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ENVIRONMENTAL STUDY

Project Name: **ANTELOPE FRONTAGE ROADS**

Project No.: **n/a**

Prepared By: **KEVIN KILPATRICK - HDR**

PIN: **n/a**

Job/Proj: **n/a**

For guidance in preparing this environmental study, refer to the UDOT Environmental Process Manual of Instruction:

<http://www.udot.utah.gov/go/environmental>

REQUIRED SIGNATURES

I have reviewed the information presented in this Environmental Study and I hereby attest that the document is complete and the details of the document are correct.

Reviewer (Signature): _____ **Date:** _____

Reviewer (Printed): _____

Firm/UDOT Region: _____

STATE FUNDED PROJECTS

As a result of this Environmental Study, UDOT finds that this project will NOT cause significant environmental impacts.

Approved: _____ **Date:** _____

UDOT Region Environmental Manager

1. Purpose and Need for Action

Bluff Road currently has an at-grade, stop sign-controlled intersection at Antelope Drive (also known as State Route [S.R.] 127) in Syracuse, Davis County, Utah. The planned West Davis Corridor (WDC) project includes a new WDC single-point urban interchange (SPUI) on Antelope Drive just west of Bluff Road. UDOT also has another project planned to widen Antelope Drive to two lanes in each direction between the WDC and 2000 West with turn lanes from Antelope Drive to the WDC on ramps. The WDC Antelope Drive SPUI and Antelope Drive widening projects have been evaluated in previous UDOT environmental studies. The alignment of both planned improvements are shown on the Study Map in the Appendix.

The WDC and Antelope Drive widening projects assumed that Bluff Road north of Antelope Drive would terminate in a cul-de-sac near 1653 S. Bluff Road; Bluff Road south of Antelope Drive would connect with an at-grade intersection at 2625 West (see Study Area figure in the Appendix).

Through further coordination between UDOT and Syracuse City as part of progressing the WDC and Antelope Drive widening designs a new, independent need has been identified. The planned cul-de-sac on Bluff Road north of Antelope Drive reduces local connectivity between Bluff Road and Antelope Drive on the north side. Residents east of WDC and north of Antelope Drive who want to go east on Antelope Drive must travel north to 3000 West, go south under the WDC on 3000 West, and then turn east on Antelope Drive. This out-of-direction travel would result in delays and additional traffic using the WDC Antelope Drive SPUI. In addition, the planned Antelope Drive/2625 West intersection that would reconnect Bluff Road to the south has limited turning movements (for example, left turns on to Antelope Drive from 2625 West would be prohibited) due to its close proximity with the eastern WDC Antelope SPUI interchange ramp terminal. There is a need to make this an intersection capable of accommodating all turning movements to improve system connectivity.

The purpose of the Antelope Frontage Roads project is to improve connectivity and mobility to the broader transportation network between Bluff Road and Antelope Drive.

2. Description

UDOT would eliminate the previously planned intersection at Antelope Drive and 2625 West and would construct two new frontage roads between Bluff Road and 2500 West (one on the north side of Antelope Drive and one on the south side of Antelope Drive).

The proposed north Antelope Drive frontage road would connect to Bluff Road near 1653 S. Bluff Road and connect to 2500 West at 1624 South 2500 West. The intersection of the north Antelope Drive frontage road and 2500 West would have a stop sign. The north Antelope Drive frontage road would match the cross section of

Bluff Road north of S.R. 127 and would have a total width of 25 feet with one 12.5 foot lane in each direction.

The proposed south Antelope Drive frontage road would connect to Bluff Road near 1800 S. Bluff Road and connect to 2500 West at 1745 South 2500 West. The intersection of the south Antelope Drive frontage road and 2500 West would have a stop sign. The south Antelope Drive frontage road would match the cross section of Bluff Road south of S.R. 127 and have a total width of 35 feet with one 12 foot lane and 5.5 foot shoulders in each direction.

Appendix A includes a figure showing the north and south Antelope Drive frontage roads.

DRAFT

3. Public Hearing/Opportunity for Public Hearing

- YES** This project could result in public controversy or substantial impacts to adjacent properties, or substantially changes roadway geometry.
- NO** There are significant social, economic, environmental or other effects. If YES, a Categorical Exclusion is not applicable. Consult with UDOT Central Environmental Services.
- YES** UDOT/FHWA has determined that a public hearing is in the public interest.

If the answer to ANY of the above questions is YES, a public hearing or opportunity for a public hearing is required (attach documentation identifying date and location of hearing, summary of comments, and responses to substantial comments, or include certification of opportunity for hearing.)

The following types of public involvement have been provided:

- YES** Public Hearing in accordance with state and federal procedures
- NO** Opportunity for Public Hearing
- YES** Open House
- YES** Other: Project specific website, email, and phone number have been provided.
- NO** Documentation is attached identifying the date and location of hearing, summary of comments, and responses to substantial comments; or the Certification of Opportunity for a Hearing is attached.

Comments: A 30-day public comment period on this Draft State Environmental Study will be held from July 9, 2020 to August 7, 2020. Study documentation, including a virtual open house and online comment submission will be available on the WDC website (westdavis.udot.utah.gov) beginning July 9, 2020. An in-person, by appointment only, public hearing will be held Wednesday, July 15, 2020 from 4:00 to 7:00 PM at Syracuse City Hall (1979 West 1900 South, Syracuse, UT). To schedule an in-person public comment appointment, contact the Public Information Team at 877-298-1991 or westdavis@utah.gov. Public comments can also be submitted via email to westdavis@utah.gov or postal mail to the WDC Project Office - 801 North 500 West, 3rd Floor Bountiful, UT 84010.

4. Right-of-Way

YES Acquisition of Right-of-Way is required.

NO The right-of-way required is significant because of its size, location, use, or relationship to remaining property and abutting properties. (If the right-of-way required is significant, the project does not qualify as a Categorical Exclusion.)

Comments: The Proposed Action's footprint would require about 5.4 acres of right-of-way and would affect 27 parcels. Of these 27 parcels, UDOT has either purchased or is in the process of purchasing 22 of the parcels for the WDC and Antelope Drive widening projects. UDOT would need to purchase additional right-of-way from five parcels totaling 3.0 acres. The Proposed Action would require full acquisition of four additional residential properties that total about 2.8 acres. The properties impacted by the WDC and Antelope Drive widening projects and the Proposed Action are shown on the Property Impact figure in the Appendix.

DRAFT

5. Cultural

According to the UDOT Region NHPA/NEPA Specialist and/or the Architectural Historian, the Finding of Effect for the project is one of the following:

NO No historic properties affected

NO No adverse effect

YES Adverse effect

Project documentation for determination of eligibility and finding of effect consists of one of the following and is attached:

NO Memo from UDOT Region NEPA/NHPA Specialist and/or Architectural Historian stating a finding of No Historic Properties Affected.

YES SHPO concurrence with the Determinations of Eligibility and Finding of Effect AND memo from UDOT Region NEPA/NHPA Specialist and/or Architectural Historian stating a finding of No Adverse Effect or Adverse Effect.

NO Have letters for Native American Consultation been sent? Attach letters.

NO Have letters for federal and state agencies, CLGs, historical societies, etc. been sent? If so attach letters.

YES Do the impacts to historic properties require mitigation?

If YES, a signed Memorandum of Agreement (MOA) is attached.

Comments: Native American consultation and coordination with the Utah SHPO is in progress in July 2020. A DOE/FOE and draft MOA will be submitted to the Utah SHPO in July 2020.

6. Paleontological

- NO** This project is one of the 16 types of projects listed in Stipulation III of the Memorandum of Understanding (MOU) with the Utah Geological Survey (UGS) that has no effect on paleontological resources and does not require notification to the UGS. If YES, a memo from the UDOT Region NEPA/NHPA Specialist is attached (can be included in cultural memo).

For all other projects, the UGS has been notified and has responded with the following (attach UGS letter and memo from the UDOT Region NEPA/NHPA Specialist):

- YES** There are no known paleontological localities in the area of potential effects and the formations in the project area have a low potential for containing fossil remains (Class 1 or 2).
- NO** Fossil-bearing formations (Class 3-5) and/or known paleontological localities are present in the area of potential effects, but the UDOT Region NEPA/NHPA Specialist (or paleontologist) has determined that they will not be affected by the project.
- NO** Fossil-bearing formations (Class 3-5) and/or known paleontological localities are present in the area of potential effects and may be affected by construction activities. A survey and/or monitoring by a qualified paleontologist is required.

Comments: The project area was reviewed by the UGS as part of the Antelope Drive widening project. The UGS provided a memo on July 1, 2019 for this project. A copy of this memo is attached.

7. Threatened, Endangered, or Candidate Species

For Federally or State Funded Projects:

- YES** Project will have "**no effect**" to T&E species, or their critical habitats, protected under the Endangered Species Act. If YES, attach "**no effect**" memo or review/comments (in the case of local government projects) from UDOT's Wildlife Biologist.
- NO** Project "**may affect, but is not likely to adversely affect**" T&E species, or their critical habitats, protected under the Endangered Species Act. If YES, attach BA and "concurrence" from the U.S. Fish and Wildlife Services (USFWS). List all mitigation/conservation measures.
- NO** Project "**may affect, and is likely to adversely affect**" threatened and endangered species, or their critical habitats, protected under the Endangered Species Act. If YES, attach BA and USFWS BO. List all mitigation/conservation measures.
- NO** The USFWS has issued a "**jeopardy**" opinion regarding this project. If YES, attach BA and BO as above. This project cannot go forward without being reconsidered.

Comments: Clearance memo from UDOT's Wildlife Biologist is attached.

8. Wildlife

- NO** Project has the potential to affect state-sensitive species, important wildlife habitat, big game migration routes, habitat connectivity, migratory birds, or fish spawning habitat or fish passage.
- Memo from UDOT Wildlife Biologist is attached.

Comments: Clearance memo from UDOT's Wildlife Biologist is attached.

9. Invasive Species

If the project involves earthwork, grading or landscaping, there is potential to introduce or spread invasive weed species.

- YES** Based upon location, this project has the potential to introduce or spread invasive species included on the noxious weed list of the State of Utah and the county noxious weed lists.

10. Noise

Projects that may affect noise levels to adjacent receptors include changes in roadway alignment, roadway widening and the addition of traffic lanes.

YES This project has the potential to increase noise to adjacent receptors.

YES A noise study is attached.

Comments: This project is considered a Type I project that requires a noise study because it would construct new frontage roads. Noise levels in the study area would generally increase by about 1 dBA as a result of the Antelope Drive frontage roads. Of the 93 residential receptors that were modeled for the Antelope Frontage Roads project, 22 residential receptors would have traffic noise impacts as defined in UDOT's Noise Abatement Policy.

None of the five noise walls evaluated for the Antelope Frontage Roads project were determined to be feasible and reasonable pursuant to UDOT's Noise Abatement Policy. No noise walls are recommended.

See the attached Noise Technical Report for more information.

11. Wetlands, Water Resources, Storm Water, and Floodplains

Wetlands and Water Resources

- NO** The project is a type that does not have the potential to affect or cross Waters of the United States. If YES, no concurrence letter is needed.
- NO** Project affects waters of the United States (e.g. wetlands, mudflats, lakes, or perennial or ephemeral streams). If NO, have a UDOT Landscape Architect provide a concurrence letter stating they agree with the determination. In order to indicate "NO" on this question, answers to the following statements must also be "NO".
- NO** Project impacts perennial, intermittent, or ephemeral streams that have a riparian vegetation component. If YES, a Programmatic General Permit 40 (PGP40), also known as a Stream Alteration Permit, from the Utah Division of Water Rights will be required.
- NO** Project exceeds the impact limitations for streams or washes indentified in the PGP40. If YES, both a PGP40 and a separate Department of the Army permit will be required.
- NO** Project impacts an ephemeral wash not captured under PGP40 that has an ordinary high water mark (OHWM) with a connected flow to a downstream Traditional Navigable Water and the impact below the OHWM exceeds 1/10 of an acre per crossing. If YES, a Department of the Army permit will be required.
- NO** Project impacts a perennial or intermittent stream below the OHWM less than 1/10 of an acre per crossing. If YES, notification to the U.S. Army Corps of Engineers will be required.
- NO** Project impacts navigable waters of the United States (Lake Powell, Flaming Gorge Reservoir, Bear Lake, Green River - mouth to 20 miles above Green River Station, Colorado River - mouth of Castle Creek to Cataract Canyon - 4.5 miles below mouth of Green River) below the OHWN. If YES, a Section 10 Department of the Army permit will be required.
- NO** Project impacts jurisdictional wetlands. If YES, a Department of Army Nationwide Permit (NWP) will be required for wetland impacts under the 1/2 acre threshold; a Letter of Permission (LOP) will be required for wetland impacts between 1/2 and 1 acre; an Individual Permit (IP) will be required for impacts greater than 1 acre.
- NO** Project impacts non-jurisdictional wetlands. If YES, wetland mitigation may still be required under the federal policy of "no net loss." Consult UDOT Environmental Section.

Storm Water Runoff

- YES** Project disturbs 1 acre or more of ground surface.

If YES, a UPDES Storm Water Discharge Permit for Construction Activities is required from the Utah Division of Water Quality.

