitat in or adjacent to work areas will be fenced and/or flagged prior to the initiation of any earthwork or construction.

7. A pre-construction meeting will be conducted involving all personnel, including contractors, who will be working on the site to review the practices to be followed to avoid impacts to sensitive resources.

8. Whenever possible, native plant species will be salvaged and relocated into suitable habitat.

9. Temporary impact areas will be revegetated with appropriate native plants to avoid erosion or sedimentation into areas supporting listed or sensitive species.

10. All planting stock will be inspected to ensure that it is free of pest species that may invade natural areas, including but not limited to Argentine ants (*Iridomyrmex humii*), fire ants (*Solenopsis invicta*), and other pests.

11. The use of outdoor lighting in association with new construction shall be limited to that needed for safety and security and would be fully shielded to avoid spillover of lighting into sensitive habitat areas.

In addition to the measures described previously, to minimize impacts associated with the implementation of various public uses on the Refuge, significant portions of the Refuge will be closed to public use to provide sanctuaries for listed and sensitive species. As a result, no significant adverse effects to listed or sensitive species are anticipated under Alternative B.

There is limited, if any, potential for impacts to listed or sensitive species as a result of constructing Refuge-related facilities at Rancho Jamul because the site is already developed and already supports a range of similar facilities.

5.5.3 Alternative C

Wildlife and Habitat Management

The analysis of impacts to listed and sensitive species of implementing the wildlife and habitat management actions proposed under Alternative C, as well as the mitigation measures proposed to minimize these impacts, would be essentially the same as those described for Alternative B.

Pest Management

The analysis of impacts to listed and sensitive species from the implementation of an IPM Plan for the Refuge and the BMPs and other measures proposed to minimize these impacts would be essentially the same under Alternative C as those described for Alternative B.

Public Use

Hunting. The proposal to open portions of the McGinty Mountain, Las Montañas, and Otay Mesa and Lakes areas to hunting could result in impacts to listed and sensitive wildlife related to disturbance and trampling during off-trail activity by hunters and hunting dogs. The wildlife species present in this area that could be affected include coastal California gnatcatcher, the MSCP-covered bird species listed in Table 3-7 that occur in southern mixed chaparral, oak woodland, and coastal sage scrub, and sensitive reptiles and the Hermes copper butterfly.

Sensitive plant species present in this area that could be directly or indirectly impacted by hunting include San Diego thornmint, Otay tarplant, and the MSCP-covered plant species listed in Table 3-7 that occur in coastal sage scrub, southern mixed chaparral, and oak woodland. Off-trail activity could result in disturbance to nesting gnatcatchers and other birds and potentially in the loss of one or more nests during the breeding season. The loss of gnatcatcher eggs or chicks would be considered a significant adverse effect; therefore, to avoid impacts to gnatcatchers, hunting would not be permitted in the McGinty Mountain and Las Montañas areas during the nesting season (February 15 to August 15). This measure would also avoid the potential for disturbance to other sensitive bird species during the nesting season.

Potential effects to sensitive plant species and disturbance to sensitive butterfly habitat can be minimized by excluding areas that support these species from the designated hunting area and/or noting areas to be avoided on a map provided to hunters or by posting or otherwise marking the areas to be avoided in the field.

The implementation of a hunting program on the Refuge would result in direct and indirect impacts to southern mule deer, a MSCP-covered species. To avoid adverse impacts to the region's mule deer population due to overharvesting, harvest levels would be determined based on existing knowledge of the populations of these species within the region and would be evaluated annually based on estimated annual take and estimated population size. As a result, no significant impact to the local or regional southern mule deer population is anticipated.

San Diego black-tailed jackrabbit, a California species of special concern but not covered by the MSCP, may also be present in the designated hunting areas. Hunting of jackrabbit would only be permitted in a portion of the Otay Mesa and Lakes area, a relatively small portion of the land between CDFW and BLM hunt areas; therefore, the potential for take on the Refuge is low. The remainder of this Refuge parcel would provide sanctuary for the species.

Jackrabbit hunting is not proposed for the designated hunting areas within the McGinty Mountain and Las Montañas areas, however, there is also a potential for the unintentional wounding or take of this species in the course of hunting desert cottontail and brush rabbits in these areas. To minimize this potential, the training session required prior to hunting on these portions of the Refuge would include a discussion on the need to verify the species of rabbit present prior to shooting.

Implementing the measures describe above would minimize impacts to sensitive species related to hunting.

Other Wildlife-dependent Recreational Uses.
As discussed under Alternative B, listed and sensitive species would be subject to direct and indirect impacts due to disturbance and potential trampling associated with wildlife observation, photography, environmental education, and interpretation. The measures presented under Alternative B to minimize these impacts would also be implemented under Alternative C.

Trails. The discussion of impacts and measures to minimize impacts related to trail use as described under Alternative B would also be applicable to Alternative C. However, unlike Alternative B, dog walking would be permitted on trails under Alternative C. The effects to listed and sensitive species of allowing dogs on the Refuge under Alternative C would be similar to those described under Effects to Wildlife for Alternative C.

Research. The potential effects to sensitive species from the implementation of compatible research activities on the Refuge would be the same as those described under Effects to Habitat and Vegetation Resources and Effects to Wildlife.

Refuge Operations
The impacts related to the proposals in Alternative C related to Refuge operations would be similar to those described previously under Alternative B. To avoid any adverse direct or indirect impacts to these species, the measures presented under Alternative B would also be implemented as part of all future construction projects proposed on the Refuge under Alternative C.

Alternative C includes several additional trail proposals including the construction of an interpretive boardwalk trail within the Shinohara vernal pool restoration site. This trail would facilitate guided interpretive walks through a portion of the site's vernal pool habitat. To ensure that no adverse effects to listed or sensitive species supported in the pools occur during or after construction, the following measures would be implemented:

- To minimize the extent of ground disturbance and protect the microhydrology of the site, construction techniques for the boardwalk would include pin foundations or other comparable system in which the posts holding up the boardwalk sit on the surface of the ground; and

- To avoid any unauthorized off-trail activity, use of the boardwalk would be limited to guided walks.

The implementation of these measures would ensure that no significant adverse impacts to listed and sensitive vernal pool species would occur.

There is limited, if any, potential for impacts to listed or sensitive species as a result of constructing Refuge-related facilities at Rancho Jamul because the site is already developed and already supports a range of similar facilities.

5.5.4 Alternative D

Wildlife and Habitat Management

The analysis of impacts to listed and sensitive species of implementing the wildlife and habitat management actions proposed under Alternative D, as well as the mitigation measures proposed to minimize these impacts, would be essentially the same as those described for Alternative B. Alternative D also includes a proposal to monitor for and control when present feral pigs on the Refuge in accordance with Appendix E.

As described previously, activities associated with monitoring, trapping, and lethally removing (shooting) feral pigs has the potential to result in adverse effects to vegetation, including listed and sensitive plant species due to trampling during monitoring or control efforts. Damage could also often during trap installation. To avoid such impacts, ground disturbance and vegetation removal would be minimized within any designated critical habitat, sensitive vegetation communities, or areas occupied or historically known to support listed or sensitive plant species (e.g., riparian habitat, vernal pools). In addition, using GIS data of the trapping locations, the Refuge biologist or other qualified biologist will conduct a vegetation survey at least one week prior to trap installation to determine presence or absence of sensitive vegetation, and if necessary, the biologist will flag sensitive vegetation and notify trap installers about areas to avoid.

There is also the potential for impacts to sensitive and listed wildlife species (e.g., least Bell's vireo, California gnatcatcher, cactus wren, burrowing owl, bald eagles, orange-throated whiptail, San Diego horned lizard) due to disturbance from monitors, marksmen and their dogs, helicopters, and activities associated with the installation of traps. To avoid such impacts, mitigation measures and restrictions have been developed that will be implemented during all feral pig monitoring and control efforts. These measures and restrictions are presented here.

- Prior to implementing control or installing traps, the Refuge biologist will provide recommendations or restrictions for access within the affected area and/or recommendations for potential placement of traps within the site.

