



WEST DAVIS  
CORRIDOR

# Wildlife Analysis Methodology

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Technical Memorandum 17  
in support of the  
Environmental Impact Statement

## West Davis Corridor Project

Federal Highway Administration  
Utah Department of Transportation



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Prepared by  
HDR Engineering, Inc.  
3949 South 700 East, Suite 500  
Salt Lake City, UT 84107

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## 1.0 Purpose of This Technical Memorandum

The purpose of this technical memorandum is to document the methodology that Federal Highway Administration (FHWA) and the Utah Department of Transportation (UDOT) (the WDC team) will use to analyze impacts to wildlife and sensitive species and their habitat in the West Davis Corridor study area. This methodology was developed in coordination with the U.S. Army Corps of Engineers (USACE), the U.S. Fish and Wildlife Service (USFWS), the Utah Division of Wildlife Resources (UDWR), and the U.S. Environmental Protection Agency (EPA). This methodology will be used in the Environmental Impact Statement (EIS) for the West Davis Corridor project to analyze the wildlife impacts of the project alternatives. This memorandum explains the scope of the analysis that will be performed to evaluate the impacts of the alternatives to be evaluated in detail in the EIS on wildlife and habitat.

## 2.0 Project Overview

FHWA, in cooperation with UDOT, is in the process of preparing an EIS for a proposed action to address projected transportation demand in western Davis and Weber Counties in Utah. The transportation need study area for the project is from Centerville in the south to 4000 South in West Haven in the north and from the Great Salt Lake on the west to Interstate-15 (I-15) on the east (see Figure 1 below).

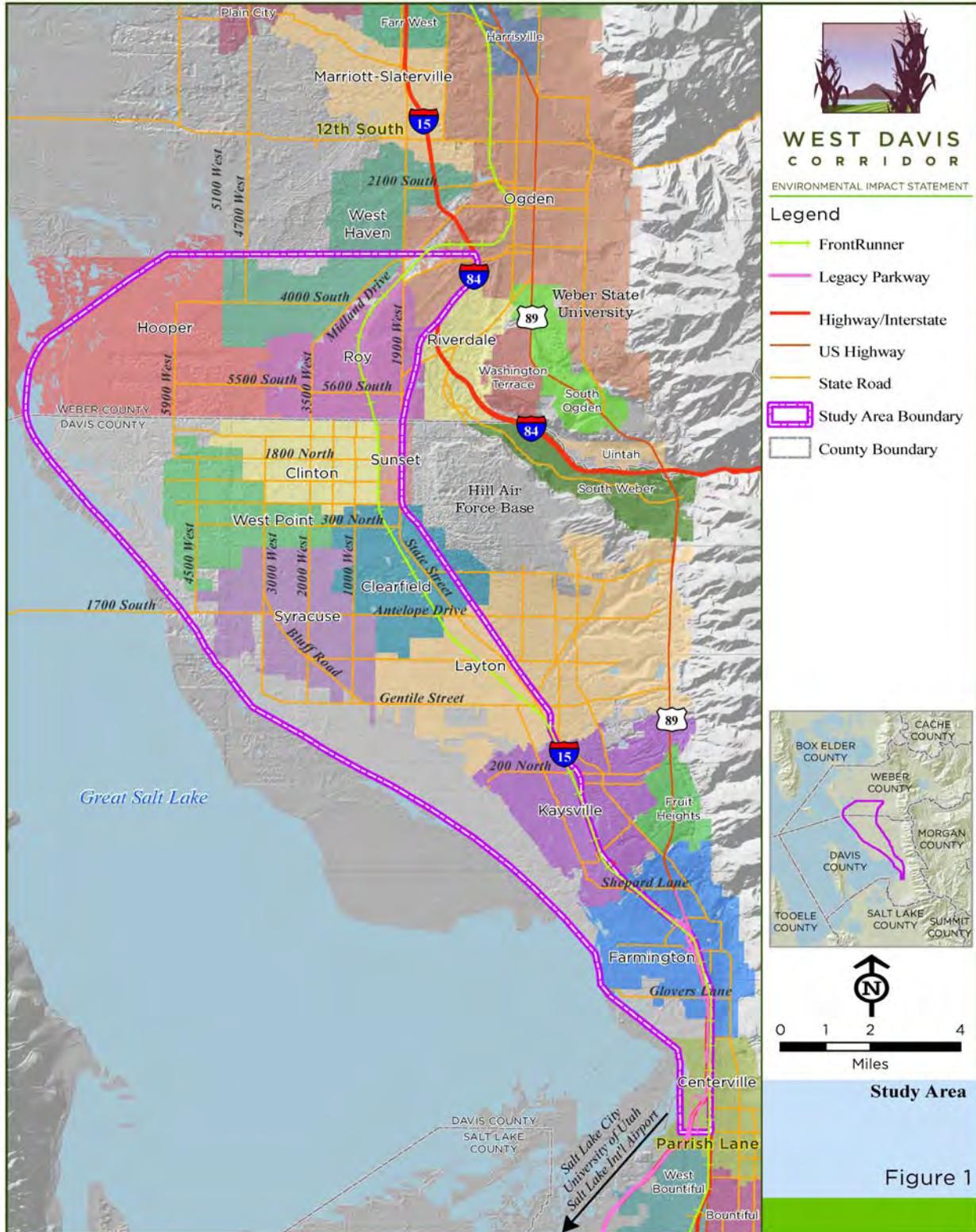
## 3.0 Introduction to the Wildlife Study Area

