Chapter 14: Ecosystem Resources

14.1 Introduction

What is the ecosystem impact analysis area?

The ecosystem impact analysis area is the area bounded by the southern extent of the Great Salt Lake on the south, Willard Bay on the north, the Great Salt Lake on the west, and the lowest benches of the Wasatch Mountains on the east.

This chapter provides a general overview of the Great Basin ecosystem along with detailed descriptions of the habitat types and wildlife species that are specific to the ecosystem impact analysis area. This chapter also presents the impacts of the West Davis Corridor (WDC) project alternatives on wildlife, habitat types, vegetation communities, sensitive species, and wetlands.

This chapter was developed based on extensive consultation with the resource agencies (see Section 14.2.5, Agency Consultation, Coordination, and Roles), which requested that all of the resources listed above be evaluated in one chapter of this Environmental Impact Statement (EIS) that discusses impacts to the overall ecosystem.

Chapter 24, Cumulative Impacts, provides a detailed analysis of the potential cumulative impacts to these ecosystem resources. Section 14.4.8, Recommendations to Minimize Growth Impacts to the Ecosystem, summarizes that analysis.

Ecosystem Impact Analysis Area. The ecosystem impact analysis area is the area bounded by the southern extent of the Great Salt Lake on the south, Willard Bay on the north, the Great Salt Lake on the west, and the lowest benches of the Wasatch Mountains on the east. Many bird species that use this area travel great distances to feed and rest at the Great Salt Lake and its adjacent habitats. The ecosystem impact analysis area is larger than the needs assessment study area (see Section 1.2, Description of the Needs Assessment Study Area) to ensure that species that migrate between different habitats are included in the analysis. In order to provide specific information about habitats that are likely to be affected by the WDC, the description in this chapter focuses on the areas within or adjacent to the footprints of the project alternatives.

14.2 Regulatory Setting

14.2.1 Endangered Species Act

How does the Endangered Species Act apply to the WDC Project?

The Endangered Species Act is not pertinent to the WDC Project because no federally listed threatened or endangered species could be affected by the project alternatives.

The Endangered Species Act requires that federal agencies ensure that their actions neither jeopardize the continued existence of species listed as endangered or threatened nor result in destruction or adverse modification of the critical habitat of these species. Federal agencies must consult with the U.S. Fish and Wildlife Service (USFWS) if an action may affect a listed species or critical habitat. If the lead agency for the project determines that an action would have “no effect” on these species, then no consultation with USFWS is required.

The Endangered Species Act is not pertinent to the WDC Project because there are no federally listed threatened or endangered species in the ecosystem impact analysis area that could be affected by the project alternatives. Table 14-1 provides an overview of the Endangered Species Act consultation process for the WDC Project. For copies of the correspondence related to this consultation, see Appendix 14B, Ecosystems Correspondence.

In addition to threatened and endangered species, USFWS also identifies a third category: candidate species. This category implies that a species of concern has a strong possibility of being listed under the Endangered Species Act in the future, though at this time the species has no protection under the Endangered Species Act.

The Federal Highway Administration's (FHWA) policy on candidate species (FHWA 2002) states that impacts to candidate species should be addressed in environmental documents for federal-aid highway projects. The FHWA policy states that documents prepared under the National Environmental Policy Act (NEPA) should identify candidate species as such and should describe any planned conservation measures. The FHWA policy also encourages state departments of transportation to implement conservation measures or proactively partner with federal agencies to avoid the need to list the species in the future.

Table 14-1. Status of the Informal Endangered Species Act Consultation Process for the WDC Project

Step	Status
Develop species list; USFWS concurs with list.	**Completed.** Initial species list reviewed in June 2010. List updated yearly during EIS process. ↓
Identify threatened or endangered species and/or critical habitat.	**Completed.** Conducted field surveys and literature reviews of the ecosystem impact analysis area. ↓
If species or critical habitat are identified, prepare a Biological Assessment.	**Completed.** A Biological Assessment is required only if the preferred alternative could affect federally listed species. No threatened or endangered species are in areas that could be affected by the project alternatives. ↓
Make determination to USFWS if the preferred alternative is likely to adversely affect species or critical habitat.	**No-effect determination submitted to the Utah Department of Transportation (UDOT).** USFWS does not require consultation if there is a no-effect determination. ↓
USFWS concurs with determination of no adverse impacts or starts the formal consultation process.	**Not required.** USFWS does not have to concur with no-effect determinations. ↓
Start the formal consultation process.	**Not required.**

14.2.2 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act prohibits the take, sale, purchase, possession, barter, or transport, or offer to do any of the above, to either the bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*) at any time or in any manner (16 USC 668a–d). The Bald and Golden Eagle Protection Act could apply to the WDC Project if any individual bird or occupied nest of these two eagle species could be affected.

The Endangered Species Act no longer applies to the bald eagle. As of June 28, 2007, the bald eagle has been delisted from threatened status under the Endangered Species Act. The bald eagle is still protected by the Bald and Golden Eagle Protection Act.

14.2.3 Migratory Bird Treaty Act of 1918

The Migratory Bird Treaty Act (16 USC 703–712) makes it unlawful at any time, by any means, or in any manner, to pursue, hunt, take, capture, kill, possess, or sell migratory birds. The law grants full protection to any bird parts and applies to the removal of nests occupied by migratory birds during the breeding season (such as swallow nests on bridges). This statute applies to all migratory birds in the United States with the exception of a few exotic species such as the European starling and house sparrow. Executive Order 13186, Responsibilities of Federal Agencies To Protect Migratory Birds, which was signed by President Bill Clinton on January 10, 2001, directs federal agencies taking actions that are likely to have a measurable negative effect on migratory birds to undertake a number of actions in support of the Migratory Bird Treaty Act.

One of these actions is for federal agencies to ensure that the environmental analyses required by NEPA evaluate the effects of actions and agency plans on migratory birds, with an emphasis on species of concern. Even though the bald eagle was delisted from threatened status under the Endangered Species Act, it is still protected under the Migratory Bird Treaty Act, as are many other species of migratory birds.

The area within and surrounding the ecosystem impact analysis area is part of an important migratory flyway for birds in the Intermountain West and provides important migratory stopover habitat for birds traveling north and south. This area also provides nesting habitat for numerous migratory bird species.

The WDC could affect migratory bird nests during construction. If protected species are found nesting within the construction zone or buffer zone during construction, UDOT would coordinate with USFWS and the Utah Division of Wildlife Resources (UDWR) to ensure compliance with the Migratory Bird Treaty Act.

14.2.4 Clean Water Act

The U.S. Army Corps of Engineers (USACE) developed a definition of waters of the U.S. in the 1972 Clean Water Act (33 USC 1251). *Waters of the U.S.* are defined as waters that are currently used, that were used in the past, or that might be susceptible to use in interstate or foreign commerce; all interstate waters; any waters, the destruction of which could affect interstate or foreign commerce; all impoundments; tributaries of the previously mentioned waters; the territorial seas; and wetlands adjacent to waters (40 Code of Federal Regulations [CFR] 230).

Wetlands are defined as a subset of waters of the U.S. and, under the Clean Water Act 404(b)(1) regulations (40 CFR 230), are considered special aquatic sites.

What are waters of the U.S. and wetlands?

Waters of the U.S. are waters that are currently used, that were used in the past, or that might be susceptible to use in interstate or foreign commerce; all interstate waters; any waters, the destruction of which could affect interstate or foreign commerce; all impoundments; tributaries of the previously mentioned waters; the territorial seas; and wetlands adjacent to waters.

Wetlands are a subset of waters of the U.S. and are considered special aquatic sites.

Pursuant to the Clean Water Act, USACE has jurisdiction over all waters of the U.S., including but not limited to traditionally navigable waters. USACE further defines wetlands in Section 404 of the Clean Water Act as:

> … those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

USACE presently has jurisdiction over any waters that are adjacent to, bordering, or contiguous with navigable waterways. This EIS assumes that all waters of the U.S. in the ecosystem impact analysis area are jurisdictional and are subject to the authority of USACE.

Under Section 404 of the Clean Water Act, no discharge of dredged or fill material is permitted in waters of the U.S. if there is a less environmentally damaging practicable alternative to that part of the activity that would result in a discharge of fill material to waters of the U.S. An alternative is *practicable* if it is available and capable of being implemented after taking into consideration cost, existing technology, and logistics in light of the overall project purposes.

For actions that require a Section 404 permit, FHWA seeks to ensure that the alternatives analysis in FHWA’s NEPA document provides the information necessary to assist the USACE in making a Clean Water Act Section 404(b)(1) decision. FHWA also must comply with Executive Order 11990, Protection of Wetlands, which closely follows the requirements of the Clean Water Act in that it requires federal agencies to avoid to the extent possible long- and short-term impacts to wetlands and requires agencies to implement all practicable measures to minimize harm to wetlands when there is no practicable alternative to avoiding wetland impacts. The executive order includes both jurisdictional and non-jurisdictional wetlands as defined under the Clean Water Act. As part of the Section 404 permit, UDOT will need to obtain a Clean Water Act Section 401 State Water Quality Certification (for more information, see Chapter 13, Water Quality).

14.2.5 Agency Consultation, Coordination, and Roles

During the scoping process for the WDC Project, the WDC team consulted regulatory and resource agencies regarding any resources that could be affected by the project alternatives. Coordination letters and figures illustrating the location of the ecosystem impact analysis area were sent to USFWS, UDWR, UDWR's Utah Natural Heritage Program, and USACE. Each agency was given an opportunity to provide feedback regarding the resources under its jurisdiction.

What is scoping?

Scoping is an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action.

USFWS was consulted regarding any federally designated threatened or endangered species that could be present. The Utah Natural Heritage Program was consulted regarding any state-listed species of concern. UDWR and USFWS biologists were also consulted about specific habitat types and wildlife present in the ecosystem impact analysis area. Throughout the process, USACE was consulted regarding methods for identifying waters of the U.S. (For copies of correspondence related to this consultation, see Appendix 14B, Ecosystems Correspondence.)

Habitat biologists with USFWS and UDWR were consulted about the wildlife species that represent each healthy habitat type in the ecosystem impact analysis area. Once the species that indicate suitable habitat were determined, agency specialists in the biology of each species were consulted to verify the conditions that are needed to provide optimal habitat for these indicator animals. Before the WDC wildlife assessment was started, the WDC team held numerous meetings with USACE, UDWR, and USFWS to develop a methodology for the wildlife habitat inventory and impact analysis. The methods that were developed and agreed to by this team are described in detail in *Technical Memorandum 9: Wildlife Assessment Methodology – Existing Conditions* (HDR 2010a).

In addition, before the WDC wetland assessment was started, the WDC team held numerous meetings with USACE, UDWR, USFWS, and the U.S. Environmental Protection Agency (EPA) to develop a methodology for the wetland inventory and impact analysis (see Section 14.3.1.3, Methodology for Identifying Wetlands and Waters of the U.S.).

14.3 Affected Environment

14.3.1 Methodology

The WDC team used several methods to collect data on the elements of the ecosystem that could be affected by the project alternatives. These methods consisted of conducting literature reviews, consulting with agency personnel, performing field surveys, and interpreting aerial photographs and map resources. Data were confirmed in the field and recorded using global positioning system (GPS) receivers, and these data were digitized and added to geographic information system (GIS) databases.

What is the WDC team?

The WDC team consists of the lead agencies for the WDC Project (FHWA and UDOT).

14.3.1.1 Methodology for Assessing Wildlife and Habitat

To assess wildlife habitats and their value to wildlife species in the ecosystem impact analysis area, the WDC team used several methods to acquire information about migratory birds, upland and wetland habitats, and special-status species. The WDC team initially identified habitat by identifying species and by conducting preliminary GIS mapping. Then the team compiled a list of all sensitive species that are found in or adjacent to the impact analysis area, including Endangered Species Act–listed species, state-listed sensitive species, conservation agreement species, birds of conservation concern, Wildlife Action Plan species, and Partners in Flight priority species. The wildlife habitat assessment was conducted in the WDC study area (defined in Section 1.2, Description of the Needs Assessment Study Area) to help with screening of alternatives.

What is the WDC study area?

The WDC study area is the area described in Section 1.2, Description of the Needs Assessment Study Area.

To guide the reconnaissance-level field survey, the WDC team developed a final list of eight representative species with known specific habitat needs based on likely habitats that exist near the WDC alternatives, with coordinated guidance from UWDR and USFWS. The WDC team biologists gathered available data from scientific literature, wildlife data produced by state and federal wildlife agencies, and conservation organization data and used these data to identify known or potential habitats for the representative wildlife species. The representative species and their habitats are the following:

What are riparian areas?

Riparian areas are areas that border a river, canal, or other waterway.

- Long-billed curlew and grasshopper sparrow for open pasture and grasslands
- Brewer’s sparrow for sage-steppe shrubland
- Bobolink for wet meadow
- Yellow-billed cuckoo for riparian areas
- Mule deer for mixed cover of trees, grasses, and shrubs
- Northern leopard frog for emergent marsh and waters
- American avocet for playa and saline meadow wetlands

To evaluate the existing habitat quality as part of the wildlife assessment, the WDC team developed a rapid assessment checklist prior to conducting field surveys. This checklist includes the eight representative species and their associated habitats. In the checklist, each habitat parcel is ranked based on its value to the eight representative sensitive species based on factors including parcel size, amount and type of native vegetation cover, and amount of disturbance within and surrounding the parcel. Because no parcel contained potential habitat for all of the representative species, not all of the representative species were given ranks for each habitat parcel. However, many parcels did contain potential habitat for more than one of the species, with as many as four species ranked for some parcels. The ranks are None (urban), Very Low, Low, Medium, Medium-High, or High value. The individual species ranks (1 for Low, 3 for Medium, and 6 for High) for each habitat parcel were summed and divided by the total number of species evaluated for that parcel to arrive at an overall rating for that habitat parcel. Field surveys using the rapid assessment checklist were conducted in the summer of 2010.

More details regarding the methods used to identify wildlife habitat are available in *Technical Memorandum 9: Wildlife Assessment Methodology – Existing Conditions* (HDR 2010a). The results of the field assessment are summarized below and are described in detail in the report *Preliminary Wildlife Study Results* (HDR 2010b).

The wildlife habitat data obtained in 2010 were refined and adjusted based on comments by USFWS. Many of these refinements included dividing a few of the larger habitat parcels into smaller parcels to better represent different habitats. This change better reflected the habitat quality for habitats that provide specialized habitat for one or two species. Some of the large parcels with a complex mosaic of habitats were not included in this refinement.

An additional adjustment included a resurvey of some of the parcels during the wetland verification process in 2011 (see the section titled Methodology for Determining Wetland Quality on page 14-10) to review habitat quality and make slight adjustments to individual wildlife rankings as needed. Adjustments were also made in 2016 to account for urban development that occurred in the WDC study area after the Draft EIS was released.

14.3.1.2 Methodology for Assessing Threatened, Endangered, and Sensitive Species

The WDC team initially researched data regarding threatened, endangered, and sensitive species by coordinating with USFWS and UDWR. UDWR maintains a list of threatened, endangered, and candidate species that could be present in Utah. This list is organized by county. The team also acquired from the State of Utah a list of federally listed species that are or have historically been known to be present in Davis and Weber Counties (UDWR 2014).

In addition to the federally listed species, the State of Utah lists sensitive species. The WDC team coordinated with the Utah Natural Heritage Program to obtain a list of state sensitive species. Additionally, the Utah Natural Heritage Program provided GIS files that show the general locations of these species.

After the WDC team compiled the threatened and endangered species lists, the team researched the biology of each species on the list. The species with habitat requirements that were not consistent with habitats present in the ecosystem impact analysis area were eliminated from further study, while species with habitat requirements that were consistent with habitats in the impact analysis area were evaluated more fully.

14.3.1.3 Methodology for Identifying Wetlands and Waters of the U.S.

Formal wetland delineations were not conducted for the entire ecosystem impact analysis area because of the large size of this area. Instead, wetland resources were identified and mapped in a smaller area (about 8,265 acres) where most of the wetlands that could be affected by the project alternatives are located. This smaller area is the wetlands impact analysis area (see Figures 14-1 and 14-2, Wetlands by Overall Quality Rating, in Volume IV).

What is the wetlands impact analysis area?

The wetlands impact analysis area is a smaller, 8,265-acre area within the ecosystem impact analysis area where most of the wetlands that could be affected by the project alternatives are located.

The WDC team used the *1987 Corps of Engineers Wetlands Delineation Manual* and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Environmental Laboratory 1987, 2008) to identify and map the wetlands in the wetlands impact analysis area.

Open water features, some of which could be jurisdictional waters of the U.S., were also identified and mapped in the wetlands impact analysis area during the wetland surveys. The ordinary high-water mark (OHWM) was evaluated in the field, and GPS units were used to map the water features. The OHWM was determined by observing the banks of the features to discern where indicators such as scour and deposition, lack of vegetation, and drift deposits were located.

In most cases, the creeks, canals, and drainages in the wetlands impact analysis area were either greatly incised or channelized, resulting in an abrupt change (in the horizontal axis) between the area above and below the OHWM. Named creeks, canals, unnamed flowing drainages, springs, ponds, and ditches connected to or within wetlands were mapped, if they were observed within the wetlands impact analysis area. Constructed ditches in uplands are common in agricultural areas, so these were not mapped.

If one of the WDC action alternatives is selected as the preferred alternative, a formal wetland delineation report will be submitted to USACE for that alternative before construction.

What is a wetland delineation?

A wetland delineation is a survey to determine the extent and types of wetlands that would be affected by a project.

Methodology for Determining Wetland Quality

What is hydrology?

As used in this chapter, *hydrology* refers to the water source for a wetland.

In 2016, at the request of the resource agencies, the WDC team completed a wetland quality assessment using the UDOT Wetland Functional Assessment Method (UDOT 2006). During the 2016 field work for the habitat quality assessment, the WDC team also verified the wetland delineation data initially collected in 2012. The UDOT Wetland Functional Assessment Method is a science-based, rapid, economical, repeatable wetland evaluation method applicable to Utah. The method is designed to specifically address highways and other lineal projects. It is intended to evaluate wetland functions and values, not to delineate wetland boundaries. The Wetland Functional Assessment Method incorporates Utah wetland types, wildlife, other Utah-specific issues, water quality, connectivity, and stream type classifications. The method classifies wetlands in four categories:

- **Category I** – Wetlands that are of exceptionally high quality or that are important from a regulatory standpoint.
- **Category II** – Wetlands that are more prevalent than Category I wetlands and may provide habitat for sensitive species of plants and animals, function at high levels for wildlife habitat, or be assigned a high rating for many of the assessed values.
- **Category III** – Wetlands that are more prevalent than Category I and II wetlands, generally have a moderate to low plant community composition rating, and have a higher level of disturbance than Category I and II wetlands.
- **Category IV** – Wetlands that are generally small and isolated and are rated low for plant community composition. These wetlands provide little in the way of wildlife habitat.

During the 2016 wetland survey, UDOT did not identify any Category IV wetlands. All wetlands were classified as Category I, II, or III.

14.3.2 General Overview of the Ecosystem Impact Analysis Area

14.3.2.1 Great Salt Lake

What is a playa?

A playa, or mud flat, is a flat-bottomed basin that becomes a lake when surface water is available. The water seasonally evaporates away, leaving a deposit of salts, clays, and silts.

The WDC alternatives are located in the eastern margin of the Great Basin that is a remnant of the ancient Lake Bonneville. This area is now altered by agriculture and urban development. The Great Salt Lake, which is west of the ecosystem impact analysis area, is one of the remnant water bodies of Lake Bonneville. The Great Salt Lake supports a rich and dynamic biological system of regional, national, and global importance.

Having no outlet, the lake water varies in both elevation and salinity over time due to the combined effects of freshwater flowing in from three rivers (the Bear, Weber, and Jordan Rivers), numerous smaller river tributaries, precipitation, and groundwater and outflow generated by evaporation. The lake water also receives stormwater runoff and discharges from wastewater treatment plants in the area. This variation in water level influences the nutrient base and habitats for plants, invertebrates, reptiles, amphibians, mammals, and birds. The variation also creates a mosaic of habitats including wetlands (ranging from freshwater to hyper-saline playas), shorelines, and uplands.

The water level in the Great Salt Lake is dynamic, with seasonal variations of a few feet and historic variations of up to 20 feet. Recorded lows have occurred in 1963 and more recently in 2008 and 2010, with the most well-known highs in 1983 to 1986 when flooding caused hundreds of millions of dollars in damage to agriculture and infrastructure. Because of the very gradual elevation contours in the Great Salt Lake basin, small changes in lake level can drastically change the coverage of the lake. The natural fluctuations in lake level over time can cause dynamic shifts in soil salinity and wetness, which affect the types and locations of available habitats around the lake shore (WHSRN, no date).

Because of the variety and abundance of shorebirds at the Great Salt Lake, it is designated as a Hemispheric Site of Importance by the Western Hemisphere Shorebird Reserve Network (WHSRN, no date). Birds of regional, national, and international importance are drawn to its 15,000 square miles of water environment, remote islands, shoreline, and 400,000 acres of wetlands. An estimated 5 million birds representing 257 species rely on the lake for resident feeding and sanctuary, breeding, or migratory stopovers (WHSRN, no date). Similarly, the National Audubon Society has designated the Great Salt Lake area as an Important Bird Area.

How is the Great Salt Lake important to bird populations?

An estimated 5 million birds representing 257 species rely on the Great Salt Lake for resident feeding and sanctuary, breeding, or migratory stopovers.

A few studies have been conducted regarding the number of shorebirds that use the Great Salt Lake (Paul and Manning 2002). These studies suggest that high numbers of shorebirds use the lake for breeding and migration. A few one-day counts have been conducted for a few species, and these provide a base count from which to extrapolate and estimate total counts for these species.

For some species, such as the Wilson’s phalarope (*Phalaropus tricolor*), the lake is a major staging area. A one-day aerial survey in July 1986 estimated a population of 387,000 Wilson’s phalaropes. On a single day in July 2001, the population of Wilson’s phalaropes was estimated at 566,834. Numbers of red-necked phalarope (*Phalaropus lobatus*), the populations of which seem more variable, have been estimated as high as 240,000 on a single day. Recent ongoing studies suggest that at least 5,000 to 10,000 snowy plovers (*Charadrius alexandrinus*) nest on the alkaline flats surrounding the lake. The current estimates for breeding American avocets and black-necked stilts are 40,000 and 30,000, respectively, with peak lake-wide counts of 250,000 and 65,000, respectively (Paul and Manning 2002).

The Great Salt Lake is also important to many other bird species. Hundreds of thousands of eared grebes (*Podiceps nigricollis*) stage on the lake, fattening on the abundant brine shrimp. One of the world’s largest populations (about 21,600) of white-faced ibis (*Plegadis chihi*) nests in the marshes along the east side of the lake. The Great Salt Lake hosts the largest number of breeding California gulls (*Larus californicus*), including the world's largest recorded single colony. About 160,000 breeding adults have been documented in recent years. The American white pelican (*Pelecanus erythrorhynchos*) colony on Gunnison Island, where up to 20,000 breeding adults have been recorded, ranks in the top three populations in North America. Numerous other species depend on the lake, such as other species of gulls, waterfowl, herons, egrets, terns, raptors, and songbirds (Paul and Manning 2002).

Although the Great Salt Lake provides important habitat for wildlife, it has been extensively altered by human development along the eastern shore in the ecosystem impact analysis area. Wildlife habitat, wetlands, rivers, and the lake have been extensively altered as a result of urban and agricultural development during the past century. The wetlands adjacent to the Great Salt Lake have been extensively altered or lost, invasive species have been introduced, and many of the streams that flowed into the Great Salt Lake have been altered for water supplies, control of stormwater, agricultural uses, and urban development. The human disturbances have also resulted in more noise and light pollution near the eastern edge of the Great Salt Lake in the ecosystem impact analysis area. Very few undisturbed habitats remain in the impact analysis area.

14.3.2.2 Springs

No springs or seeps were identified during the wetland and biological field surveys conducted in 2010, 2011, 2012, and 2016 or identified based on the WDC team's review of U.S. Geological Survey maps.

14.3.2.3 Conservation Areas

This section describes conservation areas specifically managed to enhance wildlife value. Several conservation areas administered by UDWR; the Utah Reclamation, Mitigation, and Conservation Commission (URMCC); or The Nature Conservancy are located within or immediately adjacent to the proposed WDC alternatives (see Figure 14-3, Wildlife Management and Conservation Areas, in Volume IV). From north to south, these conservation areas are the Ogden Bay Waterfowl Management Area (WMA), the Howard Slough WMA, the Great Salt Lake Shorelands Preserve, and the Farmington Bay WMA.

The WMAs managed by UDWR—Ogden Bay, Howard Slough, and Farmington Bay—are a combination of diked ponds, impoundments, and wetland areas (both native and artificial). The WMAs are managed for waterfowl and other water bird habitats (including foraging and nesting), recreational hunting, educational uses, and other recreational uses such as hiking, biking, and photography. Ogden Bay is the largest at about 20,000 acres, followed by Farmington Bay at about 18,000 acres and Howard Slough at about 3,000 acres. The ecosystem impact analysis area overlaps with all three WMAs, with the overlap with the Farmington Bay WMA being the smallest (Utah Department of Natural Resources 2013).

The Great Salt Lake Shorelands Preserve, which is over 4,400 acres, is managed by The Nature Conservancy but reflects property acquisitions and partnerships of The Nature Conservancy, URMCC, and private entities. Unlike the WMAs, this preserve consists primarily of undiked, natural shoreline habitat, including marshes, mud flats, sloughs, and uplands, that is managed primarily for wildlife habitat. More than half of the preserve is within the western boundary of the ecosystem impact analysis area.

The preserve is a composite of natural saline shoreline, freshwater pools and emergent marshes, wet meadows, adjacent uplands, and agricultural fields, all managed as an intact ecosystem to provide prime avian habitat for migrating, nesting, and foraging birds. In 2013, The Nature Conservancy conducted a Great Salt Lake Shorelands Bird Survey to demonstrate the richness and abundance of bird species that use the preserve as well as habitat use of the preserve during migration, nesting, and foraging. During the survey, the Conservancy documented avian numbers of more than 30,000 individuals and 139 species from April through August 2013. The most abundant species were white-faced ibis (9,099), American avocet (3,099), red-winged blackbird (1,315), California gull (1,296), yellow-headed blackbird (1,290), and European starling (988). Response 32.14.2I in Chapter 32, Response to Comments, provides more details about the bird survey and the species that were identified.

Waterfowl hunting is a common use of the Great Salt Lake and the aforementioned WMAs. Waterfowl hunting is also allowed on a small portion of the Great Salt Lake Shorelands Preserve in limited, designated areas. UDWR estimated that, in 2009, there were 194,557 waterfowl hunting trips in Utah, with about 55% of those trips occurring at the Great Salt Lake and 25,475 waterfowl hunting trips to the Farmington Bay WMA (Utah Department of Natural Resources 2013).

14.3.2.4 Wildlife Habitat

The wildlife habitats identified in the WDC wildlife habitat assessment are grouped into two general types: uplands and wetlands (including waters) (see Figures 14-4 and 14-5, Wildlife by Habitat Type, in Volume IV). Within these general types are more-specific habitat types such as grassland and shrubland in the upland type, and emergent marsh, wet meadow, and playas in the wetlands type. The discussion on wildlife habitat types are based on field surveys conducted in the ecosystems impact analysis area in 2010, 2011, 2012, 2013, 2015, and 2016.

It is important to note that the wetland habitat types used in the wildlife habitat analysis were identified using aerial photographs and field surveys. The wetlands used in the wildlife habitat analysis are different from the wetlands used in the wetlands analysis. The wetland habitats used in the wildlife analysis were not delineated using the USACE guidance or UDOT functional assessment methodology. Additionally, since the wildlife assessment area covered a much larger area than the wetland assessment area, there are more wetlands identified in the wildlife habitat analysis than in the wetlands impact analysis.

Wetlands associated with the Great Salt Lake are important for providing a diversity of habitats. This diversity is maintained mainly by fluctuations in lake level. The wildlife function of the wetlands changes greatly depending on whether the lake level is high or low. The habitats discussed in this section are characteristic of those along the Wasatch Front and in other parts of the Great Basin and are described as they appear at the current low lake levels.

Uplands

What is upland habitat?

Upland habitat is areas that include pastures/grasslands, shrublands, hayfields, croplands, and urban areas.

Upland habitat is found throughout the ecosystem impact analysis area, but more so in the eastern and central parts of the impact analysis area where the elevations are slightly higher and groundwater is deeper. Uplands in the impact analysis area are identified as pastures/grasslands, shrublands, hayfields, croplands, and urban areas (developed and/or cleared). Upland habitats that provide wildlife with their foraging and reproductive needs typically are the more natural habitats such as grasslands and shrublands but can also include human-manipulated lands such as pastures, hayfields, and even croplands. Although agricultural-based land types provide fewer services to native species than do the original, natural habitats they replaced, such land types can still have more function and utility to wildlife than developed and highly disturbed or cleared lands.

Pastures/grasslands in the impact analysis area vary among dry native bunchgrass, dry planted bunchgrass, and irrigated pasture. Herbaceous plant species in the grasslands can include cheat grass (*Bromus tectorum*), intermediate wheatgrass (*Thinopyrum intermedium*), crested wheatgrass (*Agropyron cristatum*), basin wildrye (*Leymus cinereus*), sheep fescue (*Festuca ovina*), meadow fescue (*Festuca pratensis*), quackgrass (*Elymus repens*), foxtail barley (*Hordeum jubatum*), bulbous bluegrass (*Poa bulbosa*), Kentucky bluegrass (*Poa pratensis*), whitetop (*Cardaria draba*), clasping pepperweed (*Lepidium perfoliatum*), common dandelion (*Taraxacum officinale*), and white clover (*Trifolium repens*). Most of the grasslands in the impact analysis area are being or have been used for grazing cattle and/or horses.

The shrubland habitats in the impact analysis area tend to be dominated by either greasewood (*Sarcobatus vermiculatus*) or a mixed community of greasewood, big sagebush (*Artemisia tridentata*), and rabbitbrush (*Ericameria nauseosa*). Where some of the shrublands have been overgrazed, weeds such as cheat grass and clasping pepperweed can be present.

The remaining upland areas in the impact analysis area are managed in some way by humans, whether intensely with machines and chemicals as with croplands and some hayfields (grass hay or alfalfa) or with only occasional mowing or seeding as with pastures or low-value grass hayfields. Urban and other developed areas, including residential areas, are also highly managed habitats. Urban areas have the least to offer to wildlife species, since these areas have the most pavement, structures, and disturbance.

Wetlands and Waters

Wetlands and various bodies of water are located throughout the ecosystem impact analysis area. These become more prevalent toward the western edge of the area where the lakeshore wetlands of the Great Salt Lake begin.

What are emergent marshes?

Emergent marshes are marshes that are usually inundated with water. Their surface water levels generally vary from a few inches to 2 or 3 feet. Emergent marshes can be adjacent to lake fringes, pond edges, or river edges, or they can end by feeding into the groundwater system.

The wetland wildlife habitats in the impact analysis area are typically composed of emergent marshes and wet meadows but also include some small mud flats and playa habitat. In addition to the Great Salt Lake, the water bodies in the impact analysis area include ponds, streams, ditches, canals, sloughs, and rivers. Most water bodies in the impact analysis area drain toward and into the Great Salt Lake, though some smaller ditches or other agricultural drainages empty out into fields or small evaporative basins. Many of the streams, sloughs, and rivers also have some riparian habitat along their banks.

