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Pedestrian Crossing Environmental Impact Statement

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PEDESTRIAN CROSSING ENVIRONMENTAL IMPACT STATEMENT

by

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Capstone submitted in partial fulfillment of the requirements for graduation with

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with a major in
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in the Department of Civil and Environmental Engineering

Approved:

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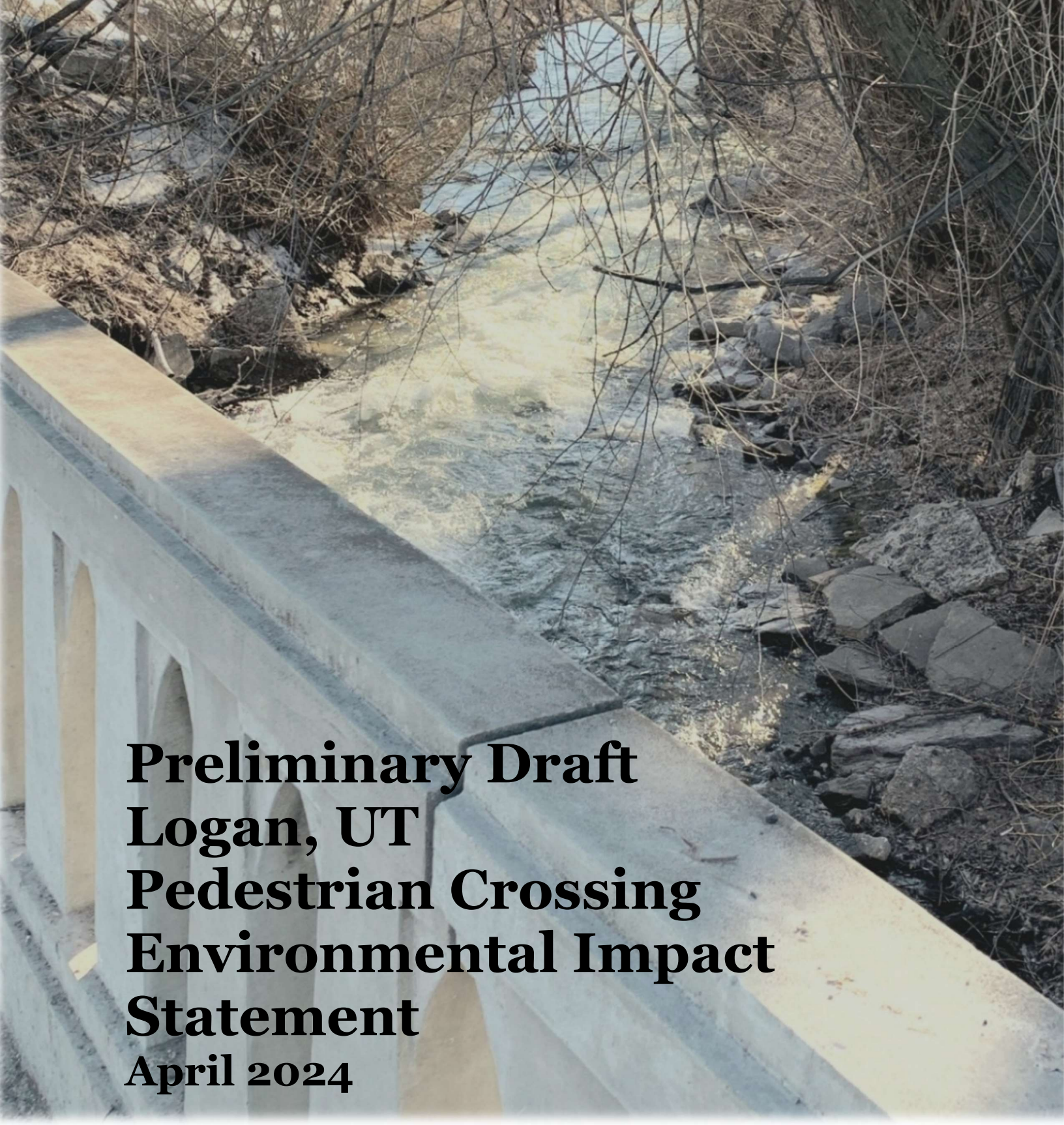

Preliminary Draft Logan, UT Pedestrian Crossing Environmental Impact Statement

April 2024

UDOT Keeping Utah Moving

U.S. Department of Transportation
Federal Highway Administration

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EXECUTIVE SUMMARY

Logan, Utah is divided by US Highway 89/91, which bisects much of the city. This makes it difficult to pass to the other side without a vehicle. A pedestrian crossing has been proposed to connect the eastern and western sides of Logan without impacting traffic flow. The Environmental Impact Statement aims to look at reasonable alternatives and identify many resources that will be affected by its implementation. Four main alternatives were considered: an underpass, an overpass with an elevator, an overpass with a ramp, and the no-change alternative to be used as a baseline alternative. The underpass is the preferred alternative based on sustainability, cost, maintenance, and pedestrian traffic usage. Some of the major negative impacts of the pedestrian crossing include right-of-way acquisition, hydrology impacts, water quality, and noise-and-vibration impacts. Some of the major positive impacts are increased pedestrian facilities and increased socioeconomic potential. These resources were then analyzed for cumulative impacts over time and space to show how they will impact the future of the project site and beyond. After a thorough analysis, the underpass is still the best alternative for the location.

ACKNOWLEDGEMENTS

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I would also like to thank Utah State University's College of Engineering. The College of Engineering's education, guidance, and experiences they provided gave me all the tools I utilized in this Environmental Impact Statement. The Engineering College's experiences drew me to complete an Environmental Impact Statement in the first place.

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Preliminary Draft Environmental Impact Statement

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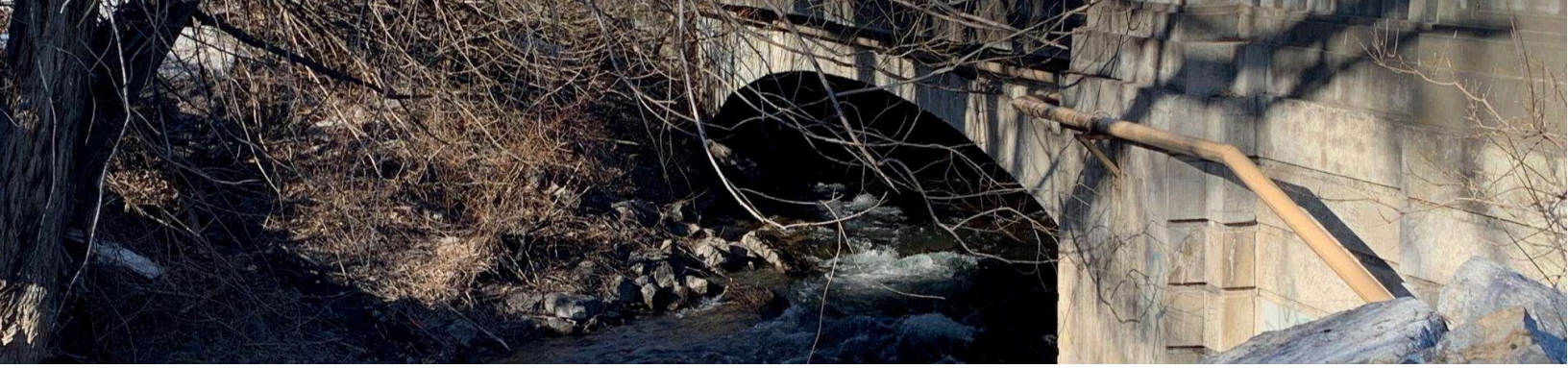


CHAPTER 1 – PURPOSE OF AND NEED FOR ACTION

1.1 Introduction

In 1926, US Highway 89 and US Highway 91 were created within the Wasatch Mountain Range of Utah. Construction of these highways predates the Federal Aid-Highway Act of 1956 (Phelps 2021), but they serve the same purpose as the Act's intention: to connect people through infrastructure. Since the mountains were difficult to traverse, these highway systems eased navigation and connected the cities along their paths. Logan City is situated in Cache Valley between the mountains of the Wasatch Range with the primarily north-south highways separating the city's eastern and western halves. With Logan being at a convergence of the two roads, this single road was referred to as US-89/91.

As vehicular reliance grew with the size of Logan City, the road was also widened to increase its capacity. This aided both local and through traffic, making US-89/91 faster transportation through the city center. However, the higher capacity and associated priority of US-89/91 reduced the ability for vehicles, pedestrians, and cyclists to cross from the east to the west side of the city.

The current lack of pedestrian infrastructure on US-89/91 creates difficulties for pedestrians and cyclists trying to access the east and west sides of Logan. The highway through Logan only has stop lights with pedestrian crossing signals, where pedestrians and cyclists press a button to cross. But with the main street being a US Highway, continuous traffic is prioritized over other transportation routes. This causes longer wait times and dissuades active transportation due to those wait times.

Logan is researching alternatives to add a secondary route tangential to US-89/91 to redirect traffic and remedy vehicle congestion. In the past, Logan City conducted a feasibility study to reduce traffic on US-89/91 using one-way couplet systems to divert current traffic volumes (Logan 2013). The Utah Department of Transportation (UDOT) is also conducting a study on surrounding roads to redirect traffic and reduce congestion. This study is set to finish in the spring of 2024 (UDOT 2023a). This research will aid in understanding where to increase total vehicle capacity in Logan while decreasing congestion on US-89/91. Pedestrians and cyclists, meanwhile, have yet to receive similar attention to aid their transportation.

To help remedy pedestrian crossing accessibility issues, the Logan City Public Works Department and UDOT propose improving pedestrian and cyclist transportation facilities. This would occur across US-89/91 near West 600 South. This action would create pedestrian and cyclist facilities to cross US-89/91 without impacting traffic. Due

to its proximity to the Logan River, it is necessary to evaluate the best practices so environmental hazards do not persist further downstream.

Figure 1 shows the intended project location area within Logan City. The plan is to use the area north of the river to create pedestrian passing. This location encroaches on the fewest number of businesses and residents. Additionally, this location connects with a trail that can be utilized for continuous access across the city.

Figure 2 shows the vicinity map with the Utah map inset. This figure is included to illustrate the multiple high-density roads that pass through the center of Logan. Furthermore, this map shows the project area for those unfamiliar with Logan City.

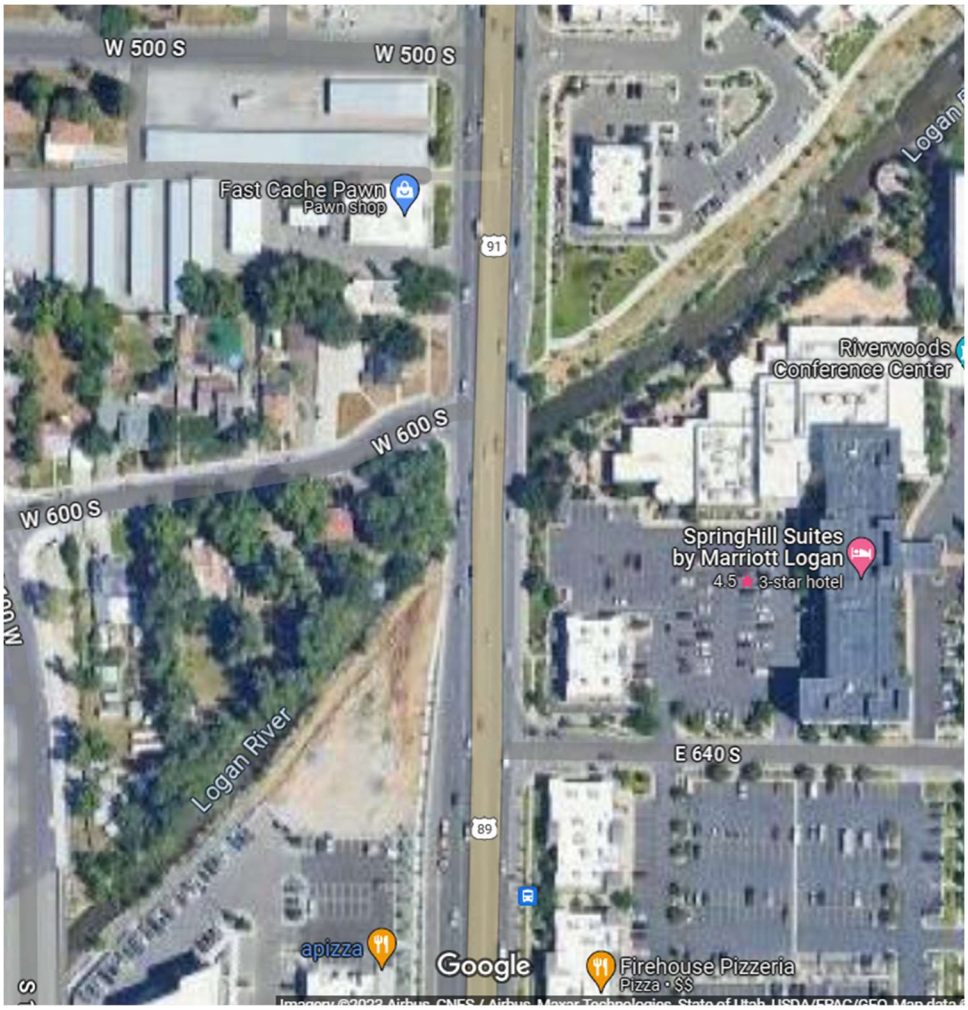


Figure 1. Project Location – W 600 S and US-89/91

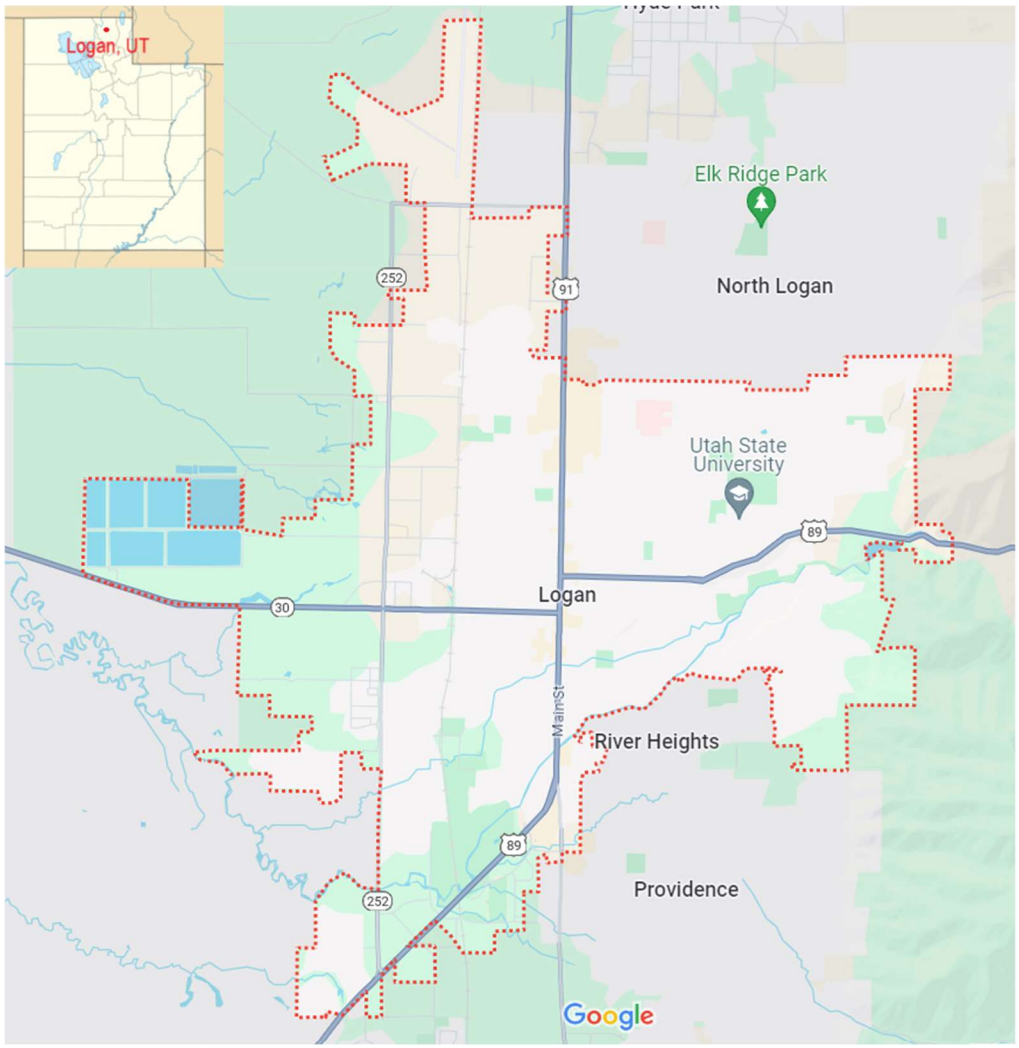


Figure 2. Vicinity Map with Utah Map Inset

1.2 Purpose of the Pedestrian Crossing

The purpose of the pedestrian crossing is to improve access, mobility, and safety for pedestrians. This action includes creating designated pedestrian and cyclist infrastructure that incentivizes more use of active transportation facilities. The proposed action also needs the crossing facility to prevent significant impacts to through traffic of US Highway 89/91, as per UDOT regulations. The long-term improvements are intended to reduce congestion and improve the walkability of Logan City. Logan City aims to minimize the adverse impacts on neighborhoods, businesses, and the environment by creating pedestrian infrastructure.

1.3 Need for the Pedestrian Crossing

The need for this project comes from multiple sources. The lack of pedestrian facilities, poor walkability of the city, increased vehicular traffic, connectivity to public transportation, and air quality benefits of the addition of this project all drive the need for the pedestrian crossing. Each subsection below presents the individual needs in more depth.

1.3.1 Pedestrian Facilities

Pedestrian facilities need to be implemented frequently to ensure active transportation is seen as a viable method of transportation. The higher the availability of these facilities, the more likely pedestrians will use them. The lack of pedestrian facilities at the proposed crossing is evidenced by the considerable distance to the nearest pedestrian infrastructure. No pedestrian crossing exists within 1,400 ft either north or south of the site. Most pedestrians will walk ¼ mile (1,320 ft) to a transit stop (FHWA 2013). This means the nearest crossing locations are further than people are willing to wait for public transit.

Additionally, increased vehicular traffic exacerbates active transportation issues. As roads collect more traffic, pedestrians are influenced to react more erratically to protect themselves. Additionally, uncontrolled crossing locations, like at non-intersections, can correspond to higher crash rates from inadequate pedestrian facilities (FHWA 2018). This unfortunately has been proven due to a fatality happening at the exact project location in 2011 (City-data.com 2021). The higher level of traffic can also cause pedestrians to give up walking in favor of self-preservation.

