Southeast Carson City
Area Drainage Master Plan

Prepared By:

Kimley»Horn

April 2024

GEOFFREY S. BROWNELL
Exp. 12/30/24
CIVIL
No. 020306
STATE OF NEVADA
PROFESSIONAL ENGINEER

6/21/24

In Association With:

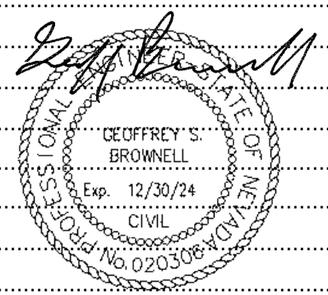
CARSON CITY PUBLIC WORKS

CARSON WATER SUBCONSERVANCY DISTRICT

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

Table of Contents

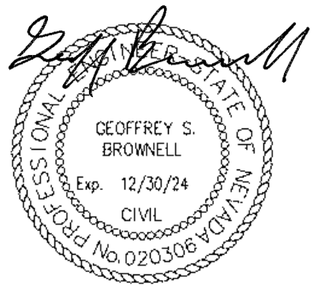


6/21/24

List of Figures

List of Tables

Appendix



6/21/24

1 Purpose and Project Area

The purpose for the Southeast Carson City Area Drainage Master Plan (SECC ADMP) is to define the existing flood hazards for the southeastern region of Carson City, Nevada, and develop a proposed drainage mitigation plan to reduce flooding through this portion of the City. The study area is located in Carson City, Nevada, and is approximately bounded by Interstate 580 to the west, Prison Hill to the east, Clear Creek to the south, and Fairview Drive to the north. The study contains two watersheds. The first watershed is generally bounded by Interstate 580 to the west, Prison Hill to the east, Fairview Drive to the north, and Clearview Drive to the south. The second watershed is generally bounded by the prison complex to the west, the Carson River and Golden Eagle Lane to the east and south respectively and Prison Hill to the north. The Vicinity, Location and Aerial Maps can be seen in Figure 1, Figure 2, and Figure 3, respectively.

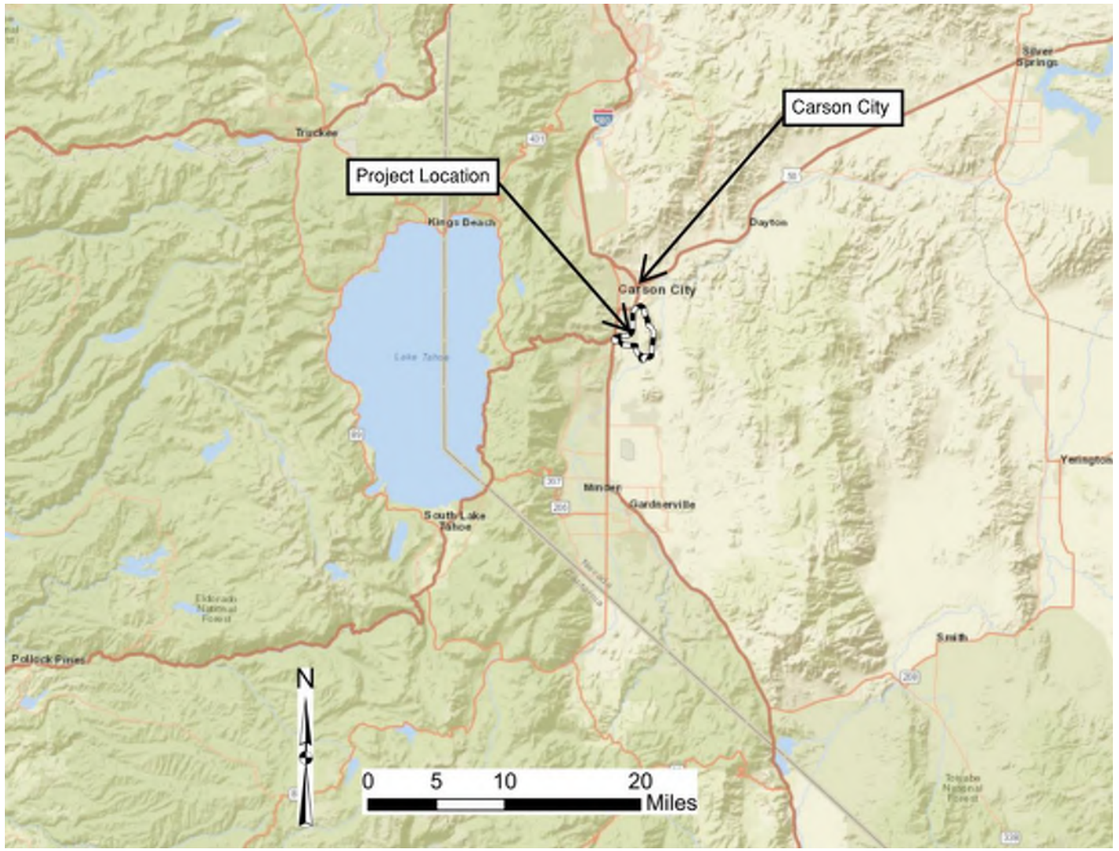


Figure 1: Vicinity Map

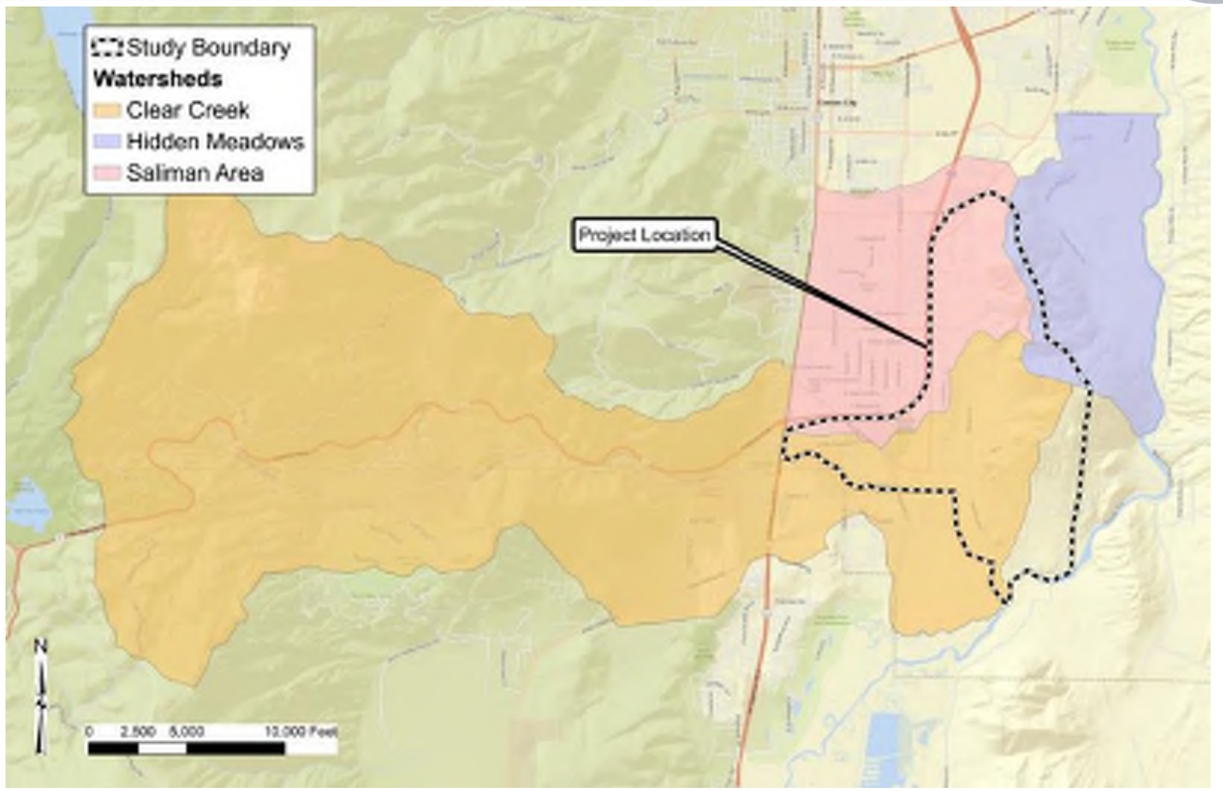
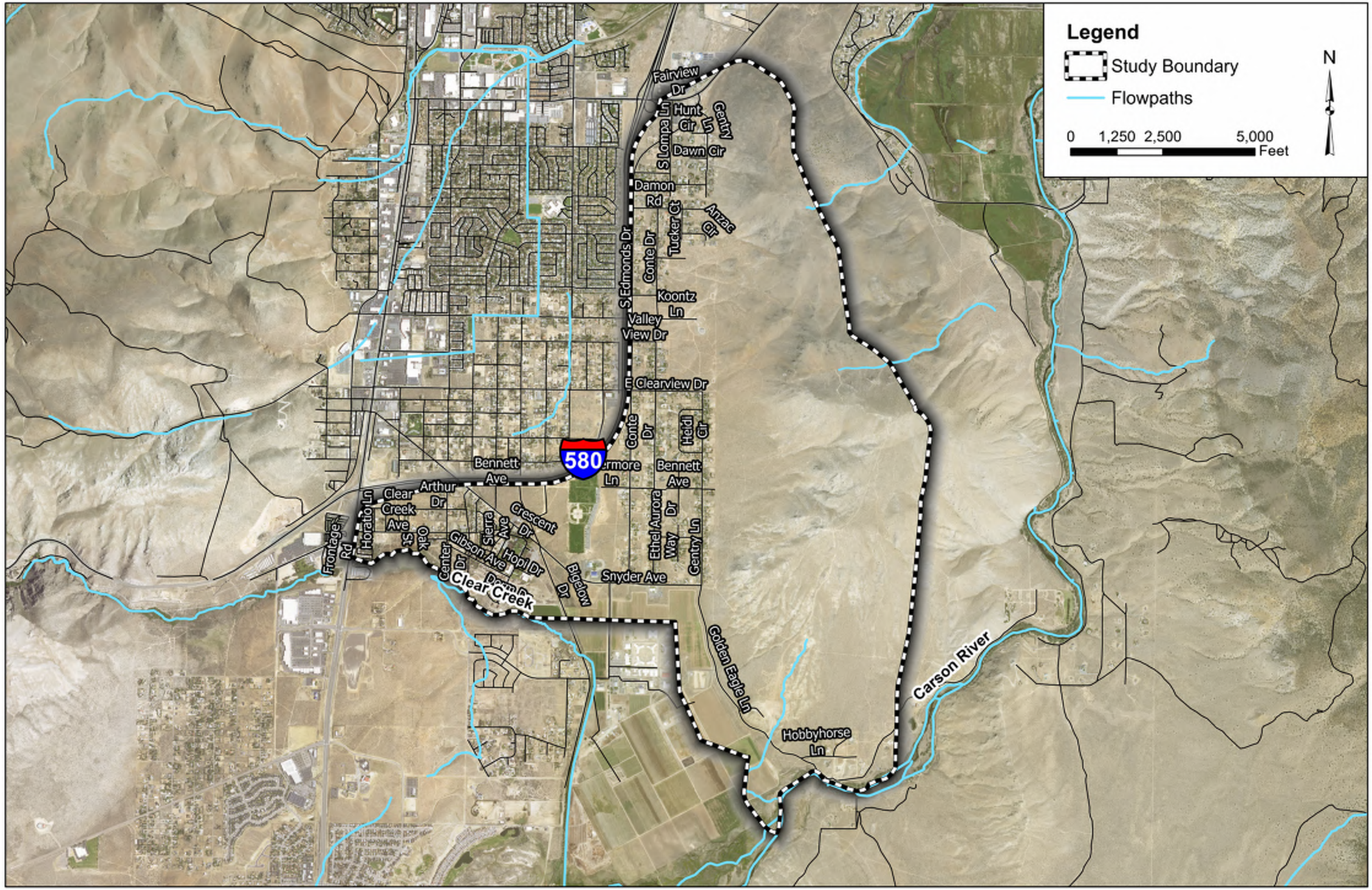