Emergent marsh habitat is scattered throughout the impact analysis area, but it is more commonly located toward the large, extensive lakeshore wetlands on the western side of the impact analysis area. Some of the emergent marshes in the impact analysis area have dominant vegetation communities of the invasive common reed (*Phragmites australis*), reed canarygrass (*Phalaris arundinacea*), and broad-leaf cattail (*Typha latifolia*). Other marshes contain more native bulrush (*Schoenoplectus acutus* and *S. americanus*) and common threesquare (*Schoenoplectus pungens*).

What are mesic habitats?

Mesic habitats have a moderate amount of water, as compared to hydric (high-water) or xeric (low-water) habitats.

Wet meadows in the impact analysis area can range between mesic, grassy pastures with a few wetland vegetation species present to diverse wetland meadows consisting of wetland vegetation including Baltic rush (*Juncus balticus*), clustered field sedge (*Carex praegracilis*), Nebraska sedge (*Carex nebraskensis*), common spikerush (*Eleocharis palustris*), saltgrass (*Distichlis spicata*), and Nuttall's alkaligrass (*Puccinellia nuttalliana*).

Mud flat habitat, including playa habitat, is generally composed of variably sized evaporative basins or exposed alkaline soil where the alkalinity of the soil is very high. This high alkalinity is difficult for many plant species to tolerate, so it restricts the composition and diversity of plant species. Sometimes the lowest parts of these evaporative basins do not have any plant life. Plant species that can tolerate this habitat include pickleweed (*Salicornia rubra*), iodine bush (*Allenrolfea occidentalis*), saltgrass, little barley (*Hordeum pusillum*), and Nuttall's alkaligrass.

Waters, such as ponds, ditches, streams, canals, sloughs, and rivers, are located throughout the impact analysis area but are more common toward the western side. Because these waters are open-water habitats, they tend to have far fewer plant species living in them than do surrounding habitats (such as marshes or meadows). Typically, such open-water features have wetland species growing along their banks, including broad-leaf cattail, common reed, reed canarygrass, bulrush, and common threesquare.

Riparian areas in the impact analysis area have been altered compared to more-natural riparian areas in other parts of Utah. Many of the streams and rivers in this area have been channelized or in some ways have had their natural floodplains altered or restricted. Also, various developments, especially agriculture, have encroached toward the edges of all streams and rivers in the impact analysis area, which has reduced the extent and diversity of the native riparian vegetation.

Vegetation that currently exists along the riparian corridors includes woody species such as cottonwoods (*Populus* spp.), crack willow (*Salix fragilis*), boxelder (*Acer negundo*), coyote willow (*Salix exigua*), Wood's rose (*Rosa woodsii*), and the invasive trees Russian olive (*Elaeagnus angustifolia*) and Siberian elm (*Ulmus pumila*). Some riparian areas do not have any woody species and contain only a narrow fringe of herbaceous wetland and upland species such as Baltic rush, common reed, reed canarygrass, meadow fescue, quackgrass, Kentucky bluegrass, and teasel (*Dipsacus fullonum*).

14.3.2.5 Wildlife Habitat Locations and Quality

The habitat types described in Section 14.3.2.4, Wildlife Habitat, are generally found throughout the WDC study area, with the wetter habitats being more common toward the western part of the area and the drier habitats more common in the eastern part (see Figures 14-4 and 14-5, Wildlife by Habitat Type, in Volume IV). The western edge of the WDC study area is nearly all wetlands and is a mosaic of wetland and water types—marsh, wet meadow, playa, and small ponds and channels. Because the eastern edge of the WDC study area is Interstate 15 (I-15), most of the land along this border is predominantly urbanized developments from Farmington to Ogden. However, there are a few remaining pockets of undeveloped pastures in the south between Kaysville and Farmington (see Figure 14-5, Wildlife by Habitat Type, in Volume IV). These undeveloped parcels are currently being developed or are planned to be developed as part of the Farmington Station Park development.

The central part of the WDC study area is a mixture of developments, pastures, and croplands (see Figures 14-4 and 14-5, Wildlife by Habitat Type, in Volume IV). Historically, this area was probably dominated by agricultural land interspersed with small towns or communities. However, now urban developments are spreading west from the I-15 urban corridor, replacing the agricultural land use with residential and commercial development.

This area also contains streams, such as Howard Slough, Farmington Creek, and Kays Creek, along with many irrigation canals and ditches. Although most of the land in the central part of the WDC study area has been manipulated by people in some way over the last 150 years, it still contains wet meadows, marshes, and playas or other alkaline mud flats. Even in their modified state, these areas still have value for wildlife species. Table 14-2 below shows the acreage of each habitat type in the WDC study area.

Table 14-2. Habitat Types in the WDC Study Area

Habitat Type	Number of Features	Total Acres	Percentage of Total Project Area
Crop	245	5,312	8
Hayfield	394	6,544	10
Marsh[a]	23	8,020	12
Pasture[a]	378	9441	13
Playa	7	510	0.8
Riparian	34	249	0.4
Shrubland	1	13	2.0
Urban	1,011[b]	34,554	53
Waters	40	312	0.5

[a] These habitats frequently are a mix of many other habitat types, and, because they are a mosaic of types within large, contiguous pieces of land, they were grouped under one type.

[b] This number is an artifact of the way the GIS database was constructed from state land-use data layers and therefore is not an actual number of discrete parcels.

As discussed in Section 14.3.1.1, Methodology for Assessing Wildlife and Habitat, to evaluate the existing habitat quality, the WDC team in consultation with USFWS and UDWR developed a rapid assessment checklist involving the eight representative species and their associated habitats. Table 14-3 summarizes the results of the field surveys using the rapid assessment checklist as compiled into the six quality rank categories for the sensitive-species habitat.

Table 14-3. Quality of Sensitive-Species Habitat in the WDC Study Area

Quality Rank Category[a]	Number of Parcels	Total Acres	Percentage of Total Project Area
None	502	34,554	53
Very Low	693	12,801	20
Low	108	1,725	3
Medium	94	2,450	4
Medium-High	34	2,816	4
High	32	10,649	16

[a] Category definitions:

None = 0.00 to 0.24
Very Low = >0.24 to 1.00
Low = >1.00 to 2.00
Medium = >2.00 to 3.00
Medium-High = >3.00 to 4.00
High = >4.00 to 6.00

Figures 14-6 and 14-7, Wildlife by Habitat Quality Ranking, in Volume IV show the distribution of the quality rank categories for sensitive-species habitat area. Over 70% of the area is within the two lowest ranks (the None and Very Low categories), which is not surprising since about 53% of this area is urbanized areas that have a value of 0. The middle ranks, Low to Medium-High, include about 11% of the total. The highest rank (the High category), at 16%, contains the lakeshore wetlands, playas, and marshes that make up the western edge of the WDC study area along with some higher-quality areas elsewhere in the WDC study area.

14.3.2.6 Wildlife Habitat and Great Salt Lake Flooding

The dynamic nature of the Great Salt Lake creates a healthy ecosystem that relies on frequent changes to the various habitat types. As a consequence, habitat functions change over time naturally in accord with the varying hydrologic regimes. For example, fringe emergent marsh wetlands will decrease as open saline water from the lake inundates and kills the vegetation of established wetlands. Further, upland habitat currently located in the impact analysis area can be reduced as lake levels rise and create additional wet areas. Conversely, as lake levels recede, bare ground and mud flats or playas are exposed.

This natural cycle of disturbance also makes these habitat types more vulnerable to invasive plants, which are less valuable as habitat. These changes are part of the natural cycle of the impact analysis area and cause only small variations in the amount of total available habitat currently in the impact analysis area. The wildlife can adapt to the natural cycles but needs to have a variety of habitat types on a landscape level to adapt to these changes over time. For descriptions of habitats at high lake levels, see Section 14.4.3.6, Changes in Lake Level and Habitat Availability, and Figure 14-8, Varying Lake Levels, in Volume IV.

The loss of habitats from a dramatic increase in lake level would have far-reaching effects on wildlife. The species that require dry land and vegetation to nest or for forage would be forced to move inland in search of these habitats as the lake level rises, potentially into developed or other less desirable and higher-risk areas. Other species, such as ducks or shorebirds, might be less affected, since the increase in shallow, flooded lands and a general increase in shoreline habitat as the lake expands could provide greater foraging opportunities. However, the ducks and shorebirds that nest in Utah still require some dry land. Some bird species might be forced to migrate farther and even out of state to find suitable nesting grounds. However, others that nest close to the lake might benefit from lake flooding as their nesting locations become islands, thereby providing isolation and protection from some predators. Terrestrial species with limited mobility would likely be the most affected by a sudden and high rise in lake level, and many individuals could be killed by drowning or predation.

14.3.2.7 Fragmentation of Wildlife Habitat

The diminishment of open space, including wildlife habitat and agricultural land, along the Wasatch Front is a concern of federal and state resource agencies and special-interest groups. Development pressures have increased along the Wasatch Front in the past few decades because of population growth. As growth continues over time, so does the development of more residential, commercial, and industrial properties along with the infrastructure to accommodate this growth.

The earliest loss of habitats, especially wetlands, began with the conversion of much of the WDC study area to agriculture during early pioneer settlement of the Wasatch Front starting about 165 years ago. The existing habitats in the impact analysis area are extensively fragmented today due to previous construction of railroad corridors (the Union Pacific and Denver & Rio Grande Western Railroads), I-15, and many smaller highways and secondary roads as well as other previous development and disturbance (such as farming, grazing, and building dikes and fences) in the WDC study area. These and other land-use changes in the impact analysis area and along the Great Salt Lake have extensively affected and fragmented the wildlife habitats, especially wetlands, along the Wasatch Front (Lee 2001).

In particular, these changes have created movement barriers to wildlife between the Wasatch Mountains and the Great Salt Lake. Agriculture, development, and rural and urban road networks in the intervening uplands have also significantly fragmented historic wildlife habitats in the Great Salt Lake basin. The wildlife populations currently in these areas are likely to have already experienced many of the population changes typically associated with habitat fragmentation (such as reduced carrying capacity, lower reproductive success, and higher susceptibility to predation). However, aside from GIS information that documents these habitat changes, no data are available to substantiate or detail these changes locally. There is a considerable body of scientific literature on the general topic of fragmentation effects from roads and other developments (examples include Tscharntke and others 2002; Forman and others 2003; and Shepard and others 2008).

What is carrying capacity?

The carrying capacity of a species in an environment is the maximum population size of the species that the environment can sustain indefinitely, given the food, habitat, water, and other necessities available in the environment.

The existing populations have changed greatly since historic times. Based on observed changes in other fragmented wildlife populations described in the literature (Soulé 1987; Forman 1995; Primack 2000), the WDC team presumes that wildlife has experienced reduced species diversity, population densities, and distributions in response to the cumulative long-term effects of these land-use changes.

14.3.3 Wildlife, Sensitive Species, and Migratory Birds

14.3.3.1 Wildlife (Non-avian)

The WDC study area provides a range of breeding and foraging habitats for many non-avian wildlife species such as small mammals, reptiles and amphibians, and fish. For a listing of avian wildlife species, see Table 14-6, Potential Migratory and Resident Birds in the Ecosystem Impact Analysis Area by Habitat Type, on page 14-28. The areas with the greatest potential diversity of wildlife are the more native habitats such as emergent marshes, grasslands, and riparian areas. Table 14-4 below lists the non-avian species that could be present in all the habitats in the WDC study area, including urban areas.

Table 14-4. Potential Non-avian Wildlife in the WDC Study Area by Habitat Type

Habitat Type	Likely Wildlife Species	
Emergent marsh wetlands	• American bullfrog[a] • Little brown myotis • Muskrat • Northern leopard frog	• Northern raccoon • Long-tailed weasel • Western chorus frog • Woodhouse's toad
Playas and mud flats	• Northern raccoon • Red fox	
Rivers, streams, lakes, and ponds	• American beaver • American bullfrog[a] • Channel catfish[a] • Common carp[a] • Muskrat • Northern leopard frog • Long-tailed weasel • Speckled dace	• Tiger salamander • Utah chub • Western (boreal) toad • Western chorus frog • Western mosquitofish[a] • Woodhouse's toad • Yellow perch[a]
Wet meadow wetlands	• Common gartersnake • Deer mouse • Eastern racer • Gophersnake • Great Basin spadefoot • Long-tailed weasel • Meadow vole • Mule deer	• Northern leopard frog • Red fox • Striped skunk • Tiger salamander • Western (boreal) toad • Western chorus frog • Western harvest mouse • Woodhouse's toad
Pastures and other grasslands (upland)	• Badger • Black-tailed jackrabbit • Common gartersnake • Coyote • Deer mouse • Eastern racer • Gophersnake • Great Basin spadefoot • Great Plains toad	• Least chipmunk • Long-tailed weasel • Meadow vole • Mountain cottontail rabbit • Mule deer • Red fox • Striped skunk • Western harvest mouse • Western spotted skunk
Shrublands and thickets	• Black-tailed jackrabbit • Common sagebrush lizard • Deer mouse • Gophersnake • Great Basin spadefoot • Least chipmunk • Long-legged myotis	• Long-tailed weasel • Mountain cottontail rabbit • Mule deer • Northern raccoon • Rock squirrel • Striped skunk • Western spotted skunk

(*continued on next page*)

Table 14-4. Potential Non-avian Wildlife in the WDC Study Area by Habitat Type

Habitat Type	Likely Wildlife Species	
Riparian	• American beaver • American bullfrog[a] • Common gartersnake • Eastern racer • Gophersnake • Least chipmunk • Little brown myotis • Long-legged myotis • Long-tailed weasel • Mountain cottontail rabbit • Mule deer	• Muskrat • Northern leopard frog • Northern raccoon • Nutria[a] • Red fox • Striped skunk • Tiger salamander • Western (boreal) toad • Western chorus frog • Western spotted skunk • Woodhouse's toad
Hayfields (actively managed)	• Common gartersnake • Deer mouse • Eastern racer • Gophersnake • Great Plains toad	• Little brown myotis • Mule deer • Red fox • Western chorus frog • Western harvest mouse
Croplands (active)	• Deer mouse • Great Plains toad • House mouse[a] • Mule deer	• Northern raccoon • Striped skunk • Western chorus frog • Western harvest mouse
Urban and other developed areas	• House mouse[a] • Little brown myotis • Mule deer	• Northern raccoon • Red fox • Striped skunk

Source: UDWR 2014

[a] Non-native species

14.3.3.2 Threatened, Endangered, and Sensitive Species

Many sensitive species, including federally listed threatened, endangered, and candidate species and State of Utah sensitive species, are listed as possibly being present in Davis and Weber Counties. The WDC study area and surrounding areas contain potential habitat for some of these sensitive species, including those that are candidates for federal listing and species listed by the State of Utah as being wildlife species of concern.

Table 14-5 below lists all federal and state-listed species for Davis and Weber Counties including their potential for occurrence in the WDC study area. Only species with records of occurrence in the last 25 years or with habitat in or adjacent to the study area are discussed further in this section.

Table 14-5. Federal and State-Listed Species for Davis and Weber Counties

Common Name	Scientific Name	Status[a]	County[b]	Potential for Occurrence in and adjacent to the WDC Study Area[c]
Birds				
American white pelican	*Pelecanus erythrorhynchos*	SPC	D, W	Records of sightings and nesting, habitat in area
Bald eagle	*Haliaeetus leucocephalus*	SPC	D, W	Records of sightings and nesting, habitat in area
Bobolink	*Dolichonyx oryzivorus*	SPC	D, W	Records of sightings, habitat in area
Burrowing owl	*Athene cunicularia*	SPC	D, W	Two historic records, potential habitat in area
Ferruginous hawk	*Buteo regalis*	SPC	D, W	One record, potential habitat in area
Grasshopper sparrow	*Ammodramus savannarum*	SPC	D, W	Potential habitat in area
Greater sage-grouse	*Centrocercus urophasianus*	C	W	Potential habitat near but outside area in sage habitat
Lewis's woodpecker	*Melanerpes lewis*	SPC	D, W	Potential habitat in or near area
Long-billed curlew	*Numenius americanus*	SPC	D, W	Recorded observations and nesting, habitat in area
Mountain plover	*Charadrius montanus*	SPC	W	One historic record, potential habitat outside of area
Northern goshawk	*Accipiter gentilis*	CS	W	Potential habitat near but outside area
Sharp-tailed grouse	*Tympanuchus phasianellus*	SPC	W	Potential habitat in or near area
Short-eared owl	*Asio flammeus*	SPC	D, W	Records of sightings and nesting, habitat in area
Western yellow-billed cuckoo	*Coccyzus americanus*	T	D, W	Records of sightings, potential habitat in area
Fish				
Bluehead sucker	*Catostomus discobolus*	SPC	D, W	One record in area, potential habitat in Weber River
Bonneville cutthroat trout	*Oncorhynchus clarkii utah*	CS	D, W	Potential habitat near but outside area
June sucker	*Chasmistes liorus*	E	W	Not found in area, and no habitat within or around WDC alternatives
Least chub	*Iotichthys phlegethontis*	C	D, W	Not found in area, and no habitat within or around WDC alternatives
Mammals				
Canada lynx	*Lynx canadensis*	T	W	Not found in area, and no habitat in or adjacent to area
Kit fox	*Vulpes macrotis*	SPC	D, W	Two records, potential habitat in area
Townsend's big-eared bat	*Corynorhinus townsendii*	SPC	D, W	Potential habitat in or near area

(*continued on next page*)

Table 14-5. Federal and State-Listed Species for Davis and Weber Counties

Common Name	Scientific Name	Status[a]	County[b]	Potential for Occurrence in and adjacent to the WDC Study Area[c]
Mollusks				
Deseret mountainsnail	*Oreohelix peripherica*	SPC	W	Not found in area, and no habitat in or adjacent to area
Lyrate mountainsnail	*Oreohelix haydeni*	SPC	W	Not found in area, and no habitat in or adjacent to area
Western pearlshell	*Margaritifera falcata*	SPC	D	Potential habitat in or near area, but likely extirpated from Utah
Wasatch mountainsnail	*Oreohelix peripherica wasatchensis*	SPC	W	Not found in area, and no habitat in or adjacent to area
Reptiles and Amphibians				
Columbia spotted frog	*Rana luteiuentris*	CS	D, W	Potential habitat in or near area
Smooth greensnake	*Liochlorophis vernalis*	SPC	W	Potential habitat near area in Wasatch Mountains
Western toad	*Bufo boreas*	SPC	D	Potential habitat in or near area

Source: UDWR 2010

[a] Species status designations: E = endangered (federal), T = threatened (federal), C = candidate (federal), CS = conservation agreement species (state), SPC = wildlife species of concern (state)

[b] County designations: D = Davis County, W = Weber County

[c] The term *area* refers to the WDC study area. The WDC team evaluated the potential for the species or species habitat to occur in or near the WDC study area in order to evaluate effects on mobile species that could come into areas affected by the WDC.

Federally Listed Species

Western Yellow-Billed Cuckoo. This cuckoo species was listed as threatened under the Endangered Species Act on October 3, 2014. The western yellow-billed cuckoo historically is a common-to-uncommon summer visitor in Utah and across the Great Basin. The current distribution of yellow-billed cuckoos (western population) in Utah is poorly understood, although they appear to be an extremely rare breeder in lowland riparian habitats statewide. They arrive in late May or early June and breed during late June through July. Cuckoos typically start their southerly migration by late August or early September.

What is an obligate species?

An obligate species is one that requires a certain habitat. For example, a riparian obligate species requires riparian habitat.

Yellow-billed cuckoos are considered a riparian obligate species and are usually found in large tracts of cottonwood-willow habitat with dense subcanopies. There is potential habitat for this species, and there have been a few sightings, in the riparian corridors along the rivers and sloughs in the ecosystem impact analysis area, though most of these riparian areas have been reduced and degraded by human activities. However, there are no recent recorded sightings in the WDC study area.

The Endangered Species Act final listing did not include any critical habitat for the western yellow-billed cuckoo in Davis or Weber Counties.

During the summer of 2013, surveys were conducted for yellow-billed cuckoos in potential habitat areas according to protocols provided by USFWS (see *Technical Memorandum 27: 2013 Yellow-Billed Cuckoo Surveys* [HDR 2013a]). During the four survey periods, no yellow-billed cuckoos were detected at the Farmington Creek, Haight Creek, or Howard Slough survey sites. Based on the characteristics of the survey sites and consideration of the species' habitat requirements, yellow-billed cuckoos are not likely to inhabit these areas because the areas do not contain suitable habitat for this species.

In July 2016, USFWS provided the WDC team with the 2015 *Guidelines for Identification of Suitable Habitat for WYBCU [Western Yellow-Billed Cuckoo] in Utah* (USFWS 2015) and requested that habitat be re-evaluated based on the new guidelines. The following is a summary of the re-evaluation.

- **Farmington Creek.** Riparian vegetation along Farmington Creek has an overstory of native trees but little or no understory. The 6.3-hectare patch of riparian vegetation consists of a narrow (27-to-57-meter width) band of vegetation immediately adjacent to the creek. The site is not suitable nesting habitat for yellow-billed cuckoos because of the lack of understory and the narrow width of the riparian vegetation.

- **Haight Creek.** Most of this area is an open marsh with dense patches of shrubs and a sparse, open canopy of trees. Riparian overstory vegetation covers about 2.3 hectares. The largest patch of that vegetation is about 150 meters long by 50 to 90 meters wide, and the remainder of the riparian overstory is 10 to 30 meters wide. Because of the lack of overstory and small size and narrow width of the riparian vegetation, the site is not suitable nesting habitat for yellow-billed cuckoos.

- **Howard Slough.** This site is dominated by a dense, single-layered stand of non-native Russian olive. The riparian vegetation covers 2.3 hectares and is 12 to 43 meters wide. The riparian corridor at this site is too small and narrow to be suitable nesting habitat for yellow-billed cuckoos.

State Listed Species

American White Pelican. This species is a spring and summer resident of northern Utah, nesting primarily on Gunnison Island in the northwestern arm of the Great Salt Lake. The American white pelican forages in the shallow, freshwater shores and wetlands that surround the Great Salt Lake where there are abundant stocks of fish. Many wetlands and ponds in the far western part of the ecosystem impact analysis area are potential foraging areas for the American white pelican, but fewer potential areas exist in the WDC study area. During The Nature Conservancy's survey in 2013, about 239 American white pelicans were identified in the Great Salt Lake Shorelands Preserve, 16 of which were within or adjacent to the right-of-way of the WDC alternatives and the rest between 599 and 4,287 feet from the right-of-way. Most shallow freshwater shores are at a distance greater than 2,000 feet from WDC alternatives.

Bald Eagle. The bald eagle was previously protected under the Endangered Species Act and has been delisted, but it is still protected by the Bald and Golden Eagle Protection Act. This eagle species is primarily a visitor to Utah during its annual migration and for winter roosting. Over 1,200 bald eagles have been counted during migration, many of which winter in Utah (UDWR 2009). However, fewer than a dozen pairs of bald eagles nest in Utah, including the Great Salt Lake area. There is potential foraging habitat for bald eagles in the ecosystem impact analysis area along the Weber River and the wetlands and sloughs in the far western part of the area. One nest was recorded in 2005 near the edge of the ecosystem impact analysis area in the Ogden Bay WMA. There are also winter roosting and foraging records for many of the WMAs (Ogden Bay, Farmington Bay, etc.) and a few reports along Farmington Creek near Glovers Lane and areas to the south and west of Glovers Lane. Two individuals were identified during The Nature Conservancy's survey in 2013, at a distance of 4,287 feet from the project right-of-way.

Bobolink. Bobolink distribution is fairly continuous in the eastern United States but is patchy in the western United States. There are isolated breeding populations in northern Utah and Nevada, central Washington, and eastern Arizona. Bobolinks are present in low abundance and in isolated patches primarily in the northern half of the state. Bobolinks breed or have bred near Logan, Brigham City, Kamas, Heber, Morgan, Mountain Green, Huntsville, West Layton, and Provo and at the south end of Bear Lake. In the West, they nest and forage in wet meadow (grasses and sedges), wet grassland, and irrigated agricultural areas (primarily pastures and hay fields). Many sightings of bobolinks have been recorded in the ecosystem impact analysis area, and this species has been seen nesting in the Great Salt Lake Shorelands Preserve. During The Nature Conservancy's survey in 2013, 21 bobolinks were identified in the preserve, nine of which were within or adjacent to the right-of-way for the WDC alternatives and the rest between 491 and 847 feet from the right-of-way.

Burrowing Owl. This species prefers very open and level grasslands or low shrublands and is closely associated with the burrows of prairie dogs or other fossorial (digging) mammals, which it uses for nesting. Burrowing owl sightings and historic (more than 80 years ago) nesting have likely occurred in the ecosystem impact analysis area, but there has been historic nesting recorded from only two locations in the central part of the WDC study area. However, development has since destroyed much of the appropriate habitat.

Ferruginous Hawk. This species prefers open grasslands and shrublands such as that found in the uplands in the eastern parts of Davis and Weber Counties. Some of this upland habitat is degraded in the ecosystem impact analysis area. The species' nesting habitat requirements include an abundant small-mammal food source with juniper trees as a primary nesting substrate. Ferruginous hawks might also nest on the ground or power line structures. The species is not known to be present in the WDC study area. One observation has been recorded of this species foraging in the Ogden Bay WMA over 15 years ago (outside the WDC study area).

Grasshopper Sparrow. The grasshopper sparrow is a bird of the grasslands of the Western Hemisphere. The densest breeding populations are found in the central and northern Great Plains, but nesting occurs across the eastern United States and at scattered locations west of the Rocky Mountains. In Utah, breeding populations have been found only in the northern parts of the state. The dry grassland habitat in the ecosystem impact analysis area provides some habitat, though much of it has been disturbed by agricultural activities since most of those grasslands are managed for livestock grazing. During The Nature Conservancy's survey in 2013, four grasshopper sparrows were identified in the Great Salt Lake Shorelands Preserve, three of which were 814 feet from the right-of-way of the WDC alternatives and one at 847 feet from the right-of-way.

Long-Billed Curlew. This species forages and breeds in the playa habitats and fallow croplands, hayfields, and pastures of the ecosystem impact analysis area. There are several sightings and reports of long-billed curlews nesting in the western part of the impact analysis area. There is potential foraging and nesting habitat in many of the larger areas of playas, meadows, and pastures throughout the WDC study area, though the extensive wetlands and playas along the western border of the area are most likely to contain the higher-quality habitat. During The Nature Conservancy's survey in 2013, 44 long-billed curlews were identified in the Great Salt Lake Shorelands Preserve, all between 847 and 3,245 feet from the right-of-way of the WDC alternatives.

Short-Eared Owl. This species inhabits northern Utah, typically preferring open grasslands, scrublands, or fields in which it hunts small mammals. The ecosystem impact analysis area includes some open land that could be used by short-eared owls, although such habitat is common throughout this area of Utah. Many sightings and some nests have been recorded in the western parts of the impact analysis area, where open lands (including pastures and shrublands) are more common. During The Nature Conservancy's survey in 2013, seven short-eared owls were identified in the Great Salt Lake Shorelands Preserve, two of which were adjacent to or within the right-of-way of the WDC alternatives and the rest between 599 and 3,245 feet from the right-of-way.

Kit Fox. In the West, this fox species prefers open, arid habitats for hunting and reproduction. In Utah, the species is found mostly in the desert areas of the western and southeastern parts of the state. The shrubland and grassland areas along the eastern shore of the Great Salt Lake constitute the eastern edge of the kit fox range in northern Utah. There are two older records of kit fox sightings in the ecosystem impact analysis area in the open lands at the western edge of this area. There could still be potential foraging and den habitat in the drier parts of the WDC study area.

Townsend's Big-Eared Bat. Townsend's big-eared bat can be found in many types of habitat, but the species is often found near forested areas. Caves, mines, and buildings are used for day roosting and winter hibernation. Consequently, human disturbances of caves and the closures of abandoned mines can constitute threats to the species. Because there are no forested areas, caves, or mines in or near the WDC study area, it is unlikely that this species s present near a WDC alternative, although bats could migrate near the study area.

Other Species. The WDC team's review of literature shows that potential habitat for greater sage-grouse, Lewis's woodpecker, northern goshawk, and sharp-tailed grouse is not present in the WDC study area. However, Lewis's woodpeckers and northern goshawks, which are more mobile, could migrate into the area. There was an unofficial sighting of a Lewis's woodpecker in the Great Salt Lake Shorelands Preserve on October 5, 2013 (HDR 2013b). The western toad and Columbia spotted frog could have potential habitat, including slow-moving streams, wetlands, and ponds, in the WDC study area.

14.3.3.3 Migratory and Resident Birds

The ecosystem impact analysis area provides a range of nesting and foraging habitats for many migratory and resident bird species. USFWS has identified birds of conservation concern (BCC) that are present in conservation regions throughout North America (USFWS 2008). The WDC action alternatives are in Bird Conservation Region 9, the Great Basin. The areas with the greatest potential diversity of birds are the more native habitats such as emergent marshes, playas, and shrublands. Table 14-6 below lists the likely migratory and resident bird species that could be present in all the habitats in the ecosystem impact analysis area, including urbanized areas.

In 2013, The Nature Conservancy conducted a Great Salt Lake Shorelands Bird Survey to demonstrate the richness and abundance of bird species that use the Great Salt Lake Shorelands Preserve as well as habitat use of the preserve during migration, nesting, and foraging. During the survey, the Conservancy documented avian numbers of more than 30,000 individuals and 139 species from April through August 2013. The most abundant species were white-faced ibis (9,099), American avocet (3,099), red-winged blackbird (1,315), California gull (1,296), yellow-headed blackbird (1,290), and European starling (988).

Table 14-6. Potential Migratory and Resident Birds in the Ecosystem Impact Analysis Area by Habitat Type

Habitat Type	Likely Migratory or Resident Birds	
Emergent marsh wetlands	• American bittern • Cattle egret • Common moorhen • Common snipe • Common yellowthroat • Forester’s tern • Franklin’s gull • Great blue heron • Marsh wren	• Northern shoveler • Red-winged blackbird • Snowy egret • Song sparrow • Sora • Spotted sandpiper • Virginia rail • White-faced ibis • Yellow-headed blackbird
Playas and mud flats	• American avocet[a] • Black-necked stilt[a] • California gull • Long-billed curlew[b,c]	• Long-billed dowitcher • Snowy plover[c] • Spotted sandpiper • Wilson’s phalarope
Rivers, streams, lakes, and ponds	• American white pelican[b] • American coot • California gull • Caspian tern • Clark’s grebe • Double-crested cormorant • Eared grebe[c]	• Forester’s tern • Great blue heron • Mallard • Pied-billed grebe • Snowy egret • Western grebe • Wilson’s phalarope
Wet meadow wetlands	• Bobolink[b] • Brewer’s blackbird • Cattle egret • Common snipe • Common yellowthroat • Killdeer • Long-billed curlew[b,c] • Northern harrier	• Red-winged blackbird • Sandhill crane • Short-eared owl[b] • Spotted sandpiper • White-faced ibis • Willet • Yellow-headed blackbird
Pastures and other grasslands (upland)	• Burrowing owl[b] • Golden eagle[c] • Grasshopper sparrow[b] • Horned lark • Killdeer • Long-billed curlew[b,c] • Northern harrier • Peregrine falcon[c] • Red-tailed hawk	• Ring-necked pheasant[d] • Sandhill crane • Savannah sparrow • Short-eared owl[b] • Swainson’s hawk • Vesper sparrow • Western meadowlark
Shrublands and thickets	• Black-capped chickadee • Brewer’s sparrow[a,c] • Peregrine falcon[c] • Ring-necked pheasant[d]	• Short-eared owl[b] • Vesper sparrow • Western meadowlark

(*continued on next page*)

Table 14-6. Potential Migratory and Resident Birds in the Ecosystem Impact Analysis Area by Habitat Type

Habitat Type	Likely Migratory or Resident Birds	
Riparian	• American crow • American goldfinch • Bald eagle[b] • Bank swallow • Belted kingfisher • Black-billed magpie • Broad-tailed hummingbird[a] • Bullock's oriole • Cliff swallow	• Eastern kingbird • Gray catbird • Great horned owl • Long-eared owl • Northern flicker • Red-tailed hawk • Song sparrow • Western kingbird • Yellow warbler
Hayfields (actively managed)	• Barn owl • Barn swallow • Eastern kingbird • Horned lark • Northern harrier	• Savannah sparrow • Swainson's hawk • Western kingbird • Western meadowlark
Croplands (active)	• American crow • American kestrel • Brewer's blackbird • Eastern kingbird • European starling[d]	• Mourning dove • Ring-necked pheasant[d] • Sandhill crane • Western kingbird • White-faced ibis
Urban and other developed areas	• American crow • American kestrel • American robin • Barn owl • Barn swallow • Black-billed magpie • Brewer's blackbird	• Brown-headed cowbird • California quail[d] • European starling[d] • House finch • House sparrow[d] • Mourning dove • Rock dove[d]

Source: UDWR 2010

[a] Utah Partners in Flight priority species

[b] Utah Sensitive List species

[c] USFWS Birds of Conservation Concern (BCC) species

[d] Introduced species

14.3.4 Potential Jurisdictional Wetlands and Waters of the U.S. in the Wetlands Impact Analysis Area

In the wetlands impact analysis area, the WDC team identified and characterized 260 wetlands and 23 constructed basins (mostly stormwater facilities). These wetlands cover an area of about 402 acres (or 421 acres with constructed wetlands) in the wetlands impact analysis area (see Figures 14-1 and 14-2, Wetlands by Overall Quality Rating, in Volume IV).