These issues dissuade walking to locations and reduce accessibility to businesses and services. The lack of walking is a problem due to a densely packed business area near the project site that has limited parking stalls available. This is illustrated in Figure 3. Another crossing location is needed to allow more accessibility for active transportation. Another pedestrian facility will allow more accessibility between the east and west sides of the city.

Figure 3. Business Area near project location (top left)

1.3.2 Walkability

The walkability of a city is how easy it is for someone walking to reach businesses and services within an average walking distance for a person in a day. WalkScore.com is a website that consolidates multiple walkability scores for different cities into a website for users to study cities and towns. Walk Score rated Logan a 40 out of 100 in walk score and a 51 out of 100 in bike score (Walk Score 2023).

However, WalkScore.com is criticized for how it evaluates the walkability of a city. Users indicate that it utilizes too few metrics for true walkability, such as how enjoyable the walk is. But that criticism only augments the evidence that Logan City is not a walkable city, and as such WalkScore.com provides evidence of problems existing for those wishing to walk. WalkScore.com rates cities based on the time walking, biking, or public transportation is required to go from a home to a business or service. Given this rating system, this implies that it takes a significant distance and time to reach businesses and services from home. This poor walkability dissuades pedestrians from walking, causing more people to drive and exacerbating problems on US-89/91.

1.3.3 Vehicular Traffic

As vehicle volumes increase on the US-89/91, the crossing becomes a more dangerous place for pedestrians. The current vehicle volume of US-89/91 over the bridge is 39,000 AADT (UDOT 2023b). COVID ended up causing this value to drop from its previous high of 45,000 AADT. However, the trend from 2012 to 2019 showed a significant increase yearly (UDOT 2023c). With US-89/91 being the main street for Logan, there are also significant historical resources that exist on the east and west sides of the street. With these historical buildings being close to the road's edge, this area limit reduces the ability to expand US-89/91 further to meet future traffic volumes. In the future, the volume-to-capacity (v/c) ratio is expected to be at minimum 1.0 to as high as 1.2 (UDOT 2023d).

With the v/c ratio being 1.0 or greater, more emphasis will be put on conveying through traffic on this route. Traffic engineers will focus on vehicle transportation to reduce the length and time US-89/91 spends in Level of Service (LOS) E or F ratings (Landmark Design, INC. 2011). Logan City eventually plans to convey traffic through the city via multiple main roads rather than one. The diversion would reduce the intensity of poor LOS issues on US-89/91 after enough time.

With the focus on vehicle transportation and preventing LOS issues, this sacrifices pedestrian abilities to navigate the city. Pedestrians and cyclists are not provided with more facilities or means to access each side of Logan as vehicle facilities increase. If vehicle facilities increase and make traversing the city easier, it increases people's reliance on vehicles. Furthermore, more vehicle facilities reduce the number of pedestrian facilities and further reduce reliance on walking, cycling, or public transportation.

1.3.4 Public Transportation

Public transportation requires more pedestrian facilities to be effective. The more facilities allow people to traverse the city without a car, the more likely people are to utilize those facilities. Those facilities must also be intuitive and enjoyable to use for pedestrians to utilize them. Additionally, proper public transportation systems can reduce congestion on streets by up to 36.6% (Sultana 2020), further aiding in the previous issue involving vehicular traffic.

Connecting the two sides of Logan City at the project location allows the bus system to be within 700 ft of both sides of the crossing. Returning to the pedestrian facilities section, this is well within the ¼ mile pedestrians are willing to walk. The pedestrian crossing, therefore, fits into the bus system and active transportation modes available in Logan City.

1.3.5 Air Quality

Every gallon of gasoline consumed by vehicles can produce up to 20 pounds of carbon emissions (EPA 2023). Cache Valley is surrounded by mountains. The mountains trap vehicle pollution with inversions and lead to poor air quality. Poor air quality impacts people with respiratory problems. However, walking and cycling produce no excess carbon aside from breathing. This creates a growing need for improved connectivity for bicycle and pedestrian facilities to encourage more active and public transportation modes.

1.4 Goals and Objectives of the Pedestrian Crossing

The following goals would be accomplished by implementing a pedestrian crossing. Quantifying these goals and objectives is provided in the latter sections of this report. The community goals include:

- Increase the quality of life for pedestrians and community members.
- Create an uncongested, pedestrian-friendly route across the city.
- Increase community connectivity.
- Improve air quality by encouraging active transportation.
- Increase economic development with more pedestrian access.

The environmental objectives include:

- Avoid impacts on the fish in the Logan River.
- Minimizing pedestrian crossing impacts on the riparian habitat.
- Mitigate further impacts on the river environment as alternatives apply.

CHAPTER 2 - ALTERNATIVES

2.1 Description of Alternatives

Four alternatives were evaluated for comparative analysis.

2.1.1 Underpass Alternative

An underpass utilizes grade separation to allow pedestrians to pass underneath vehicular traffic and provide for a constant flow of traffic. This alternative would utilize a concrete box culvert approximately 120 feet long and would have a required width of 12 feet, and a preferred width of 18 feet wide for pedestrian security (AASHTO 2004). Figure 3 presents the approximate location and length of the underpass. Underpasses are common in Logan City, with underpasses existing near Utah State University to travel underneath the highway. This option would provide familiarity to those living in Logan.

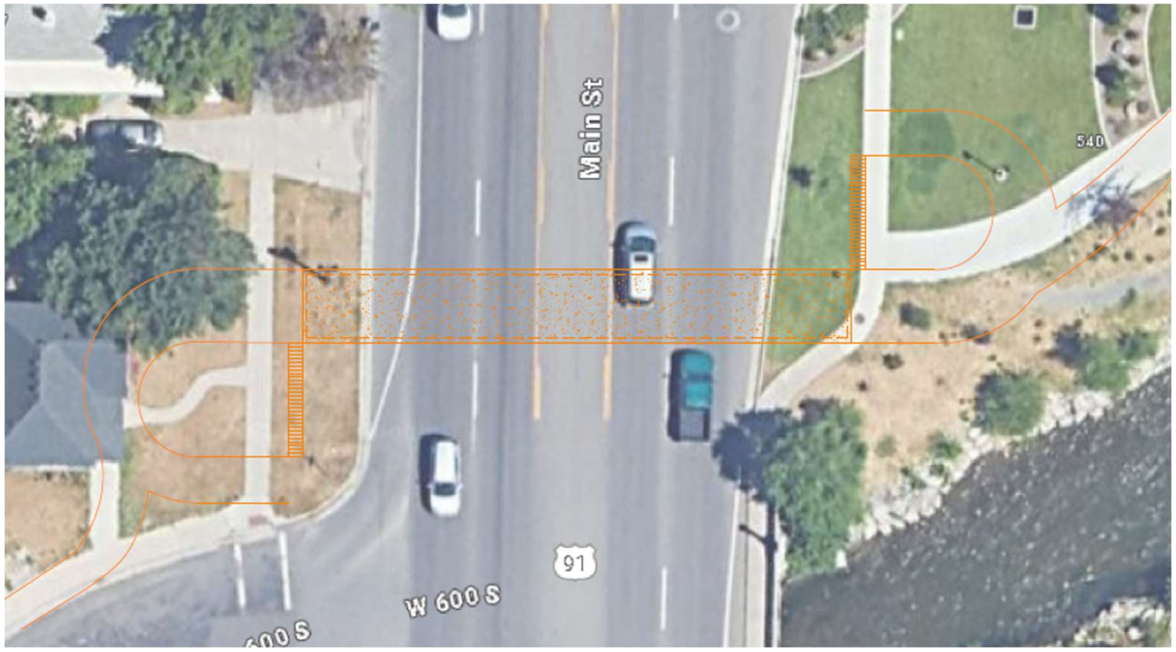


Figure 4. Underpass proposed crossing location

The underpass alternative would provide a path that connects the two sides of the city by constructing a box culvert underneath the highway. The placement of the underpass would increase Logan City's walkability by meeting pedestrian's need to not exceed ¼ mile walking distance (FHWA 2013). The underpass also prevents impacts on the natural flow of traffic by being grade-separated. An underpass augments the public transportation system by providing more accessible transportation. The underpass

additionally improves (or at least does not impair) air quality by encouraging active transportation and reducing vehicular congestion.

Table 1 lists the Underpass Cost Estimate. The table provides the estimates as lump sums for categories. Due to all the alternatives requiring the surrounding trail to be modified for a proper approach, their cost is not added to the current cost estimate. A detailed cost estimate can be found in the appendix.

Table 1. Basic Underpass Cost Estimate

Item	**Amount**
Construction	$1,702,362
Utilities	$168,000
Landscaping	$1,154,500
Engineering	$1,099,202
Total:	$4,124,064

2.1.2 Overpass with Elevator Alternative

An overpass also utilizes grade separation to bring pedestrians over vehicular traffic and create a constant traffic flow. This alternative would involve the construction of a structure approximately 120 feet long, 14 feet wide, and 7 feet tall for pedestrian security (AASHTO 2004). Additionally, due to the height clearance that would be required over the traffic (FHWA 2014), an elevator should be installed to meet Americans with Disabilities Act (ADA) compliance in a location smaller than a 15’x15’ area. Figure 4 presents the estimated location and length of the underpass. While pedestrian overpasses are not common in Logan, they are relatively common throughout Utah and may provide familiarity.

The overpass alternative would provide a path above vehicular traffic. The placement of the overpass would increase Logan City’s walkability by meeting pedestrian walking requirements. The overpass also prevents impacts on the natural flow of traffic by being grade-separated. An overpass also augments the public transportation system by providing more accessible transportation, including an elevator for ADA compliance. The overpass additionally aids air quality by encouraging active transportation and reducing vehicular congestion.

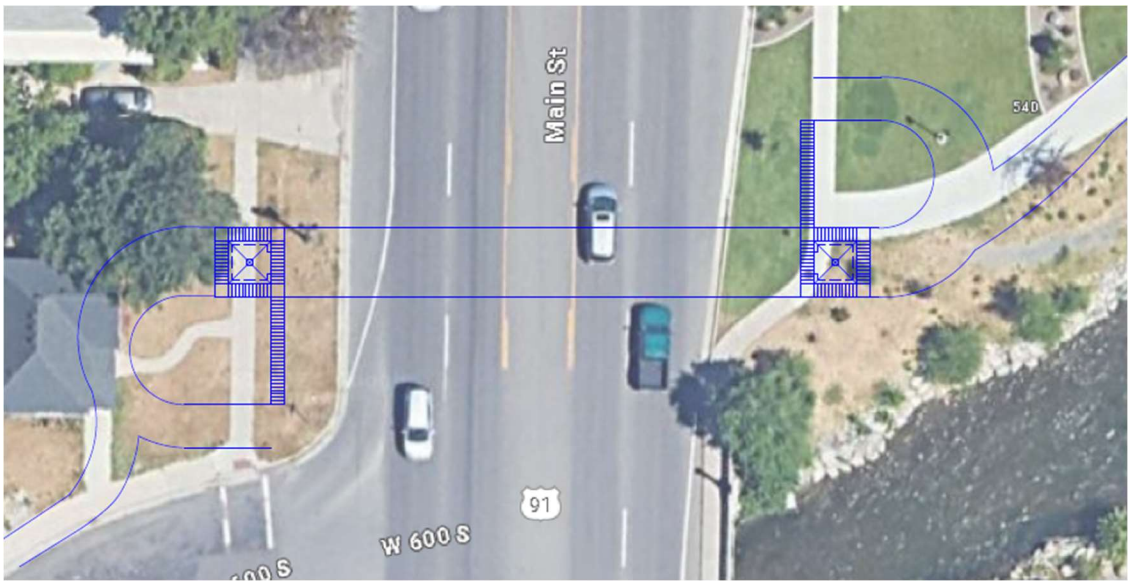


Figure 5. Elevator Overpass proposed crossing location

Table 2 lists the Elevator Overpass Cost Estimate. The table provides the estimates as lump sums for categories. A detailed cost estimate can be found in the appendix.

Table 2. Basic Elevator Overpass Cost Estimate

Item	**Amount**
Construction	$3,038,440
Utilities	$140,000
Landscaping	$1,154,500
Engineering	$1,518,554
Total:	$5,851,494

2.1.3 Overpass with Ramp Alternative

As stated before, an overpass utilizes grade separation to direct pedestrians over vehicular traffic. To meet ADA compliance, the first alternative utilized an elevator to minimize the construction footprint required to help those with walking disabilities. However, elevators are not always desired. This alternative investigates the space required to maintain ADA compliance ratings with the maximum 1:12 allowed grade.

The previous section identifies most of the reasons why the overpass would address the transportation issues identified. However, rather than using an elevator for ADA compliance, this option would utilize ramps at the maximum grade allowed for both sides of the crossing. Figure 5 illustrates how this alternative may appear. Table 3

further lists the Ramp Overpass Cost Estimate. The table provides the estimated lump sums each for category. A detailed cost estimate can be found in the appendix.

Table 3. Basic Ramp Overpass Cost Estimate

Item	**Amount**
Construction	$3,283,244
Utilities	$140,000
Landscaping	$1,154,500
Engineering	$1,146,311
Total:	$5,724,055

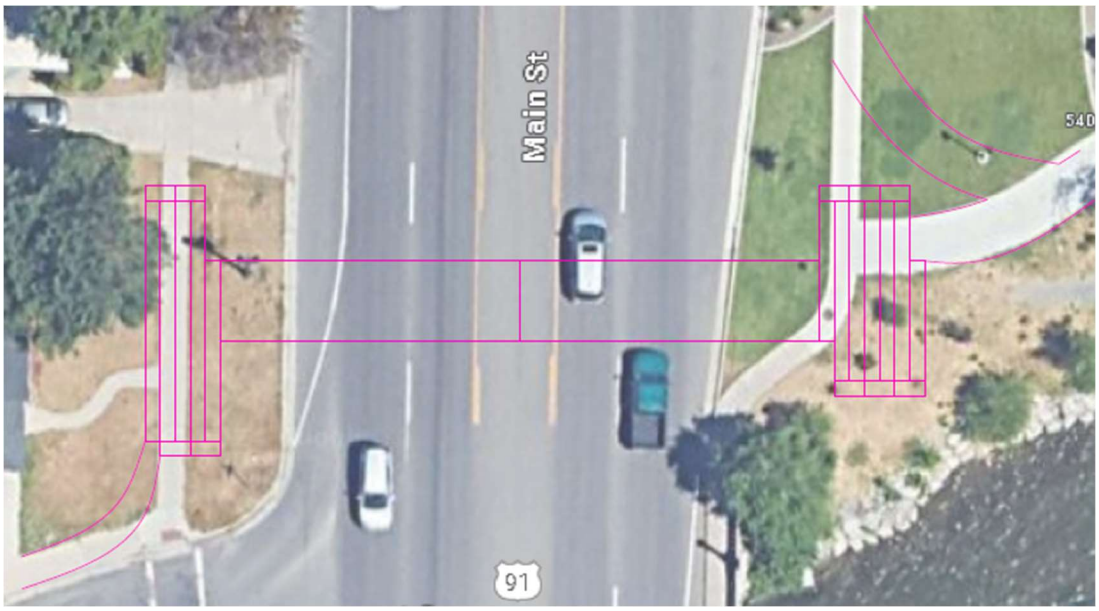


Figure 6. Ramp Overpass proposed crossing location

2.1.4 No Build Alternative

The No Build Alternative fails to meet the primary goal of the project of connecting the east and west sides of Logan City. The No Build Alternative would leave the current conditions as they are for US-89/91. This would leave multiple objectives unmet:

- No additional pedestrian facilities,
- A low walkability score,
- A lack of incentive for public transportation, and
- Air quality remains the same.

This alternative would meet Logan City's objective of maintaining Vehicular Traffic. However, without meeting the other objectives, this alternative is not preferred.

2.1.5 Common Design Features of the Build Alternatives

Each alternative listed would require removing the building on the west side of US-89/91. Additionally, to have the alternatives fit into the current pedestrian infrastructure, the surrounding area would require removal of adjacent sidewalks that would be replaced upon completion. These alternatives would also require the surrounding landscape to be reseeded and replanted. Logan City has also expressed interest in turning W 600 S into a cul-de-sac rather than an intersection, so each of these alternatives would require additional construction.

2.2 Screening Criteria and Evaluation Measures

Below are listed the screening criteria and evaluation measures that are used to compare the alternatives. The screening criteria are applied in Section 2.3 to discuss alternatives eliminated from further evaluation. The evaluation measures are used in Section 2.4 to compare the alternatives with one another.

2.2.1 Screening Criteria

The following criteria are utilized as pass or fail statements for the elimination of alternatives before they reach the comparison stage.

Vehicle Traffic. Vehicle Traffic is used to describe the impacts of through traffic on US-89/91. Since US-89/91 is a connecting highway, disruptions to through traffic may result in extended congested traffic. UDOT requires that this is not an issue on the state highways for that through traffic. If the road is significantly impacted, motorists may utilize alternative methods for getting to their destinations that are not as controlled. Any alternative that directly impacts traffic flow will be eliminated from further consideration.

Accessibility (ADA Compliance). Accessibility requires reasonable access for pedestrians of all capabilities. According to the ADA, this means that people with disabilities should not be discriminated against in transportation programs. Since the pedestrian crossing would reduce the distance traveled between locations, this would qualify as a program that must consider disability access issues. Any alternative that creates difficulty in accessing for those with disabilities will be eliminated from further consideration.

2.2.2 Evaluation Measures

The following evaluation measures are applied to each alternative on a scale from 1 to 5, with 1 being the best and 5 being the worst. These criteria are compiled into a Pugh

matrix to compare the four primary alternatives for the best option. The criteria are listed in order of highest weight to lowest weight.

Pedestrian Traffic. Pedestrian traffic is tied to accessibility due to how each alternative encourages active transportation. Accessibility is considered because even if a crossing method is accessible, that does not mean it is practical or desired. Additionally, while pedestrians are the focus, cyclists, equestrians, skaters, and others may also need an option to help them cross as well. If the effort to cross at a designated location is seen as excessive, pedestrians will seek alternate means. Pedestrian traffic can be evaluated by determining the intensity of effort a pedestrian must go through to cross the street.

Management of Traffic. The management of traffic is tied to the vehicle traffic requirement but is related to the short-term impacts of construction. When UDOT funds the pedestrian crossing, they add a stipulation that the highway cannot be fully shut down unless there is an additional UDOT road that traffic can be directed to. With no UDOT road in the near vicinity, this means that US-89/91 cannot be fully shut down during the length of construction. The management of traffic will be evaluated based on the duration that construction would impact the traffic.