Figure 2: Location Map



Kimley»Horn
© 2023 KIMLEY-HORN AND ASSOCIATES, INC.
Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

NO	REVISION	BY	DATE	APP'D

SCALE: AS SHOWN
DESIGNED BY: CTH
DRAWN BY: GBK
CHECKED BY: GAB
DATE: 09/2023

South East Carson City ADMP
Aerial Map

PROJECT NO.
291411702

DRAWING NAME
AERIAL MAP

FIGURE 3

1.1 Goals

The SECC ADMP project goals are to define the existing flood hazards for the southeast portion of Carson City using detailed two-dimensional surface modeling coupled with current hydrologic and hydraulic parameters and current methodologies consistent with Carson City standards. Once the existing conditions were defined, proposed mitigation projects were developed to reduce flooding impacts and continue to build resiliency within the watershed. Public input was collected from two public meetings and was a major input to the existing flood hazards determination and mitigation projects development. The proposed mitigation projects were developed into design concepts with a corresponding engineer's estimate of probable cost for future planning purposes. The overarching goals for the SECC ADMP are as follows:

- Generate detailed two-dimensional hydrologic and hydraulic flood models defining the existing conditions
- Determine flood hazard areas based on the model results and public input
- Identify proposed mitigation solutions

2 Project History

2.1 Previous Studies

There are two studies associated with this area:

- Cardno completed a restudy in order to remap and update the flood hazard mapping of the *Voltaire Canyon and Saliman Road Tributaries in the Voltaire and Saliman Floodplain Restudy and Remapping* (Cardno, 2019).
- Cardno (Stantec) is also in the process of completing a study to update the flood hazard mapping of the *Clear Creek Floodplain Restudy* (Cardno, n.d.)

2.2 FEMA Floodplain Delineation for Clear Creek

Clear Creek and the Carson River are FEMA delineated floodplains. The Clear Creek floodplain has a defined floodway along with Zone AE and shaded Zone X and is delineated along the southern boundary of the study. Clear Creek flows southeast where it joins the Carson River which also has a defined floodway along with Zone AE and shaded Zone X. A Zone A floodplain is present from just north of Hudson Drive and runs south through the study area where it ties into the Clear Creek floodplain. Figure 4 shows the limits of the FEMA Special Flood Hazard Areas (SFHA) within the study boundary.

The Voltaire Canyon Creek Letter of Map Revision (LOMR) was submitted and approved by FEMA (FEMA Case No. 20-09-1029P) and is now effective as of November 28, 2021. The LOMR modified the Zone AH just south of I-580 within the project boundary.

A LOMR for Clear Creek is currently in progress. This LOMR will modify Clear Creek along the southern boundary of the study area.

3 Survey and Terrain Data

The terrain data required for this study was downloaded from USGS National Topographic Map (USGS, n.d.). USGS captured LiDAR for this portion of Carson City in 2017. The LiDAR data was downloaded in LAZ format. A bare ground elevation terrain dataset was then generated from the LAZ file. The bare ground terrain dataset was then used for the hydraulic analyses. The USGS LiDAR data used the following coordinate systems.

USGS LiDAR Coordinate System (USGS and DAS, 2017)

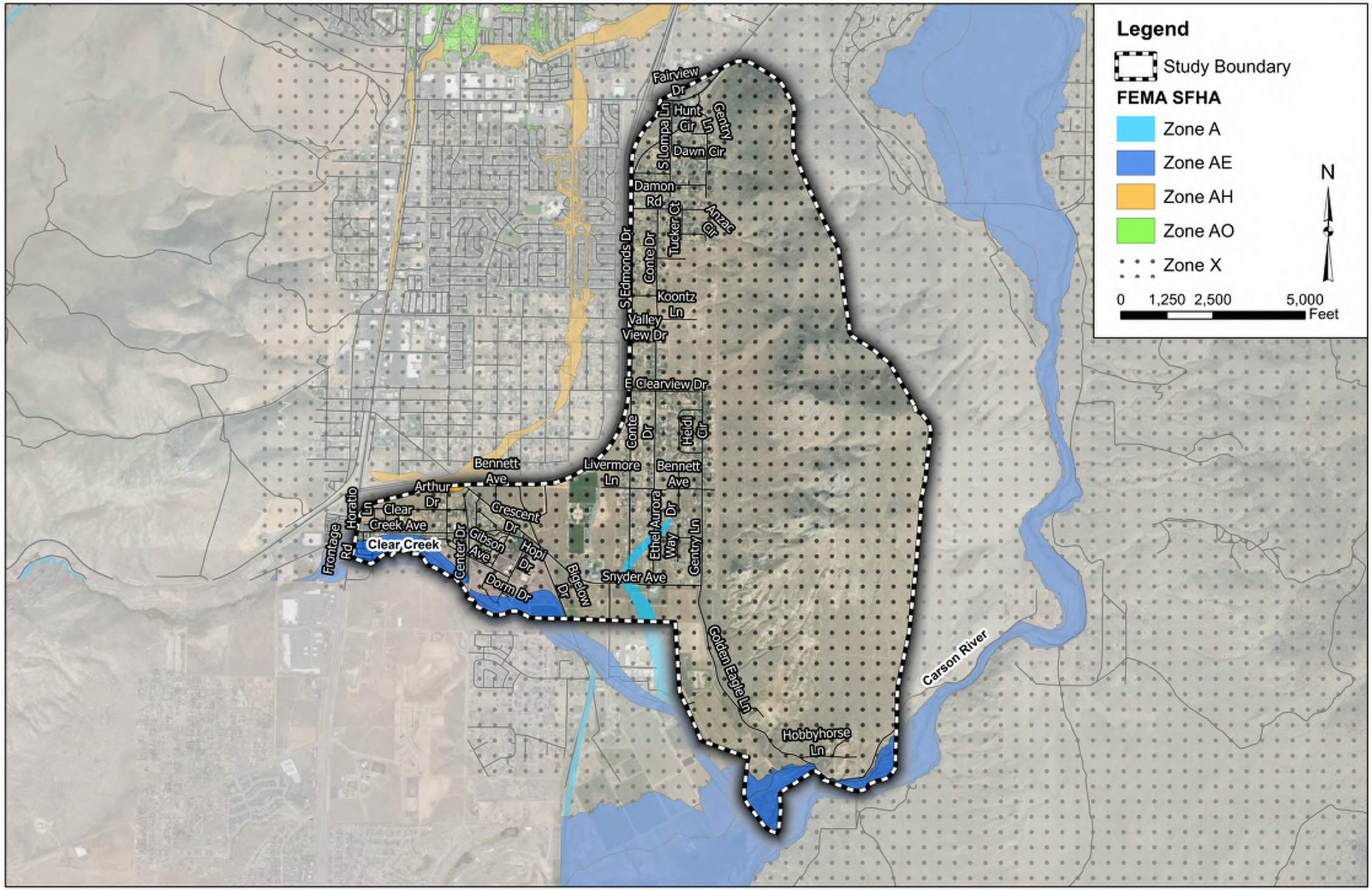
- Coordinate System: Universal Transverse Mercator 11 North
- Horizontal Datum: North American Datum of 1983 of 2011
- Vertical Datum: North American Vertical Datum of 1988
- Units: Meters