Table 14-7 below summarizes the results by wetland quality rating and wetland type. The WDC team also identified and mapped 106 areas of open water that cover about 70 acres.

Table 14-7. Summary of Wetlands in the Wetlands Impact Analysis Area

Wetland Rating	Total Acres	Percentage of Total Wetland Acres	Wetland Type	Total Acres	Percentage of Total Wetland Acres
Category I	138.0	32.8	Emergent marsh	124.3	29.5
Category II	64.9	15.4	Playa	3.7	0.9
Category III	198.8	47.2	Wet meadow	272.0	64.6
			Riparian	1.7	0.4
Constructed	19.5	4.6	Constructed	19.5	4.6
Total wetlands	**421.2**	**100.0**	**Total wetlands**	**421.2**	**100.0**
Open water	70				

Section 14.3.1.3, Methodology for Identifying Wetlands and Waters of the U.S., provides an overview of how wetland ratings were assigned. The highest percentage of the wetlands mapped is Category III wetlands and is classified as wet meadow (wet meadow and emergent marsh). Many of these wetlands are along the western side of the wetlands impact analysis area along the Great Salt Lake shoreline. The wetlands that are not along the Great Salt Lake are near water courses (such as Howard Slough, Haight Creek, and Kays Creek) and irrigation canals, along the west side of the natural bluff, or in a remnant saline area west of the bluff and north of Gentile Road. The presence of wetlands near irrigation canals and ditches confirms the field observations that the hydrology of many wetlands is influenced by irrigation practices.

USACE has identified the OHWM of the Great Salt Lake as elevation 4,200 feet (North American Vertical Datum of 1988, or NAVD 88) above mean sea level for the South Arm (USACE 2015). The Federal Emergency Management Agency (FEMA) has identified the 100-year stillwater floodplain elevation of the Great Salt Lake in Davis and Weber Counties as elevation 4,215 feet (NAVD 88) above mean sea level (FEMA 2005, 2007) with maximum 1% chance of wave crest elevations of 4,218.6 to 4,219.3 feet above mean sea level (FEMA 2007). Using 4,217 feet as an elevation between the stillwater and wave crest elevations of the wetlands delineated, about 72.6 acres of the 403 acres (18.2%) are at or below 4,217 feet. See Chapter 15, Floodplains, for a discussion of floodplains.

What is a 100-year floodplain?

A 100-year flood (also referred to as a base flood) is an event subject to a 1% probability of a certain size flood occurring in any given year. A 100-year floodplain is the area around a water body that would be inundated by a 100-year flood.

Open-water features recorded in the wetlands impact analysis area include the named creeks Howard Slough, Haight Creek, Kays Creek, Bair Creek, Farmington Creek, and Holmes Creek. Also located in the wetlands impact analysis area are the Hooper Canal and various unnamed smaller drainages, ponds, basins, and ditches. Many of these water features are directly connected to the Great Salt Lake and are likely jurisdictional. Other unnamed features and smaller agricultural ponds and basins might or might not have a clear connection to the Great Salt Lake or other traditional navigable water. All water features that are either connected to a traditional navigable water or are connected to a wetland and possibly connected to a traditional navigable water were included in the analysis. A more in-depth connectivity analysis would be performed as a part of a formal delineation report and Section 404 permit in the future.

14.4 Environmental Consequences

This section describes the direct and indirect effects on ecosystem resources from the No-Action and WDC action alternatives. Additionally, this section describes the methods used to analyze the impacts.

The WDC action alternatives were evaluated equally in this chapter. However, to reduce repetitive discussions, if impacts from one alternative would be the same as impacts from a previously discussed alternative, the text is not repeated but instead references the previous analysis.

14.4.1 Methodology

14.4.1.1 Methodology for Assessing Impacts to Wildlife Habitat

This section describes the methodology that was used to assess the impacts of the project alternatives to wildlife habitat. For a complete description of this methodology, see *Technical Memorandum 9: Wildlife Assessment Methodology – Existing Conditions* (HDR 2010a).

Habitat Loss

The construction of any of the action alternatives would remove some wildlife habitat because it would be cleared to accommodate the WDC's footprint. The loss of habitat would be a direct loss rather than an indirect effect, which is defined as an effect to habitat outside the right-of-way but within some distance of the right-of-way (see the section titled Habitat Degradation on page 14-34). Direct loss was measured in terms of the acreages of habitats that would be cleared for an alternative's footprint along with the type and quality of the habitats cleared.

What are indirect effects?

Indirect effects are effects that are caused by the proposed action but are later in time or farther removed in distance.

Acreages of Direct Impact

As part of documenting the existing habitat conditions, the WDC team prepared a wildlife habitat map in the ArcGIS software program that shows the different types and locations of wildlife habitats based on field surveys. The wildlife habitat map is included as part of the technical memorandum *Preliminary Wildlife Study Results* (HDR 2010b). To compare the project alternatives, the direct habitat loss from the project alternatives was determined by overlaying the right-of-way boundary for each WDC alternative onto the wildlife habitat map and using ArcGIS to calculate the total area of each habitat type within those boundaries.

Habitat Quality Ranks

As a more-focused means of comparing the alternatives than simply their acreages of impacts, the WDC team used habitat quality ranks that are based on levels of human disturbance, vegetation types, and patch size. This allowed the team to compare the alternatives not only by using the acreages of direct impacts but also by weighting those acreages according to their habitat quality ranks (by multiplying the affected acreage by the habitat quality rank for each affected habitat parcel). This weighting was done to give more emphasis to impacts to higher-quality habitat. Using weighted acreages of impacts amplifies and clarifies what could otherwise appear to be small differences among alternatives in terms of only the acreages of direct impacts.

The WDC team selected eight species—long-billed curlew, grasshopper sparrow, Brewer's sparrow, bobolink, yellow-billed cuckoo, mule deer, northern leopard frog, and American avocet—that were used to evaluate seven general habitat types. These species and their habitat needs were agreed to by the resource agencies during meetings in 2010. Based on the habitat needs of these species, the WDC team developed a habitat quality rapid assessment checklist that was used during the field surveys in 2010. Because a given parcel often included more than one habitat type with different quality rankings, the WDC team calculated average habitat quality rankings for the wildlife and habitat analysis. For more details about this process, see the technical memorandum *Preliminary Wildlife Study Results* (HDR 2010b).

For wildlife habitat, the species' individual rankings range between 1 and 6, with 6 being the highest quality. For each habitat parcel, an overall average habitat quality rank was calculated by adding the habitat quality ranks of the individual species and dividing that sum by the number of species ranked for that parcel.

Intensively farmed agricultural land was not evaluated for wildlife habitat use but was assigned values of 0.25 for cropland and 0.75 for managed alfalfa. Urban land was assigned a habitat value of zero. Even though farmed and urban lands are occasionally used by wildlife, they are not considered native habitats. For display and descriptive purposes, the ranks have been placed into discrete categories (see Table 14-8). The Low rank includes not only croplands and hayfields but also other low-quality pastures where the quality of the habitat was low for all species.

Table 14-8. Habitat Quality Ranks and Descriptions

Quality Rank	Descriptive Rank
0.00 – 0.24	Very Low
0.25 – 1.00	Low
1.01 – 2.00	Medium-Low
2.01 – 3.00	Medium
3.01 – 4.00	Medium-High
4.01 – 6.00	High

As one example of calculating a habitat quality ranking, a parcel of disturbed pasture has patches of wetter and drier grasses. This habitat is ranked Low (1) quality for two species and Medium (3) quality for one species. The overall ranking for the parcel is (1+1+3)/3 = 5/3 = 1.66, or Medium-Low quality.

As a second example, a large, low-disturbance but grazed grassy pasture with a small pond is surrounded by a willow and cottonwood zone. This habitat is ranked Medium (3) quality for two species and High (6) quality for one species. The overall ranking for the parcel is (3+3+6)/3 = 12/3 = 4.00, or Medium-High quality.

The average habitat quality rank value (which can range from 0.25 to 6.00 for each parcel) and the individual species' quality rank values (which can be 1, 3, or 6 for each parcel) for each affected parcel were multiplied by the affected acreage as a way to weight impacts based on habitat quality. Therefore, during the comparison of alternatives, this simple, overall index of the weighted acreage of impacts, the habitat quality index, was clearly and graphically compared among the alternatives.

What is a habitat quality index?

A habitat quality index is a measure of the habitat quality rank of each affected parcel multiplied by the acreage of the parcel.

Indices are a common tool to condense complex information into a manageable measure for comparison. Although indices are unit-less and cannot be taken out of the context for which they were developed, they can help summarize complex ecological data into a readily comparable measure.

Habitat Fragmentation

The WDC team analyzed the average habitat patch size and the number of patches to evaluate and compare the fragmentation effects of the project alternatives on each habitat type (marsh, pasture, playa, and so on). The patches used in the analyses were the generalized wildlife habitat parcels of relatively continuous and homogeneous wildlife habitat that were defined and created in the wildlife habitat quality work. The edges of the patches were defined by paved streets, large structures, and abrupt changes in land type but not by small houses, sheds, driveways, or extremely low-use unimproved access roads. In addition, if a patch of native habitat or pasture was adjacent to cropland, the cropland defined the edge of the patch.

What is a habitat patch?

A habitat patch is a continuous parcel of land that provides some wildlife habitat and is not separated by roads, structures, or other types of urban development.

The habitat fragmentation analysis considered a series of fragmentation metrics including number of patches, patch density, average patch area, effective patch size, patch shape, average perimeter-to-area ratio, and average nearest habitat distance. The analysis also qualitatively examined the degree of dispersion (whether patches were more clumped or more spread out) of habitat patches and types.

If an alternative approached the western edge of the WDC study area, the habitats and the impact analysis area were extended westward up to 2,000 feet from the western edge of the alternative.

These analyses used GIS spatial analysis tools along with the FRAGSTATS analysis program (McGarigal and others 2012). The results of these various fragmentation analyses for each alternative were compared to the existing conditions as a way to assess the effects of each alternative, given the ecosystems impact analysis area's existing level of fragmentation by development and agriculture.

Habitat Degradation

Habitat can be degraded by many factors such as lowered water quality, lowered air quality, artificial lighting, and noise from a nearby highway, assuming that some or all of these factors do disturb and limit the habitat's usefulness to wildlife. Because noise is more easily measured and more obvious to human senses than other potential disrupting factors, such as air quality or artificial lighting, the recent scientific literature (such as Francis and others 2009; Fahrig and Rytwinski 2009; Halfwerk and others 2011; and Herrera-Montes and Aide 2011) has focused on noise.

The WDC team reviewed scientific literature and research reports, including the *Legacy Avian Noise Research Program Final Report* (BIO-WEST 2011), that analyze the noise levels and other effects and distances from highways at which wildlife is likely to be disturbed.

The WDC team synthesized the findings from the *Legacy Avian Noise Research Program Final Report* and other recent scientific literature (including Forman and others 2003; Seiler 2001; FHWA 2004; Biglin and Dupigny-Giroux 2006; Palomino and Carrascal 2007; McGregor and others 2008; and Benitez-Lopez and others 2010) to qualitatively analyze the habitat effects of the project alternatives. To accomplish this analysis, the WDC team in coordination with USFWS developed three buffer distances for the Draft EIS (also known in the scientific literature as effect zones) to quantify the type and amount of wildlife habitats at three distances away from the right-of-way on either side of the highway. In its comments on the Draft EIS, USFWS said that, based on its evaluation of the scientific literature, the potential impacts could extend farther, to 3,900 feet. In response to USFWS's comment, a fourth zone was added to the buffer distances for this Final EIS.

The WDC team developed the four buffer zones to quantify the type, quality, and amount of wildlife habitat at different distances from the roadway alignments as a means to compare the amount of wildlife habitat at given distances to the WDC alternatives. These buffer zones are not experimentally tested distances at which some degree of effect could occur to wildlife (such experimentally tested zones have not been described in the literature). Based on the scientific literature, species' responses to the potential degradation factors appear to differ among different types of animals (birds, small mammals, amphibians, etc.) and habitat types.

These buffer zones are the near, intermediate, far, and extended buffer zones.

- The **near buffer zone** begins at the edge of the right-of-way and extends out 300 feet.
- The **intermediate buffer zone** begins at the outer edge of the near buffer zone and extends out 500 feet (to a distance of 800 feet from the edge of the right-of-way).
- The **far buffer zone** begins at the outer edge of the intermediate buffer zone and extends out 500 feet (to a distance of 1,300 feet from the edge of the right-of-way).
- The **extended buffer zone** begins at the outer edge of the far buffer zone and extends out 2,600 feet (to a distance of 3,900 feet from the edge of the right-of-way).

The WDC team made the following assumptions for any areas outside the WDC study area:

- **Eastern border:** If an area did not appear on aerial photographs to be a riparian corridor or other densely vegetated area, it was considered developed.
- **Western border:** If an area did not appear on aerial photographs to be developed, farmed, or otherwise disturbed, it was considered high-quality wetlands and lakeshore migratory bird habitat. Weedy or abandoned alfalfa fields, other less-managed grass hay fields, and pastures were not classified as farmed areas.

Noise

The WDC team used data from the noise analysis for the EIS (see Chapter 12, Noise) and recently published data from the *Legacy Avian Noise Research Program Report* (*Legacy Report*; BIO-WEST 2011) to develop distances at which the noise of the project alternatives would not be substantially audible above the existing background noise.

The *Legacy Report* included many measurements at the Legacy Nature Preserve from 2007 to 2010 (for a detailed discussion of the study results, see the section titled Comparison of Noise Data between the WDC and Legacy Parkway on page 14-49). The *Legacy Report* recorded average noise levels of 43.5 to 48 dBA (decibels on the A-weighted scale) about 800 feet west of the operational Legacy Parkway and noise levels of 48 to 53.5 dBA about 400 feet from the parkway. For context regarding different noise levels, Table 12-1, Weighted Noise Levels and Human Response, in Chapter 12, Noise, lists typical noise levels for common noise sources.

The amount of traffic recorded on Legacy Parkway in 2008 and 2009 was similar to but slightly higher than the maximum projected amount of traffic on any of the WDC alternatives in 2040, and both projects would use similar noise-reducing pavement. Therefore, the noise effects of Legacy Parkway on the sites monitored as part of the *Legacy Report* are likely to be similar to the noise effects that would be caused by the WDC alternatives. To verify that noise levels on the WDC would be similar to those on Legacy Parkway, the WDC team used the FHWA Traffic Noise Model (TNM), version 2.5. The FHWA TNM requires inputs for recorded noise levels, vehicle speeds, vehicle volumes, and vehicle fleet mixes to calibrate the noise model. The WDC team used recorded noise levels, vehicle speeds, vehicle volumes, and vehicle fleet mixes from the I-15 milepost 362 location as inputs to calibrate the TNM. Specifically, on January 28, 2014, from 10 AM to 11 AM, at a location 300 feet from the edge of the right-of-way on I-15 at milepost 362, the WDC team recorded a 1-hour L_{eq} (equivalent sound level) of 56.2 dBA, with a total traffic volume of 972 vehicles (62% cars, 6% medium trucks, and 32% heavy trucks).

Once the FHWA TNM had been calibrated for the I-15 inputs described above, the WDC team changed the inputs to the TNM to account for the WDC's vehicle speeds in 2040 (67 miles per hour), vehicle volumes (average 1-hour volume of 1,425 vehicles per hour), and vehicle fleet mix (92% cars, 5% medium trucks, and 3% heavy trucks). Using the WDC inputs, the TNM predicted that the WDC's 24-hour average of 1-hour L_{eq} noise levels would be 50.3 dBA at 300 feet from the WDC right-of-way. For a line source such as highway noise, noise levels generally decrease by 3 dBA with each doubling of distance from the roadway.

The noise monitoring conducted on I-15, which is described above, also took noise measurements at 600 feet from the edge of the right-of-way and confirmed this 3-dBA decrease with a doubling of distance. The TNM predicted 50.3-dBA noise level at 300 feet and a 47.3-dBA noise level at 600 feet. These noise levels are similar to those in the *Legacy Report*, which reported recorded average noise levels of 43.5 to 48 dBA about 800 feet west of the operational Legacy Parkway and noise levels of 48 to 53.5 dBA about 400 feet from Legacy Parkway. Therefore, the WDC team anticipates that the WDC would have a 24-hour average of 1-hour L_{eq} noise levels of 47.3 dBA at 600 feet from the WDC right-of-way.

The first two buffer distances discussed above, near (0 to 300 feet) and intermediate (300 to 800 feet), are the most applicable for assessing the noise effects of the WDC based on the data from the *Legacy Report*. Beyond 800 feet from the proposed highway, noise levels should be at or within a few decibels of current background noise levels as recorded by the WDC team.

Based on the Legacy Parkway noise-monitoring data and supported by the WDC noise analysis, from about 400 to 800 feet from the proposed highway, noise levels could still be within the threshold of audible interference to some avian communication, which is about 50 dBA based on recent research (Dooling and Popper 2007). At less than 400 feet from the proposed highway, noise levels would begin to increase quickly to the edge of the right-of-way, well into the range of audible interference to communication for some species. The WDC team developed the 300-foot buffer zone to show the area that should have noise levels above the 50-dBA threshold for interfering with avian communication. This distance also is the same as the distance used to determine potential indirect wetland effects (see the section titled Water Quality and Hydrology Impacts adjacent to the Highway on page 14-38).

Lake Level Dynamics and Habitat Availability

The WDC team conducted a GIS analysis to evaluate the direct habitat availability and losses that would result from the project alternatives in combination with habitat availability and losses that could result from higher levels of the Great Salt Lake. As the lake level rises, wildlife would be pushed toward higher ground and concentrated into the remaining non-inundated habitats. In effect, the rise in lake level would make the remaining habitat more valuable, because the total available habitat for some species would be reduced. The additional impacts to these remaining wildlife habitats from the alternatives were analyzed and explained in the context of the alternatives' greater additive impact to wildlife habitat than what would occur from direct impacts alone.

The wildlife habitat map in ArcGIS (see the section titled Acreages of Direct Impact on page 14-31) was combined with two inundation zone datasets (see the descriptions below) for the Great Salt Lake in order to evaluate the amount of remaining habitat due to habitat loss from (1) natural fluctuations in lake level and (2) the project alternatives. The analysis examined two lake levels that are higher than the current level.

- **The highest lake level at 4,217 feet.** Elevation 4,217 feet is the highest recorded lake elevation and is an elevation between the FEMA 4,215-foot 1% annual chance stillwater elevation and the 4,218.6-to-4,219.3-foot maximum 1% annual chance wave crest elevation for Davis and Weber Counties. The GIS data at the lake's 4,217-foot elevation that were used in the analysis were developed by USACE and FEMA for floodplain regulation from digital elevation maps (FEMA 2005, 2007).
- **An intermediate level of 4,209 feet.** The 4,209-foot level was used as an intermediate level because it is the closest available data layer to 4,208 feet, which is the elevation at which the Utah Division of Water Quality designates beneficial uses for all Great Salt Lake open waters. The Great Salt Lake open waters at or below 4,208 feet are protected through the Utah Pollution Discharge Elimination System (UPDES) permit program for primary and secondary contact recreation, waterfowl, shore birds, and other water-oriented wildlife including their necessary food chain (Utah Administrative Code [UAC] R317-2-6). The 4,209-foot level also has been developed as an existing GIS data layer over a decade ago from U.S. Geological Survey (USGS) maps and aerial photographs (AGRC 2001). Note that the digitized 4,209-foot elevation might not have the same level of accuracy as the 4,217-foot elevation data.

The WDC team analyzed the effect of each alternative on the non-inundated habitat that would remain with the high and intermediate lake levels specified above. For each alternative, the analysis summarized, by habitat quality, the acres of directly affected wildlife habitat and the percentage of the total non-inundated wildlife habitat for each of the lake levels that these direct impacts would represent.

14.4.1.2 Methodology for Identifying Impacts to Wetlands and Waters of the U.S.

The Clean Water Act mandates an evaluation to determine a proposed project's least environmentally damaging practicable alternative; USACE uses this determination when deciding whether to issue a Clean Water Act Section 404 permit. This mandate was considered when assessing impacts to wetlands and other waters of the U.S.

Assessment of wetland quality, in terms of functions and values, was also conducted using UDOT's full Wetland Functional Assessment Methods as requested by USACE, EPA, and USFWS.

Note that USACE has not approved the wetland delineation GIS data layer describing wetlands and waters of the U.S. that was used for the analysis of direct and indirect effects on wetlands and waters of the U.S. Although the wetland data were identified following the formal wetland delineation process, USACE and the WDC team agreed that a formal wetland delineation report would be submitted for the selected alternative and would be submitted with the Clean Water Act Section 404 permit application.

What is a Section 404 individual permit?

Section 404 of the Clean Water Act regulates the discharge of dredged, excavated, or fill material in waters of the U.S. USACE is the federal agency authorized to issue Section 404 permits for certain activities conducted in wetlands or waters of the U.S. An individual permit is required for activities that would potentially affect jurisdictional wetlands that exceed 0.5 acre or 300 linear feet of stream.

Direct Impacts within the Right-of-Way

Impacts to wetlands and other waters of the U.S. from the project alternatives were calculated and assessed using the wetland and water feature data. A GIS analysis, which overlaid each alternative's footprint on the wetlands and waters data, was performed to calculate the acreage of directly affected wetlands and waters. The directly affected wetlands were classified by quality and type for each alternative. Linear feet of all linear waters (not ponds and lakes) were also calculated by overlaying the alternative's footprint onto the water feature layer and then measuring the linear feet of each feature that would be affected by the WDC alternative.

Water Quality and Hydrology Impacts adjacent to the Highway

For the EIS, the acreage of wetlands within 300 feet of the right-of-way was calculated to provide the acreage of wetlands adjacent to the highway for each alternative. The 300-foot distance was based on a literature review which showed that most effects on wetlands occur within 300 feet of the source. To evaluate the potential for water quality and hydrologic impacts to these wetlands, the WDC team evaluated the technical memorandum *Assessing Indirect Impacts to Waters of the U.S.* (HDR 2016). This memorandum assesses the potential indirect effects to jurisdictional and other waters of the U.S. as a result of the construction and operation of the WDC. The term *indirect* refers to impacts that could occur outside the direct wetland fill impact area.

Water Quality

The stormwater drainage design is described in Chapter 13, Water Quality. To minimize WDC stormwater runoff indirectly affecting wetlands, the WDC would be designed so that drainage diversions and detention basins would be included with the WDC design anywhere there are wetlands within 20 feet of the WDC right-of-way. These drainage design measures would minimize indirect impacts, but winter salt applications and roadway pollutants could still affect the water quality of wetlands. The pollutants could change the water quality of the wetlands adjacent to the WDC. See Chapter 13, Water Quality, for more discussion of the drainage design.

What is a detention basin?

A detention basin is a pond that holds stormwater runoff temporarily before releasing it.

To protect water quality during construction, UDOT would use appropriate measures such as mulch and diversion features to ensure that no construction-related discharges of stormwater to wetlands occur. See Chapter 13, Water Quality, for more discussion.

Hydrology

Another concern that must be addressed concerning indirect effects on wetlands is the effect that the WDC could have on hydrology. The Clean Water Act Section 404(b)(1) Guidelines list fluctuating water levels as a secondary impact that must be evaluated.

The WDC design would include structures (for example, pipes, culverts, or bridges) that would allow the conveyance and hydrologic connection of all surface waters crossed by the WDC. Culverts would be designed and constructed at channelized drainages to maintain surface flow, thereby maintaining hydrology in open-water areas, areas abutting riparian wetlands, and hydrologically connected adjacent wetlands. During the final design phase of the project, UDOT will conduct additional evaluation of the hydrologic connection of wetlands to minimize impacts to natural hydrologic connection features and try to maintain hydrologic connectivity comparable to the existing hydrologic conditions. However, the WDC would change the connectivity compared to existing conditions, which could affect the wetlands adjacent to the highway.

Along the WDC action alternatives are four locations where wetlands would be bisected. These locations are a complex south of Glovers Lane in Farmington where a small drainage feature connects the wetlands, a wetland area in west Farmington on the conservation easements where a drainage feature connects the wetlands, a wetland area north and west of the intersection of Gentile Street and Bluff Road which is connected by groundwater, and immediately south of 1800 North and 4100 West where wetlands are connected by a drainage feature that has been altered by development. In these locations, UDOT will try to maintain hydraulic connectivity through the use of culverts and other design features.

The WDC would be constructed above the natural ground elevation, so it would not directly affect the shallow groundwater aquifer. However, the fill material used to construct the highway could change soil conditions and possibly restrict shallow groundwater flows under the highway. For more information, see Chapter 13, Water Quality.

14.4.2 No-Action Alternative

With the No-Action Alternative, the WDC would not be constructed. No direct impacts to ecosystem resources would occur from WDC-related activities. Other transportation projects identified in the Wasatch Front Regional Council's (WFRC) Regional Transportation Plan and by local communities would be constructed. These projects, along with other future projects, could affect ecosystem resources in the future.

As development continues on the west side of Davis and Weber Counties, previously undeveloped land—mostly consisting of farmland and pasture land that provides some wildlife habitat—would be lost. The Utah Governor's Office of Management and Budget has projected that there could be 66,000 acres of new development between 2005 and 2040, most of which would occur on farmland and pasture land (GOMB 2008). The No-Action Alternative would not prevent this future development. The most substantial effect on wildlife habitat would be the projected conversion of some areas of farmland to residential or commercial development.

Most of the jurisdictions along the proposed WDC action alternatives expect most of their communities to be fully developed by 2040 (see Chapter 23, Indirect Effects). If the WDC is not constructed, the agricultural and open land that would be used for the WDC would likely be developed for other urban uses and associated infrastructure, which could cause ecosystem impacts similar to those described in this chapter for the WDC action alternatives.

14.4.2.1 Wildlife (Habitat Types)

As developments are platted in the western part of Davis and Weber Counties in Farmington, Kaysville, Layton, Syracuse, Clinton, West Point, Hooper, and West Haven, much of the existing farmland habitats would be lost. The Cities' land-use plans show large areas of agricultural land and upland habitats being converted to urban uses. Within these cities, most of the available land for development is the remaining farmland. Wetland habitats along Bluff Road and within city limits would likely be affected by residential and commercial developments as cities expand (see Figures 14-4 and 14-5, Wildlife by Habitat Type, in Volume IV). Direct and indirect effects associated with future development would result in additional loss of habitat, habitat fragmentation, and increased ambient noise levels.

What is a plat?

A plat is a map showing the divisions of a piece of land. Further refinement often splits these pieces into individual lots, known collectively as a subdivision.

14.4.2.2 Threatened, Endangered, and Sensitive Species

There are no federally listed threatened or endangered species in the ecosystem impact analysis area, so no impacts would occur with the No-Action Alternative. The western yellow-billed cuckoo, a threatened species under the Endangered Species Act, could have habitat in the ecosystem impact analysis area. There have been a few sightings, but there currently are no recorded observations of this species near (within 1 mile of) any of the WDC alternatives, and the Endangered Species Act's final listing for the western yellow-billed cuckoo did not designate any critical habitat for this species in Davis or Weber Counties.

There are some state listed species with potential habitat and known recent or historic occurrences in the impact analysis area, such as bald eagle, burrowing owl, ferruginous hawk, long-billed curlew, and kit fox (for a complete list and description, see Section 14.3.3.2, Threatened, Endangered, and Sensitive Species). All state listed sensitive species habitats in the area could be affected by ongoing activities that would occur with the No-Action Alternative. The loss of these areas to ongoing development could further fragment habitat for state listed sensitive species, reduce the size of the habitat through direct construction, and indirectly adversely affect habitat use due to human presence and related noise.

14.4.2.3 Migratory Birds

With the No-Action Alternative, no direct impacts to migratory birds would occur due to WDC-related activities. With the No-Action or action alternatives, other transportation projects identified in WFRC's Regional Transportation Plan and by local communities would be constructed and could affect migratory birds in the future. All migratory bird habitats in the ecosystem impact analysis area could be affected by ongoing activities that would occur with the No-Action Alternative. The loss of these areas to ongoing development could further fragment migratory bird habitat, reduce the size of the habitat through direct construction, and indirectly adversely affect habitat use due to human presence and related noise.

14.4.2.4 Wetlands

Wetlands and linear aquatic features could be gradually permitted and filled under many different smaller, unrelated development and infrastructure projects that could occur if the No-Action Alternative is implemented. In addition, with the No-Action and action alternatives, much of the area in western Davis and Weber Counties within the WDC study area would be developed as a result of the predicted population and employment growth (GOMB 2008). These developments would likely fill wetlands, especially along Bluff Road (see Figures 14-1 and 14-2, Wetlands by Overall Quality Rating, in Volume IV). Because any impacts to jurisdictional wetlands and waters would be regulated by USACE, it is likely that there would be no overall net loss of wetland functions or waters of the U.S.

14.4.2.5 Summary of Impacts to Ecosystem Resources

With the No-Action Alternative, the WDC would not be constructed. No direct or indirect effects on ecosystem resources would occur due to WDC-related activities. Continued residential and commercial development and related infrastructure projects could harm ecosystem resources throughout Davis and Weber Counties.

14.4.3 General Impact Information for the WDC Action Alternatives

14.4.3.1 Wildlife Habitat Fragmentation, Edge Effects, and Barrier Effects

Fragmentation

All of the WDC action alternatives would directly cause some loss of wildlife habitat, which could displace the existing birds, mammals, amphibians, and reptiles and increase the number of deaths of these animals. In addition, the direct loss of wildlife habitat would fragment other habitat and cause additional pressure on surrounding habitat parcels that are less fragmented. Urbanization and development also change the wildlife structure; some species thrive, while others that are less tolerant of human activity leave the area.

The area east of the proposed rights-of-way from Farmington to Syracuse and all of the area north of Gentile Road in Syracuse are largely modified by development and are experiencing continued rapid urban growth. Projected future growth in these areas is likely to result in complete build-out. Additionally, most of this land is privately owned parcels that are not managed for wildlife habitat. Most of the privately owned parcels are less than 10 acres.

What is build-out?

Build-out means that there is no more land available for new development because any undeveloped land is already being used for its intended use of open space, agriculture, or other defined uses.