The West Davis Corridor EIS wildlife study area is the same as the project study area described above. This area, which includes the smaller wetland study area (see the technical memorandum *Preliminary Wetland Study Results* [UDOT 2010b]), covers about 64,276 acres on the west side of I-15. The West Davis Corridor wildlife study area is adjacent to the Great Salt Lake. The Great Salt Lake and the wetlands surrounding its shoreline provide important habitat for a large variety of amphibians, reptiles, birds, and mammals.

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 (Bear, Weber, and Jordan), precipitation, groundwater, and outflow from evaporation. This variation in water level influences the nutrient base and habitats for plants, invertebrates, reptiles, amphibians, mammals, birds, and fish. The variation also creates a mosaic of habitats including wetlands (ranging from freshwater to hyper-saline playas), shorelines, and uplands.

Because of the breadth 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 2009).

**Figure 1. Study Area**



Birds of regional, national, and international importance are drawn to its 15,000 square miles of water environment, remote islands, shoreline, and wetlands. The Great Salt Lake Ecosystem Project estimates that over 7.5 million birds representing 257 species rely on the lake for resident feeding and sanctuary, breeding, or migratory stopovers (GSLEP 2011).

The wildlife study area is located between the Great Salt Lake lakeshore and I-15 and contains a mix of wetland and upland areas. Much of this area has been either modified for agriculture (such as being cleared, ditched, drained, leveled, or irrigated) or more recently developed for residential or commercial uses. Western parts of the study area include mitigation areas, nature preserves, and wildlife management areas. The study area also contains a variety of drainages including irrigation canals, streams, and rivers that flow generally from the east to the west and into the Great Salt Lake.

## 4.0 Proposed Analysis Methodology

*Technical Report 9: Wildlife Assessment Methodology – Existing Conditions* (UDOT 2010a) presents the methods that the WDC team used to characterize the existing conditions of wildlife and habitat in the wildlife study area. Now that the existing conditions information has been collected and documented (see the technical memorandum *Preliminary Wildlife Study Results* [UDOT 2010c]), this technical memorandum will describe the methods that the team will use to analyze the impacts of the project alternatives on wildlife and habitat.

The WDC team will use ArcGIS, a GIS (geographic information systems) software program, to determine how wildlife habitats in the wildlife study area would change if the West Davis Corridor were built and how these changes would affect the species that use these habitats. Measures of habitat change include habitat loss, habitat fragmentation, and habitat degradation. The following sections describe the methods that the team will use to assess these measures of habitat change.