- Using GIS data of the trapping locations, the Refuge biologist or other qualified biologist will conduct a survey of the area at least one week prior to trap installation to determine presence or absence of sensitive wildlife, and if necessary, the biologist will flag sensitive habitat areas and notify trap installers about areas to avoid or of required setbacks from sensitive habitat areas.

- A qualified biologist shall visit the trapping sites periodically throughout the duration of the trapping project to ensure that all practicable measures are being employed to avoid incidental disturbance to listed species.

- Trapping and helicopter flights will be prohibited within 6,000 feet of known bald eagle or golden eagle nesting or wintering sites during the species' nesting or wintering seasons.

- Ground disturbing activities, including trap placement, would be minimized within known or suspected habitat for Quino checkerspot butterfly, as well as within areas supporting host plants for this species.

Pest Management

The analysis of impacts to listed and sensitive species from the implementation of an IPM Plan for the Refuge and the BMPs and other measures proposed to minimize these impacts would be essentially the same under Alternative D as those described for Alternative B.

Public Use

Hunting. Under Alternative D, only a portion of the Otay Mesa and Lakes area would be opened to hunting, and the boundaries of that hunting area were delineated in a manner that would minimize the potential for adverse effects to listed and sensitive species. Access to the hunting area would be via adjacent hunting areas managed by CDFW and BLM.

Southern mule deer, an MSCP-covered species, would be impacted directly and indirectly from hunting. To avoid adverse impacts to mule deer due to overharvesting, harvest levels would be determined based on existing knowledge of the populations of the species within the region and would be evaluated annually based on estimated annual take and estimated population size. As a result, no significant impact to the local or regional southern mule deer population is anticipated.

Potential impacts to San Diego black-tailed jackrabbit would be similar to those described under Alternative C.

Other Wildlife-dependent Recreational Uses.
The analysis of impacts to listed and sensitive species from trail activities related to wildlife observation, photography, environmental education, and interpretation and the measures proposed to minimize these impacts would be essentially the same under Alternative D as described for Alternative B.

Trails. The discussion of impacts and measures to minimize impacts related to trail use as described under Alternative B would also be applicable to Alternative D. However, unlike Alternative B, dog walking would be permitted on all multiple use trails under Alternative D. The effects to listed and sensitive species of allowing dogs on the Refuge under Alternative D would be similar to those described under Effects to Wildlife for Alternative C.

Research. The potential effects to sensitive species from the implementation of compatible research activities on the Refuge would be the same as those described under Effects to Habitat and Vegetation Resources and Effects to Wildlife.

Refuge Operations

The impacts related to the proposals in Alternative D related to Refuge operations would be similar to those described previously under Alternative C. To avoid any adverse direct or indirect impacts to these species, the measures presented under Alternative C would also be implemented as part of all future construction projects proposed on the Refuge under Alternative D.

There is limited, if any, potential for impacts to listed or sensitive species as a result of constructing Refuge-related facilities at Rancho Jamul because the site is already developed and already supports a range of similar facilities.

5.6 Effects to Cultural Resources

The NHPA establishes the Federal government's policy on historic preservation and the programs through which that policy is implemented. Relevant policies on historic preservation and associated programs, including the NRHP, were described in Chapter 3. According to the NHPA, historic properties include "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places" (16 USC 470w(5)). The criteria used to evaluate eligibility were presented in Chapter 3.

Section 106 (16 USC 470f) of the NHPA requires Federal agencies, prior to taking action, to take into account the effects of their undertaking on historic properties. Specific regulations regarding compliance with Section 106 state that although the tasks necessary to comply with Section 106 may be delegated to others, the Federal agency is ultimately responsible for ensuring that the process is completed according to statute. The four steps in the Section 106 process are:

- Identify and evaluate historic properties;
- Assess adverse effects of the project on historic properties;
- Resolve any adverse effects of the project on historic properties in consultation with the SHPO/Tribal Historic Preservation Officer, and other interested parties, resulting in a Memorandum of Agreement (MOA); and
- Proceed in accordance with the MOA.

An impact to cultural resources would be considered significant if it adversely affects a resource listed in or eligible for listing in the NRHP. In general, an adverse effect may occur if a cultural resource would be physically damaged or altered, isolated from the context considered significant, or affected by project elements that would be out of character with the significant property or its setting. Title 36 CFR Part 800 defines effects and adverse effects on historic resources as follows:

> Section 800.5(1) Criteria of Adverse Effects. An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative.

Section 800.5(2) Examples of Adverse Effects. Adverse effects on historic properties include but are not limited to the following:

(i) Physical destruction, damage, or alteration of all or part of the property;
(ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines;
(iii) Removal of the property from its historic location;
(iv) Change of the character of the property's use or of physical features within the property's setting that contributes to its historic significance;
(v) Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;
(vi) Neglect of a property that causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
(vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

5.6.1 Alternatives A, B, C, and D

All of the alternatives include proposals that require ground-disturbing activities; therefore, the implementation of any of the alternatives has the potential to adversely affect cultural resources. Alternative D includes a proposal to monitor and, if necessary, control feral pigs in accordance with a Feral Pig Monitoring and Eradication Plan (Appendix E). Ensuring a feral pig population does not become established on the Refuge would avoid the potential for impacts to cultural resources associated with pig rooting and digging, impacts that have occurred elsewhere in the Region. The siting and construction of temporary traps, such as corral traps, could however result in impacts to cultural resources; therefore, these actions would be subject to preconstruction cultural resource surveys and adherence to Federal regulations and Service policies regarding the protection of cultural resources.

To determine if a proposed action could adversely affect a cultural resource, it is necessary to conduct a survey of the Area of Potential Effects (APE) or, if a survey has been previously conducted, to review the results of that survey and determine if any resources identified are eligible for inclusion in the NRHP. The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties. It is not necessary to know that the area in question contains historic properties, or even to suspect that such properties exist, in order to determine the APE. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking. In addition, the APE is not always a contiguous area; there may be multiple alternative project sites or multiple areas in which changes are anticipated.

A number of actions on the ground are proposed to implement the CCP. Each action would have its own project-specific APE. As described in Chapter 3, investigations, surveys and research have previously been conducted for various portions of the APE, and cultural resources have been identified; however, there are also large areas of the Refuge that have not been previously surveyed.

The potential for archaeological resources to be present within a specific portion of the Refuge varies depending upon the topography, soil types, proximity to water, proximity to food resources, and many other factors. Overall, the potential for yet undiscovered buried deposits to be present on the Refuge is considered high.

Surveys of those previously unsurveyed areas and determinations of eligibility for any features that have not yet been evaluated would be required prior to the implementation of any ground-disturbing activities necessary to implement wildlife and habitat management, public use, or Refuge operations actions or activities. The potential effect of these activities on cultural resources must be reviewed in accordance with Section 106 and the procedures established by the Service's Cultural Resources Program to ensure that no adverse effects to known or unknown cultural resources occur as a result of Refuge activities.

To avoid adverse effects to cultural resources under any of the alternatives, when a project is first being considered for implementation that will require ground disturbance, Refuge staff will submit a Request for Cultural Resource Compliance to the Service's Cultural Resources Program. This request is to be submitted as early in the planning process as possible. The Request will include a map, indicating the APE for the project site and any associated access requirements that may involve grading, along with a detailed project description. Based on this information, Cultural Resource staff will determine the appropriate measures to be implemented to protect cultural resources. For example, for projects involving ground disturbance that are determined to be located in an area of sensitivity for an archaeological resource, an archaeological monitor, meeting the Secretary of the Interior's Guidelines, would be present during grading, digging, coring, or any other activity that would affect subsurface materials.

If any cultural resources are discovered during excavation, all earthwork on the site would be halted and the Regional Historic Preservation Officer would be contacted to review the materials and recommend a treatment that is consistent with applicable laws and policies. The treatment plan would likely require the boundaries of the site to be defined before excavation could be reinitiated in an area well away from the discovered resource. The site would also be recorded and evaluated for eligibility to the NRHP. Once this work is completed, additional measures may be required depending upon the results of the eligibility determination. If any site is encountered that is determined to be eligible to the NRHP, the Service would consult with SHPO, federally recognized tribes, and interested parties.

