BANGERTER

13400 SOUTH

APPENDICES

Appendices

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Appendix D: Environmental Resources

Cultural and Paleontological Clearance with Tier 1 Screening Form

Cultural and Paleo Clearance with Tier 1 Screening Form

Pursuant to the Programmatic Agreement between the UDOT and the Utah SHPO Regarding Implementation of U.C.A. 9-8-404 for State Funded Transportation Projects in Utah, UDOT has taken into account the effects of this undertaking on historic properties and has determined that the finding of effect is No Historic Properties Affected.

Pursuant to the Memorandum of Understanding between the UDOT and the Utah Geological Survey Concerning Agency Responsibilities Pursuant to U.C.A. 79-3-508, the UDOT has taken into account the effects of this undertaking on paleontological resources. If applicable, consultation letter from UGS is included in the environmental document.

PROJECT: PIN 18808—S-0154(92)0; Bangerter Highway Corridor Environmental: 13400 South, Salt Lake County

DATE: October 19, 2021
PREPARER: Jonathan Dugmore, M.A.A.; Region 2 Archaeologist
CONTACT: 385-414-2066, jdugmore@utah.gov
REVIEWER: Elizabeth Giraud AICP, UDOT Architectural Historian Elizabeth Giraud

PROJECT STIPULATIONS

1) Clearance is contingent upon the contractor adhering to the proposed scope of work and remaining within cleared areas. **Notify Region Environmental of any scope changes.**
2) *UDOT Standard Specification 01355 Part 3.7, Environmental Clearances by Contractor*
3) *UDOT Standard Specification 01355 Part 3.8, Discovery of Historical Archaeological, or Paleontological Objects, Features, Sites or Human Remains*. **Notify Region Environmental immediately of any discoveries during construction.**

PROJECT DESCRIPTION

UDOT proposes to improve the intersections of SR-154 (Bangerter Highway) at California Avenue, 3500 South/SR-201, 4700 South, 9800 South, 13400 South, and 2700 West in Salt Lake County, Utah. Separate environmental studies will be conducted for each individual intersection, and this document pertains to the intersection at Bangerter Highway and 13400 South. The proposed project will include: construction of a new grade-separated interchange configuration; relocation and/or replacement of existing utilities; installation of new and/or modification of existing storm drainage systems; and reconstruction of existing roadways to facilitate transitions to the proposed interchange. In addition, the project will include: modification and/or replacement of sidewalks/bike lanes and pedestrian ramps; the relocation and/or replacement of existing noise walls; installation/update of roadway signage; and replacement of pavement markings. Acquisition of right-of-way (ROW) and relocation of residences are anticipated in order to facilitate construction of the proposed interchange.

SCREENING PROCESS

Screened undertakings have the potential to affect historic properties, but have been determined by UDOT to require no further review or consultation under the Agreements. Screening may include any the following tasks and should be appropriate to the complexity, scale, and location of the undertaking. Documentation of the screening will be included in the project files, quarterly report submitted to SHPO, and environmental document.

Antiquities Project Number: U21HX0501

Literature Review

- ☐ Class I literature search (date completed and by whom):
- ☒ Records review (i.e. UDSH, UDOT, BLM, etc.): Sego
- ☐ Project plans
- ☐ As-built project plans
- ☒ Aerial photographs: DNR/UGS aerial imagery collection
- ☒ Historic Maps: BLM GLO Maps
- ☐ Topographic Maps:
- ☐ ROW/Ownership/Parcel Data:
- ☐ Other:

Description of search results: The search was conducted by archaeologists for Horrocks Engineers and is confined to the project APE which extends from approximate milepost 4.9 to milepost 6.6 and on 13400 South between approximately 3600 West and 4100 West in Salt Lake County. No cultural properties have been identified at this time.

Field Review

☒ Pedestrian survey (Class III) (survey interval): 15 meter
☒ Field review other than Class III (reconnaissance, windshield, etc.): selective-reconnaissance architectural survey
☐ Other:
☐ None

Description of survey results (If no field survey was conducted, explain why not):

The archaeological survey for this project was conducted by archaeologists for Horrocks Engineers. One NRHP-eligible site was identified at this time: 42SL86, the Utah Lake Distributing Canal. A previously undocumented portion of the established site was recorded within the APE. The architectural survey for this project was conducted by the architectural historian for Horrocks Engineers. One NRHP-eligible architectural property was identified within the APE at the time of survey. The potential for additional cultural resources in this area is very low.

Supporting Documentation

Reports and/or forms generated from any cultural resource inventories shall be submitted quarterly to the Utah Division of State History (UDSH) for filing.

Title of report: *A Cultural Resource Inventory of Bangerter Highway at 13400 South*

Consultation

☐ Utah SHPO (including APE consultation):
☐ Certified Local Government (CLG):
☒ Tribes: see below
☐ State/Federal Agencies:
☐ Knowledgeable Informants:
☐ Other:
☐ None:

Description of consultation efforts (If no consultation was done, explain why not):

Native American consultation was initiated through letters sent to the Eastern Shoshone Tribe of the Wind River Reservation, Shoshone-Bannock Tribes, Paiute Indian Tribe of Utah, Northwestern Band of Shoshone Nation, Uintah and Ouray Ute Tribes, and the Skull Valley Band of Goshute Indians (sent September 9, 2021). In addition, notification was also sent to those tribes with whom UDOT has Section 106 Programmatic Agreements: Cedar Band of Paiutes, Shivwits Band of Paiute Indian Tribe, and the Confederated Tribes of the Goshute Reservation (sent September 9, 2021). To date, none of the tribes have responded to these notifications.

☐ Controversy based on historic preservation issues? If yes, consultation with SHPO and UDOT Central Environmental is required. Additional consultation with FHWA may be required.

Finding of Effect

The undertaking will result in the following finding of effect:

☐ No Historic Properties Affected: no cultural resources present
☐ No Historic Properties Affected: cultural resources present but none eligible
☒ No Historic Properties Affected: historic properties present, but are completely avoided by the undertaking and the potential for substantial indirect effects is very low

Description of impacts:

While 1 NRHP-eligible archaeological site and 1 NRHP-eligible architectural property were identified within the APE, construction will not impact these resources in any form. Therefore, the UDOT has determined that this project will result in No Historic Properties Affected

Appendix D: Environmental Resources

Tribal Notification Form

State of Utah

SPENCER J. COX
Governor

DEIDRE M. HENDERSON
Lieutenant Governor

DEPARTMENT OF TRANSPORTATION

CARLOS M. BRACERAS, P.E.
Executive Director

TERIANNE S. NEWELL, P.E.
Deputy Director of Planning and Investment

LISA J. WILSON, P.E.
Deputy Director of Engineering and Operations

Tribal Notification Form

The Utah Department of Transportation (UDOT) is preparing to undertake the subject state-aid project. In accordance with the *Programmatic Agreement between the UDOT and the Utah State Historic Preservation Officer Regarding Implementation of U.C.A. 9-8-404 for State Funded Transportation Projects in Utah* (renewed January 22, 2018), the UDOT has taken into account the effects of this undertaking on historic properties and seeks consultation with Native American tribes on the undertaking.

UDOT Project: 18808; S-0154(92)0; Bangerter Highway Environmental Document: 13400 South, Salt Lake County.
Contact Name: Jonathan Dugmore Date: September 9, 2021
Address: 2010 South 2760 West, Salt Lake City, Utah 84104
Telephone: 385-414-2066 Email: jdugmore@utah.gov

Project Description:
UDOT proposes to improve the intersections of SR-154 (Bangerter Highway) at California Avenue, 3500 South/SR-201, 4700 South, 9800 South, 13400 South, and 2700 West in Salt Lake County, Utah. Separate environmental studies will be conducted for each individual intersection, and this document pertains to the intersection at Bangerter Highway and 13400 South. The proposed project will include: construction of a new grade-separated interchange configuration; relocation and/or replacement of existing utilities; installation of new and/or modification of existing storm drainage systems; and reconstruction of existing roadways to facilitate transitions to the proposed interchange. In addition, the project will include: modification and/or replacement of sidewalks/bike lanes and pedestrian ramps; the relocation and/or replacement of existing noise walls; installation/update of roadway signage; and replacement of pavement markings. Acquisition of right-of-way (ROW) and relocation of residences are anticipated in order to facilitate construction of the proposed interchange.

Archaeological Potential (Prehistoric or Historic Sites):

- ☐ Known prehistoric sites in the project area
- ☒ Known historic sites in the project area
- ☐ Likely to find prehistoric sites in the project area
- ☐ Likely to find historic sites in the project area
- ☒ Unlikely to find prehistoric sites in the project area
- ☐ Unlikely to find historic sites in the project area
- ☐ No expected ground disturbance
- ☐ Other:

Additional Information/Comments: A pedestrian survey of the project area has been conducted by archaeologists for Horrocks Engineers. One NRHP-eligible historic site was identified during the survey; 42SL286, the Utah Lake Distributing Canal/Welby Canal.

Tribal Information
«AddressBlock»

Copies to: «cc_1»
«cc_2»
«cc_3»
«cc_4»

Comments:

1. Do you wish to be a consulting party on this project? ☐Yes ☐No ☐Not Sure
2. If you do not wish to be a consulting party, do you wish to continue to be involved in the development of this project? ☐Yes ☐No ☐Not Sure
   Note: If your answer is "Not Sure," UDOT will continue to provide information.
3. Are you aware of any traditional religious or culturally important places in or near the project area? ☐Yes ☐No ☐Not Sure
4. If yes, can you share details about the place (e.g., location and other characteristics) and any concerns you may have? ☐Yes ☐No
5. Is this information sensitive? ☐Yes ☐No

Additional Comments:

Name of person completing this form, if different from above:

Signature: Date:

Identical copies of the Project Notification Form sent to the following recipients:

Original to:	CC to:	Email to:
Mr. John St. Clair, Chairman Eastern Shoshone Tribe of the Wind River Reservation P.O. Box 538/15 North Fork Rd Fort Washakie, WY 82514	Ms. Glenda Trosper, Director, Cultural Center Eastern Shoshone Tribe of the Wind River Reservation P.O. Box 538/15 North Fork Rd Fort Washakie, WY 82514 Mr. Joshua Mann, THPO Eastern Shoshone Tribe of the Wind River Reservation P.O. Box 538/15 North Fork Rd Fort Washakie, WY 82514	vhill@easternshoshone.org glendatrosper@washakie.net wferris@easternshoshone.org
Mr. Devon Boyer, Chairman Shoshone-Bannock Tribes of Fort Hall P.O. Box 306 Pima Drive Fort Hall, ID 83203	Ms. Carolyn Smith, Cultural Resource Director Shoshone-Bannock Tribes of Fort Hall P.O. Box 306 Pima Drive Fort Hall, ID 83203	csmith@shoshonebannocktribes.com
Mr. Dennis Alex, Chairman Northwestern Band of Shoshone Nation 2575 Commerce Way Ogden, UT 84401	Ms. Patty Timbimboo-Madsen, Cultural Specialist Northwestern Band of Shoshone Nation 2575 Commerce Way Ogden, UT 84401	banner02@gmail.com ptimbimboo@nwbshoshone.com
Mr. Luke Dunkin, Chairperson Ute Indian Tribe of the Uintah and Ouray Ute Indian Reservation P.O. Box 190 Fort Duchesne, UT 84026	Ms. Betsy Chapoose, Director, Cultural Rights and Protection Ute Indian Tribe of the Uintah and Ouray Ute Indian Reservation P.O. Box 190 Fort Duchesne, UT 84026	luked@utetribe.com betsyc@utetribe.com
Ms. Candace Bear, Chairwoman Skull Valley Band of Goshute Indians 407 Skull Valley Rd Skull Valley, UT 84029	None	candaceb@svgoshutes.com
Mr. Tom Delice, Band Chairman Cedar Band of Paiutes 600 North 100 East P.O. Box 235 Cedar City, UT 84721	Mr. Robert Pete, Cultural Resources Representative Cedar Band of Paiutes 601 North 100 East P.O. Box 235 Cedar City, UT 84721	robertpete58@yahoo.com
Ms. Hope Silvas, Band Chairwoman Shivwits Band of Paiute Indian Tribe of Utah 6060 West 3650 North Ivins, UT 84738	Ms. Carmen Clark, Cultural Resources Director Shivwits Band of Paiute Indian Tribe of Utah 6060 West 3650 North Ivins, UT 84738	carmenclark435@gmail.com
Mr. Rupert Steele, Chairman Confederated Tribes of the Goshute Reservation P.O. BOX 6104 195 Tribal Center Rd. Ibapah, UT 84034	Ms. Mary Pete-Freeman, Cultural Resources Coordinator Confederated Tribes of the Goshute Reservation P.O. BOX 6104 195 Tribal Center Rd. Ibapah, UT 84034	rupertsteele@yahoo.com mary.freeman@ctgr.us

Appendix D: Environmental Resources

Utah Geological Survey Letter

State of Utah

SPENCER J. COX
Governor

DEIDRE M. HENDERSON
Lieutenant Governor

Department of Natural Resources

BRIAN C. STEED
Executive Director

Utah Geological Survey
R. WILLIAM KEACH, II
State Geologist/Division Director

July 12, 2021

Haylie Ferguson
Horrocks Engineers
2162 West Grove Parkway, Suite 400
Pleasant Grove UT 84062

RE: Paleontological file search and recommendations for the UDOT Bangerter Highway (SR-154) at 13400 South Interchange Project, Salt Lake County, Utah
U.C.A. 79-3-508 (Paleontological) Compliance; Request for Confirmation of Literature Search according to the UDOT/UGS Memorandum of Understanding.

Dear Haylie:

I have conducted a paleontological file search for the Bangerter Highway at 13400 South Interchange Project in response to your request of July 9, 2021. This project qualifies for treatment under the UDOT/UGS executed Memorandum of Understanding.

There are no paleontological localities recorded in our files for this project area. Quaternary and Recent alluvial and lacustrine deposits that are exposed along this project right-of-way have a low potential for yielding significant fossil localities (PFYC 2). Unless fossils are discovered as a result of construction activities, this project should have no impact on paleontological resources.

If you have any questions, please call me at (801) 537-3311.

Sincerely,

Martha Hayden

Martha Hayden
Paleontological Assistant

Appendix D: Environmental Resources

UDOT Threatened and Endangered Species and Wildlife Concurrence Memo

Memorandum

Environmental Services

DATE: November 2, 2021

TO: Amy Croft, HDR

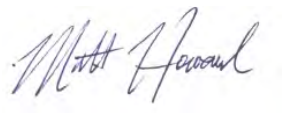
FROM: Matt Howard, Natural Resources Manager

SUBJECT: Bangerter Highway 13400 South Intersection PIN 18808

Amy,

I have reviewed the Biological Review for the Bangerter Highway 13400 South Intersection project concerning potential impacts to threatened and endangered species and concur with its findings. The proposed improvements would not negatively impact federally listed species due to the extensive development in the area and a lack of suitable habitat. The project would not result in direct or incidental take under the BGEPA and MBTA. I have evaluated the project for impacts to greater sage-grouse. The project does not take place within a SGMA, nor does it take place within mapped habitat for sage-grouse and would therefore have no impact on sage-grouse or its habitat.

Sincerely,



Matt Howard
Natural Resource Manager

Appendix D: Environmental Resources

Biological Resources Evaluation Memo

Memo

Date:	Wednesday, October 06, 2021
Project:	PIN: 18808; Project Number: S-0154(92)0; Bangerter Highway at 13400 South Interchange Improvements
To:	Matt Howard, Naomi Kisen, and Tyler Allen, UDOT
From:	HDR
Subject:	Biological Resources Evaluation for Bangerter Highway at 13400 South Interchange

Introduction

The Utah Department of Transportation (UDOT) is preparing a State Environmental Study (SES) to evaluate improvements to Bangerter Highway (State Route 154) at 13400 South in Riverton, Utah (the project). These improvements would improve traffic flow and safety on Bangerter Highway and 13400 South. The project includes a grade-separated interchange at 13400 South; utility and storm drainage modifications; and installing new pavement, traffic signals, advanced traffic management systems (ATMS) equipment, and roadway signs. This project might also include relocating and constructing a pedestrian structure over Bangerter Highway. This memorandum summarizes the existing biological resources that could be affected by the proposed improvements.

Regulatory Setting

Threatened and Endangered Species

The Endangered Species Act (16 United States Code [USC] Sections 1531–1544) provides for the conservation of threatened and endangered species and the ecosystems on which they depend. Section 3 of the Endangered Species Act prohibits the “taking” of any endangered species, and defines “taking” broadly to include actions that are not necessarily intended to cause harm to the species (an “incidental taking”).

Section 7 of the Endangered Species Act requires federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) before taking any action that could affect a federally listed threatened or endangered species or designated critical habitat for an endangered species. In addition, federal agencies must ensure that their actions are not likely to jeopardize the continued existence of any listed species or to destroy or adversely modify any designated critical habitat.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 USC Sections 703–712) makes it unlawful to take, import, export, possess, sell, purchase, or barter any migratory bird, with the exception of the taking of game birds during established hunting seasons. The law also applies to feathers, eggs, nests, and products made from migratory birds. Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (January 10, 2001), directs federal agencies taking actions likely to affect migratory birds to support the implementation of the Migratory Bird Treaty Act by requiring agencies to analyze impacts to migratory birds and species of concern in accordance with the National Environmental Policy Act as appropriate.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 USC Sections 668–668d) makes it unlawful to take, import, export, sell, purchase, transport, or barter any bald or golden eagle or their parts, products, nests, or eggs. “Take” includes pursuing, shooting, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing eagles.

Other Special-status Species

Resource and land management agencies, including the Utah Division of Wildlife Resources (UDWR), the U.S. Department of Agriculture Forest Service (USFS), the National Park Service (NPS), and the Bureau of Land Management (BLM), designate sensitive species, identify wildlife habitat areas (such as those for big-game species), and establish conservation agreements. These agencies and the U.S. Fish and Wildlife Service (USFWS) also manage designated lands as wildlife refuges or lands otherwise protected for wildlife. Sensitive species and conservation agreement species typically include species listed under the Endangered Species Act and additional species identified as those that warrant management considerations and actions in order to avoid becoming threatened or endangered.

Candidate Conservation Agreements encourage conservation actions for species that are candidates for listing as threatened or endangered, or that are likely to become candidates. Conservation agreements are designed to remove enough threats to the target species to eliminate the need for protection under the Endangered Species Act.

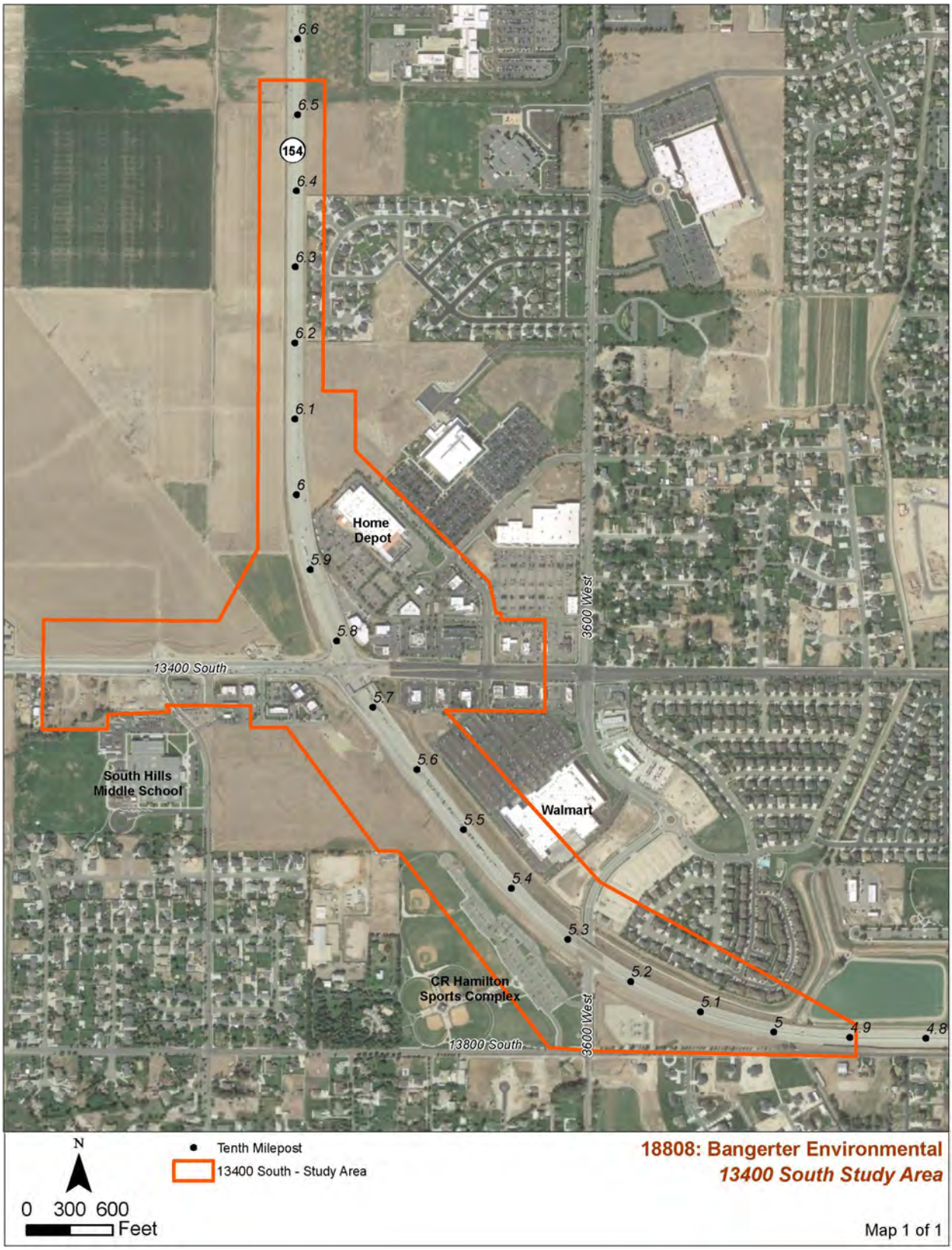
Methodology

Study Area

The project study area is located on both sides of Bangerter Highway between about 13800 South/3300 West to about 12700 South and on both sides of 13400 South between about 3630 West and 4150 West. Figure 1 shows the general vicinity of the study area.

The study area, which ranges in elevation from about 4,560 to 4,680 feet, is part of the Central Basin and Range Ecoregion and includes the Moist Wasatch Front Footslopes subregion (Woods and others 2001). The study area is part of the Jordan hydrologic region in the Jordan River watershed (hydrologic unit code 16020204), and the waters in the area eventually drain to the Great Salt Lake. In general, the study area consists primarily of residential and commercial development with some open fields and agricultural areas.

Figure 1. 13400 South Study Area



Analyses

HDR used several methods to collect data regarding the biological resources in the study area. These methods included conducting literature reviews, interpreting aerial photographs, and conducting a reconnaissance-level field survey for biological resources on August 20, 2021.

HDR obtained a species list from the USFWS Information, Planning, and Conservation System (IPaC) website for federally threatened, endangered, or candidate species that might occur in the study area and/or might be affected by the project. HDR also consulted the USFWS Environmental Conservation Online System (ECOS) for a list of species under conservation agreement that are known to occur in Salt Lake County. Additionally, HDR obtained a species list from the Utah Natural Heritage Program online data request website to determine whether there are records of occurrence for state-listed Species of Greatest Conservation Need (as designated by the Utah Wildlife Action Plan) in the vicinity of the study area. Reports from IPaC and the Utah Natural Heritage Program are provided in Appendix A, *Pertinent Correspondence*. The Utah Species Field Guide (UDWR, no date), NatureServe (www.natureserve.org), Audubon (Audubon, no date), and Cornell Lab's All About Birds website (Cornell Lab of Ornithology, no date) were referenced for species habitat descriptions.

Results

Special-status Species

SPECIAL-STATUS PLANT SPECIES

No special-status plant species of concern were identified in the IPaC report or listed under conservation agreement and known to occur in Salt Lake County.

SPECIAL-STATUS WILDLIFE SPECIES

Threatened, Endangered, and Candidate Species. The IPaC report identified one federally listed fish species, June sucker (*Chasmistes liorus*), that could occur or is known to occur in or near the study area. The study area does not include designated or proposed critical habitat for this species. Table 1 describes the preferred habitat for this species. Potentially suitable habitat does not exist in the study area.

Table 1. Federally Listed Wildlife Species Known to Occur in or near the Study Area

Common Name[a]	Scientific Name	Federal Status	Preferred Habitat[b]	Potentially Suitable Habitat Present?[b]
June sucker	*Chasmistes liorus*	Threatened	June suckers are endemic to Utah Lake and its tributaries (the Provo and Spanish Fork Rivers).	There is no potentially suitable habitat in the study area. Additionally, there is no downstream habitat or water withdrawals that would impact downstream habitat.

[a] Source: USFWS 2021

[b] Sources: NatureServe, no date; UDWR, no date

Species Listed under Conservation Agreements. HDR consulted the USFWS ECOS for a list of species listed under conservation agreements that are known to occur or could occur in Salt Lake County. One amphibian species, one bird species, and two fish species were identified. Table 2 describes the preferred habitat for each species. There is no suitable habitat in the study area for any of the species.

Table 2. Species under Conservation Agreements That Are Known to Occur in Salt Lake County

Common Name	Scientific Name	Preferred Habitat[a]	Potentially Suitable Habitat Present?[a]
Amphibians			
Columbia spotted frog	*Rana luteiventris*	Columbia spotted frogs are highly aquatic and are rarely found far from permanent quiet water. They usually live at the grassy/sedgy margins of streams, lakes, ponds, springs, and marshes and use stream-side small mammal burrows as shelter. Breeding typically occurs in small pools or ponds with little or no current surrounded by dense aquatic vegetation.	There is no suitable breeding habitat in the study area.
Birds			
Greater sage-grouse	*Centrocercus urophasianus*	Greater sage-grouse are found throughout Utah and require sagebrush habitat.	There is no suitable habitat in the study area.
Fish			
Bonneville cutthroat trout	*Oncorhynchus clarkii utah*	Habitat for Bonneville cutthroat trout ranges from high-elevation streams with coniferous and deciduous riparian trees, to low-elevation streams in sage-steppe grasslands containing herbaceous riparian zones, to lakes.	There is no suitable habitat in the study area. Additionally, there is no downstream habitat or water withdrawals that would impact downstream habitat.
Least chub	*Iotichthys phlegethontis*	Least chubs are endemic to the Bonneville Basin of Utah. There are only five wild populations, three in the Snake Valley in Utah's West Desert and two in the Sevier River drainage. Least chubs inhabits spring-fed marshes and wetlands.	There is no suitable habitat in the study area. Additionally, there is no downstream habitat or water withdrawals that would impact downstream habitat.

[a] Sources: Audubon, no date; Cornell Lab of Ornithology, no date; NatureServe, no date; UDWR, no date

Migratory Birds. Table 3 lists the migratory bird species included in the IPaC report that could occur in or near the study area. There is no suitable habitat in the study area for any of the species.

Table 3. Migratory Birds Known to Occur in or near the Study Area

Common Name[a]	Scientific Name	Preferred Habitat[b]	Potentially Suitable Habitat Present?[b]
Brewer's sparrow	*Spizella breweri*	Brewer's sparrows breed primarily in shrub-steppe habitats in Utah and are considered to be shrub-steppe obligates. They also breed in large sagebrush openings in pinyon-juniper habitat or coniferous forests. Breeding habitats are usually dominated by big sagebrush. Nest sites are almost always well-concealed in a low shrub.	There is no suitable breeding or nesting habitat in the study area.
Clark's grebe	*Aechmophorus clarkii*	Clarke's grebes prefer to nest on large freshwater lakes and marshes among tall, emergent vegetation on the water's edge. Winter habitat includes saltwater habitats including shores, bays, and rivers.	There is no suitable breeding or nesting habitat in the study area.
Golden eagle	*Aquila chrysaetos*	Golden eagles generally inhabit open and semi-open country such as prairies, sagebrush, arctic and alpine tundra, savannah or sparse woodland, and barren areas, especially in hilly or mountainous regions, in areas with sufficient mammalian prey base and near suitable nesting sites. Nests are most often on rock ledges of cliffs.	There is no suitable breeding or nesting habitat in the study area.
Green-tailed towhee	*Pipilo chlorurus*	Green-tailed towhees breed in dense, shrubby habitat with scattered conifers. Nest sites are concealed at about knee height in very dense vegetation, in the low branches of shrubs or small trees.	There is no suitable breeding or nesting habitat in the study area.
Long-billed curlew	*Numenius americanus*	Long-billed curlews breed in prairies and grassy meadows and sometimes in agricultural fields. Nests are located on the ground on a flat, dry area with short grass.	There is no suitable breeding or nesting habitat in the study area. Although there are agricultural fields in the study area, they are highly disturbed and do not provide suitable breeding or nesting habitat.
Marbled godwit	*Limosa fedoa*	Marbled godwits breed in meadows, short-grass prairies, pastures, and marshes. Nest are placed on the ground, usually in a dry spot in short grass fairly close to water. Winter habitat includes coastal mudflats, estuaries, and beaches. They are common migrants in northern Utah, especially in areas around the Great Salt Lake and Utah Lake.	There is no suitable breeding or nesting habitat in the study area.
Pinyon jay	*Gymnorhinus cyanocephalus*	Pinyon-juniper forests are the preferred habitat for pinyon jays. Their diet consists primarily of pinyon and other pine seeds, and the timing and location of breeding is tied to pine seed availability. Nests are located in trees, usually conifers, 5 to 30 feet off the ground.	There is no suitable breeding or nesting habitat in the study area.

(*continued on next page*)

Table 3. Migratory Birds Known to Occur in or near the Study Area

Common Name[a]	Scientific Name	Preferred Habitat[b]	Potentially Suitable Habitat Present?[b]
Sage thrasher	*Oreoscoptes montanus*	Sagebrush communities are the preferred breeding habitat for sage thrashers. They require relatively dense ground cover for concealment, but also some bare ground for foraging since they spend a majority of their time on the ground. Nest sites are located in sagebrush or other low shrubs. Sage thrashers use arid or semi-arid open country with scattered bushes, grasslands, and open pinyon-juniper woodlands during migration and wintering.	There is no suitable breeding or nesting habitat in the study area.
Virginia's warbler	*Leiothlypis virginiae*	The preferred breeding habitat for Virginia's warblers is in low, brushy areas on dry mountainsides where an herbaceous or woody understory is well-developed. Lower mountain habitats with dense stands of Gambel oak and a relatively high slope are preferred for breeding, although mountain mahogany woodlands, riparian areas, Ponderosa pine forests, and pinyon-juniper woodlands, all with shrubby understories, are also used for breeding. Breeding occasionally occurs in Douglas-fir and aspen habitats with the required shrubby understory. Nests are often placed under grass tufts on ground covered by dense brush.	There is no suitable breeding or nesting habitat in the study area.
Willow flycatcher	*Empidonax traillii*	Willow flycatchers are associated with dense riparian deciduous shrub cover separated by open areas. The presence of water (running water, pools, or saturated soils) and willow, alder, or other deciduous riparian shrubs are essential habitat elements. Nests are primarily near slow streams, standing water or seeps, or swampy thickets (especially of willow and buttonbush, but also dogwood, elderberry, hawthorn, rose, tamarisk, and others).	There is no suitable breeding or nesting habitat in the study area. A small section of Rose Creek, between roughly 4100 West and 4200 West, is lined with willows, but it is a singular patch and does not provide the preferred dense riparian patches separated by open spaces.

[a] Source: USFWS 2021

[b] Sources: Audubon, no date; Cornell Lab of Ornithology, no date; NatureServe, no date; UDWR, no date; UDWR 2021

Summary

HDR identified 1 federally listed wildlife species, 4 species listed under conservation agreements, and 10 migratory bird species that could occur or are known to occur in the study area. There is no suitable habitat in the study area for any of the species.

References

Audubon

No date Guide to North American Birds. https://www.audubon.org/bird-guide. Accessed September 14, 2021.

Cornell Lab of Ornithology

No date All About Birds. https://www.allaboutbirds.org/news/. Accessed September 14, 2021.

NatureServe

No date NatureServe Explorer. http://explorer.natureserve.org. Accessed September 14, 2021.

[UDWR] Utah Division of Wildlife Resources

No date Utah Species Field Guide. https://fieldguide.wildlife.utah.gov/. Accessed September 14, 2021.

2021 Utah Natural Heritage Program Online Species Search Report. Report Number 12405. June 24.

[USFWS] United States Fish and Wildlife Service

2021 List of threatened and endangered species for the Bangerter Highway and 13400 South SES. Species list provided by the Utah Ecological Services Field Office. June.

Woods, A.J., D.A. Lammers, S.A. Bryce, J.M. Omernik, R.L. Denton, M. Domeier, and J.A. Comstock

2001 Ecoregions of Utah (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,175,000). https://gaftp.epa.gov/EPADataCommons/ORD/Ecoregions/ut/ut_front.pdf.

Appendix A

Pertinent Correspondence

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
Phone: (801) 975-3330 Fax: (801) 975-3331
http://www.fws.gov
http://www.fws.gov/utahfieldoffice/

In Reply Refer To: June 24, 2021
Consultation Code: 06E23000-2021-SLI-0573
Event Code: 06E23000-2021-E-01208
Project Name: Bangerter Highway and 13400 South SES

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
(801) 975-3330

Project Summary

Consultation Code: 06E23000-2021-SLI-0573
Event Code: 06E23000-2021-E-01208
Project Name: Bangerter Highway and 13400 South SES
Project Type: TRANSPORTATION
Project Description: Bangerter Highway and 13400 South SES
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@40.50974445,-111.98382628978023,14z

Counties: Salt Lake County, Utah

Endangered Species Act Species

There is a total of 1 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Fishes

NAME	STATUS
June Sucker *Chasmistes liorus*	Threatened

There is **final** critical habitat for this species. The location of the critical habitat is not available.
Species profile: https://ecos.fws.gov/ecp/species/4133

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Brewer's Sparrow *Spizella breweri* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9291	Breeds May 15 to Aug 10
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jan 1 to Dec 31
Golden Eagle *Aquila chrysaetos* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/1680	Breeds Dec 1 to Aug 31

NAME	BREEDING SEASON
Green-tailed Towhee *Pipilo chlorurus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9444	Breeds May 1 to Aug 10
Long-billed Curlew *Numenius americanus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5511	Breeds Apr 1 to Jul 31
Marbled Godwit *Limosa fedoa* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	Breeds elsewhere
Pinyon Jay *Gymnorhinus cyanocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9420	Breeds Feb 15 to Jul 15
Sage Thrasher *Oreoscoptes montanus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9433	Breeds Apr 15 to Aug 10
Virginia's Warbler *Vermivora virginiae* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9441	Breeds May 1 to Jul 31
Willow Flycatcher *Empidonax traillii* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/3482	Breeds May 20 to Aug 31

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

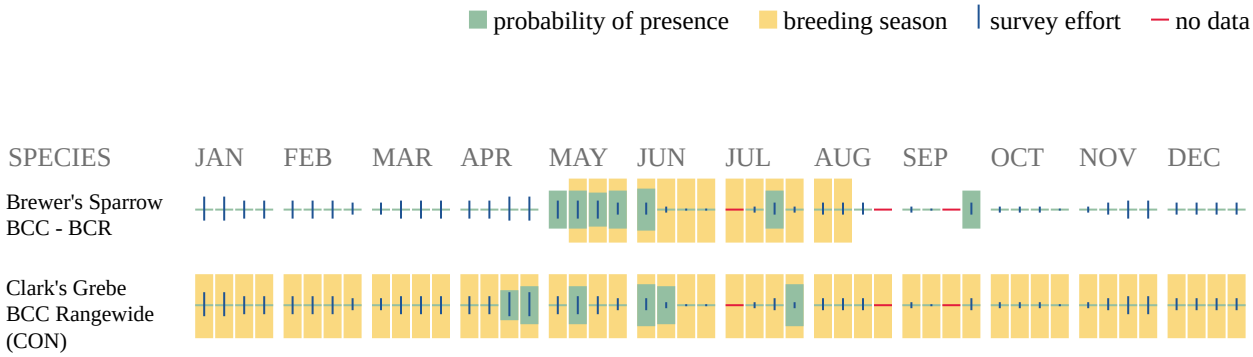
1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

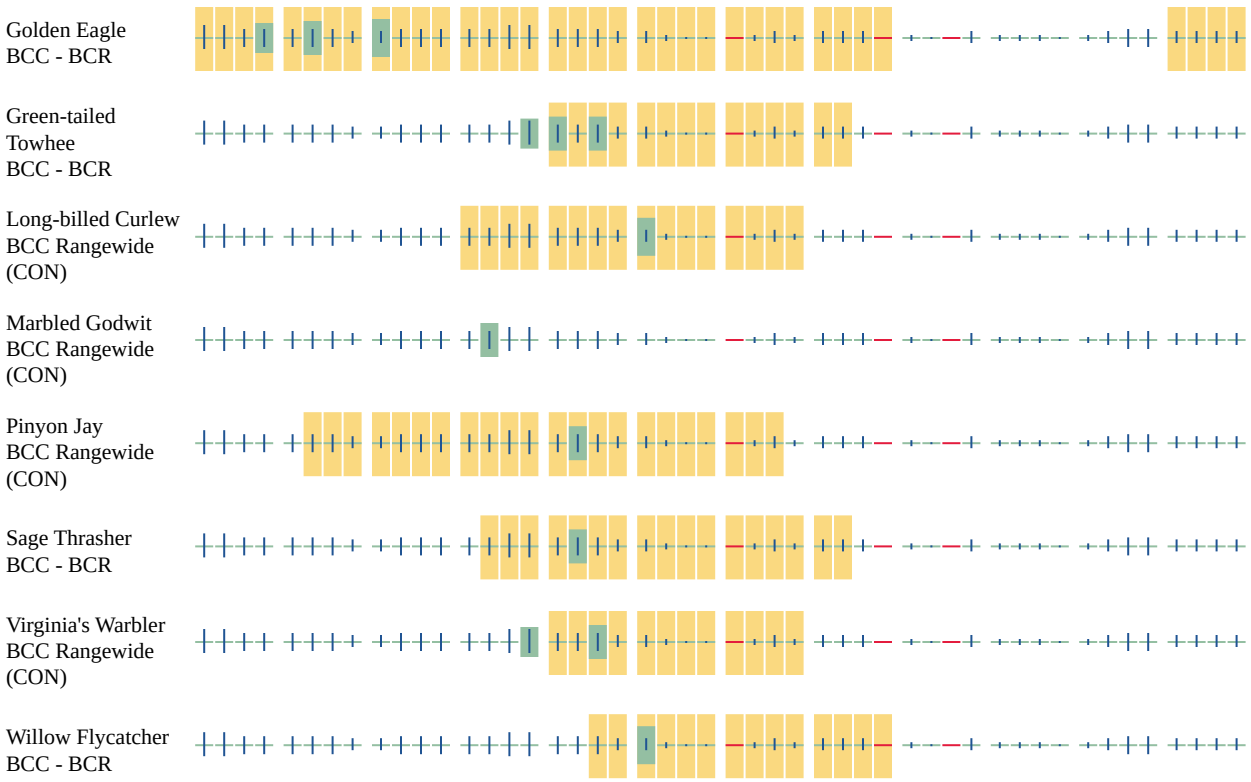
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?
The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and

3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell

me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Utah Division of Wildlife Resources
Utah Natural Heritage Program
1594 W. North Temple
PO Box 146301
Salt Lake City, UT 84116

Report Number: 12405
June 24, 2021

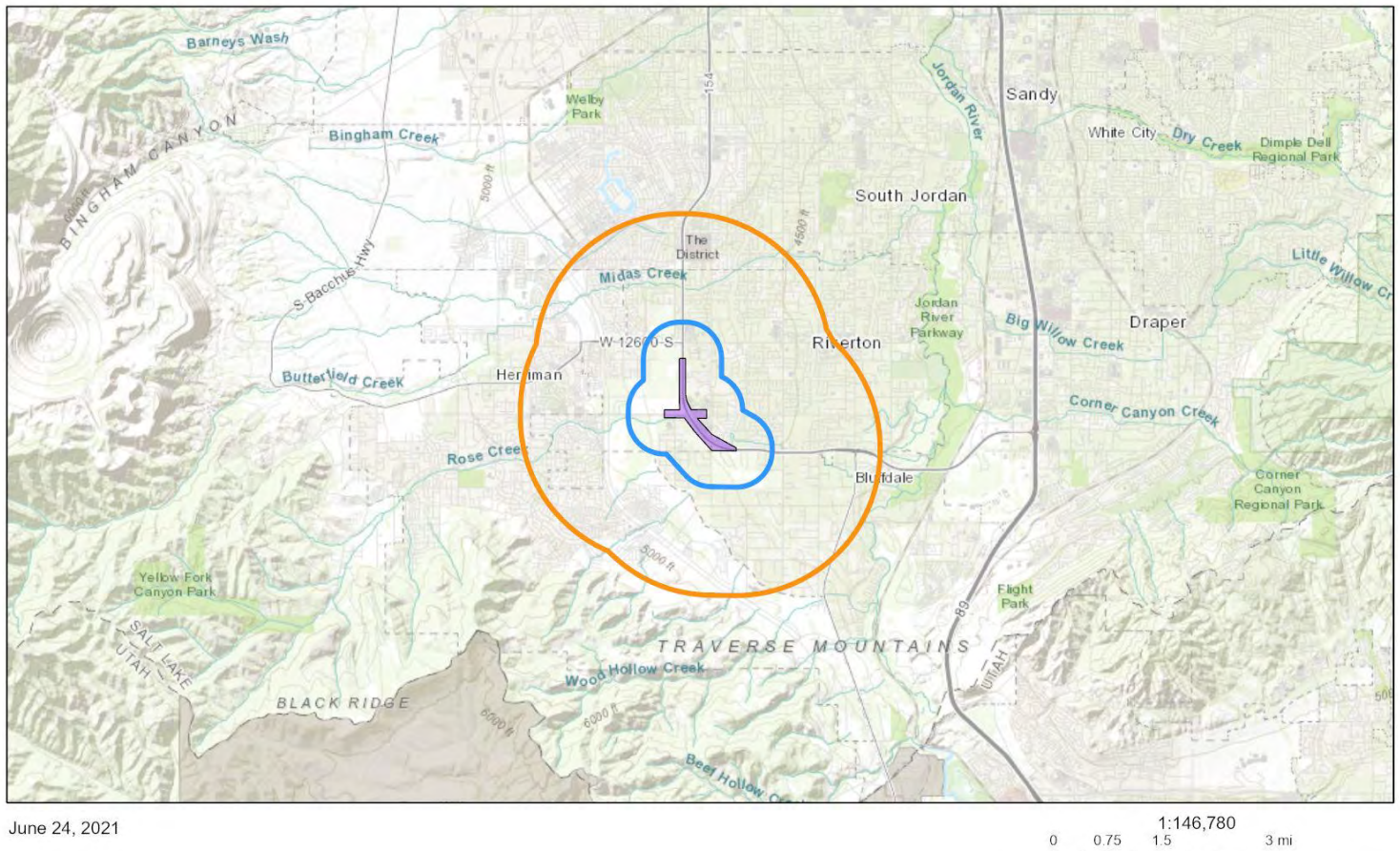
Utah Natural Heritage Program Online Species Search Report

Project Information

Project Name
Bangerter Highway and 13400 South SES

Project Description
Bangerter Highway and 13400 South SES

Location Description
Bangerter Highway and 13400 South SES



June 24, 2021

1:146,780
0 0.75 1.5 3 mi
0 1.5 3 6 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Animals within a ½ mile radius

Common Name	Scientific Name	State Status	U.S. ESA Status	Last Observation Year
No Species Found				

Plants within a ½ mile radius

Common Name	Scientific Name	State Status	U.S. ESA Status	Last Observation Year
No Species Found				

Animals within a 2 mile radius

Common Name	Scientific Name	State Status	U.S. ESA Status	Last Observation Year
No Species Found				

Plants within a 2 mile radius

Common Name	Scientific Name	State Status	U.S. ESA Status	Last Observation Year
No Species Found				

Definitions

State Status

SGCN	Species of greatest conservation need listed in the Utah Wildlife Action Plan

U.S. Endangered Species Act

LE	A taxon that is listed by the U.S. Fish and Wildlife Service as "endangered" with the probability of worldwide extinction
LT	A taxon that is listed by the U.S. Fish and Wildlife Service as "threatened" with becoming endangered
LE;XN	An "endangered" taxon that is considered by the U.S. Fish and Wildlife Service to be "experimental and nonessential" in its designated use areas in Utah
C	A taxon for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threats to justify it being a "candidate" for listing as endangered or threatened
PT/PE	A taxon "proposed" to be listed as "endangered" or "threatened" by the U.S. Fish and Wildlife Service

Disclaimer

The information provided in this report is based on data existing in the Utah Division of Wildlife Resources' central database at the time of the request. It should not be regarded as a final statement on the occurrence of any species on or near the designated site, nor should it be considered a substitute for on-the-ground biological surveys. Moreover, because the Utah Division of Wildlife Resources' central database is continually updated, any given response is only appropriate for its respective request.

The UDWR provides no warranty, nor accepts any liability, occurring from any incorrect, incomplete, or misleading data, or from any incorrect, incomplete, or misleading use of these data.

The results are a query of species tracked by the Utah Natural Heritage Program, which includes all species listed under the U.S. Endangered Species Act and species on the Utah Wildlife Action Plan. Other significant wildlife values might also be present on the designated site. Please contact UDWR's regional habitat manager if you have any questions.

Contact the U.S. Fish and Wildlife Service at (801) 975-3330 for the purpose of consultation under the Endangered Species Act.

Please contact our office at (801) 538-4759 or habitat@utah.gov if you require further assistance.

Your project is located in the following UDWR region(s): Central region

---

Report generated for:
Amy Croft
HDR
2825 East Cottonwood Parkway Suite 200
Cottonwood Heights, UT 84121
(801) 743-7832
amy.croft@hdrinc.com

Appendix D: Environmental Resources

UDOT Environmental Review for Water Resources and Wetlands, Noxious Weeds, and Visual Aesthetics

MEMORANDUM

Date: Monday, November 1, 2021

To: Amy Croft
Environmental Scientist/Biologist
HDR

From: Dan Bolin
UDOT Landscape Architect

RE: **ENVIRONMENTAL REVIEW FOR WATER RESOURCES AND WETLANDS, NOXIOUS WEED, AND VISUAL AESTHETICS**

PROJECT DESCRIPTION AND SCOPE OF WORK

UDOT is proposing to construct a grade-separated, single-point urban interchange (SPUI) at the existing intersection of SR-154 (Bangerter Highway) and 13400 South. The new interchange would allow unimpeded traffic flow on Bangerter Highway and is projected to operate at level of service (LOS) D in 2050. The project area is along Bangerter Highway from milepost 4.9 to 6.5 and along 13400 South between 3700 West and 4100 West.

