Chapter 2

Tenth Circuit Court Ruling Analysis

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2.0 Introduction

2.0.1 Background

This chapter of the Supplemental EIS summarizes the information assembled in relation to the limited deficiencies of the Legacy Parkway Final EIS and the Clean Water Act Section 404 permit, as identified by the U.S. Circuit Court of Appeals for the Tenth Circuit. This chapter summarizes the approach, methodology, results, and conclusions of the technical analysis of the issues raised by the court decision.

As part of the environmental scoping process for the Supplemental EIS, a public open house was held to inform the public about the issues to be analyzed in addressing the court decision. Specific focus-group meetings and community planning information committee (CPIC) meetings were also held to gather public and agency input on the approach to conducting the analyses to address the court's concerns. In addition to the scoping process, the following measures were undertaken.

- The lead agencies requested that UDOT and the technical consultants prepare five preliminary draft technical memoranda, in collaboration with and under the direction of the lead agencies, to address each of the subjects covered in the court ruling.
- The lead agencies requested that the U.S. Environmental Protection Agency (EPA) and U.S. Fish and Wildlife Service (USFWS) serve as cooperating agencies in preparation of the Supplemental EIS.
- The lead agencies provided all the preliminary draft technical memoranda to the cooperating agencies for review and comment.
- The lead agencies considered and responded to cooperating agency comments.
- CPIC meetings on specific topics were held to advise interested parties of the ongoing evaluation and to seek input on the agency approaches and preliminary findings.
- When requested by outside organizations, the lead agencies met with these organizations, including their consultants and experts, to hear additional comments and suggestions on the approaches and preliminary findings.
- UDOT and the consultants incorporated revisions and prepared the final technical memoranda.

- The lead agencies independently reviewed the results presented in the five technical memoranda and the administrative record and, in applying their expertise and professional judgment, determined that the information was sufficient to use in this Supplemental EIS and support initial determinations for the Supplemental EIS.

2.0.2 Technical Memoranda

As described above, five technical memoranda were prepared. The analysis and results of the studies contained in the technical memoranda are hereby incorporated by reference into this Supplemental EIS. The five technical memoranda are listed below.

- Legacy Parkway Technical Memorandum: *Right-of-Way Issues* (HDR Engineering 2005a).
- Legacy Parkway Technical Memorandum: *Denver & Rio Grande Corridor Evaluation* (HDR Engineering 2004a).
- Legacy Parkway Technical Memorandum: *Integration of Mass Transit with Legacy Parkway* (Fehr & Peers 2004).
- Legacy Parkway Technical Memorandum: *Sequencing of the North Corridor Shared Solution* (HDR Engineering 2004b).
- *Legacy Parkway Wildlife Impacts Analysis Technical Memorandum* (Jones & Stokes 2005).

The technical memoranda and their results are summarized in Sections 2.1 through 2.5 of this chapter.

Section 2.1
Right-of-Way Issues

2.1.1 Summary of Approach for Supplemental EIS

2.1.1.1 Updates Since Previous Final EIS

The Preferred Alternative identified in the Final EIS, and the evaluation of the least environmentally damaging practicable alternative identified in the CWA Section 404(b)(1) analysis, was based on a 100-m (328-ft) right-of-way that followed the proposed Alternative D (Final EIS Preferred Alternative) alignment. The right-of-way for Alternative D, as well as that of all the other build alternatives evaluated in the Final EIS, included a 20-m (66-ft) wide median, which was based on UDOT design standards at the time the Final EIS was published, and a 27-m (84-ft) wide buffer area, including a trail.

Following the appellate court decision, the lead agencies reviewed information related to the components of the right-of-way to assess whether narrower widths were reasonable. Among other considerations, the lead agencies reviewed information to document whether the median width was selected, in part, to provide for additional travel lanes in the future, and examined the possibility of constructing an alternative without a berm or future utility corridor. Concerns related to the median and berm are addressed below. For a description of the trail component, see Chapter 1, *Purpose of and Need for Action*, and Section 3.3.4, *Alternatives without a Trail Component or Separate Trail Facility*.

In examining a narrower right-of-way, the lead agencies reviewed information presented in the Final EIS relative to the selection of the right-of-way width for Alternative D (Final EIS Preferred Alternative). The federal lead agencies also reviewed new information that has been developed since publication of the Final EIS and requested that UDOT provide detailed information on design standards and guidelines for all components within the right-of-way of the build alternatives. In addition, the federal lead agencies requested that UDOT analyze alternative right-of-way widths based on reductions in both the median and buffer area widths, and that UDOT assemble information on the roadway footprint (i.e., the area of disturbance within the right-of-way) to evaluate opportunities to further minimize project impacts. This supplemental information is contained in the Legacy Parkway technical memorandum: *Right-of-Way Issues* (right-of-way technical memorandum) (HDR Engineering 2005a) and will be used to assist in the determination of the least environmentally damaging practicable alternative that would be feasible to serve the basic project purpose.

2.1.1.2 Changes since the Draft Supplemental EIS

Since publication of the Draft Supplemental EIS in December 2004, UDOT has updated the analysis of the design of Alternative E. This updated analysis indicated that a larger acreage of wetlands could be avoided under Alternative E as a result of design flexibility (i.e., the opportunity for the design engineer to modify, consistent with design standards, facility components). Specifically, the Draft Supplemental EIS stated that approximately 6 ha (14 ac) of wetlands in the right-of-way of Alternative E could be avoided through design/build flexibility, which affected the acreage of wetlands impacts presented in Section 2.1.2.4, *Alternative Right-of-Way Widths and Wetlands Impact Evaluation*. The updated analysis conducted since the Draft was published indicates that approximately 4 ha (10 ac) of wetlands in the right-of-way of Alternative E could be avoided through design/build flexibility, a reduction of 1.6 ha (4 ac). This reflects a reduction in the acreage of wetlands that could potentially be avoided in the Alternative E right-of-way between Parrish Lane and Glovers Lane.

2.1.2 Summary of Right-of-Way Analysis

As a result of the analysis documented in the right-of-way technical memorandum, the proposed overall right-of-way width for the build alternatives evaluated in this Supplemental EIS has been reduced from 100 m (328 ft) to 95 m (312 ft). This overall reduction results from narrowing the open median from the 20-m (66-ft) width presented in the Final EIS to the 15-m (50-ft) width consistent with recent research on roadway geometrics and a revised UDOT design standard for medians. Under UDOT standards, reducing the median to less than 15 m (50 ft) would require that a design exception for a new rural freeway be granted, the placement of a median barrier,[1] and a corresponding alternative water quality treatment method to replace the water quality control functions of the vegetation in the open median. Consistent with the Final EIS, the 95-m (312-ft) right-of-way includes a 27-m (84-ft) buffer area in areas with a berm and a 25-m (81-ft) buffer area in areas without a berm. A reduced 11-m (36-ft) buffer area is proposed in specific areas of the alignment (i.e., where no berm or interchange is present) to avoid sensitive resources, which would reduce the roadway footprint to 80 m (264 ft) within the proposed 95-m (312-ft) right-of-way in these areas. As indicated in the right-of-way technical memorandum, the analysis found that further reductions in the buffer area, even substantial reductions, resulted in only minor savings in overall wetland impacts and would not provide a safe separation between the roadway facility and the multiuse trail users.

The following sections summarize the analysis of the right-of-way issues particular to the median and buffer area components of the proposed build alternatives. Additional information (e.g., design standards and guidelines) regarding the other components of the proposed right-of-way is provided in Section 3.0 of the right-of-way technical memorandum and in the administrative record.

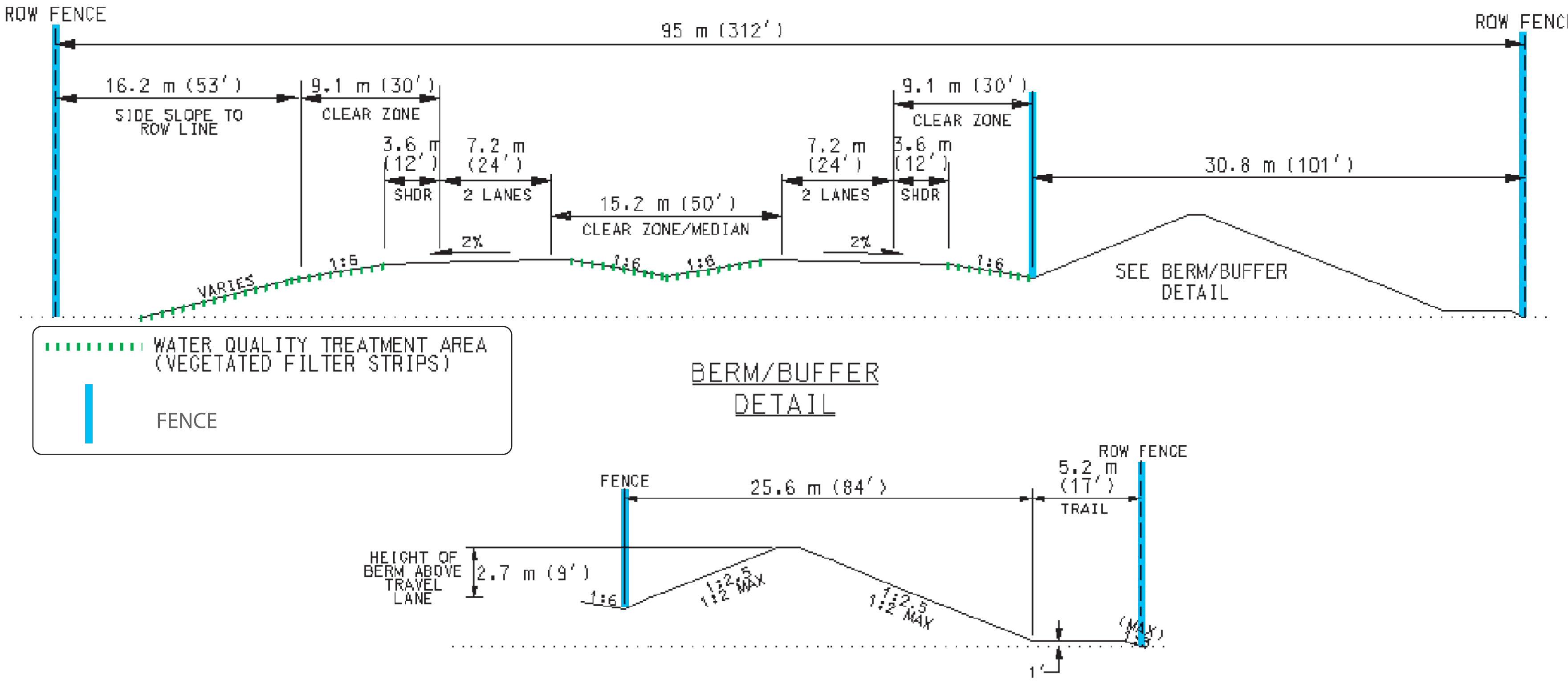
2.1.2.1 Right-of-Way Cross-Section Components in Supplemental EIS

Mainline Components

For the reasons discussed below, all the build alternatives evaluated in the Supplemental EIS are based on a 95-m (312-ft) right-of-way. Tables 2.1-1 and 2.1-2 below provide the applicable design standards and references used for each component within the right-of-way. These tables also identify which components rely on fixed-dimension widths and which fall within a range of acceptable widths. Where a range of widths could be used, rationale is provided for the dimensions selected.

Figure 2.1-1 illustrates the proposed right-of-way cross section with the berm in place (Table 2.1-1), and Figure 2.1-2 illustrates the proposed right-of-way cross section without the berm in place (Table 2.1-2).

[1] *Median barrier* refers to a longitudinal system such as a concrete barrier used to minimize the possibility of an errant vehicle crossing into the path of traffic traveling in the opposite direction.



Note: Figure 2.1-1 corresponds to Table 2.1-1

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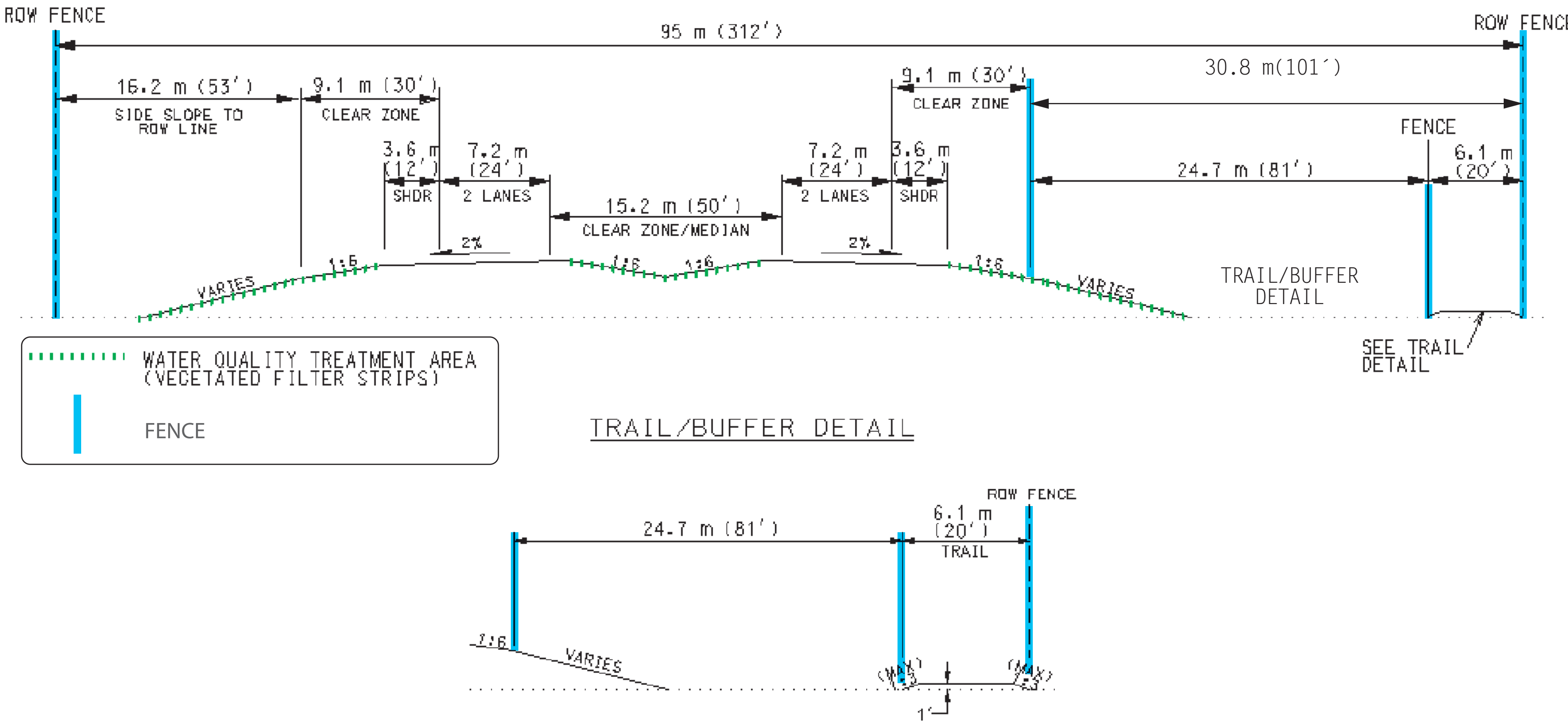
Figure 2.1-1
Legacy Parkway Supplemental EIS
95m (312′) Right-of-Way Cross Section with Berm



Note: Figure 2.1-2 corresponds to Table 2.1-2

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Figure 2.1-2
Legacy Parkway Supplemental EIS
95m(312′) Right-of-Way Cross Section without Berm

Table 2.1-1 Legacy Parkway Proposed Right-of-Way Cross-Section Components and Dimensions (with Berm)

Component (Left to Right)	Dimension, m (ft)	Fixed or Variable	Standard/ Reference	Notes
Side slope to right-of-way line	16 m (53 ft)	Variable	UDOT[2]	• Area required to safely transition from clear zone to existing grade. • Side slope must meet UDOT minimum requirements for maintenance and access. As such, side slope varies and depends on height of embankment—1:6 for fill heights less than 1.5 m (5 ft); 1:4 for fill heights between 1.5 m (5 ft) and 3 m (10 ft); and 1:3 for fill heights above 3 m (10 ft). The maximum height of fill that can be accommodated with the 95-m (312-ft) right-of-way without using a retaining wall is 6.5 m (21.4 ft). The minimum height of fill that can be used while allowing for cross pipes is 1.0 m (3.3 ft). (Embankment fill height brings roadway facility above 1,285 m [4,215 ft].)
Clear zone (includes shoulder)	9 m (30 ft)	Fixed	AASHTO[1, 3] UDOT[2]	• *Clear zone* is the unobstructed area beyond the edge of the traveled way that allows for recovery of errant vehicles. • Area includes 3.6-m (12-ft) paved (outside) shoulder. • 1:6 maximum slope.
Travel lanes (southbound)	7 m (24 ft)	Fixed	UDOT[2] AASHTO[1]	• Provides two southbound 3.6-m (12-ft) travel lanes.
Median/Clear Zone	15 m (50 ft)	Fixed	UDOT[2] AASHTO[1, 3]	• Provides safe separation distance for opposing travel lanes, given an open median. • Includes two 1.2-m (4-ft) paved (inside) shoulders. • UDOT standard requires a fixed 15-m (50-ft) median on rural freeways. AASHTO standard recommends a range of 15 m to 30 m (50 ft to 100 ft) for open medians on rural freeways.[5]
Travel lanes (northbound)	7 m (24 ft)	Fixed	AASHTO[1] UDOT[2]	• Provides two northbound 3.6-m (12-ft) travel lanes.
Clear zone (includes shoulder)	9 m (30 ft)	Fixed	AASHTO[1, 3] UDOT[2]	• *Clear zone* is the unobstructed area beyond the edge of the traveled way that allows for recovery of errant vehicles. • Area includes 3.6-m (12-ft) paved (outside) shoulder. • 1:6 maximum slope.

Component (Left to Right)	Dimension, m (ft)	Fixed or Variable	Standard/ Reference	Notes
Buffer area	27 m (84 ft)	Variable	AASHTO, safety, visual screening, noise attenuation	• Buffer width based on height of berm (2.7 m [9 ft], as measured from the roadway surface at its highest point, to provide screening). Berm side slopes (1:2.5 maximum) must meet UDOT standards for maintenance. • Berm location: East side between 500 South and Porter Lane (Woods Cross), west side between Glover's Lane and State Street (Farmington). • Berm length: 5.1 km (3.2 mi) of overall alignment.
Trail	5 m (17 ft)	Variable	AASHTO[4]	• Provides a 2.4-m-wide (8-ft-wide) paved bicycle/pedestrian path with adjacent 1.8-m-wide (6-ft-wide) unpaved equestrian trail. There would be 0.9 m (3 ft) between the trail and right-of-way line.
Total right-of-way width	**95 m (312 ft)**			

Sources:

[1] *A Policy on the Geometric Design of Highways and Streets* (American Association of State Highway and Transportation Officials 2004).

[2] UDOT Standard Drawing DD 4 (Utah Department of Transportation 2005a).

[3] *Roadside Design Guide* (American Association of State Highway and Transportation Officials 2002).

[4] *Guide for Development of Bicycle Facilities* (American Association of State Highway and Transportation Officials 1999).

[5] A *rural freeway* is defined as an arterial highway with full control of access in an area outside an urban setting (American Association of State Highway and Transportation Officials 2004).

Table 2.1-2 Legacy Parkway Roadway Components and Dimensions (without Berm)

Component (Left to Right)	Dimension, m (ft)	Fixed or Variable	Standard/ Reference	Notes
Buffer area	25 m (81 ft)	Variable	AASHTO,[4] safety, visual screening, noise attenuation	• Buffer area provides safe separation between vehicle traffic on the parkway and pedestrians, bicyclists, and equestrians on the trail.
Trail	6 m (20 ft)	Variable	AASHTO[d]	• Provides a 2.4-m-wide (8-ft-wide) paved bicycle/pedestrian path with adjacent 1.8-m-wide (6-ft-wide) unpaved equestrian trail. There would be 0.9 m (3 ft) between the trail and right-of-way line. • Includes 1-m (3.3-ft) trail fill slope where there is no berm.
Total right-of-way width	**95 m (312 ft)**			

Component (Left to Right)	Dimension, m (ft)	Fixed or Variable	Standard/ Reference	Notes

Sources:

[1] *A Policy on the Geometric Design of Highways and Streets* (American Association of State Highway and Transportation Officials 2004).

[2] UDOT Standard Drawing DD 4 (Utah Department of Transportation 2005a).

[3] *Roadside Design Guide* (American Association of State Highway and Transportation Officials 2002).

[4] *Guide for Development of Bicycle Facilities* (American Association of State Highway and Transportation Officials 1999).

(Note: Only buffer area and trail dimensions are provided; all other dimensions are the same as Table 2.1-1.)

The following sections summarize the analyses used to determine the minimum median and buffer area widths and to ensure that they were the minimum necessary to meet the basic project purpose.

Frontage Roads

All the build alternatives described in the June 2000 Final EIS and Supplemental EIS would require frontage roads at certain locations to provide access to properties where access would be cut off by implementation of the proposed action. Without such frontage roads, the affected properties would be inaccessible and would not retain any use. These frontage roads would be adjacent to the mainline of the associated build alternative. The locations of the frontage roads are described in Section 2.5, *Descriptions of Alternatives Evaluated in Detail*, of the Final EIS.

In September 2005, at the request of the lead agencies, UDOT prepared a memorandum (Shingleton pers. comm.) describing the components associated with the frontage roads and the standard or reference that was used to determine their widths. As described in the memorandum, each of the proposed frontage roads would be 20-m (66-ft) wide and would include two 3.7-m (12-ft) side slopes, two 3-m (10-ft) clear zones/shoulders, and two 3.4-m (11-ft) travel lanes. Just as the components of the Legacy Parkway mainline were reviewed to evaluate whether a narrower cross section could be developed to reduce impacts on wetlands and other sensitive resources, the design of the frontage roads was reviewed to look for opportunities to reduce the width (Shingleton pers. comm.). Dimensions for each of these components were based on UDOT design standards, which were, in turn, based on national standards and generally accepted engineering and design practices for roadway facilities. As stated in the memorandum, it was determined that 20 m (66 ft) was the minimum width for the frontage roads that would reflect state and federal design standards.

It should be noted that the width of the frontage roads would be in addition to the 95-m (312-ft) right-of-way width attributed to the build alternative alignments. All evaluations conducted for the Final EIS and the Supplemental EIS considered and disclosed the environmental impacts that would be associated with construction of the frontage roads.

2.1.2.2 Median Width Evaluation

Median Width: Approach

To determine whether a narrower median could be proposed that would still meet the project purpose, the following approach was used.

- Review state and national design standards and guidelines.
- Review recent and relevant safety studies.
- Evaluate alternative water quality control methods to replace the stormwater treatment functions of vegetated filter strips in the 15-m (50-ft) open median. (Vegetated filter strips are described in Section 4.10.3.2, *Surface Water Quality*, of this Supplemental EIS.)

See Section 2.1.2.4 for additional information on the impacts associated with a variety of median widths.

As a related matter, the right-of-way width evaluation considered whether the 20-m (66-ft) median width of Alternative D (Final EIS Preferred Alternative) might be used to accommodate future travel lanes that were mentioned in the Corps's 404(b)(1) evaluation report. Future travel lanes are neither proposed nor reasonably foreseeable for the Legacy Parkway project. (See Section 3.2.2 for a discussion of the Legacy Parkway Beyond Four Lanes Alternative that was evaluated and eliminated from further consideration.)

Design Standards and Guidelines Review

Review of State of Utah and national design standards and guidelines for roadway facilities similar to Legacy Parkway published after the Final EIS (2000) revealed that there were some changes in the design standards recommended for a minimum median width without the use of a median barrier. In February 2005, after publication of the Final EIS, UDOT updated its Standard Drawing DD 4 (Geometric Design for Freeways) to show a fixed width of 15-m (50-ft) for open medians to reflect recent research on roadway geometrics.[2] The 15-m (50-ft) open median is supported by guidelines in *A Policy on the Geometric Design of Highways and Streets* (Green Book) from the American Association of State Highway and Transportation Officials (AASHTO) (2004) and the *Roadside Design Guide* (American Association of State Highway and Transportation Officials 2002) and several safety studies.

The Green Book provides guidance to the designer by referencing a recommended range of values for critical highway dimensions, including median width. Recommending a range of values provides designers with the flexibility to use best professional judgment in determining the appropriate dimensions for a highway, taking into consideration the context, location, and setting of the project. The Green Book recommends that median widths on rural freeways (similar to Legacy Parkway) be between 15 m and 30 m (50 ft and 100 ft).[3] The 15-m (50-ft) median provides for 1.2-m (4-ft) shoulders, 1:6 foreslopes, and a 1-m (3-ft) median ditch, all of which provide adequate space for vehicle recovery. The determination of open median width is based on safety and the best professional judgment, using AASHTO guidance.

The *Roadside Design Guide* presents the state-of-the-practice information on roadway safety based on current accident and research studies.[4] The intent of the *Roadside Design Guide* is to present the concepts of roadway safety to the designer to facilitate selection of the most practical, appropriate, and beneficial roadside design for an individual project. The *Roadside Design Guide* indicates that "a roadside free of fixed objects with stable, flattened slopes enhances the opportunity for reducing accident severity" (American Association of State Highway and Transportation Officials 2002) and that median barriers

[2] The Standard Drawing 815-2 in the Final EIS used a 20-m (66-ft) open median.
[3] The classification of *rural freeway* is appropriate for Legacy Parkway because the parkway is proposed to be located in an area that is currently rural and the proposed parkway would act as a barrier to development in the corridor and would therefore likely abut undeveloped areas (including the Legacy Nature Preserve on the western side of the alignment).
[4] The guidelines for determining median width and/or median barrier application presented in the *Roadside Design Guide* are based on limited analysis of median crossover and research studies. For this reason, UDOT reviewed additional recent research and relevant safety studies to gather information.

should be installed only if the consequences of striking the barrier are expected to be less severe than if no barrier existed. It states that on high-speed, controlled-access roadways with average daily traffic greater than 20,000 vehicles per day (similar to Legacy Parkway), a median barrier is not normally considered for median widths greater than 15 m (50 ft). Safety data indicates that the use of a median barrier generally increases the overall crash accident rate.

Safety Data Review

To further evaluate the guidance in the *Roadside Design Guide* in light of the lack of site-specific data for Legacy Parkway (as it is a new facility), recent research and relevant safety studies were reviewed to analyze the relationship among median width, median characteristics (open median versus median barriers), and safety. The following sources of information were used for the safety data analysis.

- Highway Safety Information System (HSIS) study, *The Association of Median Width and Highway Accident Rates* (Federal Highway Administration 1993). This study is based on a multi-state safety database with accident, roadway inventory, and traffic volume data for a select group of states, including Utah.
- National Cooperative Highway Research Program (NCHRP) study *Improved Guidelines for Median Safety Report* (National Cooperative Highway Research Program 2004).
- *Public Roads* “Low-Cost Solutions Yield Big Savings” (Zeits 2003).
- Utah Accident Data, UDOT Maintenance Division database (Highway Reference System Volumes I and II, 1995) and Roadview Explorer (photo log) (Utah Department of Transportation 1995).
- New Jersey Accident Data (New Jersey Department of Transportation 2003).

The 1993 FHWA study (*Association of Median Width and Highway Accident Rates*) stated, “...the total accident rate appears to decline steadily with increasing median width.” The study also mentions that medians that are 15 m (50 ft) wide are much safer than a narrower median. The study states, “…in the design of new highways, our findings would support medians considerably wider than 30 to 40 ft (9.2 to 12.2 m).”

The NCHRP study (*Improved Guidelines for Median Safety Report* [2004]) provides improved guidelines for using median barriers and selecting median widths on newly constructed and reconstructed high-speed roadways as referenced in the *Roadside Design Guide*. The report evaluated median safety using cross-section data, roadway inventory data, and data on crashes within medians. The study states that, although median width designs vary from state to state, they are based on safety studies indicating that medians narrower than 13.7 to 15 m (45 to 50 ft) are not safe without a barrier. One of the conclusions drawn from the NCHRP study is that increasing median widths on divided, limited-access highways decreases crash frequency.

The FHWA publication *Public Roads* featured an article on fatality rates on South Carolina’s interstates (Zeits 2003). The article, “Low-Cost Solutions Yield Big Savings,” examined South Carolina’s approach to addressing median-related traffic fatalities. Based on the article, the South Carolina Department of Transportation (SCDOT) decided to install barriers on medians less than 18 m (60 ft). SCDOT determined that wider medians were safer than narrow medians.

UDOT also reviewed safety data collected on existing freeway systems in Utah (Interstates 15, 215, 70, and 80). Data from the UDOT Maintenance Division database and the UDOT roadway photo log were reviewed, and a visual inspection of the urban freeways in the Salt Lake area was performed to determine the locations of concrete barrier medians. The accident reports described the accident type, number of vehicles involved, accident severity, object struck, collision type, date, and other accident information. The findings of this study indicate that the average total accident rate (1997–2001) is 1.29 accidents per million vehicle-miles traveled (VMT) for roadway sections with a barrier and 0.67 accidents per million VMT for sections without a barrier.

The safety studies and median-related accident data analyzed resulted in the following conclusions regarding the relationship among median width, median characteristics, and safety. For more detailed information regarding these studies, see Section 3.0 and Appendices B and C of the right-of-way technical memorandum (HDR Engineering 2005a).

