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3. AFFECTED ENVIRONMENT

3.1 Introduction

This chapter addresses the baseline conditions for the proposed reallocation of flood storage to conservation in Chatfield Reservoir. This study focuses mainly on the affected environment at Chatfield Reservoir and surrounding state park, but because there is a potential for flooding and a concern about downstream flow regimes, the neighborhoods downstream from the reservoir to the Adams/Weld county line, adjacent to the South Platte River, are also considered.

Unless otherwise noted, land use data were obtained for the Chatfield Reservoir storage reallocation study area, including the South Platte River flood plain (300 feet on each side of the river) downstream from the reservoir to the Adams/Weld county line.

Chapter 3 focuses on the 17 resources that define the current affected environment within the study area (Figure 1-2):

- Geology and Soils
- Hydrology
- Water Quality
- Aquatic Life and Fisheries
- Vegetation
- Wetlands
- Wildlife
- Endangered, Threatened, and Candidate Species, Species of Special Concern, and Sensitive Communities
- Land Use
- Hazardous, Toxic, and Radiological Wastes
- Air Quality
- Noise
- Aesthetics
- Socioeconomic Resources
- Transportation

- Recreation
- Cultural Resources

It should be noted that not all resources may be relevant to all portions of the study area. For example, noise from recreation may not affect downstream landowners. In addition, a number of issues were identified through the scoping process and agency consultations. These issues, described in the public involvement chapter (Chapter 8), are addressed throughout this section based on the applicable resource areas.

3.1.1 Jurisdiction and Ownership

Chatfield Reservoir is located at the confluence of the South Platte River and Plum Creek within the South Platte Basin. The reservoir itself is located southwest of Denver in Douglas, Jefferson, and Arapahoe Counties. The drainage area for the South Platte River Basin upstream of the reservoir encompasses 3,018 square miles and originates at the headwaters of the North Fork of the South Platte River and the South Fork of the South Platte River in Park County, Colorado. USFS manages most of the lands along the mainstem of the South Platte River upstream of the reservoir. Plum Creek, the second largest of the reservoir's tributaries, flows through a mixture of rangelands and suburban areas. The Buffalo Creek and Hayman fires burned large areas within the South Platte Watershed, resulting in the deposition of sediments and other pollutants into the South Platte River drainage. Reservoirs located upstream of Chatfield include Strontia Springs, Cheesman Lake, Elevenmile Canyon, Spinney Mountain, and Antero Reservoirs. Downstream, the South Platte River joins with the North Platte River in western Nebraska to form the Platte River. The Platte River ultimately joins the Missouri River at the Nebraska/Iowa border. The study area (Figure 1-2) encompasses the area in the immediate vicinity of Chatfield Reservoir and extends downstream to where the river intersects the Adams/Weld county line.

A Real Estate Plan (Appendix L) was prepared to describe the types of estates needed for construction and the legal requirements necessary to operate and maintain the Chatfield Reservoir Reallocation Project. The Real Estate Plan (REP) recommends that the non-federal sponsor acquire fee simple interest in the lands to be used to mitigate the environmental impacts associated with the recommended alternative. In cases where the sponsor is unable to acquire a fee interest in the mitigation areas, the REP recommends the use of a non-standard Conservation easement as an alternative. Prior to the sponsor using such an easement, the non-standard easement would need to be submitted to USACE and the Department of Justice for approval. On-site modifications and mitigation will occur within the area leased to Colorado Department of Natural Resources.

Under Alternative 3, project construction would take place on federally-owned lands, the majority of which are leased to the state of Colorado, the city and county of Denver, the city of Littleton and Highlands Ranch who manage the lands for public park and recreation purposes. The project also includes numerous outgrants, such as recreational trails; public parks; overhead and buried fiber optics cable; road maintenance, right-of-way and maintenance, operation and maintenance of electric powered water intake pumping station including installation, operation and maintenance, buried feeder power lines; pipeline easements; operation and maintenance on sewer lines, roads, water lines, water pump stations, telephone facilities, buried communication cable; buried gas line; return flow ditch; overhead electric lines; drainage easement for runoff. Privately owned

improvements lie within the proposed project area. Most of these improvements were constructed in conjunction with third-party agreements held by the state of Colorado, the city of Denver, county of Denver, and Highlands Ranch. Improvements include campground areas, a marina, recreational trails, roads, toilets, and wild life habitat.

The state of Colorado owns no lands within the project footprint. CDNR would be required by the WSA to acquire lands for ecosystem mitigation, of which most would be offsite (Appendix K). The WSA would require the CDNR to incrementally acquire mitigation lands after the determination of available onsite mitigation areas. CDNR would not acquire the offsite mitigation lands until project approval. The available onsite mitigation lands would be determined after the water elevation began to increase. The Corps Project Manager would develop a schedule if Alternative 3 were selected. The reallocation of the water would not take place until documentation of the required acquisitions had been provided, reviewed, and confirmed as stated in the WSA. The CDNR would construct the project with oversight by the Corps. The offsite mitigation lands would not be open to the public.

CDNR has provided the Corps with a map with a listing of owners and the probable mitigation lands available on each parcel. This project is a willing seller only, and CDNR would not subject any owner to condemnation. The issue of water rights is highly sensitive; therefore, an agreement that the CDNR would acquire the appropriate number of mitigation units (acreage vary by habitat available) as the project progresses is stated within the WSA. The CDNR would be required to self-certify the ability and experience to acquire and provide the Land, Easements, Rights-Of-Way, Relocation, and Disposal Areas (LERRD) for construction, operation, maintenance of the project, including its condemnation authority and quick-take capability.

3.1.2 Water Rights

The existing conservation pool contains existing water rights held by Denver Water that are used for M&I uses. The reallocated storage space would be filled using existing or future water rights belonging to a consortium of water providers (Table 1-1). This reallocation would enable the providers to supply water to local users for municipal, industrial, agricultural, recreational, and fishery needs in response to population growth in the Denver Metro area. In the state of Colorado, water rights are based on the doctrine of prior appropriation, or first in time, first in right (Colorado Constitution, Article XVI, Sections 5 and 6). Senior water rights, therefore, are those with a relatively early date of water right establishment. Junior water rights are those with a later date than the senior water rights. Water providers include entities supplying water to the municipal jurisdictions (Table 1-1). Water providers are typically municipalities that provide water to consumers within their jurisdiction. Water users include consumers, businesses, and agricultural consumers.

3.2 Geology and Soils

This section describes the regional and local geology along the Front Range and soils for parts of Adams, Arapahoe, Denver, Douglas, and Jefferson Counties. These characteristics apply to the entire study area in which geology and soils could be affected, including Chatfield Reservoir, the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits.

Sediment transport was not modeled in this FR/EIS because it is not a significant issue. Channel form is the product of a range of discharges and the temporal sequence of flow events (Knighton,

1998). The return period for the effective discharge depends on the flow and sediment-transport regime of an individual river or reach. Hey (as cited in Biedenharn & Copeland, 2000) indicates that the effective discharge lies within the range 1.01 and 3 years, regardless of the type of river. The USACE modeled streamflows with a 2-year return interval (Q_2) at more than 1,000 river stations along more than 250 miles of the South Platte River downstream of Chatfield Reservoir. This modeling effort is described in Section 3.3, and modeled Q_2 results are presented in Appendix I. The alternatives would not substantially alter the frequency of effective discharge flows. At most, Q_2 would decrease by 2 percent, from 5,100 cfs under Alternatives 1 and 2 to 5,000 cfs under Alternatives 3 and 4, over approximately 12 miles of the South Platte River downstream of the reservoir. As a result, changes to sediment transport downstream of the reservoir are not anticipated. Related impacts to stream morphology or associated ecological communities of the South Platte River are not expected under any alternative.

3.2.1 Regional and Local Geology

The Rocky Mountain foothills near Chatfield State Park are within the Denver Formation and consist of hogbacks and valleys that expose scenic dipping plates, spires, and monoliths from the Precambrian to Late Mesozoic age. Cenozoic Age Rocky Flats alluvium, cobble, gravel, and silt washed down from the Front Range overlie older sediments. Recent alluvium, eroded from the rock formations, is deposited in the valleys and along drainages (Colorado State Parks, 2005a).

Potential geological hazards within the study area may include seismic activity from active faults, including earthquakes, and potential flooding hazards. USACE conducted a Seismic Safety Review of Chatfield Dam (USACE, 2005c). The findings of that study included the recommendation to further evaluate the seismic hazards for Chatfield Dam based on the fact that the state-of knowledge has changed and the site ground motions calculated in a previous evaluation (USACE, 1986) need to be confirmed as still valid. The Seismic Hazard Evaluation for Chatfield Dam was completed and documented in a report entitled "Seismic and Ground Motion Study, Chatfield Dam & Lake, South Platte River Basin, Denver, Colorado" prepared by William Lettis & Associates (2010). Results from the Seismic Hazard Evaluation were used in subsequent evaluations, including the Chatfield Liquefaction Assessment (USACE, 2009b), Post-Liquefaction Stability Analysis (USACE, 2010b, included in Appendix A), and Seismic Analysis of the Intake Tower and Effect of Pool Reallocation (USACE 2010c). These documents were evaluated in preparing the Chatfield Dam Potential Failure Mode Analysis (USACE, 2010a) and the Water Supply Re-Allocation Study Dam Safety Evaluation (Appendix A). A summary of each of these studies follows. A memo signed by the Chief of Engineering stating that there is no impact to the primary flood risk management purpose of Chatfield reservoir nor is there a change to the system flood control storage evacuation releases during a Level II flood as defined in the FR/EIS is included in Appendix A.

Geotechnical/Structural Dam Safety Evaluation. This evaluation addressed potential dam safety concerns based on a permanent increase in the reservoir elevation due to reallocation. The evaluation was based strictly on static loading and specifically addressed instrumentation data, past visual inspections, slope protection, slope stability, and seepage. The study concluded that the new "normal" pool elevation proposed under Alternative 3 would not adversely impact the integrity of the embankment or structures. The study recommended the development and implementation of a Reservoir Raise Monitoring Plan, which would include additional inspections, instrumentation data acquisition, and data analysis. The study also recommended updating, as appropriate, the Project

Surveillance Plan and Emergency Action Plan. The study further recommended installation of additional instrumentation prior to the pool raise, along with an increase in instrumentation readings and inspection frequencies during and following the pool raise. The evaluation emphasized that any dam safety concerns that develop during the pool raise could result in lowering the reservoir elevation and/or a pool restriction.

The current Dam Safety Action Classification (DSAC) is IV, or Priority. The DSAC scale includes I (Urgent and Compelling) through V (Normal). The DSAC rating at Chatfield Dam is not permanent and could change depending on future assessments and dam performance.

Liquefaction Assessment. The liquefaction assessment evaluated the liquefaction susceptibility of both the Chatfield Dam embankment and foundation for the existing conservation reservoir and a 12-foot raise proposed under Alternative 3. The assessment utilized information obtained from original design documents, studies, and limited field work. Results of the assessment indicated probable zones of liquefaction both upstream and downstream for the valley and right abutment. The assessment recommended a follow-on Post-Liquefaction Stability Analysis (see details below) to determine if the embankment would remain stable if zones of the foundation were to liquefy after a Maximum Credible Earthquake.

Post-Liquefaction Stability Analysis. A Post-Liquefaction Stability Analysis was performed as a result of the recommendation from the Liquefaction Assessment. The study evaluated whether the embankment would remain stable if zones of the foundation were to liquefy after a Maximum Credible Earthquake. Results of the study indicated the embankment and foundation would remain stable after this event. No further seismic studies related to the embankment or foundation were recommended.

Seismic Analysis of the Intake Structure. A modal analysis of the intake structure was conducted to evaluate performance of the intake structure during and immediately after a Maximum Design Earthquake. The analysis concluded that the intake structure meets or exceeds Corps criteria for during and immediately after a Maximum Design Earthquake, at the current normal pool and the proposed pool elevation under Alternative 3. No additional seismic studies for the intake structure were recommended.

Potential Failure Mode Analysis (PFMA). A Potential Failure Mode Analysis was completed April 2010. The analysis was conducted to identify and evaluate potential failure modes at Chatfield Dam as the result of the reallocation. Nine potential failure modes were identified to be credible failure modes which are those potential failure modes that are physically possible under a specified loading condition. Although none of the failure modes identified during the PFMA were determined to be significant, items were identified to further investigate many of the failure modes identified. These investigations will be incorporated into the on-going dam safety program. The PFMA can be found in Appendix EE. The five counties within the study area are located within a geographic area that can receive intensely heavy rainfall. The streams and drainage ways, primarily along Plum Creek, Cherry Creek, and the South Platte River, can flood in these instances. Chatfield Reservoir provides flood protection, and while the dam may not prevent all flooding, it substantially reduces the amount of flooding downstream.

Sediment Depletion Rates Analysis. A study was also completed on Chatfield sediment depletion rates. The purpose of this analysis, which was completed January 2012, was to project long-term sediment depletions for the next 50 and 100 years. The last hydrographic survey of Chatfield Lake was completed in 2010. Study findings indicated the reservoir storage capacity in 50 years (2060) would be 25,561 acre-feet when 90.8 percent of the total storage capacity will remain at the multipurpose pool elevation of 5432.0 using a storage depletion rate of -30.3 acre-feet/year. Using the same storage depletion rate, in 100 years (2110) the reservoir storage capacity will be 24,046 acre feet with 85.4 percent of total storage capacity remaining. The Chatfield Sediment Depletion Rates - Future Conditions study can be found in Appendix FF.

3.2.2 Soils

Chatfield State Park is situated in the lower foothills of Colorado's Front Range on the southwestern edge of the Denver Metro area. The park occupies a gently rolling plain layered with Pleistocene and recent silty loess and alluvial cobble, gravel, sand, silt, and clay; some older sandstones and shales are also exposed. From these materials, the following soil types are found at Chatfield State Park: predominantly mollisols (found in drier areas of the humid continental climate), and a few entisols (newer soils) and aridisols (found in arid and semiarid climates). Soil textures range from clays to gravelly loams and sands.

Soil erodibility is an estimate of the ability of soils to resist water and wind erosion, based on the physical characteristics of each soil. Generally, soils with faster infiltration rates, higher levels of organic matter and improved soil structure have a greater resistance to erosion. Sand, sandy loam, and loam-textured soils tend to be less erodible than silt, very fine sand, and certain clay textured soils. Soil K factors represent a relative index of susceptibility to particle detachment and transport by rainfall as compared to bare, cultivated soil. Based on the low K factors of the soil types, which range from 0.05 to 0.28 (Natural Resources Conservation Service [NRCS], 2005a), erodibility is expected to be low.

In general, the primary source of sediment deposition into Chatfield Lake is watershed sheet, rill, and gully erosion, followed by shoreline erosion as the secondary source (USACE, 2007). Reservoir deposits generally accumulate near or below the sediment pool elevation of 5,426 feet msl, except during storm events. No significant storm events have occurred between 1998 and 2006 (USACE, 2007). Deposition in the flood control zone (5,500 to 5,430 feet msl) is confined within the former stream channel banks and would be progressively redistributed into the sediment pool zone during subsequent flows.

The loss of vegetation makes soil vulnerable to erosion by wind and water. Plants provide protective cover on the land and prevent soil erosion for the following reasons: (1) plants slow down water as it flows over the land, allowing much of the rain to soak into the ground; (2) plant roots hold the soil in position and prevent it from being blown or washed away; (3) plants break the impact of a raindrop before it hits the soil, reducing the soil's potential to erode; and (4) plants in wetlands and on the banks of rivers slow down the flow of the water, and their roots bind the soil, preventing erosion.

3.2.2.1 Fires

Chatfield Reservoir is a part of the Upper South Platte Watershed, which has been identified as a watershed at risk to catastrophic wildfire by the Upper South Platte Watershed Protection and Restoration Project (USFS, 2000). This watershed is within the South Platte River Basin, which includes the river and its tributaries from the Rocky Mountains in Colorado into Wyoming and Nebraska. Because soils in a high-intensity burn area often become hydrophobic, or water repellent, which increases flood and erosion potential, downstream water quality can become degraded. Soils that are water repellent exhibit a decreased water infiltration rate and an increased water runoff rate, creating extreme soil erosion potential. Initially, rainwater will run off hydrophobic soils instead of infiltrating and promoting germination of seed and growth of roots. This makes it difficult to establish a stand of vegetation. If torrential rains occur in a burn area, the non-stabilized soils travel along the rivers and streams towards the watershed's reservoirs, including Chatfield Reservoir.

In 1996 and 2002, respectively, the Buffalo Creek and Hayman fires occurred in the South Platte River Basin upstream of Chatfield Reservoir. The Buffalo Creek fire burned nearly 12,000 acres. Following the fire, several torrential rainstorms occurred, which resulted in over 300,000 cubic yards of sediment moving into the Strontia Springs Reservoir, upstream of Chatfield Reservoir (Agnew et al., 2000). Volumes of sediment captured in Strontia Springs Reservoir increased from an average of 20,000 cubic feet per year prior to the Buffalo Creek fire to 67,000 cubic feet per year after the fire (Bob Peters, personal communication, 2007). Nutrients contained within this sediment introduced thousands of tons of nitrogen and phosphorus into Chatfield Reservoir, which affected the water quality at Chatfield (Wohl, 1998).

The Hayman fire was the largest recorded wildfire in Colorado, burning nearly 138,000 acres and destroying 600 structures. After the Hayman fire, crews entered the burned areas and attempted to stabilize soils by raking, seeding, and hydro-mulching the surface. This soil stabilization reduced runoff, and helped to protect both the ecosystem and the watershed (Cyberwest Magazine, 2003). Similar to the Buffalo Creek fire, the Hayman fire caused increased total levels of phosphorus and metal runoff into Chatfield Reservoir, which impeded attainment of water quality standards.

In 2006, the USACE completed a reconnaissance-level sediment survey of portions of Chatfield Reservoir to determine whether the runoff following the Hayman fire had contributed measurable sediment deposition (USACE, 2007). They compared cross-section surveys completed in 1977, 1991, 1998, and 2006, and looked for trends of increasing or decreasing sedimentation levels that may have been associated with the 2002 Hayman fire. Analysis of the data did not show additional, unexpected sediment deposition. At several cross sections, annual deposition rates decreased, in part because of severe drought in the basin.

Cheesman Reservoir, located on the South Platte River upstream of Chatfield Reservoir, acts as a sediment trap and has likely captured most of the sediment runoff associated with the Hayman fire (USACE, 2007). A sedimentation problem could develop in the future if sediments in Cheesman Reservoir were transported into Chatfield Reservoir. Under a permit issued by USACE, Denver Water periodically removes sediment from traps in Cheesman Reservoir, including 17,000 cubic yards from the Goose Creek sediment trap and 28,000 cubic yards from the Turkey Creek trap in 2005, and another 60,0000 cubic yards from the Turkey Creek trap in 2006 (Bob Peters, personal communication, 2007).

The Chatfield Watershed Authority produces an annual report that describes the water quality of the entire Chatfield Reservoir watershed. Since the Hayman fire, this report has included the results of a special monitoring program for South Platte River inflow and reservoir water quality for selected fire-related runoff parameters. USFS estimates that the Hayman burn area could take 20 to 50 years for full recovery. A minimum of 10 years is needed to begin revegetation of grasses and the forest recovery could take decades (Chatfield Watershed Authority 2006). This large burn area could generate considerable amounts of erosion, even with best mitigation efforts, until revegetation has occurred. Long-term erosional potential causes uncertainty about sediment, nutrient and metal loading to downstream waterbodies. The erosion potential from the runoff area affected by the Hayman fire remains extreme (Chatfield Watershed Authority, 2006). Downstream water quality data for 2003 to 2005 show that some nutrients and metals exceed historic data trends. Wildfire runoff pollutants could exceed numeric water quality standards.

Chatfield data show a nutrient-loading problem associated with fire runoff (Chatfield Watershed Authority, 2006). The data are variable and the magnitude of the loading is difficult to predict. Historic average loading of total phosphorus in surface water in the Chatfield Reservoir has increased since the 2002 Hayman fire, from less than 30 micrograms per liter (µg/L) between 1997 and 2002, to 38, 40, 27, and 31µg/L in each subsequent year. Chatfield Reservoir exceeded the growing season total phosphorus standard in 2003 and 2004 despite extremely low runoff from the burned area because of drought. Although 2006 inflow into Chatfield Reservoir was below normal, the flow-based phosphorus loading was increased as a result of runoff from the Upper South Platte River Watershed. Increasing runoff in the South Platte River could continue to carry phosphorus into the reservoir.

3.2.2.2 Prime and Unique Farmland

This section addresses farmland in Douglas, Jefferson, Denver, Arapahoe, Adams, Weld, and Morgan Counties, including prime and unique farmland as defined by the NRCS. Weld and Morgan Counties were included in this analysis to address potential impacts farther downstream, such as drying of agricultural lands if water rights were transferred from irrigation to other users.

Congress passed the Agriculture and Food Act of 1981 (Public Law 97-98) containing the Farmland Protection Policy Act (Subtitle I of Title XV, Section 1539–1549) as a result of the drastic loss of agricultural lands throughout the nation. This act protects prime and unique farmland and is intended to minimize the impact federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses.

Prime Farmland

Prime farmland is defined as "land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, without intolerable soil erosion, as determined by the Secretary [of Agriculture]" (NRCS, 2002). Non-irrigated farmland in Colorado is not considered to be prime farmland by NRCS.

Unique Farmland

Unique farmland is defined as "land other than prime farmland that is used for the production of specific high value food and fiber crops, as determined by the Secretary [of Agriculture]. It has the

special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods" (NRCS, 2002).

Information on soils within the study area was obtained from NRCS soil maps for the five-county study area. According to the maps, none of the soil units identified supported prime or unique farmland. Some soils would be classified as prime or unique if certain requirements were met—if the land was irrigated and/or reclaimed of excess salts and sodium. As noted in the discussion of economics, less than 1 percent of employment is related to farming in the study area, with the exception of Weld County, which has over 5 percent of employment related to farming. However, there were many farmland soils that are of statewide importance (NRCS, 2005a). In Colorado, all agricultural lands that are irrigated, regardless of soil quality considerations, are considered farmlands of statewide importance.

3.3 Hydrology

This section describes hydrological conditions in the South Platte River Watershed, including its mountains-and-plains climate, temperature, and precipitation patterns. These characteristics apply to the entire study area, including Chatfield Reservoir, the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits. Surface water and groundwater conditions also are presented for the study area.

3.3.1 Climate, Temperature, and Precipitation

According to the Colorado Climate Center (2004), Colorado has a continental-type climate modified by topography, with large temperature ranges (from -30 to 100 degrees Fahrenheit) and irregular seasonal and annual precipitation. Colorado's Front Range climate is considered semiarid. Winter and fall are dry seasons, and spring and summer are wet seasons. The weather is highly changeable and includes abbreviated periods of high winds and occasional thunderstorms with damaging hail. The growing season lasts about 138 days.

Precipitation patterns in the South Platte River Basin upstream of Chatfield Reservoir depend on altitude. The greatest amount of annual precipitation (30 inches) occurs in the mountains as snow and less than 15 inches of annual precipitation occurs on the plains. Most of the precipitation on the plains occurs from April to September as thunderstorms. From 1971 to 2000, the annual average temperature in the Denver Metro area was 50 degrees Fahrenheit, and the average annual precipitation was 15.81 inches (National Oceanic and Atmospheric Administration [NOAA], 2003).

The impact of climate change on runoff in the Platte Basin has not been studied extensively (Ray et al., 2009). The average temperature in the southwestern United States has increased roughly 1.5°F compared to a 1960—1979 baseline period (Karl et al., 2009). Climate models project that Colorado will warm by approximately 2.5°F by 2025 and by approximately 4°F by 2050, relative to a 1950—1999 baseline period (Ray et al., 2009). The projections show summers warming more (+5°F) than winters (+3°F), and suggest that typical summer temperatures in 2050 will be as warm as or warmer than the hottest 10 percent of summers that occurred between 1950 and 1999. Individual models projections do not agree whether annual mean precipitation will increase or decrease in Colorado by 2050. More mid-winter precipitation throughout the state is predicted, and in some areas, a decrease in late spring and summer precipitation. Regardless of precipitation, the timing of

spring runoff is projected to shift earlier in the spring, and late-summer flows may be reduced (Ray et al., 2009).

3.3.2 Surface Water Hydrologic Conditions

The primary sources of water in Colorado are snowmelt and stormwater runoff. These sources discharge into Rocky Mountain rivers and lakes and provide the water supply for one-quarter of the nation. East of the Continental Divide, the Arkansas, Missouri, North and South Platte, and Yellowstone Rivers flow toward the Gulf of Mexico. On the east side of the mountains, water supports agriculture, municipal supplies, and recreation (Stohlgren, 2005).

The South Platte River originates as snowmelt in central Colorado at an elevation of about 12,500 feet. From its source, the river flows southeastward, then northeastward, and after crossing the Colorado-Nebraska border, flows almost due east to join the North Platte River. The South Platte River is about 450 miles long and drains approximately 24,300 square miles (USGS, 2005). The Platte River flows through Nebraska and joins the Missouri River south of Omaha, Nebraska.

In the South Platte River Basin, stream water quality generally depends more on adjacent land use than on upstream land use because upstream water often is removed from the river by diversions. The SWSI (CWCB, 2004), which used U.S. Geological Survey (USGS) 1992 National Land Cover Data, found that approximately one-third of the South Platte River Basin is publicly owned. The majority of those lands are forest areas in the mountains. Western portions of the basin and montane and subalpine areas are primarily forested, while the High Plains region is mainly grassland and planted/cultivated land. According to USGS (1998), rangeland comprised 41 percent of the land use in the South Platte River Basin in 1992—1995, but this use had a relatively small effect on water quality because of the lack of overland flow and minimal water use. Irrigated agriculture comprised only 8 percent of the land area in the basin in 1992—1995 but accounted for 71 percent of the water use in 1990 (USGS, 1998). Urban lands comprised only 3 percent of the basin in 1992—1995 but accounted for 12 percent of the water use in 1990, or 27 percent if power generation is considered an urban water use (USGS, 1998). The SWSI (CWCB, 2004) reports gross water use for the South Platte River Basin in 2003. Self-supplied industrial use and M&I use, combined, comprised 23 percent (772,400 acre-feet per year) of the total demand. Agricultural use accounted for the remaining 77 percent (2,606,000 acre-feet per year) in 2003 (CWCB, 2004). Comparing these studies, irrigated agriculture use of surface water in South Platte Basin appears to have increased from 71 percent in 1990 to 77 percent in 2003. Urban water use appears to have increased from 12 percent in 1990 to 23 percent in 2003.

Historical (1942 to 2000) data from South Platte River stream gages and Chatfield Reservoir operations (beginning after the reservoir was constructed) were entered into a Corps' computer model (HEC-5). A detailed description of the modeling effort is described in Chapter 4 and included in Appendices H and I. The hydrology of the reservoir pool elevations, the flows coming into the reservoir from upstream, and the flows leaving the reservoir have varied considerably during the 61-year POR. The record captures cycles of wetter and drier periods. Drought is a regular feature in Colorado (Colorado State University 2007). In the 1900s alone, four prolonged dry spells occurred, beginning with one in the 1910s. Another in the 1930s caused the dust-bowl period. The second worst drought on record occurred in the 1950s. A series of hot, dry summers following a period of

low mountain snowpack created water shortages. The fourth drought hit parts of Colorado in the late 1970s. In the 21st century, the most severe drought since 1723 hit the state in 2002.

Chatfield Reservoir inflows from the South Platte River upstream consist primarily of snowmelt and stormwater, which generally occur in spring and late summer, respectively. Mean flow for the entire period of record is 231 cfs. Flows provided by streamflow regulation via Antero and Spinney Reservoirs are sustained throughout the year. These baseflows allow Chatfield Reservoir operators to minimize potential impacts to the reservoir caused by rapid spring runoff or large storm events. Flows greater than approximately 500 cfs occur less than 10 percent of the time.

3.3.3 Groundwater Hydrologic Conditions

Groundwater generally occurs in one of two forms. One form, alluvial or shallow groundwater occurs within the sands and gravel below and adjacent to stream and river channels. Alluvial groundwater is closely tied to surface water as the water may readily flow from the streambed into the alluvium and vice versa. Groundwater also occurs within water-bearing geologic formations deep below the surface within "confining" layers and without any direct contact to surface water flows. Both types of aquifers exist within the study area.

The Denver Basin aquifer system is a deep groundwater source, composed of four principal aquifers (Dawson, Denver, Arapahoe, and Laramie-Fox Hills). An overlying alluvial aquifer occurs along the South Platte River and its tributaries (USGS, 1995). The deep aquifer system underlies an area of about 7,000 square miles that extends from Greeley south to near Colorado Springs and from the Front Range east to near Limon. The aquifer consists of a 600- to 1,000-foot-thick series of moderately consolidated, interbedded shale, claystone, siltstone, and sandstone. Water-yielding layers of sandstone and siltstone occur in poorly defined irregular beds that are dispersed within relatively thick (100 to 300 feet) sequences of claystone and shale.

The Denver Basin groundwater was deposited millions of years ago when the basin was formed. Because of the nature of the confining layers and the limited connection between these aquifers and surface water, groundwater in the aquifers is considered nonrenewable (USGS, 1995). The USGS (1987) estimated the total volume of groundwater in storage within the Denver Basin aquifer system (including the Dawson, Denver, Arapahoe, and Laramie-Fox Hill aquifers) at 467 million acre-feet with a volume of 269 million acre-feet recoverable. This recoverable volume is a regional estimate for the entire Denver Basin area and is not representative of what may be available from the aquifers on a localized basis.

Historically, the Denver Metro area relied on surface water; however, in the past 30 years new housing developments, particularly in the south metropolitan area, have relied on groundwater from the bedrock aquifers since surface water is essentially fully appropriated and in short supply. The principal means of groundwater discharge from the Denver Basin aquifers are withdrawal from wells and inter-aquifer movement of water from the bedrock to overlying alluvial aquifers. Estimated groundwater withdrawal from the bedrock aquifers increased from about 14,000 acre-feet per year during 1960 to about 29,000 acre-feet per year during 1980. The CDNR estimated that annual pumping rates reached 57,000 acre-feet in 1998 (CWCB, 2002).

On average, about 5 million acre-feet of water falls as precipitation each year on the Denver Basin. Over 4.9 million acre-feet of this water is lost to evaporation, transpiration by plants, or surface runoff. The remaining water, about 40,000 acre-feet, recharges the four Denver Basin aquifers (USGS, 1995).

The alluvial aquifer occurs along much of the South Platte River valley ranging in width from 1 to 10 miles and from less than 5 to more than 100 feet deep. Sand and gravel are the principal water yielding materials in the alluvial aquifer, and depth to water usually ranges from 0 to 40 feet. The alluvial aquifer is estimated to hold 8 million acre-feet of water (CWCB, 2002). Shallow, discontinuous alluvial aquifers overlie parts of the Denver Basin aquifer system, primarily along small streams that extend south from the South Platte River. The alluvial aquifers generally are thicker and more extensive in the northern half of the Denver Basin, where they supply water for irrigation, stock, and domestic use. The surface water in streams and reservoirs and water used for irrigation purposes are the principal sources of recharge for these aquifers. Water discharged to alluvial aquifers can contribute to the flow in the aquifers or streams adjacent to them or can be lost to evapotranspiration (USGS, 1995).

USGS (1998) conducted a survey from 1992 to 1995 in the South Platte River Basin. The study concluded that groundwater levels in the mountains and plains showed seasonal patterns. Groundwater levels in the mountains fluctuated in response to snowmelt and subsequent infiltration of water, which resulted in the highest water levels occurring between March and June. Groundwater levels in the alluvial aquifer in the plains fluctuated in response to the application of irrigation water for agriculture, which resulted in the highest water levels occurring between July and September. The South Platte alluvial aquifer in the plains is used primarily for irrigation, but also as a source of domestic water in rural areas of the state.

3.4 Water Quality

The following section presents a discussion of federal water quality criteria for and location-specific details of water quality measurements in the study area, including ambient water quality and surface water and groundwater quality in the South Platte River Basin. These characteristics apply to the entire study area, including Chatfield Reservoir, the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits.

3.4.1 Ambient Water Quality

Controlling water pollution is necessary to protect public health and welfare, as well as the environment. Clean water has other positive benefits, including the maintenance of aquatic life, wildlife habitats, vegetation, and aesthetics.

Section 304 (a)(1) of the Clean Water Act of 1972 (33 USC §§ 1251–1387; Public Law 92-500, as amended in 1990) requires EPA to develop and publish criteria for water quality accurately reflecting the latest scientific knowledge. EPA developed freshwater, saltwater, and human health criteria for priority pollutants, non-priority pollutants, and organoleptic (i.e., taste, odor) effects (EPA, 1999). These criteria provide guidance for states adopting their own water quality standards under Section 303 (c) of the Act. Compliance with the Clean Water Act of 1972 and coordination with the EPA is described in Appendix S.

CWQCC has identified beneficial uses for all waters of the state by individual stream segment and developed water quality standards necessary to protect those uses. Table 3-1 presents the designated uses and water quality standards by segment for waters within the study area. The CWQCC adopted the Chatfield Reservoir Control Regulation (Colorado Regulation Number 73) to address specific water quality regulatory requirements for Chatfield Reservoir Watershed and Chatfield Reservoir. The control regulation assures watershed point and nonpoint source water quality compliance consistent with adopted stream standards and classifications.

3.4.2 Surface Water

The main surface waters within the study area include the South Platte River, Plum Creek, Cherry Creek, and Bear Creek with the South Platte River and Plum Creek being the major contributors to Chatfield Reservoir. The Chatfield Watershed Authority is the designated water quality management agency for the Chatfield Reservoir Watershed, which consists of the area upstream from the outlet of Chatfield Reservoir. The agency manages long-range planning of municipal wastewater treatment (point source pollution) and non-permitted (nonpoint) sources of pollution. Under Colorado Regulation Number 73, the Chatfield Watershed Authority is also responsible for implementing the control regulation and monitoring water quality and trends.

Chatfield Reservoir maintains a state water quality classification of Class E recreation and Class 1 cold-water aquatic life. The Class E recreation classification is designated to protect primary body contact uses. As defined by these regulations, these surface waters are suitable for recreation activities in or on the water where the ingestion of small quantities of water is likely to occur. The Class 1 cold-water aquatic life classification defines acceptable water quality conditions as set forth in Table 3-1. Waters with this classification contribute no substantial impairment of the abundance and diversity of species and are capable of sustaining a wide variety of cold-water biota, including sensitive species (CWQCC, 2009a).

The Chatfield Reservoir Clean Lakes Study identified potential water quality problems for Chatfield Reservoir because of increases along the eutrophication scale caused by nutrient loading and other pollutants (DRCOG, 1984; Chatfield Watershed Authority, 2006). The study recommended several standards and treatment options to protect the water quality at the reservoir (CWQCC, 2009b). In 1984, CWQCC used water quality data and hydrologic conditions from 1982 along with estimates of future conditions to establish a TMAL for phosphorus of 59,000 pounds total phosphorus in conjunction with 261,000 acre-feet of water, resulting in a phosphorus standard within the reservoir at 0.027 milligrams per liter (mg/L). The TMAL distributions of total phosphorus by sources were based on a spreadsheet model developed specifically for Chatfield Reservoir by local authorities and later approved by the state. Point sources of phosphorus to Chatfield Reservoir were limited to 7,533 pounds per year with 51,291 pounds per year allocated to nonpoint and background sources (CWQCC, 2009b).