The bare ground terrain dataset was then converted to match the project coordinate systems:

Project Coordinate System:

- Horizontal Datum: North American Datum of 1983 (NAD83)
- Vertical Datum: North American Vertical Datum of 1988 (NAVD88)
- Units: Feet

The USGS Survey Report excerpts have been provided in Appendix A. A topographic map is provided in Figure 5.



Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

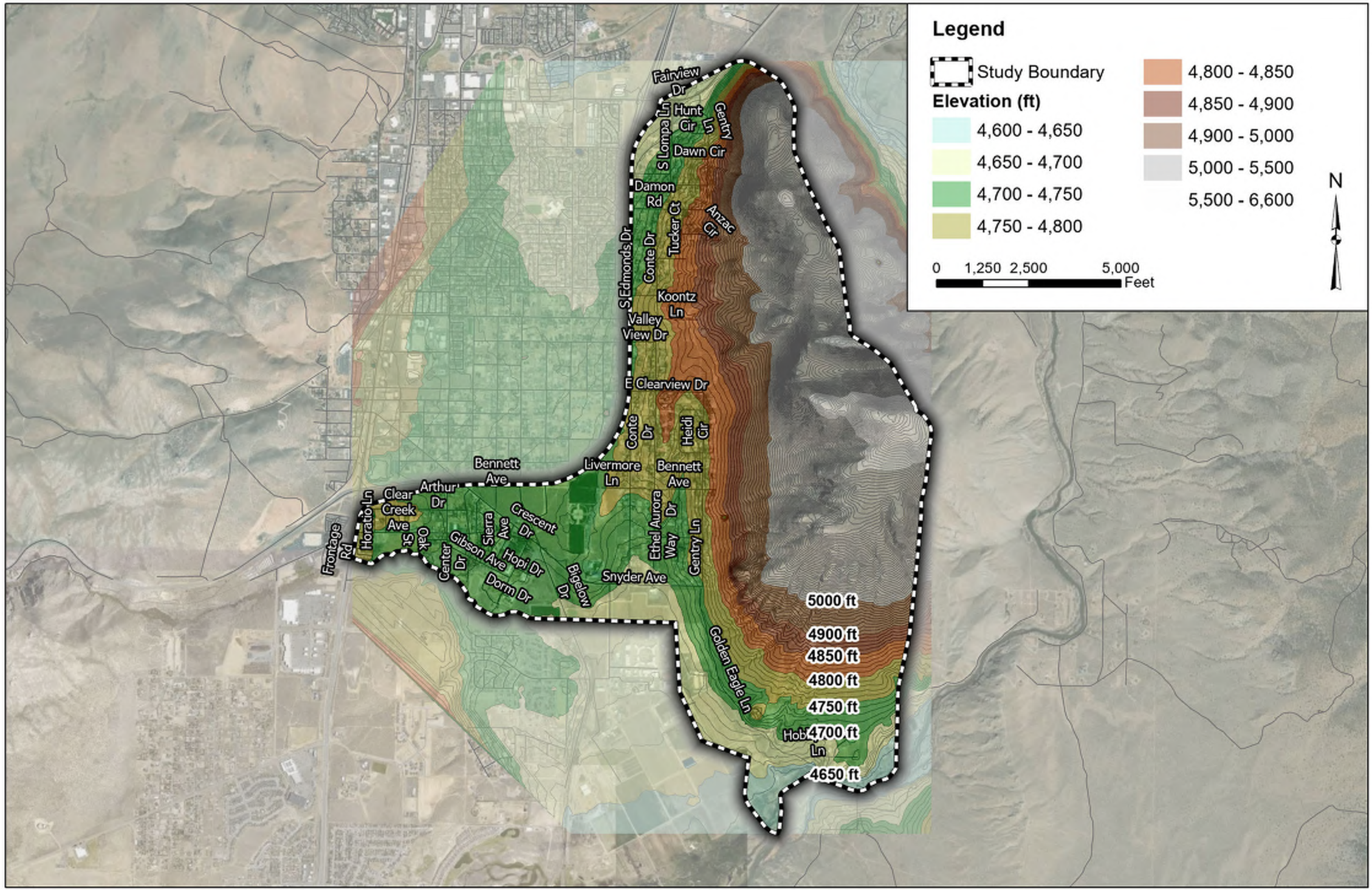
SCALE(V): 1"=2000'
SCALE(H): NONE
DESIGNED BY: CTH
DRAWN BY: DBK
CHECKED BY: GSB
DATE: 06/2023

South East Carson City ADMP
FEMA SFHA

PROJECT NO.
291417002

DRAWING NAME
FEMA SFHA

FIGURE 4



Kimley»Horn

South East Carson City ADMP
Topographic Map

PROJECT NO.
291417002

DRAWING NAME
TOPOGRAPHY MAP

FIGURE 5

4 Hydrology

The study boundary encompasses three of the City's watersheds. The watersheds are shown in Figure 6. Two of the watersheds, Clear Creek and the Saliman Area, contribute flow to the study area. The Hidden Meadows watershed flows east and out of the study area.