Project work for the Proposed Action includes the construction of a grade-separated interchange at Bangerter Highway and 13400 South as well as the associated entrance and exit ramps. Project work would also include minor widening and restriping on 13400 South to accommodate the turn lanes for the new grade-separated interchange. If funding is available, project work may also include extensions of the northbound off-ramp and southbound on-ramp east of 3600 West, auxiliary lanes between the 13400 South northbound on-ramp and the 12600 South northbound off-ramp, auxiliary lanes between the 12600 South southbound on-ramp and the 13400 South southbound off-ramp, and a new pedestrian structure over 13400 South near 4150 West.

There are three options for the Proposed Action's grade-separated interchange:

Over Option. The vertical alignment for 13400 South would stay at the existing grade and Bangerter Highway would go over 13400 South, above the existing grade.
Hybrid Option. The vertical alignment for 13400 South would be lower than the existing grade and Bangerter Highway would go over 13400 South, above the existing grade. Both Bangerter Highway and 13400 South would be at lower elevations compared to the Over Option.
Under Option. The vertical alignment for 13400 South would be at the existing grade and Bangerter Highway would go under 13400 South, below the existing grade.

All three options for the Proposed Action would include modifying utilities and storm drains and installing new pavement, traffic signals, advanced traffic management system (ATMS) equipment, and roadway signs. This project would also require right of way acquisition.

See the attached Project figures to see proposed project improvements for each option.

Water Resources and Wetlands:

HDR evaluated the project for waters of the U.S. (WOTUS), including wetlands and streams regulated by US Army Corps of Engineers (Army Corps) and other waters under the jurisdiction of the State of Utah. To determine whether WOTUS are situated within or adjacent to the project limits, HDR conducted a desktop analysis using aerial imagery,

U.S. Fish and Wildlife Service NWI data, the U.S. Geological Survey National Hydrography Dataset, and the FEMA Flood Map Service Center. HDR also conducted an aquatic resources delineation on August 20, 2021.

No potential wetland features having presence of hydrophytic vegetation and surface hydrology were identified in the study area. The delineation identified three aquatic features including Rose Creek, the Utah Lake Distribution Canal, and the Danny R. Crump Fishing Pond. The entire delineation survey area is about 200 acres and contains a total of 0.77 acre of aquatic resources. The aquatic resources that were delineated in the survey area consist of 0.49 acre (5,269 linear feet) of perennial stream, 0.05 acre (221 linear feet) of canals, and 0.23 acre of open-water ponds. Aquatic resource impacts for the three options being considered are summarized in the following table.

	Linear feet of Rose Creek that will be impacted (either the existing channel or the existing box culvert)		Linear feet of Rose Creek that will be replaced in either a new channel segment or a box culvert	
Alternative	**Existing Channel**	**Existing Box Culvert**	**Channel**	**Box Culvert**
Bangerter Over	1,305 LF (0.13 acres)	300	1,010	635
Hybrid	1,508 LF (0.13 acres)	300	1,010	845
Bangerter Under	1,305 LF (0.12 acres)	300	1,010	635

The Utah Lake Distribution Canal and the Danny R. Crump Fishing Pond will not be impacted by this project. Impacts to Rose Creek exceed the 300' linear foot limit for a PGP-10 permit and will require both a Utah Stream Alteration Permit as well as a Nationwide 14 Permit from the U.S. Army Corps of Engineers.

Mitigation Commitments:

1. **Obtain a Utah Stream Alteration Permit from the Utah Division of Water Rights prior to construction. (UDOT Responsible)**
2. **Obtain a Nationwide Permit from the U.S. Army Corps of Engineers prior to construction. (UDOT Responsible)**
3. **Comply with all conditions of both the Utah Stream Alteration Permit and USACE Nationwide Permit. (Awarded Contractor Responsible)**

Utah Pollutant Discharge Elimination System (UPDES):

This project will disturb more than one (1) acre of earth and is therefore required to obtain a SWPPP to comply with the Utah Pollutant Discharge Elimination System (UPDES) Utah Construction General Permit (UCGP).

Mitigation Commitments:

1. **Comply with UCGP, by preparing a SWPPP during design and advertisement; provide SWPPP to the project awarded contractor prior to Notice to Proceed. (UDOT Responsible)**
2. **Comply with UCGP, by finalizing the SWPPP prior to beginning earth disturbing activities; implementing and maintaining the project SWPPP throughout project construction. (Awarded Contractor Responsible)**

Federal Emergency Management Agency (FEMA) Floodplains:

This project does occur partially within a FEMA Special Flood Hazard Area. A floodplain development permit must be obtained from the local floodplain administrator prior to construction.

Mitigation Commitments:

1. **Obtain a Floodplain Development Permit from the local floodplain administrator prior to construction. (UDOT Responsible)**

Noxious Weeds:

Noxious weed species, as defined by the Utah Noxious Weed Act (Utah Administrative Code, Rule R68-9) including Scotch thistle and Russian olive, have been identified growing within the project limits. Additionally the project includes earthwork which has the potential to introduce noxious weeds. To reduce the introduction and spread of noxious weeds, the project is required to properly clean earthmoving construction equipment before mobilizing onto the project and treat noxious weeds within the project limits prior to earth disturbance and as they appear during construction.

Mitigation Commitments:

1. **Include UDOT Special Provision Section 02924S NOXIOUS WEED CONTROL in the contract documents to require that earthmoving construction equipment is to be properly cleaned before mobilizing onto the project site and to treat any noxious weeds within the project limits and schedule. (UDOT Responsible)**

2. **Comply with UDOT Special Provision Section 02924S NOXIOUS WEED CONTROL requirements by properly cleaning all earthmoving construction equipment before mobilizing onto the project site, avoiding unnecessary earth disturbances, and treating any noxious weeds before earth disturbing activities and as they appear during construction. (Awarded Contractor Responsible)**

Visual Aesthetics:

This proposed project has limited disturbance and will not have significant visual impacts to the surrounding areas.

Mitigation Commitments:

1. **Visual: Reclaim all disturbed areas per UDOT standard specifications. (Awarded Contractor Responsible)**

Legend

- Rose Creek Relocation
- Detention Basins
- Pavement and Striping
- Rose Creek

The pedestrian bridge over 13400 South, auxiliary lanes between 12600 S. and 13400 S., the extension of the northbound off-ramp, and the extension of the southbound on-ramp would only be built if additional funding is available.

18808: Bangerter Environmental - 13400 South

Proposed Action - Over Alternative

0 0.13 0.25 Miles

Legend

- Rose Creek Relocation
- Detention Basins
- Pavement and Striping
- Rose Creek

The pedestrian bridge over 13400 South, auxiliary lanes between 12600 S. and 13400 S., the extension of the northbound off-ramp, and the extension of the southbound on-ramp would only be built if additional funding is available.

18808: Bangerter Environmental - 13400 South

Proposed Action - Under Alternative

0 0.13 0.25 Miles

Legend

- Rose Creek Relocation
- Detention Basins
- Pavement and Striping
- Rose Creek

The pedestrian bridge over 13400 South, auxiliary lanes between 12600 S. and 13400 S., the extension of the northbound off-ramp, and the extension of the southbound on-ramp would only be built if additional funding is available.

18808: Bangerter Environmental - 13400 South

Proposed Action - Hybrid Alternative

0 0.13 0.25 Miles

Appendix D: Environmental Resources

Aquatic Resources Delineation Report

Aquatic Resources Delineation Report

Bangerter Highway at 13400 South Interchange Improvements

UDOT PIN 18808

Riverton, Utah

October 11, 2021

Executive Summary

On behalf of the Utah Department of Transportation (UDOT), HDR, Inc. (HDR), has prepared this aquatic resources delineation report in support of the proposed interchange improvements at the intersection of State Route 154 (Bangerter Highway) at 13400 South in Riverton, Utah. HDR conducted fieldwork for the delineation on August 20, 2021.

The delineation was conducted in accordance with the following delineation manuals and delineation reference guides:

- *Corps of Engineers Wetlands Delineation Manual* (USACE 1987)
- *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (USACE 2008)
- *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States: A Delineation Manual* (Lichvar and McColley 2008)
- *Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (Curtis and Lichvar 2010)
- U.S. Army Corps of Engineers regulatory guidance letters and joint agency regulations, policies, references, and guidance

The entire delineation survey area is about 200 acres and contains a total of 0.77 acre of aquatic resources. The aquatic resources that were delineated in the survey area consist of 0.49 acre (5,269 linear feet) of perennial stream, 0.05 acre (221 linear feet) of canals, and 0.23 acre of open-water ponds.

Contents

Tables

Appendices

1 Introduction

On behalf of the Utah Department of Transportation (UDOT), HDR, Inc. (HDR), has prepared this aquatic resources delineation report in support of the Bangerter Highway at 13400 South Interchange Improvements project (Proposed Project) in Riverton, Utah.

The purpose of this report is to identify and describe aquatic resources in the delineation survey area (survey area) for the Proposed Project (see Appendix A, Project Location Overview Map). The results of the delineation are summarized in Table 3, Aquatic Resources Summary, on page 8. The jurisdictional status of the delineated aquatic resources is subject to determination by the U.S. Army Corps of Engineers (USACE).

1.1 Aquatic Resources Delineation Survey Area

The survey area is located on both sides of Bangerter Highway between about 13800 South/ 3300 West and about 12700 South and on both sides of 13400 South between about 3630 West and 4150 West in Riverton, Utah, along Bangerter Highway and 13400 South. It covers about 200 acres and includes property owned by UDOT and property that is privately owned.

The survey area can be accessed from Bangerter Highway from the east and the north. It can also be accessed from the east and the west along 13400 South. As defined by the Public Land Survey System, the survey area is located in Townships 3 and 4 South, Range 1 West, and Sections 5, 6, 31, and 32. The elevation in the survey area ranges from about 4,560 to 4,680 feet above mean sea level.

1.2 Contact Information

1.2.1 Project Applicant and Owner

Utah Department of Transportation, Region Two
Attention: Brian Allen
(385) 414-1092
brianja@utah.gov

1.2.2 Land Ownership

Land in the survey area includes property owned by UDOT as well as property that is privately owned. Contact and access information for landowners can be coordinated as necessary.

1.2.3 Contact Information for the Delineation Consultant

HDR, Inc.
2825 E. Cottonwood Parkway, Suite 200
Salt Lake City, Utah 84121

Field biologists:

Amy Croft, PhD
(801) 743-7832
amy.croft@hdrinc.com

Joshua McMillin
(801) 743-7860
joshua.mcmillin@hdrinc.com

2 Delineation Methodology

2.1 Preliminary Data Gathering

Before conducting delineation fieldwork, HDR reviewed information from several sources, including the following:

- Aerial images of the Proposed Project area
- Topography and surface water maps from the U.S. Geological Survey
- National Hydric Soils List for Utah (USDA NRCS 2021a)
- U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps in geographic information systems (GIS) format
- U.S. Department of Agriculture, Natural Resources Conservation Service's (USDA NRCS) Web Soil Survey (USDA NRCS 2021b)
- USACE delineation manuals and delineation reference guides (described in Section 2.3, Delineation Procedures)

2.2 Delineation Survey Area Boundaries

All areas within the approximately 200-acre survey area were included in the delineation.

2.3 Delineation Procedures

HDR surveyed for wetlands and other waters of the United States on August 20, 2021. The delineation was conducted in accordance with the following delineation manuals and delineation reference guides:

- *Corps of Engineers Wetlands Delineation Manual* (USACE 1987)
- *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (*Arid West Regional Supplement*; USACE 2008)
- *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States: A Delineation Manual* (Lichvar and McColley 2008)
- *Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (Curtis and Lichvar 2010)
- USACE regulatory guidance letters and joint agency (USACE and EPA) regulations, policies, references, and guidance

HDR assessed the entire survey area to determine the presence or absence of aquatic features. The routine method was applied by selecting sampling point locations in the field. These sampling points were placed at locations where landform, vegetative, or hydrologic characteristics indicated the potential for wetlands. A minimum of one set of paired data points (one within a wetland and one just outside wetland boundaries) was established to help delineate each wetland or wetland complex. Additional data points were located as needed to help determine wetland boundaries.

HDR recorded detailed information about vegetation, soils, and hydrologic characteristics for each data point and used this information to determine whether an area qualifies as a wetland and to help identify the wetland boundaries. Photographs of aquatic resources in the survey area and sample locations identified by HDR are included as Appendix B, On-site Representative Photographs.

Based on information gathered from sample points and observable changes in elevation and plant communities, HDR mapped aquatic resource boundaries in the survey area through a combination of global positioning system (GPS)-based field mapping (using ArcGIS Collector and an iPad) and desktop digitization using Google Images files dated 2018. To produce aquatic resources delineation maps for the survey area, data were exported into GIS software (ArcGIS Pro 10.8.1). Appendix C, Aquatic Resources Delineation Map Series, provides the aquatic resources delineation maps. These data were also used to calculate the area of aquatic features in the survey area.

2.3.1 Wetlands

A determination of the occurrence of wetlands is based on the presence or absence of hydrophytic (wetland) vegetation, hydric (wetland) soils, and wetland hydrology. The presence of all three of the criteria is necessary for an area to be designated as a wetland unless problematic conditions or significant disturbance is identified and evaluated in accordance with delineation procedures. Wetland boundaries are considered to be a line across which the vegetation, soils, and hydrologic characteristics begin or cease to meet wetland criteria.

Vegetation

Hydrophytic vegetation includes plants that are adapted to grow in water, or in a substrate that is at least periodically deficient in oxygen as a result of excessive water contact. Hydrophytic vegetation indicators include a prevalence of hydrophytic vegetation (that is, a majority of dominant plant species that are facultative or obligate wetland plants as listed in the National Wetland Plant List [NWPL; Lichvar et al. 2016]) and morphological or physiological adaptations to saturated soil conditions. Table 1 lists the most recent NWPL indicator statuses assigned to plant species for the purpose of delineating wetlands (Lichvar et al. 2012).

Table 1. Wetland Indicator Status System

Indicator Status	Indicator Symbol	Definition
Obligate wetland	OBL	Plants that almost always occur in wetlands.
Facultative wetland	FACW	Plants that usually occur in wetlands but could occur in non-wetlands.
Facultative	FAC	Plants that occur in wetlands and non-wetlands.
Facultative upland	FACU	Plants that usually occur in non-wetlands but could occur in wetlands.
Upland plants	UPL	Plants that almost never occur in wetlands.
Not listed	NL	Plants that are not listed on the NWPL and therefore are assumed to be upland.

Source: Lichvar et al. 2012

HDR documented vegetation within a sample plot surrounding each sampling point location. Each polygon area was visually inspected, and plant species were identified. Vegetation was considered hydrophytic when over 50% of the dominant species had an indicator status of facultative (FAC), facultative wetland (FACW), or obligate (OBL) or when the prevalence index was less than 3.0 in cases where the dominance was less than or equal to 50%. To identify the appropriate indicator status of each plant species recorded, HDR referenced the version of the Arid West Regional Wetland Plant List (a subset of the NWPL) that was available for delineation fieldwork and analysis (Lichvar et al. 2016).

Soils

Hydric soils are soils that are saturated, flooded, or ponded for long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile. Anaerobic conditions favor the growth and regeneration of hydrophytic vegetation. Hydric soil indicators can include organic soils (histosols), mineral soils saturated and rich in organics (histic epipedons), sulfidic odor, low dissolved oxygen concentration (aquic moisture regime) and reducing conditions, gleyed and/or low chroma soils, soils listed on national, state, or local hydric soils lists, and iron and manganese concentrations close to the soil surface. HDR used a standard Munsell soil color chart to determine the soil matrix and mottle colors (Munsell Color 2009). In accordance with USACE methodology, soil profiles were investigated at sampling points in the survey area and were examined for indicators of hydric conditions.

Hydrology

The term *wetland hydrology* encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season. Areas with evident characteristics of wetland hydrology are those where the presence of water has an overriding influence on the characteristics of vegetation and soils due to anaerobic and reducing conditions, respectively. Wetland hydrology indicators include obvious characteristics such as surface water, soil saturation, and water table depth. Other indicators include soil cracking, a salt crust, drainage patterns, water-stained leaves, and the presence of oxidized rhizospheres. HDR evaluated hydrology at each sampling point in the survey area.

2.3.2 Other (Non-wetland) Aquatic Resources

This delineation also evaluated the presence of aquatic resources other than wetlands potentially subject to USACE's jurisdiction. In non-tidal areas, USACE maintains jurisdiction over areas below the OHWM in water features such as navigable streams, rivers, and lakes; interstate waters; and tributaries to navigable waters.

HDR delineated non-wetland aquatic features based on the presence of a bed and bank and an OHWM (Lichvar and McColley 2008; USACE 2005). Potentially jurisdictional non-wetland features were delineated along the OHWM. If a feature did not exhibit a bed and bank and an OHWM, and did not show distinct vegetation changes, it was not further evaluated as a potential aquatic resource or considered to be a potentially jurisdictional water.

3 Environmental Setting

The survey area is located on both sides of Bangerter Highway between about 13800 South/ 3300 West and about 12700 South and on both sides of 13400 South between about 3630 West and 4150 West in Riverton, Utah. The survey area consists primarily of residential and commercial development, disturbed upland plant communities, and agricultural land. Rose Creek flows throughout the extent of the survey area.

The survey area is part of the Central Basin and Range ecoregion in the Moist Wasatch Front Footslopes subregion (Woods et al. 2001). The average annual precipitation in the survey area is 18.57 inches, and the average annual snowfall is 47 inches (U.S. Climate Data, 2021).

3.1 National Wetlands Inventory Wetland Mapping

NWI maps provide data regarding wetlands and deepwater habitats such as lakes and streams, categorized by the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin Classification System; Cowardin et al. 1979). NWI data are based primarily on the interpretation of high-altitude images and do not represent regulatory boundaries.

Appendix D, National Wetlands Inventory Map Series, provides a map series that shows NWI data across the survey area. These maps identify multiple potential riverine and open-water features in the survey area.

3.2 Existing Field Conditions

The delineation field reconnaissance was conducted on August 20, 2021.

Weather data for the survey area were obtained from historical records collected in Salt Lake City, Utah (U.S. Climate Data 2021). During the field survey, temperatures ranged from 54 to 76 degrees Fahrenheit, with no measurable precipitation and mostly sunny to partly cloudy skies.

The survey area is located in the Jordan River watershed in the Great Basin Region Watershed, hydrologic unit code 16020204 (USGS 2021). Rose Creek is located in the survey area and is a tributary to the Jordan River. The Jordan River flows from Utah Lake north through the Salt Lake Valley where it drains to the Great Salt Lake. The Great Salt Lake is considered a traditional navigable water under 33 Code of Federal Regulations Section 328.3 (a)(1) (UtahCleanWater.org, no date).

3.2.1 General Soil Conditions

The survey area has a variety of soil types, none of which are listed as hydric in the *Soil Survey of Utah* (USDA NRCS 2021a). Table 2 lists the four soil types that were identified in the survey area. Soil map unit boundaries for the survey area are provided in Appendix E, USDA NRCS Soil Map Series (USDA NRCS 2021b).

Table 2. Soil Types Identified in the Survey Area

Soil Name	Map Unit Symbol	Acreage
Bingham gravelly loam, 1 to 3 percent slopes	8001	7.4
Bluffdale silty clay loam, 1 to 3 percent slopes	BnB	1.4
Kearns silt loam, 1 to 3 percent slopes	KaB	109.6
Parleys silt loam, 0 to 3 percent slopes	PeA	81.7
Total		**200.1**

3.2.2 General Plant Community Types

In general, the survey area consists primarily of residential and commercial development, disturbed upland roadsides, and agricultural land. Rose Creek flows throughout the extent of the survey area.

Upland and agricultural areas consist primarily of a mix of native and introduced grasses and forbs. Cheatgrass (*Bromus tectorum*) and burning bush (*Bassia scoparia*) are present throughout the survey area.

Common plant species that are present along Rose Creek include barnyardgrass (*Echinochloa crus-galli*), curly dock (*Rumex crispus*), and two-scale saltbush (*Atriplex micrantha*). Russian olive (*Elaeagnus angustifolia*), broadleaf cattail (*Typha latifolia*), and Siberian elm (*Ulmus pumila*) grow on the banks of the Utah Lake Distribution Canal.

4 Results

Section 4 describes the results of the aquatic resources delineation. The maps in Appendix C, Aquatic Resources Delineation Map Series, show the aquatic resource areas in the survey area and the locations of wetland delineation sampling points. On-site photographs are provided in Appendix B, On-site Representative Photographs.

The entire delineation survey area is about 200 acres and contains a total of 0.77 acre of aquatic resources. These resources consist of 0.49 acre (5,269 linear feet) of perennial stream, 0.05 acre (221 linear feet) of canals, and 0.23 acre of open-water ponds. Table 3, Aquatic Resources Summary, on page 8 summarizes all of the aquatic resource features that were delineated by HDR. The following subsections describe the delineated features by each aquatic resource type.

4.1 Wetlands

No wetlands were delineated in the survey area.

4.2 Other (Non-wetland) Aquatic Resources

One perennial stream, one canal, and one open-water pond feature were identified in the survey area.

4.2.1 Perennial Streams

Perennial Stream Segments P-1a, P-1b, P-1c, P-1d, and P-1e (Rose Creek). Perennial stream P-1, also known as Rose Creek, runs through the extent of the survey area and is represented by five segments (P-1a, P-1b, P-1c, P-1d, and P-1e) totaling 0.49 acre (5,269 linear feet). The channel width to the OHWM at representative transects averaged 5 feet. The lateral extent of the OHWM was indicated by physical characteristics including breaks in bank slopes, changes in vegetation cover and species, changes in sediment texture, and flow observations. Rose Creek (stream P-1) is a tributary to the Jordan River. The Jordan River is a tributary to the Great Salt Lake, a traditional navigable water (TNW); therefore, this stream would be considered jurisdictional.

4.2.2 Canals

Canal Segments C-1a and C-1b (Utah Lake Distribution Canal). Canal C-1, also known as the Utah Lake Distribution Canal, is represented by two segments in the survey area (C-1a and C-1b) totaling 0.05 acre (221 linear feet). The channel width to the OHWM averaged 10 feet. The lateral extent of the OHWM was indicated by physical characteristics including breaks in bank slopes, changes in vegetation cover and species, and flow observations. The Utah Lake Distribution Canal (canal C-1) is a diversion of the Jordan River in Bluffdale, Utah, and terminates near 7000 South and 3200 West in West Jordan, Utah. Since canal C-1 does not reconnect to a TNW or a tributary to a TNW, this canal would not be considered jurisdictional.

4.2.3 Open-water Ponds

PUB-1 (Danny R. Crump Fishing Pond). Pond PUB-1, also known as the Danny R. Crump Fishing Pond, is a small open-water pond used for recreational fishing. About 0.23 acre of the pond is in the study area. This pond is filled by secondary water from the Jordan River and is maintained by the City of Riverton. Given that PUB-1 was artificially created in uplands, this pond would not be considered jurisdictional.

Table 3. Aquatic Resources Summary

Aquatic Resource Feature Name	Cowardin Classification[a]	Size (acres)	Length (feet)	Latitude[b]	Longitude[b]	Map Sheet Number(s)[c]
Perennial Streams						
P-1a	R	0.07	764	40.506627 40.507027	–111.989811 –111.987301	5
P-1b	R	0.03	282	40.507565 40.507616	–111.986105 –111.985112	3,5
P-1c	R	0.08	630	40.507604 40.507157	–111.984849 –111.982827	3,4,5,6
P-1d	R	0.19	2,008	40.507082 40.503105	–111.981829 –111.977063	6,7,8
P-1e	R	0.12	1,585	40.502889 40.501686	–111.976575 –111.971524	7,8
Canals						
C-1a	R	0.04	201	40.501586 40.501121	–111.971280 –111.971634	8
C-1b	R	<0.01	20	40.500676 40.500617	–111.971572 –111.971556	8
Open-water Ponds						
PUB-1	PUB	0.23	—	40.501325	–111.970859	8

[a] Codes from *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979): PUB (palustrine unconsolidated bottom), R (Riverine).

[b] Two sets of coordinates are included for long, linear features. The top row provides the uppermost (upstream) location of the feature in the survey area, and the bottom row provides the lowest downstream location of the feature in the survey area.

[c] See Appendix C, Aquatic Resources Delineation Map Series.

5 Delineation Summary

All areas in the delineation survey area were assessed to determine the presence or absence of aquatic resources, including wetlands and other waters, in accordance with the procedures and guidelines established by USACE. There is a total of 0.77 acre of aquatic resources in the survey area. These resources consist of 0.49 acre (5,269 linear feet) of perennial stream, 0.05 acre (221 linear feet) of canals, and 0.23 acre of open-water ponds. All features recorded and mapped are included in Appendix C, Aquatic Resources Delineation Map Series.

Table 3 above summarizes all delineated aquatic resource features in the survey area. Features are ordered by resource type and then by their locations on the map sheets in Appendix C. Table 4 summarizes the criteria and rationale for the jurisdictional determination for each feature, subject to USACE's review and concurrence.

Table 4. Criteria and Rationale for Jurisdictional Determination for Each Aquatic Resource Feature in the Survey Area[a]

Aquatic Resource Feature Name	Size (acres)	Length (feet)	Map Sheet Number(s)[b]	Criteria and Rationale for Jurisdictional Determination Consistent with the Pre-2015 Regulatory Regime
Perennial Streams				
P-1a, P-1b, P-1c, P-1d, P-1e (Rose Creek)	0.49	5,269	3,4,5,6,7,8	Rose Creek (stream P-1) is a tributary to the Jordan River. The Jordan River is a tributary to the Great Salt Lake, a TNW; therefore, this stream would be considered jurisdictional.
Canals				
C-1a, C-1b (Utah Lake Distribution Canal)	0.05	221	8	The Utah Lake Distribution Canal (canal C-1) is a diversion of the Jordan River in Bluffdale, Utah, and terminates near 7000 South and 3200 West in West Jordan, Utah. Since canal C-1 does not reconnect to a TNW or a tributary to a TNW, it would not be considered jurisdictional.
Open-water Ponds				
PUB-1 (Danny R. Crump Fishing Pond)	0.23	-	8	PUB-1 is filled by secondary water from the Jordan River. Given that PUB-1 was artificially created in uplands, this pond would not be considered jurisdictional.

[a] The criteria and rationale presented in this table are subject to USACE's review and concurrence.
[b] See Appendix C, Aquatic Resources Delineation Map Series.

6 References

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe

1979 Classification of Wetlands and Deepwater Habitats of the United States. Office of Biological Services, U.S. Department of the Interior, FWS/OBS-79/31.

Curtis, K.E., and R.W. Lichvar

2010 Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States. ERDC/CRREL TN-10-1. Hanover, New Hampshire: U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory.

Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin

2016 The National Wetland Plant List: 2016 Wetland Ratings. *Phytoneuron* 2016-30: 1–17. ISSN 2153 733X. Published April 28, 2016.

Lichvar, R.W., and S.M. McColley

2008 A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States: A Delineation Manual. ERDC/CRREL TR-08-12. Hanover, New Hampshire: U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory.

Lichvar, R.W., N.C. Melvin, M. Butterwick, and W.N. Kirchner

2012 National Wetland Plant List Indicator Rating Definitions. ERDC/CRREL TR-12-1. Hanover, New Hampshire: U.S. Army Corps of Engineers, Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory.

Munsell Color

2009 Munsell Soil-Color Charts. Grand Rapids, Michigan.

U.S. Climate Data

2021 Climate Data for Salt Lake City, Utah. Available online at https://www.usclimatedata.com/climate/salt-lake-city/utah/united-states/usut0225. Accessed September 20, 2021.

[USACE] U.S. Army Corps of Engineers

1987 Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

2005 Regulatory Guidance Letter No. 05-05. Available online at http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/GuidanceLetters.aspx. December 7, 2005.

2008 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0), ed. J.S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/EL TR-08-28. Vicksburg, Mississippi: U.S. Army Engineer Research and Development Center.

[USDA NRCS] U.S. Department of Agriculture, Natural Resources Conservation Service

2021a National Hydric Soils List for Utah. Available online at https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1316620.html. Accessed September 20, 2021.

2021b Web Soil Survey. Soil Survey Staff, USDA NRCS. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed September 20, 2021.

[USGS] U.S. Geological Survey

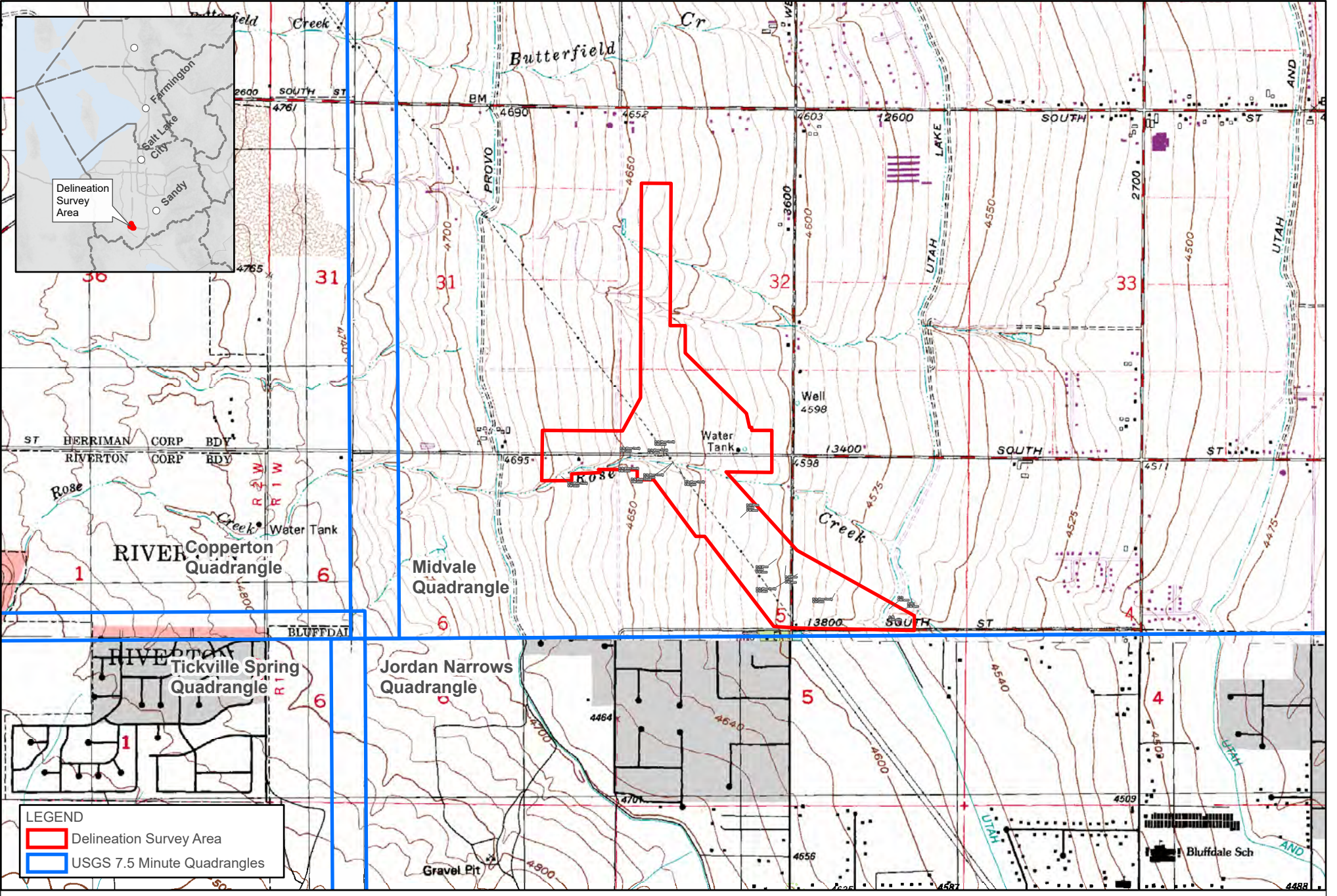
2021 Science in Your Watershed. https://water.usgs.gov/wsc/cat/16020204.html. Accessed September 20, 2021.

Woods, A.J., D.A. Lammers, S.A. Bryce, J.M. Omernik, R.L. Denton, M. Domeier, and J.A. Comstock

2001 Ecoregions of Utah (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,175,000). https://gaftp.epa.gov/EPADataCommons/ORD/Ecoregions/ut/ut_front.pdf.

APPENDIX A

Project Location Overview Map



DATA SOURCES:
USGS Topo: State of Utah

PROJECTION:
Utah Stateplane Central

CARTOGRAPHERS: HDR

0 0.25 0.5 Miles

18808: Bangerter Environmental - 13400 South
Project Location Overview Map

APPENDIX B

On-site Representative Photographs

P-1a (Rose Creek)

P-1b (Rose Creek)

P-1c (Rose Creek)

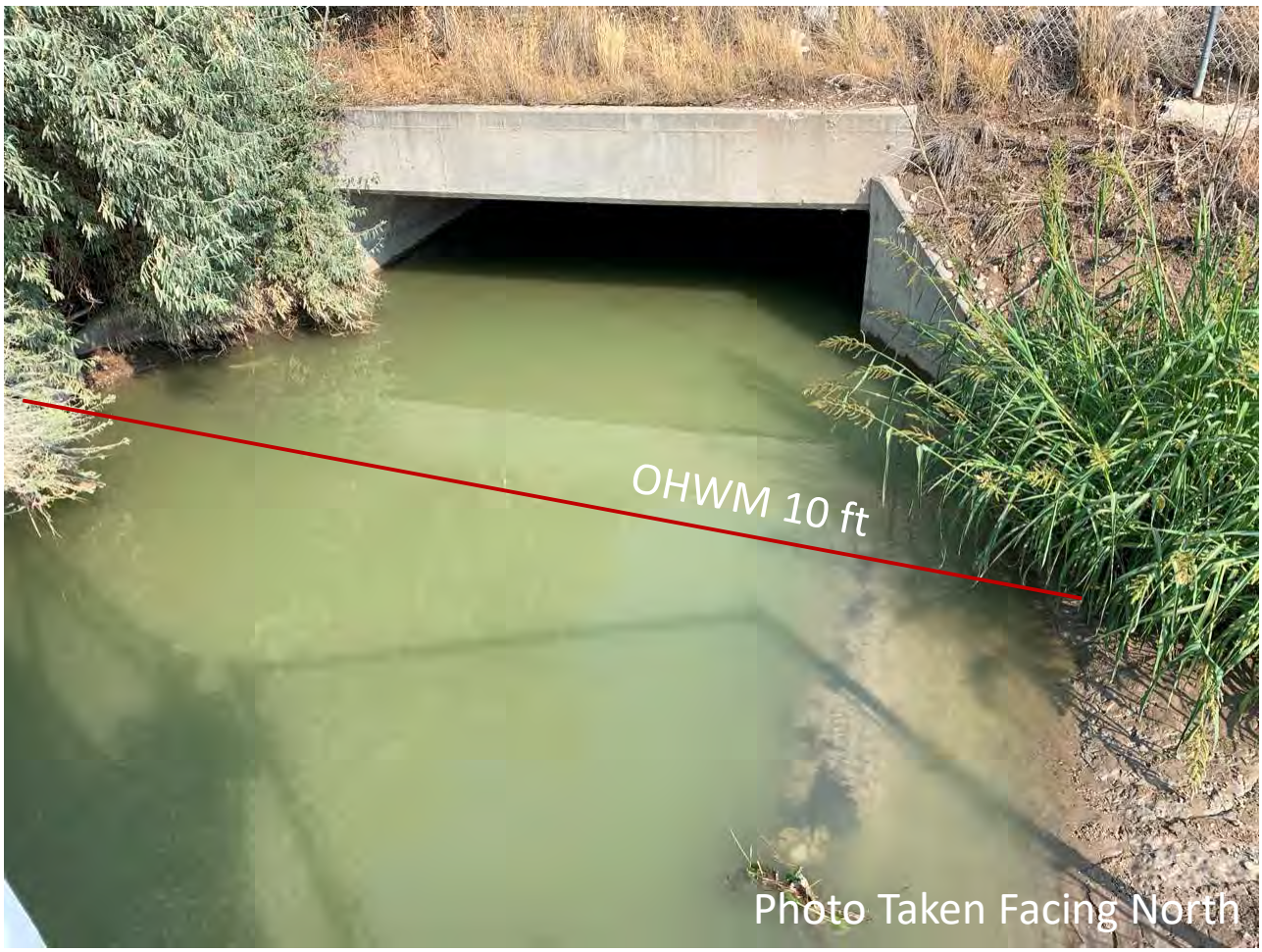
P-1d (Rose Creek)

No photos available

P-1e (Rose Creek)

Canal C-1a
(Utah Lake Distribution Canal)

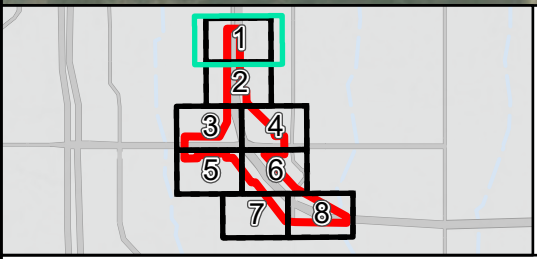
Canal C-1b
(Utah Lake Distribution Canal)



PUB-1
(Danny R. Crump Fishing Pond)

APPENDIX C

Aquatic Resources Delineation Map Series



LEGEND

Delineation Survey Area

DATA SOURCES:
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

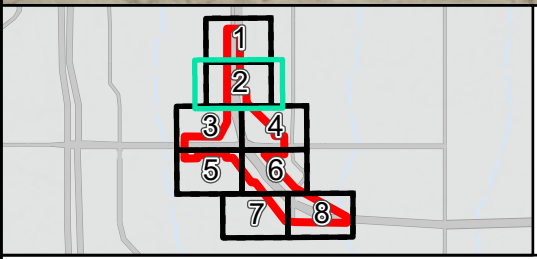
CARTOGRAPHERS: HDR

0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

Aquatic Resources Delineation Map Series



LEGEND

Delineation Survey Area

DATA SOURCES:
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

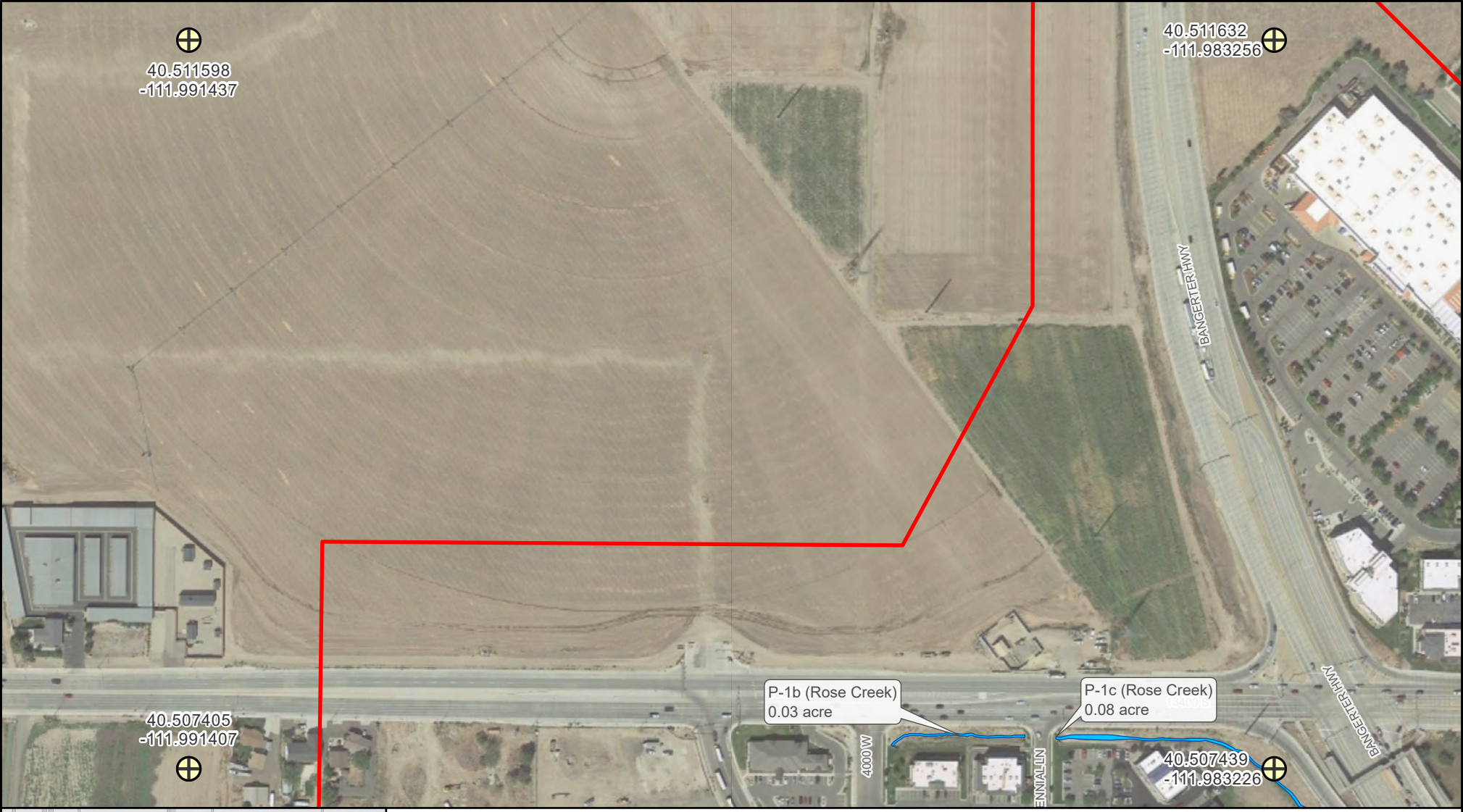
CARTOGRAPHERS: HDR

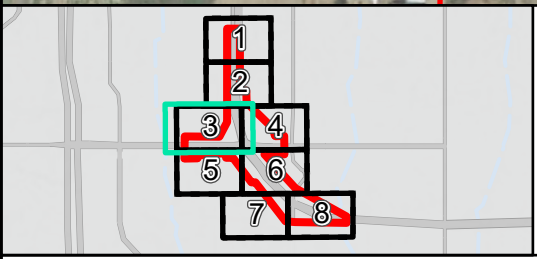
0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

Aquatic Resources Delineation Map Series





LEGEND

- Delineation Survey Area
- Perennial Stream

DATA SOURCES:
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

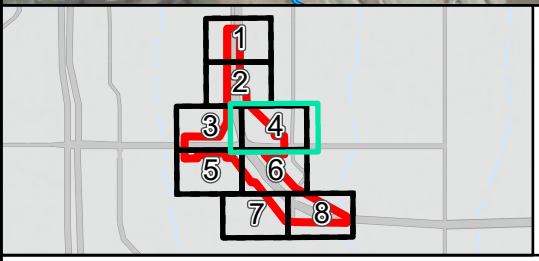
CARTOGRAPHERS: HDR

0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

Aquatic Resources Delineation Map Series



LEGEND

- Delineation Survey Area
- Perennial Stream

DATA SOURCES:
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

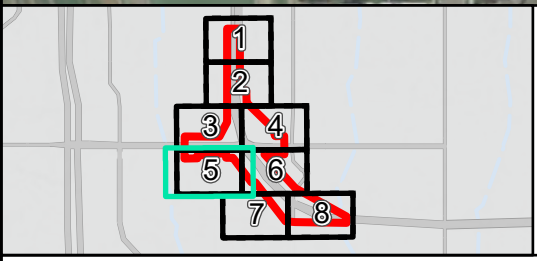
CARTOGRAPHERS: HDR

0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

Aquatic Resources Delineation Map Series



LEGEND

Delineation Survey Area

Perennial Stream

DATA SOURCES:
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

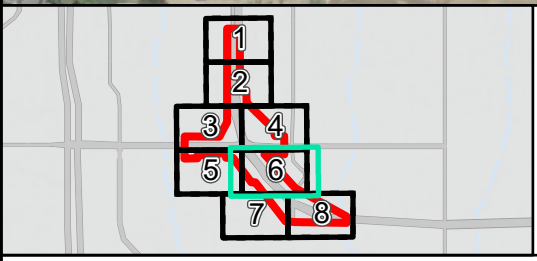
CARTOGRAPHERS: HDR

0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

Aquatic Resources Delineation Map Series



LEGEND

- Delineation Survey Area
- Perennial Stream

DATA SOURCES:
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

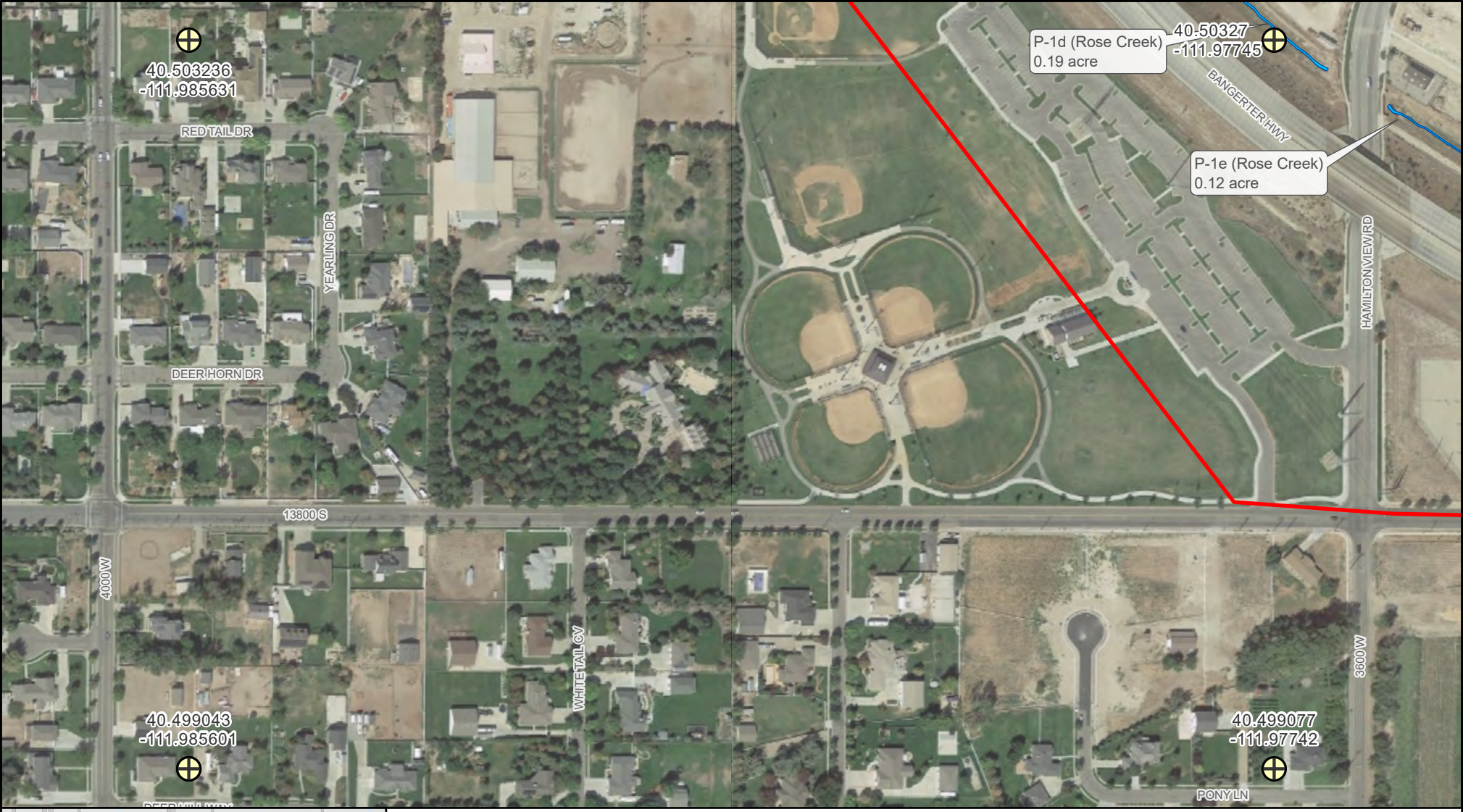
CARTOGRAPHERS: HDR

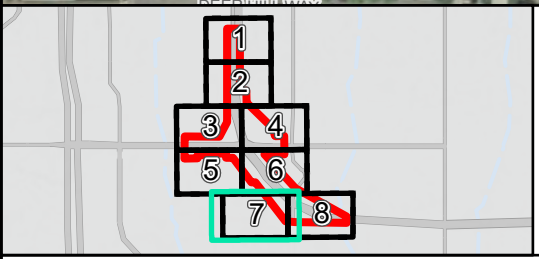
0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