However, total phosphorus loads generally did not cause Chatfield Reservoir to exceed the previous TMAL or the former chlorophyll-a goal of 0.017 mg/L. The Chatfield Watershed Authority (2005) observed that total phosphorus within Chatfield Reservoir varied with the water yield in the basin. In natural lakes and streams, phosphorus concentrations of inflows tend to correlate with phosphorus concentrations in the lakes. According to Dr. James Saunders, Surface Water Standards Scientist of the Colorado Water Quality Control Division, the relationship in Chatfield Reservoir is

not as strong because a significant amount of sediment (and phosphorus) settles out of the South Platte River as the flows are detained in Strontia Springs and Cheesman Reservoirs upstream of Chatfield Reservoir (Chatfield Watershed Authority, 2008). As a result, the sediment that remains in the water flowing to Chatfield Reservoir appears finer than in a natural system. It tends to remain suspended longer and, in general, is more likely to be flushed out of Chatfield Reservoir. Exceptions occur occasionally when Chatfield Reservoir receives sediment-laden waters as Denver Water flushes out upstream reservoirs. Also, an underflow may develop in the upstream reservoirs where sediment is sucked through the system during high flows (Chatfield Watershed Authority, 2008).

In July 2007, the CWQCC heard evidence that the phosphorus standard in Chatfield Reservoir had been exceeded in 5 of the previous 6 years, while the chlorophyll-a goal was not exceeded. During this triennial review hearing, the CWQCC agreed that the linkages between in-lake chlorophyll and total phosphorus concentrations and between total phosphorus concentrations and total phosphorus load to the reservoir were critical to the TMAL and called for their review. The CWQCC held a rule-making hearing in November 2008 to consider revisions to the control regulation and related water quality standards in Regulation Number 38. They directed the Water Quality Control Division to conduct a Technical Review of the TMAL and the underlying standard. Based on the results of the Technical Review, the CWQCC adopted revised site-specific standards for total phosphorus and chlorophyll-a for Chatfield Reservoir in relevant sections of Regulation Number 38, which became effective on March 30, 2009. These current standards are total phosphorus of 0.030 mg/L and chlorophyll-a of 10 µg/L, and are evaluated based on evaluation criteria. The criteria for phosphorus is 0.035 mg/L, and for chlorophyll-a is 11.2 µg/L, both measured through the collection of samples that are representative of the mixed layer during summer months (July, August, and September) and with a maximum allowable exceedance frequency of once in five years. As a result of these changes, the CWQCC adopted a new allowable load of total phosphorus of 19,600 pounds per year under a median inflow of 100,860 acre-feet per year. The new allowable load better reflects the linkage between watershed total phosphorus load and the in-lake total phosphorus concentration. Revised allocations of the load will be developed to complete revisions to the TMAL. Until that time, the previous load allocations remain in effect.

Since 1985, the reservoir has been generally considered to have good water quality, although Trophic State Index data have indicated the reservoir was in a slightly eutrophic condition because of elevated nutrient levels. Phosphorus levels established in the previous TMAL were exceeded in 11 out of 24 years between 1982 and 2006 (Chatfield Watershed Authority, 2007) while the chlorophyll-a goal was met continuously. Water quality data also indicate that the reservoir generally maintains pH values in compliance with the standard, in the range of 6.5 to 9.0. Four metals (copper, iron, mercury, and manganese) exceeded standards in 2004. These metals are generally associated with erosion and runoff from wildfire burn areas (i.e., Hayman fire).

Large water bodies, including Chatfield Reservoir, become thermally stratified as cold water sinks to the bottom and warm water stays near the surface. During the spring season, the first several feet of water begin to warm and float, as the warmer water is less dense than the cooler water below. At this time, the thin surface layer of warm water is subject to mixing from wind and wave action. As spring progresses into summer, the surface waters warm faster than the heat is distributed by mixing, and the warm water layer expands into deeper water. This process accelerates through warmer summer months, and reservoirs can stratify into three layers: the epilimnion (the upper layer of warm, less

Table 3-1
Chatfield Reservoir Stream Classifications and Water Quality Standards

Basin: Upper South Platte River Stream Segment Description	Classifications	Numeric Standard Physical and Biological	Inorganic (mg/L)		Metals (µg/L)			Temporary Modifications and Qualifiers
6a. Mainstem of the South Platte River from the outlet of Cheesman Reservoir to the inlet of Chatfield Reservoir	Aquatic Life Cold 1 Recreation E Water Supply Agriculture	T=TVS(CS-II) ºC D.O. = 6.0 mg/L D.O. (sp)=7.0 mg/L pH = 6.5-9.0 E. Coli=126/100mL	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=WS	As(ac)=340 As(ch)=0.02(Trec) Cd(ac)=TVS(Tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=WS(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ac/ch)=TVS Mn(ch)=WS(dis) Hg(ch)=0.01(Tot)	Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac)=TVS Ag(ch)=TVS(Tr) Zn(ac/ch)=TVS	
6b. Chatfield Reservoir	Aquatic Life Cold 1 Recreation E Water Supply Agriculture	T=TVS(CLL) ºC April-December $T_{(WAT)}$=23.5ºC D.O. = 6.0 mg/L D.O. (sp)=7.0 mg/L pH = 6.5-9.0 E. Coli=126/100mL P(Tot)=0.030 mg/L chlorophyll=10 ug/L measured through samples that are representative of the mixed layer during July-September, with an allowable exceedance frequency of 1 in 5 years	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=10 Cl=250 SO_4=WS	As(ac)=340 As(ch)=0.02(Trec) Cd(ac)=TVS(Tr) Cd(ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=WS(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ac/ch)=TVS Mn(ch)=WS(dis) Hg(ch)=0.01(Tot)	Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac)=TVS Ag(ch)=TVS(Tr) Zn(ac/ch)=TVS	The following criteria shall be used when assessing whether 6b is in attainment of the specified standard. chlorophyll = 11.2 µg/L, summer average, 1 in 5 year allowable exceedance frequency phosphorus(Tot) = 0.035 mg/L, summer average, 1 in 5 year allowable exceedance frequency
7. All tributaries to the South Platte River, including all wetlands from a point immediately below the confluence with the North Fork of the South Platte River to the outlet of Chatfield Reservoir except for specific listings in Segments 8, 9, 10, 11, 12, and 13.	Aquatic Life Cold 2 Recreation E Agriculture	T=TVS(CS-II) ºC D.O. = 6.0 mg/L D.O. (sp)=7.0 mg/L pH = 6.5-9.0 E. Coli=126/100mL	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.05 NO_3=100	As(ac)=340 As(ch)=100(Trec) Cd(ac)=TVS(Tr) Cd(ch)=TVS CrIII(ac/ch)=TVS CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ac/ch)=TVS Hg(ch)=0.01(Tot)	Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac)=TVS Ag(ch)=TVS(Tr) Zn(ac/ch)=TVS	
10a. Mainstems of East Plum Creek, West Plum Creek, and Plum Creek from the boundary of National Forest lands to Chatfield Reservoir, mainstems of Stark Creek and Gove Creek from the boundary of National Forest lands	Aquatic Life Warm 1 Recreation E Water Supply Agriculture	T=TVS(WS-I) ºC D.O.= 5.0 mg/L pH = 6.5-9.0 E. Coli=126/100mL	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.5 NO_3=10 Cl=250 SO_4=WS	As(ac)=340 As(ch)=0.02(Trec) Cd(ac/ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS	Fe(ch)=WS(dis) Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ac/ch)=TVS Mn(ch)=WS(dis)	Hg(ch)=0.01(Tot) Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac/ch)=TVS Zn(ac/ch)=TVS	Temporary modifications: Cu (ac/ch)=TVSx2.4 on East Plum Creek and Plum Creek below the Plum Creek Wastewater Authority Discharge (Type iii). Expires 12/31/2015.

Table 3-1
Chatfield Reservoir Stream Classifications and Water Quality Standards

Basin: Upper South Platte River Stream Segment Description	Classifications	Numeric Standard Physical and Biological	Inorganic (mg/L)		Metals (µg/L)			Temporary Modifications and Qualifiers
to their confluence.								
14. Mainstem of the South Platte River from the outlet of Chatfield Reservoir to the Burlington Ditch diversion in Denver, Colorado.	Aquatic Life Warm 1 Recreation E Water Supply Agriculture	T=TVS(WS-I) ºC summer=14 Feb - Nov D.O.=5.0 mg/L pH=6.5-9.0 E. Coli=126/100mL	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=0.5 NO_3=10 Cl=250 SO_4=WS	As(ac)=340 As(ch)=0.02(Trec) Cd(ac/ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS Fe(ch)=WS(dis)	Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=190(dis) Mn(ac/ch)=TVS Hg(ch)=0.01(Tot) Ni(ac/ch)=TVS	Se(ac/ch)=TVS Ag(ac/ch)=TVS Zn(ac/ch)=TVS	Temporary modifications: Cu(ac/ch)=TVSx2.7 (Type iii). Applies below the confluence with Marcy Gulch. Expires 12/31/2015. T=current conditions (Type iii). Expires 12/31/2015. Se(ac/ch)=current conditions (Type iii). Expires 12/31/2013. As(ch)=0.02-3.0(Trec) Expires 10/31/2013.
15. Mainstem of the South Platte River from the Burlington Ditch diversion in Denver, Colorado, to a point immediately below the confluence with Big Dry Creek.	Aquatic Life Warm 2 Recreation E Water Supply Agriculture UP designation	T=TVS(WS-I) ºC D.O. as follows: Early Life Stage Protection Period (April 1 through July 31) 1-Day=3.0 mg/L (acute) 7-Day Average =5.0 mg/L Older Life Stage Protection Period (August 1 through March 31) 1-Day=2.0 mg/L (acute) 7-Day Mean of Minimums=2.5 mg/L 30-Day Average=4.5 mg* pH = 6.5-9.0** E. Coli=126/100mL	NH_3(ac/ch)=TVS Cl_2(ac)=0.019 Cl_2(ch)=0.011 CN=0.005	S=0.002 B=0.75 NO_2=1.0 NO_3=10 Cl=250 SO_4=WS	As(ac)=340 As(ch)= 0.02-10(Trec) Cd(ac/ch)=TVS CrIII(ac)=50(Trec) CrVI(ac/ch)=TVS Cu(ac/ch)=TVS Fe(ch)=WS(dis)	Fe(ch)=1000(Trec) Pb(ac/ch)=TVS Mn(ch)=400(dis) Mn(ac/ch)=TVS Hg(ch)=0.01(Tot)	Ni(ac/ch)=TVS Se(ac/ch)=TVS Ag(ac/ch)=TVS Zn(ac/ch)=TVS	*For the purpose of determining attainment of the standard, dissolved oxygen measurements shall only be taken in the flowing portion of the stream and at mid depth, and at least six inches above the bottom of the channel. Dissolved oxygen measurements in man-made pools are not to be used for determination of attainment of the standards. **pH=6.0-9.0 from 64th Ave. downstream 2 miles. Temporary modifications: NH3(ac)=TVS(old) NH3(ch)=0.10 mg/l (Type i). Expires 12/31/2014. Cu(ac/ch)=TVSx2.3 (Type iii). Expires 12/31/2015. T=current conditions (Type iii). Expires 12/31/2015.

Source: Source: CWQCC 2012

ac	acute (1-day)	dis	Dissolved	Se	Selenium
Ag	Silver	D.O.	Dissolved oxygen	sp	spawning
As	Arsenic	E. coli	Escherichia coli	SO_4	Sulfate
B	Boron	Fe	Iron	T	Temperature
Cd	Cadmium	Hg	Mercury	Tr	Trout
ch	Chronic (30-day)	mg/L	Milligrams per liter	Tot	Total
Cl	Chloride	mL	Milliliters	Trec	Total recoverable
Cl_2	Residual chlorine	Mn	Manganese	TVS	Table value standard
CLL	Cold large lake temperature tier	NH_3	ammonia as N (nitrogen)	µg/L	Micrograms per liter
CN	free cyanide	Ni	Nickel	UP	Use-protected
Cold 1	Cold water aquatic life	NO_2	Nitrite as N (nitrogen)	Warm 1	Warm water aquatic life
Cold 2	Cold and warm water aquatic life	NO_3	Nitrate as N (nitrogen)	Warm 2	Cold and warm water aquatic life
CrIII	trivalent chromium	P	Phosphorus	WAT	Weekly average temperature)
CrVI	Hexavalent chromium	Pb	Lead	WS	See (**) below
CS-II	Cold stream temperature tier two	pH	potential of Hydrogen	WS-I	Warm stream temperature tier one
Cu	Copper	Recreation E	Existing primary contact use	Zn	Zinc
ºC	degrees Celsius	S	Sulfide as undissociated hydrogen sulfide		

** For all surface waters with an actual water supply use, the less restrictive of the following two options shall apply as numerical standards, as specified in the Basic Standards and Methodologies at 31.11(6); (i) existing quality as of January 1, 2000; or (ii) Iron = 300 µg/l (dissolved), Manganese = 50 µg/L (dissolved), SO4 = 250 mg/l. For all surface waters with a "water supply" classification that are not in actual use as a water supply, no water supply standards are applied for iron, manganese or sulfate, unless the Commission determines as the result of a site-specific rulemaking hearing that such standards are appropriate.

*** As used in the "Temporary Modifications and Qualifiers" column of the tables, the term "type i" refers to a temporary modification adopted pursuant to subsection 31.7(3)(a)(i) of the Basic Standards and Methodologies for Surface Water (i.e., "where the standard is not being met because of human-induced conditions deemed correctable within a twenty-(20) year period"). The term "type iii" refers to a temporary modification adopted pursuant to subsection 31.7(3)(a)(iii) of the Basic Standards and Methodologies for Surface Water (i.e., "where there is significant uncertainty regarding the appropriate long-term underlying standard").

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dense water of similar temperature), the hypolimnion (the lower layer of cold, often anoxic, more dense water below the epilimnion), and the metalimnion (the small zone where the temperature cools dramatically between the epilimnion and hypolimnion). Once thermal stratification develops, the top layer (epilimnion) does not mix with the lower layer (hypolimnion), due to the strong water density-temperature barrier at the metalimnion. As the fall season approaches, water temperatures at the surface begin to cool and with increasing density, the cooler water sinks. Wave action assists with distributing the cooler water throughout the epilimnion. Eventually, the entire water column mixes in the fall turnover.

The chemistry between the layers differs as cold water remains on the bottom due to its relatively high density and the dissolved oxygen is used and not replenished; ultimately an anoxic or hypoxic zone forms in which oxygen concentration is too low to support aquatic life. For purposes of this analysis the hypoxic zone occurs where oxygen concentrations are less than 2.0 mg/L. These low oxygen levels also influence the chemistry of bottom sediments allowing nutrients and metals that had been attached to sediments to re-enter the water column. Phosphorus is released from sediments more quickly under hypoxic conditions. When the thermal layers naturally turn over due to seasonal temperature changes in the water body, the nutrients and metals within the hypoxic zone can become mixed throughout the water column. Based on water quality data collected since 2009, Chatfield Reservoir appears to stratify strongly throughout the summer, developing hypoxic layers along the reservoir bottom. As a result, internal loading (i.e., the amount of phosphorus that is re-suspended from the sediments on the bottom of the reservoir) may contribute to phosphorus levels in Chatfield Reservoir. The impact analysis presented in Chapter 4 addresses the potential for changes in the size and behavior of the hypoxic zone with changes in water levels of the reservoir.

Water quality within the South Platte River below Chatfield Reservoir is generally in compliance with water quality standards for most parameters. The 303(d) list identifies portions of water bodies where water quality standards are being exceeded and a total maximum daily load (TMDL) will need to be developed to address pollutant loadings. The List of Water Quality-Limited Segments Requiring TMDLs (i.e., the 303(d) list) adopted by the CWQCC in 2012 includes the South Platte River from the outlet of Chatfield Reservoir to the Burlington Ditch diversion, which is listed for arsenic. West Plum Creek upstream of Chatfield Reservoir has a low-priority, provisional listing for aquatic life. According to the Colorado Department of Public Health and Environment (CDPHE) (2013), four TMDLs have been completed for the segments of the South Platte River that are listed in Table 3-1, including two in Segment 14 (Bowles Avenue to Burlington Ditch), and two in Segment 15 (Burlington Ditch to Big Dry Creek). A TMDL for E. coli was completed in Segment 14, released for public comment in September 2006, and finalized in October 2007. In addition, EPA approved a TMDL for nitrate in Segment 14, with an establishment date of June 4, 2004. In Segment 15, EPA approved a TMDL for dissolved oxygen with an establishment date of July 30, 2000, and for cadmium with an establishment date of September 8, 2006, revised in July 2011.

3.5 Aquatic Life and Fisheries

The aquatic resources portion of the Chatfield Reservoir storage reallocation study is divided into four sections and includes: 1) Chatfield Reservoir; 2) the South Platte River from the reservoir downstream to the Adams County/Weld county line; 3) tributaries draining to the Chatfield Reservoir including Plum Creek, Deer Creek, and the South Platte River upstream to Strontia

Springs Reservoir; and 4) the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits.

Table 3-2 lists all fish species present in the aquatic study area. Special status fish species are discussed in Section 3.9.

Table 3-2
Fish Species Present In the Study Area

Family	Scientific Name	Common Name	Location [a]
Herrings	*Dorosoma cepedianum*	Gizzard shad*	aCR, CR
Carps/Minnows	*Campostoma anomalum*	Stoneroller*	aCR
	Cyprinus carpio	Common carp	aCR, CR, bCR
	Luxilus cornutus	Common shiner*(1)	aCR
	Notropis dorsalis	Bigmouth shiner*	aCR, bCR
	Notropis hudsonius	Spottail shiner	aCR, CR
	Notropis stramineus	Sand shiner*	aCR, bCR
	Phoxinus eos	Northern redbelly dace*	aCR
	Pimephales promelas	Fathead minnow*	aCR, CR, bCR
	Rhinichthys cataractae	Longnose dace*	aCR, CR, bCR
	Semotilus atromaculatus	Creek chub*	aCR, bCR
Suckers	*Catostomus catostomus*	Longnose sucker*	aCR, bCR
	Catostomus commersonii	White sucker*	aCR, CR, bCR
Bullhead catfishes	*Ameiurus melas*	Black bullhead*	bCR
	Ictalurus punctatus	Channel catfish*	CR, bCR
Pikes	*Esox lucius X E. masquinongy*	Tiger muskellunge	CR
Trout	*Oncorhynchus mykiss*	Rainbow trout	aCR, CR
	Salmo trutta	Brown trout	aCR, CR, bCR
Killifishes	*Fundulus sciadicus*	Plains topminnow*	aCR, bCR
Sticklebacks	*Culaea inconstans*	Brook stickleback*	aCR, bCR
Sunfishes	*Lepomis cyanellus*	Green sunfish*	CR, bCR
	Lepomis gibbosus	Pumpkinseed sunfish	CR, bCR
	Lepomis humilis	Orangespotted sunfish*	CR, bCR
	Lepomis macrochirus	Bluegill	CR, bCR
	Micropterus dolomieu	Smallmouth bass	CR, bCR
	Micropterus salmoides	Largemouth bass	CR, bCR
	Pomoxis nigromaculatus	Black crappie	CR, bCR
Perches	*Etheostoma exile*	Iowa darter*(2)	aCR, CR, bCR
	Etheostoma nigrum	Johnny darter*	aCR, bCR
	Perca flavescens	Yellow perch	CR, bCR
	Sander vitreus	Walleye	CR, bCR
Goldfish	*Carassius auratus*	Goldfish	bCR
Mosquitofish	*Gambusia affinis*	Mosquitofish	bCR

Source: Nesler 2003.

Location (a): aCR = above Chatfield Reservoir (tributaries draining to reservoir); CR = within Chatfield Reservoir; bCR = below Chatfield Reservoir

* Represents species that are native to the South Platte River drainage

(1) State Threatened

(2) State Species of Special Concern

3.5.1 Chatfield Reservoir

Chatfield Reservoir is suitable to cold-water fish species as well as cool- and warm-water species. The reservoir has a state designation of Class I for recreation and cold-water aquatic life. The Class I cold-water aquatic life designation defines acceptable water quality conditions, flow conditions, and bed material for cold-water aquatic species. While the reservoir has been generally considered to have good water quality, it is slightly eutrophic because of elevated phosphorus levels (USFWS, 2006).

Chatfield Reservoir has a robust sport fish community managed by the CDOW. Important sport fish in the reservoir include walleye, yellow perch, black crappie, bluegill, smallmouth bass, largemouth bass, channel catfish, brown trout, and rainbow trout. Of these, rainbow trout, channel catfish, and walleye are stocked by the CDOW. The balance of the sport fish community is produced via natural reproduction. In addition, Chatfield Reservoir is important as one of the primary walleye brood fish and wild egg collection sources for the CDOW as approximately 25 million wild eggs are secured annually from this population for statewide stocking needs (CDOW, 2005a).

Sport fish in Chatfield Reservoir are heavily reliant on certain forage species to maintain growth and population balance. Primary forage species in the reservoir include gizzard shad, spottail shiner, and crayfish. Additional forage production also comes from young-of-the-year production of certain game fish, primarily yellow perch and bluegill.

A few species native to the South Platte drainage do exist within Chatfield Reservoir and include gizzard shad, white sucker, and green sunfish. Of these species, none are recognized as sensitive, threatened, endangered, or a Species of Special Concern in Colorado and all are commonly found in many aquatic habitats throughout the state.

3.5.2 South Platte River below Chatfield Reservoir

The aquatic resources study area for the South Platte River below Chatfield is defined as the South Platte River from Chatfield Reservoir to the Adams/Weld county line. Overall riverine habitat through this section is characterized by wide, shallow, gravel riffles and long runs; there are few instream habitat structures throughout the reach (USGS, 2006). This reach has little sinuosity as a large portion has been channelized by the Corps.

Relatively cool water temperatures occur in the upstream portion of the reach due to releases of cold water from the reservoir but shifts to warm-water habitat in the downstream portions of the reach. Abundance and diversity decrease downstream of the reservoir due to lower flows and sediment loading resulting in this reach having little useable habitat (USFWS, 2006). This reach is also subject to highly fluctuating flow releases from the reservoir during spring runoff or during periods of demand.

The fisheries community in this reach includes a wide variety of sport fish, non-sport fish, and native fish species (Table 3-2). Sport fish include walleye, yellow perch, smallmouth bass, largemouth bass, green sunfish, orangespotted sunfish, pumpkinseed sunfish, channel catfish, black bullhead, and brown trout. Native sport species include channel catfish, green sunfish, and black bullhead (Nesler, 2003).

Non-sport fish in this reach include white sucker, longnose sucker, common carp, longnose dace, fathead minnow, sand shiner, bigmouth shiner, brook stickleback, johnny darter, Iowa darter, mosquitofish, creek chub, plains topminnow, and common goldfish. Native non-sport fish include brook stickleback, fathead minnow, longnose dace, longnose sucker, white sucker, sand shiner, bigmouth shiner, johnny darter, Iowa darter, and plains topminnow (Table 3-2).

As indicated in Chapter 1, CDOW subleases land on the downstream side of Chatfield Dam for development of fish production and rearing areas including water supply lines, drain lines, ponds, raceways, roads, and parking areas. The Chatfield State Fish Unit (SFU), also known as the Chatfield Fish Planting Base, is located on these lands and receives its water supply from Chatfield Reservoir via a water supply pipe that also feeds City Ditch and Nevada Ditch. Another water supply pipe extends downstream of Chatfield Dam to feed the Last Chance Ditch.

3.5.3 Tributaries Draining to the Chatfield Reservoir

The aquatic resources study area for the tributaries draining to the Chatfield Reservoir includes Plum Creek, Deer Creek, and the South Platte River from Chatfield Reservoir upstream to Strontia Springs Reservoir. The upper reach of the South Platte River is a clean, cold-water stream that has good riparian habitat and other characteristics that sustain populations of rainbow and brown trout (USFWS, 2006). Other species that commonly occur in this reach include white sucker, longnose sucker, and longnose dace (Nesler, 2003). The dam at Strontia Springs Reservoir, 8.88 river miles upstream of the Chatfield Reservoir, partially controls flows in this reach. Releases at the Strontia Springs dam maintain both minimum winter and summer flows (USFWS, 2006).

Other major tributaries to the Chatfield Reservoir include Plum Creek and Deer Creek. The lower reach potentially impacted along Plum Creek is highly braided, with few quality pools. The lower reach of Deer Creek potentially impacted is an intermittent stream that is limited in quality of game fish habitats (USFWS, 2006).

3.5.4 Penley Reservoir, Pipeline Area, and Downstream Gravel Pits

The proposed Penley Reservoir and the downstream gravel pits currently contain no water; therefore, fisheries do not currently exist in these areas. The proposed pipeline area (associated with Penley Reservoir) would likely cross Indian Creek, Rainbow Creek, Willow Creek, and their tributaries. These small, warm-water, perennial streams likely contain a mix of native and non-native warm-water fish species. Native species may include white sucker, brook stickleback, fathead minnow, and longnose dace. The streams probably do not contain significant warm-water game fish.

3.6 Vegetation

This section describes the types of vegetation that may be found in the entire study area including Chatfield Reservoir, the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits.

3.6.1 Chatfield Reservoir

The Chatfield Reservoir area lies at the western limits of the Great Plains Physiographic Province, with some representative vegetation from the adjacent montane ecosystem of the Rocky Mountains (USACE, 2002a). Six vegetation community types occur within the study area around the reservoir: shortgrass steppe, shrubland, riparian, weedy/disturbed, landscape plantings, and wetlands.

Wetlands have special characteristics that extend beyond vegetation communities and so are discussed in Section 3.7. The location and acreage of each vegetation community type is indicated on Figure 3-1. The rocky areas shown along the inside of the dam are included on the figure as a land cover type and are included in the discussion of wildlife habitat (Section 3.8). These areas are not discussed as part of the vegetation type because they are generally unvegetated. Special status plant species and rare plant communities are discussed in Section 3.9.

3.6.1.1 Shortgrass Steppe Community

The shortgrass steppe community comprises the largest acreage within the study area. This community generally occurs adjacent to riparian areas on the rolling hills and flat plateaus surrounding Chatfield Reservoir. Species typical within this community type include blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), western wheatgrass (*Agropyron smithii*), alyssum (*Alyssum minus*), and scarlet globemallow (*Sphaeralcea coccinea*). Several shrubs, half-shrubs, and succulents are also scattered throughout this community and include rubber rabbitbrush (*Chrysothamnus nauseosus*), fringed sage (*Artemisia frigida*), and plains prickly pear cactus (*Opuntia polyacantha*).

3.6.1.2 Shrubland Community

Two shrubland communities occur within the study area, the mountain mahogany (*Cercocarpus montanus*) community and a mixed deciduous shrubland community. This community is found west of Chatfield Reservoir in the transition zone from plains to montane. Plant species in this community include mountain mahogany, blue grama, prairie junegrass (*Koeleria macrantha*), mountain muhly (*Muhlenbergia montana*), scarlet globemallow, and Colorado locoweed (*Oxytropis lambertii*). The mixed deciduous shrubland community is found in the swales south of the reservoir, near the campground and along the north- and west-facing hillsides. Typical plant species in this community include chokecherry (*Prunus virginiana*), skunkbush (*Rhus trilobata*), antelope bitterbrush (*Purshia tridentata*), smooth sumac (*Rhus glabra*), blue grama, Indian ricegrass (*Oryzopsis hymenoides*), and prairie goldenrod (*Solidago missouriensis*).

3.6.1.3 Riparian Community

The cottonwood/willow riparian community occurs in association with Plum Creek, Deer Creek, and the upstream and downstream reaches of the South Platte River; their respective flood plains; and along the southwestern shoreline of Chatfield Reservoir. Most of this community consists of forested, scrub/shrub, and riverine wetlands, but open water and uplands occur as well. Sizes of this community vary from narrow bands along Deer Creek to large expanses within the drier flood plains along Plum Creek, the South Platte River, and along the southwestern shoreline of the reservoir. The canopy of this community includes species such as plains cottonwood (*Populus deltoides*), peachleaf willow (*Salix amygdaloides*), boxelder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), and narrowleaf cottonwood (*Populus angustifolia*). The shrub layer includes coyote willow (*Salix exigua*), western snowberry (*Symphoricarpos occidentalis*), redtwig dogwood (*Cornus stolonifera*), and golden currant (*Ribes aureum*). The understory is dominated by a variety of herbaceous vegetation such as broad-leaved cattail (*Typha latifolia*), reed canarygrass (*Phalaris arundinacea*), and great bulrush (*Scirpus validus*). Weed species also occur within this community including Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), and leafy spurge (*Euphorbia esula*). The expanse of cottonwoods along the southwestern shoreline of the reservoir and the other riparian areas within the study area along the South Platte River and Plum Creek are important habitats for migratory birds and many other

species of wildlife. In general, riparian corridors provide crucial stopover habitat for birds during migration and nesting areas for many breeding birds. They also provide habitat corridors, food, and shelter for many other species of wildlife. Riparian areas are one of the most diverse and productive wildlife habitats.

Plum Creek and its associated wetland and riparian communities within Chatfield State Park are dynamic. Substantial accumulation of sediment in the upper reaches of Plum Creek has created channel changes and multiple channels, while reaches of Plum Creek closer to the reservoir have severely down cut (USACE 2011c, Figure 4-30). These changes in channel morphology have in turn affected wetland areas and riparian resources along Plum Creek. Areas of accumulated sediment have raised the channel bottom, buried existing riparian areas and wetlands in sediment, and shifted the channel away from existing wetland and riparian resources. Channel down cutting has substantially lowered the alluvial water table leaving wetlands and riparian vegetation without a supportive hydrology. There are many areas of dead trees and desiccated wetlands which border the down cut reaches. These changes to Plum Creek and its wetland and riparian resources within the park are likely to continue to occur as major flow events allow the down culling to extend further up the channel.

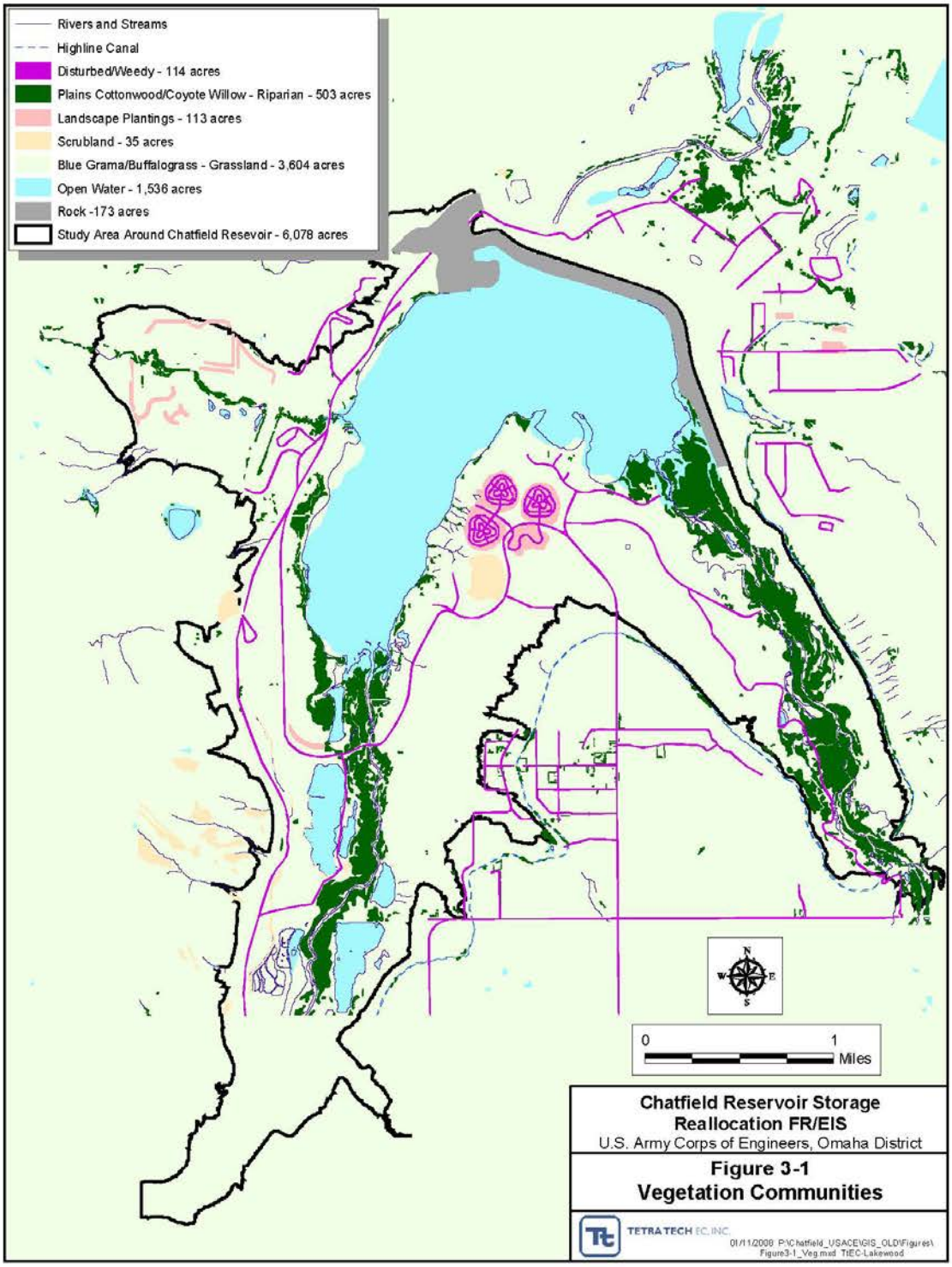
3.6.1.4 Disturbed/Weedy Community

The plants within this community are weedy species that are indicative of the disturbed nature of the study area and are found where frequent and perpetual soil disturbance occurs. The construction of Chatfield Dam disturbed land to the east, south, and west of the existing reservoir. In addition, much of the South Platte River corridor through what is now Chatfield State Park was disturbed with gravel operations, which were still ongoing when portions of the park were first opened to recreation. This disturbance, coupled with the recreational use of the area, has allowed the influx of weedy species along the roadways, campgrounds, marina, old gravel mining areas, and shorelines. Native vegetation has been removed or damaged, and weedy, opportunistic species have infiltrated. Species in this community are usually annual and produce a large seed source. Plants in this community include musk thistle, leafy spurge, Canada thistle, diffuse knapweed (*Centaurea diffusa*), reed canarygrass, hoary cress (*Cardaria draba*), dalmation toadflax (*Linaria genistifolia*), and annual sunflower (*Helianthus annuus*). The weedy species are also intermixed into reclaimed areas dominated by smooth brome (*Bromus inermis*), crested wheatgrass (*Agropyron crisatum*), and thickspike wheatgrass (*Agropyron dasystachyum*).

3.6.1.5 Landscape Plantings

A number of tree plantings have occurred throughout Chatfield State Park and have also been added to the campgrounds and surrounding recreation areas for aesthetic reasons and to provide shade, windbreaks, and privacy. These plantings, which also occur along bike trails and in parks along the South Platte River below Chatfield Reservoir, include Colorado red cedar (*Juniperus scopulorum*), ponderosa pine (*Pinus ponderosa*), green ash, locust (*Gleditsia triacanthos inermis*), and quaking aspen (*Populus tremuloides*).

Figure 3-1
Vegetation Communities



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3.6.2 Penley Reservoir and Pipeline Area

The proposed Penley Reservoir lies within the Great Plains Physiographic Province (USACE 2002a). Three vegetation communities occur within this area, deciduous oak, mesic upland shrub, and wetlands (Figure 3-2). Wetlands have special characteristics that extend beyond vegetation communities and so are discussed in Section 3.7. The deciduous oak and mesic upland shrub communities are described below. No agriculture use was identified. Special-status plant species and rare plant communities are discussed in Section 3.9.