When archaeological resources are encountered, the Refuge will comply with Federal regulations regarding curation (36 CFR 79). Specifically, the Refuge will ensure proper care of federally owned and administered archaeological collections, including ensuring that significant prehistoric and historic artifacts, and associated records, are deposited in an institution with adequate long-term curatorial capabilities that can provide professional, systematic, and accountable curatorial services on a long-term basis.

To identify and preserve traditional cultural properties and sacred sites and to determine the level of confidentiality necessary to protect them, the Refuge would work with interested tribal groups to establish government-to-government relationships that would ensure meaningful consultation with tribal governments during the planning phase of projects. The Refuge Complex has initiated discussions with interested tribal groups to create a Memorandum of Understanding (MOU) to implement the inadvertent discovery clause of NAGPRA. Development of this MOU would involve identifying the Native American tribes, groups, and direct lineal descendants that may be affiliated with these Refuge lands, initiating consultation with the affiliated parties, developing procedures to

follow for intentional and inadvertent discoveries, and identifying the persons to contact for the purposes of NAGPRA.

Implementation of the procedures described is expected to avoid any significant adverse effects to cultural resources.

5.7 Effects to the Social and Economic Environment

This section examines the effects of the three management alternatives to the social and economic environment in which the Refuge is located, including effects related to land use, recreational opportunities, traffic circulation/parking, public utilities/easements, economics/employment, and environmental justice.

With regard to land use, this section analyzes the potential land use conflicts between the habitat management and public use proposals presented in each alternative and the existing and planned land uses in the immediate vicinity of the Refuge. Adverse effects related to land use would be considered significant if:

- Substantial incompatibility between proposed uses or activities and adjacent existing uses and uses proposed in approved general plans would occur.

- Changes in use or the intensity of use are proposed where the resulting activity or use pattern would create substantial increases in noise, traffic, public safety, or similar environmental impacts that would alter community character or conflict with existing uses in the area.

With regard to recreational opportunities, this section analyzes the effects of the various alternatives on existing recreational uses within and surrounding the Refuge. Adverse effects related to recreational opportunities would be considered significant if:

- Substantial loss of regional recreational opportunities occurs as a result of the proposed action.

With regard to traffic circulation, this section analyzes the effects of the various alternatives on the existing and planned traffic facilities in the vicinity of the proposed action. Adverse effects would be considered significant if:

- A project would add a substantial amount of traffic to a congested freeway segment, interchange, or freeway ramp.

- A project would increase traffic hazards to motor vehicles, bicyclists, or pedestrians due to proposed non-standard design features (e.g., poor sight distance, proposed driveway onto an access-restricted roadway).

With regard to parking, this section analyzes the effects of the various alternatives on the availability of parking within the vicinity of the project. Adverse effects would be considered significant if:

- The need for parking generated by a proposed action would substantially reduce the availability of parking in an adjacent residential or commercial area.

With regard to public utilities/easements, this section analyzes the potential effects of the various management alternatives on existing public utilities and easements in the immediate vicinity of the Refuge. Adverse effects to public utilities and easements would be considered significant if:

- Direct or indirect damage to utilities, utility service, or other public facilities would occur as a result of a proposed action.

- Disruption of access to a public utility or other facility would occur during implementation of a proposed action.

With regard to economics and employment, this section evaluates the effect of implementing the various alternatives on the regional economy and employment level. Economic or social changes resulting from an action are considered to produce significant effects if they result in a substantial adverse physical change in the environment (e.g., urban blight).

With regard to environmental justice, this section evaluates the potential for adverse human health or environmental effects to minority populations or low-income populations living in the vicinity of the Refuge as a result of implementing the various actions proposed in each alternative. Impacts related to environmental justice would be considered significant if:

- A proposed action would result in disproportionate adverse human health impacts or environmental effects to low-income or minority populations.

5.7.1 Effects to Land Use

5.7.1.1 Alternative A – No Action

Under Alternative A, no changes to the current management practices are proposed. The activities occurring on the lands within the Refuge would be consistent with the activities occurring on other open space and conserved lands within the region.

Efforts would continue to be made to minimize impacts to sensitive habitat and species as a result of unauthorized off-trail activities, and some changes would occur to the current trail system; however, a designated system of trails would not be developed. As a result, it will be more difficult under this alternative to manage trail activities. Instances of trail users crossing private lands to access trails on the Refuge could continue, although efforts would continue to be made to close trails that cannot be accessed from public land or the public right-of-way.

Acquisition of lands from willing sellers within the approved Refuge boundary would continue per available funding under any of the alternatives. The effects of acquisition on the land use proposals with the region were addressed in the MSCP Program EIR/EIS (City of San Diego 1997), as well as the EA and Land Protection Plan for the Otay-Sweetwater Unit (USFWS 1997a). As described previously in this document, the MSCP was implemented to support a balance between preserving listed and sensitive species and accommodating development within the San Diego region. The lands acquired for the San Diego NWR represent the Federal government's contribution to the implementation of the MSCP.

Continued acquisition within the approved Refuge boundary would not adversely affect vacant land sales or values, nor would it be expected to adversely affect adjacent residential parcels. When the Refuge boundary was approved in 1997, many landowners stated that the proposed Refuge would

ensure that their views of open space would be maintained and thereby enhance the value of their properties (USFWS 1997a).

An issue of concern for some residents located adjacent to the Refuge is the potential for adverse effects related to wildland fire. Where necessary, the Refuge maintains fire breaks to reduce the potential for the spread of wildfire into developed area. This, in combination with the requirements of local jurisdictions for residents to maintain brush management areas around the perimeter of private parcels, helps reduce the potential for the spread of fire into developed areas. The Service also maintains two fire engine crews in the vicinity of the Otay-Sweetwater Unit during the fire season. To reduce the risk for unintentional ignition of fires on the Refuge, smoking and campfires are prohibited. These measures reduce but do not eliminate the effects of wildland fires on Refuge lands and adjacent properties.

Overall, the implementation of the actions proposed under Alternative A would not result in significant adverse effects related to land use.

5.7.1.2 Alternative B

The effects to surrounding land uses of implementing Alternative B would be similar to Alternative A. Actions proposed under Alternative B, such as expanding current monitoring of listed and sensitive species, restoring habitat, fencing and posting Refuge boundaries, and controlling invasive species, would have little, if any, effect on adjacent properties. The establishment of a designated trail system would reduce the potential for access onto the Refuge through private property. Under this alternative, dogs would not be permitted on the Refuge, which would represent a change from current conditions; however, there are significant areas of open space in the vicinity of the Refuge where dogs are permitted. Therefore, this change would not represent a significant adverse effect with respect to land use.

Facilities proposed for development to support Refuge operations, such as a Refuge visitor contact station, and trail parking areas within the Las Montañas, Sweetwater River, and McGinty Mountain areas, would be located on sites within the Refuge that are generally situated well away from existing development. Additionally, in the all cases except the proposed north McGinty Mountain parking area, these facilities would be surrounded by Refuge property and/or abut a major street. Therefore, no adverse effects to existing or future development are anticipated. With respect to the north McGinty Mountain parking lot, the facility would be small and fairly remote; therefore, limited use of this facility is anticipated, and impacts to adjacent parcels would be minimal.

To avoid any adverse effects to adjacent private property, the designated trail corridors were laid out in an effort to minimize the potential that public access onto the trail system would be taken through private property. All access points onto the Refuge area designed to take access from the public right-of-way or from the existing county regional trail system. Adequate separation is provided between the proposed trail corridors and adjacent private lands, therefore, potential issues related to land use compatibility have been avoided. The specific trail alignments within the proposed trail corridors would be determined during step-down trail planning, which would begin upon approval of the Final CCP.