Cost. Cost is always a principal factor in civil engineering projects. Since the project uses tax dollars, a lower cost is important not only to Logan City and UDOT but also to Utah citizens who are the shareholders of the project. This criterion will evaluate the most cost-effective option in the alternatives.

Maintenance. Each crossing method should use simple and common maintenance methods to lower costs and increase longevity of the project. The maintenance can be evaluated by identifying the alternatives with the lowest maintenance required for the best pedestrian experience.

Sustainability. The sustainability of a given alternative evaluates how the project will affect the local environment. The longevity of a given alternative also affects sustainability. A sustainable alternative mitigates negative effects on the environment, is long-lasting, and requires less upkeep. This criterion will be evaluated by the area of impact of each alternative, as well as the longevity of the project.

Aesthetics. While aesthetics is not as quantifiable as the above criteria, people must enjoy where they are walking as much as they can walk. If the walkways do not feel safe to walk on, pedestrians will avoid those feelings of discomfort. Additionally, the most context-sensitive alternative will attract the most use from pedestrians, as it will

feel most familiar. The criterion will be evaluated on the difficulty of incorporating the design into the surrounding environment.

2.3 Alternatives Considered but Eliminated from Further Consideration.

Some alternatives that were considered did not make it past the concept stage. The following alternatives describe the concept of each idea and how it would be implemented. The section then details the reasons why the alternative was removed before evaluation.

2.3.1 Traffic Signal Alternative

A traffic signal would utilize the least amount of area for pedestrian crossing. Utilizing a High-Intensity Activated Crosswalk (HAWK) system, pedestrians would push a button so stop lights would activate to stop traffic. The pedestrian would then cross before traffic was allowed to move again. Figure 6 demonstrates where this alternative would be placed.

Figure 7. Traffic Signal proposed crossing location

The placement of the crosswalk would increase Logan City's walkability by meeting pedestrian walking distance requirements. A crosswalk also provides more accessibility to the public transportation network by better connecting both sides of the city.

This alternative, however, does not satisfy the required objectives of Logan City and UDOT. Grade separation is a requirement due to US-89/91 being a highway. Minimum disruption to travelers is necessary since this is a connector road in addition to being Logan City's main road. Excessive disruption can agitate drivers and can cause traffic jams to persist longer than without the HAWKs system.

Additionally, this alternative may increase air pollution. While more people walking may reduce the pollution they produce, stopping vehicles frequently as they drive creates an increase in emissions (Choudhary & Gokhale 2016). Excessive stopping would produce more emissions and decrease total air quality.

2.4 Comparison of Alternatives

The alternative evaluation is based on the Pugh Matrix analysis, utilizing a weighted ranking system. The following paragraphs summarize the main advantages and disadvantages of each alternative.

2.4.1 Underpass Alternative

The underpass alternative has multiple benefits, primarily in its accessibility. The underpass creates an area that pedestrians and cyclists alike can access, as well as being a familiar travel corridor. Additionally, the underpass is easier to maintain than the other alternatives and has a better capacity to aesthetically fit in with the surroundings.

The traffic management for this project, however, is the worst of all the potential alternatives. Additionally, while the cost is reasonable for a project of its size, it is also the most expensive of the alternatives provided. The underpass has average sustainability compared to other possible alternatives.

2.4.2 Elevator Overpass Alternative

The elevator overpass alternative was ranked as neutral for every category. While it was intuitive for users and decently accessible, it was also more difficult for cyclists to utilize. The traffic management would not be as extensive as the underpass, but there would still be significant impacts. The cost was also the second most expensive of the alternatives, but reasonable for a project of this size.

The elevator overpass is also decent to maintain, with difficulties possible with the elevator, as well as climbing up the stairs to keep them clean. The project is moderately sustainable, with the project building a crossing that is recognizable to maintain but utilizing power to ensure the crossing is ADA-compliant. The project is mildly aesthetic, with concerns from Storm Engineering members voicing that the placement can be distracting.

2.4.3 Ramp Overpass Alternative

The overpass alternative has many of the same issues as the elevator overpass, but worse. While the ramp overpass is less costly, it loses accessibility with the extra 200 feet of climbing ramp to meet ADA requirements on each side. This design would also impact traffic more significantly with trucks having to disrupt traffic to bring materials.

The extra length also makes the ramp overpass much harder to maintain properly. The extra materials also make the design less sustainable, even if it encourages more pedestrian activity. Lastly, the ramps significantly decrease the overall aesthetic appeal of this alternative. There is a possibility that it could be turned into a public art statement to increase its value as an aesthetic piece; however, since aesthetics is weighted low, it would not make a difference in its ranking.

2.4.4 No Build Alternative

The no-build alternative has multiple merits. There is no cost if the overpass is not built, and it is the easiest to maintain of the acceptable options. It is mostly sustainable, the only factor making it less than perfectly sustainable being the short-term nature of the no-build alternative.

It was rated as moderately aesthetic, due to nature being nearby but not well maintained compared to other possible alternatives. Rather, it appears to be a product of its surroundings. This alternative hurts the most due to the pedestrian traffic issues. The no-build alternative offers no intuitive way for pedestrians to cross, making it dangerous and incentivizing alternate transportation modes. This was rated the worst alternative for pedestrian traffic.

After comparing and weighing the benefits and impacts of all the reasonable alternatives, the Underpass Alternative has been identified as the Preferred Alternative. There are no current oppositions to the alternative outcome. Table 4 provides the specific values utilized for the evaluation of the alternatives.

Table 4. Pugh Matrix for Four Alternatives

			Ranking System: 1-5		1: Best 2: Good 3: Neutral 4: Bad 5: Worst				
Criteria Weight			Underpass		Elevator Overpass		Ramp Overpass		No Change
Pedestrian Traffic	35%		1	0.35	3	1.05	4	1.4	5	1.75
Management of Traffic	25%		5	1.25	3	0.75	4	1	2	0.5
Cost	10%		3	0.4	4	0.4	4	0.4	1	0.1
Maintenance	15%		2	0.3	3	0.45	4	0.6	1	0.15
Sustainability	10%		3	0.3	3	0.3	4	0.4	2	0.2
Aesthetics	5%		2	0.1	3	0.15	4	0.2	3	0.15
Results	100%			2.6		3.1		4		2.85

2.5 Identification of a Preferred Alternative

The preferred alternative is the Underpass Alternative. The underpass meets the primary two screening criteria, being ADA-compliant and grade-separated to maintain traffic flow. This ensured that the underpass would allow people of all capabilities to utilize it with ease, as well as prevent lasting impacts on traffic while in use.

Additionally, the underpass cost less than the provided alternatives and met the pedestrian traffic evaluation best, as well as the aesthetic design and maintenance best. While it was midway on sustainability, the possible benefit could be longevity and proper maintenance.

Mitigation measures incorporated into the alternative would include proper construction practices to prevent pollution of the nearby river. Additionally, the box culvert designs would utilize water-resistant coatings to reduce water infiltration into the tunnel. Drainage systems would be implemented so the water can be treated rather than

dumped directly into the Logan River. Proper disposal units would also be incorporated to reduce the risk of garbage being spread through the surrounding area.

For the duration of the project, the removal of soil and gravel will be designated to the closer side of US-89/91 that they will be working on at that time frame. Once the soil is removed, if it is deemed useful, the contractor may take the soil with them for future projects. If not, it can be delivered to Logan Landfill to be removed.

2.6 Permits and Approvals Needed

The following permits, approvals, and licenses would be required for project construction.

Table 5. Permit/Approval/License and Agency Table

Agency	Permit/Approval/License
Bureau of Land Management	Right-of-Way Grant
Logan City Building Department	Building Permit
Utah Department of Fish and Wildlife	Fish and Wildlife Habitat Mitigation Policy
Logan City Public Works Department	Utility Easement
Logan City Community Development Department	Conditional Use Permit
U.S. Army Corps	Joint 404 Permit

CHAPTER 3 – AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

The “Affected Environment” part of the section will detail pertinent information about the environment at the location where the project is occurring. The “Environmental Consequences” part of the section will detail the expected impacts of the implementation of the alternative into the project. The “Avoidance, Minimization, and Mitigation Measures” part of this section will detail how these impacts will be reduced where possible.

3.1 Transportation Facilities

The Transportation Facilities section provides background information on existing and planned transportation routes, discusses possible impacts on land use by project alternatives, and includes potential mitigation actions that would prevent, diminish, or offset adverse transportation impacts. This section also addresses project alternatives’ compatibility and consistency with applicable transportation plans and compliance with Utah Unified Transportation Planning Goals.

3.1.1 Regulatory setting

The primary missions of UDOT and the FHWA are related to transportation facilities and safety; therefore, this proposed action is transportation-oriented, and the National Environmental Protection Act (NEPA) analysis focuses on transportation-related impacts. NEPA provides the overall regulatory setting for this section. With regard to traffic forecasts, in general, the design year traffic should accommodate a 20-year forecast from the expected date of completion of the facility [Title 23, United States Code – Highways Section 109 Standards].

FHWA regulations provide policies and procedures relating to the provision of pedestrian and bicycle accommodations and Federal participation in the cost of these accommodations. FHWA directs that full consideration should be given to the safe accommodation of pedestrians and bicyclists. FHWA further directs that the special needs of the elderly and the disabled must be considered in all federal-aid projects that include pedestrian facilities. When current or anticipated pedestrians and/or bicycle traffic presents a potential conflict with motor vehicle traffic, every effort must be made to avoid, minimize, and mitigate the detrimental effects on all highway users who share the facility (23 CFR 652).

The 1990 ADA extends to individuals with disabilities and provides civil rights protection like those provided to persons based on age, sex, national origin, and religion under the Civil Rights Act of 1964. Federal-aid highway projects must comply with the ADA and do so by building transportation facilities that provide equal access for all persons. Federally funded transportation projects shall comply with the most current ADA guidelines. The same degree of convenience, accessibility, and safety available to the public will be provided to persons with disabilities. Design, signing, and marking of pedestrian and bicycle facilities shall be in conformance with the Logan Bicycle and Pedestrian Master Plan (Logan City 2015).

Utah operates under a Unified Transportation Plan (Utah's Unified Transportation Plan 2023) that is used to evaluate the benefits of transportation facilities for Utah. These benefits derive from five overall goals, which include Safety, Economic Vitality, State of Good Repair, Air Quality and Environment, and Mobility. These criteria are utilized throughout plans to enhance Utah's interconnectivity across various transportation plans.

3.1.2 Affected Environment

The affected environment of this project encompasses a 42,000-square-foot area. The depth of the area varies significantly around the area and may be replaced or removed entirely. This area includes a plot of land for designated grass and pedestrian walkways to the east, the housing area to the west, the road where the underpass will be placed, and part of the riverbed, which can be seen in **Figure 8**. This area will be converted into pedestrian walkways, a cul-de-sac on the house property location, and the road will be rebuilt overtop of it.

Figure 8. Project location for all alternatives

UDOT requires that when construction is done on state highways, there must be another viable state route for full closure. In Logan, no such route exists, so full closure of the road is unacceptable. This means the phasing of construction must be done to satisfy UDOT. This will incentivize vehicles to take alternative routes provided by Logan or instead utilize a smaller portion of the highway to travel past the construction.

3.1.3 Environmental Consequences

The current location of the pedestrian crossing location includes pedestrian walkways walking tangent to the roadway as can be seen in Figure 8. This allows for easier north and south travel through the city. There is also a bike path to the east side (Additionally seen in Figure 8 as a faded path), and a distance away there is a bike path to the west side. Lastly, there is a road heading west, W 600 S that connects US 89/91. This setup favors the vehicular travel aspect significantly.

The project will create a significant walking location that will better connect both halves of the city. This connection aids not only human crossing but also wildlife crossing such as deer (Bhardwaj, Olsson, and Seiler 2020). While there is not expected to be significant deer crossing, there is still the chance for it. This connectivity will also improve the ADA compliance of the surrounding area, improving the usability of the location and enjoyment of travel.

Additionally, the west side road, W 600 S will become a cul-de-sac, reducing vehicular access at the location. Further, the project will temporarily reduce the effectiveness of the highway. This will negatively impact public perception of the project due to the reduced capacity and effectiveness.

3.1.4 Avoidance, Minimization, and Mitigation Measures

For the transportation facilities, the consequences of implementing the pedestrian crossing contain mostly desirable traits. Mitigations will be implemented to address potentially severe issues, including proactive communication with Logan City to avert recurrent neighborhood cut-offs due to cul-de-sac problems. By effectively conveying this issue, we aim to prevent frustration among residents, who would otherwise face considerable inconvenience due to the extended driving distances resulting from such disruptions.

Additionally, issues with the highway's effectiveness will be communicated well beforehand. There will be alternate routes that residents can utilize to cross the highway to reduce the ineffectiveness of the highway until the pedestrian crossing is completed.

3.2 Land Use

This section provides background information on existing and planned land uses, discusses possible impacts on land use by project alternatives, and includes potential mitigation actions that would prevent, diminish, or offset adverse land use impacts. This section also addresses project alternatives' compatibility and consistency with applicable land use plans and compliance with Utah Statewide Planning Goals.

3.2.1 Regulatory Setting

3.2.1.1 *Federal, State, Regional, and Local Plans*

In 1998, Cache County adopted a Countywide Comprehensive Plan that rested on 3 primary goals for the community. These goals include improving the physical environment, uniting the community within Cache County, and considering future developments in their design.

3.2.1.2 *Existing and Planned Land Use*

The NEPA, 42 USC 4321 et seq., requires that all actions sponsored, funded, permitted, or approved by federal agencies be reviewed to ensure that environmental considerations such as impacts on land use are given due weight in project decision-making.

CEQ regulations and FHWA Technical Advisory T6640.8A require that an EIS include a discussion of possible conflicts between the proposed action and the objectives of Federal, Tribal, regional, state, and local land use plans, policies, and controls for the area concerned, and the extent to which the agency would reconcile its proposed action with the plan or law. Currently, this plan has no known regional or state conflicts with future land use plans, except the state plan of always keeping US-89/91 open for construction. Additionally, the project is far removed from tribal or federal lands to be a concern to their plans.

3.2.1.3 *Wild and Scenic Rivers*

The National Wild and Scenic Rivers System was created by Congress in 1968 (Public Law 90-542; 16 U.S.C. 1271 et seq.) to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Act is notable for safeguarding the special character of these rivers, while also recognizing the potential for their appropriate use and development. It encourages river management that crosses political boundaries and promotes public participation in developing goals for river protection.

3.2.2 Affected Environment

The Area of Potential Impact (API) for land use includes the highway immediately over the underpass location, as well as within 30 feet to the sides. The API additionally includes the house to the west and the greenery to the east. These locations were directly affected by the project in all the project alternatives. The API also includes the river to the south of the project location, primarily to the west to follow the flow of the river, but there are potential impacts upstream to the east. Additionally, the road to the north and south of the project location could be indirectly affected by the project.

Figure 9. River impact path and North and South US-89/91 impacts

3.2.3 Environmental Consequences

The alternatives each would impact these areas similarly. The overpass with an elevator design would impact the least amount of space, while the overpass with a ramp would impact the most space. The underpass, while impacting a significant area, especially with the temporary destruction of the highway, would also create more interconnectivity between the east and west sides of the highway which would increase the usability of the area.

The impact of the land use is expected to fall within desired land use guides. The transportation aspect of the pedestrian crossing will meet the desire for interconnectivity with the current land use and not significantly change the land use standards for the location.

3.2.4 Avoidance, Minimization, and Mitigation Measures

The project will additionally avoid utilizing land that is unnecessary for the work. This includes highway roadways, additional properties, and public land use. One goal of the project is to connect the trails; however, this goal should be met with the least removal of unnecessary infrastructure possible.

The project will minimize alternate land use by decreasing the footprint of the project to the minimum practical size. Additionally, the land use will utilize the surrounding area to fill the public space requirements more fully with the original land use. This includes creating a more welcoming environment on either side of the pedestrian crossing to encourage pedestrian activities.

3.3 Right-of-Way and Utilities

3.3.1 Regulatory Setting

In cooperation with the FHWA, the UDOT Right-of-Way Section implements Public Law 91-646, the Uniform Relocation Assistance and Real Properties Acquisition Policies Act of 1970, as amended (Uniform Act). The Uniform Act ensures the fair and equitable relocation and reestablishment of persons, businesses, farms, and nonprofit organizations displaced because of federal or federally assisted projects are treated consistently, and equitably so that such displaced persons will not suffer disproportionate injuries because of projects designed for the benefit of the public. The UDOT Right-of-Way Section and its Region Right-of-Way offices through its Relocation Assistance Program assure compliance with the Uniform Act and Federal rules and regulations.

Relocation policies and procedures under the administration of UDOT shall be non-discriminatory per Title VI of the Civil Rights Act of 1964, which states: “Section 601: No person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal Financial Assistance.”

3.3.2 Affected Environment

The construction of the project must provide adequate space for pedestrians and cyclists on each side of the highway. Since there is limited space available, there is a need for a right-of-way acquisition located on the west side of the highway to create the

structure. This location is where the western part of the pedestrian crossing will terminate. This location includes a residence that will require proper compensation for acquisition. There is another parcel of land to the east that Logan City already has which will be used for the pedestrian crossing. These are the only right-of-way acquisitions that will be obtained for the project. Any other right-of-way acquisitions are not anticipated.

The utilities will be affected on both sides of the highway regardless of the alternative selected. These utilities may need to be temporarily shut down for relocation and construction near them. Residents who are affected by these temporary shutdowns would be informed beforehand to prevent access issues.

3.3.3 Environmental Consequences

3.3.3.1 *Residential Impacts*

There is a singular household that would be displaced regardless of the alternative selected. There needs to be a connecting location on the western side of Main Street to create proper pedestrian access. The house value is slightly below median home values in the area. While the owner of the residence is not known, the home is in an area with an above-average density of minorities. The location of the parcel requiring acquisition is in Figure 10, with the estimated pedestrian crossing in black.

Figure 10. Parcel map around the project area

There is no knowledge of the number of people within the residence, nor the disability level of the household. Right-of-way impacts are based on information that is currently available and may change as the project proceeds.

3.3.3.2 *Business Relocations*
There currently are no businesses that are expected to be impacted by right-of-way requirements. The anticipated impact of this project on business is primarily confined to the sidewalks leading to the business area. Right-of-way impacts are based on information that is available at this time and may change as the project further develops and when the project completes the final design.