However, the habitats in these areas do not appear to be ecologically unique or high-quality habitats. The area west of the proposed alternatives, including the Farmington Bay WMA and the Great Salt Lake Shorelands Preserve, retains a greater proportion of higher-quality wetlands and wildlife habitats. Because the area east of the proposed alternatives is largely developed and would likely continue to be developed with or without the WDC, habitat fragmentation would continue in this area. The WDC would also cause some additional fragmentation but is not expected to reduce the diversity of habitat types.

In addition to the primary fragmentation effect described above, all the WDC action alternatives would fragment existing wildlife habitat patches at a finer scale. Each action alternative would generally reduce the size of habitat patches available to wildlife in the area and reduce the number of larger patches, particularly in upland habitats. Most of the habitats that would be affected by the WDC are on land that is farmed or used for pasture except for a few parcels of the Great Salt Lake Shorelands Preserve.

Although the WDC action alternatives would be built mostly on farmland or pasture that has been fragmented, the additional fragmentation would likely have a number of effects on wildlife habitat, including a reduction in habitat patch size, an increase in the perimeter-to-area ratio of patches and associated edge effects, reduced connectivity between habitat patches, and the introduction of barriers to dispersal for some species. Reduced habitat patch size can decrease the resources available to wildlife species, which in turn reduces the local carrying capacity for those species.

Moreover, smaller habitat patches are typically characterized by an increase in the length of the patch edge relative to the patch area, as well as a reduction in the distance from the edge to the center of the patch. These changes can favor a reduction in the ecological buffering capacity of the patch for species that are sensitive to detrimental factors surrounding the patch (such as microclimate, competition from other species, predation, noise and human disturbance, pollution, and highway-related deaths).

Construction of any of the WDC action alternatives would also introduce a physical barrier to movement and dispersal of some species. The wildlife species most affected by habitat fragmentation would be those with low dispersal capabilities, such as small mammals, reptiles, and amphibians (Forman and others 2003).

If individual animals, such as mammals, reptiles, and amphibians, are separated from their core populations by the highway and wanted to disperse or migrate, this would require longer, roundabout travel, possibly through marginal or unsuitable habitat, to reach formerly connected areas. The increased level of exposure from such longer travel paths would increase the amount of energy required and increase the risk of animals being killed. Reduced connectivity between habitat areas could also reduce the gene flow between populations, resulting in decreased biodiversity or genetic variability (Transportation Research Board 2002; Garner and others 2005; Dixon and others 2007; Marsh and others 2008). Depending on the species, the impact could be moderate and could have an appreciable effect on the abundance and distribution of the species.

However, birds would likely be less affected because they can generally move more readily between available habitat patches both within and outside the WDC study area, although some mortality caused by vehicles that use the highway could occur if birds migrate over the road to access a different habitat patch. A quantitative assessment of the habitat fragmentation impacts is provided under each alternative evaluation in this chapter.

The overall effects of construction of the WDC on habitat fragmentation are summarized below.

- The number of habitat patches would increase with all action alternatives. There are currently 665 habitat patches (including all habitat types but urban). With the A Alternatives, the number of patches would increase to 795 or 809 patches, and with the B Alternatives, the number would increase to 773 or 776 patches. The A Alternatives would create more patches because they are longer than the B Alternatives and would impact more patches.
- The mean (average) patch size would decrease slightly from 490 hectares under current conditions to 481.6 to 484.0 hectares with all alternatives. The small change in mean patch size from current conditions suggests that the existing patches are already greatly fragmented and that there would be little fragmentation from the WDC action alternatives.
- All of the unique or unusually valuable habitat types (terrestrial or wetland/riparian) in the area east of the WDC action alternatives would still be represented in the remaining area west of the alternatives. Therefore, the primary fragmentation effect

of bisecting habitat with the WDC action alternatives would not reduce the diversity of habitat types available in general but could still decrease the local movement of some species. If the reduction in size of some patches is too small, it could make these patches unsuitable for some species, and they would avoid the habitat patch.

- The location that could experience the greatest degree of habitat fragmentation is the Gentile Street area (Alternatives A1 and A2). In this location, the alternatives would split pastures that could provide some connection or corridors for wildlife moving from the Great Salt Lake shore areas to the interior of Davis County and back. Fragmentation would also occur in the Bluff Road area (Alternatives B1 and B2), but this area is surrounded by small farms and residential development with more development to the east, so overall fragmentation is less likely to affect wildlife moving from the lake to habitats on the shore.
- The section that all alternatives share, from I-15 to Gentile Street, is an example of an area with dense human land use (such as farming, housing, and commercial) close to the Great Salt Lake shore. The alternatives run along the eastern edge of the Great Salt Lake shore areas. Intensive farming and residential development have encroached all the way to the edge in most locations. For species such as ducks, geese, and ibis that might use croplands for foraging, the WDC action alternatives could act as a minor barrier, since the birds would have to fly over the traffic lanes to access the croplands. This effect would likely decrease over the years as more farms are developed for residential or commercial purposes. The effect of a potential barrier such as a highway varies widely among species, but not in predictable ways based on species' life histories (Bélisle and St. Clair 2001). For non-flying species, this effect might be stronger, since the highway might act as a deterrent or increase the risk of death.

Many of the future wildlife habitat and fragmentation impacts would be caused by future urban growth. Section 14.4.8, Recommendations to Minimize Growth Impacts to the Ecosystem, describes the ways the local communities could implement land-use control measures to reduce impacts to sensitive habitats.

Edge Effects and Invasive Species

The WDC could create what is referred to as *edge effect*. Edge effect refers to the boundary between two habitats such as a road and the natural habitat beyond (Coffin 2007). This edge can be abrupt or more gradual depending on the amount of edge created by the road (Coffin 2007). Roadside edges also tend to facilitate the establishment on non-native vegetation. Roadsides often provide habitat for generalist species, both plants and wildlife, which can tolerate less hospitable conditions. This is especially true for plant species that can survive mowing, soil compaction, and chemicals from vehicle emissions and road treatment (Forman and others 2003; Coffin 2007). Roads can act as a conduit, where vehicles aid in the introduction and dispersal of exotic plant species. These species are able to take advantage of and establish in the bare patches on the road shoulder with ample sunlight (Forman and others 2003; Coffin 2007). Successful roadside species are ones that can get there, establish, and spread when conditions are favorable. Invasive species typically have seeds that are easily dispersed and viable and can survive in the high light and rough conditions of the roadway shoulder.

Barrier Effects

The WDC could induce barrier effects on wildlife. The barrier effect can be both physical, where a road creates a movement barrier, and behavioral, where wildlife species respond with behavioral avoidance toward a road (Forman and Alexander 1998; Coffin 2007; D'Amico and others 2016). The barrier effect could influence species differently depending on the animal's behavior, population density, and ability to disperse.

Physical barriers from the WDC could be detrimental to wildlife, because the highway could block migration of some wildlife from farm fields to the east of the highway and natural habitat associated with the Great Salt Lake on the west. Wildlife could be hit or blocked trying to reach resources such as food, water, den sites, or mates (Forman and others 2003; Coffin 2007). Population fragmentation occurs when wildlife populations are split up into smaller subpopulations and genetic exchange between the groups ceases to occur because the road is impassable. The overall effect is to make local extinctions more likely as sources of immigrants are disconnected (Forman and Alexander 1998; Forman and others 2003; Coffin 2007).

14.4.3.2 Highway Mortality

Some wildlife might be killed during construction of the WDC action alternatives, particularly less-mobile species such as amphibians and invertebrates. Once a WDC action alternative is constructed, the increased traffic would increase the number of highway-related deaths of individuals of some species—particularly birds foraging and flying between habitat patches on different sides of the highway (Mumme and others 2000) and dispersing amphibians, reptiles, and small mammals (Seiler 2001). This increased number of highway-related deaths would be more likely when the lake level is higher and when waterfowl and shorebirds are more likely to use upland habitats adjacent to the highway.

A study of a road in France 1 year after its opening found that traffic considerably affected vertebrate populations. Overall, the study concluded that roadway traffic severely influenced both wildlife species demography and population exchanges, resulting in effective population isolation. The volume of traffic on the roadway (19,320 vehicles per day) can be regarded as enough to severely affect local populations of certain species (Lode 2000). Note that this study was conducted in a much less developed area than that of the WDC alternatives. The WDC alignments have urban development along the east side, making it less likely that abundant wildlife populations would migrate across the WDC to the west.

Another study found that, despite the high number of wildlife mortalities each year, vehicle-caused mortality has been assumed to have less of an effect on persistence than some indirect effects of roads. Only three bird species found in the United States appear to suffer population declines as a result of road mortality: Florida scrub-jay, Audubon's crested caracara, and Hawaiian goose (Kociolek and others 2011).

A study on mortality of barn owls along a 248-kilometer (154-mile) segment of Interstate 84 in Idaho documented vehicle collision mortality rates of barn owls of up to 6 owls per kilometer per year. Although it is difficult to correlate the density of barn owls and habitat of the study in Idaho to the WDC study area, the Idaho study concluded that barn owls in the region of the study might not persist under that level of mortality without significant immigration or management (Boves and Belthoff 2012).

The right-of-way fences proposed to border the highway right-of-way would help reduce these impacts by forcing some birds, particularly larger waterfowl, to fly higher and/or by deterring other species from trying to cross the highway. The drainage culverts that would be installed under the highway could also help some wildlife move to the other side of the highway without being killed. However, depending on the size and shape of the culverts, smaller species and species more willing to use the culverts would benefit more than larger or warier species such as mule deer.

New stormwater ponds, ponding ditches, highway landscaping, and vehicle lights could attract some wildlife species, thereby encourage nesting, foraging, and predation. These new elements could indirectly result in some wildlife deaths if these wildlife activities occur along the proposed alternatives.

In addition, traffic can increase the general mortality rate in an area, though this phenomenon is not well understood (Transportation Research Board 2002). Some biologists suggest that highway noise can mask a species’ predator warning calls and the movement of the predators themselves (Dooling and Popper 2007). However, the opposite can also occur—highway noise can decrease predation if the predator relies on sound to find prey (Francis and others 2009; Siemers and Schaub 2011).

Overall, the effects of highway-related wildlife deaths would likely be similar south of Gentile Street with all the WDC action alternatives. North of Gentile Street, the A Alternatives could have more potential for wildlife mortality compared to the B Alternatives since there is more undeveloped land on both sides of the A Alternatives. These effects could cause a detectable change in some wildlife, but, given that the WDC would be in only a small segment of the ecosystem impact analysis area, the change would not likely affect the viability of any species.

14.4.3.3 Wildlife Noise Impacts

Overview of Noise Impacts

The effect of construction and traffic noise on wildlife has been an ongoing topic of research in the transportation industry. In the last decade, several studies have been published on the effects of human-induced noise on wildlife, though no conclusive distance of effect from roads has been determined. Few noise studies have been conducted for invertebrates, reptiles, or amphibians, but more studies have been conducted for fish, birds, and mammals. For birds, noise can have a substantial effect; however, the results are not consistent or universal. Some species are adversely affected, many are unaffected, and others become more common near interstate highways (Peris and Pescador 2004; Kaseloo 2005; FHWA 2004; Parris and Schneider 2009).

Possibly the greatest effect of noise on wildlife is its interference with communication if traffic noise is in the same decibel range as the audible communication range for a species. Birds use vocal signals to communicate information about many aspects of their status and behavior that are important for survival, social cohesion, and reproductive success. Songs and calls function to identify the caller’s species, sex, age (experienced adult versus juvenile), territorial status, and motivational state (such as aggressive or submissive); to attract mates and repel rivals; to stimulate egg laying and synchronize hatching; to strengthen pair bonds; to signal changes in domestic duties; to entice young to eat; to warn of predators; to maintain flock cohesion; and to incite group mobbing action against intruders (FHWA 2004; Dooling and Popper 2007). Therefore, the life history period during which most species would be most sensitive to added noise from the WDC is the reproductive period, which is generally in the spring through mid-summer for most species.

Many species have complex vocal repertoires of songs and calls that can vary subtly in many ways, including frequency and timing of use, intensity (amplitude variation), and syntax (order of signal presentation). Clear transmission and reception of these signals and the subtleties of their variation are critical for maintaining the normal biological and ecological function of each species. Other noise effects include stress and damage to hearing (Dooling and Popper 2007).

Impacts from increases in noise levels could also cause an overall reduction in functional habitat area, reduce connectivity between habitats, and introduce barriers to dispersal for some species (Forman and others 2003). The reduced habitat size could decrease the habitat resources available to wildlife, which in turn would reduce the local carrying capacity (Seiler 2001; Torres and others 2011). These changes could reduce the ecological buffering capacity of the habitat areas and thus affect wildlife. These effects would be greater in previously undisturbed native habitats than in either urban or disturbed partially native habitats where species that are able to thrive in such places have presumably adapted to the increased levels of noise and other disturbances.

What is masking?

Masking is the direct interference of sound with effective communications between organisms.

Highway noise typically is neither loud nor startling enough to cause marked stress effects on wildlife (Sarigul-Kligin and others 1977). However, highway noise can mask important vocal communication and natural sounds important for mate attraction, social cohesion, predator avoidance, prey detection, navigation, and other basic behaviors. Using birds as an example for explaining how noise created from highways can affect a wildlife species, vocal communications can be masked when highway noise interferes with the transmission of a sound by drowning out the sound or parts of the sound (for example, the low-amplitude elements of a bird song) or by degrading the sound to a point where it is no longer recognizable to other members of a species (Dooling and Popper 2007).

Depending on the degree of masking and the particular species' capacity to adapt (for example, by singing louder), sound masking could cause a species to abandon an area or could reduce the species' ability to reproduce and survive (Halfwerk and others 2011). Sound masking could also prevent males from attracting mates or repelling territorial rivals. Additional energy could be required for a male bird to maintain a territory and to sing louder or alter the frequency of its song (Patricelli and Blickley 2006; Parris and Schneider 2009). Predator warning signals and parent-offspring signals can be impaired. All of these factors could reduce the survival and reproductive success of affected populations adjacent to the highway.

Not all bird species are affected the same way by noise. These masking effects are highly species-specific and depend largely on the unique bioacoustic characteristics of each species' vocal signals. Some species might be more tolerant of increased noise or might be able to adapt their communications by modifying the pitch or speed of their song (Slabbekoorn and den Boer-Visser 2006; Leonard and Horn 2008; Summers and others 2011). Some studies found that the distance at which a species could be affected by noise can extend from less than 125 feet to much greater than 3,500 feet from the highway (Benitez-Lopez and others 2010).

Noise effects might not apply equally to other groups, such as reptiles and amphibians, because of differences such as calling at night instead of the daytime (Herrera-Montes and Aide 2011). In addition, the effects of roads on reptiles and amphibians appear to be local and likely due to highway-related deaths or creating a barrier to movement. Mammals (particularly large species) might avoid highway noise, but other road effects are likely involved (Fahrig and Rytwinski 2009; Benitez-Lopez and others 2010). However, there is evidence for smaller mammal species that noise might be less important than the additional habitat and corridors for movement that could be provided by roads (FHWA 2004).

Legacy Parkway Avian Noise Research

The Legacy Avian Noise Research Program was designed to assess the impacts of highway noise on breeding bird communities in the Great Salt Lake ecosystem in an area that is similar to the WDC study area. This section discusses the findings of the final report that summarizes and provides conclusions based on 4 years of data collection (2007–2010) (BIO-WEST 2011). The effects of highway noise on breeding bird communities were assessed at nine study sites throughout the Great Salt Lake ecosystem by measuring effects of noise on (1) the abundance, diversity, and richness of breeding bird communities and (2) the nesting success of two abundant and widespread semicolonially nesting shorebirds: American avocet (*Recurvirostra americana*; hereafter, avocet) the black-necked stilt (*Himantopus mexicanus*; hereafter, stilt).

The effects of highway noise on breeding bird communities in the Great Salt Lake ecosystem were evaluated by assessing species-specific density estimates generated from the nine study sites. The report concluded that there was a very weak relationship between highway noise and species diversity or richness near the highway.

Additionally, highway noise did have apparent effects on the density of yellow-headed blackbird (*Xanthocephalus xanthocephalus*) and common yellowthroat (*Geothlypis trichas*). Common yellowthroat abundance was negatively correlated with distance from the highway, which suggests that highway noise, as relatable to distance, could reduce the distribution of common yellowthroat. Such effects were presumed to be the result of masking. The density of yellow-headed blackbird was positively related to the distance from the highway. This positive relationship, which seems counterintuitive, might be explained by several factors, including yellow-headed blackbirds' social structure, auditory capacity, and visual displays.

To assess the relationship between highway noise and nesting success, noise data were also collected at 1,084 stilt, avocet, and snowy plover (*Charadrius alexandrinus*) nests at a variety of distances from the highway after the breeding season. From a productivity standpoint, the effects of noise on nesting success are less clear. There was no evidence of a relationship between highway noise, distance to the highway, distance to the nearest neighbor, and nesting success for avocets, stilts, and plovers collectively. However, when looking at the species separately, there was a positive relationship between avocets' nest success and the distance to the nearest neighbor, but this relationship likely has less to do with highway noise effects and more to do with avocets' biology, such as their preference for nesting semicolonially (Robinson and others 1997).

Conversely, noise levels at successful nests of all three species were higher than noise levels at failed nests. This positive relationship might be caused by highway effects such as noise or other factors changing predator communities by excluding species that kill birds in avocet and plover nests or by otherwise interfering with predators' ability to kill birds in these nests. However, although the primary cause of nest failure for all species was birds being killed by predators, a clear link between noise and deaths due to predators was not apparent.

The report concluded that, considered collectively, both point-count and nest success data collected over 4 years do not explain the effects of highway noise on breeding bird communities in the Great Salt Lake ecosystem. Inferences about highway noise on the effects of both avian abundance and nesting success should be treated cautiously given the limitations in collecting noise data.

Comparison of Noise Data between the WDC and Legacy Parkway

Legacy Parkway is a useful comparison to the WDC because Legacy Parkway was also constructed close to the edge of the Great Salt Lake shore habitats. Also, its maximum traffic volume is similar to what is predicted for the WDC (27,600 vehicles per day).

The *Legacy Avian Noise Research Program Final Report* (*Legacy Report*; BIO-WEST 2011) measured noise data for 3 to 5 years on the west side of Legacy Parkway, which is on the east shore of the Great Salt Lake. Noise levels averaged 43.5 to 48 dBA about 800 feet west of Legacy Parkway and 48 to 53.5 dBA about 400 feet from Legacy Parkway. According to the BIO-WEST data, noise levels appeared to remain in the mid-40s dBA for over a mile and a half or more until dropping into the upper 30s dBA at distances 2 miles or farther from Legacy Parkway. Since the WDC is predicted to have similar traffic volumes in 2040 as the current volumes for Legacy Parkway and would use similar noise-reducing pavement, the noise levels from the WDC would be similar at those same distances (for more information, see the section titled Noise in Section 14.4.1.1, Methodology for Assessing Impacts to Wildlife Habitat).

Note that noise levels were higher than the levels mentioned above at the same distances from Legacy Parkway where it runs adjacent and parallel to I-15. The high traffic volumes and other noise associated with the I-15 corridor were the likely source for the increased noise levels. In addition, in some cases, noise levels were slightly higher (by about 5 dBA) over a mile west of Legacy Parkway, but that increase is likely because that area is directly underneath the flight path for the Salt Lake City International Airport.

Noise monitoring conducted for the WDC Project found similar noise levels as those recorded from the operational Legacy Parkway in the *Legacy Report*, which suggests that background noise levels are already similar to what would be experienced after the WDC is built. Some of the quietest background noise levels near the WDC action alternatives, 37.4 to 41 dBA, are along the western part of Gentile Street in Syracuse and include areas of the Great Salt Lake Shorelands Preserve. Therefore, the A Alternatives, which parallel this area, could substantially increase noise levels and result in greater noise impacts.

Background noise levels in the area between Gentile Street and the Central Davis Sewer Treatment Plant in Kaysville vary widely, from a monitored low of 34.9 dBA to a monitored high of 67.3 dBA. Generally, in this area, most noise monitoring locations were in the 43-to-55-dBA range.

The Glovers Lane segment south of the Central Davis Sewer Treatment Plant is similar to the Kaysville segment but has lower noise levels of 42.5 to 45.5 dBA in areas farther from residential developments and levels of 49.7 to 55.5 dBA in mixed residential and agricultural areas.

In the areas north of Antelope Drive and south of 5500 South in Hooper, background noise levels are generally higher but are also highly variable depending on the proximity of monitoring sites to some of the higher-traffic surface roads in the area, such as 700 South, 1800 North, and 4500 West in West Point. Background noise levels range from about 40 to 71 dBA, with most in the 45-to-60-dBA range. This area is characterized by a mix of cropland, livestock farms, and relatively new residential developments expanding from the east. This area also experiences frequent fly-overs from loud military aircraft that use Hill Air Force Base.

In conclusion, the current noise levels near the proposed WDC alternatives are similar to the current noise levels in areas adjacent to Legacy Parkway, such as the Legacy Nature Preserve. The *Legacy Report* concluded that highway noise could have had both positive and negative impacts to selected species in breeding bird communities in the Great Salt Lake ecosystem. The *Legacy Report* found that there was no statistically significant relationship between avian density and distance to the nearest highway, and that there were statistically significant relationships between species richness and noise and between species diversity and noise. In addition, the traffic volumes currently on Legacy Parkway are similar to those predicted in the future for the WDC. Therefore, based solely on the results of the *Legacy Report*, the noise effects on wildlife in the habitats adjacent to the WDC cannot be conclusively determined.

Construction Noise

During construction, ambient noise levels would temporarily increase due to construction activities. Construction noise would result from pile driving or drilled shaft construction (proofing or vibrating) into bedrock substrate for construction of bridges, noise associated with construction activities (for example, clearing, grading, excavation, and shaft drilling), and noise associated with construction equipment moving to and from the project site.

Summary of WDC Noise Levels and Potential Effects

Noise levels from the WDC action alternatives would be similar among each other and similar to what was reported in the *Legacy Avian Noise Research Program Final Report* (*Legacy Report*; BIO-WEST 2011). Noted below are some key points for the WDC action alternatives.

- Noise levels from the WDC action alternatives would be similar to those monitored as part of the *Legacy Report*. The report concluded that there was a very weak but significant relationship between highway noise and species diversity or richness. Additionally, highway noise (distance from the highway) did have apparent negative effects on the abundance of common yellowthroats and positive effects on the abundance of yellow-headed blackbirds. From a reproductive productivity standpoint, the effects of noise on nesting success are less clear. There was no evidence of a relationship between highway noise, distance to the highway, and nesting success for American avocets, black-necked stilts, or snowy plovers.
- The *Legacy Report* is relevant to the WDC because of the WDC's proximity to similar wildlife habitat and because its roadway design and anticipated traffic volumes are similar to those of Legacy Parkway. However, the *Legacy Report* is only one study that has looked at potential impacts to wildlife from highways. Other studies that looked at different species in different locations (such as Forman and others 2003; Kuitunen and others 2003; and Halfwerk and others 2011) have concluded that noise from highways could affect bird species at various distances from the highway, and this noise could change habitat quality and consequently change the abundance and distribution of the species. The distance at which a species could be affected by noise can extend from less than 125 feet to much greater than 3,500 feet from the highway (Benitez-Lopez and others 2010).
- All WDC action alternatives share a common segment that parallels the Great Salt Lake Shorelands Preserve from Kaysville to Syracuse. This area has some suburban developments up to the east boundary of the preserve. The WDC would introduce a new noise element into habitat set aside for wildlife protection. The segments of the action alternatives from Kaysville to Syracuse would have the greatest potential for noise impacts on wildlife of any of the WDC segments.
- Both of the A Alternatives would be near the north end of the Great Salt Lake Shorelands Preserve immediately north of Gentile Street in Davis County where existing noise levels are some of the lowest in the WDC study area. This segment

would have greater potential for noise impacts on the preserve property and would bisect farmland and a conservation easement that provide a buffer between the preserve and suburban development. The B Alternatives, which are north and east of this area, would have less noise and no fragmentation impacts to this portion of the preserve (see Figure 14-3, Wildlife Management and Conservation Areas, in Volume IV). About 840 more acres of the preserve property would be within 3,900 feet of the highway with the A Alternatives than with the B Alternatives (see Section 14.4.3.8, Impacts to Conservation Areas).

- Both of the B Alternatives would be immediately west of Bluff Road in Syracuse and West Point in medium- to high-quality wildlife habitat (see Figure 14-7, Wildlife by Habitat Quality Ranking, in Volume IV). These alternatives would have potential noise impacts on this habitat.

14.4.3.4 Water Quality Impacts

Construction activities would remove vegetation and disturb soil, which could lead to erosion of and increased sedimentation in riparian, wetland, and stream habitats, and such sedimentation could decrease water quality. Additionally, construction activities could release hazardous materials and wastes such as oil, grease, and fuels used for construction equipment, as well as other products such as concrete or silicants. If these materials entered riparian, wetland, or stream habitats, they would lower the water quality.

To minimize construction-related discharges of pollutants, a UPDES stormwater construction permit and a Stormwater Pollution Prevention Plan would be required for construction activities. Best management practices specified in the Stormwater Pollution Prevention Plan would be used during construction to minimize impacts to surface water. Water quality impacts related to construction are discussed in more detail in Section 20.3.4, Water Quality Construction Impacts.

Direct operational stormwater impacts are assessed and calculated by the area of new impervious surface created by the WDC. The primary operational impacts to water quality are due to stormwater runoff from new impervious surfaces created from the new road and bridges over riparian, wetland, and stream habitats. All the WDC action alternatives would result in similar increases in highway runoff contaminants.

Where habitat patches are bisected by the roadway, this could increase the levels of various airborne and waterborne pollutants. In particular, small, isolated wetlands are more likely than larger ones to concentrate pollutants, which could potentially degrade habitat quality (Forman and others 2003).

Chapter 13, Water Quality, lists the primary contaminants from highway runoff (see Table 13-6, Typical Highway Runoff Contaminants). The primary contaminants reduce water quality and potentially affect wildlife in a variety of ways (Forman and others 2003). Because of the increased transportability of many of these contaminants in aquatic systems, wetlands adjacent to the highway would most likely be the areas most affected. The proposed stormwater best management practices listed in Chapter 13, Water Quality, would be designed to reduce pollution associated with stormwater runoff and decrease runoff velocities into waterways.

Stormwater runoff from new bridges would be conveyed off the bridges through pipes and would be treated using standard best management practices before being discharged into surface waters. The proposed stormwater treatment facilities would be used to treat runoff during the entire operation of the highway. See Chapter 13, Water Quality, for specific impacts related to water quality and proposed treatment methods for water quality impacts.

14.4.3.5 Visual and Artificial Light Disturbance

Behavioral avoidance refers to an individual changing its behavior in order to avoid a road. Behavioral avoidance can take many forms including light avoidance and visual avoidance (Forman and Alexander 1998; Fahrig and Rytwinski 2009). Visual avoidance can be caused by the introduction of vehicles on the WDC which can cause wildlife to avoid the area around the highway.

New artificial lighting associated with the WDC would include street lamps at on ramps and off ramps, luminaries (lighting for highway signs), and traffic headlights. When the Great Salt Lake level is high, many migratory birds are likely to use the wetlands and uplands close to the highway. During periods of low visibility, the lights at intersections could attract migratory birds that then become disoriented. Under such conditions, birds could collide with moving vehicles or light poles. Although such bird deaths have been documented in the Great Salt Lake Basin and elsewhere (Jones and Stokes 2005), adverse low-visibility weather in the WDC study area generally occurs during winter inversions from December through February. The length and duration of winter inversions vary from year to year depending on weather conditions.

For the WDC roadway, lights would be installed only at the six interchanges and intersections over the 20-to-22-mile alternatives, and all lights would be directional lights pointed toward the ground (dark-sky lighting). The main highway would not be lighted. Overall, the WDC action alternatives would add a minimal amount of light over the length of the alternatives to the existing conditions. The effects of light on birds, amphibians, mammals, fish, aquatic invertebrates, and terrestrial invertebrates also are likely to be detectable in the area of interchanges and intersections (Jones and Stokes 2005). The light disturbance impacts would be similar among all WDC action alternatives.

14.4.3.6 Changes in Lake Level and Habitat Availability

To account for the dynamics of the level of the Great Salt Lake, the WDC team examined the combined effects of natural inundation from changes in lake level and implementation of each WDC action alternative. This analysis was conducted to determine how these factors act in concert to affect the pattern of overall availability of wildlife habitats. The analysis in this section was conducted by determining the remaining wildlife habitat at each lake level and then subtracting the WDC right-of-way from the remaining wildlife habitat. If the level of the Great Salt Lake inundated an area, it was not considered to be “available” habitat, and the

WDC alternatives were not considered to affect these areas since they would not be considered available habitat in this scenario.

Table 14-9 shows the percentage change in wildlife habitat with each WDC action alternative and shows that there would be little difference in impacts among the action alternatives. The percentages in Table 14-9 represent impacts to the non-inundated wildlife habitats excluding urban, croplands, and hayfields. As shown in the table below, there is very little difference between lake levels and the percentage impact at the different levels. In the area evaluated for this analysis, almost all land is higher than 4,209 feet in elevation (all but about 106 acres), so the percentages for these two lake levels are very similar. As the lake elevation increases to 4,217 feet, the amount of total acreage decreases by about 2,300 acres, but the percentage impact can decrease because the alternative's right-of-way would be in the inundated area and would not decrease available habitat because it would be already covered by water from the Great Salt Lake. Since this overlap would now be inundated, that area would not count as an impact from the alternative.

Table 14-9. Acreage and Percent Impacts to Non-inundated Wildlife Habitat at Different Lake Elevations for the Action Alternatives

	4,202 Feet[a]		4,209 Feet[b]		4,217 Feet[c]	
Wildlife Quality	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Alternative A1						
High	49.4	0.5	49.4	0.5	46.1	0.6
Medium	210.9	4.1	208.2	4.0	177.0	3.4
Low	101.2	3.6	101.2	3.6	95.9	3.5
Total	**361.5**	**1.9**	**358.8**	**1.9**	**319.0**	**2.0**
Alternative A2						
High	45.8	0.4	45.8	0.4	42.5	0.5
Medium	202.6	3.9	199.8	3.9	168.6	3.3
Low	106.4	3.8	106.4	3.8	101.1	3.6
Total	**354.8**	**1.9**	**352.0**	**1.9**	**312.2**	**1.9**
Alternative B1						
High	48.9	0.5	48.9	0.5	45.6	0.6
Medium	277.7	5.4	274.0	5.3	242.7	4.5
Low	120.9	4.3	120.9	4.3	115.6	4.2
Total	**446.5**	**2.4**	**443.8**	**2.4**	**403.9**	**2.5**
Alternative B2						
High	45.3	0.4	45.3	0.4	42.0	0.5
Medium	265.6	5.2	262.9	5.1	231.6	4.5
Low	121.9	4.3	121.9	4.4	116.6	4.2
Total	**432.8**	**2.3**	**430.1**	**2.3**	**390.2**	**2.4**

(*continued on next page*)

Table 14-9. Acreage and Percent Impacts to Non-inundated Wildlife Habitat at Different Lake Elevations for the Action Alternatives

	4,202 Feet[a]		4,209 Feet[b]		4,217 Feet[c]	
Wildlife Quality	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Alternative A1 with Wetland Avoidance Options						
High	36.8	0.4	36.8	0.3	33.5	0.4
Medium	210.5	4.1	209.3	4.1	179.4	3.5
Low	101.2	3.6	101.2	3.6	95.9	3.5
Total	**348.5**	**1.9**	**347.3**	**1.9**	**308.8**	**1.9**
Alternative A2 with Wetland Avoidance Options						
High	33.2	0.3	33.2	0.3	29.9	0.4
Medium	202.2	3.9	201.0	3.9	171.0	3.3
Low	106.4	3.8	106.4	3.8	101.1	3.6
Total	**341.8**	**1.8**	**340.5**	**1.8**	**302.0**	**1.9**
Alternative B1 with Wetland Avoidance Options						
High	36.3	0.3	36.3	0.3	33.0	0.4
Medium	276.3	5.4	275.1	5.4	245.2	4.8
Low	120.9	4.3	120.9	4.3	115.6	4.2
Total	**433.5**	**2.3**	**432.3**	**2.3**	**393.8**	**2.4**
Alternative B2 with Wetland Avoidance Options						
High	32.6	0.3	32.7	0.3	29.3	0.3
Medium	265.2	5.2	264.0	5.1	234.1	4.6
Low	121.9	4.3	121.9	4.4	116.6	4.2
Total	**419.8**	**2.3**	**418.6**	**2.3**	**380.1**	**2.3**

Sources: AGRC 2001; FEMA 2005, 2007

All lake elevations are in NAVD 88.