Other proposals, including the construction of barracks for seasonal staff, development of a greenhouse/native plant nursery to facilitate Refuge restoration projects, and relocation of a storage facility, would occur on Rancho Jamul, a State of California-owned parcel that is well removed from any private property. As a result, no adverse effects to land use are anticipated from these proposals.

5.7.1.3 Alternative C

Alternative C includes a limited hunting program that would allow seasonal hunting on a portion of the McGinty Mountain area and the southern portion of the Las Montañas area. Year-round hunting would be permitted on a portion of the Otay Mesa and Lakes area. The proposal to open these areas to hunting would represent a change in use over current conditions; however, an adequate buffer would be provided between the Refuge property line and adjacent parcels to ensure that no significant adverse effects to adjacent uses would occur. In addition, in the seasonal hunt areas, hunting would be conducted using a reservation system to limit the number of hunters present in the area at any one time. The use of rifles would be prohibited. Prior to initiating a hunting program on the Refuge, a step-down hunt plan would be developed to further describe the details of the hunting program and the facilities (e.g., on-Refuge parking, restroom) that would be provided to accommodate this use. Implementing these measures would reduce the potential for adverse effects to adjacent land uses.

The majority of the landowners in proximity to the area designated for hunting in the Otay Mesa and Lakes area are public agencies, with hunting permitted on both CDFW and BLM lands that abut the area. No residential uses occur in proximity to this area. Therefore, no adverse effects related to land use compatibility are anticipated.

Land use effects related to the designated trail system and proposed refuge facilities would be the same under Alternative C as described under Alternative B.

5.7.1.4 Alternative D

The effects to land use of implementing Alternative D would be similar to Alternative C. The primary difference between the two alternatives with respect to land use is that under Alternative D, hunting is only proposed within the Otay Mesa and Lakes area.

5.7.2 Effects to Recreational Opportunities

5.7.2.1 Alternatives A, B, C, and D

None of the alternatives evaluated for implementation on the San Diego NWR would result in a significant reduction in the availability of recreational opportunities throughout the region. All of the alternatives would provide some level of trail use, and all would accommodate the county's Sweetwater Loop and River Trail, a regional trail that is proposed to provide access to the California Riding and Hiking Trail. Although hunting is not proposed under Alternatives A or B, there are other opportunities for hunting in the county; therefore, no significance adverse effects related to hunting would result if either alternative were to be selected as the preferred alternative.

With respect to the continued acquisition of properties from willing sellers per the approved Refuge acquisition boundary, no properties considered for acquisition are proposed for development as a public park. Therefore, no significant adverse effects to planned recreational opportunities are anticipated.

5.7.3 Effects to Traffic Circulation and Parking

5.7.3.1 Alternative A – No Action

Under Alternative A, no changes to the current management practices or authorized public uses would occur. Implementing the various wildlife and habitat management activities and other Refuge operations actions would have little impact on current and future traffic volumes on the

roads surrounding the Refuge. The public uses on the Refuge generate a moderate, although not quantified, number of trips that generally occur outside of peak traffic hours. These trips do not result in direct impacts to traffic circulation in the area, nor do they represent a cumulatively significant adverse effect to traffic circulation.

Public access to the Refuge is currently available from Jamul Drive, where the Refuge maintains a parking lot that provides access to trails on McGinty Mountain. This lot is of adequate size to accommodate current use. To access the trail system to the west of Par Four Drive requires that the public park on residential streets near the trailhead. The highest use periods occur on the weekends. This situation can affect existing residents, particularly those who live on streets immediately adjacent to the trailhead. To ensure that significant adverse effects related to loss of on-street parking availability for residents, Refuge events involving more than a few cars should not be staged from this location.

Access to the Sweetwater River area is available from Sweetwater Regional Park and from a small parking area off Highway 94 that is maintained by the County of San Diego. The county's parking lot is heavily used by visitors using the county's Sweetwater Loop and River Trail, as well as by visitors interested in observing the resources supported on the Refuge. Use of this parking lot is highest on the weekends.

If existing uses on the Refuge are maintained at current levels, no significant adverse effects related to available on or off-street parking are anticipated, provided Refuge events are planned in a manner that takes into account parking availability at particular locations throughout the Refuge.

5.7.3.2 Alternative B

Expansion of the current wildlife and habitat management activities and other Refuge operations actions proposed under Alternative B would not result in a significant increase in the number of vehicle trip generated by the Refuge. Therefore, there would be little impact on current and future traffic volumes on the roads surrounding the Refuge.

The proposal to construct a visitor staging area, visitor contact station, and restrooms along the south side of Highway 94 to the west of Millar Ranch Road would also require coordination with Caltrans, as well as an encroachment permit to obtain access from Highway 94 to the site. A traffic study would be required, as part of future site and engineering design, to determine how many trips would be generated from this site following the development of the proposed facilities. Because the majority of trips would occur during non-peak hours, no significant contribution to traffic flow on Highway 94 during peak hours is anticipated. However, because this roadway operates at LOS E and F, any contribution of traffic onto Highway 94 from Millar Ranch Road would require the implementation of measures to avoid safety issues and/or impacts to overall traffic flow. Such measures could include the installation of a traffic signal at this intersection. Other potential design features may include improvements to existing acceleration and deceleration lanes, the provision of a center turning lane, and/or roadway widening to add shoulders. Such measures would be developed in coordination with Caltrans to ensure that no significant adverse effects related to traffic circulation along Highway 94 would occur.

5.7.3.3 Alternative C

The types of wildlife-dependent recreational uses permitted on the Refuge would be expanded under this alternative to include hunting. The hunting program would include three relatively small sites within the Refuge, and hunting on two of these sites would be permitted by reservation

only, while the third site would abut two much larger hunting areas. Therefore, the new trips generated by this proposal would be minimal (less than 30 peak hour trips per day).

Although the need for parking to accommodate this use would be minimal, there is currently no parking available in the vicinity of the Las Montañas area; therefore, before hunting, or any other public use, can be accommodated at this location, an on-Refuge parking area would have to be developed. Construction of the future parking area, should it be proposed off Highway 94, would require analysis of the effects to future users, as well as the effects to those traveling on Highway 94, of adding a driveway or intersection along this segment of Highway 94. The analysis would include an evaluation of existing accident rates along this road segment, proposed intersection geometrics, proximity of adjacent driveways, sight distance, and other factors. Approval of the project design, as well as an encroachment permit, would be required from Caltrans. Potential design features may include limited ingress and egress, such as right turns in and out only, installation of a traffic signal, and/or road improvements (e.g., acceleration and deceleration lanes, provision of turnouts, roadway widening to add shoulders). Such measures would be coordinated with Caltrans early in the design process and would avoid any significant adverse effects to traffic circulation along Highway 94.

No onsite parking is proposed on Refuge land to accommodate hunting on the Otay Mesa and Lakes area. Access to this area would be via the adjacent CDFW and BLM parcels.

The impacts to traffic circulation and parking as a result of implementing the visitor services facilities proposed under Alternative C would be similar to those described in Alternatives A and B.

5.7.3.4 Alternative D

The impacts to traffic circulation and parking as a result of implementing Alternative D would be similar to those described in Alternatives A, B, and C.

5.7.4 Effects to Public Utilities and Easements

5.7.4.1 Alternatives A, B, C, and D

The effects to public utilities and public utility easements as a result of the Refuge management and public use proposals included within any of the alternatives would be less than significant. No changes to the existing easements on the Refuge are proposed, and no facilities are proposed that would obstruct or otherwise adversely affect access over existing easements and access roads maintained on the Refuge by SDG&E, AT&T, Otay Water District, and Sweetwater Authority, nor are any proposals included in the alternatives that would affect the facilities maintained within these easements. Any construction proposed on the Refuge that could temporarily affect one or more of these easements would be coordinated with the appropriate utilities during the project design phase to avoid any temporary access conflicts.