The proposed pipeline area that would be associated with Penley Reservoir, if constructed, would be located to the south and east of Chatfield Reservoir in Douglas County. Based on the Colorado Gap Analysis Land Cover Map (Thompson et al. 1996), the pipelines would cross seven land cover types: deciduous oak, mesic upland shrub, tallgrass prairie, midgrass prairie, foothills/mountain grassland, dry-land crops, and irrigated crops (Figure 3-3). The vegetation associated with these land cover types is briefly described in the following paragraphs, based on Thompson et al. (1996).

3.6.2.1 Deciduous Oak Community

The deciduous oak community comprises the largest area near the proposed Penley Reservoir. Within this shrub community, Gambel oak (*Quercus gambeli*) accounts for more than 25 percent of the vegetative cover (Natural Diversity Information Source [NDIS], 2008a). Gamble oak does not occur north of Denver, but it can be found on the western slope of the Rocky Mountains into Wyoming. The main shrub species that occur are mountain mahogany, Utah serviceberry (*Amelanchier utahensis*), Saskatoon serviceberry (*Amelanchier alnifolia*), big sagebrush (*Artemisia tridentata*), and mountain snowberry (*Symphoricarpus oreophilus*).

3.6.2.2 Mesic Upland Shrub Community

Lesser amounts of mesic upland shrub communities are found within the area of the proposed Penley Reservoir. Mesic upland community types encompass a variety of plant compositions that grow in mesic sites. Common species include, but are not limited to, Rocky Mountain maple (*Acer glabrum*), serviceberry (*Amelanchier* sp.), and chokecherry. Mesic shrub species make up over 25 percent of this plant community (NDIS, 2008a).

3.6.2.3 Tallgrass Prairie

Tallgrass prairie is also referred to as "true prairie." This grassland habitat received the most rainfall of the grassland types in the central plains. The vegetation in this habitat is predominantly bunch grasses, sod-forming grasses, and long-lived perennials. The dominant grass species are big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), and little bluestem (*Schizachyrium scoparium*).

3.6.2.4 Midgrass Prairie

This habitat type is a mix of tallgrass and shortgrass prairie and has the greatest plant diversity of the grassland types in the central plains. The dominant plant species in midgrass prairie habitat include: sideoats grama (*Bouteloua curtipendula*), galleta (*Hilaria jamesii*), foxtail barley (*Hordeum jubatum*), western wheatgrass, bluebunch wheatgrass (*Pseudoregeneria spicata*), little bluestem, New Mexico feathergrass (*Hesperostipa neomexicana*), and green needlegrass (*Stipa viridula*).

3.6.2.5 Foothills/Mountain Grasslands

This habitat type occurs on steep south-facing slopes in Douglas-fir and ponderosa pine (Thompson et al. 1996). Typical plant species include Parry's oatgrass (*Danthonia parryi*), Arizona fescue (*Festuca arizonica*), Idaho fescue (*Festuca idahoensis*), Thurber's fescue (*Festuca thurberi*), slimstem muhly (*Muhlenbergia filiculmis*), mountain muhly, and bluebunch wheatgrass.

3.6.2.6 Dryland Agriculture

This habitat type includes non-irrigated cropland; fallow lands; dryland improved pastures; and rural development, farm and ranch facilities, and shelter belts. Crops that are characteristic of this land include: wheat, barley, rye, and small grains.

3.6.2.7 Irrigated Agriculture

This habitat type includes any irrigated agricultural land. Typical crops of this land type include: corn, beans, row crops, irrigated hayfields, and pastures.

3.6.3 Downstream Gravel Pits

The downstream gravel pits that would be developed into water storage as part of Alternatives 1, 2, and 4 are located within the Great Plains Physiographic Province (USACE, 2002a). These areas are currently highly disturbed due to ongoing gravel extraction, and are currently believed to be unvegetated; however, they occur near a variety of wetland habitat types. The previous classification of this land is irrigated crop or dry-land crop (Figures 3-4 and 3-5).

3.7 Wetlands

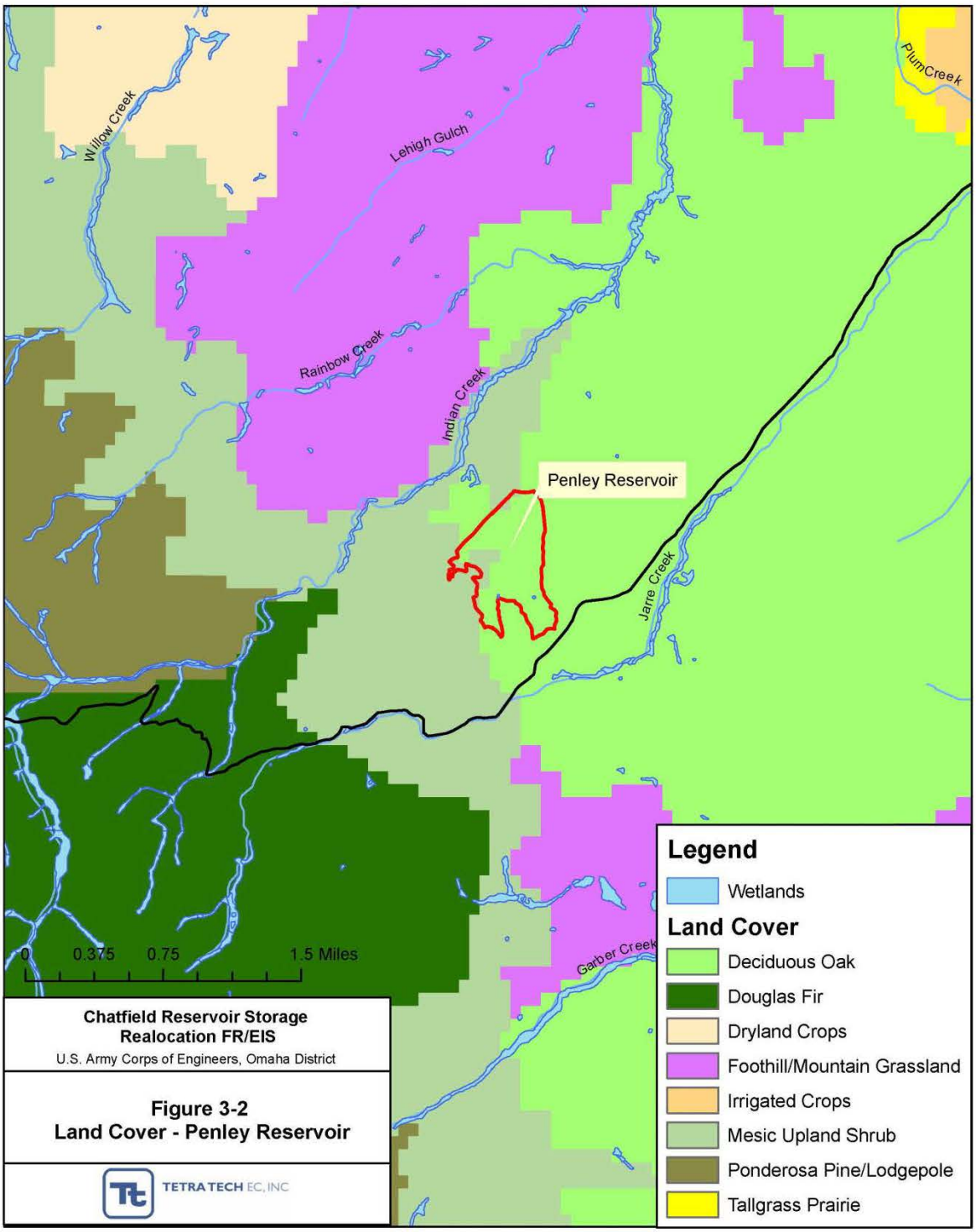
This section describes the types of wetlands that may be found in the study area, including Chatfield Reservoir, the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits.

3.7.1 Chatfield Reservoir

Wetland systems can occur within any of the other vegetation communities discussed in Section 3.6. Wetlands are a productive and biologically diverse type of ecosystem. They serve many different functions including providing habitat for many different species of aquatic and terrestrial wildlife, protecting and improving water quality, storing floodwaters, protecting shorelines, recharging groundwater aquifers, and maintaining surface water flow during dry periods. Wetlands also serve as transitional areas or ecotones between terrestrial and aquatic systems.

The variety of hydrology and topography within the study area provides a range of wetland types including riverine, palustrine, and lacustrine. The riverine system includes all wetlands and deepwater habitats contained within a channel. The riverine system is bounded on the landward side by upland, by the channel bank (including natural and man-made levees), or by wetlands dominated by trees, shrubs, and persistent emergents such as cattails (Cowardin et al., 1979). There are two types of riverine systems within the study area: lower perennial (i.e., slow-flowing waters) and upper perennial (i.e., fast-moving and swift-flowing waters).

Figure 3-2
Land Cover—Penley Reservoir



Land Cover obtained from: United States Geological Survey. 2007. Available at http://gapanalysis.nbii.gov.
Wetlands obtained from: Colorado Division of Wildlife. 2007. Available at http://ndis.nrel.colostate.edu.

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Figure 3-3
Land Cover—Penley Pipeline Area

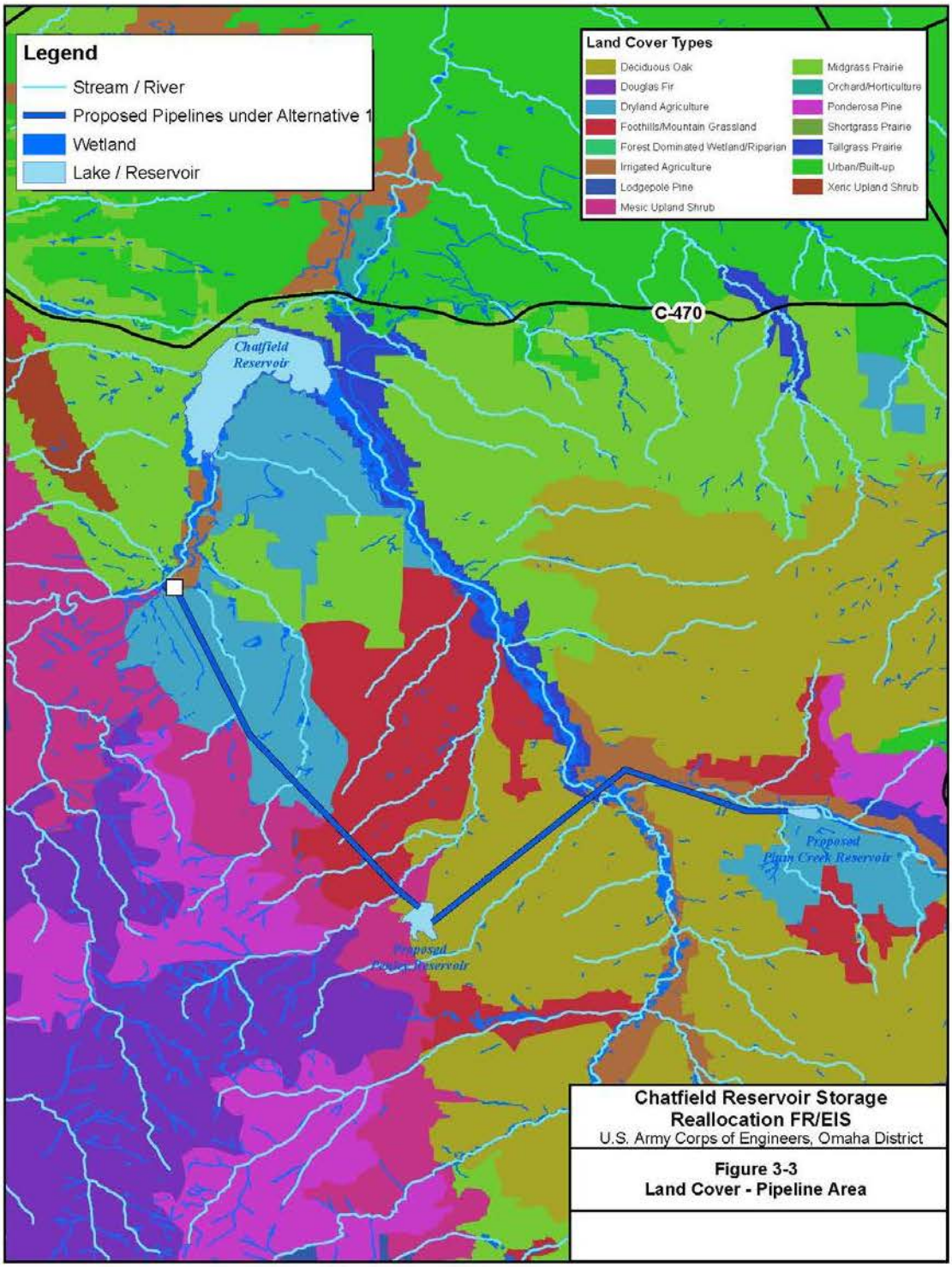

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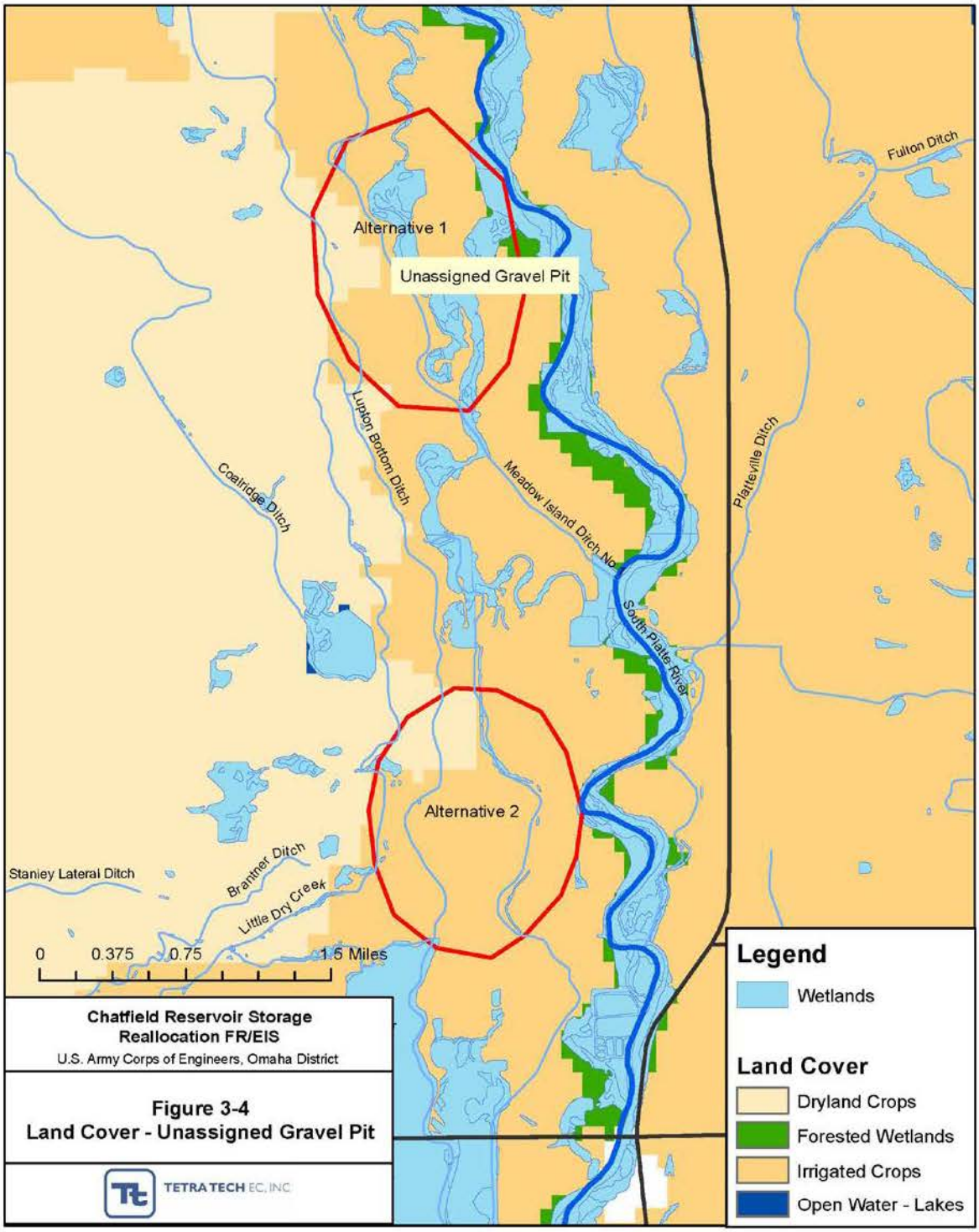
Figure 3-4
Land Cover—Unassigned Gravel Pit



Land Cover obtained from: United States Geological Survey. 2007. Available at http://gapanalysis.nbii.gov.
Wetlands obtained from: Colorado Division of Wildlife. 2007. Available at http://ndis.nrel.colostate.edu.

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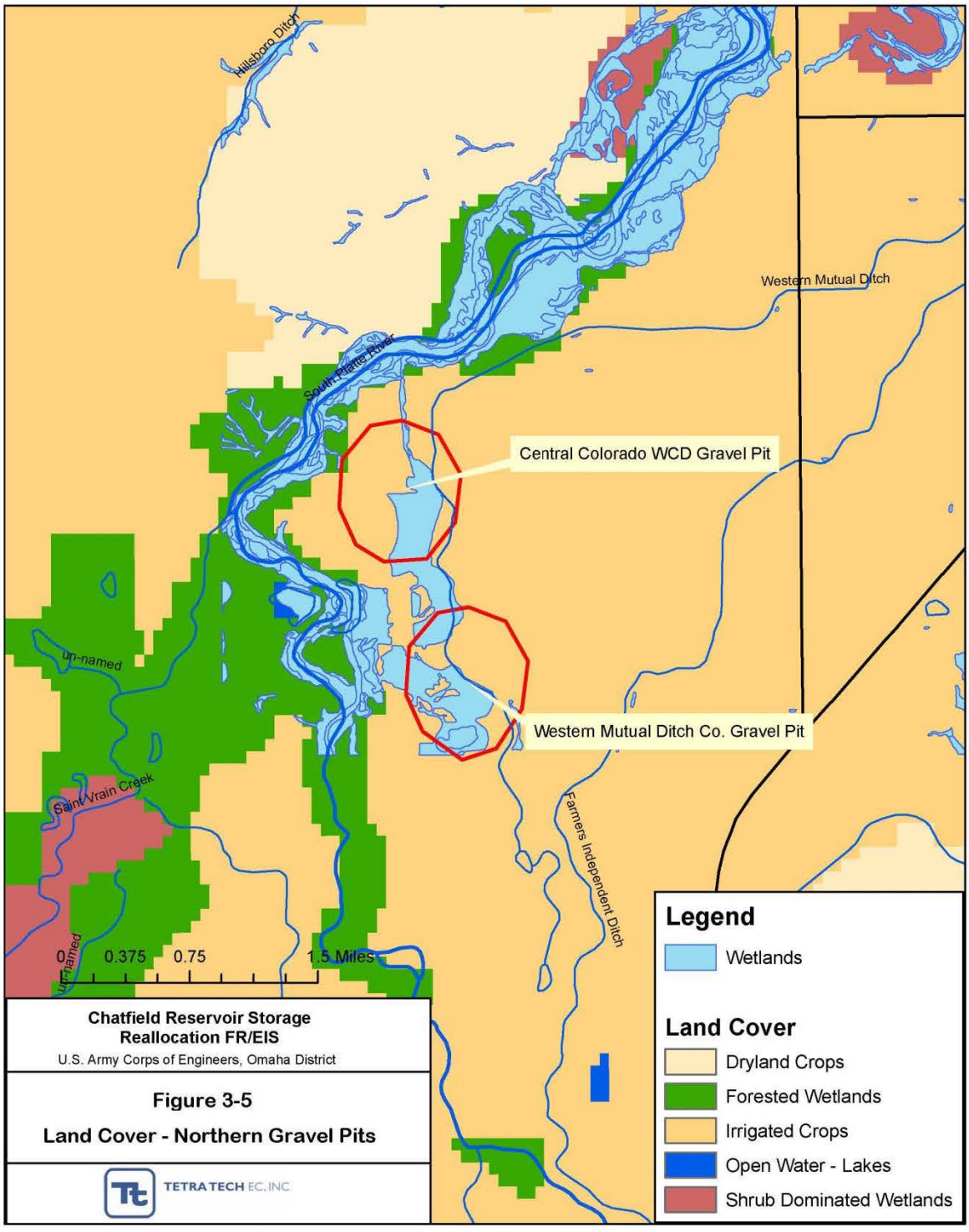
Figure 3-5
Land Cover—Northern Gravel Pits



Land Cover obtained from: United States Geological Survey. 2007. Available at http://gapanalysis.nbii.gov.
Wetlands obtained from: Colorado Division of Wildlife. 2007. Available at http://ndis.nrel.colostate.edu.

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The palustrine system consists of forested wetlands dominated by trees, scrub/shrub wetlands dominated by shrubs, and emergent wetlands dominated by non-woody species that are outside tidal influences (Cowardin et al., 1979). This system is found in association with the adjacent flood plain wetland pockets along Plum Creek, Deer Creek, the South Platte River upstream and downstream of the reservoir, shorelines of the various ponds to the south of Chatfield Reservoir and to the west of the South Platte River, and natural or human-made depressions near and adjacent to the reservoir itself.

The lacustrine system includes wetlands and deepwater habitats situated on a topographic depression. This system lacks trees, shrubs, and persistent emergents with greater than 30 percent cover, and the total area exceeds 20 acres in size (Cowardin et al., 1979). Chatfield Reservoir is categorized as a lacustrine system, as are the ponds that occur south of the reservoir and west of the upstream section of the South Platte River, and additional scattered ponds along the river downstream of the reservoir. These lacustrine systems are important fisheries in the study area.

National Wetland Inventory (NWI) maps provide reconnaissance level data for site investigations and an approximation of wetland areas. Furthermore, they do not provide jurisdictional boundaries for wetlands. In order to gain a firm understanding of impacts to wetlands from the proposed project from a regulatory standpoint, wetlands within the study area were mapped in the field and from aerial photography by investigating hydric characteristics. USACE (1987) characterizes wetlands as those areas containing hydrophytic vegetation, hydric soils, and wetland hydrology. Many areas identified on NWI maps do not meet this stricter definition.

Within the study area, biologists mapped areas that met all three of the wetland characteristics (wetland areas) in areas that are proposed to be affected by the project surrounding Chatfield Reservoir. Wetland areas were grouped into five main categories: emergent, submergent, scrub/shrub, forested, and seasonal wetlands. These categories were developed with input from the USACE and include natural or man-made wetlands. These categories follow Cowardin classification (Cowardin et al., 1979). Additional categories were added to enhance wetland mapping and include "Other" and "Uplands."

Emergent wetlands include all areas dominated by rooted herbaceous plant species that extend above the water or hydric soils. These include areas within riverine and palustrine systems and typically include such plant species as sedges (*Carex* sp.), rushes (*Juncus* sp.), or cattails (*Typha* sp.). In Plum Creek, invasive wetland species including reed canarygrass (*Phalaris arundinacea*) and common reed (*Phragmites australis*) are prevalent in emergent wetlands as well as wetlands with woody vegetation. Submergent wetlands are those areas below the water along shallow shorelines of lacustrine systems. Typical aquatic plants of shorelines within eastern Colorado are coon's tail (*Ceratophyllum demersum*) and native milfoil (*Myriophyllum* sp.). One off-channel pond along the South Platte River supports the noxious weed, Eurasian water milfoil (*Myriophyllum spicatum*). Scrub/shrub areas support woody vegetation including hydrophytic trees and shrubs that extends above the water or hydric soils. Common plant species include coyote willow and peach-leafed willow. The woody vegetation does not need to be dominant, but must be at least present over 30 percent of the vegetative cover. Forested wetlands include trees of 20 feet or higher. Typical plant species include narrow-leaved cottonwood (*Populus angustifolia*) and plains cottonwood. Seasonal wetland areas are found along the shoreline of the reservoir and include areas that are flooded frequently due to

reservoir operations. These areas have sandy soils and support hydrophytic vegetation seasonally, but are greatly influenced from year to year by fluctuating water levels. Typical species can include sprangletop (*Leptochloa fascicularis*), toad rush (*Juncus bufonius*) and pigweed (*Amaranthus* sp.).

The majority of natural wetlands in the study area occur adjacent to Plum Creek and the South Platte River. Forested wetlands and scrub/shrub wetlands dominate the drainages upstream and downstream of the reservoir along the Plum Creek and South Platte River. Figures 3-6, 3-7, and 3-8 illustrate wetlands designated by NWI. Appendix E supplements these figures and includes 11 maps and associated table taken from the Draft Existing Conditions Report for Biological Resources (Foster Wheeler 2000a) that illustrate NWI wetlands and deepwater habitats by type.

In addition to naturally-occurring wetlands, approximately 20 acres of wetlands have been created upstream of the reservoir west of the South Platte River through a partnership of the Colorado Department of Transportation, CDOW, Colorado State Parks, Denver Water, Ducks Unlimited, Martin Marietta Astronautics, and USACE. Appendix E includes additional information on wetlands.

3.7.2 Penley Reservoir and Pipeline Area

Two small wetlands are located near the proposed Penley Reservoir; however, these areas were classified as non-riparian upland grass and upland shrub by Natural Diversity Information Source (NDIS) (2007, Figure 3-2). Pipelines associated with Penley Reservoir, if constructed, would likely cross numerous wetland types including those associated with Indian Creek, Rainbow Creek, Willow Creek, and their tributaries.

3.7.3 Downstream Gravel Pits

The downstream gravel pits proposed as part of Alternatives 1 and 2 all occur within close proximity to the South Platte River and therefore occur near a wide variety of wetland habitat types (NDIS, 2007). The Unassigned Gravel Pit area contains herbaceous grasses, deciduous cottonwood, willow shrub, and open water riparian habitats (Figure 3-4). The Western Mutual Ditch Company and Central Colorado WSD Gravel Pit areas contain herbaceous grasses, deciduous cottonwood, and open water (Figure 3-5). All of these gravel pits were previously agricultural land and are currently being mined for gravel. As a result, wetland vegetation may no longer exist in these areas.

3.8 Wildlife

This section describes the types of wildlife that may be found in the study area, including Chatfield Reservoir, the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits.

3.8.1 Chatfield Reservoir

Wildlife habitats within the study area include grasslands, shrubland, open water, rocky areas, landscaped/disturbed areas, and riparian areas, which include wetlands. Wildlife known to occur within the study area are listed in Appendix F. Common large mammals present in the study area include mule deer and white-tailed deer. Riparian habitats provide essential cover and browse for these species, and grasslands and scrublands are used as forage areas in the early mornings and evenings. Mule deer also use the landscaped areas in the winter when other browse is sparse.

Figure 3-6
Chatfield Reservoir Vicinity with NWI

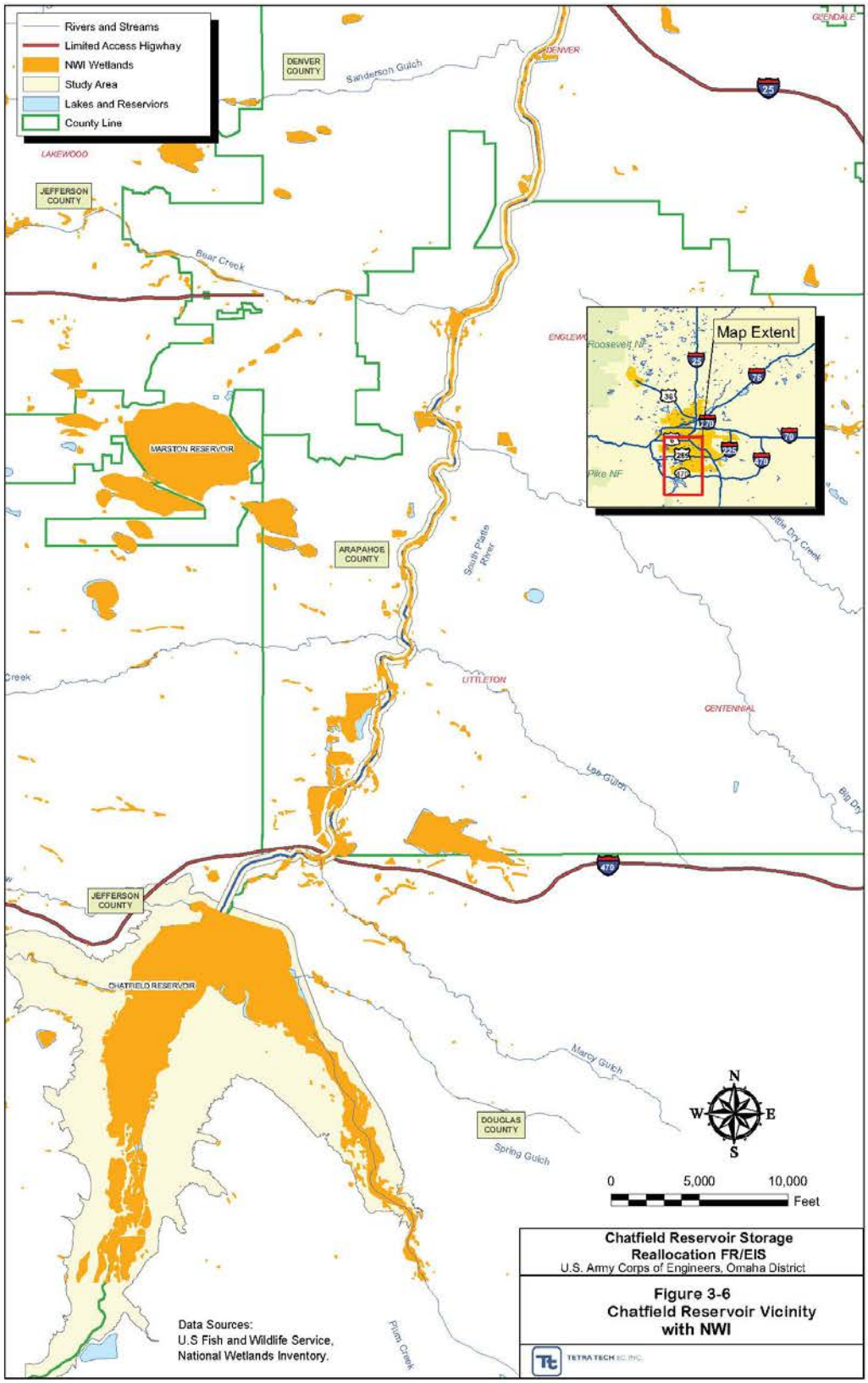

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Figure 3-7
Denver Gage Vicinity with NWI

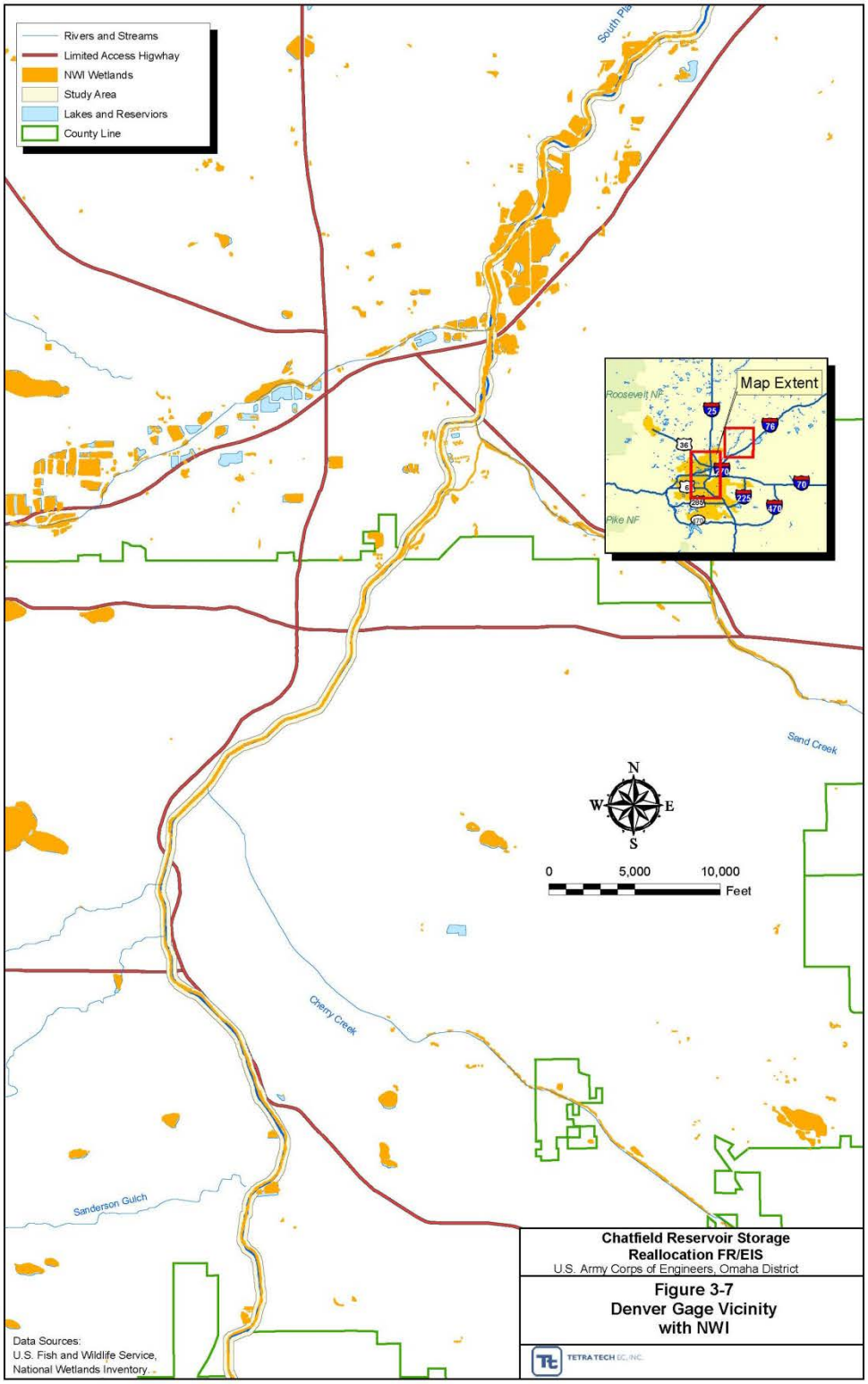

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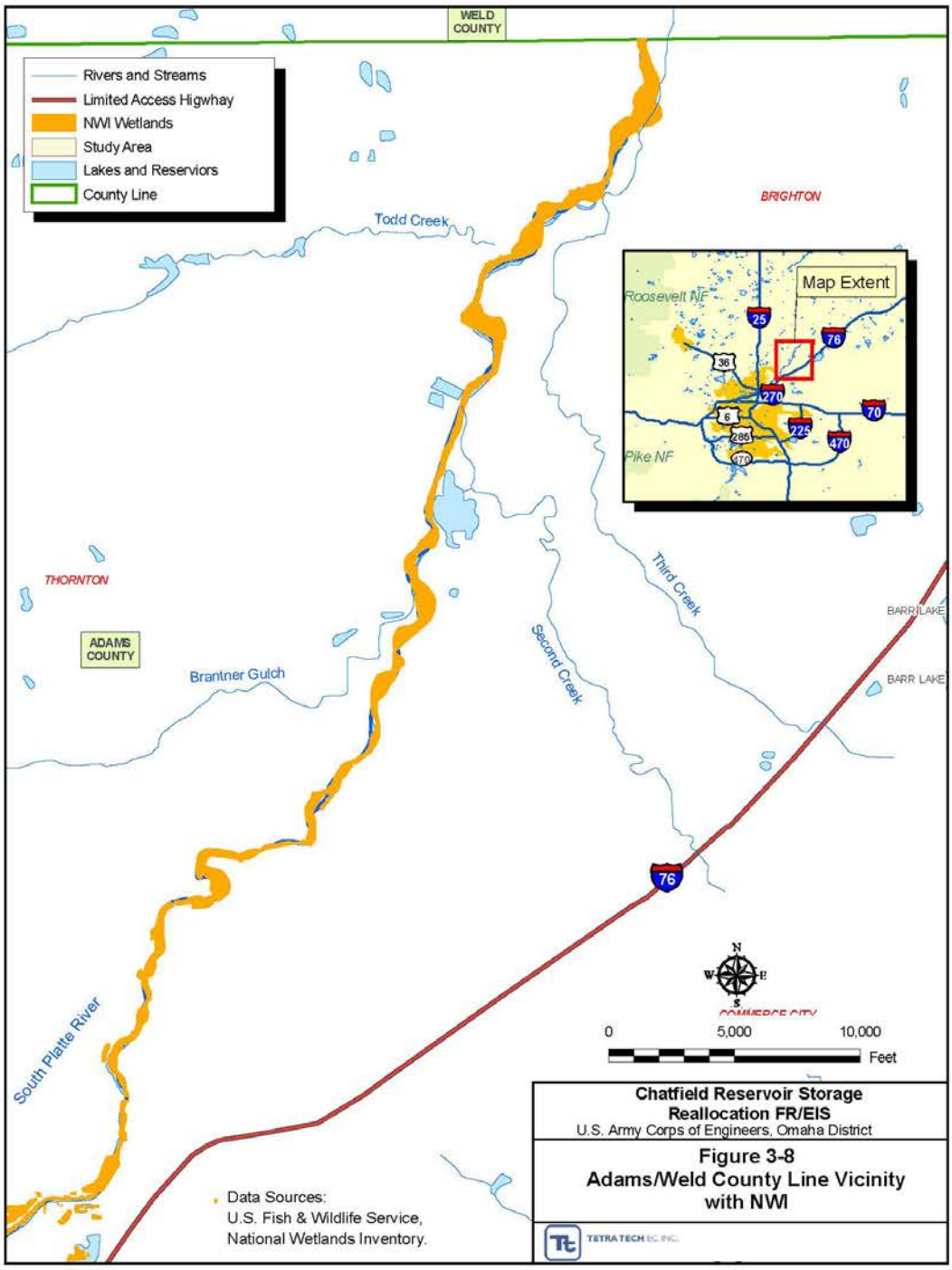
Figure 3-8
Adams/Weld County Line Vicinity with NWI



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Mule deer activity within the study area includes concentration areas west, northeast, and south of Chatfield Reservoir. Winter concentration areas and severe winter range lay west of the study area within the foothills west of Denver, and summer range lies west and south of the study area (CDOW, 2005a). Appendix F provides additional information on wildlife in the area.