Aquatic Resources Delineation Map Series





LEGEND

- Delineation Survey Area
- Perennial Stream

DATA SOURCES:
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

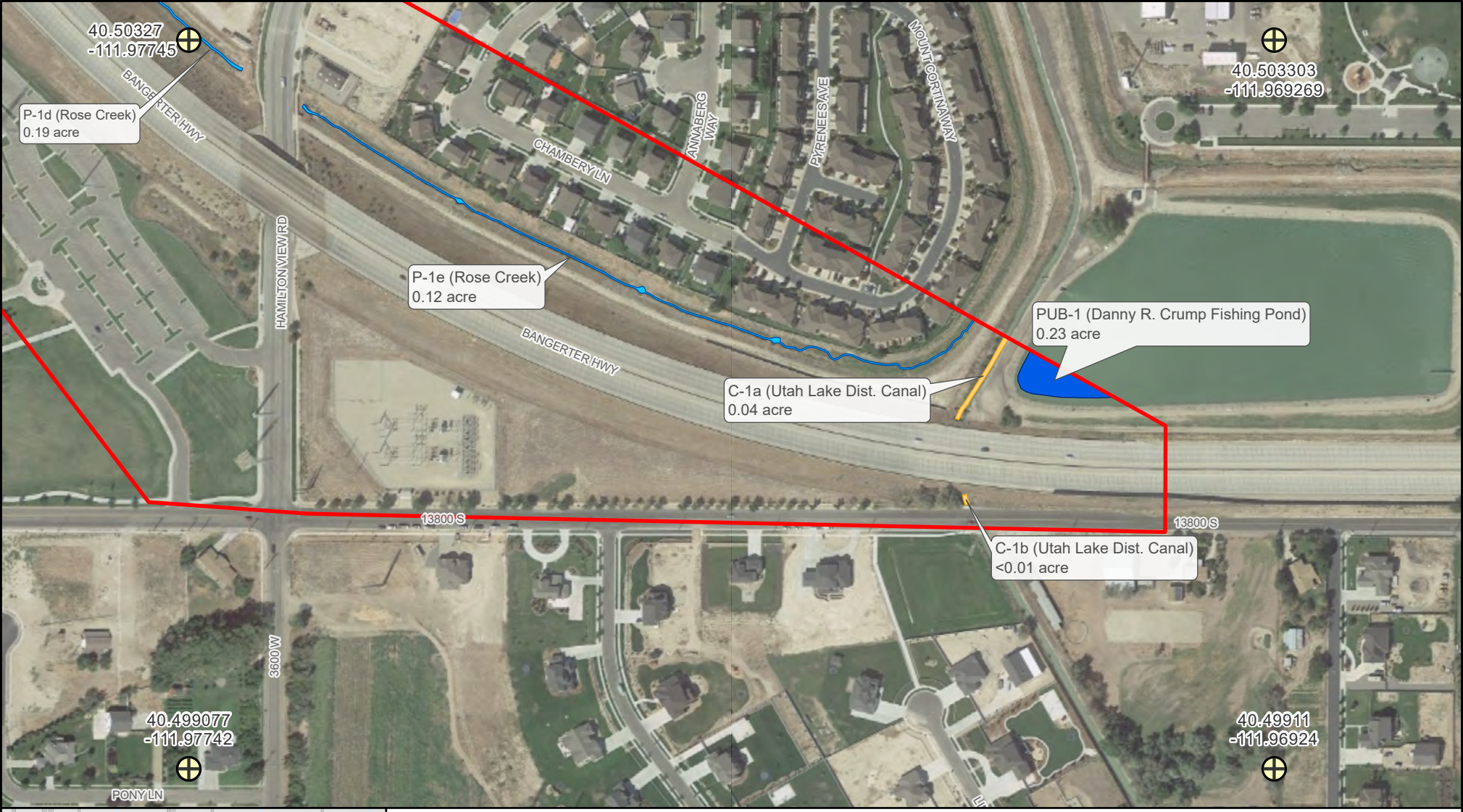
CARTOGRAPHERS: HDR

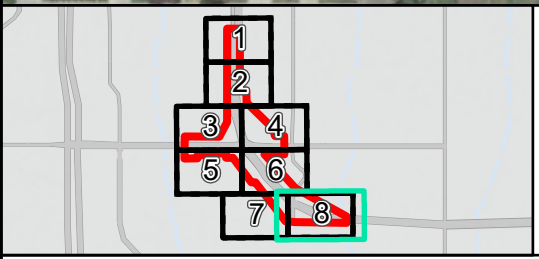
0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

Aquatic Resources Delineation Map Series





LEGEND

- Delineation Survey Area
- Canal/Ditch
- Open Water
- Perennial Stream

DATA SOURCES:
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

CARTOGRAPHERS: HDR

0 Feet 250

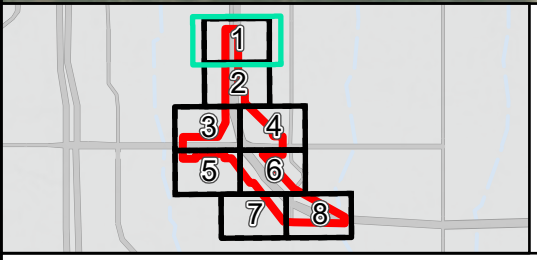
1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

Aquatic Resources Delineation Map Series

APPENDIX D

National Wetlands Inventory Map Series



LEGEND

Delineation Survey Area

DATA SOURCES:
NWI: U.S. Fish & Wildlife Service
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

CARTOGRAPHERS: HDR

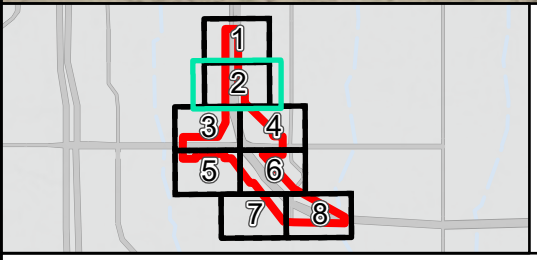
0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

National Wetlands Inventory Map Series

Figure 1 of 8



LEGEND

Delineation Survey Area

DATA SOURCES:
NWI: U.S. Fish & Wildlife Service
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

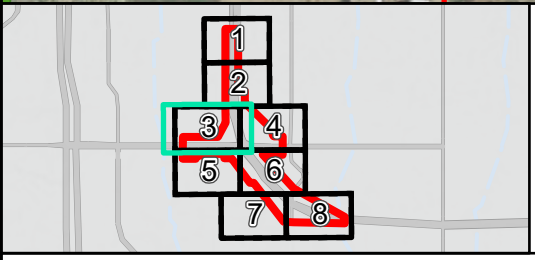
CARTOGRAPHERS: HDR

0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

National Wetlands Inventory Map Series



LEGEND

- Delineation Survey Area
- Intermittent riverine

DATA SOURCES:
NWI: U.S. Fish & Wildlife Service
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

CARTOGRAPHERS: HDR

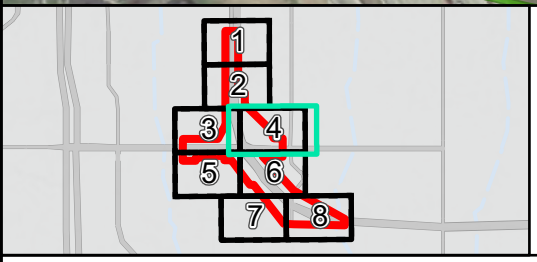
0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

National Wetlands Inventory Map Series

Figure 3 of 8



LEGEND

- Delineation Survey Area
- Intermittent riverine

DATA SOURCES:
NWI: U.S. Fish & Wildlife Service
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

CARTOGRAPHERS: HDR

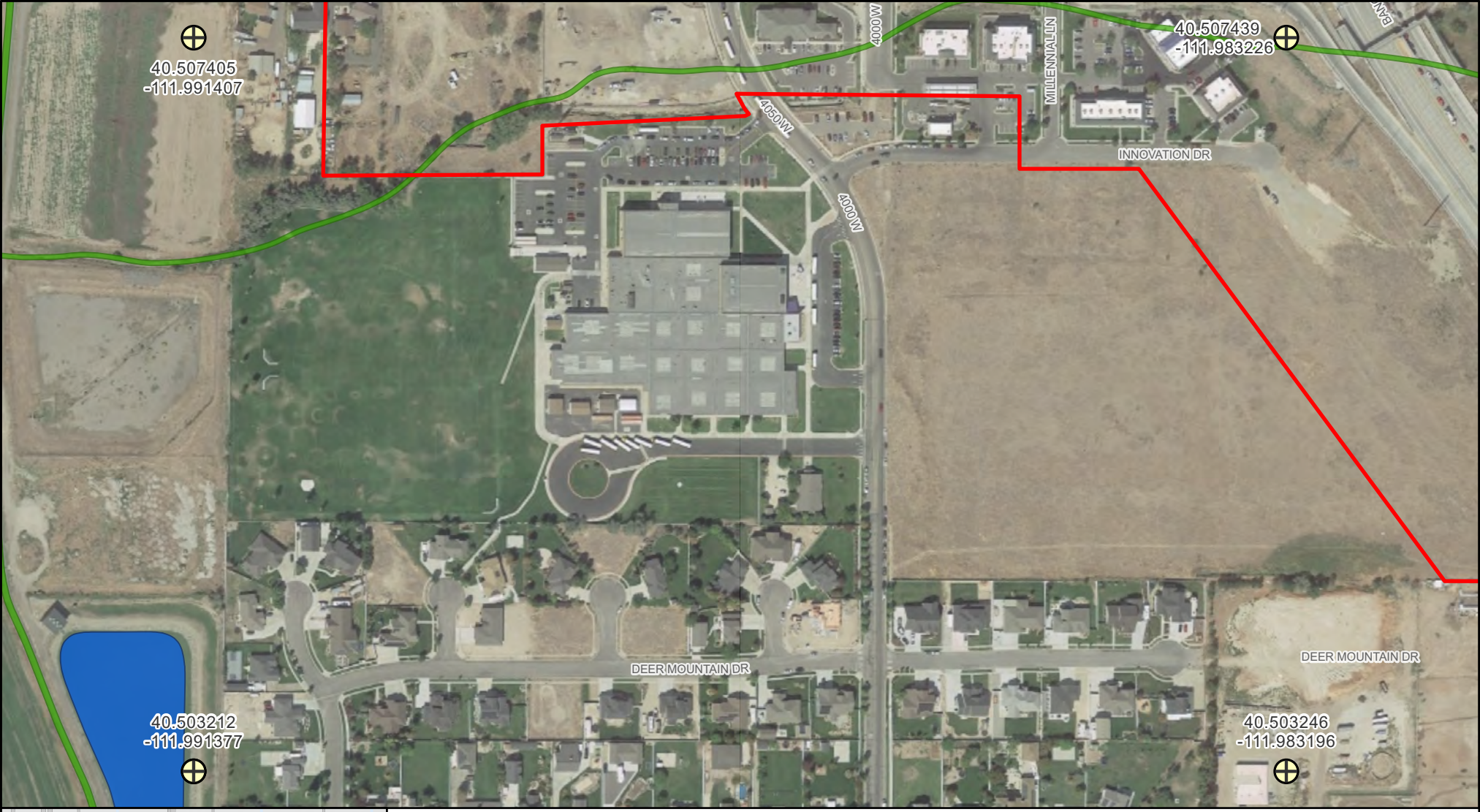
0 Feet 250

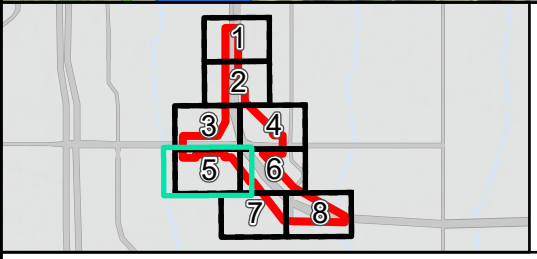
1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

National Wetlands Inventory Map Series

Figure 4 of 8





LEGEND

- Delineation Survey Area
- Intermittent riverine
- Palustrine

DATA SOURCES:
NWI: U.S. Fish & Wildlife Service
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

CARTOGRAPHERS: HDR

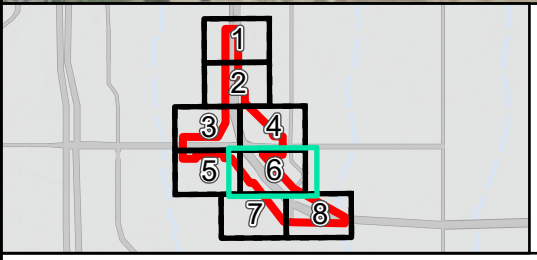
0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

National Wetlands Inventory Map Series

Figure 5 of 8



LEGEND

- Delineation Survey Area
- Intermittent riverine

DATA SOURCES:
NWI: U.S. Fish & Wildlife Service
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

CARTOGRAPHERS: HDR

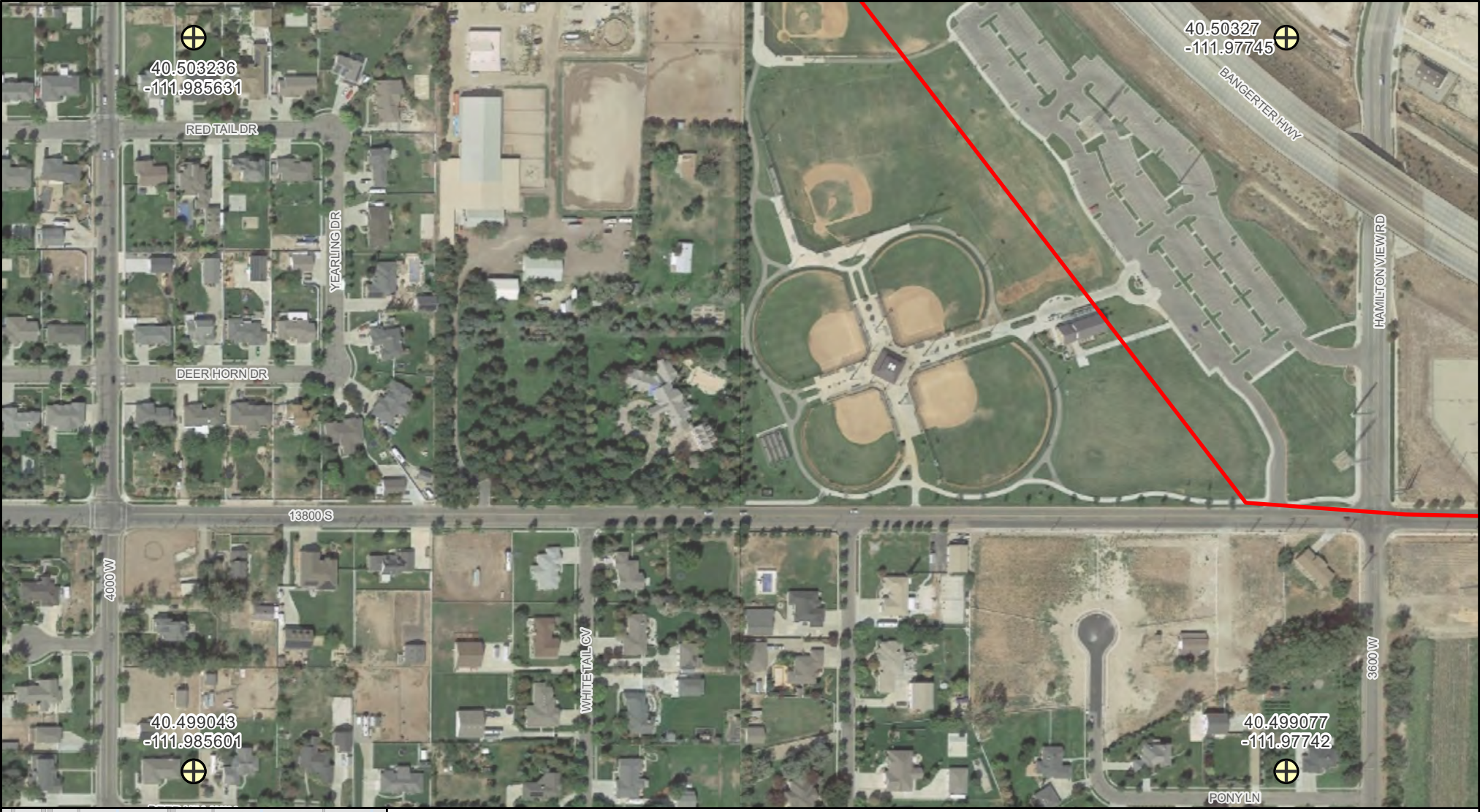
0 Feet 250

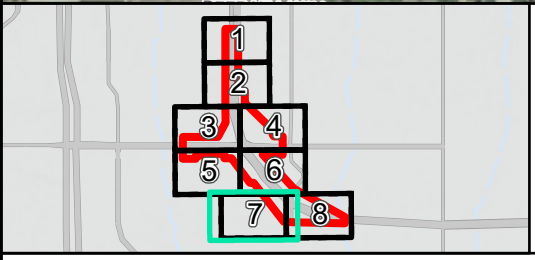
1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

National Wetlands Inventory Map Series

Figure 6 of 8





LEGEND

Delineation Survey Area

DATA SOURCES:
NWI: U.S. Fish & Wildlife Service
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

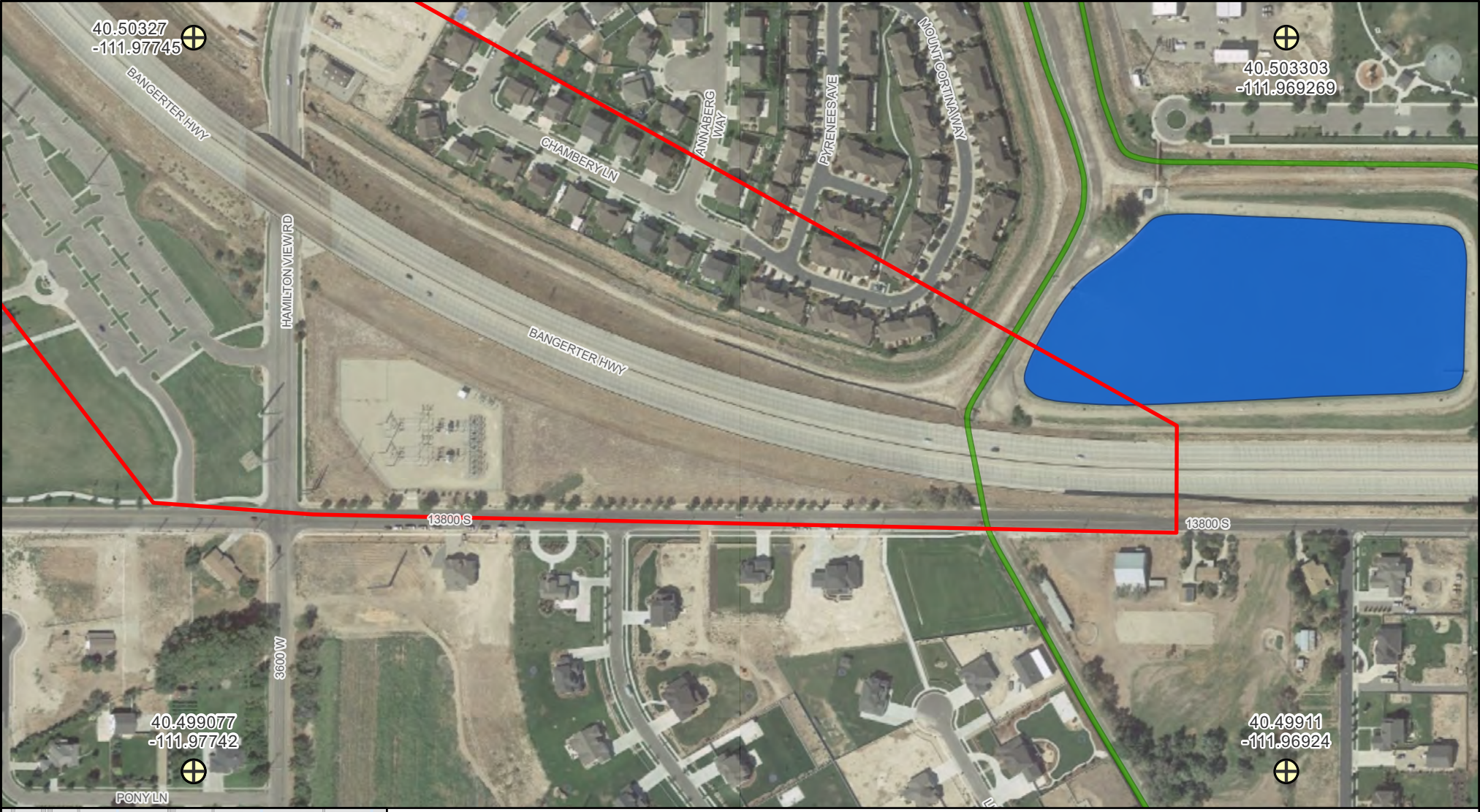
CARTOGRAPHERS: HDR

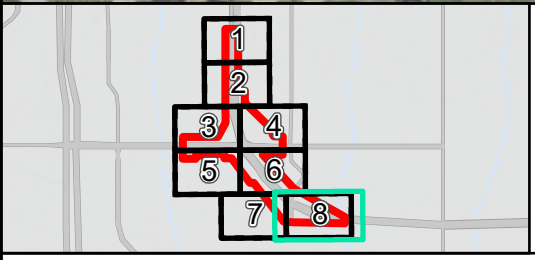
0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

National Wetlands Inventory Map Series





LEGEND

- Delineation Survey Area
- Intermittent riverine
- Palustrine

DATA SOURCES:
NWI: U.S. Fish & Wildlife Service
Aerial Imagery: State of Utah
Google Imagery (2018)

PROJECTION:
Utah Stateplane Central

CARTOGRAPHERS: HDR

0 Feet 250

1 inch equals 250 feet

18808: Bangerter Environmental - 13400 South

National Wetlands Inventory Map Series

Figure 8 of 8

APPENDIX E

USDA NRCS Soil Map Series

United States Department of Agriculture

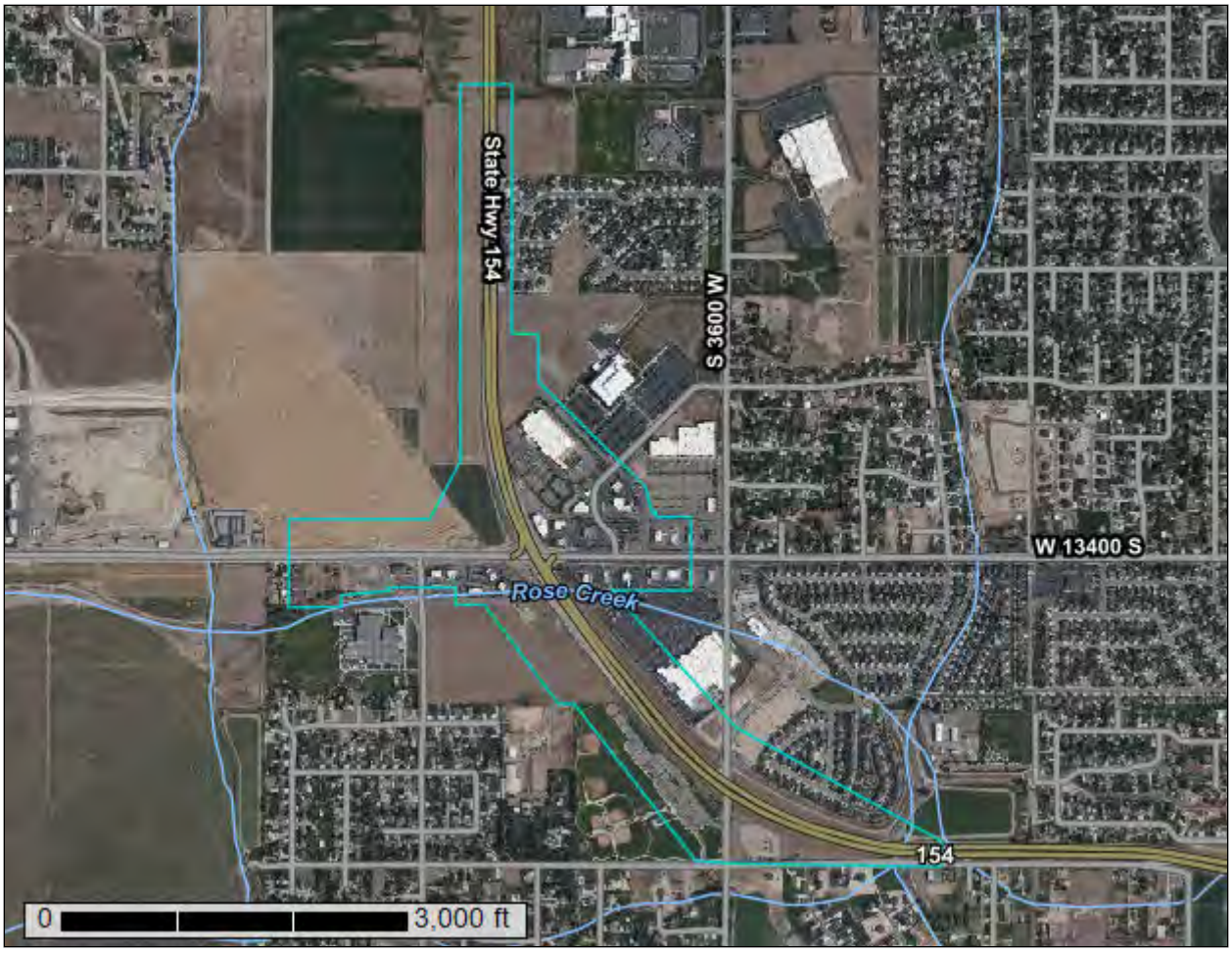
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Salt Lake Area, Utah

Bangerter 13400 S Interchange



September 17, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

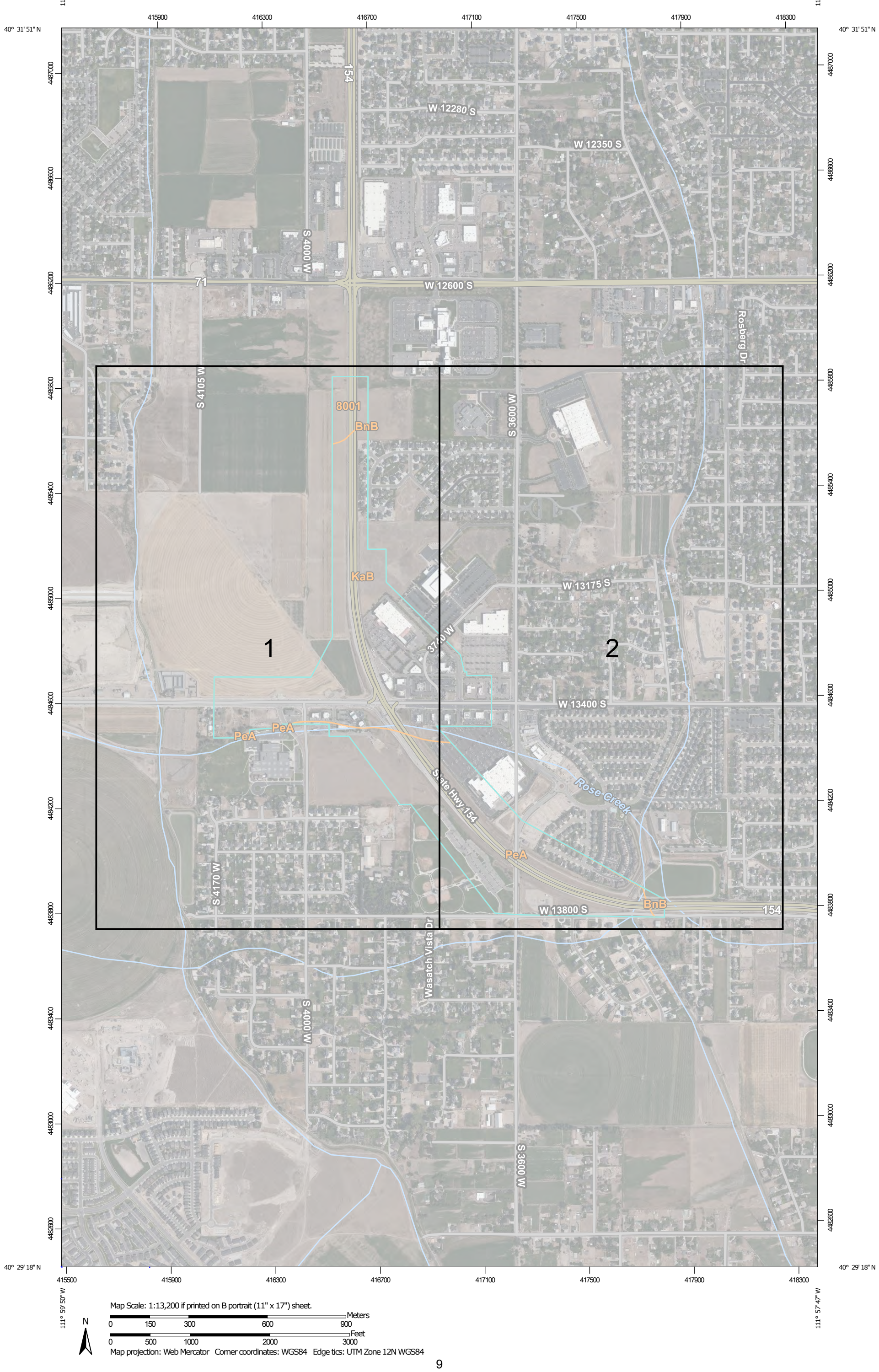
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map
Index Sheet



Map Scale: 1:13,200 if printed on B portrait (11" x 17") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

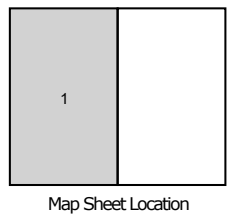
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

Map Scale: 1:6,000 if printed on B portrait (11" x 17") sheet.

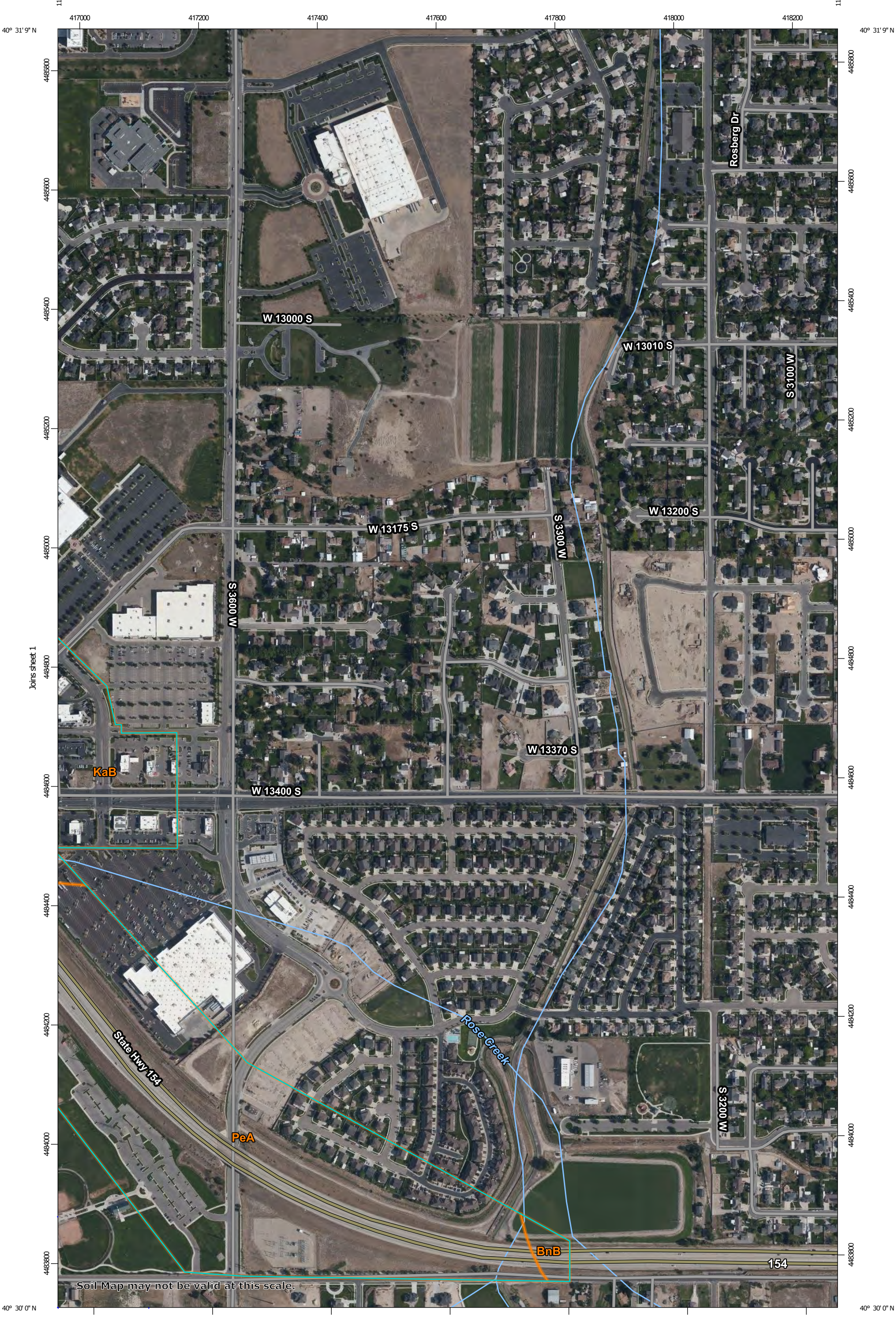
Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84



Map Sheet Location

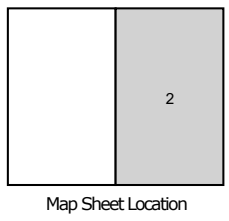


Map Scale: 1:6,000 if printed on B portrait (11" x 17") sheet.

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84



Map Sheet Location

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Salt Lake Area, Utah
Survey Area Data: Version 13, Jun 8, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 5, 2018—Sep 14, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8001	Bingham gravelly loam, 1 to 3 percent slopes	7.4	3.7%
BnB	Bluffdale silty clay loam, 1 to 3 percent slopes	1.4	0.7%
KaB	Kearns silt loam, 1 to 3 percent slopes	109.6	54.8%
PeA	Parleys silt loam, 0 to 3 percent slopes	81.7	40.8%
Totals for Area of Interest		**200.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Salt Lake Area, Utah

8001—Bingham gravelly loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tjsk
Elevation: 4,320 to 5,350 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 49 to 51 degrees F
Frost-free period: 150 to 180 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Bingham and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bingham

Setting

Landform: Lake terraces, fan remnants
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear, concave
Across-slope shape: Convex
Parent material: Fine-loamy slope alluvium derived from quartzite and/or limestone over sandy and gravelly lacustrine deposits derived from quartzite and/or limestone

Typical profile

Ap - 0 to 6 inches: gravelly loam
Bt1 - 6 to 12 inches: gravelly sandy clay loam
Bt2 - 12 to 18 inches: gravelly fine sandy loam
2Btk - 18 to 27 inches: very gravelly sandy loam
2Ck - 27 to 60 inches: extremely gravelly sand

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: 20 to 34 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 3.0
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: B
Ecological site: R028AY306UT - Upland Gravelly Loam (Bonneville Big Sagebrush)
Hydric soil rating: No

Minor Components

Unnamed soils
Percent of map unit: 15 percent
Hydric soil rating: No

BnB—Bluffdale silty clay loam, 1 to 3 percent slopes

Map Unit Setting
National map unit symbol: j6gs
Elevation: 4,400 to 4,700 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 49 to 51 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Bluffdale and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bluffdale

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits

Typical profile
Ap - 0 to 9 inches: silty clay loam
B1t - 9 to 16 inches: silty clay loam
B21t - 16 to 22 inches: silty clay
B22tca - 22 to 31 inches: silty clay
C1ca - 31 to 40 inches: silty clay
C2&C3 - 40 to 62 inches: silty clay loam

Properties and qualities
Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 13.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Bramwell
Percent of map unit: 3 percent

Kearns
Percent of map unit: 3 percent

Hillville
Percent of map unit: 3 percent

Harrisville
Percent of map unit: 3 percent

Taylorsville
Percent of map unit: 3 percent

KaB—Kearns silt loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: j6jd
Elevation: 4,400 to 4,700 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 155 to 180 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Kearns and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kearns

Setting

Landform: Alluvial fans
Down-slope shape: Concave

Across-slope shape: Convex
Parent material: Alluvium

Typical profile

Ap - 0 to 12 inches: silt loam
A1 - 12 to 17 inches: silt loam
B21 - 17 to 24 inches: silt loam
B22 - 24 to 30 inches: silty clay loam
C1ca - 30 to 42 inches: silty clay loam
IIC2&C3 - 42 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Parleys

Percent of map unit: 4 percent

Bingham

Percent of map unit: 4 percent

Redrock

Percent of map unit: 4 percent

Lakewin

Percent of map unit: 3 percent

PeA—Parleys silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: j6k9
Elevation: 4,300 to 5,200 feet

Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 130 to 180 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Parleys and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parleys

Setting

Landform: Alluvial fans, lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

Ap - 0 to 7 inches: silt loam
B21&B22t - 7 to 17 inches: silty clay loam
B3&C1ca - 17 to 29 inches: silty clay loam
C2ca - 29 to 36 inches: silty clay loam
C3ca - 36 to 46 inches: loam
C4 - 46 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Red rock

Percent of map unit: 5 percent

Bingham

Percent of map unit: 5 percent

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix D: Environmental Resources

Noise Study

BANGERTER HIGHWAY AT 13400 SOUTH INTERSECTION IMPROVEMENTS NOISE STUDY

PIN: 18808
PROJECT NUMBER: S-0154(92)0

PREPARED FOR:
Utah Department of Transportation

PREPARED BY:
HDR, Inc.

December 2021

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
dB	decibels
dBA	A-weighted decibels
FHWA	Federal Highway Administration
L_{eq}	equivalent noise level
LOS	level of service
ML	monitoring location
mph	miles per hour
NAC	noise-abatement criteria
SPUI	single-point urban interchange
TNM	Traffic Noise Model
UDOT	Utah Department of Transportation

NOISE STUDY

1.0 INTRODUCTION

This Noise Analysis was prepared in accordance with the Utah Department of Transportation's (UDOT) Noise Abatement Policy (UDOT 2020) and is consistent with 23 Code of Federal Regulations (CFR) Part 772 and Utah Administrative Code Rule R930-3.

2.0 DESCRIPTION OF PROJECT

UDOT is proposing to construct a grade-separated single-point urban interchange (SPUI) at the existing intersection of State Route 154 (Bangerter Highway) and 13400 South. The noise study area is along Bangerter Highway from milepost 4.9 to 6.5 and on 13400 South between 3700 West and 4100 West (see Figure 3-1).

The proposed project would construct a grade-separated interchange and associated on- and off-ramps. When funding is available, the project might also include adding a dual northbound off-ramp, extending the southbound on-ramp east of 3600 West, constructing auxiliary lanes between the 13400 South northbound on-ramp and the 12600 South northbound off-ramp, and constructing auxiliary lanes between the 12600 South southbound on-ramp and the 13400 South southbound off-ramp. The proposed project improvements on 13400 South include minor widening and restriping to accommodate the turn lanes for the new grade-separated interchange. The proposed project would include modifying utilities and storm drains and installing new pavement, traffic signals, advanced traffic management system (ATMS) equipment, and roadway signs. This project would require acquiring additional right-of-way.

The noise study area is the land adjacent to Bangerter Highway and 13400 South that could be affected by an increase in noise levels to a distance of approximately 500 feet. This report includes the expected noise impacts from three options.

- **Bangerter Highway Over Option.** The vertical alignment for 13400 South would stay at the existing grade, and Bangerter Highway would go over 13400 South above the existing grade.
- **Bangerter Highway Under Option.** The vertical alignment for 13400 South would be at the existing grade and would go over Bangerter Highway on a structure. Bangerter Highway would be below the existing grade and would go under 13400 South.
- **Bangerter Highway Hybrid Option.** The vertical alignment for 13400 South would be lower than the existing grade, and Bangerter Highway would go over 13400 South above the existing grade. Both Bangerter Highway and 13400 South would be at lower elevations compared to the Bangerter Highway Over Option.

2.1 Applicability

UDOT's Noise Abatement Policy states that "noise abatement will be considered for all Type I projects where noise impacts are identified." Type I projects are projects that include any of the following: the construction of a highway at a new location; the physical alteration of an existing highway that substantially alters its alignment; the addition of a through traffic lane; the addition of an auxiliary lane; the addition or relocation of interchange lanes or ramps; or the addition or substantial alteration of a weigh station, rest stop, ride share lot, or toll plaza. The proposed project is considered a Type I project because of the horizontal and vertical changes proposed to Bangerter Highway and the addition of the interchange ramps.

3.0 ANALYSIS OF TRAFFIC NOISE IMPACTS

Traffic noise is measured in A-weighted sound levels in decibels (dBA), which most closely approximates the way the human ear hears sounds at different frequencies (Table 3-1). Since traffic noise varies over time, the sound levels for this noise analysis are expressed as "equivalent levels" or L_{eq}, representing the average sound level over a 1-hour period. Unless noted otherwise, all sound levels in this noise analysis are expressed in the hourly equivalent noise level.

3.1 Noise Abatement Criteria

The Federal Highway Administration (FHWA) has established noise-abatement criteria (NAC) for several categories of land use activities (Table 3-2). FHWA's NAC are based on sound levels that are considered to be an impact to nearby noise-sensitive areas, also known as receptors. According to FHWA guidance, UDOT must give primary consideration for noise abatement to exterior areas that are frequently used by people.

UDOT has developed a noise abatement policy for transportation projects, which conforms to FHWA's noise abatement requirements in 23 CFR Section 772.

For each land use category, UDOT's noise-abatement criterion is the noise decibel (dBA) value reflecting the approach criterion of 1 dBA below the noise-abatement criterion value listed in 23 CFR Section 772 for that land use category (Table 3-2).

UDOT's Noise Abatement Policy states that a traffic noise impact occurs when either (1) the future worst-case noise level is equal to or greater than the UDOT noise-abatement criterion for a specified land-use category or (2) the future worst-case noise level is greater than or equal to an increase of 10 dBA over the existing noise level.

Noise impact and abatement analyses are required within land use activity categories A, B, C, D, and E (Table 3-2) only when development exists or has been permitted (formal building permit issued prior to the date when the final environmental decision document is approved). Activity categories F and G include lands that are not sensitive to traffic noise. There are no impact criteria for these land use types, and an analysis of noise impacts is not required.

For this noise analysis, aerial photographs and on-site visits were used to identify existing land uses and structure locations.

Table 3-1: Weighted Noise Levels and Human Response

Sound Source	dBA[a]	Response Descriptor
Carrier deck jet operation	140	Limit of amplified speech
	130	Painfully loud
Jet takeoff (200 feet) Auto horn (3 feet)	120	Threshold of feeling and pain
Riveting machine Jet takeoff (2,000 feet)	110	
Shout (0.5 foot) New York subway station	100	Very annoying
Heavy truck (50 feet) Pneumatic drill (50 feet)	90	Hearing damage (8-hour exposure)
Passenger train (100 feet) Helicopter (in-flight, 500 feet) Freight train (50 feet)	80	Annoying
Freeway traffic (50 feet)	70	Intrusive
Air conditioning unit (20 feet) Light auto traffic (50 feet)	60	
Normal speech (15 feet)	50	Quiet
Living room, bedroom, library	40	
Soft whisper (15 feet)	30	Very quiet
Broadcasting studio	20	
	10	Just audible
	0	Threshold of hearing

Source: CEQ 1970

[a] Typical A-weighted noise levels taken with a sound-level meter and expressed as decibels on the "A" scale. The "A" scale approximates the frequency response of the human ear.

Table 3-2: UDOT's Noise-abatement Criteria

Activity Category	FHWA Criterion L_{eq} (dBA)	L_{eq} Noise Level (dBA)	Evaluation Location	Description of Activity Category
A	57	56	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67	66	Exterior	Residential.
C	67	66	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	52	51	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting room, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	71	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in categories A–D or F.
F	—	—	—	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	—	—	—	Undeveloped lands that are not permitted.