3.3.4 Avoidance, Minimization, and Mitigation Measures
The project will minimize property acquisition and the utilization of right-of-way to prevent excessive purchases or encroachments. The project will also avoid removing excess amounts of roadways or utility lines to prevent lengthened periods of poor access to transit and utility infrastructure. The design of the project should remain relatively limited to remove this potential issue for both right-of-way acquisition and utility access.

The project will minimize the utility access issue by identifying the location of utilities before construction and having the repair equipment immediately available during construction. The construction crew would be required to warn residents before the utilities would be shut off and would be required to repair the damage within a specified time limit. Should any issues occur with utility repairs, then the residents must be informed as soon as possible to create alternative arrangements where needed.

3.4 Environmental Justice

3.4.1 Regulatory Setting
All projects involving a federal action (funding, permit, or land) must comply with Title VI of the Civil Rights Act and Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.* Title VI prohibits discrimination based on race, color, or national origin. EO 12898 directs each federal agency, "[t]o the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations…" (EO 12898 Section 1-1.)

3.4.2 Affected Environment

3.4.2.1 *Population and Households*

The location of the project is in a primarily commercial area with a connection to a residential neighborhood. The average household size is found to be 2.82. The current growth rate of Logan City is 2.01% in 2024 and is expected to decrease until 2029. More than 60% of people of all races graduate with a high school diploma. 83.2% of the population is white, with 6.97% of the population being a mix of two races as the next highest percentage of race.

3.4.2.2 *Low Income*

The location of the project is identified to be a lower-income subdivision. This project is seen to help this subdivision overall. Lower-income neighborhoods may require alternative means of transportation. This can be achieved with the pedestrian crossing.

The crossing would directly connect the neighborhood with the business area to the southeast of the project. This would aid in interconnectivity as well as purchasing freedom for residents. The more locations that residents can access using public transportation or existing within walking distance allows them to select locations depending on their individual needs.

A house is planned to be purchased for this project. However, the house and associated relocation expenses will be paid at fair market value to reduce undue hardship. Additionally, while one family will be displaced, it is expected that the project will benefit more people overall.

3.4.2.3 *Race and Ethnicity*

The location identified has a mix of African American, Asian, Native American, Hispanic, and Caucasian races. Potential property purchase is not known to affect the single residence with any racial bias.

The area surrounding the project site was deemed ineligible for the crossing location to be implemented. Further north and further south would impact multiple businesses rather than a single entity. Additionally, this location is preferable due to the grass area that is already maintained within Logan City’s control.

Further, the house was priced at fair market value to ensure that the homeowners could properly purchase another house with little issue. The project will not purchase more housing than is required for the project to prevent a significant impact, and utilize the area allotted to the best of their ability.

3.4.3 Environmental Consequences
In compliance with EO 12898, minority and low-income populations have been identified. The current project is seen to have benefits for the environmental justice communities by providing healthier transportation modes by its implementation. Additionally, the project is expected to mitigate environmental justice issues for the community rather than impact it.

Based on the above discussion and analysis, the alternatives will not cause disproportionately high and adverse effects on any minority or low-income populations as per EO 12898 regarding environmental justice.

3.4.4 Avoidance, Minimization, and Mitigation Measures
All considerations under Title VI of the Civil Rights Act of 1964 and related statutes have also been considered in this project. The project will avoid impacting the excess area of the low-income community and focus on the smaller area for the project. The project will also prevent any directed impacts on the environmental justice community where possible to allow the community to benefit from rather than be harmed by the project.

3.5 Socioeconomic Analysis

3.5.1 Regulatory Setting
The National Environmental Policy Act of 1969 as amended (NEPA), established that the federal government must use all practicable means to ensure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings (42 U.S.C. 4331[b][2]). The Federal Highway Administration in its implementation of NEPA (23 U.S.C. 109[h]) directs that final decisions regarding projects are to be made in the best overall public interest. This requires considering adverse environmental impacts, such as destruction or disruption of human-made resources, community cohesion, and the availability of public facilities and services.

The framework provided by Executive Order 12898 on Environmental Justice and the U.S. DOT Order (5610.2) addresses only minority populations and low-income populations. However, concentrations of the elderly, children, disabled, and other populations protected by Title VI of the Civil Rights Act of 1964 and related nondiscrimination statutes will also be discussed.

This EIS addresses all impacts (to the human and natural environments) and describes any mitigating protections or benefits that would be provided by Federal or State law, or as part of the action. In particular, the Age Discrimination Act of 1975, as amended (42 U.S.C. 6101 et seq.), prohibits discrimination based on age in programs receiving

Federal financial assistance, and Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794 and 49 C.F.R. Part 27.7) protects handicapped persons.

3.5.2 Affected Environment

Community Features

There is a Church of Jesus Christ of Latter-Day Saints church near the project site. The social atmosphere of the neighborhood is not deeply known, but it is not expected to be intensely connected due to the proximity to the highway. US-89/91 creates a less conducive environment to developing deep interpersonal connections since the traffic connects close by. This paired with South 100 West becoming a more major roadway, the traffic has been increasing near the project location, meaning walking to locations from further distances is less desired by pedestrian.

Emergency services will be impacted by the creation of any alternative selected. Since the alternatives will make the road a cul-de-sac, each alternative will impact emergency service access. The businesses to the southeast of the proposed pedestrian crossing, with additional businesses more intermittently to the north and south of the pedestrian crossing on either side of the highway.

Demographic and Economic Trends

The median age of Logan residents is 23.9 years of age. The distribution of age is not known at the project location. There is no public knowledge of housing conditions, disability rates, or public transit access. The median income is around $30,000 for the community. The racial distribution is more widespread at this location. This gives rise to possible concern for a possible environmental justice community, but the data is not known yet.

Housing and Property Values

The housing is owner-occupied at this location. The housing is zoned as single-family housing. No mobile housing or senior housing is known in this location. While the income is lower than some of Logan City, it is not considered poorer living conditions. The average house price was estimated to be $425,000.

3.5.3 Environmental Consequences: Community Character and Cohesion

The community character is expected to improve overall by creating this pedestrian crossing. With W 600 South turned into a cul-de-sac, road speeds and traffic volumes are expected to decrease to match a residential neighborhood, making the area safer to live in.

The pedestrian crossing will also invite more outdoor activity from the crossing, as well as the introduction of more park land that can be maintained constantly. This pedestrian crossing to businesses additionally incentivizes the community bonding while commuting. With the trip being made by people in similar locations, this could aid in additional connections.

Additionally, as mentioned in the first chapter, this underpass offers increased access to public transportation. While the neighborhood currently has access to one bus stop, this connection will allow pedestrians to connect to the bus stop on the other side of the highway and save time. This will help to increase the community's character overall. Lastly, the design of the crossing is expected to fit with the personality of the community and complement the current arrangements of the neighborhood.

3.5.4 Avoidance, Minimization, and Mitigation Measures: Community Character and Cohesion

While the project is expected to bring benefits toward the community's character, there is the potential that constructing the connection between the east and west sides of the trail could invite unsavory consequences. This may include littering and unwanted passerby activity. These issues will be mitigated in part by the inclusion of trash bins at the entrance of the underpass on both sides. Another mitigation effort will be with the inclusion of cameras in the underpass as well as at the entrance and exit. These will increase the cost of all the alternatives, and will require maintenance on a repeated basis, but will mitigate the environmental costs down the line.

3.5.5 Environmental Consequences: Community Facilities

With each of the alternatives, there must be a way for pedestrians with disabilities to utilize the system. With the underpass, this is done using a graded entrance to allow pedestrians to enter. The elevator overpass includes the use of the elevator. With the ramp overpass, this includes the use of the maximum grade ramp up to the overpass height.

The overpass ramp decreases access the most due to the relatively intrusive nature of the design. Additionally, this can tire even well-trained wheelchair users from the design and is the least desirable alternative for wheelchair users. The elevator is more practical and is the expected element in the design of an overpass. However, accessibility issues can be unmet if the elevator is for some reason shut off. The underpass is more practical as the elevation difference is minimized, a constant energy supply is not required, it can be used year-round with proper maintenance, and it is intuitive in design as several similar facilities are present in the surrounding area.

The design will decrease vehicular access to the neighborhood. This decrease in access by vehicles will be exchanged for higher access by pedestrians and active transportation. This may impact emergency vehicle access to the location and how the neighborhood is accessible will need to be conveyed to emergency services. The design may also increase parking by a small margin in the cul-de-sac design, but likely only for visitors and not residents. With no houses at the end of the street and a cul-de-sac created, this will allow for a small amount of vehicle parking.

3.5.6 Avoidance, Minimization, and Mitigation Measures: Community Facilities

The project will avoid emergency service issues by properly communicating when construction in the area begins and offering alternative routes to access locations within that area. The project will also avoid making the pedestrian crossing choice unintuitive, as that would disincentivize pedestrians from using the crossing.

3.5.7 Environmental Consequences: Businesses and Established Business Districts

The construction will impact business access along the highway due to reduced traffic. These businesses may experience a short-term decline in revenues due to reduced access. When the construction is finished, these issues will be removed. In the long term, the introduction of a pedestrian crossing will create more access to other businesses.

3.5.8 Avoidance, Minimization, and Mitigation Measures: Businesses and Established Business Districts

The damage of the business issues will be minimized through efficient selection of traffic staging. The goal is to minimize the construction period. However, there will also need to be a balance of the number of lanes kept open for transportation, as well as construction mobility. There will be construction limitations that prevent the entire road from shutting down for a short period, as well as access as required by UDOT. This likely will be completed by shutting down half the road to allow two way traffic, but still allow the most construction in a short period of time.

3.5.9 Environmental Consequences: Local, Regional, and State Economy

The pedestrian crossing will provide a short-term profit for construction and implementation. As the construction companies implement the design, this will also indirectly impact the businesses they utilize for the materials of the project. This will benefit the regional economy by distributing businesses impacted by purchases.
The local economy will be temporarily stunted by the business access issues discussed in the previous section. This will prevent some access issues and possibly impair the living situation of some of the workers. However, after the construction is completed, it

is expected that the local economy will experience a small boost from the access to more businesses with active transportation.

3.5.10 Avoidance, Minimization, and Mitigation Measures: Local, Regional, and State Economy

If there are significant losses to any business, then UDOT and Logan City will work to provide a supplementary package to allow civilians to not be poorly affected by the situation. However, they will need to go through the proper authorities to receive this compensation, so that will be marketed before the project begins to ensure proper knowledge of the compensatory benefits.

3.6 Parks and Recreational Facilities, Wildlife, or Waterfowl Refuges

As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

There are no parks and recreation facilities where the project will be occurring. The area impacted by the project additionally does not impact wildlife refuges or waterfowl refuges. At most there is a possibility for impacts on the river environment, and those impacts will be discussed in the floodplain and the water quality sections.

3.7 Historic Resources

As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

The project area has not been evaluated to hold any significant historical resources to the current official's knowledge. In the case that unevaluated historic materials are discovered during construction, all earth-moving activity within and around the immediate discovery area will cease and will be protected until a qualified archaeologist can assess the nature and significance of the find.

If human remains are discovered, all earth-moving activity related to the project must cease immediately. The immediate area surrounding the find must be protected and the state police and Regional Archaeologist must be contacted.

3.8 Visual Resources

3.8.1 Regulatory Setting

The National Environmental Policy Act of 1969 (NEPA) has established that the federal government must use all practicable means to ensure all Americans have safe, healthful, productive, aesthetically, and culturally pleasing surroundings (42 U.S.C. 4331[b][2]). To further emphasize this point, the FHWA in its implementation of NEPA (23 U.S.C. 109[h]) directs that final decisions regarding projects are to be made in the best overall public interest considering adverse environmental impacts, including among others, the destruction or disruption of aesthetic values.

3.8.2 Affected Environment

The pedestrian crossing will remove the current greenery surrounding the highway and may partially impact the river sites. If an overpass is utilized, the visual environment will be further cluttered with the built-up structure overtop the highway. With an underpass, this environment is less impacted due to creating more visual space that is available. The environment will also impact the visual resources of the pathways leading to the structures.

3.8.3 Environmental Consequences

The design of the pedestrian crossing must fit in with the accepted environmental standards. If the design is not fitting or desired, it will inhibit pedestrians from using it. Additionally, the design may cause drivers to dislike the design from a visual perspective and not desire to utilize the active transportation facilities.

3.8.4 Avoidance, Minimization, and Mitigation Measures

The pedestrian facility will be designed with visual appeal in mind. There will be appropriate vegetation to increase the visual atmosphere of the pedestrian crossing. Additionally, the finished product will have a finishing on it to increase textural desire. The design will also be designed to be appealing with proper lighting and safety designs implemented into the design.

The design will also need to be overall pleasing and predictable to active transportation mode users. If the design is unpredictable, people may feel uncomfortable navigating it. The design also must look nice, as a poorly maintained or poorly designed crossing will also unnerve pedestrians.

3.9 Hydrology, Floodplain and Floodway

3.9.1 Regulatory Setting

Executive Order 11988 (Floodplain Management) directs all federal agencies to refrain from conducting, supporting, or allowing actions in floodplains unless it is the only

practicable alternative. The Federal Emergency Management Agency (FEMA) is the primary jurisdictional agency regarding potential impacts to floodplains and floodways. The Federal Highway Administration requirements for compliance with Executive Order 11988 are outlined in 23 CFR 650 Subpart A.

While the project is only government-funded, we will utilize the federal actions for hydrology. Proposed federal actions must consider:

- The practicability of alternatives to any longitudinal encroachments,
- Risks the proposed action poses to the floodplains and floodways,
- Impacts on natural and beneficial floodplain values,
- Support of incompatible floodplain development,
- Measures to minimize floodplain impacts and to preserve/restore any beneficial floodplain values impacted by the proposed action.

The base floodplain is defined as “the area subject to flooding by the flood or tide having a one percent chance of being exceeded in any given year,” which is also referred to as the 100-year food. An encroachment is defined as “an action within the limits of the base floodplain.”

3.9.2 Affected Environment

The impacted environment encompasses the vicinity adjacent to the river, where the parcel closest to the waterway will experience partial inundation during a 100-year flood event. Depending on the design of the pedestrian crossing, this can become a significant issue, or it can be a smaller issue that is not as problematic.

The overpass designs, for instance, will likely minimally impact the hydrology and floodplain. However, if the underpass is improperly designed, the floodplain could directly be impacted. Regardless, however, the underpass will guarantee an impact to the hydrology because of its depth.

3.9.3 Environmental Consequences

The pedestrian crossing with the use of the overpass alternatives will not significantly change the floodplain of the location. The floodplain and hydrology may be partially affected using footings and foundations; however, the design of the overpass will be designed to accept those forces and dimensions.

However, the underpass alternative has the potential to significantly affect the floodplain. The depth of the underpass, as well as the surrounding sidewalks will change the grading of the surroundings where it could be an issue. The best way to

remove this significant issue is to design the underpass with retaining walls that can accommodate water loads in the event of flooding.

3.9.4 Avoidance, Minimizations, and Mitigation Measures
The issue of flooding will be avoided by designing the pedestrian crossing to stay away from the current floodplain as much as possible. This includes building slightly farther north for safety reasons. If this is not possible, then the design of the pedestrian crossing will impact the current floodplain as little as possible.

The design of the underpass will reduce impacting the floodplain significantly by utilizing retaining walls or drainage systems to reroute the water. Additionally, the fill dirt will maintain the same porosity to ensure that the water flows through as the normal, untouched environment.

3.10 Water Quality and Storm Water Runoff

3.10.1 Regulatory Setting
The Federal Water Pollution Control Act commonly referred to as the Clean Water Act (CWA) is the primary law addressing water quality. The CWA is intended to restore and maintain the chemical, physical, and biological integrity of the nation's waters by preventing point and non-point pollution sources, assisting owned treatment works for the improvement of wastewater treatment, and maintaining the integrity of wetlands. If a UDOT project requires a CWA Section 404 permit from the U.S. Army Corps of Engineers (Corps), then UDOT must also receive a CWA Section 401 water quality certification from the Utah Department of Environmental Quality (DEQ).

UDOT construction projects that disturb more than 1 acre are regulated under the NPDES 1200-CA permit and are required to develop and implement an erosion control plan before ground-breaking. However, the project site in total is expected to be less than 1 acre of land, therefore negating this plan requirement.

Discharges to groundwater through Underground Injection Control Systems (UICs) are regulated as Class V injection wells under the Federal Safe Drinking Water Act. If a project needs to construct a UIC, then a permit from DEQ is required. These permits typically have conditions for treatment before discharge and monitoring of the quality of stormwater. The Safe Drinking Water Act (SDWA) also governs the protection of sole-source aquifers, critical aquifer protection areas, and wellhead protection areas.

3.10.2 Affected Environment
The downstream water of the river is expected to be affected by the stormwater runoff of the project, regardless of the design being an overpass or an underpass. The river

has a flow rate that can vary from approximately 20 cfs to 1720 cfs with a typical flow of 130 cfs.

The Logan River quality generally has oxygen ranges from “very good” to “good” based on ecological standards; however, the summer base flow is classified as “poor” due to lower flow levels. The water near Main Street is expected to be at most 14.6°C. The dissolved oxygen content at Main Street is about 6.3 mg/L but has daily variability of a few mg/L every 24 hours (Neilson, Strong, and Horsburgh 2021).

The riparian buffer to the east and west of the project location provides decent shading around the river edges. They are also utilized for filtration purposes in the neighborhood. As more impervious surfaces have been implemented throughout Logan, more water is siphoned into the river from present runoff conditions.

3.10.3 Environmental Consequences

With the implementation of the pedestrian crossing, each design will increase the impervious surface and cause additional surface runoff. The overpass designs have the additional issue of collecting water that can fall onto the vehicular traffic below and affect driving conditions.

With the design of the underpass, however, there is a subsequent issue persisting depending on the depth of it. The surface runoff may be siphoned into the underpass rather than the river, which will make the underpass unusable. The plan would be to implement a drainage system to redirect that water into the Logan River.

In each design, the acts of pedestrians and active transportation modes may affect the pollution loads in the water. This can make the river quality plummet with too much pollution in the river from the river.

3.10.4 Avoidance, Minimizations, and Mitigation Measures

With the designs of the overpasses, the overpass will redirect the water into piping that will let the water fall at a safe location rather than fall on vehicles on the highway. This will remove the water from the walkway as pedestrians use it and will prevent vehicular traffic from being affected.

With the designs of the underpass, a collection system must be created to redirect the runoff to the river. This may require the use of a pump but may be avoided depending on the design of the piping system and depth of the underpass. Additionally, grassland leading towards the entrance will be redirected to locations that can handle the water runoff better.