4.1 Methodology

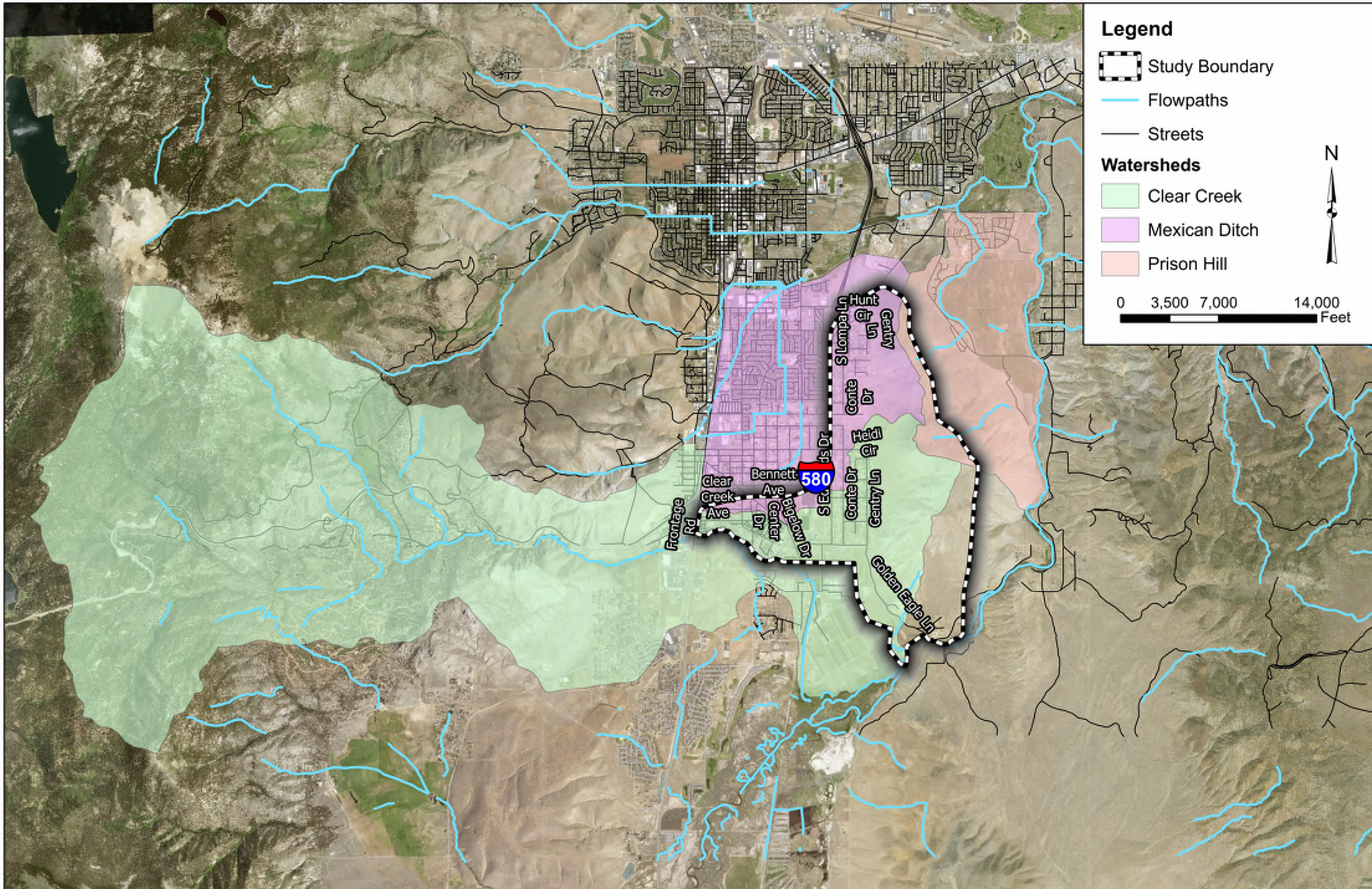
A FLO-2D model (FLO-2D, 2023) Build No 20.07.22 was created for the combined watersheds. The modeled area covers all contributing areas for the watershed with no inflows; therefore, no inflow hydrographs were included. The FLO-2D model uses rainfall on the grid to account for runoff generated in the project area.

4.2 Rainfall and Storm Duration

NOAA14 rainfall was used and spatially varied in the FLO-2D model. The controlling storm duration is 24-hours per the Carson City Restudy Hydrology (HDR, 2010). Table 1 shows the maximum and minimum rainfall that was used in the FLO-2D model input. Figure 7 shows the rainfall spatial variation over the study boundary for the 100-year, 24-hour model. SCS Type II rainfall distribution was applied in the FLO-2D model domain.

Table 1: NOAA14 Rainfall Data

Storm Event	Rainfall Minimum (inches)	Rainfall Maximum (inches)
10-year, 24-hour	2.104	2.343
25-year, 24-hour	2.522	2.809
100-year, 24-hour	3.192	3.562



South East Carson City ADMP
Watershed Boundaries

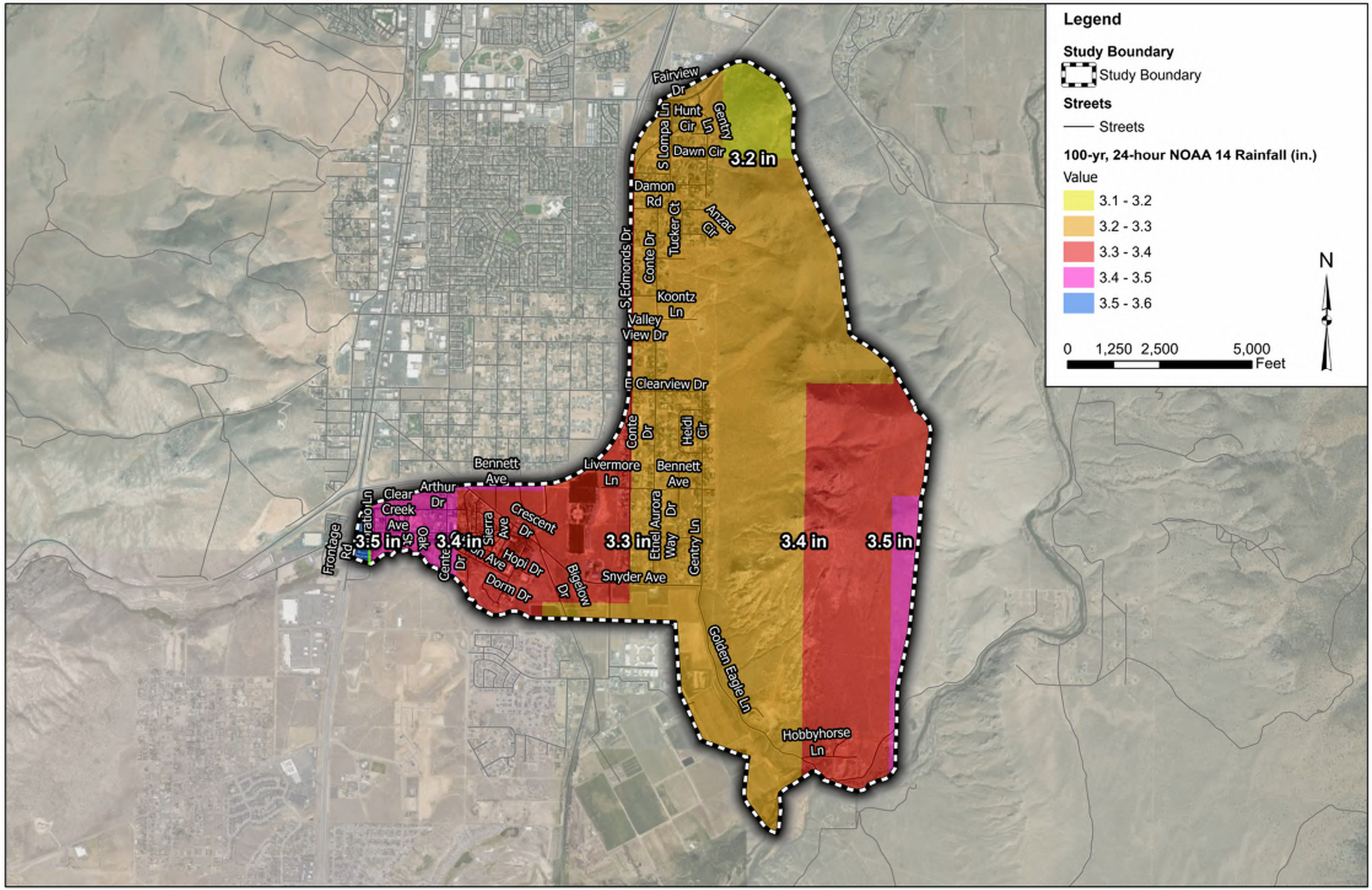
SCALE(H): 1"=6500'
SCALE(V): NONE
DESIGNED BY: CTH
DRAWN BY: DBK
CHECKED BY: GSB
DATE: 06/2023

Kimley»Horn

Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

NO. REVISION BY DATE APPR.

PROJECT NO. 291417002
DRAWING NAME WATERSHED
FIGURE 6



Kimley»Horn

South East Carson City ADMP
100-year, 24-hour Rainfall Depths

PROJECT NO. 29141700Z

DRAWING NAME 100 YEAR, 24 HOUR

FIGURE 7

4.3 Soils

Soils data was extracted from the Natural Resource Conservation Service (NRCS) Soil Survey Geographic (SSURGO) data base for Carson City Area, Nevada (NRCS, 2022). The FLO-2D model uses the Green-Ampt Method to compute rainfall losses. Green-Ampt parameters including the hydraulic conductivity (XKSAT), wetting front capillary suction (PSIF), volumetric soil moisture deficit for normal (DTHETA normal) conditions were assigned per the NRCS as shown in Table 2 and spatially in Figure 8.