Floodplains

NO This project requires new construction or alteration of existing structures within the FEMA designated 100-year flood plain.

If YES, a Development Permit is required from the local permit official.

Comments: Clearance memo from UDOT's Senior Landscape Architect is attached.

12. Hazardous Waste

NO Has a visual inspection of the project area found substances that may be hazardous to human health and/or the environment?

YES This project involves excavation beyond or below the existing roadway footprint.

If YES to either question 1 or 2, then site investigations and coordination with DEQ may be necessary.

Comments: A review of the Utah Department of Environmental Quality's (UDEQ) Interactive Map (<http://enviro.deq.utah.gov>) and the U.S. Environmental Protection Agency's (EPA) EnviroMapper (<https://enviro.epa.gov/enviro/em4ef.home>) on June 19, 2020, identified no facilities within or near the project area.

If hazardous materials are encountered during work, all work will stop in the area of contamination according to UDOT Standard Specification 01355, and the contractor will consult with UDOT and UDEQ to determine the appropriate remedial measures.

13. Prime, Unique, Statewide, or Locally Important Farmland

Projects in areas whose land use maps indicate no current or future farming activities would not usually affect farmlands.

NO This project MAY affect Prime, Unique, Statewide, or Locally Important Farmlands.

N/A The Natural Resource Conservation Service letter and Form AD1006 are attached.

14. Air Quality

YES This project has the potential to increase particulate matter due to construction activities.

YES This project adds or alters roadway capacity or will result in increased traffic volumes at signalized intersections.

If YES, the Air Quality Supplement is attached.

15. Relocations

YES There may be relocations of residences or businesses as a result of this project.

Comments: The Proposed Action would require the full acquisition of four residential parcels (see attached Project Figures with Property Impacts).

-1743 S. Bluff Road

-1686 South 2625 West

-1624 South 2500 West

-1745 South 2500 West

16. Land Use/Urban Policy

NO This project may affect land use or urban policy.

17. Section 4(f) Properties

- N/A** Section 4(f) properties are impacted.
- N/A** An Individual Section 4(f) Evaluation AND written concurrence from UDOT Environmental Services on the Individual Section 4(f) determination is attached.
- N/A** A Programmatic Section 4(f) Evaluation AND written concurrence from UDOT Environmental Services on the Programmatic Section 4(f) determination is attached.
- N/A** The 4(f) property(s) is an historic property and the impact is considered **de minimis**.
- N/A** SHPO has concurred in writing on UDOT's "**no adverse effect**" determination to historic properties and has been notified of the intent to make a **de minimis** finding. Attach letter to SHPO and **de minimis** agreement letter.
- N/A** The 4(f) property(s) is a park, recreational area, wildlife or waterfowl refuge and the impact is considered **de minimis**.
- N/A** The official(s) with jurisdiction have concurred, in writing, that the project will "**not adversely affect**" the activities, features, and attributes that qualify the resource for protection under Section 4(f) and have been notified of the intent to make the **de minimis** impact finding. Letters are attached.
- N/A** The project sponsor has provided public notice and opportunity for public review and comment. Describe public involvement efforts in the comments below.
- N/A** Written concurrence from UDOT Environmental Services is attached.

18. Other Environmental Factors Considered

This Project, except as noted and explained in attachments, will have no disproportionate, serious or lasting effect on the following:

- NO** Visual
- NO** Social/Economic
- NO** Title VI and/or Environmental Justice
- NO** Natural Resources
- NO** Construction
- NO** Energy
- NO** Geology/Soils
- NO** Wild/Scenic Rivers
- NO** Ecology

19. Conclusion

- NO** This project may have substantial controversy or significant impacts.

MITIGATION COMMITMENTS

CONSTRUCTION		Responsible
Air Quality	Requirements outlined in Standard Specification 01572 titled "Dust Control and Watering" will be followed.	Contractor
Cultural	UDOT Standard Spec 01355, Parts 3.7 and 3.8	Contractor
Hazardous Waste	Requirements in UDOT Standard Specification 01355, Part 3.1 will be followed.	Contractor
Invasive Species	Supplemental Specification 02924S titled "Invasive Weed Control" will be included in the contract documents and outlines BMPs that will be incorporated.	Contractor
PRELIMINARY ENGINEERING		Responsible
Relocations	Property Owners will be compensated according to the requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act, as amended.	Udot Right Of Way
Water Quality	The project will disturb 1 acre or more of ground surface. Therefore, a storm water pollution prevention plan (SWPPP) must be included in the plans.	Udot Region Environmental
Water Quality 2	UPDES Permit from the Division of Water Quality must be obtained prior to construction.	Contractor

AIR QUALITY SUPPLEMENT

Revised 3/2012

A. Regional Conformity Requirements

YES This project is in a non-attainment or maintenance area for carbon monoxide (CO), particulate matter (PM10 or PM2.5), or ozone (O₃).

If NO, no additional analysis is required.

If YES, the project must be included in a Metropolitan Planning Organization (MPO) conforming Long Range Plan (LRP) and Transportation Improvement Program (TIP). There must be no substantial changes to the project's design and scope since the conformity analysis. For questions, contact the UDOT Air Quality Program Coordinator.

B. Project Level Requirement

I. Carbon Monoxide (CO)

NO The project is in a non-attainment or maintenance area and affects intersections that are at level-of-service D, E or F or those that will change to D, E or F because of increased traffic volumes related to the project.

If NO, a CO Analysis is not required.

If YES, a CO hot-spot analysis of peak emissions is required using CAL3QHC and the EPA "MOVES" model. Attach results of analysis.

____ The CO hot-spot analysis shows compliance with the NAAQS.

____ The CO hot-spot analysis shows that the project will cause or contribute to new localized CO violations of the NAAQS, will increase the frequency or severity of existing violations, or will delay attainment of the NAAQS.

If YES, revise the signal timing data and re-run the analysis. If the NAAQS are still exceeded, compare the Build CO levels with No-Build CO levels for the design year. CO levels for the project must be less than or equal to the No-Build levels for the design year; otherwise the project must be modified.

II. Particulate Matter (PM_{2.5} and PM₁₀)

- NO** The project is in a non-attainment or maintenance area and involves a new or expanded highway and will have a significant number of diesel vehicles or significant increase in the number of diesel vehicles. An example is a facility with more than 125,000 annual average daily traffic (AADT) and 8% (10,000) or more is truck traffic.
- NO** The project is in a non-attainment or maintenance area and affects intersections that are at level-of service D, E or F with a significant number of diesel vehicles or affects intersections that will change to D, E or F because of increased traffic volumes from a significant number of diesel vehicles.

If NO to both of the above, a PM analysis is not required.

If YES to either of the above, a PM hot-spot analysis of peak emissions is required using CAL3QHCR and the EPA "MOVES" model. Attach analysis results.

____ The PM hot-spot analysis shows compliance with the NAAQS.

____ The PM hot-spot analysis shows that the project will cause or contribute to new localized PM violations of the NAAQS, will increase the frequency or severity of existing violations, or will delay attainment of the NAAQS.

If YES, compare the Build PM levels with No-Build PM levels for the design year. PM levels for the project must be less than or equal to the No-Build levels for the design year; otherwise the project must be modified.

Environmental Commitments Signature Page

Project Name: Antelope Frontage Roads

Project Number: N/A PIN: N/A

The purpose of this page is to ensure the environmental commitments that are made while following the environmental process are reasonable and feasible to those divisions they will affect. Frequently, as in maintenance preservation projects, UDOT Standard Specifications will provide the mitigation necessary for potential environmental impacts and only require review by the Environmental Manager. However, if special commitments exist that cannot be mitigated by current UDOT Specifications, then additional review is required from both the Project Manager and District Engineer (or Designee). This signature page is required to be included on all UDOT environmental documents regardless of type.

☐ The environmental commitments in this document can be mitigated by following current UDOT specifications.

Required Signatures:

UDOT Environmental Manager:

Signature

Printed Name

Date

☒ The environmental commitments in this document require mitigation beyond what is provided by following current UDOT specifications. Special commitments are believed to be designable, financially feasible, constructible, and maintainable.

Required Review and Signatures:

UDOT Project Manager:

Signature

Printed Name

Date

District Engineer or Designee:

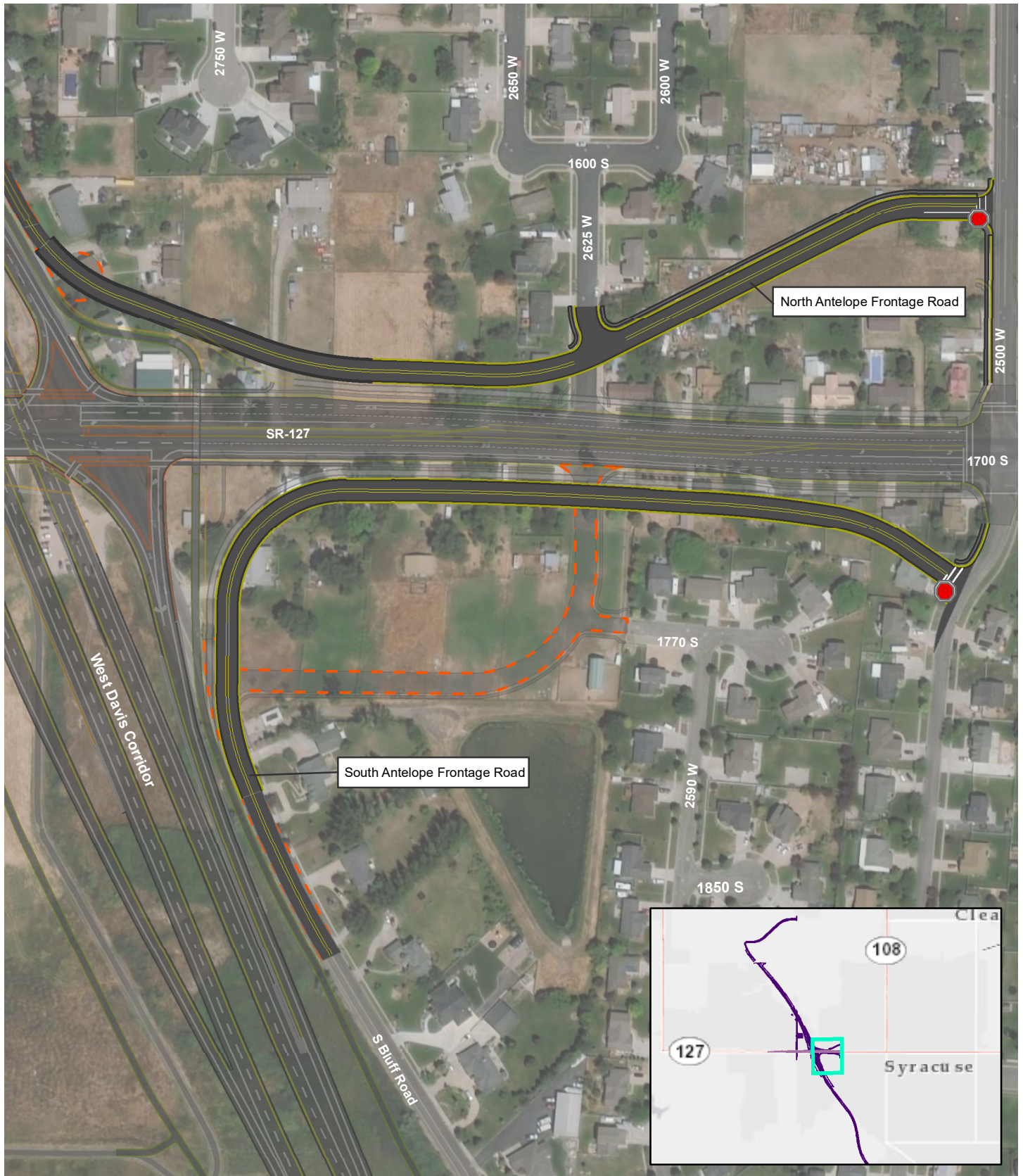
Signature

Printed Name

Date

APPENDIX A

Figures



Legend

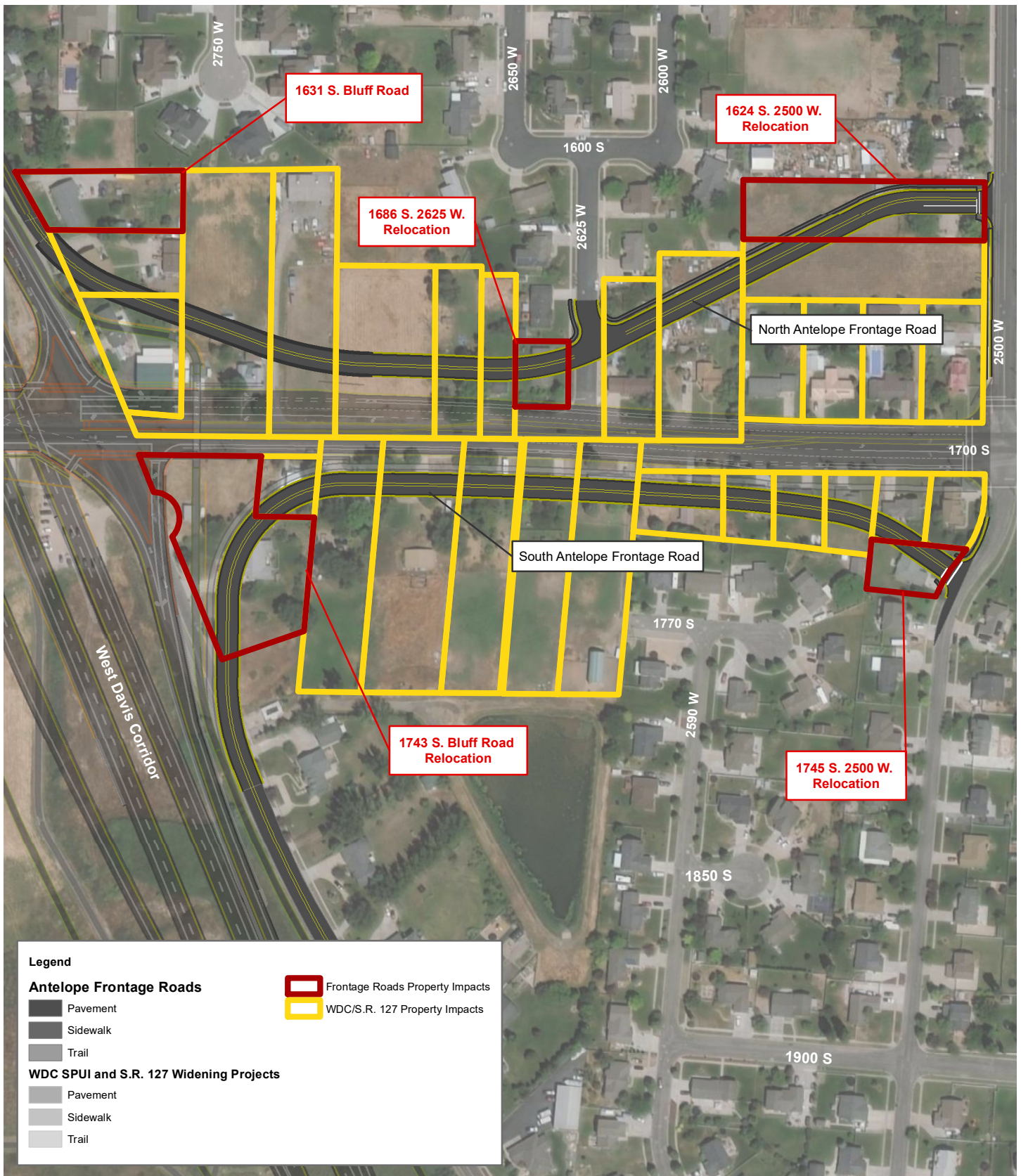
- Pavement
- Sidewalk
- Trail
- WDC SPUI Design

Antelope Drive Frontage Roads State Environmental Study

Proposed Improvements



0 125 250 500 Feet



Antelope Drive Frontage Roads State Environmental Study

Property Impacts



0 125 250 500 Feet

APPENDIX B

Clearance Memoranda



Memorandum

Environmental Service

DATE: May 21, 2020

TO: Kevin Kilpatrick, Transportation NEPA Project Manager, HDR

FROM: Matt Howard, Natural Resources Manager

SUBJECT: Antelope Frontage Road SES Non-PIN

Project Description

UDOT plans to remove the previously planned intersection at Antelope Drive and 2625 West and would construct two new frontage roads between Bluff Road and 2500 West (one on the north side of Antelope Drive and one on the south side of Antelope Drive).

The proposed North Antelope Frontage Road would connect to Bluff Road near 1653 S. Bluff Road and connect to 2500 West at 1624 S. 2500 W. The intersection of the North Antelope Frontage Road and 2500 West would have a stop sign. The North Antelope Frontage Road would match the cross section of Bluff Road north of S.R. 127 and would have a total width of 25' with one 12.5' lane in each direction.

The proposed South Antelope Frontage road would connect to Bluff Road near 17XX S. Bluff Road and connect to 2500 West at 1745 S. 2500 W. The intersection of the South Antelope Frontage Road and 2500 West would have a stop sign. The South Antelope Frontage Road would match the cross section of Bluff Road south of S.R. 127 and have a total width of 35' with one 12' lane and 5.5' shoulders in each direction.

This assessment has been prepared to address potential for occurrence of and impacts to species or habitat listed under the Endangered Species Act (ESA), as well as birds protected by the Migratory Bird Treaty Act (MBTA), and the Bald and Golden Eagle Protection Act (BGEPA). Greater sage-grouse (*Centrocercus urophasianus*), which are protected by Governor's Executive Order EO/2015/002, are also addressed in this memo.

Project Setting

This project takes place in Davis County, UT. Recent (2016-2018) aerial images show land use in the vicinity of the project area consists of residential development and vacant lots. Vegetation consists of landscaping and undeveloped lots. Elevation in the vicinity of the project area is approximately 4,300 ft. amsl.

Determinations

Threatened and Endangered Species

The U.S. Fish and Wildlife Service's Information, Planning and Consultation database was consulted for species considered to have potential to occur in the vicinity of the project area. In addition, Utah Natural Heritage Program records of occurrence were reviewed for documentation of species occurrences within the vicinity of the project. Other sources, including

recent aerial imagery, USFWS Critical Habitat shapefiles, USGS, topographic data and surficial geology shapefiles from the State of Utah were used in the supporting analysis. This project would not result in take of threatened or endangered species.

Migratory Birds, Bald and Golden Eagles

No known raptor nests have been documented within 1 mile of the project area, and little suitable habitat exists. It is unlikely this project would result in direct or indirect take under the BGEPA. The project would not result in direct take under the MBTA and is unlikely to result in indirect take.

Greater Sage-grouse

A review of recent aerial imagery and Utah Sage-grouse Management Area boundaries shows that the project does not occur within a SGMA. The project also does not occur within mapped sage-grouse habitat. The project would not impact greater sage-grouse.

Summary

This assessment satisfies the UDOT's responsibilities under Section 9 of the ESA, the MBTA (50 CFR § 10.12), the BGEPA (16 USC § 668), and Governor's Executive Order EO/2015/002. If additional information or clarification is needed regarding this assessment, please contact me at matthoward@utah.gov.

Sincerely,

A handwritten signature in blue ink, reading "Matt Howard". The signature is fluid and cursive, with the first name "Matt" and last name "Howard" clearly distinguishable.

Matt Howard
Natural Resource Manager

MEMORANDUM

Date: Monday, June 15, 2020

To: Randy Jefferies
UDOT WDC Project Manager

From: Rod Hess
UDOT Senior Landscape Architect

RE: **ENVIRONMENTAL REVIEW FOR WATER RESOURCES AND WETLANDS**
Antelope Drive Frontage Roads

PROJECT PURPOSE, DESCRIPTION AND SCOPE OF WORK

Bluff Road currently has an at-grade stop sign controlled intersection at Antelope Drive (also known as S.R. 127) in Syracuse, Utah. The planned West Davis Corridor (WDC) project includes a new WDC single-point urban interchange (SPUI) on Antelope Drive just west of Bluff Road. UDOT also has another project planned to widen Antelope Drive to two lanes in each direction between WDC and 2000 West with turn lanes from Antelope Drive to the WDC on-ramps. The WDC Antelope Drive SPUI and Antelope Drive widening projects have been evaluated in previous UDOT environmental studies.

Because of the construction of the WDC and widened Antelope Drive projects, Bluff Road would not be allowed to have access on to S.R. 127 in its current location because it would be located too close to the WDC SPUI ramp termini intersections. The WDC and Antelope Drive widening projects had assumed that Bluff Road north of Antelope Drive would have a cul-de-sac near 1653 S. Bluff Road, and that Bluff Road south of Antelope Drive would be connected to intersect Antelope Drive with an at-grade intersection at 2625 West.

After the completion of the WDC Antelope SPUI EIS Re-evaluation and the Antelope Drive Widening State Environmental Study, UDOT and Syracuse City identified two needs:

- **Safety on Antelope Drive east of the WDC Antelope SPUI:** The Antelope Drive/2625 West at-grade intersection is located 700 feet from the eastern WDC Antelope SPUI interchange ramp terminal. Because this is closer than the 1,320 feet minimum distance for signal spacing on arterials in the UDOT design standards, certain turning movements (for example left on to Antelope from 2625 West) would not be allowed at the planned Antelope Drive/2625 West intersection.
- **Poor system connectivity:** Because of the cul-de-sac on Bluff Road north of Antelope Drive that is part of the WDC Antelope SPUI design, residents east of WDC and north of Antelope Drive who want to go east on Antelope Drive would need to cross under WDC on 3000 West and then go through the WDC Antelope Drive interchange to continue east on Antelope Drive. This movement is out-of-direction and would result in additional traffic going through the WDC Antelope Drive SPUI.

Based on these needs, UDOT and Syracuse determined that the purpose of the project is (1) to eliminate the Antelope Drive/2625 West at-grade intersection and to improve safety on Antelope Drive east of the WDC Antelope Drive SPUI by having intersection spacing that meets UDOT design standards, and (2) provide a new connection between Bluff Road and 2500 West on the north side of Antelope Drive to improve mobility and connectivity for residents east of WDC and north of Antelope Drive who are traveling east on S.R. 127.

To meet the project needs, UDOT would remove the previously planned intersection at Antelope Drive and 2625 West and would construct two new frontage roads between Bluff Road and 2500 West (one on the north side of Antelope Drive and one on the south side of Antelope Drive).

The proposed North Antelope Frontage Road would connect to Bluff Road near 1653 S. Bluff Road and connect to 2500 West at 1624 S. 2500 W. The intersection of the North Antelope Frontage Road and 2500 West would have a stop sign. The North Antelope Frontage Road would match the cross section of Bluff Road north of S.R. 127 and would have a total width of 25' with one 12.5' lane in each direction.

The proposed South Antelope Frontage road would connect to Bluff Road near 17XX S. Bluff Road and connect to 2500 West at 1745 S. 2500 W. The intersection of the South Antelope Frontage Road and 2500 West would have a stop sign. The South Antelope Frontage Road would match the cross section of Bluff Road south of S.R. 127 and have a total width of 35' with one 12' lane and 5.5' shoulders in each direction.

The above referenced project has been reviewed within the proposed project limits for the following categories of resources identified in the Environmental Document. UDOT provides the following mitigation commitments for the project.

Noxious Weeds:

To reduce the introduction and spread of noxious weed species and to comply with Utah Noxious Weed Act (Utah Administrative Code, Rule R68-9), the project is required to properly clean earthmoving construction equipment before mobilizing onto the project.

Mitigation Commitments:

1. **Include UDOT Special Provision Section 02924S INVASIVE WEED CONTROL in the contract documents to require proper cleaning of earthmoving construction equipment before mobilizing onto the project. (UDOT)**
2. **Comply with UDOT Special Provision Section 02924S INVASIVE WEED CONTROL. (Awarded Contractor)**

Water Resources and Wetlands:

The project has been evaluated for waters of the U.S. (WOTUS) including wetlands regulated by U.S. Army Corps of Engineers (Corps), under Section 404 of the Clean Water Act and other waters under the jurisdiction of the State of Utah as part of the State Alteration Permit Program. The proposed project limit has been evaluated in previous UDOT environmental studies.

Based on a review of the project proposed description and previous UDOT environmental studies within the project limits, no WOTUS, including wetlands will be impacted as a result of this project.

Mitigation Commitments:

None

Utah Pollutant Discharge Elimination System (UPDES):

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

Mitigation Commitments:

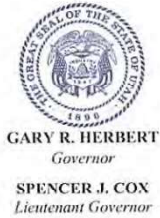
1. Comply with CGP, by preparing the Stormwater Pollution Prevention Plan (SWPPP) during project design; provide SWPPP to the project awarded contractor before Notice to Proceed. (UDOT)
2. Comply with CGP, by finalizing the SWPPP before beginning any earth disturbing activities and submit Notice of Intent (NOI); implement and maintain the project SWPPP according to CGP requirements throughout project construction. (Awarded Contractor)

Federal Emergency Management Agency (FEMA) Floodplains:

No Special Flood Hazard Areas (SFHA) are shown on the FEMA floodplain maps within the project scope of work. The project is not required to obtain a floodplain development permit from the local authority.

Mitigation Commitments:

None



State of Utah
DEPARTMENT OF NATURAL RESOURCES

MICHAEL R. STYLER
Executive Director

Utah Geological Survey

R. William Keach II
State Geologist/Division Director

July 1, 2019

Sheri Murray Ellis
CERTUS Environmental Solutions, LLC
655 7th Avenue
Salt Lake City UT 84103

RE: Paleontological File Search and Recommendations for UDOT Project S-0127(7)2; PIN 16717: SR-127 State Environmental Study, Syracuse, Davis 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 Sheri:

I have conducted a paleontological file search for the SR-127 State Environmental Study Project in response to your letter of June 27, 2019. This project qualifies for treatment under the UDOT/UGS executed Memorandum of Understanding.

There are no paleontological localities recorded in our files within 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,

A handwritten signature in blue ink that reads "Martha Hayden".