To avoid the pollution load from increased pedestrian traffic, trashcans will be placed on each side of the pedestrian crossing. This will decrease the amount of pollution introduced into the system, as well as incentivize pedestrians to hold on to their trash until they can access the trashcan. The pumping and trash collection may create new jobs for maintenance and upkeep but should make the community healthier and safer.

3.11 Natural Systems and Communities

3.11.1 Affected Environment

At the project location, there is no provided safe crossing method for terrestrial wildlife. This barrier has existed for some time, keeping the terrestrial wildlife relatively confined to the east or west halves of the city. With the overpass designs, this barrier would likely persist, as animals would need to comprehend how to get up the steps and cross before coming down. The underpass meanwhile has the potential to allow animal crossing without human interference, though the enclosed nature of the underpass would deter various animals from using it.

3.11.2 Environmental Consequences

If the pedestrian crossing is an underpass, this means that animals can cross the highway more easily. This can reduce small animal crossing collisions, as well as allow larger animals to cross at the location. This can help further connect the ecosystem on both sides of the highway.

With more animal activity in the underpass, however, this could lead to instances where the animals are scared by human activity. There is the potential for animals to react to human presence while trying to use the passing if they are not careful.

3.11.3 Avoidance, Minimizations, and Mitigation Measures

The design of the underpass alternative will avoid animal-human injuries with the inclusion of lights in the underpass. This will allow animals and humans to see each other and react as needed upon their approach. We can also minimize situations by observing how humans and animals interact with cameras if it is a repeated issue and figuring out the best solution for both humans and animals with its implementation.

3.12 Wetlands and Other Waters

As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

The water near the project site is not considered a wetland. The project site is located next to a river, but the issues will be discussed in the floodplain issues, as well as the water quality issues.

3.13 Threatened and Endangered Species

As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

The project limits consist of an area of less than an acre that is deep within the city. There are expected to be few to no endangered species within the project area. Should there be a threatened or endangered species that is found during the project, the proper authorities will be contacted and create guidance for the next course of action.

3.14 Non-Threatened and Endangered Species

As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

The project limits consist of an area of less than an acre that is deep within the city. While there may be brown and rainbow trout in the project area, the impact on the river environment is expected to be minimal. Should significant impacts to the Logan River occur, the project will ensure that the new river environment can withhold animal life as it did before the project.

3.15 Invasive Species

3.15.1 Regulatory Setting

Executive Order 13112 requires Federal agencies to combat the introduction or spread of invasive species in the United States. The order defines invasive species as “any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem whose introduction does or is likely to cause economic or environmental harm or harm to human health.” Federal Highway Administration guidance issued on August 10, 1999, directs the use of the state’s noxious weed list to define the invasive plants that must be considered as part of the NEPA analysis for a proposed project. Notably, invasive species include wildlife as well as plants.

3.15.2 Affected Environment

Two invasive species types may be found within the project area and the surrounding project area. There are no known invasive plants within the study area. Due to budgetary restrictions, this list is compiled from resources from the institution and does not currently confirm there are nests within the site itself.

Red Firebug (Pyrrhocoris apterus)

Red Firebugs are originally native to central Europe, but are also found in India, western Siberia, northwestern China, and southwestern Mongolia. In 2008 they were discovered in southeastern Salt Lake City, Utah, and have expanded to Idaho since. These bugs are typically found on plants in the Malvaceae family but are also known to seek shade during the day which includes on homes and buildings (Richardson and Hodgson 2023).

Elm Seed Bug (Arocatus melanocephalus)

Elm Seed Bugs are native to Europe and were first identified in Idaho in 2012. They were first discovered in Salt Lake County, but they are now widely spread through Cache County and the Wasatch Front. The elm seed bug primarily feeds on elm seeds but has also been found on linden and oak trees. Like Red Firebugs, they will attempt to seek shade in houses during the day to escape the heat (Davis 2018).

All alternatives cover the same general location for the possible location of these species. The construction of each alternative is expected to cover the same location, with minor changes in the borders of the work location. The underpass may create a darker environment that the bugs could exist on; however, the underpasses provide more vertical space for the bugs to exist with.

3.15.3 Environmental Consequences

None of the alternatives are expected to significantly impact the spread of invasive species either positively or negatively. The area being impacted is relatively small, with the full location being across the highway for the most part. The alternatives that may impact the spread of invasive species are through promoting active transportation and a clear crossing, species will now cross between the east and west sides of Logan easier.

3.15.4 Avoidance, Minimization, and/or Mitigation Measures

In compliance with the Executive Order on Invasive Species, E.O. 13112, and subsequent guidance from the Federal Highway Administration, landscaping and the erosion control plan included in the project will not use species listed as noxious weeds. In areas of sensitivity, extra precautions will be taken if invasive species are found in or adjacent to the construction areas. The measures include the inspection and cleaning of

construction equipment and eradication strategies to be implemented should significant instances of invasive species be identified.

During construction, pesticides and physical means may be utilized to remove any invasive species that exist in the project area. Additionally, these species are known to have preferred flora that they attach to, such as elm trees and Malvaceae plants. When plants are being placed after the construction is completed, these plant types will be avoided to discourage the bugs from nesting.

3.16 Air Quality

3.16.1 Regulatory Setting

Criteria Pollutants

The Clean Air Act as amended in 1990 is the federal law that governs air quality. This law sets standards for the quantity of pollutants that can be in the air. These standards are called National Ambient Air Quality Standards (NAAQS).

Under the 1990 Clean Air Act Amendments, the U.S. Department of Transportation cannot fund, authorize, or approve Federal actions to support programs or projects that are not first found to conform to the State Implementation Plan (SIP). Conformity with the Clean Air Act takes place at the regional level and at the project level. Any build alternative must conform at both levels to be approved.

Regional Conformity

Regional-level conformity in Utah is concerned with how well the region meets the standards set for carbon monoxide (CO), ozone (O_3), sulfur dioxide (SO_2), and particulate matter (PM). Utah is designated attainment reached for the other criteria pollutants. At the regional level, Metropolitan Planning Organizations (MPOs) develop Regional Transportation Plans (RTP) that include all the transportation projects planned for that region over at least the next 20 years. Based on the projects included in the fiscally constrained RTP, an EPA air quality model is used to determine whether the implementation of those projects meets the emissions budget or other tests showing that attainment requirements of the Clean Air Act are met. If all requirements of regional conformity are met, the FHWA and the Federal Transit Administration jointly make a conformity determination that the RTP conforms to the SIP for achieving the goals of the Clean Air Act. MPOs are also required to develop a Transportation Improvement Program (TIP), which includes projects that will be funded and implemented in the near term. Both RTPs and TIPs are required to meet regional conformity requirements.

Project-Level Conformity
In addition to meeting regional-scale conformity requirements, individual Federal projects must meet certain project-level conformity requirements. Federal projects are required to be in a conforming RTP and TIP, and the design concept and scope of the project need to be consistent with those analyzed in the RTP and TIP. Conformity at the project level also requires consideration of "hot spot" analysis, which is an analysis of localized pollutant concentrations, when an area is classified as nonattainment or maintenance for carbon monoxide (CO) and/or particulate matter (PM). In general, pollutant concentrations due to building the project either need to be below the NAAQS, or lower than the concentrations associated with not building the project (the no-build alternative).

Mobile Source Air Toxins
In addition to the criteria for air pollutants for which there are NAAQs, the EPA also regulates air toxins. Most air toxins originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

The EPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the U.S. EPA regulate 188 air toxins, also known as hazardous air pollutants. The EPA has addressed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS). In addition, the EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxins Assessment (NATA).

Mobile Source Air Toxins (MSATs) are a subset of the 188 air toxins defined by the CAA. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in the fuel and are emitted into the air when the fuel evaporates or passes through the engine unburned. Other toxins are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxins also result from engine wear or impurities in oil or gasoline.

3.16.2 Affected Environment
The environmental consequence of this project is that the highway will be partially closed for a significant portion of time. This will increase the emissions from vehicles as

they idle longer to pass the construction. There are few ways to cross the river, so this will create a bottleneck situation.

However, when the path is fully constructed, it is expected to increase active transportation modes. This will in turn decrease the total emissions from vehicular travel from the active transportation interconnectivity. The west side road, W 600 S will become a cul-de-sac after construction. While vehicles may have to cross longer distances to connect to these locations, the distance will be less significant than the potential increase in pedestrian activity at the crossing.

Table 6 provides a summary of the State of Utah and Federal Standards for the criteria pollutants.

Table 6. Summary of National Ambient Air Quality Standards and Utah Air Quality Standards.

Pollutant	Averaging Time	State Standard	Federal Standard	Health and Atmospheric Effects	Typical Sources
Ozone (O_3)	8 hours	0.070 ppm	0.070 ppm	High concentrations irritate lungs. Long-term exposure may cause lung tissue damage. Long-term exposure damages plant materials and reduces crop productivity. Precursor organic compounds include several known toxic air contaminants.	Low-altitude ozone is almost entirely formed from reactive organic gases (ROG) and nitrogen oxides (NO_x) in the presence of sunlight and heat. Major sources include motor vehicles and other mobile sources, solvent evaporation, and industrial and other combustion processes. Biologically produced ROG may also contribute.
Carbon Monoxide (CO)	1 hour 8 hours	35 ppm 9 ppm	35 ppm 9 ppm	Asphyxiant. CO interferes with the transfer of oxygen to the blood and deprives sensitive tissues of oxygen.	Combustion sources, especially gasoline-powered engines and motor vehicles. CO is the traditional signature pollutant for on-road mobile sources at the local and neighborhood scale.
Nitrogen Dioxide (NO_2)	Annual Hourly	0.053 ppm 0.10 ppm	0.053 ppm 0.10 ppm	Irritating to eyes and respiratory tract. Colors atmosphere reddish-brown. Contributes to acid rain.	Motor vehicles and other mobile sources; refineries; industrial operations.

Sulfur Dioxide (SO_2)	1000 hours 24 hours Annual 3-year	0.50 ppm 0.14 ppm 0.03 ppm 0.075 ppm	0.50 ppm 0.14 ppm 0.03 ppm 0.075 ppm	Irritates respiratory tract; injures lung tissue. Can yellow plant leaves. Destructive to marble, iron, and steel. Contributes to acid rain. Limits visibility.	Fuel combustion (especially coal and high-sulfur oil), chemical plants, sulfur recovery plants, and metal processing.
Lead (Pb)	Rolling 3-month average	0.15 $\mu g/m^3$	0.15 $\mu g/m^3$	Disturbs the gastrointestinal system. Causes anemia, kidney disease, and neuromuscular and neurological dysfunction. Also considered a toxic air contaminant.	Primary: lead-based industrial processes like batter production and smelters. Previously: lead paint, leaded gasoline. Moderate to high levels of aerially deposited lead from gasoline may still be present in soils along major roads and can be a problem if large amounts of soil are disturbed.
Respirable Particulate Matter (PM_{10})	24 hours	150 $\mu g/m^3$	150 $\mu g/m^3$	Irritates eyes and respiratory tract. Decreases lung capacity. Associated with increased cancer and mortality. Contributes to haze and reduces visibility. Includes some toxic air contaminants. Many aerosol and solid compounds are part of PM_{10}.	Dust- and fume-producing industrial and agricultural operations; combustion smoke; atmospheric chemical reactions; construction and other dust-producing activities; unpaved road dust and re-entrained paved road dust; natural sources (wind-blown dust, ocean spray).
Fine Particulate Matter ($PM_{2.5}$)	24 hours Annual	35 $\mu g/m^3$ 12 $\mu g/m^3$	35 $\mu g/m^3$ 12 $\mu g/m^3$	Increases respiratory disease, lung damage, cancer, and premature death. Reduces visibility and produces surface soiling. Most diesel exhaust particulate matter – considered a toxic air contaminant – is in the $PM_{2.5}$ size range. Many aerosol and solid compounds are part of $PM_{2.5}$.	Combustion including motor vehicles other mobile sources, and industrial activities; residential and agricultural burning; also formed through atmospheric chemical (including photochemical) reactions involving other pollutants including NO_x, sulfur oxides (SO_x) ammonia, and ROG.

3.16.3 Environmental Consequences

Background concentrations representing the cumulative emissions of other sources in the area are added to the predicted local concentrations for CO at intersections. Because of these inclusive analysis methodologies, the forecast impacts represent cumulative air quality impacts.

During construction, short-term degradation of air quality may occur due to the release of particulate emissions (airborne dust) generated by excavation, grading, hauling, and various other activities. Emissions from construction equipment also are anticipated and would include CO, nitrogen oxides (NO_x), volatile organic compounds (VOCs), directly emitted particulate matter (PM_{10} and $PM_{2.5}$), and toxic air contaminants such as diesel exhaust particulate matter. Ozone is a regional pollutant that is derived from NO_x and VOCs in the presence of sunlight and heat.

Site preparation and roadway construction would involve cut-and-fill activities, grading, removing, or improving existing roadways, and paving roadway surfaces. Construction-related effects on air quality from most highway projects would be greatest during the site preparations phase because most engine emissions are associated with the excavation, handling, and transporting of soils to and from the site. If not properly controlled, these activities would temporarily generate PM_{10}, $PM_{2.5}$, and small amounts of CO, SO_2, NO_x, and VOCs.

Sources of fugitive dust would include disturbed soil at the construction site and trucks carrying uncovered loads of soil. Unless properly controlled, vehicles leaving the site would deposit mud on the streets, which could be an additional source of airborne dust after it dries. PM_{10} emissions would vary from day to day, depending on the nature and magnitude of construction activity and local weather conditions. PM_{10} emissions would depend on soil moisture, silt content of soil, wind speed, and the amount of equipment operating. Larger dust particles would settle near the source, while fine particles would be dispersed over greater distances from the construction site.

In addition to dust related PM_{10} emissions, heavy trucks and construction equipment powered by gasoline and diesel engines would generate CO, SO_2, NO_x, VOCs, and some soot particulates (PM_{10} and $PM_{2.5}$) in exhaust emissions. If construction activities were to increase traffic congestion in the area, CO and other emissions from traffic would increase slightly while those vehicles are delayed. These emissions would be temporary and limited to the immediate area surrounding the construction site.

The construction of concrete structures may have associated dust-emitting sources, such as concrete mixing operations. Asphalt mix plants could have particulate, hazardous air pollutants, and combustion source emissions. Stationary sources such as concrete and asphalt mix plants are generally required to obtain an air permit from the Utah Department of Environmental Quality.

Most of the construction impacts on air quality are short-term in duration and, therefore, will not result in adverse or long-term conditions.

3.16.4 Avoidance, Minimizations, and Mitigation Measures

Construction contractors are required to comply with Division 208 of OAR 340 which addresses visible emissions and nuisance requirements. Subsection 210 of OAR 340-208 places limits on fugitive dust that causes a nuisance or violates other regulations. Violations of the regulations can result in enforcement action and fines. The regulation provides a list of reasonable precautions to be taken to avoid dust emissions:

- Use of water or chemicals, where possible, for the control of dust in the demolition of existing buildings or structures, construction operations, the grading of roads, or the clearing of land;
- Application of asphalt, oil, water, or other suitable chemicals on unpaved roads, materials stockpiles, and other surfaces which can create airborne dust;
- Full or partial enclosure of materials stockpiles in cases where application of oil, water, or chemicals are not sufficient to prevent particulate matter from becoming airborne;
- Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials;
- Adequate containment during sandblasting or other similar operations;
- When in motion, always covering open-bodied trucks transporting materials likely to become airborne;
- The prompt removal from paved streets of earth or other material that does or may become airborne.

In addition, contractors are required to comply with UDOT standard specifications. Section 01355 of the specifications has requirements for environmental protection, which include air pollution control measures. These control measures include vehicle and equipment idling limitations and are designed to minimize vehicle track-out and fugitive dust. These measures would be documented in the pollution control plan that the contractor is required to submit before the pre-construction conference. To reduce the impact of construction delays on traffic flow and resultant emissions, road or lane closures should be restricted to non-peak traffic periods when possible.

3.17 Noise and Vibration

3.17.1 Regulatory Setting

The NEPA of 1969 provides a regulatory framework that promotes general welfare and fosters a healthy environment for noise considerations. 23 CFR 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise,* and UDOT's Noise

Manual provide the basis for analyzing and abating highway traffic noise impacts in Utah.

3.17.1.1 *National Environmental Policy Act and 23 CFR 772*

For highway transportation projects with FHWA involvement, the Federal-Aid Highway Act of 1970, and the associated implementing regulations (23 CFR 772) govern the analysis and abatement of traffic noise impacts. The regulations require that potential noise impacts in areas of frequent human use be identified during the planning and design of a highway project.

The noise regulations govern noise prediction requirements, noise analyses, noise abatement criteria, and requirements for informing local officials. The noise abatement criteria (NAC) are used to determine when a noise impact would occur. The NAC differs depending on the type of land use under analysis. For example, the NAC for residences (67 dBA) is lower than the NAC for commercial areas (72 dBA). Table 7 lists the noise abatement criteria for use in the FHWA noise analysis.

Table 7. FHWA Noise Analysis – Noise Abatement Criteria

Activity Category	NAC, Hourly A- Weighted Noise Level, dBA $L_{eq}(h)$	Description of Activities
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

3.17.1.2 *UDOT Noise Policy*

UDOT is responsible for implementing the FHWA regulations in the State of Utah. Under the *UDOT Noise Manual*, which explains the UDOT noise policy, a noise impact

occurs when the future noise level for one or more build alternatives results in a substantial increase in noise level (defined as a 10 dBA or more increase over the existing noise levels) or when the future noise level for one or more build alternatives approaches or exceeds the NAC. The UDOT noise policy is described in Table 8 below.

Table 8. Utah Noise Analysis – Noise Abatement Criteria

Activity Category	Utah Approach Criteria Hourly A- Weighted Noise Level, dBA $L_{eq}(h)$	Description of Activities
A	56 (Exterior)	Lands on which serenity and quiet are of extra ordinary 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 rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	71 (Exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	No Limit	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	No Limit	Undeveloped lands that are not permitted

3.17.1.3 *Utah Department of Environmental Quality Noise Policy*

The Utah Department of Environmental Quality (DEQ) Noise Prediction, Mitigation, and Management Program sets allowable noise levels for individual vehicles and industrial

and commercial uses. Maximum allowable noise levels for in-use vehicles in Utah are determined by vehicle type, operating conditions, and model year.

3.17.1.4 *Local Noise Policy*
The city of Logan has noise ordinances for nuisance noise or limits on construction noise times or sound levels. Logan allows construction between the hours of 7 a.m. and 7 p.m. Mondays through Saturdays.

3.17.1.5 *Project Noise Abatement Requirements*
If the project will have noise impacts, then potential abatement measures must be considered. Noise abatement measures that are determined to be reasonable and feasible at the time of final design are incorporated into the project plans and specifications. This document discusses noise abatement measures that would be considered in the final design of the project.