Resident populations of elk occur south of the study area, but elk activity occurs throughout the study area. Winter and severe winter ranges occur southwest and west of the study area. According to CDOW, range coverage for elk is associated with montane meadows, scrublands, and forests west and south of the study area (CDOW, 2005a).

Large carnivores in the area include black bear, bobcat, and mountain lion. Black bear are not common within the study area, but may wander into the vicinity in search of food. Suitable black bear habitat lies in the foothills to the west of Chatfield Reservoir. Mountain lions and bobcat may also occur around Chatfield Reservoir. Both cats occur in rocky, broken land of the foothills and canyonlands, preferably in pinyon-juniper woodlands, shrublands, and montane forests (CDOW, 2008a).

Avian predators, such as raptors and owls, occur within the study area. Species most commonly observed during the breeding season include Swainson's hawks, red-tailed hawks, and great-horned owls. Red-tailed hawks and great-horned owls nest in large trees that surround Chatfield Reservoir as well as other locations in the Park. Hugh Kingery (comment letter August 14, 2012) reported that red-tailed hawks nest along the South Platte River in several places and just north of the Deer Creek entrance, and great horned owls had a dozen nests in the Park for several years after it opened, including many along the South Platte and one near the Deer Creek entrance. Kingery also reported that Swainson's hawks typically nest in tall trees in grasslands and there is a nest in the Park along the Highline Canal west of the Roxborough Park road entrance. Cooper's hawk, long-eared owl, and northern saw-whet owl also nest in the Park (Kingery comment letter). Cooper's hawk and long-eared owl nested near the Audubon banding station from 2010-2011, and in 2012 three northern saw-whet owl fledglings were observed in dense thicket in the mature forest south of Kingfisher bridge. Avian predators are long-lived species with low reproductive rates and will reuse a nest for multiple years.

Grasslands dominate most of the habitat in the study area and occur in upland areas surrounding Chatfield Reservoir. These areas provide habitat for a variety of wildlife species including mammals, birds, reptiles, amphibians, and invertebrates. Common species include western meadowlark, red-tailed hawk, coyote, raccoon, mule deer, white-tailed deer, western fence lizard, and the six-lined racerunner.

Pockets of scrubland habitat are interspersed in swales in the upland habitat surrounding Chatfield Reservoir. This habitat is generally more mesic than the grassland habitat and provides cover for several species of wildlife including mule deer, white-tailed deer, raccoon, and a variety of bird species.

Open water habitat occurs as Chatfield Reservoir, ponds located south of the reservoir and west of the South Platte River, and the flowing water portions of Deer Creek, Plum Creek, and the South Platte River. Open water provides habitat for several species of waterfowl, shorebirds, and amphibians. Common bird species that use open water habitat include double-crested cormorant,

white pelican, mallard, Canada goose, California gull, and great blue heron. Waterfowl that are relatively common in open water habitats during spring or fall migration include pied-billed grebe, eared grebe, western grebe, gadwall, northern shoveler, green-winged teal, common goldeneye, and common merganser (Kellner & Spencer, 2006). Rocky areas occur primarily as riprap along the northeast and east sides of Chatfield Reservoir. This riprap was placed along the dam to counteract the effects of erosion and scouring that can result from wave action. These areas may provide habitat for small mammals (e.g., deer mouse [*Peromyscus maniculatus*], meadow vole [*Microtus pennsylvanicus*]), amphibians (e.g., tiger salamander [*Ambystoma tigrinum*], western chorus frog [*Pseudacris triseriata*], northern leopard frog [*Rana pipiens*]), and invertebrates (various species of crayfish and aquatic insects).

Landscaped/disturbed areas such as picnic areas, campgrounds, concession areas, parking lots, and wildlife viewing areas occur in developed areas of Chatfield State Park and along the South Platte River. These areas most likely do not provide significant habitat for wildlife although several species of wildlife may be found in these areas on a temporary basis.

Riparian habitats are biologically diverse and productive ecosystems and provide several important ecological functions including providing food, water, and cover for resident and migratory wildlife species. Riparian habitats occur along the shoreline of the reservoir; along Plum Creek, Deer Creek, and the South Platte River as they flow into Chatfield Reservoir; and along the South Platte River downstream throughout the study area to the Adams/Weld county line. Cover in riparian habitats is predominantly provided by cottonwood trees around Chatfield Reservoir with lesser amounts of other tree species. Along with willow shrubs, trees create riparian woodlands stretching out along the river and stream floodplains. These woodland areas are particularly important to songbirds and many mammalian species and often support many wildlife species for at least some part of their life cycle. Numerous species of birds (including raptors, waterfowl, shorebirds, and songbirds), mammals (including beaver), reptiles, and amphibians all use the biologically-diverse riparian habitats. Suitable habitat for the federally-threatened Preble's meadow jumping mouse includes well-developed riparian woodlands and wetland areas. This and other special status species are further discussed in Section 3.9.

Joe Farah and Dan Baker of the North American Field Herping Association (NAFHA) conducted a volunteer survey of Chatfield State Park's reptiles and amphibians starting in 2007 (Baker & Farah, 2009). The majority of the survey time was spent in and around the riparian zones of Plum Creek and the South Platte River, which they indicated contain the highest abundance and diversity of reptiles and amphibians in the park. Their report indicated there are healthy populations of at least 15 species of reptiles and amphibians in the Park (including two species identified by Joey Kellner in 2008-2009). Among the 15 species were ten reptile species, including prairie rattlesnake, bull snake, western terrestrial garter snake, plains garter snake, yellow-bellied racer, milk snake, western hognose snake, snapping turtle, painted turtle, and six-lined racerunner, and five amphibian species, including bullfrog, leopard frog (see Section 3.9.1.2 for additional details), chorus frog, tiger salamander, and Woodhouse's toad. There are other species of reptiles and amphibians that they report as likely to occur at the park but they did not observe during the 2007-2009 survey due to limited time and manpower, these include: eastern fence lizard, northern water snake, common garter snake, plains black-headed snake, and many-lined skink. They also report that short-horned lizard, plains spadefoot toad, and smooth green snake are possible occurrences at the park.

Riparian habitats create natural connectivity or travel corridors for wildlife due to their linear nature. Conservation biologists researching species viability and the design and configuration of conservation reserves have found that connectivity between reserves increases dispersal, allows genetic interchange, provides avenues for nearby meta-populations to recolonize reserves, and improves overall population viability (Beier & Noss, 1998; Beier & Loe, 1992; Sondgerath & Schroder, 2002).

In addition to federally listed as threatened or endangered bird species discussed in Section 3.9, the USFWS has identified birds of conservation concern (BCC) and in greatest need of conservation action, by region (USFWS, 2008). Among those listed in USFWS Region 6, the Mountain-Prairie Region, that have been confirmed to occur within the study area are:

- Northern harrier (*Circus cyaneus*)
- Swainson's hawk (*Buteo swainsoni*)
- Ferruginous hawk (*Buteo regalis*)
- Golden eagle (*Aquila chrysaetos*)
- Peregrine falcon (*Falco peregrinus*)**
- Prairie falcon (*Falco mexicanus*)
- Solitary sandpiper (*Tringa solitaria*)
- Upland sandpiper (*Bartramia longicauda*)
- Stilt sandpiper (*Calidris himantopus*)*
- Long-billed curlew (*Numenius americanus*)
- Marbled godwit (*Limosa fedoa*)
- Wilson's phalarope (*Phalaropus tricolor*)
- Short-eared owl (*Asio flammeus*)
- Lewis's woodpecker (*Melanerpes lewis*)
- Red-headed woodpecker (*Melanerpes erythrocephalus*)
- Loggerhead shrike (*Lanius ludovicianus*)
- Virginia's warbler (*Vermivora virginiae*)
- Cassin's sparrow (*Aimophila cassinii*)
- Brewer's sparrow (*Spizella breweri*)
- Harris's sparrow (*Zonotrichia querula*)*
- Grasshopper sparrow (*Ammodramus savannarum*)
- Sage sparrow (*Amphispiza belli*)
- Horned grebe (*Podiceps auritus*)
- Bald eagle (*Haliaeetus leucocephalus*)**
- Willow flycatcher (*Empidonax traillii*)
- Sage thrasher (*Oreoscoptes montanus*)

*Species is on National BCC List, not USFWS Region 6 BCC List
**Species is ESA delisted

All of the species above are migratory and could seasonally be found in the study area. However, only Swainson's hawk and willow flycatcher are likely to breed regularly in the study area.

Chatfield Reservoir and the South Platte River are also important areas for waterfowl. The following species of waterfowl are on the USFWS list of "Birds of Management Concern/Game Birds Below

Desired Condition" (USFWS, 2004b) and have been confirmed at South Platte Park: canvasback (*Aythya valisineria*), ring-necked duck (*Aythya collaris*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), redhead (*Aythya americana*), greater scaup (*Aythya marila*), and lesser scaup (*Aythya affinis*). Of these waterfowl species, wood duck and mallard have been confirmed as nesting at South Platte Park (South Platte Park, 2008).

The riparian areas within Chatfield State Park, along the tributaries of Chatfield Reservoir, and adjacent to the South Platte River provide important habitat for numerous species of migratory birds during the breeding season, nesting season, spring and fall migration, and winter. Chatfield State Park has been documented as a swallow staging and feeding area during spring migration, and the reservoir itself attracts large numbers of waterfowl during spring and fall migration. Chatfield State Park also hosts the largest populations of breeding American redstarts and least flycatchers in Colorado (Audubon Colorado, 2004).

Because this area offers important habitat to many different species of birds, Chatfield State Park has been designated as an Important Bird Area (IBA) by Audubon Colorado (2004). An IBA is a site that provides essential habitat to one or more bird species during some portion of the year, including breeding season, migration, and/or winter. Chatfield State Park meets four of the five IBA criteria, including (1) being important to endangered or threatened species in Colorado; (2) containing rare or unique habitat that holds important species or species assemblages largely restricted to a distinctive habitat type; (3) significant numbers of birds concentrate for breeding, during migration, or in the winter (waterfowl, heronries, and landbirds); and (4) the site is important for long-term research and/or monitoring projects that contribute substantially to ornithology, bird conservation, and/or education.

To gain a better understanding of migratory bird habitat use in the study area, biologists consulted with members of the Audubon Society of Greater Denver, who in turn provided contact information for bird data for the Chatfield study area. Observations of birds at Chatfield State Park have been recorded by a number of sources, including Joey Kellner, Hugh Kingery, Rocky Mountain Bird Observatory (RMBO), CDOW, and Bioblitz (Kellner, 2006; Bonnell, 2006a, 2006b; RMBO, 2006; CDOW, 2006; Colorado Urban Wildlife Partnership, 2006, 2007). Collectively these sources report a total of 351 species of birds that have been observed at Chatfield State Park. Some of the most commonly seen species during the breeding season (May through July) are double-crested cormorant, great blue heron, mallard, killdeer, belted kingfisher, rock dove, mourning dove, western kingbird, black-billed magpie, American crow, tree swallow, violet-green swallow, barn swallow, cliff swallow, black-capped chickadee, house wren, American robin, European starling, yellow warbler, common yellowthroat, yellow-breasted chat, song sparrow, red-winged blackbird, western meadowlark, common grackle, and brown-headed cowbird (Kellner 2006). Chatfield is home to the largest breeding populations of American redstarts and least flycatchers in Colorado (Audubon Colorado, 2007).

The most recent bird checklist for Chatfield State Park indicates that there are a total of 345 species that have been observed at the park (Colorado State Parks 1998). This includes 83 species that are summer or year-round residents, 23 additional species that spend the winter at Chatfield, and 98 species that are migrants. About 141 species are reported as "Infrequently Seen." Thirty species were

not reported on the Chatfield State Park list that were reported from the other sources cited above. Thus, the total number of species observed at Chatfield based on all of these sources is 375 species.

In addition and at the request of USFWS, the Corps' contracted biologists conducted point count surveys (50-meter radius) in three types of riparian habitats in June 2006 (see Appendix Q). This information was used to better characterize breeding birds in riparian areas likely to be affected by the proposed project including herbaceous wetlands/non-woody areas, riparian shrublands, and cottonwood forest. Twelve point count stations (50-meter radius) were established in these three habitat types; each type having four stations each. Wetland/non-woody areas included herbaceous wetlands, mudflats, and backwaters that were associated with riparian areas. Riparian shrublands included areas dominated by coyote willow. Tree-dominated areas included successional and mature forest types. Successional forest types included cottonwood, box elder, and narrow-leaf cottonwood forests that are even aged or simply smaller in stature. Mature forest types were comprised of large cottonwood trees that represent mature bottomland forest. The mature forests are restricted to areas along the South Platte River.

Table 3-3 presents standard indices of species' richness and diversity, based on field surveys conducted in June 2006 that included four stations of each habitat type and two observation dates (see Appendix Q). Wetlands had the highest total number of species observed (31), followed by woodlands (23), and shrublands (21). The findings in Table 3-3 are based on the June 2006 field studies conducted by the Corps' contractor (see Appendix Q). Additional years of field data would increase precision. Field data were summarized by calculating averages of species richness, abundance, and diversity. A dominant species is listed for each habitat type.

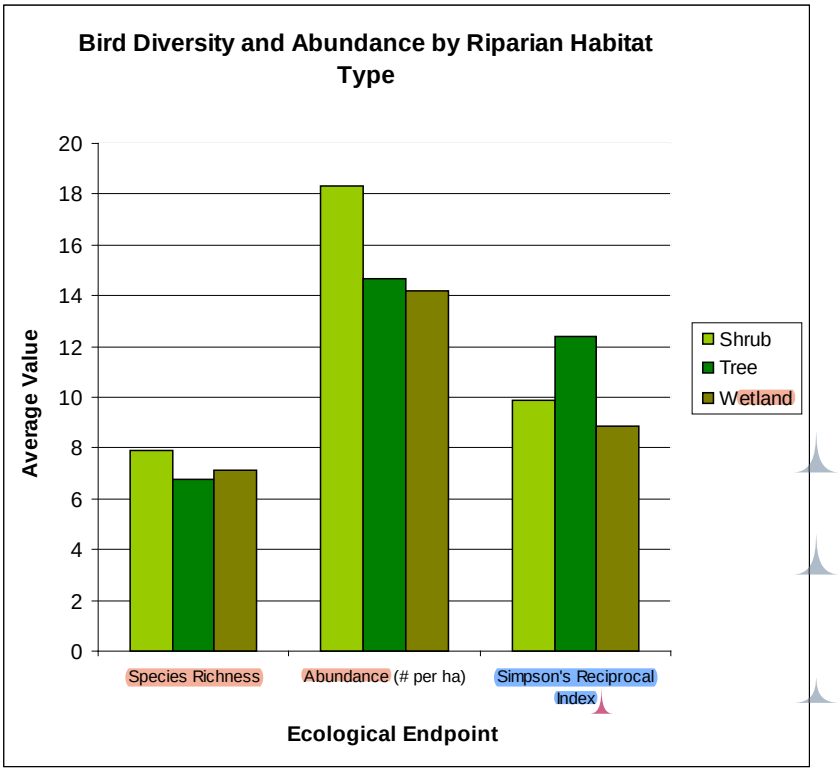
Table 3-3
Breeding Bird Ecological Parameters[1] by Riparian Habitat Type

Habitat Type	Species Richness	Abundance (# per ha)[5]	Diversity[2]	Dominant Species[3]
Wetlands	7.13	14.16	8.87	Red-winged blackbird or common yellowthroat[4]
Shrublands	7.88	18.30	9.90	Song sparrow, spotted towhee
Woodlands	6.75	14.64	12.37	Yellow warbler, hairy woodpeckers, great horned owls

[1] Parameter values are averages; n = 8
[2] Simpson's Reciprocal Index of Diversity
[3] Dominant species observed during June 2006 surveys
[4] Cattail dominated or sedge/rush dominated, respectively
[5] 1 hectare (ha) equals approximately 2.5 acres.

Based on the results of the June 2006 point count surveys, a total of 43 bird species was identified in at least one of the riparian habitat types. Riparian shrublands comprised the greatest variety of species (species richness = 7.88, Table 3-3, Figure 3-9) and had the greatest number of birds per area. Woodlands had the lowest variety of species, but the species present tended to be relatively even in abundance resulting in the greatest diversity of the three habitat types sampled (Figure 3-9).

Figure 3-9. Bird Diversity in Riparian Habitats at Chatfield



Each habitat type supports a different community of bird species, with additional bird species using two or all three habitat types. The most dramatic difference is between wetlands and woody vegetation, such as woodlands and shrubs. Wetlands support a distinct group of birds including shorebirds, red-winged blackbirds, killdeer, and yellow warblers depending on the type and height of vegetation present. Red-winged blackbirds and many shorebirds nest exclusively in wetland habitats; however, killdeer and yellow warbles are more widespread. Woody vegetation supports a variety of passerines, woodpeckers, and owls not found in wetlands.

Less dramatic is the difference in bird communities among woodlands and shrublands. Spotted towhees, willow flycatchers, and gray catbirds are most often found in shrublands. Woodlands support many cavity nesting birds, including woodpeckers, black-capped chickadees, and house wrens. Woodlands with thick understory support Bullock's orioles, red-eyed vireos, yellow-breasted chats and many other warbler species. Open woodlands support western wood-peewees, least flycatchers, and American redstarts.

One forest type that is rather unique along the foothills and plains interface of Colorado's Front Range is mature cottonwood forest. The study area has over 50 acres of mature cottonwood forest along the South Platte River that offer a variety of habitats as understory, midstory, and canopy layers. This forest type is rich in diversity and provides habitat niches for a variety of birds including red-eyed vireos and thrushes.

In more general terms, the study area provides riparian and wetland habitats for birds and other wildlife species. In Colorado's semiarid environment, riparian and wetland habitats are essential to many wildlife species. Riparian habitats harbor 2 to 10 times as many individual birds as do adjacent, non-riparian, vegetation (Rich, 2002). Many species depend on riparian habitats for at least some part of their life cycle. In terms of breeding birds, species that nest in riparian habitats over 90 percent of the time are considered "riparian obligate species." Species that nest over 60 percent of the time in riparian habitats are considered "riparian dependent species." Table 3-4 lists bird species observed during the 2006 breeding season that are either riparian obligates or dependent species.

Table 3-4
Bird Species Supported by Riparian Habitats at Chatfield Reservoir

Bird Species	Riparian Use[1]	Riparian Habitat Observed[2]
American Redstart	O	Wet
Belted Kingfisher	O	Wet
Broad-tailed Hummingbird	O	Wet, Shrub, Wood
Common Yellowthroat	O	Wet
Song Sparrow	O	Wet, Shrub, Wood
Willow Flycatcher	O	Wet
Yellow Warbler	O	Wet, Shrub, Wood
Yellow-breasted Chat	O	Wet, Shrub, Wood
American Goldfinch	D	Wet, Shrub, Wood
Black-Capped Chickadee	D	Shrub, Wood
Bullock's Oriole	D	Wood
Gray Catbird	D	Wet, Shrub
House Wren	D	Wet, Shrub, Wood
Red-eyed Vireo	D	Wood
Tree Swallow	D	Wet
Western Wood-Peewee	D	Wet, Shrub, Wood

Source: Bird Species – 2006 Chatfield Breeding Bird Surveys (see Appendix Q)

[1] Riparian Use: Obligate (O) or Dependent (D) (based on Rich 2002)

[2] Riparian Habitat Observed: Wetlands (Wet); Shrublands (Shrub); Woodland (Wood)

The Bureau of Land Management (BLM) states that the presence of the yellow-breasted chat and song sparrow indicates healthy riparian habitats especially along the South Platte River (BLM, n.d.). This, coupled with the presence of many other obligate and dependent riparian bird species, indicates that the riparian habitats within the study area are in good health.

Bird habitats at Chatfield should be considered as breeding habitat and as migration habitat. The study area including the habitats mentioned above is considered ideal stop-over habitat providing fresh water, protection from predators, and food resources (Duncan et al., 2001). Stop-over habitat allows birds to regain mass lost during migration and allows birds to replenish themselves in order to continue migration. The stop-over habitat is likely most important to small forest dwelling birds that typically require frequent stops during migration. The forested portions of the study area, especially along the South Platte River and Plum Creek, provide all the resources forest dwelling birds need during migration. Given the large body of water and the extensive shoreline, the study area is important stop-over habitat for shorebirds as well.

Considering areas that may be inundated by the proposed project, biologists created a habitat map (Figure 3-10) of six bird habitats, including the three bird survey habitats. The bird habitats that were mapped included wetlands, woodlands (including mature cottonwood forest), shrublands, open water, shorelines, and upland habitats. Although this habitat map does not comprise habitats throughout the entire study area, it provides a tool to assess impacts to bird habitats surrounding Chatfield Reservoir resulting from the implementation of selected alternatives. Biologists used high-resolution aerial photography to map habitats in the field. The field maps were digitized into a GIS where they could be further summarized and analyzed. This GIS analysis of the bird habitat maps is discussed further in Chapter 4.

South Platte Park is a municipal park located downstream of Chatfield State Park in Littleton, along an unchannelized portion of the South Platte River. This site is also designated as an IBA by Audubon Colorado. The 878-acre site meets two of the IBA criteria, including (1) significant numbers of birds concentrate for breeding, during migration, or in the winter (waterfowl and landbirds) and (2) the site is important for long-term research and/or monitoring projects that contribute substantially to ornithology, bird conservation, and/or education. The site is a lowland riparian ecosystem that includes wetlands, grasslands, mature cottonwood forests, and shrub thickets. Observers have recorded 253 species of birds at the site, and have confirmed 59 species of breeding birds and an additional 9 species that are possibly nesting (Cecily Mui, personal communication, 2008; Audubon Colorado, 2004).

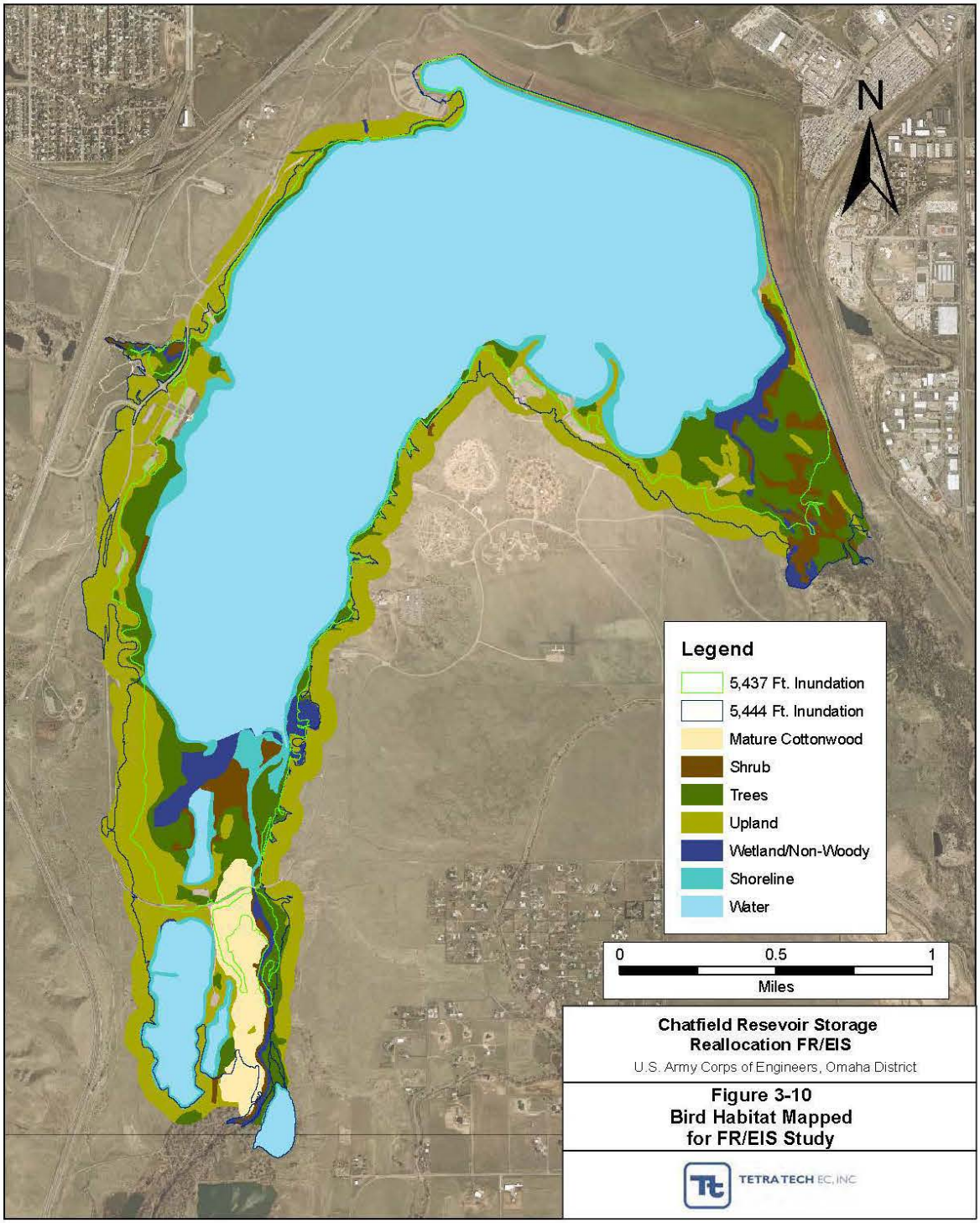
Data from Denver Botanic Gardens at Chatfield (formerly Chatfield Arboretum) provide an indication of the variety of butterfly species that are likely to inhabit the study area (Wiseman, 2006). Annual butterfly surveys conducted each July from 1992 to 2001 (except 1998) identified 17 to 26 species each year (mean = 21), with a total of 44 butterfly species identified over the survey period. The observed species of butterflies represented 8 families and 31 genera. Appendix G provides additional information on the butterfly survey.

3.8.2 Penley Reservoir, Pipeline Area, and Downstream Gravel Pits

Bird surveys are not available for the proposed Penley Reservoir site. However, given the similarities in location and habitat, the species of birds using the proposed Penley Reservoir site are likely to be similar to those occurring in comparable habitat types at Roxborough State Park (Bonnell, 2007). Birds in the grassland areas of the proposed Penley Reservoir site would likely include western meadowlark, horned lark, robin, bluebird, and a variety of sparrows and finches. A mix of pine and oak is found on the steeper slopes surrounding the grassland areas. These areas likely support a variety of bird species, including woodpeckers, flycatchers, jays, chickadees, nuthatches, wrens, and warblers.

The proposed pipeline area associated with the Penley Reservoir, if constructed, would cross a broader variety of wildlife habitats than the reservoir itself. Grasslands predominate, but lesser amounts of deciduous forest and forested wetlands are also present. These areas provide habitat for a variety of mammals, birds, reptiles, amphibians, and invertebrates. Common species include mule deer, white-tailed deer, coyote, black-tailed prairie dog, horned lark, meadowlark, Swainson's hawk, and western fence lizard. Deciduous oak and forested wetlands are also found along the pipeline corridor. These habitats likely contain forest obligate species such as robins, woodpeckers, flycatchers, jays, chickadees, nuthatches, wrens, and warblers. Other wildlife species likely present in

Figure 3-10
Bird Habitat Mapped for FR/EIS Study



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the vicinity of the proposed Penley Reservoir site are white-tailed deer, squirrel, raccoon, and a variety of bat species.

The downstream gravel pits occur in close proximity to urban areas and agricultural land. Wildlife diversity is likely to be low except where native or wetland habitats exist. Common species present within the gravel pits' inundation area likely include squirrel, rabbit, black-tailed prairie dog, coyote, rock pigeon, house sparrow, and house finch; however, less common mammal, bird, reptile, amphibian, and invertebrate species are also possible in the riparian corridor surrounding the South Platte River.

3.9 Endangered, Threatened, and Candidate Species, Species of Special Concern, and Sensitive Communities

This section describes special status species that may be found in the study area, including Chatfield Reservoir, the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits. USFWS (2004a, 2010), CDOW (2005a), and Colorado Natural Heritage Program (CNHP) (2000) were consulted in regard to special status species, those species having federal or state protection as threatened, endangered, or some other special protective status, and potentially occurring within the study area.

3.9.1 Chatfield Reservoir

Special status species that were identified as potentially occurring within the study area are listed in Table 3-5.

3.9.1.1 Special Status Plant Species

Five special status plant species are known to occur or potentially occur within the study area (Table 3-5). Two of these species are federally listed as threatened and are also ranked by CNHP. The other three species are not state or federally-listed, but are ranked by CNHP. Two plant communities listed by CNHP also potentially occur within the study area. An additional federally-threatened plant species, the western prairie fringed orchid, may be potentially impacted by water depletions in the Platte River system.

The federally listed threatened Ute ladies'-tresses orchid (57 Federal Register 2048) has limited distribution in the western U.S., including four counties in Colorado's Front Range (Jefferson, Boulder, Larimer, and Weld Counties) (Fertig et al., 2005). It is not currently reported from any locations along the South Platte River (Fertig et al., 2005). This orchid is found in seasonally moist soils and wet meadows near springs, lakes, or perennial streams and their associated flood plains below 6,500 feet msl. Typical sites include old stream channels, abandoned meanders, alluvial terraces, sub-irrigated meadows, and other sites where soils are saturated to within 18 inches of the surface, at least temporarily, during the spring and summer growing season (USFS, 1994). In October 2004, USFWS initiated a status review to assess the orchid population abundance and distribution, recovery progress, and existing threats. Upon conclusion of the status review, USFWS will issue a finding regarding whether the orchid should remain listed or should be proposed for delisting (69 Federal Register 60605).

In a 1998 survey, five areas around Chatfield Reservoir were considered to be potential Ute ladies'-tresses orchid habitat. All sites were surveyed for the orchid and no individuals or populations were

found (Burns & McDonnell, 1998). In 2004, six general areas were identified as potential orchid habitat around Chatfield Reservoir. These sites were surveyed and no individuals or populations were found (USACE, 2005b). Surveys for the Ute ladies'-tresses orchid within the study area were conducted again in August 2005. Although potential habitat exists within the study area, no Ute ladies'-tresses orchid plants were found (USACE, 2006).

The federally-listed threatened Colorado butterfly plant (65 Federal Register 62302) is endemic to southeastern Wyoming, western Nebraska, and northeastern Colorado, including Boulder, Douglas, Larimer, and Weld Counties in Colorado (Spackman et al., 1997). This short-lived, perennial herb grows in moist soils in mesic or wet meadows of flood plain areas at elevations of 5,800 to 6,200 feet msl. In 2004, five general areas were identified as potential habitat and surveyed for the Colorado butterfly plant within the study area. No individuals or populations were found (USACE, 2005b). In January 2005, USFWS designated 3,538 acres of critical habitat along approximately 50 stream miles within Platte and Laramie counties in Wyoming (70 Federal Register 1940). Surveys for the Colorado butterfly plant within the study area were conducted again in August 2005. Potential habitat was found within the study area; however, no Colorado butterfly plants were found (USACE, 2006).

The three plant species listed only by CNHP include American currant, Bell's twinpod, and forktip three-awn. The American currant may occur in the study area because potential suitable habitat exists and because a known population is located nearby in South Platte Park. Bell's twinpod is endemic to the Niobrara Formation limestone and calcareous shale outcrops in Larimer, Boulder, and Jefferson Counties (CNPS 1997). Because the study area does not encompass the Niobrara Formation, the occurrence of Bell's twinpod is unlikely. CNHP indicates that forktip three-awn has been identified in Jefferson County in the vicinity of Chatfield Reservoir and the South Platte River, so it may occur within the study area (CNHP, 2000).

Two rare plant communities were identified by CNHP as potentially occurring within the study area (CNHP, 2000). The xeric tallgrass prairie community is dominated by big bluestem and little bluestem. The CNHP database shows this community as occurring along the southern edge of the study area. It is an extension of the tallgrass prairie that used to dominate the central plains of the nation. This remnant community is rare because most of it has been lost to development, agriculture, and commercialization.

The plains cottonwood/chokecherry community lies in association with the South Platte River south of Chatfield Reservoir (CNHP, 2000). It occurs in mesic flood plains that are seasonally flooded. It also occurs in association with swales within the surrounding low hills. This community is rare because chokecherry generally occurs as a monoculture without an overstory component. Plains cottonwood usually occurs with coyote willow as the dominant woody mid-story species.

3.9.1.2 Special Status Animal Species

Table 3-5 lists the special status animal species that may occur in the study area based on the literature and agency database review. The potential occurrence of these species in the study area is discussed in this section.