Martha Hayden
Paleontological Assistant



APPENDIX C

Noise Report

Noise Technical Report

Antelope Frontage Roads
State Environmental Study

July 2020

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Acronyms and Abbreviations

CFR	Code of Federal Regulations
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
L _{eq}	equivalent noise level
LOS	level of service
ML	monitoring location
mph	miles per hour
NA	not applicable
NAC	noise-abatement criteria
SES	State Environmental Study
S.R.	State Route
UDOT	Utah Department of Transportation
WDC	West Davis Corridor

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1 Introduction

The purpose of this technical report is to evaluate the expected noise impacts and potential noise mitigation measures for the Antelope Frontage Roads State Environmental Study (SES) project in Syracuse, Davis County, Utah.

The Antelope Frontage Roads project area is located on Antelope Drive (also known as State Route [S.R.] 127) between Bluff Road (about 2800 West) and 2500 West in Syracuse.

Noise impacts in this area have been previously evaluated as part of the West Davis Corridor (WDC) project in the WDC Final Environmental Impact Statement (EIS) in 2017 and the WDC/Antelope Single-point Urban Interchange Re-evaluation (WDC Re-evaluation #4) that was approved in March 2020. Noise impacts and potential noise mitigation measures from widening S.R. 127 between the WDC and 2000 West were evaluated in 2020 as part of the S.R. 127 SES that was approved in March 2020.

After the completion of WDC Re-evaluation #4 and the S.R. 127 SES, UDOT and Syracuse City made changes to the frontage road connections on the north and south sides of Antelope Drive between Bluff Road and 2500 West. This report evaluates the traffic-generated noise impacts from this change. More details about this change are described in Section 2, Project Description, of this report.

This noise analysis was prepared in accordance with the Utah Department of Transportation's (UDOT) Noise Abatement Policy, last revised May 28, 2020, which is consistent with federal regulation 23 Code of Federal Regulations (CFR) Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*, and Utah Administrative Code Rule R930-3, *Highway Noise Abatement*.

What is the Antelope Frontage Roads project?

The Antelope Frontage Roads project would build new frontage roads north and south of Antelope Drive in Syracuse, Utah, between Bluff Road (about 2800 West) and 2500 West.

2 Project Description

The project area for this report is the area along Antelope Drive from Bluff Road (about 2800 West) to 2500 West in Syracuse.

After the completion of WDC Re-evaluation #4 and the S.R. 127 SES, UDOT and Syracuse City made changes to improve safety on Antelope Drive east of the WDC/Antelope Drive single-point urban interchange (SPUI) by removing the Antelope Drive 2625 West intersection and improving system connectivity by providing a new frontage road connection between Bluff Road and 2500 West on the north side of Antelope Drive. Additionally, UDOT and Syracuse City also realigned the frontage road on the south side of Antelope Drive so that it was closer to Antelope Drive and did not leave unused property between the two roads. The south frontage road was also extended to 2500 West. With the WDC Re-evaluation #4 and S.R. 127 SES projects, the south frontage road was assumed to extend westward only to 2625 West.

Applicability

The Antelope Frontage Roads project includes constructing new travel lanes. Therefore, this project is a Type 1 project that requires considering noise-abatement measures.

UDOT evaluated noise impacts using noise models and methodologies approved by the Federal Highway Administration (FHWA) and UDOT (Policy 08A2-01, *Noise Abatement*, revised May 28, 2020). Noise impacts were identified and evaluated at residential receptors within about 500 feet from the nearest travel lane between Bluff Road and 2500 West using traffic volumes at a level of service (LOS) C to represent the worst-case noise conditions while traffic is operating at uncongested, free-flow speeds of 35 miles per hour (mph) on the frontage roads, 65 mph on the WDC, 45 mph on the on and off ramps to and from the WDC, and 45 mph on Antelope Drive.

What is a Type 1 project?

According to UDOT's Noise Abatement Policy, a Type 1 project is a project that alters the horizontal or vertical alignment of a road or increases the number of through travel lanes.

3 Characteristics of Noise

Sound travels through the air as waves of minute air-pressure fluctuations caused by vibration. In general, sound waves travel away from the noise source as an expanding spherical surface. As a result, the energy contained in a sound wave is spread over an increasing area as it travels away from the source. This results in a decrease in loudness at greater distances from the noise source.

Sound-level meters measure the actual pressure fluctuations caused by sound waves and record separate measurements for different sound frequency ranges. The decibel (dB) scale used to describe sound is a logarithmic scale that accounts for the large range of sound-pressure levels in the environment. Most sounds consist of a broad range of sound frequencies. Several frequency-weighting schemes have been used to develop composite decibel scales that approximate the way the human ear responds to sound levels. The A-weighted decibel (dBA) scale most closely approximates the way the human ear hears sounds and is the most widely used scale in assessing traffic-related noise impacts. Typical A-weighted noise levels for various types of sound sources are summarized in Table 1.

Varying noise levels are often described in terms of the equivalent noise level (L_{eq}). Equivalent noise levels are used to develop single-value descriptions of average noise exposure over stated periods of time (for example, 1 hour) and are generally based on A-weighted sound-level measurements.

The logarithmic nature of decibel scales is such that individual decibel ratings for different noise sources cannot be added directly to give the noise level for the combined noise source. For example, two noise sources that produce equal decibel ratings at a given location will produce a combined noise level that is 3 dBA greater than either sound alone. When two noise sources differ by 10 dBA, the combined noise level will be 0.4 dBA greater than the louder source alone.

People generally perceive a 10-dBA increase in a noise source as a doubling of loudness. For example, a 70-dBA sound will be perceived by an average person as twice as loud as a 60-dBA sound. People generally cannot detect a 1-to-2-dBA increase in noise levels. Under ideal listening conditions, differences of 2 or 3 dBA can be detected by some people. A 5-dBA change would probably be perceived by most people under normal listening conditions.

When distance is the only factor considered, sound levels from isolated point sources of noise typically decrease by about 6 dBA for every doubling of distance from the noise source. When the noise source is a continuous line (for example, vehicle traffic on a highway), noise levels decrease by about 3 dBA for every doubling of distance away from the source.

Table 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.

Noise levels at different distances can also be affected by factors other than the distance from the noise source. Topographic features and structural barriers that absorb, reflect, or scatter sound waves can increase or decrease noise levels. Atmospheric conditions

(wind speed and direction, humidity levels, and temperatures) can also affect the degree to which sound is attenuated over distance.

4 Regulatory Setting

The federal regulation that FHWA uses to assess noise impacts is 23 CFR Part 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*. This regulation was most recently updated on July 13, 2010. Utah Administrative Code Rule R930-3, *Highway Noise Abatement*, and UDOT Policy 08A2-01, *Noise Abatement*, revised May 28, 2020, establish UDOT's noise impact and abatement policies and procedures, which are compliant with 23 CFR Part 772.

Noise-abatement criteria (NAC) are used to define the noise levels that are considered an impact (in hourly A-weighted sound-level decibels) for each land use activity category. 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 NAC for specified land use activity categories or (2) the future worst-case noise level is greater than or equal to an increase of 10 dBA over the existing noise level (substantial increase).

The UDOT NAC are summarized in Table 2.

Table 2. UDOT's Noise-abatement Criteria

Activity Category	Leq Noise Levels (dBA)	Description of Activity Category
A	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	66 (exterior)	Residential.
C	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	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	71 (exterior)	Hotels, motels, offices, restaurants/bars, and other undeveloped 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

5 Affected Environment

The noise study area (Figure 1) includes parts of Syracuse, Utah, within a 500-foot buffer from the farthest-north travel lane of the north Antelope Drive frontage road and the farthest-south travel lane of the south Antelope Drive frontage road from Bluff Road (about 2800 West to 2500 West in Syracuse).

The project corridor is primarily residential developments. Because the existing noise conditions assume that the WDC and Antelope Drive widening projects will be completed, the predominant source of existing noise in the noise study area is the automobile and truck traffic that will be on the WDC and Antelope Drive.

5.1 Existing Noise Levels

The primary source of existing noise in the noise study area is automobile and truck traffic on the WDC and Antelope Drive.

Traffic-related noise with the existing conditions scenario were estimated with FHWA's Traffic Noise Model version 2.5 based on the proposed roadway design as shown in Figure 1. The modeled roadway for the existing condition included the planned WDC, the WDC/Antelope Drive SPUI, and a five-lane Antelope Drive (two travel lanes in each direction) from the WDC to 2000 West.

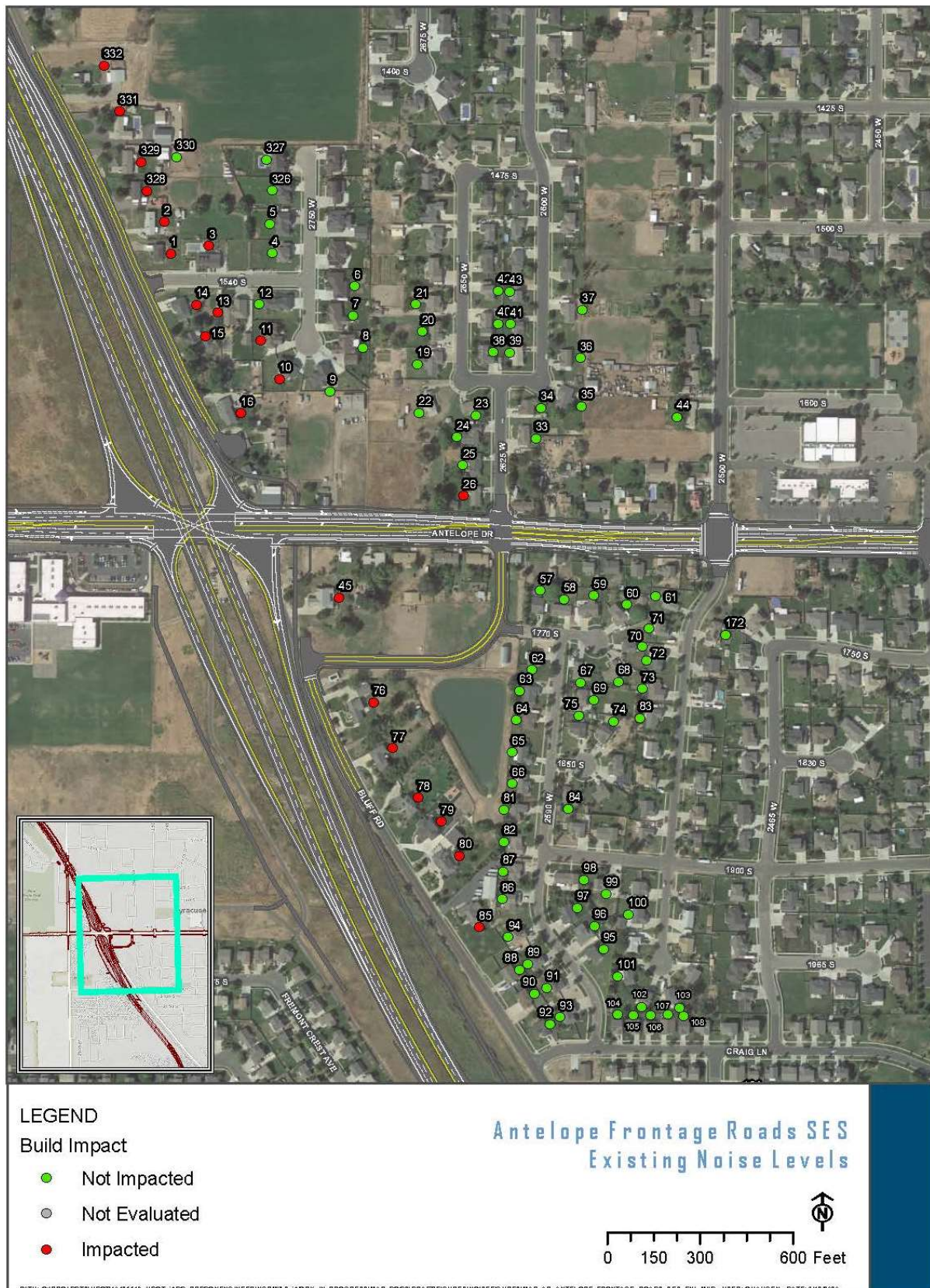
Roadway links were modeled in 100-foot increments to provide a high degree of accuracy in the model output. Traffic volumes used in the model were based on LOS C volumes for the WDC and Antelope Drive, with traffic on the WDC operating at 65 mph and traffic on Antelope Drive operating at 45 mph.

The noise model developed for the existing conditions scenario included 97 residential receptors (Activity Category B receptors) throughout the noise study area. Under existing conditions, 21 receptors exceeded the NAC of 66 dBA. The locations of the receptors modeled for existing conditions are shown in Figure 1.

Properties that will be acquired by UDOT for the WDC project and the S.R. 127 widening project were not included as receptors in the noise analysis for the existing conditions or the Antelope Frontage Roads project's build scenario.

Overall, noise levels with the existing conditions would range from 56 to 70 dBA.