- Total accident rate appears to decline steadily for open medians on divided, limited access highways as the median width increases.
- While the use of a median barrier can reduce the required median width, safety data indicate that the use of median barriers generally increases overall accident rates because of the reduced recovery area for errant vehicles and the introduction of a fixed object (barrier).
- Research on median safety does not definitively identify 15 m (50 ft) as preferable over other widths. Rather, the research supports an open median width of 15 m (50 ft) or greater for new facilities rather than a median barrier.

Alternative Water Quality Control Methods Evaluation

The original June 2000 Final EIS and CWA 404(b)(1) evaluation was based, in part, on treating stormwater runoff on a 20-m (66-ft) open vegetated median (referred to as a “vegetated filter strip” in Section 4.10.3.2, *Surface Water Quality*, of this Supplemental EIS and referenced in Figures 2.1-1 and 2.1-2). This open vegetated median provides a portion of the required compliance with state water quality standards (i.e., removal of 80 percent of the total suspended solids [TSS] in the stormwater runoff) that is required to ensure that state numeric water quality standards are not exceeded. Additional water quality control treatment is provided by side slopes, as shown on Figures 2.1-1 and 2.1-2.

The right-of-way technical memorandum evaluated the effectiveness of alternative water quality control methods in meeting required state water quality treatment standards. The analysis included a complete comparative evaluation of alternative median widths, including the proposed 15-m (50-ft) open median and an 8-m (26-ft) median, although the 8-m (26-ft) median would not be allowable under current UDOT design standards for new rural freeways.[5] The analysis determined that any median less than 15 m (50 ft) would require placement of a median barrier as required by UDOT for a new facility. Replacing this open median (vegetated filter strip) with a median barrier to reduce the overall median width would require implementation of at least one of the following alternate water quality treatment methods in conjunction with a median barrier to provide the same level of water quality treatment for stormwater runoff as the vegetated filter strips in the proposed open median.

- Detention basins with oil/gas skimmers.

[5] The 8-m (26-ft) width was selected for the analysis because, at the time of the initial evaluation, it was the narrowest width for a median with a barrier allowable under UDOT design standards. In February 2005, UDOT design standards were revised to reflect a fixed 15-m (50-ft) required open median width, making the narrower 8-m (26-ft) width incompatible with current UDOT design standards.

- Retention basins.
- Sediment traps/basins.

These alternative water quality treatment methods were evaluated for their ability to adequately treat stormwater runoff (80 percent removal of TSS). The required acreage of the basins, long-term maintenance requirements, and other additional potential impacts on groundwater and hydrology were also considered. Table 2.1-3 compares the proposed 15-m (50-ft) vegetated filter strips in the open median with detention basins with oil/gas skimmers, retention basins, and sediment traps/basins. (See Section 3.0 of the right-of-way technical memorandum for a more detailed discussion.)

The analysis showed that the proposed reduction of the median to a 15-m (50-ft) open vegetated median (vegetated filter strip) could still provide adequate stormwater retention to meet the required water quality standards. Within the 15-m (50-ft) median, water would be detained for an average of 3 minutes as it travels perpendicularly to the center of the median, and an average of an additional 10 minutes as it travels longitudinally to catch basins located every 100 m (328 ft). This detention time (approximately 13 minutes) would provide for removal of 80 percent of the total suspended solids (TSS) in the stormwater runoff.

The analysis also found that while removal of 80 percent of TSS could be met by either detention or retention basins, these basin methods would require additional land in the vicinity of the proposed action, which would be comparable to the acreage required for the 15-m (50-ft) open median;[6] would require additional long-term maintenance; and could result in additional detrimental environmental impacts.

[6] Detention and retention basins would result in direct impacts on approximately 0.8 ha (2 ac) of wetlands (see Section 2.1.2.4, *Alternative Right-of-Way Widths and Wetlands Impact Evaluation*).

Table 2.1-3 Summary of Impacts of Alternative Water Quality Control Methods

Water Quality Treatment Method	Hydraulic System	Average Treatment Efficiency for Total Suspended Solids Removal	Total Land Required[1]	Other Impacts[2]
Open, 15-m (50-ft) vegetated median (vegetated filter strip)	Sheet flow	Meets water quality treatment objectives of 80 percent	364 ha (900 ac) (ROW)	None
Detention Basins (applicable only for use with median barrier)	Concentrated discharges (Stormwater runoff is detained in basins and discharged to surrounding areas)	Meets water quality treatment objectives of 80 percent	363 ha (898 ac) (356-ha [880-ac] ROW plus 7 ha [18 ac] for detention basins) • Total area requiring treatment with detention basins is approximately 18 ha (44 ac). The remaining portions of the highway would use overland flow through vegetated side slopes and existing ground on outside edges of roadway. • Detention basins could be no deeper than 1 m (3 ft) because of high groundwater table in area. • Based on estimates of runoff quantities and required detention time, about 7 ha (18 ac) of detention basin area would be required (calculated using a 50-yr design storm) for the ROW. • Assuming a detention basin every 305 m (1,000 ft) along the length of the roadway results in 45 basins of about 0.16 ha (0.4 ac) each (see Section 3.3.3, *Area Required for Detention Basins*, in the right-of-way technical memorandum).	Due to the flat nature of land in the study area, open channels or drainage ditches would be required rather than pipelines to collect and convey stormwater to detention basins. These open channels or drainage ditches could • result in draining surface and near surface (shallow) groundwater, which could drain wetlands and lower the groundwater table in the vicinity of the ditches. • encourage the growth and dispersal of invasive species.

Water Quality Treatment Method	Hydraulic System	Average Treatment Efficiency for Total Suspended Solids Removal	Total Land Required[1]	Other Impacts[2]
Retention Basins (applicable only for use with median barrier)	No discharge (water remains in retention basins)	Exceeds water quality treatment objectives of 80 percent (no discharges associated with retention basins)	More than 363 ha (898 ac) (356-ha [880-ac] ROW plus more than 7ha [18 ac] for detention basins) • Retention basins could be no deeper than 1 m (3 ft) because of high groundwater table in area • Assumes more than 45 basins because greater capacity requirements are necessary to retain all stormwater runoff (see Section 3.3.3, *Retention Basins*, in the right-of-way technical memorandum).	See detention basin impacts for similar impacts of open channels or drainage ditches required to collect and convey stormwater to retention basins.
Sediment Traps/Basins	Discharges after water is retained for a period of time to allow sediment to settle.	Sediment traps/basins trap sediment but do not achieve 80 percent TSS removal	363 ha (898 ac) (356-ha [880-ac] ROW plus more than 7 ha [18 ac] for sediment traps/basins)	See detention basin impacts.

Notes:

[1] Includes acreage for right-of-way and additional acreage for detention or retention basins, as applicable. Acreage calculations for the open vegetated median are based on a 95-m (312-ft) right-of-way, which includes the 15-m (50-ft) open median, and acreage calculations for the detention and retention basins are based on an 87-m (285-ft) right-of-way, which includes an 8-m (26-ft) closed median.

[2] Wetlands impacts are described in Section 2.1.2.4, *Alternative Right-of-Way Widths and Wetlands Impact Evaluation.*

Summary of Results of Median Width Evaluation

As a result of the median width analysis, the proposed median width for the build alternatives evaluated in the Supplemental EIS has been reduced from the Final EIS median width of 20 m (66 ft) to 15 m (50 ft) based on updated UDOT Standard Drawing DD 4 (Geometric Design for Freeways). This 15-m (50-ft) median reflects the revised UDOT design standard for open medians on rural freeways, which is consistent with state and national design standards and guidelines. The safety studies analyzed were consistent with median width guidance and design standards used by AASHTO and relied on by UDOT in selecting a 15-m (50-ft) open median width for the proposed build alternatives. This median width is intended to provide a safe separation (without a barrier) of traffic and an adequate vehicle recovery area consistent with UDOT standards. It is also within AASHTO's recommended range for medians on rural freeways (Table 2.1-1). Any median less than 15 m (50 ft) would not reflect the fixed median width UDOT design standard for rural freeways.

The 15-m (50-ft) median is based on safety study findings indicating that, although employing a median barrier can reduce the median width, median barriers generally increase overall accident rates compared to open medians. Safety study review showed that, in general, accident rates decrease as median width increases. The alternative water quality control method evaluation determined that reducing the median below 15 m (50 ft), which would necessitate the use of a median barrier and eliminate the vegetated median, would require the use of detention or retention basins, which could result in 0.8 ha (2 ac) or more of wetlands impacts. In effect, reducing the median further such that a median barrier and alternative water quality method is necessary (although not within UDOT design standards) would result in environmental impacts similar to or greater than the proposed 15 m (50 ft) open median. The wetland impacts associated with reducing the median width are described in Section 2.1.2.4, *Alternative Right-of-Way Widths and Wetlands Impact Evaluation*.

2.1.2.3 Buffer Area Width Evaluation

To determine whether a narrower buffer area, capable of meeting the basic project purpose, could be incorporated into the proposed right-of-way, the following approach was used.

- Describe and clarify the purpose of the buffer area.
- Review design standards and guidelines.
- Consider public scoping comments regarding buffer area.

Description and Clarification of Buffer Area Purposes

For purposes of this section, it is important to identify the distinct purposes of the buffer and berm. The federal lead agencies requested that UDOT evaluate and clarify the purpose of the buffer and berm area to facilitate selection of an appropriate width, particularly given variable design guidance relative to buffer areas (see *Design Standards and Guidelines Review* below). As described in the right-of-way technical memorandum, the buffer area would provide a buffer between the trail and the roadway's clear zone outside the travel lanes and is proposed for the full length of the proposed build alignments. As such, the buffer area serves the following purposes.

- Safe separation between the roadway and pedestrians, bicyclists, and equestrians on the trail.
- Visual and acoustic buffer between the roadway and the adjacent trail and land uses.

Within this buffer area, two separate berms (totaling 5.1 km [3.2 mi]) are proposed to provide additional visual and acoustic buffering along the east side between 500 South and Porter Lane in West Bountiful, and along the west side between Glovers Lane and State Street in Farmington. (See Figure 2.1-3 for berm locations along Alternative E.) The berm is intended to provide visual buffering for future planned development in Farmington, and for existing and future planned development in West Bountiful. It is also intended to provide acoustic buffering for future planned development at both locations. Berms are included in the proposed right-of-way to address the desires of the Cities of Farmington and West Bountiful for a landscaped, natural visual and acoustic barrier at the above noted locations. Public comments expressed a desire for the proposed parkway project to provide these benefits to their communities during the public comment periods for both the Final EIS and the Supplemental EIS. Providing a berm in these locations along with a parkway type setting would help compensate the local communities for impacts of the project.

Providing for a future utility corridor is not a purpose of the buffer area. In response to the court's concern as to the practicability of a right-of-way without a future utility corridor (assumed to be within the buffer area), the right-of-way technical memorandum states that no utility corridor is proposed or planned as part of the Legacy Parkway project, and the dimensions of the buffer area were not selected to accommodate the placement of utilities in the right-of-way. Although Figure 2-9 in the Final EIS identified the buffer area as a "potential future utility corridor," the dimensions of the buffer area were established to accommodate the berm rather than a utility corridor.[7] Further, the dimensions of the buffer area would not be affected by the inclusion of a utility corridor if one were proposed. In fact, a utility corridor could be placed within almost any component of the right-of-way (clear zone, median, trail, etc.) and would not affect the overall right-of-way width.

Buffer Area Width: Evaluation

AASHTO's *Guide for Development of Bicycle Facilities* (1999) was referenced for guidance regarding the appropriate buffer width between the proposed Legacy Parkway and multi-use trail. AASHTO recommends a "wide separation" between shared-use paths and adjacent highway facilities but does not provide a fixed minimum dimension design standard for an acceptable separation. Similarly, neither UDOT nor other state departments of transportation consulted during preparation of the right-of-way technical memorandum have specific numeric design standards or guidelines for separating trails from adjacent highways.

In the absence of fixed or variable numeric design standards, the appropriate minimum buffer area width was selected by UDOT using best professional judgment and accepted by the lead agencies to attain the following goals.

[7] Administrative Rule R930-6 requires UDOT to allow utility lines on public rights-of-way. The Jordan Valley Water Conservancy District and the Weber Basin Water Conservancy District have identified a 64-km (40-mi) pipeline in their long-range plan (to be completed in 15–20 years). However, there is currently no proposal or formal request to build this pipeline, and this pipeline is not considered to be part of the Legacy Parkway project. If a utility corridor were proposed in the future for placement in the right-of-way, the impacts of the action would be fully disclosed and analyzed. This issue is discussed at length in Responses to Comments in the Final EIS (Letter 842, comments 201 and 206).

- Provide a safe separation between the roadway facility and multiuse trail.
- Provide adequate visual screening and acoustic (traffic noise) buffering.
- Contribute to a "parkway" type project in keeping with the desires of local communities and with UDOT's commitment to CSS principles. (See Chapter 1 for discussion of CSS.)
- Use CSS principles to provide the trail as an asset to the community while minimizing impacts on sensitive resources.

For all build alternatives evaluated in the Supplemental EIS, the proposed buffer area would have the following characteristics.

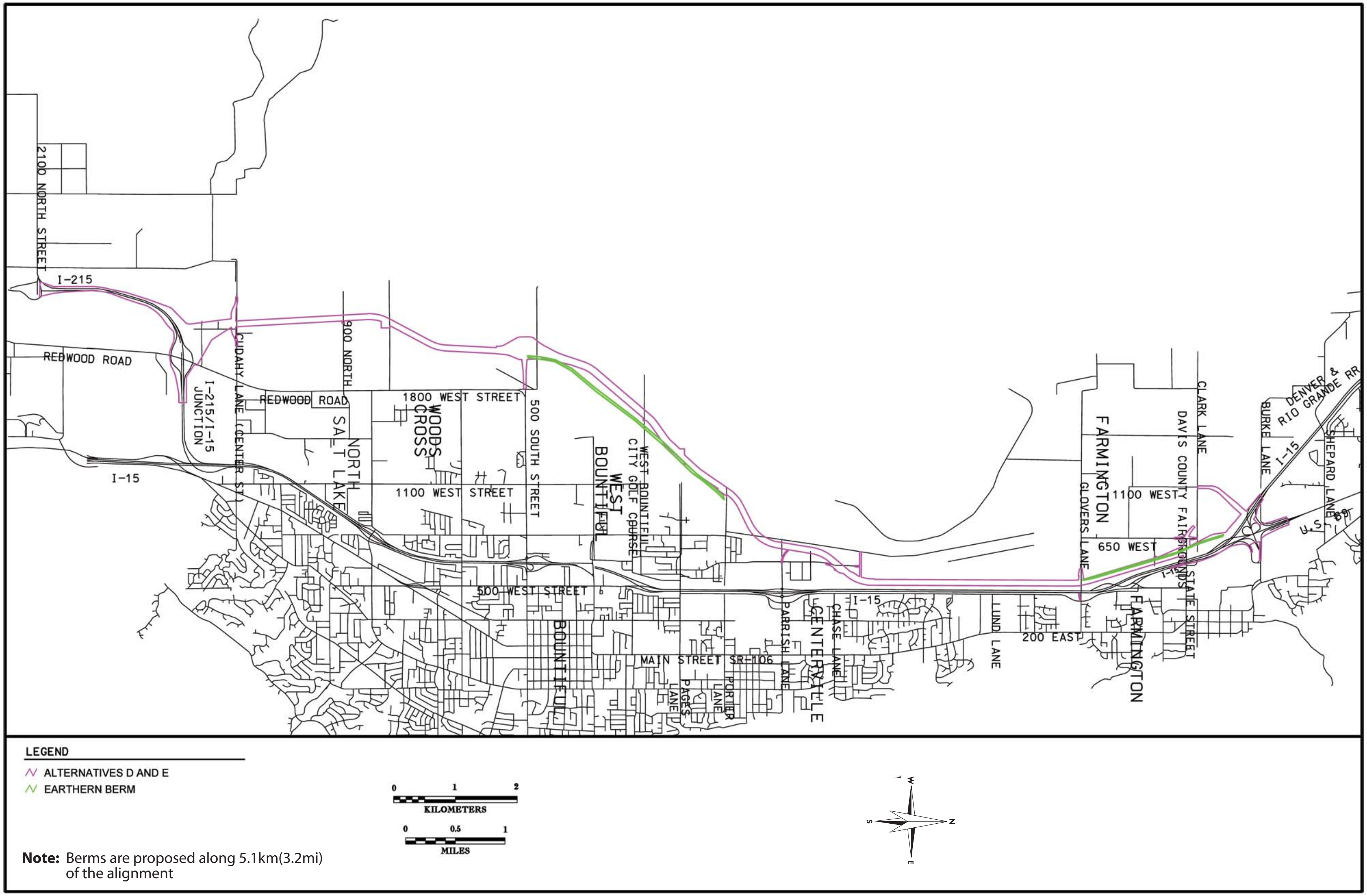
- 25 m (81 ft) in areas without a berm (17.4 km [10.2 mi] of the alignment).
- 26 m (84 ft) in the remaining 5.1 km (3.2 mi) of the alignment where a berm would be located.
- A minimum 11-m (36-ft) buffer area in areas where the roadway facility crosses sensitive resources (and where there is no berm or interchange). [8]

All cross sections use a 4-foot chain-link fence between the buffer area and roadway facility to separate the buffer area and trail from motorists. A reduced buffer of a minimum of 11 m (36 ft) would be used to position the footprint within the 95-m (312-ft) right-of-way to avoid sensitive resources where engineering and design constraints allow (estimated to be used on up to 3.2 km [2 mi] of right-of-way based on locations of berms and interchanges). Figure 2.1-4 illustrates the reduced footprint that results from reducing the buffer area width. This reduced footprint is part of a proposed design-bid-build approach and is consistent with UDOT's policy on CSS. Even though the use of an 11-m (36-ft) buffer lessens the advantages of the buffer described above, this tradeoff minimizes impacts on sensitive resources to the greatest extent practicable. Many of the advantages of the buffer area would remain, although slightly reduced. A similar approach would be applied to construction of the trail, placing the footprint of the trail outside and around the edges of wetlands. It is important to note that while the right-of-way would not be reduced in these areas (i.e., it would remain at the 95-m (312-ft) right-of-way analyzed in this Supplemental EIS), the footprint impacts would be reduced to an 80-m (264-ft) footprint. As a result of this design-bid-build approach, direct impacts on wetlands associated with Alternative D and E right-of-way options could be reduced by approximately 0.8 ha (2 ac) with the limited application of this reduced 11-m (36-ft) buffer width (see Section 2.1.2.4 below).

2.1.2.4 Alternative Right-of-Way Widths and Wetlands Impact Evaluation

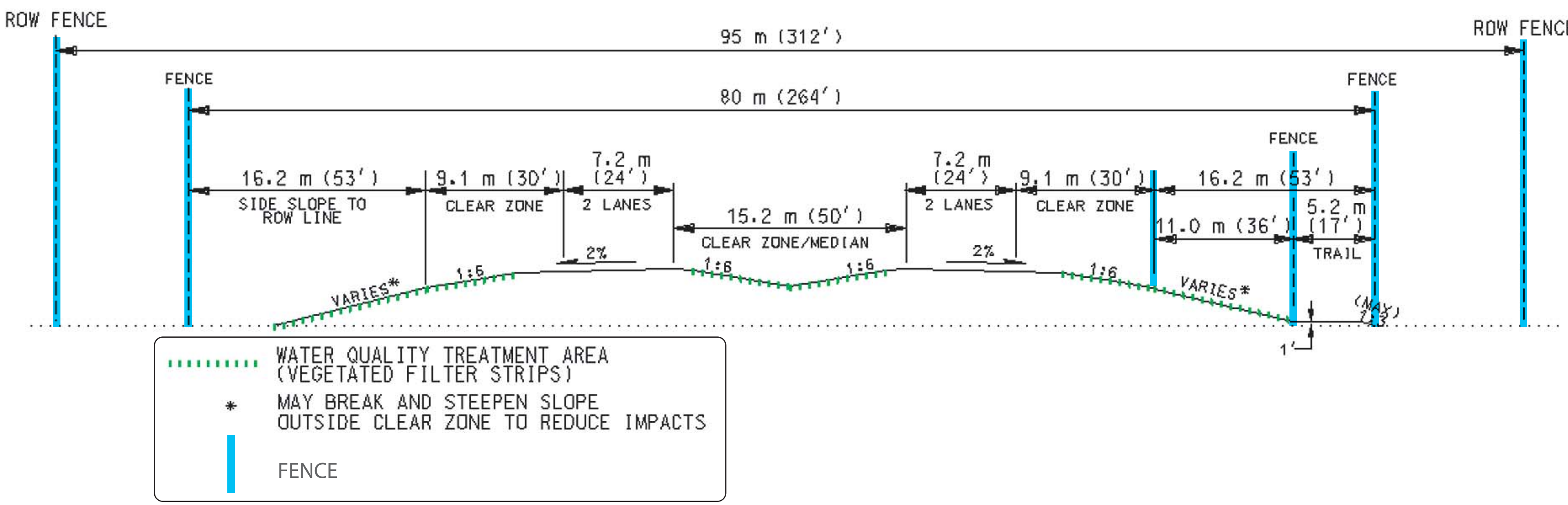
As described in Sections 2.1.2.2 and 2.1.2.3, the proposed right-of-way width for Alternative E evaluated in the Supplemental EIS is 95 m (312 ft). This width reflects a 5-m (16-ft) reduction from the right-of-way width of Alternative D (Final EIS Preferred Alternative). Impacts on the wetlands within the right-of-way have been reduced from 46 ha (114 ac) for Alternative D (Final EIS Preferred Alternative) to 45 ha (113 ac) for Alternative E in the Supplemental EIS. To determine whether wetland impacts could be

[8] In the Great Salt Lake and the D&RG regional corridor alternatives analysis, this reduced footprint was used to minimize impacts on wetlands, Section 4(f) resources, and homes.



03076.03 SEIS (7-05)

Figure 2.1-3
Berm Locations along Proposed Right-of-Way



Note: The 80 m (264 ft) reduced footprint is proposed along specific areas of the alignment to avoid sensitive resources within the right-of-way. The reduction is the result of narrowing the buffer area from 24.7 m (81 ft) to 11m (36 ft). It is estimated that this reduced footprint could be used on up to 3.2 km (2 mi) of the right-of-way.

03076.03 SEIS (7-05)

Figure 2.1-4
Reduced Footprint Cross Section to Minimize Impacts

reduced by further narrowing the median and/or buffer areas, the federal lead agencies requested that UDOT evaluate additional right-of-way widths, as described in Table 2.1-4. Cross sections for these alternative right-of-way widths are provided in Figure 2.1-5. It should be noted that the wetland impacts presented in this section are based on the Alternative D and E alignment, which is described in Chapter 3 of this document.

Compared to the alternatives evaluated in the Final EIS, all the evaluated alternative right-of-way widths represent a reduction in the median width, the buffer area width, or a combination thereof. Slight changes in the side slope dimensions are also included in the alternative right-of-way widths where they depend on the median and berm widths. It should be noted that reductions in the median width to less than 15-m (50-ft) would not be consistent with UDOT design standards; they were evaluated for comparative purposes to evaluate relative impacts on wetlands. In addition, one of the alternative right-of-way widths evaluates the wetlands impacts savings that would be associated with eliminating the multi-use trail, although this alternative would not meet the transportation and community interest objectives for the proposed action. (See Section 1.3.2 and Section 3.3.4 in this document for discussions of the trail and how it is consistent with the primary project purpose). The lead agencies requested that UDOT present the impacts of this alternative for comparative purposes only because the trail meets the primary part of the purpose and need of the project. Based on the court ruling upholding the trail as part of the project purpose and need, the Corps and FHWA have described the trail as a feature of the parkway design without further evaluating alternate alignments without a trail.[9]

The wetland impact evaluation determined that additional reductions in the median and buffer area result in minor reductions in overall direct wetland impacts, but they also result in a loss of safety, visual, and acoustic buffering, as well as additional adverse environmental impacts. Replacing the 15-m (50-ft) open median (vegetated filter strip) with a minimum 8-m (26-ft) median with a barrier and reducing the buffer area from 25–27 m (81–84 ft) to a 3-m (10-ft) landscaped area (refer to the 80-m [261-ft] right-of-way alternative right-of-way width in Table 2.1-4) would reduce direct wetland impacts by approximately 1.2 ha (3 ac).[10] However, detention and retention basins and their associated open channels or drainage ditches (alternative water quality control methods needed to replace the open median function as a vegetated filter strip) result in up to an estimated 0.8 ha (2 ac) of direct impacts on wetlands, with additional environmental impacts on hydrology. Considering wetland acreage within the right-of-way that would be avoided through design flexibility (i.e., 4.0 ha [10 ac] for Alternative E, See Section 4.12.3.1, *Direct Impacts*), wetland impacts associated with the 95-m (312-ft) and the 80-m (261-ft) rights-of-way would be 42 ha (103 ac) and 41 ha (102 ac), respectively. Note that the design flexibility provided by the 80-m (264-ft) reduced footprint within both the 95-m (312-ft) and the 80-m (261-ft) rights-of-way provides the potential to avoid an additional 0.8 ha (2 ac) of wetlands. This could bring the wetland impacts to 41 ha (101 ac) under the 95-m (312-ft) right-of way and 40 ha (100 ac) under the 80-m (261-ft) right-of-way.

2.1.3 Conclusions

As a result of the right-of-way analysis, the proposed overall right-of-way width for the build alternatives evaluated in this Supplemental EIS has been reduced from 100 m (328 ft) to 95 m (312 ft). The right-of-way technical memorandum proposes a 15-m (50-ft) open median, which reflects UDOT design standards

[9] The Corps Record of Decision for the Final EIS Preferred Alternative contains an extensive discussion regarding the need for the trail. Page 64 of the court opinion clearly states: “The COE reasonably concluded that removing the trails was not practicable in light of the project’s overall purpose of meeting the transportation needs of the Northern Corridor in 2020, thus the issuance of the permit is not arbitrary and capricious on this basis.”

[10] 0.4 ha (1 ac) associated with the median, 0.8 ha (2 ac) associated with the landscaped area.

and is consistent with AASHTO guidelines for open medians on rural freeways. This median width provides three things: a safe separation between opposing traffic lanes, an adequate recovery area for errant vehicles, and adequate stormwater treatment to ensure that state water quality standards are met. Research on median safety supports use of an open median that is at least 15 m (50 ft) wide, rather than a median barrier.

Replacing the 15-m (50-ft) open median with an 8-m (26-ft) narrower median and median barrier (which would not be consistent with UDOT design standards) would reduce impacts on wetlands by 0.4 ha (1 ac). However, reducing the median width would require replacement of the water quality treatment functions associated with the vegetated filter strips through construction of detention or retention basins. Given the topography and shallow groundwater table in the area, it is likely that construction of detention or retention basins could affect up to approximately 0.8 ha (2 ac) of wetlands, which would offset any reduction in wetlands impacts achieved by reducing the median width. In addition, the construction of open drainage channels typically associated with detention basins could affect local hydrology by removing additional amounts of surface water, potentially causing a reduction in the groundwater table and adversely affecting additional acres of wetlands not directly affected by construction of the basins. As a related matter, UDOT does not currently propose or have future plans to propose additional travel lanes in the median of the proposed highway corridor, and additional travel lanes were not a consideration in the selection of the median width for the Final or Supplemental EIS build alternatives.

A 26-m (81-ft) buffer area in areas where a berm is not located and an 11-m (36-ft) buffer area in areas where the roadway crosses environmental resources and neither a berm nor an interchange is located, is proposed for the project. These widths are based on the best professional engineering judgment of UDOT considering local engineering environmental factors such as temperature and precipitation to provide a reasonable, safe separation between the roadway and the trail users, particularly given the lack of definitive numeric national or state guidance on appropriate buffer widths. The design flexibility provided by the 80-m (264-ft) reduced footprint in areas where sensitive resources are present could minimize potential impacts on wetland resources by up to 0.8 ha (2 ac).

A 27-m (84-ft) buffer width in locations where the berm is proposed (e.g., east side of the roadway between 500 South and Porter Lane, and along the west side of the roadway between Glover’s Lane and State Street) is proposed for the project. This width is based on a berm height of 2.7 m (9 ft) (as measured from the roadway surface at its highest point), which is the height necessary to visually screen the roadway from a person outside the roadway corridor... Construction of a natural vegetated berm is consistent with local jurisdictions expectations and input received from the public and would contribute to a parkway-type facility. The berm provides visual buffering for existing and future planned development and for future planned development in the locations noted. The proposed buffer area width was not influenced or dictated by the potential to use Legacy Parkway as a future utility corridor, although, as referenced earlier, Administrative Rule R930-6 requires UDOT to allow utility lines on public rights-of-way. If a utility corridor were proposed in the future for placement in the right-of-way, the impacts of the action would be fully disclosed and analyzed.