Source: UDOT 2020

3.2 Noise-sensitive Land Uses

Table 3-3 and Figure 3-1 show noise-sensitive land uses within each of the activity categories in the noise study area.

Table 3-3: Noise-sensitive Land Uses

Activity Category	Description of Activity Category within Study Area
A	• None
B	• Residential locations within the noise study area
C	• CR Hamilton Sports Complex • South Bangerter Health Center • Riverton City Fishing Pond • Utah Lake Distribution Canal Trail
D	• None
E	• Restaurants on 13400 South
F	• Retail facilities • Rocky Mountain Power facility • Dominion Energy odorization station
G	• Undeveloped lands within the noise study area

UDOT's Noise Abatement Policy states that a noise impact analysis is not required for activity categories F and G. However, for activity category G, an estimate of the distance to the approach criteria must be provided to local governments. For more information, see Section 6.0, *Information for Local Officials*, of this noise study.

3.3 Existing Noise

The primary source of noise in the noise study area is automobile and truck traffic from Bangerter Highway, 13400 South, and other roads in the area.

Existing noise levels were established via noise modeling for receptors located adjacent to, and approximately 500 feet from, Bangerter Highway and 13400 South. Existing traffic sound levels for receptors in this area were calculated with the FHWA Traffic Noise Model (TNM) 2.5 software using existing conditions (travel lane configurations and the posted speed limit).

On-site measurements were taken on July 29 and 30, 2021, with a Larson Davis model 824 sound-level meter for a duration of 20 minutes at the locations listed in Table 3-4 (see Appendix A, *Noise Monitoring Data Sheets and Existing Noise Receptor Maps,* for data sheets and noise measurement locations). Recorded measurements for locations M1–M6 were used to validate the noise model and to ensure it represents existing conditions. To be considered valid, the field noise measurements must be within 3 dBA of the model's predicted noise. The model validation results range between 0 and 3 dBA, so the noise model is considered valid (Table 3-4).

Table 3-4: Model Validation

Monitoring Location	Address	Measured Noise Level (dBA)	Modeled Noise Level (dBA)	Difference (dBA)
ML-1	East side of Bangerter near 12900 S.	70.0	67.2	–2.8
ML-2	3853 W. Sand Creek Dr., Riverton	48.9	51.3	2.4
ML-3[a]	3648 W. 13400 S., Riverton	57.2		
ML-4	3956 W. 13400 S., Riverton,	64.0	65.1	1.1
ML-5	3620 W. 13800 S., Riverton	62.5	59.8	–2.7
ML-6	13613 S. Pyrenees Ave., Riverton	61.1	63.6	2.5

[a] ML-3 is outside the noise study area and was not used for model validation.

Of the 168 receptors in the noise study area, 13 currently experience a noise level above the NAC threshold (see Table 3-5, Table 3-6, Table 3-7 and Existing Noise Levels maps in Appendix A). An existing 6-foot-tall masonry fence on the west side of the subdivision near 13000 South was included in the noise modeling for the existing conditions (see Appendix A).

Figure 3-1: Noise-monitoring Locations and Activity Categories

3.4 Proposed Project Noise

Projected traffic noise levels for the three project options were calculated with TNM 2.5 software using build conditions (travel lane configurations and traffic volumes). To be consistent with UDOT's Noise Abatement Policy, level of service (LOS) C traffic volumes were used to determine the greatest hourly traffic noise conditions that are likely to occur regularly. There is an existing 6-foot-tall masonry fence on the west side of the subdivision near 13000 South. The northern section of this 6-foot-tall masonry fence would be removed by the three options but would need to be replaced pursuant to UDOT's right-of-way policies. Therefore, a 6-foot-tall masonry fence in this area was included with the noise modeling for the three options (see Appendix B, *Build Noise Receptor Maps*). The results are summarized below by option.

Bangerter Highway Over Option. Overall, noise levels with the Bangerter Highway Over Option would range from 53 to 73 dBA compared to the existing conditions of 49 to 71 dBA.

With the Bangerter Highway Over Option, 78 of the 168 receptors (77 activity category B and 1 activity category E) would have traffic noise impacts; that is, they would exceed the NAC as defined in Section 3.1, *Noise Abatement Criteria*. None of the receptors would have future worst-case noise levels greater than or equal to an increase of 10 dBA over the existing noise level. The locations of those receptors exceeding the NAC are shown in Appendix B, *Build Noise Receptor Maps*.

Bangerter Highway Under Option. Overall, noise levels with the Bangerter Highway Under Option would range from 53 to 73 dBA compared to the existing conditions of 49 to 71 dBA.

With the Bangerter Highway Under Option, 65 of the 168 receptors would have traffic noise impacts; that is, they would exceed the NAC as defined in Section 3.1, *Noise Abatement Criteria*. None of the receptors would have future worst-case noise levels greater than or equal to an increase of 10 dBA over the existing noise level. The locations of those receptors exceeding the NAC are shown in Appendix B, *Build Noise Receptor Maps*.

Bangerter Highway Hybrid Option. Overall, noise levels with the Bangerter Highway Hybrid Option would range from 53 to 74 dBA compared to the existing conditions of 49 to 71 dBA.

With the Bangerter Highway Hybrid Option, 54 of the 168 receptors (53 activity category B and 1 activity category E) would have traffic noise impacts; that is, they would exceed the NAC as defined in Section 3.1, *Noise Abatement Criteria*. None of the receptors would have future worst-case noise levels greater than or equal to an increase of 10 dBA over the existing noise level. The locations of those receptors exceeding the NAC are shown in Appendix B, *Build Noise Receptor Maps*.

3.5 Existing and Proposed Project Summary

Table 3-5 summarizes the existing and build noise levels for the Bangerter Highway Over Option, Table 3-6 summarizes the existing and build noise levels for the Bangerter Highway Under Option, and Table 3-7 summarizes the existing and build noise levels for the Bangerter Highway Hybrid Option. Refer to the maps in Appendix A and Appendix B for receptor locations.

Table 3-5: Summary of Existing and Build Noise Levels for Bangerter Highway Over Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Over Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-001	B	66	50	No	55	No	No	5
A-002	B	66	51	No	55	No	No	4
A-003	B	66	52	No	56	No	No	4
A-004	B	66	56	No	60	No	No	4
A-005	B	66	55	No	60	No	No	5
A-006	B	66	54	No	58	No	No	4
A-007	B	66	50	No	55	No	No	5
A-008	B	66	50	No	54	No	No	4
A-009	B	66	53	No	57	No	No	4
A-010	B	66	59	No	63	No	No	4
A-011	B	66	58	No	62	No	No	4
A-012	B	66	64	No	68	No	Yes	4
A-013	B	66	67	Yes	72	No	Yes	5
A-014	B	66	65	No	70	No	Yes	5
A-015	B	66	64	No	70	No	Yes	6
A-016	B	66	68	Yes	73	No	Yes	5
A-017	B	66	67	Yes	72	No	Yes	5
A-018	B	66	66	Yes	70	No	Yes	4
A-019	B	66	65	No	69	No	Yes	4
A-020	B	66	69	Yes	72	No	Yes	3
A-021	B	66	64	No	68	No	Yes	4
A-022	B	66	59	No	62	No	No	3
A-023	B	66	55	No	59	No	No	4
A-024	B	66	53	No	57	No	No	4
A-025	B	66	52	No	57	No	No	5
A-026	B	66	53	No	57	No	No	4
A-027	B	66	58	No	62	No	No	4
A-028	B	66	56	No	60	No	No	4
A-029	B	66	49	No	53	No	No	4
A-030	B	66	50	No	54	No	No	4
A-031	E	71	66	No	67	No	No	1
A-032	E	71	71	Yes	71	No	Yes	0
A-033	E	71	68	No	68	No	No	0

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Table 3-5: Summary of Existing and Build Noise Levels for Bangerter Highway Over Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Over Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-034	E	71	64	No	66	No	No	2
A-035	E	71	59	No	61	No	No	2
A-036	C	66	61	No	64	No	No	3
A-037	B	66	57	No	61	No	No	4
A-038	B	66	57	No	61	No	No	4
A-039	B	66	56	No	60	No	No	4
A-040	C	66	56	No	60	No	No	4
A-041	C	66	59	No	64	No	No	5
A-042	C	66	57	No	61	No	No	4
A-043	C	66	57	No	62	No	No	5
A-044	B	66	57	No	62	No	No	5
A-045	B	66	58	No	62	No	No	4
A-046	B	66	58	No	62	No	No	4
A-047	B	66	60	No	64	No	No	4
A-048	B	66	61	No	65	No	No	4
A-049	B	66	60	No	65	No	No	5
A-050	B	66	61	No	66	No	Yes	5
A-051	B	66	61	No	65	No	No	4
A-052	B	66	60	No	65	No	No	5
A-053	B	66	60	No	65	No	No	5
A-054	B	66	57	No	62	No	No	5
A-055	B	66	55	No	59	No	No	4
A-056	B	66	56	No	61	No	No	5
A-057	B	66	55	No	60	No	No	5
A-058	B	66	60	No	65	No	No	5
A-059	B	66	62	No	67	No	Yes	5
A-060	B	66	58	No	63	No	No	5
A-061	B	66	58	No	63	No	No	5
A-062	B	66	57	No	62	No	No	5
A-063	B	66	55	No	60	No	No	5
A-064	B	66	54	No	60	No	No	6
A-065	B	66	54	No	59	No	No	5
A-066	B	66	53	No	58	No	No	5
A-067	B	66	53	No	58	No	No	5
A-068	B	66	51	No	55	No	No	4
A-069	B	66	51	No	55	No	No	4
A-070	B	66	53	No	57	No	No	4
A-071	B	66	56	No	60	No	No	4
A-072	B	66	55	No	60	No	No	5
A-073	B	66	56	No	61	No	No	5
A-074	B	66	57	No	62	No	No	5

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Table 3-5: Summary of Existing and Build Noise Levels for Bangerter Highway Over Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Over Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-075	B	66	62	No	67	No	Yes	5
A-076	B	66	62	No	67	No	Yes	5
A-077	B	66	62	No	67	No	Yes	5
A-078	B	66	62	No	67	No	Yes	5
A-079	B	66	62	No	67	No	Yes	5
A-080	B	66	60	No	65	No	No	5
A-081	B	66	60	No	65	No	No	5
A-082	B	66	59	No	64	No	No	5
A-083	B	66	58	No	62	No	No	4
A-084	B	66	61	No	66	No	Yes	5
A-085	B	66	62	No	67	No	Yes	5
A-086	B	66	63	No	67	No	Yes	4
A-087	B	66	63	No	68	No	Yes	5
A-088	B	66	65	No	69	No	Yes	4
A-089	B	66	66	Yes	70	No	Yes	4
A-090	B	66	66	Yes	71	No	Yes	5
A-091	B	66	66	Yes	71	No	Yes	5
A-092	B	66	66	Yes	71	No	Yes	5
A-093	B	66	66	Yes	71	No	Yes	5
A-094	B	66	66	Yes	71	No	Yes	5
A-095	B	66	66	Yes	71	No	Yes	5
A-096	B	66	65	No	70	No	Yes	5
A-097	B	66	65	No	70	No	Yes	5
A-098	B	66	64	No	69	No	Yes	5
A-099	B	66	64	No	69	No	Yes	5
A-100	B	66	64	No	69	No	Yes	5
A-101	B	66	65	No	70	No	Yes	5
A-102	B	66	64	No	70	No	Yes	6
A-103	B	66	64	No	69	No	Yes	5
A-104	B	66	64	No	69	No	Yes	5
A-105	B	66	63	No	69	No	Yes	6
A-106	B	66	63	No	68	No	Yes	5
A-107	B	66	63	No	68	No	Yes	5
A-108	B	66	63	No	68	No	Yes	5
A-109	B	66	63	No	67	No	Yes	4
A-110	B	66	61	No	65	No	No	4
A-111	B	66	60	No	64	No	No	4
A-112	B	66	57	No	61	No	No	4
A-113	B	66	53	No	58	No	No	5
A-114	B	66	51	No	55	No	No	4
A-115	B	66	51	No	54	No	No	3

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Table 3-5: Summary of Existing and Build Noise Levels for Bangerter Highway Over Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Over Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-116	B	66	51	No	55	No	No	4
A-117	B	66	52	No	56	No	No	4
A-118	B	66	53	No	57	No	No	4
A-119	B	66	55	No	60	No	No	5
A-120	B	66	58	No	63	No	No	5
A-121	B	66	57	No	62	No	No	5
A-122	B	66	57	No	62	No	No	5
A-123	B	66	56	No	61	No	No	5
A-124	B	66	56	No	60	No	No	4
A-125	B	66	56	No	61	No	No	5
A-126	B	66	57	No	62	No	No	5
A-127	B	66	55	No	60	No	No	5
A-128	B	66	54	No	58	No	No	4
A-129	B	66	54	No	58	No	No	4
A-130	B	66	54	No	58	No	No	4
A-131	B	66	54	No	58	No	No	4
A-132	B	66	55	No	59	No	No	4
A-133	B	66	56	No	61	No	No	5
A-134	B	66	62	No	67	No	Yes	5
A-135	B	66	62	No	67	No	Yes	5
A-136	B	66	62	No	67	No	Yes	5
A-137	B	66	62	No	67	No	Yes	5
A-138	B	66	62	No	67	No	Yes	5
A-139	B	66	62	No	67	No	Yes	5
A-140	B	66	62	No	67	No	Yes	5
A-141	B	66	64	No	68	No	Yes	4
A-142	B	66	64	No	68	No	Yes	4
A-143	B	66	63	No	67	No	Yes	4
A-144	B	66	63	No	67	No	Yes	4
A-145	B	66	63	No	67	No	Yes	4
A-146	B	66	62	No	67	No	Yes	5
A-147	B	66	62	No	67	No	Yes	5
A-148	B	66	62	No	67	No	Yes	5
A-149	B	66	62	No	67	No	Yes	5
A-150	B	66	62	No	67	No	Yes	5
A-151	B	66	62	No	67	No	Yes	5
A-152	B	66	62	No	67	No	Yes	5
A-153	B	66	62	No	67	No	Yes	5
A-154	B	66	62	No	67	No	Yes	5
A-155	B	66	62	No	67	No	Yes	5
A-156	B	66	62	No	67	No	Yes	5

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Table 3-5: Summary of Existing and Build Noise Levels for Bangerter Highway Over Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Over Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-157	B	66	62	No	67	No	Yes	5
A-158	B	66	62	No	67	No	Yes	5
A-159	B	66	62	No	67	No	Yes	5
A-160	B	66	61	No	66	No	Yes	5
A-161	B	66	61	No	66	No	Yes	5
A-162	B	66	61	No	66	No	Yes	5
A-163	B	66	61	No	66	No	Yes	5
A-164	B	66	61	No	66	No	Yes	5
A-165	B	66	61	No	66	No	Yes	5
A-166	B	66	61	No	66	No	Yes	5
A-167	B	66	61	No	66	No	Yes	5
A-168	B	66	61	No	65	No	No	4

Table 3-6: Summary of Existing and Build Noise Levels for Bangerter Highway Under Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Under Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-001	B	66	50	No	54	No	No	4
A-002	B	66	51	No	55	No	No	4
A-003	B	66	52	No	56	No	No	4
A-004	B	66	56	No	60	No	No	4
A-005	B	66	55	No	60	No	No	5
A-006	B	66	54	No	58	No	No	4
A-007	B	66	50	No	54	No	No	4
A-008	B	66	50	No	54	No	No	4
A-009	B	66	53	No	57	No	No	4
A-010	B	66	59	No	63	No	No	4
A-011	B	66	58	No	62	No	No	4
A-012	B	66	64	No	68	No	Yes	4
A-013	B	66	67	Yes	71	No	Yes	4
A-014	B	66	65	No	69	No	Yes	4
A-015	B	66	64	No	69	No	Yes	5
A-016	B	66	68	Yes	73	No	Yes	5
A-017	B	66	67	Yes	72	No	Yes	5
A-018	B	66	66	Yes	70	No	Yes	4
A-019	B	66	65	No	69	No	Yes	4
A-020	B	66	69	Yes	72	No	Yes	3
A-021	B	66	64	No	68	No	Yes	4
A-022	B	66	59	No	62	No	No	3
A-023	B	66	55	No	58	No	No	3
A-024	B	66	53	No	56	No	No	3
A-025	B	66	52	No	56	No	No	4
A-026	B	66	53	No	57	No	No	4
A-027	B	66	58	No	62	No	No	4
A-028	B	66	56	No	61	No	No	5
A-029	B	66	49	No	53	No	No	4
A-030	B	66	50	No	53	No	No	3
A-031	E	71	66	No	66	No	No	0
A-032	E	71	71	Yes	71	No	Yes	0
A-033	E	71	68	No	68	No	No	0
A-034	E	71	64	No	65	No	No	1
A-035	E	71	59	No	61	No	No	2
A-036	C	66	61	No	63	No	No	2
A-037	B	66	57	No	59	No	No	2
A-038	B	66	57	No	59	No	No	2
A-039	B	66	56	No	59	No	No	3
A-040	C	66	56	No	59	No	No	3
A-041	C	66	59	No	62	No	No	3

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Table 3-6: Summary of Existing and Build Noise Levels for Bangerter Highway Under Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Under Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-042	C	66	57	No	61	No	No	4
A-043	C	66	57	No	62	No	No	5
A-044	B	66	57	No	61	No	No	4
A-045	B	66	58	No	62	No	No	4
A-046	B	66	58	No	62	No	No	4
A-047	B	66	60	No	64	No	No	4
A-048	B	66	61	No	65	No	No	4
A-049	B	66	60	No	64	No	No	4
A-050	B	66	61	No	64	No	No	3
A-051	B	66	61	No	64	No	No	3
A-052	B	66	60	No	64	No	No	4
A-053	B	66	60	No	64	No	No	4
A-054	B	66	57	No	61	No	No	4
A-055	B	66	55	No	59	No	No	4
A-056	B	66	56	No	60	No	No	4
A-057	B	66	55	No	59	No	No	4
A-058	B	66	60	No	64	No	No	4
A-059	B	66	62	No	66	No	Yes	4
A-060	B	66	58	No	62	No	No	4
A-061	B	66	58	No	62	No	No	4
A-062	B	66	57	No	61	No	No	4
A-063	B	66	55	No	59	No	No	4
A-064	B	66	54	No	58	No	No	4
A-065	B	66	54	No	58	No	No	4
A-066	B	66	53	No	57	No	No	4
A-067	B	66	53	No	57	No	No	4
A-068	B	66	51	No	55	No	No	4
A-069	B	66	51	No	55	No	No	4
A-070	B	66	53	No	56	No	No	3
A-071	B	66	56	No	60	No	No	4
A-072	B	66	55	No	59	No	No	4
A-073	B	66	56	No	60	No	No	4
A-074	B	66	57	No	61	No	No	4
A-075	B	66	62	No	66	No	Yes	4
A-076	B	66	62	No	66	No	Yes	4
A-077	B	66	62	No	66	No	Yes	4
A-078	B	66	62	No	67	No	Yes	5
A-079	B	66	62	No	66	No	Yes	4
A-080	B	66	60	No	65	No	No	5
A-081	B	66	60	No	64	No	No	4
A-082	B	66	59	No	64	No	No	5

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Table 3-6: Summary of Existing and Build Noise Levels for Bangerter Highway Under Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Under Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-083	B	66	58	No	62	No	No	4
A-084	B	66	61	No	66	No	Yes	5
A-085	B	66	62	No	67	No	Yes	5
A-086	B	66	63	No	67	No	Yes	4
A-087	B	66	63	No	68	No	Yes	5
A-088	B	66	65	No	69	No	Yes	4
A-089	B	66	66	Yes	70	No	Yes	4
A-090	B	66	66	Yes	70	No	Yes	4
A-091	B	66	66	Yes	70	No	Yes	4
A-092	B	66	66	Yes	70	No	Yes	4
A-093	B	66	66	Yes	70	No	Yes	4
A-094	B	66	66	Yes	70	No	Yes	4
A-095	B	66	66	Yes	69	No	Yes	3
A-096	B	66	65	No	69	No	Yes	4
A-097	B	66	65	No	68	No	Yes	3
A-098	B	66	64	No	68	No	Yes	4
A-099	B	66	64	No	68	No	Yes	4
A-100	B	66	64	No	67	No	Yes	3
A-101	B	66	65	No	68	No	Yes	3
A-102	B	66	64	No	68	No	Yes	4
A-103	B	66	64	No	67	No	Yes	3
A-104	B	66	64	No	67	No	Yes	3
A-105	B	66	63	No	66	No	Yes	3
A-106	B	66	63	No	66	No	Yes	3
A-107	B	66	63	No	66	No	Yes	3
A-108	B	66	63	No	66	No	Yes	3
A-109	B	66	63	No	66	No	Yes	3
A-110	B	66	61	No	64	No	No	3
A-111	B	66	60	No	64	No	No	4
A-112	B	66	57	No	61	No	No	4
A-113	B	66	53	No	57	No	No	4
A-114	B	66	51	No	54	No	No	3
A-115	B	66	51	No	54	No	No	3
A-116	B	66	51	No	55	No	No	4
A-117	B	66	52	No	55	No	No	3
A-118	B	66	53	No	56	No	No	3
A-119	B	66	55	No	59	No	No	4
A-120	B	66	58	No	62	No	No	4
A-121	B	66	57	No	61	No	No	4
A-122	B	66	57	No	60	No	No	3
A-123	B	66	56	No	60	No	No	4

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Table 3-6: Summary of Existing and Build Noise Levels for Bangerter Highway Under Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Under Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-124	B	66	56	No	60	No	No	4
A-125	B	66	56	No	60	No	No	4
A-126	B	66	57	No	61	No	No	4
A-127	B	66	55	No	59	No	No	4
A-128	B	66	54	No	57	No	No	3
A-129	B	66	54	No	57	No	No	3
A-130	B	66	54	No	57	No	No	3
A-131	B	66	54	No	58	No	No	4
A-132	B	66	55	No	58	No	No	3
A-133	B	66	56	No	60	No	No	4
A-134	B	66	62	No	66	No	Yes	4
A-135	B	66	62	No	66	No	Yes	4
A-136	B	66	62	No	66	No	Yes	4
A-137	B	66	62	No	66	No	Yes	4
A-138	B	66	62	No	66	No	Yes	4
A-139	B	66	62	No	66	No	Yes	4
A-140	B	66	62	No	66	No	Yes	4
A-141	B	66	64	No	67	No	Yes	3
A-142	B	66	64	No	68	No	Yes	4
A-143	B	66	63	No	66	No	Yes	3
A-144	B	66	63	No	66	No	Yes	3
A-145	B	66	63	No	66	No	Yes	3
A-146	B	66	62	No	66	No	Yes	4
A-147	B	66	62	No	66	No	Yes	4
A-148	B	66	62	No	65	No	No	3
A-149	B	66	62	No	65	No	No	3
A-150	B	66	62	No	66	No	Yes	4
A-151	B	66	62	No	66	No	Yes	4
A-152	B	66	62	No	66	No	Yes	4
A-153	B	66	62	No	66	No	Yes	4
A-154	B	66	62	No	66	No	Yes	4
A-155	B	66	62	No	66	No	Yes	4
A-156	B	66	62	No	66	No	Yes	4
A-157	B	66	62	No	66	No	Yes	4
A-158	B	66	62	No	65	No	No	3
A-159	B	66	62	No	65	No	No	3
A-160	B	66	61	No	65	No	No	4
A-161	B	66	61	No	65	No	No	4
A-162	B	66	61	No	65	No	No	4
A-163	B	66	61	No	65	No	No	4
A-164	B	66	61	No	65	No	No	4

(*continued on next page*)

Table 3-6: Summary of Existing and Build Noise Levels for Bangerter Highway Under Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Under Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-165	B	66	61	No	65	No	No	4
A-166	B	66	61	No	65	No	No	4
A-167	B	66	61	No	65	No	No	4
A-168	B	66	61	No	64	No	No	3

Table 3-7: Summary of Existing and Build Noise Levels for Bangerter Highway Hybrid Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Hybrid Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-001	B	66	50	No	54	No	No	4
A-002	B	66	51	No	55	No	No	4
A-003	B	66	52	No	56	No	No	4
A-004	B	66	56	No	60	No	No	4
A-005	B	66	55	No	60	No	No	5
A-006	B	66	54	No	58	No	No	4
A-007	B	66	50	No	55	No	No	5
A-008	B	66	50	No	54	No	No	4
A-009	B	66	53	No	57	No	No	4
A-010	B	66	59	No	63	No	No	4
A-011	B	66	58	No	62	No	No	4
A-012	B	66	64	No	68	No	Yes	4
A-013	B	66	67	Yes	72	No	Yes	5
A-014	B	66	65	No	70	No	Yes	5
A-015	B	66	64	No	70	No	Yes	6
A-016	B	66	68	Yes	74	No	Yes	6
A-017	B	66	67	Yes	72	No	Yes	5
A-018	B	66	66	Yes	70	No	Yes	4
A-019	B	66	65	No	69	No	Yes	4
A-020	B	66	69	Yes	71	No	Yes	2
A-021	B	66	64	No	67	No	Yes	3
A-022	B	66	59	No	62	No	No	3
A-023	B	66	55	No	58	No	No	3
A-024	B	66	53	No	56	No	No	3
A-025	B	66	52	No	56	No	No	4
A-026	B	66	53	No	57	No	No	4
A-027	B	66	58	No	62	No	No	4
A-028	B	66	56	No	60	No	No	4
A-029	B	66	49	No	53	No	No	4
A-030	B	66	50	No	53	No	No	3
A-031	E	71	66	No	67	No	No	1
A-032	E	71	71	Yes	72	No	Yes	1
A-033	E	71	68	No	69	No	No	1
A-034	E	71	64	No	66	No	No	2
A-035	E	71	59	No	61	No	No	2
A-036	C	66	61	No	64	No	No	3
A-037	B	66	57	No	60	No	No	3
A-038	B	66	57	No	60	No	No	3
A-039	B	66	56	No	59	No	No	3
A-040	C	66	56	No	59	No	No	3
A-041	C	66	59	No	63	No	No	4

(*continued on next page*)

Table 3-7: Summary of Existing and Build Noise Levels for Bangerter Highway Hybrid Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Hybrid Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-042	C	66	57	No	61	No	No	4
A-043	C	66	57	No	61	No	No	4
A-044	B	66	57	No	61	No	No	4
A-045	B	66	58	No	62	No	No	4
A-046	B	66	58	No	62	No	No	4
A-047	B	66	60	No	64	No	No	4
A-048	B	66	61	No	65	No	No	4
A-049	B	66	60	No	64	No	No	4
A-050	B	66	61	No	65	No	No	4
A-051	B	66	61	No	64	No	No	3
A-052	B	66	60	No	64	No	No	4
A-053	B	66	60	No	64	No	No	4
A-054	B	66	57	No	61	No	No	4
A-055	B	66	55	No	59	No	No	4
A-056	B	66	56	No	60	No	No	4
A-057	B	66	55	No	58	No	No	3
A-058	B	66	60	No	64	No	No	4
A-059	B	66	62	No	65	No	No	3
A-060	B	66	58	No	62	No	No	4
A-061	B	66	58	No	62	No	No	4
A-062	B	66	57	No	61	No	No	4
A-063	B	66	55	No	59	No	No	4
A-064	B	66	54	No	58	No	No	4
A-065	B	66	54	No	58	No	No	4
A-066	B	66	53	No	57	No	No	4
A-067	B	66	53	No	57	No	No	4
A-068	B	66	51	No	55	No	No	4
A-069	B	66	51	No	55	No	No	4
A-070	B	66	53	No	56	No	No	3
A-071	B	66	56	No	59	No	No	3
A-072	B	66	55	No	59	No	No	4
A-073	B	66	56	No	60	No	No	4
A-074	B	66	57	No	61	No	No	4
A-075	B	66	62	No	66	No	Yes	4
A-076	B	66	62	No	66	No	Yes	4
A-077	B	66	62	No	66	No	Yes	4
A-078	B	66	62	No	66	No	Yes	4
A-079	B	66	62	No	66	No	Yes	4
A-080	B	66	60	No	64	No	No	4
A-081	B	66	60	No	64	No	No	4
A-082	B	66	59	No	64	No	No	5

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Table 3-7: Summary of Existing and Build Noise Levels for Bangerter Highway Hybrid Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Hybrid Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-083	B	66	58	No	62	No	No	4
A-084	B	66	61	No	65	No	No	4
A-085	B	66	62	No	67	No	Yes	5
A-086	B	66	63	No	67	No	Yes	4
A-087	B	66	63	No	68	No	Yes	5
A-088	B	66	65	No	69	No	Yes	4
A-089	B	66	66	Yes	70	No	Yes	4
A-090	B	66	66	Yes	70	No	Yes	4
A-091	B	66	66	Yes	70	No	Yes	4
A-092	B	66	66	Yes	70	No	Yes	4
A-093	B	66	66	Yes	70	No	Yes	4
A-094	B	66	66	Yes	70	No	Yes	4
A-095	B	66	66	Yes	69	No	Yes	3
A-096	B	66	65	No	69	No	Yes	4
A-097	B	66	65	No	68	No	Yes	3
A-098	B	66	64	No	68	No	Yes	4
A-099	B	66	64	No	68	No	Yes	4
A-100	B	66	64	No	67	No	Yes	3
A-101	B	66	65	No	68	No	Yes	3
A-102	B	66	64	No	68	No	Yes	4
A-103	B	66	64	No	67	No	Yes	3
A-104	B	66	64	No	67	No	Yes	3
A-105	B	66	63	No	67	No	Yes	4
A-106	B	66	63	No	67	No	Yes	4
A-107	B	66	63	No	67	No	Yes	4
A-108	B	66	63	No	67	No	Yes	4
A-109	B	66	63	No	66	No	Yes	3
A-110	B	66	61	No	64	No	No	3
A-111	B	66	60	No	64	No	No	4
A-112	B	66	57	No	61	No	No	4
A-113	B	66	53	No	57	No	No	4
A-114	B	66	51	No	54	No	No	3
A-115	B	66	51	No	54	No	No	3
A-116	B	66	51	No	55	No	No	4
A-117	B	66	52	No	55	No	No	3
A-118	B	66	53	No	56	No	No	3
A-119	B	66	55	No	58	No	No	3
A-120	B	66	58	No	61	No	No	3
A-121	B	66	57	No	61	No	No	4
A-122	B	66	57	No	60	No	No	3
A-123	B	66	56	No	60	No	No	4

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Table 3-7: Summary of Existing and Build Noise Levels for Bangerter Highway Hybrid Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Hybrid Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-124	B	66	56	No	60	No	No	4
A-125	B	66	56	No	60	No	No	4
A-126	B	66	57	No	61	No	No	4
A-127	B	66	55	No	59	No	No	4
A-128	B	66	54	No	57	No	No	3
A-129	B	66	54	No	57	No	No	3
A-130	B	66	54	No	57	No	No	3
A-131	B	66	54	No	58	No	No	4
A-132	B	66	55	No	59	No	No	4
A-133	B	66	56	No	60	No	No	4
A-134	B	66	62	No	65	No	No	3
A-135	B	66	62	No	66	No	Yes	4
A-136	B	66	62	No	66	No	Yes	4
A-137	B	66	62	No	66	No	Yes	4
A-138	B	66	62	No	66	No	Yes	4
A-139	B	66	62	No	66	No	Yes	4
A-140	B	66	62	No	66	No	Yes	4
A-141	B	66	64	No	67	No	Yes	3
A-142	B	66	64	No	68	No	Yes	4
A-143	B	66	63	No	66	No	Yes	3
A-144	B	66	63	No	66	No	Yes	3
A-145	B	66	63	No	66	No	Yes	3
A-146	B	66	62	No	65	No	No	3
A-147	B	66	62	No	65	No	No	3
A-148	B	66	62	No	65	No	No	3
A-149	B	66	62	No	65	No	No	3
A-150	B	66	62	No	65	No	No	3
A-151	B	66	62	No	65	No	No	3
A-152	B	66	62	No	66	No	Yes	4
A-153	B	66	62	No	66	No	Yes	4
A-154	B	66	62	No	65	No	No	3
A-155	B	66	62	No	65	No	No	3
A-156	B	66	62	No	65	No	No	3
A-157	B	66	62	No	65	No	No	3
A-158	B	66	62	No	65	No	No	3
A-159	B	66	62	No	65	No	No	3
A-160	B	66	61	No	65	No	No	4
A-161	B	66	61	No	65	No	No	4
A-162	B	66	61	No	65	No	No	4
A-163	B	66	61	No	65	No	No	4
A-164	B	66	61	No	65	No	No	4

(*continued on next page*)

Table 3-7: Summary of Existing and Build Noise Levels for Bangerter Highway Hybrid Option

Receptor	NAC	UDOT NAC $L_{eq}(h)$	Existing		With Bangerter Highway Hybrid Option			
			Existing Noise Levels (dBA)	Existing Over NAC	Noise Levels (dBA)	**≥ 10** dBA Increase over Existing Noise Level?	**≥ UDOT** NAC?	Difference
A-165	B	66	61	No	64	No	No	3
A-166	B	66	61	No	64	No	No	3
A-167	B	66	61	No	64	No	No	3
A-168	B	66	61	No	64	No	No	3

4.0 NOISE ABATEMENT

According to UDOT's Noise Abatement Policy, specific conditions must be met before traffic noise abatement is implemented. Noise abatement must be considered both feasible and reasonable.

The factors considered when determining whether abatement is feasible are:

- **Engineering Considerations:** Engineering considerations such as safety, presence of cross streets, sight distance, access to adjacent properties, wall height, topography, drainage, utilities, maintenance access, and maintenance of the abatement measure must be taken into account as part of establishing feasibility. Noise-abatement measures are not intended to serve as privacy fences or safety barriers. Abatement measures installed on structures will not exceed 10 feet in height measured from the top of deck or roadway to the top of the noise wall. Noise walls will not be installed on structures that require retrofitting to accommodate the noise-abatement measure. Noise-abatement measures will be considered if the project meets the criteria established in this policy if structure replacement is included as part of the project. Abatement measures shall be consistent with general American Association of State Highway and Transportation Officials (AASHTO) design principles.
- **Safety on Urban Non-access-controlled Roads:** To avoid a damaged barrier from becoming a safety hazard, in the event of a failure, barrier height shall be no greater than the distance from the back-of-curb to the face of the proposed barrier. Because the distance from the back-of-curb to the face of a proposed barrier varies, barrier heights that meet this safety requirement might also vary.
- **Acoustic Feasibility:** Noise abatement must be considered "acoustically feasible." This is defined as achieving at least a 5-dBA highway traffic noise reduction for at least 50% of front-row receptors.

The factors considered when determining whether abatement is reasonable are:

- **Noise-abatement Design Goal.** Every reasonable effort should be made to obtain substantial noise reductions. UDOT defines the minimum noise reduction (design goal) from proposed abatement measures to be 7 dBA or greater for at least 35% of front-row receptors.
- **Cost-effectiveness.** The cost of a noise-abatement measure must be deemed reasonable in order for it to be included in a project. Noise-abatement costs are based on a fixed unit cost of $20 per square foot, multiplied by the height and length of the wall, in addition to the cost of any other item associated with the abatement measure that is critical to safety. The fixed unit cost is based on the historical average cost of noise walls installed on UDOT projects and is reviewed at regular intervals, not to exceed 5 years. The cost-effectiveness of abatement is determined by analyzing the cost of a wall that would provide a noise reduction of 5 dBA or more for a benefited receptor. A reasonable cost is considered to be a maximum of $30,000 per benefited

receptor for activity category B and $360 per linear foot for activity categories A, C, D, or E. If the anticipated cost of the noise-abatement measure is less than the allowable cost, then the abatement is deemed reasonable.

The cost effectiveness calculation needs to take into account the cost of any items associated with the abatement measure that is critical to safety, such as snow storage and safety barriers. Therefore, the cost to construct items necessary for snow storage and safety barriers was taken into consideration as part of the cost effectiveness calculation.

- **Viewpoints of Property Owners and Residents.** As part of the final design phase, public balloting would take place if noise-abatement measures appear to meet the criteria in UDOT's Noise Abatement Policy.

4.1 Noise Barriers

For a noise barrier to be effective, it must be high enough and long enough to block the view of the noise source from the receptor's perspective. FHWA's *Highway Traffic Noise: Analysis and Abatement Guidance* states that a good rule of thumb is that the noise barrier should extend 4 times as far in each direction as the distance from the receptor to the barrier. For instance, if the receptor is 50 feet from the proposed noise barrier, the barrier needs to extend at least 200 feet on either side of the receptor in order to shield the receptor from noise traveling past the ends of the barrier.

Openings in noise barriers for driveway and cross street access greatly reduce the effectiveness of noise barriers. Therefore, impacted receptors with direct access onto local streets do not qualify for noise barriers.

The anticipated cost of each wall was calculated by multiplying the wall area and the wall cost per square foot ($20). The allowable cost was calculated using two variables: (1) activity category B allowable cost and (2) activity category C allowable cost. The activity category B allowable cost was calculated by multiplying the allowable cost per benefited receptor ($30,000) by the number of receptors benefited by the wall. The activity category C allowable cost was calculated by multiplying the length of the wall associated with activity category C land use by the allowable cost for activity category C land ($360 per linear foot). These two variables, activity category B allowable cost and activity category C allowable cost, were combined to produce the allowable cost for each wall (see Appendix D, *Noise Wall Analysis*, for detailed wall analyses).

In an effort to provide an objective analysis of traffic noise reduction at impacted receptors, a variety of noise wall heights were considered. If multiple wall heights would meet noise-abatement requirements, the shortest wall height found to be both feasible and reasonable would be recommended for balloting. A total of two noise walls were considered for each option. See the noise wall maps in Appendix C, *Build Scenario Noise Walls*.

4.2 Barrier Analysis for Bangerter Highway Over Option

Barrier 1

A noise wall on the east side of Bangerter Highway from about 12900 South to 13050 South was evaluated where noise impacts are expected to a total of 10 residential receptors (A-012 to A-021). There are 10 front-row residential receptors in this area. There is an existing 6-foot-tall masonry fence on the west side of the subdivision near 13000 South. The northern section of this 6-foot-tall masonry fence would be removed by the Bangerter Highway Over Option but would need to be replaced pursuant to UDOT's right-of-way policies. The proposed Barrier 1 would be a separate, longer structure both north and south along an alignment parallel to the existing masonry fence. The noise wall would be located near the clear zone for northbound Bangerter Highway traffic and would be about 1,230 feet long (see Appendix C, *Build Scenario Noise Walls*).

As summarized in Table 4-1, UDOT evaluated the proposed wall at heights varying from 10 to 20 feet (for detailed information, see Appendix D, *Noise Wall Analysis*).

Table 4-1: Noise-abatement Analysis for Barrier 1 for Bangerter Highway Over Option

Barrier Height (feet)	Feasible		Reasonable					Is Barrier Feasible and Reasonable?
	% Front-row with 5-dBA Reduction	Acoustically Feasible?[a]	% Front-row with 7-dBA Reduction	Noise Abatement Design Goal?[b]	Anticipated Cost	Allowable Cost	Cost-effective?[c]	
10	30%	No	N/A	N/A	N/A	N/A	N/A	No
12	90%	Yes	40%	Yes	$295,200	$270,000	No	No
14	100%	Yes	60%	Yes	$344,400	$300,000	No	No
16	100%	Yes	80%	Yes	$393,600	$300,000	No	No
18	100%	Yes	80%	Yes	$442,800	$300,000	No	No
20	100%	Yes	100%	Yes	$492,000	$300,000	No	No

[a] 5-dBA reduction for at least 50% of front-row receptors.
[b] 7-dBA reduction for at least 35% of front-row receptors.
[c] Anticipated cost is less than allowable cost.

Walls 10 feet tall or shorter are not acoustically feasible. Walls ranging in heights from 12 feet tall to 20 feet tall do not meet UDOT's cost-effective criterion for reasonableness. Therefore, walls are not recommended for balloting. In accordance with UDOT's right-of-way policies, the northern section of the 6-foot-tall masonry fence would be replaced.

Barrier 2

A noise wall on the east side of Bangerter Highway from about 13650 South to 13750 South was evaluated where noise impacts are expected to a total of 67 residential receptors (A-050, A-059, A-075 to A-079, A-084 to A-109, and A-134 to A-167). There are 29 front-row residential receptors in this area. There are no existing noise walls in this area. The noise wall would be located near the clear zone for northbound Bangerter Highway traffic and across the bridge that spans 3600 West. The wall would be about 2,119 feet long (1,864 feet long on ground and 255 feet on structure) (see Figure C-1, *Noise Wall Analysis for All Options*).

As summarized in Table 4-2, UDOT evaluated the proposed wall at heights varying from 12 to 20 feet within the clear zone of Bangerter Highway and 6 feet high across the structure over 3600 West (for detailed information, see Appendix D, *Noise Wall Analysis*).

Table 4-2: Noise-abatement Analysis for Barrier 2 for Bangerter Highway Over Option

Barrier Height (feet)	Feasible		Reasonable					Is Barrier Feasible and Reasonable?
	% Front-row with 5-dBA Reduction	Acoustically Feasible?[a]	% Front-row with 7-dBA Reduction	Noise Abatement Design Goal?[b]	Anticipated Cost	Allowable Cost	Cost-effective?[c]	
12	62%	Yes	0%	No	N/A	N/A	N/A	No
14	66%	Yes	41%	Yes	$552,512	$1,350,000	Yes	Yes
16	76%	Yes	52%	Yes	$627,071	$1,830,000	Yes	Yes
18	76%	Yes	52%	Yes	$701,631	$2,070,000	Yes	Yes
20	76%	Yes	59%	Yes	$776,191	$2,250,000	Yes	Yes

[a] 5-dBA reduction for at least 50% of front-row receptors.
[b] 7-dBA reduction for at least 35% of front-row receptors.
[c] Anticipated cost is less than allowable cost.

Walls 12 feet tall or shorter do not meet UDOT's design goal criterion for reasonableness. Walls ranging in heights from 14 feet tall to 20 feet tall are acoustically feasible, meet the noise abatement design goal, and are cost-reasonable. Therefore, a 2,119-foot-long noise wall that is 14 feet high on ground and 6 feet high on structure is recommended for balloting.

Balloting for and construction of this wall would occur only when funding is available for the dual northbound off-ramp and extension of the southbound on-ramp east of 3600 West.

4.3 Barrier Analysis for Bangerter Highway Under Option

UDOT evaluated noise walls for two locations along Bangerter Highway where noise impacts would occur with the Bangerter Highway Under Option. One noise wall, Barrier 2, was found to be both feasible and reasonable. Barrier 1 was found to be feasible but not reasonable. The analyses for the proposed Barriers 1 and 2 are summarized below.

Barrier 1

A noise wall on the east side of Bangerter Highway from about 12900 South to 13050 South was evaluated where noise impacts are expected to a total of 10 residential receptors (A-012 to A-021). There are 10 front-row residential receptors in this area. There is an existing 6-foot-tall masonry fence on the west side of the subdivision near 13000 South. The northern section of this 6-foot-tall masonry fence would be removed by the Bangerter Highway Under Option but would need to be replaced pursuant to UDOT's right-of-way policies. The proposed Barrier 1 is a separate, longer structure both north and south along an alignment parallel to the existing masonry fence. The noise wall would be located near the clear zone for northbound Bangerter Highway traffic and would be about 1,230 feet long (see Appendix C, *Build Scenario Noise Walls*).

As summarized in Table 4-3, UDOT evaluated the proposed wall at heights varying from 12 to 20 feet (for detailed information, see Appendix D, *Noise Wall Analysis*).

Table 4-3: Noise-abatement Analysis for Barrier 1 for Bangerter Highway Under Option

Barrier Height (feet)	Feasible		Reasonable					Is Barrier Feasible and Reasonable?
	% Front-row with 5-dBA Reduction	Acoustically Feasible?[a]	% Front-row with 7-dBA Reduction	Noise Abatement Design Goal?[b]	Anticipated Cost	Allowable Cost	Cost-effective?[c]	
12	90%	Yes	30%	No	N/A	N/A	N/A	No
14	100%	Yes	50%	Yes	$344,400	$300,000	No	No
16	100%	Yes	80%	Yes	$393,600	$300,000	No	No
18	100%	Yes	90%	Yes	$442,800	$300,000	No	No
20	100%	Yes	100%	Yes	$492,000	$300,000	No	No

[a] 5-dBA reduction for at least 50% of front-row receptors.
[b] 7-dBA reduction for at least 35% of front-row receptors.
[c] Anticipated cost is less than allowable cost.

Walls 12 feet tall or shorter do not meet UDOT's design goal criterion for reasonableness. Walls ranging in heights from 14 feet tall to 20 feet tall do not meet UDOT's cost-effective criterion for reasonableness. Therefore, walls are not recommended for balloting. In accordance with UDOT's right-of-way policies, the northern section of the 6-foot-tall masonry fence would be replaced.

Barrier 2

A noise wall on the east side of Bangerter Highway from about 13650 South to 13750 South was evaluated where noise impacts are expected to a total of 54 residential receptors (A-059, A-075 to A-079, A-084 to A-109, A-134 to A-147, and A-150 to A-157). There are 29 front-row residential receptors in this area. There are no existing noise walls in this area. The noise wall would be located near the clear zone for northbound Bangerter Highway traffic and across the bridge that spans 3600 West. The wall would be about 2,119 feet long (1,864 feet long on ground and 255 feet on structure) (see Figure C-1, *Noise Wall Analysis for All Options*).

As summarized in Table 4-4, UDOT evaluated the proposed wall at heights varying from 16 to 20 feet within the clear zone of Bangerter Highway and 6 feet high across the structure over 3600 West (for detailed information, see Appendix D, *Noise Wall Analysis*).

Table 4-4: Noise-abatement Analysis for Barrier 2 for Bangerter Highway Under Option

Barrier Height (feet)	Feasible		Reasonable					Is Barrier Feasible and Reasonable?
	% Front-row with 5-dBA Reduction	Acoustically Feasible?[a]	% Front-row with 7-dBA Reduction	Noise Abatement Design Goal?[b]	Anticipated Cost	Allowable Cost	Cost-effective?[c]	
16	62%	Yes	34%	No	N/A	N/A	N/A	No
18	72%	Yes	45%	Yes	$701,631	$1,800,000	Yes	Yes
20	72%	Yes	48%	Yes	$776,191	$1,920,000	Yes	Yes

[a] 5-dBA reduction for at least 50% of front-row receptors.
[b] 7-dBA reduction for at least 35% of front-row receptors.
[c] Anticipated cost is less than allowable cost.