Figure 1. Existing Noise Receptor Map



6 Expected Impacts with the Antelope Frontage Roads Project

Traffic-related noise impacts with the Antelope Frontage Roads project were estimated with FHWA's Traffic Noise Model version 2.5 based on the proposed roadway design as shown in Figure 2, Build Scenario Noise Receptor Map, on page 11. The modeled roadway included the proposed north and south Antelope Drive frontage road improvements between Bluff Road (about 2800 West) and 2500 West in Syracuse. The modeled roadway for the build condition also included the planned WDC, the WDC/Antelope Drive SPUI, and a five-lane Antelope Drive (two travel lanes in each direction) from the WDC to 2000 West.

Roadway links were modeled in 100-foot increments to provide a high degree of accuracy in the model output. Traffic volumes used in the model were based on LOS C volumes for the Antelope Drive frontage roads, the WDC, and Antelope Drive, with traffic on the Antelope Drive frontage roads operating at 35 mph, on the WDC operating at 65 mph, and on Antelope Drive operating at 45 mph.

Overall, noise levels with the Antelope Frontage Roads project would range from 57 to 71 dBA compared to the existing conditions of 56 to 70 dBA. The Antelope Frontage Roads project would generally increase noise levels by about 1 dBA throughout the noise study area.

The noise model developed for the Antelope Frontage Roads build conditions included 93 residential receptors (Activity Category B receptors) throughout the noise study area. With the Antelope Frontage Roads project, 22 residential receptors would have traffic noise impacts; that is, they would approach or exceed the NAC as defined above in Table 2. None of the receptors would have noise levels that substantially exceed the existing noise levels (≥ 10 -dBA increase over existing noise levels).

With the Antelope Frontage Roads project, UDOT would acquire four residential properties (1743 S. Bluff Road, 1686 South 2625 West, 1624 South 2500 West, and 1745 South 2500 West). These acquired properties would be demolished and were not included as receptors in the noise analysis for the Antelope Frontage Roads' build scenario. The locations of the receptors that would approach, exceed, or substantially exceed the NAC are shown in Figure 2, Build Scenario Noise Receptor Map, on page 11.

7 Summary of Existing and Expected Noise Levels

Table 3 summarizes the modeled existing noise levels and the predicted noise levels with the Antelope Frontage Roads build scenario at receptors in the noise study area. Shaded cells indicate impacts with the Antelope Frontage Roads project. For receptor locations, refer to Figure 1, Existing Noise Receptor Map, and Figure 2, Build Scenario Noise Receptor Map.

Table 3. Modeled Existing Noise Levels and Predicted Noise Levels with the Antelope Frontage Roads Project in the Noise Study Area

Receptor	Activity Category	UDOT NAC Leq(h) (dBA)	Existing (with WDC and widened Antelope Drive)		With Antelope Frontage Roads Project		
			Existing Noise Level (dBA)	Existing Impact?	Build Noise Level (dBA)	≥ UDOT NAC?	≥ 10 dBA Increase over Existing Noise Level?
N1	B	66	68	Yes	70	Yes	No
N2	B	66	68	Yes	69	Yes	No
N3	B	66	66	Yes	67	Yes	No
N4	B	66	63	No	64	No	No
N5	B	66	63	No	64	No	No
N6	B	66	61	No	62	No	No
N7	B	66	62	No	63	No	No
N8	B	66	62	No	63	No	No
N9	B	66	65	No	65	No	No
N10	B	66	67	Yes	67	Yes	No
N11	B	66	66	Yes	67	Yes	No
N12	B	66	65	No	66	Yes	No
N13	B	66	68	Yes	69	Yes	No
N14	B	66	69	Yes	71	Yes	No
N15	B	66	69	Yes	70	Yes	No
N16	B	66	70	Yes	71	Yes	No
N19	B	66	61	No	62	No	No
N20	B	66	60	No	61	No	No
N21	B	66	60	No	61	No	No
N22	B	66	62	No	63	No	No
N23	B	66	60	No	61	No	No
N24	B	66	62	No	63	No	No
N25	B	66	63	No	64	No	No
N26	B	66	67	Yes	NA ^a	NA ^a	NA ^a
N33	B	66	60	No	63	No	No
N34	B	66	58	No	61	No	No
N35	B	66	59	No	62	No	No
N36	B	66	57	No	59	No	No
N37	B	66	56	No	57	No	No
N38	B	66	59	No	60	No	No

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Table 3. Modeled Existing Noise Levels and Predicted Noise Levels with the Antelope Frontage Roads Project in the Noise Study Area

Receptor	Activity Category	UDOT NAC L _{eq} (h) (dBA)	Existing (with WDC and widened Antelope Drive)		With Antelope Frontage Roads Project		
			Existing Noise Level (dBA)	Existing Impact?	Build Noise Level (dBA)	≥ UDOT NAC?	≥ 10 dBA Increase over Existing Noise Level?
N39	B	66	58	No	59	No	No
N40	B	66	58	No	59	No	No
N41	B	66	58	No	59	No	No
N42	B	66	57	No	58	No	No
N43	B	66	57	No	58	No	No
N44	B	66	61	No	NA ^a	NA ^a	NA ^a
N45	B	66	69	Yes	NA ^a	NA ^a	NA ^a
N57	B	66	64	No	66	Yes	No
N58	B	66	63	No	65	No	No
N59	B	66	64	No	66	Yes	No
N60	B	66	63	No	65	No	No
N61	B	66	65	No	NA ^a	NA ^a	NA ^a
N62	B	66	61	No	62	No	No
N63	B	66	61	No	62	No	No
N64	B	66	61	No	62	No	No
N65	B	66	61	No	62	No	No
N66	B	66	61	No	62	No	No
N67	B	66	59	No	60	No	No
N68	B	66	58	No	59	No	No
N69	B	66	59	No	60	No	No
N70	B	66	59	No	60	No	No
N71	B	66	60	No	62	No	No
N72	B	66	58	No	59	No	No
N73	B	66	58	No	59	No	No
N74	B	66	58	No	59	No	No
N75	B	66	59	No	60	No	No
N76	B	66	68	Yes	69	Yes	No
N77	B	66	68	Yes	69	Yes	No
N78	B	66	67	Yes	68	Yes	No
N79	B	66	66	Yes	66	Yes	No
N80	B	66	66	Yes	66	Yes	No
N81	B	66	62	No	63	No	No
N82	B	66	63	No	63	No	No
N83	B	66	58	No	59	No	No
N84	B	66	59	No	60	No	No
N85	B	66	67	Yes	67	Yes	No
N86	B	66	64	No	64	No	No
N87	B	66	63	No	64	No	No
N88	B	66	63	No	63	No	No
N89	B	66	63	No	63	No	No
N90	B	66	62	No	63	No	No

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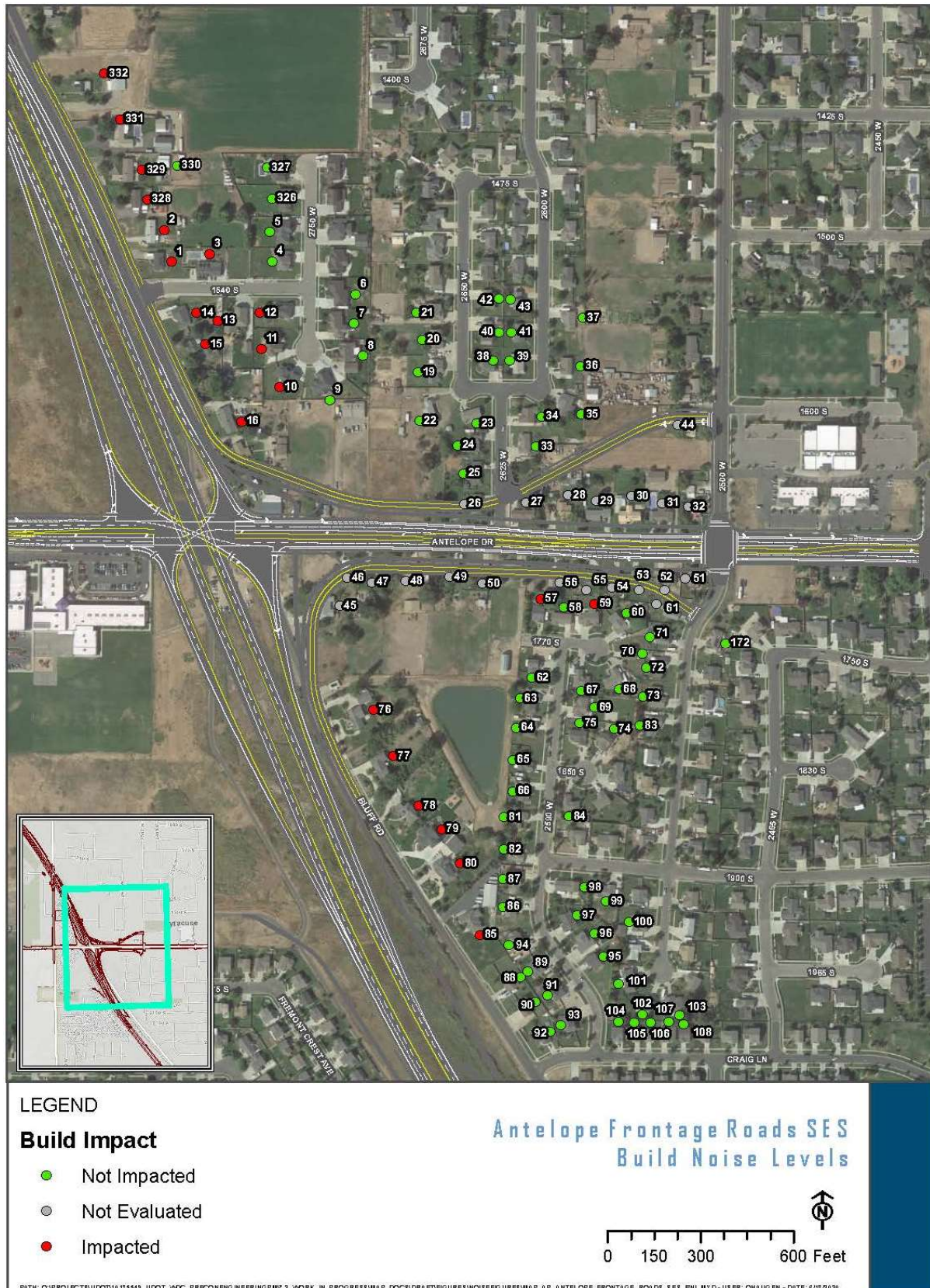
Table 3. Modeled Existing Noise Levels and Predicted Noise Levels with the Antelope Frontage Roads Project in the Noise Study Area

Receptor	Activity Category	UDOT NAC L _{eq} (h) (dBA)	Existing (with WDC and widened Antelope Drive)		With Antelope Frontage Roads Project		
			Existing Noise Level (dBA)	Existing Impact?	Build Noise Level (dBA)	≥ UDOT NAC?	≥ 10 dBA Increase over Existing Noise Level?
N91	B	66	64	No	64	No	No
N92	B	66	63	No	63	No	No
N93	B	66	64	No	64	No	No
N94	B	66	64	No	65	No	No
N95	B	66	60	No	60	No	No
N96	B	66	60	No	60	No	No
N97	B	66	60	No	61	No	No
N98	B	66	59	No	60	No	No
N99	B	66	59	No	59	No	No
N100	B	66	58	No	59	No	No
N101	B	66	60	No	60	No	No
N102	B	66	59	No	60	No	No
N103	B	66	58	No	58	No	No
N104	B	66	60	No	61	No	No
N105	B	66	60	No	60	No	No
N106	B	66	59	No	59	No	No
N107	B	66	59	No	59	No	No
N108	B	66	58	No	59	No	No
N172	B	66	59	No	60	No	No
N326	B	66	62	No	63	No	No
N327	B	66	61	No	62	No	No
N328	B	66	68	Yes	68	Yes	No
N329	B	66	68	Yes	68	Yes	No
N330	B	66	65	No	65	No	No
N331	B	66	68	Yes	68	Yes	No
N332	B	66	68	Yes	68	Yes	No

Gray shaded cells indicate impacts with the Antelope Frontage Roads project.

^a Not applicable because these receptors would be purchased and demolished with the Antelope Frontage Roads project. These properties are discussed in the last paragraph of Section 6, Expected Impacts with the Antelope Frontage Roads Project.

Figure 2. Build Scenario Noise Receptor Map



8 Noise Abatement Methodology

This section discusses UDOT's methodology for evaluating noise-abatement mitigation measures for the traffic noise impacts identified in Section 6, Expected Impacts with the Antelope Frontage Roads Project.

For a noise wall to be effective, it must be high enough and long enough to block the view of the noise source (that is, traffic on the roadway) from the receptor's line of sight. FHWA's *Highway Traffic Noise: Analysis and Abatement Guidance* (FHWA 2011) states that, as a general rule of thumb, the noise barrier should extend 4 times as far in each direction as the distance from the receptor to the barrier. For example, 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.

Gaps in a noise wall cause "noise leaks," which reduce the effectiveness of the wall at homes near the gap. In addition, the effectiveness of noise walls decreases with increasing distance from the wall. For example, a residence that is 300 feet from a noise wall might experience noise levels that exceed the residential NAC. However, the noise wall might be ineffective in reducing noise levels by 7 dBA or more at that distance, and, therefore, a noise barrier might not be warranted according to UDOT's Noise Abatement Policy. The goal of noise abatement is to substantially reduce noise, which might or might not result in noise levels below the residential NAC.

