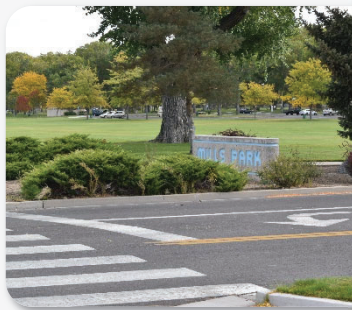




## Attachment C – Design Alternatives Study



# Design Alternatives Report

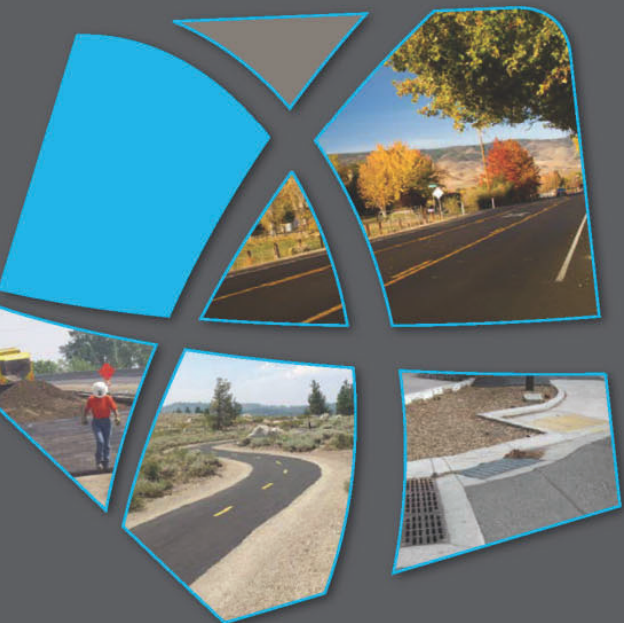
East William Complete Streets Project

June 2022



Reno, NV

1885 S. Arlington Ave., Suite 111  
Reno, NV 89509



## Carson City Public Works

3505 Butti Way  
Carson City, Nevada 89701



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**Design Alternatives Report**  
**East William Complete Streets Project**  
**Carson City, Nevada**

June 2022

**Prepared for:**

**Carson City Public Works Department**  
3505 Butti Way  
Carson City, Nevada 89701

**Prepared by:**

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## Executive Summary

The Carson City Public Works Department (City) is implementing the East William Complete Streets Project (Project), which extends from North Carson Street to Interstate 580.

The Project will transform East William Street into an efficient, multimodal street providing roadway, bicycle, pedestrian, safety, and beautification improvements through one of Carson City's primary commercial corridors. To determine the preferred alternative for the Project, the City initiated schematic design, including an investigation of existing conditions, the development and evaluation of alternatives, and the selection of a preferred alternative. This Design Alternatives Report documents the schematic design.

### INVESTIGATION OF EXISTING CONDITIONS AND COMMUNITY OUTREACH

Technical studies were performed to evaluate the condition of the corridor and form a basis for the development of alternatives. These studies included a traffic analysis, a traffic signal modifications and interconnect review, a drainage analysis, a lighting and electrical design evaluation, a geotechnical investigation, and pavement structural analysis. In addition, the City conducted community outreach to ascertain the interests, hopes, and goals for the Project from the businesses and public that utilize the corridor. The outreach included one-on-one meetings with businesses, an online survey, open-house meetings, and a public meeting.

### ALTERNATIVE DEVELOPMENT AND EVALUATION

The project was divided into 4 segments and a number of alternatives were considered for each segment. Each alternative aimed to fulfill the Project goals, comply with the guidelines and priorities of the City's existing plans and policies, and improve deficiencies identified in the existing conditions evaluation. In addition, two other factors were key: incorporating the results of community outreach efforts and implementing recommended traffic operation modifications. These alternatives were evaluated based on operations, cost, sustainability, and user experience. Based on the results of the evaluation and subsequent discussions regarding maintenance requirements, functionality, and Project goal fulfillment, City staff recommended a preferred alternative for each section of the corridor to the Regional Transportation Commission.

### PREFERRED ALTERNATIVE

The preferred alternative includes varied configurations of bicycle, pedestrian, and landscape improvements along with travel lane and intersection reconfigurations, reduced automobile lane widths, signal modifications and interconnects, transit stops, drainage and low-impact-development water quality improvements, lighting and utility improvements, and pavement reconstruction.

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## List of Abbreviations

Abbreviation	Definition
AB	aggregate base
AC	asphalt concrete
ADA	Americans with Disabilities Act
AM	ante meridiem
CAMPO	Carson Area Metropolitan Planning Organization
City	Carson City Public Works Department
CMP	corrugated metal pipe
EPA	United States Environmental Protection Agency
FYA	flashing yellow arrow
I-	Interstate
IES	Illuminating Engineering Society
LED	light-emitting diode
LID	low-impact development
LOS	Level of Service
NE	northeast
NW	northwest
OGFC	open-graded friction course
PCC	Portland Cement Concrete
PM	post meridiem
Project	East William Complete Streets Project
RCP	reinforced concrete pipe
ROW	right-of-way
SE	southeast
SW	southwest
US	United States

## 1 Introduction and Background

### 1.1 INTRODUCTION

The Carson City Public Works Department (City) is implementing the East William Complete Streets Project (Project). As shown in Figure 1, the boundaries of the 1.5-mile Project are North Carson Street to the west and Interstate (I-) 580 to the east. To determine the preferred alternative for the Project, the City initiated schematic design, including an investigation of existing conditions, the development and evaluation of alternatives, and the selection of a preferred alternative. The process is documented in this Design Alternatives Report.

### 1.2 PROJECT LOCATION

The Project is within Carson City, Nevada, in Sections 9 and 17 of Township 15 North, Range 20 East of the Mount Diablo Principal Meridian. East William Street is classified as a minor arterial and provides access to and connection between Carson City's downtown core, I-580, and United States (US) Route 50. Major signalized intersections within the Project include North Carson Street, North Stewart Street, North Roop Street, North Saliman Road, and I-580. There is a traffic signal at Gold Dust West Way to provide access to large commercial complexes. The road currently has 2 lanes in each direction with center turning lanes between North Carson Street and east of North Saliman Road, where it transitions to 3 lanes in each direction to east of I-580.

To develop alternatives, the Project has been divided into 4 segments: North Carson Street to North Stewart Street, North Stewart Street to North Roop Street, North Roop Street to North Saliman Road, and North Saliman Road to I-580.