In addition, the CCP does not preclude the potential for the extension of utility easements through the Refuge; however, any such proposals would require evaluation of potential impacts to the environment, including sensitive Refuge resources, in accordance with NEPA and—because of the presence of listed species on the Refuge—consultation under the Endangered Species Act would also be required. All proposals for a right-of-way on or over lands included within the National Wildlife Refuge System would also have to comply with the Rights-of-Way General Regulations included in Title 50, Part 29, Subpart B of the Code of Federal Regulations. Section 29.21 includes the procedures for filing applications and the terms and conditions under which rights-of-way over

and across the lands administered by the Service may be granted. No right-of-way will be approved unless it is determined by the Regional Director to be compatible with the purposes for which the Refuge was established. More information about compatibility and the Service's Compatibility Policy is provided in Chapter 1.

5.7.5 Effects to Economics and Employment

5.7.5.1 Alternative A – No Action

Under Alternative A, the Refuge would continue to maintain its existing staffing levels (i.e., one full-time permanent Refuge Manager, one full-time wildlife biologist, and one full-time Refuge Operations Specialist). Therefore, the effects to economics and employment at the local and regional level of implementing Alternative A would be negligible.

The Refuge currently provides recreational opportunities for an estimated 16,000 to 22,000 visitors annually, including naturalists, students, hikers, dog walkers, mountain bikers, and equestrians. Unfortunately, there is no estimate of how many of these visitors may be from out of the area. Even with the majority of the visitors coming from the local area, there is a small benefit to the economy from these uses. The economic benefits of outdoor recreation are well understood and have been documented in publications such as *Banking on Nature: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation* (Carver and Caudill 2013). Benefits from the visitation experienced on the Refuge come in the form of retail expenditures, which in turn generate additional revenues and jobs.

Under any of the alternatives, lands within the Refuge acquisition boundary (refer to Figure 1-2) would continue to be considered for acquisition based on the availability of funding and habitat and species protection priorities. The approved acquisition boundary gives the Service the authority to acquire properties from willing sellers. As required by law, the Service would offer fair-market value for real property and interests therein. The fair-market value is based upon approved appraisals conducted by professional appraisers in conformance with policies outlined in the *Uniform Appraisal Standards for Federal Land Acquisition*. The appraisal process requires that all impacts upon value be considered.

5.7.5.2 Alternative B

Alternative B includes proposals to expand the current staffing levels on the Refuge, which would have a greater benefit in terms of economics and employment than does Alternative A; however, in the context of the regional economy, this increase would be negligible. Additional economic benefits to the local and regional economy would also result from construction jobs and the purchase of materials to implement the various facilities proposed to accommodate Refuge operations and visitor services. The jobs created from these projects would be temporary but would still be considered an important contribution to the overall regional effort to create jobs, particularly in the construction industry.

Visitation on the Refuge would be expected to increase as the visitor services proposals included in Alternative B are implemented. Once access to the Refuge is improved, particularly within the Sweetwater River area, visitation by hikers, mountain bikers, and equestrians is expected to increase. The Refuge would also have better opportunities for conducting events related to wildlife observation, interpretation, and environmental education.

5.7.5.3 Alternative C

The benefits to the economy and employment would be similar to those described for Alternative B. The primary difference in terms of economics is that a hunting program is proposed under Alternative C, and a hunting program on the Refuge would generate economic benefits of its own. Statewide, California hunters spent an estimated 1,033,989 days and contributed $27.1 million to local economies in pursuit of resident game birds alone during the 2002 hunting season (USFW Service and U.S. Bureau of the Census 1993; CDFG 2002). Although the exact figure is unknown, CDFW has concluded that approximately 100,000 hunters buy hunting licenses solely for the purpose of hunting resident game birds. In 2004, this number of licenses generated about $3.77 million in revenue for CDFW ($31.25 license + $6.50 upland game bird stamp x 100,000) (CDFG 2004b).

5.7.5.4 Alternative D

The benefits to the economy and employment would be slightly less under Alternative D than those described for Alternative C based on the scale of the Refuge hunting program based under Alternative D.

5.7.6 Effects to Environmental Justice

5.7.6.1 Alternatives A, B, C, and D

The goal of environmental justice in the United States is to afford the same degree of protection from environmental and health hazards to all individuals and communities throughout the nation. Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

The mission of the Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. The environmental justice strategy of the Service extends this mission by seeking to ensure that all segments of the human population have equal access to America's fish and wildlife resources, as well as equal access to information that will enable them to participate meaningfully in activities and policy shaping.

The Refuge occurs at the urban interface with rural development to the north and east and urban development to the south and west. Both the communities of Spring Valley and El Cajon support larger populations of lower income households than the other communities in the immediate vicinity of the Refuge. The programs and public uses proposed on the Refuge under any of the alternatives would be equally accessible to all visitors. All of the designated access points onto the Refuge under any alternative would occur from other public lands or public rights-of-way. Access is not permitted via private properties or gated communities, to avoid providing some members of the community with access that would not be available to all. Within the spirit and intent of Executive Order 12898, no minority or low-income populations would be impacted by any Service action proposed in this CCP, and equal access to Refuge resources or Refuge programs under any alternative would be afforded to all visitors.

5.8 Unavoidable Adverse Impacts

All actions that take place within the natural environment are likely to result in some unavoidable adverse impacts. As described in the proceeding sections, even species monitoring can result in short term impacts that are unavoidable. Within each of the management alternatives for the San

Diego NWR, measures are proposed to minimize to the extent practical any adverse impacts to the environment. Appropriate mitigation measures (e.g., BMPs, seasonal restrictions, buffers, fencing, use restrictions) would be incorporated into the scope of future construction projects and refuge programs and monitoring of the Refuge's resources would be conducted as part of any proposed management action to enable Refuge staff to identify and analyze management results and adapt management policies should any unforeseen problems arise.

5.9 Irreversible and Irretrievable Commitments of Resources

Most management actions identified in this document would require a commitment of funds that would then be unavailable for use on other Service projects. At some point, commitment of funds to these projects would be irreversible, and once used, these funds would be irretrievable. Non-renewable or non-recyclable resources committed to projects identified in the CCP would also represent irreversible and irretrievable commitments of resources, such as fuel for Refuge vehicles and construction equipment; electricity for office and maintenance operations; supplies used in management or maintenance activities (e.g., herbicide, fencing, building material, signs); and construction materials needed for new facilities, trails, and parking areas.

5.10 Short-term Uses versus Long-term Productivity

An important goal of the System is to maintain the long-term ecological productivity and integrity of the biological resources on refuges. This system-wide goal is the foundation for the goals presented in the CCP. The implementation of Alternative D, the proposed action, would include increased management of wildlife and habitats and development of visitor service activities and facilities. The resulting long-term productivity would include increased protection and survival of listed and MSCP-covered species, as well as a myriad of other native plant and animal species. The public would also gain through long-term opportunities for wildlife-dependent recreational activities.

5.11 Cumulative Effects

Cumulative effects (impacts) are those effects on the environment resulting from incremental consequences of the Service's proposed actions when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes these actions. Cumulative effects can be the result of individually minor impacts, which can become significant when added over time.

Accurately summarizing cumulative effects is difficult in that while one action increases or improves a resource in an area, other unrelated actions may decrease or degrade that resource in another area. As stated in the Service Manual (550 FW 1), in an EA, a cumulative impact assessment should be conducted if it is determined necessary through scoping to make a determination of significance of the proposed action. When a cumulative effects analysis is included in an EA, the analysis need only be sufficient for the decision maker to reach a conclusion on the significance of the impact in order to determine if the preparation of an EIS is required.

In conducting the analysis of cumulative effects, the interaction of activities on the San Diego NWR with other actions occurring over a larger spatial reference and a temporal reference of about 15 years (the intended life of the CCP) has been considered. The cumulative impact analysis prepared for the County of San Diego General Plan Update (County of San Diego 2011) was used as the basis of this analysis, as it includes consideration of recently approved, currently proposed,

and reasonably foreseeable future projects within the region. This cumulative effects analysis focuses on the physical environment, wildlife and habitat, the effects of upland game and bird hunting, cultural resources, and social and economic resources.