Table 3-5
Special Status Species Found or Potentially Found Within the Study Areas

Common Name (Scientific Name)	Special Status			Area of Potential Occurrence			
	Federal[1]	State[2]	CNHP[3]	Chatfield Reservoir	Down-stream South Platte River	Penley Reservoir and Pipeline Area	Down-stream Gravel Pits
Plants							
American currant (*Ribes americanum*)			G5; S2	•		•	
Bell's twinpod (*Physaria bellii*)			G2; S2	•			
Colorado butterfly plant (*Gaura neomexicana ssp. coloradensis*)	FT		G3T2; S1	•		•	•
Colorado watercress (*Rorippa coloradensis*)			GH; SH				•
Dog parsley (*Lomatium nuttallii*))			G3; S1				•
Dwarf milkweed (*Asclepias uncialis ssp. uncialis*)			G3G4T2T3; S2				•
Front Range alum-root (*Heuchera hallii*)			G3; S3			•	
Front Range milkvetch (*Astragalus sparsiflorus*)			G3; S3			•	
Forktip three-awn (*Aristida basiramea*)			G5; S1	•			
Gay-feather (*Liatris ligulistylis*))			G5; S1S2				•
Jeweled blazingstar (*Mentzelia speciosa*)			G3; S3			•	
Mountain cat's-eye (*Cryptantha cana*)			G5; S2				•
New Mexico cliff fern (*Woodsia neomexicana*)			G4; S2			•	
Peck's sedge (*Carex peckii*)			G4G5; S1			•	
Plains milkvetch (*Astragalus gilviflorus*)			G5; S1				•
Prairie violet (*Viola pedatifida*)			G5; S2			•	•
Richardson alum-root (*Heuchera richardsonii*)			G5; S1			•	•
Rocky Mountain bulrush (*Schoenoplectus saximontanus*)			G5; S1				•
Rocky Mountain sedge (*Carex saximontana*)			G5; S1			•	
Sandhill goosefoot (*Chenopodium cycloides*)			G3G4; S1				•
Selkirk's violet (*Viola selkirkii*)			G5; S1			•	
Sensitive fern (*Onoclea sensibilis*)			G5; SH			•	
Ute ladies'-tresses orchid (*Spiranthes diluvialis*)	FT		G2; S2	•			•
Western prairie fringed orchid (*Platanthera praeclara*)	FT				•		

Table 3-5
Special Status Species Found or Potentially Found Within the Study Areas

Common Name (Scientific Name)	Special Status			Area of Potential Occurrence			
	Federal[1]	State[2]	CNHP[3]	Chatfield Reservoir	Down-stream South Platte River	Penley Reservoir and Pipeline Area	Down-stream Gravel Pits
Alpine feverfew (*Parthenium alpinum*)			G3; S1				•
Plant Communities							
Xeric tallgrass prairie (NA)			G2; S2	•			
Plains cottonwood/ chokecherry (NA)			G1Q; S1Q	•			
Mammals							
Black-footed ferret (*Mustela nigripes*)	FE	SE	G1; S1	•			•
Black-tailed prairie dog (*Cynomys ludovicianus*)		SC	G3G4; S4	•			•
Canada lynx (*Lynx canadensis*)	FT	SE	G5; S1	•			
Northern pocket gopher (*Thomomys talpoides*)		SC	G5; T3	•		•	
Northern pocket gopher subspecies (*Thomomys talpoides macrotis*)		SC	G5T1; S1			•	
Preble's meadow jumping mouse (*Zapus hudsonius preblei*)	FT	ST	G5T2; S1	•		•	•
Swift fox (*Vulpes velox*)		SC	G3; S3				•
Townsend's big-eared bat (pale sp.) (*Plecotus townsendii pallescens*)		SC	G4; S2	•			
Birds							
American peregrine falcon (*Falco peregrinus anatum*)		SC	G4; S2B	•		•	
American white pelican (*Pelecanus erythrorhynchos*)			G3; S1B	•			•
Bald eagle (*Haliaeetus leucocephalus*)	FP	ST	G4; S1B, S3N	•	•	•	•
Black-necked stilt (*Himantopus mexicanus*)			G5; S3B				•
Chestnut-collared longspur (*Calcarius ornatus*)			G5; S1B				•
Golden eagle (*Aquila chrysaetos*)	FP		Not tracked	•			
Ferruginous hawk (*Buteo regalis*)		SC	G4; S3B, S4N	•			•
Greater prairie chicken (*Tympanuchus cupido pinnatus*)			G4T4; S3				•
Greater sandhill crane (*Grus canadensis tabida*)		SC	G4; S2B, S4N	•			
Interior Least Tern (*Sterna antillarum*)	FE	SE	G4; S1B	•	•		
Lewis's woodpecker (*Melanerpes lewis*)			G4; S4			•	•
Long-billed curlew (*Numenius americanus*)			G5; S2B				•
McCown's longspur (*Calcarius mccownii*)			G4; S2B				•

Table 3-5
Special Status Species Found or Potentially Found Within the Study Areas

Common Name (Scientific Name)	Special Status			Area of Potential Occurrence			
	Federal[1]	State[2]	CNHP[3]	Chatfield Reservoir	Down-stream South Platte River	Penley Reservoir and Pipeline Area	Down-stream Gravel Pits
Mexican spotted owl (*Strix occidentalis lucida*)	FT	ST	G3T3; S1B, SUN	•		•	
Mountain plover (*Charadrius montanus*)		SC	G2; S2B	•			•
Ovenbird (*Seiurus aurocapilla*)			G5; S2B			•	
Piping plover (*Charadrius melodus*)	FT	ST	G3; S1B	•	•		
Plains sharp-tailed grouse (*Tympanuchus phasianellus jamesi*)		SE	G4T4; S1	•		•	
Snowy egret (*Egretta thula*)			G5; S2B				•
Western burrowing owl (*Athene cunicularia*)		ST	G4; S4B	•			
Western snowy plover (*Charadrius alexandrinus*)		SC	G5	•			
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	FC	SC	G5T3Q	•			
White-faced Ibis (*Plegadis chihi*)			G5; S2B				•
Whooping crane (*Grus americana tabida*)	FE	SE	G1; SNA		•		
Amphibians							
Northern leopard frog (*Rana pipiens*)		SC	G5; S3	•		•	•
Fish							
Common shiner (*Luxilus cornutus*)		ST		•			
Greenback cutthroat trout (*Oncorhynchus clarki stomias*)	FT	ST	G4T2T3; S2	•			
Hornyhead chub (*Nocomis biguttatus*)			G5; SX				•
Iowa darter (*Etheostoma exile*)		SC		•			
Northern redbelly dace (*Phoxinus eos*)		SE	G5; S1	•		•	•
Pallid sturgeon (*Scaphirhynchus albus*)	FE				•		
Mollusks							
Cylindrical papershell (*Anodontoides ferussacianus*)		SC	G5; S2				•
Invertebrates							
American burying beetle (*Nicrophorus americanus*)	FE				•		
Colorado blue (*Euphilotes rita coloradensis*)			G3G4T2T3; S2				•
Hops azure (*Celastrina humulus*)			G2G3; S2			•	
Moss' elfin (*Callophrys mossii schryveri*)			G4T3; S2S3	•		•	

Table 3-5
Special Status Species Found or Potentially Found Within the Study Areas

Common Name (Scientific Name)	Special Status			Area of Potential Occurrence			
	Federal[1]	State[2]	CNHP[3]	Chatfield Reservoir	Down-stream South Platte River	Penley Reservoir and Pipeline Area	Down-stream Gravel Pits
Mottled dusky wing (*Erynnis martialis*)			G3G4; S2S3			•	
Ottoe Skipper (*Hesperia ottoe*)			G3G4; S2			•	•
Pawnee montane skipper (*Hesperia leonardus montana*)	FT		G4T1; S1	•		•	
Rhesus skipper (*Polites rhesus*)			G4; S2S3				•
Tiger beetle (*Cicindela nebraskana*)			G4; S1			•	
Wiest's sphinx moth (*Euproserpinus wiesti*)			G3G4; S2				•

[1] Federal Status: FE = federally listed endangered; FT = federally listed threatened; FC = federal candidate species; FP= federally protected

[2] Colorado State Status: SE = state endangered; ST = state threatened; SC = state Species of Special Concern

[3] Colorado Natural Heritage Program Ranking:

Ranks:

G1/S1	Critically imperiled globally/state because of rarity (5 or fewer occurrences in the world/state or 1,000 or fewer individuals) or because some factor of its biology makes it vulnerable to extinction
G2/S2	Imperiled globally/state because of rarity, or because other factors demonstrably make it very vulnerable to extinction throughout its range
G3/S3	Vulnerable through its range or found locally in a restricted range
G4/S4	Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery
G5/S5	Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery
S#B	Refers to the breeding season imperilment of elements that are not permanent residents
S#N	Refers to the non-breeding season imperilment of elements that are not permanent residents
NA	Accidental; infrequent and outside its usual range
SU	Unrankable because there is a lack of information or because the information conflicts substantively

Subranks:

N	Refers to the non-breeding population
T	Status of a subspecies or varieties
Q	Questionable taxonomy

Mammals

The federally-listed endangered black-footed ferret (35 Federal Register 8495) is not expected to occur within the study area. Natural populations of black-footed ferrets are presently known to exist only in Wyoming, in the Shirley Basin, and in Colorado, in the Coyote Basin and near Dinosaur National Monument (CDOW, 2005a). USFWS has established minimum areas of prairie dog habitat (80 acres of black-tailed prairie dog towns and 200 acres of white-tailed prairie dog towns) needed to support black-footed ferrets (USFWS, 1989). A small black-tailed prairie dog town is present within the study area, southeast of the model airplane flying field at Chatfield State Park (Wiley 2000). This town is less than 80 acres in size and is not large enough to support the black-footed ferret. All project components for all alternatives are also within the 2009 Black-Footed Ferret Block-Clearance Area where USFWS has determined that ferrets are unlikely to occur and black-footed ferret surveys are not required (USFWS, 2009).

In Colorado, the black-tailed prairie dog is classified as a small game species and inhabits areas east of the foothills up to 6,000 feet msl. The largest areas of active prairie dog colonies are located along the Front Range and in the south-central and southeastern portions of Colorado. Black-tailed prairie dogs form large towns in shortgrass or mixed prairie and dig complex burrow systems with entrances marked by conspicuous mounds (CDOW, 2005a). In 1998, USFWS received two petitions to list the black-tailed prairie dog as an endangered or threatened species. In August 2004, after completing an evaluation of the status of black-tailed prairie dog, USFWS determined the prairie dog is not likely to become an endangered or threatened species in the near foreseeable future and is not warranted for listing (69 Federal Register 51217). A recent review by USFWS, completed in December 2009, again found that the black-tailed prairie dog does not warrant listing as threatened or endangered (74 Federal Register 63343).

The federally-listed threatened Canada lynx (65 Federal Register 16051) is a medium-sized cat that inhabits boreal forests of northern North America. The principal food of the lynx is snowshoe hare (*Lepus americanus*), which comprises 80 percent of the lynx's diet. Habitat includes dense spruce-fir stands in association with rock outcrops and large boulders in the subalpine zone and timberline where lynx use caves, rock crevices, overhanging banks, or hollow logs for denning. The Canada lynx was historically found in high-elevation forested areas in Colorado in the late 1800s; by 1930, however, they were considered rare. By the mid 1970s the lynx population in Colorado was extirpated or reduced to a few animals. In 1999, CDOW began a reintroduction program using lynx from Alaska and Canadian provinces for release in southwestern Colorado. As of February 2005, a total of 166 adult lynx have been released in the mountains of Colorado. Most of the lynx released remain in the core release area: New Mexico north to Gunnison, west as far as Taylor Mesa, and east to Monarch Pass. Some movement of lynx into Utah, Wyoming, and New Mexico has also occurred (CDOW, 2005a). There is no potential habitat for the Canada lynx in the study area.

The northern pocket gopher prefers deep soils along streams and in meadows and cultivated fields. It occurs in a wide range of habitats from grasslands, sagebrush steppe, mountain meadows and tundra, agricultural fields, and suburban lawns. This species does not hibernate and is active throughout the year. In Colorado, this species is found at elevations greater than 5,000 feet msl (CDOW, 2008b). This species is unlikely to occur within the study area because it is not known to occur west of U.S Highway (US-85) and not known to occur in Douglas County.

The Preble's meadow jumping mouse is found in and near shrub-dominated riparian (streamside) areas along Colorado's Front Range from Colorado Springs north into southeastern Wyoming. It hibernates from September or October until May. Preble's meadow jumping mouse occupied range (those areas where Preble's mice are known or very likely to occur) (NDIS 2006) within the study area is illustrated in Figure 3-11. This mouse is a rare subspecies of the meadow jumping mouse (*Zapus hudsonius*) and was listed as a federally-threatened species in 1998 (63 Federal Register 26517). In June 2003, USFWS designated critical habitat (68 Federal Register 37275-37332) for the mouse along 359 stream miles in Colorado and Wyoming, including portions of the Upper South Platte River (i.e., the Upper South Platte critical habitat unit [CHU]). Critical habitat is a term used in the ESA and is defined as those areas essential for the conservation of a federally-protected species (USFWS, 2000a). On the Upper South Platte River, USFWS (68 Federal Register 37275-37332a) defines critical habitat as extending 460 feet outward from normal high water on both sides of the Upper South Platte River above Chatfield Reservoir. Within the study area around Chatfield

Reservoir, approximately 297.3 acres of critical habitat are within the "Chatfield subunit" of the Upper South Platte CHU. In December 2010, USFWS designated additional areas of critical habitat for the mouse, including Unit 9 "West Plum Creek" (i.e., the West Plum Creek CHU), which includes much of the Plum Creek/West Plum Creek Watershed (75 Federal Register 78430). Plum Creek from Chatfield Lake upstream to its confluence with East Plum Creek and West Plum Creek is included in Unit 9, with the exception of 0.14 miles of Plum Creek at the Highline Canal crossing.

In February 2005, USFWS was petitioned to delist the Preble's meadow jumping mouse. On November 1, 2007, the USFWS revised its proposed rule to amend the listing of the Preble's mouse to specify over what portion of its range the subspecies is threatened. Also noted, is the finding that the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) is a valid subspecies and remains federally protected. A final rule was published in July 2008 (73 Federal Register 39789-39838).

Habitat for the mouse is found along the South Platte River and Plum Creek above Chatfield Reservoir. Approximately 552 acres of potential habitat exists within the study area around Chatfield Reservoir. Not all of this potential habitat is considered occupied but areas trapped along the South Platte River and Plum Creek have relatively high numbers of captures (Burns & McDonnell, 1998) indicating moderate to high densities at the time of trapping. Potential habitat below the reservoir has been previously disqualified by the USFWS by a block-clearance of the Denver Urban Drainage and Flood Control District (USFWS 2004c), but did not include South Platte Park and areas below the Chatfield Dam. No Preble's meadow jumping mice have been captured in the Chatfield study area below Chatfield Reservoir or along Deer Creek despite recent trapping efforts. The USFWS updated its Denver Urban Drainage and Flood Control District Block-Clearance by adding the area of South Platte Park south to Colorado State Highway C-470 (USFWS, 2007). The Preble's meadow jumping mouse was identified at two sites in the study area in 1998, the South Platte River above Chatfield Reservoir and along Plum Creek. It is expected that the mouse populations in these areas extend beyond the survey area. Elevation of the South Platte River site was 5,440 feet msl and the elevation for the Plum Creek site was 5,460 feet msl (Burns & McDonnell, 1998).

Preble's mouse habitat is comprised of well-developed plains riparian vegetation with adjacent, relatively undisturbed grassland communities and a nearby water source. These riparian areas include a relatively dense combination of grasses, forbs, and shrubs. Preble's mice are known to regularly range outward into adjacent uplands to feed and hibernate. Considering areas that may be inundated by the proposed project, biologists created a habitat map of four Preble's mouse habitat components to include "high quality riparian areas," "low quality riparian areas," "upland habitat," and "non-habitat areas" (Figure 3-12). These map units are defined as:

- High quality riparian areas—stream-side habitats within the floodplain that contain dense stands of vegetation often in multi-vegetative strata such as herbaceous ground cover, riparian shrubs, young trees, or combinations of all three in an arrangement that creates thick vegetative cover.

- Low quality riparian areas—stream-side habitats with limited vegetative cover. This includes mid-succession riparian forest lacking a shrub or grass/forb understory or recently inundated areas that may support vegetation but not enough to provide thick cover.

Figure 3-11
Preble's Mouse Occupied Range and Critical Habitat within the Chatfield Project Area

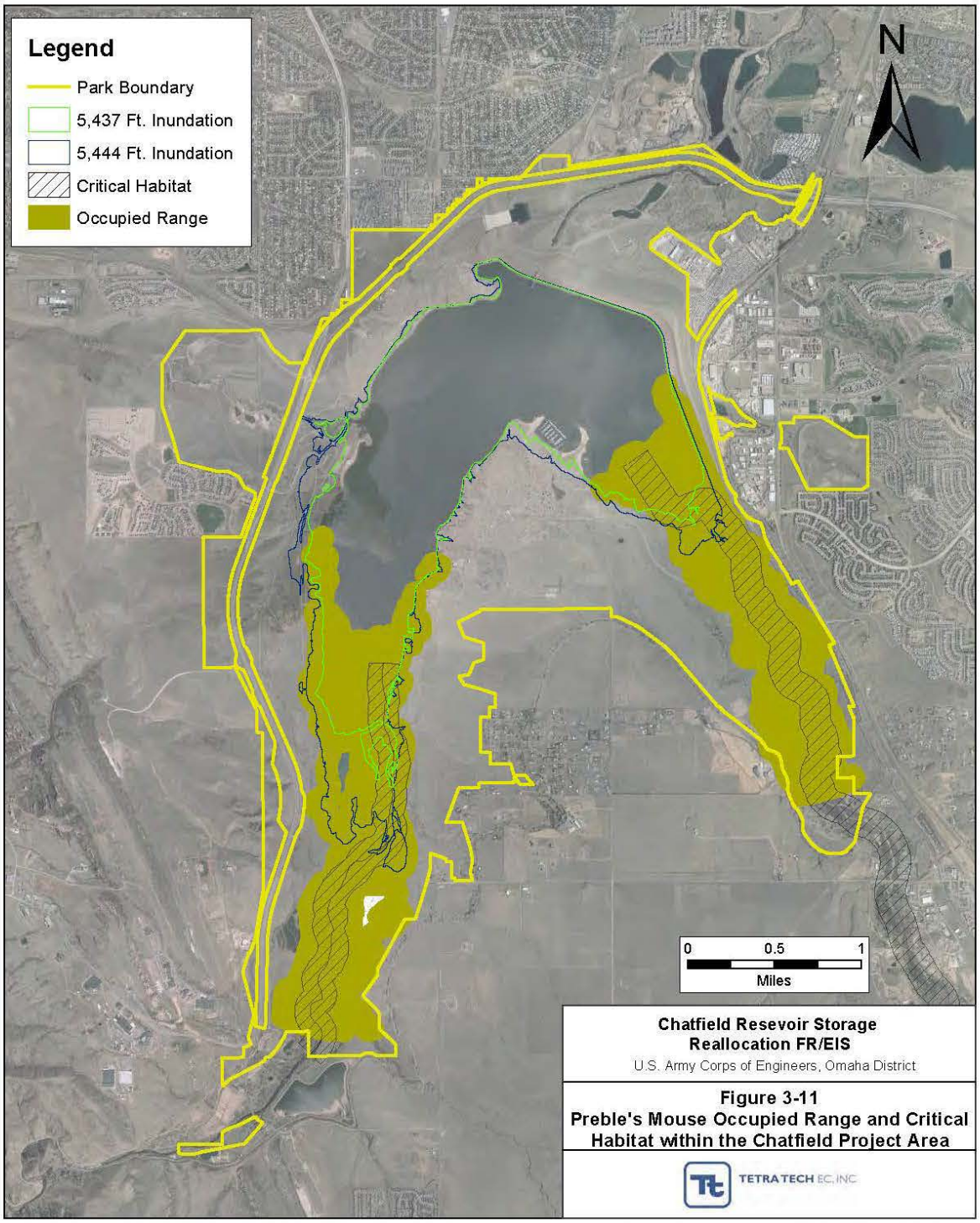

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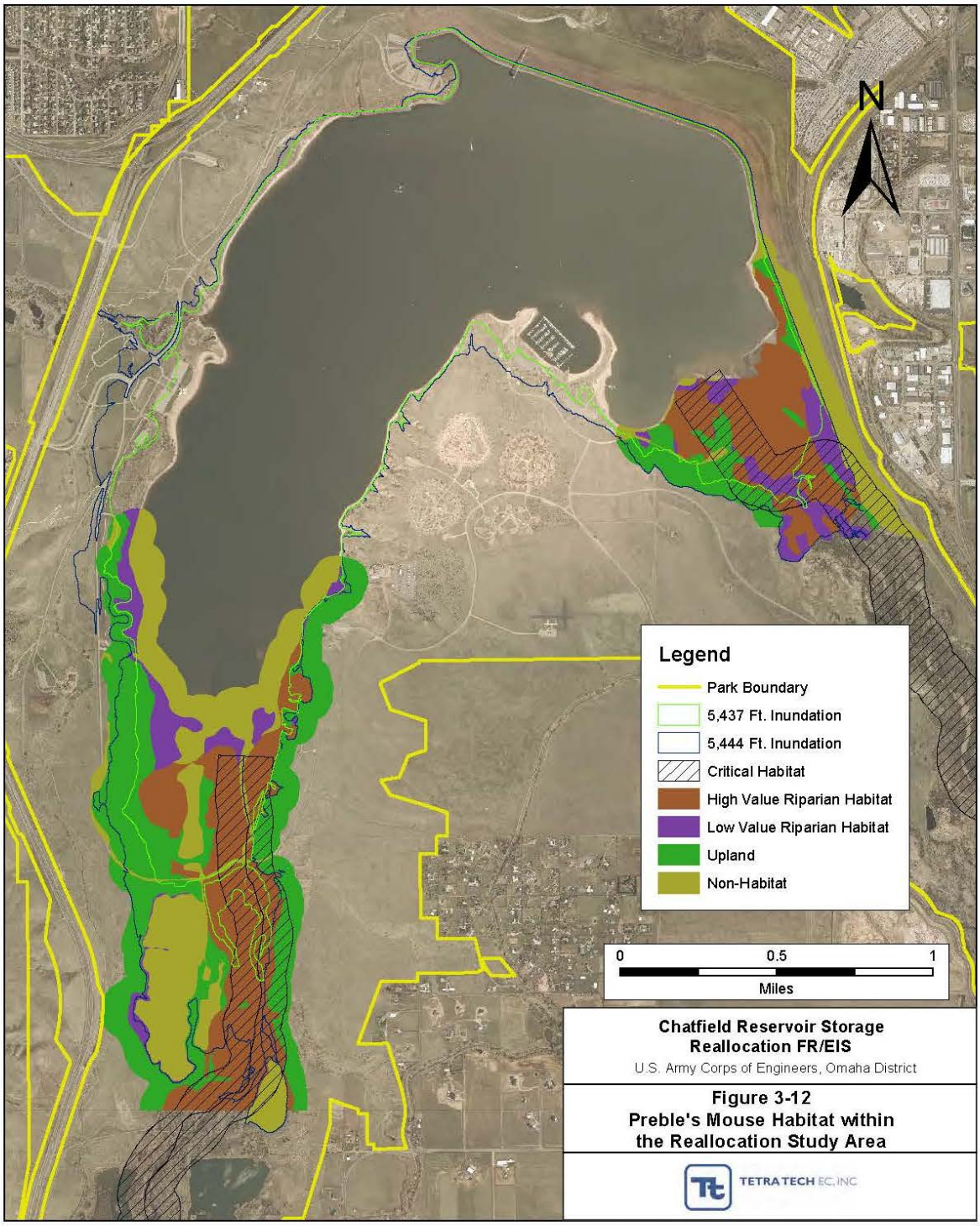
Figure 3-12
Preble's Mouse Habitat within the Reallocation Study Area



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- Uplands habitat—dense mesic grasslands, shrublands, or combinations of both adjacent to riparian areas. Uplands may be part of the floodplain or extend beyond the floodplain up to 300 feet.

- Non-habitat areas—includes roads, buildings, parking lots, and other human-altered features not considered habitat for the Preble's mouse.

- These map units are intended to be large blocks of habitat found within known and suspected occupied range within the study area. For example, small patches of low quality habitat would be incorporated into larger blocks of high quality habitat if the low quality patch was less than an acre.

Although this habitat map does not comprise habitats throughout the entire study area, it provides a tool to assess impacts to the Preble's mouse in terms of habitat surrounding Chatfield Reservoir resulting from the application of selected alternatives. Biologists used high-resolution aerial photography to map habitats in the field. The field maps were digitized into a GIS where they could be further summarized and analyzed. This GIS analysis of the Preble's mouse habitat maps is discussed further in Chapter 4.

Townsend's big-eared bat is found in riparian habitats within forests, shrublands, grasslands, and deserts. Maternal roosts occur in caves and mine tunnels and night roosts are in caves, buildings, and trees cavities. This bat feeds on various flying insects, particularly moths, near the foliage of trees and shrubs. This bat may occur in the study area in the summer, particularly if roosting habitat is available.

Birds

The American peregrine falcon is a subspecies of the peregrine falcon that can be identified by its intermediate coloration between the pale arctic subspecies and the dark northwestern subspecies. This falcon is found along cliffs and tall buildings in forested, shrubland, and urban habitats. This species nests on cliff faces with sheltering overhangs and tall buildings. It feeds primarily on medium-sized passerines and small waterfowl. This raptor currently nests in Waterton Canyon and may occur in the study area while foraging or during the wintering season, but nesting habitat is not present.

The bald eagle was federally listed and reclassified from endangered to threatened in 1995 (60 Federal Register 35999), and was delisted by the USFWS July 9, 2007, effective on August 8, 2007 (72 Federal Register 37346). However, bald eagles remain protected under provisions of the Bald and Golden Eagle Protection Act (16 USC 668) and the Migratory Bird Treaty Act (16 USC 703-712). The bald eagle migrates in summer to northern breeding grounds but returns to lower latitudes during the winter. Winter habitat consists of roost trees along rivers and other large open bodies of ice-free waters that allow access to fish (USFS, 1994). Typical nesting sites include trees on reservoir edges, cottonwoods along rivers, and conifers near lakes or streams (Kingery 1998). The bald eagle is a regular winter visitor to Chatfield Reservoir and is often seen perched on trees along the shoreline or standing on the ice. Principal eagle food resources available in the project area include fish, waterfowl, and prairie dogs (USFWS, 2006). A bald eagle nest was present in 2004 at South Platte Park, north of Chatfield Sate Park. However, successful breeding did not occur, and in

2005 great-horned owls occupied the nest. In 2005, bald eagles built a nest along the Highline Canal just south of Chatfield State Park (USFWS, 2006). The nesting attempt was abandoned. It is highly likely that bald eagles will continue to attempt nesting in the vicinity of Chatfield Reservoir (USFWS, 2006). According to the NDIS (2008c) there are no roost sites including winter roost sites at Chatfield or the surrounding area. The South Platte River and the reservoir are considered winter range and winter foraging areas for bald eagles.

The golden eagle, like the bald eagle, is protected under provisions of the Bald and Golden Eagle Protection Act (16 USC 668) and the Migratory Bird Treaty Act (16 USC 703-712). Golden eagles are more common in western Colorado, but are observed especially in winter in eastern Colorado often along the foothills. Additionally, golden eagles are known to nest in eastern Colorado but this is considered uncommon (Andrews & Righter, 1992). Golden eagles have been known to nest along the hogback at Roxborough State Park, the Lockheed Martin Property, and possibly near the proposed Penley Reservoir and associated pipelines.

The ferruginous hawk occupies grasslands and shrub-steppe communities. These hawks avoid areas of intensive agriculture, high human disturbance, high elevation interior forests, and narrow canyons. Breeding birds nest in isolated trees, on rock outcrops and structures such as windmills and power poles, or on the ground. Prey availability influences habitat selection and the ferruginous hawk tends to be most numerous where black-tailed prairie dog towns are plentiful. The ferruginous hawks found east of the Rocky Mountains winter primarily in grasslands, particularly where prairie dogs are abundant. On Colorado's eastern plains, these hawks are considered a rare to uncommon summer resident and a fairly common winter resident (CDOW, 2005a). This hawk may occur in the study area as a winter resident.

The greater sandhill crane is a frequent migrant in eastern Colorado. It is unclear if the sandhill cranes use the study area during migration. Typically, sandhill cranes use river channels as roosts and adjacent agricultural fields and grasslands to feed while stopping over during migration. The study area does not provide these types of habitats. River bottoms are heavily wooded and do not provide the open river channels used by cranes. Therefore, it is unlikely that greater sandhill cranes use the study area.

Interior least terns were federally listed endangered in 1985 (50 Federal Register 21784). They are highly dependent on the presence of dry, exposed sandbars and favorable river flows that support a forage fish supply and isolate the sandbars from the riverbanks. Characteristic riverine nesting sites are dry, flat, sparsely vegetated sand and gravel bars within a wide, unobstructed, water-filled river channel. Nests are initiated only after spring and early summer flows recede and dry areas on sandbars are exposed, usually at higher elevations away from the water's edge (Nebraska Game and Parks Commission [NGPC], 2005). Following regulation of the Platte River that decreased flows, the establishment of trees and shrubs on the flood plain greatly reduced the habitat for the least tern (Currier et al., 1985). In Nebraska, least terns currently breed along the Platte River from its mouth, west to North Platte, at one or two isolated sites along the South Platte River, along the lower reaches of the Niobrara River, along reaches of the Loup and Elkhorn Rivers, and on the unchannelized section of the Missouri River below the Fort Randall and Gavins Point Dams. A few least terns nest on the shoreline of Lake McConaughy on the North Platte River, usually in years when low lake levels expose wide, sandy beaches (NGPC, 2005).

The federally-listed threatened (58 Federal Register 14248) Mexican spotted owl has been observed in the Pikes Peak, South Platte, and San Carlos Ranger Districts of the Pike National Forest. All nests in Colorado found to date occur on cliff ledges or caves along canyon walls (USFS 1994). This species occupies either large, steep canyons with exposed cliffs and dense old-growth mixed forest of Douglas-fir, white fir, and ponderosa pine or canyons in pinyon-juniper areas with small and widely scattered patches of old Douglas-firs. In 2004, USFWS designated 8.6 million acres of Critical Habitat within the owl's geographic range, including 322,326 acres in Colorado (69 Federal Register 53181). The nearest Critical Habitat Unit is located in the southern areas of Douglas and Jefferson Counties on land managed by USFS. This owl is not expected to occur within the study area, however, because there is a lack of suitable habitat and the area lies at the edge of the owl's geographic distribution.

The mountain plover occurs in shortgrass prairie grassland, primarily on level areas with very short grass and a low density of cactus, and often with a heavy grazing regime. Prairie dog towns also appear to be important habitat for the mountain plover. The plover avoids taller grassland habitats and steep hillsides. Colorado is the primary breeding ground for the mountain plover—more than half of the world's plover population nests in the state. Major breeding areas exist at the Pawnee National Grasslands and in southeastern Colorado (CDOW, 2005a). The mountain plover was proposed for listing as a threatened species in 1999. In September 2003, USFWS withdrew the proposal for listing because new information indicated that the threats to the species included in the proposed listing were not as significant as earlier believed (68 Federal Register 53083). All counties within the study area except Jefferson County and Denver County are included in the NDIS mountain plover occurrence map (NDIS, 2007). This species may occur within the study area.

The northern Great Plains breeding population of the piping plover was federally listed threatened in 1985 (50 Federal Register 50726). It is found in Nebraska along the Platte River, preferring riverine island habitat that is largely unvegetated and made of sand, sediment, and gravel (Currier et al., 1985). In Nebraska, the Platte River was included in the critical habitat designated in 2002 (67 Federal Register 57638). This species has been affected through habitat loss by woody plant encroachment as a result of decreased flows in the Platte River (NGPC, 2005). An October 11, 2005, court ruling vacated critical habitat for the piping plover in Nebraska; it has been recommended to the USFWS for possible rededication (USFWS, 2006).

The plains sharp-tailed grouse inhabits a mix of tall and short grasses interspersed with stands of shrubs, especially where the shrubs form a dense cover with a relatively open understory. The woody cover is especially important for brood cover. Croplands and riparian areas are also used, especially in fall and winter. Leks, or traditional courting grounds, are located in wet meadows, on ridges and knolls, or in recently burned areas (Colorado Partners in Flight [CPIF], 2005). Although this species has not been identified within the study area, habitat is present and a population is known to occur nearby, and it is possible that this species could occasionally occupy available habitat within the study area.

In Douglas County, the plains sharp-tailed grouse has suffered population declines and state strongholds are now in northeastern Colorado (Ron Beane, personal communication 2008; and Andrews & Righter, 1992). The present population in Douglas County has not successfully bred in several years. However, the last known documented occurrences are approximately 1.5 miles

southeast of the Chatfield State Park boundary along Plum Creek. Several formal lek sites are also found within Douglas County several miles south of Chatfield State Park.

In Colorado, the western burrowing owl is a migratory species, and can be found from late March or early April through October on the eastern plains where prairie dog burrows occur. Owls have also been observed, but are uncommon, in mountain parks and on the Western Slope. During winter, western burrowing owls in Colorado migrate to Mexico and Central America. The burrowing owl is a grassland specialist that is dependent on the presence of fossorial, or burrowing, mammals. These owls use well-drained, flat to gently sloping grassland habitats with sparse vegetation and a relatively large proportion of bare ground. This species nests in underground burrows in grasslands and grazed pastures, and other dry, open habitats such as deserts and grassy urban areas, including golf courses, airports, cemeteries, vacant lots, and road rights-of-way (CDOW, 2005a). Although this species has not been identified within the study area, burrowing owls have been identified south of Chatfield Reservoir during the breeding season. Because suitable habitat does occur in the study area, the owl could potentially move into this habitat.

The western snowy plover is found along playa salt flats, sand dunes, and sandy shores of rivers, lakes, and ponds. It nests on the ground in bare open beaches or salt flats where vegetation is sparse, but it is sensitive to human disturbance. It eats insects and small crustaceans that it picks from the substrate. This species could occur in the study area if beaches are left undisturbed by humans.

The western yellow-billed cuckoo is found in open woodlands with thick undergrowth, parks, and deciduous riparian woodlands. This subspecies requires patches of at least 25 acres of dense riparian forest with a canopy cover of at least 50 percent in both the understory and overstory. Given the strict habitat requirements of this subspecies, the western yellow-billed cuckoo is unlikely to occur in the study area.

The American white pelican is summer resident and migrant on the eastern plains of Colorado and an occasional migrant elsewhere in the state. Individual birds or flocks are often seen flying over areas far from reservoirs; and many reservoirs on the eastern plains have large populations of nonbreeders. White pelicans are known to breed at three reservoirs in Colorado: Riverside Reservoir in Weld County, Antero Reservoir in Park County, and McFarlane Reservoir in Jackson County (CDOW, 2005a). The white pelican is known to feed at Chatfield Reservoir and therefore occurs within the study area.