The two primary criteria to consider when evaluating noise-abatement measures are feasibility and reasonableness. Noise abatement would be provided by UDOT only if UDOT determines that noise-abatement measures are *both* feasible and reasonable.

8.1 Feasibility and Reasonableness Factors

8.1.1 Feasibility Factors

Under UDOT's noise-abatement policy, a noise barrier must be considered "acoustically feasible"—that is, the barrier must reduce noise by at least 5 dBA for at least 50% of front-row receptors. The feasibility of noise-abatement measures also deals with construction and engineering considerations such as safety, location of cross streets, sight distance, and access to adjacent properties.

If a noise-abatement measure is determined by UDOT to be acoustically feasible, then the abatement measure will be evaluated to determine whether its construction is reasonable. If a noise-abatement measure is determined by UDOT to be not feasible, it will not be considered any further.

8.1.2 Reasonableness Factors

Under UDOT's noise-abatement policy, reasonableness factors must be collectively achieved in order for a noise-abatement measure to be considered "reasonable." All three reasonableness factors described below must be met in order for a noise barrier to be considered reasonable.

What are reasonableness factors?

Reasonableness factors are the noise-abatement design goal, cost-effectiveness, and the viewpoints of property owners and residents.

- **Noise-abatement Design Goal.** Every reasonable effort should be made to achieve substantial reductions in noise. 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. No abatement measure will be considered reasonable if the noise-abatement design goal cannot be achieved.
- **Cost-effectiveness.** The cost of a noise-abatement measure must be considered reasonable in order for it to be included in a project. Noise-abatement costs are determined by multiplying a fixed unit cost per square foot by the height and length of the barrier.

For residential receptors, cost-effectiveness is based on the cost of the abatement measure (for example, a noise wall) divided by the number of benefited receptors (the total number of dwelling units at which noise is reduced by a minimum of 5 dBA as a result of the abatement measure).

Currently, the maximum cost used to determine the reasonableness of a noise-abatement measure is \$30,000 per benefiting residence (Activity Category B) based on a unit cost of \$20 per square foot of barrier, and \$360 per lineal foot for Activity Categories A, C, D, or E.

- **Viewpoints of Property Owners and Residents.** If a noise-abatement measure is both feasible and cost-effective, UDOT will also consider the viewpoints of property owners and residents to determine whether the noise-abatement measures are desired. Balloting will be conducted for those noise-abatement measures that both meet the noise-abatement design goal and are cost-effective consistent with the procedures described in UDOT's noise-abatement policy.

The noise walls considered for the Antelope Frontage Roads project are discussed below. UDOT evaluated a total of five noise walls where noise impacts would occur with the Antelope Frontage Roads project. **None of the five noise walls evaluated in this noise study area was determined to be feasible and reasonable pursuant to UDOT's noise-abatement policy.**

UDOT did not consider noise walls for the impacted receptors that are north of 1653 S. Bluff Road or south of 1743 S. Bluff Road. Impacted receptors north of 1653 S. Bluff Road and south of 1743 S. Bluff Road are impacted primarily by noise from the WDC. Because the driveways for the impacted properties north of 1653 S. Bluff Road and south of 1743 S. Bluff Road all have access on the east side of Bluff Road, it would not be feasible to have a continuous noise wall with no gaps on the east side of Bluff Road in these locations.

8.1.3 Noise Wall Evaluations

In this section, noise walls evaluations are summarized for locations where there would be impacts to noise receptors as defined in Sections 6 and 7.

The locations of the evaluated noise walls are shown in Figure 3.

Antelope Frontage Roads SE Noise Walls

Build Impact		Build Noise Walls	
(Green Dot)	Not Impacted	(Red Line)	Not Recommended
(Grey Dot)	Not Evaluated	(Green Line)	Recommended
(Red Dot)	Impacted		

0 150 300 600 Feet

N

PATH: Q:\PROJECTS\UDOT\1155545 UDOT - MOC PRECON ENGINEERING\M7.2 WORK IN PROGRESS\MAP DOCS\FIGURES\NOISE\FIGURES\MAP AP ANTELOPE FRONTAGE ROADS SE\N\MXD-USER:CHAUEN-DATE: 5/15/2020

Barrier 1

A noise wall from about 1780 S. Bluff Road to 2650 West on the south side of the south Antelope Drive frontage road was evaluated where noise impacts are expected to a total of five residential receptors (76 to 80). All receptors are Activity Category B. There is one front-row receptor in this area (N76). The noise wall would be located near the right-of-way line on the south side of the south Antelope Drive frontage road and would be about 765 feet long (see Figure 3, Build Scenario Noise Walls, above).

As summarized in Table 4, UDOT evaluated a wall 17 feet high (for detailed information, see Appendix A, Noise Wall Analysis).

Table 4. Noise-abatement Analysis for Barrier 1

Barrier Height (feet)	Feasibility		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	
17	0%	No	NA	NA	NA	NA	NA	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.

The evaluated wall is not feasible; therefore, a wall at this location is not recommended.



Barrier 2

A noise wall from about 2650 West to 2500 West on the south side of the south Antelope Drive frontage road was evaluated where noise impacts are expected to a total of two residential receptors (N57 and N59). All receptors are Activity Category B. There are five front-row receptors in this area (N57 to N60, N71). The noise wall would be located near the right-of-way line on the south side of the south Antelope Drive frontage road and would be about 703 feet long (see Figure 3, Build Scenario Noise Walls, above).

As summarized in Table 5, UDOT evaluated walls between 11 and 17 feet high (for detailed information, see Appendix A, Noise Wall Analysis).

Table 5. Noise-abatement Analysis for Barrier 2

Barrier Height (feet)	Feasibility		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	
11	80%	Yes	20%	No	NA	NA	NA	No
12	80%	Yes	40%	Yes	\$168,720	\$120,000	No	No
13	80%	Yes	40%	Yes	\$182,780	\$120,000	No	No
14	100%	Yes	40%	Yes	\$196,840	\$150,000	No	No
15	100%	Yes	40%	Yes	\$210,900	\$150,000	No	No
16	100%	Yes	60%	Yes	\$224,960	\$150,000	No	No
17	100%	Yes	60%	Yes	\$239,020	\$150,000	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.

The evaluated wall is feasible at all evaluated heights, but the 11-foot-tall wall does not meet UDOT's reasonable design-goal criteria, and the 12-foot-tall to 17-foot-tall walls do not meet UDOT's reasonable cost-effectiveness criteria; therefore, a wall at this location is not recommended.

Because Barrier 2 was close to passing the reasonable test at the full length of 703 feet, two reduced-length versions of Barrier 2 were also evaluated. A modified version of Barrier 2 that was shortened in length from the west (total length of 550 feet) and a modified version of Barrier 2 that was shortened in length from the east (total length of 553 feet) were both modeled. The impacted receptors and front-row receptors are the same as those described for Barrier 2 above. The results for these two modified versions of Barrier 2 are shown in the next two tables.

Table 6. Noise-abatement Analysis for Barrier 2 (550 feet in length, shortened length from the west)

Barrier Height (feet)	Feasibility		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	60%	Yes	20%	No	NA	NA	NA	No
13	60%	Yes	40%	Yes	\$143,000	\$90,000	No	No
14	60%	Yes	40%	Yes	\$154,000	\$90,000	No	No
15	60%	Yes	40%	Yes	\$165,000	\$90,000	No	No
16	80%	Yes	40%	Yes	\$176,000	\$120,000	No	No
17	80%	Yes	40%	Yes	\$187,000	\$120,000	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.

The modified version of Barrier 2 with a shortened length from the west (shown in Table 6) is feasible at all evaluated heights, but the 12-foot-tall wall does not meet UDOT's reasonable design-goal criteria, and the 13-foot-tall to 17-foot-tall walls do not meet UDOT's reasonable cost-effectiveness criteria; therefore, a wall at this location is not recommended.

Table 7. Noise-abatement Analysis for Barrier 2 (553 feet in length, shortened length from the east)

Barrier Height (feet)	Feasibility		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	
15	80%	Yes	20%	No	NA	NA	No	No
16	80%	Yes	40%	Yes	\$176,960	\$120,000	No	No
17	80%	Yes	40%	Yes	\$188,020	\$120,000	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.

The modified version of Barrier 2 with a shortened length from the east (shown in Table 7) is feasible at all evaluated heights, but the 15-foot-tall wall does not meet UDOT's reasonable design-goal criteria, and the 16-foot-tall and 17-foot-tall walls do not meet UDOT's reasonable cost-effectiveness criteria; therefore, a wall at this location is not recommended.

Barrier 3

A noise wall from about 1650 S. Bluff Road to 2700 West on the north side of the north Antelope Drive frontage road was evaluated where noise impacts are expected to a total of seven residential receptors (N10 to N16). All receptors are Activity Category B. There are three front-row receptors in this area (N9, N10, and N16). The noise wall would be located near the right-of-way line on the north side of the north Antelope Drive frontage road and would be about 497 feet long (see Figure 3, Build Scenario Noise Walls, above).

As summarized in Table 8, UDOT evaluated a wall 17 feet high (for detailed information, see Appendix A, Noise Wall Analysis).

Table 8. Noise-abatement Analysis for Barrier 3

Barrier Height (feet)	Feasibility		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	
17	0%	No	NA	NA	NA	NA	NA	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.

The evaluated wall is not feasible; therefore, a wall at this location is not recommended.

9 Construction Noise

9.1 Construction Noise Activities

Table 9 shows the noise levels produced by various types of construction equipment. Properly maintained equipment will produce noise levels near the middle of the indicated ranges. The types of construction equipment used for this project will typically generate noise levels of 80 dBA to 90 dBA at a distance of 50 feet while the equipment is operating (EPA 1971; Gharabegian and others 1985; Toth 1979).

Construction equipment operations can vary from intermittent to fairly continuous with multiple pieces of equipment operating concurrently. Assuming that a bulldozer (85 dBA), backhoe (90 dBA), grader (90 dBA), and front-end loader (82 dBA) are operating concurrently in the same area, peak construction-period noise would generally be about 94 dBA at 50 feet from the construction site. Table 9 summarizes noise levels expected near an active construction site with the above equipment operating.

Table 9. Typical Noise Levels for Construction Equipment

Type of Equipment	Noise Level (dBA) at 50 feet
Bulldozer	85
Front loader	72 – 84
Jack hammer or rock drill	81 – 98
Crane with headache ball	75 – 87
Backhoe	72 – 93
Scraper and grader	80 – 93
Electrical generator	71 – 82
Concrete pump	81 – 83
Concrete vibrator	76
Concrete and dump trucks	83 – 90
Air compressor	74 – 87
Pile drivers (peaks)	95 – 106
Pneumatic tools	81 – 98
Roller (compactor)	73 – 75
Saws	73 – 82

Source: EPA 1971

Locations within about 1,900 feet of a construction site will experience occasional episodes of noise levels greater than 60 dBA. Areas within about 750 feet of a construction site will experience episodes of noise levels greater than 70 dBA. Such episodes of high noise levels associated with the proposed construction would not be continuous throughout the day and would generally be restricted to daytime hours.

Most construction activities associated with the Antelope Frontage Roads project would occur during daylight hours, which would minimize the number of noise impacts. Noise impacts could occur when construction directly adjacent to residential, park, or recreational areas is necessary.

9.2 Construction Noise Mitigation

To reduce temporary noise impacts associated with construction, contractors will comply with all state and local regulations relating to construction noise.

The contractor will be required to follow UDOT Special Provision Section 00555M, *Prosecution and Progress*. The contractor will be required to conform to this specification to reduce the impact of construction noise on the surrounding community.

10 Information for Local Officials

Activity Categories F and G include lands that are not sensitive to traffic noise. There are no impact criteria for these land use types, so noise abatement is not required. However, for Activity Category G, an estimate of the distance to the approach criteria must be provided to local governments.

There are no Activity Category F or G lands in the project area. Some of the Activity Category B parcels could be subdivided or have new development. The modeled noise levels for the receptors listed in Section 7, Summary of Existing and Expected Noise Levels, provide estimates of expected future noise levels to adjacent residential properties with the Antelope Frontage Roads project.

In general, noise levels between 66 and 70 dBA are expected on the west end of the Antelope Drive frontage roads near the existing Bluff Road. Properties adjacent to the frontage roads east of Bluff Road are expected to have noise levels approaching 66 dBA (similar to receptors N57 to N60). These modeled noise levels will help local government officials promote compatibility between land development and the Antelope Drive frontage roads. Syracuse City is the local government that has land use jurisdiction in the noise study area.

11 Conclusions

The Antelope Frontage Roads project would generally increase noise levels by 1 dBA throughout the noise study area compared to existing conditions. Of the 93 receptors that were modeled for the Antelope Frontage Roads build condition, 22 would have traffic noise impacts from the Antelope Frontage Roads project.

None of the five noise walls evaluated in the noise study area were determined to be feasible and reasonable pursuant to UDOT's noise-abatement policy.

12 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.

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- 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 Policy 08A2-1. Effective November 6, 1987. Revised May 28, 2020. <https://www.udot.utah.gov/main/uconowner.gf?n=10496602977480171>.