Table 2: Soil Parameters

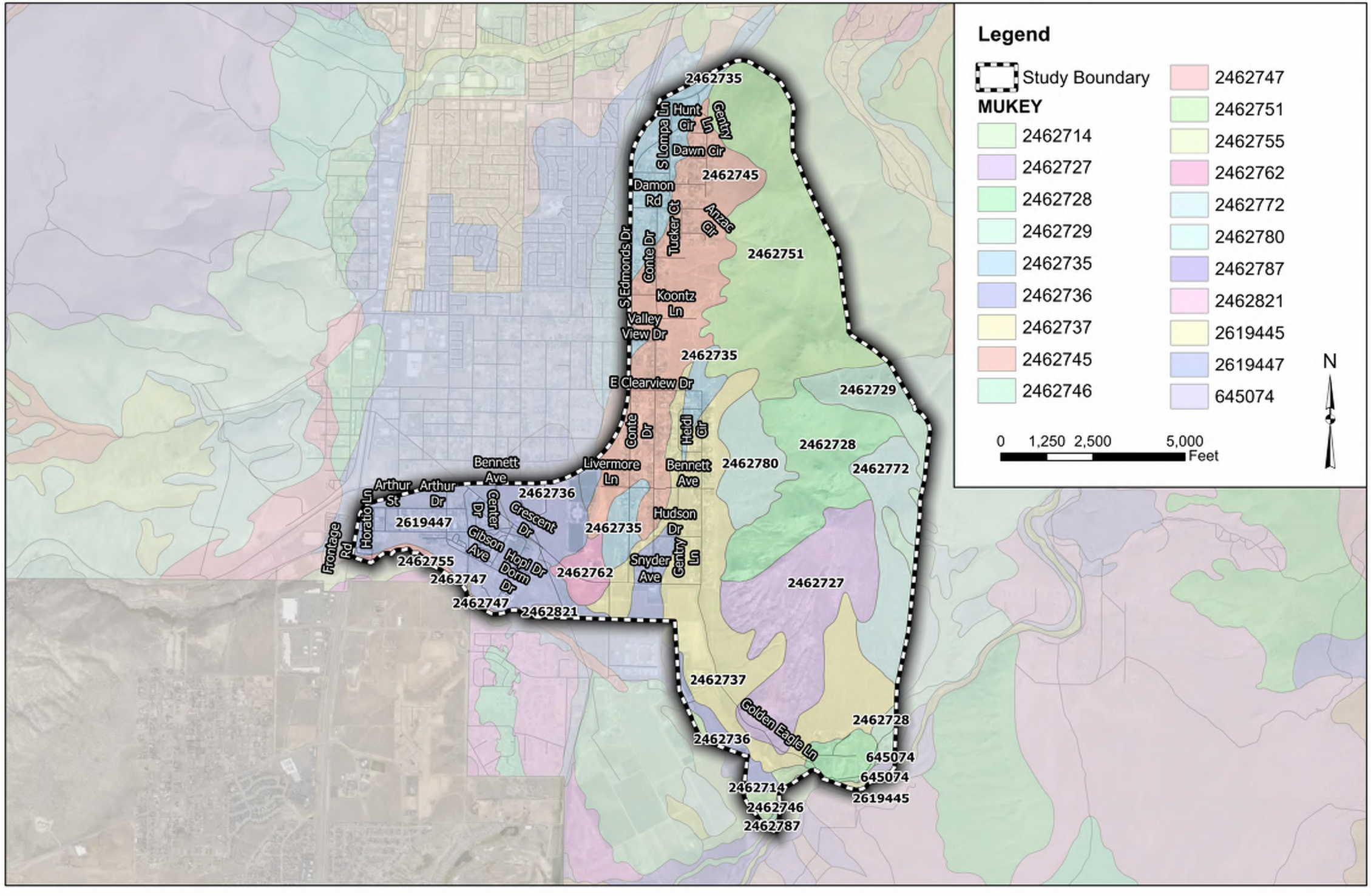
MUKEY	Soil Name	XKSAT (in/hr)	PSIF (Inches)	DTHETA
2462714	Bishop loam, saline	0.10	3.50	0.25
2462727	Glenbrook gravelly loamy coarse sand, 4 to 8 percent slopes	0.48	2.40	0.30
2462728	Glenbrook-Rock outcrop complex, 8 to 30 percent slopes, loamy sand	0.48	2.40	0.30
2462729	Glenbrook-Rock outcrop complex, 30 to 50 percent slopes, loamy sand	0.48	2.40	0.30
2462735	Haybourne sandy loam, 0 to 2 percent slopes	0.16	4.30	0.25
2462736	Haybourne sandy loam, 4 to 8 percent slopes	0.16	4.30	0.25
2462737	Haybourne gravelly sandy loam, 2 to 8 percent slopes	0.16	4.30	0.25
2462745	Indiano variant gravelly fine sandy loam, 4 to 15 percent slopes	0.16	4.30	0.25
2462746	Jubilee coarse sandy loam, 0 to 2 percent slopes	0.16	4.30	0.25
2462747	Jubilee sandy loam, 2 to 4 percent slopes	0.16	4.30	0.25
2462751	Koontz-Sutro complex, 30 to 50 percent slopes, Loam	0.16	3.50	0.25
2462755	Mottsville loamy coarse sand, 2 to 4 percent slopes	0.48	2.40	0.30
2462762	Prey fine sandy loam, gravelly substratum, 4 to 8 percent slopes	0.16	4.30	0.25
2462772	Tarloc gravelly coarse sandy loam, 4 to 8 percent slopes	0.16	4.30	0.25
2462780	Toll gravelly loamy sand, 0 to 15 percent slopes	0.48	2.40	0.30
2462787	Voltaire silty clay loam, saline	0.02	10.80	0.15
2619445	Riverwash-Water complex, sand	0.48	2.40	0.30
2619447	Surpass gravelly sandy loam, 0 to 2 percent slopes	0.16	4.30	0.25
645074	Carwalker fine sand	0.48	2.40	0.30

4.4 Land Use

Land use coverages were obtained from Carson City Open GIS Portal. Shapefiles were downloaded and verified with recent aerial imagery. This file was used to develop hydrology parameters for FLO-2D for initial abstraction (IA) and effective impervious areas (RTIMP). Table 3 shows the effective RTIMP and IA associated with the land use type. The land use map is provided in Figure 9.

Table 3: Land Use Parameters

Land use Type	IA (inches)	Effective RTIMP (%)
Commercial	0.1	80
Building	0.05	95
High Density Residential (8-36 du/ac)	0.25	45
Industrial	0.15	55
Low Density Residential (0.2-3 du/ac or 5-0.33 ac/du)	0.3	15
Medium Density Residential (3-8 du/ac)	0.25	30
Agricultural	0.5	0
Parks & Recreation	0.2	0
Rangeland	0.35	0
Roadway	0.05	95
Water	0	0