Walls 16 feet tall or shorter do not meet UDOT's design goal criterion for reasonableness. Walls ranging in heights from 18 feet tall to 20 feet tall are acoustically feasible, meet the noise abatement design goal, and are cost-reasonable. Therefore, a 2,119-foot-long noise wall that is 18 feet high on ground and 6 feet high on structure is recommended for balloting.

Balloting for and construction of this wall would occur only when funding is available for the dual northbound off-ramp and extension of the southbound on-ramp east of 3600 West.

4.4 Barrier Analysis for Bangerter Highway Hybrid Option

UDOT evaluated noise walls for two locations along Bangerter Highway where noise impacts would occur with the Bangerter Highway Hybrid Option. One noise wall, Barrier 2, was found to be both feasible and reasonable. Barrier 1 was found to be feasible but not reasonable. The analyses for the proposed Barriers 1 and 2 are summarized below.

Barrier 1

A noise wall on the east side of Bangerter Highway from about 12900 South to 13050 South was evaluated where noise impacts are expected to a total of 10 residential receptors (A-012 to A-021). There are 10 front-row residential receptors in this area. An existing 6-foot-tall masonry fence is the existing condition in this location. There is an existing 6-foot-tall masonry fence on the west side of the subdivision near 13000 South. The northern section of this 6-foot-tall masonry fence would be removed by the Bangerter Highway Hybrid Option but would need to be replaced pursuant to UDOT's right-of-way policies. The proposed Barrier 1 is a separate, longer structure both north and south along an alignment parallel to the existing masonry fence. The noise wall would be located near the clear zone for northbound Bangerter Highway traffic and would be about 1,230 feet long (see Appendix C, *Build Scenario Noise Walls*).

As summarized in Table 4-5, UDOT evaluated the proposed wall at heights varying from 12 to 20 feet (for detailed information, see Appendix D, *Noise Wall Analysis*).

Table 4-5: Noise-abatement Analysis for Barrier 1 for Bangerter Highway Hybrid Option

Barrier Height (feet)	Feasible		Reasonable					Is Barrier Feasible and Reasonable?
	% Front-row with 5-dBA Reduction	Acoustically Feasible?[a]	% Front-row with 7-dBA Reduction	Noise Abatement Design Goal?[b]	Anticipated Cost	Allowable Cost	Cost-effective?[c]	
12	80%	Yes	20%	No	N/A	N/A	N/A	No
14	100%	Yes	50%	Yes	$344,400	$300,000	No	No
16	100%	Yes	80%	Yes	$393,600	$300,000	No	No
18	100%	Yes	80%	Yes	$442,800	$300,000	No	No
20	100%	Yes	90%	Yes	$492,000	$300,000	No	No

[a] 5-dBA reduction for at least 50% of front-row receptors.
[b] 7-dBA reduction for at least 35% of front-row receptors.
[c] Anticipated cost is less than allowable cost.

Walls 12 feet tall or shorter are do not meet UDOT's design goal criterion for reasonableness. Walls ranging in heights from 14 feet tall to 20 feet tall do not meet UDOT's cost-effective criterion for reasonableness. Therefore, walls are not recommended for balloting. In accordance with UDOT's right-of-way policies, the northern section of the 6-foot-tall masonry fence would be replaced.

Barrier 2

A noise wall on the east side of Bangerter Highway from about 13650 South to 13750 South was evaluated where noise impacts are expected to a total of 43 residential receptors (A-075 to A-079, A-085 to A-109, A-135 to A-145, and A-152 to A-153). There are 29 front-row residential receptors in this area. There are no existing noise walls in this area. The noise wall would be located near the clear zone for northbound Bangerter Highway traffic and across the bridge that spans 3600 West. The wall would be about 2,119 feet long (1,864 feet long on ground and 255 feet on structure) (see Figure C-1, *Noise Wall Analysis for All Options*).

As summarized in Table 4-6, UDOT evaluated the proposed wall at heights varying from 16 to 20 feet within the clear zone of Bangerter Highway and 6 feet high across the structure over 3600 West (for detailed information, see Appendix D, *Noise Wall Analysis*).

Table 4-6: Noise-abatement Analysis for Barrier 2 for Bangerter Highway Hybrid Option

Barrier Height (feet)	Feasible		Reasonable					Is Barrier Feasible and Reasonable?
	% Front-row with 5-dBA Reduction	Acoustically Feasible?[a]	% Front-row with 7-dBA Reduction	Noise Abatement Design Goal?[b]	Anticipated Cost	Allowable Cost	Cost-effective?[c]	
16	62%	Yes	3%	No	N/A	N/A	N/A	No
18	62%	Yes	38%	Yes	$701,631	$1,290,000	Yes	Yes
20	66%	Yes	52%	Yes	$776,191	$1,410,000	Yes	Yes

[a] 5-dBA reduction for at least 50% of front-row receptors.
[b] 7-dBA reduction for at least 35% of front-row receptors.
[c] Anticipated cost is less than allowable cost.

Walls 16 feet tall or shorter do not meet UDOT's design goal criterion for reasonableness. Walls ranging in height from 18 feet tall to 20 feet tall are acoustically feasible, meet the noise abatement design goal, and are cost-reasonable. Therefore, a 2,119-foot-long noise wall that is 18 feet high on ground and 6 feet high on structure is recommended for balloting.

Balloting for and construction of this wall would occur only when funding is available for the dual northbound off-ramp and extension of the southbound on-ramp east of 3600 West.

5.0 CONSTRUCTION IMPACTS

Construction noise impacts are considered temporary and will be minimized by following UDOT Special Provision 01355M (Environmental Compliance) and Special Provision 00555 (Prosecution and Progress). UDOT does not expect that normal activities would be disrupted for an extended time, since no receptors are expected to be exposed to construction noise for a long time.

6.0 INFORMATION FOR LOCAL OFFICIALS

According to UDOT's Noise Abatement Policy, UDOT must provide to local governments an estimated distance from the edge of pavement to where the worst-hour $L_{eq}(h)$ levels of 66 dBA and 71 dBA occur for land uses with activity category G.

There are undeveloped areas located in the northwest, southwest, and northeast quadrants of the Bangerter Highway and 13400 South intersection. Table 6-1 lists the distances from the edge of the roadway pavement to the locations where the worst-hour $L_{eq}(h)$ levels of 66 dBA and 71 dBA would occur. The 66-dBA contour line represents the areas that would have residential noise impacts under UDOT's Noise Abatement Policy. The 71-dBA contour line represents the areas that would have noise impacts at hotels, motels, offices, restaurants and bars, and other undeveloped lands, properties, or activities not included in activity categories A–D or F under UDOT's Noise Abatement Policy (see Appendix E, *Noise Levels on Undeveloped Land*).

Table 6-1: Contour Distance to Future Noise Levels

Roadway	Approximate Distance from Edge of Bangerter Highway Pavement to Noise-level Contour (All Options)	
	66-dBA Noise-level Contour	71-dBA Noise-level Contour
Northwest Quadrant – north of 13400 South and east of Bangerter Highway	130 feet	30 feet
Southwest Quadrant – south of 13400 South and west of Bangerter Highway	120 feet	20 feet
Northeast Quadrant – north of 13400 South and east of Bangerter Highway	220 feet	120 feet

7.0 CONCLUSIONS

Bangerter Highway Over Option. Overall, noise levels with the Bangerter Highway Over Option would range from 53 to 73 dBA, compared to the existing conditions of 49 to 71 dBA.

Bangerter Highway Under Option. Overall, noise levels with the Bangerter Highway Under Option would range from 53 to 73 dBA compared to the existing conditions of 49 to 71 dBA.

Bangerter Highway Hybrid Option. Overall, noise levels with the Bangerter Highway Hybrid Option would range from 53 to 74 dBA compared to the existing conditions of 49 to 71 dBA.

Recommended noise walls in the noise study area that met the requirements of UDOT's Noise Abatement Policy are discussed below. The final decision to build a noise barrier will not be made until the project design is completed and refined utility and right-of-way costs are available. Reasonableness will be revisited using refined costs prior to balloting for benefited receptors. A barrier identified as recommended for balloting is a barrier that has been shown to be both feasible and reasonable. However, that finding is not a commitment to build a barrier.

7.1 Summary of Evaluated Walls for Bangerter Highway Over Option

Table 7-1 summarizes the evaluated walls for the Bangerter Highway Over Option.

Table 7-1: Bangerter Highway Over Option Evaluated Walls

Wall	Length (feet)	Minimum Height (feet)	Determination
1	Not Recommended		
2	2,119	14 on ground, 6 on structure	Recommended for balloting

7.2 Summary of Evaluated Walls for Bangerter Highway Under Option

Table 7-2 summarizes the evaluated walls for the Bangerter Highway Under Option.

Table 7-2: Bangerter Highway Under Option Evaluated Walls

Wall	Length (feet)	Minimum Height (feet)	Determination
1	Not Recommended		
2	2,119	18 on ground, 6 on structure	Recommended for balloting

7.3 Summary of Evaluated Walls for Bangerter Highway Hybrid Option

Table 7-3 summarizes the evaluated walls for the Bangerter Highway Hybrid Option.

Table 7-3: Bangerter Highway Hybrid Option Evaluated Walls

Wall	Length (feet)	Minimum Height (feet)	Determination
1	Not Recommended		
2	2,119	18 on ground, 6 on structure	Recommended for balloting

8.0 REFERENCES

[CEQ] Council on Environmental Quality

1970 Environmental Quality: The First Annual Report of the Council on Environmental Quality. U.S. Government Printing Office, Washington, DC.

[EPA] U.S. Environmental Protection Agency

1971 Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances. NTID300.1. Prepared by Bolt, Beranek, & Newman, Boston, Mass. U.S. Government Printing Office, Washington, DC.

[FHWA] Federal Highway Administration

2011 Highway Traffic Noise: Analysis and Abatement Guidance. FHWA-HEP-10-025. https://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/analysis_and_abatement_guidance/revguidance.pdf. December.

Gharabegian, A., K.M. Cosgrove, J.R. Pehrson, and T.D. Trinh

1985 Forest Fire Fighters' Noise Exposure. Noise Control Engineering Journal 25(3): 96–111.

Toth, W.J.

1979 Noise-Abatement Techniques for Construction Equipment. HS-803 293; DOT-TSC-NHTSA-79-45: PB-300 948. U.S. Department of Transportation, National Highway Traffic Safety Administration, Washington, DC.

[UDOT] Utah Department of Transportation

2020 Noise Abatement. UDOT 08A2-1. Effective November 6, 1987. Revised May 28, 2020. https://www.udot.utah.gov/main_old/uconowner.gf?n=10496602977480171.

Appendix A: Noise Monitoring Data Sheets and Existing Noise Receptor Maps

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET Reading: ML-1

Project Description: Bangerter 12 Environmental – 13400 South

Noise Source: Bangerter Highway Date: 7/29/2021 Personnel: KK & JM

Equipment	Type	Serial #
Sound Level Meter	Larson Davis 824	A2635
Microphone/Preamp	Larson Davis 2541	7490
Calibrator	Larson Davis CAL200	3669

SLM SETTINGS (circle one) FAST SLOW

WEIGHTING (circle one) A Lin.

Location Description: North side of subdivision on east side of Bangerter Highway in empty field.

SITE SKETCH: Including noise source, receptors, reference distances, North arrow, wind direction arrow, terrain and shielding, roadway profile, and direct lines of sight:

N

GPS 40 31'01" N 111 59'02" W
See attached photos of location.

Data File #5.
Leq 70.0 dBA, Max 83.4 dBA, Min 43.5 dBA

Neighborhood wall to the south is 72-inches tall with panel wall.

2 lanes SB and 2 lanes NB during monitoring due to construction at Bangerter 12600 South. Lanes were shifted slightly closer to monitoring location. Speeds were likely lower than posted speed limit during monitoring period due to construction (probably in the 45-55 mph range).

Start Time:	Stop Time:	Duration:
1:19 PM	1:39 PM	20 min.

Wind Speed/Direction: 4-8 MPH from NE Percentiles: Sunny

Temperature: 84 deg. F Humidity: 46%

Calibration results before: 114.3 dBA and after 114.3 dBA

Traffic Count Roadway: Bangerter Highway

Direction	Auto	Med. Truck	Heavy Truck	Bus	Motorcycles
SB	418	7	14	0	1
NB	384	3	3	0	0

*Note roadway direction in table

ML-1 NW

ML-1 SW

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET Reading: ML-2

Project Description: Bangerter 12 Environmental – 13400 South

Noise Source: Bangerter Highway Date: 7/29/2021 Personnel: KK & JM

Equipment	Type	Serial #
Sound Level Meter	Larson Davis 824	A2635
Microphone/Preamp	Larson Davis 2541	7490
Calibrator	Larson Davis CAL200	3669

SLM SETTINGS (circle one) FAST SLOW

WEIGHTING (circle one) A Lin.

Location Description: Park strip of residential property in subdivision on east side of Bangerter Highway. Address 3853 W. Sand Creek Dr., Riverton, UT.

SITE SKETCH: Including noise source, receptors, reference distances, North arrow, wind direction arrow, terrain and shielding, roadway profile, and direct lines of sight:

N

GPS 40 30'58" N 111 58'59" W
See attached photos of location.

Data File #6
Leq 48.9 dBA, Max 71.4 dBA, Min 38.1 dBA

Neighborhood wall between Bangerter and subdivision is 72-inches tall with panel wall.

The number of lanes were 3 lanes SB and 3 lanes NB on the south end of the subdivision and 2 lanes NB and 2 lanes SB on the north end of the subdivision near ML-2 due to 12600 South construction during monitoring. The speeds were lower than due to the reduction in lanes and construction zone by 12600 South (probably in the 45-55 mph range).

Start Time:	Stop Time:	Duration:
1:58 PM	2:18 PM	20 min.

Wind Speed/Direction: 4-8 MPH from NE Percentiles: Partly Cloudy

Temperature: 84 deg. F Humidity: 46%

Calibration results before: 114.3 dBA and after 114.3 dBA

Traffic Count Roadway: Bangerter Highway

Direction	Auto	Med. Truck	Heavy Truck	Bus	Motorcycles
SB	455	11	14	0	0
NB	450	4	6	0	1

*Note roadway direction in table

ML-2 NW

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET Reading: ML-3

Project Description: Bangerter 12 Environmental – 13400 South

Noise Source: 13400 South Date: 7/28/2021 Personnel: KK & JM

Equipment	Type	Serial #
Sound Level Meter	Larson Davis 824	A2635
Microphone/Preamp	Larson Davis 2541	7490
Calibrator	Larson Davis CAL200	3669

SLM SETTINGS (circle one) FAST SLOW

WEIGHTING (circle one) A Lin.

Location Description: Parking lot of Einstein's' Bagels. Commercial property on north side of 13400 South. Address 3648 W. 13400 S., Riverton, UT.

SITE SKETCH: Including noise source, receptors, reference distances, North arrow, wind direction arrow, terrain and shielding, roadway profile, and direct lines of sight:

N

GPS 40 30'29" N 111 58'41" W
See attached photos of location.

Data File #4
Leq 57.2 dBA, Max 77.1 dBA, Min 49.2 dBA

3 lanes EB and 3 lanes WB during monitoring. Speeds were mostly free-flow at posted speed limit (35 mph) during monitoring period. Some slower traffic due to signals on 13400 South. Some cars drove through the parking lot during the monitoring period.

Start Time:	Stop Time:	Duration:
4:50 PM	5:10 PM	20 min.

Wind Speed/Direction: 3-5 MPH from N Percentiles: Partly Cloudy

Temperature: 88 deg. F Humidity: 40%

Calibration results before: 114.1 dBA and after 114.1 dBA

Traffic Count Roadway: 13400 South

Direction	Auto	Med. Truck	Heavy Truck	Bus	Motorcycles
EB	263	0	0	0	1
WB	209	0	1	0	1

*Note roadway direction in table

ML-3 NW

ML-3 S

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET Reading: ML-4

Project Description: Bangerter 12 Environmental – 13400 South

Noise Source: 13400 South Date: 7/28/2021 Personnel: KK & JM

Equipment	Type	Serial #
Sound Level Meter	Larson Davis 824	A2635
Microphone/Preamp	Larson Davis 2541	7490
Calibrator	Larson Davis CAL200	3669

SLM SETTINGS (circle one) FAST SLOW

WEIGHTING (circle one) A Lin.

Location Description: Side yard north of outside deck of Wicked Peel Restaurant. Commercial property on south side of 13400 South. Address 3956 W. 13400 S., Riverton, UT.

SITE SKETCH: Including noise source, receptors, reference distances, North arrow, wind direction arrow, terrain and shielding, roadway profile, and direct lines of sight:

N

GPS 40 30'27" N 111 59'06" W
See attached photos of location.

Data File #1
Leq 64.0 dBA, Max 88.9 dBA, Min 51.0 dBA

3 lanes EB and 3 lanes WB during monitoring. Speeds were mostly free-flow at posted speed limit (35 mph) during monitoring period. Some slower traffic due to signals on 13400 South. Some cars drove in on access road lot during the monitoring period.

Start Time:	Stop Time:	Duration:
3:00 PM	3:20 PM	20 min.

Wind Speed/Direction: 0-5 MPH from N Percentiles: Partly Cloudy

Temperature: 93 deg. F Humidity: 26%

Calibration results before: 114.1 dBA and after 114.1 dBA

Traffic Count Roadway: 13400 South

Direction	Auto	Med. Truck	Heavy Truck	Bus	Motorcycles
EB	560	8	13	0	3
WB	700	10	17	0	1

*Note roadway direction in table

ML-4 NE

ML-4 SW

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET Reading: ML-5

Project Description: Bangerter 12 Environmental – 13400 South

Noise Source: Bangerter Highway Date: 7/28/2021 Personnel: KK & JM

Equipment	Type	Serial #
Sound Level Meter	Larson Davis 824	A2635
Microphone/Preamp	Larson Davis 2541	7490
Calibrator	Larson Davis CAL200	3669

SLM SETTINGS (circle one) FAST SLOW

WEIGHTING (circle one) A Lin.

Location Description: CR Hamilton Sports Complex Softball field. Recreational property on west side of Bangerter Highway. Address 3620 W. 13800 S., Riverton, UT.

SITE SKETCH: Including noise source, receptors, reference distances, North arrow, wind direction arrow, terrain and shielding, roadway profile, and direct lines of sight:

N

GPS 40 30'14" N 111 58'49" W
See attached photos of location.

Data File #2
Leq 62.5 dBA, Max 76.3 dBA, Min 51.0 dBA

3 lanes NB and 3 lanes SB during monitoring. CFI NB exit lanes were also just north of the monitoring location. Speeds were mostly free-flow at posted speed limit (55-60 mph) during monitoring period with the exception of some traffic slowing for NB CFI left turn movements. Additional southbound on-ramp is located just north of the ML-5 location and SB acceleration noise could be heard from ML-5.

Start Time:	Stop Time:	Duration:
3:36 PM	3:56 PM	20 min.

Wind Speed/Direction: 5-8 MPH from N Percentiles: Partly Cloudy

Temperature: 90 deg. F Humidity: 38%

Calibration results before: 114.1 dBA and after 114.1 dBA

Traffic Count Roadway: Bangerter Highway

Direction	Auto	Med. Truck	Heavy Truck	Bus	Motorcycles
SB	432	7	17	0	0
NB	759	6	17	0	2

*Note roadway direction in table

ML-5 N

ML-5 NE

ML-5 W

SHORT-TERM TRAFFIC NOISE MONITORING LOG SHEET Reading: ML-6

Project Description: Bangerter 12 Environmental – 13400 South

Noise Source: Bangerter Highway Date: 7/28/2021 Personnel: KK & JM

Equipment	Type	Serial #
Sound Level Meter	Larson Davis 824	A2635
Microphone/Preamp	Larson Davis 2541	7490
Calibrator	Larson Davis CAL200	3669

SLM SETTINGS (circle one) FAST SLOW

WEIGHTING (circle one) A Lin.

Location Description: Backyard of residential subdivision Rose Creek Crossing. Residential property on east side of Bangerter Highway. Address 13613 S. Pyrenees Ave., Riverton, UT.

SITE SKETCH: Including noise source, receptors, reference distances, North arrow, wind direction arrow, terrain and shielding, roadway profile, and direct lines of sight:

N

GPS 40 30'06" N 111 58'25" W
See attached photos of location.

Data File #3
Leq 61.1 dBA, Max 81.3 dBA, Min 46.4 dBA

3 lanes NB and 3 lanes SB during monitoring. Speeds were mostly free-flow at posted speed limit (55-60 mph) during monitoring period with the exception of some traffic slowing for NB CFI left turn movements. Occasional dog barking, air conditioner units, and lawn maintenance equipment in general area during monitoring period.

Start Time:	Stop Time:	Duration:
4:15 PM	4:35 PM	20 min.

Wind Speed/Direction: 2-5 MPH from N Percentiles: Partly Cloudy

Temperature: 90 deg. F Humidity: 39%

Calibration results before: 114.1 dBA and after 114.1 dBA

Traffic Count Roadway: Bangerter Highway

Direction	Auto	Med. Truck	Heavy Truck	Bus	Motorcycles
SB	619	7	15	0	2
NB	803	8	15	0	4

*Note roadway direction in table

ML-6 SE

ML-6 SW

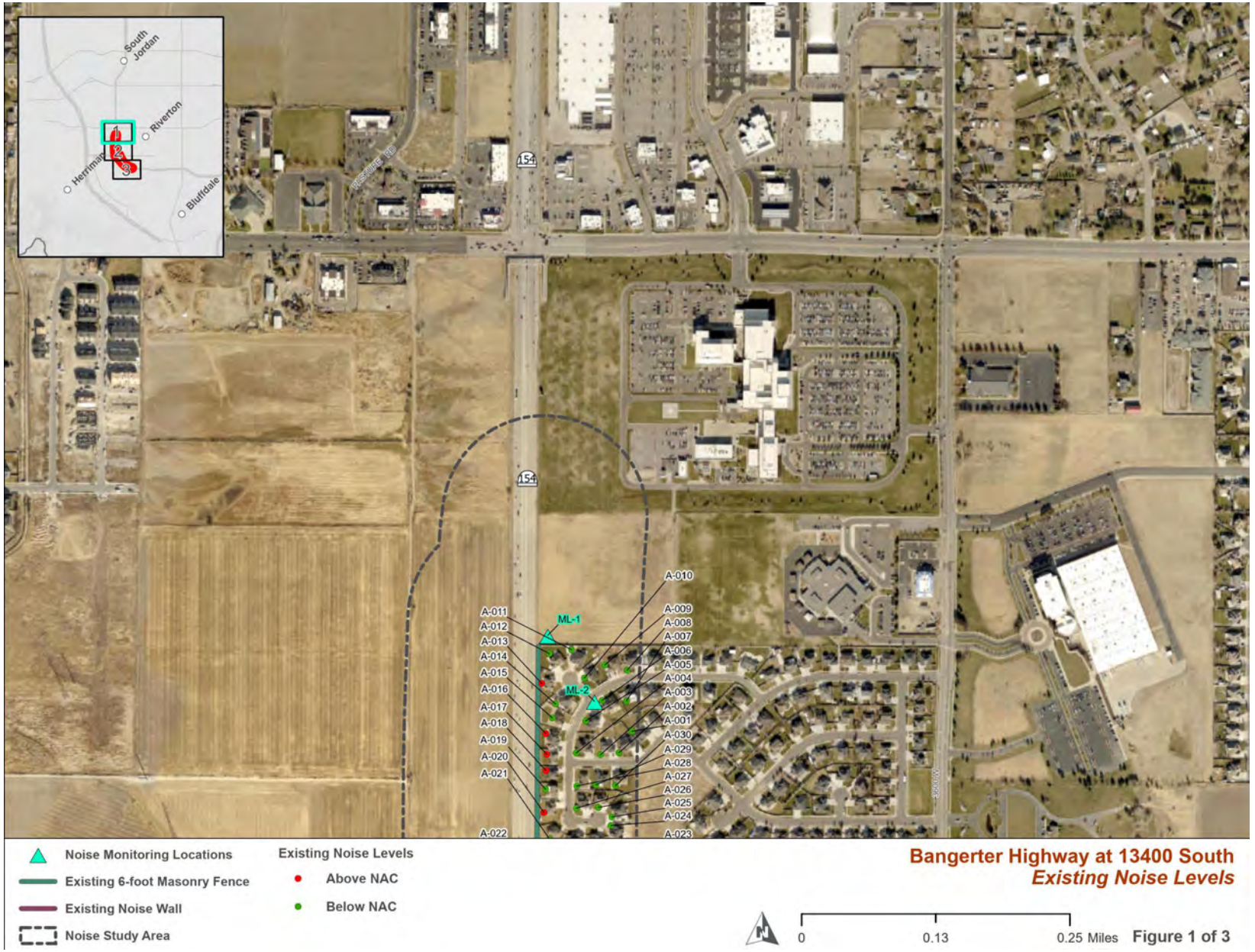

Figure A-1: Existing Noise Levels (1 of 3)

Figure A-2: Existing Noise Levels (2 of 3)

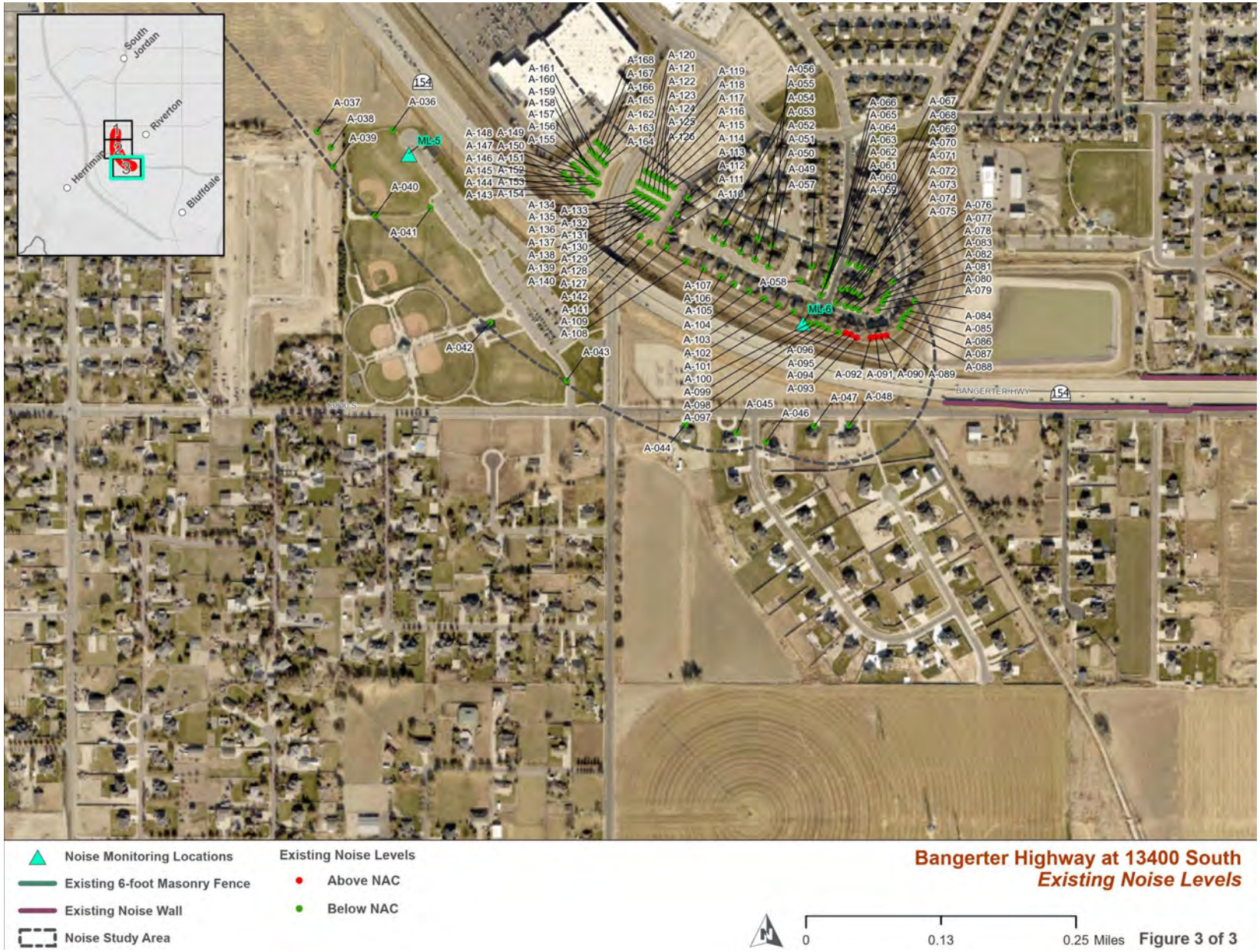

Figure A-3: Existing Noise Levels (3 of 3)

Appendix B: Build Noise Receptor Maps

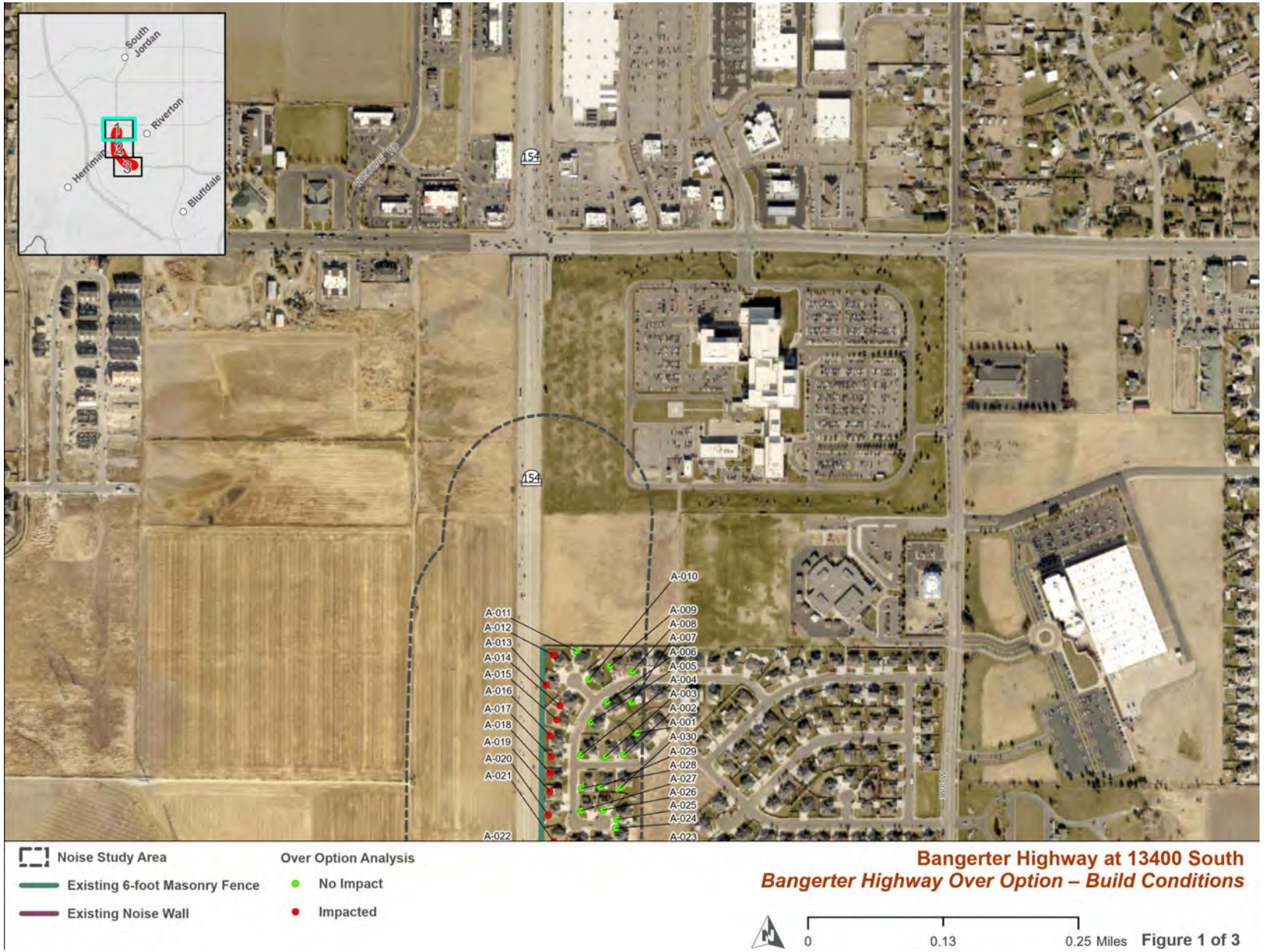

Figure B-1: Bangerter Highway Over Option Build Scenario Noise Levels (1 of 3)

Figure B-2: Bangerter Highway Over Option Build Scenario Noise Levels (2 of 3)

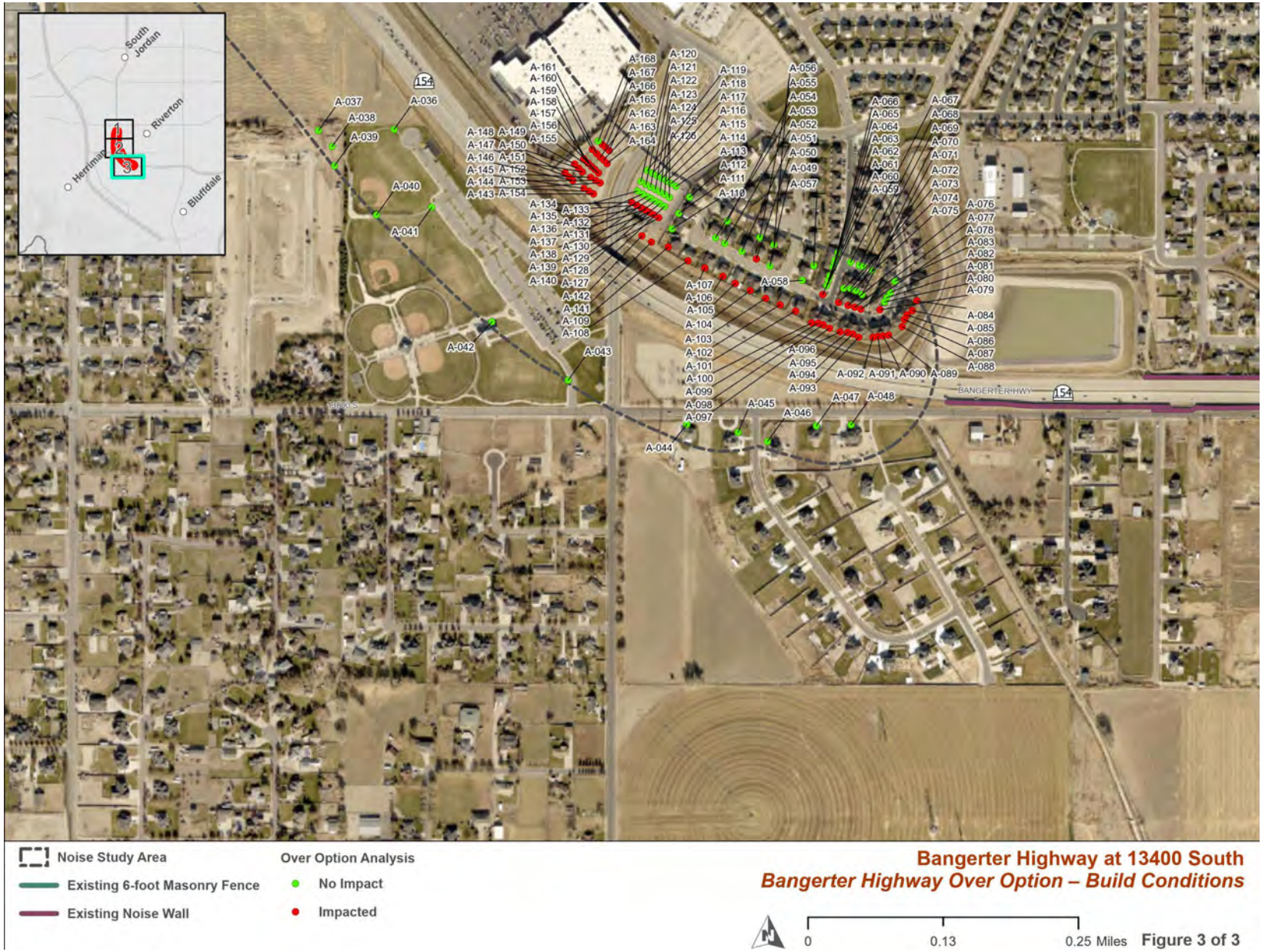

Figure B-3: Bangerter Highway Over Option Build Scenario Noise Levels (3 of 3)

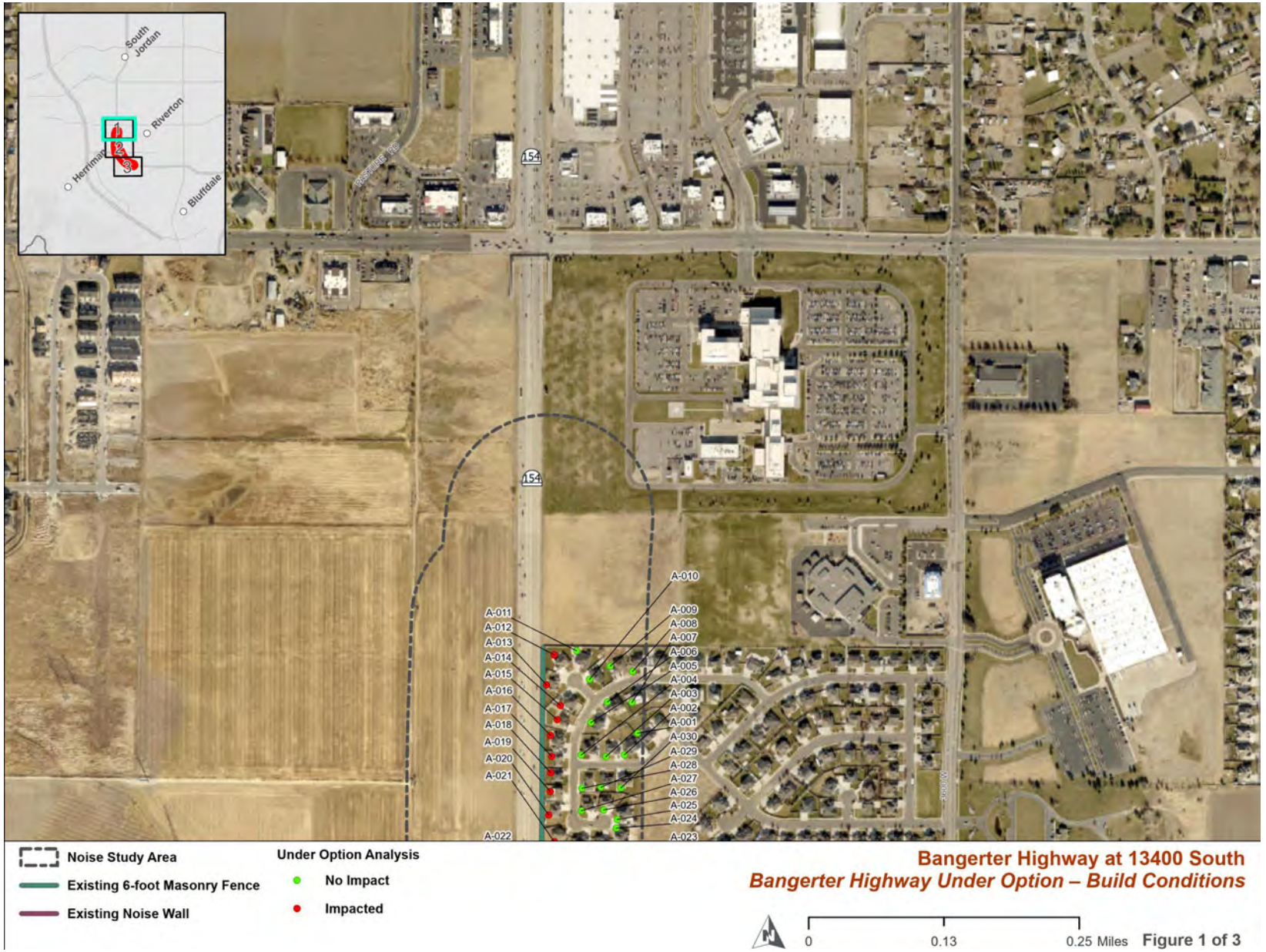

Figure B-4: Bangerter Highway Under Option Build Scenario Noise Levels (1 of 3)

Figure B-5: Bangerter Highway Under Option Build Scenario Noise Levels (2 of 3)

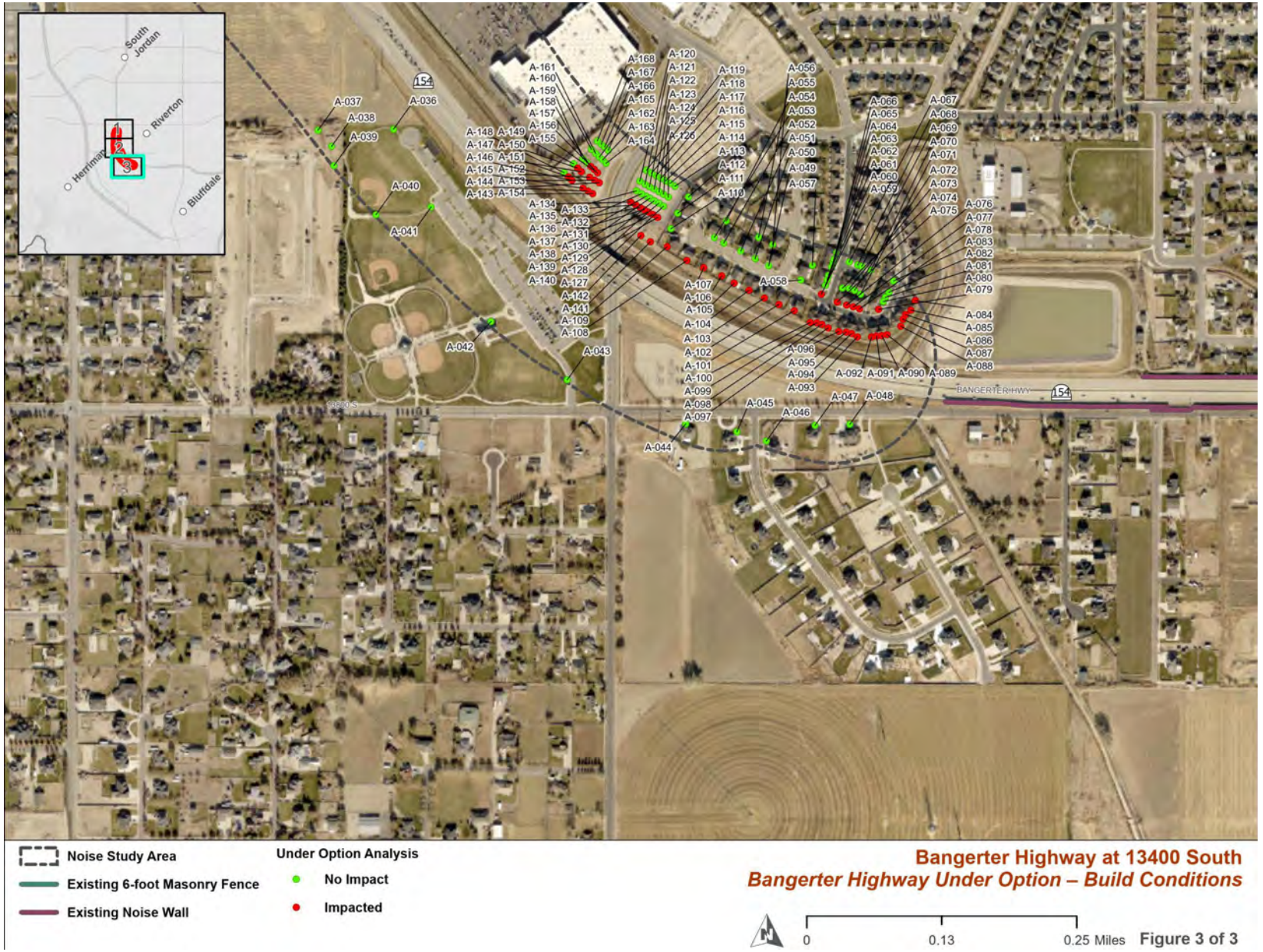

Figure B-6: Bangerter Highway Under Option Build Scenario Noise Levels (3 of 3)

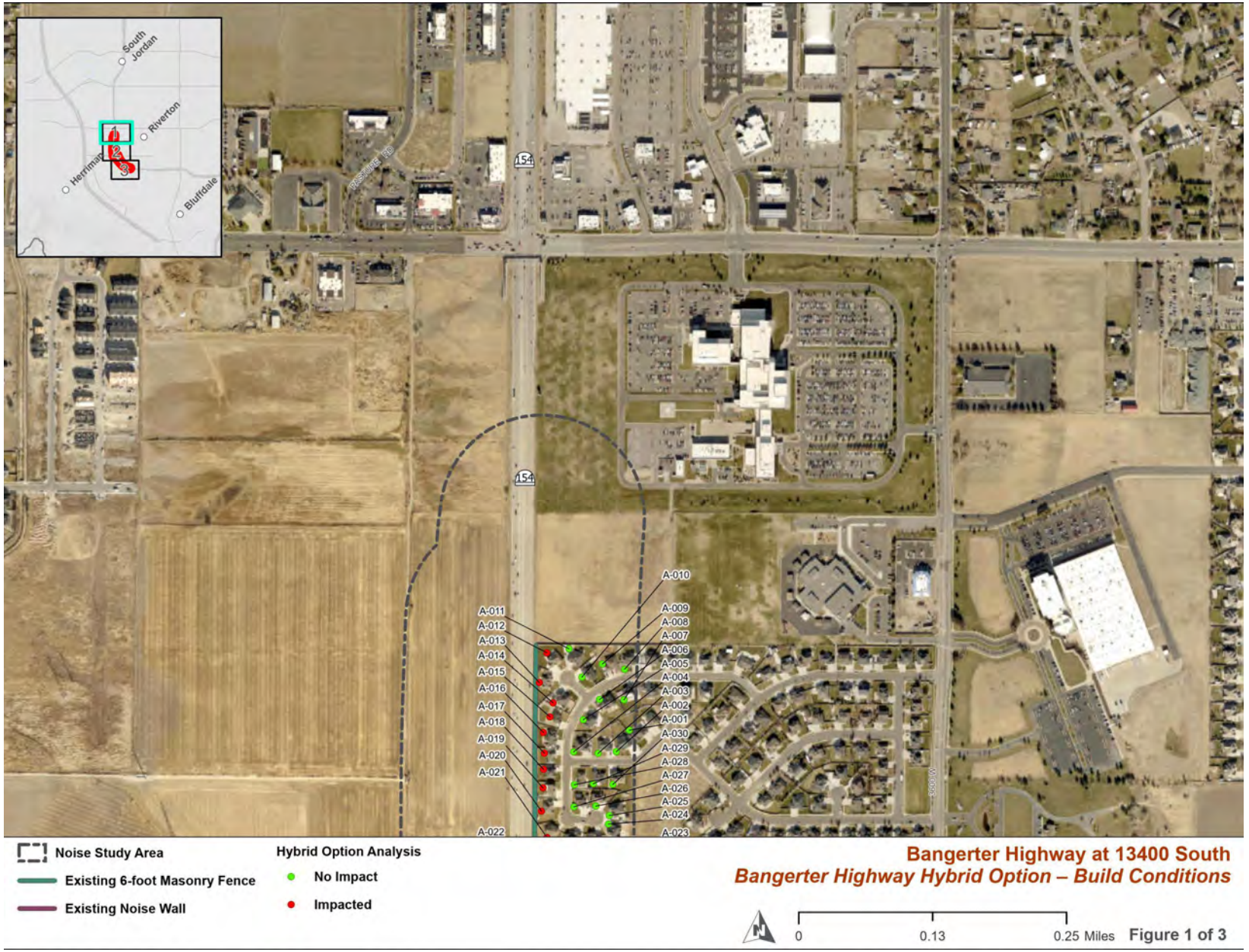

Figure B-7: Bangerter Highway Hybrid Option Build Scenario Noise Levels (1 of 3)