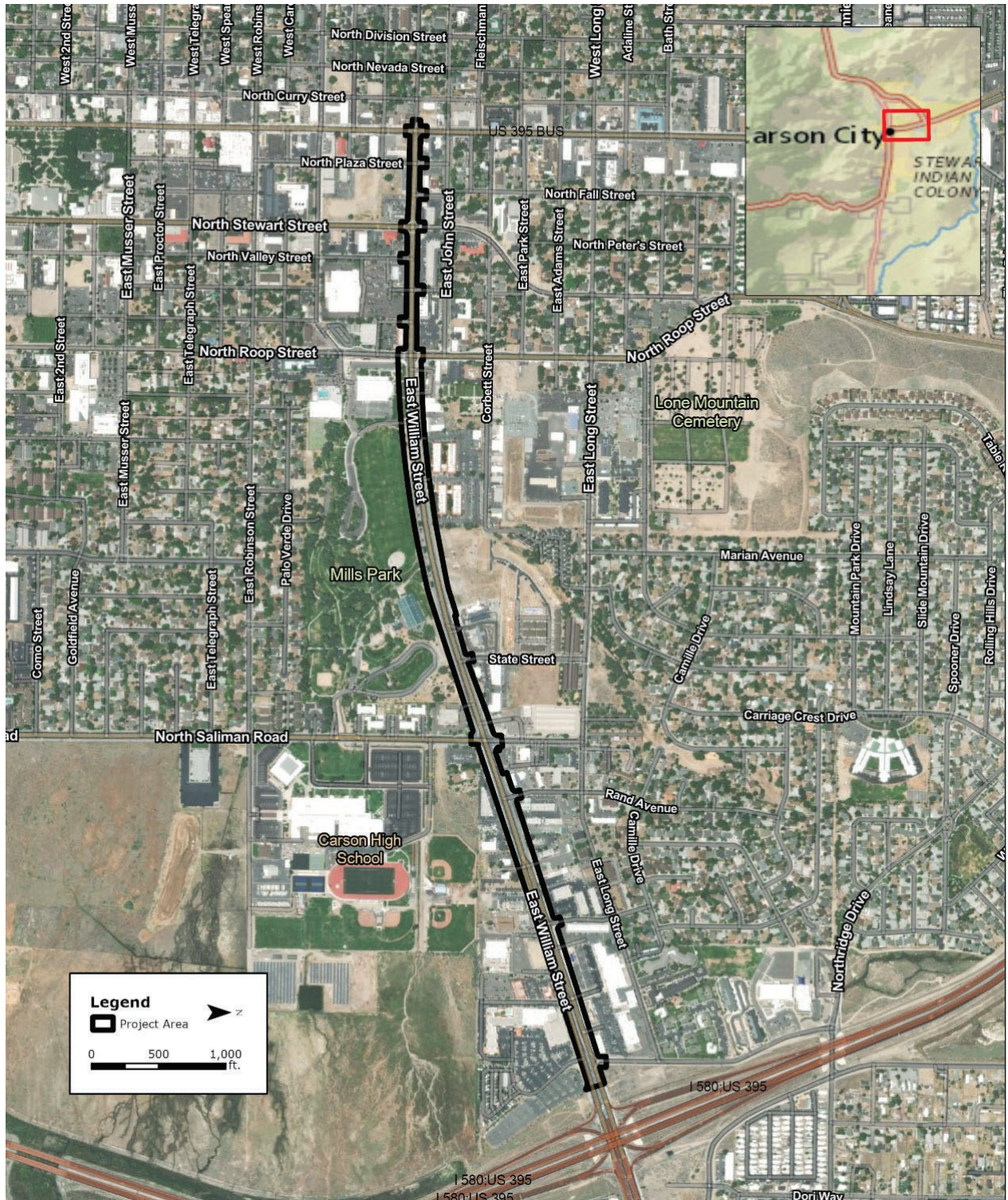


Figure 1. Site Map

### **1.3 PROJECT DESCRIPTION**

The Project will provide roadway, bicycle, pedestrian, safety, and beautification improvements to East William Street, creating an efficient multimodal roadway along one of Carson City’s primary commercial corridors.

The Project specifically includes pavement rehabilitation and preservation treatments throughout the corridor, access management infrastructure to improve safety and circulation for commercial driveways and side streets, enhanced street lighting, signalized pedestrian crossings, bus stop amenities to support a planned transit line along the corridor, electric vehicle charging stations at Mills Park, traffic signal infrastructure upgrades, sidewalk infrastructure to establish compliance with the Americans with Disabilities Act (ADA), added bike facilities, landscaping and streetscape beautification, and significant upgrades to water, sewer, and storm water utility systems, including low-impact-development (LID) storm water infrastructure.

### **1.4 GOALS AND BENEFITS OF THE PROJECT**

The existing road network does not support safe multimodal transportation and deficient bike, pedestrian, and transit facilities limit access to nearby community resources and essential goods and services. The Project’s goal is to reconfigure and rehabilitate the East William Street corridor into a safe, sustainable, and accessible transportation facility for all users.

Project benefits will include improved safety for pedestrians, cyclists, and automobiles; improved accessibility for all users; support of land use plans and economic development; increased multimodal travel capacity to accommodate Carson City’s growing population and employment; improved aesthetics of the road and adjacent areas; and improved utility and drainage infrastructure.

### **1.5 EXISTING PLANS AND POLICIES**

A number of plans and policies were considered in the development of alternatives, including:

- *2050 Regional Transportation Plan* (Carson Area Metropolitan Planning Organization [CAMPO], 2021)
- *Carson City Master Plan* (Carson City 2006a)
- *Unified Pathways Master Plan* (Carson City 2006b)
- Greening America’s Capitals program (EPA 2016)
- *Carson City 2020 Americans with Disabilities Act (ADA) Transition Plan for Pedestrian Facilities in the Public Right-of-Way* (CAMPO 2019)
- *Title VI Plan for Carson City Regional Transportation Commission and Carson Area Metropolitan Planning Organization* (CAMPO 2020)
- “Carson City Complete Streets Policy” (Carson City 2014)

## 1.6 DESIGN ALTERNATIVES PROCESS

The design alternatives process consisted of an investigation of existing conditions, the development and evaluation of alternatives, and the recommendation and selection of a preferred alternative by the Project team and the Regional Transportation Commission. A number of alternatives were developed for each section of the roadway. Each of these alternatives considered the following:

- Project goals
- Existing City plans and policies
- Existing conditions
- Results of community outreach efforts
- Traffic operations

Evaluation criteria based on operations, cost, sustainability, and user experience were established and each alternative was evaluated against these criteria. Based on the analysis results and subsequent discussions regarding maintenance requirements, functionality, and satisfying the goals of the Project, City staff selected a preferred alternative for each section of the corridor. A detailed cost estimate was prepared for the preferred alternative.