[a] With a lake elevation of 4,202 feet (the current lake elevation), 18,532 acres of wildlife habitat are not inundated.

[b] With a lake elevation of 4,209 feet, 18,426 acres of wildlife habitat are not inundated.

[c] With a lake elevation of 4,217 feet, 16,203 acres of wildlife habitat are not inundated.

Proportionally, the amount of any habitat and habitat quality that would be lost with any proposed alternative is very small (1.9% to 2.5%). Because of the very large area of habitat available regionally and the comparatively small area of the WDC, the change in lake level does not measurably affect the proportion of habitat lost, even though the level of the lake can cause up to a 13% change in the regional availability of habitat. As shown in the footnotes of Table 14-9 above, at a lake level of 4,217 feet, there would be 16,203 acres of wildlife habitat that are not inundated. At a lake level of 4,202 feet, there would be 18,532 acres of wildlife habitat that are not inundated. This difference would be a 13% decrease ([16,203–18,532]/ 18,532) in habitat availability due to a higher lake level.

The principal ecological effects of the dynamics of the combined effects of lake level changes and habitat loss associated with the action alternatives are summarized below.

- The B Alternatives would have a greater impact than the A Alternatives because overall they would affect more wildlife habitat.
- The relative impacts of the WDC action alternatives would change with changes in lake level. The amount of each habitat type remaining at various inundation levels for each of the WDC action alternatives is directly related to the actual distribution of different habitat types and the differences in the spatial alignments of each alternative.
- Upland, riparian, and wetland habitats are more abundant at low lake levels than at high lake levels. With a rising lake level, all habitats would be less abundant. Inundation combined with the direct habitat loss that would result from the WDC action alternatives would also reduce the overall availability of wildlife habitat. The least habitat would be available at the highest lake levels. Higher lake levels would inundate a portion of the highway footprint and would make this habitat unavailable, whether or not an alternative is constructed. Therefore, at high lake levels, there would be less available habitat, and the direct loss of available habitat caused by the WDC action alternatives would be lower. At low lake levels, there would be more available habitat, and the direct loss of available habitat caused by the WDC action alternatives would be higher. (Note that the highway itself would not be inundated because it would be raised above the 4,217-foot level.)
- The overall carrying capacity for wildlife species using these habitats could decrease proportionally with the decrease in resource availability as the lake level rises.
- As the lake level rises, the diminishing available habitat would be located progressively nearer to the alternatives’ rights-of-way. This spatial relationship would likely increase the potential for wildlife impacts (such as noise effects, disturbance effects, and highway-related deaths).
- The higher-elevation portions of the ecosystem impact analysis area provide important refuge habitats for many wetland species when lake levels are high. With an increasing lake level, the relative impacts of the WDC action alternatives to these refuge areas would increase. However, large areas of wildlife habitat that characterize the impact analysis area are found throughout the Great Salt Lake ecosystem (see Section 14.3.2.1, Great Salt Lake, for more details).
- The wider availability of habitats makes the impact analysis area less important on a regional scale.
- If the lake level increases rapidly, the impacts to some less-mobile wildlife (such as mice, snakes, frogs, and nonflying insects) would be greater because these individuals would die unless they can move to suitable habitat above the waterline. If the rise is gradual (such as over several seasons), local populations would change in size in proportion to the reduced carrying capacity of the remaining habitat.

14.4.3.7 Threatened, Endangered, and Sensitive Species

Species Listed under the Federal Endangered Species Act

The determination of effect for federally listed threatened, endangered, or candidate species considers the expected effects of the proposed action on these species and their habitat. It includes the direct and indirect effects of taking an individual of a listed species, adversely affecting a population of a listed species, or degrading designated critical habitat of a listed species. Table 14-10 lists the species that are being evaluated and FHWA's Finding of Effect that was determined for each species. Appendix 14B, Ecosystems Correspondence, includes the correspondence with USFWS regarding these determinations. The reasons for these findings are discussed after the table.

Table 14-10. Federally Listed Species Addressed and Evaluation of Effects from the WDC Action Alternatives

Common Name (Scientific Name)	Status	County(ies)	Effect
Birds			
Greater sage-grouse (*Centrocercus urophasianus*)	Candidate	Weber	No effect
Yellow-billed cuckoo (*Coccyzus americanus*)	Threatened	Davis, Weber	No effect
Fish			
June sucker (*Chasmistes liorus*)	Endangered	Weber	No effect
Least chub (*Iotichthys phlegethontis*)	Candidate	Davis	No effect
Mammals			
Canada lynx (*Lynx canadensis*)	Threatened	Weber	No effect

Sources: USFWS 2012, 2013b

In summary, five federally listed species were identified for evaluation. The two listed fish species, June sucker (Weber County) and least chub (Davis County), are listed only for their recent introduction into managed refuges, either in those counties or into refuges in watersheds that extend into those counties. Because these refuge sites are known and managed by the State of Utah, no impacts to them or their hydrology sources are anticipated. There is no habitat for two other species (Canada lynx and greater sage-grouse) in the ecosystem impact analysis area.

One threatened bird species, the yellow-billed cuckoo (western population), has some potential to be present in the impact analysis area because suitable habitat for this species could still exist in Davis and/or Weber Counties. Cuckoos have recently (within the last decade or so) been sighted in Weber County in the Ogden River area (over 4 miles north of any alternative). However, a lack of historical data placing it in the more narrowly defined WDC study area suggests that the species has a low likelihood of being present adjacent to any WDC alternatives. Yellow-billed cuckoos are rare migrants in the Great Salt Lake area; they have low potential to be present near the WDC alternatives because of limited suitable riparian breeding habitat. All of the WDC action alternatives would result in direct loss of less than 6 acres of low- to medium-quality riparian (upland) habitat.

The yellow-billed cuckoo (western population) prefers large, contiguous tracts of riparian habitat. The riparian habitat associated with Haight Creek is not contiguous between I-15 and 950 North (a distance of about 2,000 feet). This habitat is segmented into four 500-foot segments by Shepard Lane (a two-lane road), a house, and the Denver and Rio Grande Western Trail. This habitat consists mostly of emergent marsh with a single row of trees along the edge between the steep slope above the marsh and the farm fields or housing developments surrounding it. In some areas, dense shrubs such as multiflora rose, Woods rose, coyote willow, and hawthorn dominate the edges instead of taller trees. The thin row of taller trees (25 to over 50 feet tall) is mostly box elder, maple, walnut, cottonwood, and Russian olive.

The Endangered Species Act final listing for the western yellow-billed cuckoo did not designate any critical habitat for this species in Davis or Weber Counties.

During the summer of 2013, surveys were conducted for yellow-billed cuckoos according to protocols provided by USFWS (see *Technical Memorandum 27: 2013 Yellow-Billed Cuckoo Surveys* [HDR 2013a]). During the four survey periods, no yellow-billed cuckoos were detected at the Farmington Creek, Haight Creek, or Howard Slough survey sites. Based on the characteristics of the survey sites and consideration of the species' habitat requirements, yellow-billed cuckoos are not likely to inhabit these areas because the areas do not contain suitable habitat for this species. The species' habitat requirements were determined based on 2015 Utah yellow-billed cuckoo habitat guidelines from USFWS.

Based on the surveys, the evaluation concluded that no contiguous, large, high-quality riparian habitat for yellow-billed cuckoos would be removed by any of the WDC action alternatives, and no cuckoos were identified during the surveys. Therefore, the WDC action alternatives would have no effect on yellow-billed cuckoos.

State of Utah Sensitive Species

To ensure that all listed species potentially present near a WDC alternative were studied, the WDC team included state listed species of concern for Davis and Weber Counties in the EIS and also reviewed species from Salt Lake and Box Elder Counties. In September 2010, the Utah Natural Heritage Program compiled a list of species that have been known to be present in an area likely to be directly or indirectly affected by a WDC alternative. The list was delivered in the form of a GIS shapefile, and the species locations in this file were then compared to the locations of the WDC alternatives. This list is shown in Table 14-11 below.

Of the 23 state sensitive species that are listed for Davis and Weber Counties near the proposed WDC alternatives, 13 would not be affected (marked "No impact") by the WDC for a variety of reasons: (1) no habitat for the species is near a WDC alternative, (2) populations are now extirpated from (no longer found in) their historical range, or (3) species are known to use habitats similar to those in the counties but have never been recorded there. A general discussion of species that could be affected follows Table 14-11; detailed discussions are provided in the analysis of impacts from each WDC action alternative.

Table 14-11. State of Utah Listed Sensitive Species Addressed and Evaluation of Effects from the WDC Action Alternatives

Common Name (Scientific Name)	County(ies)	Impact
Birds		
American white pelican (*Pelecanus erythrorhynchos*)	Davis, Weber	May impact but not adversely
Bald eagle (*Haliaeetus leucocephalus*)	Davis, Weber	May impact but not adversely
Bobolink (*Dolichonyx oryzivorus*)	Davis, Weber	May impact but not adversely
Burrowing owl (*Athene cunicularia*)	Davis, Weber	No impact
Ferruginous hawk (*Buteo regalis*)	Davis, Weber	No impact
Grasshopper sparrow (*Ammodramus savannarum*)	Davis, Weber	May impact but not adversely
Lewis' woodpecker (*Melanerpes lewis*)	Davis, Weber	No impact
Long-billed curlew (*Numenius americanus*)	Davis, Weber	May impact but not adversely
Snowy plover (*Charadrius alexandrinus*)	Davis, Weber	May impact but not adversely
Northern goshawk (*Accipiter gentilis*)	Weber	No impact
Sharp-tailed grouse (*Tympanuchus phasianellus*)	Weber	No impact
Short-eared owl (*Asio flammeus*)	Davis, Weber	May impact but not adversely
Fish		
Bluehead sucker (*Catostomus discobolus*)	Davis, Weber	No impact
Bonneville cutthroat trout (*Oncorhynchus clarkii utah*)	Davis, Weber	No impact
Mammals		
Kit fox (*Vulpes macrotis*)	Davis, Weber	May impact but not adversely
Townsend's big-eared bat (*Corynorhinus townsendii*)	Davis, Weber	No impact
Mollusks		
Deseret mountainsnail (*Oreohelix peripherica*)	Weber	No impact
Lyrate mountainsnail (*Oreohelix haydeni*)	Weber	No impact
Western pearlshell (*Margaritifera falcata*)	Davis	No impact
Wasatch mountainsnail (*Oreohelix peripherica wasatchensis*)	Weber	No impact
Reptiles and Amphibians		
Columbia spotted frog (*Rana luteiventris*)	Davis, Weber	May impact but not adversely
Smooth greensnake (*Opheodrys vernalis*)	Weber	No impact
Western toad (*Bufo boreas*)	Davis	May impact but not adversely

Sources: Lindsey 2010; UDWR 2015

General Discussion of Impacts to Sensitive Species

USFWS provided the WDC team with a list of species to consider in detail in the EIS. The direct and indirect effects on these species would be similar for all of the WDC action alternatives (see Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives). The species discussed below are those listed in Table 14-11 above that could be affected by the WDC.

American White Pelican. This species is a spring and summer resident of northern Utah and nests primarily on Gunnison Island in the northwestern arm of the Great Salt Lake. American white pelicans forage in the shallow, freshwater shores and wetlands that surround the Great Salt Lake where there are abundant stocks of fish. Many wetlands and ponds in the far western part of the ecosystem impact analysis area are potential foraging areas for American white pelicans, but fewer potential areas exist in the WDC study area. During The Nature Conservancy's survey in 2013, about 239 American white pelicans were identified in the Great Salt Lake Shorelands Preserve and some within or adjacent to the WDC right-of-way. Most shallow freshwater shores are greater than 2,000 feet from the WDC alternatives; thus the potential to affect this species is low.

What is a snag?

A snag is an upright, dead tree.

Bald Eagle (Winter Roosting). The closest documented winter roosting to the WDC alternatives is the Weber River delta (Wilson and Gessaman 2003) to the north of any of the WDC alternatives (the Ogden Bay WMA is about 3 miles from the nearest WDC alternative) and the Jordan River delta to Farmington Bay (Brown and others 2006) to the south of the alternatives.

There are also reports of daytime use along Farmington Creek in the vicinity of Glovers Lane and to the south and west of Glovers Lane (Kramer and others 2013). Bald eagles that use this area could be adversely disturbed during construction activity and highway operations, but the WDC would not adversely affect the greater species population. Winter roosting surveys would need to be conducted for the selected alternative before construction in areas where taller trees or snags are present along the Great Salt Lake shore. If an alternative that uses Glovers Lane is selected, the area around Glovers Lane would also need winter roosting surveys. If winter roosting is observed within 0.5 mile of potential construction areas, coordination with USFWS and/or UDWR would be conducted to determine what mitigation measures, if any, would be necessary.

Black-Necked Stilt. Extensive foraging and nesting have been recorded for this species along the Great Salt Lake shore wetlands and playas to the west of the ecosystem impact analysis area from Layton to Farmington Bay (Paul and Manning 2002). None of the alternatives are anticipated to directly affect black-necked stilt nesting habitats, but some indirect effects from noise and light disturbance could be possible. However, recent evidence from the Legacy Nature Preserve, which is adjacent to Legacy Parkway, suggests that a nearby road does not appear to have a significant negative effect on black-necked stilt nesting productivity but could have a slight positive effect by reducing the efficiency of nest predators (BIO-WEST 2011).

Bobolink. This species has been observed in the Farmington Bay and Kaysville area in the past (Lindsey 2010) and most recently by the WDC wildlife survey crew in a horse pasture west of Farmington in the early summer of 2011 and by The Nature Conservancy in 2013 within the Great Salt Lake Shorelands Preserve. The indirect wildlife effects from the WDC action alternatives on individual bobolinks could result from habitat fragmentation and associated edge effects, mortality to bobolinks from vehicles, noise, pollution, and visual disturbances (lights and vehicles). It is likely that individual birds could be affected by the

WDC, but the WDC would not adversely affect the greater species population. For direct construction impacts, preconstruction nesting surveys as required by the Migratory Bird Treaty Act (see Section 14.4.7, Mitigation Measures) would be necessary to determine whether any nests would be affected by the selected alternative. Some current nesting or foraging habitat could be permanently removed or indirectly affected (for example, by indirect noise or visual effects).

Burrowing Owl. There is one previous record for this species near the WDC alternatives and one close to the northern end of the A Alternatives near 4000 South in Weber County (Lindsey 2010). No recent records (since 1984) were located, nor were any owls observed by the WDC wildlife survey crew. Little potential habitat exists because of the disruptive land uses in the area such as tilled croplands and residential development. The area could also be less desirable because of the number of pets (cats and dogs) from the area’s farms and developments and other predatory species such as red foxes and raccoons in the area. Burrowing owls would still be surveyed for during the preconstruction raptor nesting surveys (see Section 14.4.7, Mitigation Measures) within 0.5 mile of the selected alternative to check for any nesting birds.

Grasshopper Sparrow. Four grasshopper sparrows were identified in the Great Salt Lake Shorelands Preserve during the 2013 Nature Conservancy bird surveys. Potential nesting or foraging habitat could exist in some of the wilder pastures in less populated areas, and, if those areas would be affected, they would be surveyed before construction for any nests as a part of the preconstruction nesting surveys required by the Migratory Bird Treaty Act (see Section 14.4.7, Mitigation Measures).

Long-Billed Curlew. No sightings were recorded by the WDC wildlife survey crew; however, 44 curlews were identified in 2013 during The Nature Conservancy’s bird survey of the Great Salt Lake Shorelands Preserve. Potential foraging habitat could exist in some of the pastures and alkaline flats close to the Great Salt Lake, and, if those areas would be affected, they would be surveyed before construction for any nests as a part of the preconstruction nesting surveys required by the Migratory Bird Treaty Act (see Section 14.4.7, Mitigation Measures).

Northern Leopard Frog. Although this species in currently not listed as a federal or State of Utah sensitive species, the species in the western United States is considered under threat from habitat loss and degradation. However, after a recent and extensive 2-year review of both the species and its western population for listing, USFWS announced on October 4, 2011, that the species did not warrant federal protection under the Endangered Species Act. This species was not specifically surveyed for by the WDC wildlife survey crew or by UDWR personnel, but various aquatic habitats exist that could support this species. Substantial impacts to frog habitat are not anticipated. However, the northern leopard frog could be affected, but not adversely, even if the loss of potential habitat would be mitigated under the Section 404 permit process.

Short-Eared Owl. This sensitive owl species has been observed in the 1980s and 1990s in some of the Great Salt Lake wildlife management areas such as Howard Slough WMA and Bear River WMA (Lindsey 2010). Additionally, seven owls were identified in the Great Salt

Lake Shorelands Preserve during the 2013 Nature Conservancy bird surveys. The WDC team does not anticipate that the WDC would directly affect any short-eared owl nesting habitat. The indirect wildlife effects from the WDC action alternatives on individual owls could result from habitat fragmentation and associated edge effects, mortality to owls from vehicles, noise, pollution, and visual disturbances (lights and vehicles). It is likely that individual owls could be affected by the WDC, but the WDC would not adversely affect the greater species population. For direct construction impact, if potential nesting habitat exists and would be affected by the WDC, preconstruction nest surveys would be necessary (see Section 14.4.7, Mitigation Measures).

Snowy Plover. This species is a Bird of Conservation Concern (USFWS 2008) and might nest in the Great Salt Lake shore habitats close to the WDC action alternatives through the western areas of Kaysville, Syracuse, and Layton. Recent surveys suggest extensive snowy plover nests surrounding Farmington Bay from the southeastern shore of Antelope Island to the Howard Slough WMA (Cavitt 2008). However, most of the snowy plover nests are in the large, open alkaline areas not found near the WDC alternatives, and therefore the nests are not likely to be directly affected by any of the alternatives. Of all the alternatives, Alternatives A1 and A2 would have the greatest possibility of indirect effects from noise and light disturbance, since those alternatives include both the Glovers Lane segment and the segment that follows Gentile Street to the west closest to the Great Salt Lake shore habitats.

Other Species. The WDC team’s review of literature shows that potential habitat for greater sage-grouse, Lewis’s woodpecker, northern goshawk, and sharp-tailed grouse is not present in the WDC study area. However, Lewis’s woodpeckers and northern goshawks, which are more mobile, could migrate into the area. Given that these species do not have nesting habitat near a WDC alternative and might only migrate into the area, no impact to these species’ overall population is expected.

The western toad and Columbia spotted frog could have potential habitat in riparian areas, including slow-moving streams, wetlands, and ponds, in the WDC study area. Potential impacts from the WDC to wetlands could affect habitat for these species and change migration patterns if their migration paths are blocked by the highway. See the section titled Impacts to Fish and Amphibians on page 14-101 for details regarding how impacts to migration paths would be minimized.

14.4.3.8 Impacts to Conservation Areas

The Great Salt Lake Shorelands Preserve is an important management area adjacent to the Great Salt Lake that would be directly and indirectly affected by the WDC action alternatives (see Figures 14-9 through 14-12, The Nature Conservancy and URMCC Impact Areas, in Volume IV). All of the WDC action alternatives would directly remove about 64 acres of upland wildlife habitat in the Great Salt Lake Shorelands Preserve. In addition, other parcels of the preserve would be bisected by the WDC, leaving about 48 acres of wildlife habitat cut off from the main preserve. This would reduce the wildlife habitat value. Impacts to wetlands and combined wildlife habitats are listed below in Table 14-12.

Table 14-12. Impacts to the Great Salt Lake Shorelands Preserve from All Alternatives

in acres

Area of Impacts	A1	A2	B1	B2
Wetlands[a]				
Direct impacts within the right-of-way	8.5	8.5	8.5	8.5
Wetlands within 300 feet of the right-of-way[b]	26.7	26.7	22.4	22.4
Wildlife Habitat				
Direct impacts within the right-of-way[c]	72.6	72.6	72.6	72.6
Remnant parcels[d]	50	50	50	50
Wildlife Habitat Buffer Zone (Distance from Right-of-Way)[c]				
0 to 300 feet	158	158	121	121
300 to 800 feet	373	373	309	309
800 to 1,300 feet	404	404	302	302
1,300 to 3,900 feet	2,204	2,204	1,364	1,364

[a] Does not include waters or constructed wetlands.

[b] Includes unrated wetlands outside the original survey area.

[c] Includes both wetland and upland habitat, but does not include areas with farm buildings, barns, or other structures.

[d] Remnant parcels are land that would be cut off from the main Great Salt Lake Shorelands Preserve by the WDC, thereby reducing the wildlife habitat value.

Impacts would be very similar among the action alternatives because the majority of the impacts to the Great Salt Lake Shorelands Preserve would occur on the Kaysville segment, from the Central Davis Sewer Treatment Plant to Gentile Street, which is shared by all alternatives. The differences would be due to differences in the A and B Alternatives' alignments in Syracuse. In Syracuse, the A Alternatives continue west to the north of Gentile Street, overlapping the edges of the Great Salt Lake Shorelands Preserve to the west. The WDC would introduce a new noise and visual element into habitat set aside for wildlife protection. The noise levels and associated impacts to avian species would be similar to those described in the section titled Legacy Parkway Avian Noise Research on page 14-48 and in the section titled Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives on page 14-64.

The *Legacy Report* mentioned in Section 14.4.3.3, Wildlife Noise Impacts, is relevant to the expected indirect effects of the WDC on the Great Salt Lake Shorelands Preserve because of the WDC's proximity to similar wildlife habitat and because its roadway design and anticipated traffic volumes would be similar to those of Legacy Parkway. In addition, noise modeling conducted for the WDC shows that anticipated noise levels would be similar to those from Legacy Parkway. The *Legacy Report* found that there was a very weak statistical relationship between highway noise and species diversity or richness. Additionally, highway noise had apparent positive impacts to the abundance of yellow-headed blackbirds and negative impacts to the abundance of common yellowthroats. From a productivity standpoint, the impacts of noise to nesting success are less clear. Evidence for a relationship between highway noise and nesting success for avocets, stilts, and plovers was unclear. There was no apparent relationship between highway noise and nest success.

However, the *Legacy Report* is only one study that has looked at impacts to wildlife from highways. Other studies that looked at different species in different locations (such as Forman and others 2003; Kuitunen and others 2003; and Halfwerk and others 2011) have concluded that wildlife impacts from highways could affect bird species at various distances from the highway, and this could change habitat quality and consequently change the abundance and distribution of the species. One study found that the distance at which a species could be affected can extend from less than 125 feet to much greater than 3,500 feet from the highway (Benitez-Lopez and others 2010). Another study showed a 14% to 44% reduction in abundance of species at up to 4,920 feet from a road with 50,000 vehicles per day and found that decibel thresholds were 47 dBA for all species combined (USFWS 2013a). Overall, the proximity of the WDC to the Great Salt Lake Shorelands Preserve would result in negative impacts to wildlife in this area that is set aside for wildlife habitat protection.

There would be no direct right-of-way impacts to the Farmington Bay WMA. However, all of the WDC action alternatives are in proximity to this WMA, and the amount of land within the buffer area would be the same for all alternatives. From 0 to 300 feet there would be 0 acres within the buffer area, from 300 feet to 800 feet there would be 4 acres, from 800 feet to 1,300 feet there would be 34 acres, and from 1,300 feet to 3,900 feet there would be 405 acres. These acreages exclude any farm buildings, barns, or other structures.

14.4.3.9 Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives

As stated in Section 14.4.3, General Impact Information for the WDC Action Alternatives, the WDC action alternatives would result in both direct and indirect effects on ecosystems including a portion of the eastern shore of the Great Salt Lake. The Great Salt Lake has been designated as a Hemispheric Site of Importance by the Western Hemisphere Shorebird Reserve Network because of the variety and abundance of shorebirds that visit it. Because of the importance of preserving Great Salt Lake shorelands habitat, URMCC and The Nature Conservancy worked together to establish the roughly 4,400-acre Great Salt Lake Shorelands Preserve. All of the WDC action alternatives would cause direct impacts (land acquisition) to the preserve of up to 72 acres and some indirect effects as described in the following paragraph.

The indirect wildlife effects from the WDC action alternatives could result from habitat fragmentation and associated edge effects, mortality to wildlife from vehicles, noise, pollution, and visual disturbances (lights and vehicles). Based on the differing results of studies on wildlife impacts from highways, there is no set guidance from USFWS, USACE, FHWA, or UDOT to measure or quantify the indirect effects on wildlife or the amount of wildlife habitat indirectly affected by a specific project. Causal variables such as noise or distance to a road have never been established for specific effects (for example, effects on species richness, abundance, or reproductive success). Variables such as road type, traffic volumes, topography, bird species, and surrounding vegetation and land uses all play an important factor in determining the distance at which an indirect effect could occur, and no one study can be applied to reasonably or accurately predict the specific impacts of a project such as the WDC.

However, when combining all of the effects from a highway, numerous scientific studies support the conclusion that roads have an indirect effect on wildlife, as shown in Table 14-13 below. Potential effects on some species (note that other species could have no effect or positive effects) include a decrease in species richness (number of species), abundance (number of individuals), nesting density, and nesting success. In general, habitat close to roads is less favorable for a variety of activities, including nesting and foraging for some species, while other species might experience no effects. Impacts could occur to birds, amphibians, reptiles, mammals, and plant species.

Although not every species would be affected negatively, some studies indicate that the majority of species experience neutral or negative effects. The overall loss of habitat and habitat use for even a portion of species creates changes in community composition; the prevalence of “urban-adapted” species; the loss of more sensitive, disturbance-intolerant species; and decreased species diversity. One study concluded that one of the contributors to the worldwide decline of bird populations is the increasing prevalence of roads, which have several negative effects on birds and other vertebrates. The study stated that the well-known direct effects of roads on birds include habitat loss and fragmentation, vehicle-caused mortality, pollution, and poisoning. Nevertheless, indirect effects might exert a greater influence on bird populations. These effects include noise, artificial light, barriers to movement, and edges associated with roads. Of the many effects of roads, it appears that road mortality and traffic noise might have the most substantial effects on birds relative to other effects and taxonomic groups (Kociolek and others 2011).

As shown in Table 14-13, the distances at which roads affect wildlife vary between studies and range from 75 to 1,200 meters (82 to 1,312 yards) for birds and up to 5 kilometers (3.1 miles) for some mammal species.

In addition to the studies in Table 14-13, other studies with traffic volumes similar to the WDC (up to 27,600 vehicles per day) reported a reduction in the number of breeding birds adjacent to highways (with 30,000 to 40,000 vehicles per day) at a distance of 985 feet (FHWA 2004). Another study found that 17 of 23 species studied for 3 years showed some negative effect from roads (with 40,000 to 52,000 vehicles per day) (FHWA 2004).

Finally, it is important to note that other studies that reviewed an extensive number of species found some to be negatively affected, but some species had neutral (no) effects, and some species increased in numbers (FHWA 2004). Although the studies in Table 14-13 show effects, these studies are correlative and have limitations with regard to determining quantifiable results for other projects or for species in other areas.

In summary, it is not possible to determine an exact distance at which roadway impacts occur based on other studies that used different project factors, different species, and different areas from the WDC, but studies do support the conclusion that roads similar to the WDC have direct and indirect effects on wildlife. It is also important to note that the impacts from the

WDC would occur along the Great Salt Lake ecosystem, which is an important wildlife habitat. For detailed information about the habitat by alternative that is within the distances suggested by the different studies, see Appendix 14C, Expanded Summary Table of Ecosystem Impacts from the WDC Action Alternatives.

Table 14-13. Review of Roadway Ecology Studies

Citation	Species	Study Conclusions
Forman and others 2002	Birds (grassland species including bobolink and meadow-lark	Bobolink and meadow-lark presence and breeding are reduced within 700 meters (766 yards) of roads with 15,000 to 30,000 vehicles per day (similar range as the WDC). Avian presence and breeding are reduced within 1,200 meters (1,312 yards) of roads with greater than 30,000 vehicles per day.
Benitez-Lopez and others 2010	Birds and mammals	Meta-analysis of 49 studies of 235 mammal and bird species found bird population declines within 1 kilometer (0.6 mile) of roads and mammal population declines within 5 kilometers (3.1 miles).
Reijnen and others 1987	Birds	Reported a reduction in the number of breeding birds adjacent to a busy highway (30,000 to 40,000 vehicles per day) at a distance of 300 meters (328 yards).
Reijnen and Foppen 1996	Birds	Seven of 12 species studied showed some effect. Roads with moderate traffic volumes (50,000 vehicles per day) showed a reduction of 12% to 52% at a distance of 500 meters (547 yards).
Fahrig and Rytwinski 2009	Birds, amphibians, reptiles, and mammals	Review of roadway ecology literature found 79 studies examining 131 species. Negative effects were concluded for 114 species, positive effects for 22 species, and neutral (no effects) for 56 species. Amphibians and reptiles show mostly negative or no effects. Birds showed mainly negative or no effects, with a few positive effects for small birds. Small mammals generally showed either positive or no effects, and mid-sized mammals showed either negative or no effects. Positive effects were generally found only for species that can avoid on-road mortality and are attracted to roadsides for food or lack of predators.
Reijnen and Foppen 2006	Breeding birds	Review of 18 studies concludes negative impacts of road traffic on species densities of breeding birds. About 50% of species have reduced abundance near roads with traffic volumes similar to the WDC (22,000 to 30,000 vehicles per day). About 40% of breeding bird species in open habitats have reduced abundance. Estimated effect distance at 50,000 vehicles per day vary from 75 to 930 meters (82 to 1,017 yards) for grassland birds. For all species combined, the average distance was 560 meters (612 yards).
Findlay and Houlahan 1997	Birds, amphibians, reptiles, and mammals	Study evaluated factors influencing species richness in wetlands in Ontario, Canada. The study concluded that the influence of road density extended up to 0.5 kilometer (0.3 mile) for birds, 1 kilometer (0.6 mile) for plants, and 2 kilometers (1.2 miles) for herptiles; mammal species richness showed no relationship to road distance. Numerous other factors could have caused or influenced abundance, but it is likely that there was some effect beyond 400 meters (437 yards) for some species.
Van der Zande and others 1980	Breeding birds	Measured abundance of four bird species in agricultural grasslands in the Netherlands and showed that the abundance of two species had increases in abundance out to 750 meters (820 yards) and possible increases out to 2,000 meters (1.2 miles) along roads with the highest traffic volume. Some of the birds might have avoided nesting 400 to >750 meters (437 to >820 yards) from roads (and closer).

14.4.3.10 Summary of WDC Wetland Avoidance Measures

The Clean Water Act implementing guidance and Executive Order 11990, Protection of Wetlands, requires that projects sequence their activities to first avoid, then minimize, impacts to wetlands before any mitigation is considered. For the WDC Project, the WDC team made an extensive effort to avoid wetland impacts to the extent practicable while considering highway safety design requirements. This section summarizes the avoidance measures that the WDC team implemented as part of the WDC design process.