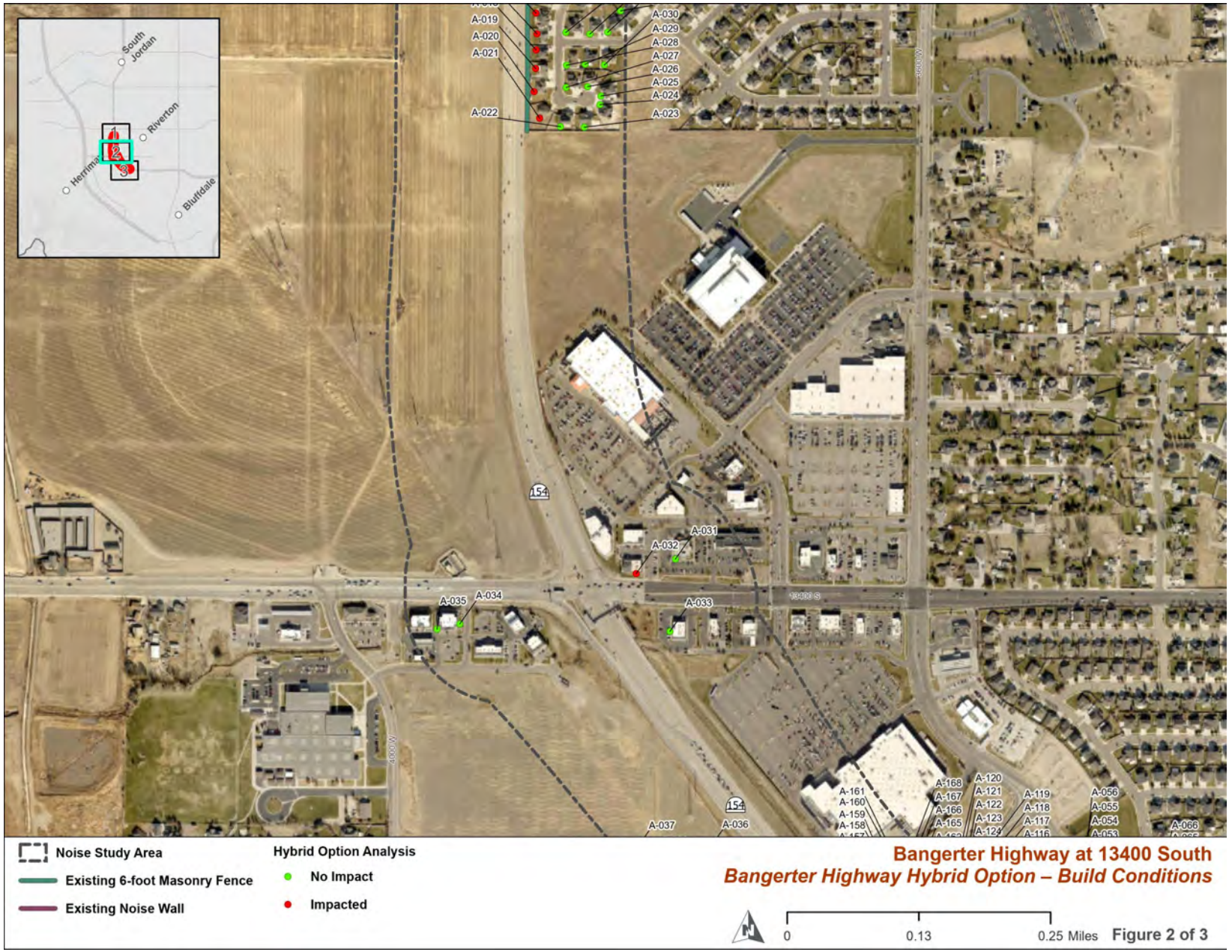

Figure B-8: Bangerter Highway Hybrid Option Build Scenario Noise Levels (2 of 3)

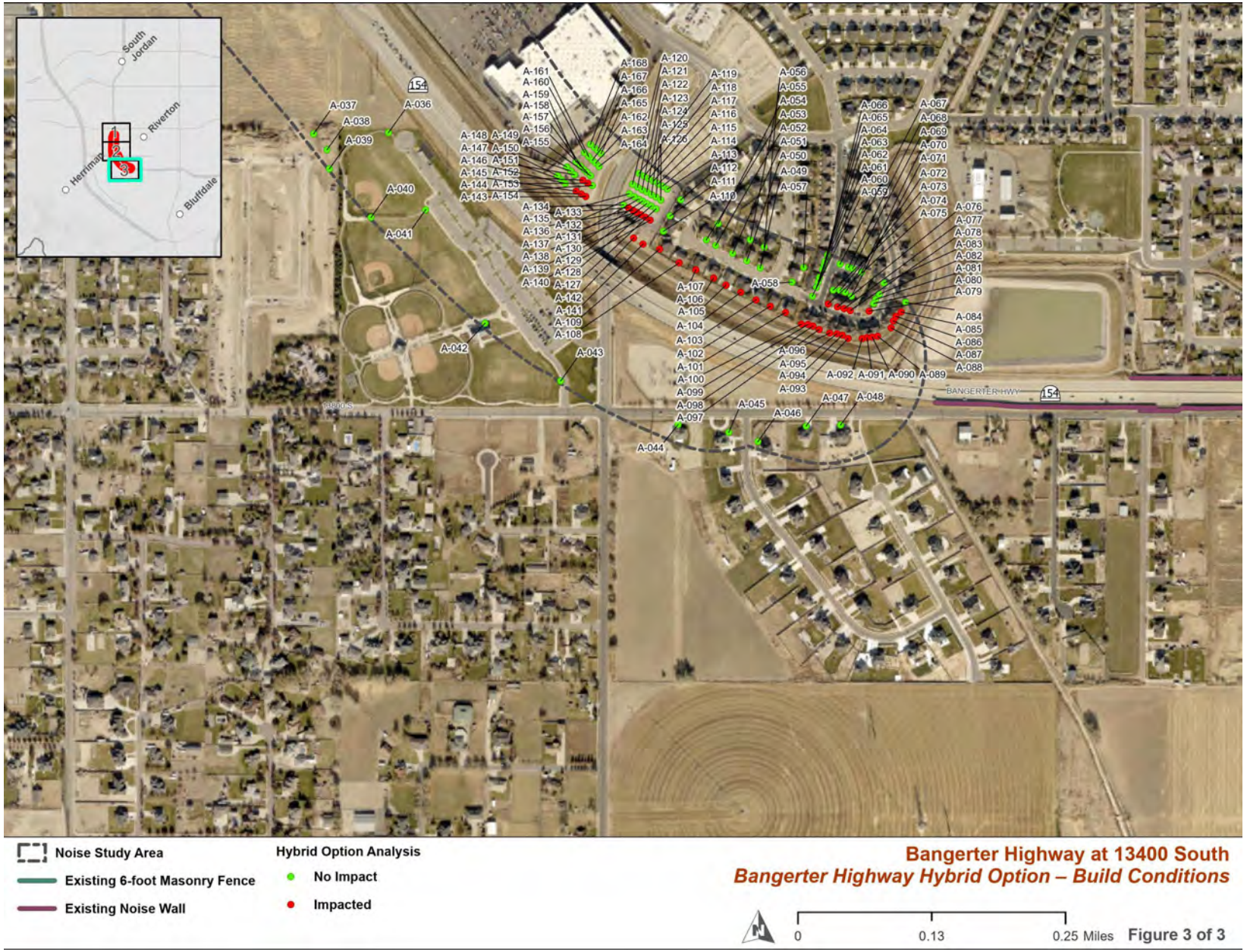

Figure B-9: Bangerter Highway Hybrid Option Build Scenario Noise Levels (3 of 3)

Appendix C: Build Scenario Noise Walls

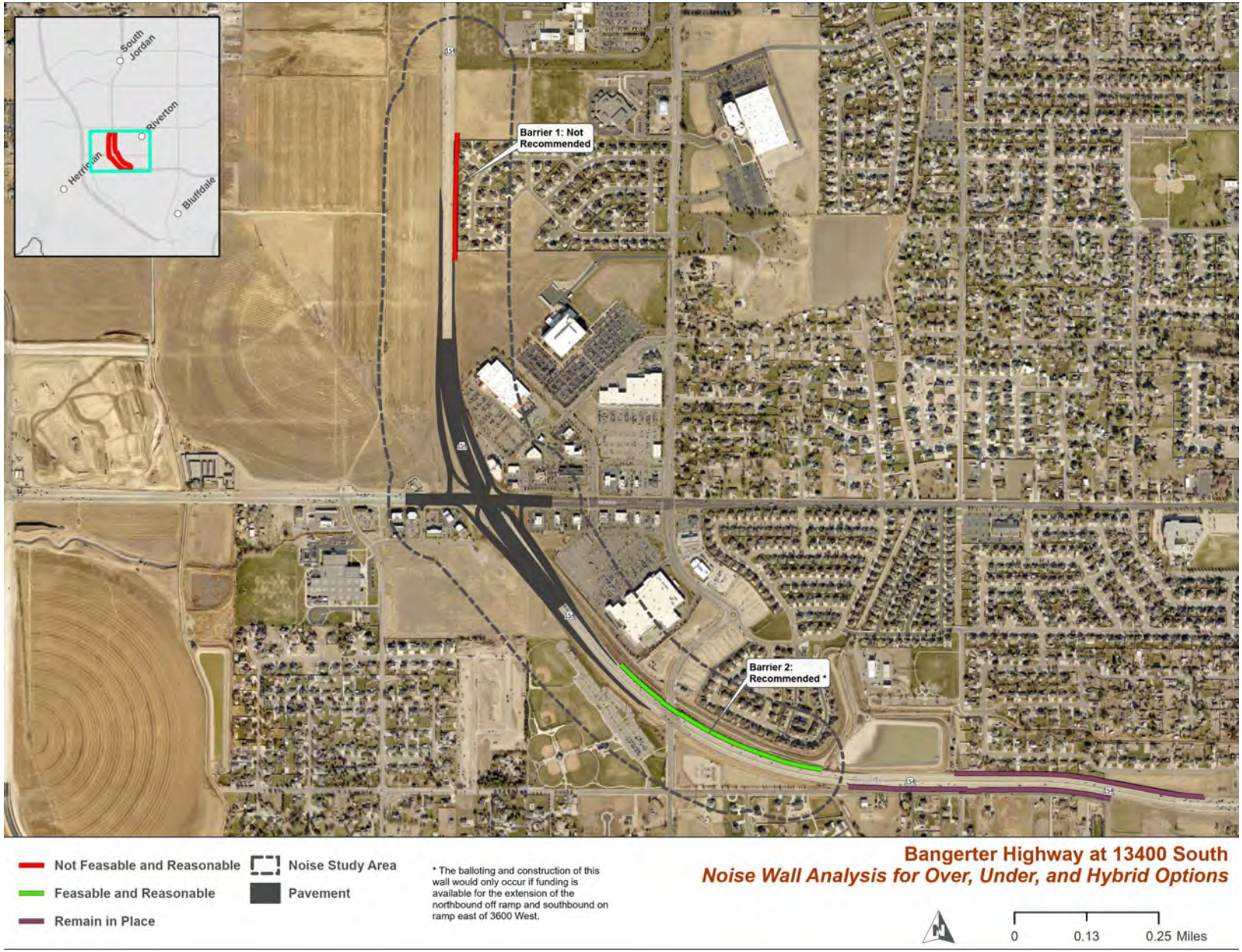

Figure C-1: Noise Wall Analysis for All Options (Over, Under, and Hybrid)

Appendix D: Noise Wall Analysis

BARRIER 1 BANGERTER HIGHWAY OVER OPTION NOISE WALL ANALYSIS

Table 8-1: Barrier 1 at 10 feet tall and 1,230 feet long (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	10-ft noise level	10-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	54	1	No	No	No	No
A-002	1	B		55	54	1	No	No	No	No
A-003	1	B		56	55	1	No	No	No	No
A-004	1	B		60	59	1	No	No	No	No
A-005	1	B		60	58	2	No	No	No	No
A-006	1	B		58	56	2	No	No	No	No
A-007	1	B		55	55	0	No	No	No	No
A-008	1	B		54	53	1	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	62	1	No	No	No	No
A-011	1	B		62	61	1	No	No	No	No
A-012	1	B	Yes	68	65	3	No	No	No	No
A-013	1	B	Yes	72	66	6	Yes	No	Yes	No
A-014	1	B	Yes	70	66	4	No	No	No	No
A-015	1	B	Yes	70	66	4	No	No	No	No
A-016	1	B	Yes	73	69	4	No	No	No	No
A-017	1	B	Yes	72	67	5	Yes	No	Yes	No
A-018	1	B	Yes	70	66	4	No	No	No	No
A-019	1	B	Yes	69	65	4	No	No	No	No
A-020	1	B	Yes	72	67	5	Yes	No	Yes	No
A-021	1	B	Yes	68	65	3	No	No	No	No
A-022	1	B		62	61	1	No	No	No	No
A-023	1	B		59	58	1	No	No	No	No
A-024	1	B		57	56	1	No	No	No	No
A-025	1	B		57	56	1	No	No	No	No
A-026	1	B		57	56	1	No	No	No	No
A-027	1	B		62	60	2	No	No	No	No
A-028	1	B		60	58	2	No	No	No	No
A-029	1	B		53	52	1	No	No	No	No
A-030	1	B		54	53	1	No	No	No	No

Table 8-2: Barrier 1 at 10 feet tall summary (Over Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	3
Percent of first row receivers achieve >=5 dBA reduction	30%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	No
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	0
Percent of first row receivers achieve design goal >=7 dBA reduction	0%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	No
Number of receivers benefited	3
Cost of noise wall (length x height x $20 per sq ft)	$246,000
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$246,000
Allowable cost ($30,000 per benefited receptor)	$90,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-3: Barrier 1 at 12 feet tall and 1,230 feet long (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	12-ft noise level	12-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	54	1	No	No	No	No
A-002	1	B		55	53	2	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	58	2	No	No	No	No
A-005	1	B		60	57	3	No	No	No	No
A-006	1	B		58	56	2	No	No	No	No
A-007	1	B		55	54	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	61	2	No	No	No	No
A-011	1	B		62	60	2	No	No	No	No
A-012	1	B	Yes	68	64	4	No	No	No	No
A-013	1	B	Yes	72	65	7	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	64	6	Yes	No	Yes	No
A-015	1	B	Yes	70	64	6	Yes	No	Yes	No
A-016	1	B	Yes	73	66	7	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	65	7	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	65	5	Yes	No	Yes	No
A-019	1	B	Yes	69	64	5	Yes	No	Yes	No
A-020	1	B	Yes	72	65	7	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	63	5	Yes	No	Yes	No
A-022	1	B		62	60	2	No	No	No	No
A-023	1	B		59	58	1	No	No	No	No
A-024	1	B		57	55	2	No	No	No	No
A-025	1	B		57	55	2	No	No	No	No
A-026	1	B		57	56	1	No	No	No	No
A-027	1	B		62	59	3	No	No	No	No
A-028	1	B		60	58	2	No	No	No	No
A-029	1	B		53	52	1	No	No	No	No
A-030	1	B		54	53	1	No	No	No	No

Table 8-4: Barrier 1 at 12 feet tall summary (Over Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	9
Percent of first row receivers achieve >=5 dBA reduction	90%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	4
Percent of first row receivers achieve design goal >=7 dBA reduction	40%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	9
Cost of noise wall (length x height x $20 per sq ft)	$295,200
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$295,200
Allowable cost ($30,000 per benefited receptor)	$270,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-5: Barrier 1 at 14 feet tall and 1,230 feet long (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	14-ft noise level	14-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	54	1	No	No	No	No
A-002	1	B		55	53	2	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	57	3	No	No	No	No
A-005	1	B		60	57	3	No	No	No	No
A-006	1	B		58	56	2	No	No	No	No
A-007	1	B		55	54	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	61	2	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	63	5	Yes	No	Yes	No
A-013	1	B	Yes	72	64	8	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	65	8	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	64	8	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	64	6	Yes	No	Yes	No
A-019	1	B	Yes	69	63	6	Yes	No	Yes	No
A-020	1	B	Yes	72	65	7	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	63	5	Yes	No	Yes	No
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	57	2	No	No	No	No
A-024	1	B		57	55	2	No	No	No	No
A-025	1	B		57	55	2	No	No	No	No
A-026	1	B		57	56	1	No	No	No	No
A-027	1	B		62	59	3	No	No	No	No
A-028	1	B		60	58	2	No	No	No	No
A-029	1	B		53	52	1	No	No	No	No
A-030	1	B		54	52	2	No	No	No	No

Table 8-6: Barrier 1 at 14 feet tall summary (Over Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	6
Percent of first row receivers achieve design goal >=7 dBA reduction	60%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$344,400
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$344,400
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-7: Barrier 1 at 16 feet tall and 1,230 feet long (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	53	2	No	No	No	No
A-002	1	B		55	53	2	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	57	3	No	No	No	No
A-005	1	B		60	57	3	No	No	No	No
A-006	1	B		58	55	3	No	No	No	No
A-007	1	B		55	54	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	60	3	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	62	6	Yes	No	Yes	No
A-013	1	B	Yes	72	63	9	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	64	9	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	63	9	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-019	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-020	1	B	Yes	72	64	8	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	62	6	Yes	No	Yes	No
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	57	2	No	No	No	No
A-024	1	B		57	55	2	No	No	No	No
A-025	1	B		57	55	2	No	No	No	No
A-026	1	B		57	55	2	No	No	No	No
A-027	1	B		62	59	3	No	No	No	No
A-028	1	B		60	58	2	No	No	No	No
A-029	1	B		53	51	2	No	No	No	No
A-030	1	B		54	52	2	No	No	No	No

Table 8-8: Barrier 1 at 16 feet tall summary (Over Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	8
Percent of first row receivers achieve design goal >=7 dBA reduction	80%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$393,600
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$393,600
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-9: Barrier 1 at 18 feet tall and 1,230 feet long (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	53	2	No	No	No	No
A-002	1	B		55	52	3	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	57	3	No	No	No	No
A-005	1	B		60	56	4	No	No	No	No
A-006	1	B		58	55	3	No	No	No	No
A-007	1	B		55	54	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	60	3	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	62	6	Yes	No	Yes	No
A-013	1	B	Yes	72	62	10	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	63	10	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	63	9	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-019	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-020	1	B	Yes	72	63	9	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	62	6	Yes	No	Yes	No
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	57	2	No	No	No	No
A-024	1	B		57	55	2	No	No	No	No
A-025	1	B		57	55	2	No	No	No	No
A-026	1	B		57	55	2	No	No	No	No
A-027	1	B		62	59	3	No	No	No	No
A-028	1	B		60	57	3	No	No	No	No
A-029	1	B		53	51	2	No	No	No	No
A-030	1	B		54	52	2	No	No	No	No

Table 8-10: Barrier 1 at 18 feet tall summary (Over Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	8
Percent of first row receivers achieve design goal >=7 dBA reduction	80%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$442,800
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$442,800
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-11: Barrier 1 at 20 feet tall and 1,230 feet long (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	53	2	No	No	No	No
A-002	1	B		55	52	3	No	No	No	No
A-003	1	B		56	53	3	No	No	No	No
A-004	1	B		60	57	3	No	No	No	No
A-005	1	B		60	56	4	No	No	No	No
A-006	1	B		58	54	4	No	No	No	No
A-007	1	B		55	54	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	55	2	No	No	No	No
A-010	1	B		63	60	3	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-013	1	B	Yes	72	61	11	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	60	10	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	60	10	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	62	11	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	62	10	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-019	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-020	1	B	Yes	72	63	9	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	57	2	No	No	No	No
A-024	1	B		57	55	2	No	No	No	No
A-025	1	B		57	55	2	No	No	No	No
A-026	1	B		57	55	2	No	No	No	No
A-027	1	B		62	58	4	No	No	No	No
A-028	1	B		60	57	3	No	No	No	No
A-029	1	B		53	51	2	No	No	No	No
A-030	1	B		54	52	2	No	No	No	No

Table 8-12: Barrier 1 at 20 feet tall summary (Over Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	10
Percent of first row receivers achieve design goal >=7 dBA reduction	100%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$492,000
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$492,000
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

BARRIER 2 BANGERTER HIGHWAY OVER OPTION NOISE WALL ANALYSIS

Table 8-13: Barrier 2 at 12 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	12-ft noise level	12-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	60	5	Yes	No	No	No
A-050	1	B		66	61	5	Yes	No	No	No
A-051	1	B		65	60	5	Yes	No	No	No
A-052	1	B		65	60	5	Yes	No	No	No
A-053	1	B		65	60	5	Yes	No	No	No
A-054	1	B		62	58	4	No	No	No	No
A-055	1	B		59	55	4	No	No	No	No
A-056	1	B		61	56	5	Yes	No	No	No
A-057	1	B		60	55	5	Yes	No	No	No
A-058	1	B		65	61	4	No	No	No	No
A-059	1	B		67	62	5	Yes	No	No	No
A-060	1	B		63	58	5	Yes	No	No	No
A-061	1	B		63	57	6	Yes	No	No	No
A-062	1	B		62	56	6	Yes	No	No	No
A-063	1	B		60	54	6	Yes	No	No	No
A-064	1	B		60	54	6	Yes	No	No	No
A-065	1	B		59	54	5	Yes	No	No	No
A-066	1	B		58	53	5	Yes	No	No	No
A-067	1	B		58	54	4	No	No	No	No
A-068	1	B		55	54	1	No	No	No	No
A-069	1	B		55	54	1	No	No	No	No
A-070	1	B		57	55	2	No	No	No	No
A-071	1	B		60	57	3	No	No	No	No
A-072	1	B		60	57	3	No	No	No	No
A-073	1	B		61	57	4	No	No	No	No
A-074	1	B		62	58	4	No	No	No	No
A-075	1	B		67	63	4	No	No	No	No
A-076	1	B		67	63	4	No	No	No	No
A-077	1	B		67	63	4	No	No	No	No
A-078	1	B		67	64	3	No	No	No	No
A-079	1	B		67	63	4	No	No	No	No
A-080	1	B		65	62	3	No	No	No	No
A-081	1	B		65	62	3	No	No	No	No
A-082	1	B		64	61	3	No	No	No	No
A-083	1	B		62	60	2	No	No	No	No
A-084	1	B		66	64	2	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	66	1	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	12-ft noise level	12-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-088	1	B		69	67	2	No	No	No	No
A-089	1	B	Yes	70	67	3	No	No	No	No
A-090	1	B	Yes	71	67	4	No	No	No	No
A-091	1	B	Yes	71	66	5	Yes	No	Yes	No
A-092	1	B	Yes	71	66	5	Yes	No	Yes	No
A-093	1	B	Yes	71	65	6	Yes	No	Yes	No
A-094	1	B	Yes	71	65	6	Yes	No	Yes	No
A-095	1	B	Yes	71	65	6	Yes	No	Yes	No
A-096	1	B	Yes	70	64	6	Yes	No	Yes	No
A-097	1	B	Yes	70	64	6	Yes	No	Yes	No
A-098	1	B	Yes	69	64	5	Yes	No	Yes	No
A-099	1	B	Yes	69	63	6	Yes	No	Yes	No
A-100	1	B	Yes	69	63	6	Yes	No	Yes	No
A-101	1	B	Yes	70	64	6	Yes	No	Yes	No
A-102	1	B	Yes	70	64	6	Yes	No	Yes	No
A-103	1	B	Yes	69	63	6	Yes	No	Yes	No
A-104	1	B	Yes	69	63	6	Yes	No	Yes	No
A-105	1	B	Yes	69	63	6	Yes	No	Yes	No
A-106	1	B	Yes	68	63	5	Yes	No	Yes	No
A-107	1	B	Yes	68	62	6	Yes	No	Yes	No
A-108	1	B	Yes	68	63	5	Yes	No	Yes	No
A-109	1	B	Yes	67	64	3	No	No	No	No
A-110	1	B		65	63	2	No	No	No	No
A-111	1	B		64	62	2	No	No	No	No
A-112	1	B		61	59	2	No	No	No	No
A-113	1	B		58	55	3	No	No	No	No
A-114	1	B		55	53	2	No	No	No	No
A-115	1	B		54	53	1	No	No	No	No
A-116	1	B		55	54	1	No	No	No	No
A-117	1	B		56	55	1	No	No	No	No
A-118	1	B		57	56	1	No	No	No	No
A-119	1	B		60	56	4	No	No	No	No
A-120	1	B		63	59	4	No	No	No	No
A-121	1	B		62	58	4	No	No	No	No
A-122	1	B		62	58	4	No	No	No	No
A-123	1	B		61	58	3	No	No	No	No
A-124	1	B		60	58	2	No	No	No	No
A-125	1	B		61	58	3	No	No	No	No
A-126	1	B		62	58	4	No	No	No	No
A-127	1	B		60	57	3	No	No	No	No
A-128	1	B		58	56	2	No	No	No	No
A-129	1	B		58	56	2	No	No	No	No
A-130	1	B		58	57	1	No	No	No	No
A-131	1	B		58	57	1	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	12-ft noise level	12-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-132	1	B		59	57	2	No	No	No	No
A-133	1	B		61	57	4	No	No	No	No
A-134	1	B		67	64	3	No	No	No	No
A-135	1	B		67	64	3	No	No	No	No
A-136	1	B		67	64	3	No	No	No	No
A-137	1	B		67	64	3	No	No	No	No
A-138	1	B		67	64	3	No	No	No	No
A-139	1	B		67	63	4	No	No	No	No
A-140	1	B		67	63	4	No	No	No	No
A-141	1	B	Yes	68	65	3	No	No	No	No
A-142	1	B	Yes	68	66	2	No	No	No	No
A-143	1	B	Yes	67	64	3	No	No	No	No
A-144	1	B	Yes	67	64	3	No	No	No	No
A-145	1	B	Yes	67	64	3	No	No	No	No
A-146	1	B	Yes	67	63	4	No	No	No	No
A-147	1	B	Yes	67	63	4	No	No	No	No
A-148	1	B	Yes	67	63	4	No	No	No	No
A-149	1	B		67	63	4	No	No	No	No
A-150	1	B		67	63	4	No	No	No	No
A-151	1	B		67	63	4	No	No	No	No
A-152	1	B		67	63	4	No	No	No	No
A-153	1	B		67	64	3	No	No	No	No
A-154	1	B		67	63	4	No	No	No	No
A-155	1	B		67	63	4	No	No	No	No
A-156	1	B		67	63	4	No	No	No	No
A-157	1	B		67	63	4	No	No	No	No
A-158	1	B		67	63	4	No	No	No	No
A-159	1	B		67	63	4	No	No	No	No
A-160	1	B		66	62	4	No	No	No	No
A-161	1	B		66	62	4	No	No	No	No
A-162	1	B		66	62	4	No	No	No	No
A-163	1	B		66	62	4	No	No	No	No
A-164	1	B		66	62	4	No	No	No	No
A-165	1	B		66	62	4	No	No	No	No
A-166	1	B		66	62	4	No	No	No	No
A-167	1	B		66	62	4	No	No	No	No
A-168	1	B		65	62	3	No	No	No	No

Table 8-14: Barrier 2 at 12 feet tall on ground and 6 feet tall on structure summary (Over Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	18
Percent of first row receivers achieve >=5 dBA reduction	62%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	0
Percent of first row receivers achieve design goal >=7 dBA reduction	0%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	No
Number of receivers benefited	33
Cost of noise wall (length x height x $20 per sq ft)	$477,952
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$477,952
Allowable cost ($30,000 per benefited receptor)	$990,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	No

Table 8-15: Barrier 2 at 14 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	14-ft noise level	14-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	59	6	Yes	No	No	No
A-050	1	B		66	59	7	Yes	Yes	No	No
A-051	1	B		65	59	6	Yes	No	No	No
A-052	1	B		65	59	6	Yes	No	No	No
A-053	1	B		65	60	5	Yes	No	No	No
A-054	1	B		62	57	5	Yes	No	No	No
A-055	1	B		59	54	5	Yes	No	No	No
A-056	1	B		61	55	6	Yes	No	No	No
A-057	1	B		60	54	6	Yes	No	No	No
A-058	1	B		65	59	6	Yes	No	No	No
A-059	1	B		67	60	7	Yes	Yes	No	No
A-060	1	B		63	57	6	Yes	No	No	No
A-061	1	B		63	56	7	Yes	Yes	No	No
A-062	1	B		62	55	7	Yes	Yes	No	No
A-063	1	B		60	53	7	Yes	Yes	No	No
A-064	1	B		60	53	7	Yes	Yes	No	No
A-065	1	B		59	53	6	Yes	No	No	No
A-066	1	B		58	52	6	Yes	No	No	No
A-067	1	B		58	54	4	No	No	No	No
A-068	1	B		55	53	2	No	No	No	No
A-069	1	B		55	54	1	No	No	No	No
A-070	1	B		57	55	2	No	No	No	No
A-071	1	B		60	56	4	No	No	No	No
A-072	1	B		60	56	4	No	No	No	No
A-073	1	B		61	56	5	Yes	No	No	No
A-074	1	B		62	57	5	Yes	No	No	No
A-075	1	B		67	62	5	Yes	No	No	No
A-076	1	B		67	62	5	Yes	No	No	No
A-077	1	B		67	62	5	Yes	No	No	No
A-078	1	B		67	63	4	No	No	No	No
A-079	1	B		67	63	4	No	No	No	No
A-080	1	B		65	61	4	No	No	No	No
A-081	1	B		65	61	4	No	No	No	No
A-082	1	B		64	61	3	No	No	No	No
A-083	1	B		62	59	3	No	No	No	No
A-084	1	B		66	64	2	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	66	1	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No
A-088	1	B		69	67	2	No	No	No	No
A-089	1	B	Yes	70	66	4	No	No	No	No
A-090	1	B	Yes	71	66	5	Yes	No	Yes	No
A-091	1	B	Yes	71	66	5	Yes	No	Yes	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	14-ft noise level	14-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-092	1	B	Yes	71	65	6	Yes	No	Yes	No
A-093	1	B	Yes	71	65	6	Yes	No	Yes	No
A-094	1	B	Yes	71	64	7	Yes	Yes	Yes	Yes
A-095	1	B	Yes	71	64	7	Yes	Yes	Yes	Yes
A-096	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-097	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-098	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-099	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-100	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-101	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-102	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-103	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-104	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-105	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-106	1	B	Yes	68	62	6	Yes	No	Yes	No
A-107	1	B	Yes	68	62	6	Yes	No	Yes	No
A-108	1	B	Yes	68	62	6	Yes	No	Yes	No
A-109	1	B	Yes	67	63	4	No	No	No	No
A-110	1	B		65	62	3	No	No	No	No
A-111	1	B		64	61	3	No	No	No	No
A-112	1	B		61	58	3	No	No	No	No
A-113	1	B		58	54	4	No	No	No	No
A-114	1	B		55	53	2	No	No	No	No
A-115	1	B		54	53	1	No	No	No	No
A-116	1	B		55	54	1	No	No	No	No
A-117	1	B		56	55	1	No	No	No	No
A-118	1	B		57	55	2	No	No	No	No
A-119	1	B		60	56	4	No	No	No	No
A-120	1	B		63	58	5	Yes	No	No	No
A-121	1	B		62	58	4	No	No	No	No
A-122	1	B		62	57	5	Yes	No	No	No
A-123	1	B		61	57	4	No	No	No	No
A-124	1	B		60	57	3	No	No	No	No
A-125	1	B		61	57	4	No	No	No	No
A-126	1	B		62	58	4	No	No	No	No
A-127	1	B		60	56	4	No	No	No	No
A-128	1	B		58	56	2	No	No	No	No
A-129	1	B		58	56	2	No	No	No	No
A-130	1	B		58	56	2	No	No	No	No
A-131	1	B		58	56	2	No	No	No	No
A-132	1	B		59	57	2	No	No	No	No
A-133	1	B		61	57	4	No	No	No	No
A-134	1	B		67	64	3	No	No	No	No
A-135	1	B		67	64	3	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	14-ft noise level	14-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-136	1	B		67	64	3	No	No	No	No
A-137	1	B		67	63	4	No	No	No	No
A-138	1	B		67	63	4	No	No	No	No
A-139	1	B		67	63	4	No	No	No	No
A-140	1	B		67	63	4	No	No	No	No
A-141	1	B	Yes	68	65	3	No	No	No	No
A-142	1	B	Yes	68	66	2	No	No	No	No
A-143	1	B	Yes	67	63	4	No	No	No	No
A-144	1	B	Yes	67	64	3	No	No	No	No
A-145	1	B	Yes	67	63	4	No	No	No	No
A-146	1	B	Yes	67	63	4	No	No	No	No
A-147	1	B	Yes	67	63	4	No	No	No	No
A-148	1	B	Yes	67	63	4	No	No	No	No
A-149	1	B		67	63	4	No	No	No	No
A-150	1	B		67	63	4	No	No	No	No
A-151	1	B		67	63	4	No	No	No	No
A-152	1	B		67	63	4	No	No	No	No
A-153	1	B		67	63	4	No	No	No	No
A-154	1	B		67	63	4	No	No	No	No
A-155	1	B		67	63	4	No	No	No	No
A-156	1	B		67	63	4	No	No	No	No
A-157	1	B		67	63	4	No	No	No	No
A-158	1	B		67	63	4	No	No	No	No
A-159	1	B		67	63	4	No	No	No	No
A-160	1	B		66	62	4	No	No	No	No
A-161	1	B		66	62	4	No	No	No	No
A-162	1	B		66	62	4	No	No	No	No
A-163	1	B		66	62	4	No	No	No	No
A-164	1	B		66	62	4	No	No	No	No
A-165	1	B		66	62	4	No	No	No	No
A-166	1	B		66	62	4	No	No	No	No
A-167	1	B		66	61	5	Yes	No	No	No
A-168	1	B		65	61	4	No	No	No	No

Table 8-16: Barrier 2 at 14 feet tall on ground and 6 feet tall on structure summary (Over Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	19
Percent of first row receivers achieve >=5 dBA reduction	66%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	12
Percent of first row receivers achieve design goal >=7 dBA reduction	41%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	45
Cost of noise wall (length x height x $20 per sq ft)	$552,512
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$552,512
Allowable cost ($30,000 per benefited receptor)	$1,350,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	Yes

Table 8-17: Barrier 2 at 16 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	58	7	Yes	Yes	No	No
A-050	1	B		66	58	8	Yes	Yes	No	No
A-051	1	B		65	58	7	Yes	Yes	No	No
A-052	1	B		65	58	7	Yes	Yes	No	No
A-053	1	B		65	59	6	Yes	No	No	No
A-054	1	B		62	56	6	Yes	No	No	No
A-055	1	B		59	53	6	Yes	No	No	No
A-056	1	B		61	54	7	Yes	Yes	No	No
A-057	1	B		60	53	7	Yes	Yes	No	No
A-058	1	B		65	58	7	Yes	Yes	No	No
A-059	1	B		67	59	8	Yes	Yes	No	No
A-060	1	B		63	56	7	Yes	Yes	No	No
A-061	1	B		63	55	8	Yes	Yes	No	No
A-062	1	B		62	54	8	Yes	Yes	No	No
A-063	1	B		60	52	8	Yes	Yes	No	No
A-064	1	B		60	51	9	Yes	Yes	No	No
A-065	1	B		59	51	8	Yes	Yes	No	No
A-066	1	B		58	51	7	Yes	Yes	No	No
A-067	1	B		58	53	5	Yes	No	No	No
A-068	1	B		55	52	3	No	No	No	No
A-069	1	B		55	53	2	No	No	No	No
A-070	1	B		57	54	3	No	No	No	No
A-071	1	B		60	55	5	Yes	No	No	No
A-072	1	B		60	55	5	Yes	No	No	No
A-073	1	B		61	55	6	Yes	No	No	No
A-074	1	B		62	56	6	Yes	No	No	No
A-075	1	B		67	61	6	Yes	No	No	No
A-076	1	B		67	61	6	Yes	No	No	No
A-077	1	B		67	61	6	Yes	No	No	No
A-078	1	B		67	62	5	Yes	No	No	No
A-079	1	B		67	62	5	Yes	No	No	No
A-080	1	B		65	61	4	No	No	No	No
A-081	1	B		65	61	4	No	No	No	No
A-082	1	B		64	60	4	No	No	No	No
A-083	1	B		62	58	4	No	No	No	No
A-084	1	B		66	64	2	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	65	2	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No
A-088	1	B		69	66	3	No	No	No	No
A-089	1	B	Yes	70	66	4	No	No	No	No
A-090	1	B	Yes	71	66	5	Yes	No	Yes	No
A-091	1	B	Yes	71	65	6	Yes	No	Yes	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-092	1	B	Yes	71	65	6	Yes	No	Yes	No
A-093	1	B	Yes	71	64	7	Yes	Yes	Yes	Yes
A-094	1	B	Yes	71	64	7	Yes	Yes	Yes	Yes
A-095	1	B	Yes	71	63	8	Yes	Yes	Yes	Yes
A-096	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-097	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-098	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-099	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-100	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-101	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-102	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-103	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-104	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-105	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-106	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-107	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-108	1	B	Yes	68	62	6	Yes	No	Yes	No
A-109	1	B	Yes	67	63	4	No	No	No	No
A-110	1	B		65	62	3	No	No	No	No
A-111	1	B		64	61	3	No	No	No	No
A-112	1	B		61	58	3	No	No	No	No
A-113	1	B		58	54	4	No	No	No	No
A-114	1	B		55	53	2	No	No	No	No
A-115	1	B		54	53	1	No	No	No	No
A-116	1	B		55	53	2	No	No	No	No
A-117	1	B		56	54	2	No	No	No	No
A-118	1	B		57	55	2	No	No	No	No
A-119	1	B		60	56	4	No	No	No	No
A-120	1	B		63	58	5	Yes	No	No	No
A-121	1	B		62	57	5	Yes	No	No	No
A-122	1	B		62	57	5	Yes	No	No	No
A-123	1	B		61	57	4	No	No	No	No
A-124	1	B		60	57	3	No	No	No	No
A-125	1	B		61	57	4	No	No	No	No
A-126	1	B		62	57	5	Yes	No	No	No
A-127	1	B		60	56	4	No	No	No	No
A-128	1	B		58	56	2	No	No	No	No
A-129	1	B		58	56	2	No	No	No	No
A-130	1	B		58	56	2	No	No	No	No
A-131	1	B		58	56	2	No	No	No	No
A-132	1	B		59	56	3	No	No	No	No
A-133	1	B		61	57	4	No	No	No	No
A-134	1	B		67	63	4	No	No	No	No
A-135	1	B		67	64	3	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-136	1	B		67	63	4	No	No	No	No
A-137	1	B		67	63	4	No	No	No	No
A-138	1	B		67	63	4	No	No	No	No
A-139	1	B		67	63	4	No	No	No	No
A-140	1	B		67	63	4	No	No	No	No
A-141	1	B	Yes	68	65	3	No	No	No	No
A-142	1	B	Yes	68	66	2	No	No	No	No
A-143	1	B	Yes	67	63	4	No	No	No	No
A-144	1	B	Yes	67	63	4	No	No	No	No
A-145	1	B	Yes	67	63	4	No	No	No	No
A-146	1	B	Yes	67	62	5	Yes	No	Yes	No
A-147	1	B	Yes	67	62	5	Yes	No	Yes	No
A-148	1	B	Yes	67	62	5	Yes	No	Yes	No
A-149	1	B		67	63	4	No	No	No	No
A-150	1	B		67	63	4	No	No	No	No
A-151	1	B		67	63	4	No	No	No	No
A-152	1	B		67	63	4	No	No	No	No
A-153	1	B		67	63	4	No	No	No	No
A-154	1	B		67	63	4	No	No	No	No
A-155	1	B		67	63	4	No	No	No	No
A-156	1	B		67	62	5	Yes	No	No	No
A-157	1	B		67	62	5	Yes	No	No	No
A-158	1	B		67	62	5	Yes	No	No	No
A-159	1	B		67	62	5	Yes	No	No	No
A-160	1	B		66	62	4	No	No	No	No
A-161	1	B		66	62	4	No	No	No	No
A-162	1	B		66	62	4	No	No	No	No
A-163	1	B		66	62	4	No	No	No	No
A-164	1	B		66	62	4	No	No	No	No
A-165	1	B		66	61	5	Yes	No	No	No
A-166	1	B		66	61	5	Yes	No	No	No
A-167	1	B		66	61	5	Yes	No	No	No
A-168	1	B		65	61	4	No	No	No	No

Table 8-18: Barrier 2 at 16 feet tall on ground and 6 feet tall on structure summary (Over Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	22
Percent of first row receivers achieve >=5 dBA reduction	76%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	15
Percent of first row receivers achieve design goal >=7 dBA reduction	52%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	61
Cost of noise wall (length x height x $20 per sq ft)	$627,071
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$627,071
Allowable cost ($30,000 per benefited receptor)	$1,830,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	Yes

Table 8-19: Barrier 2 at 18 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	57	8	Yes	Yes	No	No
A-050	1	B		66	58	8	Yes	Yes	No	No
A-051	1	B		65	57	8	Yes	Yes	No	No
A-052	1	B		65	58	7	Yes	Yes	No	No
A-053	1	B		65	59	6	Yes	No	No	No
A-054	1	B		62	56	6	Yes	No	No	No
A-055	1	B		59	52	7	Yes	Yes	No	No
A-056	1	B		61	53	8	Yes	Yes	No	No
A-057	1	B		60	52	8	Yes	Yes	No	No
A-058	1	B		65	57	8	Yes	Yes	No	No
A-059	1	B		67	59	8	Yes	Yes	No	No
A-060	1	B		63	55	8	Yes	Yes	No	No
A-061	1	B		63	54	9	Yes	Yes	No	No
A-062	1	B		62	53	9	Yes	Yes	No	No
A-063	1	B		60	51	9	Yes	Yes	No	No
A-064	1	B		60	51	9	Yes	Yes	No	No
A-065	1	B		59	51	8	Yes	Yes	No	No
A-066	1	B		58	50	8	Yes	Yes	No	No
A-067	1	B		58	52	6	Yes	No	No	No
A-068	1	B		55	52	3	No	No	No	No
A-069	1	B		55	53	2	No	No	No	No
A-070	1	B		57	53	4	No	No	No	No
A-071	1	B		60	55	5	Yes	No	No	No
A-072	1	B		60	55	5	Yes	No	No	No
A-073	1	B		61	55	6	Yes	No	No	No
A-074	1	B		62	55	7	Yes	Yes	No	No
A-075	1	B		67	60	7	Yes	Yes	No	No
A-076	1	B		67	60	7	Yes	Yes	No	No
A-077	1	B		67	61	6	Yes	No	No	No
A-078	1	B		67	62	5	Yes	No	No	No
A-079	1	B		67	61	6	Yes	No	No	No
A-080	1	B		65	60	5	Yes	No	No	No
A-081	1	B		65	60	5	Yes	No	No	No
A-082	1	B		64	59	5	Yes	No	No	No
A-083	1	B		62	58	4	No	No	No	No
A-084	1	B		66	64	2	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	65	2	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No
A-088	1	B		69	66	3	No	No	No	No
A-089	1	B	Yes	70	66	4	No	No	No	No
A-090	1	B	Yes	71	66	5	Yes	No	Yes	No
A-091	1	B	Yes	71	65	6	Yes	No	Yes	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-092	1	B	Yes	71	65	6	Yes	No	Yes	No
A-093	1	B	Yes	71	64	7	Yes	Yes	Yes	Yes
A-094	1	B	Yes	71	63	8	Yes	Yes	Yes	Yes
A-095	1	B	Yes	71	63	8	Yes	Yes	Yes	Yes
A-096	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-097	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-098	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-099	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-100	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-101	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-102	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-103	1	B	Yes	69	60	9	Yes	Yes	Yes	Yes
A-104	1	B	Yes	69	60	9	Yes	Yes	Yes	Yes
A-105	1	B	Yes	69	60	9	Yes	Yes	Yes	Yes
A-106	1	B	Yes	68	60	8	Yes	Yes	Yes	Yes
A-107	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-108	1	B	Yes	68	62	6	Yes	No	Yes	No
A-109	1	B	Yes	67	63	4	No	No	No	No
A-110	1	B		65	62	3	No	No	No	No
A-111	1	B		64	61	3	No	No	No	No
A-112	1	B		61	58	3	No	No	No	No
A-113	1	B		58	53	5	Yes	No	No	No
A-114	1	B		55	52	3	No	No	No	No
A-115	1	B		54	52	2	No	No	No	No
A-116	1	B		55	53	2	No	No	No	No
A-117	1	B		56	54	2	No	No	No	No
A-118	1	B		57	55	2	No	No	No	No
A-119	1	B		60	55	5	Yes	No	No	No
A-120	1	B		63	57	6	Yes	No	No	No
A-121	1	B		62	57	5	Yes	No	No	No
A-122	1	B		62	57	5	Yes	No	No	No
A-123	1	B		61	57	4	No	No	No	No
A-124	1	B		60	57	3	No	No	No	No
A-125	1	B		61	57	4	No	No	No	No
A-126	1	B		62	57	5	Yes	No	No	No
A-127	1	B		60	55	5	Yes	No	No	No
A-128	1	B		58	55	3	No	No	No	No
A-129	1	B		58	56	2	No	No	No	No
A-130	1	B		58	56	2	No	No	No	No
A-131	1	B		58	56	2	No	No	No	No
A-132	1	B		59	56	3	No	No	No	No
A-133	1	B		61	56	5	Yes	No	No	No
A-134	1	B		67	63	4	No	No	No	No
A-135	1	B		67	64	3	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-136	1	B		67	63	4	No	No	No	No
A-137	1	B		67	63	4	No	No	No	No
A-138	1	B		67	63	4	No	No	No	No
A-139	1	B		67	63	4	No	No	No	No
A-140	1	B		67	63	4	No	No	No	No
A-141	1	B	Yes	68	65	3	No	No	No	No
A-142	1	B	Yes	68	66	2	No	No	No	No
A-143	1	B	Yes	67	63	4	No	No	No	No
A-144	1	B	Yes	67	63	4	No	No	No	No
A-145	1	B	Yes	67	63	4	No	No	No	No
A-146	1	B	Yes	67	62	5	Yes	No	Yes	No
A-147	1	B	Yes	67	62	5	Yes	No	Yes	No
A-148	1	B	Yes	67	62	5	Yes	No	Yes	No
A-149	1	B		67	63	4	No	No	No	No
A-150	1	B		67	63	4	No	No	No	No
A-151	1	B		67	63	4	No	No	No	No
A-152	1	B		67	63	4	No	No	No	No
A-153	1	B		67	63	4	No	No	No	No
A-154	1	B		67	63	4	No	No	No	No
A-155	1	B		67	62	5	Yes	No	No	No
A-156	1	B		67	62	5	Yes	No	No	No
A-157	1	B		67	62	5	Yes	No	No	No
A-158	1	B		67	62	5	Yes	No	No	No
A-159	1	B		67	62	5	Yes	No	No	No
A-160	1	B		66	62	4	No	No	No	No
A-161	1	B		66	62	4	No	No	No	No
A-162	1	B		66	62	4	No	No	No	No
A-163	1	B		66	62	4	No	No	No	No
A-164	1	B		66	62	4	No	No	No	No
A-165	1	B		66	61	5	Yes	No	No	No
A-166	1	B		66	61	5	Yes	No	No	No
A-167	1	B		66	61	5	Yes	No	No	No
A-168	1	B		65	61	4	No	No	No	No