## 2 Investigation of Existing Conditions

Using existing aerial imagery provided by the City, along with site visits and discussions with City staff, NCE identified existing improvements along the corridor that may remain (e.g., multiuse paths, lighting, and sidewalks), as well as areas where pedestrian, lighting, and landscaping improvements do not exist. Parcel data provided by the City were used to delineate the existing ROW. Pedestrian, auto, and transit travel patterns were also considered.

In addition, the following technical studies were prepared to evaluate the existing conditions:

- Traffic Analysis
- Traffic Signal Modifications And Interconnect Review
- Preliminary Drainage Analysis
- Lighting And Electrical Design Evaluation
- Geotechnical Investigation
- Pavement Structural Investigation

### 2.1 PUBLIC TRANSIT

The Carson City public transit system, JAC (Jump Around Carson), began operating in October 2005. The system currently features a curb-to-curb assistance program for eligible persons with disabilities and a fixed-route system consisting of 4 routes. Fixed routes run from the downtown transfer station on Plaza Street north to Carson Tahoe Regional Medical Center, south to Fuji Park, and in a circuit west to Western Nevada College and east to FoodMaxx. The existing service nearest to the Project area is on Long Street and North Roop Street.

### 2.2 TECHNICAL STUDIES

#### 2.2.1 Traffic Analysis

The *East William Street Traffic Data Collection and Analysis Traffic Report* was completed for the Project. The traffic study examined the corridor crash history, conducted existing traffic counts at the major intersections, projected future (2030 and 2050) traffic volumes for the corridor, performed a queue length analysis, and completed a level of service (LOS) analysis for the 4 segments of the Project for existing and future conditions for 3 time periods: ante meridiem (AM), midday, and post meridiem (PM). The study also examined the potential of converting each segment within the corridor from 4 lanes (2 lanes in each direction) to 2 or 3 lanes (1 or 2 lanes in each direction).

The traffic study concluded that mitigation measures to address deficiencies at North State Street and North Stewart Street will be required and the only segment of the corridor that would continue to operate at acceptable service levels with a

lane reduction is North Carson Street to North Stewart Street, where removal of one eastbound lane, with some mitigation measures, will be acceptable.

### 2.2.2 Traffic Signal Modifications and Interconnect Review

A field review of the traffic signal systems was conducted to determine traffic signal modification work items necessary to provide ADA compliant pedestrian facilities and accommodate the proposed roadway geometry changes. A summary of the evaluation is included as **Appendix A**. The evaluation also included identification of optional work items that would update aging equipment, resolve minor existing deficiencies, or generally improve the traffic signal systems for more efficient maintenance and operations. The following traffic signal systems were evaluated:

- North Carson Street/East William Street
- North Stewart Street/East William Street
- North Roop Street/East William Street
- North Saliman Road/East William Street
- Gold Dust West Way/East William Street

The traffic signal interconnect systems serving the above locations were also reviewed to identify opportunities to construct conduits for future fiber optic cables concurrently with utility work in the corridor. The traffic signals listed above are currently connected to the City Operations Building and can be remotely managed via radio communication.

### 2.2.3 Preliminary Drainage Analysis

NCE performed preliminary hydrologic/hydraulic and storm water analyses per the guidelines provided in the *Carson City Drainage Manual* (Carson City 2021). The hydrologic and hydraulic analyses were completed to identify deficiencies in the storm drainpipes crossing or within the Project corridor. Peak runoff from minor and major storm events (10- and 100-year, respectively) for the watersheds contributing flows to the storm drain was calculated using the U.S. Army Corps of Engineers Hydrologic Engineering Center Hydrologic Modeling System software, Version 4.9. Full-flow capacities of the existing storm drainpipes were determined using normal depth calculations. Information regarding pipe slopes was unavailable; a slope of 0.5% was assumed for all pipe segments. Documentation and calculations for the drainage analysis are included in **Appendix B**.

The City provided NCE with a list of storm water and flooding issues in the Project area. City-identified issues and those that NCE determined from the preliminary hydrologic and hydraulic analyses are as follows:

- The 30-inch reinforced concrete pipe (RCP) at the intersection of North Carson Street and East William Street is undersized for the 10- and 100-year events.

- The 24-inch RCP under East William Street at North Roop Street is undersized for the 10- and 100-year events.
- The 18-inch corrugated metal pipe (CMP) under East William Street at North Saliman Road is undersized for the 10- and 100-year events and should be upgraded to RCP.
- The 18-inch RCPs at Rand Avenue are undersized for the 10- and 100-year events.
- During heavy rains, the gutters on Rand Avenue overflow and create large puddles at the intersection with East William Street.

#### **2.2.4 Lighting and Electrical Design Evaluation**

An investigation of the existing street lighting and recommendations for lighting and power infrastructure within the Project corridor are included as **Appendix C**. The existing lighting along the Project corridor comprises streetlights owned and operated by NV Energy. These lights are typically “nite-guard” style lights on wooden utility poles on the south side of East William Street and approximately 25-foot steel light poles with roadway cobrahead luminaires on the north side. Intersection lighting is owned and operated by Carson City, typically consisting of high-output light-emitting diode (LED) luminaires.

#### **2.2.5 Geotechnical Investigation**

Subsurface exploration was performed along the corridor on March 7, 2022. Soil samples were visually examined and classified during exploration. Soil testing was performed in accordance with ASTM standards and methodologies. The field and laboratory studies resulted in the following design and construction recommendations:

- The presence of shallow groundwater will impact subsurface installation. Dewatering will be required.
- Granular low-cohesion to cohesionless soil encountered above and below groundwater is considered susceptible to caving. Open-cut excavations will be impacted by caving and/or sloughing during construction. Undercutting of trenches within the roadway may occur.
- A majority of the on-site soil excavated is anticipated to be reusable as Class E trench backfill.

The geotechnical investigation is included as **Appendix D**.

#### **2.2.6 Pavement Structural Investigation**

NCE performed a condition assessment and structural investigation of the existing pavement along the Project route. The pavement design memorandum is included as **Appendix E**.



The existing pavement is in good-to-fair condition. Overall, the primary distress is longitudinal cracking along the paving joints. Between North Carson Street and North Roop Street, there is some raveling and weathering on the surface, and evidence of a few small previously repaired base areas.

Between North Roop Street and North Saliman Drive, the pavement is in fair condition. Transverse cracks are spaced approximately 35 to 50 feet within this segment, along with some wheel path fatigue cracking. About 5% of the pavement will need base repair and full-depth patching. The open-graded friction course (OGFC) on the pavement surface is wearing away, resulting in a rough and noisy surface. There is also raveling and weathering throughout this segment.