The results of the right-of-way technical memorandum show that substantial reductions in the median and buffer area result in minor reductions in overall direct wetland impacts, but they also result in a reduction of safety, visual, and acoustic buffering, as well as additional adverse environmental impacts. Reducing the median to the minimum median width of 8 m (26 ft) using a median barrier and reducing the buffer area to a 3-m (10-ft) landscaped area with a noise wall would reduce impacts on wetlands by approximately 1.2 ha (3 ac). However, detention and retention basins and associated channels (alternative water quality control methods needed to replace the open median function as a vegetated filter strip) result in approximately 0.8 ha (2 ac) of direct wetland impacts, with additional environmental impacts on hydrology. Considering wetland acreage within the right-of-way that would be avoided through design

Table 2.1-4 Alternative Right-of-Way Widths Evaluated for Impacts on Wetlands[1]

Right-of-Way Width	Right-of-Way Component: Median	Right-of-Way Component: Buffer Area	Wetlands Located in Right-of-Way, in ha (ac)	Wetland Impacts, in ha (ac)[2]	Comment
100 m (328 ft) Alternative D (Final EIS Preferred Alternative)	20 m (66 ft)	26 m (81 ft) in areas without a berm 27 m (84 ft) in areas with berm	46 (114)	41 (104) Avoids ~4 ha (10 ac) in the interchange areas.	Alternative D (Final EIS Preferred Alternative) right-of-way width, using previous UDOT standard drawing for open median widths. Impacts on an additional 0.8 ha (2 ac) of wetlands could be avoided by using an 80-m (264-ft) footprint in areas with wetlands, bringing wetland impacts from 42 ha (104 ac) to 41 ha (102 ac).
95 m (312 ft) Alternative E	15 m (50 ft)	26 m (81 ft) in areas without a berm 27 m (84 ft) in areas with berm	45 (113)	42 (103) Avoids ~4 ha (10 ac) in the interchange areas.	Right-of-way width based on updated UDOT standard drawing DD 4 for open median widths (Utah Department of Transportation 2004). Impacts on an additional 0.8 ha (2 ac) of wetlands could be avoided by using an 80-m (264-ft) footprint in areas with wetlands, bringing wetland impacts from 41.7 ha (103 ac) to 41 ha (101 ac).
87 m (285 ft)	8 m (26 ft) (median barrier required)	26 m (81 ft) in areas without a berm 27 m (84 ft) in areas with berm	45 (112)	42 (104) Avoids ~4 ha (10 ac) in the interchange areas.	Analyzes the impacts of using the minimum median width allowed under UDOT standards for a "closed" median (e.g., uses pavement with a median barrier). The total wetland impacts shown reflect the 0.8 ha (2 ac) of wetland impacts associated with the construction of alternative water quality control facilities to treat stormwater runoff. These could be offset by the additional 0.8 ha (2 ac) of wetland impacts that could be avoided by using an 80-m (264-ft) design flexibility reduced footprint in areas with wetlands, bringing the total wetland impacts to 41 ha (102 ac).
80 m (261 ft)	8 m (26 ft) (median barrier required)	3 m (10 ft) landscaped area	44 (110)	41 (102) Avoids ~4 ha (10 ac) in the interchange areas.	Analyzes the impacts of using the minimum median width allowed under UDOT standards for a "closed" median (e.g., uses pavement with a median barrier) in addition to a substantially reduced buffer area that incorporates 3-m (10-ft) landscaped area. The total wetland impacts shown reflect the 0.8 ha (2 ac) of wetland impacts associated with the construction of alternative water quality control facilities to treat stormwater runoff . These impacts could be offset by the additional 0.8 ha (2 ac) of wetland impacts that could be avoided by using the 80-m (264-ft) design flexibility reduced footprint in areas with wetlands, bringing total wetland impacts to 100 ac.
71 m (234 ft)	8 m (26 ft) (median barrier required)	Trail and buffer area eliminated	43 (106)	39 (98) Avoids ~4 ha (10 ac) in the interchange areas.	Analyzes the impacts of using the minimum median width allowed under UDOT standards for a "closed" median (e.g., uses pavement with a median barrier) in addition to eliminating the buffer area and multi-use trail. This right-of-way is presented for comparative purposes only (to illustrate the wetland impacts of the trail and buffer area). Eliminating the trail is not consistent with the primary project purpose and does not meet the transportation and community interest objectives for the proposed action. (See Chapter 1 for project purpose.) The total wetland impacts shown reflect the 0.8 ha (2 ac) of wetland impacts associated with the construction of alternative water quality control facilities to treat stormwater runoff, bringing the total wetland impacts from 39 ha (96 ac) to 40 ha (98 ac).

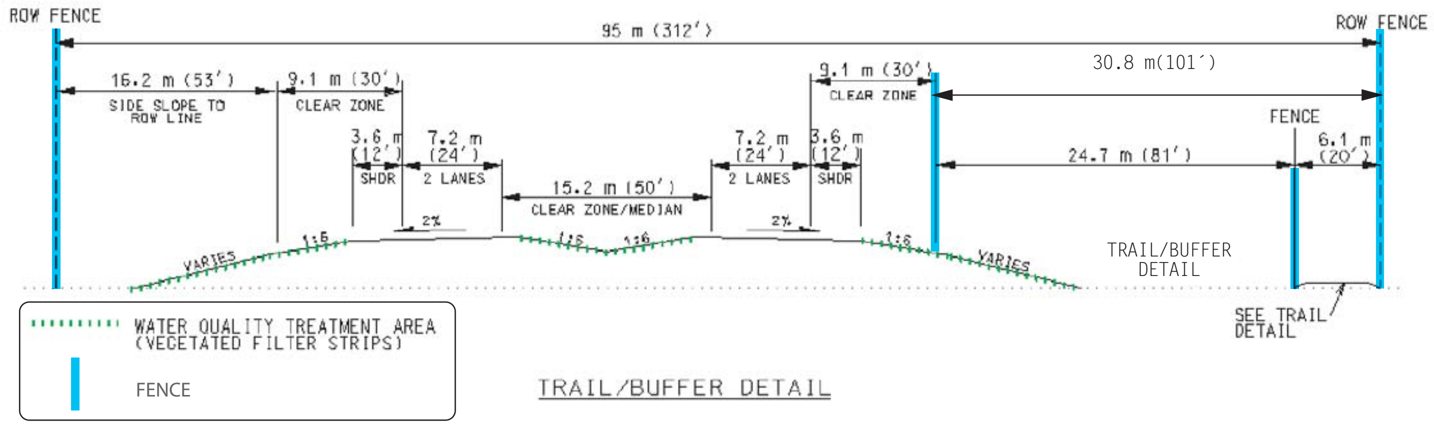
Notes:
This table refers to wetland impacts associated with Alternatives D and E only. Wetland impacts associated with Alternatives A, B, and C of the Final EIS were 44 ha (108 ac), 76 ha (187 ac), and 60 ha (147 ac), respectively. Taking into account the 1–2 ha (2–4 ac) savings associated with a reduced 95-m (312-ft) right-of-way for these build alternatives and 1 ha (2 ac) savings from the 80-m (264-ft) reduced footprint would result in revised wetlands impacts of 41 ha (102 ac) under Alternative A, 73 (181 ha) under Alternative B, and 57 ha (141 ac) under Alternative C. Updated design analysis shows that for Alternative A, reductions associated with final design are approximately 3 ha (8 ac). It would be expected that reductions associated with final design for other build alternatives would be similar to those associated with Alternatives D and E (i.e., an additional 4 ha [10ac]).

[1] See Figure 2.1-5 for cross sections of the alternative rights-of-way.

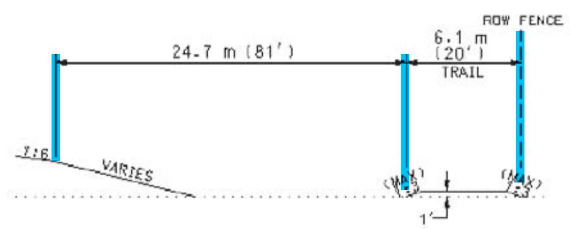
[2] Figures in this column reflect that the actual roadway facility does not occupy the entire right-of-way, and that as a result, not all the wetlands in the proposed rights-of-way would be directly affected. All alternatives reflect the fact that through final detailed design, UDOT determined that approximately 4 ha (10 ac) of wetlands within the right-of-way, primarily in the north and south interchanges, could be avoided by design-build flexibility.

95m(312´) ROW Cross Section (Shown without Berm)

Uses minimum median available by UDOT standards without a median barrier.



TRAIL/BUFFER DETAIL



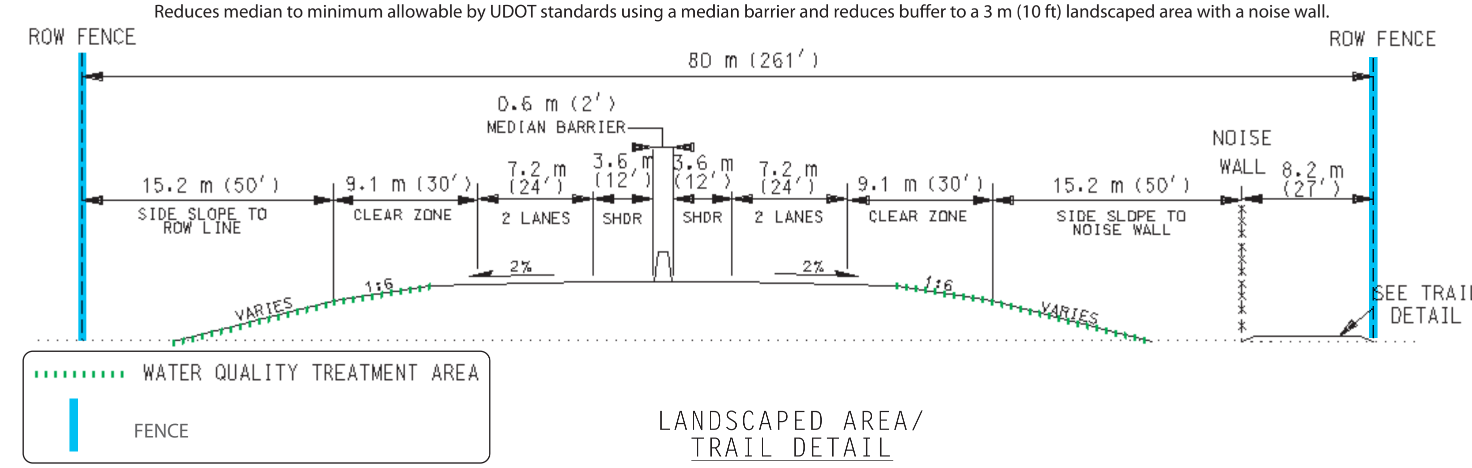
Wetlands Located in ROW ha(ac)	Wetland Impacts ha(ac)
45(113)	42(103)

Note: This diagram corresponds to Table 2.1-2

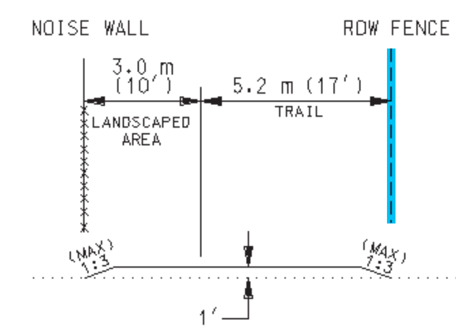
(see Table 2.1-4 for more information)

80m(261´) Alternative ROW Cross Section*

Reduces median to minimum allowable by UDOT standards using a median barrier and reduces buffer to a 3 m (10 ft) landscaped area with a noise wall.



LANDSCAPED AREA/ TRAIL DETAIL



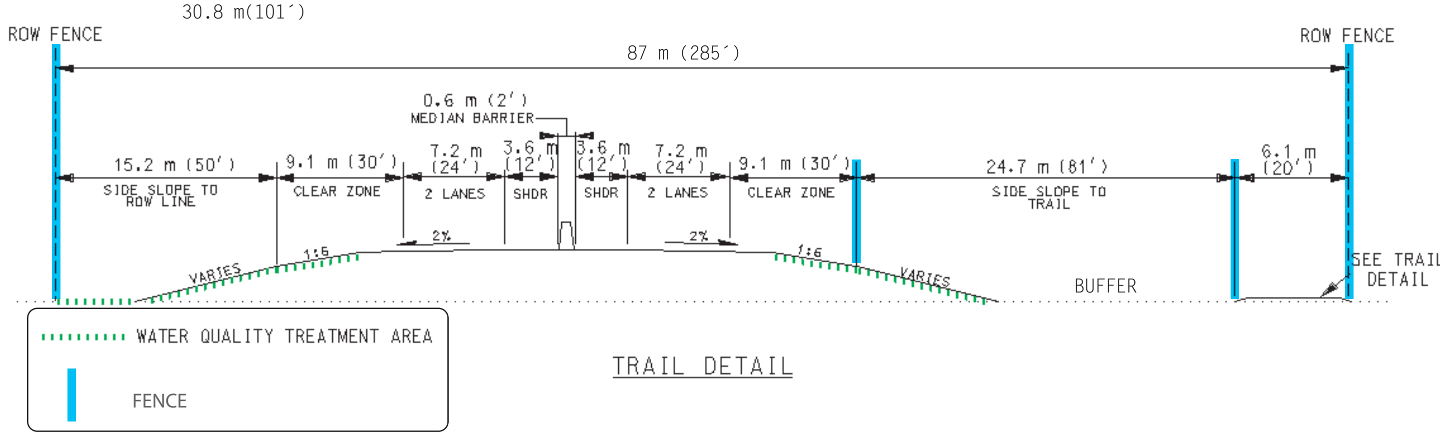
*** Note:** The conversion between metric and English is a soft conversion, not a hard conversion. This means the conversion is not exact, because a "12-ft" lane converts to "3.6576 meters", which would be built as either 3.6 meters or 3.7 meters. For that reason, the reader will note that this figure discusses an 80 m (261 ft) alternative cross section, and that Figure 2.1-4 discusses an 80 m (264 ft) reduced footprint. They are respectively, 79.55 m and 80.46 m, so both are considered 80 m.

Wetlands Located in ROW ha(ac)	Wetland Impacts ha(ac)
44(110)	41(102)

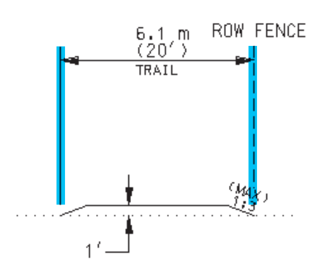
(see Table 2.1-4 for more information)

87m(285´) Alternative ROW Cross Section (Shown without Berm)

Reduces median to minimum allowable by UDOT standards using a median barrier.



TRAIL DETAIL

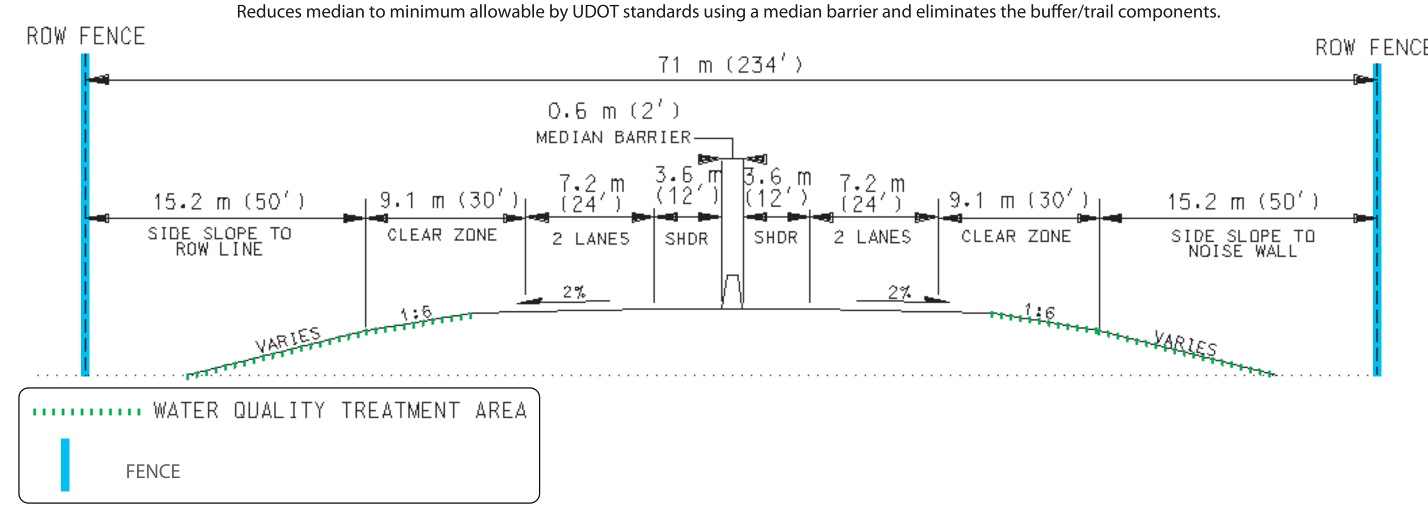


Wetlands Located in ROW ha(ac)	Wetland Impacts ha(ac)
45(112)	42(104)

(see Table 2.1-4 for more information)

71m(234´) Alternative ROW Cross Section

Reduces median to minimum allowable by UDOT standards using a median barrier and eliminates the buffer/trail components.



Wetlands Located in ROW ha(ac)	Wetland Impacts ha(ac)
39(96)	36(88)

(see Table 2.1-4 for more information)

Figure 2.1-5
Alternative Right-of-Way Cross Sections

flexibility (i.e., 4.0 ha [10 ac] for Alternative E, See Section 4.12.3.1, *Direct Impacts*), the 95-m (312-ft) right-of-way would result in 42 ha (103 ac) of wetlands impacts, and the 80-m (261-ft) right-of-way would result in 41 ha (102 ac) of wetlands impacts. Therefore, the acreage of wetlands saved by reducing the median by use of a median barrier, significantly reducing the buffer area, and adding a noise wall would be minimal, if any. Both rights-of-way have the potential for avoiding an additional 0.8 ha (2 ac) of wetlands with the design flexibility provided by the 80-m (264-ft) reduced footprint, which could bring the wetland impacts to 41 ha (101 ac) and 40 ha (100 ac), respectively.

This Supplemental EIS incorporates the following finding of the right-of-way technical memorandum.

> The median can be reduced by 5 m (16 ft), resulting in a reduction in the total right-of-way from the 100-m (328-ft) width presented in the Final EIS to 95 m (312 ft). This 95-m (312-ft) right-of-way width would be used except in areas where wetlands, residences, or Section 4(f) properties can be completely avoided by further reducing the footprint to 80 m (264 ft). The build alternatives evaluated in this Supplemental EIS have been modified to reflect this narrower right-of-way width and the design flexibility provided by the 80-m (264-ft) reduced footprint within the 95-m (312-ft) right-of-way.

Section 2.2
Denver & Rio Grande Corridor Evaluation

2.2.1 Summary of Approach for Supplemental EIS

2.1.1.1 Updates Since Previous Final EIS

The appellate court remand of the Legacy Parkway Final EIS stated that the elimination of the Denver & Rio Grande Railroad (D&RG) Corridor Alternative based on high costs and substantial impacts on existing development was insufficiently substantiated under NEPA and the federal Clean Water Act (CWA). The court held that the lead agencies failed to verify the cost estimates used to eliminate the D&RG regional corridor and to select the Great Salt Lake regional corridor. The court also held that there was insufficient information in the administrative record regarding the project's cost-estimating methodology to meet NEPA goals of informed decision-making and meaningful public comment. Regarding the CWA in particular, the court stated that the Corps's issuance of the Section 404 permit was arbitrary and capricious because the administrative record lacked quantifiable evidence regarding the "high impacts on existing development" cited as part of the rationale for eliminating the D&RG regional corridor. In addition, although not directed specifically at the elimination of the D&RG regional corridor, the court found that the Corps failed to consider whether a narrower right-of-way was a practicable alternative.

The lead agencies requested that UDOT reexamine the right-of-way needed for all build alternatives considered in the Final EIS, including the D&RG regional corridor alignment alternative, to ensure that the cost estimates are based on the right-of-way width necessary at that location. For more information, see the right-of-way technical memorandum (HDR Engineering 2005a). The lead agencies also requested that UDOT provide updated cost estimates and documentation of the cost-estimating methodology for all five regional corridors initially evaluated in the Final EIS.

To provide quantitative information on the impacts of the D&RG regional corridor in particular, the lead agencies requested that UDOT further refine the D&RG regional corridor by creating five specific conceptual alignments within this corridor and evaluating them using a methodology similar to the one used to evaluate the regional corridors in the Final EIS, but at a much greater level of detail.[1] The cost estimates and methodology documentation were then reviewed by lead agency staff, their independent consultants, and the cooperating agencies. As part of the review, public comments received during the public scoping process and the July 2003 community planning information committee (CPIC) meeting regarding conceptual highway alignments within the D&RG regional corridor were incorporated into the evaluation. In addition to participating in the CPIC meetings, local community planners from Davis

[1] Agencies do not normally develop alignments with this level of detail to evaluate regional corridors at the planning stage. However, because of the court's concerns and public interest, the D&RG regional corridor was evaluated at a greater level of detail herein than the other regional corridors that were rejected in the Final EIS.

County and the Cities of Woods Cross, North Salt Lake, Farmington, Centerville, and West Bountiful were individually interviewed to identify specific, localized impacts associated with potential alignments within the D&RG regional corridor.

The information contained in this section is based on the D&RG technical memorandum (HDR Engineering 2004a).

2.2.1.2 Changes since the Draft Supplemental EIS

Since publication of the Draft Supplemental EIS in December 2004, UDOT has updated the analysis of the design of Alternative E. This updated analysis indicated that a larger acreage of wetlands could be avoided under Alternative E as a result of design flexibility (i.e., the opportunity for the design engineer to modify, consistent with design standards, facility components). Specifically, the Draft Supplemental EIS stated that approximately 6 ha (14 ac) of wetlands in the right-of-way of Alternative E could be avoided through design/build flexibility, which affected the acreage of wetlands impacts presented in 2.2.3.2, *Impacts on Wetlands*. The updated analysis conducted since the Draft was published indicates that approximately 4 ha (10 ac) of wetlands in the right-of-way of Alternative E could be avoided through design/build flexibility, a reduction of 1.6 ha (4 ac). This reflects a reduction in the acreage of wetlands that could potentially be avoided in the Alternative E right-of-way between Parrish Lane and Glovers Lane.

The number of platted lots in the study area has increased since publication of the Draft Supplemental EIS. This increase affected information presented in Section 2.2.3, *Evaluation of D&RG Conceptual Alignments*. As noted in Table 2.2-3, the number of cul-de-sacs and cut-off roads required under D&RG alignments 2, 3, 4, and 5 increased. Similarly, the length of retaining walls and noise walls that would be needed for noise abatement in the vicinity of the newly platted lots also increased under all D&RG alignments (see Tables 2.2-3 and 2.2-5).

Alignment-specific cost estimates were also revised since publication of the Draft Supplemental EIS, based on a review by FHWA. The costs presented in Tables 2.2-9 and 2.2-10 represent updated material quantity estimates and reflect 2005 prices.

2.2.2 Summary of D&RG Analysis

In the Final EIS, five regional alignments (Great Salt Lake, Antelope Island, Trans-Bay, Farmington Bay, and the railroad regional alignment) were evaluated at a corridor-planning level and compared by cost, impacts on wetlands, and impacts on existing developed areas. The regional corridors were labeled as having high, medium, and low impacts in these three categories. Based on the Final EIS evaluation, the Great Salt Lake regional alignment was selected because it balanced medium impacts on environmental resources (wetlands) and impacts on local communities and businesses (existing development) with a reasonable estimated cost. The Antelope Island, Trans-Bay, and Farmington Bay regional alignments were eliminated because of their high costs and impacts on wetlands. The railroad regional alignment was eliminated in the Final EIS because of its high impacts on local communities and businesses as well as high costs. (The railroad regional alignment analyzed in the Final EIS included alignments along both the D&RG and UPRR railroads. It is referred to as the D&RG regional corridor from this point forward in the Supplemental EIS.) The Supplemental EIS updates the information contained in the Final EIS regarding the following topics.

- Cost estimates for the five regional corridors evaluated in the Final EIS.

- Development of five conceptual alignments within the D&RG regional corridor to allow more detailed evaluation of the high impacts on existing development and the costs relied on in the Final EIS.
- Quantification of impacts on existing development, which include relocation impacts; impacts on community cohesion (including impacts on schools and churches); impacts on travel patterns, accessibility, and walkability; noise and visual impacts; and impacts on environmental justice populations.
- Quantification of impacts on wetlands.
- Refinement of cost estimates for the D&RG regional corridor and conceptual alignments based on the appropriate and necessary right-of-way width.

2.2.2.1 Development of D&RG Conceptual Alignments

To evaluate the reasonableness and practicability of a highway within the D&RG corridor, UDOT developed five conceptual alignments within the corridor: DRG1 through DRG5. These conceptual alignments are shown in Figure 2.2-1. These alignments represent attempts to find a technically feasible, reasonable, practicable alignment through the D&RG corridor that avoids or minimizes wetlands and development impacts. All the D&RG conceptual alignments include the multi-use trail as a component of the right of way for reasons discussed in Section 3.3.4 of the Supplemental EIS.

To accommodate the D&RG conceptual alignments and because of the location of the southern interchange, the D&RG regional corridor depicted in the Final EIS needed to be expanded. The corridor was expanded to the west through North Salt Lake, Woods Cross, and West Bountiful to meet the eastern boundary of the Great Salt Lake regional corridor.

Criteria for D&RG Conceptual Alignments

The following criteria and methodology were used to develop the five D&RG conceptual alignments.

- Avoid properties that are eligible for the National Register of Historic Places (NRHP).

  The existing D&RG railroad right-of-way is eligible for the NRHP. Therefore, the D&RG alignments cannot lie within the D&RG right-of-way; they must be placed adjacent to the right-of-way (except at rail crossings, where the alignments could lie within the right-of-way). The D&RG is also protected under Section 4(f) of the U.S. Department of Transportation Act of 1966[2] because of its eligibility as an NRHP historic resource.

- Avoid the most densely developed residential and commercial areas.
- Avoid direct impacts that would require relocating an oil refinery.

[2] Section 4(f) of the U.S. Department of Transportation Act of 1966 requires the selection of an alternative that avoids designated public parks, recreation areas, wildlife refuges, and historic sites if a prudent and feasible alternative exists.

UDOT assumed that the impacts from taking an oil refinery would make the alignment unreasonable and impracticable because of the high cost of relocation and because the site would likely require extensive cleanup of hazardous materials.

- Avoid properties that would likely be subject to Section 4(f) regulations, such as the Lakeside Golf Course (also called the West Bountiful Golf Course), which is a publicly owned recreation facility.

  Conceptual alignments DRG1 and DRG2 traverse the farthest south before cutting west to link back with I-215. DRG1 and DRG2 avoid all identified parks (Hatch, Hogan Memorial, Clover Dale, Mills, and West Bountiful City) by going around them on the south. All alignments traverse east of the Lakeside Golf Course. Any alignments that would traverse northeast on the northern side of Lakeside Golf Course would essentially be located in the Great Salt Lake regional corridor. Alternative D (Final EIS Preferred Alternative) is located in the Great Salt Lake regional corridor; Alternative E, which has the same alignment as Alternative D but has a narrower right-of-way, is used in this analysis as a comparison for the D&RG conceptual alignments.

- Avoid active rail lines.

  The rail lines considered in the Final EIS and the Supplemental EIS include those that are actively being used. The D&RG rail line is still active from the southern end of the North Corridor to 400 North in West Bountiful, and provides a freight transportation link to the petroleum refineries in North Salt Lake, Woods Cross, and West Bountiful. UDOT assumed that taking this active rail line would require relocating it to continue to serve these industrial users. Therefore, in active areas, the roadway was located alongside the rail right-of-way to avoid relocating an active rail corridor. The average width of the rail right-of-way through this area is 18.3 m to 30.5 m (60 ft to 100 ft). If an alignment used the railroad right-of-way, UDOT would need to purchase additional acreage of right-of-way to accommodate a roadway within the rail corridor.

- Have a variable right-of-way width that is only as wide as necessary.

  To minimize impacts on wetlands and existing development associated with the D&RG conceptual alignments, UDOT used a variable right-of-way width. In areas with wetlands, 4(f) resources, or existing development (i.e., residences and existing businesses), the alignments are reduced to 80 m (264 ft); in all other areas, a 95-m (312-ft) right-of-way is used. (See Figure 2.1-5 of Section 2.1 for cross section of an 80-m (264-ft) reduced footprint for information on the components of the similar 80-m (264-ft) right-of-way used in the D&RG analysis.)

- Follow the Alternative E alignment from about Parrish Lane north to the northern project terminus.

  Through this portion of the study area, a relatively narrow strip of land between Farmington Bay and the existing developments on the foothills of the Wasatch Mountains is the only land corridor available for a highway alignment west of I-15. In this area, the Great Salt Lake and D&RG corridors overlap. The Final EIS found that the Alternative D (Final EIS Preferred Alternative) alignment was the least environmentally damaging practicable alternative because of its location relative to the lakeshore and the associated wetlands. The Alternative E alignment analyzed in this Supplemental EIS is the same as the Alternative D alignment, except that Alternative E has a narrower right-of-way.