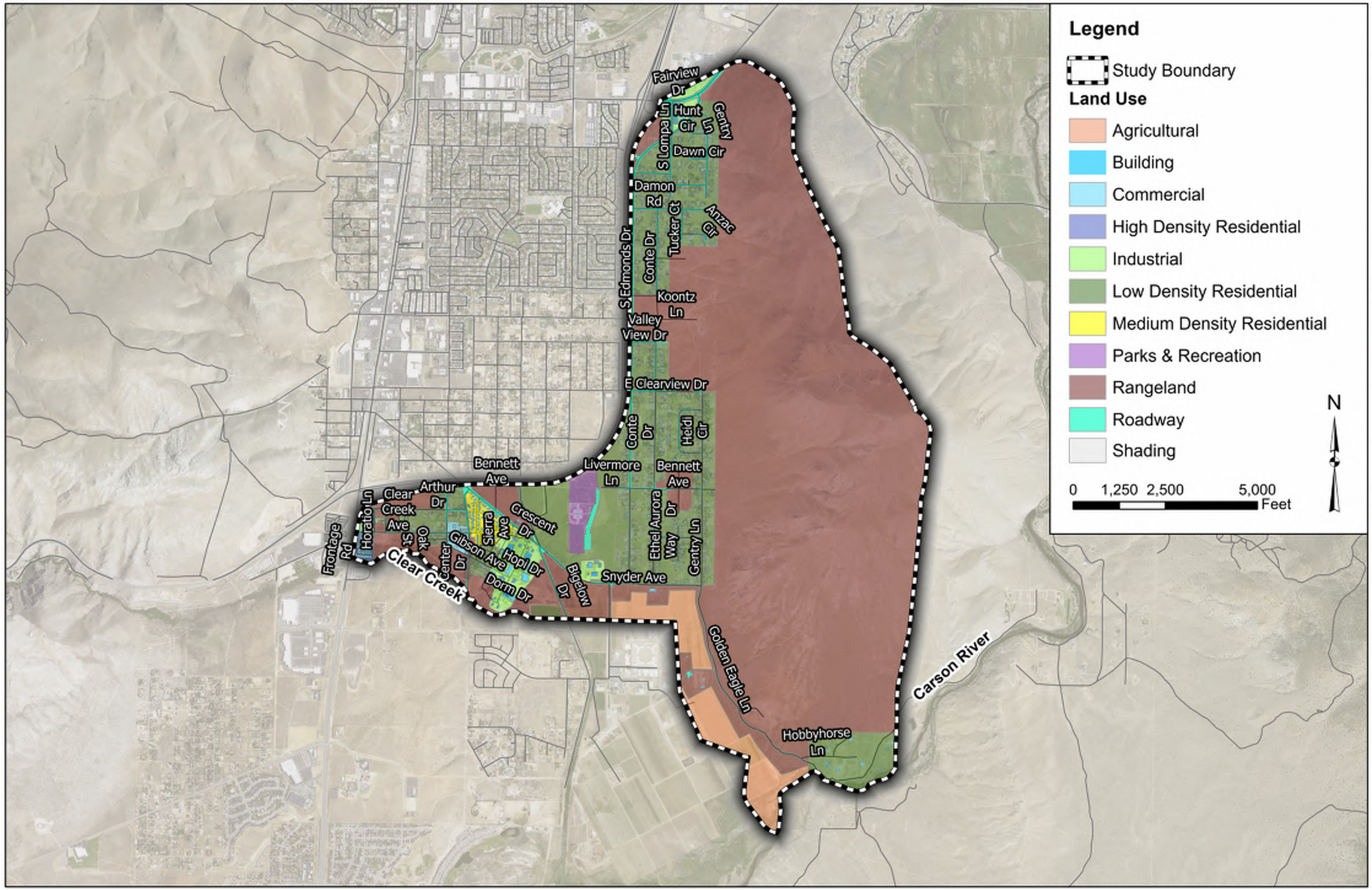
Kimley»Horn

South East Carson City ADMP
NRCS Soil Database

PROJECT NO.
291417002

DRAWING NAME
SOIL DATABASE

FIGURE 8



Kimley»Horn

Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

NO	REVISION	BY	DATE	APP'D

SCALE(H): 1"=2500'
SCALE(V): NONE
DESIGNED BY: CTH
DRAWN BY: DBK
CHECKED BY: GSB
DATE: 09/2023

South East Carson City ADMP
Land Use

PROJECT NO.
291417002

DRAWING NAME
LANDUSE

FIGURE 9

4.5 Hydrology Verification

There are no stream gages within the FLO-2D model domain, but the rainfall loss percentages were reviewed for the FLO-2D model domain and are in line with what would be expected for this urban portion of the watershed.

Instead of verifying runoff at certain points in the watershed, rainfall excess percentages were reviewed for the FLO-2D model verification. Rainfall excess is the portion of rainfall which becomes runoff within the watershed, the remainder of the rainfall is loss due to infiltration and storage. Table 4 shows the total rainfall volume, rainfall loss, and rainfall excess percentages. The rainfall losses and rainfall excesses are within the anticipated ranges for urban watersheds in this region with similar hydrology, land use, and soil conditions. It should be noted that the intent of this project is to identify and mitigate flood hazards. While specific data is not available for more robust calibration, this verification results in model results that adequately define potential flood hazards.

Table 4: FLO-2D Rainfall Loss and Excess Percentages

Storm Event	Total Rainfall Volume (AC-ft)	Total Rainfall Loss Volume (AC-ft)	Rainfall Excess Percentage (%)	Rainfall Loss Percentage (%)
10-year, 24-hour	588	465	21%	79%
25-year, 24-hour	705	517	27%	73%
100-year, 24-hour	892	597	33%	67%

5 Hydraulics

5.1 Methodology

FLO-2D was used for the hydraulic modeling. Due to the size of structures and the proclivity for clogging, culverts and storm drain were not modeled within the FLO-2D study domain for this study.

5.2 FLO-2D Model Controls

The model simulation time for the 24-hour storm duration was set to 30 hours. The timestep is 0.1 hours. The courant number is 0.6 and a TOLER value of 0.1 ft. The shallow n-value is 0.20.

5.3 Grid Size

The FLO-2D model used 15’ x 15’ grids for the study area. This grid size was determined based on wash and street widths.

5.4 Manning’s n-Values

Manning’s n-values were derived from the land use file and were assigned spatially in the FLO-2D model. The n-values were assigned based on typical values for two-dimensional models in and around Carson City. A shallow n-value of 0.2 was assigned globally. Figure 10 shows the Manning’s n-values assigned in the FLO-2D model.

Table 5: FLO-2D Floodplain n-Values

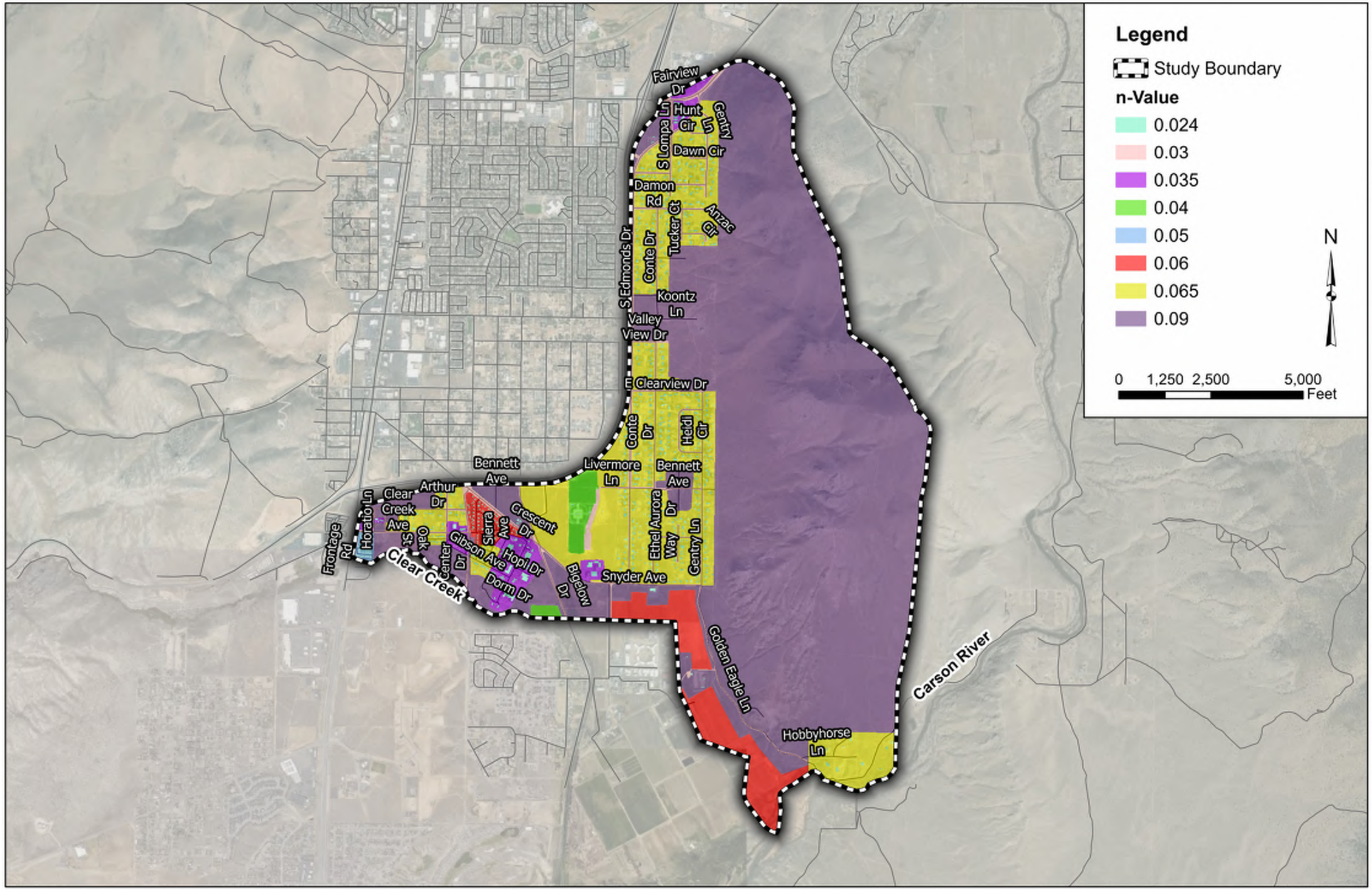
Land Use Type	FLO-2D Floodplain n-Values
Commercial	0.035
Building	0.024
High Density Residential (8-36 du/ac)	0.05
Industrial	0.035
Low Density Residential (0.2-3 du/ac or 5-0.33 ac/du)	0.065
Medium Density Residential (3-8 du/ac)	0.06
Agricultural	0.06
Parks & Recreation	0.04
Rangeland	0.09
Roadway	0.03
Water	0.04

5.5 Boundary Conditions

Outflow nodes were place along the downstream boundary of the FLO-2D model. Outflow nodes remove the flow off the grid using normal depth calculations.

5.6 Results

The FLO-2D model results are provided in the figures Figure 11 through Figure 16. These results show the max flow depths and velocities for each storm event (10-, 25-, and 100-year).