Between North Saliman Drive to 800 feet east of North Saliman Drive, where there is a pavement change, the pavement is in fair condition and similar to the pavement between North Saliman Drive and North Roop Street. There are longitudinal cracks forming at the paving joints and some raveling of the OGFC. Between 800 feet east of North Saliman Drive and the I-580 interchange, the pavement is in much better condition, likely from work performed during the interchange construction. The limited distress observed was primarily longitudinal cracking in the paving joints.

Eight cores and 5 soil samples were taken throughout the Project limits. The average HMA thickness varies throughout the Project and ranges from 4 inches to 12 inches. The upper layer of pavement (under the OGFC) consists of a 2-inch overlay on top of a 1-inch stress relief course, constructed in 2004. No aggregate base was encountered between North Carson Street and North Roop Street. The subgrade between North Carson Street and North Stewart Street is significantly weaker compared to the rest of the Project limits.

## 3 Alternatives Development and Analysis

### 3.1 GOALS OF ALTERNATIVES DEVELOPMENT

Each alternative aimed to fulfill the Project goals, comply with the guidelines and priorities of the City's existing plans and policies, and improve deficiencies identified in the existing conditions evaluation. In addition, two other factors were key: incorporating the results of community outreach efforts and implementing recommended traffic operation modifications, as described below.

#### 3.1.1 Community Outreach

The City conducted community outreach to ascertain the interests, hopes, and goals for the Project from the businesses and public that utilize the corridor. The overwhelming response to the outreach was positive support for implementation of the Project. Priorities identified from the outreach efforts included beautification, safety improvements, improved traffic operations, and bike and pedestrian enhancements. Specifically, users indicated they want the following: separation of bike and pedestrian traffic from automobile traffic, wider sidewalks, enhanced street lighting, protected left turns, LID and drainage improvements, driveway elimination/consolidation, improved site distance, more electric car charging stations, increased parking for Mills Park, improved pedestrian crossings, and the undergrounding of utilities.

#### 3.1.2 Traffic Operations

Each alternative developed strived to address the traffic operational goals for all modes of transportation through the corridor including auto, transit, bicycle, and pedestrian. The traffic analysis identified a number of deficiencies in the future years. To mitigate these deficiencies, as well as to make space within the corridor for other uses, each alternative incorporates the traffic modifications recommended in the traffic study.

Additional modifications, recommended due to future queues, may be incorporated during Project design. These modifications did not impact the development or evaluation of the alternatives.

Medians can be installed throughout the corridor where restricting movements is recommended in the traffic analysis, to promote traffic calming, improve safety and access management, and provide opportunities for landscaping and pedestrian refuge.

### 3.2 DEVELOPED ALTERNATIVES

Alternatives developed for each of the 4 segments included varied configurations of bicycle, pedestrian, and landscape improvements, including dedicated bike lanes, shared-use lanes, or buffered bike lanes along with varying widths of sidewalk and

landscape areas. To minimize Project costs, only alternatives with minimal ROW impacts (minor sidewalk and driveway transitions) were developed. In addition, a number of pedestrian facilities including sidewalks and a multiuse path exist throughout the corridor. Accessible facilities in good condition meeting the intent of the Project will remain. Existing landscaping throughout the corridor will remain if it does not conflict with proposed improvements.

Universal improvements included in all the alternatives include travel lane and intersection reconfigurations recommended from the traffic analysis, reduced automobile lane widths, signal modifications and interconnect improvements, transit stops, drainage and LID water quality improvements, lighting and utility improvements, and pavement reconstruction. These improvements are described in more detail in the Preferred Alternative section.

### **3.2.1 North Carson Street to North Stewart Street**

Existing conditions between North Carson Street and North Stewart Street include narrow ROW with some existing buildings located at the back of walk. There is limited existing private landscaping. There are 2 travel lanes in each direction with a 2-way left-turn lane. Within this segment, there is little opportunity to install multimodal improvements without significant ROW impacts and/or modifications to the travel lanes.

The following alternatives were developed and evaluated for the segment:

1. Bike Lane (Westbound)/Shared-use Lane (Eastbound) with Wide Sidewalk

This alternative would add a dedicated westbound bike lane and an eastbound shared-use lane. The north side of the road would have a standard-width sidewalk; the south side of the road would have a wide sidewalk with a landscape area. This alternative would eliminate 1 eastbound lane.

2. Dedicated Bike Lanes (Westbound/Eastbound)

This alternative would add dedicated bike lanes in each direction. Standard-width sidewalk would be included on the north and south sides of the road, along with a landscape area on the south side. This alternative would eliminate 1 eastbound lane.

3. Buffered Bike Lanes (Westbound/Eastbound)

This alternative would add buffered bike lanes in each direction with standard-width sidewalk on the north side of the road and a wide sidewalk on the south side of the road. This alternative would eliminate 1 eastbound lane.

### 3.2.2 North Stewart Street to North Roop Street

Existing conditions between North Stewart Street and North Roop Street include narrow ROW with some existing buildings and landscaping located at the back of walk. There are 2 travel lanes in each direction with a 2-way left-turn lane. Within this segment, there is little opportunity to install multimodal improvements without significant ROW impacts and/or modifications to the travel lanes.

The following alternatives were developed and evaluated for the segment:

1. Bike Lane (Westbound)/Shared-use Lane (Eastbound) with Wide Sidewalk

This alternative would add a dedicated westbound bike lane and an eastbound shared-use lane with minimum-width sidewalk on the north side of the road and wide sidewalk on the south side of the road.

2. Dedicated Bike Lanes (Westbound/Eastbound)

This alternative would add dedicated bike lanes in each direction with standard-width sidewalks on both sides of the road.

### 3.2.3 North Roop Street to North Saliman Road

Existing conditions between North Roop Street and North Saliman Road include wide ROW, an existing multiuse path, and some landscaping. Mills Park borders the south side of East William Street for most of this segment. There are 2 travel lanes in each direction with a 2-way left-turn lane. Within this segment, there is the opportunity to install multimodal improvements without ROW impacts and/or modifications to the travel lanes. Limitations in this segment include the required intersection configuration at North Saliman Road to maintain an acceptable LOS. Because this segment has few constraints and has ample space to include all the proposed multimodal improvements, only 1 alternative was developed.

1. Buffered Bike Lanes (Westbound/Eastbound) and Wide Sidewalks

This alternative would add buffered bike lanes in each direction and wide sidewalks on the north and south sides of the street. The existing multiuse path on the south side of the road would remain. Landscaping would be added throughout.

### 3.2.4 North Saliman Road to I-580 (Gold Dust West Way)

Existing conditions between North Saliman Road and I-580 include wide ROW, pedestrian facilities with some gaps in connectivity on the north side of the road, and existing landscaping. There are 2 travel lanes in each direction with a 2-way left-turn lane and dedicated turn pockets; the roadway transitions to 3 lanes in each direction near I-580.