5.11.1 Cumulative Effects to the Physical Environment

The projects considered in the county's cumulative effects analysis range from new development and redevelopment to habitat restoration and conservation. The development and redevelopment projects would result in modifications to existing community character and visual quality within the area immediately surrounding the different project sites. The projects within the San Diego region therefore have the potential to result in a cumulative impact to visual quality if, in combination, they would:

- result in the obstruction, interruption, or detraction from a scenic vista;
- result in the removal or substantial adverse change of one or more features that contribute to the valued visual character or image of a neighborhood, community, State scenic highway, or localized area; and/or
- substantially degrade the existing visual character or quality of the site and its surroundings by introducing features that would detract from or contrast with the existing visual character and/or quality of a neighborhood, community, or localized area.

All of these impacts can be mitigated to below a level of significance through adherence to General Plan policies and proposed mitigation measures. Such measures include the integration of natural features into project design; providing contiguous open space areas that protect wildlife habitat and corridors, preserving scenic vistas, and connecting existing or planned recreational opportunities; implementing projects that conform to the natural topography; respecting and conserving unique natural features; avoiding sensitive or intact environmental resources and hazard; protecting scenic resources; and siting and designing projects to minimize visual impacts and preserve unique or special visual features.

Construction and management projects proposed for the Refuge under any of the action alternatives would also implement the intent of these policies, along with measures to minimize adverse effects to the existing visual quality of the area, particularly those areas of the Refuge visible from the public right-of-way. Therefore, the CCP would not contribute cumulatively to any significant adverse effects related to community character or visual quality.

Projects located in the San Diego region would have the potential to result in a cumulative impact to air quality plans if, in combination, they would conflict with or obstruct implementation of regional air quality standards. However, projects, such as those addressed in the various alternatives presented in the draft CCP for the San Diego NWR, that are consistent with regional planning documents (on which the regional air quality standards are based), would not conflict with or obstruct the implementation of regional air quality standards. Therefore, no cumulative effects related to the implementation of regional air quality standards are anticipated as a result of the implementing the San Diego NWR CCP under any of the proposed alternatives.

The County of San Diego (2011), in the General Plan Update EIR, identified significant, unavoidable cumulative impacts associated with nonattainment criteria pollutants (i.e., O_3, PM_{10}, $PM_{2.5}$). Although the implementation of any of the alternatives presented in the draft CCP would result in a slight increase in vehicle emissions and the potential for temporary impacts related to particulate emissions during construction projects, the overall contribution to the region would be nominal and would therefore not contribute cumulatively to significant air quality impacts.

With respect to water quality, cumulative projects would result in multiple developments that would potentially alter existing drainage patterns in a manner that would result in substantial erosion or siltation. This increase has the potential to result in a significant cumulative erosion and siltation impact. Implementing any of the alternatives presented in the draft the CCP, including the proposal to control of feral pigs, as presented in Alternative D, would involve some disturbance of native soils that could result in temporary increases in turbidity in adjacent waterways. However, through the implementation of best management practices, these temporary impacts would be expected to be minimal. Where projects involve habitat restoration, there could be long-term incremental benefits to downstream water quality due to the natural filtering process provided by native vegetation. If feral pigs become established on the Refuge, this population would create impacts to water quality that would contribute to the cumulative adverse effects pigs are currently on having on regional water quality.

Urbanization and growth within the San Diego region, as well as the conservation of lands to protect sensitive resources, have the potential to result in land uses that are incompatible with mining and resource recovery and therefore result in a cumulative loss of available resources. When incompatible uses are established within the region in areas that support mineral resources such as aggregate material, there is a reasonably foreseeable loss of mineral resources, representing a cumulative impact related to mineral resource availability.

Within the exception of potential future acquisitions within the Refuge acquisition boundary, the projects and management actions described in the action alternatives would have no effect on existing or future sand, gravel, and rock mining operations outside the Refuge. The 33 acres of Refuge land that are designated as MRZ-2 are located immediately upstream of the Sweetwater Reservoir, making it unlikely that these deposits would be available for mining, even if they were not located within the Refuge. In addition, some of the lands not yet acquired within the Refuge acquisition boundary are classified as MRZ-3. These lands represent less than three percent of the total area within the county that are classified as MRZ-3. Therefore, the management of the Refuge's existing lands and the potential for future acquisitions within the Refuge acquisition boundary would not represent a significant cumulative impact related to mineral resource availability.

5.11.2 Cumulative Effects to Biological Resources

The projects identified in the General Plan Update have the potential to result in impacts to special status plant and wildlife species and their habitat, direct and indirect loss or degradation of riparian habitat and other sensitive natural communities, and loss or disruption of wildlife movement corridors and nursery sites. The purpose of the San Diego NWR is to conserve listed and sensitive species and their habitats, and all of the actions and uses proposed on the Refuge must be compatible with this purpose. Therefore, the implementation of any of the alternatives described in the draft CCP would not contribute to regionally significant cumulative impacts to biological resources.

Although hunting has not occurred on the Refuge since it was established, hunting has traditionally occurred in California on private lands, State-owned conservation properties, and federally owned public lands located near the Refuge. Within the State, there is a long history of hunters investing significant resources into the betterment of many of California's habitats. The interest generated by these programs has resulted in the formation of numerous local sportsmen's organizations dedicated to the protection and improvement of wildlife habitat. Moreover, organizations, such as Ducks Unlimited, California Waterfowl Association, National Wild Turkey

Federation, Quail Unlimited, Pheasants Forever, and California Deer Association, invest resources to benefit many types of wildlife.

Wildlife populations are currently hunted on both private and public lands in San Diego County. Public lands open to various forms of hunting include Barrett Reservoir, portions of the Cleveland National Forest, BLM properties in McCain Valley and the Border Mountains of western San Diego County, and CDFW lands at Hollenbeck Canyon Wildlife Area, San Felipe Valley Wildlife Area, Boden Canyon Ecological Reserve, Otay Mountain Ecological Reserve, Rancho Jamul Ecological Reserve, and Walker Canyon Ecological Reserve. Hunting is a highly regulated activity and generally takes place at specific times and seasons (e.g., dawn, fall, and winter) when the game animal is less vulnerable (e.g., non-breeding season).

Alternatives C and D both include proposals to open portions of the San Diego NWR to hunting in accordance with refuge-specific regulations. The areas proposed for hunting on the Refuge under either alternative represent only a portion of the lands preserved within the Refuge to protect wildlife. Those portions of the Refuge that would not be available for hunting include high-quality habitat with a diversity of vegetation types providing wildlife with breeding habitat; escape cover that offers safety from predators, including humans; shelter from weather-related elements; resting areas; and water. Although hunting directly affects individual animals, the amount of harvest would not be expected to have a measurable effect on Refuge wildlife population levels. In addition, hunting is monitored, regulated, and designed to ensure that harvest does not reduce populations to unsustainable levels. Moreover, the amount of hunting on the Refuge would not be expected to increase significantly in the future.

In California, 38 Refuges provide more than 471,526 acres of habitat for wildlife. Fourteen refuges are closed to the public, 18 refuges currently allow waterfowl hunting, nine allow pheasant hunting, and Clear Lake Refuge allows pronghorn hunting. Sacramento River Refuge is the only refuge in California that currently allows deer, quail, turkey, and dove hunting opportunities, in addition to waterfowl and pheasant hunting. Hunting on the San Diego NWR would have little, if any, effect on wildlife species within California. Opening the Refuge to hunting would benefit hunters in California, although it would be a relatively small benefit considering the limited area of the Refuge that could be opened for hunting (i.e., 860 acres on three areas of the Refuge under Alternative C, 160 acres in one area under Alternative D). The number of hunters expected on the San Diego NWR would be low due to the limited area allocated for hunting, and number of hunters on the Refuge would be controlled through a reservation system. The number of hunters present on the Refuge is expected to remain relatively stable over the life of the CCP. In addition, hunting would be monitored, regulated, and designed to ensure that harvest does not reduce populations to unsustainable levels. Hunters would be required to report harvest on the kill record portion of their registration permit. Field checks by Refuge law enforcement officers would be planned, conducted, and coordinated with staff and other agencies to maintain compliance with regulations. A step-down hunting plan would be prepared and provided for public review and comment upon approval of the CCP. The plan would describe management actions and address the need for changes to the hunt program if negative impacts are observed on the Refuge during monitoring.