In December 2010, USACE suggested 28 segment refinements or modifications to avoid wetlands for the initial alternatives developed for the WDC Project. The segment refinements for alternatives that were advanced to the Draft EIS were considered during the preliminary engineering of the Draft EIS alternatives and were incorporated into the WDC alternatives' designs where possible. The segment refinements for alternatives that were not advanced to the Draft EIS were not considered further.

During the screening process, several alignment options were eliminated because other alternatives could be implemented that would avoid wetland impacts. These options include the following.

- The WDC team screened out other potential alternatives that would connect to I-15 and Legacy Parkway farther south of the current Glovers Lane Option. Although a connection farther south would have avoided impacts to a business area, it would have affected a wetland complex. To avoid the wetland impacts, the WDC team moved the alignment as far north as possible while still meeting design constraints with the Glovers Lane crossing of Legacy Parkway and I-15.
- The public requested alternatives that would have avoided or reduced community impacts by placing the Glovers Lane Option south of Glovers Lane and west of the Farmington conservation easements. The WDC team eliminated this option because an option north of Glovers Lane closer to the community and within the Farmington conservation easements avoided extensive wetland areas.
- The public in Kaysville and Layton suggested alternatives farther west than the current alignment to avoid and minimize community impacts. The WDC team eliminated the westerly options to avoid large wetland complexes along the Great Salt Lake.
- The public and Cities recommended that the WDC alternatives north of Gentile Street should follow the alignment from the 2001 *North Legacy Transportation Corridor Study* (2001 alignment) along the bluff in Syracuse and West Point. The WDC team eliminated sections of the 2001 alignment to avoid large wetland complexes along the bluff.

Once the practicable alternatives were identified, the WDC team refined the alternatives further to avoid wetland impacts as follows.

- Glovers Lane in Farmington
    - The system interchange with I-15 and Legacy Parkway was refined to locate the alignment on farmland north of wetlands on the Farmington–Centerville border.
    - The Glovers Lane Option was shifted north of Glovers Lane between 900 West and 1525 West. This resulted in more direct and indirect effects on the community as a result of this alignment. This shift avoided impacts to wetlands and placed the Glovers Lane Option farther from Farmington Bay WMA.
    - Curves in the Glovers Lane Option on the Farmington conservation easements are entirely for wetland avoidance. These shifts resulted in placing the Glovers Lane Option closer to existing residential development in the area. Many residents have requested a change to the Glovers Lane alignment to move it farther west in these locations.
- All WDC alternatives between Farmington and Gentile Street
    - The WDC alignments were placed east of the Rocky Mountain Power corridor between the Central Davis Sewer District property and Angel Street in Kaysville. This alignment avoids a large wetland area west of the power corridor. The WDC team received many comments from residents requesting that the alignment be moved to the west side of the power corridor in this area.
    - The WDC alignments were placed adjacent to the power corridor between Angel Street and about 200 North in Kaysville. This alignment avoids impacts to wetlands in the area and the Great Salt Lake Shorelands Preserve. The WDC team received many comments from residents requesting that the WDC alignment be moved farther west in this area to avoid residential impacts.
    - The WDC alignment was placed on upland farmlands between 2200 West and 3700 West in Layton. This alignment avoids all wetlands and direct impacts to the Great Salt Lake Shorelands Preserve in this area. Layton City and many residents have requested that the WDC alignment be moved farther west in this area.
    - The WDC alternatives were placed adjacent to residential developments south of Gentile Street, on the eastern edge of the Great Salt Lake Shorelands Preserve near Gentile Street. This alignment avoids wetland impacts. The WDC team received many comments from residents requesting that the WDC alternatives be placed farther west in this area to reduce community impacts.

- B Alternatives in Syracuse
    - The WDC team refined the 2001 alignment along Bluff Road to an alignment farther west between Gentile Street and 2300 South in Syracuse to avoid wetland impacts. This alignment shift resulted in community impacts on 2000 West. The WDC team received many comments from residents requesting that the WDC use the 2001 Bluff Road alignment for the WDC in this area.
- Alternative B1 in West Point
    - The WDC team moved the Alternative B1 alignment west of the 2001 Bluff Road alignment, which included many parcels that UDOT had previously acquired for corridor-preservation purposes. The WDC ream received comments from many residents and Cities requesting that the 2001 Bluff Road alignment should be used for the WDC in West Point. The shift to the west of the bluff in this area greatly avoided wetland impacts.
- Wetland avoidance options
    - The WDC team developed the wetland avoidance options, which could be implemented with all of the WDC alternatives. These options avoid wetlands in Farmington and Layton.

14.4.4 Alternatives A1–A2

As described in Chapter 2, Alternatives, Alternative A is the more westerly alternative and consists of two separate alternatives: Alternatives A1 and A2. These alternatives are defined in Table 14-14.

Table 14-14. Components of Alternatives A1–A2

Alternative	I-15 Connection	Four-Lane Highway	Two-Lane Highway	West Point/ Hooper Cities Segment	North Terminus
A1	Glovers Lane	I-15 to 2000 West	2000 West to 1800 North	4100 West	1800 West (West Point)
A2	Glovers Lane	I-15 to 2000 West	2000 West to 5500 South	5400 West	5500 South (Hooper)

The analysis in this section focuses on quantifiable differences in impacts to ecosystem resources among the A Alternatives. Impacts to highway-related deaths; water quality; artificial light disturbance; changes in lake levels and habitat availability; threatened, endangered, and sensitive species; and conservation areas would be similar for both of the A Alternatives and are described in Section 14.4.3, General Impact Information for the WDC Action Alternatives.

Table 14-15 summarizes the ecosystem impacts by resource for Alternatives A1 and A2. For an expanded summary table of ecosystem impacts from the A Alternatives, see Appendix 14C, Expanded Summary Table of Ecosystem Impacts from the WDC Action Alternatives.

Table 14-15. Summary of Ecosystem Impacts from Alternatives A1–A2

in acres

Type of Habitat Affected	A1	A2
Wildlife Habitat		
Direct impacts within the right-of-way by habitat quality[a]		
Low	101.2	106.4
Medium	210.9	202.6
High	49.5	45.8
Total	**361.6**	**354.8**
Wetlands[b]		
Direct impacts within the right-of-way by wetland quality[c]		
Category I	15.9	15.2
Category II	8.2	7.7
Category III	4.0	4.0
Total	**28.1**	**26.9**
Constructed[d]	1.0	0.7
Open water (acres)	4.8	3.8
Open water (linear feet)[e]	17,285	17,854
Wetlands within 300 feet of the right-of-way		
Wetlands total	**80.5**	**64.3**
Constructed[d]	4.4	4.4
Open water	13.2	10.3

[a] Low = Level 2–3 (Ranks 1–2), does **not** includes Urban, Croplands, or Hayfields; Medium = Level 4–5 (Ranks 3–4), includes Pastures and Wetlands; High = Level 6 (Ranks >4), includes Pastures and Wetlands, including Great Salt Lake shore areas. See Table 14-4, Potential Non-avian Wildlife in the WDC Study Area by Habitat Type, for the species that use this habitat.

[b] Wetland impact acres could change during the Clean Water Act Section 404 permitting process after the Final EIS is released.

[c] For definitions of Category I, II, and III wetlands, see Section 14.3.1.3, Methodology for Identifying Wetlands and Waters of the U.S.

[d] Constructed wetlands are constructed basins such as stormwater basins.

[e] Includes constructed canals, major ditches, natural drainages, and named creeks.

Chart 14-1. Wildlife Habitat Quality Index Values for Impacts from All Alternatives

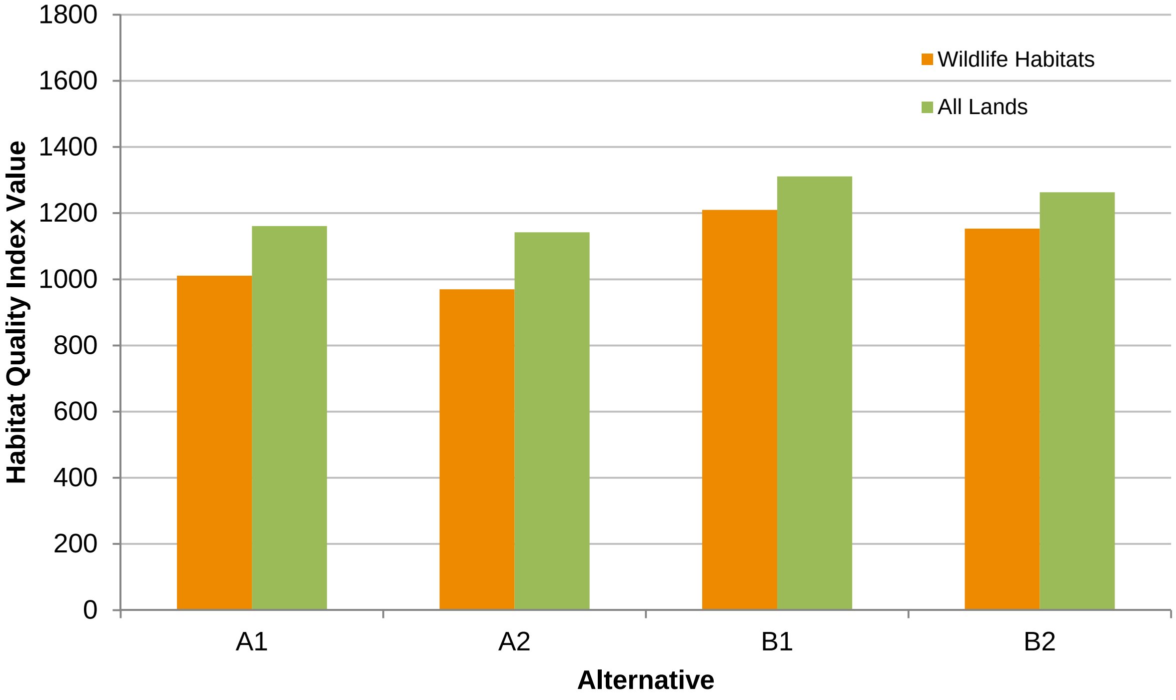

Chart 14-1 above shows the wildlife habitat quality index values for impacts from all action alternatives; the green bars show the values for all non-urban habitat types, which include wildlife habitats, croplands, and hayfields, and the orange bars show the values for just the wildlife habitats (pasture, marsh, riparian, waters, etc.). The habitat quality index is a measure of the habitat quality rank of each affected parcel multiplied by the acreage of impact to the parcel.

This index can be helpful as a comparative representation of the quality of the acreage affected by each alternative. The index number itself has meaning only as an expression of comparative value among alternatives. The higher the index value, the greater the combined quality and acreage of impact. This index can be useful in situations where alternatives would affect a similar number of acres but would affect acres with very different habitat qualities. The impacts shown in the chart represent only direct impacts to wildlife habitat from the alternatives.

Chart 14-1 above shows that Alternative B1 would have the highest habitat quality index values, meaning that it would have the highest combined effects on habitat quality and acreage. Chart 14-1 shows that Alternative A2 would have the lowest habitat quality index values, meaning that it would have the lowest combined effects on habitat quality and acreage.

14.4.4.1 Alternative A1 – Glovers Lane and 4100 West/1800 North

Wildlife

Habitat Loss

To better focus the discussion on the results of the analysis that have the greatest importance to wildlife, direct, quantitative results for habitat loss were calculated for low-, medium-, and high-quality habitats (see Section 14.3.1.1, Methodology for Assessing Wildlife and Habitat, for definition of the habitat quality types). Urban areas or active cropland/hayfields adjacent to urban areas that ranked as very-low-quality habitat were not included as a wildlife habitat impact. However, note that a few species that are highly tolerant of human activity, such as house sparrow, black-billed magpie, and house mouse, might nest in some of these precluded land types, such as urban.

Of the various habitat types, agricultural pastures/grasslands would have the most acreage removed by the WDC action alternatives. Alternative A1 would remove 361.6 acres of wildlife habitat, including 49.5 acres of high-quality habitat. The direct wildlife habitat impacts from Alternative A1 would be the highest of the A Alternatives (see Table 14-15 above, Summary of Ecosystem Impacts from Alternatives A1–A2).

Habitat Quality Index

The habitat quality index is a measure of the habitat quality rank of each affected parcel multiplied by the acreage of the parcel (see the section titled Habitat Loss on page 14-31). Alternative A1 has the highest habitat quality index value of the A Alternatives and was the third highest of the four action alternatives (see Chart 14-1 above, Wildlife Habitat Quality Index Values for All Alternatives).

Southern Terminus to Gentile Street in Syracuse

From the system interchange with I-15 and Legacy Parkway to Gentile Street, Alternative A1 would remove 234.9 acres of pasture, 3.3 acres of marsh, 1.7 acres of waters, and 0.9 acre of riparian habitats. Almost two-thirds of the habitat affected by this segment is of medium quality, and nearly all of that is pasture. Less than 7% of the total impact for this segment would be high-quality habitat, and all of that is pasture (34.8 acres) and marsh (3.3 acres). Most of the removed marsh habitat would be removed by the alternative crossing a “finger” of emergent marsh habitat that extends north from Farmington Bay to an area south of Glovers Lane near 900 West. Most of the low-quality habitat removed by this segment is pasture or weedy and disturbed open land on either side of Glovers Lane.

Gentile Street in Syracuse to 700 South in West Point

From Gentile Street in Syracuse to 700 South in West Point, both of the A Alternatives share the same alignment. The majority of affected land along this part of Alternative A1 is croplands and urban development. This part of Alternative A1 would remove 77 acres of pasture and 0.5 acre of marsh habitats. A total of 41 acres of the affected pasture are lower-quality habitat dominated by non-native wheatgrass with some weeds. A total of 28.6 acres of the affected pasture are medium-quality habitat (a mix of upland wheatgrass and wet pastures), and 7.1 acres are high-quality pastures. The 0.5 acre of affected marsh habitat is high-quality habitat located on the fringe between the croplands and the marshlands west of 3000 West in Syracuse.

700 South in West Point to Northern Terminus

From 700 South to the WDC's northern terminus, Alternative A1 would affect primarily croplands, hayfields, and urban developments. A total of 45 acres of pasture habitat would be affected by this segment. The affected pasture habitat is high-quality (2 acres), medium-quality (24 acres), and low-quality (19 acres) habitat. There would also be 1 acre of high-quality water habitat removed in this segment.

Wildlife Habitat Fragmentation

Table 14-16 summarizes the fragmentation metrics for Alternative A1 and the existing conditions. For a complete list of results, see Appendix 14A, Habitat Fragmentation Analysis.

Table 14-16. Alternative A1 – Fragmentation Summary

	Habitat Type				
Computational Metric	**All[a]**	**Pasture**	**Marsh**	**Riparian**	**Waters**
Existing (No Action)					
Number of patches	655	198	28	34	36
Patch density (#P/100 ha)	2.44	0.73	0.10	0.12	0.13
Mean patch area (ha)	490.4	242.1	1,408.4	10.6	11.1
Mean perimeter/area ratio	116.4	124.1	51.0	592.0	331.3
Mean nearest neighbor (m)	109.7	92.9	25.4	278.2	708.1
Alternative A1					
Number of patches	795	258	30	38	41
Patch density (#P/100 ha)	2.91	0.95	0.11	0.14	0.15
Mean patch area (ha)	481.6	198.2	1,408.0	10.6	11.1
Mean perimeter/area ratio	123.2	137.1	51.0	595.4	331.2
Mean nearest neighbor (m)	101.4	79.4	25.4	278.4	616.5

All means shown are area-weighted.

Units: #P = number of patches, ha = hectares, m = meters

[a] The All habitat type is not a sum; it represents the entire WDC study area landscape including habitat types such as cropland and hayfields but treats urban areas, the right-of-way for the alternatives, and areas outside the study area as background.

Alternative A1 would increase the number of wildlife habitat patches by about 21% compared to the existing conditions, with the pasture habitat being the most affected (see Table 14-16 above). The change in the number and density of habitat patches can be misleading by itself, since not all patches are necessarily viewed equally among species that could use them. Since the means of patch area, perimeter/area ratio, and nearest-neighbor changed only slightly (most changing by less than 10%), these metrics suggest that the habitat effects would not be substantial. The small changes in mean patch area, perimeter/area ratio, and nearest neighbor from the existing conditions to the conditions with Alternative A1 imply that Alternative A1 would have little fragmentation effect, the current habitat is already greatly fragmented, and any changes caused by Alternative A1 would not be dramatically different than the current conditions.

In summary, Alternative A1 would increase the fragmentation of wildlife habitat. Overall, this would not likely have a substantial effect on wildlife using those habitats, since fragmentation from agriculture, the existing transportation network, and more recent residential developments have already greatly fragmented the habitats.

General Habitat Buffer Zones

Table 14-17 and Table 14-18 below summarize the existing wildlife habitat types in four buffer zones for Alternative A1. Note that these four buffer zones are not experimentally tested distances at which some degree of effect is expected to occur to wildlife. These four buffer distances were chosen to show the types of wildlife habitats that are within 3,900 feet of each alternative. See Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives, for information about the types of impacts that could occur within these zones and Section, 14.4.1.1, Methodology for Assessing Impacts to Wildlife Habitat, for information about how the buffer zones were developed. Wildlife habitat within the 300-foot buffer would be more likely to experience indirect effects such as reduced air quality and water quality, artificial lighting, and other road effects such as visual deterrence and general noise.

Table 14-17. Alternative A1 – Habitat Buffer Zone Summary by Type[a]

in acres

	Habitat Type				
Buffer Distance by Segment[b]	**Pasture**	**Marsh**	**Riparian**	**Playa**	**Waters**
S. Terminus to Gentile St.					
0 to 300 feet	329	22	2	0	10
300 to 800 feet	521	128	4	0	29
800 to 1,300 feet	396	242	6	0	19
1,300 to 3,900 feet	1,168	2,275	36	0	167
Gentile St. to 700 South					
0 to 300 feet	109	25	0	0	1
300 to 800 feet	179	67	0	0	7
800 to 1,300 feet	204	103	0	0	3
1,300 to 3,900 feet	881	1,053	0	10	20
700 South to N. Terminus					
0 to 300 feet	133	0	1	0	2
300 to 800 feet	176	0	2	0	0
800 to 1,300 feet	96	0	7	0	0
1,300 to 3,900 feet	258	0	24	0	0

[a] The four buffer distances were chosen to show the types of wildlife habitats that are within 3,900 feet of each alternative to assist in comparing alternatives. For a summary of the literature on the potential for wildlife impacts from roadways that could occur in these zones, see Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives.

[b] Distances begin from the outer edge of the designed right-of-way.

Table 14-18. Alternative A1 – Habitat Buffer Zone Summary by Quality[a]

in acres

Buffer Distance by Segment[b]	Habitat Quality Low	Medium	High	Total
S. Terminus to Gentile St.				
0 to 300 feet	54	232	77	363
300 to 800 feet	86	336	260	682
800 to 1,300 feet	64	213	386	663
1,300 to 3,900 feet	194	354	3,098	3,646
Gentile St. to 700 South				
0 to 300 feet	42	64	30	135
300 to 800 feet	29	167	57	253
800 to 1,300 feet	17	209	84	310
1,300 to 3,900 feet	73	742	1,139	1,964
700 South to N. Terminus				
0 to 300 feet	37	87	12	136
300 to 800 feet	26	136	16	178
800 to 1,300 feet	14	84	5	103
1,300 to 3,900 feet	111	164	7	282

[a] The four buffer distances were chosen to show the types of wildlife habitats that are within 3,900 feet of each alternative to assist in comparing alternatives. For a summary of the literature on the potential for wildlife impacts from roadways that could occur in these zones, see Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives.

[b] Distances begin from the outer edge of the designed right-of-way.

As shown in Table 14-17 above, most of the wildlife habitat in the buffer zones is pasture and marsh. As shown in Table 14-18 above, the largest amount of high-quality habitat for all zones is found on the segment from the southern terminus to Gentile Street along the Great Salt Lake Shorelands Preserve.

Other Wildlife Impacts

Section 14.4.3, General Impact Information for the WDC Action Alternatives, provides a detailed summary of the expected impacts of the WDC. The impacts from the alternatives would be similar for each alternative; however, there are subtle differences. Alternative A1 could have overall greater impacts to wildlife since this alternative uses segments close to the Great Salt Lake shoreline habitats: the Glovers Lane, Gentile Street, and Kaysville segments. Parts of the Glovers Lane and Gentile Street segments are close to the Great Salt Lake shoreline habitats, which have a fairly low background noise level. In these areas, there is a greater chance of interference with wildlife from roadway noise, artificial light, visual disturbance, roadway mortality, and wildlife movement for some species. As previously discussed in Section 14.4.1.1, Methodology for Assessing Impacts to Wildlife Habitat, species vary widely in their sensitivity to roadway disturbances and their adaptability to the disturbance. See Table 14-17 above for comparative acreages and types of habitats in the near (0–300 foot) and intermediate (300–800 foot) zones where overall roadway disturbance would be the greatest.

Migratory Birds

USFWS has identified birds of conservation concern (BCC) that are present in conservation regions throughout North America (USFWS 2008). The WDC would be in Bird Conservation Region 9, the Great Basin. Alternative A1 would not cause substantive, long-term adverse effects on adult birds. For more information, see Section 14.4.3, General Impact Information for the WDC Action Alternatives.

In addition to operational impacts from the WDC, if construction takes place during the avian breeding season, it could destroy bird nests, eggs, and/or young. A few of the BCC species could be affected by construction during the breeding season. Alternative A1 would remove 356.1 acres of pasture (a mix of upland and wetland) habitat, 3.8 acres of marsh habitat, 1.4 acres of riparian habitat, and 3.1 acres of open water. Given that the largest habitat impacts would occur in the pasture habitats, birds associated with this community type would have the highest potential to be adversely affected by construction. BCC and other state sensitive birds that could be directly affected by construction include the long-billed curlew, burrowing owl, Brewer’s sparrow, grasshopper sparrow, bobolink, and short-eared owl.

Because these impacts would occur within the highway footprint and immediately adjacent to the roadway, they would affect individual birds but not affect bird populations. Long-term noise, visual, fragmentation, and mortality effects could reduce the use of habitat near the roadway, which could result in impacts to some bird populations if they were to abandon the area. These impacts would be the same as those described in Section 14.4.3, General Impact Information for the WDC Action Alternatives.

Wetlands

The wetlands evaluated in this analysis were identified using the methods described in Section 14.3.1.3, Methodology for Identifying Wetlands and Waters of the U.S. These wetlands have not been formally verified by USACE.

Wetlands within the Right-of-Way

Alternative A1 would remove 28.1 acres of wetlands including 4 acres of Category III, 8.2 acres of Category II, and 15.9 acres of Category I wetlands. The wetland types affected would include wet meadows (17.8 acres), emergent marsh (9.1 acres), riparian (0.6 acre), and playa (0.6 acre). Alternative A1 would also remove 4.8 acres of waters and 1 acre of constructed wetlands. Overall, Alternative A1 would have the highest number of wetland impacts of the A Alternatives. The segment with the highest number of wetland impacts for this alternative would be from the southern terminus to Gentile Street in Syracuse (19.3 acres).

Southern Terminus to Gentile Street

A total of 19.3 acres of wetlands would be removed by this segment. Within this segment, 10.6 acres are Category I, 5.9 acres are Category II, and 2.8 are Category III wetlands. This segment could also remove 2.3 acres of open water and of various creeks, canals, and ditches, with a total of 7,948 linear feet of impacts to constructed ditches and unnamed drainages, and 4,968 linear feet of impacts to named creeks (Bair, Davis, Holmes, Kays, Steed, Farmington, and Haight Creeks). Most of the impacts to unnamed drainages, about 2,440 linear feet, would be from a single constructed and landscaped drainage that runs along the west side of Legacy Parkway and then turns west and drains into a wetland system south of Glovers Lane.

Gentile Street in Syracuse to 700 South in West Point

A total of 7.8 acres of wetlands would be removed by this segment. Within this segment, 4.6 acres are Category I, 1.8 acres are Category II, and 1.4 acres are Category III wetlands. This segment would remove 0.8 acre of open water, primarily from various drainages including canals and ditches. Most of the impact to waters would be to 3,324 linear feet of constructed ditches, agricultural drainages, and canals.

700 South in West Point to Northern Terminus

A total of 1 acre of Category I wetland would be removed by this segment. Combined open water impacts would be 1.7 acres, with 1,069 linear feet of impacts to constructed ditches and canals.

Wetlands within 300 Feet of the Right-of-Way

Table 14-15 above, Summary of Ecosystem Impacts from Alternatives A1–A2, shows that 80.5 acres of non-constructed wetlands are located within 300 feet of the right-of-way of Alternative A1. Of the A Alternatives, Alternative A1 would have the greatest number of wetland acres within 300 feet of the right-of-way. As described in Section 14.4.1.2, Methodology for Identifying Impacts to Wetlands and Waters of the U.S., UDOT would design the highway to maintain hydrologic connections to wetlands and would implement a stormwater management system to minimize impacts to wetlands adjacent to the highway. Although UDOT would implement measures to minimize water quality and hydrologic impacts to wetlands adjacent to the highway, there is a potential for some indirect impacts including reduced water quality and changes in hydrology.

14.4.4.2 Alternative A2 – Glovers Lane and 5400 West/5500 South

Wildlife

Habitat Loss

Habitat Quality Index

Alternative A2 ranks as having the lowest score in wildlife habitat quality index values among all the WDC action alternatives (see Chart 14-1 above, Wildlife Habitat Quality Index Values for All Alternatives), and its direct impacts to wildlife habitat would be very similar to those from Alternative A1 (see Table 14-15 above, Summary of Ecosystem Impacts from Alternatives A1–A2).

Southern Terminus to Gentile Street in Syracuse

The impacts from Alternative A2 would be the same as the impacts from Alternative A1.

Gentile Street in Syracuse to 700 South in West Point

The impacts from Alternative A2 would be the same as the impacts from Alternative A1.

700 South in West Point to Northern Terminus

From 700 South to the WDC's northern terminus, Alternative A2 would affect primarily croplands, hayfields, and urban developments. A total of 35 acres of pasture habitat would be affected by this segment. The affected pasture habitat is medium-quality (24 acres) and low-quality (21 acres) habitat. There would also be 4 acres of riparian habitat affected (3 acres of low-quality and 1 acre of medium-quality habitat).

Wildlife Habitat Fragmentation

Table 14-19 summarizes the fragmentation metrics for Alternative A2 and the existing conditions. For a complete list of results, see Appendix 14A, Habitat Fragmentation Analysis.

Table 14-19. Alternative A2 – Fragmentation Summary

	Habitat Type				
Computational Metric	**All**[a]	**Pasture**	**Marsh**	**Riparian**	**Waters**
Existing (No Action)					
Number of patches	655	198	28	34	36
Patch density (#P/100 ha)	2.44	0.73	0.10	0.12	0.13
Mean patch area (ha)	490.4	242.1	1,408.4	10.6	11.1
Mean perimeter/area ratio	116.4	124.1	51.0	592.0	331.3
Mean nearest neighbor (m)	109.7	92.9	25.4	278.2	708.1
Alternative A2					
Number of patches	809	259	30	40	39
Patch density (#P/100 ha)	2.96	0.95	0.11	0.15	0.14
Mean patch area (ha)	482.5	200.7	1,408.0	8.9	11.0
Mean perimeter/area ratio	123.9	136.7	51.0	603.1	329.5
Mean nearest neighbor (m)	100.9	78.1	25.4	286.8	633.4

All means shown are area-weighted.

Units: #P = number of patches, ha = hectares, m = meters

[a] The All habitat type is not a sum; it represents the entire WDC study area landscape including habitat types such as cropland and hayfields but treats urban areas, the right-of-way for the alternatives, and areas outside the study area as background.

The fragmentation effects of Alternative A2 would be similar to those of Alternative A1. For a complete discussion, see the section titled Wildlife Habitat Fragmentation on page 14-73.

General Habitat Buffer Zones

Table 14-20 and Table 14-21 below summarize the wildlife habitat types in four buffer zones for Alternative A2. Note that these four buffer zones are not experimentally tested distances at which some degree of effect is expected to occur to wildlife. These four buffer distances were chosen to show the types of wildlife habitats that are within three-quarters of a mile of each alternative. See Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives, for information regarding the types of impacts that could occur within these zones and Section, 14.4.1.1, Methodology for Assessing Impacts to Wildlife Habitat, for information about how the buffer zones were developed. Wildlife habitat within the 300-foot buffer would be more likely to experience indirect effects such as reduced air quality and water quality, artificial lighting, and other road effects such as visual deterrence and general noise.

Table 14-20. Alternative A2 – Habitat Buffer Zone Summary by Type[a]

in acres

	Habitat Type				
Buffer Distance by Segment[b]	**Pasture**	**Marsh**	**Riparian**	**Playa**	**Waters**
S. Terminus to Gentile St.					
0 to 300 feet	329	22	2	0	10
300 to 800 feet	521	128	4	0	29
800 to 1,300 feet	396	242	6	0	19
1,300 to 3,900 feet	1,168	2,275	36	0	167
Gentile St. to 700 South					
0 to 300 feet	109	25	0	0	1
300 to 800 feet	179	67	0	0	7
800 to 1,300 feet	204	103	0	0	3
1,300 to 3,900 feet	881	1,053	0	10	20
700 South to N. Terminus					
0 to 300 feet	99	0	8	0	0
300 to 800 feet	139	0	14	0	0
800 to 1,300 feet	129	0	24	0	0
1,300 to 3,900 feet	705	0	52	0	3

[b] The four buffer distances were chosen to show the types of wildlife habitats that are within 3,900 feet of each alternative to assist in comparing alternatives. For a summary of the literature on the potential for wildlife impacts from roadways that could occur in these zones, see Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives.

[a] Distances begin from the outer edge of the designed right-of-way.

Table 14-21. Alternative A2 – Habitat Buffer Zone Summary by Quality[a]

in acres

	Habitat Quality			
Buffer Distance by Segment[b]	Low	Medium	High	Total
S. Terminus to Gentile St.				
0 to 300 feet	54	232	77	363
300 to 800 feet	86	336	260	682
800 to 1,300 feet	64	213	386	663
1,300 to 3,900 feet	194	354	3,098	3,646
Gentile St. to 700 South				
0 to 300 feet	42	64	30	135
300 to 800 feet	29	167	57	253
800 to 1,300 feet	17	209	84	310
1,300 to 3,900 feet	73	742	1,139	1,964
700 South to N. Terminus				
0 to 300 feet	50	57	0	107
300 to 800 feet	28	125	0	153
800 to 1,300 feet	29	124	0	153
1,300 to 3,900 feet	202	419	139	760

[b] The four buffer distances were chosen to show the types of wildlife habitats that are within 3,900 feet of each alternative to assist in comparing alternatives. For a summary of the literature on the potential for wildlife impacts from roadways that could occur in these zones, see Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives.

[a] Distances begin from the outer edge of the designed right-of-way.

The effects of Alternative A2 on habitat buffer zones would be very similar to the effects of Alternative A1. The only difference with Alternative A2 would be along the segment from 700 South to the northern terminus, where Alternative A2 would affect about 99 more acres of high-quality pasture within the 1,300-to-3,900-foot zone. Because of its greater length, this alternative would affect more low- and medium-quality pasture habitat within this zone. This alternative would also affect about 27 more acres of riparian habitat within the 1,300-to-3,900-foot zone.

Other Wildlife Impacts

Other wildlife impacts from Alternative A2 would be similar to those from Alternative A1; see the section titled Other Wildlife Impacts on page 14-76.

Migratory Birds

The impacts to migratory birds from Alternative A2 would be very similar to those from Alternative A1. The only slight differences are in the acreages of impacts for the habitat types: 346.9 acres of pasture, 3.9 acres of marsh, 5.3 acres of riparian, and 1.7 acres of open water. The species affected by Alternative A2 would be the same as those affected by Alternative A1.