Within this segment, there is the opportunity to install multimodal improvements without ROW impacts and/or modifications to the travel lanes. The existing roadway needs repurposing to provide bicycle facilities and traffic calming. Limitations in this segment include the required intersection configuration at North Saliman Road, the number of travel lanes nearing I-580 to maintain an acceptable LOS, and the extent of existing improvements.

The following alternatives were developed and evaluated for the segment:

1. Buffered Bike Lanes (Westbound/Eastbound) with Auxiliary Lane

This alternative would add standard buffered bike lanes in each direction with a wide sidewalk and landscaping on the north side of the road. On the south side of the road, a portion of the roadway between the buffered bike lane and existing sidewalk would be repurposed to an auxiliary lane to facilitate right turn movements.

2. Buffered Bike Lanes (Westbound/Eastbound) and Wide Sidewalks

This alternative would add wide buffered bike lanes in each direction and wide sidewalk and landscaping along the north side of the road. Existing sidewalk and landscaping on the south side of the road would remain.

3. Buffered Bike Lanes (Westbound/Eastbound), Wide Sidewalks with Reduced Curb-to-Curb Width

This alternative would add standard buffered bike lanes in each direction and wide sidewalks and landscaping along the north side. The north curb line would be shifted south, reducing the overall road width. Existing sidewalk and landscaping on the south side of the road would remain.

The above improvements would extend from North Saliman Road to Gold Dust West Way. East of Gold Dust West Way to I-580, only minor striping changes to facilitate the buffered bike lane are proposed.

### **3.3 ALTERNATIVES CONSIDERED BUT NOT EVALUATED**

A number of alternatives were considered but not evaluated, including roundabouts, a pedestrian bridge, retention of the eastbound lane between North Carson Street and North Stewart Street, elimination of an eastbound lane between North Stewart Street and North Roop Street, and a complete overhaul of the corridor east of North Saliman Road. These alternatives were dismissed due to significant ROW impacts, cost, impacts to traffic operations, or because the alternative did not meet the goals of the Project.

### 3.4 ALTERNATIVES ANALYSIS

Evaluation criteria were established for the alternatives analysis. The criteria included operations, costs, sustainability, and user experience. Specifically, each alternative was compared to the other alternatives with regard to the following:

- Transit operational conflicts with bicycles
- ROW acquisition requirements
- Capital cost, including construction materials and labor
- Maintenance costs
- Opportunity areas to place LID improvements
- Pedestrian safety and enjoyment with separation from automobile traffic
- Wide sidewalk widths
- Designated bicycle lanes
- Bicycle enjoyment with separation from automobile traffic
- Opportunities for beautification, including landscaping and seating
- Automobile enjoyment with separation from bicycles

The results of the evaluation were presented to City staff. Based on the analysis results and subsequent discussions regarding maintenance requirements, functionality, and Project goal fulfillment, City staff recommended a preferred alternative for each section of the corridor to the Regional Transportation Commission. A detailed cost estimate was prepared for the preferred alternative.

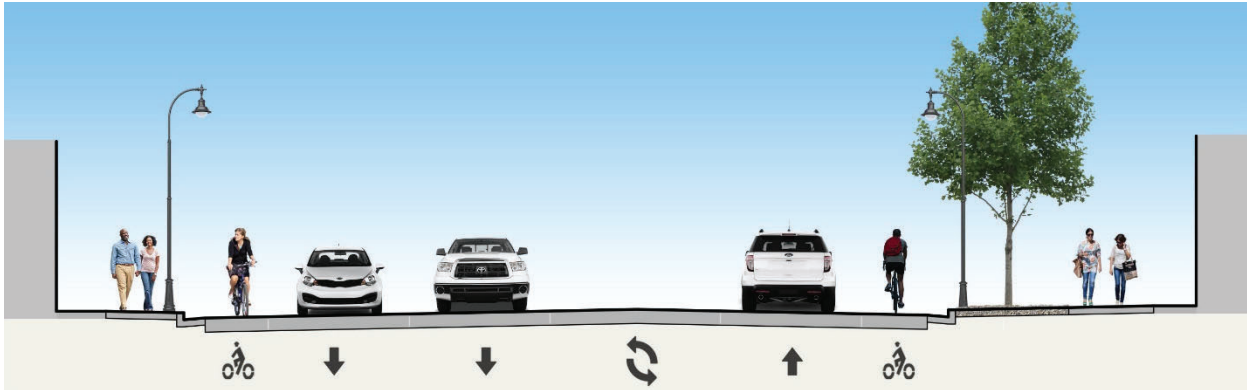
## 4 Preferred Alternative

The preferred alternative for the East William Street corridor is presented below.

### 4.1 LANE CONFIGURATION

#### 4.1.1 North Carson Street to North Stewart Street

The preferred alternative for North Carson Street to North Stewart Street is the Dedicated Bike Lane option shown in Figure 2.

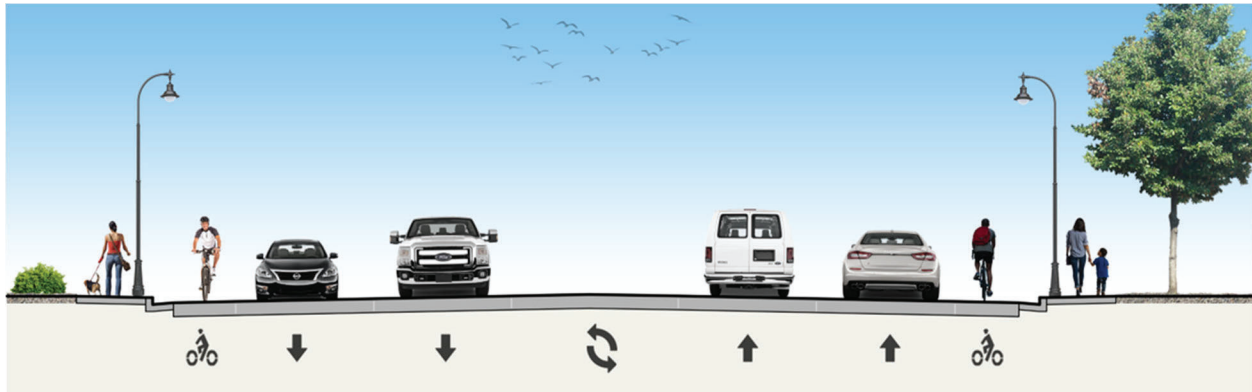


**Figure 2. Preferred Alternative for North Carson Street to North Stewart Street**

The alternative will remove 1 eastbound travel lane and provide a dedicated bike lane in each direction. A standard sidewalk will be installed on the north side of the road and a landscape area and standard sidewalk will be installed on the south side of the street.