Based on the analysis presented earlier in this chapter, the Service has concluded that there would be no significant cumulative impacts on the region's wildlife populations, either hunted or non-hunted species, as a result of implementing any of the alternatives presented in the draft CCP. Although mortality would occur to some wildlife under the Refuge's hunt program, the analysis presented previously supports the conclusion that there would be no adverse population level impacts to hunted or non-hunted wildlife species, even when added to other hunt programs regionally or nationally. The Service has also concluded that the proposed action would not

cumulatively impact the Refuge environment or programs. This determination was based upon a careful analysis of potential environmental impacts of hunting on the Refuge together with other projects and/or actions. Some wildlife disturbance would occur during the hunting seasons. Proper zoning and regulations will be designated during the development of the step-down hunting plan to minimize the potential for negative impacts to all wildlife populations using the Refuge, including listed and sensitive species, as well as species to be hunted.

All alternatives would provide long-term benefits for native wildlife species and habitats within the area. The protection of wildlife habitats within the Refuge represents a benefit to the long-term conservation of threatened and endangered species and other native wildlife species. Alternatives B and C would provide greater benefits than would Alternative A due to the increased amount of habitat restoration that would take place. However, the benefits derived from Alternatives B, C, and D would restore and protect only a fraction of the habitat that has been lost in the region. The proposal to monitor for and control feral pigs that is included in Alternative D would provide additional benefits, should pigs expand their range onto Refuge lands.

Feral pig activity is expected to contribute to the impacts caused by other non-native plant and animal species, along with trampling and disturbance from recreational uses and unauthorized motorized use, to biological resources on conserved lands in the San Diego region. Implementing feral pig monitoring and eradication on the Refuge, as proposed under Alternative D, would contribute to the reduction or elimination of feral pigs as a stressor to native vegetation and wildlife.

5.11.3 Cumulative Effects to Cultural Resources

Adherence to the policies and regulations pertaining to the protection of cultural resources would avoid or mitigate any significant adverse effects as a result of implementing the projects defined by the County General Plan Update; therefore, significant cumulative impacts to cultural resources are not anticipated. The projects proposed on the Refuge under any of the alternatives would also be implemented consistent with all Federal regulations and policies; therefore, these projects would not result in any cumulatively significant adverse effects to cultural resources.

Feral pig activity has resulted in damage to cultural resources in the region, therefore, not implementing a pig control plan on the Refuge, should a pig population become established, could increase the potential for cumulative adverse effects to cultural resources from pig foraging activities.

5.11.4 Cumulative Effects to the Social and Economic Environment

The implementation of any of the alternatives presented in the draft CCP would not result in any significant adverse effects related to land use; therefore, no significant cumulative land use effects are anticipated.

The projects described in the county's Updated General Plan, would have a potentially significant impact to unincorporated county traffic and LOS standards; adjacent cities traffic and LOS standards; transportation hazards; emergency access; parking capacity; and alternative transportation. Some measures have been identified to reduce these effects; however, these measures do not adequately reduce the cumulative effects of the projects to below a level of significance. The proposals included within the CCP under any of the action alternatives would result in minor increases in trips to and from the Refuge; however, from a regional prospective, the number of trips to be generated is nominal. Effects to specific intersections would be mitigated to below a level of significance through various traffic improvements during project construction. Therefore, the CCP would not contribute to significant adverse effects related to traffic.

The projects described in the General Plan Update would result in potentially significant cumulative impacts related to adequate water supply, sufficient landfill capacity, and energy. Although the implementation of the CCP under any of the action alternatives would result in slight increases in the amount of water and energy used and waste accumulated, the increase would be nominal and would not represent a measurable increase as compared to the region as a whole, therefore, the implementation of the CCP would not represent a significant cumulative effect with respect to water and energy availability and landfill capacity.

None of the action alternatives described in the CCP would have an effect on issues related to environmental justice; therefore, the implementation of the CCP would not contribute to any impacts related to environmental justice that may result from other projects in the immediate vicinity of the Refuge or the San Diego region.

5.12 Summary of Effects

Provided in Table 5-5 is a summary of the potential effects associated with each of the alternatives evaluated for the San Diego NWR.

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Physical Environment				
Topography	Proposed actions would involve minimal changes to the existing landform; therefore, no adverse effects to the Refuge's topographic character are anticipated.	Wildlife and habitat management proposals would have no effect on the existing landform; several public use projects (e.g., parking lots, kiosk installations, visitor contact station, trail bridges) are proposed that would involve grading and other site preparation activities, however the proposed project sites are relatively level requiring little change to the existing landform; development of a sustainable trail system and closure of existing pathways that follow the fall line would reduce existing and minimize the potential for future impacts to the natural landform.	Although some additional trails and the construction of a refuge office in the Sweetwater River management area are proposed under Alternative C, these projects would have impacts similar to those described under Alternative B. All construction projects would be located on relatively flat land and sustainable trail practices would be followed in the construction of any new trails.	Same as Alternative B

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Visual Quality	Removing of invasive plants can change the appearance of an area, particularly wetland areas, until the native vegetation is restored. These actions, although resulting in minor temporary changes to the visual appearance of the site, would no longer be apparent once the native vegetation is restored. Removal of trash and other debris from Refuge lands improves the visual quality of the area. No actions occur on the Refuge that would block public views.	Invasive plant control would be expanded under this alternative, but the effects of these actions to visual quality would continue to be temporary and minor. Revegetating unwanted trails would reduce the overall appearance of disturbed pathways throughout the Refuge. Parking lots, visitor contact stations, information kiosks, and interpretive signs would be sited and designed to protect views into the natural areas of the Refuge from adjacent public areas. Measures are proposed to minimize the visibility of Refuge facilities from adjacent areas.	Same as Alternative B.	Similar to Alternative B; in addition, feral pig control would provide potential benefits by minimizing impacts associated with pig rooting, while conservation measures would be implemented to minimize visual impacts along trails related to the temporary construction of corral traps used in pig control.

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Geology, Soils, and Geological Hazards	Wildlife and habitat management activities would not result in adverse effects to geology or soils. None of the management activities proposed under Alternative A would trigger or accelerate substantial slope instability, subsidence or ground failure. Erosion associated with water flow down poorly laid out trails would continue until the subject trails are closed and/or rehabilitated. BMPs are implemented for all projects that involve grading or ground disturbance. Areas of the Refuge are subject to rock fall hazards.	No adverse effects related to geology and soils would result for the expanded wildlife and habitat management activities. The construction of the proposed public use facilities could result in increased erosion during construction, to minimize the potential for such impacts, the implementation of site specific BMPs are proposed. Projects of an acre or more in size would be required to implement conditions outlined in a SWPPP. Periodic monitoring of potential rock fall areas would occur and trails in these areas would be subject to closure to avoid impacts to trail users.	Same as Alternative B	Similar to Alternative B; in addition, feral pig control would provide potential benefits by minimizing impacts to soils associated with pig rooting, while conservation measures would be implemented to minimize erosion impacts associated with the construction of temporary corral traps used in pig control.