Table 8-20: Barrier 2 at 18 feet tall on ground and 6 feet tall on structure summary (Over Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	22
Percent of first row receivers achieve >=5 dBA reduction	76%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	15
Percent of first row receivers achieve design goal >=7 dBA reduction	52%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	69
Cost of noise wall (length x height x $20 per sq ft)	$701,631
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$701,631
Allowable cost ($30,000 per benefited receptor)	$2,070,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	Yes

Table 8-21: Barrier 2 at 20 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Over Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	57	8	Yes	Yes	No	No
A-050	1	B		66	57	9	Yes	Yes	No	No
A-051	1	B		65	57	8	Yes	Yes	No	No
A-052	1	B		65	57	8	Yes	Yes	No	No
A-053	1	B		65	58	7	Yes	Yes	No	No
A-054	1	B		62	56	6	Yes	No	No	No
A-055	1	B		59	52	7	Yes	Yes	No	No
A-056	1	B		61	53	8	Yes	Yes	No	No
A-057	1	B		60	51	9	Yes	Yes	No	No
A-058	1	B		65	57	8	Yes	Yes	No	No
A-059	1	B		67	58	9	Yes	Yes	No	No
A-060	1	B		63	55	8	Yes	Yes	No	No
A-061	1	B		63	54	9	Yes	Yes	No	No
A-062	1	B		62	53	9	Yes	Yes	No	No
A-063	1	B		60	50	10	Yes	Yes	No	No
A-064	1	B		60	50	10	Yes	Yes	No	No
A-065	1	B		59	50	9	Yes	Yes	No	No
A-066	1	B		58	49	9	Yes	Yes	No	No
A-067	1	B		58	52	6	Yes	No	No	No
A-068	1	B		55	51	4	No	No	No	No
A-069	1	B		55	52	3	No	No	No	No
A-070	1	B		57	53	4	No	No	No	No
A-071	1	B		60	55	5	Yes	No	No	No
A-072	1	B		60	55	5	Yes	No	No	No
A-073	1	B		61	54	7	Yes	Yes	No	No
A-074	1	B		62	54	8	Yes	Yes	No	No
A-075	1	B		67	60	7	Yes	Yes	No	No
A-076	1	B		67	60	7	Yes	Yes	No	No
A-077	1	B		67	61	6	Yes	No	No	No
A-078	1	B		67	61	6	Yes	No	No	No
A-079	1	B		67	61	6	Yes	No	No	No
A-080	1	B		65	60	5	Yes	No	No	No
A-081	1	B		65	60	5	Yes	No	No	No
A-082	1	B		64	59	5	Yes	No	No	No
A-083	1	B		62	58	4	No	No	No	No
A-084	1	B		66	64	2	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	65	2	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No
A-088	1	B		69	66	3	No	No	No	No
A-089	1	B	Yes	70	66	4	No	No	No	No
A-090	1	B	Yes	71	65	6	Yes	No	Yes	No
A-091	1	B	Yes	71	65	6	Yes	No	Yes	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-092	1	B	Yes	71	64	7	Yes	Yes	Yes	Yes
A-093	1	B	Yes	71	63	8	Yes	Yes	Yes	Yes
A-094	1	B	Yes	71	63	8	Yes	Yes	Yes	Yes
A-095	1	B	Yes	71	62	9	Yes	Yes	Yes	Yes
A-096	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-097	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-098	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-099	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-100	1	B	Yes	69	60	9	Yes	Yes	Yes	Yes
A-101	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-102	1	B	Yes	70	60	10	Yes	Yes	Yes	Yes
A-103	1	B	Yes	69	60	9	Yes	Yes	Yes	Yes
A-104	1	B	Yes	69	60	9	Yes	Yes	Yes	Yes
A-105	1	B	Yes	69	60	9	Yes	Yes	Yes	Yes
A-106	1	B	Yes	68	60	8	Yes	Yes	Yes	Yes
A-107	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-108	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-109	1	B	Yes	67	63	4	No	No	No	No
A-110	1	B		65	62	3	No	No	No	No
A-111	1	B		64	61	3	No	No	No	No
A-112	1	B		61	58	3	No	No	No	No
A-113	1	B		58	53	5	Yes	No	No	No
A-114	1	B		55	52	3	No	No	No	No
A-115	1	B		54	52	2	No	No	No	No
A-116	1	B		55	53	2	No	No	No	No
A-117	1	B		56	54	2	No	No	No	No
A-118	1	B		57	55	2	No	No	No	No
A-119	1	B		60	55	5	Yes	No	No	No
A-120	1	B		63	57	6	Yes	No	No	No
A-121	1	B		62	57	5	Yes	No	No	No
A-122	1	B		62	57	5	Yes	No	No	No
A-123	1	B		61	57	4	No	No	No	No
A-124	1	B		60	57	3	No	No	No	No
A-125	1	B		61	57	4	No	No	No	No
A-126	1	B		62	57	5	Yes	No	No	No
A-127	1	B		60	55	5	Yes	No	No	No
A-128	1	B		58	55	3	No	No	No	No
A-129	1	B		58	56	2	No	No	No	No
A-130	1	B		58	56	2	No	No	No	No
A-131	1	B		58	56	2	No	No	No	No
A-132	1	B		59	56	3	No	No	No	No
A-133	1	B		61	56	5	Yes	No	No	No
A-134	1	B		67	63	4	No	No	No	No
A-135	1	B		67	63	4	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-136	1	B		67	63	4	No	No	No	No
A-137	1	B		67	63	4	No	No	No	No
A-138	1	B		67	63	4	No	No	No	No
A-139	1	B		67	63	4	No	No	No	No
A-140	1	B		67	62	5	Yes	No	No	No
A-141	1	B	Yes	68	65	3	No	No	No	No
A-142	1	B	Yes	68	66	2	No	No	No	No
A-143	1	B	Yes	67	63	4	No	No	No	No
A-144	1	B	Yes	67	63	4	No	No	No	No
A-145	1	B	Yes	67	63	4	No	No	No	No
A-146	1	B	Yes	67	62	5	Yes	No	Yes	No
A-147	1	B	Yes	67	62	5	Yes	No	Yes	No
A-148	1	B	Yes	67	62	5	Yes	No	Yes	No
A-149	1	B		67	62	5	Yes	No	No	No
A-150	1	B		67	62	5	Yes	No	No	No
A-151	1	B		67	62	5	Yes	No	No	No
A-152	1	B		67	63	4	No	No	No	No
A-153	1	B		67	63	4	No	No	No	No
A-154	1	B		67	62	5	Yes	No	No	No
A-155	1	B		67	62	5	Yes	No	No	No
A-156	1	B		67	62	5	Yes	No	No	No
A-157	1	B		67	62	5	Yes	No	No	No
A-158	1	B		67	62	5	Yes	No	No	No
A-159	1	B		67	62	5	Yes	No	No	No
A-160	1	B		66	61	5	Yes	No	No	No
A-161	1	B		66	62	4	No	No	No	No
A-162	1	B		66	62	4	No	No	No	No
A-163	1	B		66	62	4	No	No	No	No
A-164	1	B		66	62	4	No	No	No	No
A-165	1	B		66	61	5	Yes	No	No	No
A-166	1	B		66	61	5	Yes	No	No	No
A-167	1	B		66	61	5	Yes	No	No	No
A-168	1	B		65	61	4	No	No	No	No

Table 8-22: Barrier 2 at 20 feet tall on ground and 6 feet tall on structure summary (Over Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	22
Percent of first row receivers achieve >=5 dBA reduction	76%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	17
Percent of first row receivers achieve design goal >=7 dBA reduction	59%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	75
Cost of noise wall (length x height x $20 per sq ft)	$776,191
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$776,191
Allowable cost ($30,000 per benefited receptor)	$2,250,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	Yes

BARRIER 1 BANGERTER HIGHWAY UNDER OPTION NOISE WALL ANALYSIS

Table 8-23: Barrier 1 at 12 feet tall and 1,230 feet long (Under Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	12-ft noise level	12-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	52	2	No	No	No	No
A-002	1	B		55	53	2	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	57	3	No	No	No	No
A-005	1	B		60	57	3	No	No	No	No
A-006	1	B		58	56	2	No	No	No	No
A-007	1	B		55	53	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	61	2	No	No	No	No
A-011	1	B		62	60	2	No	No	No	No
A-012	1	B	Yes	68	64	4	No	No	No	No
A-013	1	B	Yes	72	65	6	Yes	No	Yes	No
A-014	1	B	Yes	70	63	6	Yes	No	Yes	No
A-015	1	B	Yes	70	64	5	Yes	No	Yes	No
A-016	1	B	Yes	73	66	7	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	65	7	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	65	5	Yes	No	Yes	No
A-019	1	B	Yes	69	64	5	Yes	No	Yes	No
A-020	1	B	Yes	72	65	7	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	63	5	Yes	No	Yes	No
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	57	1	No	No	No	No
A-024	1	B		57	55	1	No	No	No	No
A-025	1	B		57	54	2	No	No	No	No
A-026	1	B		57	55	2	No	No	No	No
A-027	1	B		62	59	3	No	No	No	No
A-028	1	B		60	58	3	No	No	No	No
A-029	1	B		53	52	1	No	No	No	No
A-030	1	B		54	52	1	No	No	No	No

Table 8-24: Barrier 1 at 12 feet tall summary (Under Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	9
Percent of first row receivers achieve >=5 dBA reduction	90%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	3
Percent of first row receivers achieve design goal >=7 dBA reduction	30%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	No
Number of receivers benefited	9
Cost of noise wall (length x height x $20 per sq ft)	$295,200
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$295,200
Allowable cost ($30,000 per benefited receptor)	$270,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-25: Barrier 1 at 14 feet tall and 1,230 feet long (Under Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	14-ft noise level	14-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	52	2	No	No	No	No
A-002	1	B		55	53	2	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	57	3	No	No	No	No
A-005	1	B		60	57	3	No	No	No	No
A-006	1	B		58	55	3	No	No	No	No
A-007	1	B		55	53	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	60	3	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	63	5	Yes	No	Yes	No
A-013	1	B	Yes	72	64	7	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	62	7	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	63	6	Yes	No	Yes	No
A-016	1	B	Yes	73	65	8	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	64	8	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	64	6	Yes	No	Yes	No
A-019	1	B	Yes	69	63	6	Yes	No	Yes	No
A-020	1	B	Yes	72	64	8	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	62	6	Yes	No	Yes	No
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	57	1	No	No	No	No
A-024	1	B		57	55	1	No	No	No	No
A-025	1	B		57	54	2	No	No	No	No
A-026	1	B		57	55	2	No	No	No	No
A-027	1	B		62	59	3	No	No	No	No
A-028	1	B		60	58	3	No	No	No	No
A-029	1	B		53	52	1	No	No	No	No
A-030	1	B		54	52	1	No	No	No	No

Table 8-26: Barrier 1 at 14 feet tall summary (Under Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	5
Percent of first row receivers achieve design goal >=7 dBA reduction	50%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$344,400
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$344,400
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-27: Barrier 1 at 16 feet tall and 1,230 feet long (Under Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	52	2	No	No	No	No
A-002	1	B		55	52	3	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	56	4	No	No	No	No
A-005	1	B		60	56	4	No	No	No	No
A-006	1	B		58	55	3	No	No	No	No
A-007	1	B		55	53	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	60	3	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	62	6	Yes	No	Yes	No
A-013	1	B	Yes	72	63	8	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	62	7	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	62	7	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	64	9	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	63	9	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-019	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-020	1	B	Yes	72	64	8	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	62	6	Yes	No	Yes	No
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	56	2	No	No	No	No
A-024	1	B		57	54	2	No	No	No	No
A-025	1	B		57	54	2	No	No	No	No
A-026	1	B		57	54	3	No	No	No	No
A-027	1	B		62	59	3	No	No	No	No
A-028	1	B		60	57	4	No	No	No	No
A-029	1	B		53	51	2	No	No	No	No
A-030	1	B		54	51	2	No	No	No	No

Table 8-28: Barrier 1 at 16 feet tall summary (Under Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	8
Percent of first row receivers achieve design goal >=7 dBA reduction	80%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$393,600
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$393,600
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-29: Barrier 1 at 18 feet tall and 1,230 feet long (Under Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	52	2	No	No	No	No
A-002	1	B		55	52	3	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	56	4	No	No	No	No
A-005	1	B		60	56	4	No	No	No	No
A-006	1	B		58	55	3	No	No	No	No
A-007	1	B		55	53	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	60	3	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	62	6	Yes	No	Yes	No
A-013	1	B	Yes	72	62	9	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	61	8	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	61	8	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	63	10	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	62	10	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-019	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-020	1	B	Yes	72	63	9	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-022	1	B		62	58	4	No	No	No	No
A-023	1	B		59	56	2	No	No	No	No
A-024	1	B		57	54	2	No	No	No	No
A-025	1	B		57	54	2	No	No	No	No
A-026	1	B		57	54	3	No	No	No	No
A-027	1	B		62	58	4	No	No	No	No
A-028	1	B		60	57	4	No	No	No	No
A-029	1	B		53	51	2	No	No	No	No
A-030	1	B		54	51	2	No	No	No	No

Table 8-30: Barrier 1 at 18 feet tall summary (Under Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	9
Percent of first row receivers achieve design goal >=7 dBA reduction	90%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$442,800
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$442,800
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-31: Barrier 1 at 20 feet tall and 1,230 feet long (Under Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	51	3	No	No	No	No
A-002	1	B		55	52	3	No	No	No	No
A-003	1	B		56	53	3	No	No	No	No
A-004	1	B		60	56	4	No	No	No	No
A-005	1	B		60	56	4	No	No	No	No
A-006	1	B		58	54	4	No	No	No	No
A-007	1	B		55	52	2	No	No	No	No
A-008	1	B		54	51	3	No	No	No	No
A-009	1	B		57	55	2	No	No	No	No
A-010	1	B		63	59	4	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-013	1	B	Yes	72	61	10	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	60	9	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	60	9	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	62	11	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	62	10	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-019	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-020	1	B	Yes	72	62	10	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-022	1	B		62	58	4	No	No	No	No
A-023	1	B		59	56	2	No	No	No	No
A-024	1	B		57	54	2	No	No	No	No
A-025	1	B		57	54	2	No	No	No	No
A-026	1	B		57	53	4	No	No	No	No
A-027	1	B		62	58	4	No	No	No	No
A-028	1	B		60	57	4	No	No	No	No
A-029	1	B		53	50	3	No	No	No	No
A-030	1	B		54	51	2	No	No	No	No

Table 8-32: Barrier 1 at 20 feet tall summary (Under Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	10
Percent of first row receivers achieve design goal >=7 dBA reduction	100%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$492,000
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$492,000
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

BARRIER 2 BANGERTER HIGHWAY UNDER OPTION NOISE WALL ANALYSIS

Table 8-33: Barrier 2 at 16 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Under Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	57	7	Yes	Yes	No	No
A-050	1	B		66	57	7	Yes	Yes	No	No
A-051	1	B		65	57	7	Yes	Yes	No	No
A-052	1	B		65	57	7	Yes	Yes	No	No
A-053	1	B		65	58	6	Yes	No	No	No
A-054	1	B		62	55	6	Yes	No	No	No
A-055	1	B		59	52	7	Yes	Yes	No	No
A-056	1	B		61	53	7	Yes	Yes	No	No
A-057	1	B		60	51	8	Yes	Yes	No	No
A-058	1	B		65	57	7	Yes	Yes	No	No
A-059	1	B		67	58	8	Yes	Yes	No	No
A-060	1	B		63	55	7	Yes	Yes	No	No
A-061	1	B		63	54	8	Yes	Yes	No	No
A-062	1	B		62	53	8	Yes	Yes	No	No
A-063	1	B		60	51	8	Yes	Yes	No	No
A-064	1	B		60	51	7	Yes	Yes	No	No
A-065	1	B		59	51	7	Yes	Yes	No	No
A-066	1	B		58	50	7	Yes	Yes	No	No
A-067	1	B		58	52	5	Yes	No	No	No
A-068	1	B		55	51	4	No	No	No	No
A-069	1	B		55	52	3	No	No	No	No
A-070	1	B		57	53	3	No	No	No	No
A-071	1	B		60	55	5	Yes	No	No	No
A-072	1	B		60	55	4	No	No	No	No
A-073	1	B		61	54	6	Yes	No	No	No
A-074	1	B		62	54	7	Yes	Yes	No	No
A-075	1	B		67	60	6	Yes	No	No	No
A-076	1	B		67	60	6	Yes	No	No	No
A-077	1	B		67	61	5	Yes	No	No	No
A-078	1	B		67	61	6	Yes	No	No	No
A-079	1	B		67	61	5	Yes	No	No	No
A-080	1	B		65	60	5	Yes	No	No	No
A-081	1	B		65	60	4	No	No	No	No
A-082	1	B		64	59	5	Yes	No	No	No
A-083	1	B		62	58	4	No	No	No	No
A-084	1	B		66	64	2	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	65	2	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-088	1	B		69	66	3	No	No	No	No
A-089	1	B	Yes	70	66	4	No	No	No	No
A-090	1	B	Yes	71	66	4	No	No	No	No
A-091	1	B	Yes	71	65	5	Yes	No	Yes	No
A-092	1	B	Yes	71	65	5	Yes	No	Yes	No
A-093	1	B	Yes	71	64	6	Yes	No	Yes	No
A-094	1	B	Yes	71	63	7	Yes	Yes	Yes	Yes
A-095	1	B	Yes	71	63	6	Yes	No	Yes	No
A-096	1	B	Yes	70	62	7	Yes	Yes	Yes	Yes
A-097	1	B	Yes	70	61	7	Yes	Yes	Yes	Yes
A-098	1	B	Yes	69	61	7	Yes	Yes	Yes	Yes
A-099	1	B	Yes	69	61	7	Yes	Yes	Yes	Yes
A-100	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-101	1	B	Yes	70	61	7	Yes	Yes	Yes	Yes
A-102	1	B	Yes	70	60	8	Yes	Yes	Yes	Yes
A-103	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-104	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-105	1	B	Yes	69	60	6	Yes	No	Yes	No
A-106	1	B	Yes	68	60	6	Yes	No	Yes	No
A-107	1	B	Yes	68	60	6	Yes	No	Yes	No
A-108	1	B	Yes	68	61	5	Yes	No	Yes	No
A-109	1	B	Yes	67	62	4	No	No	No	No
A-110	1	B		65	62	2	No	No	No	No
A-111	1	B		64	61	3	No	No	No	No
A-112	1	B		61	58	3	No	No	No	No
A-113	1	B		58	53	4	No	No	No	No
A-114	1	B		55	52	2	No	No	No	No
A-115	1	B		54	52	2	No	No	No	No
A-116	1	B		55	53	2	No	No	No	No
A-117	1	B		56	54	1	No	No	No	No
A-118	1	B		57	55	1	No	No	No	No
A-119	1	B		60	55	4	No	No	No	No
A-120	1	B		63	57	5	Yes	No	No	No
A-121	1	B		62	57	4	No	No	No	No
A-122	1	B		62	57	3	No	No	No	No
A-123	1	B		61	57	3	No	No	No	No
A-124	1	B		60	56	4	No	No	No	No
A-125	1	B		61	57	3	No	No	No	No
A-126	1	B		62	57	4	No	No	No	No
A-127	1	B		60	55	4	No	No	No	No
A-128	1	B		58	55	2	No	No	No	No
A-129	1	B		58	55	2	No	No	No	No
A-130	1	B		58	55	2	No	No	No	No
A-131	1	B		58	55	3	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-132	1	B		59	56	2	No	No	No	No
A-133	1	B		61	56	4	No	No	No	No
A-134	1	B		67	62	4	No	No	No	No
A-135	1	B		67	63	3	No	No	No	No
A-136	1	B		67	62	4	No	No	No	No
A-137	1	B		67	62	4	No	No	No	No
A-138	1	B		67	62	4	No	No	No	No
A-139	1	B		67	62	4	No	No	No	No
A-140	1	B		67	62	4	No	No	No	No
A-141	1	B	Yes	68	64	3	No	No	No	No
A-142	1	B	Yes	68	65	3	No	No	No	No
A-143	1	B	Yes	67	62	4	No	No	No	No
A-144	1	B	Yes	67	62	4	No	No	No	No
A-145	1	B	Yes	67	62	4	No	No	No	No
A-146	1	B	Yes	67	62	4	No	No	No	No
A-147	1	B	Yes	67	62	4	No	No	No	No
A-148	1	B	Yes	67	62	3	No	No	No	No
A-149	1	B		67	62	3	No	No	No	No
A-150	1	B		67	62	4	No	No	No	No
A-151	1	B		67	62	4	No	No	No	No
A-152	1	B		67	62	4	No	No	No	No
A-153	1	B		67	62	4	No	No	No	No
A-154	1	B		67	62	4	No	No	No	No
A-155	1	B		67	62	4	No	No	No	No
A-156	1	B		67	62	4	No	No	No	No
A-157	1	B		67	62	4	No	No	No	No
A-158	1	B		67	62	3	No	No	No	No
A-159	1	B		67	62	3	No	No	No	No
A-160	1	B		66	61	4	No	No	No	No
A-161	1	B		66	61	4	No	No	No	No
A-162	1	B		66	61	4	No	No	No	No
A-163	1	B		66	61	4	No	No	No	No
A-164	1	B		66	61	4	No	No	No	No
A-165	1	B		66	60	5	Yes	No	No	No
A-166	1	B		66	60	5	Yes	No	No	No
A-167	1	B		66	60	5	Yes	No	No	No
A-168	1	B		65	60	4	No	No	No	No

Table 8-34: Barrier 2 at 16 feet tall on ground and 6 feet tall on structure summary (Under Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	18
Percent of first row receivers achieve >=5 dBA reduction	62%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	10
Percent of first row receivers achieve design goal >=7 dBA reduction	34%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	No
Number of receivers benefited	51
Cost of noise wall (length x height x $20 per sq ft)	$627,071
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$627,071
Allowable cost ($30,000 per benefited receptor)	$1,530,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	No

Table 8-35: Barrier 2 at 18 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Under Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	57	7	Yes	Yes	No	No
A-050	1	B		66	57	7	Yes	Yes	No	No
A-051	1	B		65	57	7	Yes	Yes	No	No
A-052	1	B		65	57	7	Yes	Yes	No	No
A-053	1	B		65	58	6	Yes	No	No	No
A-054	1	B		62	55	6	Yes	No	No	No
A-055	1	B		59	52	7	Yes	Yes	No	No
A-056	1	B		61	52	8	Yes	Yes	No	No
A-057	1	B		60	51	8	Yes	Yes	No	No
A-058	1	B		65	56	8	Yes	Yes	No	No
A-059	1	B		67	58	8	Yes	Yes	No	No
A-060	1	B		63	55	7	Yes	Yes	No	No
A-061	1	B		63	54	8	Yes	Yes	No	No
A-062	1	B		62	52	9	Yes	Yes	No	No
A-063	1	B		60	50	9	Yes	Yes	No	No
A-064	1	B		60	50	8	Yes	Yes	No	No
A-065	1	B		59	50	8	Yes	Yes	No	No
A-066	1	B		58	49	8	Yes	Yes	No	No
A-067	1	B		58	51	6	Yes	No	No	No
A-068	1	B		55	51	4	No	No	No	No
A-069	1	B		55	52	3	No	No	No	No
A-070	1	B		57	53	3	No	No	No	No
A-071	1	B		60	55	5	Yes	No	No	No
A-072	1	B		60	54	5	Yes	No	No	No
A-073	1	B		61	54	6	Yes	No	No	No
A-074	1	B		62	54	7	Yes	Yes	No	No
A-075	1	B		67	59	7	Yes	Yes	No	No
A-076	1	B		67	60	6	Yes	No	No	No
A-077	1	B		67	61	5	Yes	No	No	No
A-078	1	B		67	61	6	Yes	No	No	No
A-079	1	B		67	61	5	Yes	No	No	No
A-080	1	B		65	60	5	Yes	No	No	No
A-081	1	B		65	60	4	No	No	No	No
A-082	1	B		64	59	5	Yes	No	No	No
A-083	1	B		62	58	4	No	No	No	No
A-084	1	B		66	64	2	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	65	2	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No
A-088	1	B		69	66	3	No	No	No	No
A-089	1	B	Yes	70	66	4	No	No	No	No
A-090	1	B	Yes	71	65	5	Yes	No	Yes	No
A-091	1	B	Yes	71	65	5	Yes	No	Yes	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-092	1	B	Yes	71	64	6	Yes	No	Yes	No
A-093	1	B	Yes	71	63	7	Yes	Yes	Yes	Yes
A-094	1	B	Yes	71	63	7	Yes	Yes	Yes	Yes
A-095	1	B	Yes	71	62	7	Yes	Yes	Yes	Yes
A-096	1	B	Yes	70	62	7	Yes	Yes	Yes	Yes
A-097	1	B	Yes	70	61	7	Yes	Yes	Yes	Yes
A-098	1	B	Yes	69	61	7	Yes	Yes	Yes	Yes
A-099	1	B	Yes	69	60	8	Yes	Yes	Yes	Yes
A-100	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-101	1	B	Yes	70	60	8	Yes	Yes	Yes	Yes
A-102	1	B	Yes	70	60	8	Yes	Yes	Yes	Yes
A-103	1	B	Yes	69	59	8	Yes	Yes	Yes	Yes
A-104	1	B	Yes	69	59	8	Yes	Yes	Yes	Yes
A-105	1	B	Yes	69	59	7	Yes	Yes	Yes	Yes
A-106	1	B	Yes	68	60	6	Yes	No	Yes	No
A-107	1	B	Yes	68	60	6	Yes	No	Yes	No
A-108	1	B	Yes	68	61	5	Yes	No	Yes	No
A-109	1	B	Yes	67	62	4	No	No	No	No
A-110	1	B		65	62	2	No	No	No	No
A-111	1	B		64	61	3	No	No	No	No
A-112	1	B		61	58	3	No	No	No	No
A-113	1	B		58	52	5	Yes	No	No	No
A-114	1	B		55	52	2	No	No	No	No
A-115	1	B		54	52	2	No	No	No	No
A-116	1	B		55	53	2	No	No	No	No
A-117	1	B		56	54	1	No	No	No	No
A-118	1	B		57	55	1	No	No	No	No
A-119	1	B		60	55	4	No	No	No	No
A-120	1	B		63	57	5	Yes	No	No	No
A-121	1	B		62	56	5	Yes	No	No	No
A-122	1	B		62	56	4	No	No	No	No
A-123	1	B		61	56	4	No	No	No	No
A-124	1	B		60	56	4	No	No	No	No
A-125	1	B		61	56	4	No	No	No	No
A-126	1	B		62	56	5	Yes	No	No	No
A-127	1	B		60	55	4	No	No	No	No
A-128	1	B		58	55	2	No	No	No	No
A-129	1	B		58	55	2	No	No	No	No
A-130	1	B		58	55	2	No	No	No	No
A-131	1	B		58	55	3	No	No	No	No
A-132	1	B		59	56	2	No	No	No	No
A-133	1	B		61	56	4	No	No	No	No
A-134	1	B		67	62	4	No	No	No	No
A-135	1	B		67	63	3	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-136	1	B		67	62	4	No	No	No	No
A-137	1	B		67	62	4	No	No	No	No
A-138	1	B		67	62	4	No	No	No	No
A-139	1	B		67	62	4	No	No	No	No
A-140	1	B		67	62	4	No	No	No	No
A-141	1	B	Yes	68	64	3	No	No	No	No
A-142	1	B	Yes	68	65	3	No	No	No	No
A-143	1	B	Yes	67	62	4	No	No	No	No
A-144	1	B	Yes	67	62	4	No	No	No	No
A-145	1	B	Yes	67	62	4	No	No	No	No
A-146	1	B	Yes	67	61	5	Yes	No	Yes	No
A-147	1	B	Yes	67	61	5	Yes	No	Yes	No
A-148	1	B	Yes	67	62	3	No	No	No	No
A-149	1	B		67	62	3	No	No	No	No
A-150	1	B		67	62	4	No	No	No	No
A-151	1	B		67	62	4	No	No	No	No
A-152	1	B		67	62	4	No	No	No	No
A-153	1	B		67	62	4	No	No	No	No
A-154	1	B		67	61	5	Yes	No	No	No
A-155	1	B		67	61	5	Yes	No	No	No
A-156	1	B		67	61	5	Yes	No	No	No
A-157	1	B		67	61	5	Yes	No	No	No
A-158	1	B		67	61	4	No	No	No	No
A-159	1	B		67	62	3	No	No	No	No
A-160	1	B		66	61	4	No	No	No	No
A-161	1	B		66	61	4	No	No	No	No
A-162	1	B		66	61	4	No	No	No	No
A-163	1	B		66	61	4	No	No	No	No
A-164	1	B		66	61	4	No	No	No	No
A-165	1	B		66	60	5	Yes	No	No	No
A-166	1	B		66	60	5	Yes	No	No	No
A-167	1	B		66	60	5	Yes	No	No	No
A-168	1	B		65	60	4	No	No	No	No

Table 8-36: Barrier 2 at 18 feet tall on ground and 6 feet tall on structure summary (Under Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	21
Percent of first row receivers achieve >=5 dBA reduction	72%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	13
Percent of first row receivers achieve design goal >=7 dBA reduction	45%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	62
Cost of noise wall (length x height x $20 per sq ft)	$701,631
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$701,631
Allowable cost ($30,000 per benefited receptor)	$1,860,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	**Yes**

Table 8-37: Barrier 2 at 20 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Under Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	56	8	Yes	Yes	No	No
A-050	1	B		66	57	7	Yes	Yes	No	No
A-051	1	B		65	57	7	Yes	Yes	No	No
A-052	1	B		65	57	7	Yes	Yes	No	No
A-053	1	B		65	58	6	Yes	No	No	No
A-054	1	B		62	55	6	Yes	No	No	No
A-055	1	B		59	51	8	Yes	Yes	No	No
A-056	1	B		61	52	8	Yes	Yes	No	No
A-057	1	B		60	51	8	Yes	Yes	No	No
A-058	1	B		65	56	8	Yes	Yes	No	No
A-059	1	B		67	58	8	Yes	Yes	No	No
A-060	1	B		63	55	7	Yes	Yes	No	No
A-061	1	B		63	53	9	Yes	Yes	No	No
A-062	1	B		62	52	9	Yes	Yes	No	No
A-063	1	B		60	50	9	Yes	Yes	No	No
A-064	1	B		60	50	8	Yes	Yes	No	No
A-065	1	B		59	50	8	Yes	Yes	No	No
A-066	1	B		58	49	8	Yes	Yes	No	No
A-067	1	B		58	51	6	Yes	No	No	No
A-068	1	B		55	51	4	No	No	No	No
A-069	1	B		55	52	3	No	No	No	No
A-070	1	B		57	53	3	No	No	No	No
A-071	1	B		60	55	5	Yes	No	No	No
A-072	1	B		60	54	5	Yes	No	No	No
A-073	1	B		61	54	6	Yes	No	No	No
A-074	1	B		62	54	7	Yes	Yes	No	No
A-075	1	B		67	59	7	Yes	Yes	No	No
A-076	1	B		67	60	6	Yes	No	No	No
A-077	1	B		67	60	6	Yes	No	No	No
A-078	1	B		67	61	6	Yes	No	No	No
A-079	1	B		67	61	5	Yes	No	No	No
A-080	1	B		65	60	5	Yes	No	No	No
A-081	1	B		65	60	4	No	No	No	No
A-082	1	B		64	59	5	Yes	No	No	No
A-083	1	B		62	58	4	No	No	No	No
A-084	1	B		66	64	2	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	65	2	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No
A-088	1	B		69	66	3	No	No	No	No
A-089	1	B	Yes	70	66	4	No	No	No	No
A-090	1	B	Yes	71	65	5	Yes	No	Yes	No
A-091	1	B	Yes	71	65	5	Yes	No	Yes	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-092	1	B	Yes	71	64	6	Yes	No	Yes	No
A-093	1	B	Yes	71	63	7	Yes	Yes	Yes	Yes
A-094	1	B	Yes	71	63	7	Yes	Yes	Yes	Yes
A-095	1	B	Yes	71	62	7	Yes	Yes	Yes	Yes
A-096	1	B	Yes	70	61	8	Yes	Yes	Yes	Yes
A-097	1	B	Yes	70	61	7	Yes	Yes	Yes	Yes
A-098	1	B	Yes	69	60	8	Yes	Yes	Yes	Yes
A-099	1	B	Yes	69	60	8	Yes	Yes	Yes	Yes
A-100	1	B	Yes	69	59	8	Yes	Yes	Yes	Yes
A-101	1	B	Yes	70	60	8	Yes	Yes	Yes	Yes
A-102	1	B	Yes	70	59	9	Yes	Yes	Yes	Yes
A-103	1	B	Yes	69	59	8	Yes	Yes	Yes	Yes
A-104	1	B	Yes	69	59	8	Yes	Yes	Yes	Yes
A-105	1	B	Yes	69	59	7	Yes	Yes	Yes	Yes
A-106	1	B	Yes	68	59	7	Yes	Yes	Yes	Yes
A-107	1	B	Yes	68	60	6	Yes	No	Yes	No
A-108	1	B	Yes	68	61	5	Yes	No	Yes	No
A-109	1	B	Yes	67	62	4	No	No	No	No
A-110	1	B		65	61	3	No	No	No	No
A-111	1	B		64	61	3	No	No	No	No
A-112	1	B		61	58	3	No	No	No	No
A-113	1	B		58	52	5	Yes	No	No	No
A-114	1	B		55	52	2	No	No	No	No
A-115	1	B		54	52	2	No	No	No	No
A-116	1	B		55	53	2	No	No	No	No
A-117	1	B		56	54	1	No	No	No	No
A-118	1	B		57	55	1	No	No	No	No
A-119	1	B		60	55	4	No	No	No	No
A-120	1	B		63	57	5	Yes	No	No	No
A-121	1	B		62	56	5	Yes	No	No	No
A-122	1	B		62	56	4	No	No	No	No
A-123	1	B		61	56	4	No	No	No	No
A-124	1	B		60	56	4	No	No	No	No
A-125	1	B		61	56	4	No	No	No	No
A-126	1	B		62	56	5	Yes	No	No	No
A-127	1	B		60	55	4	No	No	No	No
A-128	1	B		58	55	2	No	No	No	No
A-129	1	B		58	55	2	No	No	No	No
A-130	1	B		58	55	2	No	No	No	No
A-131	1	B		58	55	3	No	No	No	No
A-132	1	B		59	55	3	No	No	No	No
A-133	1	B		61	56	4	No	No	No	No
A-134	1	B		67	62	4	No	No	No	No
A-135	1	B		67	62	4	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-136	1	B		67	62	4	No	No	No	No
A-137	1	B		67	62	4	No	No	No	No
A-138	1	B		67	62	4	No	No	No	No
A-139	1	B		67	62	4	No	No	No	No
A-140	1	B		67	62	4	No	No	No	No
A-141	1	B	Yes	68	64	3	No	No	No	No
A-142	1	B	Yes	68	65	3	No	No	No	No
A-143	1	B	Yes	67	62	4	No	No	No	No
A-144	1	B	Yes	67	62	4	No	No	No	No
A-145	1	B	Yes	67	62	4	No	No	No	No
A-146	1	B	Yes	67	61	5	Yes	No	Yes	No
A-147	1	B	Yes	67	61	5	Yes	No	Yes	No
A-148	1	B	Yes	67	61	4	No	No	No	No
A-149	1	B		67	62	3	No	No	No	No
A-150	1	B		67	62	4	No	No	No	No
A-151	1	B		67	61	5	Yes	No	No	No
A-152	1	B		67	61	5	Yes	No	No	No
A-153	1	B		67	62	4	No	No	No	No
A-154	1	B		67	61	5	Yes	No	No	No
A-155	1	B		67	61	5	Yes	No	No	No
A-156	1	B		67	61	5	Yes	No	No	No
A-157	1	B		67	61	5	Yes	No	No	No
A-158	1	B		67	61	4	No	No	No	No
A-159	1	B		67	61	4	No	No	No	No
A-160	1	B		66	61	4	No	No	No	No
A-161	1	B		66	61	4	No	No	No	No
A-162	1	B		66	61	4	No	No	No	No
A-163	1	B		66	61	4	No	No	No	No
A-164	1	B		66	61	4	No	No	No	No
A-165	1	B		66	60	5	Yes	No	No	No
A-166	1	B		66	60	5	Yes	No	No	No
A-167	1	B		66	60	5	Yes	No	No	No
A-168	1	B		65	60	4	No	No	No	No

Table 8-38: Barrier 2 at 20 feet tall on ground and 6 feet tall on structure summary (Under Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	21
Percent of first row receivers achieve >=5 dBA reduction	72%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	14
Percent of first row receivers achieve design goal >=7 dBA reduction	48%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	64
Cost of noise wall (length x height x $20 per sq ft)	$776,191
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$776,191
Allowable cost ($30,000 per benefited receptor)	$1,920,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	Yes

BARRIER 1 BANGERTER HIGHWAY HYBRID OPTION NOISE WALL ANALYSIS

Table 8-39: Barrier 1 at 12 feet tall and 1,230 feet long (Hybrid Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	12-ft noise level	12-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	53	1	No	No	No	No
A-002	1	B		55	53	2	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	58	2	No	No	No	No
A-005	1	B		60	57	3	No	No	No	No
A-006	1	B		58	56	2	No	No	No	No
A-007	1	B		55	54	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	61	2	No	No	No	No
A-011	1	B		62	60	2	No	No	No	No
A-012	1	B	Yes	68	64	4	No	No	No	No
A-013	1	B	Yes	72	65	7	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	65	5	Yes	No	Yes	No
A-015	1	B	Yes	70	65	5	Yes	No	Yes	No
A-016	1	B	Yes	73	67	7	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	66	6	Yes	No	Yes	No
A-018	1	B	Yes	70	65	5	Yes	No	Yes	No
A-019	1	B	Yes	69	64	5	Yes	No	Yes	No
A-020	1	B	Yes	72	66	5	Yes	No	Yes	No
A-021	1	B	Yes	68	63	4	No	No	No	No
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	57	1	No	No	No	No
A-024	1	B		57	55	1	No	No	No	No
A-025	1	B		57	55	1	No	No	No	No
A-026	1	B		57	55	2	No	No	No	No
A-027	1	B		62	59	3	No	No	No	No
A-028	1	B		60	57	3	No	No	No	No
A-029	1	B		53	51	2	No	No	No	No
A-030	1	B		54	52	1	No	No	No	No

Table 8-40: Barrier 1 at 12 feet tall summary (Hybrid Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	8
Percent of first row receivers achieve >=5 dBA reduction	80%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	2
Percent of first row receivers achieve design goal >=7 dBA reduction	20%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	No
Number of receivers benefited	8
Cost of noise wall (length x height x $20 per sq ft)	$295,200
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$295,200
Allowable cost ($30,000 per benefited receptor)	$240,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-41: Barrier 1 at 14 feet tall and 1,230 feet long (Hybrid Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	14-ft noise level	14-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	53	1	No	No	No	No
A-002	1	B		55	53	2	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	57	3	No	No	No	No
A-005	1	B		60	57	3	No	No	No	No
A-006	1	B		58	55	3	No	No	No	No
A-007	1	B		55	54	1	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	60	3	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	63	5	Yes	No	Yes	No
A-013	1	B	Yes	72	64	8	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	65	9	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	65	7	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	64	6	Yes	No	Yes	No
A-019	1	B	Yes	69	63	6	Yes	No	Yes	No
A-020	1	B	Yes	72	65	6	Yes	No	Yes	No
A-021	1	B	Yes	68	62	5	Yes	No	Yes	No
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	57	1	No	No	No	No
A-024	1	B		57	55	1	No	No	No	No
A-025	1	B		57	55	1	No	No	No	No
A-026	1	B		57	55	2	No	No	No	No
A-027	1	B		62	59	3	No	No	No	No
A-028	1	B		60	58	2	No	No	No	No
A-029	1	B		53	51	2	No	No	No	No
A-030	1	B		54	52	1	No	No	No	No

Table 8-42: Barrier 1 at 14 feet tall summary (Hybrid Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	5
Percent of first row receivers achieve design goal >=7 dBA reduction	50%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$344,400
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$344,400
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-43: Barrier 1 at 16 feet tall and 1,230 feet long (Hybrid Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	53	1	No	No	No	No
A-002	1	B		55	53	2	No	No	No	No
A-003	1	B		56	54	2	No	No	No	No
A-004	1	B		60	57	3	No	No	No	No
A-005	1	B		60	56	4	No	No	No	No
A-006	1	B		58	55	3	No	No	No	No
A-007	1	B		55	53	2	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	60	3	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	62	6	Yes	No	Yes	No
A-013	1	B	Yes	72	63	9	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	64	10	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	64	8	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	63	7	Yes	Yes	Yes	Yes
A-019	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-020	1	B	Yes	72	64	7	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	62	5	Yes	No	Yes	No
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	57	1	No	No	No	No
A-024	1	B		57	55	1	No	No	No	No
A-025	1	B		57	55	1	No	No	No	No
A-026	1	B		57	55	2	No	No	No	No
A-027	1	B		62	59	3	No	No	No	No
A-028	1	B		60	57	3	No	No	No	No
A-029	1	B		53	51	2	No	No	No	No
A-030	1	B		54	52	1	No	No	No	No

Table 8-44: Barrier 1 at 16 feet tall summary (Hybrid Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	8
Percent of first row receivers achieve design goal >=7 dBA reduction	80%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$393,600
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$393,600
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-45: Barrier 1 at 18 feet tall and 1,230 feet long (Hybrid Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	53	1	No	No	No	No
A-002	1	B		55	52	3	No	No	No	No
A-003	1	B		56	53	3	No	No	No	No
A-004	1	B		60	57	3	No	No	No	No
A-005	1	B		60	56	4	No	No	No	No
A-006	1	B		58	55	3	No	No	No	No
A-007	1	B		55	53	2	No	No	No	No
A-008	1	B		54	52	2	No	No	No	No
A-009	1	B		57	56	1	No	No	No	No
A-010	1	B		63	60	3	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	62	6	Yes	No	Yes	No
A-013	1	B	Yes	72	62	10	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	63	11	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	63	9	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-019	1	B	Yes	69	62	7	Yes	Yes	Yes	Yes
A-020	1	B	Yes	72	63	8	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	61	6	Yes	No	Yes	No
A-022	1	B		62	59	3	No	No	No	No
A-023	1	B		59	56	2	No	No	No	No
A-024	1	B		57	54	2	No	No	No	No
A-025	1	B		57	54	2	No	No	No	No
A-026	1	B		57	54	3	No	No	No	No
A-027	1	B		62	58	4	No	No	No	No
A-028	1	B		60	57	3	No	No	No	No
A-029	1	B		53	51	2	No	No	No	No
A-030	1	B		54	51	2	No	No	No	No

Table 8-46: Barrier 1 at 18 feet tall summary (Hybrid Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	8
Percent of first row receivers achieve design goal >=7 dBA reduction	80%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$442,800
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$442,800
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

Table 8-47: Barrier 1 at 20 feet tall and 1,230 feet long (Hybrid Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-001	1	B		55	52	2	No	No	No	No
A-002	1	B		55	52	3	No	No	No	No
A-003	1	B		56	53	3	No	No	No	No
A-004	1	B		60	57	3	No	No	No	No
A-005	1	B		60	56	4	No	No	No	No
A-006	1	B		58	54	4	No	No	No	No
A-007	1	B		55	53	2	No	No	No	No
A-008	1	B		54	51	3	No	No	No	No
A-009	1	B		57	55	2	No	No	No	No
A-010	1	B		63	59	4	No	No	No	No
A-011	1	B		62	59	3	No	No	No	No
A-012	1	B	Yes	68	61	7	Yes	Yes	Yes	Yes
A-013	1	B	Yes	72	61	11	Yes	Yes	Yes	Yes
A-014	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-015	1	B	Yes	70	61	9	Yes	Yes	Yes	Yes
A-016	1	B	Yes	73	63	11	Yes	Yes	Yes	Yes
A-017	1	B	Yes	72	62	10	Yes	Yes	Yes	Yes
A-018	1	B	Yes	70	62	8	Yes	Yes	Yes	Yes
A-019	1	B	Yes	69	61	8	Yes	Yes	Yes	Yes
A-020	1	B	Yes	72	63	8	Yes	Yes	Yes	Yes
A-021	1	B	Yes	68	61	6	Yes	No	Yes	No
A-022	1	B		62	58	4	No	No	No	No
A-023	1	B		59	56	2	No	No	No	No
A-024	1	B		57	54	2	No	No	No	No
A-025	1	B		57	54	2	No	No	No	No
A-026	1	B		57	54	3	No	No	No	No
A-027	1	B		62	58	4	No	No	No	No
A-028	1	B		60	57	3	No	No	No	No
A-029	1	B		53	50	3	No	No	No	No
A-030	1	B		54	51	2	No	No	No	No