#### 4.1.2 North Stewart Street to North Roop Street

The preferred alternative for North Stewart Street to North Roop Street is the Dedicated Bike Lane option shown in Figure 3.

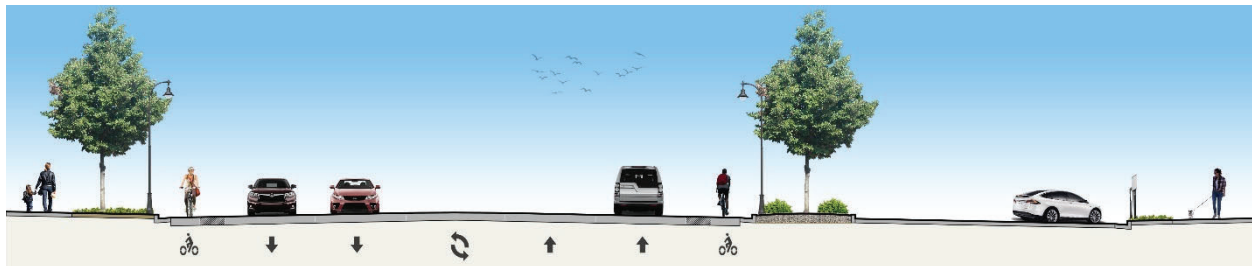


**Figure 3. Preferred Alternative for North Stewart Street to North Roop Street**

The alternative will have a dedicated bike lane in each direction and standard sidewalks on both sides. Existing landscaping will remain.

#### 4.1.3 North Roop Street to North Saliman Road

The preferred alternative for North Roop Street to North Saliman Road is the Buffered Bike Lanes option shown in Figure 4.



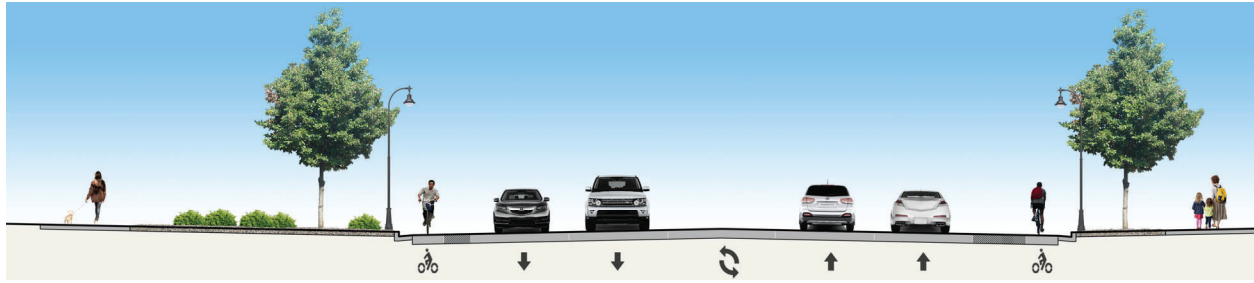
**Figure 4. Preferred Alternative for North Roop Street to North Saliman Road**

This alternative will have buffered bike lanes in each direction and wide sidewalks on the north and south sides of the street. The existing multiuse path on the south side of the road will remain. Landscaping will be added throughout. This segment will include additional parking along Mills Park and electric vehicle charging stations.

#### 4.1.4 North Saliman Road to Interstate 580

The preferred alternative for North Saliman Road to Gold Dust West Way is the Buffered Bike Lanes and Wide Sidewalks with Reduced Curb-to-Curb Width, shown in Figure 5.





**Figure 5. Preferred Alternative for North Saliman Road to Gold Dust West Way**

This alternative will have buffered bike lanes in each direction and wide sidewalks and landscaping along the north side. The north curb line will be shifted south, reducing the overall road width. Existing sidewalk and landscaping on the south side of the road will remain. From Gold Dust West Way to I-580, the roadway will be restriped to create buffered bike lanes in each direction.

#### 4.2 TRAFFIC AND SIGNAL MODIFICATIONS AND INTERCONNECT

The preferred alternative includes the traffic operation modifications described in the traffic study, as well as reduced automobile lane widths to calm traffic and provide additional space for other uses. It also includes intersection improvements such as shortened pedestrian crossings, directional pedestrian ramps, and increased pedestrian storage.

Following a field review and development of the preferred alternative roadway configuration, which conceptually defines the roadway/lane configurations and scope of curb and gutter, sidewalk, pedestrian ramp, and crosswalk locations, the scope of necessary and optional traffic signal modifications and interconnect infrastructure was determined. Necessary items are defined as those required to implement the preferred alternative in accordance with the Manual on Uniform Traffic Control Devices standards and to provide compliance with ADA and Public Right of Way Accessibility Guidelines. Optional items are defined as those elements which are beneficial to the City, the project, or the end user, but are not required to meet minimum national design standards. The findings for necessary and optional improvements at each location are listed below and illustrated in the attached Conceptual Signal Modification exhibits in **Appendix A**.

##### 4.2.1 North Carson Street / East William Street

Necessary traffic signal improvements at the North Carson Street/East William Street intersection include:

- Modify pedestrian push buttons/locations/signs/mounting heights
- Construct pedestrian ramps coordinated with pedestrian push buttons
- Relocate pull boxes to be outside of new pedestrian ramps

Optional traffic signal improvements at the North Carson Street/East William Street intersection include:

- Remove 5-section configuration protected/permissive left turn phasing and replace with 4-section flashing yellow arrow (FYA) configuration
- Install new signal poles with longer arms for FYA configuration
- Update equipment for new configuration and phasing changes
- Replace dented/damaged signal pole in southwest quadrant
- Replace non traffic rated pull boxes with traffic rated pull boxes
- Replace existing legacy street name signs
- Install new detection system
- Consider replacing westbound advanced overhead sign pole

#### 4.2.2 North Stewart Street / East William Street

Necessary traffic signal improvements at the North Stewart Street/East William Street intersection include:

- Modify pedestrian push buttons/locations/signs/mounting heights
- Relocate pedestrian push button post
- Install new signal pole with longer arm (northeast (NE) quadrant)
- Reconfigure signal head locations on NE and southeast (SE) quadrant poles for lane adjustments
- Replace mast arm sign (NE quadrant)
- Relocate pull box (SE quadrant)

Optional traffic signal improvements at the North Stewart Street/East William Street intersection include:

- Replace non traffic rated pull boxes with traffic rated pull boxes
- Replace existing legacy street name signs
- Install new detection system
- Improve crosswalk/intersection lighting

#### 4.2.3 North Roop Street / East William Street

Necessary traffic signal improvements at the North Roop Street/East William Street intersection include:

- Modify pedestrian push buttons/locations/signs/mounting heights
- Construct new pedestrian push button posts
- Reconfigure signal head locations on northwest (NW) and SE quadrant poles for lane adjustments
- Replace mast arm sign (NW quadrant and SE quadrant)
- Relocate pull box (NE quadrant)
- Replace or relocate signal pole on NE quadrant

Optional traffic signal improvements at the North Roop Street/East William Street intersection include:

- Replace non traffic rated pull boxes with traffic rated pull boxes
- Replace existing legacy street name signs
- Install new detection system
- Consider replacing signal poles on NW and SE quadrants due to outdated specifications

#### 4.2.4 North Saliman Road / East William Street

Necessary traffic signal improvements at the North Saliman Road/East William Street intersection include:

- Modify pedestrian push buttons/locations/signs/mounting heights
- Construct new pedestrian push button post(s)
- Replace signal pole on southwest (SW) quadrant for longer arm
- Reset signal pole (SE quadrant)
- Reconfigure signal heads/locations on SW and SE quadrant poles for lane adjustments/FYA
- Remove mast arm sign (SE quadrant pole)
- Relocate pull box (NE quadrant)
- Update equipment for new configuration and phasing changes
- Replace/relocate signal pole on NW quadrant

Optional traffic signal improvements at the North Saliman Road/East William Street intersection include:

- Replace non traffic rated pull boxes with traffic rated pull boxes
- Replace existing legacy street name signs
- Install new detection system
- Improve crosswalk/intersection lighting
- Replace signal pole on NE quadrant due to outdated specifications

#### 4.2.5 Gold Dust West Way / East William Street

Necessary traffic signal improvements at the Gold Dust West Way/East William Street intersection include:

- Modify pedestrian push buttons/locations/signs/mounting heights
- Reconfigure signal heads for northbound/southbound FYA
- Update equipment for new configuration and phasing changes

Optional traffic signal improvements at the Gold Dust West Way/East William Street intersection include:

- Replace aging internally illuminated street name sign on SE quadrant pole
- Install new detection system

#### 4.2.6 Interconnect Conduit for Future Fiber Optic Communications

We understand communications to the signal systems are currently provided via radio. Necessary improvements include replacing the four NDOT count stations along the corridor. Optional improvements for future fiber optic interconnect include:

- Construct interconnect conduit or multi-duct with tracer wire and pull ropes from Carson Street to Saliman Road with other utility work (joint trench)
- Construct pull boxes/splice vaults as appropriate for the conduit installation limits

#### 4.3 TRANSIT STOPS

The Jump Around Carson public transit system may be expanded to provide eastbound service along East William Street from North Carson Street to the I-580 interchange and westbound service from the I-580 interchange to North Roop Street. Potential locations for eastbound stops include near Plaza Street, North Valleys Street, Mills Park, North Saliman Road, and Gold Dust West Way. Potential westbound stop locations include near Russell Way, North Saliman Road, and Mills Park. Each transit stop may include a bus pullout with loading zone. Bus pullouts would be located outside of bicycle and travel lanes to minimize traffic delays.

#### 4.4 DRAINAGE IMPROVEMENTS

To address the capacity and drainage deficiencies identified by the City and the drainage analysis, the following proposed drainage improvements have been identified and are included in the preferred alternative. The figures showing the alignment of the improvements are included in **Appendix B**.

1. Upsize the storm drainpipe crossing North Carson Street at East William Street and replace the associated manholes. Replace the existing CMP storm drain along the south side of East William Street to the North Stewart Street intersection with a RCP (Figure B.2).
2. Add a catch basin and associated manhole at the intersection of North Fall Street at East William Street. A new storm drainpipe will connect these improvements to a new manhole, tying into the existing storm drain crossing at the North Stewart Street intersection (Figure B.2).
3. Add a new catch basin and associated manhole at the intersection of Anderson Street at East William Street. A new storm drainpipe will connect these improvements to the existing storm drain at the North Roop Street intersection (Figure B.3).
4. Add a new catch basin, manholes, and storm drainpipes to convey flows along the westbound gutter of East William Street from a location east of

Roop Street to an existing storm drain crossing that drains to a channel within Mills Park (Figure B.4).

5. Add new facilities to drain the curb and gutter proposed for sections of East William Street between North Roop Street and Saliman Road, including catch basins, manholes, and storm drainpipes. This new section of storm drain will tie into the proposed storm drain facilities included in the City's Saliman and Mills Park Drainage Improvement Project, which is currently at the 30% design phase (Figure B.4, Future Storm Drain By Others). Since both projects are in the initial phases of planning and design, NCE anticipates coordination of drainage improvements in this area between the City staff and NCE as both projects move forward with design.
6. Replace the storm drain crossing just east of North Saliman Road with a RCP (Figure B.5).

#### **4.5 LID WATER QUALITY IMPROVEMENTS**

To improve the quality of runoff and drainage conditions in the Project area in frequent storm runoff events, storm water improvement/LID features such as bioswales are included in the preferred alternative. The bioswales will be incorporated into new and existing landscaped areas along the shoulders of the road between North Carson Street and North Stewart Street and on the north side of the roadway from North Roop Street to North Saliman Road. Because East William Street will be superelevated to the north between North Roop Street and North Saliman Road, bioswales located in the northern shoulder have the potential to treat runoff from the entire ROW width. These bioswales will divert, detain, treat, and infiltrate a portion of runoff generated on the roadway. The facilities include curb cuts or grated inlets to divert runoff, a planted depressed surface area to contain flow, an engineered soil profile to filter pollutants, and a subsurface gravel volume for additional storage. The bioswales will either be connected to the new and existing storm drain systems with underdrains or be allowed to overflow back onto the street, depending on their location and proximity to the storm drain.

An analysis was completed to determine the volume-based treatment facilities that would comply with Section 2.1.1.3, "Volume-Based Water Quality Control Design," of the *Carson City Drainage Manual* (Carson City 2021) for the impervious portions of the ROW from North Carson Street to North Stewart Street and from North Roop Street to North Saliman Road. The water quality volume for this section of the Project area per the Manual would be approximately 8,300 cubic feet.

The proposed treatment facilities would be classified as "volume based" per the *Carson City Drainage Manual*. A surface area of 5,000 square feet of bioswale is included in the preferred alternative cost estimate and could be incorporated into the landscaped areas described above.

## 4.6 LIGHTING AND ELECTRICAL

### 4.6.1 Lighting Infrastructure

The type of proposed lighting included in the preferred alternative varies per segment. Lighting similar to the aesthetic recently installed on the South Carson Street project is recommended for North Carson Street to North Stewart Street. These lights are spaced approximately 90 feet apart. They are mounted at 12 feet with a post-top-lantern-style luminaire, installed approximately 30 inches from back-of-curb, as space allows for ADA clear path. Lights will be installed along both sides of the roadway in this section.