Amphibians

The northern leopard frog inhabits wet meadows and the banks and shallows of marshes, ponds, glacial kettle ponds, beaver ponds, lakes, reservoirs, streams, and irrigation ditches. The frogs are active from March until October or November, when they become dormant for the winter. The northern leopard frog occurs throughout Colorado, excluding most of the southeastern and east-central portions of the state. Its elevation range extends from below 3,500 feet msl in northeastern Colorado to above 11,000 feet msl in southern Colorado (Hammerson, 1999; NDIS, 2008b). The distribution of the northern leopard frog includes portions of Jefferson, Douglas, and Arapahoe Counties that include the study area. This species has been found in Chatfield State Park in several riparian habitats along the South Platte River and Plum Creek (Baker and Farah c. 2009). Baker and Farah (c. 2009) observed adults primarily in early spring and early fall, and juveniles primarily during

the summer. Northern leopard frogs were observed cohabitating with chorus frogs in several seasonal ponds, but it was noted that they are seldom found sharing habitat with bullfrogs (Baker & Farah, 2009).

Fish

The common shiner is currently present in the upper reaches of Plum Creek. Colorado is west of the major distribution of this species, which is centered around the Great Lakes and upper Mississippi River (Lee et al. 1980). This species was never considered abundant in Colorado, and by some historical accounts, it has been considered rare and restricted to the eastern part of Colorado. In recent years only Goettl (1980 and 1981) reported common shiners in the mainstem South Platte River; one individual near Sterling and one in Denver. Of all sections of South Platte River streams sampled during a warm-water stream sampling survey, the West Plum Creek system contained the highest concentration of this species (Propst, 1982). These stream areas are at least 13 miles upstream from Chatfield Reservoir. The common shiner is apparently restricted in this system to tributaries near the foothills. The limited distribution of this species in the South Platte River system is likely a result of its preference for small, less-turbid streams and spawning habitat, such as gravel beds in flowing water (Woodling, 1985). The tributary streams of the Chatfield Reservoir are not likely to have habitat characteristics that would support this species. This species, therefore, is not expected to occur within the study area.

The historical range of the federally-listed threatened greenback cutthroat trout (43 Federal Register 16343) includes much of the South Platte River drainage from its headwaters to the confluence with the Cache la Poudre River just upstream from Greeley, Colorado, and the headwaters of the Arkansas River upstream from Pueblo, Colorado. However, current distribution is limited to a few streams and lakes in the upper headwaters of these drainages. These sites are not currently within the study area or under project influences. Introduction of nonnative trout species was the primary reason for the species decline, but habitat degradation and over harvesting also contributed to the decline. Habitat requirements include clear, cold streams and lakes and clean gravel in flowing streams during spring for spawning. The objective of the 1998 greenback cutthroat trout recovery plan included actions intended to allow removal of the species from the threatened list, which was to be accomplished by establishing 20 stable populations of greenback trout. All areas identified in the 1998 plan for locating these 20 populations are in headwater areas of the South Platte and Arkansas River drainages, far from the current study area (USFWS, 1998a). Currently, greenback trout occur in 58 lakes and streams and 23 of these bodies meet the population criteria required by recovery goals. Many of the historic and restored populations are located in Rocky Mountain National Park (CDOW, 2005a). The greenback trout, therefore, is not expected to occur within the study area.

Distribution of the Iowa darter in Colorado is limited. Populations are found in the South Platte Park reach of the South Platte River; some northeastern plains streams, including Plum Creek; and in single locations on the Saint Vrain and Big Thompson Rivers. Characteristic habitat includes cool, clear water over a sand or organic matter substrate (Trautman, 1957). Populations in Colorado are found in lakes, over mats of rooted aquatic plants, and in streams with vegetation along the stream bank extending into the water (Propst, 1982). This species may occur within the study area.

The northern redbelly dace is present in the upper tributaries of Plum Creek. Primary distribution of this fish is typically far north of Colorado, ranging in a narrow band from Newfoundland through

the Great Lakes to western Montana, Alberta, and northeastern British Columbia (Lee et al., 1980). It is considered extremely rare in Colorado either because of habitat modification or because it is located on the periphery of its range. In a survey of Colorado Platte River warm-water streams, only two specimens were found, both near or in Garber Creek, a tributary to Plum Creek. This stream is located more than 13 miles upstream from Chatfield Reservoir. The characteristic habitat of this species is slow-flowing streams with abundant vegetation. The habitat where they were found consists of a small section of stream (less than 4 feet wide) below irrigation ponds with substrate of small gravel and a fine silt surface layer (Propst, 1982). Three specimens were collected from a farm pond adjacent to a Plum Creek tributary (Woodling, 1985). Currently, some of the farm ponds in the area may be a refuge for the northern redbelly dace and common shiner. As with the common shiner, habitat in or near Chatfield Reservoir does not appear suitable for this species. This species is therefore not expected to occur within the study area.

Invertebrates

The Moss' elfin butterfly species occupies the foothills and lower montane canyons between 6,000 and 8,000 feet msl from Larimer County south to Pueblo County. Its distribution is the eastern foothills of the Front Range of the Rocky Mountains, specifically the north-central part of Colorado. The CNHP database identifies the Moss' elfin as being found along the South Platte River just south of Chatfield Reservoir. The species is highly dependent on its host plant, stonecrop (*Sedum lanceolatum*), which occurs in shortgrass steppe communities (CNHP, 2000). Marginal habitat for this species occurs within the study area, so this species may occupy the study area.

The federally-listed threatened Pawnee montane skipper (52 Federal Register 36176) inhabits dry, open ponderosa pine woodlands with sparse understory at 6,000 to 7,500 feet msl with moderately steep slopes and soils derived from Pikes Peak granite. Blue grama grass and prairie gayfeather (*Liatris punctata*) are two necessary components of the ground cover. The Pawnee montane skipper occurs only on the Pikes Peak Granite Formation in the South Platte River drainage system in Colorado, involving portions of Jefferson, Douglas, Teller, and Park Counties. An intensive distribution survey found the range of the skipper to be centered at Deckers, Colorado, and to extend northwest just beyond Pine, Colorado, and southward to the point where the Teller, Park, Jefferson, and Douglas county lines nearly converge (USFWS, 1998b). Based on this habitat and distribution information, the Pawnee montane skipper is not expected to occur in the study area.

3.9.2 Downstream in the South Platte River

USFWS identified several special status species that may be potentially impacted by water depletions in the Platte River drainage downstream of the study area (USFWS, 2000b, 2004a). These species are listed in Table 3-5 and are further discussed in this section.

The Platte River Recovery Implementation Program, established January 2007, is implementing actions designed to assist in the conservation and recovery of the above species and their associated habitats along the central and lower Platte River in Nebraska through a basin-wide cooperative approach agreed to by the states of Colorado, Nebraska, and Wyoming and the U.S. Department of the Interior. The program addresses the adverse impacts of existing and new water related activities with depletive effects to the South Platte River drainage and provides ESA compliance for effects to the species and critical habitat from such activities.

3.9.2.1 Special Status Plants Species

The western prairie fringed orchid was listed as a threatened species under both the federal (54 Federal Register 39857) and Nebraska endangered species acts in 1989 because its numbers declined as a result of development and conversion of tallgrass prairie to cropland. The range of the orchid extends from the Mississippi River westward to the Sandhills of Nebraska, north to Manitoba, Canada, and as far south as Oklahoma (NGPC, 1993). The orchid occurs in wet prairies and sedge meadows associated with tallgrass prairie overlying glacial drift and calcium-rich loess soils (Farrar, 1990).

3.9.2.2 Special Status Animal Species

Birds

Bald eagles are known to winter along the South Platte River system in riparian woodlands (Currier et al., 1985) but tend to avoid densely urbanized areas with limited riparian cottonwood corridors. General life history information about the bald eagle can be found in Section 3.9.1.2. Reduced or altered river flows as a result of diversions and dams can severely affect the ability of the aquatic system to attract wintering waterfowl or to support an adequate fishery for nesting or wintering eagles (NGPC, 2005).

Interior least terns were federally listed endangered in 1985 (50 Federal Register 21784). General life history information about the interior least tern can be found in Section 3.9.1.2. The northern Great Plains breeding population of the piping plover was federally listed threatened in 1985 (50 Federal Register 50726). General life history information about the piping plover can be found in Section 3.9.1.2. Whooping cranes were federally listed endangered in 1970 (35 Federal Register 8495). They migrate through Nebraska twice each year on their way to and from wintering grounds in the Aransas National Wildlife Refuge in Texas to summer grounds on freshwater marshes in Alberta, Canada. The primary migration route through Nebraska is approximately 140 miles wide; the Big Bend Region of the Platte River in Nebraska is an important stopover area (NGPC, 2005). This area was designated as critical habitat in 1978 (43 Federal Register 20938). No whooping cranes occur at Chatfield Reservoir.

Fish

The pallid sturgeon was federally listed as endangered in 1990 (55 Federal Register 36641). The range of the pallid sturgeon extends over 3,500 river miles, including the Missouri River from Fort Benton, Montana, to its confluence with the Mississippi River, and the Mississippi River mouth. The lower 200 miles of the Yellowstone River and lowermost portion of some of the major tributaries within this range, including the Kansas and Platte rivers, comprise part of the pallid sturgeon's known range. Pallid sturgeon require large, turbid, free-flowing river habitat with rocky or sandy substrate (Gilbraith et al., 1988). These sturgeon are more often found in deep, swift water and in the Missouri and Mississippi rivers in sandy bottom areas. During spring, they are known to make spawning migrations in the Yellowstone River in response to increased flows. Pallid sturgeons have been present in the Platte River or near its mouth, most often during above-normal spring flows (Berg, 1981). No pallid sturgeons occur at Chatfield Reservoir.

Invertebrates

The American burying beetle was federally listed as endangered in 1989 (54 Federal Register 29652) and seems to be restricted to areas largely undisturbed by human influence. In Nebraska, it is known to occur in the Sandhills, Gothenburg, Brady, North Platte, and the Valentine National Wildlife Refuge. Habitats in Nebraska where these beetles have been recently found consist of grassland prairie, forest edge, and scrubland. Specific habitat requirements are unknown (NGPC, 2005).

3.9.3 Penley Reservoir and Pipeline Area

This section identifies special status species that may potentially occur in the area of the proposed Penley Reservoir and the proposed pipeline area. Figure 3-13 shows the proposed location of Penley Reservoir and the downstream gravel pits as discussed in Chapter 2. It also shows the counties where these features would be located. Figure 2-1 shows the pipeline area that would be associated with the proposed Penley Reservoir. Special status species that were identified as potentially occurring within the study area are listed in Table 3-5.

3.9.3.1 Special Status Plant Species

The Colorado butterfly plant, is federally-listed as threatened and is also ranked by CNHP. General life history information about the Colorado butterfly plant can be found in Section 3.9.1.1. Site-specific survey data are not available for this species in the Penley area. The likelihood of occurrence within the proposed Penley Reservoir site is low to moderate based on absence of open meadow habitat, as identified from Gap Analysis Project (GAP) data (Figure 3-2).

CDOW has identified 11 plant species within Douglas County in decline at the state level or species whose population status is not well known but thought to be in decline (CDOW, 2007c, Table 3-5). These include American currant, Front Range alum-root, Front Range milkvetch, jeweled blazingstar, New Mexican cliff fern, peck sedge, prairie violet, Richardson alum-root, Rocky Mountain sedge, Selkirk violet, and sensitive fern. Species mentioned here are those monitored by the CNHP and may not be a complete list of sensitive species within the proposed Penley Reservoir area and its associated pipeline corridor.

3.9.3.2 Special Status Animal Species

Of the 31 species listed as federally endangered, threatened, or candidate species in the state of Colorado, three federally-threatened, endangered, or candidate wildlife species occur within Douglas County (CDOW, 2007c). All species monitored by the CNHP that occur within the vicinity of the proposed Penley Reservoir are included in Table 3-5.

Mammals

The federally-threatened Preble's meadow jumping mouse is found in thickly vegetated riparian habitats with adjacent grasslands (EPA, 1997). In Colorado, this species occurs throughout the South Platte River and its tributaries (NatureServe, 2007). A more detailed description of this species habitat requirements and range is found in Section 3.9.1.2. The known occupied range of this species does not occur within the proposed location of Penley Reservoir. Pipeline construction in the proposed pipeline area could cross Preble's meadow jumping mouse habitats and occupied range (Figures 3-14 and 3-15).

Figure 3-13
Penley Reservoir and Gravel Pits

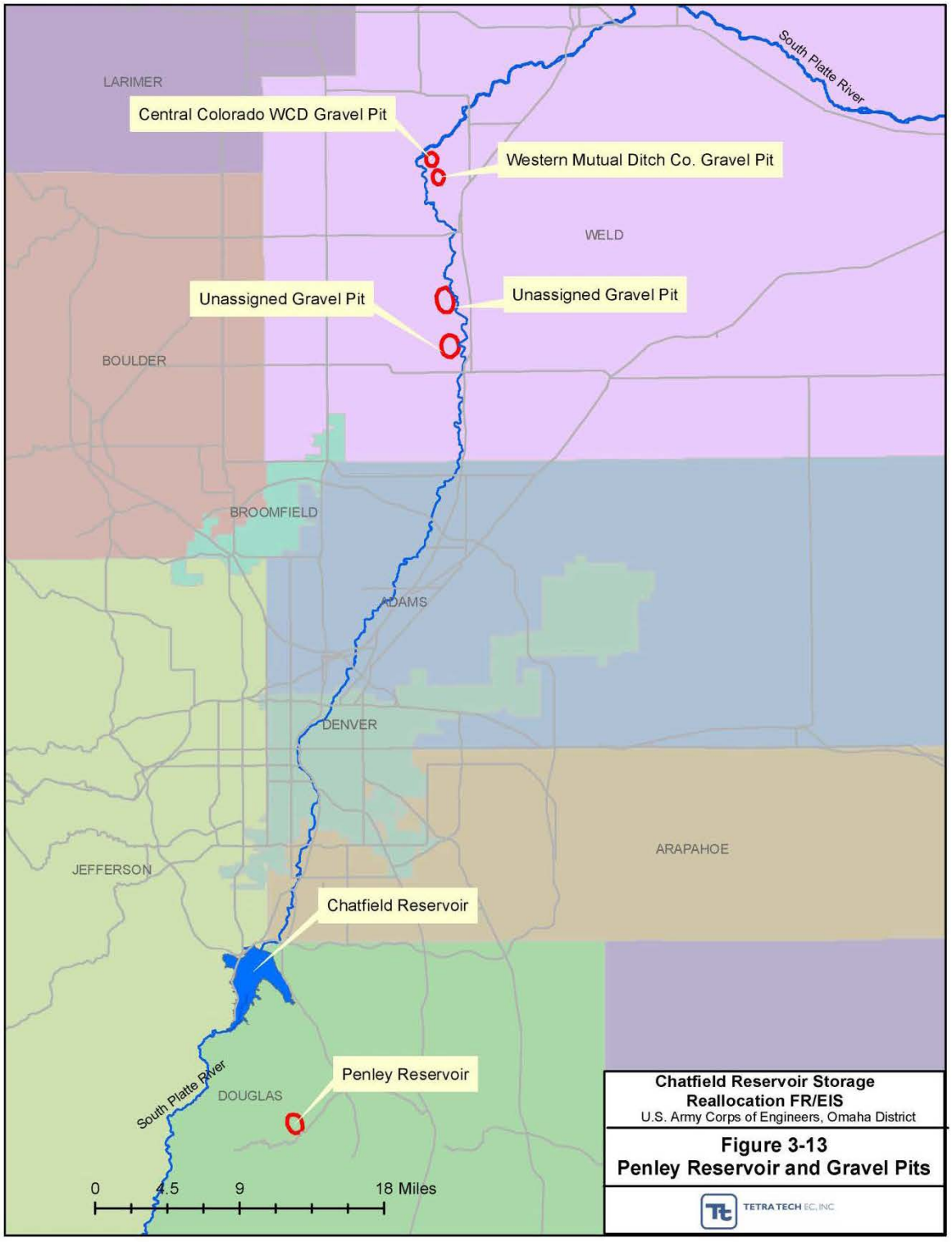

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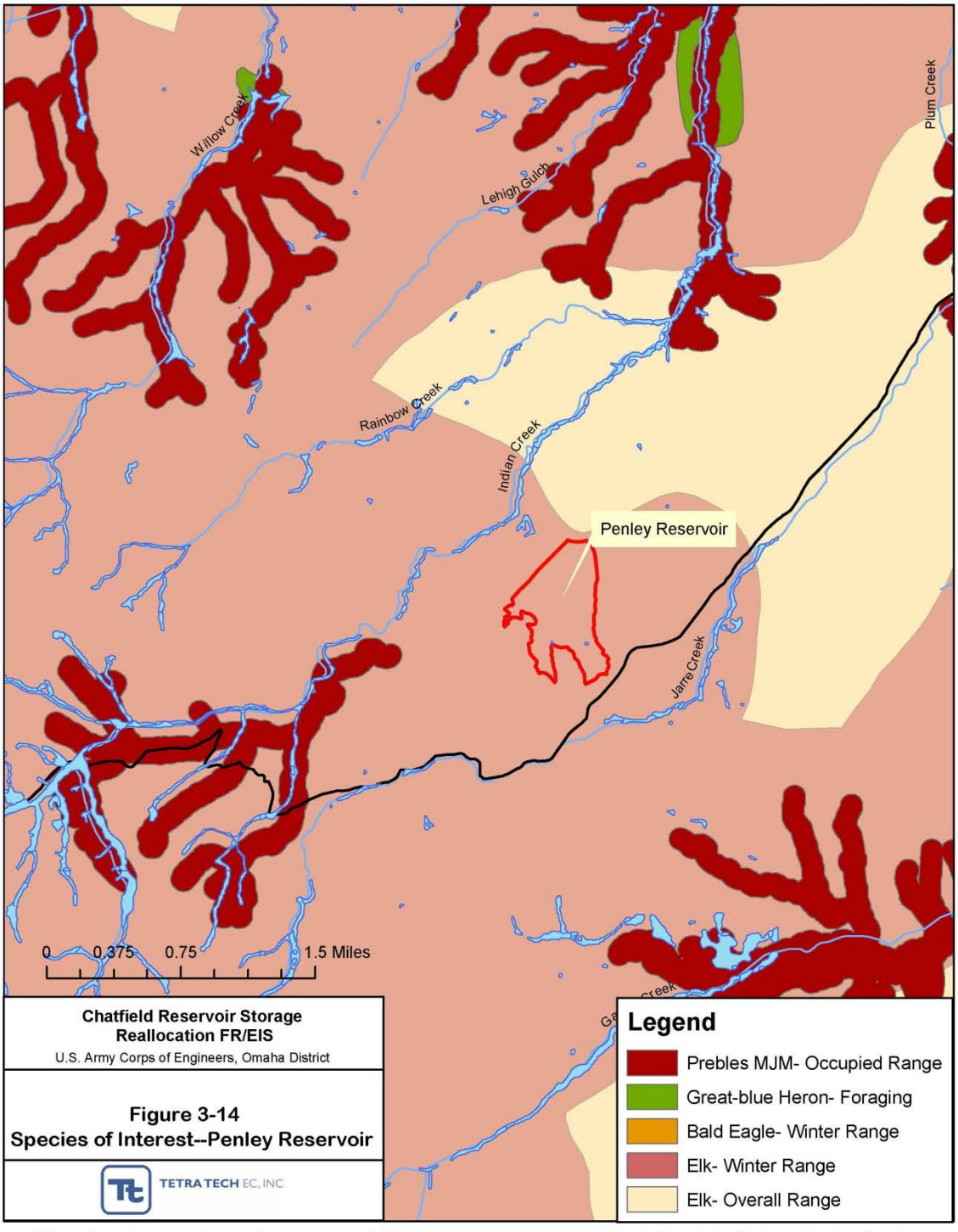
Figure 3-14
Species of Interest—Penley Reservoir



Wetlands and species data obtained from: Colorado Division of Wildlife. 2007. Available at http://ndis.nrel.colostate.edu.
RWSD = Roxborough Water and Sanitation District

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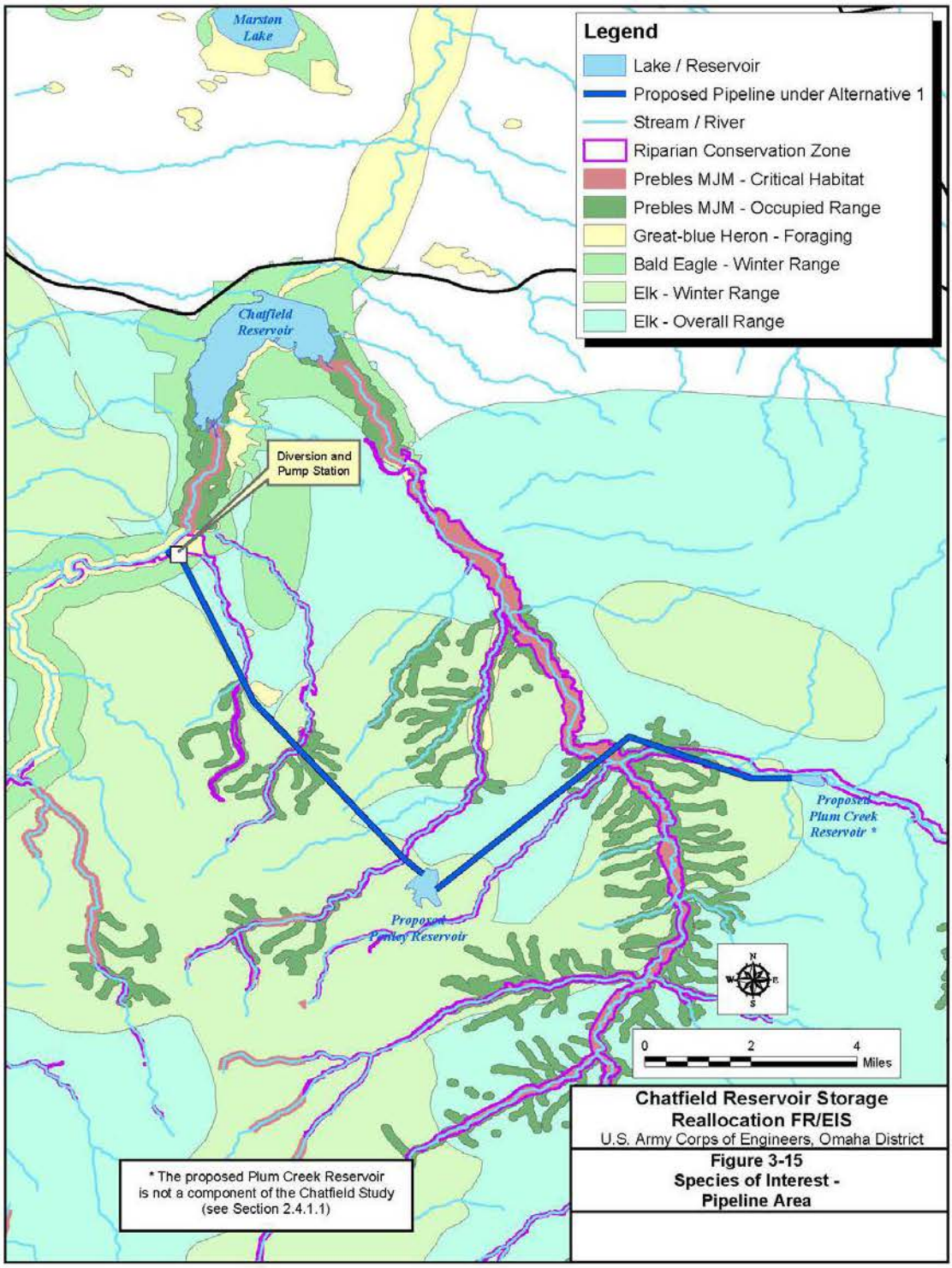
Figure 3-15
Species of Interest—Pipeline Area



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Birds

The federally-listed threatened (58 Federal Register 14248) Mexican spotted owl has been observed in the Pikes Peak, South Platte, and San Carlos Ranger Districts of the Pike National Forest. All nests in Colorado found to date occur on cliff ledges or caves along canyon walls (USFS, 1994). General life history information about the Mexican spotted owl can be found in Section 3.9.1.2. This owl is not expected to occur within the proposed Penley Reservoir site or within the pipeline area.

Bald eagles may be either seasonal or permanent residents in Colorado, foraging or nesting along the South Platte River year-round. Because of the close proximity of proposed Penley Reservoir and its associated pipelines to the South Platte River, the likelihood of occurrence is high (Figures 3-14 and 3-15). General life history information about the bald eagle can be found in Section 3.9.1.2.

Invertebrates

The federally listed threatened Pawnee montane skipper (52 Federal Register 36176) inhabits dry, open ponderosa pine woodlands. General life history information about the Pawnee montane skipper can be found in Section 3.9.1.2. Based on this habitat and distribution information, the Pawnee montane skipper is not expected to occur in the proposed Penley Reservoir site or pipeline area.

State-Protected Species and Other Species in Need of Conservation

CDOW has identified eight vertebrate species within Douglas County that are state-listed or of special concern (CDOW, 2007; Table 3-5). Of the 74 state listed species, 6 could occur within the Penley Reservoir area: a subspecies of the northern pocket gopher, American peregrine falcon, bald eagle, plains sharp-tailed grouse, northern leopard frog, and northern red-bellied dace (Table 3-5). In addition, CNHP monitors seven species within Douglas Country that are not state or federally listed (i.e., Lewis's woodpecker, ovenbird, hops feeding azure, Moss's elfin, mottled dusky wing, Ottoe skipper, and a tiger beetle). Species mentioned here are those monitored by the CDOW and may not be a complete list of threatened species within the area, particularly for elusive species or for highly mobile species such as birds.

3.9.4 Downstream Gravel Pits

This section assesses special status species that may potentially occur within the downstream South Platte River gravel pits. Figure 3-13 shows the locations of the three gravel pits. Special status species that were identified as potentially occurring within the area are listed in Table 3-5.

3.9.4.1 Special Status Plant Species

The federally-threatened Colorado butterfly plant is found in low depressions along wide meandering streams at the interface between riparian meadows and dry grassland. General life history information about the Colorado butterfly plant can be found in Section 3.9.1.1. The likelihood of occurrence within the gravel pit sites is low based on the high level of disturbance already present within the gravel pits.

The federally-threatened Ute ladies'-tresses are found in moist soils on flood plains of rivers and wet meadows, and habitats suitable for this species occur within close proximity to the South Platte River. General life history information about the Ute ladies'-tresses can be found in Section 3.9.1.1. The potential of species occurrence within the two gravel pits located in Weld County is low based

on the disturbance already present in the area, but Ute ladies'-tresses could occur in the proposed pipeline area near the South Platte River if native habitats are present. CDOW has identified 10 plant species within Adams and Weld Counties in decline at the state level or species whose population status is not well known but thought to be in decline (CDOW, 2007; Table 3-5). These include Colorado watercress, dog parsley, dwarf milkweed, gay-feather, mountain cat's-eye, plains milkvetch, prairie violet, Rocky Mountain bulrush, Sandhill goosefoot, and Wyoming feverfew. Species mentioned here are those monitored by the CNHP and may not be a complete list of sensitive species within each of the gravel pit areas and their associated pipeline corridors, particularly for elusive species.

3.9.4.2 Special Status Animal Species

Of the 31 species listed as federally-endangered, threatened, or candidate species in the state of Colorado, two federally-threatened, endangered, or candidate wildlife species occur within Adams or and Weld Counties (CDOW, 2007). All state- or federally-listed species that are monitored by the CNHP that occur within the vicinity of the gravel pit areas are included in Table 3-5.

Mammals

The federally-threatened Preble's meadow jumping mouse is found in thickly vegetated riparian habitats with adjacent grasslands (EPA, 1997). In Colorado, this species occurs throughout the South Platte River and its tributaries (NatureServe, 2007). A more detailed description of this species habitat requirements and range is found in Section 3.9.1.2. The known occupied range of this species does not occur within any of the proposed gravel pit areas (Figures 3-16 and 3-17).

The federally-endangered black-footed ferret is found in short- to midgrass prairies where there is an abundance of prairie dogs. General life history information about the black-footed ferret can be found in Section 3.9.1.2. The likelihood of occurrence within the No-Action Alternative is low based on low populations size and a high level of disturbance already present in the proposed gravel pit areas.

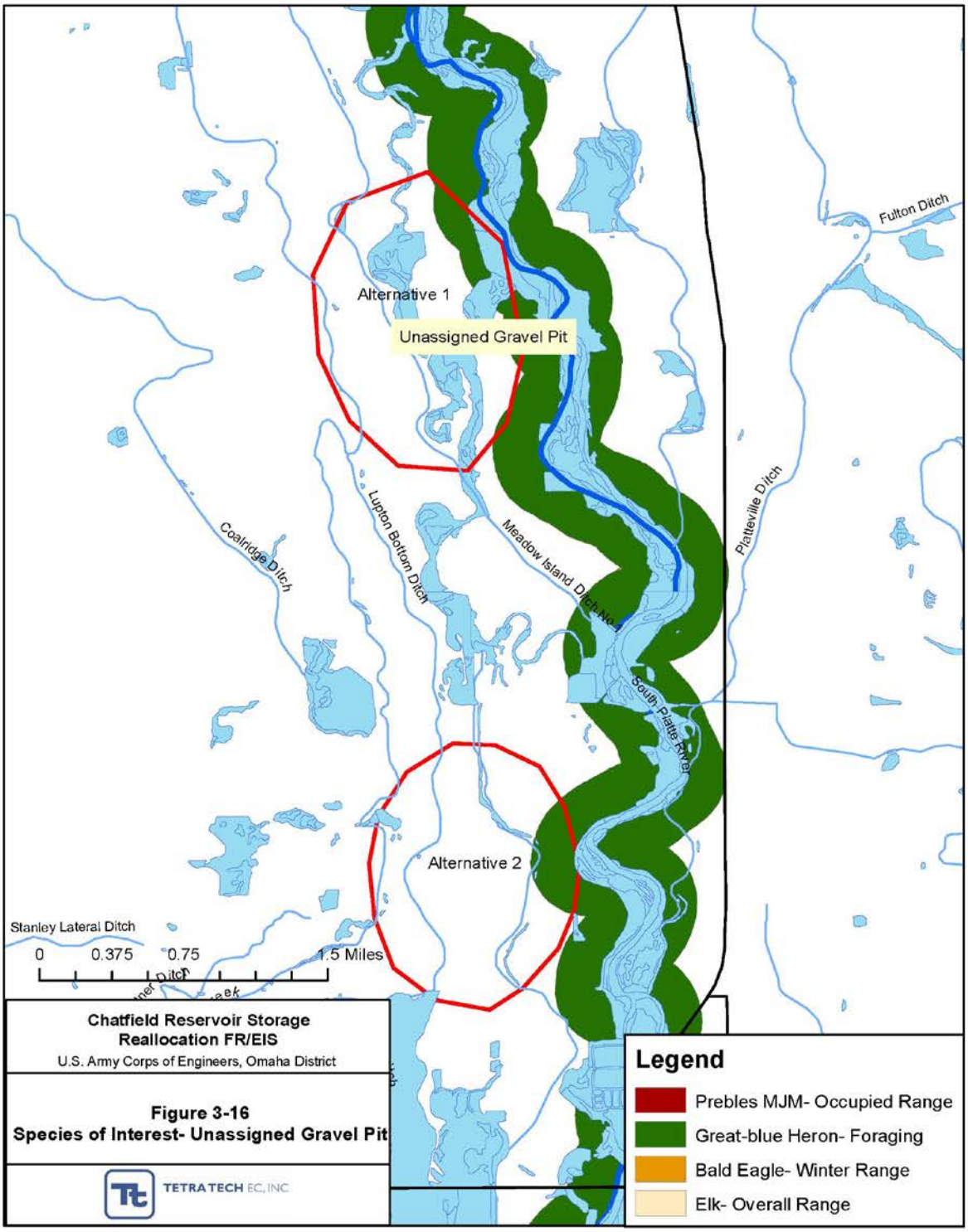
Birds

General life history information about the bald eagle can be found in Section 3.9.1.2. Because of the close proximity of all gravel pit areas to the Platte River, the likelihood of occurrence is high (Figures 3-16 and 3-17).

State-Protected Species and Other Species in Need of Conservation

CDOW has identified 10 species within Adams and Weld Counties that are state listed or of special concern (CDOW, 2007, Table 3-5). Of the 74 state-listed species, 7 could occur within the gravel pit areas: black-tailed prairie dog, swift fox, ferruginous hawk, mountain plover, northern leopard frog, northern red-bellied dace, and cylindrical papershell (Table 3-5). In addition, CNHP monitors 14 species within Adams and Weld Counties that are not state- or federally-listed (i.e., black-necked stilt, chestnut-collared longspur, greater prairie chicken, Lewis's woodpecker, long-billed curlew, McCown's longspur, snowy egret, white-faced ibis, American white pelican, hornyhead chub, Colorado blue, Ottoe skipper, Rhesus skipper, and Weist's sphinx moth). Species mentioned here are those monitored by the CDOW and may not be a complete list of threatened species within each of the five sites, particularly for elusive species or for highly mobile species such as birds.

Figure 3-16
Species of Interest—Unassigned Gravel Pit



Wetlands and species data obtained from: Colorado Division of Wildlife. 2007. Available at http://ndis.nrel.colostate.edu.

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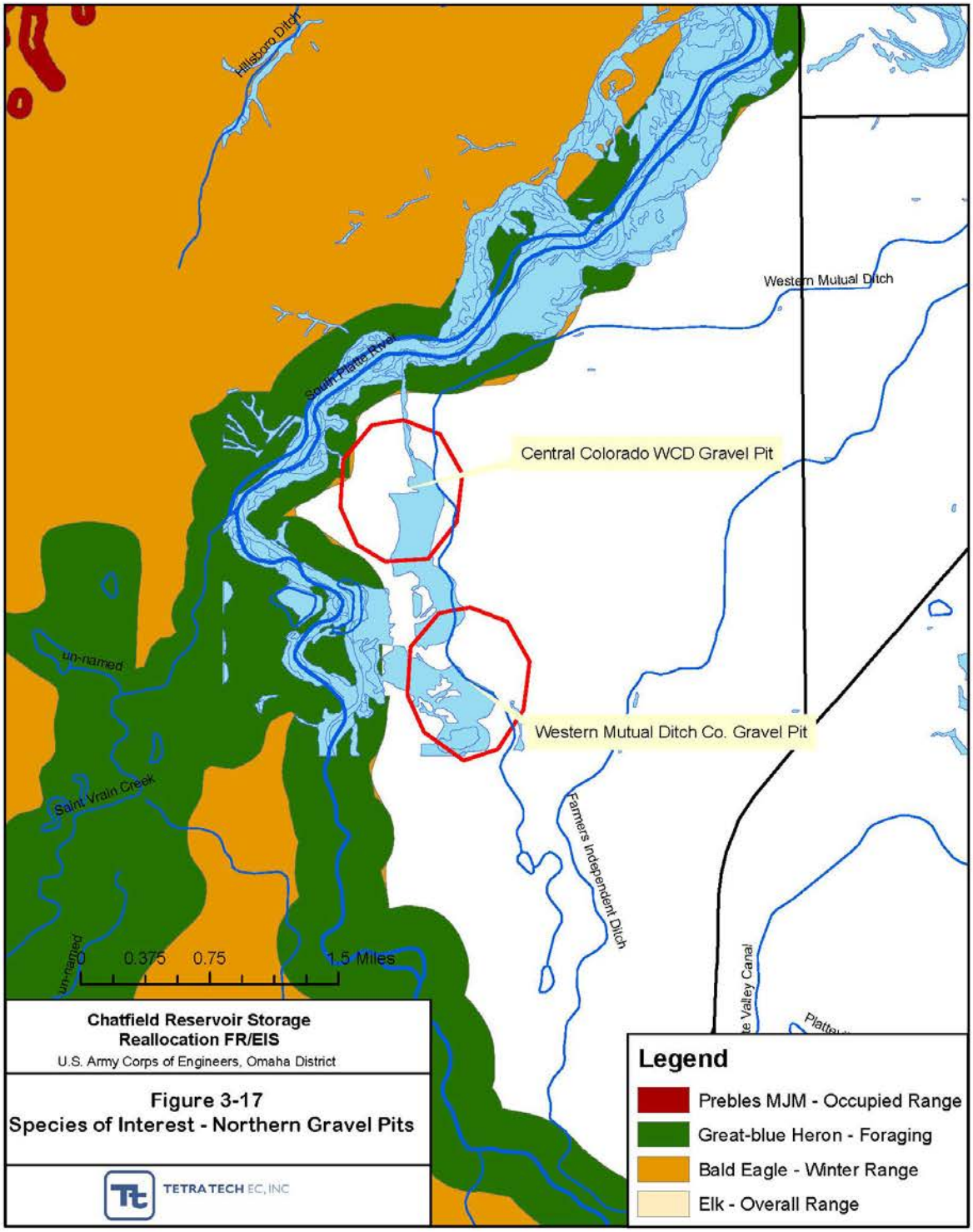
Figure 3-17
Species of Interest—Northern Gravel Pits



Wetlands and species data obtained from: Colorado Division of Wildlife. 2007. Available at http://ndis.nrel.colostate.edu.