Table 8-48: Barrier 1 at 20 feet tall summary (Hybrid Option)

Receiver Summary:	
Total receiver count	30
First row receiver count	10
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	10
Percent of first row receivers achieve >=5 dBA reduction	100%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	9
Percent of first row receivers achieve design goal >=7 dBA reduction	90%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	10
Cost of noise wall (length x height x $20 per sq ft)	$492,000
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$492,000
Allowable cost ($30,000 per benefited receptor)	$300,000
Cost effective (anticipated cost < allowable cost)	No
Feasible and Reasonable:	No

BARRIER 2 BANGERTER HIGHWAY HYBRID OPTION NOISE WALL ANALYSIS

Table 8-49: Barrier 2 at 16 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Hybrid Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	58	6	Yes	No	No	No
A-050	1	B		66	58	7	Yes	Yes	No	No
A-051	1	B		65	58	6	Yes	No	No	No
A-052	1	B		65	58	6	Yes	No	No	No
A-053	1	B		65	59	5	Yes	No	No	No
A-054	1	B		62	56	5	Yes	No	No	No
A-055	1	B		59	53	6	Yes	No	No	No
A-056	1	B		61	54	6	Yes	No	No	No
A-057	1	B		60	53	5	Yes	No	No	No
A-058	1	B		65	58	6	Yes	No	No	No
A-059	1	B		67	59	6	Yes	No	No	No
A-060	1	B		63	56	6	Yes	No	No	No
A-061	1	B		63	55	7	Yes	Yes	No	No
A-062	1	B		62	54	7	Yes	Yes	No	No
A-063	1	B		60	51	8	Yes	Yes	No	No
A-064	1	B		60	51	7	Yes	Yes	No	No
A-065	1	B		59	51	7	Yes	Yes	No	No
A-066	1	B		58	51	6	Yes	No	No	No
A-067	1	B		58	53	4	No	No	No	No
A-068	1	B		55	52	3	No	No	No	No
A-069	1	B		55	53	2	No	No	No	No
A-070	1	B		57	54	2	No	No	No	No
A-071	1	B		60	55	4	No	No	No	No
A-072	1	B		60	55	4	No	No	No	No
A-073	1	B		61	55	5	Yes	No	No	No
A-074	1	B		62	56	5	Yes	No	No	No
A-075	1	B		67	61	5	Yes	No	No	No
A-076	1	B		67	61	5	Yes	No	No	No
A-077	1	B		67	61	5	Yes	No	No	No
A-078	1	B		67	62	4	No	No	No	No
A-079	1	B		67	62	4	No	No	No	No
A-080	1	B		65	61	3	No	No	No	No
A-081	1	B		65	61	3	No	No	No	No
A-082	1	B		64	60	4	No	No	No	No
A-083	1	B		62	58	4	No	No	No	No
A-084	1	B		66	64	1	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	65	2	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-088	1	B		69	66	3	No	No	No	No
A-089	1	B	Yes	70	66	4	No	No	No	No
A-090	1	B	Yes	71	66	4	No	No	No	No
A-091	1	B	Yes	71	65	5	Yes	No	Yes	No
A-092	1	B	Yes	71	65	5	Yes	No	Yes	No
A-093	1	B	Yes	71	64	6	Yes	No	Yes	No
A-094	1	B	Yes	71	64	6	Yes	No	Yes	No
A-095	1	B	Yes	71	63	6	Yes	No	Yes	No
A-096	1	B	Yes	70	63	6	Yes	No	Yes	No
A-097	1	B	Yes	70	62	6	Yes	No	Yes	No
A-098	1	B	Yes	69	62	6	Yes	No	Yes	No
A-099	1	B	Yes	69	61	7	Yes	Yes	Yes	Yes
A-100	1	B	Yes	69	61	6	Yes	No	Yes	No
A-101	1	B	Yes	70	62	6	Yes	No	Yes	No
A-102	1	B	Yes	70	62	6	Yes	No	Yes	No
A-103	1	B	Yes	69	61	6	Yes	No	Yes	No
A-104	1	B	Yes	69	61	6	Yes	No	Yes	No
A-105	1	B	Yes	69	61	6	Yes	No	Yes	No
A-106	1	B	Yes	68	61	6	Yes	No	Yes	No
A-107	1	B	Yes	68	61	6	Yes	No	Yes	No
A-108	1	B	Yes	68	62	5	Yes	No	Yes	No
A-109	1	B	Yes	67	63	3	No	No	No	No
A-110	1	B		65	62	2	No	No	No	No
A-111	1	B		64	61	3	No	No	No	No
A-112	1	B		61	58	3	No	No	No	No
A-113	1	B		58	53	4	No	No	No	No
A-114	1	B		55	52	2	No	No	No	No
A-115	1	B		54	53	1	No	No	No	No
A-116	1	B		55	53	2	No	No	No	No
A-117	1	B		56	54	1	No	No	No	No
A-118	1	B		57	55	1	No	No	No	No
A-119	1	B		60	55	3	No	No	No	No
A-120	1	B		63	57	4	No	No	No	No
A-121	1	B		62	57	4	No	No	No	No
A-122	1	B		62	57	3	No	No	No	No
A-123	1	B		61	57	3	No	No	No	No
A-124	1	B		60	57	3	No	No	No	No
A-125	1	B		61	57	3	No	No	No	No
A-126	1	B		62	57	4	No	No	No	No
A-127	1	B		60	56	3	No	No	No	No
A-128	1	B		58	55	2	No	No	No	No
A-129	1	B		58	56	1	No	No	No	No
A-130	1	B		58	56	1	No	No	No	No
A-131	1	B		58	56	2	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	16-ft noise level	16-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-132	1	B		59	56	3	No	No	No	No
A-133	1	B		61	56	4	No	No	No	No
A-134	1	B		67	63	2	No	No	No	No
A-135	1	B		67	63	3	No	No	No	No
A-136	1	B		67	63	3	No	No	No	No
A-137	1	B		67	63	3	No	No	No	No
A-138	1	B		67	63	3	No	No	No	No
A-139	1	B		67	63	3	No	No	No	No
A-140	1	B		67	62	4	No	No	No	No
A-141	1	B	Yes	68	65	2	No	No	No	No
A-142	1	B	Yes	68	66	2	No	No	No	No
A-143	1	B	Yes	67	63	3	No	No	No	No
A-144	1	B	Yes	67	63	3	No	No	No	No
A-145	1	B	Yes	67	63	3	No	No	No	No
A-146	1	B	Yes	67	62	3	No	No	No	No
A-147	1	B	Yes	67	62	3	No	No	No	No
A-148	1	B	Yes	67	62	3	No	No	No	No
A-149	1	B		67	62	3	No	No	No	No
A-150	1	B		67	62	3	No	No	No	No
A-151	1	B		67	62	3	No	No	No	No
A-152	1	B		67	62	4	No	No	No	No
A-153	1	B		67	62	4	No	No	No	No
A-154	1	B		67	62	3	No	No	No	No
A-155	1	B		67	62	3	No	No	No	No
A-156	1	B		67	62	3	No	No	No	No
A-157	1	B		67	62	3	No	No	No	No
A-158	1	B		67	62	3	No	No	No	No
A-159	1	B		67	62	3	No	No	No	No
A-160	1	B		66	61	4	No	No	No	No
A-161	1	B		66	62	3	No	No	No	No
A-162	1	B		66	62	3	No	No	No	No
A-163	1	B		66	62	3	No	No	No	No
A-164	1	B		66	62	3	No	No	No	No
A-165	1	B		66	61	3	No	No	No	No
A-166	1	B		66	61	3	No	No	No	No
A-167	1	B		66	61	3	No	No	No	No
A-168	1	B		65	61	3	No	No	No	No

Table 8-50: Barrier 2 at 16 feet tall on ground and 6 feet tall on structure summary (Hybrid Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	18
Percent of first row receivers achieve >=5 dBA reduction	62%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	1
Percent of first row receivers achieve design goal >=7 dBA reduction	3%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	No
Number of receivers benefited	41
Cost of noise wall (length x height x $20 per sq ft)	$627,071
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$627,071
Allowable cost ($30,000 per benefited receptor)	$1,230,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	No

Table 8-51: Barrier 2 at 18 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Hybrid Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	57	7	Yes	Yes	No	No
A-050	1	B		66	58	7	Yes	Yes	No	No
A-051	1	B		65	57	7	Yes	Yes	No	No
A-052	1	B		65	57	7	Yes	Yes	No	No
A-053	1	B		65	58	6	Yes	No	No	No
A-054	1	B		62	55	6	Yes	No	No	No
A-055	1	B		59	52	7	Yes	Yes	No	No
A-056	1	B		61	53	7	Yes	Yes	No	No
A-057	1	B		60	52	6	Yes	No	No	No
A-058	1	B		65	57	7	Yes	Yes	No	No
A-059	1	B		67	59	6	Yes	No	No	No
A-060	1	B		63	55	7	Yes	Yes	No	No
A-061	1	B		63	54	8	Yes	Yes	No	No
A-062	1	B		62	53	8	Yes	Yes	No	No
A-063	1	B		60	51	8	Yes	Yes	No	No
A-064	1	B		60	51	7	Yes	Yes	No	No
A-065	1	B		59	51	7	Yes	Yes	No	No
A-066	1	B		58	50	7	Yes	Yes	No	No
A-067	1	B		58	52	5	Yes	No	No	No
A-068	1	B		55	52	3	No	No	No	No
A-069	1	B		55	52	3	No	No	No	No
A-070	1	B		57	53	3	No	No	No	No
A-071	1	B		60	55	4	No	No	No	No
A-072	1	B		60	55	4	No	No	No	No
A-073	1	B		61	55	5	Yes	No	No	No
A-074	1	B		62	55	6	Yes	No	No	No
A-075	1	B		67	60	6	Yes	No	No	No
A-076	1	B		67	60	6	Yes	No	No	No
A-077	1	B		67	61	5	Yes	No	No	No
A-078	1	B		67	62	4	No	No	No	No
A-079	1	B		67	61	5	Yes	No	No	No
A-080	1	B		65	60	4	No	No	No	No
A-081	1	B		65	60	4	No	No	No	No
A-082	1	B		64	60	4	No	No	No	No
A-083	1	B		62	58	4	No	No	No	No
A-084	1	B		66	64	1	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	65	2	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No
A-088	1	B		69	66	3	No	No	No	No
A-089	1	B	Yes	70	66	4	No	No	No	No
A-090	1	B	Yes	71	66	4	No	No	No	No
A-091	1	B	Yes	71	65	5	Yes	No	Yes	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-092	1	B	Yes	71	65	5	Yes	No	Yes	No
A-093	1	B	Yes	71	64	6	Yes	No	Yes	No
A-094	1	B	Yes	71	63	7	Yes	Yes	Yes	Yes
A-095	1	B	Yes	71	63	6	Yes	No	Yes	No
A-096	1	B	Yes	70	62	7	Yes	Yes	Yes	Yes
A-097	1	B	Yes	70	61	7	Yes	Yes	Yes	Yes
A-098	1	B	Yes	69	61	7	Yes	Yes	Yes	Yes
A-099	1	B	Yes	69	61	7	Yes	Yes	Yes	Yes
A-100	1	B	Yes	69	61	6	Yes	No	Yes	No
A-101	1	B	Yes	70	61	7	Yes	Yes	Yes	Yes
A-102	1	B	Yes	70	61	7	Yes	Yes	Yes	Yes
A-103	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-104	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-105	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-106	1	B	Yes	68	60	7	Yes	Yes	Yes	Yes
A-107	1	B	Yes	68	61	6	Yes	No	Yes	No
A-108	1	B	Yes	68	62	5	Yes	No	Yes	No
A-109	1	B	Yes	67	63	3	No	No	No	No
A-110	1	B		65	62	2	No	No	No	No
A-111	1	B		64	61	3	No	No	No	No
A-112	1	B		61	58	3	No	No	No	No
A-113	1	B		58	53	4	No	No	No	No
A-114	1	B		55	52	2	No	No	No	No
A-115	1	B		54	52	2	No	No	No	No
A-116	1	B		55	53	2	No	No	No	No
A-117	1	B		56	54	1	No	No	No	No
A-118	1	B		57	55	1	No	No	No	No
A-119	1	B		60	55	3	No	No	No	No
A-120	1	B		63	57	4	No	No	No	No
A-121	1	B		62	57	4	No	No	No	No
A-122	1	B		62	57	3	No	No	No	No
A-123	1	B		61	57	3	No	No	No	No
A-124	1	B		60	57	3	No	No	No	No
A-125	1	B		61	57	3	No	No	No	No
A-126	1	B		62	57	4	No	No	No	No
A-127	1	B		60	55	4	No	No	No	No
A-128	1	B		58	55	2	No	No	No	No
A-129	1	B		58	56	1	No	No	No	No
A-130	1	B		58	56	1	No	No	No	No
A-131	1	B		58	56	2	No	No	No	No
A-132	1	B		59	56	3	No	No	No	No
A-133	1	B		61	56	4	No	No	No	No
A-134	1	B		67	63	2	No	No	No	No
A-135	1	B		67	63	3	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	18-ft noise level	18-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-136	1	B		67	63	3	No	No	No	No
A-137	1	B		67	63	3	No	No	No	No
A-138	1	B		67	63	3	No	No	No	No
A-139	1	B		67	62	4	No	No	No	No
A-140	1	B		67	62	4	No	No	No	No
A-141	1	B	Yes	68	65	2	No	No	No	No
A-142	1	B	Yes	68	66	2	No	No	No	No
A-143	1	B	Yes	67	63	3	No	No	No	No
A-144	1	B	Yes	67	63	3	No	No	No	No
A-145	1	B	Yes	67	62	4	No	No	No	No
A-146	1	B	Yes	67	62	3	No	No	No	No
A-147	1	B	Yes	67	62	3	No	No	No	No
A-148	1	B	Yes	67	62	3	No	No	No	No
A-149	1	B		67	62	3	No	No	No	No
A-150	1	B		67	62	3	No	No	No	No
A-151	1	B		67	62	3	No	No	No	No
A-152	1	B		67	62	4	No	No	No	No
A-153	1	B		67	62	4	No	No	No	No
A-154	1	B		67	62	3	No	No	No	No
A-155	1	B		67	62	3	No	No	No	No
A-156	1	B		67	62	3	No	No	No	No
A-157	1	B		67	62	3	No	No	No	No
A-158	1	B		67	62	3	No	No	No	No
A-159	1	B		67	62	3	No	No	No	No
A-160	1	B		66	61	4	No	No	No	No
A-161	1	B		66	61	4	No	No	No	No
A-162	1	B		66	61	4	No	No	No	No
A-163	1	B		66	61	4	No	No	No	No
A-164	1	B		66	61	4	No	No	No	No
A-165	1	B		66	61	3	No	No	No	No
A-166	1	B		66	61	3	No	No	No	No
A-167	1	B		66	61	3	No	No	No	No
A-168	1	B		65	61	3	No	No	No	No

Table 8-52: Barrier 2 at 18 feet tall on ground and 6 feet tall on structure summary (Hybrid Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	18
Percent of first row receivers achieve >=5 dBA reduction	62%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	11
Percent of first row receivers achieve design goal >=7 dBA reduction	38%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	43
Cost of noise wall (length x height x $20 per sq ft)	$701,631
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$701,631
Allowable cost ($30,000 per benefited receptor)	$1,290,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	**Yes**

Table 8-53: Barrier 2 at 20 feet tall and 1,864 feet long on the ground, and 6 feet tall and 255 feet long across the structure for 3600 West (Hybrid Option)

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-049	1	B		65	57	7	Yes	Yes	No	No
A-050	1	B		66	57	8	Yes	Yes	No	No
A-051	1	B		65	57	7	Yes	Yes	No	No
A-052	1	B		65	57	7	Yes	Yes	No	No
A-053	1	B		65	58	6	Yes	No	No	No
A-054	1	B		62	55	6	Yes	No	No	No
A-055	1	B		59	52	7	Yes	Yes	No	No
A-056	1	B		61	52	8	Yes	Yes	No	No
A-057	1	B		60	51	7	Yes	Yes	No	No
A-058	1	B		65	57	7	Yes	Yes	No	No
A-059	1	B		67	58	7	Yes	Yes	No	No
A-060	1	B		63	55	7	Yes	Yes	No	No
A-061	1	B		63	54	8	Yes	Yes	No	No
A-062	1	B		62	52	9	Yes	Yes	No	No
A-063	1	B		60	50	9	Yes	Yes	No	No
A-064	1	B		60	50	8	Yes	Yes	No	No
A-065	1	B		59	50	8	Yes	Yes	No	No
A-066	1	B		58	49	8	Yes	Yes	No	No
A-067	1	B		58	52	5	Yes	No	No	No
A-068	1	B		55	51	4	No	No	No	No
A-069	1	B		55	52	3	No	No	No	No
A-070	1	B		57	53	3	No	No	No	No
A-071	1	B		60	55	4	No	No	No	No
A-072	1	B		60	54	5	Yes	No	No	No
A-073	1	B		61	54	6	Yes	No	No	No
A-074	1	B		62	54	7	Yes	Yes	No	No
A-075	1	B		67	59	7	Yes	Yes	No	No
A-076	1	B		67	60	6	Yes	No	No	No
A-077	1	B		67	61	5	Yes	No	No	No
A-078	1	B		67	61	5	Yes	No	No	No
A-079	1	B		67	61	5	Yes	No	No	No
A-080	1	B		65	60	4	No	No	No	No
A-081	1	B		65	60	4	No	No	No	No
A-082	1	B		64	59	5	Yes	No	No	No
A-083	1	B		62	58	4	No	No	No	No
A-084	1	B		66	64	1	No	No	No	No
A-085	1	B		67	65	2	No	No	No	No
A-086	1	B		67	65	2	No	No	No	No
A-087	1	B		68	66	2	No	No	No	No
A-088	1	B		69	66	3	No	No	No	No
A-089	1	B	Yes	70	66	4	No	No	No	No
A-090	1	B	Yes	71	65	5	Yes	No	Yes	No
A-091	1	B	Yes	71	65	5	Yes	No	Yes	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-092	1	B	Yes	71	64	6	Yes	No	Yes	No
A-093	1	B	Yes	71	63	7	Yes	Yes	Yes	Yes
A-094	1	B	Yes	71	63	7	Yes	Yes	Yes	Yes
A-095	1	B	Yes	71	62	7	Yes	Yes	Yes	Yes
A-096	1	B	Yes	70	62	7	Yes	Yes	Yes	Yes
A-097	1	B	Yes	70	61	7	Yes	Yes	Yes	Yes
A-098	1	B	Yes	69	61	7	Yes	Yes	Yes	Yes
A-099	1	B	Yes	69	60	8	Yes	Yes	Yes	Yes
A-100	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-101	1	B	Yes	70	61	7	Yes	Yes	Yes	Yes
A-102	1	B	Yes	70	60	8	Yes	Yes	Yes	Yes
A-103	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-104	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-105	1	B	Yes	69	60	7	Yes	Yes	Yes	Yes
A-106	1	B	Yes	68	60	7	Yes	Yes	Yes	Yes
A-107	1	B	Yes	68	60	7	Yes	Yes	Yes	Yes
A-108	1	B	Yes	68	61	6	Yes	No	Yes	No
A-109	1	B	Yes	67	63	3	No	No	No	No
A-110	1	B		65	62	2	No	No	No	No
A-111	1	B		64	61	3	No	No	No	No
A-112	1	B		61	58	3	No	No	No	No
A-113	1	B		58	53	4	No	No	No	No
A-114	1	B		55	52	2	No	No	No	No
A-115	1	B		54	52	2	No	No	No	No
A-116	1	B		55	53	2	No	No	No	No
A-117	1	B		56	54	1	No	No	No	No
A-118	1	B		57	55	1	No	No	No	No
A-119	1	B		60	55	3	No	No	No	No
A-120	1	B		63	57	4	No	No	No	No
A-121	1	B		62	57	4	No	No	No	No
A-122	1	B		62	57	3	No	No	No	No
A-123	1	B		61	57	3	No	No	No	No
A-124	1	B		60	56	4	No	No	No	No
A-125	1	B		61	57	3	No	No	No	No
A-126	1	B		62	57	4	No	No	No	No
A-127	1	B		60	55	4	No	No	No	No
A-128	1	B		58	55	2	No	No	No	No
A-129	1	B		58	55	2	No	No	No	No
A-130	1	B		58	56	1	No	No	No	No
A-131	1	B		58	56	2	No	No	No	No
A-132	1	B		59	56	3	No	No	No	No
A-133	1	B		61	56	4	No	No	No	No
A-134	1	B		67	63	2	No	No	No	No
A-135	1	B		67	63	3	No	No	No	No

Receptor	Number of dwelling units	NAC	1st row receptor	Baseline noise level	20-ft noise level	20-ft noise reduction	Benefited	Design Goal	1st row >= 5 dBA reduction	1st row design goal
A-136	1	B		67	63	3	No	No	No	No
A-137	1	B		67	63	3	No	No	No	No
A-138	1	B		67	63	3	No	No	No	No
A-139	1	B		67	62	4	No	No	No	No
A-140	1	B		67	62	4	No	No	No	No
A-141	1	B	Yes	68	65	2	No	No	No	No
A-142	1	B	Yes	68	66	2	No	No	No	No
A-143	1	B	Yes	67	63	3	No	No	No	No
A-144	1	B	Yes	67	63	3	No	No	No	No
A-145	1	B	Yes	67	62	4	No	No	No	No
A-146	1	B	Yes	67	62	3	No	No	No	No
A-147	1	B	Yes	67	62	3	No	No	No	No
A-148	1	B	Yes	67	62	3	No	No	No	No
A-149	1	B		67	62	3	No	No	No	No
A-150	1	B		67	62	3	No	No	No	No
A-151	1	B		67	62	3	No	No	No	No
A-152	1	B		67	62	4	No	No	No	No
A-153	1	B		67	62	4	No	No	No	No
A-154	1	B		67	62	3	No	No	No	No
A-155	1	B		67	62	3	No	No	No	No
A-156	1	B		67	62	3	No	No	No	No
A-157	1	B		67	62	3	No	No	No	No
A-158	1	B		67	62	3	No	No	No	No
A-159	1	B		67	62	3	No	No	No	No
A-160	1	B		66	61	4	No	No	No	No
A-161	1	B		66	61	4	No	No	No	No
A-162	1	B		66	61	4	No	No	No	No
A-163	1	B		66	61	4	No	No	No	No
A-164	1	B		66	61	4	No	No	No	No
A-165	1	B		66	61	3	No	No	No	No
A-166	1	B		66	61	3	No	No	No	No
A-167	1	B		66	61	3	No	No	No	No
A-168	1	B		65	61	3	No	No	No	No

Table 8-54: Barrier 2 at 20 feet tall on ground and 6 feet tall on structure summary (Hybrid Option)

Receiver Summary:	
Total receiver count	119
First row receiver count	29
Feasibility Factors:	
Number of first row receivers achieve >=5 dBA reduction	19
Percent of first row receivers achieve >=5 dBA reduction	66%
Acoustic feasibility (>=5 dBA reduction for >=50% of front-row)	Yes
Reasonableness Factors:	
Number of first row receivers achieve design goal >=7 dBA reduction	15
Percent of first row receivers achieve design goal >=7 dBA reduction	52%
Noise abatement design goal (>=7dBA reduction for >=35% of front-row)	Yes
Number of receivers benefited	47
Cost of noise wall (length x height x $20 per sq ft)	$776,191
Cost of any other items critical to safety	0
Anticipated cost of noise abatement	$776,191
Allowable cost ($30,000 per benefited receptor)	$1,410,000
Cost effective (anticipated cost < allowable cost)	Yes
Feasible and Reasonable:	**Yes**

Appendix E: Noise Levels on Undeveloped Land

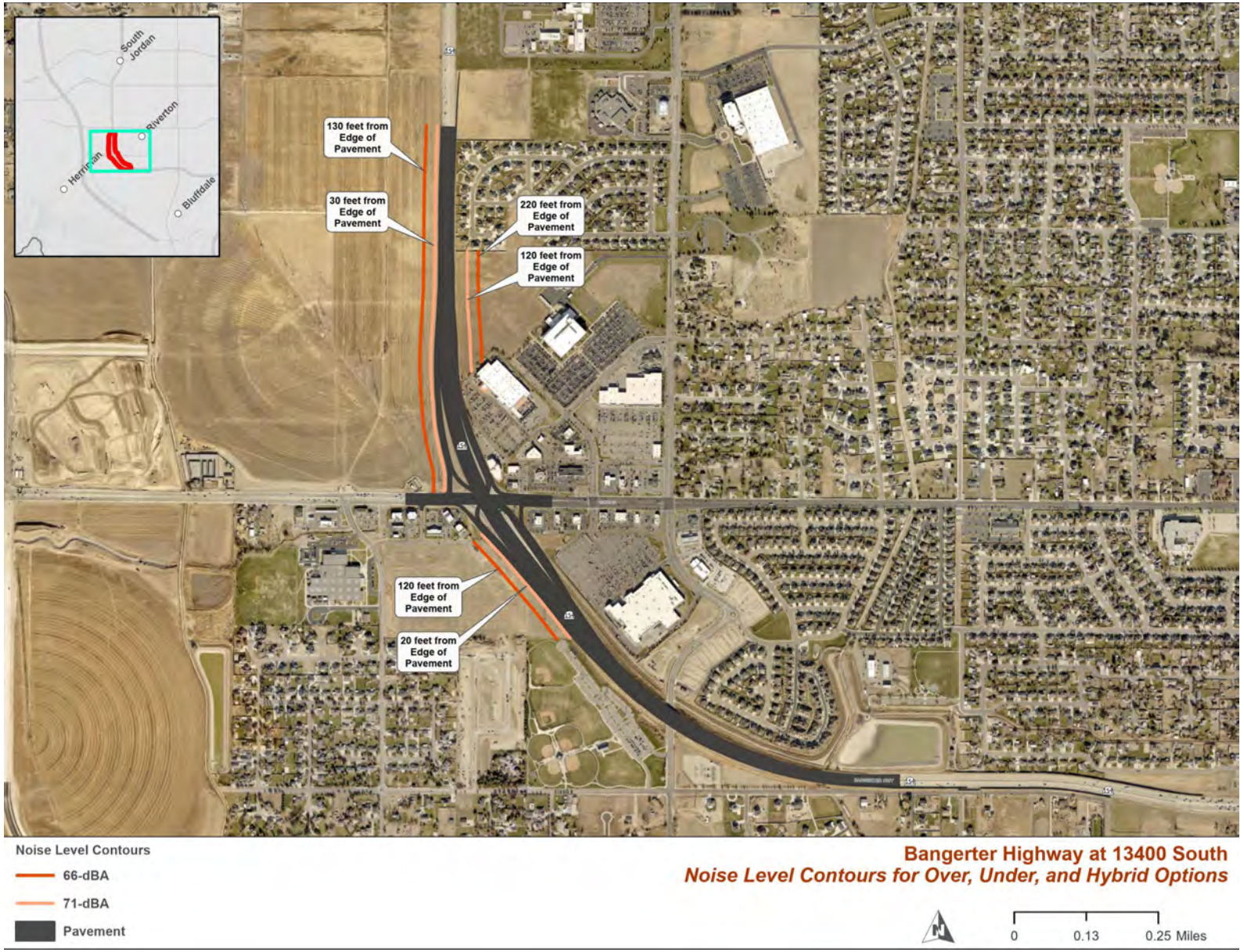

Figure E-1: Noise Levels on Undeveloped Land Analysis

Appendix D: Environmental Resources

Hazardous Materials Memo

MEMORANDUM

Date:	Thursday, December 23, 2021
Project::	PIN: 18808; Project Number: S-0154(92)0; Bangerter Highway at 13400 South Interchange Improvements
To:	Project File
From:	HDR
Subject:	Evaluation of Hazardous Materials Sites

INTRODUCTION

HDR, Inc., has prepared this evaluation in support of the Utah Department of Transportation's (UDOT) proposal to construct a grade-separated interchange at the intersection of Bangerter Highway and 13400 South in Riverton, Utah (the Proposed Action).

There are three options for the Proposed Action's grade-separated interchange:

Bangerter Highway Over Option. The vertical alignment for 13400 South would stay at the existing grade, and Bangerter Highway would go over 13400 South, above the existing grade.

Bangerter Highway Under Option. The vertical alignment for 13400 South would be at the existing grade, and Bangerter Highway would go under 13400 South, below the existing grade.

Bangeter Highway Hybrid Option. The vertical alignment for 13400 South would be lower than the existing grade, and Bangerter Highway would go over 13400 South, above the existing grade. Both Bangerter Highway and 13400 South would be at lower elevations compared to the Over Alternative.

HAZARDOUS MATERIALS

Hazardous materials include any solid, liquid, or gaseous materials that, if improperly managed or disposed of, could pose substantial hazards to human health and the environment. A material is considered hazardous if it exhibits one or more of the following characteristics: ignitability, corrosivity, reactivity, and toxicity.

The Resource Conservation and Recovery Act (RCRA) was enacted in 1976 to regulate the safe management of hazardous and non-hazardous solid waste (that is, garbage) and underground storage tanks (USTs) that hold petroleum products or certain chemicals, including leaking underground storage tanks (LUSTs). Under the RCRA, hazardous wastes are tracked from the time they are generated until the time they are ultimately disposed of or recycled.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) was enacted in 1980. CERCLA provides for the cleanup and remediation of closed and abandoned hazardous waste sites where hazardous waste has been abandoned, accidentally spilled, or illegally dumped, and also created a "Superfund" to help pay for cleanup costs.

AFFECTED ENVIRONMENT

Hazardous materials and waste sites were evaluated by reviewing records from the Utah Department of Environmental Quality (UDEQ). These sites included Brownfields; Compensation, and Liability Information System (CERCLIS) sites; Environmental Incidents; Enforceable Written Assurances (EWAs); Formerly Used Defense (FUD) Sites; Leaking Underground Storage Tanks (LUSTs); National Priorities list (NPL) sites; Solid Waste Sites; Tier II sites; Toxic Release Inventory (TRI); Used Oil Facilities; and Underground Storage Tanks (USTs). Sites were reviewed for the potential to be affected by the Proposed Action based on standard radius distances as shown in Table 1.

Table 1: Description of Hazardous Materials Sites and Search Radius

Site Type	Search Radius Beyond Study Area	Description
Brownfield	0.5 mile	Brownfields are former industrial areas.
CERCLIS	0.5 mile	CERCLIS sites contain listed chemicals under CERCLA but have not been categorized as NPL sites.
Environmental Incident	Study area or adjacent property	Environmental incidents are locations where a spill or other incident regarding hazardous materials has been reported.
EWA	0.5 mile	EWA sites are properties where the owner has come to an agreement with UDEQ regarding obligations associated with hazardous materials or waste on the site.
Formerly Used Defense Site	0.5 mile	Formerly used defense sites that were once under the jurisdiction of the U.S. Department of Defense and could contain hazardous, toxic, or radioactive wastes in the soil, water, or containers on site.
LUST	0.5 mile	LUSTs are UST sites where a leak has been detected.
NPL	1 mile	NPL sites are those containing listed chemicals under CERCLA and that have been identified as priorities for cleanup.
Solid Waste Site	0.5 mile	Solid waste sites include landfills and transfer stations.
Tier II	0.5 mile	Tier II sites are sites with documented hazardous chemicals stored on site.
TRI	0.5 mile	TRI sites are sites such as manufacturing or mining facilities that manufacture or process listed chemicals.
Used Oil Facility	Study area or adjacent property	Used oil facilities are sites that store, transport, or recycle used oil.
UST	Study area or adjacent property	USTs are sites where underground storage tanks are currently being used or have been used to store petroleum products such as gasoline or diesel fuel.

Brownfield

No brownfield sites are located within 0.5 mile of the study area.

CERCLIS

No CERCLIS sites are located within 0.5 mile of the study area.

Environmental Incident

No Environmental Incidents have occurred in the study area or on an adjacent property.

Enforceable Written Assurances (EWA)

Two EWA sites are located within 0.5 mile of the study area. Both sites are located east of Bangerter Highway and north of 13400 South near its intersection with Bangerter Highway. Both EWAs were issued in 2007 prior to the current developments on these sites. See Table 2 for a listing of EWA sites and Figure 1 for the locations.

Formerly Used Defense Site

No formerly used defense sites are located within 0.5 mile of the study area.

National Prioirites List (NPL)

No NPL sites are located within 1 mile of the study area.

Solid Waste Site

No soild waste sites are located within 0.5 mile of the study area.

Tier II

There is one Tier II site in the study area. Dominion Energy has an active odorant station at 3950 West 13400 South to add the “rotten-egg smell” to natural gas. See Table 2 for a listing of the Tier II site and Figure 1 for the location.

Toxic Release Inventory (TRI)

No TRI sites are located within 0.5 mile of the study area.

Used Oil Facility

No used oil facility sites are located in the study area or on an adjacent property.

Underground Storage Tanks (UST) and Leaking Underground Storage Tanks (LUST)

Four UST sites are located in the study area. All four sites are west of Bangerter Highway and south of 13400 South near its intersection with Bangerter Highway. Two of the sites are active, and two were removed in 1990 or 1991. See Table 2 for a listing of UST sites and Figure 1 for the locations.

Table 2: Hazardous Materials Sites Identified in the Corresponding Search Radius for the Proposed Action

Map Key	Name	Address	Site Type	UDEQ ID	Comments on Status
A	Deluca, Inc.	4091 W 13400 S	UST	4000241	Closed 1991
B	Maverik	13400 S 4050 W	UST	4002560	Active UST
C	Forest Hill Turf and Nursery	4000 W 13400 S	UST	4001658	Closed 1990
D	Holiday Oil	3978 Innovation Drive	UST	4002348	Active UST
E	Riverton Office Building	13200 S 3600 W	EWA	7 / Pending5117	Issued 2007 prior to development
F	Vacant parcel	13150 S 3600 W	EWA	8 / New82	Issued 2007 prior to development
G	Dominion Energy Riverton Odorant Station	3950 W 13400 S	Tier 2	UT009966	Active Tier II Facility

ENVIRONMENTAL CONSEQUENCES

Four UST sites and one Tier II site have been identified in the study area. Two EWA sites have been identified within 0.5 mile of the study boundary. Of these sites, two UST sites (B and D) and the Tier II site (G) are considered active sites.

The Proposed Action and its three alternatives would have no direct or indirect impacts to hazardous materials sites identified in this memo, nor would the sites affect the proposed action. The hazardous waste sites listed in this memo are outside the area of impact. Properties outside those identified in this memo that have been closed by UDEQ with no evidence of contamination extending beyond the property boundary were not included because they would have no potential to affect the Proposed Action. Any contamination encountered during project activities will be handled in accordance with the UDOT 2022 Standard Specification 01355 regarding the treatment and disposal of hazardous materials.

Figure 1: Study Area Overview and Hazardous Materials Sites

Appendix D: Environmental Resources

Air Quality Summary

Air Quality Summary

Bangerter Highway at 1300 South Intersection Improvements

Project Number: S-0154(92)0; PIN: 18808

Lead Agency: Utah Department of Transportation

December 2021

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Abbreviations and Acronyms

CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
EPA	United States Environmental Protection Agency
GHG	greenhouse gas
ID	identifier
LOS	level of service
MSATs	mobile-source air toxics
NAAQS	National Ambient Air Quality Standards
NO_2	nitrogen dioxide
O_3	ozone
PM	particulate matter
SIP	state implementation plan
TIP	transportation improvement program
U.S.	United States
UDOT	Utah Department of Transportation
USC	United States Code
VMT	vehicle-miles traveled
WFRC	Wasatch Front Regional Council

1.0 Introduction

The Utah Department of Transportation (UDOT) is conducting a State Environmental Study to evaluate a potential freeway-style interchange at Bangerter Highway and 13400 South in Riverton, Utah, in order to reduce congestion and improve safety.

1.1 Project Study Area

The proposed interchange would be constructed in Riverton, Utah. The study area is located on both sides of Bangerter Highway from milepost 4.9 to 6.5 and on both sides of 13400 South between about 3630 West and 4150 West.

1.2 Proposed Action

Project work for the Proposed Action includes constructing a grade-separated interchange at Bangerter Highway and 13400 South as well as the associated on- and off-ramps. Project work would also include minor widening and restriping on 13400 South to accommodate the turn lanes for the new grade-separated interchange; modifying utilities and storm drainage; and installing new pavement, traffic signals, advanced traffic management systems (ATMS) equipment, and roadway signs. These improvements would improve traffic flow and safety on Bangerter Highway and 13400 South.

When funding is available, project work might also include adding a dual northbound off-ramp, extending the southbound on-ramp east of 3600 West, constructing auxiliary lanes between the 13400 South northbound on-ramp and the 12600 South northbound off-ramp, and constructing auxiliary lanes between the 12600 South southbound on-ramp and the 13400 South southbound off-ramp. A noise wall would be added on the east side of Bangerter Highway from about 13650 South to 13750 South near the clear zone for northbound Bangerter Highway traffic and across the bridge that spans 3600 West if the auxiliary lanes are constructed.

2.0 Purpose and Need

The primary purpose of this project is to alleviate congestion and improve traffic operations and mobility at the Bangerter Highway and 13400 South intersection.

During the current (2021) AM and PM peak periods, drivers waiting at this intersection experience an average delay of 58 and 64 seconds, respectively. These delay conditions are both classified as level of service (LOS) E. If no operational improvements are made at this intersection (No-Action Alternative), traffic modeling indicates that, by 2050, this intersection would operate at LOS F, and delays would exceed 180 seconds per vehicle during the AM and PM peak periods.

Additionally, traffic modeling indicates that, by 2050, long queues of vehicles stopped at the Bangerter Highway and 13400 South intersection would extend back through adjacent intersections on 13400 South (4050 West, Market Center Drive, and Hamilton View Road), causing those intersections to also operate at LOS F during at least one peak period. The new grade-separated interchange would improve traffic flow on Bangerter Highway.

3.0 Attainment Status for the Project Study Area

3.1 Background on National Ambient Air Quality Standards

The U.S. Environmental Protection Agency (EPA), under the authority of the Clean Air Act (42 United States Code [USC] Section 7401 and subsequent sections), established National Ambient Air Quality Standards (NAAQS) for ubiquitous pollutants considered harmful to public health and the environment (40 Code of Federal Regulations [CFR] Part 50). The current NAAQS for criteria pollutants are shown in Table 1. According to EPA, transportation sources currently contribute to four of the six criteria pollutants: carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), ozone (O_3), and nitrogen dioxide (NO_2).

If an area meets the NAAQS for a given air pollutant, the area is called an *attainment area* for that pollutant (because the NAAQS have been attained). If an area does not meet the NAAQS for a given air pollutant, the area is called a *nonattainment area*. A *maintenance area* is an area previously designated as a nonattainment area that has been redesignated as an attainment area and is required by Section 175A of the Clean Air Act, as amended, to have a maintenance plan for the 20 years following its redesignation to attainment or maintenance status. The Clean Air Act also requires each State to prepare and submit a state implementation plan (SIP) to attain, maintain, and enforce the NAAQS.

Table 1. National and Utah Ambient Air Quality Standards for Criteria Pollutants and Attainment Status for Salt Lake County

Pollutant	Primary/Secondary Standard	Averaging Time	Level	Form	Attainment Status for Salt Lake County
Carbon monoxide (CO)	Primary	8 hours	9 ppm	Not be exceeded more than once per year	Partial attainment area[a]
		1 hour	35 ppm	Not be exceeded more than once per year	
Ozone (O_3)	Primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years	Marginal nonattainment area
Particulate matter ($PM_{2.5}$)	Primary	1 year	12.0 µg/m^3	Annual mean, averaged over 3 years	Serious nonattainment area
	Secondary	1 year	15.0 µg/m^3	Annual mean, averaged over 3 years	
	Primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years	
Particulate matter (PM_{10})	Primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years	Maintenance area
Nitrogen dioxide (NO_2)	Primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years	Attainment area
	Primary and secondary	1 year	53 ppb	Annual mean	Attainment area
Sulfur dioxide (SO_2)[b]	Primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years	Attainment area
	Secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year	Attainment area
Lead (Pb)	Primary and secondary	Rolling 3-month average	0.15 µg/m^3	Not to be exceeded	Attainment area

Sources: 49 CFR Part 50 (NAAQS) and EPA Greenbook (https://www.epa.gov/green-book)

µg/m^3 = micrograms per cubic meter; ppm = parts per million; ppb = parts per billion; $PM_{2.5}$ = particulate matter 2.5 microns in diameter or less; PM_{10} = particulate matter 10 microns in diameter or less

[a] A section of Salt Lake County is a CO maintenance area, but the rest is an attainment area. The project study area is located in the attainment area.

[b] The SO_2 standards shown in this table are the current standards, which were established in 2010. Salt Lake County has been designated as an attainment area based on these standards. However, Salt Lake County is an SO_2 nonattainment area based on previous standards set in 1971 and has yet to be designated as an attainment area based on the 1971 standards.

Section 176(c) of the Clean Air Act, and its related amendments, require that transportation plans, programs, and projects that are developed, funded, or approved by the Federal Highway Administration and/or Federal Transit Administration, and metropolitan planning organizations, must demonstrate that such activities conform to the SIP. An individual project is said to conform to the SIP if, both by itself and in combination with the other planned transportation projects, it would not result in any of the following conditions [42 USC Section 7506(c)]:

- Cause or contribute to new air quality violations of the NAAQS,
- Worsen existing violations of the NAAQS, or
- Delay timely attainment of the NAAQS or required interim milestones.

3.2 Attainment Status of the Study Area

The project study area is located in Salt Lake County, which is a nonattainment area for $PM_{2.5}$, O_3, and SO_2. Salt Lake County is a maintenance area for PM_{10}, having transitioned from a nonattainment area effective March 27, 2020. Table 1 above shows Salt Lake County's attainment status for each criteria pollutant. Sulfur dioxide (SO_2) and lead (Pb) are not considered transportation-related criteria pollutants and are not discussed further.

What are attainment, nonattainment, and maintenance areas?

An attainment area is an area that meets (or "attains") the NAAQS for a given air pollutant.

A nonattainment area is an area that does not meet the NAAQS for a given air pollutant.

A maintenance area is an area previously designated as a nonattainment area that has been redesignated to attainment status and is required to have a maintenance plan.

The Proposed Action is identified as a Phase 1 project (Project ID: R-S-197) in the Wasatch Front Regional Council's (WFRC) 2019–2050 *Wasatch Front Regional Transportation Plan*[1] and is also identified in WFRC's conforming 2021–2026 transportation improvement program (TIP).

During the current (2021) AM and PM peak periods, drivers at the Bangerter Highway and 13400 South intersection experience an average delay of 58 and 64 seconds, respectively. These delay conditions are both classified as LOS E. If no operational improvements are made at this intersection (No-Action Alternative), traffic modeling indicates that, by 2050, this intersection would operate at LOS F, and delays would exceed 180 seconds per vehicle during the AM and PM peak periods.

Additionally, traffic modeling indicates that, by 2050, long queues of vehicles stopped at the Bangerter Highway and 13400 South intersection would extend back through adjacent intersections on 13400 South (4050 West, Market Center Drive, and Hamilton View Road), causing those intersections to also operate at LOS F during at least one peak period.

The new grade-separated interchange would improve traffic flow on Bangerter Highway. Vehicle emissions would be lower with the Proposed Action because there would be less traffic congestion and decreased travel times compared to the existing conditions and the No-Action Alternative.

[1] https://wfrc.org/VisionPlans/RegionalTransportationPlan/Adopted2019_2050Plan/RTP_2019_2050_ADOPTED.pdf

4.0 Hazardous Air Pollutants

In addition to the criteria air pollutants for which there are NAAQS, EPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., locomotives, construction equipment, and airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries). Mobile-source air toxics (MSATs) are a subset of the 188 air toxics defined by the Clean Air Act. MSATs are compounds emitted from highway vehicles and non-road equipment.[2] Based on the Federal Highway Administration's analysis using MOVES2014a, diesel particulate matter (diesel PM) remains the dominant MSAT of concern for highway projects.

The amount of MSATs emitted for the No-Action and Proposed Action alternatives would be proportional to the vehicle-miles traveled (VMT), assuming that other variables such as fleet mix are the same for each alternative. The VMT estimated for each alternative should be equal given that the Proposed Action is not adding capacity. There would be an overall increase in VMT for both the No-Action and Proposed Action alternatives due to additional households and employment in the study area. Although this increase in VMT would lead to higher MSAT emissions, the increase for the Proposed Action would be offset somewhat by lower MSAT emission rates as a result of decreased travel times and increased speeds. According to EPA's MOVES2014 model, emissions of all of the priority MSATs decrease as speed increases.

Regardless of the alternative chosen, emissions in the design year (2050) will likely be lower than current levels as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by over 90% between 2010 and 2050.[2] Local conditions might differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the air quality impact analysis area are likely to be lower in the future in nearly all cases.

5.0 Greenhouse Gas Emissions

Greenhouse gases (GHG) trap heat and make the planet warmer. Human activities are responsible for almost all the increase in greenhouse gases in the atmosphere over the last 150 years.

The largest source of GHG emissions from human activities in the United States is burning fossil fuels for electricity, heat, and transportation. Carbon dioxide (CO_2) released through the consumption of gasoline and diesel fuel is the main GHG produced by vehicles.

CO_2 emissions are expected to increase by 2050 whether the Proposed Action is implemented or not. This increase is a direct factor of increased VMT in the project study area. The carbon content in fuel is constant, and the amount of CO_2 produced is directly related to the amount of fuel consumed. Increased VMT equates to more fuel burned and more CO_2 released into the atmosphere. Although fuel economy is expected to increase in the future, it would not be enough to offset the increase in VMT.

[2] https://www.fhwa.dot.gov/Environment/air_quality/air_toxics/policy_and_guidance/msat

6.0 Conclusions

The Proposed Action is identified as a Phase 1 project in WFRC's 2019–2050 RTP and is also identified in WFRC's conforming 2021–2026 TIP and therefore conforms to the SIP. For this reason, UDOT does not expect the Proposed Action to adversely affect local compliance with the NAAQS. Atmospheric CO_2 emissions are projected to increase in 2050 due to the greater number of vehicles and increased VMT in 2050. This increase would occur with or without the Proposed Action. The amounts of all other pollutants are projected to decrease in future years due to improved fuel and emissions standards.