Description of D&RG Conceptual Alignments

As originally conceived and in its purest form, a D&RG alignment would follow a route along the D&RG right-of-way beginning at I-215 near the I-15 interchange. However, the engineering analysis performed by HDR for UDOT indicated that a southern interchange where the D&RG tracks meet I-215 would be

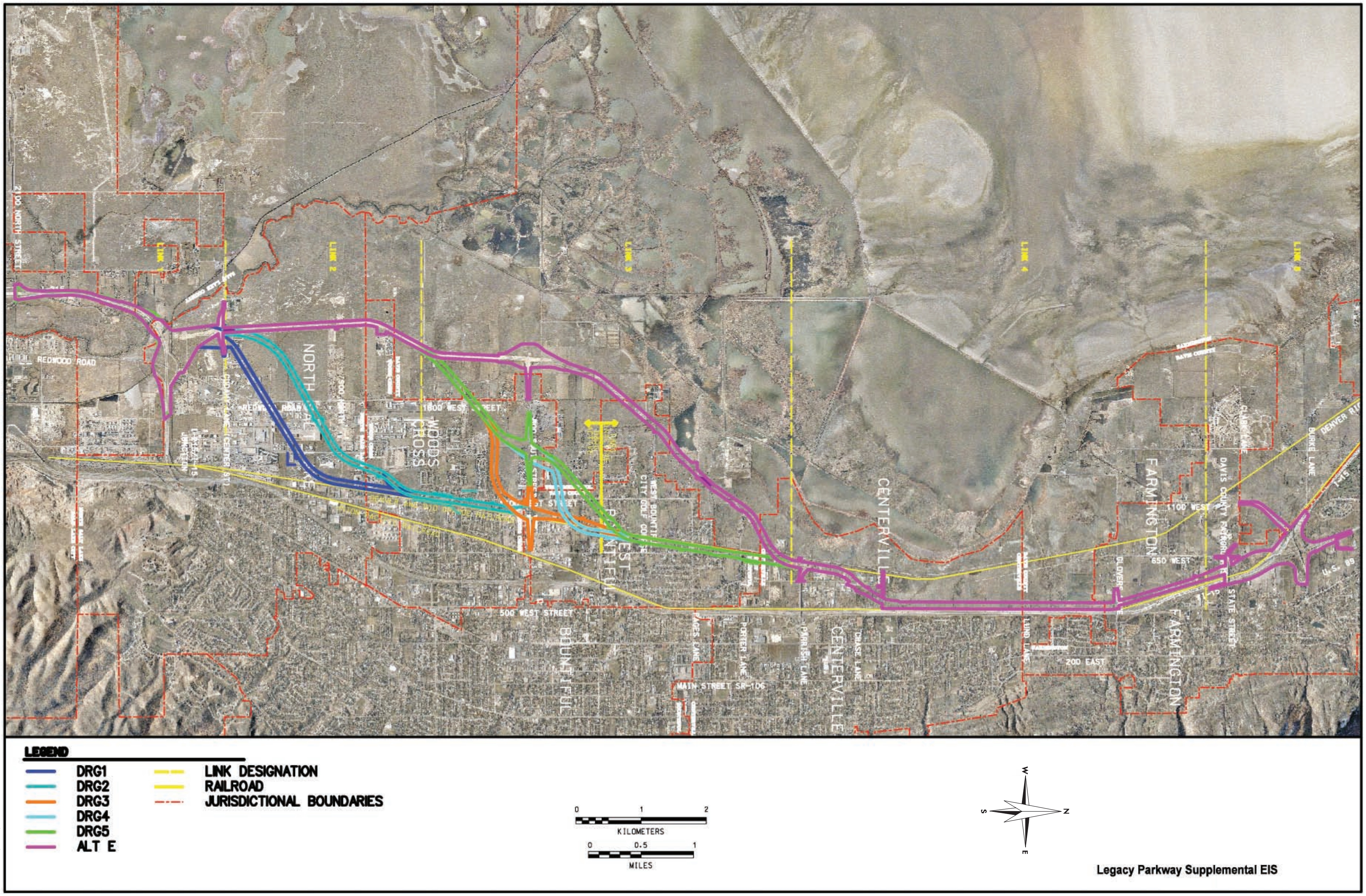


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Figure 2.2-1
D&RG Conceptual Alignments

impracticable and unreasonable because of impacts, poor functionality, and physical constraints.[3] Therefore, the southern terminus of the D&RG conceptual alignments is at I-215 to the west of the D&RG tracks, at the same southern interchange location proposed for all the build alternatives. All D&RG conceptual alignments follow the same alignment as Alternative E north of Parrish Lane (through Centerville and Farmington [Parrish Lane to I-15/US-89]), and use a northern terminus that provides a system-to-system connection between I-15, US-89, and the proposed alternative at the northern end.[4]

Except at rail crossings, none of the D&RG conceptual alignments lies within the D&RG right-of-way. South of 400 North, the rail line is active and the conceptual alignments parallel the tracks on the west. North of 400 North, the conceptual alignments cross the tracks to avoid the Lakeside Golf Course, a Section 4(f) property. DRG1 and DRG2 follow the tracks for the longest length—from North Salt Lake to Parrish Lane in Centerville. DRG3, DRG4, and DRG5 follow the tracks through West Bountiful and Centerville only. Figure 2.2-1 shows the five conceptual alignments.

The five D&RG conceptual alignments and the locations where they would vary from Alternative E are described below.

- **DRG1**. From the southern interchange at I-215 to the west of the D&RG tracks, DRG1 runs north past Center Street and northeast to cross Redwood Road at 200 North. The alignment continues northeast to the D&RG tracks, where it runs along the western side of the D&RG tracks to avoid refineries and the active portions of the D&RG line that extend north to 400 North. At 400 North, DRG1 crosses the tracks to avoid the Lakeside Golf Course, a Section 4(f) property, and runs parallel to the tracks on the east, where it then meets and follows the Alternative E alignment through the remaining northern portion of the study area. DRG1 is the alignment that follows the D&RG right-of-way for the greatest distance.

- **DRG2**. From the southern interchange at I-215 to the west and south of the D&RG tracks, DRG2 runs north past Center Street then northeast to cross Redwood Road between 200 North and 900 North (farther north than DRG1), continuing northeast until it intersects with 2600 North. At 2600 North, the alignment turns north and travels along the western side of the D&RG tracks. Like DRG1, this alignment runs on the western side of the D&RG tracks to 400 North, then crosses the tracks to avoid the Lakeside Golf Course and parallels the tracks on the east, where it then meets and follows the Alternative E alignment.

- **DRG3**. DRG3 follows Alternative E from the southern interchange at I-215 to the west and south of the D&RG tracks through North Salt Lake into Woods Cross. The alignment diverges from the Alternative E alignment just south of 1500 South in Woods Cross and runs east then north toward the 500 South interchange. DRG3 follows the D&RG tracks on the west to 400 North before crossing the tracks to avoid the Lakeside Golf Course. The alignment then turns north to parallel the D&RG tracks on the east, where it then meets and follows the Alternative E alignment.

- **DRG4**. DRG4 is identical to DRG3 through North Salt Lake where it crosses into Woods Cross. DRG4 diverges from Alternative E just south of 1500 South in Woods Cross and continues northeast to the 500 South interchange (on a more westerly alignment than DRG3), before turning to head east

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[3] An interchange where the D&RG tracks meet I-215 would require a three-level bridging system to accommodate all highway-to-highway movements, the possible relocation of two oil refineries, and excavation of mountainous terrain to provide adequate accommodation of traffic to and from I-15, I-215, and Legacy Parkway. For additional information, see Section 2.1.1 of the D&RG technical memorandum.

[4] The Final EIS examined four locations for a northern terminus. See page 2-24 of the Final EIS for the locations and rationale behind the selection of the locations.

to intersect the D&RG tracks. This alignment then turns north to parallel the D&RG tracks on the east, where it then meets and follows the Alternative E alignment.

- **DRG5**. DRG5 follows the same alignment as DRG4 to the 500 South interchange. Unlike DRG4, this alignment continues northeast to intersect the D&RG tracks north of 400 North. DRG5 then turns north just past where the D&RG tracks become inactive, and goes around the Lakeside Golf Course. The alignment parallels the D&RG tracks on the east, where it meets and follows the Alternative E alignment.

2.2.3 Evaluation of D&RG Conceptual Alignments

To be consistent with the Final EIS, UDOT evaluated the alignments according to the following criteria.

- Impacts on existing development.
- Impacts on wetlands.
- Costs.

The findings of this evaluation are presented on two levels. First, each of the five D&RG conceptual alignments was evaluated in its entirety—from terminus to terminus—and the impacts of those alignments were compared to the impacts of Alternative E. Second, because the D&RG alignments and Alternative E are the same through much of the North Corridor, the study area was divided into five segments or "links" to help identify where impacts actually occur and where they differ along the conceptual alignments. This approach was similar to the process used in Section 2.4.1 of the Final EIS for the Great Salt Lake Regional corridor. The five links are described below. As discussed below, the conceptual alignments are identical to the Alternative E alignment in Links 1, 4, and 5, but differ in Links 2 and 3.

- Link 1 encompasses the southern interchange north through and including Center Street. All five of the D&RG conceptual alignments and Alternative E are identical in Link 1.
- Link 2 covers North Salt Lake and about half of Woods Cross. The boundary between Link 2 and Link 3 is located where conceptual alignments DRG3, DRG4, and DRG5 diverge from Alternative E.
- Link 3 extends from the northern end of Link 2 to just south of Parrish Lane in Centerville. Its location was intended to highlight the segments where all the D&RG alignments differ from Alternative E.
- Link 4 goes through Centerville to just south of State Street in Farmington. All the alternatives alignments are identical in Link 4.
- Link 5 encompasses the northern interchange. All the alternative alignments are identical in Link 5.

Each alignment was then evaluated link by link to compare the similarities and differences among the various conceptual alignments and the differences between the conceptual alignments and Alternative E. Information on all the quantitative impacts of each link of the various alignments is summarized at the end of this section. However, only the impacts of Links 2 and 3 are discussed in detail because the impacts of the D&RG alignments and Alternative E are identical in Links 1, 4, and 5.

2.2.3.1 Impacts on Existing Development

In the Final EIS, the D&RG regional corridor was rejected due in part to the "high impact on existing land development." This section documents the impacts of the D&RG conceptual alignments on existing development and defines the high impact that lead agencies found to be unreasonable. All the numbers and analysis in this section are based on the refined D&RG conceptual alignments and reflect a more detailed level of analysis than was conducted for the Final EIS.

"Impacts on existing development" essentially means impacts on the built environment, which in turn means impacts on people, communities, utilities, and public and social institutions. To fully ascertain those impacts, the scoping process for this Supplemental EIS gathered information on both quantifiable and non-quantifiable impacts associated with D&RG alignment alternatives. Through public scoping, the communities in the study area identified specific community impacts associated with alignments in the D&RG regional corridor. In general, the communities did not support building Legacy Parkway along any alignment in the D&RG regional corridor because of the following impacts.

- Severe residential and business displacements.
- Loss of community cohesion and quality of life.
- Inconsistency with general plans.
- Loss of tax base.
- Visual and noise impacts and vehicle emission pollution.
- Negative impacts on travel patterns and accessibility (longer trips for emergency vehicles to access existing development west of the DR&G alignments and longer trips for daily activities).

In particular, communities were concerned that a major new roadway in the D&RG corridor would create a physical and social barrier in the area that would sever neighborhoods and communities west of the alignments and negatively affect community cohesion. (See the D&RG technical memorandum for additional details on the impacts of specific D&RG conceptual alignments.) Based on these community concerns, UDOT conducted a community cohesion analysis to more accurately quantify these community impacts. The results of the community cohesion analysis are incorporated into this section.

Impacts on existing development include the following impacts, which are discussed at length below.

- Relocation impacts (residential, business, and utilities).
- Impacts on community cohesion, including impacts on schools and churches.
- Impacts on travel patterns, accessibility, and walkability.
- Noise and visual impacts.

- Impacts on Section 4(f) and historic properties.
- Impacts on environmental justice populations.

Relocations

Table 2.2-1 identifies relocation impacts associated with each of the D&RG conceptual alignments on residences, businesses, and major utilities.[5] Table 2.2-1 presents the impacts for the municipalities that would be most affected by the D&RG alignments (North Salt Lake, Woods Cross, and West Bountiful). Impacts on the two other municipalities in the study area (Centerville and Farmington) would be the same under the D&RG alignments as under Alternative E. Table 2.2-1 also identifies the impacts of the D&RG Alignments on new residential developments that have been platted or developed since publication of the D&RG technical memorandum and Draft Supplemental EIS. These new residential developments include Valentine Estates and Mountain View in Woods Cross and Birnam Woods in West Bountiful, as well as construction within the Foxboro development in North Salt Lake. Some of these platted lots contain homes, and some are currently being developed. Impacts on lots containing a home may result in a relocation impact. Due to ongoing active construction, the number of lots affected represents potential relocation impacts and is the minimum number of additional relocations for the D&RG conceptual alignments.[6]

The relocation impacts on existing development under the D&RG conceptual alignments range from 149 to 279 residential and business relocations and from 13 to 28 major utility relocations. The D&RG conceptual alignments would also affect between 36 and 70 residential lots and sever 30 percent of the West Bountiful community to the west of the D&RG conceptual alignments. The relocation impacts on existing development under Alternative E would be 18 residential and business relocations and 21 major utility relocations (see Figure 2.2-2). There would be no impacts on newly platted residential lots associated with Alternative E. All D&RG alignments would result in an approximate 10 percent reduction in the total number of existing households in West Bountiful; DRG1 and DRG2 would result in a 3.5 percent reduction in the total number of households in Woods Cross. These relocation impacts would have corresponding negative impacts on the local tax base and remaining neighborhoods.

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[5] Buildings within an alignment’s right-of-way were included in the calculations of the number of relocations. Relocation impacts were determined using aerial imagery, Davis County parcel information, tax records, and field surveys to distinguish between residential and industrial/business structures and between a main building and an ancillary feature such as a barn or shed. A full description of the methodology for determining relocation impacts is presented in Section 5.4 of the D&RG technical memorandum.

[6] Although a narrower (80-m [262-ft]) footprint was used to minimize impacts in areas of existing development, the 95-m (312-ft) right-of-way was used for the D&RG alignments in the areas associated with new platted developments because the extent of the developments was not fully known at the time the analysis was completed.

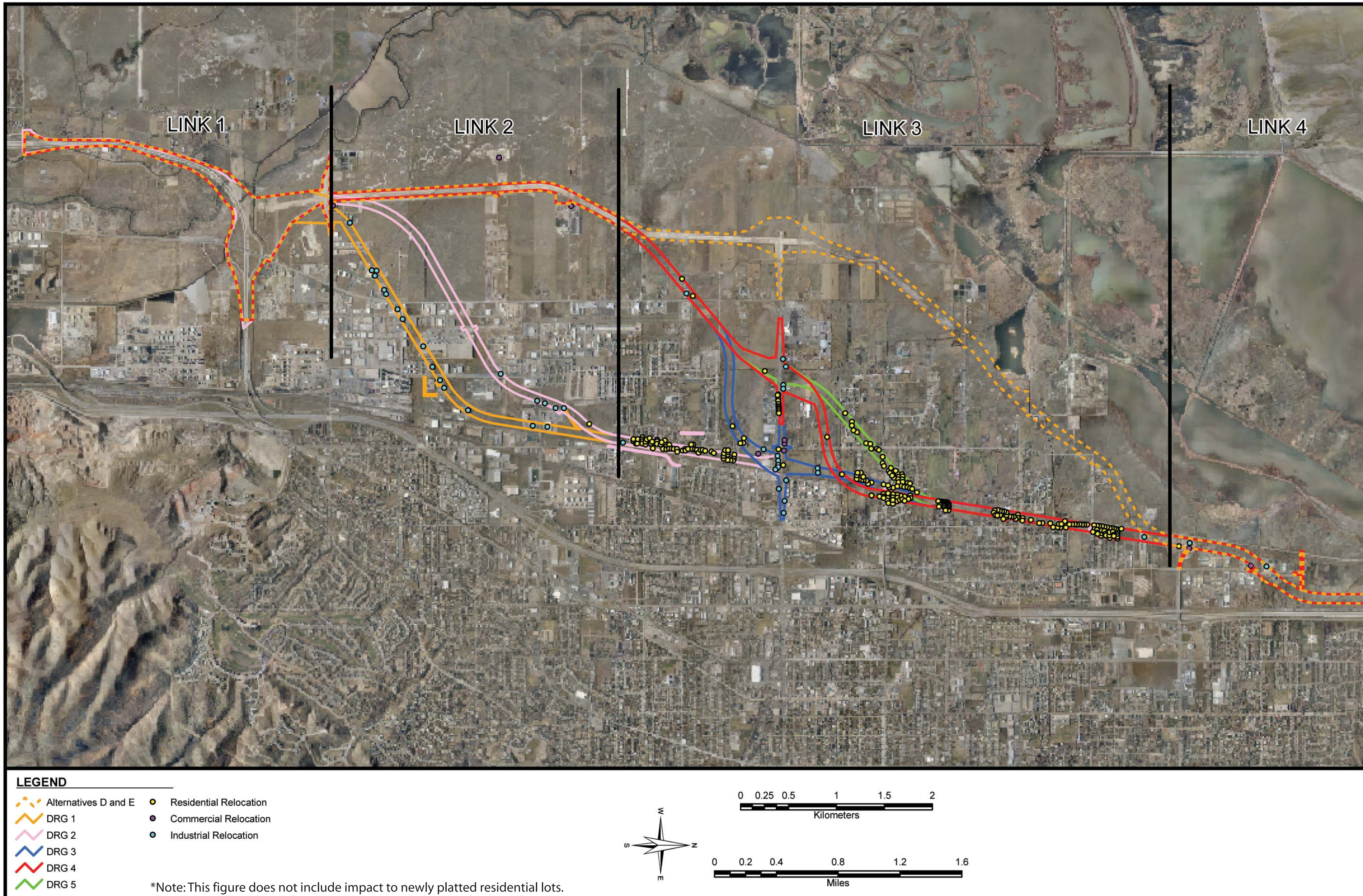

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Figure 2.2-2
Relocations

Table 2.2-1 Comparison of D&RG Alignment Relocations with Alternative E Relocations

Alignment (right-of-way width)	Identified Relocations	Residential Relocations as Percentage of Total Households			Residential Platted Lots[1]	Major Utility Impacts
		North Salt Lake	Woods Cross	West Bountiful		
Alt E (95 m)	Residential–4 Business–14 **Total–18**	NA[2]	NA[2]	NA[2]	0	Petroleum–5 Water–6 Power–5 Gas–5 **Total–21**
DRG1 (80–95 m)	Residential–193 Business–86 **Total–279**	0	3.5	9.3	0	Petroleum–13 Water–15 **Total–28**
DRG2 (80–95 m)	Residential–196 Business–46 **Total–242**	<1	3.5	9.3	Foxboro–70	Petroleum–9 Water–13 **Total–22**
DRG3 (80–95 m)	Residential–129 Business–39 **Total–168**	0	<1	9.5	Mountain View–36	Petroleum–4 Water–9 **Total–13**
DRG4 (80–95 m)	Residential–128 Business–21 **Total–149**	0	1	8.9	Mountain View–36	Petroleum–4 Water–10 **Total–14**
DRG5 (80–95 m)	Residential–139 Business–20 **Total–159**	0	1	9.8	Mountain View–36	Petroleum–4 Water–9 **Total–14**

Notes:

[1] None of the other platted developments would be directly affected by the D&RG conceptual alignments.

[2] Alternative E would not displace populations in North Salt Lake, Woods Cross, or West Bountiful.

Additional information is presented for Links 2 and 3 only in this and following sections because the impacts of the D&RG alignments vary from Alternative E in these two links only. Table 2.2-2 compares the identified relocations in Links 2 and 3.

Table 2.2-2 Relocations in Links 2 and 3

Alignment	Residential Displacements in Link 2	Residential Displacements in Link 3	Business Displacements in Link 2	Business Displacements in Link 3
Alternative E	0	0	2	1
DRG1	0	189	51	24
DRG2	3	189	11	24
DRG3	0	125	2	26
DRG4	0	124	2	8
DRG5	0	135	2	7

Community Cohesion

According to FHWA (Technical Advisory T 6640.8A, 1987), changes in neighborhoods, or community cohesion, can include splitting neighborhoods, isolating a portion of a neighborhood or an ethnic group, generating new development, changing property values, or separating residents from community facilities.[7] All the D&RG conceptual alignments would place a four-lane freeway through established residential and commercial developments as well as through planned or newly developing areas. In many locations, these alignments would need to be elevated on bridges to cross surface streets and railroad tracks, and ramps with embankments and possibly elevated bridges would be required at locations with interchanges. Where surface streets are not routed over or under the alignment, they would be terminated with cul-de-sacs or frontage roads running parallel to the freeway, which would cut off movements across the alignment.

Because the D&RG alignments would be in close proximity to residential areas, UDOT's Noise Abatement Policy (UDOT 08A2-1) would likely require the installation of noise walls. UDOT's noise policy allows noise abatement for planned residential areas if development plans predate the environmental approval process for the transportation project. Because Legacy Parkway is proposed as a high-speed, controlled-access facility, the entire right-of-way would be fenced to keep pedestrians and bicyclists from crossing at unsafe locations. In some cases, the alignments would make it more difficult for residents to access schools, places of worship, community centers, and businesses, which would disrupt the residents' sense of community cohesion. Table 2.2-3 quantifies the physical barriers that would be created under each D&RG conceptual alignment and under the Alternative E alignment. These physical barriers would result in substantial adverse impacts on community cohesion in North Salt Lake, Woods Cross, and West Bountiful. Table 2.2-4 presents the percentages of the populations in each community that would be segmented by existing transportation facilities and facilities that would be created under each D&RG conceptual alignment and under the Alternative E alignment.

Public opinion from local communities has been consistent over the years, with an emphasis on keeping the Legacy Parkway alignment as far west as possible. Transportation agencies have placed a priority on minimizing the segmentation of developable lands in the existing communities, which includes new developments.

[7] FHWA is required to look at community impacts in accordance with 23 USC 109 (h).

Table 2.2-3 Community Cohesion Impacts: Physical Barriers Created by Alignment

Alignment	Number of Bridges (Cross Streets)	Number of Cul-de-Sacs and Cut-Off Roads	Length of Noise Wall, m (ft)*	Length of Retaining Wall not Including Termini Interchanges, m (ft)*
Alternative E	4	4	0 (0)	500 (1,600)
DRG1	12	14	10,600 (34,800)	4,900 (16,100)
			300 (33,700)	
DRG2	12	22	13,800 (45,200)	4,900 (16,100)
DRG3	10	13	7,400 (24,400)	3,800 (12,600)
DRG4	10	12	7100 (23,300)	3,800 (12,400)
DRG5	10	12	7,600 (25,100)	3,100 (10,300)

Note:

* Estimates only. More detailed design would be required to calculate the exact lengths. Lengths were rounded to nearest hundred, and there may be discrepancies when converting units directly.

Table 2.2-4 Percentages of Population Segmented by Transportation Facilities within Each Community*

Alignment	West of Alignment	Between Roadway and D&RG	Between D&RG and UPRR	Between UPRR and I-15
North Salt Lake				
Alternative E	<1%	<1%	1%	19%
DRG1	<1%	<1%	1%	19%
DRG2	<1%	<1%	1%	19%
DRG3	<1%	<1%	1%	19%
DRG4	<1%	<1%	1%	19%
DRG5	<1%	<1%	1%	19%
Woods Cross				
Alternative E	2%	35%	6%	55%
DRG1	37%	0%	6%	55%
DRG2	33%	4%	6%	55%
DRG3	8%	29%	6%	55%
DRG4	4%	33%	6%	55%
DRG5	4%	33%	6%	55%
West Bountiful				
Alternative E	0%	35%	53%	12%
DRG1	28%	6%	53%	12%
DRG2	28%	6%	53%	12%
DRG3	28%	6%	53%	12%

Alignment	West of Alignment	Between Roadway and D&RG	Between D&RG and UPRR	Between UPRR and I-15
DRG4	24%	11%	53%	12%
DRG5	17%	18%	53%	12%

Note:

* Percentages are based on the population distribution in the 2000 U.S. Census. Numbers do not add up to 100% because there are portions of these populations that are east of I-15 and outside the study area.

Public School Service Area Impacts

The D&RG conceptual alignments divide the service areas of two schools in the Davis County School District: West Bountiful Elementary and Woods Cross Elementary. Alignments DRG1 and DRG2 divide the service areas of both schools; DRG3, DRG4, and DRG5 primarily divide the service area of West Bountiful Elementary. Alternative E passes west of most development on the western edge of the service area of West Bountiful Elementary. There is currently no housing west of Alternative E, except five houses in West Bountiful. The planned Legacy Nature Preserve would take up most of the land west of Alternative E, so future residential development west of Alternative E would be limited, and few future students would be affected.

A new elementary school will be constructed in 2007 as part of the Foxboro development. While no plans for the school currently exist, the school is planned to be located in the northwestern portion of the development. DRG1 and DRG2 would divide the service area of the school; DRG3, DRG4, and DRG5 would not have any impact on the school or access to the school.

Church Impacts

There are several buildings west of I-15 affiliated with the Church of Jesus Christ of Latter-day Saints (LDS). Congregations of this church, called wards, are defined by geographic boundaries. General conclusions regarding the community cohesion impacts on church members were based on the geographic relationships between D&RG alignments, church locations, and residential areas.

The D&RG conceptual alignments would likely divide several established LDS wards. Members of these wards would experience minor adverse impacts because they would need to follow major streets to cross the highway. The LDS church leadership could possibly redraw the ward boundaries so that the highway did not divide wards. There would be no impacts on church buildings associated with Alternative E.

Travel Patterns, Accessibility, and Walkability

The D&RG conceptual alignments would divide communities, school districts, and LDS church wards, and would create cul-de-sacs, dead-end streets, and bridges with ramps on earthen embankments. These changes would have a major impact on local travel patterns. Trips that currently are relatively direct on gridded street patterns would instead require circuitous routes to access an overpass or underpass to cross the highway.

All the D&RG conceptual alignments would adversely affect community walkability by introducing another physical barrier to pedestrians in a corridor that is already divided by the UPRR tracks and I-15. Because Alternative E mostly traverses the edge of existing and proposed future development where there are fewer reasons for residents to cross the alignment, it would have little effect on local travel patterns.

Visual and Noise Impacts

The D&RG conceptual alignments would intersect established residential areas, as well as the previously mentioned new developments, causing major impacts on local viewsheds and increasing ambient noise levels in residential neighborhoods adjacent to the alignments. Areas with adjacent residential properties both developed and platted would likely qualify for noise walls according to UDOT's Noise Abatement Policy (UDOT 08A2-I). The noise walls would add to the height of the overall facility and would increase the visual impacts. The earthen ramps, elevated bridges, and fences would also cause visual impacts along the alignment (Table 2.2-3).

Table 2.2-5 identifies the number of existing and platted residential properties adjacent to the various alignments and the length of noise walls and retaining walls that would likely be constructed. These measurements are an indicator of the level of noise and visual impacts that could be anticipated. A higher number of residential properties adjacent to the alignment indicates a greater number of people directly affected by noise and visual impacts. A longer noise wall indicates a higher level of visual impacts and a longer portion of the alignment that is likely to experience noise impacts. A longer retaining wall indicates a longer portion of the alignment that would be raised and subject to visual impacts.

Table 2.2-5 Noise and Visual Impacts

Alignment	Residential Properties adjacent to Alignment (Platted Lots adjacent to Alignment)	Length of Noise Wall, m (ft)*	Length of Retaining Wall not Including Termini Interchanges, m (ft)*
Alternative E	7 (0)	0 (0)	500 (1,600)
DRG1	125 (0)	10,600 (34,800)	4,900 (16,100)
DRG2	129 (32)	13,800 (45,200)	4,900 (16,100)
DRG3	115 (26)	7,400 (24,400)	3,800 (12,600)
DRG4	89 (26)	7,100 (23,300)	3,800 (12,400)
DRG5	114 (26)	7,600 (25,000)	3,100 (10,300)

Note:

* Estimates only. More detailed design would be required to calculate the exact lengths. No noise walls are required for Alternative E because residential development plans were designed with the knowledge of a highway along the Alternative E alignment. There are no newly platted lots adjacent to Alternative E because the new development plans include a buffer strip, park, or open space between the residential lots and the Alternative E right-of-way.

Environmental Justice

Environmental justice addresses the proportionality of impacts of a project; that is, whether the adverse impacts of a project's construction and operation are disproportionately borne by minority or low-income households (Executive Order 12898). Conversely, environmental justice also considers whether these households share the positive impacts of a project. The D&RG alternatives and Alternative E were analyzed for environmental justice issues using FHWA-recommended procedures. No environmental justice issues were identified.

2.2.3.2 Impacts on Wetlands

This section summarizes the wetlands impacts associated with the D&RG conceptual alignments in the D&RG regional corridor and Alternative E in the Great Salt Lake regional corridor. As part of this analysis, the D&RG alignments were surveyed in July 2003 for wetlands not previously delineated for the evaluation in the Final EIS.[8] Based on more refined wetland identification, the wetland impacts in the D&RG regional corridor and the Great Salt Lake regional corridor would now both be characterized as *medium* rather than *low* and *medium*, respectively, as stated in the Final EIS. The analysis identifies 42–46 ha (105–114 ac) of wetlands within the D&RG conceptual alignment rights-of-way, as compared to 46 ha (113 ac) for Alternative E, and 36-39 ha (90–97 ac) of wetlands impacts within the footprints of the D&RG conceptual alignments, as compared to 42 ha [103 ac] for Alternative E). Acreage of wetlands impacts were calculated by determining the acreage in the alignment right-of-way and the acreage that would likely fall within the footprint of the roadway. Through final detailed design for Alternative E, UDOT determined that 4ha (10 ac) of wetlands within the right-of-way—primarily in the north (Link 5) and south (Link 1) interchanges, where all the D&RG alignments and Alternative E are the same—would not be affected by highway construction. These interchange areas would be similar under all alternatives because the design of the interchanges is based on the area needed to accommodate the ramps that connect to the roadway, not the right-of-way of the roadway itself. Therefore, this 4-ha (10-ac) reduction of wetlands impacts applies to all alternatives. For the D&RG alignments, the wetland impacts would be further reduced by the use of a narrower 80-m (264-ft) right-of-way in wetland areas. The reduction varies for the D&RG alignments. Considering just the highway footprint (80 m [264 ft]) and not the entire right-of-way width for Alternative E, there is a potential to avoid up to 0.8 ha (2 ac) of wetlands impacts in addition to the wetland impacts avoided at the interchanges. To provide the most conservative picture of the possible wetland impacts, this potential reduction is not included in Table 2.2-6

Table 2.2-6 below identifies direct impacts on wetlands within the D&RG conceptual alignments and the Alternative E alignment. Direct impacts on wetlands associated with each D&RG alignment ranged from about 43 ha to 46 ha (105 ac to 114 ac), compared to about 46 ha (113 ac) under Alternative E. See Table 2.2-7 for wetlands impacts in Links 2 and 3. Wetlands impacts in Links 1, 4, and 5 are the same under all alternatives.