Kimley»Horn

Engineering, Planning and Environmental Consultants

7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

NO	BY	DATE	REVISION

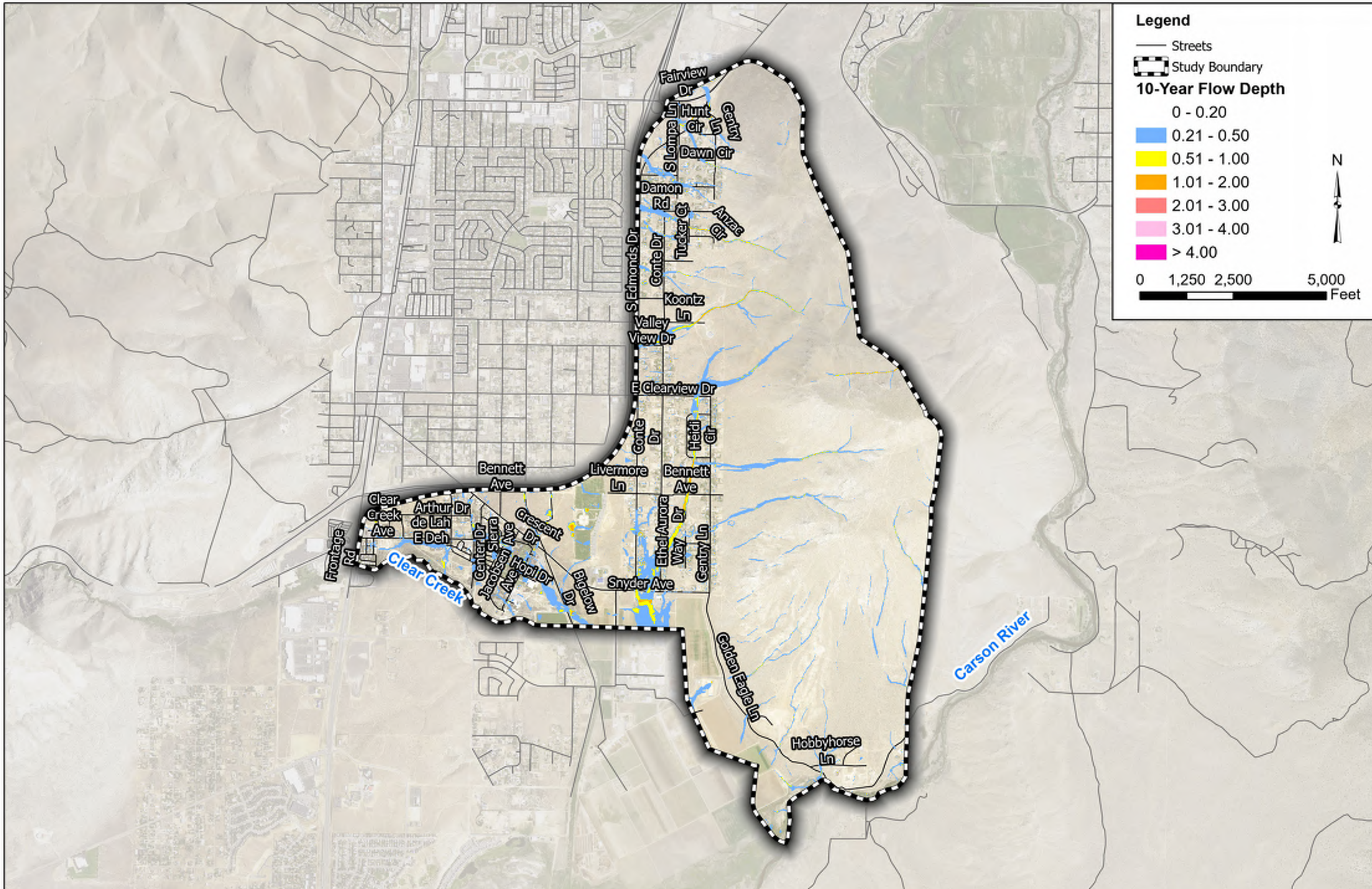
SCALE: AS SHOWN
DESIGNED BY: CTH
DRAWN BY: DBK
CHECKED BY: GSB
DATE: 06/2023

South East Carson City ADMP Manning's Values

PROJECT NO.
20141760

DRAWING NAME
N VALUES

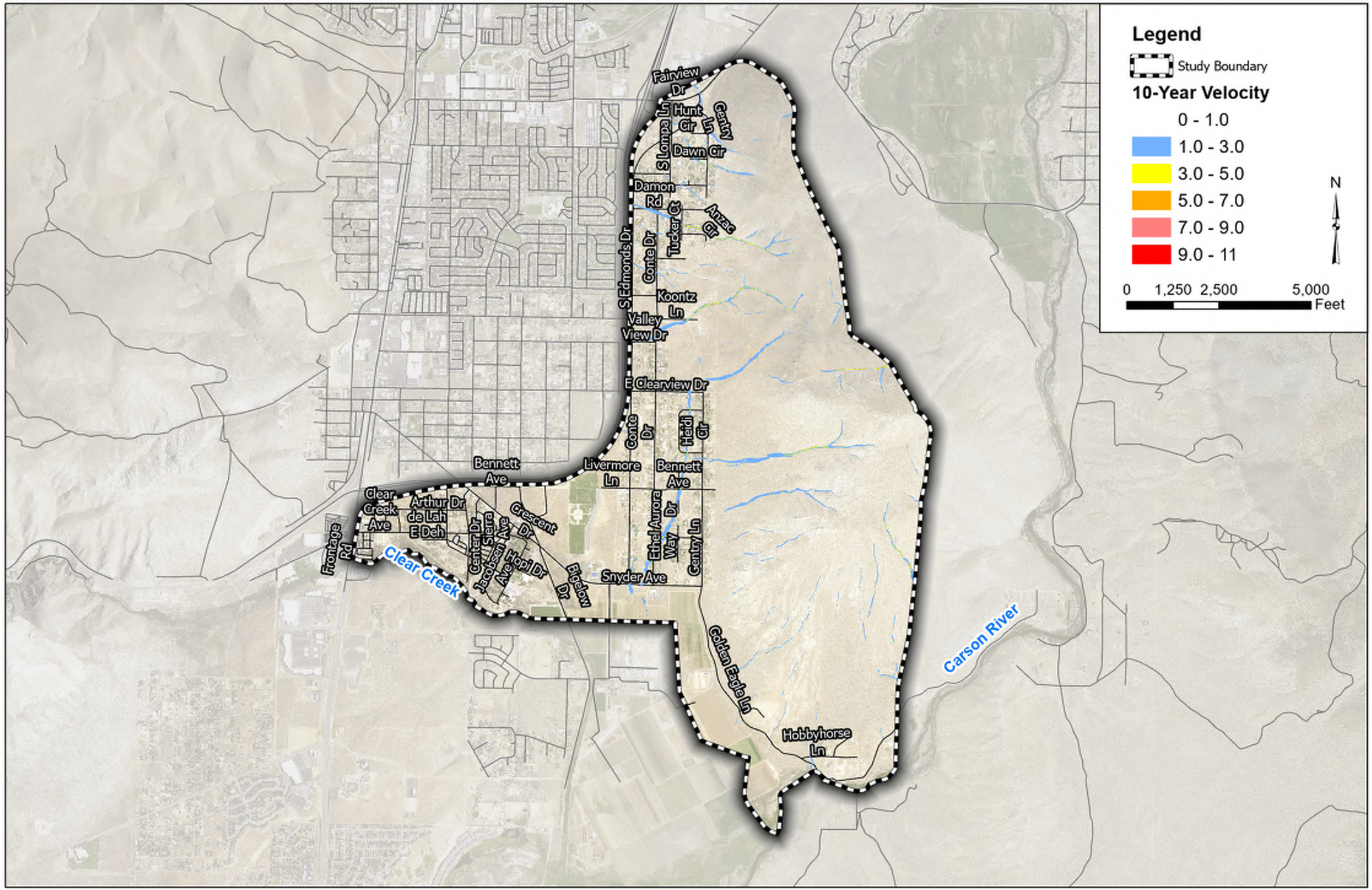
FIGURE 10


Legend
Streets
Study Boundary
10-Year Flow Depth
0 - 0.20
0.21 - 0.50
0.51 - 1.00
1.01 - 2.00
2.01 - 3.00
3.01 - 4.00
> 4.00
0 1,250 2,500 5,000
Feet
N
Fairview Dr
Hunt Cir
Gentry Ln
S Lompa Ln
Dawn Cir
Damon Rd
Tucker Ct
Anzac Cir
S Edmonds Dr
Conte Dr
Koontz Ln
Valley View Dr
E Clearview Dr
Heidi Cir
Bennett Ave
Livermore Ln
Clear Creek Ave
Arthur Dr
de Lah
E Deh
Crescent Dr
Center Dr
Sierra
Jacobsen Ave
Ave
Hopi Dr
Frontage Rd
Clear Creek
Bigelow Dr
Ethel Aurora Way
Snyder Ave
Golden Eagle Ln
Hobbyhorse Ln
Carson River