Wetlands

Wetlands within the Right-of-Way

Alternative A2 would remove 26.9 acres of wetlands including 4 acres of Category III, 7.7 acres of Category II, and 15.2 acres of Category I wetlands. The segment of this alternative with the highest number of wetland impacts would be from the southern terminus to Gentile Street in Syracuse (19.3 acres).

Southern Terminus to Gentile Street in Syracuse

The impacts from Alternative A2 would be the same as the impacts from Alternative A1.

Gentile Street in Syracuse to 700 South in West Point

The impacts from Alternative A2 would be the same as the impacts from Alternative A1.

700 South in West Point to Northern Terminus

There would be no impacts to wetlands in this segment from Alternative A2. There would be 0.7 acre of open-water impacts to drainages and canals. The linear feet of impacts to water features would be 1,614 linear feet with most impacts to canals and ditches.

Wetlands within 300 Feet of the Right-of-Way

Table 14-15 above, Summary of Ecosystem Impacts from Alternatives A1–A2, shows that 64.3 acres of non-constructed wetlands are located within 300 feet of the right-of-way of Alternative A2. These wetlands could be indirectly affected by Alternative A2. Alternative A2 would have the fewest number of wetlands within 300 feet of the right-of-way. As described in Section 14.4.1.2, Methodology for Identifying Impacts to Wetlands and Waters of the U.S., UDOT would design the highway to maintain hydrologic connections to wetlands and would implement a stormwater management system to minimize impacts to wetlands adjacent to the highway. Although UDOT would implement measures to minimize water quality and hydrologic impacts to wetlands adjacent to the highway, there is a potential for some indirect impacts including reduced water quality and changes in hydrology.

14.4.5 Alternatives B1–B2

As described in Chapter 2, Alternatives, Alternative B is the more easterly alternative and consists of two separate alternatives: Alternatives B1 and B2. These alternatives are defined in Table 14-22.

Table 14-22. Components of Alternatives B1–B2

Alternative	I-15 Connection	Four-Lane Highway	Two-Lane Highway	West Point City Segment	North Terminus
B1	Glovers Lane	I-15 to Antelope Drive[a]	Antelope Drive to 1800 North	4100 West	1800 North (West Point)
B2	Glovers Lane	I-15 to Antelope Drive[a]	Antelope Drive to 1800 North	4800 West	1800 North (West Point)

[a] The transition from a four-lane highway to a two-lane highway would occur between Antelope Drive and 700 South.

The analysis in this section focuses on quantifiable differences between the B Alternatives. Impacts to highway-related deaths; water quality; artificial light disturbance; changes in lake levels and habitat availability; threatened, endangered, and sensitive species; and conservation areas would be similar for both of the B Alternatives and are described in Section 14.4.3, General Impact Information for the WDC Action Alternatives.

Table 14-23 below summarizes the ecosystem impacts by resource for Alternatives B1 and B2. For an expanded summary table of ecosystem impacts from the B Alternatives, see Appendix 14C, Expanded Summary Table of Ecosystem Impacts from the WDC Action Alternatives.

Table 14-23. Summary of Ecosystem Impacts from Alternatives B1–B2

in acres

Type of Habitat Affected	B1	B2
Wildlife Habitat		
Direct impacts within the right-of-way by habitat quality[a]		
Low	120.9	121.9
Medium	276.7	265.6
High	48.9	45.3
Total	**446.5**	**432.8**
Wetlands[b]		
Direct impacts within the right-of-way by wetland quality[c]		
Category I	15.7	15.1
Category II	15.3	14.8
Category III	16.9	16.7
Total	**47.9**	**46.6**
Constructed[d]	1.0	0.7
Open water (acres)	4.2	2.8
Open water (linear feet)[e]	17,316	17,203
Wetlands within 300 feet of the right-of-way		
Wetlands total	**101.6**	**85.2**
Constructed[d]	4.7	4.9
Open water	11.8	10.5

[a] Low = Level 2–3 (Ranks 1–2), does **not** includes Urban, Croplands, or Hayfields; Medium = Level 4–5 (Ranks 3–4), includes Pastures and Wetlands; High = Level 6 (Ranks >4), includes Pastures and Wetlands, including Great Salt Lake shore areas.

[b] Wetland impact acres could change during the Clean Water Act Section 404 permitting process after the Final EIS is released.

[c] For definitions of Category I, II, and III wetlands, see Section 14.3.1.3, Methodology for Identifying Wetlands and Waters of the U.S.

[d] Constructed wetlands are constructed basins such as stormwater basins.

[e] Includes constructed canals, major ditches, natural drainages, and named creeks.

14.4.5.1 Alternative B1 – Glovers Lane and 4100 West/1800 North

Wildlife

Habitat Loss

Habitat Quality Index

The habitat quality index is a measure of the habitat quality rank each affected parcel multiplied by the acreage of the parcel (see the section titled Habitat Loss on page 14-31). Alternative B1 has the highest wildlife index value among all action alternatives (see Chart 14-1 above, Wildlife Habitat Quality Index Values for All Alternatives), as is shown by the direct-acreage impacts to wildlife habitat (see Table 14-23 above, Summary of Ecosystem Impacts from Alternatives B1–B2).

Southern Terminus to Gentile Street in Syracuse

The impacts from Alternative B1 would be the same as the impacts from Alternative A1.

Gentile Street in Syracuse to 700 South in West Point

This segment of Alternative B1, which is shared by both of the B Alternatives, starts at Gentile Street and runs west, then runs north through various pastures a short distance until it turns northwest, paralleling Bluff Road and ending at 700 South in West Point. There are interchanges planned at 2000 West and Antelope Drive. This segment would remove about 154.2 acres of wildlife habitat, primarily pastures (139.9 acres). The other wildlife habitats removed would be marsh (14.2 acres). Because the pasture habitat removed in this segment is not along the Great Salt Lake shore and is surrounded by expanding housing developments, the pasture impacts are mostly split between low (58.8 acres) and medium (77.0 acres) quality, with little high-quality habitat (7.1 acres). The only marsh habitat that would be removed is also low quality because it was created by an adjacent housing development as a detention basin.

700 South in West Point to Northern Terminus

Most of the wildlife habitats that would be removed in this segment are pastures (52.3 acres), many of which are either wet or are considered wetlands. Most of the pasture impacts would be to medium-quality habitat (43.9 acres), followed by 6.2 acres of low-quality and 2.2 acres of high-quality pasture habitat. Less than an acre of medium-quality riparian habitat would also be removed. One water would also be removed: a large pond (1.9 acres). The pond is rated as high quality because it is surrounded by wetlands and other open land.

Wildlife Habitat Fragmentation

Table 14-24 summarizes the fragmentation metrics for Alternative B1 and the existing conditions. For a complete list of results, see Appendix 14A, Habitat Fragmentation Analysis.

Table 14-24. Alternative B1 – Fragmentation Summary

	Habitat Type				
Computational Metric	**All**[a]	**Pasture**	**Marsh**	**Riparian**	**Waters**
Existing (No Action)					
Number of patches	655	198	28	34	36
Patch density (#P/100 ha)	2.44	0.73	0.10	0.12	0.13
Mean patch area (ha)	490.4	242.1	1,408.4	10.6	11.1
Mean perimeter/area ratio	116.4	124.1	51.0	592.0	331.3
Mean nearest neighbor (m)	109.7	92.9	25.4	278.2	708.1
Alternative B1					
Number of patches	773	258	31	40	41
Patch density (#P/100 ha)	2.83	0.95	0.11	0.15	0.15
Mean patch area (ha)	483.4	197.8	1,410.8	10.6	11.1
Mean perimeter/area ratio	122.6	138.2	51.5	596.7	331.2
Mean nearest neighbor (m)	102.7	84.3	21.5	278.1	616.5

All means shown are area-weighted.

Units: #P = number of patches, ha = hectares, m = meters

[a] The All habitat type is not a sum; it represents the entire WDC study area landscape including habitat types such as cropland and hayfields but treats urban areas, the right-of-way for the alternatives, and areas outside the study area as background.

The fragmentation effects of Alternative B1 would be similar to those of Alternative A1. Alternative B1 would increase the number of wildlife patches by about 16% compared to existing conditions, which is a little less than the A Alternatives, which increase the number of patches by about 21%.

In terms of potentially becoming a barrier to species moving from the Great Salt Lake shore wetlands and into the interior pastures and other agricultural land, Alternative B1 is similar to Alternative A1 except in the Gentile Street area. Just after crossing Gentile Street, Alternative B1 turns north to roughly parallel Bluff Road, thus avoiding the Great Salt Lake edge areas in western Syracuse. However, by going that route, Alternative B1 would fragment more inland pastures and a few marshes on the western side of Bluff Road. This fragmenting of interior pasture and marsh complexes would continue north to the end of the alternative at 1800 North.

General Habitat Buffer Zones

Table 14-25 and Table 14-26 below summarize the wildlife habitat types in four buffer zones for Alternative B1. Note that these four buffer zones are not experimentally tested distances at which some degree of effect is expected to occur to wildlife. These four buffer distances were chosen to show the types of wildlife habitats that are within three-quarters of a mile of each alternative. See Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives, for information regarding the types of impacts that could occur within these zones and Section, 14.4.1.1, Methodology for Assessing Impacts to Wildlife Habitat, for information about how the buffer zones were developed. Wildlife habitat within the 300-foot buffer would be more likely to experience indirect effects such as reduced air quality and water quality, artificial lighting, and other road effects such as visual deterrence and general noise.

Table 14-25. Alternative B1 – Habitat Buffer Zone Summary by Type[a]

in acres

	Habitat Type				
Buffer Distance by Segment[b]	**Pasture**	**Marsh**	**Riparian**	**Playa**	**Waters**
S. Terminus to Gentile St.					
0 to 300 feet	329	22	2	0	10
300 to 800 feet	521	128	4	0	29
800 to 1,300 feet	396	242	6	0	19
1,300 to 3,900 feet	1,168	2,275	36	0	167
Gentile St. to 700 South					
0 to 300 feet	108	6	0	0	1
300 to 800 feet	157	0	0	0	9
800 to 1,300 feet	163	5	0	0	3
1,300 to 3,900 feet	672	38	0	0	1
700 South to N. Terminus					
0 to 300 feet	140	0	2	0	2
300 to 800 feet	177	0	1	0	0
800 to 1,300 feet	85	0	6	0	0
1,300 to 3,900 feet	273	0	28	0	0

[a] The four buffer distances were chosen to show the types of wildlife habitats that are within 3,900 feet of each alternative to assist in comparing alternatives. For a summary of the literature on the potential for wildlife impacts from roadways that could occur in these zones, see Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives.

[b] Distances begin from the outer edge of the designed right-of-way.

Table 14-26. Alternative B1 – Habitat Buffer Zone Summary by Quality[a]

in acres

	Habitat Quality			
Buffer Distance by Segment[b]	**Low**	**Medium**	**High**	**Total**
S. Terminus to Gentile St.				
0 to 300 feet	54	232	77	363
300 to 800 feet	86	336	260	682
800 to 1,300 feet	64	213	386	663
1,300 to 3,900 feet	194	354	3,098	3,646
Gentile St. to 700 South				
0 to 300 feet	25	81	9	115
300 to 800 feet	27	121	16	166
800 to 1,300 feet	35	103	33	171
1,300 to 3,900 feet	63	506	142	711
700 South to N. Terminus				
0 to 300 feet	13	119	12	144
300 to 800 feet	23	139	16	178
800 to 1,300 feet	19	67	5	91
1,300 to 3,900 feet	156	139	6	301

[b] The four buffer distances were chosen to show the types of wildlife habitats that are within 3,900 feet of each alternative to assist in comparing alternatives. For a summary of the literature on the potential for wildlife impacts from roadways that could occur in these zones, see Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives.

[a] Distances begin from the outer edge of the designed right-of-way.

The acreages of wildlife habit affected in the buffer zones by Alternative B1 in the first segment (southern terminus to Gentile Street) would be the same as those for Alternative A1.

The second segment, from Gentile Street to 700 South, is shared by only the B Alternatives and contains less acreage of wildlife habitat in all four buffer zones than the equivalent segment for the A Alternatives. The difference occurs primarily for two reasons: (1) this segment is shorter than the equivalent segment for the A Alternatives and (2) the segment turns north shortly after Gentile Street and stays away from Great Salt Lake shore habitats. Although this segment along Bluff Road still is close to some pastures and other open land, it is surrounded by encroaching residential development, which reduces the wildlife habitats in the outer buffer zones.

The last segment, from 700 South to the northern terminus, is similar to the previous segment (pastures surrounded by some developments) but with less high-quality habitat in the outer buffer zones and more riparian habitat in all four zones.

Other Wildlife Impacts

Other wildlife impacts from Alternative B1 would be similar to those from Alternative A1 except that the next segment after Layton, from Gentile Street to 700 South, would affect only the eastern portion of Gentile Street near Bluff Road before turning north and paralleling Bluff Road. Alternative B1 would therefore avoid the quiet section of Gentile Street and the associated Great Salt Lake shoreline habitats. See Table 14-25 above, Alternative B1 – Habitat Buffer Zone Summary by Type, for comparative acreages and types of habitats in the near (0–300 feet) and intermediate (300–800 feet) zones where roadway disturbance would be the greatest.

Migratory Birds

The impacts to migratory birds from Alternative B1 would be very similar to those from Alternative A1. The only differences are in the acreages of impacts for the habitat types: 427.14 acres of pasture, 17.6 acres of marsh, 1.6 acres of riparian, and 3.1 acres of open water. The species affected by Alternative B1 would be the same as those affected by Alternative A1.

Wetlands

Wetlands within the Right-of-Way

Alternative B1 would remove 47.9 acres of wetlands including 16.9 acres of Category III, 15.3 acres of Category II, and 15.7 acres of Category I wetlands. Alternative B1 would also remove 4.7 acres of constructed basins. Overall, Alternative B1 would have the highest number of wetland impacts of any of the action alternatives. The segment of this alternative with the highest number of wetland impacts would be from Gentile Street in Syracuse to 700 South in West Point (22.9 acres).

Southern Terminus to Gentile Street in Syracuse

The impacts from Alternative B1 would be the same as the impacts from Alternative A1.

Gentile Street in Syracuse to 700 South in West Point

The impacts to wetlands in this segment would be the highest (22.9 acres) among all segments for Alternative B because this segment goes through wet areas north of Gentile Street and along Bluff Road. Most of the impacts to wetlands would be to Category III wetlands (9.6 acres), followed by 8.8 acres of Category II wetlands and 4.5 acres of Category I wetlands. There would be no open-water impacts in this segment. Most of the 2,783 linear feet of waterway impacts would be old canals and constructed ditches.

700 South in West Point to Northern Terminus

In this segment, about 4.6 acres of Category I, 0.5 acre of Category II, and 0.6 acre of Category III wetlands would be removed. Alternative B1 would also remove 0.3 acre of constructed basins in this segment. Impacts to open water would be 1.9 acres, much of it to a large pond. Of the 1,617 linear feet of impacts to waterways, all would be to constructed ditches and canals.

Wetlands within 300 Feet of the Right-of-Way

Table 14-23 above, Summary of Ecosystem Impacts from Alternatives B1–B2, shows that 101.6 acres of wetlands are located within 300 feet of the right-of-way of Alternative B1. These wetlands could be indirectly affected by Alternative B1. Alternative B1 has the greatest number of wetland acres within 300 feet of the right-of-way. As described in Section 14.4.1.2, Methodology for Identifying Impacts to Wetlands and Waters of the U.S., UDOT would design the highway to maintain hydrologic connections to wetlands and would implement a stormwater management system to minimize impacts to wetlands adjacent to the highway. Although UDOT would implement measures to minimize water quality and hydrologic impacts to wetlands adjacent to the highway, there is a potential for some indirect impacts including reduced water quality and changes in hydrology.

14.4.5.2 Alternative B2 – Glovers Lane and 4800 West/1800 North

Wildlife

Habitat Loss

Habitat Quality Index

Alternative B2 has the second-highest wildlife index value among all action alternatives (see Chart 14-1 above, Wildlife Habitat Quality Index Values for All Alternatives), as shown by the direct-acreage impacts to wildlife habitat (see Table 14-23 above, Summary of Ecosystem Impacts from Alternatives B1–B2).

Southern Terminus to Gentile Street in Syracuse

The impacts from Alternative B2 would be the same as the impacts from Alternative A1.

Gentile Street in Syracuse to 700 South in West Point

The impacts from Alternative B2 would be the same as the impacts from Alternative B1.

700 South in West Point to Northern Terminus

Most of the impacts to wildlife habitat (63.0 acres) would be to pastures (38.8 acres), with most to medium-quality pastures (31.7 acres) and the remainder to low-quality pastures (7.1 acres). The only other wildlife habitat that would be removed is riparian habitat (1.7 acres) where Alternative B2 crosses Howard Slough and one of its tributaries. Less than half of the riparian impacts would be to medium-quality habitat (1.2 acres), with the remainder to low-quality habitat (0.5 acres).

Wildlife Habitat Fragmentation

Table 14-27 summarizes the fragmentation metrics for Alternative B2 and the existing conditions. For a complete list of results, see Appendix 14A, Habitat Fragmentation Analysis.

Table 14-27. Alternative B2 – Fragmentation Summary

	Habitat Type				
Computational Metric	**All**[a]	**Pasture**	**Marsh**	**Riparian**	**Waters**
Existing (No Action)					
Number of patches	655	198	28	34	36
Patch density (#P/100 ha)	2.44	0.73	0.10	0.12	0.13
Mean patch area (ha)	490.4	242.1	1,408.4	10.6	11.1
Mean perimeter/area ratio	116.4	124.1	51.0	592.0	331.3
Mean nearest neighbor (m)	109.7	92.9	25.4	278.2	708.1
Alternative B2					
Number of patches	776	259	31	41	39
Patch density (#P/100 ha)	2.84	0.95	0.11	0.15	0.14
Mean patch area (ha)	484.0	200.1	1,410.8	9.3	11.0
Mean perimeter/area ratio	112.7	137.6	51.5	599.5	329.5
Mean nearest neighbor (m)	102.7	83.4	21.5	283.5	633.4

All means shown are area-weighted.

Units: #P = number of patches, ha = hectares, m = meters

[a] The All habitat type is not a sum; it represents the WDC entire study area landscape including habitat types such as cropland and hayfields but treats urban areas, the right-of-way for the alternatives, and areas outside the study area as background.

The fragmentation effects of Alternative B2 would be very similar to those of Alternative B1.

General Habitat Buffer Zones

Table 14-28 and Table 14-29 below summarize the wildlife habitat types in four buffer zones for Alternative B2. Note that these four buffer zones are not experimentally tested distances at which some degree of effect is expected to occur to wildlife. These four buffer distances were chosen to show the types of wildlife habitats that are within three-quarters of a mile of each alternative. See Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives, for information regarding the types of impacts that could occur within these zones and Section, 14.4.1.1, Methodology for Assessing Impacts to Wildlife Habitat, for information about how the buffer zones were developed. Wildlife habitat within the 300-foot buffer would be more likely to experience indirect effects such as reduced air quality and water quality, artificial lighting, and other road effects such as visual deterrence and general noise.

Table 14-28. Alternative B2 – Habitat Buffer Zone Summary by Type[a]

in acres

	Habitat Type				
Buffer Distance by Segment[b]	**Pasture**	**Marsh**	**Riparian**	**Playa**	**Waters**
S. Terminus to Gentile St.					
0 to 300 feet	329	22	2	0	10
300 to 800 feet	521	128	4	0	29
800 to 1,300 feet	396	242	6	0	19
1,300 to 3,900 feet	1,168	2,275	36	0	167
Gentile St. to 700 South					
0 to 300 feet	108	6	0	0	1
300 to 800 feet	157	0	0	0	9
800 to 1,300 feet	163	5	0	0	3
1,300 to 3,900 feet	672	38	0	0	1
700 South to N. Terminus					
0 to 300 feet	104	0	6	0	0
300 to 800 feet	143	0	5	0	0
800 to 1,300 feet	100	0	9	0	0
1,300 to 3,900 feet	388	0	45	0	3

[b] The four buffer distances were chosen to show the types of wildlife habitats that are within 3,900 feet of each alternative to assist in comparing alternatives. For a summary of the literature on the potential for wildlife impacts from roadways that could occur in these zones, see Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives.

[a] Distances begin from the outer edge of the designed right-of-way.

Table 14-29. Alternative B2 – Habitat Buffer Zones Summary by Quality[a]

in acres

	Habitat Quality			
Buffer Distance by Segment[b]	Low	Medium	High	Total
S. Terminus to Gentile St.				
0 to 300 feet	54	232	77	363
300 to 800 feet	86	336	260	682
800 to 1,300 feet	64	213	386	663
1,300 to 3,900 feet	194	354	3,098	3,646
Gentile St. to 700 South				
0 to 300 feet	25	81	9	115
300 to 800 feet	27	121	16	166
800 to 1,300 feet	35	103	33	171
1,300 to 3,900 feet	63	506	142	711
700 South to N. Terminus				
0 to 300 feet	20	90	0	110
300 to 800 feet	15	133	0	148
800 to 1,300 feet	17	92	0	109
1,300 to 3,900 feet	164	148	124	436

[b] The four buffer distances were chosen to show the types of wildlife habitats that are within 3,900 feet of each alternative to assist in comparing alternatives. For a summary of the literature on the potential for wildlife impacts from roadways that could occur in these zones, see Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives.

[a] Distances begin from the outer edge of the designed right-of-way.

The effects of Alternative B2 on habitat buffer zones would be very similar to the effects of Alternative B1 except in the final segment from 700 South to the northern terminus that runs to the west. Overall, there is slightly more acreage of wildlife habitats within the outer two buffer zones than for Alternative B1 because Alternative B2 runs west into an area surrounded by croplands with more pastures and riparian areas.

Other Wildlife Impacts

Other wildlife impacts from Alternative B2 would be similar to those from Alternative B1; see the section titled Other Wildlife Impacts on page 14-90. See Table 14-28 above, Alternative B2 – Habitat Buffer Zone Summary by Type, for comparative acreages and types of habitats in the near (0–300 feet) and intermediate (300–800 feet) zones where roadway disturbance would be the greatest.

Migratory Birds

The impacts to migratory birds from Alternative B2 would be very similar to those from Alternative A1. The only differences are in the acreages of impacts for the habitat types: 413.7 acres of pasture, 17.6 acres of marsh, 2.8 acres of riparian, and 1.7 acres of open water. The species affected by Alternative B2 would be the same as those affected by Alternative A1.

Wetlands

Wetlands within the Right-of-Way

Alternative B2 would remove 46.6 acres of wetlands including 16.7 acres of Category III, 14.8 acres of Category II, and 15.1 acres of Category I wetlands. Alternative B2 would also remove 4.9 acres of constructed basins. The segment of this alternative with the highest number of wetland impacts would be from Gentile Street in Syracuse to 700 South in West Point (22.9 acres).

Southern Terminus to Gentile Street in Syracuse

The impacts from Alternative B2 would be the same as the impacts from Alternative A1.

Gentile Street in Syracuse to 700 South in West Point

The impacts from Alternative B2 would be the same as the impacts from Alternative B1.

700 South in West Point to Northern Terminus

The wetland impacts in this segment (4.4 acres) would occur only in the southern section of this segment between 300 North and 700 South. All impacts would be to Category III wetlands. There would also be a small amount of impacts to open water (0.5 acre), specifically to Howard Slough and its tributaries. Most of the total linear feet of waterway impacts (1,504 linear feet) would be to constructed ditches and canals.

Wetlands within 300 Feet of the Right-of-Way

Table 14-23 above, Summary of Ecosystem Impacts from Alternatives B1–B2, shows that 85.2 acres of wetlands are located within 300 feet of the right-of-way of Alternative B2. These wetlands could be indirectly affected by Alternative B2. As described in Section 14.4.1.2, Methodology for Identifying Impacts to Wetlands and Waters of the U.S., UDOT would design the highway to maintain hydrologic connections to wetlands and would implement a stormwater management system to minimize impacts to wetlands adjacent to the highway. Although UDOT would implement measures to minimize water quality and hydrologic impacts to wetlands adjacent to the highway, there is a potential for some indirect impacts including reduced water quality and changes in hydrology.

14.4.6 Wetland Avoidance Options

Two wetland avoidance options are being evaluated in this Final EIS, as shown in Table 14-30. The purpose of these options is to avoid wetland impacts per guidance from USACE on wetland avoidance. Either wetland avoidance option could be implemented with any of the A or B Alternatives.

In this section, the impact information for the wetland avoidance options provides only the differences in impacts for the A and B Alternatives as a result of using the wetland avoidance options. The differences in impacts would apply to any of the A and B Alternatives if they were to use the wetland avoidance options.

Table 14-30. Components of the Wetland Avoidance Options

Option	Location	City	Description
Farmington	Prairie View Drive and West Ranches Road	Farmington	Shift the A and B Alternatives in Farmington about 150 feet east to the southwest side of the intersection of Prairie View Drive and West Ranches Road.
Layton	2200 West and 1000 South	Layton	Shift the A and B alternatives in Layton about 500 feet east to the Northeast side of the intersection of 2200 West and 1000 South.

Table 14-31 below summarizes the ecosystem impacts of the wetland avoidance options when implemented with Alternatives A1, A2, B1, and B2.

Table 14-31. Summary of Ecosystem Impacts from the Wetland Avoidance Options with Alternatives A1–A2 and B1–B2

in acres

Type of Habitat Affected	A1	A2	B1	B2
Wildlife Habitat				
Direct impacts within the right-of-way by habitat quality[a]				
Low	101.2	106.4	120.9	121.9
Medium	210.5	202.2	276.3	265.2
High	36.8	33.2	36.3	32.7
Total	**348.5**	**341.8**	**433.5**	**419.8**
Wetlands[b]				
Direct impacts within the right-of-way by wetland quality[c]				
Category I	13.7	13.1	13.6	13.0
Category II	3.3	2.8	10.4	9.9
Category III	4.0	4.0	16.9	16.7
Total	**21.0**	**19.9**	**40.9**	**39.6**
Constructed[d]	1.0	0.7	1.0	0.7
Open water (acres)	4.8	3.8	4.2	2.8
Open water (linear feet)[e]	16,890	17,435	16,897	16,784
Wetlands within 300 feet of the right-of-way				
Wetlands total	**68.7**	**52.4**	**89.7**	**73.3**
Constructed[d]	4.4	4.4	4.7	4.9
Open water	13.2	10.3	11.8	10.5

[a] Low = Level 2–3 (Ranks 1–2), does **not** includes Urban, Croplands, or Hayfields; Medium = Level 4–5 (Ranks 3–4), includes Pastures and Wetlands; High = Level 6 (Ranks >4), includes Pastures and Wetlands, including Great Salt Lake shore areas.

[b] Wetland impact acres could change during the Clean Water Act Section 404 permitting process after the Final EIS is released.

[c] For definitions of Category I, II, and III wetlands, see Section 14.3.1.3, Methodology for Identifying Wetlands and Waters of the U.S.

[d] Constructed wetlands are constructed basins such as stormwater basins.

[e] Includes constructed canals, major ditches, natural drainages, and named creeks.

The difference in ecosystem impacts for the wetland avoidance options when implemented with Alternatives A1, A2, B1, and B2 would be the same for each alternative as follows.

- The wetland avoidance options would result in about 7 acres fewer of total wetland impacts. Of these 7 acres, 2.1 acres would be Category I wetlands and 4.9 acres would be Category II wetlands.
- The wetland avoidance options would result in about 12 fewer acres of wetlands within 300 feet of the right-of-way.
- The wetland avoidance options would result in 13 fewer acres of wildlife habitat being affected. All 13 acres of the habitat affected by the alternatives without the wetland avoidance options would be high-quality wildlife habitat.
- Because the amount of wildlife habitat affected would be similar if the alternatives were implemented with the wetland avoidance options or without the wetland avoidance options, the lake level and habitat evaluation results would be similar (less than a 1% difference).
- The wetland avoidance options would result in 26 fewer acres of pasture and 1 fewer acre of waters affected within 0 to 300 feet of the right-of-way; 2 fewer acres of pasture and 1 fewer acre of marsh within 300 to 800 feet of the right-of-way; 1 fewer acre of pasture and 1 fewer acre of marsh within 800 to 1,300 feet of the right-of-way; and 5 fewer acres of pasture within 1,300 to 3,900 feet of the right-of-way.
- The wetland avoidance options would result in 2 fewer acres of low-quality habitat being affected within 0 to 3,900 feet of the right-of-way; 3 additional acres of medium-quality habitat being affected within 0 to 3,900 feet of the right-of-way; and 16 fewer acres of high-quality habitat being affected within 0 to 3,900 feet of the right-of-way.
- The wetland avoidance options would be about 200 to 250 feet farther from the Great Salt Lake Shorelands Preserve for about 0.4 mile in an area of high-quality wetlands and wildlife habitat. This would slightly reduce wildlife impacts compared to the non–wetland avoidance alternatives.
- The habitat quality indices for the wetland avoidance options would be similar to those for Alternatives A1, A2, B1, and B2 without the wetland avoidance options. The habitat quality index would be reduced by 40 for wildlife habitat.

Table 14-32 summarizes the impacts of the wetland avoidance options to the Great Salt Lake Shorelands Preserve when implemented with Alternatives A1, A2, B1, and B2.

Table 14-32. Impacts to the Great Salt Lake Shorelands Preserve from with the Wetland Avoidance Options

in acres

Area of Impacts	A1	A2	B1	B2
Wetlands[a]				
Direct impacts within the right-of-way	3.1	3.1	3.1	3.1
Wetlands within 300 feet of the right-of-way[b]	15.2	15.2	10.8	10.8
Wildlife Habitat				
Direct impacts within the right-of-way[c]	61.6	61.6	61.6	61.6
Remnant parcels[d]	50	50	50	50
Wildlife Habitat Buffer Zone (Distance from Right-of-Way)[c]				
0 to 300 feet	143	143	106	106
300 to 800 feet	369	369	304	304
800 to 1,300 feet	404	404	302	302
1,300 to 3,900 feet	2,205	2,205	1,365	1,365

[a] Does not include waters or constructed wetlands.

[b] Includes unrated wetlands outside the original survey area.

[c] Includes both wetland and upland habitat, but does not include areas with farm buildings, barns, or other structures.

[d] Remnant parcels are land that would be cut off from the main Great Salt Lake Shorelands Preserve by the WDC, thereby reducing the wildlife habitat value.

The difference in ecosystem impacts from the wetland avoidance options to the Great Salt Lake Shorelands Preserve when implemented with Alternatives A1, A2, B1, and B2 would be the same for each alternative, as follows:

- The wetland avoidance options would result in 5 fewer acres of direct wetland impacts and 11 fewer acres of wetlands within 300 feet of the right-of-way.
- The wetland avoidance options would result in 10 fewer acres of direct wildlife habitat affected.
- There would be slightly less acreage of habitat within the four 0-to-3,900-foot buffer zones.

14.4.7 Mitigation Measures

To meet Clean Water Act and Section 4(f) requirements and to provide mitigation for direct and indirect impacts to wetlands and associated habitat, UDOT proposes to purchase and perform mitigation on privately owned properties within and around the Great Salt Lake Shorelands Preserve boundary and properties on the eastern and northern border of the Farmington Bay WMA. The plan proposes to mitigate for direct and indirect impacts to wetlands, wildlife habitat, the Great Salt Lake Shorelands Preserve, and the Farmington Bay WMA in a holistic and comprehensive manner that will provide a long-term benefit to the eastern shore of the Great Salt Lake ecosystem.

Specific properties included in this mitigation plan will be a component of meeting UDOT's Clean Water Act requirements for mitigating wetland impacts from the WDC Project and will provide Section 4(f) replacement properties and mitigation for the URMCC properties affected by the project.