[8] Reference materials used included National Wetlands Inventory mapping, aerial photography, and the *Intermountain (Region 8) List from the National List of Plant Species That Occur in Wetlands* (Reed 1988). Field surveys of the general composition of vegetation and hydrology were conducted on and adjacent to the right-of-way for the five D&RG conceptual alignments.

Table 2.2-6 Wetland Impacts (in Acres)

Alignment	Wetland Acres within ROW	Difference from Alt. E Based on ROW	Wetland Acres within Footprint*	Difference from Alt. E Based on Footprint
Alternative E	113	—	103	—
DRG1	105	–8	90	– 13
DRG2	114	+1	97	– 6
DRG3	111	–2	95	– 8
DRG4	110	–3	94	– 9
DRG5	106	–7	90	– 13

Note:

* This includes the 4 -ha (10 -ac) reduction in wetland impacts identified by the design-builder in the termini interchanges, which applies to all alternatives. For the D&RG alignments the reduction is also associated with the use of the variable 80-m (264-ft) footprint width in wetland areas and in areas of existing development; the acreage of this reduction varies for the D&RG alignments

Table 2.2-7 Acres of Wetlands Impacts in Right-of-Way in Links 2 and 3

Alignment	Link 2	Link 3	Total of Link 2 and Link 3
Alternative E	9	29	38
DRG1	7	23	30
DRG2	18	21	39
DRG3	9	26	35
DRG4	9	25	34
DRG5	9	21	30

2.2.3.3 Regional Corridor Cost Estimates and D&RG Conceptual Alignment-Specific Cost Estimates

The Final EIS evaluated five regional corridors, including the D&RG regional corridor, based on costs, wetland impacts, and impacts on existing development. The planning level approach evaluation, assumed a four-lane freeway within a 100-m (328-ft) development corridor. Cost estimates were based on a 100-m right-of-way and generalized bridge requirements (see page 2-26 of the Final EIS). To ensure that all relevant information was updated for the Supplemental EIS, the lead agencies also requested that the cost estimates for all five regional corridors evaluated in the Final EIS be updated and provided below in Table 2.2-8. The revised regional cost estimates show that the costs of the regional corridors have increased since June 2000 when the Final EIS cost estimates were prepared. The increase in the regional alignment cost estimates can be attributed primarily to inflation between 2000 and 2004 and to refining the cost-estimating assumptions and applying a consistent cost-estimating methodology.

Table 2.2-8 Updated Cost Estimates for Regional Corridors

Regional Corridor	Estimated Cost (in millions)[1]	
	Final EIS 2000[2]	Supplemental EIS 2004[3]
Antelope Island	$1,400	$1,525
Trans-Bay	$1,460	$1,868
Railroad		
Denver & Rio Grande	$460	$589
Union Pacific[4]	$1,900	$1,702
Great Salt Lake	$300	$439
Farmington Bay	$520	$830

Notes:

[1] These cost estimates are essentially the base costs of an alignment within the regional corridor (including mitigation). Actual contracting involves additional costs such as pre-award engineering, stipends, and incentives, environmental oversight, and program management. It is standard practice to compare the base costs because the actual contracting expenditures can vary widely and cannot be accurately predicted (i.e., actual budget for Legacy Parkway was $451, $151 million more than the estimated $300 million cost estimate presented in the Final EIS).

[2] Source: Federal Highway Administration et al. 2000.

[3] Source: Appendix G, *Updated Cost Estimates*. These cost estimates were calculated on the basis of an overall length and width of a highway within the various regional corridors and on rough quantity estimates including earthwork, right-of-way, and bridges.

[4] The cost estimate for the Union Pacific Railroad regional alignment was reduced since the Final EIS. This is because the estimate for this regional alignment was done at a different level of detail for the Final EIS due to the fact that it was an active line and alternatives within that regional alignment would require relocating a major refinery. Therefore, a macro-scale (less detailed) calculation was appropriate.

Cost estimates also were developed for the five conceptual alignments within the D&RG regional corridor and for a conceptual alignment following Alternative E, based on a variable right-of-way of between 80 m and 95 m (264 ft and 312 ft). Conceptual alignment Alternative E is distinguished to indicate that the cost estimates were prepared using the same methodology as was used for the conceptual D&RG alignments. Table 2.2-9 presents the cost estimates for each D&RG conceptual alignment.

Table 2.2-9 D&RG Conceptual Alignment-Specific Cost Estimates

Conceptual Alignment	Length Variation from Alternative E (miles)[1]	Length along D&RG Railroad (miles)	Alignment-Specific Cost Estimates 2005 (millions) [2]	Cost Difference from Alternative E (millions)	Percent Increase over Alternative E
Alternative E	—	—	$442	—	—
DRG1	6.2	4.5	$698	$256	58%
DRG2	6.2	3.6	$665	$223	50%
DRG3	4.5	2.5	$596	$154	35%
DRG4	4.4	2.2	$578	$136	31%
DRG5	4.3	1.5	$576	$134	30%

Note:

[1] Length variation is the length, in miles, that the D&RG alignments differ from Alternative E. For the remainder of the total 14 miles of the North Corridor, the alternative alignments are identical.

[2] Alignment-specific cost estimates were revised after the Draft Supplemental EIS and are based on review by FHWA. Costs represent updated material quantity estimates and reflect 2005 prices.

Because cost estimates are identical in Links 1, 4, and 5, the primary cost differences between alignments occur in Links 2 and 3. Table 2.2-10 provides the estimated costs of Link 2 and 3 for a comparison between D&RG alignments and Alternative E.

Table 2.2-10 Alignment-Specific Cost Estimates for Links 2 and 3 (millions)

Alignment	Link 2*	Link 3	Total Cost Estimate of Links 2 and 3
Alternative E	$23	$80	103
DRG1	$126	$233	359
DRG2	$92	$233	325
DRG3	$23	$234	257
DRG4	$23	$216	239
DRG5	$23	$214	237

2.2.3.4 Summary of Impacts

Table 2.2-11 summarizes the quantifiable impacts of the D&RG evaluation for all D&RG conceptual alignments and Alternative E. The D&RG analysis determined that the impacts of the D&RG conceptual alignments and Alternative E differ only in Links 2 and 3 because the D&RG alignments and Alternative E share much of the same alignment in Links 1, 4, and 5. To compare impacts of the D&RG alignments to those of Alternative E, Table 2.2–12 identifies the impacts in Links 2 and 3 for all D&RG alignments and Alternative E.

Table 2.2-12 Summary of Cost Estimates, Wetlands Impacts, and Impacts on Existing Development for Links 2 and 3

	Estimated Costs (millions)		Wetlands in the Right-of-Way (acres)		Impacts on Existing Development					
					Link 2			Link 3		
					Relocations		Possible Relocations	Relocations		Possible Relocations
Alignment	Link 2	Link 3	Link 2	Link 3	Residence (parcels)	Business (parcel)	Platted Lot	Residence (parcels)	Business (parcels)	Platted Lot
Alt E	$23	$80	9	29	0	2	0	0	1	0
DRG1	$126	$233	7	23	0	51	0	189	24	0
DRG2	$92	$233	18	21	3	11	70	189	24	0
DRG3	$23	$234	9	26	0	2	0	125	26	36
DRG4	$23	$216	9	25	0	2	0	124	8	36
DRG5	$23	$214	9	21	0	2	0	135	7	36

2.2.4 Conclusions

2.2.4.1 Impacts on Aquatic Resources

Table 2.2-11 summarizes and compares the quantitative impacts of Alternative E and each D&RG alignment. The analysis shows that highway facility alternatives in both the Great Salt Lake corridor (Alternative E) and the D&RG regional corridor would likely result in similar levels of impacts on wetlands. There would be approximately 43 to 46 ha (105 to 114 ac) of wetlands within the D&RG alignment right-of-way compared to 46 ha (113 ac) under Alternative E. Estimated direct footprint impacts within the rights-of-way are approximately 36 to 39 ha (90 to 97 ac) of wetlands impacts within the D&RG alignments and 42 ha (103 ac) under Alternative E. (See Section 2.1, *Right-of-Way Issues*, and Section 3.3.1 for explanation of roadway footprint versus right-of-way.) Table 2.2-12 shows that fewer impacts would occur on wetlands under the D&RG alternatives in only two links (Links 2 and 3); Links 1, 4, and 5 would have identical wetland impacts to Alternative E. In Link 2, DRG1 (the alignment in Link 2 that affects the least acreage of wetlands) would affect 0.81 ha (2 ac) fewer wetlands than Alternative E. In Link 3, DRG2 and DRG 5 (the alignments in Link 3 that affect the least acreage of wetlands) would affect 3 ha (8 ac) fewer wetlands than Alternative E.

2.2.4.2 Practicability Considerations

Although implementation of an alternative in the D&RG regional corridor could result in fewer impacts on wetlands than Alternative E, the lead agencies have determined that an alignment in the D&RG corridor is not practicable because of logistics and cost considerations. In the CWA regulations, *practicable* is defined as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." If an alternative is not practicable, the Corps can eliminate that alternative from further consideration. In addition, under NEPA, if an

Table 2.2-11 Summary of Quantitative Impacts by Alignment

				Impacts on Existing Development										
		Wetlands		Relocations			Potential Relocations	Utilities	Travel Patterns		Noise and Visual Impacts		
Conceptual Alignment	Total Cost Estimate (millions)	Footprint (acres)	ROW (acres)	Residential (Parcels)	Business (parcels)	Total Relocations	Platted Lots	Major Utility Impacts (Total)	Bridges (Cross Streets)	Cul-de-Sacs and Cut-Off Roads	Residential Properties Adjacent to ROW (platted lots)	Length of Noise Wall, m (ft)	Length of Retaining Wall not Including Termini Interchanges, m (ft)
Alternative E	$442	103	113	4	14	18	0	21	4	4	7 (0)	0 (0)	500 (1,600)
DRG1	$698	90	105	193	86	279	0	28	12	14	125 (32)	10,600 (34,800)	4,900 (16,100)
DRG2	$665	97	114	196	46	242	Foxboro –70	22	12	22	129 (26)	13,800 (45,200)	4,900 (16,100)
DRG3	$596	95	111	129	39	168	Mountain View –36	13	10	13	115 (26)	7,400 (24,400)	3,800 (12,600)
DRG4	$578	94	110	128	21	149	Mountain View –36	14	10	12	89 (26)	7,100 (23,300)	3,800 (12,600)
DRG5	$576	90	106	139	20	159	Mountain View –36	14	10	12	114 (26)	7,600 (25,000)	3,100 (10,300)

alternative does not meet the project purpose and need or does not meet other criteria for reasonableness and feasibility, the lead agencies can eliminate that alternative from further consideration. See Chapter 3, Section 3.2.1 for a discussion of the reasonableness and feasibility screening criteria used to evaluate alternatives. The following summarizes the lead agencies' findings regarding the practicability of constructing an alignment in the D&RG regional corridor.

Cost

As illustrated in Table 2.2-11, the cost estimates of the conceptual D&RG alignments range between $576 million and $698 million, which is between $134 million and $256 million more than conceptual alignment Alternative E (see Appendix G, *Updated Cost Estimates*). As with all cost comparisons in this Supplemental EIS, these costs are based on dollar costs to acquire lands needed for the project and the costs of construction and mitigation for impacts on wetlands. The lead agencies recognize that actual future costs will include components not reflected in these figures, including UDOT costs of project oversight, environmental evaluations, contractor incentives, and appropriate adjustments for the time value of money (inflation), which is why cost figures addressed in the Utah State Legislature in connection with UDOT requests for funding are higher than the cost estimates presented in this Supplemental EIS. The lead agencies also recognize that these additional cost categories are applicable to all alternatives in determining whether an alternative within the D&RG regional corridor was reasonable, and, in particular the Corps acknowledges these additional cost categories in determining whether such an alternative would be practicable. On the basis of cost alone, some of the D&RG alignments may be considered practicable. However, the higher construction costs in addition to the exceptional logistical constraints (discussed below) make the D&RG regional corridor impracticable.

Existing Technology

Alternatives within both the Great Salt Lake (including Alternative E) and D&RG regional corridors (including Alternatives D&RG 1–5) would be practicable from a technological point of view. There are no constraints of existing technology that would make either set of alternatives impossible to construct.

Logistics

Although not defined specifically in the CWA regulations, for the purposes of this Supplemental EIS, the Corps considers an alternative to be logistically impracticable if any of the details associated with implementing that alternative—including not only direct construction impacts such as the relocation of homes or businesses, but also resulting neighborhood changes—make it infeasible. This definition was substantiated in the appellate court decision in which the court determined that the Corps' decision to eliminate the D&RG alignment in the June 2000 Final EIS due to high cost and high impacts on existing development was not arbitrary or capricious because "...impacts on existing development would appear to fall within both the cost and logistics portion of the practicable definition." *(Utahns for Better Transportation et al v. U.S. Department of Transportation et al.* [305 F.3d 1152 (10th Cir. 2002)]).

The five alignments in the D&RG regional corridor were located to avoid wetlands, existing development, hazardous waste sites, and Section 4(f) properties to the extent possible. Even after strategic placement of the D&RG alignments, they would still require relocating between 149 and 279 residential and commercial properties, compared to a total of 18 relocations under Alternative E (Table 2.2-11). The relocations for the D&RG alignments would account for about 3 and 10 percent of the total residences in Woods Cross and West Bountiful, respectively. Alternative E would not affect any residential properties in either of those communities.

The D&RG alignments would also have substantially greater impacts on properties that would not be relocated but would remain along the alignments. Because the D&RG alignments pass directly through developed, established neighborhoods (as opposed to Alternative E, which skirts the western edge of development), they would have considerably more impacts on community cohesion, such as requiring between 12 and 22 cut-off roadways compared to four under Alternative E. The D&RG conceptual alignments would also sever 30 percent of the West Bountiful community to the west of the D&RG conceptual alignments. In addition, the D&RG conceptual alignments would have far greater noise and visual impacts than Alternative E. Between 89 and 129 residential properties would front the freeway under the D&RG alignments (including newly platted lots it would be between 115 and 161 properties) compared to seven under Alternative E. The length of noise walls and retaining walls—two additional indicators of noise and visual impacts on remaining development—would likewise be substantially greater under the D&RG alignments.

The lead agencies consider logistically impracticable those alternatives that cannot be strategically placed to avoid a high number of homes and businesses and a high amount of neighborhood disruption and tax base impacts on established communities. Therefore, impacts that would occur on existing development and the cohesion of communities in the study area make the alignments in the D&RG regional corridor unreasonable and logistically impracticable.

Section 2.3

Integration of Legacy Parkway with Mass Transit

2.3.1 Summary of Approach for Supplemental EIS

2.3.1.1 Updates since Previous Final EIS

The appellate court remanded the Legacy Parkway Final EIS for further consideration of integration of Legacy Parkway with mass transit. To address this issue and to assist in the development of a comprehensive "integration alternative," the federal lead agencies used the Supplemental EIS scoping process to gather public input on the approach to analyzing the integration of mass transit with Legacy Parkway. Based on input received during the scoping meetings, *integration* was defined as how the roads and transit system can be built together, how they function with one another, and how the usage of both systems can be optimized (see the *Areas of Controversy* section of the *Summary* chapter of this document).

In response to the public comments, a technical team was formed to help identify and evaluate alternative ways of integrating the transportation network through the Shared Solution. This technical team consisted of representatives from the lead agencies, UDOT, UTA, and the Wasatch Front Regional Council (WFRC). As discussed in detail in Section 1.2.3, *Definition of the Shared Solution*, the Shared Solution is a multi-modal approach to solving the transportation needs of 2020 and beyond in the North Corridor. The Shared Solution consists of transportation system management (TSM) and intelligent transportation system (ITS) measures, travel demand management (TDM), an expanded mass transit system, reconstruction and expansion of I-15 to ten lanes, and construction of a four-lane Legacy Parkway. In addition to input from the technical team, the community planning information committee (CPIC) was consulted at strategic milestones in the development of the *Technical Memorandum on Integration of Highways and Transit in the North Corridor* (integration technical memorandum) (Fehr & Peers 2004) for review and input on the integration analysis and results. CPIC participants included representatives of local jurisdictions, nongovernmental organizations, and cooperating agencies. (CPIC members and goals are discussed in detail in the *Foreword/Introduction* of this document.)

Currently, the north corridor is developing regional mass transit that includes bus service and a planned commuter rail. UDOT initiated a study in August 2004 to look at the integration of expanded I-15 and commuter rail. Conceptual designs for each project had been proposed previously in their respective environmental documentation, the I-15 draft EIS and the commuter rail EIS (Federal Transit Administration and Utah Transit Authority 2004). In response to comments on system integration received during the Supplemental EIS scoping process, the Supplemental EIS includes a maximum future transit analysis scenario that added to the planned mass transit in the WFRC long-range plan. The maximum future transit scenario developed for the integration analysis assumes that transit-supportive land use is developed concurrently with implementation of commuter rail; this assumption includes transit-oriented development (TOD), transit service integration, and transit mode coordination, as well as distribution of transit service to within close walking proximity of most of the developed land use in the corridor. This approach allowed the lead agencies to assess whether and under what circumstances mass transit could carry a greater share of the travel demand and thus be more aggressively integrated with roads and the complete transportation system. The maximum future transit scenario used in the integration and sequencing analysis is robust transit package B, which was developed for this integration analysis and is referred to throughout this Supplemental EIS as “maximum future transit.” Opportunities to integrate various physical aspects of the construction of elements of the Shared Solution were also analyzed. The results are summarized below in Section 2.3.2.3.

2.3.1.2 Changes since the Draft Supplemental EIS

The baseline travel forecast was updated as part of the integration analysis for the Shared Solution for the corridor screenline (Woods Cross). It is the only transportation analysis in the Supplemental EIS that is directly comparable to transportation analysis results in the Final EIS because it reports peak-hour volumes, as was used in the previous Final EIS, rather than peak-period volumes. For example, results of the integration analysis indicate that the Final EIS Shared Solution scenario showing travel demand of 24,110 peak-hour peak-direction PCEs has been reduced by about 20 percent from 24,110 PCEs reported in the Final EIS to about approximately 19,060 PCEs in the peak hour and peak direction due to updates in modeling procedures.

2.3.2 Summary of Integration Analysis

To ensure that results of the Supplemental EIS could be compared those of the 2000 Final EIS, measures of effectiveness used for the integration analysis were consistent with those used in the Final EIS. The integration analysis used improved analysis methods or updated information where available. Consistent with the Final EIS and to facilitate comparisons with that document, the integration analysis in this section uses 2020 p.m. peak-hour peak-direction passenger car equivalents (PCEs) at the Woods Cross screenline as a measure of typical traffic patterns and flow in the corridor. This is the same indicator, same location, and same units of measure as used in the Final EIS. Other sections of the Supplemental EIS also report corridor travel in terms of PCEs crossing the Woods Cross screenline, but they focus on the 3-hour *peak period* rather than the single *peak hour*. The peak period is used to show peak traffic conditions during broader periods of the day. Peak-period peak-direction PCEs are used to compare the performance of the alternatives to the purpose of and need for the project. The peak-hour is a refined subset of the peak-period; using the peak period in the analysis ensures that the integration analysis can be compared to the alternatives analysis.

Because new modeling and new population projections were available, the integration analysis uses updated WFRC socio-economic projections and WFRC 2004 travel model (version 3.2) to predict the year 2020 baseline travel forecasts. The total population and employment forecasts for 2020 have decreased by 2 to 7 percent since publication of the Final EIS. The updated travel modeling used for the Supplemental EIS projects that peak-hour peak-direction highway and transit PCE demand across the screenline would be approximately 19,000 PCEs compared to approximately 23,500 PCEs forecast in the Final EIS. This change in forecast does not change the conclusions on the need for Legacy Parkway (see Chapter 1, *Purpose of and Need for Action*).

The WFRC long-range plan and UTA current forecasts reflect transit ridership of 4.6 percent in the p.m. peak-hour, peak-direction compared to 12 percent maximum peak-hour transit ridership estimates in the Final EIS.[1] The integration analysis uses updated figures for total person trips and a sophisticated analysis of a full array of transit enhancements to develop aggressive transit scenarios. Under the robust transit packages used in this integration analysis (Packages A and B) and described below, the transit component of the Shared Solution is projected to carry 5.0 to 5.3 percent of the p.m. peak-hour, peak-direction travel demand in the North Corridor.

The following sections summarize the technical analysis used to reach these conclusions, as documented in the integration technical memorandum (Fehr & Peers 2004). Section 2.3.2.1 below describes the development of two robust transit packages, and Section 2.3.2.2 describes the results of the analysis regarding the integration of maximum future transit with Legacy Parkway.

2.3.2.1 Development of Integrated Transit Enhancement Packages

The integration analysis approach involved the following process.

- Use public and agency scoping comments to identify a comprehensive list of potential transit enhancements, including transit-supportive land use and TDM measures.
- Confirm that the travel forecasting models are capable of accurately accounting for changes in transit use resulting from changes in land use, transit service, and TDM variables.
- Establish maximum level of transit-supportive land use considered feasible in cooperation with local jurisdictions, federal, state, and regional agencies, and nongovernmental organizations.
- Screen transit enhancements based on evaluation of effectiveness, costs, funding, land use policies, and recommendations of affected jurisdictions.
- Prioritize and package measures into two robust transit packages that could be implemented early in the period between 2005 and 2020, and be fully effective for year 2020 projections, capturing the effect of giving transit the necessary time to have an effect on transit ridership.
- Conduct transit ridership analysis to determine performance of integrated robust transit packages.
- Incorporate the more robust transit package (referred to as maximum future transit) into analysis of the implementation sequencing of transportation improvements planned for the North Corridor.
- Assess physical design and coordination efforts for planned roadways to integrate road, park and ride, bus, rail, and other features.

A separate analysis evaluated alternative construction sequencing of mass transit, I-15 improvements, and Legacy Parkway as the major components of the Shared Solution. The analysis is described and documented in the sequencing technical memorandum (HDR Engineering 2004b). See Section 2.4 of this document for a description of the sequencing analysis and results.

[1] See Appendix B, Section B3.5.1, of the Supplemental EIS for a description of the basis of the Final EIS transit ridership estimates.

The integration analysis looked at a full range of factors that can influence the success of transit within the transportation system (measured by transit mode capture rates). Comments received during the scoping process for the Supplemental EIS requested that a transit system be planned in a holistic way, considering not only modes and routes but also other features that affect how people choose to travel. Therefore, the integration and sequencing analyses incorporate the maximum future transit scenario deployed in a manner to maximize transit ridership. The resulting ridership forecasts are higher than those projected in the current long-range plan. The following transit-related enhancements were tested at a general category level as well as individually to determine their effect on transit ridership.

- Improved quality and quantity of transit service.
  - Commuter rail, express bus, and bus rapid transit (BRT).
  - Feeder bus and local bus.
  - Seamless transfers and increased service frequencies.
- Increased proximity and access to transit.
  - Land use intensification along transit corridors.
  - Expanded bus service coverage.
  - Transit access efficiency.
  - Route deviation bus service.
- Transit-oriented development (TOD).
  - Land use intensification at rail stations.
  - Urban design: development density and diversity.
- Travel demand management (TDM)
  - Parking pricing.
  - Transit fare structure.
  - Employer incentives.

Before evaluating the effectiveness of the prospective transit enhancements, the WFRC model was tested to determine its ability to accurately predict the effects of such enhancements. To test the model's accuracy, each of the above components was inserted into the model, and the highest practicable level of change above that projected in the long range plan was determined. This level of change was then compared to empirical evidence from comparable existing systems. Effectiveness testing was performed to assess the maximum transit potential of each element. Table 2.3-1 summarizes the findings with respect to increases in transit ridership from category-level and individual transit/land use enhancements.

The analysis determined that the WFRC model performed reliably with respect to measuring ridership changes associated with changes in commuter rail, bus services, seamless transfer, transit access, fares, and parking costs. However, for several components not ordinarily addressed in conventional travel models (TOD design, proximity of transit stations, and incentive-based TDM policies other than parking costs and transit fares), the model review found that additional off-model adjustments would be needed to improve the forecasts. For these components, the integration analysis therefore supplemented the WFRC model with empirically based off-model adjustments to forecast the effects of changes deemed reasonable and foreseeable by the responsible local jurisdictions and regional agencies. Table 2.3-1 identifies which transit enhancement components were measured using the WFRC model, and which were subject to off-model adjustments based on empirical evidence. The analysis found that the transit enhancements with the most significant effects on increases to transit ridership (based on increases in corridor mode-split percentages) were commuter rail service increase, transit-supportive land use and TOD, express bus services, seamless transit transfers, and parking cost increases. Based on these results, local representatives recommended using a robust transit approach that included commuter rail, BRT, and transit-supportive land use.

The next step in the integration analysis was to determine the level of transit-supportive land use considered achievable by local plans and visions. The lead federal agencies held a planning meeting with CPIC representatives to identify the highest level of transit-oriented land use that the jurisdiction, community members, property owners, and future real-estate market could support in areas surrounding commuter rail stations and prospective BRT stops. The intent of the planning session was to gather information on aggressive transit-supportive land use changes that could be used in the integration analysis. These aggressive transit assumptions include and go beyond the transit component of the current WFRC long-range plan. It is important to note that these transit assumptions are for analysis purposes only; to be implemented, they would require the passage of ordinances, the support and actions of local elected officials, and the reaction of the real estate market. Nongovernmental representatives of the CPIC attended, observed, and participated in this planning session. The land use changes identified for this analysis represent the professional judgment of senior staff at the involved jurisdictions. Planning staff in local jurisdictions consider these aggressive transit-supportive land uses and land use intensifications achievable. Participants in the planning session relied on commuter rail station location information contained in the FTA/UTA commuter rail final EIS (Federal Transit Administration and Utah Transit Authority 2005).

Representatives recommended land use shifts in terms of numbers of residents (population) and employment opportunities (jobs) within 0.8 km (0.5 mi) of all planned transit stations, with the largest recommended changes at Farmington (400 percent increase), 500 South (28 percent increase), and Woods Cross (39 percent increase). In addition, interviews were held with representatives of cities with transit station sites north of the corridor to identify land use shifts recommended for their jurisdictions. Figure 2.3-1 summarizes the land use shifts recommended by the CPIC subcommittee. For land use shifts in the corridor, the subcommittee representatives recommended shifting population and employment totaling about 5,250 people to locations within 0.8 km (0.5 mi) of transit stations. For land use shifts north of the corridor, the Cities of Pleasant View, Ogden, Roy, Clearfield, and Layton suggested shifting population and employment totaling about 3,360 people to areas within 0.8 km (0.5 mi) of planned transit stations. These land use shifts total approximately 8,600 more residents and employees that would be within a 0.8-km (0.5-mi) radius of transit stations than indicated in the current long-range plan projections.

Table 2.3-1 Increases to Transit Ridership Resulting from Individual Transit/Land Use Enhancements Based on WFRC Model Response and Empirical Evidence

Transit Enhancement	Range of Variability Tested[1]	Model Response[2]	Empirical Evidence[3,4]
Commuter Rail	Double train frequency (from 30 to 15 minutes)	Ridership up 47%	NA
Bus Rapid Transit (BRT)	Five BRT routes added on US-89 (increased total BRT routes from zero to five)	Ridership up 40%	Ridership up 20–50%
Express Bus	Increase frequency 50–100% (from 15 or 20 minutes to 10 minutes)	Ridership up 84%	Ridership up 28%
Local Bus	Double frequency (from 30 to 15 minutes, or from 20 to 10 minutes)	System Ridership up 4%	Route Ridership up 33%
Seamless Transfer	Reduce from 15 to 5 minutes	Ridership up 29%	Ridership up 33%
Transit Access	90% of all people within walking distance (0.25 mi) of any type of transit service	Area transit share up 2%	Area Transit Share up <5%
Transit-Oriented Design (TOD)	Double walkability, connectivity (placing transit-oriented development within 0.25 mile of stations)	**Negligible**	*Auto Trip Gen down 3%*
Proximity to Transit Stations	Double 0.5 mile density (varied by station)	**Ridership up 7%**	*Ridership up 20–25%*
Transit Fares	Reduce current fare by 50%	Transit share up 10%	Transit share up 10% –20%
Parking Costs	Increase current parking costs in the Salt Lake City central business district 50%	Central business district transit share up 2%	Central business district Auto Trips Down 15%[5]
Travel Demand Management (TDM)	Available to 15% to 20% of employees (up from zero)	**NA**	*Screenline Share up 5%*

Transit Enhancement	Range of Variability Tested[1]	Model Response[2]	Empirical Evidence[3,4]

Notes:

[1] Range of variability tested was the highest level that could reasonably be considered possible relative to the current long-range plan; i.e. if long-range plan stated that commuter rail would run every 30 minutes, analysis doubled it to run every 15 minutes. The range of variability is not the level used in the maximum future transit packages; instead, it is a level used to provide the study team with the maximum potential effectiveness of each element to serve as a starting point for the development of robust transit packages.

[2] In several respects not ordinarily addressed in conventional travel models, the model review found that additional off-model adjustments would be needed to improve the forecasts. Bold text indicates that the WFRC model is not sufficiently sensitive to changes to the land use/transit enhancement being tested, and therefore the analysis includes off-model adjustments based on empirical findings.