UDOT's Noise Manual sets forth the criteria for determining when an abatement measure is reasonable and feasible. Abatement must meet UDOT's reasonable and feasible criteria to be considered. The feasibility of noise abatement is primarily an engineering concern. A minimum 5 dBA reduction in the future noise level must be achieved for an abatement measure to be considered feasible. Other feasibility considerations include topography, access requirements, other noise sources, and safety considerations. The reasonableness determination is a cost-benefit analysis but also considers the input from those property owners who could receive abatement features. Factors used in determining whether a proposed noise abatement measure is reasonable include residents' acceptance, absolute noise levels, the change in the existing noise levels, environmental impacts of abatement, public and local agencies' input, newly constructed development versus development pre-dating 1996, and the cost per benefited residence. UDOT's reasonable cost criterion is $25,000/benefitted residence.

This Draft EIS provides information on the potential locations of noise abatement measures that currently meet the reasonable and feasible criteria. This document also provides information on which areas are forecast to be noise-impacted, but do not meet the reasonable and feasible criteria and therefore, will not be considered for noise abatement. The final decision on the provision for noise abatement is not made until the final design when the exact number of noise impacts is known so that the final assessment of reasonable and feasible criteria can be measured. UDOT strongly considers the desires of residents when considering providing abatement. In some cases, residents may choose not to have reasonable and feasible abatement

implemented. In these cases, those areas would not be able to access Federal-aid funding in the future for noise abatement.

3.17.2 Affected Environment

The construction is occurring on a highway, so the project does not need to follow extra precautions to be quiet. However, to the west of the project is a residential area that needs to be considered regarding hours of construction. Additionally, the construction may need some barriers for different stages of construction for noise safety. The environment may additionally extend due to the backlog of traffic expected for construction, but there is not significant action that can be taken with the citizens to follow noise ordinances.

3.17.3 Environmental Consequences

Construction of the underpass alternative may cause localized, short-duration noise impacts. These noise impacts may affect people sleeping nearby, but it is not expected to cause significant impacts to nearby wildlife. Vibrations in the ground, however, may cause more of an issue as they travel through the ground and disturb the wildlife on land and in the river. Additionally, if the vibrations are not mitigated, they can shatter glass of nearby buildings. Due to vehicle transportation across the highway, the impact is expected to be minimal.

3.17.4 Avoidance, Minimizations, and Mitigation Measures

Construction noise levels for the project would result from normal construction activities. These noise levels, although temporary, can be annoying. The following construction noise abatement measures will be included in the project specifications.

- No construction shall be performed within 1,000 feet of an occupied dwelling unit on Sundays, legal holidays, or between the hours of 7 p.m. and 7 a.m. on other days, without the approval of the UDOT Project engineer.
- All equipment used shall have sound-control devices no less effective than those provided on the original equipment. No equipment shall have an unmuffled exhaust.
- All equipment shall comply with pertinent equipment noise standards of the U.S. EPA.

3.18 Energy

NEPA (42 USC Part 4332) requires the identification of all potentially significant impacts to the environment, including energy impacts. To comply with NEPA, an energy analysis is appropriate for some proposed transportation projects.

As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

The pedestrian crossing will continue current highway traffic conditions and will allow pedestrians and other active transportation modes to cross with little impact on one another. While there will be lighting and pumping within the project, this was assessed to be relatively minimal and does not require an energy analysis for the scale of the project. The overpass with an elevator alternative; however, will require significant power to be offset. This can be mitigated with the installation of solar panels.

3.19 Geology

3.19.1 *Affected Environment*

The soils at the location were found to consist of medium-dense sand that was underlain by sandy lean clay and dense sand. The soil was found to weigh 125 pcf and had no cohesion. The water table was also found to be 15 feet under the ground.

With the construction of the overpasses, this area will be impacted by the foundations. With the ramp overpass, this area will cover a large portion of the medium-dense sand. The elevator overpass will trade surface area for depth and will go deeper into the soil. The underpass will dig into the ground for access; however, it will also affect the surrounding area so the surroundings will lead to the underpass at the correct grade. This alternative will affect the surroundings the most.

3.19.2 *Environmental Consequences*

There are no predicted landslides or severe earthquake impacts. However, each of the alternatives will have significant cuts and fill during the project. The underpass will affect the alternatives the most with significant soil cut away from the project for the design.

3.19.3 *Avoidance, Minimizations, and Mitigation Measures*

With the underpass alternative, the project will use natural gradients to remove the least practical amount of soil possible. Additionally, where it is unnecessary to cut soil from the project, there will be retaining walls implemented to maintain the strength of the surroundings without concerning the public with the stability of the slopes.

3.20 Hazardous Materials

As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

The project does not intend to use hazardous materials during the construction of the pedestrian crossing. All concrete structures will follow current standards, MSE reinforcement will not contain hazardous materials, and any water sealants will follow standards to prevent hazardous material usage.

If hazardous materials are discovered during the excavation process, the project will be halted, and the Office of Resource Conservation and Recovery (ORCR) will be contacted. Seeing as they oversee the Resource Conservation and Recovery Act (RCRA), they will ensure experts are sent to dispose of the hazardous materials as required.

CHAPTER 4 – CUMULATIVE ENVIRONMENTAL IMPACTS

Cumulative impacts result from past, present, and reasonably foreseeable future actions, combined with the potential impacts of this project. A cumulative impact assessment looks at the collective impacts posed by individual land use plans and projects. Cumulative impacts can result from individually minor, but collectively substantial impacts taking place over a period of time.

Cumulative impacts on resources in the project area may result from residential, commercial, industrial, and highway development, as well as from agricultural development and the conversion to more intensive types of agricultural cultivation. These land use activities can degrade habitat and species diversity through consequences such as displacement and fragmentation of habitats and populations, alterations of hydrology, contamination, erosion, sedimentation, disruption of migration corridors, changes in water quality, and introduction or promotion of predators. They can also contribute to potential community impacts identified for the project such as changes in community character, traffic patterns, housing availability, and employment.

Regulator Setting

Cumulative impacts are defined in 40 CFR, Section 1508.7 of the CEQ Regulations as the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period.

4.1 Resources to Consider in the Analysis.

4.1.1 Transportation Facilities

The pedestrian crossing will create a pathway to allow pedestrians to cross US-89/91, acting as an incentive for active transportation modes. As Logan City prioritizes more funding for active transportation, it will create more facilities for pedestrians, cyclists, equestrians, and other manual transportation modes. This pedestrian crossing is an early step that Logan is utilizing to increase pedestrian traffic facilities in the city.

Future active transportation facilities may not be directly connected to the pedestrian crossing under US-89/91 in either design or proximity. This project was created to evaluate pedestrian traffic volumes as more projects are implemented, as stated by the client. There was also discussion about improving pedestrian facilities such as sidewalks with staff members at Logan City's planning committee that took place at the beginning of 2024.

4.1.2 Land Use

As part of the scoping and environmental analysis conducted for the project, the Land Use issues were considered but no adverse or beneficial cumulative impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

Land use includes possible future use for the locations that are utilized in the creation of the project. There could be arguments about a new housing development on the west side of the pedestrian crossing location. Prospects for the housing design and layout may be impacted by the layout of the pedestrian crossing. However, there are not many buildings that can be placed on the east side of the pedestrian crossing. This provides a beneficial land use that does not impact most future land use.

4.1.3 Right-of-Way and Utilities

As part of the scoping and environmental analysis conducted for the project, the Right-of-Way and Utilities issues were considered but no adverse or beneficial cumulative impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

Right-of-way requirements vary with the project requirements. With this particular project, there is a right-of-way acquisition required for one property on the west side of the highway. It is recommended against utilizing large portions of land if unnecessary. However, being next to US Highway 89/91, possible changes in the highway layout can require right-of-way acquisition. This, however, would not be an impact from the pedestrian crossing, but rather it would be a similar impact from an unrelated project.

There is a potential for the underpass to disincentivize right-of-way acquisition due to the restrictions the underpass poses on buildings. The geometry of the pedestrian crossing would reduce the chances of changing the highway layout and may reduce right-of-way acquisition. However, it is not expected to have a significant impact.

4.1.4 Environmental Justice

As part of the scoping and environmental analysis conducted for the project, the Environmental Justice issues were considered but no adverse or beneficial cumulative impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

In the previous chapter on environmental justice, it was determined that the area affected would not impact an environmental justice community significantly. A singular house was impacted, and the plans for the site include turning W 600 S into a cul-de-

sac rather than a through road. Unless more housing is bought, there will be no significant impact on the area.

It could be argued that the introduction of the pedestrian underpass may incentivize investors to purchase more housing to create a park location. This could theoretically be discussed, but the locations required for a park would need to be significantly larger, and therefore not economically viable.

4.1.5 Socioeconomic Analysis

While the trail is currently designed to increase recreational access, it also serves the benefit of connecting the commercial district and the residential district. This increases the economic potential of people living in the area as well as creating more social potential. Additionally, with Logan City discussing potential future pedestrian infrastructure renovations and additions, the active transportation environment is growing.

Furthermore, the culture of the United States is pushing stronger to increase pedestrian access. This cultural change will continue to impact development to include pedestrians or increase accessibility where possible. With the pedestrian crossing being added, this will further incentivize the change of culture, and further push pedestrian access. While the cultural shift will take significant time, it will still direct progress toward more forms of active transportation.

4.1.6 Visual Resources

As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial cumulative impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

With the two overpass alternatives, there was concern that the overpass would impact the visual environment. With the ramp overpass alternative, this concern is warranted from the sheer amount of volume it would consume. However, if the overpass alternatives were utilized, it would be in the best interest to create designs that do not impact the driver's experience, while also providing an aesthetically pleasing solution. Therefore, it is a net change in the visual environment.

Further, with the underpass alternative, the visual environment is not expected to decrease for vehicle drivers. The crossing will also be constructed to be as visually appealing as possible for pedestrians, therefore leaving the visual resources approximately the same as they were before.

4.1.7 Hydrology, Floodplain, and Floodway

The pedestrian overpass alternatives likely would have little effect on the hydrology of the surrounding environment. The underpass alternative, meanwhile, may impact the hydrology further away from the river. Not only will significant soil be removed to make the underpass accessible, but the underpass will be lined with a water-resistant liner and impact the natural saturation of the ground near the river.

While there are potential issues with flooding for the maximum storm, those are relatively quick events that do not build up over time. The water table levels could impact the durability of concrete underneath the roadways and buildings, as well as impact walkway integrity and desirability. There will be a large shift in the saturation levels at the construction site when water is pumped from the ground, but the rebalancing of water after the project is finished may cause lasting impacts on the surroundings. To mitigate this matter, soil may be imported with a stronger soil strength to match the lower hydrology levels in response.

4.1.8 Water Quality and Storm Water Runoff

The area surrounding the project will have a significant change to the stormwater runoff. While the underpass is underneath the road and does not provide more surface area to collect rainwater, the earth surrounding the project area will be altered to where the stormwater will fall into the underpass. With the elevator overpass design, there will be an area over the highway that requires capturing runoff and moving the water to an alternate location, so it does not hit vehicles and cause issues. With the ramp overpass design, the impervious surface area would create a significant amount of water to carry off.

In all these designs, the water would need to be transported to a new location and treated to improve the water quality. This could be mitigated by using less impervious surfaces and utilizing natural flora. Additionally, for any water that is too excessive for normal means, a pipeline could be installed to siphon the water away. There could be issues with higher river levels preventing water from escaping the system; however, these instances are expected to be rare and uncommon for most storm sizes.

Further, as mentioned in the water quality section, the increase in pedestrians may decrease the water quality of the stormwater runoff. This is due to the pedestrians bringing in foreign material to the walkway, as well as trash being brought to the location which further impacts the water quality. If the project were not to mitigate this with trash bags and storm drains, the water table water quality may decrease in response, which could affect flora and fauna near the river.

4.1.9 Natural Systems and Communities
As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial cumulative impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

With the underpass alternative, there is a potential for animals to utilize the crossing. However, there are not known to be animals in the vicinity that may need to cross, nor have a desire to cross to the other side of the street. Even if this occurs, the animals would likely cross back and forth with little impact on the environment. Perhaps generations down the line, some animals may move to the other side of the street, but that is not expected to significantly impact any system.

4.1.10 Invasive Species
As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial cumulative impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

While the invasive insects listed in Chapter 3 may be in the location, the area is small enough that it is not expected to drastically affect the species' population. While there may be a small decrease in invasive animals, this impact is not significant enough to track, and may not be noticed from analysis after the project is completed. There could potentially be invasive species crossing more easily from one side of the street to the other; however, the distance is so large for an insect that it is not predicted to have a high incentive.

4.1.11 Air Quality
As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial cumulative impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

As mentioned in the socioeconomic section, there is the potential for more projects to be created that can impact the air quality of the area in response to changing social norms. However, the evaluation of more projects and their impacts on the environment is outside of the scope of this project and will not be considered.

4.1.12 Noise and Vibration
As part of the scoping and environmental analysis conducted for the project, the following environmental issues were considered but no adverse or beneficial cumulative impacts were identified. Consequently, there is no further discussion regarding these issues in this document.

It has been identified that there will be a period when the construction will cause a significantly higher volume of noise. However, this construction noise level will decrease after the project is completed. There additionally may be some heightened noise from the underpass alternative acting as a funnel for noise. However, the length of the underpass alternative and the location where the noise originates were determined to produce low levels of noise that should not impact people or animals.

4.1.13 Geology
There will be a significant amount of earth excavated and removed from the project site. Additionally, as mentioned in the hydrology section, there likely will be a large change in local the water table level. This can affect soil strength which can impact nearby structures and the roadway. These structures could affect the safety of people nearby, and cause damage to nearby structures. However, the soil of the project does not affect the geology, but rather what is on top of the geology. This section will refer to soil resources in place of not impacting geologic resources.

4.2 Define the Study Area for Each Resource

4.2.1 Geographic Resource Study Area
The geographic area of concern for the hydrology and geology aspects includes the immediate project area for most resources, until the area of influence in other resources such as the hydrologic resources. These would account for the possible impacts that can be predicted for each of these resources.

The geographic area for concern for the water quality includes the immediate project area and downstream in the Logan River up to two miles down. The runoff will likely be funneled into the river, which requires good water quality for this to be allowed.

Lastly, for impacts of socioeconomic effects and transportation facilities, the whole of Logan City would need to be studied. This is due to each of these impacts requiring a larger area of influence to be prevalent; however, their impacts may be overall minimal.

4.2.2 Temporal Resource Study Area
The geologic aspect and water quality would likely need a minimum of a month to track if there are any major impacts. While settlement can take years, it will be assumed that

the engineers will track the settlement to ensure no excessive settlement occurs. Additionally, while water quality will vary with time, measurements taken over this initial month of tracking should provide initial readings to ensure that the infrastructure for redirecting runoff was installed correctly.

The hydrology aspects would need a minimum of a few months to observe how the environment changes with the new water table. This would need to be done to allow the water table to reach a new equilibrium with the underpass alternative in place. If the overpass alternatives are utilized, then there likely would need to be less time from less water being drained, possibly even no time if the foundation does not impact the water table.

The socioeconomic and transportation facility aspects would require a minimum of a decade to study and be researched in their impacts. With projects being delegated slowly, it will take multiple years for large pedestrian projects to be brought into the construction stage. This analysis may be best to tally the number of pedestrian or active transportation-related projects that are created within the next ten years to see the emphasis and desire placed on active transportation in Logan.

Additionally, socioeconomic effects will likely not see a trend until pedestrians begin to utilize the underpass more. This would likely best be evaluated when it is determined more pedestrians are utilizing the underpass to compare the economic trends before and after their implementation. This could take a few years or as long as a decade to find evidence for an evaluation and may take multiple years afterward to evaluate.

4.3 Current Status/Viability and Historical Context for Each Resource

4.3.1 Current Health

The geologic and hydrologic health of the project location is predicted to be moderately healthy. With structures on top of the soil, and with no known issues, it is expected to be moderately strong at minimum. Additionally, with water quality not observed at that location, but piped through grates on the sides of the streets, the water quality is predicted to be moderate to medium quality.

The transportation facilities are good for vehicle transportation. With that being the main form of transportation in Logan, it is well maintained. Active transportation facilities, meanwhile, are not as well maintained. This poor-to-fair evaluation of the infrastructure includes steep grading in different locations, areas of good interconnectivity rivaled with areas of poor interconnectivity, good-to-poorly maintained sidewalks and curbs, and limited crosswalks. This variety in the quality of the transportation resources makes it harder to properly evaluate the whole resource.

The socioeconomic health of Logan, Utah is steadily increasing. This is determined based on employment rates, as well as the number of unemployment claims. Additionally, over 28,000 students are attending the local college, Utah State University, which expresses a high pride in education.

4.3.2 Historical Context of the Resource

In 1926, US Highway 89/91 was created to connect people through the Wasatch Mountain range. Logan City was built around the highway, bisecting each half of the city, and therefore limiting the connectivity of the community. The future development of the project area will likely include more highway lanes, further preventing active transportation modes from accessing the city, unless proactive measures are taken or trends change.

US-89/91 promoted vehicle transportation and reduced the effectiveness of active transportation access. Additionally, this reduced the overall water quality due to the bridge creating more area of impervious surface. Further, there likely were some hydrologic impacts when the bridge was put in place. However, it is uncertain how significantly the water table changed since that was not recorded in detail.

The socioeconomic impacts of the highway were significantly beneficial. The introduction of US-89/91 made trucking and shipping access easier access for trucks bringing resources. Additionally, with Logan City being a stop along the highway where it switches from US-89 to US-91, it was a convenient pit stop to take a break. This created a large economic benefit to hosting the highways and incentivized the need to maintain the highways as much as possible.

4.4 Identify the Direct and Indirect Impacts of the Project

4.4.1 Direct Impacts

The direct impact of each alternative is listed in the table below. A further breakdown of the areas utilized for direct impacts is detailed in the cost analysis in Appendix B.

Table 9. Direct Acreage for Each Alternative

Alternative	Direct Acreage
No-Build	0
Underpass	0.62
Elevator Overpass	0.52
Ramp Overpass	0.52

4.4.2 Indirect Impacts

The pedestrian crossing is proposed to connect the east and west sides of Logan City more easily by active transportation. According to the city, this project will be utilized to monitor increases or decreases in active transportation. If the project is not complete, there likely will be fewer active transportation facilities incorporated in Logan City. It is uncertain where active transportation facilities may specifically be placed near the pedestrian crossing, so the project will not include the whole city as part of the area for indirect impacts.