Appendix A. Noise Wall Analysis

Antelope Frontage - Barrier 1

17

Wall Length: ft

765 ft

Wall Cost per sq ft: \$20

Cost of items critical to safety:

of First Row Receivers: 1

Name	# of DU	Relocation	1st Row	# of 1st Row	Baseline Noise Level	17-ft Noise Level	17-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction
N57	1			0	66	66	0	No	No	No	No
N58	1			0	65	65	0	No	No	No	No
N59	1			0	66	66	0	No	No	No	No
N60	1			0	65	65	0	No	No	No	No
N62	1			0	62	62	0	No	No	No	No
N63	1			0	62	62	0	No	No	No	No
N64	1			0	62	62	0	No	No	No	No
N65	1			0	62	62	0	No	No	No	No
N66	1			0	62	62	0	No	No	No	No
N67	1			0	60	60	0	No	No	No	No
N68	1			0	59	59	0	No	No	No	No
N69	1			0	60	60	0	No	No	No	No
N70	1			0	60	60	0	No	No	No	No
N71	1			0	62	62	0	No	No	No	No
N72	1			0	59	59	0	No	No	No	No
N73	1			0	59	59	0	No	No	No	No
N74	1			0	59	59	0	No	No	No	No
N75	1			0	60	60	0	No	No	No	No
N76	1		Yes	1	69	68	1	No	No	No	No
N77	1			0	69	69	0	No	No	No	No
N78	1			0	68	68	0	No	No	No	No
N79	1			0	66	66	0	No	No	No	No
N80	1			0	66	66	0	No	No	No	No
N81	1			0	63	63	0	No	No	No	No
N82	1			0	63	63	0	No	No	No	No
N83	1			0	59	59	0	No	No	No	No
N84	1			0	60	60	0	No	No	No	No
N85	1			0	67	67	0	No	No	No	No
N86	1			0	64	64	0	No	No	No	No
N87	1			0	64	64	0	No	No	No	No
N88	1			0	63	63	0	No	No	No	No
N89	1			0	63	63	0	No	No	No	No
N90	1			0	63	63	0	No	No	No	No
N91	1			0	64	64	0	No	No	No	No
N92	1			0	63	63	0	No	No	No	No
N93	1			0	64	64	0	No	No	No	No
N94	1			0	65	65	0	No	No	No	No
N95	1			0	60	60	0	No	No	No	No
N96	1			0	60	60	0	No	No	No	No
N97	1			0	61	61	0	No	No	No	No
N98	1			0	60	60	0	No	No	No	No
N99	1			0	59	59	0	No	No	No	No
N100	1			0	59	59	0	No	No	No	No
N101	1			0	60	60	0	No	No	No	No
N102	1			0	60	60	0	No	No	No	No
N103	1			0	58	58	0	No	No	No	No
N104	1			0	61	60	1	No	No	No	No
N105	1			0	60	60	0	No	No	No	No

Antelope Frontage - Barrier 1

17

Wall Length: ft

765 ft

Wall Cost per sq ft: \$20

Cost of items critical to safety:

of First Row Receivers: 1

Name	# of DU	Relocation	1st Row	# of 1st Row	Baseline Noise Level	17-ft Noise Level	17-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction
N106	1			0	59	59	0	No	No	No	No
N107	1			0	59	59	0	No	No	No	No
N108	1			0	59	59	0	No	No	No	No
N172	1			0	60	60	0	No	No	No	No

Feasibility Factors:

of First-Row 5 dBA Reduction:

0

% of First-Row 5 dBA Reduction:

0%

Acoustic Feasibility (5 dBA reduction for 50% of front-row):

No

Reasonableness Factors:

of First-Row Design Goal:

0

% of First-Row Design Goal:

0%

Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):

No

of Benefited:

0

Cost of Noise Wall (Length x Height x \$20/sq ft):

\$260,100

Cost of any other items critical to safety:

0

Anticipated Cost of Noise Abatement:

\$260,100

Allowable Cost (\$30,000 per benefited receptor):

\$0

Cost Effective (Anticipated Cost < Allowable Cost):

No

Feasible and Reasonable:

No

Antelope Frontage - Barrier 2

Envelope Frontage - Barrier 2					11	12	13	14																					
Wall Length:					ft	703	ft	703	ft	703	ft																		
Wall Cost per sq ft:					\$20																								
Cost of items critical to safety:																													
# of First Row Receivers:					5																								
Name	# of DU	Relocation	1st Row	# of 1st Row	Baseline Noise Level	11-ft Noise Level	11-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	12-ft Noise Level	12-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	13-ft Noise Level	13-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	14-ft Noise Level	14-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction
N57	1		Yes	1	66	61	5	No	Yes	No	Yes	61	5	No	Yes	No	Yes	61	5	No	Yes	No	Yes	60	6	No	Yes	No	Yes
N58	1		Yes	1	65	60	5	No	Yes	No	Yes	59	6	No	Yes	No	Yes	59	6	No	Yes	No	Yes	59	6	No	Yes	No	Yes
N59	1		Yes	1	66	60	6	No	Yes	No	Yes	59	7	Yes	Yes	Yes	Yes	59	7	Yes	Yes	Yes	Yes	59	7	Yes	Yes	Yes	Yes
N60	1		Yes	1	65	58	7	Yes	Yes	Yes	Yes	58	7	Yes	Yes	Yes	Yes	57	8	Yes	Yes	Yes	Yes	57	8	Yes	Yes	Yes	Yes
N62	1			0	62	62	0	No	No	No	No	61	1	No	No	No	No	61	1	No	No	No	No	61	1	No	No	No	No
N63	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N64	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N65	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N66	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N67	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N68	1			0	59	59	0	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N69	1			0	60	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No
N70	1			0	60	58	2	No	No	No	No	57	3	No	No	No	No	57	3	No	No	No	No	57	3	No	No	No	No
N71	1		Yes	1	62	58	4	No	No	No	No	58	4	No	No	No	No	58	4	No	No	No	No	57	5	No	Yes	No	Yes
N72	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N73	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N74	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	58	1	No	No	No	No
N75	1			0	60	60	0	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No
N76	1			0	69	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No
N77	1			0	69	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No
N78	1			0	68	68	0	No	No	No	No	68	0	No	No	No	No	68	0	No	No	No	No	68	0	No	No	No	No
N79	1			0	66	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No
N80	1			0	66	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No
N81	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N82	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N83	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N84	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N85	1			0	67	67	0	No	No	No	No	67	0	No	No	No	No	67	0	No	No	No	No	67	0	No	No	No	No
N86	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N87	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N88	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N89	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N90	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N91	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N92	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N93	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N94	1			0	65	65	0	No	No	No	No	65	0	No	No	No	No	65	0	No	No	No	No	65	0	No	No	No	No
N95	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N96	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N97	1			0	61	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No
N98	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N99	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N100	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N101	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N102	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N103	1			0	58	58	0	No	No	No	No	58	0	No	No	No	No	58	0	No	No	No	No	58	0	No	No	No	No
N104	1			0	61	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No
N105	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N106	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N107	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N108	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N172	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No

Feasibility Factors:																													
# of First-Row 5 dBA Reduction:					4			4								4								5					
% of First-Row 5 dBA Reduction:					80%			80%								80%								100%					
Acoustic Feasibility (5 dBA reduction for 50% of front-row):					Yes			Yes								Yes							Yes						
Reasonableness Factors:																													
# of First-Row Design Goal:					1			2								2							2						
% of First-Row Design Goal:					20%			40%								40%							40%						
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):					No			Yes								Yes							Yes						
# of Benefited:					4			4								4							5						
Cost of Noise Wall (Length x Height x \$20/sq ft):					\$154,660			\$168,720								\$182,780							\$196,840						
Cost of any other items critical to safety:					0			0								0							0						
Anticipated Cost of Noise Abatement:					\$154,660			\$168,720								\$182,780							\$196,840						
Allowable Cost (\$30,000 per benefited receptor):					\$120,000			\$120,000								\$120,000							\$150,000						
Cost Effective (Anticipated Cost < Allowable Cost):					No			No								No							No						
Feasible and Reasonable:					No			No								No							No						

Antelope Frontage - Barrier 2

15

Wall Length:ft

703ft

16

Wall Cost per sq ft:\$20

17

Cost of items critical to safety:

of First Row Receivers:5

Name	# of DU	Relocation	1st Row	# of 1st Row	Baseline Noise Level	15-ft Noise Level	15-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	16-ft Noise Level	16-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	17-ft Noise Level	17-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction
N57	1		Yes	1	66	60	6	No	Yes	No	Yes	60	6	No	Yes	No	Yes	60	6	No	Yes	No	Yes
N58	1		Yes	1	65	59	6	No	Yes	No	Yes	58	7	Yes	Yes	Yes	Yes	58	7	Yes	Yes	Yes	Yes
N59	1		Yes	1	66	58	8	Yes	Yes	Yes	Yes	58	8	Yes	Yes	Yes	Yes	58	8	Yes	Yes	Yes	Yes
N60	1		Yes	1	65	57	8	Yes	Yes	Yes	Yes	57	8	Yes	Yes	Yes	Yes	56	9	Yes	Yes	Yes	Yes
N62	1			0	62	61	1	No	No	No	No	61	1	No	No	No	No	61	1	No	No	No	No
N63	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N64	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N65	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N66	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N67	1			0	60	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No
N68	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N69	1			0	60	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No
N70	1			0	60	57	3	No	No	No	No	57	3	No	No	No	No	57	3	No	No	No	No
N71	1		Yes	1	62	57	5	No	Yes	No	Yes	57	5	No	Yes	No	Yes	57	5	No	Yes	No	Yes
N72	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N73	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N74	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N75	1			0	60	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No
N76	1			0	69	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No
N77	1			0	69	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No
N78	1			0	68	68	0	No	No	No	No	68	0	No	No	No	No	68	0	No	No	No	No
N79	1			0	66	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No
N80	1			0	66	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No
N81	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N82	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N83	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N84	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N85	1			0	67	67	0	No	No	No	No	67	0	No	No	No	No	67	0	No	No	No	No
N86	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N87	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N88	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N89	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N90	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N91	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N92	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N93	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N94	1			0	65	65	0	No	No	No	No	65	0	No	No	No	No	65	0	No	No	No	No
N95	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N96	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N97	1			0	61	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No
N98	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N99	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N100	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N101	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N102	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N103	1			0	58	58	0	No	No	No	No	58	0	No	No	No	No	58	0	No	No	No	No
N104	1			0	61	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No
N105	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N106	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N107	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N108	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N172	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No

Feasibility Factors:											
# of First-Row 5 dBA Reduction:				5				5			
% of First-Row 5 dBA Reduction:				100%				100%			
Acoustic Feasibility (5 dBA reduction for 50% of front-row):				Yes				Yes			
Reasonableness Factors:											
# of First-Row Design Goal:				2				3			
% of First-Row Design Goal:				40%				60%			
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):				Yes				Yes			
# of Benefited:				5				5			
Cost of Noise Wall (Length x Height x \$20/sq ft):				\$210,900				\$224,960			
Cost of any other items critical to safety:				0				0			
Anticipated Cost of Noise Abatement:				\$210,900				\$224,960			
Allowable Cost (\$30,000 per benefited receptor):				\$150,000				\$150,000			
Cost Effective (Anticipated Cost < Allowable Cost):				No				No			
Feasible and Reasonable:				No				No			

Antelope Frontage - Barrier 2ShortW

Envelope Frontage - Barrier 2ShortW										12					13					14					15				
Wall Length: ft										550 ft					550 ft					550 ft					550 ft				
Wall Cost per sq ft: \$20																													
Cost of Items critical to safety:																													
# of First Row Receivers: 5																													
Name	# of DU	Relocation	1st Row	# of 1st Row	Baseline Noise Level	12-ft Noise Level	12-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	13-ft Noise Level	13-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	14-ft Noise Level	14-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	15-ft Noise Level	15-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction
N57	1		Yes	1	66	62	4	No	No	No	No	62	4	No	No	No	No	62	4	No	No	No	No	62	4	No	No	No	No
N58	1		Yes	1	65	60	5	No	Yes	No	Yes	60	5	No	Yes	No	Yes	60	5	No	Yes	No	Yes	60	5	No	Yes	No	Yes
N59	1		Yes	1	66	60	6	No	Yes	No	Yes	59	7	Yes	Yes	Yes	Yes	59	7	Yes	Yes	Yes	Yes	59	7	Yes	Yes	Yes	Yes
N60	1		Yes	1	65	58	7	Yes	Yes	Yes	Yes	58	7	Yes	Yes	Yes	Yes	57	8	Yes	Yes	Yes	Yes	57	8	Yes	Yes	Yes	Yes
N62	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N63	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N64	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N65	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N66	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N67	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N68	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N69	1			0	60	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No
N70	1			0	60	58	2	No	No	No	No	57	3	No	No	No	No	57	3	No	No	No	No	57	3	No	No	No	No
N71	1		Yes	1	62	58	4	No	No	No	No	58	4	No	No	No	No	58	4	No	No	No	No	58	4	No	No	No	No
N72	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N73	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N74	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N75	1			0	60	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No
N76	1			0	69	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No
N77	1			0	69	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No
N78	1			0	68	68	0	No	No	No	No	68	0	No	No	No	No	68	0	No	No	No	No	68	0	No	No	No	No
N79	1			0	66	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No
N80	1			0	66	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No
N81	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N82	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N83	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N84	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N85	1			0	67	67	0	No	No	No	No	67	0	No	No	No	No	67	0	No	No	No	No	67	0	No	No	No	No
N86	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N87	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N88	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N89	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N90	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N91	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N92	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N93	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N94	1			0	65	65	0	No	No	No	No	65	0	No	No	No	No	65	0	No	No	No	No	65	0	No	No	No	No
N95	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N96	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N97	1			0	61	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No
N98	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N99	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N100	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N101	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N102	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N103	1			0	58	58	0	No	No	No	No	58	0	No	No	No	No	58	0	No	No	No	No	58	0	No	No	No	No
N104	1			0	61	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No
N105	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N106	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N107	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N108	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N172	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No