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Paleontological Resources	No adverse effects to paleontological resources are anticipated. Prohibitions on collecting paleontological resources would be enforced.	Although there is the potential for paleontological resources to be present within the Sweetwater River and San Miguel Mountain areas of the Otay-Sweetwater Unit and within the Del Mar Mesa Vernal Pool Unit, no significant excavation is proposed in these areas. Prohibitions on collecting would be enforced.	Same as Alternative B	Same as Alternative B
Mineral Resources	Aggregate resources are present or are likely to be present within portions of the Otay-Sweetwater Unit. These resources would not be available for extraction due to the presence of listed species; but no actions are proposed that would result in the irrevocable loss of these resources.	Same as Alternative A	Same as Alternative A	Same as Alternative A

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Agricultural Resources	Some portions of the Refuge are designated as Farmland of Local Importance, these areas are relatively small and have no access to waterlines or well water.	No actions are proposed that would result in the irrevocable loss of Farmland of Local Importance.	Same as Alternative B	Same as Alternative B
Hydrology	The management activities occurring on the Refuge have limited effect on the natural flows within the Sweetwater River, Steele Canyon Creek, and other drainages on the Refuge. In addition, these activities have little influence over natural stormwater flow and velocities.	To ensure that bridges and other public facility structures do no impact water flows, particularly during flood events, the siting, structural design, and elevation of a proposed structure would take into consideration the hydrology and flood flow elevation of the affected stream or river. New parking areas would be designed to avoid any obstructions to both seasonal low flow volumes and higher stormwater flows.	Same as Alternative B	Same as Alternative B

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Water Quality	BMPs are implemented to reduce the potential for pollutants and excessive siltation to enter wetlands and storm drains. All pesticide use is approved via the Service's PUPS to ensure that only those products that pose the lowest toxicity-related threat to non-target species are applied.	BMPs for pesticide use would be implemented per the IPM Plan. In addition, a variety of BMPs would be implemented during grading for various public use facilities including trails, parking lots, and buildings. For projects involving an acre of more of land, short and long-term BMPs and monitoring during construction would be required under a Water Board approved SWPPP.	Same as Alternative B	Similar to Alternative B; in addition, feral pig control would provide potential benefits associated with protecting water quality and minimizing erosion should feral pigs expand their range and enter the Refuge.
Climate Change	The actual effects to Refuge resources as a result climate change are difficult to predict; under Alternative A, management would continue as currently implemented.	Future management actions, as proposed in Alternative B would attempt to measure and address the effects of climate change on Refuge resources through monitoring and adaptive management.	Same as Alternative B	Same as Alternative B

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Air Quality	Proper maintenance of vehicles, minimizing the generation of fugitive dust during refuge operations, and implementing BMPs when applying herbicides reduce the effects of Refuge operations on air quality to below a level of significance.	Incorporation of BMPs to reduce emissions and fugitive dust during grading and construction of public use facilities would minimize air quality impacts. In addition, BMPs to reduce the effects of herbicide application on air quality would be implemented per the requirements of the IPM Plan and Chemical Profiles.	Same as Alternative B	Same as Alternative B
Greenhouse Gas Emissions	GHG emissions associated with Refuge management and operations would not represent a significant direct or indirect impact on the environment.	Same as Alternative A	Same as Alternative A	Same as Alternative A
Contaminants	Refuge staff would continue to work with the Service's Contaminants Program to evaluate potential sources of contaminants.	Same as Alternative A	Same as Alternative A	Same as Alternative A

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Biological Resources				
Habitat/ Vegetation Resources	Current wildlife and habitat management activities have the potential to produce temporary impacts to native habitat due to trampling or minor vegetation clearing. These impacts, which are limited in scope, would not be considered significant. The primary impacts to the Refuge's native vegetation are from public use (e.g., the expanding user-created trail system, off-trail activities), which result in the loss or trampling of vegetation, particularly shrub species, soil compaction, and general degradation of habitat quality.	A number of restoration and enhancement proposals are included would result in added benefits for native vegetation and overall habitat quality. The implementation of an IPM Plan would ensure that no adverse effects to vegetation occur as a result of the use of approved herbicides. The establishment of a designated trail system and the closure of those trails that impact sensitive habitat areas would benefit native vegetation and habitat quality.	Same as Alternative B	Similar to Alternative B; in addition, feral pig control would provide potential benefits by minimizing the extent of damage to vegetation and habitat quality that could occur if pigs move onto Refuge lands. Conservation measures would be implemented as part of the feral pig control plan to minimize impacts to vegetation.

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Wildlife	Measures to minimize disturbance to wildlife such as timing activities to avoid the bird breeding season and avoiding potential butterfly habitat at appropriate seasons ensure than impacts to wildlife from Refuge management activities are minimized. Unauthorized off trail activity and the presence of dogs on the Refuge can result in deleterious effects to wildlife.	Actions to benefit wildlife would be expanded, but the measures to avoid impacts from management activities would continue to be implemented. A designated trail system would direct activities away from sensitive habitat areas in an effort to reduce impacts related to disturbance and dogs would be prohibited on the Refuge. Public use facilities would be sited to minimize the loss of sensitive habitat and buffers would be provided between sensitive habitats and public use areas.	The potential effects to wildlife would be similar to Alternative B with two exceptions: leashed dogs would be permitted on designated trails and hunting would be permitted in portions of the Refuge. Hunting would result in some direct and indirect adverse effects to hunted species as well as other wildlife, to minimize the effects of hunting and other public uses on the Refuge, large areas of habitat would be closed to all public access.	Similar to Alternative C; but with a smaller hunting area (a portion of the Otay Mesa and Lakes area) and leashed dogs would only be permitted on trails designated for multiple use. Feral pig control would provide potential benefits by minimizing conflicts between native wildlife and feral pigs should they move onto the Refuge. Conservation measures would be implemented to minimize impacts to wildlife from implementing pig control.
Federally and State Listed Species and other Species of Concern	Impacts to listed and sensitive species would be similar to the impacts described under Alternative A for vegetation and wildlife.	Impacts to listed and sensitive species would be similar to the impacts described under Alternative B for vegetation and wildlife.	Impacts to listed and sensitive species would be similar to the impacts described under Alternative C for vegetation and wildlife.	Impacts to listed and sensitive species would be similar to the impacts described under Alternative D for vegetation and wildlife.

Table 5-5
Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR

Resource	Alternative A	Alternative B	Alternative C	Alternative D
Cultural Resources				
Historical and Archaeological Resources	Adherence to existing regulations/policies would minimize the potential for impacts to cultural resources.	Same as Alternative A	Same as Alternative A	Same as Alternative A
Social and Economic Environment				
Land Use	Uses and activities occurring on the Refuge do not result in any adverse effects to adjacent development and the Refuge is managed consistent with the San Diego MSCP.	Expansion of wildlife and habitat management activities and expanded opportunities for wildlife dependent recreational use would have no effect on existing or planned land uses in the vicinity of the Refuge.	Similar in most ways to Alternative B, but under Alternative C, portions of the Refuge would be opened to hunting in accordance with a Refuge hunt plan to be developed with public involvement after the approval of the CCP. Designated hunting areas would provide adequate separation from adjacent private property and residential use and hunt days and species to be taken would vary by location.	Similar to Alternative C, but only a portion of the Otay Mesa and Lakes area would be opened to hunting. No land use issues are anticipated as the lands surrounding the hunt area are publicly owned and hunting is currently permitted on the adjoining BLM and CDFW properties.

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Recreational Opportunities	Wildlife-related recreation would be provided; the county regional trail would be accommodated, and Refuge proposals would not conflict with other regional recreational opportunities.	Same as Alternative A	Same as Alternative A	Same as Alternative A
Traffic Circulation and Parking	No impacts to the regional transportation system are anticipated. Opportunities for on Refuge parking are currently limited.	Same as Alternative A and additional parking areas are proposed on the Refuge to accommodate proposed public uses.	Same as Alternative B	Same as Alternative B
Public Utilities and Easements	No adverse effects to existing public utilities and easements are anticipated.	Same as Alternative A	Same as Alternative A	Same as Alternative A
Economics and Employment	The Refuge provides minor economic benefits related to visitation.	Same as Alternative A	The proposed hunting program would provide some additional economic benefit to the region.	Although the hunting program would be smaller, the economic benefits would be greater than those from Alternatives A and B.

Table 5-5 Summary of Potential Effects of Implementing Management Alternatives A, B, C, or D for the San Diego NWR				
Resource	**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
Environmental Justice	No disproportionate adverse impacts on minority or low-income residents in the region have been identified.	Same as Alternative A	Same as Alternative A	Same as Alternative A