### 4.1 Habitat Loss

#### 4.1.1 Comparison of Alternatives Using Acreages of Direct Impacts

As part of documenting the existing habitat conditions, the WDC team prepared a wildlife habitat map in ArcGIS that shows the different types and locations of habitat in the wildlife study area based on field surveys. The wildlife habitat map is included as part of the technical memorandum *Preliminary Wildlife Study Results* (UDOT 2010c). To compare the project alternatives the direct habitat loss from the project alternatives will be 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 parcels are relatively homogeneous, though they could contain small amounts of other habitat types (for example, a grassy pasture might contain a small clump of shrubs or a half-acre pond). Habitats in agricultural lands or urban areas were delineated using existing property lines. Habitats for clearly defined wildlife habitats were delineated based on about a

5-acre resolution (in most cases, micro-habitat patches smaller than 5 acres were combined with surrounding habitat). Therefore, if the land parcel was not a complex mosaic of a few habitats, then the clearly defined portions of habitats were broken out separately whenever possible. Only the large lakeshore wetlands on the western edge of the wildlife study area, which include a complex mixture of different wetland habitat types, were combined and classified as high-quality wetland habitat in the wildlife habitat map.

## 4.1.2 Comparison of Alternatives Using Habitat Quality Ranks

### Calculation of Habitat Quality Ranks

As a more-focused means of comparing the alternatives than simply their acreages of impacts, the WDC team will use habitat quality ranks that are based on levels of human disturbance, vegetation types, and patch size. This will allow the WDC 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 will give more emphasis to impacts to higher-quality habitat. Using weighted acreages of impacts will amplify and clarify 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 in the study area. These species and their habitat needs were agreed to by the resource agencies. 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. See the technical memorandum *Preliminary Wildlife Study Results* (UDOT 2010c) for more details about this process.

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 lands were not evaluated for wildlife habitat use but were 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 1 below). 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 1. 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.

### Calculation of Impacts from the Alternatives

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 will be 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 can be clearly and graphically compared among the alternatives. 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.

The habitat quality rank weighting will have three main effects on the comparison of alternatives:

1. Urban parcels will be eliminated from the comparison because they will have a rank of 0 (for example, 10 acres  $\times$  0 = a weighted impact acreage value of 0).
2. The impact acreage values for parcels of (active) crop and (managed) hayfield will be reduced because they will have ranks below 1 (for example, 10 acres  $\times$  0.25 = a weighted impact acreage value of 2.5).
3. All other ranks above 1 will increase in impact acreage values—up to 6 times for the highest-ranked parcel (for example, 10 acres  $\times$  5 = a weighted impact acreage value of 50). These weighted impact acreage values will be used to compare the alternatives.

## Table Output of the Habitat Quality Ranks

Additionally, the acreages of impacts by quality and habitat type for the WDC alternatives will be described separately in a table for the purpose of viewing specific types of impacts.

## 4.2 Habitat Fragmentation

The WDC team will analyze the average habitat patch size and the number of patches to evaluate and compare the fragmentation effects of the WDC alternatives on each habitat category (upland and wetland, if possible) and habitat type (marsh, pasture, playa, and so on). A habitat patch is a continuous parcel of land that provides some wildlife habitat and is not separated by roads, structures, or other type of urban development. The patches that will be used in the analyses are the 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 are defined by paved streets, large structures, and abrupt changes in land type but not by small houses, sheds, driveways, or other extremely low use unimproved access roads. In addition, if a patch of native habitat or pasture is adjacent to cropland, the cropland defines the edge of the patch.

The habitat fragmentation analysis will consider a series of fragmentation metrics including trends in fragmentation (that is, trends in the average patch size and the total amount of each habitat type by patch size), distribution of patch sizes, average perimeter-to-area ratio, and average nearest habitat distance. The analysis will also qualitatively examine the potential of the alternatives to fragment existing habitat complexes, where a collection of smaller patches is separated only by open space or other non-fragmenting lands or structures (such as small dirt access roads but not 2-lane paved roads with dense traffic). A likely scenario in the study area of such a situation would be a group of pastures separated only by managed croplands where one or more alternatives would not touch the pastures but instead impact the cropland among the pastures, acting as a potential barrier and splitting up the complex of pastures.

In the rare situation where an alternative approaches the western edge of the wildlife study area, habitats will be extended westward up to 2,000 feet from the western edge of the alternative, and that will be noted as a limitation of the data in the discussion.

These analyses will use GIS spatial analysis tools with the FRAGSTATS analysis program. The results of these various fragmentation analyses for each alternative will be compared to the existing conditions as a way to assess the potential cumulative effects of the alternative, given the wildlife study area's existing level of fragmentation by development and agriculture.