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3.10 Land Use

This section presents an evaluation of land uses associated with the study area, specifically agriculture land uses, not considered prime or unique. As mentioned previously, land use data were obtained for the Chatfield study area, including the South Platte River flood plain (300 feet on each side of the river) downstream from the reservoir to the Adams/Weld county line. However, due to irrigated farming and water related issues, this section also addresses Weld and Morgan Counties.

3.10.1 Chatfield Reservoir

When Chatfield Reservoir was first constructed, the land surrounding the lake was predominantly in agricultural use. The large population increases in Douglas and Jefferson counties since the 1950s has changed the land use. Existing land uses in and around Chatfield Reservoir include urban and industrial development, open space and parks, and irrigated and dryland farming downstream of Chatfield.

The Corps' land surrounding the lake includes easements for utilities, including a natural gas pipeline (XCEL Energy), a water pipeline (Chatfield South Water District), and a water pump station and associated utility lines (Denver Water). The locations of these easements are shown in Figure 3-18. An easement is under development for an additional natural gas pipeline for XCEL Energy.

3.10.2 Penley Reservoir and Pipeline Areas

The proposed location for Penley Reservoir is south of the Chatfield Reservoir in Douglas County. Current land use in the Penley Reservoir area is privately-owned rangeland. Pipelines associated with Penley Reservoir, if constructed, would cross seven land cover types including deciduous oak, mesic upland shrub, tallgrass prairie, midgrass prairie, foothills/mountain grassland, irrigated crops, and dryland crops (Figure 3-3).

3.10.3 Downstream Gravel Pits

Land use at and immediately adjacent to the gravel pit areas is used primarily for dryland and irrigated farming. However, over the past years the actual gravel pit footprints have been converted into active gravel mining operations. The gravel pits are discussed in more detail below.

3.10.4 Unassigned Gravel Pit

Aurora is in the process of withdrawing as a water provider; the yield allocated to Aurora will be reallocated. It is assumed that the purchaser of Aurora's yield will use gravel pits. The Unassigned Gravel Pit is located north of Denver along US-85 in Adams County. The predominant land use within this area is primarily used for irrigated and dry cropland, but the inundation area is currently being used as an open gravel pit. The areas immediately adjacent to the Unassigned Gravel Pit, including any associated pipeline routes, are used primarily for irrigated cropland.

3.10.5 Western Mutual Ditch Company Gravel Pit

The West Mutual Ditch Company Gravel Pit is located north of Denver along US-85 in Weld County. The predominant land use within this area is primarily used for irrigated cropland, but the inundation area is currently used as an open gravel pit. The areas immediately adjacent to the Western Mutual Ditch Company Pit, including any associated pipeline routes, are used primarily as irrigated cropland and forested wetlands.

Central Colorado WCD Gravel Pit

The Central Colorado WCD Gravel Pit is located north of Denver along US-85 in Weld County, just northwest of the Western Mutual Ditch Company Gravel Pit. The predominant land use within the area is irrigated cropland, but the inundation area is a heavily disturbed open gravel pit. The areas immediately adjacent to the Western Mutual Ditch Company Gravel Pit, including any associated pipeline routes, are used primarily as irrigated cropland and forested wetlands.

3.10.6 Downstream Agriculture

According to the 2002 U.S. Census of Agriculture Adams, Arapahoe, Denver, Douglas, Jefferson, Morgan, and Weld Counties had a total of nearly 3.9 million acres of land in farms. Adams, Morgan, and Weld Counties accounted for the most acreage, accounting for 701,471 acres (about 18 percent of the total) in Adams County, 757,946 acres in Morgan County (about 19 percent of the total), and more than 1.8 million acres (about 47 percent of the total) in Weld County. Of the total land in farms for all seven counties, 497,318 acres (about 13 percent of the total) was irrigated farmland.

3.11 Hazardous, Toxic, and Radiological Wastes

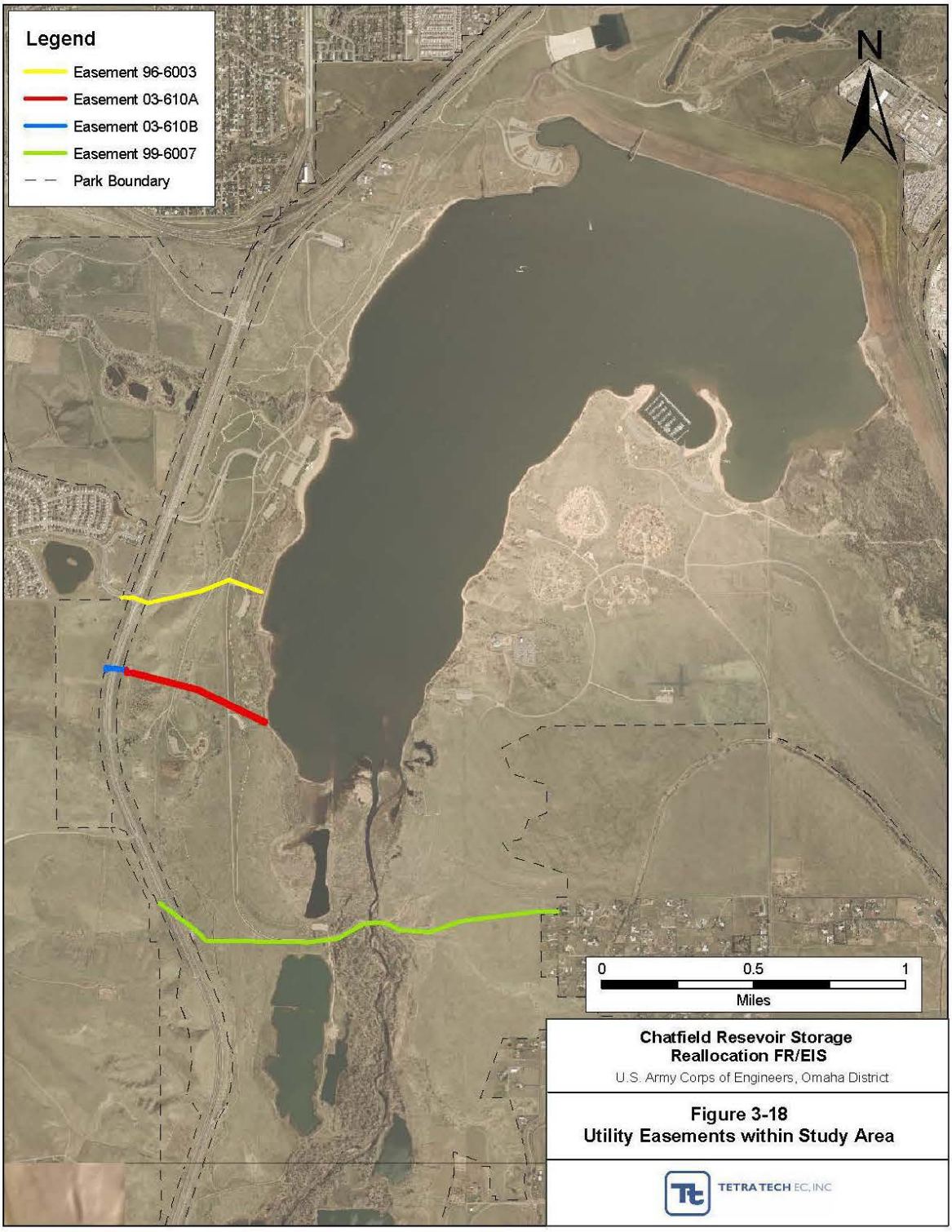
3.11.1 Chatfield Reservoir

This section describes existing conditions within Chatfield State Park pertaining to potential environmental contamination on the site, or removal of various facilities due to inundation. Most of this information is based on the Environmental Review Guide for Operations (ERGO) report (USACE, 1995). Additional information is based on EPA Region 8, queried databases.

ERGO was established to ensure USACE compliance with all applicable environmental regulations. The ERGO manual is intended to serve as the primary tool for conducting environmental compliance evaluations at USACE facilities. The objectives of the manual are to (1) compile applicable federal and engineering regulations associated with USACE operations and activities; (2) synthesize environmental regulations, good management practices, and risk management issues into consistent and easy-to-use checklists; (3) serve as a reference document for daily operations; (4) serve as a standard for evaluation of environmental compliance; and (5) serve as a guide for implementing USACE's Environmental Strategy Into the 21st Century, which emphasizes environmental stewardship.

An ERGO assessment considers 13 major environmental categories, or protocols. Each protocol includes engineering regulations, engineering manuals, federal regulations, and good management practices. The assessment team was aware of applicable state and local regulations that were considered during the assessment. This assessment considered 13 protocols, where no findings were found for 7 protocols: (1) air emissions management (no findings); (2) cultural and historical resources management (no findings); (3) hazardous materials management; (4) hazardous waste management (no findings); (5) natural resources management (no findings); (6) pesticide management; (7) petroleum, oil, and lubricant management; (8) solid waste management; (9) special pollutants (radon, asbestos, polychlorinated biphenyls [PCBs], lead); (10) underground storage tank management (no findings); (11) wastewater management; (12) water quality management (no findings); and (13) floating plant management (no findings).

Figure 3-18
Utility Easements within Study Area



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An environmental audit was conducted by USACE at Chatfield Reservoir in July 1994 as part of the ERGO report. There were no significant findings; however, six major findings were reported in the audit. The major findings were found in 5 of the 13 protocols, and suggested solutions accompanied each major finding. Many of the findings dealt with hazardous materials management and pesticide management, specifically, the storage and the marking of containers and storage areas.

Findings at Chatfield State Park included the presence of transformers that potentially contained PCBs. The report stated that USACE must check the transformers at the swim beach and marina parking lot to see if they contained PCBs. The transformer at the swim beach is a submersible transformer installed in 1983 and is subject to flooding at high pool levels. The transformer in the marina parking lot is built up on a mound of dirt to reduce the hazard of it being flooded during a high pool level. Both transformers have since been tested and do not contain PCBs.

Other potentially hazardous wastes not addressed in the ERGO report include additional transformers not mentioned in the report, tanks, sewage lift stations, and facilities (e.g., vault toilets). In addition to the two transformers mentioned above, three other transformers exist at the North Ramp, Deer Creek, and Catfish Flats. No aboveground or underground tanks are located within the potentially affected area (at 5,444 feet msl). However, several fuel storage tanks are located at the park. The fuel tanks and chemical storage areas are located at the shop and office complex in higher elevations, and these should not be impacted. Additionally, the marina has a floating fuel tank located at the dock. Lift stations are located at North Ramp, the swim beach, Jamison, Catfish Flats, and Roxborough Cove. There are several pit toilets in the park but no septic systems. An abandoned evaporation pond from Colorado State Park's wastewater system was removed in 2009 and reestablished as an upland area.

Table 3-6 identifies the percentage of recreation and electrical facilities/utilities potentially affected by a raise in the reservoir's elevation. Any facilities or use areas that fall below, or close to 5,444 feet msl are evaluated for replacement or adjustments. An important assumption that guided the conceptual design effort was that no facility or program area would lose any capacity or functionality as the result of relocation or modification (EDAW 2010).

In addition to the ERGO report, EPA, Region 8 databases (Enviromapper StoreFront Database and Emergency Response Notification System Database) were queried. The databases indicated no record of any violations of the Resource Conservation and Recovery Act; no Comprehensive Environmental Response, Compensation, and Liability Act or Superfund sites; and no record of underground storage tanks at Chatfield State Park (EPA, 2005a, 2005b). Colorado Department of Labor and Employment (CDLE), Division of Oil and Public Safety found no events (or reported releases of petroleum) within the park (CDLE, 2005). The Colorado Department of Public Health and Environment (CDPHE) found no major record of any oil spills occurring in the study area (CDPHE, 2005). No spills were reported into Chatfield Lake within this time period. The Emergency Response Notification System Database was searched for any reported releases of hazardous or toxic substances into Chatfield Reservoir from 2000 to the present (EPA, 2005b). Again, no spills were reported into Chatfield Lake within this time period.

3.11.2 Penley Reservoir, Pipeline Area, and Downstream Gravel Pits

EPA, Region 8 databases were queried (using EnviroMapper for Envirofacts) for the proposed Penley Reservoir site, the proposed pipeline area, and the downstream gravel pits. The pipeline that would traverse the area between Chatfield Reservoir and the proposed Penley Reservoir would be built near the Denver Water Foothills Water Treatment Plant, an EPA small hazardous waste generator with a National Pollutant Discharge Elimination System-permitted discharge point. This same pipeline would also pass near the Robinson Brick Company Hogback Property and the Sacred Heart Retreat, both of which are monitored under the Colorado Permit Compliance System.

The databases indicated no record of any violations of the Resource Conservation and Recovery Act; and no Comprehensive Environmental Response, Compensation, and Liability Act or Superfund sites (EPA, 2005a) in the proposed Penley Reservoir area, the proposed pipeline area, or the downstream gravel pits. CDLE, Division of Oil and Public Safety found no events (or reported releases of petroleum) within the proposed Penley Reservoir, Unassigned Gravel Pit, or Northern Gravel Pit areas (CDLE, 2005). The CDPHE found no major record of any oil spills occurring in any of these areas (CDPHE, 2005). The Emergency Response Notification System database was searched for any reported releases of hazardous or toxic substances (EPA, 2005b). No spills were reported.

3.12 Air Quality

This section presents an evaluation of the air quality associated with the study area, including a definition of climate and typical weather conditions that potentially could affect the dispersion of air emissions along Colorado's Front Range and the Clean Air Act's regulatory framework for National Ambient Air Quality Standards (NAAQS), which EPA enforces. Additionally, it describes the existing ambient air quality that is considered representative of the study area, including Chatfield Reservoir, the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits.

3.12.1 Chatfield Reservoir

As Colorado's population continues to increase in the Denver Metro area, so does the number of people who depend on cars as their primary source of transportation (DRCOG 1999). Automobile emissions and sand and dust particulates can contribute to health and safety issues. Other sources of air emissions in the metropolitan area include coal-fired power plants, wood burning, diesel-powered construction equipment, and other commercial and industrial sources.

Air quality at Chatfield Reservoir is generally good, even though the reservoir is located near a population center and just south of C-470.

The Clean Air Act of 1970 (43 USC 7401 et seq., as amended in 1990) provides the principal framework for federal and state efforts to protect air quality and requires the adoption of NAAQS to protect health, safety, and welfare from known or anticipated effects of air pollution. EPA sets standards and regulates pollutants into the air and has established NAAQS for eight pollutants:

Table 3-6. Percentage of Recreation and Electrical Facilities and Utilities within Chatfield State Park Potentially Affected by Pool Elevations of 5,444 Feet above Mean Sea Level

Items	North Ramp (%)	Massey Draw (%)	Swim Beach (%)	Eagle Cove (%)	Deer Creek (%)	Jamison (%)	Catfish Flats (%)	Fox Run (%)	Kingfisher (%)	Gravel Ponds (%)	Platte River Trailhead (%)	Marina Area (%)	Plum Creek (%)
Parking Area													
Asphalt	PI		100		50	100	100					100	
Gravel				75					100	100		100	100
Boat Facilities													
Concrete Boat Ramp	100											100	
Dock												R	
Marina												100	
Marina Slip												R	
ADA[1] Fishing Pier												100	
Trails													
Concrete	PI		100		100	100	100	50			50	100	100
Asphalt		50											
Architecture													
Shower/Restroom			100	100		100	100		100	100		100	100
Information Kiosk			100									100	
Concession			100									100	
Day Use Shelter	100											100	
First Aid Station			100										
Recreational													
Beach Volleyball Court		100						100				100	100
Horse Shoe Pits		100						100				100	
Furniture													
Picnic Table/Bench	50	100	100		100	100	100	100		100		100	100
Trash/Dumpster	50	100	100	100	100	100	100	100	100	100		100	100
Bollards	100		100										
Grills	50	100	100		100	100							
Regulatory Signs	30		100	100	50	100	100	50	100	100		100	100

Table 3-6. Percentage of Recreation and Electrical Facilities and Utilities within Chatfield State Park Potentially Affected by Pool Elevations of 5,444 Feet above Mean Sea Level

Items	North Ramp (%)	Massey Draw (%)	Swim Beach (%)	Eagle Cove (%)	Deer Creek (%)	Jamison (%)	Catfish Flats (%)	Fox Run (%)	Kingfisher (%)	Gravel Ponds (%)	Platte River Trailhead (%)	Marina Area (%)	Plum Creek (%)
Water Fountain			100			100	100	100				100	
Utilities													
Water Hydrant	50		100				100					100	
Lift Station			100			100	100					100	
Telephone			100										
Electrical													
Light Pole			100									100	
Transformer			100			100	100					100	

Source: EDAW, 2010
PI = partial inundation
R = relocate
[1] Americans with Disabilities Act

- Particulate matter less than 10 microns in diameter (PM10)
- Particulate matter less than 2.5 microns in diameter (PM2.5)
- Carbon monoxide
- Nitrogen dioxide
- Sulfur dioxide
- 1-hour ozone
- 8-hour ozone
- Lead

EPA implemented the NAAQS for 8-hour ozone and PM2.5 the two primary pollution concerns in the Denver Metro area, in 1997 and 2001, respectively. The state of Colorado adopted seven of the eight pollutant standards and has been designated by EPA as meeting the attainment/maintenance level for all seven.

The Denver Metro and North Front Range areas became nonattainment areas for the federal ozone standard on November 20, 2007, when a deferral by the EPA expired (Colorado Air Quality Control Commission [CAQCC], 2004; CDPHE, 2008a). The nonattainment designation is a result of a violation of the federal 8-hour ozone standard. The standard is based on a 3-year average of monitoring data. Air quality monitoring data for the 2005–2007 averaging period confirms a violation of the 8-hour health-based standard. One of the ozone pollutant monitoring stations is located at Chatfield Reservoir.

The process of developing an Ozone Action Plan to bring the North Front Range area into compliance with the 1997 federal 8-hour ozone standard has been completed. The plan was developed during 2008 and was approved by the Colorado Air Quality Control Commission in December 2008 (CDPHE, 2010a).

However, EPA issued a new, more stringent ozone standard in March 2008 that replaces the 1997 standard. Colorado is evaluating the impact of the new standard, which was tightened from 80 parts per billion to 75 parts per billion averaged over an 8-hour period. The state is determining which areas will violate the standard and which additional ozone control measures are needed to meet the standard (CDPHE, 2010b). In March 2009, the state recommended that the current Denver Metro/North Front Range 8-hour nonattainment area be designated as nonattainment for the 2008 revised 8-hour ozone standard. This recommendation is based on monitoring information that indicates the region is not in compliance with the 2008 8-hour ozone standard and detailed technical review and analysis (CDPHE, 2009).

3.12.2 Penley Reservoir, Pipeline Area, and Downstream Gravel Pits

The information relevant to the Denver Metro area described under Chatfield Reservoir above also applies to the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pit sites. Like Chatfield Reservoir, air quality at the proposed Penley Reservoir site and in the pipeline area is generally good. Near the gravels pits, extraction, processing, and shipping gravel is dusty. Existing BMPs, including calcium treatments on internal roads, paved entrances, and truck tarps, help to reduce dust levels.

3.13 Noise

This section discusses current noise levels at and around Chatfield State Park, as well as noise levels at and around the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits.

3.13.1 Chatfield Reservoir

Managing noise within the Denver Metro area is complicated by the varied character and amount of sources in the particular area. The ambient sound pressure level in a particular region is comprised of a variety of natural and manmade sources. Sound levels are determined by small variations in air pressure, and these pressures are referenced to a logarithmic scale in the units of decibels. Human response to sound is a function of the magnitude of pressure variations and the frequency distribution of the sound energy.

The A-weighting scale was developed to approximate the human ear's sensitivity to certain frequencies by emphasizing the middle frequencies and de-emphasizing the lower and higher frequencies. This scale, expressed as decibel level (dBA), best correlates with the human response to sound and is commonly used as a descriptor for ambient sound levels.

The threshold of human hearing is about 10 dBA, while the loudest sounds that humans hear are about 120 dBA. Table 3-7 presents typical sound levels for common conditions or activities referenced to the dBA scale.

Table 3-7
Typical Sound Levels for Common Conditions and Activities

Type of Noise	Sound Level (dBA)
Jackhammer, power drill	130 dBA
Gravel plant	Average 102 dBA; range from 88-106 dBA
Front-end loader	Average 90 dBA; range from 87-92 dBA
Personal watercraft	79 (operating 50 feet from an observer onshore) to 94 dBA
Freeway traffic	70 dBA
Daytime urban area	55 dBA
Quiet residential area	40 dBA
Quiet bedroom at night	30 dBA

Source: League for the Hard of Hearing, 2003; ELCOSH, 2002

Based on Table 3-7, noise levels at Chatfield Reservoir would be expected to be in the 40 to 94 dBA range, or moderate to high. The wide variation is primarily a result of wind speed and direction. The lowest levels occur late at night under calm conditions, while the higher levels occur during the daytime coinciding with activity in and surrounding the state park. These noise levels are moderate because of the presence of regional traffic along C-470, local traffic, and recreational (e.g., motorboat, personal watercraft) noise.

3.13.2 Penley Reservoir, Pipeline Area, and Downstream Gravel Pits

Based on Table 3-7, noise levels at the proposed Penley Reservoir and the pipeline area are about the same as noise levels at Chatfield Reservoir. Noise levels at the downstream gravel pits would be expected to be in the 70 to 106 dBA range, or moderate to high. However, most construction

equipment operates with a noise level between 75 and 90 dBA as measured at a distance of 50 feet. These noise levels are moderate to high because operation of the gravel pits requires stripping, extraction of materials, processing, and shipping. This includes daily operation noise (e.g., scrapers, front-end loaders) and traffic noise (e.g., tri-axle or tractor-trailer gravel trucks).

3.14 Aesthetics

This section discusses the aesthetics at Chatfield Reservoir and the surrounding state park, including the visual setting surrounding the reservoir and state park and viewer group expectations. Additionally, this section generally discusses the aesthetics at and around the proposed Penley Reservoir site, the proposed pipeline area, and the downstream gravel pits.

3.14.1 Chatfield Reservoir

The visual setting at Chatfield Reservoir, located on Denver's urban fringe, is rural, consisting of views of the foothills; open space; residential areas; the state park, which includes camping and picnicking areas, miles of hiking and biking trails, and bird watching; environmental education programs; and the reservoir. Various amenities such as the beach, marina, and picnic tables are available to those who come to the park to recreate and enjoy views of the mountains. Views to the west towards the Rocky Mountain foothills, including Plymouth Mountain (7,295 feet msl) and Warren Peak (8,001 feet msl), typically dominate the landscape. Areas to the north, east, and south of Chatfield Reservoir are currently open space or have been developed for residential purposes. The largest development, Highlands Ranch, lies to the east of the reservoir. Topography varies from broad expansive flat farming (open space) areas to higher outcroppings along the foothills with exceptional views. Vegetation consists of wetlands and riparian areas found near the reservoir, to landscaped residential properties and historic farming areas in the distance.

The water levels in Chatfield Reservoir fluctuate during droughts and drawdown periods (which varies each year depending on precipitation), causing aesthetic degradation. Denver Water holds all of the water rights up to the top of the multipurpose pool, 5,432 feet msl. Once the pool rises above 5,432 feet msl, USACE is responsible for management of water in the flood control pool. During the summer months (typically May 1 to September 30), the reservoir stays at a minimum of nearly 5,427 feet msl, but can rise above this elevation based on precipitation, and the remainder of the year the reservoir is typically drawn down to a minimum of 5,423 feet msl.

Visual sensitivity is dependent on viewer attitudes, the types of activities in which people are engaged when viewing the site, and the distance from which the site will be seen. Overall, higher degrees of visual sensitivity are correlated with areas where people live, are engaged in recreational outdoor pursuits, or participate in scenic or pleasure driving. Conversely, visual sensitivity is considered low to moderate in industrial or commercial areas where the scenic quality of the environment does not affect the value of the activity.

The expectation of many visitors at Chatfield State Park is either water-based (e.g., swimming, fishing, sailing, boating, scuba diving) or land-based (e.g., walking, running, hiking, biking, bird watching, dog training, air ballooning) depending on the chosen activity. The water-based and land-based visitors may be considered sensitive viewers because of the nature of their recreational pursuits, which include enjoying viewsheds of the reservoir and foothills.

3.14.2 Penley Reservoir and Downstream Gravel Pits

The visual setting at the proposed Penley Reservoir is a rural area adjacent to multiple recreation areas, including Pike National Forest to the west and Roxborough State Park to the northwest. The proposed pipeline area ranges from rural to rural-industrial. The visual setting of the downstream gravel pits is rural-industrial, with irrigated and dryland farming and related agricultural operations dominating land use, with interspersed areas of gravel pit operations.

3.15 Socioeconomic Resources

This section discusses the social and economic conditions in the study area, located in Adams, Arapahoe, Denver, Douglas, and Jefferson Counties. The socioeconomic resources study area also includes Weld and Morgan Counties to address impacts to downstream agriculture. Morgan County is discussed only in the downstream agriculture section. All seven counties (including Morgan County, which is discussed only in the downstream agriculture impacts section) are located fully within the South Platte River Basin.

3.15.1 Population

The six-county study area had a total population of 2.7 million in 2010, with a majority of this population residing in Denver (22 percent), Jefferson (20 percent), and Arapahoe (21 percent) counties. Adams, Douglas, and Weld Counties are located farther away from the core metropolitan area and are less populated. As stated above, Morgan County is discussed only in the downstream agriculture section.

County population densities ranged from 209 persons per square mile in Douglas County to 3,617 persons per square mile in Denver County in 2000. The statewide average population density was 42 persons per square mile in 2000 (U.S. Census Bureau, 2005).

Colorado is presently the third fastest-growing state in the nation (CWCB 2004). Total population increased by 31 percent in the 1990s and increased by 17 percent between 2000 and 2010 (Table 3-8). Population increased in all six counties in the 1990s. The increases range from 19 percent in Denver County to 191 percent in Douglas County (Table 3-8). From 2000 to 2010, the population increases range from 1.4 percent in Jefferson County to 62 percent in Douglas County (Table 3-8). Population projections generated by the state of Colorado anticipate continued growth in all six counties through 2020 (Table 3-9).

Population projections from Colorado's Department of Local Affairs Web site are based on assumptions about future demographic trends, as defined by the U.S. Census Bureau. Projections are estimates of the population for future dates. They illustrate plausible courses of future population change based on assumptions about future births, deaths, international migration, and domestic migration. Projected numbers are based on an estimated population consistent with the most recent decennial census as enumerated, projected forward using a variant of the cohort-component method. It is anticipated that population numbers will continue to increase throughout the balance of the 50-year period of analysis, although precise demographic trends are difficult to predict.

Table 3-8
Population by State and County 1990, 2000, and 2010

State/County	1990	2000	2010	1990 to 2000		2000 to 2010	
				Absolute Change	Percent Change (%)	Absolute Change	Percent Change (%)
Colorado	3,294,394	4,301,261	5,029,196	1,006,867	30.56	727,935	16.92
Adams	265,038	363,857	441,603	98,819	37.29	77,746	21.37
Arapahoe	391,511	487,967	572,003	96,456	24.64	84,036	17.22
Denver	467,610	554,636	600,158	87,026	18.61	45,522	8.21
Douglas	60,391	175,766	285,465	115,375	191.05	109,699	62.41
Jefferson	438,430	527,056	534,543	88,626	20.21	7,487	1.42
Weld	131,821	180,936	252,825	49,115	37.26	71,889	39.73

Source: Colorado Department of Local Affairs, 2005; 2010 Census summary file.

Table 3-9
Population Projection 2020

State/County	2000 Population	2010 Population	2020 Population Projection	2010 to 2020	
				Absolute Change	Percent Change (%)
Colorado	4,301,261	5,029,196	6,009,699	980,503	19.50
Adams	363,857	441,603	573,479	131,876	29.86
Arapahoe	487,967	572,003	624,448	52,445	9.17
Denver	554,636	600,158	673,735	73,577	12.26
Douglas	175,766	285,465	377,580	92,115	32.27
Jefferson	527,056	534,543	636,470	101,927	19.07
Weld	180,936	252,825	360,335	107,510	42.52

Source: Colorado Department of Local Affairs, 2005; 2010 Census summary file.

The age distribution of visitors to Chatfield State Park is concentrated among three age groups (PricewaterhouseCoopers, 2002). The majority of visitors are between the ages of 25 to 54 (76 percent), with the 35 to 44 age group representing the largest single age group. Many families with small children also visit Chatfield State Park but are not represented in the visitor profile, which defined State Park Users as having a minimum age of 18 years. The data were collected through telephone interviews conducted as part of the State Parks Market Assessment (PricewaterhouseCoopers, 2002). The demographic profile of visitors is summarized below (EDAW, 2010). Note that the percentages sum to 99 percent because of rounding.

- 18 to 24 years of age (4 percent)
- 25 to 34 years of age (22 percent)
- 35 to 44 years of age (32 percent)
- 45 to 54 years of age (22 percent)
- 55 to 64 years of age (10 percent)
- 65+ years of age (9 percent)

3.15.2 Economy

Total full- and part-time employment is presented for 2002 for the six-county study area, as well as the state of Colorado in Table 3-10. The data presented in this table are by place of employment, not place of residence.

Table 3-10
Employment by Sector for State and County 2002

Employment Sector	Colorado	Adams	Arapahoe	Denver	Douglas	Jefferson	Weld
Total full-time and part-time employment	2,947,476	193,479	399,651	537,005	85,225	271,216	102,949
Percent of Total Employment By Type							
Wage and salary employment	78.69%	78.99%	73.62%	87.30%	80.01%	81.11%	76.33%
Proprietors employment	21.31%	21.01%	26.38%	12.70%	19.99%	18.89%	23.67%
Percent of Total Employment By Industry							
Farm employment	1.46%	0.82%	0.10%	0.00%	1.01%	0.26%	5.63%
Nonfarm employment	98.54%	99.18%	99.90%	100.00%	98.99%	99.74%	94.37%
Agricultural services, forestry, fishing, and other	0.36%	0.18%	0.07%	NA	0.25%	0.10%	1.43%
Mining	0.79%	0.33%	0.75%	NA	0.47%	0.55%	1.57%
Construction	7.80%	12.93%	7.31%	5.08%	11.28%	7.90%	9.38%
Manufacturing	6.01%	7.62%	2.86%	5.11%	2.71%	7.36%	11.04%
Transportation and public utilities	2.75%	8.39%	1.47%	5.03%	NA	1.18%	2.98%
Wholesale trade	3.58%	7.58%	4.39%	5.44%	3.52%	2.66%	3.58%
Retail trade	10.47%	10.58%	10.66%	6.34%	18.04%	12.99%	10.55%
Finance, insurance, and real estate	5.33%	3.27%	9.64%	6.57%	6.11%	4.93%	4.57%
Other services except public administration	5.26%	5.70%	5.02%	4.73%	6.37%	5.89%	5.51%
Government and government enterprises	13.50%	10.70%	8.38%	13.90%	9.96%	12.95%	13.07%
Federal, civilian	1.75%	1.39%	0.64%	2.76%	0.23%	3.08%	0.56%
Military	1.30%	0.55%	0.51%	0.40%	0.37%	0.30%	0.56%
State and local	10.44%	8.76%	7.23%	10.74%	9.36%	9.58%	11.95%

Source: Sonoran Institute, 2005
Note: Full and part-time employment includes self-employed individuals.
NA—Data not available for 2002.

Presently, there are approximately 26 total full-time employees and approximately 54 seasonal employees (generally from May 1 to September 30) working at Chatfield State Park. Colorado State Parks employs 14 full-time staff and an additional 40 seasonal workers, typically employed 3 to 6 months annually. USACE has 7 employees working full-time at the Tri-Lakes (Chatfield, Cherry Creek, and Bear Creek lakes) office located at Chatfield's USACE Visitor Center. Concessionaires operating within the park (i.e., marina, equestrian center, swim beach) employ approximately 5 fulltime workers and about 14 seasonal workers (not including volunteers). The laundry concessionaire does not have staff located at Chatfield—just service/repairmen and coin collectors.

3.15.2.1 Chatfield State Park Economy

Potentially affected industries at Chatfield State Park include recreation, tourism, concessionaires, and commercial activities (e.g., hot air ballooning, scuba diving, guided fishing, and photography). Nearly 1.5 million visitors days were spent in the park in 2006 (Chatfield State Park, 2006). Recreation resources exist at the park, and general land-based activities (e.g., picnicking, sightseeing,

special events, wildlife viewing, model airplanes, dog training, bird watching, visitor center), trail use (e.g., walking, hiking, running, biking, horseback riding), and water activities (e.g., boat fishing, water skiing, windsurfing, personal watercraft use, swimming, fishing, sailing, kayaking, canoeing), respectively, generate the greatest number of annual visitors (CDNR, 2003). Additionally, Chatfield State Park offers campgrounds, marinas facilities, horse stables, and laundry services that provide additional revenue to the park. The parks total operating budget is nearly $1.2 million annually. In 2006, the park's total revenue generated exceeded $1.9 million, which included fees associated with each concessionaire (the concessionaires have different contracts with Colorado State Parks, each with varying terms and conditions). This revenue does not include camping fees (by reservation), which calculates revenue in fiscal years. Table 3-11 illustrates Chatfield State Park's annual revenue and visitation from 1995–2006, including concessionaire revenue.

Table 3-11
Revenue and Visitation at Chatfield State Park

Year	Chatfield Visitor Days	Chatfield Revenue ($)	Concession Revenue[1] ($)	Revenue Paid to State[2] ($)	Camping Fees Revenue[3] ($)
1995	1,410,886	705,443	739,679	40,754	54,387
1996	1,530,520	765,260	922,348	56,910	64,919
1997	1,375,761	927,596	876,663	54,248	68,007
1998	1,329,689	1,022,883	966,756	59,157	79,287
1999	1,096,203	967,131	942,569	58,332	98,995
2000	1,187,947	1,152,700	1,110,941	65,480	106,771
2001	1,373,600	1,156,775	1,109,674	64,637	109,654
2002	1,448,895	1,318,580	1,045,166	58,552	118,685
2003	1,566,580	1,464,447	1,063,049	58,195	145,428
2004	1,496,264	1,378,339	1,043,326	58,210	238,198
2005	1,582,811	1,523,196	1,146,182	41,022	139,095
2006	1,476,930	1,934,550	unknown	39,280	254,427

Source: Chatfield State Park 2005a; Chatfield State Park 2006

[1] Concessionaire revenue includes combined marina, equestrian center, swim beach, and laundry facilities.
[2] Concessionaire revenue paid to state is included in Chatfield's revenue.
[3] Camping fee by reservation revenue is in fiscal year dollars (July 1, 1995–June 30, 1996 to July 1, 2004–June 30, 2006).