Feasibility Factors:				
# of First-Row 5 dBA Reduction:	3	3	3	3
% of First-Row 5 dBA Reduction:	60%	60%	60%	60%
Acoustic Feasibility (5 dBA reduction for 50% of front-row):	Yes	Yes	Yes	Yes
Reasonableness Factors:				
# of First-Row Design Goal:	1	2	2	2
% of First-Row Design Goal:	20%	40%	40%	40%
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):	No	Yes	Yes	Yes
# of Benefited:	3	3	3	3
Cost of Noise Wall (Length x Height x \$20/sq ft):	\$132,000	\$143,000	\$154,000	\$165,000
Cost of any other items critical to safety:	0	0	0	0
Anticipated Cost of Noise Abatement:	\$132,000	\$143,000	\$154,000	\$165,000
Allowable Cost (\$30,000 per benefited receptor):	\$90,000	\$90,000	\$90,000	\$90,000
Cost Effective (Anticipated Cost < Allowable Cost):	No	No	No	No
Feasible and Reasonable:	No	No	No	No

Antelope Frontage - Barrier 2ShortW

Antelope Frontage - Barrier 2ShortW

16

17

Wall Length: ft

550 ft

550 ft

Wall Cost per sq ft: \$20

Cost of items critical to safety:

of First Row Receivers: 5

Name	# of DU	Relocation	1st Row	# of 1st Row	Baseline Noise Level	16-ft Noise Level	16-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	17-ft Noise Level	17-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction
N57	1		Yes	1	66	62	4	No	No	No	No	62	4	No	No	No	No
N58	1		Yes	1	65	60	5	No	Yes	No	Yes	59	6	No	Yes	No	Yes
N59	1		Yes	1	66	59	7	Yes	Yes	Yes	Yes	58	8	Yes	Yes	Yes	Yes
N60	1		Yes	1	65	57	8	Yes	Yes	Yes	Yes	57	8	Yes	Yes	Yes	Yes
N62	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No
N63	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No
N64	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No
N65	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No
N66	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No
N67	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No
N68	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No
N69	1			0	60	59	1	No	No	No	No	59	1	No	No	No	No
N70	1			0	60	57	3	No	No	No	No	57	3	No	No	No	No
N71	1		Yes	1	62	57	5	No	Yes	No	Yes	57	5	No	Yes	No	Yes
N72	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No
N73	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No
N74	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No
N75	1			0	60	59	1	No	No	No	No	59	1	No	No	No	No
N76	1			0	69	69	0	No	No	No	No	69	0	No	No	No	No
N77	1			0	69	69	0	No	No	No	No	69	0	No	No	No	No
N78	1			0	68	68	0	No	No	No	No	68	0	No	No	No	No
N79	1			0	66	66	0	No	No	No	No	66	0	No	No	No	No
N80	1			0	66	66	0	No	No	No	No	66	0	No	No	No	No
N81	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No
N82	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No
N83	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No
N84	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No
N85	1			0	67	67	0	No	No	No	No	67	0	No	No	No	No
N86	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No
N87	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No
N88	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No
N89	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No
N90	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No
N91	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No
N92	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No
N93	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No
N94	1			0	65	65	0	No	No	No	No	65	0	No	No	No	No
N95	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No
N96	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No
N97	1			0	61	61	0	No	No	No	No	61	0	No	No	No	No
N98	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No
N99	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No
N100	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No
N101	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No
N102	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No
N103	1			0	58	58	0	No	No	No	No	58	0	No	No	No	No
N104	1			0	61	61	0	No	No	No	No	61	0	No	No	No	No
N105	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No
N106	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No
N107	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No
N108	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No
N172	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No

Feasibility Factors:			
# of First-Row 5 dBA Reduction:	4	4	
% of First-Row 5 dBA Reduction:	80%	80%	
Acoustic Feasibility (5 dBA reduction for 50% of front-row):	Yes	Yes	
Reasonableness Factors:			
# of First-Row Design Goal:	2	2	
% of First-Row Design Goal:	40%	40%	
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):	Yes	Yes	
# of Benefited:	4	4	
Cost of Noise Wall (Length x Height x \$20/sq ft):	\$176,000	\$187,000	
Cost of any other items critical to safety:	0	0	
Anticipated Cost of Noise Abatement:	\$176,000	\$187,000	
Allowable Cost (\$30,000 per benefited receptor):	\$120,000	\$120,000	
Cost Effective (Anticipated Cost < Allowable Cost):	No	No	
Feasible and Reasonable:	No	No	

Antelope Frontage - Barrier 2ShortE

Wall Length:				ft	15	553	ft	16	553	ft	17	553	ft										
Wall Cost per sq ft:				\$20																			
Cost of items critical to safety:																							
# of First Row Receivers:				5																			
Name	# of DU	Relocation	1st Row	# of 1st Row	Baseline Noise Level	15-ft Noise Level	15-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	16-ft Noise Level	16-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction	17-ft Noise Level	17-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction
N57	1		Yes	1	66	60	6	No	Yes	No	Yes	60	6	No	Yes	No	Yes	60	6	No	Yes	No	Yes
N58	1		Yes	1	65	59	6	No	Yes	No	Yes	58	7	Yes	Yes	Yes	Yes	58	7	Yes	Yes	Yes	Yes
N59	1		Yes	1	66	59	7	Yes	Yes	Yes	Yes	59	7	Yes	Yes	Yes	Yes	58	8	Yes	Yes	Yes	Yes
N60	1		Yes	1	65	59	6	No	Yes	No	Yes	59	6	No	Yes	No	Yes	59	6	No	Yes	No	Yes
N62	1			0	62	61	1	No	No	No	No	61	1	No	No	No	No	61	1	No	No	No	No
N63	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N64	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N65	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N66	1			0	62	62	0	No	No	No	No	62	0	No	No	No	No	62	0	No	No	No	No
N67	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N68	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N69	1			0	60	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No
N70	1			0	60	59	1	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No
N71	1		Yes	1	62	61	1	No	No	No	No	61	1	No	No	No	No	61	1	No	No	No	No
N72	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N73	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	58	1	No	No	No	No
N74	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N75	1			0	60	60	0	No	No	No	No	59	1	No	No	No	No	59	1	No	No	No	No
N76	1			0	69	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No
N77	1			0	69	69	0	No	No	No	No	69	0	No	No	No	No	69	0	No	No	No	No
N78	1			0	68	68	0	No	No	No	No	68	0	No	No	No	No	68	0	No	No	No	No
N79	1			0	66	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No
N80	1			0	66	66	0	No	No	No	No	66	0	No	No	No	No	66	0	No	No	No	No
N81	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N82	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N83	1			0	59	58	1	No	No	No	No	58	1	No	No	No	No	58	1	No	No	No	No
N84	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N85	1			0	67	67	0	No	No	No	No	67	0	No	No	No	No	67	0	No	No	No	No
N86	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N87	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N88	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N89	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N90	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N91	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N92	1			0	63	63	0	No	No	No	No	63	0	No	No	No	No	63	0	No	No	No	No
N93	1			0	64	64	0	No	No	No	No	64	0	No	No	No	No	64	0	No	No	No	No
N94	1			0	65	65	0	No	No	No	No	65	0	No	No	No	No	65	0	No	No	No	No
N95	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N96	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N97	1			0	61	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No
N98	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N99	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N100	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N101	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N102	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N103	1			0	58	58	0	No	No	No	No	58	0	No	No	No	No	58	0	No	No	No	No
N104	1			0	61	61	0	No	No	No	No	61	0	No	No	No	No	61	0	No	No	No	No
N105	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No
N106	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N107	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N108	1			0	59	59	0	No	No	No	No	59	0	No	No	No	No	59	0	No	No	No	No
N172	1			0	60	60	0	No	No	No	No	60	0	No	No	No	No	60	0	No	No	No	No

Feasibility Factors:			
# of First-Row 5 dBA Reduction:	4	4	4
% of First-Row 5 dBA Reduction:	80%	80%	80%
Acoustic Feasibility (5 dBA reduction for 50% of front-row):	Yes	Yes	Yes
Reasonableness Factors:			
# of First-Row Design Goal:	1	2	2
% of First-Row Design Goal:	20%	40%	40%
Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):	No	Yes	Yes
# of Benefited:	4	4	4
Cost of Noise Wall (Length x Height x \$20/sq ft):	\$165,900	\$176,960	\$188,020
Cost of any other items critical to safety:	0	0	0
Anticipated Cost of Noise Abatement:	\$165,900	\$176,960	\$188,020
Allowable Cost (\$30,000 per benefited receptor):	\$120,000	\$120,000	\$120,000
Cost Effective (Anticipated Cost < Allowable Cost):	No	No	No
Feasible and Reasonable:	No	No	No

Antelope Frontage - Barrier 3

17

Wall Length: ft

497 ft

Wall Cost per sq ft: \$20

Cost of items critical to safety:

of First Row Receivers: 3

Name	# of DU	Relocation	1st Row	# of 1st Row	Baseline Noise Level	17-ft Noise Level	17-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction
N1	1			0	70	70	0	No	No	No	No
N2	1			0	69	69	0	No	No	No	No
N3	1			0	67	67	0	No	No	No	No
N4	1			0	64	64	0	No	No	No	No
N5	1			0	64	64	0	No	No	No	No
N6	1			0	62	62	0	No	No	No	No
N7	1			0	63	62	1	No	No	No	No
N8	1			0	63	62	1	No	No	No	No
N9	1		Yes	1	65	64	1	No	No	No	No
N10	1		Yes	1	67	66	1	No	No	No	No
N11	1			0	67	67	0	No	No	No	No
N12	1			0	66	66	0	No	No	No	No
N13	1			0	69	69	0	No	No	No	No
N14	1			0	71	71	0	No	No	No	No
N15	1			0	70	70	0	No	No	No	No
N16	1		Yes	1	71	69	2	No	No	No	No
N19	1			0	62	61	1	No	No	No	No
N20	1			0	61	60	1	No	No	No	No
N21	1			0	61	60	1	No	No	No	No
N22	1			0	63	62	1	No	No	No	No
N23	1			0	61	61	0	No	No	No	No
N24	1			0	63	62	1	No	No	No	No
N25	1			0	64	64	0	No	No	No	No
N33	1			0	63	62	1	No	No	No	No
N34	1			0	61	60	1	No	No	No	No
N35	1			0	62	62	0	No	No	No	No
N36	1			0	59	59	0	No	No	No	No
N37	1			0	57	57	0	No	No	No	No
N38	1			0	60	59	1	No	No	No	No
N39	1			0	59	59	0	No	No	No	No
N40	1			0	59	59	0	No	No	No	No
N41	1			0	59	58	1	No	No	No	No
N42	1			0	58	58	0	No	No	No	No
N43	1			0	58	58	0	No	No	No	No
N326	1			0	63	62	1	No	No	No	No
N327	1			0	62	62	0	No	No	No	No
N328	1			0	68	68	0	No	No	No	No
N329	1			0	68	68	0	No	No	No	No
N330	1			0	65	65	0	No	No	No	No

Antelope Frontage - Barrier 3

17

Wall Length: ft

497 ft

Wall Cost per sq ft: \$20

Cost of items critical to safety:

of First Row Receivers: 3

Name	# of DU	Relocation	1st Row	# of 1st Row	Baseline Noise Level	17-ft Noise Level	17-ft Noise Reduction	Design Goal	Benefited	1st Row Design Goal	1st Row 5 dBA Reduction
N331	1			0	68	68	0	No	No	No	No
N332	1			0	68	68	0	No	No	No	No

Feasibility Factors:

of First-Row 5 dBA Reduction:

0

% of First-Row 5 dBA Reduction:

0%

Acoustic Feasibility (5 dBA reduction for 50% of front-row):

No

Reasonableness Factors:

of First-Row Design Goal:

0

% of First-Row Design Goal:

0%

Noise Abatement Design Goal (7 dBA reduction for 35% of front-row):

No

of Benefited:

0

Cost of Noise Wall (Length x Height x \$20/sq ft):

\$168,980

Cost of any other items critical to safety:

0

Anticipated Cost of Noise Abatement:

\$168,980

Allowable Cost (\$30,000 per benefited receptor):

\$0

Cost Effective (Anticipated Cost < Allowable Cost):

No

Feasible and Reasonable:

No