## 4.3 Habitat Degradation

Habitat can be degraded by many factors such as water 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, the scientific literature has focused on noise in recent years.

The WDC team has reviewed scientific literature and research reports, including the recently completed Legacy Avian Noise Research Study (BIO-WEST 2011), regarding the noise levels and distances from highways at which wildlife is likely to be disturbed. However, these articles and reports do not present either conclusive or directly relatable findings, given the large variability in wildlife responses to roadway disturbance, in habitat types, and in other uncontrolled factors (such as lack of proper experimental controls). Therefore, the WDC team will synthesize the findings from the Legacy Avian Noise Research Study and other recent academic literature to qualitatively analyze the potential effects, including noise, of the roadway alternatives within three buffer distances (also known in the scientific literature as effect zones) on wildlife habitat in nonurban or agricultural areas.

The WDC team will use three buffer distances to quantify the type and amount of wildlife habitat at different distances from the roadway alignments. The near zone, which begins from the edge of the right-of-way, will extend out to 300 feet. The middle zone will extend out 500 feet from the near zone (800 feet from the edge of the right-of-way). The far zone will include areas starting from the outer edge of the middle zone and out to 1,300 feet from the right-of-way.

The WDC team will make the following assumptions for any areas outside the current study area:

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

### 4.3.1 Roadway

The WDC team will review existing literature on wildlife deaths from new roads (a direct effect). The team will also review literature about how adding artificial lighting and landscaping affects habitat for wildlife species (indirect effects). Using the information gained from these literature reviews, the team will qualitatively evaluate the potential impacts of the alternatives using the buffers described in Section 4.3 above. In addition, the team will use data from the water quality analysis in the EIS, along with stormwater treatment plans, to qualitatively evaluate how changes in stormwater runoff due to the project alternatives would affect adjacent wildlife habitat.

### 4.3.2 Noise

The WDC team will use the results of the noise analysis for the EIS to help determine the distance at which the noise of the WDC alternatives would not be significantly audible above the existing background noise. Noise contours will be modeled for each project alternative as part of the EIS noise analysis, and these contours will be overlaid on a map of the habitats in the wildlife study area.

To quantitatively assess the impacts of highway noise on wildlife, including the potential indirect impacts on birds, the WDC team will calculate and examine two noise contours: one that is 3 dBA (A-weighted decibels) more than the background noise level and one at a conservative 50 dBA. Acoustic research shows that a noise level of 50 dBA usually does not prevent birds from hearing other birds' communications (Dooling and Popper 2007). This noise level of 50 dBA is the level at which the audible difference between an alternative's noise and the background noise is below the likely threshold to significantly disturb wildlife in the study area. This sound contour will be overlaid on the habitat quality database to assess the acreage of potential impacts to wildlife from project-induced noise.

In addition, if newly published scientific literature finds that a species known to be present in the WDC study area is affected by noise within a specific distance from a highway, the WDC team will examine the effects of the project alternatives on that species within the specified buffer distance. This buffer distance might be larger or smaller than the buffer distance determined by the EIS noise analysis.

## 4.4 GIS Analysis of Changes in Lake Level and the Dynamics of Habitat Availability and Distribution

The WDC team will conduct a GIS analysis to compare the direct habitat availability and losses that would result from the WDC alternatives against the direct habitat availability and losses that could result from higher levels of the Great Salt Lake within the wildlife study area. 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, since the total available habitat for some species would be reduced. The additional impacts to these remaining wildlife habitats from the alternatives will be 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 will be combined with an inundation zone dataset (from the Federal Emergency Management Agency and the U.S. Army Corps of Engineers) for the Great Salt Lake in order to compare the amount of remaining habitat in the wildlife study area due to habitat loss from (1) natural lake level fluctuation and (2) the WDC alternatives. The analysis will examine a few selected lake levels that are higher than the current lake level, with the highest lake level being the jurisdictional ordinary high-water mark of the Great Salt Lake defined by the Corps (4,217 feet). The team will analyze the effect of each alternative on the non-inundated habitat assumed at different inundation levels. The details of



these calculations will be provided as an appendix in the Draft EIS or as a wildlife effects technical memorandum.

## 5.0 References

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