Four separate concessionaires are located in Chatfield State Park including a: (1) marina concessionaire, (2) horse stable concessionaire, (3) swim beach concessionaire, and (4) laundry concessionaire. The marina concessionaire includes a restaurant, marina slip rentals, dry storage, fuel sales, and a grill. The equestrian center concessionaire includes rentals and boarding, the swim beach concessionaire includes a food stand, and the laundry concessionaire consists of various laundry facilities in the campgrounds. Based on unforeseeable events (e.g., low water levels), gross revenue for each concessionaire fluctuates annually. Table 3-11 illustrates total concessionaire revenue.

3.15.2.2 Special Use Permits

Special activities include any event that has the "potential for a significant adverse impact on park values or the health, safety, or welfare of park visitors, or which may otherwise require special planning/scheduling for proper management. Special activities shall require prior approval in the form of a special activities permit" (Colorado State Parks, 2005b). Fishing guides and outfitters, hot

air balloon guides and outfitters, scuba diver trainers, and photographers that use Chatfield State Park for commercial activities are required to purchase a special use permit. Commercial outfitters are similar to concessionaires, but they are required to obtain a special use permit and there is minimal (if any) contractual agreement with Chatfield State Park.

3.15.2.3 Flood Damages

Flood damages downstream from Chatfield Dam can occur when flows exceed the channel capacity and can result in damage to property. The change in damage potential downstream from the dam was evaluated for the study alternatives. Hydrology and hydraulic studies presented in Appendices H and I investigate the flood damage potential for each alternative. These studies estimate flows and resulting water elevations for various floods that could be experienced along the South Platte River and present alternative differences in those areas.

3.15.2.4 Downstream Agriculture

Table 3-12 shows various statistics from the 2002 Census of Agriculture, Colorado County Level Data, published by the U.S. Department of Agriculture. The three counties shown (i.e., Adams, Morgan, and Weld Counties) are most likely the sources of additional water rights that would be needed under Alternatives 1, 2, and 4. Alternative 3 would have the existing water rights needed for implementation.

Table 3-12
County Agriculture Statistics

Agricultural Metrics	Adams County	Morgan County	Weld County
Harvested Acres	260,664	190,850	422,385
Irrigated Harvested Acres	24,799	127,816	300,959
Farm Workers	2506	1527	7898
Market Value of Agricultural Products	$98,670,000	$448,000,000	$1,127,900,000

These counties produce typical crops found in Colorado, including corn, sorghum, wheat, barley, and beans. Of the three counties, Adams County has the fewest irrigated harvested acres and the lowest market value of agricultural products sold. Morgan County has the fewest number of farm workers. Weld County has the greatest number in each category.

3.15.3 Environmental Justice

U.S. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 CFR 7629, 16 February 1994) directs federal agencies to "make…achieving environmental justice part of its mission" and to identify and address "…disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations."

This subsection is further broken down to identify minority populations and low-income populations within the five-county study area.

3.15.3.1 Minority Populations

The first step in analyzing the environmental justice issue is to identify minority and low-income populations that might be affected by implementation of the proposed action or alternatives.

Demographic information on ethnicity, race, and economic status is provided in this section as the baseline against which potential effects of future land use decisions can be identified and analyzed.

Minority populations are persons of Hispanic or Latino origin, Blacks or African Americans, American Indians or Alaska Natives, Asians, and Native Hawaiian and other Pacific Islanders. Minority populations for 2010 are identified in Table 3-13. CEQ identifies these groups as minority populations when either (1) the minority population of the affected area exceeds 50 percent or (2) the minority population percentage in the affected area is meaningfully greater than the minority population percentage in the general population or appropriate unit of geographical analysis (CEQ, 1997).

Table 3-13
Minority Populations (2010)

Race	Colorado	Adams	Arapahoe	Denver	Douglas	Jefferson	Weld	Total Six Counties
Total Population	5,029,196	441,603	572,003	600,158	285,465	534,543	252,825	2,686,597
White	3,520,793	234,970	361,747	313,012	243,297	427,160	170,827	1,751,013
Percent	70.0	53.2	63.2	52.2	85.2	79.9	67.6	65.2
Black	188,778	12,207	55.657	58,388	3,245	5,001	2,054	136,552
Percent	3.8	2.8	9.7	9.7	1.1	0.9	0.8	5.1
American Indian/Alaskan Natives	31,244	2,478	2,386	3,525	803	2,638	1,419	13,249
Percent	0.6	0.6	0.4	0.6	0.3	0.5	0.6	0.5
Asian	135,564	15,431	28,595	19,925	10,563	13,682	2,873	91,069
Percent	2.7	3.5	5.0	3.3	3.7	2.6	1.1	3.4
Native Hawaiian/Pacific Islander	5,661	476	1,036	495	175	390	158	2,730
Percent	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1
Hispanic or Latino (of any race)	1,038,687	167,878	105,522	190,965	21,392	76,445	71,680	633,882
Percent	20.7	38.0	18.4	31.8	7.5	14.3	28.4	23.6
Some Other	7,622	677	1,002	1,208	387	715	359	4,348
Percent	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2
Two or More	100,847	7,486	16058	12,640	5,603	8,512	3,455	53,754
Percent	2.0	1.7	2.8	2.1	2.0	1.6	1.4	2.0

Source: 2010 Census summary file.

Due to the size of the six-county area, consideration of impacts to minority and low income populations could be masked by county or metropolitan statistics. Data by Census tracts or the smaller Census block groups are more appropriate. Because data for persons living in poverty are not available at the block group level, it was determined for uniformity that Census tract data would be used for both evaluations.

There are 10 Census tracts surrounding or in close proximity to Chatfield Reservoir. These tracts include all major impacts of the several alternatives. Emphasis is placed on modifications to Chatfield Reservoir, Penley Reservoir, and downstream off-channel water storage at gravel pits. The installation of pipelines and wells are similar to normal construction that occurs throughout the impacted area annually, are short term in nature, and are not considered to be significant regardless of the population impacted.

Populations by race for the Census tracts considered are presented for the 10 tracts considered below (Table 3-14). The Penley Reservoir site is wholly contained within Census tract 142.02 in Douglas County.

Table 3-14
Racial Composition of Census Tracts Near Chatfield Reservoir, 2010

Geographic I.D.	Total Population	White	Percent	Black/African American	Percent	American Indian/Alaska Native	Percent	Asia	Percent	Native Hawaiian/ Pacific Islander	Percent	Hispanic/Latino	Percent	Some Other	Percent	Two or More	Percent
Census Tracts																	
141.24, Douglas County	5,456	4,608	84.5	55	1	13	0.2	190	3.5	3	0.1	461	8.4	14	0.3	112	2.1
141.30, Douglas County	7,591	6,380	84	57	0.8	14	0.2	339	4.5	3	0	619	8.2	10	0.1	169	2.2
141.31, Douglas County	3,283	2,899	88.3	38	1.2	7	0.2	136	4.1	1	0	147	4.5	3	0.1	52	1.6
141.35, Douglas County	2,412	2,139	88.7	22	0.9	11	0.5	81	3.4	0	0	132	5.5	6	0.2	21	0.9
142.02, Douglas County	1,845	1,741	94.4	6	0.3	2	0.1	11	0.6	0	0	66	3.6	1	0.1	18	1
142.03, Douglas County	6,272	5,519	88	32	0.5	19	0.3	100	1.6	5	0.1	477	7.6	8	0.1	112	1.8
142.04, Douglas County	3,188	2,720	85.3	16	0.5	13	0.4	55	1.7	0	0	304	9.5	10	0.3	70	2.2
120.36, Jefferson County	3,707	3,304	89.1	13	0.4	5	0.1	92	2.5	0	0	231	6.2	9	0.2	53	1.4
120.55, Jefferson County	3,706	3,177	85.7	20	0.5	8	0.2	72	1.9	2	0.1	357	9.6	2	0.1	68	1.8
120.57, Jefferson County	5,705	4,926	86.3	31	0.5	8	0.1	122	2.1	2	0	493	8.6	3	0.1	120	2.1
Total	43,165	37,413	86.7	290	0.7	100	0.2	1,198	2.8	16	0	3,287	7.61	66	0.2	795	1.8

Although some variations between Census tracts are indicated, as a whole, the 10-tract area generally has a smaller concentration of minorities than either Douglas or Jefferson Counties of which it is a part, and minority concentrations are significantly lower than in the six-county impact area and the state of Colorado.

3.15.3.2 Low-Income Populations

According to the Department of Housing and Urban Development, low-income neighborhoods are those where more than 50 percent of the population has an income less than 50 percent of the median per capita income for the whole community. Low-income populations for 2010 are illustrated in Table 3-15.

Table 3-15
Low-Income Populations 2010

Geography	Population Below Poverty Level (Past 12 months)	Percent Below Poverty Level (Past 12 months)
Colorado	673,912	13.4
Adams County, Colorado	57,850	13.1
Arapahoe County, Colorado	66,924	11.7
Denver County, Colorado	129,634	21.6
Douglas County, Colorado	9,420	3.3
Jefferson County, Colorado	47,574	8.9
Weld County, Colorado	37,671	14.9
Total Six Counties	349,074	13.0

2010 ACS 1-Year Estimate

For the purposes of this analysis, median household income, unemployment rate, and median home value are presented along with percent below poverty level to better describe the social and economic conditions in the impacted area. These are shown by Census tract in the table below.

Table 3-16
Median Household Income, Unemployment Rate, and Median Home Value in Census Tracts Near Chatfield Reservoir

Geographic ID	Median Household Income (2010)	Percent Below Poverty Level	Unemployment Rate	Median Home Value (2010)
Census Tracts				
141.24, Douglas County	112,908	2.1	7.7	329,900
141.30, Douglas County	111,619	0.6	1.1	291,400
141.31, Douglas County	94,167	1	3.9	570,700
141.35 Douglas County	131,696	1.4	8.4	649,000
142.02, Douglas County*	126,538	7.2	9.3	454,300
142.03, Douglas County	107,662	2.4	6.1	373,300
142.04, Douglas County	102,029	4.1	2.6	235,600
120.36, Jefferson County	119,375	1.6	5.8	447,300
120.55, Jefferson County	81,838	2.5	5.2	288,500
120.57, Jefferson County	69,331	2.6	7.6	210,800

*The Penley Reservoir site is wholly contained within this Census tract.

As shown, the area around the alternatives considered in detail is composed of middle and upper middle class suburbs. Median home values range from a low of $210,800 to $649,000. Median family incomes range from $69,331 to $131,696, well above the Colorado state average of $56,456. Although some variations between Census tracts are indicated, as a whole, the 10-tract area generally has a smaller percentage of households below the poverty rate than either Douglas or Jefferson Counties, and a lower percentage than the six-county impact area and the state of Colorado; with the exception of Census Tract 142.02, which is higher than that of Douglas County as a whole, but still significantly lower than the 13 percent present in the six-county area.

3.15.4 Penley Reservoir, Pipeline Area, and Downstream Gravel Pits

The above information on population, economy, and environmental justice is for a six-county area, which includes Chatfield Reservoir, the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits.

3.16 Transportation

This section discusses public access to Chatfield Reservoir and the surrounding state park, including access issues to, from, and within the park. Additionally, it includes a minimal discussion on transportation at the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits.

3.16.1 Chatfield Reservoir

The primary transportation system at Chatfield State Park serves visitors driving to and from the park. Chatfield State Park-managed routes provide public access to a wide array of recreational activities as described in Section 3.17. The state park road system is primarily a low-standard, paved road (approximately 2 miles are unpaved). Public access to the park requires a road system, although

once a visitor has arrived at the park, designated parking areas are available from which miles of trails can be accessed. Nearby residents can access the park via foot or bike. State Highway C-470 borders the park on the north and west, while US-85 (Santa Fe Drive) borders the park on the east, and Titan Parkway is the main access road located near the park on the south. Access to the park includes the main entrance at Deer Creek off of State Highway 121 (Wadsworth Boulevard), accessed from C-470. As an alternate route, visitors can access the Plum Creek entrance at Roxborough Park Road, off Titan Parkway.

Once inside park boundaries, visitors may access various recreational facilities (e.g., picnic tables, marina, horse stable, trails) with 24 miles of road access. Vehicle parking areas provide 2,528 parking spaces and access to 20 miles of hard surface trails with various recreation opportunities for many types of users (EDAW, 2010). Additionally, trail users can access the Colorado Trail from within park boundaries (Colorado Trail, 2005).

3.16.2 Penley Reservoir, Pipeline Area, and Downstream Gravel Pits

The primary transportation route needed to access the proposed Penley Reservoir is via I-25 and CO-67, which leads to Sedalia, Colorado, along the Front Range. Travelers along CO-67 are either residents/commuters from Sedalia to Denver, or travelers heading into the mountains. Parts of the pipeline area would pass along utility corridors along Plum Creek and along US-85. Other pipeline areas would run parallel to CO-67, or through relatively open areas. Additionally, all of the downstream gravel pits are located along the South Platte River, which generally follows US-85. Other secondary roads are located off of that route. All three of the primary roads above are considered standard-grade, paved highway roads.

3.17 Recreation

This section identifies the existing recreational uses and potentially affected areas within the study area, including water- and land-based recreation activities. Most of the recreation information in this section was gathered from the "Chatfield Reservoir Recreation Facilities Modification Plan" report prepared by EDAW (2010) (Appendix M of the FR/EIS).

Chatfield State Park must remain in outdoor recreation uses pursuant to Section 6(f) of the Land and Water Conservation Fund Act (LWCF) Act (Public Law 88-578, as amended) because LWCF assistance was used by the Colorado Division of Parks and Outdoor Recreation to obtain water for Chatfield Reservoir. The National Park Service (NPS), with assistance from Colorado State Parks, oversees compliance with the LWCF Act. The NPS has issued a letter concurring with Colorado State Parks that the Chatfield Reservoir Storage Reallocation project will not result in a Section 6(f)(3) conversion (see Attachment 3 in Appendix S). Many recreational opportunities are available at Chatfield State Park. This approximately 5,300-acre park receives approximately 1.5 million visitor days annually because its amenities are popular with the public and because the park is close to Denver (see Table 3-11). Chatfield is one of the most diverse parks in Colorado. Major facilities include 197 campsites, 10 group campsites, 4 major group picnic areas, 139 family picnic sites, 3 major boat ramps, 20 miles of paved trails, 33.3 miles of paved roadway, 9.6 miles of unpaved roadway, 2,528 parking spaces, 38 restrooms, 6 shower buildings, a maintenance shop, and a swim beach complex. The park also includes a horse stable, marina, and hot air ballooning launch area (EDAW, 2010).

The 2002 Master Plan for Chatfield Reservoir identified the following annual activity mix at the reservoir (Table 3-17). These data were based on averages for fiscal year 1993 to fiscal year 2000 (USACE, 2002b).

Table 3-17
Annual Activity Mix at Chatfield Reservoir, Compiled from USACE and Colorado State Parks Visitation Data

Activity	Average Percent Activities Per Visit[2]	Average Percent of Total[2]	Average Percent Activities Per Visit[3]	Average Percent of Total[3]
Camping	1.80%	1.05%	5.49%	3.65%
Picnicking	39.98%	22.94%	10.54%	7.00%
Boating	5.34%	3.11%	7.55%	5.02%
Fishing	40.91%	23.83%	27.58%	18.33%
Hunting	—	—	—	—
Skiing	0.77%	0.45%	0.93%	0.62%
Swimming	2.20%	1.28%	3.03%	2.02%
Other [1]	51.62%	30.08%	77.24%	51.33%
Sightseeing	29.63%	17.26%	18.11%	12.04%
Winter Activities (e.g., sledding, ice skating, etc.)	—	—	—	—
Total[4]	172.25%	100%	150.48%	100%

1 "Other" includes, but is not limited to, hiking/walking, jogging/running, bicycling, horseback riding, dog training/tracking/search and rescue, interpretive activities, wildlife observation/enjoying viewsheds, bird watching, photography, hot air ballooning, scuba diving, and participation in special events.

2 Source: USACE, 2002b. Data are based on current fiscal year seasonal traffic counts and formulas developed from surveys and traffic counts in 1992–1995.

3 Source: Monthly Visitation Data from Chatfield State Park on Activity Days and Visitors (Visitor Days), October 2006–September 2007 (fiscal year 2007). Data are based on current fiscal year traffic counts on roads and trails and formulas developed and updated from surveys and traffic counts every 5 years.

4 The total of 172 percent means that the average visitor to Chatfield State Park participates in 1.72 activities per visit. The total of 150 percent means that the average visitor to Chatfield State Park participates in 1.5 activities per visit, based on State Parks data.

3.17.1 Recreational Areas within Chatfield State Park

Recreation use areas potentially affected by storage reallocation at Chatfield Reservoir would include the North Boat Ramp, Massey Draw, Swim Beach Area (including Eagle Cove, Deer Creek, and Jamison areas), Catfish Flats and Fox Run group use areas, the Kingfisher/gravel ponds/Platte River Trailhead areas, Marina Area (including Marina Point, South Boat Ramp, Riverside Marina, and Roxborough day use areas), and Plum Creek area (EDAW, 2010). These areas are discussed below, and Table 3-18 identifies the recreational facilities at each of these areas.

The North Boat Ramp is located on the west side of the reservoir. Facilities provided here include two ramps, paved parking and circulation areas, and a variety of support facilities, including picnic shelters and restrooms (EDAW, 2010).

The Massey Draw area is a popular use area located on the west side of the reservoir and south of the north boat ramp. Facilities provided here include gravel parking and circulation areas, and a variety of support facilities, including picnic tables and restrooms (EDAW 2010).

The Swim Beach Area is heavily visited. Major development has occurred in the swim beach area, including large parking areas, a swim beach with graded slopes and sand, and a wide variety of

support facilities, including restrooms and concession buildings. Directly south of the swim beach area is the Jamison group use area which includes a paved parking area, restroom, and picnic tables. The swim beach area also includes the Eagle Cove and Deer Creek areas. Eagle Cove is a use area north of the swim beach and just north of Deer Creek. This area includes limited facilities such as a small parking area (wheel stops), a portable restroom, and a few trash receptacles. Deer Creek includes hot air balloon launch facilities and day use sites (EDAW, 2010).

The Catfish Flats and Fox Run group use areas are on the west side of the reservoir and include picnic areas, restrooms, parking, and related facilities. Specifically, the Catfish Flats area includes paved parking, a restroom, covered tables, and a few group picnic areas. The Fox Run area includes gravel parking, two portable restrooms, covered tables, and a group picnic area (EDAW, 2010).

A variety of uses occur on the southern portion of the reservoir, especially around the gravel ponds that lie upstream of the reservoir and the main park road that leads to the campground and marina area. Dog training clubs, non-motorized boaters, fishermen, and scuba divers use the large gravel pond, and there are relatively few developed facilities in this area, primarily parking areas and trails. The Kingfisher area includes gravel parking, a portable restroom, and a few trash receptacles (EDAW, 2010). The Platte River Trailhead area is located near the gravel pond area and includes paved parking, a restroom, and a few trash receptacles (EDAW, 2010).

The Marina Area includes Marina Point, South Boat Ramp, Riverside Marina, and Roxborough day use area. The Riverside Marina is a floating facility designed to allow for water-level fluctuations between 5,423 and 5,432 feet msl. All docks and the floating platform for the restaurant and store have anchor posts extending 4 feet underwater, a depth that allows most boats to moor at the marina slips when reservoir levels are at or above 5,423 feet msl. The marina facilities also include a floating gasoline tank and gasoline pump. This is a high-use area that has been extensively developed to include the marina, a fishing pier, extensive paved parking areas, a boat ramp, group picnic sites, and an extensive network of walkways and trails. Marina Point facilities include a parking area, group day use area, volleyball and horseshoe pits. The South Boat Ramp is located next to the Riverside Marina on the south side of Chatfield Reservoir. The Roxborough day use area is also included in the Riverside Marina area (EDAW, 2010).

The Plum Creek area facilities include a trailhead, a day use area with picnic tables, a restroom, and a gravel parking area (EDAW, 2010).

3.17.2 Water-Based Recreation

Water-based recreational uses at Chatfield State Park include a variety of seasonal and year-round activities geared towards local residents and visitors. The primary water-based recreational opportunities include fishing, swimming, sailing, boating, and scuba diving (in the large gravel pond). A large population of rainbow trout and smallmouth bass are stocked in Chatfield Reservoir, as are channel catfish, yellow perch, tiger muskie, crappie, and walleye. Ice fishing is a major water-based winter recreation activity. Open water fishing for rainbow trout begins in the spring, and throughout the summer, smallmouth bass, yellow perch, crappie, and channel catfish are popular catches (Chatfield State Park, 2005b).

Table 3-18
Existing Recreation Facilities

Items	North Boat Ramp	Massey Draw	Swim Beach	Eagle Cove	Deer Creek[8]	Jamison	Catfish Flats	Fox Run	Kingfisher	Gravel Ponds	Platte River Trailhead	Marina Area	Plum Creek[9]
Parking Area													
Asphalt[2]	9.18		5.46		0.60	0.95	1.40				0.44	3.40	
Gravel[2]		0.78		0.30	0.78			0.71	0.87	1.99			0.80
Wheel Stops		34	274	29	28	61	79		28	38	87	36	
Boat Facilities													
Concrete Boat Ramp[2]	0.39											0.11	
Dock	4												
Marina												1	
Marina Slip												320	
Parking/Boat Storage												265	
ADA[3] Fishing Pier												1	
Trails													
Concrete[5]	1.42		0.12		0.43	0.71	0.44	1.13			0.21	0.17	0.17
Asphalt[5]		0.22											
Foot Bridge (linear feet)					15								
Shower/Restroom	2	1	1		1	1	1				1	1	1
Information Kiosk	2		2		1							1	
Concessions			1									1	
Group Picnic Area							2	1				2	
Day Use Shelter[6]	8											1	
First Aid Station			1										
Furniture													
Portable Restroom				1				2	1	1			
Picnic Table	32	8	12		12	4	5			4		10	11
Bench	1	3	7		1	1	1				2	1	1
Water Fountain	4		2		2	2	2					1	
Dumpster	3	2	4	1	1	1	1	1	1	1		4	1
Trash Receptacle	7	3	10	1	2	1	1	2	1	1	2	4	
Bollard	4		6		4								
Grill	8	8	8		11	4							

Table 3-18
Existing Recreation Facilities

Items	North Boat Ramp	Massey Draw	Swim Beach	Eagle Cove	Deer Creek[8]	Jamison	Catfish Flats	Fox Run	Kingfisher	Gravel Ponds	Platte River Trailhead	Marina Area	Plum Creek[9]
Regulatory Sign	46	12	17	2	5	9	9	5	3	18	7	37	2
Fencing (linear feet)		487	929	84				716	375	596	743		697
Recreational Facilities													
Beach Volleyball Court		1						1				1	1
Horse Shoe Pits		2						2				2	
Utilities													
Water Hydrant	2		2		1		3	1					
Lift Station	2		1			1	1						
Telephone	1		2										
Transformer	1		2		1	1	1						
Light Pole	26		1										

Source: EDAW, 2010

1 Units are measured in acres.
2 Units were in square feet, but were changed to acres.
3 Americans with Disabilities Act.
4 Units are measured in miles.
5 Units were in square feet, but were changed to miles. Most concrete trails are 8 feet wide (one is 10 feet wide), so this was used for the calculation.
6 Includes group shelters.
7 Includes 197 regular campsites and 10 large group campsites.
8 Includes Deer Creek Entrance station and balloon launch area.
9 Includes pedestrian bridge over Plum Creek.

3.17.3 Land-Based Recreation

Land-based recreational uses at Chatfield State Park include the marina, beaches, campsites, and trails. These recreational uses are primarily associated with popular public areas and visitor attractions that provide views of the reservoir and surrounding foothills. At the Chatfield stables, horses may be leased for a fee, or visitors can bring their own horses to the west side of the park. The park is fully accessible to visitors with disabilities. The 20 miles of paved trails are wide and relatively flat to accommodate wheelchairs. An Americans with Disabilities Act (ADA) accessible fishing pier is located near the marina on the east side of the lake, and an access trail is located along the South Platte River (Chatfield State Park, 2005b).

Other parks in the area include South Platte Park which is located just north of Chatfield State Park. The two parks are separated by C-470 and are connected by a trail that passes under C-470. South Platte Park is an 878-acre natural open space area along the South Platte River owned by the city of Littleton and managed by South Suburban Parks and Recreation District. Amenities include a 2.5-mile-long paved regional trail system, 4 miles of unpaved walking trails, 5 lakes and 2.5 miles of the river open to fishing, a wildlife reserve area, over 300 species of vertebrates, a free public nature center, and a classroom. South Platte Park is visited by over 4,000 program participants per year, 12,000 nature center visitors, and hundreds of thousands of trail users (The Orion Society, 2006).

3.17.4 Penley Reservoir, Pipeline Area, and Downstream Gravel Pits

Similar to Chatfield Reservoir, the proposed Penley Reservoir site is surrounded by nearby recreation areas, including Roxborough State Park and the Pike National Forest. The route of the proposed pipeline from the South Platte River to Penley Reservoir is within one mile of the eastern border of Roxborough State Park (Figure 2-1). The routes of the other proposed pipelines are not in the proximity of the recreation areas. Additionally, the gravel pits are located along the South Platte Reservoir, so there are likely opportunities for fishing.

3.18 Cultural Resources

This section describes cultural resources within the project Area of Potential Effects (APE) based on available literature and site-specific studies. Cultural resources in the vicinity of the proposed Penley Reservoir, the proposed pipeline area, and the downstream gravel pits are also discussed.

3.18.1 Chatfield Reservoir

Cultural resources are those aspects of the physical environment that relate to human culture, society, and cultural institutions that hold communities together and link them to their surroundings. Cultural resources include expressions of human culture and history in the physical environment, such as prehistoric and historic sites, buildings, structures, objects, districts, natural features, and biota that are considered important to a culture or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifestyles and practices and are associated with community values and institutions.

Archaeological site investigations in the Chatfield State Park area date back to the late 1940s, although the earliest recorded archaeological work in the project area began in 1966 with the inception of the National Historic Preservation Act (NHPA) (Public Law 89-665 and the amendments thereto, 16 USC § 470 et seq.). This policy calls for the consideration of the effect on historic properties by undertakings funded by federal agencies or in pursuit of federal permitting

(Hutt et al., 1999). The Colorado Office of Archaeology and Historic Preservation maintains the official state site files and makes determinations on their eligibility for listing on the National Register of Historic Places (NRHP). Coordination between the USACE and the Colorado Office of Archaeology and Historic Preservation regarding the National Historic Preservation Act is included in Appendix S. Letters were sent to 14 tribes on October 13, 2005, requesting comments and their participation in the Section 106 process of the NHPA regarding the proposed Chatfield reallocation (for additional information see Appendix S).

During the summers of 1965 and 1966, an archaeological team from the University of Denver under contract to the National Park Service conducted reconnaissance studies and identified 31 prehistoric sites within the proposed area of Chatfield Reservoir (Withers, 1972). The National Park Service sponsored further archaeological investigations in the late 1970s during which test excavations were undertaken at several of the sites previously identified by Withers (Nelson, 1979). In 1986, archaeologists from the Colorado Highway Department monitored construction activities on 60 acres at Chatfield Reservoir. No previously undocumented archaeological resources were identified during that effort (Baugh, 1986; Baugh & Angulski, 1986). Reconnaissance-level investigations were conducted by the National Park Service in 1995 and 1996 to evaluate the impacts of dam construction and maintenance activities on the sites identified by the University of Denver team in the 1960s (Foster Wheeler, 2000b). Most of these sites could not be relocated and were interpreted as destroyed. Those archaeological sites that could be relocated were evaluated as significantly impacted by activities related to the construction and maintenance of Chatfield Reservoir. Foster Wheeler (2000b) conducted an archival records search in 2000 and visited several of the sites recorded within the APE from the reservoir to the Denver Gage. Field visits were limited to those sites that were relocated during the 1995–96 reconnaissance. Sites downstream of Chatfield Reservoir were not field verified during the 2000 field visit. In 2005, an archival records search was conducted from the Denver Gage to the Adams/Weld county line.

An intensive Class III archaeological pedestrian survey was recently completed for the USACE to provide an assessment of site locations and conditions within Chatfield State Park, an area that includes Chatfield Reservoir (Dominguez et al., 2007). A total of 3,605 acres was surveyed, with the identification of 25 previously unrecorded archaeological sites, of which 2 are prehistoric, 21 historic, and 2 with historic and prehistoric components. Two prehistoric and 2 historic sites have been recommended as eligible for listing on the NRHP. One prehistoric site and the 2 multi-component sites with prehistoric deposits consist of lithic debris only and have been classified as open lithic scatters. This site type is characterized by a discrete scatter of flaked lithic debris with no associated shelter. Another prehistoric site is defined as an open camp type and contained flaked lithic tools, lithic debris, and two manos exhibiting use-wear polish. In addition, small amounts of charcoal were recovered from test excavations. None of the NRHP-eligible sites are contained within proposed APE for Alternatives 3 or 4 for the Chatfield Reservoir storage reallocation project.

One of the NRHP-eligible historic sites consists of a standing cribbed log cabin. A limited number of scattered agricultural implements, fence posts, and domestic artifacts suggest this structure was a late 19th to early 20th century farmhouse. As an example of vernacular rural architecture, this site is a distinctive historic type. The second NRHP-eligible historic site is composed of a remnant cellar hole, two smaller depressions interpreted as outbuildings, a stone-lined privy, and a scatter of artifacts indicating probable use as a farmstead from the late 19th to early 20th century.

In addition to the documented sites, the survey recorded 18 isolated finds, which are defined as small scatters of five items or fewer. Of these isolated finds, 6 were prehistoric finds of nondiagnostic flaked lithic debris, and 12 consisted of single historic finds or limited trash scatters.

In previous investigations, 77 cultural resource locations were identified and recorded in Chatfield State Park. These include 28 prehistoric archaeological sites, 9 isolated prehistoric localities (i.e., defined as fewer than 5 flakes within a restricted area with no associated features), 23 historic archaeological sites, 12 historic isolated finds, and 5 archaeological sites that contain both prehistoric and historic components. The majority of these sites were destroyed by construction of Chatfield Dam and associated infrastructure, or by inundation of Chatfield Reservoir. Twenty-six sites are extant but are located outside the proposed APE. There are no NRHP-listed or NRHP-eligible sites within the APE for elevated pool levels associated with Alternatives 3 or 4 of the Chatfield Reservoir storage reallocation project.

3.18.2 Penley Reservoir, Pipeline Area, and Downstream Gravel Pits

The proposed Penley Reservoir and the proposed pipeline area traverse the ecotone between the plains to the east and the Rocky Mountain Front to the west, an area of rich environmental diversity. Numerous prehistoric archaeological sites have been identified in the foothills of the Hogback Valley, dating from the Early Archaic to the Woodland periods (6,000 B.C. to AD 1,000). An extensive survey was conducted in the region in the early 1970s by the University of Colorado Museum to assess the impact of planned water projects by Denver Water, during which dozens of archaeological sites were identified (Scott & Gillio, 1973). This survey confirmed earlier assumptions about the high concentration of archaeological sites in the Hogback Valley. A subsequent inventory of sites in Roxborough State Park by the Office of the State Archaeologist led to the eventual designation of the park as an archaeological district listed in the NRHP (Tate and Black 1979). Approximately 40 archaeological sites have been identified and determined to be potentially eligible for listing on the NRHP within Roxborough State Park. Within 1 mile of the proposed APE, outside of the park precinct, an additional 29 prehistoric archaeological sites have been determined to be potentially eligible for NRHP listing.

One of the proposed pipelines partially follows the course of East Plum Creek, which is situated between Cherokee Mountain to the north and highly dissected uplands to the south. Nineteenth century railroad builders took advantage of the low gradient of East Plum Creek to site the Denver & Rio Grande Railroad (in 1871) and the Atchison, Topeka & Santa Fe Railroad (ATSF) (in 1887) along it on their Pueblo to Denver routes. Railroad construction generated increased opportunities for settlement along East Plum Creek, spurring growth in the towns of Castle Rock, Sedalia, and Louviers. Documented cultural resources within 1 mile of the proposed reservoir and pipeline include seven historic properties in Sedalia and its vicinity, and five small prehistoric localities in proximity to the drainage. Among the historic properties, the Santa Fe Railroad Water Tank, dating from 1906, is listed in the NRHP. South of Sedalia, ranching landscapes in the West Plum Creek drainage have retained a high degree of integrity from their 19th and early 20th century origins, and have been listed in the NRHP as the Bear Canon Agricultural District. The district incorporates approximately 800 acres along a 2 ½-mile section of West Plum Creek, and includes a number of extant historic structures dating from its period of significance, 1850 to 1924.

Previous surveys within the proposed APE are portrayed in Table 3-19.

Table 3-19
Archaeological Surveys within the Proposed APE

Author	Date	Title	Report Findings
Chatfield Reservoir			
Arnold Withers (Department of Anthropology, University of Denver)	1972	Archaeological Survey of the Chatfield Reservoir, Colorado, 1968	31 prehistoric sites within reservoir Project Area
Sarah Nelson (National Park Service, Denver, Colorado)	1979	Archaeological Investigations in Chatfield Reservoir, Colorado	Testing at various sites recorded by Withers
Susan Thomas Baugh (Colorado Department of Highways)	1986	Archaeological Survey of Chatfield Arboretum, Jefferson County, Colorado	60 acres surveyed; 2 sites noted, but not impacted by project
Susan Thomas Baugh and Debra Angulski (Colorado Department of Highways)	1986	Archaeological Monitoring at the Chatfield Arboretum, Jefferson County, Colorado	60 acres monitored; no new sites noted during monitoring
Debra Angulski (Colorado Department of Highways)	1991	Cultural Resource Survey of the Proposed Wetland Area South of Chatfield Reservoir, Jefferson County, Colorado	43 acres surveyed; 1 prehistoric site, and 3 isolated prehistoric localities
Ed Brodnicki (USACE, Omaha District)	1995–96	unpublished	Updating site locations and conditions; many sites evaluated as severely impacted
Chris Bevilacqua (4G Consulting)	2006	Background Research and Field Reconnaissance Survey Regarding the Cultural Resources of Cherry Creek and Chatfield Reservoirs, South of Denver, Colorado	Survey of Chatfield State Park to identify disturbed areas unlikely to contain archaeological resources
Steven Dominguez et al. (RMC Consulting)	2007	Class III Cultural Resources Survey Of Chatfield State Park, Arapahoe, Douglas, and Jefferson Counties, Colorado	3,605 acres surveyed; 2 prehistoric sites, 21 historic sites, and 2 sites with prehistoric and historic components
Penley Reservoir and Pipeline Area			
Marcia Tate and Kevin Black	1979	Cultural Resource Inventory of Roxborough State Park, Douglas County, Colorado.	39 potentially eligible prehistoric sites identified, datable from Archaic to late-prehistoric periods; 1 historic homestead.
Douglas D. Scott and David A. Gillio	1973	A Report on the Archaeological Impact of the Proposed Foothills Project of the Denver Water Commissioners	Dozens of eligible and potentially eligible sites from paleo-Indian to historic period.

Sources: Foster Wheeler, 2000b; Dominguez et al., 2007; Colorado Office of Archaeology and Historic Preservation on-line cultural resource database (COMPASS).