Cobrahead luminaires are proposed from North Stewart Street to I-580, using a style similar to the recent South Carson Street project with steel poles and roadway luminaires. These poles follow Nevada Department of Transportation specifications for Type 7 (single head) and Type 14 (dual head) poles, consisting of a 28.5-foot-high pole with a 15-foot mounting arm, at a 34-foot/4-inch luminaire mounting height. Typical poles will be a single head Type 7 pole, with dual head Type 14 poles installed along Mills Park to provide additional lighting along the park pathway and parking areas.

Spacing of the light facilities will depend on the final scope of the lighting system. If lights are installed along both sides of the roadway, spacing can be approximately 275 feet. However, if lighting is only installed on the south side, the spacing will need to be reduced to approximately 175 feet. Lights will be installed at back of sidewalk, or outside of the clear zone where sidewalks are offset from the edge of roadway. Type 7 and Type 14 poles will be breakaway poles. Exact distribution and spacing will be determined by photometric calculations based on the streetscape layout. Photometric performance will be designed to meet the Illuminating Engineering Society (IES)-recommended practice guide for roadway lighting; RP-8-18 "Roadway Lighting" (IES 2018).

### 4.6.2 Power Infrastructure

The new street lighting will be powered from new metered electric services installed in the Project ROW. A service pedestal can typically serve an approximately 1000-foot radius while maintaining an acceptable voltage drop. Conductors will be designed to limit voltage drop to a maximum of 5% as recommended by the National Electrical Code. Branch circuit conductors will be installed in 2-inch (minimum) polyvinyl chloride conduit. Typical proposed services are 100 amp, 240 volt, single phase.

All downtown style light poles will have a ground-fault circuit interrupter (receptacle installed for decorative string lights. Lights and receptacles will be controlled by a photocell switch for automatic dusk-to-dawn operation.

A minimum of 2 Level-2 electric vehicle charging stations will be provided in the Mills Park parking area, with service pedestals located nearby.

## 4.7 UTILITIES

### 4.7.1 Sewer Improvements

The sewer main line within the Project corridor will be replaced from the western portion of the intersection with North Carson Street to just west of the intersection with North Roop Street. The main line connections will also be replaced going north on North Carson and North Plaza Streets to the limits of construction. The main line situated in the northern shoulder of East William Street will be replaced from west of the Saliman intersection to Rand Avenue along with northern connections to the main lines in North Saliman Road and Rand Avenue. The 10-inch concrete sewer pipe located in the north shoulder of East William Street between Rand Avenue and Humboldt Lane may be replaced, depending on the proposed surface improvements in this area and the Project budget. A plan view of the recommended sewer improvements is included in **Appendix F**.

### 4.7.2 Water Improvements

A new main water line will be installed within the Project corridor from the North Carson Street intersection to Rand Avenue with 3 short stretches where it will be connected to the existing line: just west of the intersection with North Stewart Street, through the intersection with North Roop Street, and west of the intersection with North Saliman Road. The new water line will include new valves, new hydrants, and new connections to intersecting lines to the limits of construction. A plan view of the recommended water improvements is included in **Appendix F**.

## 4.8 PAVEMENT DESIGN AND REHABILITATION OPTIONS

The pavement design for this Project was developed using a combination of the *Flexible Pavement Design Manual* (Regional Transportation Commission of Washoe County 2007) and the flexible pavement section of the *AASHTO Guide for Design of Pavement Structures* (1993). The recommended pavement design options are shown in **Table 1**.

**Table 1. Pavement Design Options**

From	To	Mill & Overlay	Remove/Replace Existing AC	Reconstruction
Carson	Stewart	Not Feasible	Not Feasible	6" AC on 11" AB
Stewart	Roop	Not Feasible	Not Feasible	6" AC on 6" AB
Roop	Saliman	1" Mill & 2" Overlay	---	---
Saliman	Gold Dust	1" Mill & 2" Overlay	---	---

AC = asphalt concrete; AB = aggregate base

## 4.9 COST ESTIMATE

A preliminary engineer's opinion of probable cost was prepared for the preferred alternative. Unit costs are based on recent Contractor bids within the Carson City and Northern Nevada area. Unit costs obtained from bids received prior to recent months were escalated by approximately 30% to reflect the current bidding market due to inflation.

The following assumptions were used in the cost estimate:

- Roadway, concrete, landscaping, waterline, drainage improvements, and LID water quality improvement quantities are based on the improvements as described in the Preferred Alternative section of this report.
- Sewer improvement quantities do not include replacement of the sewer main line between Rand Avenue and Humboldt Way.
- Bioswale unit costs are based on bids from public projects in Northern California.
- Signal modifications costs are based on including necessary signal improvements and interconnect.
- Lighting costs are based on including downtown-area lighting from North Carson Street to North Roop Street and lighting on both sides of the roadway from North Roop Street to Gold Dust West Way.



**Table 2** shows the cost estimate for each segment, including a 30% contingency. The cost estimate summary is included in **Appendix G**.

**Table 2. Preferred Alternative Cost Estimate**

<b>Item</b>	<b>Cost</b>
Roadway Improvements	\$3,801,000
Concrete Improvements	\$2,280,000
Landscape Improvements	\$644,000
Water Improvements	\$2,213,000
Sewer Improvements	\$727,000
Storm Drain Improvements	\$1,079,000
LID Storm Water Improvements	\$650,000
Utility Adjustments	\$300,000
Signage and Striping	\$280,000
Traffic Signal Modifications	\$557,000
Interconnect	\$370,000
Lighting	\$1,490,000
Mobilization/Demobilization (5%)	\$720,000
Traffic Control (7%)	\$1,008,000
Contingency (30%)	\$4,318,000
<b>Total</b>	<b>\$20,437,000</b>

## 5 References

- American Association of State Highway and Transportation Officials (AASHTO). 1993. *AASHTO Guide for Design of Pavement Structures*. AASHTO: Washington D.C.
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- Illuminating Engineering Society (IES) 2018. *Recommended Practice for Design and Maintenance of Roadway and Parking Facility (RP-8-18)*.
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**Distribution and Quality Control**  
**Design Alternatives Report**  
**East William Complete Streets Project**  
**Carson City, Nevada**

June 2022

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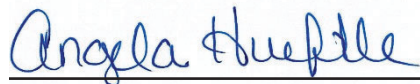
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Quality Control Reviewer:

A handwritten signature in blue ink that reads "Angela Hueftle".

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Angela Hueftle, PE  
Principal

NCE Project No. 953.10.25