Further, the water quality of the Logan River may overall improve from the implementation of the pedestrian crossing. Due to the project utilizing cleaning measures to reduce the pollutants in the water before it is put into the Logan River, this process will better maintain water quality that was not maintained before the project was implemented. Further, if the hydrology of the environment requires it, the water could be pumped into the ground to improve the ground conditions at the site and affect the area of influence of the water table. This is a controversial tactic, especially for Utah in the current drought, so alternative means will likely be considered before that. Proper calculations will need to be run for how far down the water quality influences would affect, as well as the underlying hydrologic area of influence.

The geologic impacts should not exist beyond the boundaries of the project location. Any soil dug up will be offered to the construction companies to utilize in future projects. If the construction companies do not want the soil, Logan will either stockpile it, or it will be given to help cap the landfill.

4.5 Identify other Current and Reasonably Foreseeable Actions

Logan desires to implement transportation options that increase active transportation use. This project would be one step toward this overarching project goal. With the population additionally increasing, the areas for a project location must be designed to utilize the area as best as possible. This reduces the “waste” in areas, so benefit is derived from it.

The following indirect analyses include locations along the path that are underdeveloped and may be developed further to increase the enjoyment of walking along the area. The project did not extend beyond a half mile east or west of the crossing location, as those projects may be influenced by other factors than the pedestrian crossing. All these projects will likely be low priority to fit in the general plan for Logan, UT, but are more reasonable to be chosen locations.

Table 10 details the expected acreage for the four considered alternatives. Each indirect area included a mile downstream including only the stream. Additionally, the hydrology of the impacts was lightly evaluated, but without proper calculations were not evaluated fully.

Table 10. Cumulative Acreage for Each Alternative

Alternative	Direct Acres	Indirect Acres	Cumulative Acreage
No-Build	0	0	0
Underpass	0.62	3.58	4.20
Elevator Overpass	0.52	3.58	4.10
Ramp Overpass	0.52	3.58	4.10

4.6 Assess Cumulative Impacts

4.6.1 Drawing Conclusions

Regardless of the selection of pedestrian crossing, there will be a cumulative impact on the environment. This impact will influence the surroundings for water hydrology, as well as water quality. There will be impacts on the amount or quality of pedestrian facilities surrounding the pedestrian crossing, and there will likely be socioeconomic benefits that will occur over time.

Decision-makers should be aware that some of the potential impacts are not known due to the designs of each alternative not being fully evaluated. Without proper care repairing the soil layers around the pedestrian crossing, this can cause the earthwork of the resource to become weaker. How much area is affected will depend on the alternative selected.

Hydrology and water quality may not have a significant impact, but pedestrian interactions and the introduction of concrete may impact a significant portion of these resources. The transportation facilities and the socioeconomic impacts may have a large impact on future transportation and socioeconomic impacts; however, multiple other factors may influence the resources equally or more that will need to be considered.

The pedestrian crossing will avoid removing more soil than necessary for the project. The project will be measured out and utilize only the amount of soil that must be removed so the project is minimized. The pedestrian crossing will also minimize poor water quality by restoring disturbed areas by utilizing plants that are appropriate for the Utah desert environment. Additionally, creating better infiltration to the surrounding environment should prevent negative hydrologic impacts from occurring.

4.7 Document the Results

4.7.1 Describe the Analyses, Methods, or Processes Used

The impact analysis was conducted using Google Earth for areas and previous soil data for effects on the water table. This data combined the water level data with the area and the plans for the alternative's design to evaluate the most likely scenario for handling the resources. Additionally, the analysis utilized design data from the senior design project to predict the impact that would affect the given area and its surroundings for the design.

4.7.2 Explain the Assumptions

The assumption for this environmental impact statement is that there will be an overall benefit to implementing the pedestrian crossing when it comes to the hydrology of the project. There is the possibility that the pedestrian crossing being added could negatively impact the strength of the soil or the water quality may get worse with the implementation of the pedestrian crossing. These designs will require more thorough calculations to get a more accurate estimate, but the assumption asserts that the design of the crossing will work to minimize these impacts. Additionally, if the design is overall more negative hydrologically, then it is assumed that the design of the crossing will utilize resources to account for this negative impact to increase the safety of the surroundings.

4.7.3 How to Summarize Cumulative Impact Analyses in the Environmental Document

The results show that aside from the no-change alternative, the three alternatives impact the same area overall. The underpass alternative impacts the design the most with an extra 0.1 acre. The two overpass designs impact the same amount of area, but this comes from the assumption that the overpasses have the same area impacted with different amounts of landscaping for each design. The overall types of impacts are found to be relatively similar, with the geologic and hydrologic impacts being higher for the underpass alternative. The transportation facilities and socioeconomic impacts may be positively impacted, but there will be multiple factors impacting it that will not be linked just to the pedestrian crossing. The water quality will be impacted, and the project will aim to create a better design for these impacts to be beneficial for the project.

4.8 Assess the Need for Mitigation

Climate Change

The issue of greenhouse gas (GHG) emissions and global climate change is an important national and global concern that is being addressed by various states and federal agencies, including UDOT and FHWA.

Since the context for GHG emissions is on a global scale, it is virtually impossible to perform a meaningful analysis of most local transportation projects. GHG emissions analyses are more informative at regional, state, or national levels and should be accomplished during local and regional land use planning processes when more capable modeling tools are developed. While it still may be possible to quantify GHG emissions associated with a proposed transportation project, tools have not been developed to translate those emissions into impacts on climate change on any scale. Further, the needs for most highway projects are typically a result of land use changes, development, growth, and other local and regional changing trends. Therefore, to best inform decision-making, GHG emissions estimation needs to be done during the transportation system and land use planning processes.

As of the date of publication of this document, no federal laws specifically require GHG emission analyses in project-level NEPA documents. NEPA requires federal agencies to scope and address the significant issues of any proposal and to concentrate on the analyses of issues that can be truly meaningful to the consideration of and comparison between project alternatives. In the absence of federal regulations and a regional or national framework for considering the implications of project-level GHG analyses, FHWA concludes that GHG emissions calculated for project alternatives cannot be usefully evaluated in the same way that vehicle emissions are evaluated within a local project-level context and that such an attempted analysis would not inform project decision-making in any meaningful way.

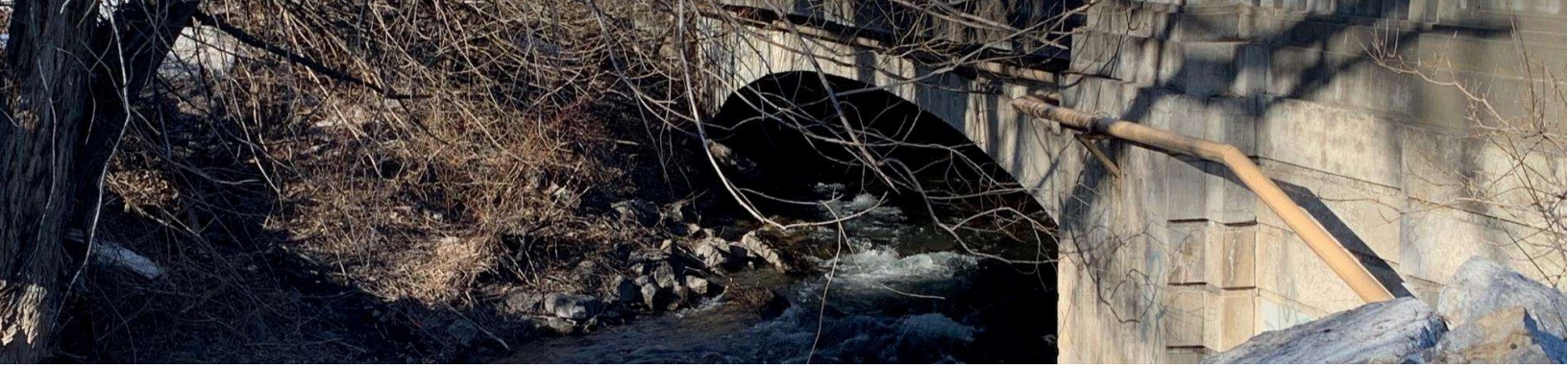
UDOT Strategies

Greenhouse gas (GHG) emissions are currently not regulated in the State of Utah. However, there are numerous goals for states and the nation to meet, and strategies to reduce GHG emissions are currently being addressed by UDOT and other state agencies throughout Utah. On August 16, 2022, the Inflation Reduction Act of 2022 (IRA) came into effect with the passage of the Congress bill H.R.7376 creates GHG emission reduction goals for the United States. During Phase 1, this bill provides $3M to each state and $1M to major metropolitan areas to formulate plans to reduce current greenhouse gas emissions. After the plan is constructed, Phase 2 will provide money to implement these plans into practice.

Intelligent transportation systems (ITS) and land use planning policies will be among several strategies necessary to meet the state’s goal of reducing GHG emissions. The ITS and land use planning policies will be communicated with state agencies including UDOT and the Utah Department of Land and Conservation and Development (DLCD) to integrate GHG reduction goals into state transportation planning and land use policies currently under development. Transportation and land use policies will be designated to

stop the growth of GHG emissions, and then reduce over time, according to the specific goals set out by the Utah Legislature.

Research is also underway to develop more capable models for measuring, analyzing, evaluating, and reporting GHG emissions. UDOT is coordinating with other state and federal agencies (DOE, DEQ, FHWA, EPA) to determine appropriate contexts for measuring impacts from transportation and land use changes.



CHAPTER 5 – CHOSEN ALTERNATIVE

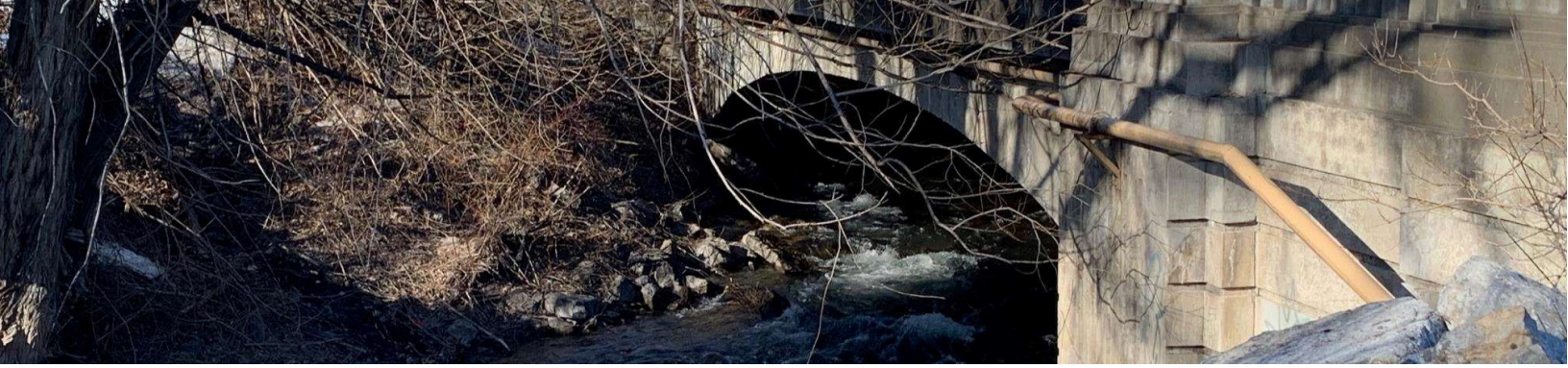
The Environmental Impact Statement aims to look at reasonable alternatives and identify many resources that will be affected by its implementation. As discussed at the beginning of this document, Logan City is bisected by US-89/91. This bisection also has limited pedestrian transportation facilities for crossing to each side of the city. This reduces the likelihood of utilizing active transportation or public transportation modes so they can feel safer or arrive at locations faster. The purpose of this project was to create an alternative that would align with Logan City's guidelines and be enjoyable for active transportation modes.

The pedestrian crossing was needed to alleviate multiple issues that exist in Logan. The lack of pedestrian facilities creates poor conditions for active transportation through the city. Without good walking conditions, this further exacerbates the poor walkability of the city. Further, Logan needs to reduce vehicular traffic so US-89/91 will not be as deeply congested. With the congestion on US-89/91 predicted to get worse, it is important to encourage active transportation and remove people off the roadways where possible.

Additionally, with more active transportation facilities, it is important to also increase public transportation use. The more public transportation use is utilized, the fewer vehicles on the road, which can reduce traffic by up to 36.6% (Sultana 2020). Lastly, the pedestrian crossing needs to increase air quality. While the singular pedestrian crossing is not found to improve air quality significantly on its own, it is meant to aid in city-wide transportation reforms to improve air quality.

Moreover, the project also needed to ensure that the pedestrian crossing was uncongested, and grade-separated. An uncongested pedestrian crossing will draw active transportation users to it as they will not need to wait for vehicles to cross it. The crossing also needs to be grade-separated so the traffic on US-89/91 will not be impacted, as per UDOT's requirement to keep the highway uncongested. These requirements ensure pedestrians and drivers are both benefiting from the inclusion of a pedestrian crossing rather than hindering its inclusion.

Once these project goals and objectives were identified, four alternatives were seriously considered, and one alternative was immediately rejected. The rejected alternative was the traffic light crossing, as this alternative was not grade-separated and would be a congested pedestrian crossing. The four alternatives included an underpass, an overpass with an elevator, an overpass with a ramp, and a no-change alternative. The no-change alternative was used as a base to ensure the other alternatives would not significantly impact the environment worse than its current situation.



From a Pugh matrix analysis, it was identified that the underpass would be the preferred alternative for the project. The underpass is the preferred alternative based on sustainability, cost, maintenance, and pedestrian traffic usage being weighted highlight and the underpass scoring the best.

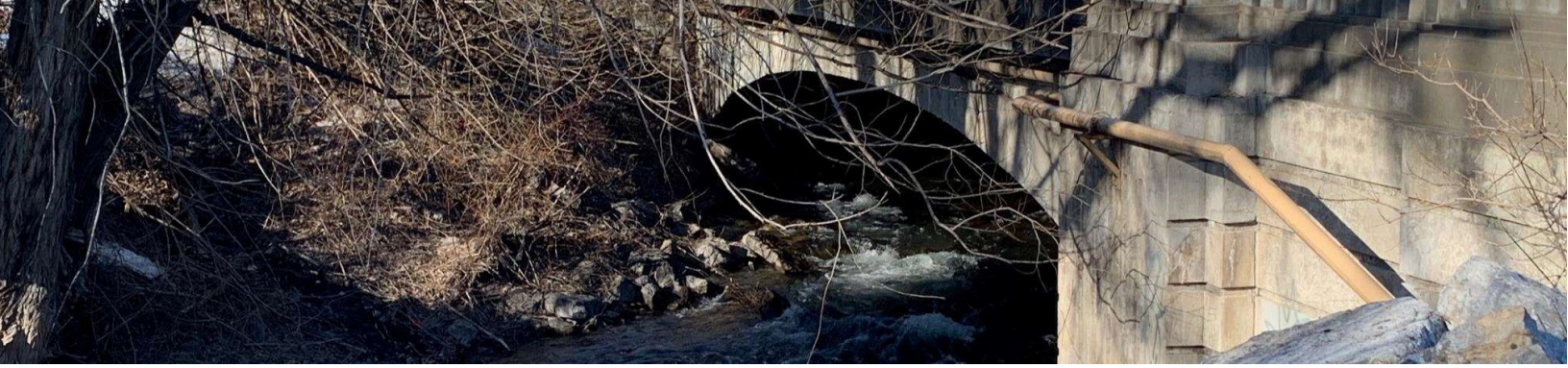
Afterward, the environmental impacts of each resource were evaluated under each resource. The Parks and Recreational Facilities, Wildlife, or Waterfowl Refuges; Historic Resources; Wetlands and other Waters; Threatened and Endangered Species; Non-Threatened and Endangered Species; Energy; and Hazardous Materials were deemed to have no significant resources within the project boundaries.

When the project is introduced, the Transportation Facilities; Land Use; Socioeconomic Analysis; Invasive Species; and Air Quality are all expected to be improved with the addition of the pedestrian crossing. Some of the major positive impacts are increased pedestrian facilities and increased socioeconomic potential.

The transportation facilities are expected to improve the best due to the introduction of the pedestrian crossing while leaving US-89/91 intact, as well as better connecting the trail along the river. Further, the socioeconomic situation of the surrounding area is expected to improve from the higher accessibility and reduced cost from gas costs increase the spending budget of people in the area.

Meanwhile, the Right-of-way and Utilities; Visual Resources; Hydrology, Floodplain, and Floodway; Natural Systems and Communities; Noise and Vibrations; and Geology are expected to be negatively impacted through the introduction of all the alternatives. The Environmental Justice resource is not known whether it will create a negative impact, and the Water Quality and Storm Water Runoff are expected to be bad for pedestrian interference but improve with the mitigation techniques. The major negative impacts of the pedestrian crossing include right-of-way acquisition, hydrology impacts, and noise-and-vibration impacts.

For the right-of-way, the project worked to mitigate this as much as possible by finding a location for only one property's acquisition; however, there is no known way to reduce this number further. The hydrological impacts are seen to be bad as well. While the overpass alternatives should not affect the hydrology as significantly, the underpass alternative is expected to severely impact the water table and likely cause a new water table curvature. Lastly, the noise and vibrations are expected to be significant during construction and will require knowing the noise bylaws of Logan City to ensure proper construction timing.



The cumulative impacts of most of the resources were found to be minimal or require many other projects and laws to establish much significance. Land Use; Right-of-Way and Utilities; Environmental Justice; Visual Resources; Natural Systems and Communities; Invasive Species; Air Quality; and Noise and Vibrations were determined to have little cumulative significance. While Right-of-Way and Air Quality both could cause significant impacts with the implementation of more pedestrian facilities, at the project level, they are not expected to have significant impacts. Noise and Vibrations will have significant impacts during the project but afterward are expected to decrease in impact.