[3] Empirical findings used were published by the Transportation Research Board, *Traveler Response to Transportation System Change,* TCRP Project B12, Third Edition, USDOT, 1999–2003.

[4] Italicized text indicates off-model adjustments will be used to incorporate this empirical evidence into forecasting.

[5] Decline in auto trips due to shifts in transit mode and other modes, including carpool, taxi, walk, and bike. Reductions in auto travel are most pronounced when parking costs are higher. A given percentage change in parking costs beginning at $10 per day will have a greater impact on auto use than the same percentage increase on parking costs beginning at $1 to $2.

NA = Not applicable.

Based on the transit-enhancement effectiveness results, recommended land use shifts, capital and operating costs, additional transit funding from flexible sources,[2] and land use policies, two robust transit packages were created for the integration analysis: robust transit package A (Package A) and robust transit package B (Package B). For purposes of analysis, both robust transit packages assume that all the highway components of the WFRC long-range plan and the Shared Solution, as well as specific additional transit enhancements, are fully operational before 2020. Consistent with the long-range plan and Shared Solution, the transit packages include the planned express bus service designed to take advantage of the planned I-15 HOV lanes. The primary difference between the two packages is that Package B includes all the elements of Package A, but assumes more aggressive TOD/TDM policies. As previously noted, these aggressive transit assumptions differ from the transit component of the current WFRC long-range plan and would require the passage of ordinances, the support and actions of local elected officials, and the reaction of the real estate market for actual implementation.

Robust Transit Package A

Package A includes transit investment above the long-range plan levels to allow increased commuter rail service, several BRT lines and improved local bus service, transit access systems, transfer synchronization, and reduced transit fares. This transit package assumes a 50 percent increase in downtown parking costs in addition to inflation adjustments. This represents an aggressive assumption given the recent downtown employment decline and proposals to reduce parking prices or increase supply, but it is consistent with WFRC and the City of Salt Lake projected increase in downtown development densities by 2020. Package A consists of the following the primary elements.

- Commuter rail: 15-minute headways.
- BRT: premium service.
- East/west bus lines with seamless transfers.
- Local bus service distributed widely enough so that 95 percent population and employment are located within 0.4 km (0.25 mi) of transit.
- Premium transit fares reduced 50 percent.
- Downtown Salt Lake City and University of Utah parking costs increased 50 percent.

[2] Flexible sources include the potential for funds in addition to those funds allocated to transit under WFRC's December 2003 regional transportation long range plan aggressive funding program, which assumes $100 million per year in state general fund revenues for highway projects and additional local tax revenue for transit projects equivalent to a 0.25-cent sales tax increase and a 30-percent contribution from joint development and community participation. The State of Utah could elect to use a percentage of the state's federal apportionment for highway projects to support the additional measures of robust transit in the Shared Solution. To accomplish the integration robust transit packages would require regional consensus to divert additional flexible funds from other facilities, modes, or jurisdictions to further enhance the transit component of the North Corridor Shared Solution. Because such additional commitments are uncertain, the integration analysis may overestimate the transit share of future travel demand.

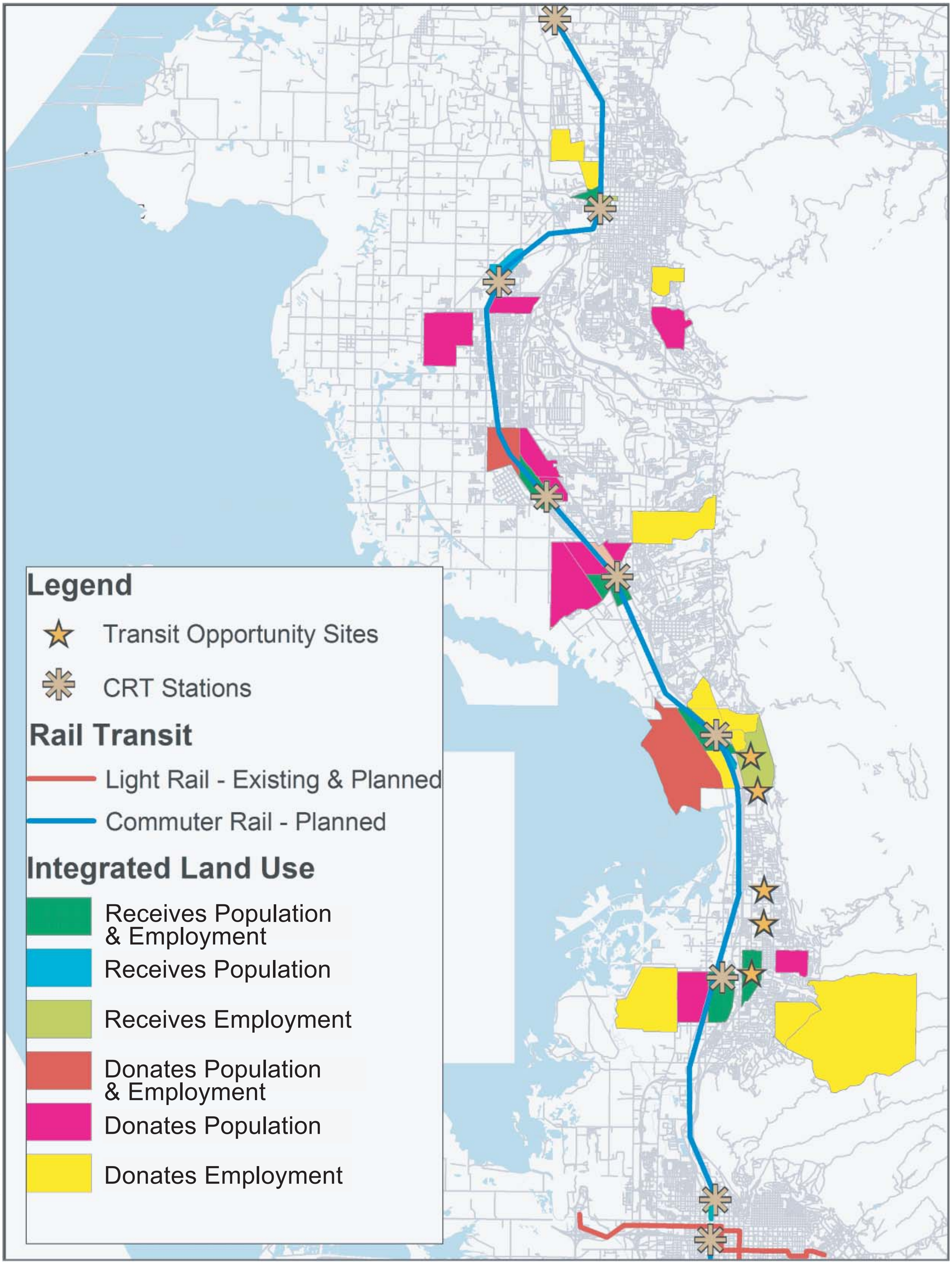

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Figure 2.3-1
Recommended Land Use Shifts

Robust Transit Package B

Package B includes all the transit elements in Package A and further strengthens the transit-supportive policy or "software" components. The following elements differ from or are in addition to Package A.

- Maximum encouragement of TOD at transit station sites, as defined by the CPIC land use subcommittee.
- Increased land use density within 0.4 km (0.25 mi) of premium transit by 24 percent in South Davis County.
- Downtown Salt Lake City and University of Utah parking costs increased by 100 percent to maximize the incentive to use mass transit.

The land use and parking-pricing strategies included in Package B are aggressive and represent the upper end of the reasonably foreseeable range. Robust transit package B is referred to as "maximum future transit" throughout the Supplemental EIS because it represents the most aggressive future mass transit scenario.

Table 2.3-2 presents a comparison of the packages to one another and to the 2020 future baseline conditions, which are referenced from the transit improvements included in the current WFRC long-range plan.

Table 2.3-2 Comparison of Robust Transit Packages A and B with Baseline Conditions Set by WFRC Long Range Plan

	Robust Transit Package	
Baseline	A—Robust Transit with Moderate TDM Policy Change	B—Robust Transit with Transit-Supportive Land Use and Aggressive TDM Policies
Land use per long-range plan	Long-range plan land use	Transit-supportive land use
Highway improvements per long-range plan*	Highway improvements per baseline	Highway improvements per baseline
Commuter rail operating per 2020 long-range plan	Increased commuter rail frequency	Increased commuter rail frequency
Express bus, I-15 and US-89	Express bus, I-15 and US-89	Express bus, I-15 and US-89
Local bus per long-range plan	Increased local bus service—designed to feed line-haul transit	Increased local bus service—designed to feed line-haul transit
Bus rapid transit—Farmington to Salt Lake	BRT re-aligned through all TOD opportunity sites	BRT re-aligned through all TOD opportunity sites
Transfers—15 to 20 minutes	Seamless transfer at BRT and CRT stations	Seamless transfer at BRT and CRT stations
Parking costs per long-range plan	Parking costs further increased by 50%	Parking costs doubled
Transit access—Baseline	Improved transit access	Improved transit access
Transit fares—Premium	Reduced fares for premium transit	Reduced fares for premium transit

	Robust Transit Package	
Baseline	A—Robust Transit with Moderate TDM Policy Change	B—Robust Transit with Transit-Supportive Land Use and Aggressive TDM Policies

Note:

* Includes Legacy Parkway and other components of North Corridor Shared Solution. Assumptions differ from 2020 LRP in that they include 10-lane I-15 and do not include the Legacy North project.

2.3.2.2 Integration Analysis Results

Figures 2.3-2 and 2.3-3 present the results of the integration analysis of the two robust transit scenarios, Packages A and B, compared to the auto, transit, and bike/walk/local numbers for the 2020 WFRC long-range plan baseline.[3] The comparisons illustrated in Figures 2.3-2 and 2.3-3 show, based on a consistent modeling base (2004 WFRC model with 2020 transit as defined in the current WRFC long-range plan), the degree by which integrating a robust transit package would increase transit ridership in the north corridor. This is measured in terms of transit riders translated into passenger-car equivalents. Consistent with and to facilitate comparisons with the Final EIS, the integration analysis in this section uses a 2020 p.m. peak-hour peak-direction travel demand volume at the Woods Cross screenline, expressed as PCEs, as a measure of typical traffic patterns and flow in the corridor. Compared to the Shared Solution with current WFRC long-range plan transit, integration Package A increases the 2020 p.m. peak-hour, peak-direction transit ridership by about 75 passengers (equivalent to 58 PCEs). This increase in transit ridership increases the corridor mode share from about 4.6 percent to about 5.0 percent. Package B increases the 2020 p.m. peak-hour, peak-direction transit ridership by about 148 passengers (equivalent to 114 PCEs). Package B also increases the number of people traveling shorter distances primarily by bike and walking, as a result of more clustered land uses (i.e., compact land uses would reduce trip lengths, thereby encouraging people to travel without an automobile). As a result, Package B reduces automobile demand at the screenline by shortening trips and converting trips to transit, bike and walk modes. In total, integration package B decreases auto traffic at the screenline by approximately 204 PCEs, from 18,046 PCEs to 17,842 PCEs.[4] The increase in transit ridership raises the corridor mode share from 4.6 percent to about 5.3 percent.

The integration analysis transit mode-share findings are consistent with transit mode shares found in corridors elsewhere in the Salt Lake region (approximately 4 to 5 percent mode shares in the TRAX/I-15 corridor south of downtown Salt Lake City at 4000 South). The integration analysis results are reasonable considering the linear nature and multiple functions of the North Corridor and the small percentage of commuter travel oriented to downtown Salt Lake City or other central travel destinations. The North Corridor serves multiple travel needs, including long-distance, interstate, international, and dispersed travel in the Salt Lake region, as well as a small percentage of commuter travel to downtown Salt Lake City. On a daily basis less than 10 percent of trips crossing the southern boundary of the North Corridor are oriented to downtown Salt Lake City. This percentage is similar for peak-hour travel. This usage

[3] The analysis presented in Figure 2.3-2 assumes completion of Legacy Parkway (by 2020) and improvements to I-15 (up to ten lanes), but excludes construction of separate Legacy project north of North Corridor.

[4] Figures 2.3-2 and 2.3-4 present the results of the integration analysis, including appropriate off-model adjustments. Integration of Package B, before off-model adjustments were made, showed 17,905 PCEs in auto, 959 PCEs in transit, and 123 PCEs in bike/walk. The results were modified with off-model adjustments to reflect changes in travel characteristics resulting from the land use changes that the travel model is not designed to capture. The off-model adjustments were to the proximity to BRT and CRT stations (within 0.8 km [0.5 mi] of BRT stops and commuter rail stations) as well as TOD design (TOD within 0.8 km [0.5 mi] of commuter rail stations). Off-model adjustments were made only to Package B.

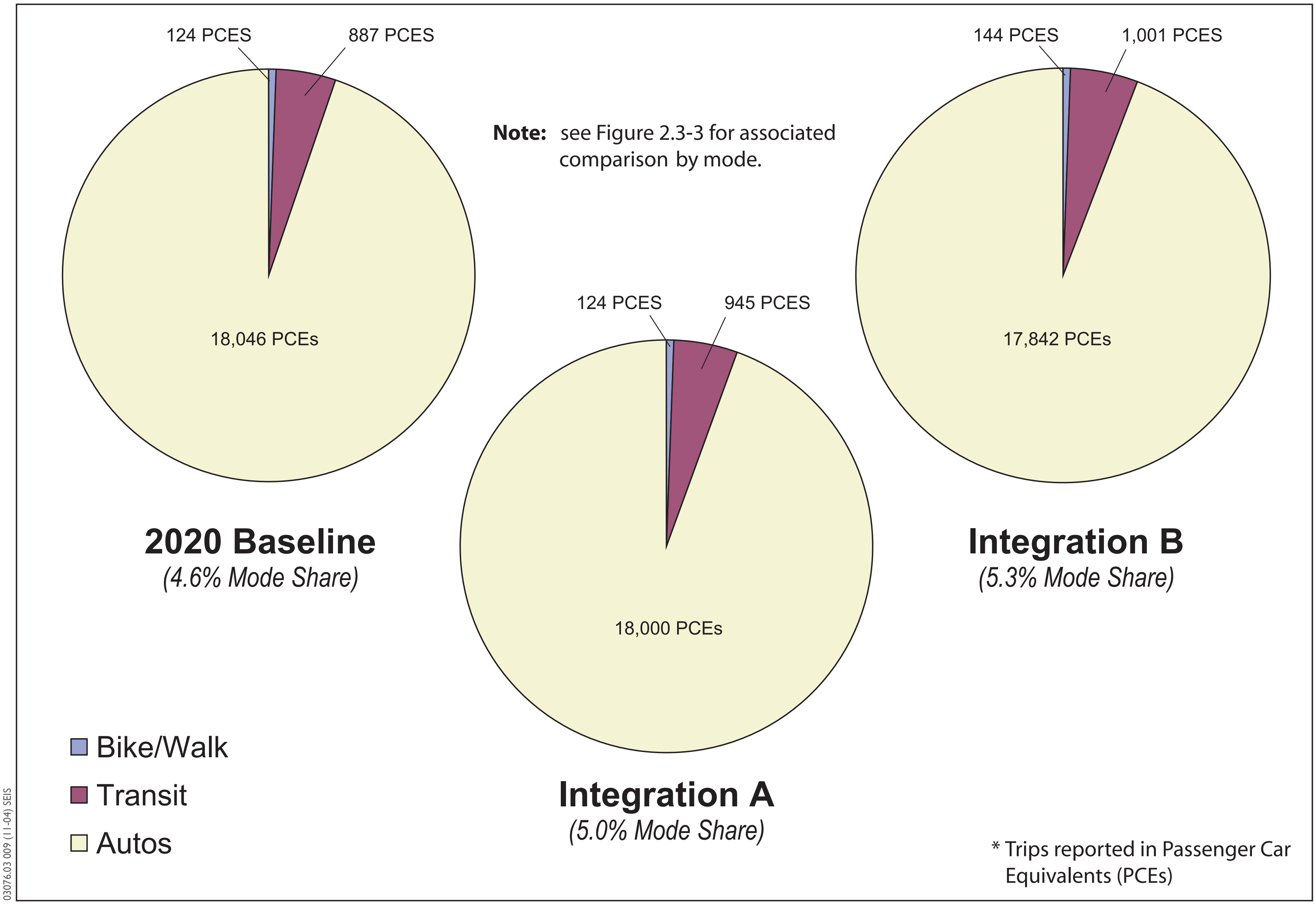
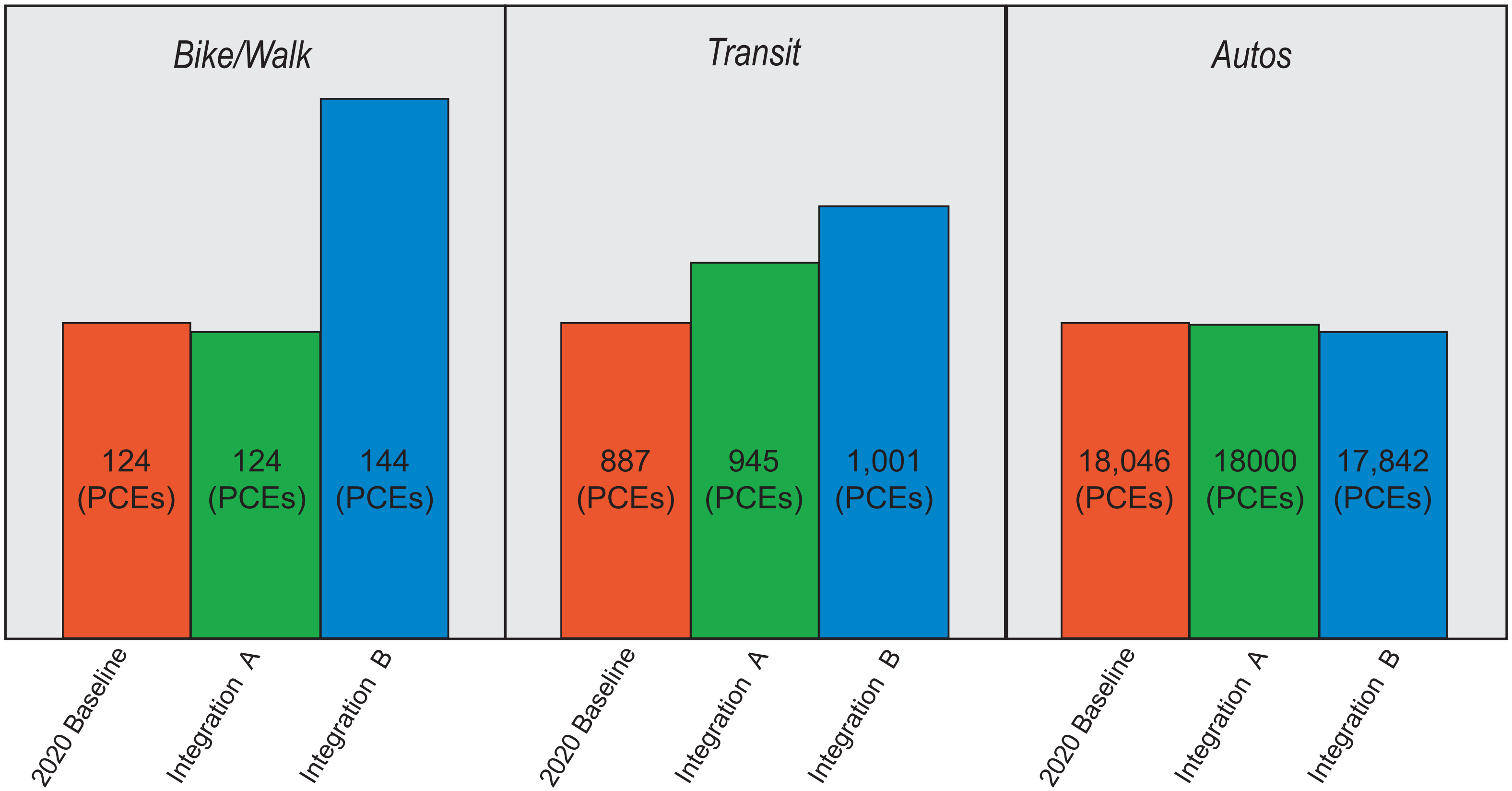


Figure 2.3-2
Comparison of Measures of Effectiveness of 2020 Baseline with Robust Transit Package A and Robust Transit Package B



* Trips reported in Passenger Car Equivalents (PCEs)

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Figure 2.3-3
Comparison of Measures of Effectiveness by Mode of 2020 Baseline with Robust Transit Package A and Robust Transit Package B

pattern limits the ability of a downtown-focused transit system to attract a high percentage of corridor travel.

2.3.2.3 Integration of Physical Construction of Legacy Parkway with Mass Transit Improvements

Since publication of the Final EIS, commuter rail planning has advanced to the stage that the commuter rail EIS has been finalized and a Record of Decision has been produced (Federal Transit Administration and Utah Transit Authority 2005). (See Appendix A of this Supplemental EIS for a copy of the charter created by UTA and UDOT for coordination and cooperation in development of the Shared Solution transportation improvements.) Now that more detailed planning and environmental compliance processes are underway for the commuter rail project, UTA is benefiting from the integration options offered by the Legacy Parkway project.

The integration analysis presents and evaluates opportunities already realized and those with future potential to integrate the construction of physical elements of the proposed Legacy Parkway with planned mass transit improvements in a way that provides efficient interfaces and service coordination of highway and transit travel. The Legacy Parkway project includes the following physical construction integration components.

- Placing interchanges at locations that can access future planned commuter rail stations.

  The commuter rail final EIS (Federal Transit Administration and Utah Transit Authority 2005) confirms that the proposed Legacy Parkway interchanges are located at or near the locations of future planned commuter rail stations (one in Farmington near the I-15/US-89/Legacy Parkway interchange and one in Woods Cross at 500 South near I-15). The proposed interchange locations of Legacy Parkway also allow for providing convenient park-and-ride facilities to facilitate carpooling and feeder-bus access to commuter rail stations.

- Changing the project design to lengthen structures to accommodate the physical integration of the commuter rail component of mass transit with Legacy Parkway and I-15.

  As a result of the work completed under the design-build contract since the Final EIS, UDOT incurred an additional $6.8 million in design and construction costs in the following structures to allow for the physical integration of commuter rail: Park Lane (formerly Burke Lane) (construction completed), I-15 southbound to Legacy Parkway southbound, Legacy Parkway northbound to I-15 northbound, US-89 southbound to Legacy Parkway southbound, Legacy Parkway northbound to US-89 northbound, State Street, and Glovers Lane. (Figure 2.3-4 identifies the location of all bridges.)

- Providing funding ($10 million) to UTA to aid in the purchase of commuter rail right-of-way that passes directly beneath a portion of the proposed Legacy Parkway and adjacent to I-15. These funds provided by UDOT were originally allocated for the design and construction of the Legacy Parkway project.

2.3.3 Conclusions

The integration analysis evaluates how the roads and transit system of the Shared Solution can be built together and function with one another, as well as how the usage of both systems can be optimized, taking into consideration the extent to which enhancements to future transportation and land use patterns are feasible and reasonably foreseeable. Package B represents maximum future transit, which is an aggressive improvement on the transit usage called for in the long-range plan that could be achieved through incorporation of transit-supportive land uses along the corridor. The federal lead agencies believe that analyzing the robust transit packages offered a reasonable way to evaluate how transit could be more fully integrated into the transportation system. The analysis used state-of-the-practice methods and a cooperative process through the CPIC meetings to involve local, regional, state, federal, and nongovernmental agencies to develop and present findings.

With the transit plan contained in the current WFRC long-range plan, which was used by FTA/UTA in the commuter rail final EIS (Federal Transit Administration and Utah Transit Authority 2005), transit as part of the Shared Solution is forecast to capture 4.6 percent of the peak-hour, peak-direction travel demand. The integration analysis results show that by integrating additional transit enhancements and modeling the effect of those features, maximum future transit could capture approximately 5.3 percent of the 2020 peak-hour, peak-direction travel demand (Package B).

For purposes of evaluating alternatives, this Supplemental EIS incorporates the following findings of the integration analysis.

- Providing funding ($10 million) to UTA to aid in the purchase of commuter rail right-of-way that passes directly beneath a portion of the proposed Legacy Parkway and adjacent to I-15.
- Design changes to the Legacy Parkway bridge and interchange structures to accommodate the integration of mass transit.
- The maximum future transit travel modeling assumptions (robust transit package B) for purposes of evaluating alternatives.

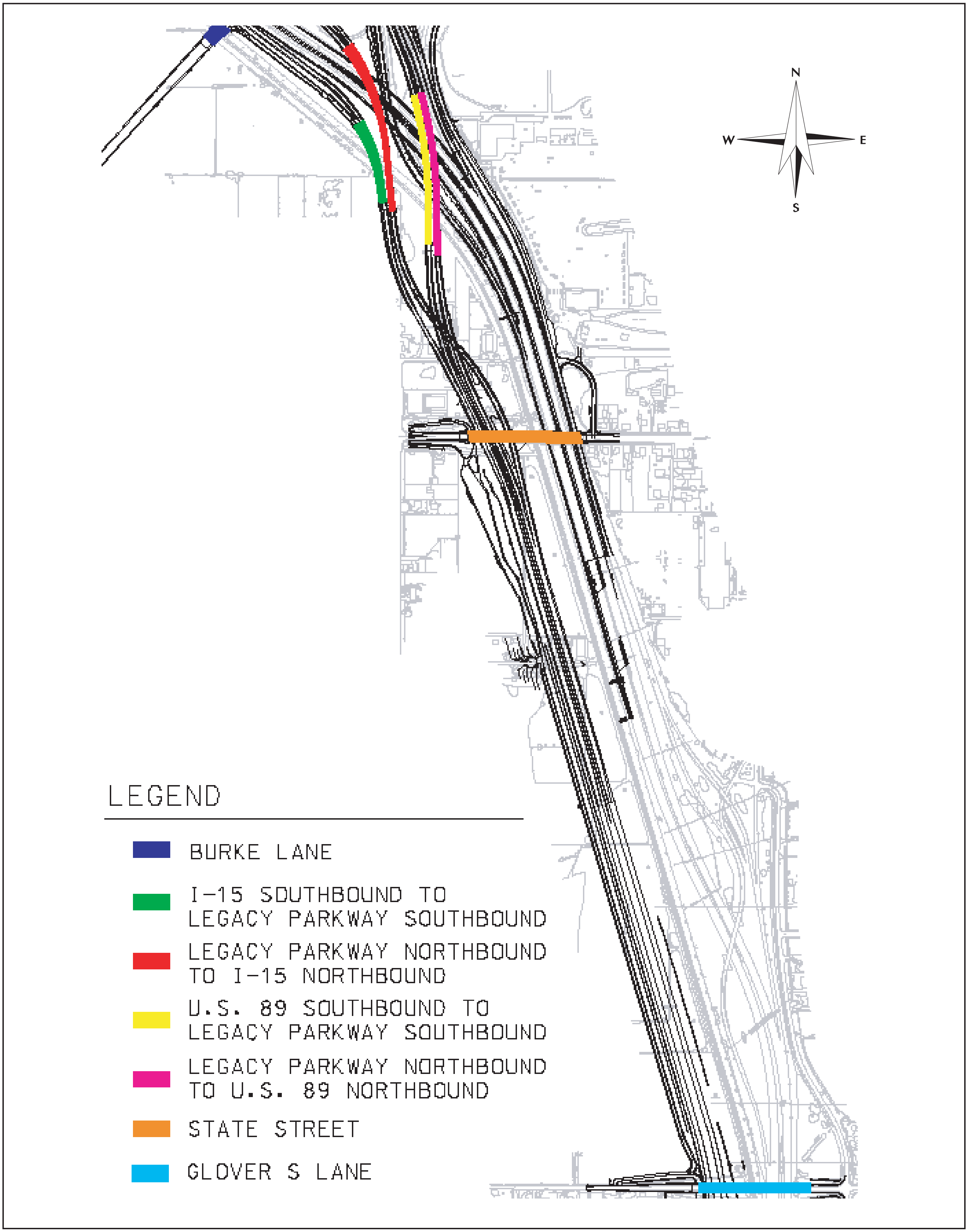

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Figure 2.3-4
Legacy Parkway Bridge Structures Designed to Accommodate Integration of Mass Transit

Section 2.4
Sequencing of the Shared Solution

2.4.1 Summary of Approach for Supplemental EIS

The term *sequencing* in this Supplemental EIS refers to the sequence, or order, in which the various major components of the Shared Solution (i.e., mass transit expansion, I-15 reconstruction, and Legacy Parkway) are constructed.

The Final EIS analyzed the following two sequencing scenarios.

- Construct Legacy Parkway prior to reconstructing I-15.
- Reconstruct I-15 prior to constructing Legacy Parkway.

These two scenarios were analyzed primarily to evaluate the ability of the sequencing scenario to provide capacity while deferring other impacts, including direct impacts on wetlands that would result from the construction of Legacy Parkway. In the June 2000 Final EIS, the lead agencies determined that reconstructing I-15 prior to constructing Legacy Parkway was not a practicable alternative because of the unacceptable level of congestion that would result on I-15. The appellate court remand stated that the Legacy Parkway Final EIS failed to consider alternative sequencing of the three major components of the Shared Solution (mass transit, I-15 improvements, and Legacy Parkway). Specifically, the court posed the following questions.[1]

- Is the [lead agencies'] conclusion [in the Final EIS] that it is not reasonable to reconstruct I-15 before building Legacy Parkway still valid?
- Is it reasonable to delay construction of Legacy Parkway until all or part of the mass transit expansion is in place?
- Can mass transit alleviate the immediacy of need for I-15 [reconstruction] or Legacy Parkway?