The mitigation plan was developed based on meetings, site visits, and other input and feedback from the owners and managers of the Great Salt Lake Shorelands Preserve and the Farmington Bay WMA regarding the best approach to mitigate WDC wetland and wildlife impacts. The resource agencies have also provided input and feedback on this mitigation proposal in meetings and site visits to potential mitigation sites.

14.4.7.1 Mitigation Measures for Impacts to Wildlife and Wildlife Habitat

Wildlife

Impacts to Nesting Birds

Mitigation for nesting birds falls under the requirements of the Migratory Bird Treaty Act. Eagles and raptor nests within the range of disturbance of project activities (Romin and Muck 2002) will be surveyed before construction if the construction will occur during the raptor nesting season (March 1 through August 31). USFWS recommends identifying nests before trees leaf out and surveying again after nesting has begun to determine which nests are active and which species are using them. If an active raptor nest is identified within the USFWS guidance distance (Romin and Muck 2002), UDOT will coordinate with USFWS and/or UDWR.

Clearing and grubbing of vegetation should occur outside migratory bird nesting season to make the area unattractive to nesting during nesting season. If clearing and grubbing of vegetation of any kind will occur during the migratory bird nesting season (March 15 through August 1), UDOT or its contractor will conduct preconstruction nesting surveys of the area that would be disturbed no more than 10 days before ground-disturbing activities to determine whether active bird nests are present. If active nests are found, the construction contractor will leave them untouched and will implement a 50-foot buffer of no disturbance until the young have fledged. Vegetation-clearing or -disturbance outside the migratory bird nesting season (August 2 through March 14) can occur without preconstruction surveys if no raptor nests or nest buffers are within the area to be cleared.

Impacts to Fish and Amphibians

To mitigate potential impacts to fish and amphibians, when designing crossings of the WDC over water, UDOT will consider using natural-bottom culverts, maintaining existing gradients, and not adding any new points where slope changes could impede the movements of fish or amphibians. Consideration and identification of the locations for these types of crossings will be determined during the Clean Water Act Section 404 permitting process.

Impacts to the Great Salt Lake Shorelands Preserve

In consultation with The Nature Conservancy and URMCC, UDOT prepared this mitigation plan that it believes will mitigate for impacts to the Great Salt Lake Shorelands Preserve. The mitigation includes acquiring lands in fee along with appurtenant water rights. These lands will be rehabilitated by UDOT to restore the ecological function unique to each parcel and will then be transferred in fee to The Nature Conservancy to be managed in perpetuity as part of the Great Salt Lake Shorelands Preserve. The mitigation will also include an endowment to fund the future management of the properties. The Section 404 permitting process will also include mitigation in areas beyond the Great Salt Lake Shorelands Preserve.

UDOT's plans are to compensate for right-of-way (direct) and indirect effects on the Great Salt Lake Shorelands Preserve caused by the WDC by purchasing private inholdings within the Great Salt Lake Shorelands Preserve. UDOT understands that there will be direct right-of-way impacts (72 acres), remnant parcel impacts (48 acres), and indirect impacts from other sources from the WDC including noise, visual, habitat fragmentation, and light. These impacts will reduce the wildlife habitat functions of those properties near the WDC within the Great Salt Lake Shorelands Preserve.

To mitigate for all impacts to the Great Salt Lake Shorelands Preserves, UDOT will mitigate by preserving and improving wetlands and wildlife habitats on private inholdings within the Great Salt Lake Shorelands Preserve (see Section 14.4.7.2, Mitigation Measures for Impacts to Wetlands). This will include purchasing about nine private inholdings totaling about 791 acres (note that UDOT has purchased some of the properties during the EIS process as part of the hardship acquisition process). Purchasing current private inholdings within the preserve and allowing them to be owned and managed by The Nature Conservancy will provide one contiguous and unfragmented wildlife habitat area not interrupted by private land holdings that could potentially be developed or used for other non-wildlife-habitat-related uses. In consultation with The Nature Conservancy and URMCC, UDOT believes that the purchase and improvements to these parcels is necessary to mitigate for the direct and indirect effects from the WDC on the Great Salt Lake Shorelands Preserve. UDOT coordinated with The Nature Conservancy as the land manager of the Great Salt Lake Shorelands Preserve to determine the mitigation that will compensate for WDC impacts.

UDOT will also coordinate closely with URMCC and The Nature Conservancy to ensure that administrative assess to the Great Salt Lake Shorelands Preserve in maintained or provided and that water delivery and distribution systems remain intact. UDOT will provide an endowment for the long-term management of the properties within the Great Salt Lake Shorelands Preserve. If UDOT is unable to acquire a private inholding within the Great Salt

Lake Shorelands Preserve, UDOT will appraise the property, and an amount of funding equal to the appraised value of the property will be put in a trust fund that can be used for future acquisition of these properties.

Overall Wildlife Impacts

The main high-quality wildlife habitat areas potentially affected by the WDC alternatives are the habitat set aside for wildlife protection in the Great Salt Lake Shorelands Preserve west of all of the WDC action alternatives from Kaysville to Syracuse and the areas near the Farmington Bay WMA south of Farmington. The other land adjacent to the WDC alternatives is either suburban land or farmland that typically provides a lower habitat value than the areas managed for wildlife conservation. Direct right-of-way mitigation for the Great Salt Lake Shorelands Preserve is described above in the section titled Impacts to the Great Salt Lake Shorelands Preserve.

Because different species could be affected by highways at different distances from the highway (Benitez-Lopez and others 2010), it is difficult to determine a specific distance from the highway at which to mitigate indirect effects. Highway noise could affect vocal communication in a number of special-status bird species that might be present near the WDC alternatives; the magnitude of this effect varies with the proximity of the birds to the highway and the required transmission distance of the species' vocal signals. Additionally, environmental variables such as wind, atmospheric turbulence, and background noise can all affect the distance that both highway noise and species' vocal signals can be transmitted. Moreover, behavioral adaptations by species could minimize the effects of highway noise masking. However, UDOT does realize that there would be some indirect effects on wildlife from the WDC and has worked with the resource agencies throughout the EIS process to determine satisfactory mitigation.

Under its current mitigation package, UDOT will purchase or provide about 1,111 acres (about 791 acres to The Nature Conservancy and URMCC and about 320 acres to UDWR) to these agencies for the continued management of wildlife and wetland habitat. The purchase or providing of this land will provide a contiguous and unfragmented wildlife habitat parcel west of the WDC from the Farmington Bay WMA to the north end of the Great Salt Lake Shorelands Preserve.

Additionally, UDOT will consider further opportunities to acquire and preserve land for wildlife habitat and/or buffers to development throughout implementation of the project. These opportunities would be based on working with willing land owners and could include using surplus properties, land exchanges, or other measures. UDOT would coordinate with USFWS and UDWR on these efforts.

Disturbance from Artificial Lights

To reduce the potential impacts from artificial lights associated with the WDC, UDOT will use directional, downward-facing lighting instead of floodlights or lights on poles more than 25 feet high in the area of interchanges. No lighting will be placed on WDC outside of interchange areas.

Disturbance from Noise

To reduce the impact from noise to wildlife, UDOT will construct the WDC using "quiet pavement."

Vegetation

Constructing the WDC would remove vegetation and could also introduce invasive species into the surrounding areas. To prevent further, permanent effects, temporary impacts to vegetation will be mitigated once construction is complete and no further disturbance is anticipated. Mitigation will include the following measures:

- All fill materials brought onto the project site will be required to be clean of any chemical contamination as per UDOT's General Standard Specifications, Section 02056, Embankment, Borrow, and Backfill. Topsoil for landscaping must also be free of weed seeds as per UDOT's General Standard Specifications, Section 02912, Topsoil.
- Compacted soils will be ripped, stabilized, and reseeded with native seed mixes.
- The contractor will be required to follow noxious weed mitigation and control measures identified in the most recent version of UDOT Special Provision Section 02924S, Invasive Weed Control.
- Reseeding with native plants, followed by monitoring seedlings and invasive species until the vegetation has re-established, will mitigate direct-disturbance impacts and reduce the potential for weed invasions. UDOT will be responsible for monitoring and determining when vegetation becomes re-established. The selection of native plant species will be coordinated with USFWS, UDWR, The Nature Conservancy, and URMCC.
- Tree and shrub removal will be timed to occur during the non-nesting season (about August 1 to March 14). If this is not possible, preconstruction surveys will be conducted to determine whether active bird nests are present. Active nests in the area will be left untouched until the young have fledged.
- Removal of riparian vegetation will be minimized to the greatest extent practicable. UDOT will revegetate temporarily affected riparian areas with native riparian plant mixes that include willows and cottonwoods.
- All directly affected riparian habitat as identified as part of the habitat evaluation in this EIS will be mitigated at a 1-to-1 ratio. Mitigation could include restoring other riparian areas near the affected area including areas in the Great Salt Lake Shorelands Preserve, Farmington Creek, Haight Creek, and waterways entering the preserve.

14.4.7.2 Mitigation Measures for Impacts to Wetlands

Before constructing the selected alternative, UDOT will submit a formal wetland delineation for the selected alternative in compliance with Section 404 of the Clean Water Act and will assess the functional value of the affected wetlands. The total acreage of jurisdictional wetlands identified during this process will determine the type and amount of mitigation required to offset impacts to waters of the U.S. A wetland mitigation plan consistent with the 2008 Mitigation Rule will be provided to USACE for approval.

Wetland Impact and Mitigation Evaluation Processes

At the time of the release of this Final EIS, the final wetland mitigation plan has not been finalized with USACE, so all information is considered preliminary. UDOT will follow USACE's processes for determining wetland impacts and associated mitigation. The WDC Clean Water Act process will be carried out in accordance with 33 CFR 320, General Regulatory Policies.

The amount of compensatory mitigation, ratios used to determine adequate mitigation, and wetland mitigation site development will be carried out in accordance with 33 CFR 332.3, General Compensatory Mitigation Requirements. For this process, USACE will require a mitigation ratio greater than 1 to 1 where necessary to account for the method of compensatory mitigation (for example, preservation), the likelihood of success, differences between the functions lost at the impact site and the functions expected to be produced by the compensatory mitigation project, temporal losses of aquatic resource functions, the difficulty of restoring or establishing the desired aquatic resource type and functions, and/or the distance between the affected aquatic resource and the compensation site. This process will include USACE using the South Pacific Division's Standard Operating Procedures for Determination of Mitigation Ratios (12501-SPD) as part of the Section 404 permit review.

The WDC wetland mitigation plan process will follow the requirements of 33 CFR 332.4, Planning and Documentation. This plan will include detailed written specifications and work descriptions for the compensatory mitigation project and a description of long-term management as defined in 33 CFR 332.7, Management. An endowment process will evaluate the long-term management needs, evaluate the annual cost estimates for these needs, and identify the funding mechanism that will be used to meet those needs. UDOT is currently working with The Nature Conservancy (the future land manager) to develop the endowment for properties within the Great Salt Lake Shorelands Preserve.

UDOT will obtain water rights for properties purchased as part of the mitigation process as well as properties purchased as part of the WDC right-of-way requirements. UDOT will coordinate with USACE and The Nature Conservancy to ensure that the water rights are enough to result in successful wetland mitigation. This process will include a determination by a qualified wetland scientist regarding the amount of water needed to support successful implementation of wetland mitigation. UDOT will also coordinate with The Nature Conservancy regarding additional water rights beyond those required for successful implementation of mitigation to provide the opportunity for enhancement of Great Salt Lake Shorelands Preserve wetlands.

Proposed Wetland Mitigation

The WDC team coordinated with The Nature Conservancy, URMCC, and UDWR to develop the specific details for wildlife and wetland mitigation described in this EIS. In addition, the WDC team conducted field visits to the proposed mitigation parcels with The Nature Conservancy, URMCC, UDWR, USFWS, and USACE. The WDC team felt that coordinating with the land managers of conservation areas affected by the WDC would provide the most-valuable input regarding how to mitigate potential impacts.

The WDC preferred alternative would have direct impacts to about 41 acres of wetlands. Additionally, there could be indirect effects on about 90 acres of wetlands (wetlands within 300 feet of the right-of-way). These wetland acreage impact numbers could change based on the USACE permit process review. Although the mitigation plan and the wetland mitigation identified in the plan have not been approved, UDOT's preliminary estimates anticipate that about 245 acres of wetland mitigation will be required for direct wetland impacts. This will include about 109 acres of wetland preservation (13.6 acres of impacts mitigated at a ratio of 8 to 1) and about 136 acres of wetland rehabilitation (27.3 acres of impacts mitigated at a ratio of 5 to 1). Again, the final ratios and total mitigation will be determined by USACE once a permit application is submitted, so UDOT expects the above numbers to change. However, UDOT anticipates that it will acquire about 1,111 acres for mitigation of impacts to wetlands, wildlife, and the Great Salt Lake Shorelands Preserve.

For the indirect wetland effects, UDOT's preliminary estimates anticipate about 61 acres of wetland mitigation, which will include about 30 acres of wetland preservation (33.5 acres of impacts mitigated at a ratio of 0.89 to 1) and 31 acres of wetland rehabilitation (56 acres of impacts mitigated at a ratio of 0.56 to 1). Preservation mitigation will compensate for some direct and indirect impacts to Category I wetlands. Rehabilitation mitigation will generally compensate for impacts to Category II and III wetlands and the remaining Category I wetlands that were not mitigated with preservation. Wetland rehabilitation will generally include the following:

- Remove ditches, dikes, and fill on the eastern shore of the Great Salt Lake to restore lost wetland acreage and function.
- Remove trash, non-native plants, and other non-native items.
- Include upland buffers adjacent to wetland mitigation sites to protect the wetland areas from future adjacent development.
- Prioritize wetland mitigation sites that provide the opportunity to restore and preserve large, undeveloped, unfragmented Great Salt Lake wetland complexes and aquatic-dependent wildlife habitats at risk from future development. The Clean Water Act implementing regulations prioritize mitigation sites that are located within the same watershed and represent an in-kind replacement of wetland type and function.

USACE, USFWS, and EPA felt that wetland and wildlife impacts should be mitigated in locations that would enhance the Great Salt Lake Shorelands Preserve or the Farmington Bay WMA. Mitigation on these parcels would provide the opportunity to provide a large, unfragmented Great Salt Lake wetland complex from Farmington Bay WMA to the north end of the Great Salt Lake Shorelands Preserve. Therefore, UDOT intends to provide the wetland mitigation on the private lands that are surrounded by the Great Salt Lake Shorelands Preserve and on parcels adjacent to the Farmington Bay WMA. UDOT already owns a few of these properties and will plan to purchase the remaining properties.

In order to provide the wetland mitigation of about 306 acres (245 acres for direct impacts and 61 acres for indirect effects), and based on preliminary estimates, UDOT will acquire about 948 acres of land. Note that about 414 of these 948 acres have been purchased by UDOT during the EIS process under the hardship acquisition process. These 948 acres will be the majority of the planned about 1,111 acres that UDOT will acquire within the Great Salt Lake Shorelands Preserve and adjacent to the Farmington Bay WMA. The additional acreage beyond 306 acres of wetland mitigation will provide appropriate upland wildlife habitat adjacent to the mitigated wetlands and will provide mitigation for both direct and indirect impacts to the preserve and wildlife habitat.

Engineering/structural avoidance options, such as additional alignment shifts and/or bridging some of the larger wetland complexes, might be incorporated into the final design in order to satisfy avoidance and minimization requirements during Section 404 permitting. The planning and design process for the WDC avoided and minimized impacts to wetlands and waters of the U.S. by shifting the alignments and constructing retaining walls to the extent feasible while complying with engineering specifications, such as minimum radius of curvature (see Section 14.4.3.10, Summary of WDC Wetland Avoidance Measures).

When feasible, during the final design phase of the project, UDOT will apply design modifications and further minimizations including shifts of the highway within the right-of-way to avoid or minimize wetland impacts through sensitive, high-quality wetland areas and adjacent to terrestrial areas that support aquatic-dependent wildlife species. The design minimization effort will look at the potential to shift the right-of-way or the highway within the right-of-way to preserve upland buffers between wetlands and the roadway to reduce the potential for indirect effects.

Additionally, FHWA and UDOT will require the construction contractor to limit ground and wetland disturbance to the area necessary for the highway improvement that is defined in the Section 404 permit. However, during construction, if any activities not covered by the Section 404 permit would affect wetlands, the contractor would need to coordinate with UDOT to determine appropriate action and permitting requirements.

Where vegetation is disturbed or destroyed, the contractor will reseed these areas with a seed mix of native wetland plants approved by the appropriate agency. Additionally, the contractor will take steps to ensure that noxious weeds are not introduced into wetland plant communities (UDOT Special Provision Section 02924S, Invasive Weed Control). Best management practices required by FHWA and UDOT will require that construction equipment entering the highway construction site be washed to remove noxious weed seeds.

Another concern that must be addressed concerning indirect effects on wetlands is the effect that the WDC could have on hydrology. The WDC design will include structures (for example, pipes, culverts, or bridges) that would allow the conveyance and hydrologic connection of all surface waters crossed by the WDC. Culverts would be designed and constructed at channelized drainages to maintain surface flow, thereby maintaining hydrology in open-water areas, areas abutting riparian wetlands, and hydrologically connected adjacent wetlands. During the final design phase of the project, UDOT will conduct additional evaluation of the hydrologic connection of wetlands to minimize impacts to hydrologic connection features comparable to the existing hydrologic conditions. UDOT will also conduct pre- and post-construction monitoring of the upper aquifer to better understand how the WDC could change subsurface water flows under the highway.

Along the WDC action alternatives are four locations where wetlands would be bisected. These locations are a complex south of Glovers Lane in Farmington where a small drainage feature connects the wetlands, a wetland area in west Farmington on the conservation easements where a drainage feature connects the wetlands, a wetland area north and west of the intersection of Gentile Street and Bluff Road which is connected by groundwater, and immediately south of 1800 North and 4100 West where wetlands are connected by a drainage feature that has been altered by development. In these locations, UDOT will try to maintain hydraulic connectivity through the use of culverts and other design features.

14.4.8 Recommendations to Minimize Growth Impacts to the Ecosystem

The way in which development is planned can have a direct effect on wildlife habitat, open spaces, and the natural landscape. For example, typical residential (conventional) developments produce a fragmented landscape in which roads and residential units take up most of the land area. This leaves little room for wildlife habitat and corridors, open space, and parks. Even so, conventional development can be designed to minimize impacts to wildlife habitat by understanding habitat and fragile lands so that these areas can be preserved.

Another type of development, compact development, can help preserve a site’s landscape character, forested areas, aquatic and terrestrial habitat, and water resources and protect these sensitive areas from the secondary impacts that are typically associated with new developments. Compact development optimizes the conversion of land to urban use and maximizes the amount of natural habitat that is retained. Several analyses of development impacts on fragile lands have been conducted, and these studies generally find that planned (that is, compact) versus conventional development would reduce the development of fragile environmental lands by almost 20%. This reduction varied from 12% to 27% compared to conventional development (EPA 2001).

Large-tract, low-density developments are usually characterized by lawns, flowers, shrubs, and trees, some of which offer habitat for certain songbirds and other human-tolerant wildlife. However, this type of development can significantly reduce the diversity of native species. In contrast, large tracts of continuous, compact development allow the preservation of more natural wildlife habitats and open space areas, which can include farmland and natural areas. Maintaining open space and natural areas contributes to the economic, recreational, and ecological value of a community (EPA 2001).

Compact development has the following effects on the environment due to its reduced use of the land and the nature of its development or redevelopment:

- Reduces disruption or fragmentation of habitat and allows wildlife corridors in areas such as riparian corridors and wetlands.
- Promotes the use of green belts, open space, and wildlife habitat to provide a better quality of life.
- Reduces impervious surfaces, resulting in improved water quality. Studies show that the impervious surface area of a compact development site is often 10% to 15% less than that of more dispersed development.
- Increases the number of activities accessible in a given area and can reduce travel distances and thus vehicle emissions.

To address water quality concerns from an increase in impervious cover, numerous site-level techniques are available to minimize development impacts. These techniques can include rain gardens, bioretention areas, and grass swales. Other options include reducing the number of parking spaces, narrowing streets, and eliminating cul-de-sacs. Incorporating these techniques can help communities meet their water quality goals.

What is a rain garden?

A rain garden is a planted depression or hole that allows rainwater runoff from impervious urban areas, such as roofs, driveways, walkways, parking lots, and compacted lawn areas, to be absorbed.

To minimize water use and impacts to wildlife habitat and wetlands, Cities could implement ordinances that require larger natural open spaces and reduce lot sizes but still allow the gross densities of structures comparable to conventional, large-lot developments. Zoning options include:

What is downzoning?

Downzoning is rezoning an area for lower development densities.

- **Downzoning.** Downzone some boundary and outlying areas to discourage development.
- **Transferable development rights.** Let property owners and developers transfer rights from downzoned areas to areas targeted for development. This helps conserve open space and environmentally sensitive areas and can encourage development near existing infrastructure.
- **Tax credits.** Allow tax credits for development in designated enterprise zones near existing infrastructure.
- **Sliding development fees.** Charge developers with the costs of extending infrastructure to remote sites to encourage the use of sites served by existing infrastructure and to minimize expansion near sensitive resources.
- **Planned unit development.** The purpose of planned unit development regulations is to encourage and allow creative design of land developments that is not allowed under current district zoning regulations. Planned unit development allows substantial flexibility in planning and designing residential and commercial developments. This flexibility often relieves developers of the need to comply with conventional zoning ordinance site and design requirements. Ideally, this flexibility results in a development that is better planned, contains more amenities, and ultimately is more desirable to live in than one produced according to typical zoning ordinances and subdivision controls.

14.4.9 Cumulative Impacts

As part of the WDC EIS process, scoping meetings were held with the public and resource agencies to help identify issues to be analyzed in this EIS. The comments received during the public and agency scoping period were reviewed to determine whether any significant issues were identified. The public and the agencies identified the loss of wildlife habitat and wetlands as a main concern. Chapter 24, Cumulative Impacts, provides a detailed analysis of the potential cumulative impacts to these ecosystems. This section provides a summary of that analysis.

What are cumulative impacts?

Cumulative impacts are the resulting impacts from the proposed action combined with impacts from other past, present, and reasonably foreseeable future actions.

14.4.9.1 Wildlife Habitat

All of the proposed WDC action alternatives would result in a loss of wildlife habitat (including agricultural land), and up to 446 acres of low-, medium-, and high-quality habitat that could be used by wildlife would be converted to a transportation use. Of these 446 acres, up to 50 acres would be high-quality wildlife habitat. It is important to note that, of these 446 acres of habitat, about 427 acres are pasture land that has been disturbed by grazing and the remainder is riparian or marsh habitat. Of the 427 acres of pasture land, 380 acres provide low- to medium-quality habitat.

What is the impact analysis area for cumulative impacts to ecosystem resources?

The cumulative ecosystem impact analysis area is the Ogden, Jordan River, Utah Lake, and Tooele Valley hydrologic units.

Additionally, most of this land is privately owned parcels that are not managed for wildlife habitat. Most of the privately owned parcels are less than 10 acres. With the exception of land in the Great Salt Lake Shorelands Preserve, other affected areas are generally smaller, privately owned parcels that are not managed for wildlife habitat.

The wildlife habitat affected by the WDC alternatives would be in Davis and Weber Counties, which include more than 45,000 acres of land set aside for wildlife management. In addition, about 260,000 acres of wetlands or wildlife habitat around the Great Salt Lake are under some form of management or protection by federal, state, municipal, or private landowners. Most of these acres are managed specifically for waterfowl or shorebird habitat, whereas a few function as mitigation to offset the discharge of fill to wetlands.

The land that would be affected by the WDC alternatives and future development would be mostly agricultural and pasture lands that have been previously disturbed. Therefore, this development would not substantially change the current natural and high-quality wildlife habitat or protected land. However, future development and the WDC alternatives would contribute to a continued change of agricultural land to developed land.

Overall, the WDC would contribute to a small percentage of the total direct cumulative impact to wildlife habitat in the cumulative ecosystem impact analysis area and would not cause this resource to lose its current sustainability. The continued loss of wildlife habitat and disturbance to wildlife from future development and the WDC (indirect effects) could push wildlife onto conservation areas around the Great Salt Lake, which could reduce overall wildlife populations because of the reduction in carrying capacity. Additionally, the indirect effects of increased noise levels could reduce the quality of habitat on conservation land, thereby causing additional cumulative impacts.

14.4.9.2 Wetlands

All of the WDC action alternatives would remove some wetlands. The WDC alternative with the greatest wetland impacts could convert up to 48 acres of wetlands (all quality types) to a transportation use (these would be direct impacts). The WDC could also cause indirect water quality or hydrology effects on the 64 to 100 acres of wetlands within 300 feet of the right-of-way. However, stormwater runoff from the WDC would be contained within the right-of-way, thereby minimizing water quality impacts. The actual indirect effects on wetlands from the preferred alternative would be determined during the Section 404 permitting process.

Indirect effects from development around proposed interchanges in Syracuse and West Point could result in an additional loss of wetlands of up to 20 acres (see Chapter 23, Indirect Effects). Because future development around the interchanges has not been planned, the exact amount of wetlands lost due to indirect effects is not known. The total direct and indirect loss of wetlands from the WDC would be less than 1% of the remaining wetlands in either the cumulative ecosystem impact analysis area or the Ogden hydrologic unit, which is the unit that includes the WDC (see Table 14-33).

Table 14-33. WDC-Related Losses of Wetlands and Wildlife Habitat

in percent

	Percentage Loss of Wetlands and Wildlife Habitat	
Alternative	**Ogden Hydrologic Unit** [a]	**Cumulative Ecosystem Impact Analysis Area**[b]
A1	0.12	0.03
A2	0.12	0.03
B1	0.21	0.05
B2	0.20	0.05

[a] Total acreage is 35,043 acres.

[b] Includes the Ogden, Jordan River, Utah Lake, and Tooele Valley hydrologic units. Total acreage is 139,764 acres.

Although other planned transportation projects could also affect wetlands, urban growth, regardless of the construction of roads and rails, will likely cause the greatest impact to wetlands between 2015 and 2040. This urban growth, which is expected to be about 66,000 acres (GOMB 2008) and which would occur with or without the WDC, would result in a loss of about 4% of the wetlands in the cumulative ecosystem impact analysis area and about 12% of the wetlands in the Ogden hydrologic unit.

However, all projects that would require a Section 404 individual permit must identify the least environmentally damaging practicable alternative, which is the goal of the wetland assessment component of this EIS process. In addition, all projects are required to complete a wetland delineation, from which mitigation measures are determined. Mitigation measures can include avoiding wetland impacts, minimizing wetland impacts, and/or some form of creating, restoring, or enhancing wetlands. Because each project is treated independently by USACE, no data are available on the exact amount of wetlands to be converted to urban uses.

The WDC team expects that wetland impacts from the WDC will have to be mitigated (through creating, restoring, or enhancing wetlands) within the general vicinity of the WDC to satisfy the federal policy of no net loss of wetland acres and/or function (Executive Order 11990, Protection of Wetlands).

In summary, the cumulative ecosystem impact analysis area has lost much of its estimated historic wetland and wildlife habitat areas. Future development projections suggest that this trend will continue. The WDC would contribute (less than 1%) to this overall decrease in wetlands and wildlife habitat in the cumulative ecosystem impact analysis area and in the Ogden hydrologic unit. The location of the WDC in the Ogden hydrologic unit would continue this trend of loss of wetlands and wildlife habitat.

14.4.10 Summary of Impacts

Table 14-34 summarizes the ecosystem impacts from all action alternatives.

Table 14-34. Summary of Ecosystem Impacts from All Alternatives

in acres

	Without Wetland Avoidance Options				With Wetland Avoidance Options			
Type of Habitat Affected	**A1**	**A2**	**B1**	**B2**	**A1**	**A2**	**B1**	**B2**
Wetlands[a]								
Direct impacts within the right-of-way by quality								
Category I	15.9	15.2	15.7	15.1	13.7	13.1	13.6	13.0
Category II	8.2	7.7	15.3	14.8	3.3	2.8	10.4	9.9
Category III	4.0	4.0	16.9	16.7	4.0	4.0	16.9	16.7
Total	**28.1**	**26.9**	**47.9**	**46.6**	**21.0**	**19.9**	**40.9**	**39.6**
Wetlands within 300 feet of the right-of-way								
Total	**80.5**	**64.3**	**101.6**	**85.2**	**68.7**	**52.4**	**89.7**	**73.3**
Waters								
Direct impacts within the right-of-way								
Open water (acres)	4.8	3.8	4.2	2.8	4.8	3.8	4.2	2.8
Open water (linear feet)	17,309	17,854	17,316	17,203	16,890	17,435	16,897	16,784
Wildlife Habitat								
Direct impacts within the right-of-way[b]								
Low	101.2	106.4	120.9	121.9	101.2	106.4	120.9	121.9
Medium	210.9	202.6	276.7	265.6	210.5	202.2	276.3	265.2
High	49.5	45.8	48.9	45.3	36.8	33.2	36.3	32.7
Total	**361.6**	**354.8**	**446.5**	**432.8**	**348.5**	**341.8**	**433.5**	**419.8**
Wildlife Habitat Buffer Zone (Distance from Right-of-Way)[b,c]								
0 to 300 feet	637.0	608.3	624.9	591.1	619.3	590.5	607.2	573.3
300 to 800 feet	1,120.4	1,094.6	1,034.0	1,003.5	1,118.7	1,093.0	1,032.4	1,001.8
800 to 1,300 feet	1,076.0	1,126.0	923.9	942.0	1,076.5	1,126.5	924.5	942.5
1,300 feet to 3,900 feet	5,890.0	6,368.3	4,656.3	4,791.9	5,895.0	6,373.4	4,661.4	4,797.0

[a] Does not include waters or constructed wetlands. Wetland impact acres could change during the Clean Water Act Section 404 permitting process after the Final EIS is released.

[b] Includes both wetland and upland habitat but does not include areas with farm buildings, barns, or other structures.

[c] The four buffer distances were chosen to show the types of wildlife habitats that are within 3,900 feet of each alternative to assist in comparing alternatives. For a summary of the literature on the potential for wildlife impacts from roadways that could occur in these zones, see Section 14.4.3.9, Summary of General Direct and Indirect Wildlife Habitat Impacts from the Action Alternatives.

Comparing all four action alternatives to each other, Alternatives A1 and A2 with the wetland avoidance options would have the overall least amount of wetland impacts, wetlands within 300 feet, and wildlife habitat impacts. Alternatives B1 and B2 would have the lowest amount of wildlife habitat acreage in the buffer zones but would have much greater direct impacts to wetlands and wildlife habitat.

For the two basic fragmentation measures, number of patches and patch density, Alternatives A1 and A2 would have more fragmentation (higher number of patches) and higher patch densities compared to Alternatives B1 and B2. Compared to the No-Action Alternative, Alternatives A1 and A2 would increase the number of patches by about 21%, and Alternatives B1 and B2 would increase the number of patches by about 16%. Overall, the fragmentation measures do not show any substantial differences among the alternatives, since the ecosystem impact analysis area is already highly fragmented.

Looking at the wildlife data separately, and using the habitat quality index (see the section titled Habitat Quality Ranks on page 14-32, the A Alternatives would have fewer compared to the B Alternatives (see Chart 14-1 above, Wildlife Habitat Quality Index Values for All Alternatives). Between the B Alternatives, Alternative B1 would have the highest impacts.

Impacts to Conservation Areas

All of the WDC action alternatives would directly remove 60 to 61 acres of upland wildlife habitat in the Great Salt Lake Shorelands Preserve. In addition, other parcels of the Great Salt Lake Shorelands Preserve would be bisected by the WDC, leaving about 50 acres of wildlife habitat cut off from the main preserve. This would reduce the wildlife habitat value.

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