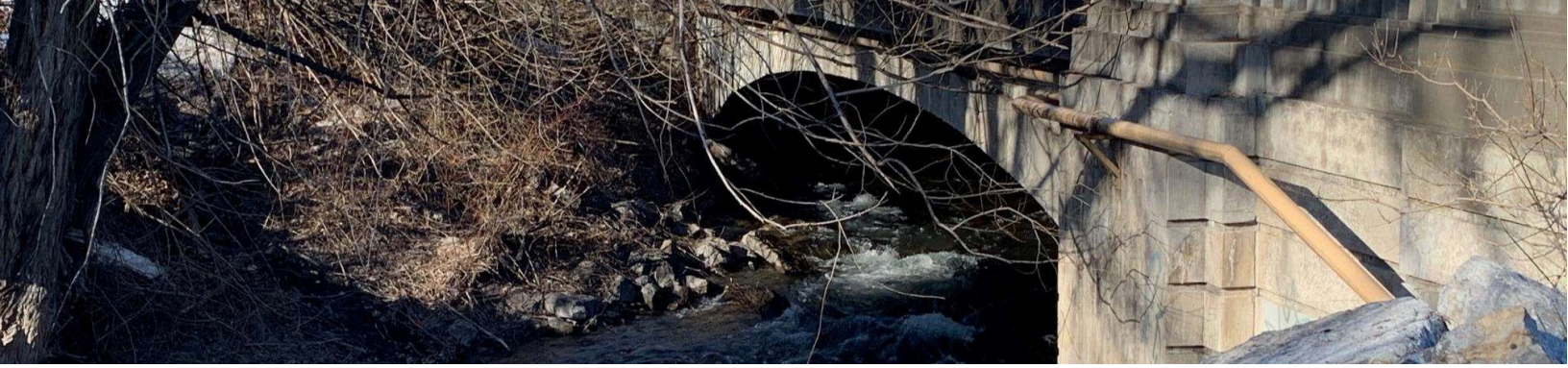
Transportation Facilities; Socioeconomic; Hydrology, Floodplain, and Floodway; Water Quality and Stormwater Runoff; and Geology were found to have a more significant impact on the project location. While Geology was stated more as soil analysis, the transportation facilities; socioeconomic; water quality, and stormwater runoff resources are expected to benefit the community with proper mitigation techniques. The Hydrology, Floodplain, and Floodway are expected to be decreased without proper design for the underpass alternative.

The area of impact for all the resources is set to be less than half a mile to the east and west of the project location, and as far north as the area of influence for the hydrology extends. The time to properly evaluate the resources averages approximately a month,; however, the socioeconomic and transportation facility resources would require multiple decades to see their true impacts.

The health of the five previous resources was evaluated to be moderately good for each of them, with the historic route requiring and receiving upkeep as one of the first US highways. The direct area of influence is approximately half a square acre; however, the indirect area of influence is approximately 3.6 square acres, creating approximately 4 square acres of area impacted in some way.

After completing this analysis, climate change mitigation must still be considered due to its global impacts. Utilizing the IRA monetary incentive, more pedestrian facilities can be created to remove vehicles from the road and help the air quality of the entire state.

After a thorough analysis, the underpass is still the best alternative for the location. It does impact the hydrology and the geology worse than the overpass alternatives, but these impacts are considered minimal enough to not overpower the favorable alternative. Additionally, the alternative will include mitigations in its design to benefit each resource.



CHAPTER 6 – LIST OF PREPARERS (CAPSTONE COMMITTEE)

Name	Role	Education
Alyssa Gaither	E.I.S. Author	B.S. Civil Engineering
Austin Ball	Civil Engineering Advisor	M.S. Civil & Environmental Engineering (Structures)
John Rice	Honors Advisor	Ph. D. Geotechnical Engineering
Kristine Miller	Approval	Ph.D. English

REFLECTIVE WRITING

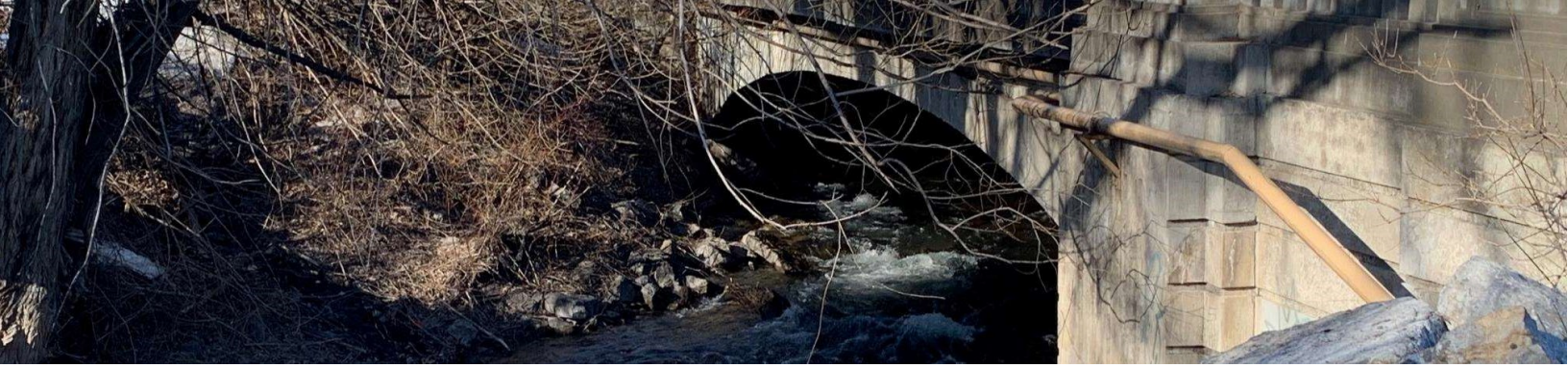
When it came to coming up with an honors capstone project, I was extremely nervous. I was originally under the impression that I could use my senior design project in engineering for it, so for most of my undergrad I did not think of different capstone projects to complete. However, after talking with Dr. Vargis while on the Honors Student Advisory Board, I realized there was very little way that I could apply my Senior Design project to barely go larger.

I could consider how being the project manager affected me, but there are not 10,000 words worth of experience I could add to that project to warrant an honors capstone. I could have theoretically taken on a single facet of the designing, but it would be difficult to differentiate what I did for the senior design project, and what I did for the honors capstone. Dr. Vargis suggested doing a completely different project for the capstone, yet with very little time to prepare since I left it for so long, that project seemed comparatively futile.

This caused me to think of what ways I could theoretically expand my senior design project based on real-world situations. I learned about UDOT funding the project that my senior design was based on and connected that with projects that were federally funded. When a civil engineering project is federally funded, they're required to complete an Environmental Impact Statement (EIS) to ensure that federal money is not being used to harm the environment. While I was misguided that the real project needed one, it was a perfect way to build upon what I was working on.

This added to my education by forcing me to consider resources I normally would not consider. Most civil engineering projects are focused on the form and function of the building, not necessarily the impacts of the project. This process was completed by senior design deepening my understanding of how to design the project. I was able to learn about the loading conditions, the design process, and even research locations to utilize in future designs.

With the honors capstone, I was able to deepen my knowledge of the subject matter that I would not have considered otherwise. I learned more in-depth how the type of material I use can environmentally affect the project location and beyond. I also learned why some structures are required for the environment's sake. It helped me to truly feel I understood the senior design project and also allowed me to apply my project knowledge to other, similar projects.



However, just because I was considering this project further on my own did not necessarily mean I understood all the facets of the project. There were numerous times when I had thought I considered something properly, but my advisor, Professor Austin Ball had to teach me what to consider more or how to write the EIS properly. While I was able to do a lot, Professor Ball helped improve not only my writing but also my understanding of the pedestrian crossing EIS.

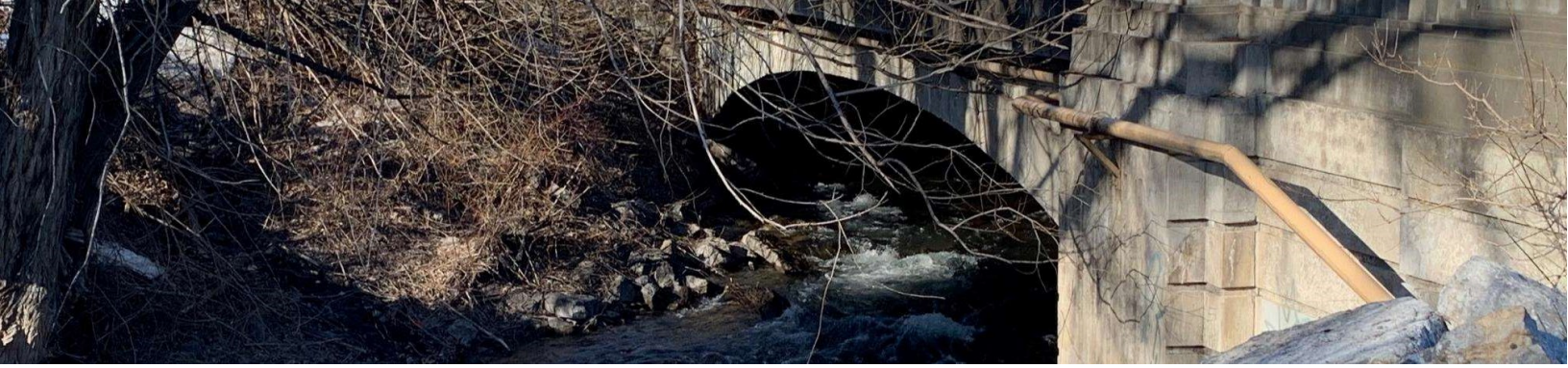
This process helped me build a deeper mentorship with my advisor as he gave me meaningful advice and worked with me to help explain where I was coming short. Professor Ball was willing to read over my work and explain how my writing was not thorough enough, or where I was misunderstanding what needed to be described in the EIS to properly convey the required knowledge.

One thing Professor Ball taught me was the need for sources to prove what is happening in Logan for the senior design project. In finding these sources, I was taught how to look at sources that specifically apply to this project, such as government policies in a specific location. This was important as it taught me construction timings and techniques, as well as taught me where to look to find current government projects and plans.

While I was doing three years of research with my old research professor, Dr. Singleton, I gained a lot of research experience in literature. This helped me significantly find sources that prove the information I'm trying to find, as well as locate reputable sources easily. However, there is a different way required to research a location or current events, as there is more time sensitivity to the sources, along with lengthier routes required to find the information you're searching for. Research could be hyper-specific to locations, which required more scrutiny for each of the sources.

That scrutiny for the EIS required me to think critically about how each resource connected with the project. With each listed resource, I had to consider how the resource could theoretically be impacted by my senior design project. Some sources may apply if they detail a scientific process, but many would not apply due to the nature of laws being more specific to cities and states than other information. I quickly learned that a law in one location was unlikely to be the same in another. Additionally, the sources were harder to cite for this very reason.

Yet, each law and ordinance did not need to apply to a singular alternative such as the underpass. They needed to apply to all alternatives that were considered to ensure the most environmentally friendly option was identified. This broadened the research to think of multiple ways the same project could affect a location in different ways. Further,



it inspired unique ways of thinking and required a detailed enough design of the alternatives to reasonably predict their impacts on the environment.

This requirement to analyze multiple alternatives against the same criteria was beneficial to my learning because it forced me to think differently. It forced me to do my design and then expand my knowledge of the alternatives to establish how each one offered unique impacts on the environment. Further, the EIS broadened my experience across disciplines by teaching me some of the work that environmental engineers need to consider on projects. It gave me a deep respect for the intense detail environmental engineers need to be aware of since so many aspects of a project can uniquely affect the project in different ways. It also showed me how even a small project may have larger impacts than previously thought. While they may not cause impacts that will destroy the environment beyond repair, they do create little impacts that could theoretically build up if not monitored.

One of the better things about this project, however, is that it builds upon more than just my education, but the promise I made to civil engineering as a whole. The EIS taught me a way to engage with my local community by addressing how my project may impact their environment and therefore health. The first canon of a civil engineer is to “Hold paramount the safety, health, and welfare of the public.” This personally impacts me, as part of the reason I became a civil engineer is to benefit the community around me and protect the people from harm. The safety, health, and welfare of the public begins with preserving the local environment for people to enjoy. This means that this project helped me practice this first fundamental canon and help engrain this practice into me as I head into the workforce. And I hope this project helps instill in me lifelong learning.

APPENDIX A – BIBLIOGRAPHY

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APPENDIX B – COST CALCULATIONS

Table 11. Detailed Underpass Cost Estimate

Item	Unit	Quantity	Unit Price	Amount
Mobilization	%	-	0.1	$148,032
Traffic Control	%	-	0.025	$37,007.88
Erosion Control/Maintenance	%	-	0.01	$14,803.15
Public Information	%	-	0.005	$7,401.58
Preconstruction Survey	L.S.	1	$25,000	$25,000
General Excavation	C.Y.	9,045	$45	$407,025
Demolition of Building	L.S.	1	$50,000	$50,000
Pavement Markings	L.F.	240	$6	$1,440
Concrete Curb and Gutter	L.F.	100	$25	$2,500
Drainage Pump and Operation	L.S.	1	$100,000	$100,000
Preconstructed Box Culvert	L.F.	130	$2,500	$325,000
Reconstruction of Road (Asphalt)	S.F.	3,360	$30	$100,800
Backfill	C.Y.	2,950	$45	$132,750
Fencing	L.F.	380	$100	$38,000
Lighting	%	-	0.01	$14,803.15
Retaining Walls	S.F.	2,420	$90	$217,800
Path Paving	S.F.	4,000	$20	$80,000
Electrical	L.F.	40	$700	$28,000
Water	L.F.	40	$1,400	$56,000
Fiber Optic	L.F.	40	$700	$28,000
Gas	L.F.	40	$700	$28,000
Communications	L.F.	40	$700	$28,000
Land Acquisition	L.S.	1	$425,000	$425,000
Relocation Assistance	E.A.	1	$45,000	$45,000
Reseeding	L.S.	1	$20,000	$20,000
Landscaping	S.F.	22,150	$30	$664,500
Environmental Wetlands	S.F.	200	$150	$30,000
Design Engineering	%	-	0.12	$366,583.47
Construction Engineering	%	-	0.08	$244,388.98
Contingency	%	-	0.15	$458,229.34
			Total:	$4,124,064.04

Most values were calculated from HDR Engineering (2017). The average price of a home in Logan was taken from Realtor.com (2024). The average cost for laying concrete was taken from Forbes Home (Crail and Tynan 2023). All other values were taken from a personal interview with Professor Austin Ball.

Table 12. Detailed Elevator Overpass Cost Estimate

Item	Unit	Quantity	Unit Price	Amount
Mobilization	%	-	0.1	$261,935
Traffic Control	%	-	0.025	$65,483.63
Erosion Control/Maintenance	%	-	0.01	$26,193.45
Public Information	%	-	0.005	$13,096.73
Preconstruction Survey	L.S.	1	$25,000	$25,000
General Excavation	C.Y.	720	$45	$32,400
Demolition of Building	L.S.	1	$50,000	$50,000
Concrete Curb and Gutter	L.F.	100	$25	$2,500
Drainage, Structures, and End Sections	%	-	0.01	$26,193
Preconstructed Bridge	S.F.	1,625	$550	$893,750
Outdoor Elevator	L.S.	2	$600,000	$1,200,000
Stairs	Stair	48	$5,640	$270,720
Backfill	C.Y.	655	$45	$29,475
Fencing	L.F.	355	$100	$35,500
Lighting	%	-	0.01	$26,193.45
Path Paving	S.F.	4,000	$20	$80,000
Electrical	L.F.	120	$700	$84,000
Fiber Optic	L.F.	40	$700	$28,000
Communications	L.F.	40	$700	$28,000
Land Acquisition	L.S.	1	$425,000	$425,000
Relocation Assistance	E.A.	1	$45,000	$45,000
Reseeding	L.S.	1	$20,000	$20,000
Landscaping	S.F.	22,150	$30	$664,500
Environmental Wetlands	S.F.	10	$150	$1,500
Design Engineering	%	-	0.12	$520,132.82
Construction Engineering	%	-	0.08	$346,755.22
Contingency	%	-	0.15	$650,166.03
			Total:	$5,851,494

Most values were calculated from HDR Engineering (2017). The average price of a home in Logan was taken from Realtor.com (2024). The average cost for a pedestrian bridge was taken from The University of Carolina at Chapel Hill (CED Program 2016). The price of stairs came from Dan Simms (2024). All other values were taken from a personal interview with Professor Austin Ball.

Table 13. Detailed Ramp Overpass Cost Estimate

Item	Unit	Quantity	Unit Price	Amount
Mobilization	%	-	0.1	$283,038.26
Traffic Control	%	-	0.025	$70,759.57
Erosion Control/Maintenance	%	-	0.01	$28,303.83
Public Information	%	-	0.005	$14,151.91
Preconstruction Survey	L.S.	1	$25,000	$25,000
General Excavation	C.Y.	720	$45	$32,400
Demolition of Building	L.S.	1	$50,000	$50,000
Concrete Curb and Gutter	L.F.	100	$25	$2,500
Drainage, Structures, and End Sections	%	-	0.01	$28,303.83
Preconstructed Bridge	S.F.	1,625	$550	$893,750
Ramp Construction	S.F.	4000	$350	$1,400,000
Ramp Support Beams (W12x53)	L.F.	126	$87.60	$11,038
Stairs	Stair	48	$5,640	$270,720
Backfill	C.Y.	655	$45	$29,475
Fencing	L.F.	355	$100	$35,500
Lighting	%	-	0.01	$28,303.83
Path Paving	S.F.	4,000	$20	$80,000
Electrical	L.F.	120	$700	$84,000
Fiber Optic	L.F.	40	$700	$28,000
Communications	L.F.	40	$700	$28,000
Land Acquisition	L.S.	1	$425,000	$425,000
Relocation Assistance	E.A.	1	$45,000	$45,000
Reseeding	L.S.	1	$20,000	$20,000
Landscaping	S.F.	22,150	$30	$664,500
Environmental Wetlands	S.F.	10	$150	$1,500
Design Engineering	%	-	0.12	$549,509.26
Construction Engineering	%	-	0.08	$366,339.51
Contingency	%	-	0.05	$228,962.19
			Total:	$5,724,054.77

Most values use the same sources as the previous overpass calculations. The cost of W12x53 beams came from Midwest Steel and Aluminum (2024). All other values were taken from a personal interview with Professor Austin Ball.

PROFESSIONAL AUTHOR BIOGRAPHY

Alyssa Gaither is a civil engineering major with a minor in mathematics. Alyssa earned the Undergraduate Researcher of the Year award for 2022-2023 for her work with Dr. Singleton in transportation statistics. Alyssa also passed her FE test, officially making her an Engineer in Training, and is now set to work at Forsgren Associates. Alyssa has made the Dean's List 3 times with 15 credit hours of graded credits while maintaining a GPA over 3.5. Alyssa also has joined the Order of the Engineer to promise integrity and honesty in engineering practices. Additionally, her GPA and character allowed Alyssa to join Tau Beta Pi, promising excellence and respect when joining the club. In the future, Alyssa will continue her education in her concurrent master's program. Alyssa then intends to work for a structural engineering company to pass her Professional Engineering Exam and later complete her Structural Engineering Exam.