The lead agencies used the Supplemental EIS scoping process to gather input on the full range of alternative construction sequencing scenarios that evaluated the timing of mass transit in relation to I-15 and Legacy Parkway, as documented in the Legacy Parkway technical memorandum: *Sequencing of the North Corridor Shared Solution* (sequencing technical memorandum) (HDR Engineering 2004b). In addition to incorporating scoping comments, the approach to the sequencing analysis and the evaluation

[1] These questions are posed on pages 25 and 26 of the appellate court decision (*Utahns for Better Transportation et al. v. U.S. Department of Transportation et al.* [305 F.3d 1152 (10th Cir. 2002)]).

of impacts of alternative sequences was presented to the CPIC in November 2003 to allow local, state, and federal agency and nongovernmental organization representatives to review and provide input.

Based on agency and public comments provided during the public scoping process for the Supplemental EIS, the lead agencies selected four sequencing scenarios that cover the reasonable range of alternative construction sequencing options.[2] Scenario 1 reevaluates the validity of the Final EIS findings that reconstructing I-15 prior to constructing Legacy Parkway is not a practicable alternative, and Scenarios 2, 3, and 4 evaluate the comparative impacts of constructing mass transit prior to, concurrent with, and after constructing Legacy Parkway. While the sequencing analysis uses the WFRC long-range plan for other inputs and information, the sequencing analysis substitutes “maximum future transit” (robust transit package B, described in detail in Section 2.3, *Integration*), which was developed for the integration analysis for the actual planned transit component of the WFRC long-range plan. Maximum future transit includes additional transit improvements to the transportation system above and beyond what is set forth in the 2020 timeframe of the 2030 WFRC long-range plan.

The lead agencies used the maximum future transit scenario to respond to scoping comments concerning whether increasing transit could affect the need for or the sequence of the construction of Legacy Parkway. Maximum future transit is used for sequencing and integration analysis purposes only in this Supplemental EIS; the transit enhancements assumed in the maximum future transit scenario would require the passage of ordinances, the support and action of local elected officials, and the reaction of the real estate market for actual implementation. Because such additional funding commitments are very uncertain, it is important to note that the sequencing and integration analyses may overestimate the share of travel demand that mass transit could carry during the study period.

Each of the four sequencing scenarios was analyzed for its relative impact on specific environmental and economic variables. These results were used to determine whether an alternative sequencing scenario would be a reasonable alternative requiring further evaluation in this Supplemental EIS.

2.4.2 Summary of Sequencing Analysis

The analysis conducted for the sequencing issues shows the following results.

- Constructing maximum future transit prior to building Legacy Parkway or reconstructing I-15 prior to building Legacy Parkway would delay the direct impacts on wetlands that would result from construction of Legacy Parkway for 3 to 7 years, respectively.
- Mass transit, even when analyzed with maximum future transit enhancements in place, does not alleviate the immediacy of the need for Legacy Parkway.
- Because of the high cost to the traveling public, it is not reasonable to delay construction of Legacy Parkway until all or part of maximum future transit is in place.

[2] Public comments were received requesting that additional alternatives be evaluated in the sequencing scenarios, including a Redwood Road expressway or a “robust” Redwood Road expanded arterial, similar to Bangerter Highway. These alternatives were evaluated and eliminated from detailed evaluation in this Supplemental EIS because they did not meet the purpose of and need for the project. The sequencing analysis focused on the other major components of the Shared Solution, which are part of all Legacy Parkway build alternatives that met the project purpose and need, not on all possible alternatives (such as varied alignment locations or configurations). See Chapter 3 for a detailed discussion of the evaluation of alternatives.

- Consistent with the Final EIS findings, it is not reasonable to reconstruct I-15 prior to building Legacy Parkway.

The analysis also shows that while direct impacts on wetlands would be delayed under Scenarios 1 and 2 (maximum future transit first), completing Legacy Parkway prior to reconstructing I-15 and prior to or concurrently with maximum future transit would have substantially lower costs to the traveling public, because there would be faster travel times, higher travel speeds, and improved level of service on I-15. In addition, completing Legacy Parkway prior to reconstructing I-15 and prior to or concurrently with maximum future transit would meet the project purpose and need by relieving traffic congestion on I-15 and providing an alternate north south route in the North Corridor.

The information described in the following sections is a summary of the technical analysis prepared for the sequencing technical memorandum used to reach these conclusions. Section 2.4.2.1, *Sequencing of the Shared Solution*, describes the approach to evaluating impacts of the four sequencing scenarios, and Section 2.4.2.2, *Results of Construction Sequencing Scenarios*, describes the results of the analysis.

2.4.2.1 Approach to Analysis of the Sequencing of the Shared Solution

The following four construction sequencing scenarios were developed for the Supplemental EIS analysis. Each scenario incorporates the three major components of the Shared Solution. As described above, Scenario 1 reevaluates the validity of the Final EIS findings that reconstructing I-15 prior to construction of Legacy Parkway is not a reasonable alternative, and Scenarios 2, 3, and 4 evaluate the comparative impacts of constructing maximum future transit prior to, concurrent with, or after Legacy Parkway construction. Comments were received from the cooperating agencies requesting that the sequencing analysis consider building maximum future transit and allowing time for transit facilities to function prior to undertaking Legacy Parkway construction or I-15 reconstruction. Although in reality the full range of transit-supportive changes would take up to 20 or more years to be fully implemented, the modeling assumptions for the sequencing analysis assume that transit-supportive changes, including seamless transfers, additional transit services, transit-oriented development, and denser populations within walking distance of transit, would be completed by the end of the construction period for maximum future transit. This demonstrates the highest level of transit mode share early and throughout the sequencing analysis time frame.

The four construction sequencing scenarios are as follows.

- Scenario 1.
  - Construct maximum future transit first.
  - Reconstruct I-15 second.
  - Construct Legacy Parkway third.
- Scenario 2.
  - Construct maximum future transit first.
  - Construct Legacy Parkway second.

- Reconstruct I-15 third.

- Scenario 3.
  - Construct maximum future transit and Legacy Parkway concurrently.
  - Reconstruct I-15 last.

- Scenario 4.
  - Construct Legacy Parkway first.
  - Construct maximum future transit second.
  - Reconstruct I-15 third.

The scenarios cover the timeframe 2005 through 2015 and assume the continuous construction of transportation improvements. The sequencing analysis seeks to identify the order in which the elements of the Shared Solution should be constructed to reasonably minimize impacts during the construction period. The sequencing analysis assumes that, following a 3-year construction period, the first component of the Shared Solution becomes available for use in 2008 and that all three components are completed by 2014. The analysis accordingly assumes the impacts of all alternatives are the same before 2008 and after 2014 since the transportation system is the same before 2008 (all scenarios have no elements of the shared solution complete) and after 2014 (all scenarios have all elements of the shared solution complete). For each scenario, it was assumed that maximum future transit and Legacy Parkway would require approximately 3 years each to complete, and I-15 reconstruction would require 4 years to complete. For a construction schedule, see the sequencing technical memorandum, Volume 2 (HDR Engineering 2004b). Within this 10-year period, the analysis addresses three phases of project construction and operation: 2005 through 2007, 2008 though 2011/2012, and 2011/2012 through 2014. Two different traffic volume threshold years are included in the analysis (2007 and 2012) to account for the growth in travel demand in the 2005 to 2015 period. Comparison of the results for the interim years shows the relative effect of delaying or accelerating the construction of the various elements of the shared solution. Consistent with the Final EIS, the geographic area is bounded by the 1-15/I-215 interchange on the south and the US-89/I-15 interchange on the north. The following variables were used in evaluating the comparative impacts of the four scenarios. The rationale for selecting each of the variables is explained in detail in Section 3.4, *Description of the Analysis*, of the sequencing technical memorandum.

- Timing of direct impacts on wetlands.
- Costs to the traveling public.
- Travel speeds on I-15.
- Travel times on I-15, transit, and Legacy Parkway.
- Level of service on I-15 and Legacy Parkway.
- Capacity compared to demand on I-15, Legacy Parkway, and parallel arterials.
- Peak period energy usage under each scenario.

- Total peak-period air pollutants emitted under each scenario.
- Costs of construction under each scenario, expressed in 2003 dollars.
- Operating and maintenance costs.

After evaluating the impacts of constructing Legacy Parkway concurrent with and prior to maximum future transit (Scenarios 3 and 4, respectively), it was determined that the environmental impacts of the two scenarios were so similar that only one, Scenario 3, was necessary for performing the comparative analysis. Therefore, the sequencing analysis discusses the impacts of the following two comparisons.

- **Comparison of Scenarios 1 and 3.** The comparison of Scenarios 1 and 3 analyzes the impacts of reconstructing I-15 prior to constructing Legacy Parkway to determine whether maximum future transit would provide a sufficient level of congestion relief in the North Corridor to make it feasible to reconstruct I-15 before constructing Legacy Parkway.
- **Comparison of Scenarios 2 and 3.** The comparison of Scenarios 2 and 3 analyzes the relative impacts of constructing maximum future transit either before construction of Legacy Parkway or concurrently with construction of Legacy Parkway, when I-15 reconstruction occurs last in the sequence.

The results of the comparison of the impacts of these construction sequence scenarios are presented in the following section.

2.4.2.2 Results of Construction Sequencing Scenarios

In both scenario comparisons, the following variables showed the most significant difference in impacts.[3]

- Timing of direct impacts on wetlands associated with the construction of Legacy Parkway.
- Costs to the traveling public.
- Average travel speeds and travel times
- Level of service on I-15.[4]

Impacts associated with all scenarios for key variables are presented in Figures 2.4-1 through 2.4-4. A discussion of the results of comparing Scenario 3 with Scenarios 1 and 2 follows.

[3] Only key results for the variables with the most significant differences in impacts are presented in this section. For figures comparing all results for each of the four scenarios, as well as a detailed discussion of these results, see Sections 5.2 and 5.3 of the sequencing technical memorandum.
[4] Level of service on Legacy Parkway is not a key result with which to compare alternatives because under Scenarios 1 and 2, Legacy Parkway is not operational until 2015 and 2011, respectively.

Timing of Wetland Impacts

Wetland impacts were analyzed because wetlands are a resource of primary interest to the Corps under Section 404 of the Clean Water Act. For purposes of this analysis, delaying direct impacts on wetlands in the project right-of-way was assumed to be environmentally beneficial because delays would allow the wetlands to continue their existing functions until the project is constructed. For simplicity, this analysis assumes that none of the impacts on wetlands and none of the mitigation associated with Legacy Parkway have occurred. Existing wetlands functions include wildlife use, flood storage benefits, and water quality benefits. (See Section 4.12, *Wetlands*, for a description of wetland functions in the study area).

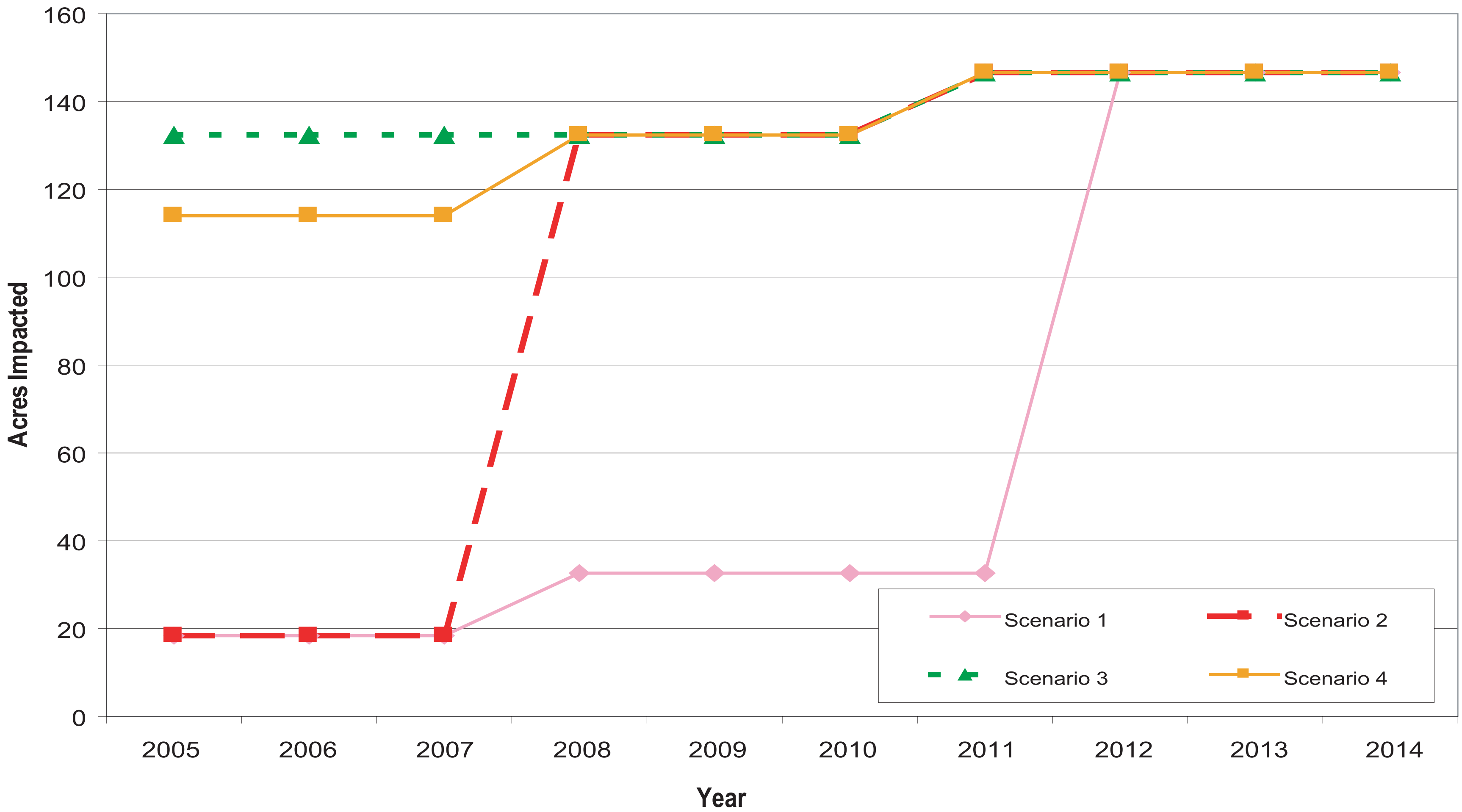
The direct wetland impacts estimated for each component of the Shared Solution (Legacy Parkway, reconstruction of I-15, maximum future transit) represent the estimated amount of wetlands within the project right-of-way as reported in the studies conducted for this Supplemental EIS, the I-15 North Corridor draft EIS (Federal Highway Administration and Utah Department of Transportation 1998), and the commuter rail final EIS (Federal Transit Administration and Utah Transportation Authority 2005). For this analysis, it was assumed that physical impacts on all the wetlands within the right-of-way would occur during the first year of a project's construction. There is insufficient information on the BRT component of maximum future transit from which to determine all wetland impacts of maximum future transit. However, the direct wetland impacts associated with the BRT component are likely to be minor, and wetland impacts associated with maximum future transit would not change significantly from the estimate in the commuter rail final EIS (Federal Transit Administration and Utah Transit Authority 2005).

Compared to Scenario 3, Scenario 1 would have a net delay of 46 ha (113 ac)[5] of wetland impacts for 3 years and a net delay of 40 ha (98 ac) for an additional 4 years. Compared to Scenario 3, Scenario 2 would have a net delay of 46 ha (113 ac) for 3 years. This means that although the total direct impacts on wetlands from all the components of the Shared Solution would be the same under all scenarios (7.2 ha [18 ac] for maximum future transit, 6.1 ha [15 ac] for I-15 reconstruction, and 46 ha [113 ac] for Legacy Parkway) for a total of 59 ha [146 ac], the wetlands in the Legacy Parkway right-of-way would continue their existing functions until commencement of Legacy Parkway construction. For Scenario 1, this would be in 2012, and for Scenario 2, this would be in 2008. There would still be 7.2 ha (18 ac) of wetlands impact in 2005 under both Scenarios 1 and 2 resulting from construction of maximum future transit and an additional 6.1 ha (15 ac) under Scenario 1 in 2012 resulting from the reconstruction of I-15. (See direct impacts on wetlands associated with each scenario in Figure 2.4-1.)

Costs to the Traveling Public and Average Travel Speeds and Times on I-15

Costs to the traveling public were analyzed for each scenario because they directly reflect the efficiency of travel (travel speeds and travel times). For this analysis, the costs to the traveling public for I-15 and Legacy Parkway are assumed to consist of the value of time spent traveling through the corridor and the cost of energy (fuel) used to accomplish this. The value of travel time during the peak period was estimated by multiplying the time it takes to travel through the corridor by the volume of traffic (or transit ridership) and by the value of the travelers' time, expressed in dollars per hour. For the cost of energy

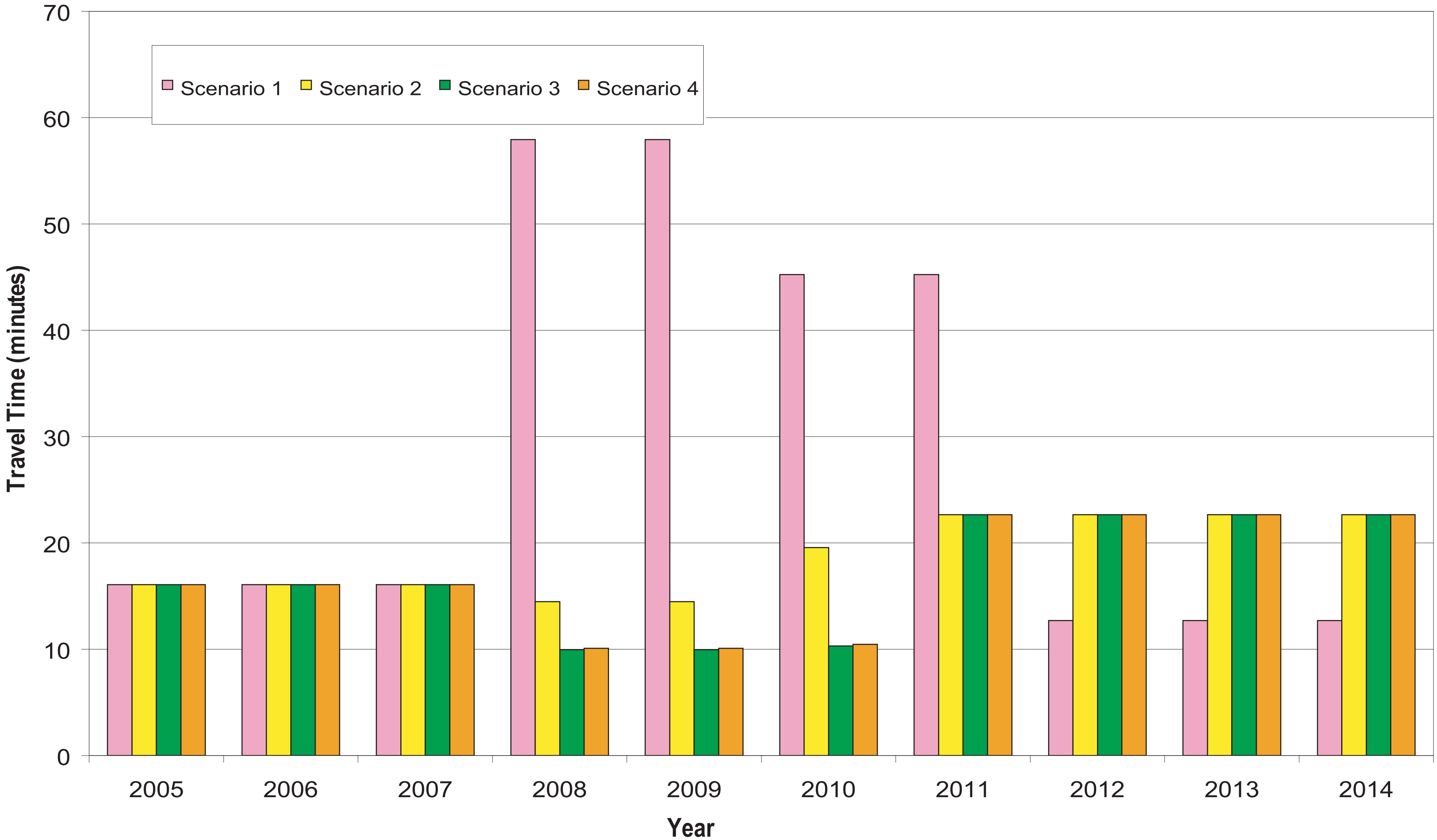
[5] The 46-ha (113-ac) figure refers to the acreage of wetlands located within the Alternative E right-of-way in this Supplemental EIS, which was used for this sequencing analysis. However, the design of interchanges and design flexibility used for the actual footprint of the roadway facility within the right-of-way could result in fewer actual acres of wetlands lost to direct impacts. See Section 2.1, *Right-of-Way Issues*, for a detailed discussion of wetlands impacts for each alternative.



03076.03 SEIS (7-05)

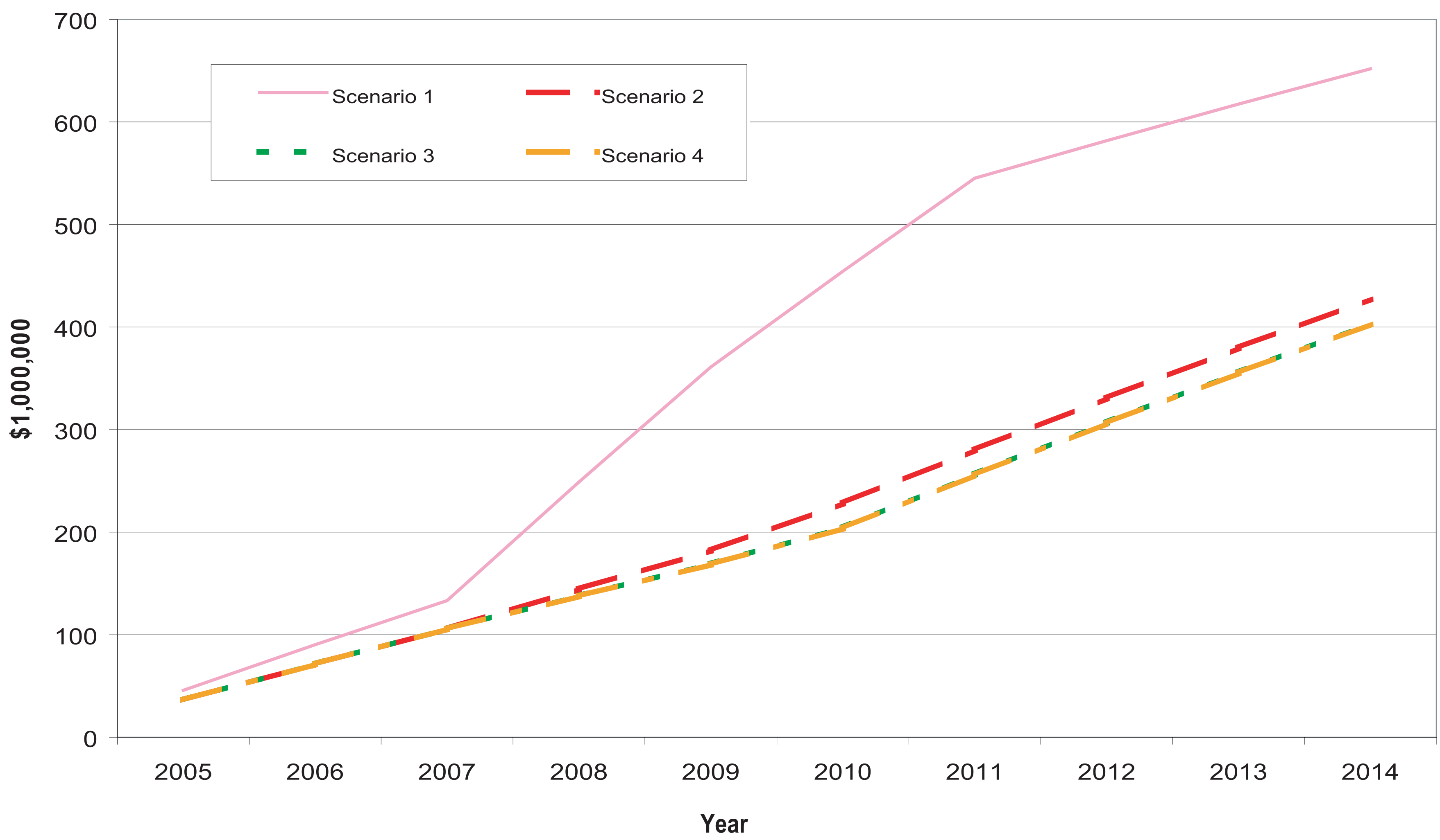
Figure 2.4-1
All Scenarios
Impacts on Wetlands

Figure 2.4-2
All Scenarios
Travel Speed on 1-15 between the US-89 and I-215 Interchanges



03076.03 SEIS (7-05)

Figure 2.4-3
All Scenarios
Average I-15 Travel Times between the US-89 and I-215 Interchange



03076.03 (9-04) SEIS

Figure 2.4-4
All Scenarios
Cumulative Cost to the Traveling Public

usage, a representative dollars-per-gallon[6] value of fuel was multiplied by the energy usage estimate. In the case of maximum future transit, the cost was assumed to be the value of time spent traveling through the corridor plus the cost of fares. Because the fares assumed for maximum future transit were reduced relative to UTA's current policy of charging premium fares for premium service, actual transit user cost is likely to be higher than indicated in this analysis.

The main difference between Scenarios 1 and 3 with respect to average speeds and travel time is that average speeds on I-15 are 80 kph (50 mph) faster under Scenario 3 than under Scenario 1 from 2008 through 2010, and 74 kph (46 mph) faster in 2011, and average travel times on I-15 range from 35 to more than 45 minutes slower in the evening peak hour under Scenario 1 than under Scenario 3 from 2008 through 2011. This is because maximum future transit does not provide sufficient congestion relief on I-15 when I-15 is being reconstructed (with no Legacy Parkway in place).

The main difference between Scenarios 2 and 3 with respect to average speeds and travel times is that average speeds on I-15 are over 31 kph (19 mph) faster under Scenario 3 than under Scenario 2 in the years 2008 and 2009, and 47 kph (29 mph) faster in 2010 and average travel times on I-15 are 5 minutes slower in 2008 and 2009, and 10 minutes slower in 2010 under Scenario 2 than under Scenario 3. This reflects the impact of delaying the construction of Legacy Parkway. During this 3-year delay, congestion on I-15 would increase at a rate exceeding the service provided by maximum future transit.

These longer travel times and slower average speeds associated with Scenarios 1 and 2 would result in higher costs to the traveling public. (See average travel speeds and travel times associated with all scenarios presented in Figures 2.4-2 and 2.4-3.) Under Scenarios 1 and 2, there would be approximately $249 million and $24 million in additional costs to the public for the evening peak period, respectively, compared to Scenario 3. With the inclusion of the morning peak period, the cost doubles to an additional $500 million and $48 million, respectively, compared to Scenario 3. (Costs to the traveling public associated with all scenarios are presented in Figure 2.4-4.)

Low travel speeds on I-15 under Scenario 1 from 2008 through 2011 also indirectly indicate changes in roadway safety. The very low speeds (10 to 13 miles per hour) and greater levels of congestion on I-15 will divert more traffic to the arterial streets. According to UDOT traffic accident statistics for large urban areas, arterials experience about four times the accident rates and similar degrees of accident severity as freeways at the same traffic volume.

Summary of Results for Scenario 1 Compared to Scenario 3

The comparison of Scenario 1 to Scenario 3 indicated that each scenario would result in certain benefits over the other, as described below.

- Benefits under Scenario 1 (maximum future transit first, I-15 reconstruction second, Legacy Parkway third).
  - Net delays of impacts on 46 ha (113 ac) of wetlands for 3 years and a net delay of 40 ha (98 ac) of wetlands impacts for an additional 4 years.

[6] The average price of gasoline and diesel used in the analysis is $1.58 and $1.64 per gallon, respectively. This was the average price on November 11 and 17, 2003, as provided by the American Automobile Association (AAA). Gasoline prices can fluctuate, and have risen in 2004 and 2005, but the 2003 costs remain reflective of long-term historic prices. Higher or lower gasoline prices would raise or lower an element of the costs to the traveling public.

- Provides a more efficient commute through the North Corridor from 2012 to 2015 by improving travel speeds from about 28 mph under Scenario 3 to about 49 mph for Scenario 1 for the 3-year period

- Benefits under Scenario 3 (construction of Legacy Parkway concurrently or prior to maximum future transit).
  - Saves approximately $249 million in costs to the traveling public for the evening peak period ($403 million in costs to the traveling public for the evening peak period under Scenario 3 compared to $652 million under Scenario 1). Saves approximately $498 million when considering travel during both the morning and evening peak periods.
  - Provides faster travel speeds through the North Corridor by about 50 mph (from 10–13 mph to about 60 mph) for the 4-year period from 2008 to 2011.
  - Reduces travel times through the North Corridor by about 35 minutes for the 4-year period from 2008 to 2011.
  - Provides for a safer and less stressful commute through the North Corridor for the 4-year period from 2008 to 2011, by reducing likelihood that through traffic would divert to local-access serving arterial streets.

Summary of Results for Scenario 2 Compared to Scenario 3

The comparison of Scenario 2 to Scenario 3 indicated that each scenario would result in certain benefits over the other.

- Benefits under Scenario 2 (maximum future transit first, Legacy Parkway second, I-15 reconstruction third).
  - Delays impacts on 46 ha (113 ac) of wetlands for 3 years.
- Benefits under Scenario 3 (concurrent construction of maximum future transit and Legacy Parkway, I-15 reconstruction last).
  - Saves approximately $24 million in costs to the traveling public for the evening peak period ($403 million in costs to the traveling public for the evening peak period under Scenario 3 compared to $427 million under Scenario 2). Saves approximately $48 million when considering travel during both the morning and evening peak periods.
  - Provides faster travel speeds through the North Corridor by about 40 kph (25 mph) for the period from 2008 to 2011.
  - Reduces travel times through the North Corridor by 5 to 10 minutes for the period from 2008 to 2011.
  - Provides for a safer and less stressful commute through the North Corridor by reducing likelihood that through traffic would divert to local-access serving arterial streets from 2008 to 2011.

2.4.3 Conclusions

The sequencing scenarios selected for analysis address the full range of alternative construction sequencing of major components of the Shared Solution and respond directly to the questions posed by the court and stated above in Section 2.4.1.

The results of this sequencing analysis with regard to those questions are as follows.

- Maximum future transit does not alleviate the immediacy of need for Legacy Parkway or I-15. It is not reasonable to delay construction of Legacy Parkway until all or part of maximum future transit is in place.
- Consistent with the findings in the Final EIS, it is not reasonable to reconstruct I-15 prior to building Legacy Parkway.

Delaying Legacy Parkway construction is not reasonable because doing so would incur additional costs to the traveling public of between $48 million and $498 million (combined morning and evening peak period loss of time and energy cost). The $48 million additional cost results from delaying Legacy Parkway until maximum transit improvements are completed, but still building Legacy before reconstructing I-15. The $498 million additional cost results from delaying Legacy until after I-15, so that I-15 reconstruction is done without the benefit of an alternate route for freeway traffic. Additional impacts associated with delaying construction of one or both highway projects include increased congestion delays and increased diversion of long-distance traffic and trucks to local streets resulting in potential for increases in accidents.

The results of the analysis of Scenarios 1 and 2 also show that maximum future transit would not reduce the immediacy of the need for Legacy Parkway because travel demand exceeds capacity in both scenarios. Comments received during the public scoping period requested that the Supplemental EIS determine whether constructing mass transit and reconstructing I-15 would meet travel demand such that Legacy Parkway would not be necessary. The results of Scenario 1 illustrate that mass transit and I-15 reconstruction alone would not meet travel demand. All components of the Shared Solution are needed to meet the travel demand. Even with maximum future transit implemented by 2008, delaying construction of Legacy Parkway (Scenario 2) would fail to meet demand from 2005 to 2015. Delaying Legacy further so that maximum future transit provides the only corridor-length alternative to I-15 during its reconstruction (Scenario 1) would substantially fail to meet demand during the I-15 reconstruction period, 2008 to 2012.

Comparing Scenarios 3 and 4, which sequence Legacy Parkway construction prior to reconstruction of I-15, to Scenario 1 demonstrates that it is more reasonable to build Legacy Parkway before the reconstruction of I-15 because I-15 would experience extreme congestion without Legacy Parkway to absorb the displaced traffic during the reconstruction. This extreme congestion is reflected in the cost to the traveling public, level of service failure, substantially slower travel speeds, and greater travel times of Scenario 1 compared to Scenarios 3 and 4. Both Scenarios 3 and 4 support the project objective of minimizing the amount of corridor through traffic that diverts from I-15 onto local streets by providing an alternative north-south route during I-15 reconstruction. Scenarios 3 and 4 indicate that there is no significant travel time savings gained by sequencing maximum future transit before Legacy Parkway and no negative impacts on travel time of building maximum future transit concurrently with Legacy Parkway. This supplemental EIS incorporates the following findings of the sequencing analysis.

- Constructing maximum future transit prior to building Legacy Parkway, and reconstructing I-15 prior to building Legacy Parkway would delay the direct impacts on wetlands that would result from construction of Legacy Parkway for 3 to 7 years, respectively.

- Mass transit, even when analyzed with maximum future transit assumptions in place, does not alleviate the immediacy of the need for Legacy Parkway.

- Because of the high cost to the traveling public, it is not reasonable to delay construction of Legacy Parkway until all or part of maximum future transit is in place.

- Implementation of either Scenario 3 or Scenario 4 would meet the project purpose and need for an alternate route 3–4 years earlier.

Section 2.5
Wildlife Issues

2.5.1 Summary of Approach for Supplemental EIS

The analysis of wildlife impacts conducted for this Supplemental EIS is described in detail in the *Legacy Parkway Wildlife Impacts Analysis Technical Memorandum* (Jones & Stokes 2005) (wildlife technical memorandum) and summarized in depth in Section 4.13, *Wildlife*, of this Supplemental EIS. This Section 2.5 provides an overview of the wildlife analysis.

The proposed Legacy Parkway project is located in the Great Salt Lake Ecosystem (GSLE), which is internationally important to millions of migratory birds as a major stopover, staging, and breeding area. The court remand stated that by limiting the impact evaluation to habitat within a 305-m (1,000-ft) area, the federal lead agencies had failed to consider certain impacts on migratory bird populations. In response to the court's holding, the lead agencies updated and expanded on the Final EIS analysis of impacts on wildlife by considering direct, indirect impacts, and past and possible future land use change effects on wildlife, particularly migratory species, within and beyond the 305-m (1,000-ft) project study area in the GSLE.

The approach and methodology used to address wildlife issues, both those issues raised by the court and others raised during the public scoping process, were developed collaboratively by a science technical team (STT) composed of ecologists and biologists from the U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (EPA), Utah Department of Natural Resources (UDNR), FHWA, the Corps, and UDOT. The comprehensive analysis of potential wildlife impacts conducted for the Supplemental EIS is based on input from the STT as well as the best scientific information available specific to wildlife impacts associated with highway construction.

For the wildlife impacts analysis, all migratory bird species that use or could potentially use the project study area were identified, and the distribution of habitats that they use within the Great Salt Lake area was defined. Effects on bird species were analyzed at two geographic levels within the Great Salt Lake ecosystem (GSLE): the project level (project study area) and the regional level (regional study area). The footprints of all of the proposed build alternatives evaluated in this document are entirely within the project study area. The regional study area, which was used to evaluate project-related effects on wildlife beyond the project study area, was defined by three parameters: (1) a subset of USGS hydrologic units in the eastern portion of the GSLE, (2) the extent of these units for which comprehensive regional GIS land-use data were available, and (3) the portion of these areas below 1,433 m (4,700) ft in elevation (Figures 4.13-1 and 4.13-2). The 1,433 m (4,700-ft) elevational boundary was selected to include wetland habitats associated with Utah Lake that could potentially be used by migrating birds that also use the project study area.

The following habitat-based and species-specific impacts were identified for evaluation in the Supplemental EIS.

- Direct habitat loss.
- Combined effects of changes in lake level and direct habitat loss from project alternatives.
- Habitat fragmentation.
- Changes in habitat quality (e.g., from changes in air and water quality).
- Habitat modification (e.g., from changes in hydrology and impacts associated with proposed landscaping).
- Wildlife highway mortality.
- Artificial light disturbance.
- Highway noise disturbance.
- Human disturbance.
- Effects on special-status wildlife.
- Cumulative impacts (including effects of historic, present, and reasonably foreseeable future actions).

Impacts were identified and assessed in this Supplemental EIS on both a habitat and a species-specific basis. Habitat-based impact analysis is a standard, scientifically valid, and widely accepted method for evaluating project effects on wildlife. This methodology was fully reviewed and approved by the Legacy Parkway STT, and was based on the best available biological information on bird species in the project study area. It was determined that habitat availability and quality are key determinants of long-term viability of species. Therefore, the analysis of impacts on wildlife in the Supplemental EIS was designed to provide specific quantitative or qualitative information on the effects of the proposed action on wildlife species and their habitats, and in particular migratory birds.

The assessment of these habitat-based impacts provides the Corps with the information necessary to make a factual finding on the potential short- and long-term effects of the proposed discharge on "…threatened and endangered species, nesting areas, escape cover, travel corridors, and preferred food sources for resident and transient wildlife species…" (40 CFR 230.30[b]) and "…impacts to sanctuaries and refuges which disrupt breeding, spawning, migratory movements or other critical life requirements of resident or transit fish and wildlife resources… (40 CFR 230.32[b]).

2.5.2 Summary of Wildlife Issues

To fully evaluate the potential impacts of the proposed action on wildlife, a comprehensive analysis was made of species distribution and seasonal abundance in the project and regional study areas and the GSLE, as well as wildlife species' habitat use and general ecological requirements. The impacts on each species or group of species (e.g., migratory birds) were then evaluated by assessing how the abundance, distribution, and quality of the habitats would change with implementation of each project alternative.

As summarized below, the analysis results show that all the build alternatives would have adverse direct and indirect effects and contribute to cumulative effects on local wildlife populations, including migratory birds. These effects include not only impacts from habitat loss and degradation but also habitat fragmentation; highway-related mortality, noise, artificial light, and human disturbances; changes in hydrology and air and water quality; and ecological changes from highway landscaping. These adverse effects would contribute to declines in the local density and diversity of wildlife species in the project area. As noted above, a detailed description of these impacts is presented in Section 4.13, *Wildlife*, of this document.

2.5.2.1 Direct Habitat Loss

The proposed Legacy Parkway project would result in the direct loss of between 252 ha (624 ac) and 350 ha (864 ac) of wildlife habitat within the project study area, depending on the alternative (Table 2.5-1). The area of wildlife habitat affected by direct habitat loss is small, approximately 0.1 percent of the total amount of wildlife habitat available throughout the regional study area.

Table 2.5-1 Direct Wildlife Habitat Loss[1]

Alternative	Wetland/Riparian Habitats	Upland Habitats	Total Habitat Loss
No Build	0 ha (0 ac)	0 ha (0 ac)	0 ha (0 ac)
Alternative A	46.6 ha (115.1 ac)	195.3 ha (482.5 ac)	241.9 ha (597.6 ac)
Alternative B	78.8 ha (194.6 ac)	261.9 ha (647.1 ac)	340.7 ha (841.7 ac)
Alternative C	63.3 ha (156.5 ac)	188.7 ha (466.2 ac)	252.0 ha (622.7 ac)
Alternative E	52.4 ha (129.5 ac)[2]	185.5 ha (458.3 ac)	237.9 ha (587.8 ac)

Notes:
[1] The acreage figures in Table 2.5-1 have been modified since publication of the Draft Supplemental EIS to reflect design modifications to the Alternative A and E alignments, updates to the 1997 developed lands dataset, and updates to the base map used to characterize habitat types (Keller pers. comm.).
[2] For purposes of this wildlife habitat classification, wetland habitat acreage includes the 46 ha (114 ac) of wetland area delineated in the Final EIS and riparian areas not included in the wetlands delineation.

Mitigation for the loss of wildlife habitat would be provided as part of the proposed Legacy Nature Preserve. As described in Section 4.13.3.14, *Mitigation Measures*, of this document, the Legacy Nature Preserve would encompass 849 ha (2,098 ac) of wildlife habitat in the project study area, including 315 ha (778 ac) of wetland /riparian habitat and 532 ha (1,315 ac) of upland habitat. Restoration and enhancement activities proposed on the Legacy Nature Preserve would include restoration of wetland hydrology; restoration of habitat structure; reestablishment of historic hydrologic connections; removal and control of noxious and invasive plants; and creation of slope wetland habitats. UDOT would protect the Legacy Nature Preserve in perpetuity.

2.5.2.2 Changes in Level of Great Salt Lake

To account for the dynamics of the level of Great Salt Lake, the combined effects of natural inundation from changes in lake level and implementation of each build alternative were examined to determine how these factors act in concert to affect the temporal pattern of overall availability of wildlife habitats within the project and regional study areas. The analysis presented in Section 4.13, *Wildlife*, of this document shows that there would be relatively little change in upland habitats (pasture, cropland, scrub) with lake level change, but that the availability of wetland habitats (hydric meadow, sedge cattail, and mudflat/pickleweed) would be markedly reduced at high lake levels. The following summarizes the results of this analysis.

- Except for open water habitat, the alignments of the different project alternatives are located such that the highest levels of impact from habitat loss occur mostly in the middle elevation zones (1,281.4–1,282.6 m [4,204–4,208 ft] and 1,282.6–1,283.8 m [4,208–4,212 ft]). This is characteristic of both wetland/riparian and upland habitats. Open water habitat (fresh water) is mostly affected in the lower inundation zones

- The probability of inundation, as estimated from historic conditions (pre-settlement; before 1847), is highest for the two inundation zones below 1,282.6 m (4,208 ft) (24–33 percent for these zones, contrasted with 1.7–8.3 percent for zones above 1,282.6 m [4,208 ft]). This trend indicates that when assessing the relative level of impacts of each alternative, these impacts should be evaluated relative to the probability of inundation, with emphasis on those zones subject to the greatest potential impact but with low probability of inundation (i.e., zones between 1,282.6 m [4,208 ft] and 1,283.8 m [4,212 ft]).

- The relative impacts of the build alternatives change with changes in lake level. The amount of each habitat type remaining in the project study area at various inundation levels for each of the build alternatives is directly related to the actual distribution of different habitat types in the project study area and differences in the spatial alignments of each alternative.

- Upland and wetland/riparian habitats are more abundant at low lake levels than at high lake levels. With rising lake level, inundation combines with direct habitat loss that would result from the build alternatives to reduce the overall availability of habitat to wildlife. Because the portion of the highway footprint that is inundated would not be available whether or not the alternative were constructed, the direct loss of available habitat caused by the build alternatives is lowest at high lake levels and highest at low lake levels. (It should be noted that the highway itself would not be inundated because it would be raised above ground level.)

- The overall carrying capacity for wildlife species using these habitats could decrease proportionally with the decrease in resource availability as lake level rises.

- As lake level rises, the diminishing available habitat will be located progressively nearer to the alternative rights-of-way. This spatial relationship would likely increase the potential for indirect wildlife impacts associated with the proposed action (e.g., noise, disturbance, highway mortality).

- The higher-elevation portions of the project study area provide important refuge habitats for many wetland species when lake levels are high. With increasing lake level, the relative impacts of the build alternatives on these refuge areas will increase (Table 4.13-9). However, large areas of the wildlife habitat that characterize the project study area are found throughout the GSLE. The wider availability of habitats makes the study area less important on a regional scale.

- The above-described effects of lake level change were determined for existing conditions. Projected future build-out within the project study area would result in a marked reduction in the amount of remaining natural habitat in the project study area (Table 4.13-5). Under the future build-out conditions, habitat will be located primarily west of the build alternatives. The combined effects of a rise in lake level, future build-out, and the proposed Legacy Parkway would leave little habitat available at high water for wildlife within the project study area. The overall habitat loss/fragmentation effects of the proposed action on the remaining small amount of natural habitat would be proportionally greater with future build-out.

- If increasing lake level occurs rapidly, some less mobile wildlife (e.g., mice, snakes, frogs, nonflying insects) will perish unless they can move to suitable habitat above the waterline. If the rise is gradual (e.g., over several seasons), local populations will change in size in proportion to the reduced carrying capacity of the remaining habitat.

- As the lake level recedes, the effects of inundation decrease as former habitat regenerates.

2.5.2.3 Habitat Fragmentation

In addition to direct habitat loss, the proposed action would result in fragmentation of existing habitats. On the most general level, each of the build alternatives would dissect the matrix of wildlife habitats in the project study area into east and west areas. The area east of the proposed rights-of-way has been largely modified by development and is currently experiencing continued rapid urban growth. Projected future growth in this area is likely to result in complete build-out. This area does not appear to support any ecologically unique habitats that are not also represented west of the proposed alignments. The area west of the proposed rights-of-way retains a greater proportion of wetlands and wildlife habitats. This primary fragmentation effect of the proposed action is not expected to reduce the diversity of habitat types within the project study area. In addition to this primary effect, all the build alternatives would result in the finer scale fragmentation of many existing wildlife habitat patches within the project study area. Each build alternative would result in a general decrease in the size of habitat patches available to wildlife in the area and a decrease in the number of larger patches, particularly in upland habitats. There would be a declining trend in the total amount of habitat in most size classes in most habitat types, with the exception of wetland habitats in the <0.4-ha (<1-ac) size class. Section 4.13.3.3, *Habitat Fragmentation,* provides a more detailed discussion of the effects of habitat fragmentation.

Mitigation for habitat fragmentation impacts would be accomplished through establishment and management of the Legacy Nature Preserve, as described above.

2.5.2.4 Changes in Habitat Quality

Water Quality

Preliminary hydrological analyses of surface and subsurface water flow in the project study area, conducted since publication of the Final EIS, indicate that, with installation of appropriate drainage structures, the proposed action would not significantly impede normal water flow among wetland habitats. Implementation of pollutant management BMPs, including incorporation of vegetated filter strips into the right-of-way, would reduce highway-associated pollution and degradation of water quality. With minimization of roadside pollutant runoff to adjacent wildlife habitats, the effects of the proposed action on species occurring there would be low and would not likely affect the long-term viability of those species.

Air Quality

Changes in air quality in the project study area would consist primarily of an increase in highway-related pollutants. Any effect on wildlife and the quality of wildlife habitat resulting from changes in air quality would be similar under all build alternatives and, given the levels of emissions forecast for 2020 (see Section 4.8, *Air Quality*), similar to the Future Conditions No-Build Alternative.

Virtually nothing is known about how changes in air quality affect wildlife. Existing air quality standards established for human health provide a baseline standard for potential effects on wildlife. Temperature inversions and local concentrations of air pollutants would likely affect humans and wildlife comparably, although differences in physiology (e.g., higher metabolism and proportionally larger alveolar lung/air sac surface area in birds) may exacerbate some effects in some species. Analysis of future (2020) air quality conditions indicates that carbon monoxide and particulate matter will likely be higher along build alignments. Ozone is not expected to cause new exceedances of the National Ambient Air Quality Standards (Utah Department of Environmental Quality, Division of Air Quality 1997), but the potential effects on wildlife caused by the proposed action are unknown. Similarly, future concentrations of nitrogen dioxide and lead are not expected to change from existing conditions in the project study area, but their effects on wildlife are unknown. Any effect on wildlife and wildlife habitat quality resulting from changes in air quality would be similar for all build alternatives.

Catastrophic Hazardous Spills

Hazardous waste or other chemical spills in wetland habitats could potentially have adverse effects on wildlife, particularly when water levels are high. Existing UDOT and FHWA/EPA requirements for safe transport of these materials and emergency spill containment programs would minimize these effects under most conditions. However, unavoidable accidents could occur. Most spills would be localized and would therefore vary in effect between build alternatives, but the effects would be worst in aquatic habitats.

2.5.2.5 Habitat Modification

Hydrology

Minimization of fill heights and incorporation of equalization culverts, surface water conveyance structures, and ground water conveyance structures into the project design would minimize impacts to hydrology resulting from the proposed action.

Highway Landscaping

Highway landscaping, which will reflect native vegetation species as much as possible, could provide both beneficial and negative effects. It could provide some habitat for wildlife, particularly migrating passerine birds and possibly raptors. However, landscaping could also favor conditions for increased highway-related mortality of these species. Use of pesticides to maintain the landscaping could also add to the highway-associated contaminant load in adjacent wildlife habitats, particularly wetlands. The beneficial and adverse effects of artificial landscaping would be similar under all build alternatives.

2.5.2.6 Wildlife Mortality

With increased vehicular traffic in the project study area, road mortality of individuals of some species—particularly birds flying between habitats on different sides of the highway and dispersing amphibians, reptiles, and small mammals—is likely to increase. This would be particularly evident during periods of high lake level, when bird species would be more likely to use upland habitats adjacent to the highway. The three fences proposed to border the highway right-of-way would help minimize these impacts by forcing birds to take higher flight paths and deterring cross-highway movement of all species. Numerous drainage culverts proposed to be installed under the highway would also facilitate wildlife movement without road mortality. The effects of the proposed action on highway-related road mortality of wildlife would be expected to be similar under all build alternatives.

2.5.2.7 Artificial Light Disturbance

Artificial light from highway lamps could potentially attract migrating birds during foggy/low visibility weather conditions. Some incidental mortality could occur from disoriented birds colliding with vehicles and light standards, but the frequency of these events would likely be low and would not adversely affect the viability of any species. The light could also provide a benefit to bats by attracting insects on which bats forage. The potential effect of additional light on wildlife would be comparable under all build alternatives.

2.5.2.8 Highway Noise Disturbance

The modeled areal extent of potential highway noise effects on wildlife habitat is shown for each build alternative in Figures 4.13-13a and 4.13-13b. The total area of wildlife habitats exposed to the different noise levels (combined area of all habitat types within each noise level contour) within the area analyzed is summarized in Table 2.5-2 below. The limitations of these estimates based on the accuracy of the FHWA TNM are described in detail in Section 4.13.3.10, *Noise Disturbance*, of this document.

Analysis of the total area of wildlife habitat that could be affected by highway noise in each noise contour interval showed an increase of between 42 percent and 61 percent in the 60+ dB impact area, depending on the alternative; an increase of between 19 percent and 58 percent in the 55 to 60 dB area; and an increase of between 27 percent and 47 percent in the 50 to 55 dB area. The noise level interval of 45 to 50 dB shows slight decreases in the area affected within the analysis area (Jones & Stokes 2005).

Table 2.5-2 Modeled Estimate of Wildlife Habitat Exposed to Noise under Build Alternatives

Alternative	Noise Level Interval (acres exposed to noise level*)			
	>/= 60 dB	>/= 55 < 60 dB	>/= 50 < 55 dB	>/= 45 < 50 dB
No-Build (Existing Conditions)	6,908	5,632	8,438	26,551
Alternative A	10,501	7,848	10,726	25,333
Alternative B	11,124	8,884	12,462	25,582
Alternative C	9,814	8,041	11,669	25,298
Alternative E	10,670	6,686	11,985	25,057

Note:
*Noise levels measured as dBA.

Although highway noise typically is neither loud nor startling enough to cause marked stress effects on wildlife, it can mask important vocal communication and natural sounds important for mate attraction, social cohesion, predator avoidance, prey detection, navigation, and other basic behaviors. Masking of vocal communication occurs when highway noise interferes with signal transmission by swamping out the signal or parts of the signal (e.g., low-amplitude elements of a song) or degrading the signal to a point at which it is no longer recognizable to other members of a species. When such masking or degradation occurs, the normal communication and associated biological functions of the species can be impaired.

Traffic noise associated with all the build alternatives could potentially mask vocal communication among some birds. These masking effects are highly species-specific and depend largely on the unique bioacoustics characteristics of each species' vocal signals. A detailed analysis of noise impacts on individual species is presented in the wildlife technical memorandum, including noise impacts to species of concern. In summary, based on a minimal vocal signal amplitude analysis, the potential effects distance of highway noise for bird species of concern could extend from less than 38 m (125 ft) to more than 915 m (3,000 ft) from the highway depending on existing noise conditions.

It is not known exactly how highway noise would affect the local density and reproductive capacity of individual species of concern currently using habitats in the project study area. Highly noise-sensitive species may leave the affected areas; others may experience reduced reproductive success due to poor communication or reduced ability to detect predators and potential prey. However, the overall impact of noise on wildlife resulting from the proposed action is not expected to jeopardize the long-term viability of any species that currently use the project study area.

The Legacy Nature Preserve would mitigate adverse biological effects of highway noise through habitat enhancement that would increase the productivity of wildlife species affected by the proposed action. By improving habitat conditions (food availability, shelter from disturbance and predation), the carrying capacity of many of these species would likely increase, thereby offsetting in part the predicted population declines of these species adjacent to the proposed highway.

As additional mitigation for unquantifiable impacts to bird populations from project noise, UDOT has committed to fund a study to determine the effects of highway noise on bird populations in the project area and comparable habitats. Because there are currently no accepted methods for assessing impacts and mitigation requirements for wildlife impacts resulting from highway noise, the lead agencies have determined that a study to develop such a methodology would be appropriate mitigation for this project. The study, which is being collaboratively designed by the lead agencies, UDOT, USFWS, and UDWR, will include monitoring bird populations and noise before, during, and after construction of the highway. The results of the monitoring will be used to develop a tool for the analysis of noise impacts on wildlife for future projects. A statement of commitment outlining the specifics of the noise study, and signed by the lead agencies, UDOT, and the resources agencies, is included in Appendix H, *Statement of Commitment*.

2.5.2.9 Human Disturbance

Access of humans and domestic pets to wildlife habitats adjacent to the highway could result in some level of habitat degradation and wildlife mortality. The existing design for the Legacy Parkway project includes three fences that would restrict access to sensitive wildlife areas; this design component is expected to minimize these effects. Localized disturbance from human use of the proposed trail corridor is also possible, but such adverse effects would likely be secondary to traffic noise effects.

2.5.2.10 Effects on Special-Status Wildlife

The principal potential effects of the proposed action on special-status wildlife would be direct loss of foraging habitat, disturbance of nesting sites, and masking of communication near the highway. The magnitude of these effects would be proportional to the level that individual species use each habitat. The effects of the proposed action on special-status wildlife are directly related to the amount of direct habitat loss. The project would result in a reduction in population of some special-status species within the project study area, but the overall impact of these losses alone would not affect the long-term viability of any of these species in the GSLE. A detailed, species-specific impact assessment is presented in Section 4.13.3.12, *Potential Effects on Species of Concern*.

2.5.2.11 Cumulative Impacts

Historic land use changes within the GSLE have significantly reduced available wildlife habitat for migratory birds and other species, both around Great Salt Lake and within the project study area, as described in the bullet items below.

- An estimated 58 percent of historic wetland/wildlife habitat in the GSLE (159,439ha [393,980 ac] of 274,633 ha [678,630 ac]) has been lost to past activities, primarily due to agriculture and urban development.

- In the Ogden and Jordan River hydrologic units combined, where the proposed action is located, approximately 66 percent of historic wetland/wildlife habitat (57,374.13 ha [141,774 ac] of 86,664 ha [214,150 ac]) has been lost.

Reasonably foreseeable future habitat loss, including that attributable to the proposed build alternatives, would result in a marked reduction in the amount of remaining natural habitat in the project study area. The combined effects of the proposed Legacy Parkway and projected land development would reduce wildlife habitat within the project study area. At higher lake elevations, the combined effects of lake level, future proposed build-out independent of the proposed action, and the proposed Legacy Parkway would leave little habitat available for wildlife within the project study area. Adverse direct and indirect effects on wildlife habitat resulting from the proposed action, when combined with historic wildlife habitat impacts and other future development impacts not related to the proposed action, would contribute to declines in the local numbers of wildlife species, including migratory birds. In addition, cumulative traffic noise from the Legacy Parkway and other roads developed in conjunction with future construction projects could potentially affect the behavior and reproductive capacity of various migratory bird species within the project study area and vicinity.

As noted in Section 4.1.2.1, *Current Land Use and Development Trends in the Study Area*, Davis County will continue to be converted to residential, industrial, and commercial uses at an annual rate of approximately 283 ha (700 ac). For purposes of projecting cumulative impacts on wildlife, it was assumed that all wildlife habitat in the project study area east of the proposed Legacy Parkway alignments would be lost to development, but that most of the wildlife habitat west of the alignments would be retained, either in the Legacy Nature Preserve or other public and private (such as gun club) uses. Although any proposed build alternative would contribute to cumulative effects on wildlife habitat loss, the area of wildlife habitat affected by direct habitat loss is small—approximately 0.1 percent of the total amount of wildlife habitat available throughout the regional study area. A detailed discussion of these effects is presented by hydrologic unit in Section 3.11.4, *Cumulative Effects Analysis Summary*, of the wildlife technical memorandum. Highway noise effects would affect a larger area, approximately 1.3 percent of existing wildlife habitat in the regional study area. Loss or degradation of these areas and biological functions (reproductive capacity of birds affected by noise) would add to the cumulative historic and foreseeable future habitat loss and associated impacts on wildlife in the GSLE. These impacts alone, however, would not likely affect the long-term viability of any wildlife species in the GSLE.

As described above, creation and maintenance of the Legacy Nature Preserve would result in the preservation of 849 ha (2,098 ac) of important wildlife habitat in perpetuity in an area that would otherwise likely be lost to development. The reasonably foreseeable effect of this action would be to mitigate some of the population declines that would likely occur without it.

2.5.3 Conclusions

The wildlife technical analysis was prepared in cooperation with ecologists and biologists from USFWS, EPA, UDNR, FHWA, the Corps, and UDOT. The analysis used the best available scientific information and analyzed the direct, indirect, and potential cumulative impacts on wildlife within multiple geographic zones surrounding the project corridor.The conclusions derived from the assessment of wildlife impacts completed for the Supplemental EIS are similar to those disclosed in the Final EIS. In summary, the majority of the potential impacts on wildlife would occur within the project study area and, in particular within 305 m (1,000 ft) of the project right-of-way. Specifically, the majority of the above-described wildlife impacts associated with direct habitat loss, habitat fragmentation, changes in habitat quality, habitat modification, mortality, artificial light disturbance, and human disturbance would occur within the project study area. Other impacts, including indirect impacts, noise impacts, and cumulative habitat impacts would likely occur, in part, outside the 305 m (1,000 ft) project right-of-way in the regional study area.

This supplemental EIS incorporates the following findings of the wildlife analysis.

- All the Legacy Parkway build alternatives would result in adverse direct and indirect effects and contribute to cumulative habitat loss, habitat fragmentation, and noise effects on local wildlife populations, including migratory birds.

- These impacts alone, however, would not likely affect the long-term viability of any wildlife species in the GSLE.

Mitigation for these impacts is being incorporated into the project through implementation of the Legacy Nature Preserve. This includes a commitment from UDOT to fund a study to determine the effects of highway noise on bird populations in the project area and comparable habitats.