Kimley»Horn

Southeast Carson City ADMP
Exisiting10-Year Flow Depths

FIGURE 11



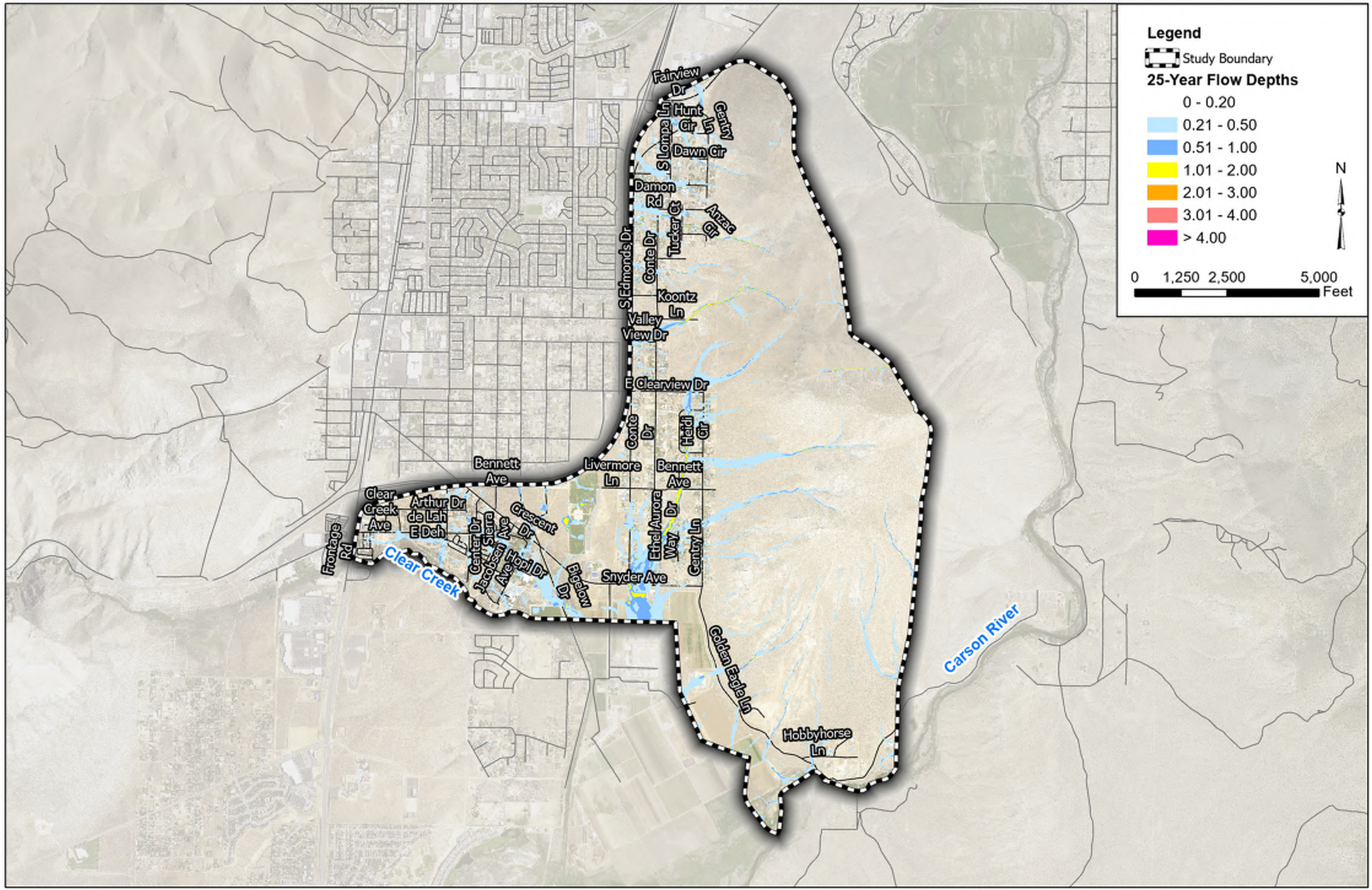
Kimley»Horn

South East Carson City ADMP
Exisiting 10-Year Velocities

PROJECT NO.
291417002

DRAWING NAME
EX. 10YR VELOCITIES

FIGURE 12



Kimley»Horn

3740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

NO	REVISION	BY	DATE	APVR

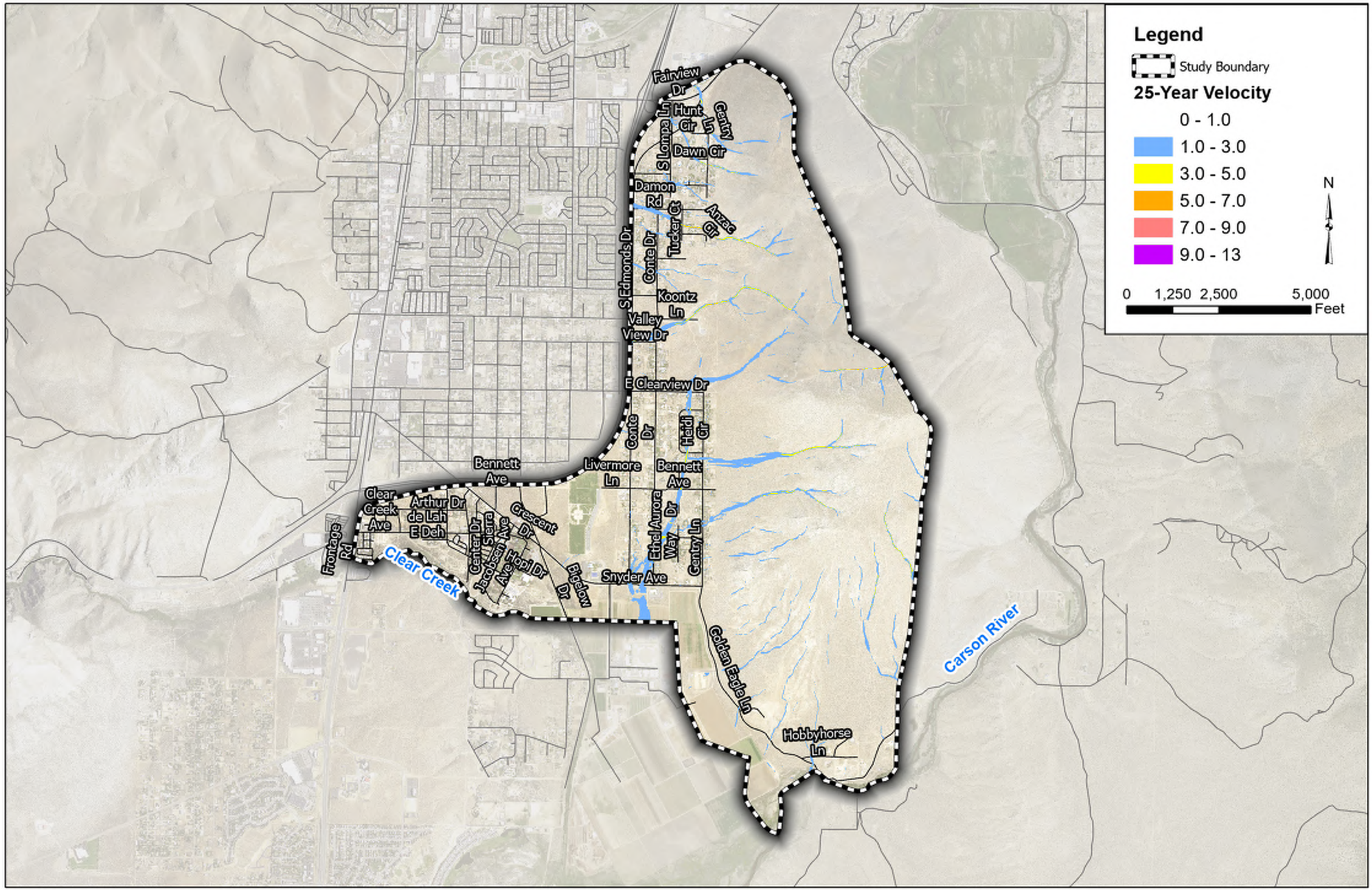
SCALE(H):1"=2000'
SCALE(V):NONE
DESIGNED BY: CTH
DRAWN BY: DBH
CHECKED BY: GSB
DATE: 08/2023

South East Carson City ADMP
Existing 25-Year Flow Depths

PROJECT NO.
291417002

DRAWING NAME
EX 25 YR FLOW DEPTHS

FIGURE 13



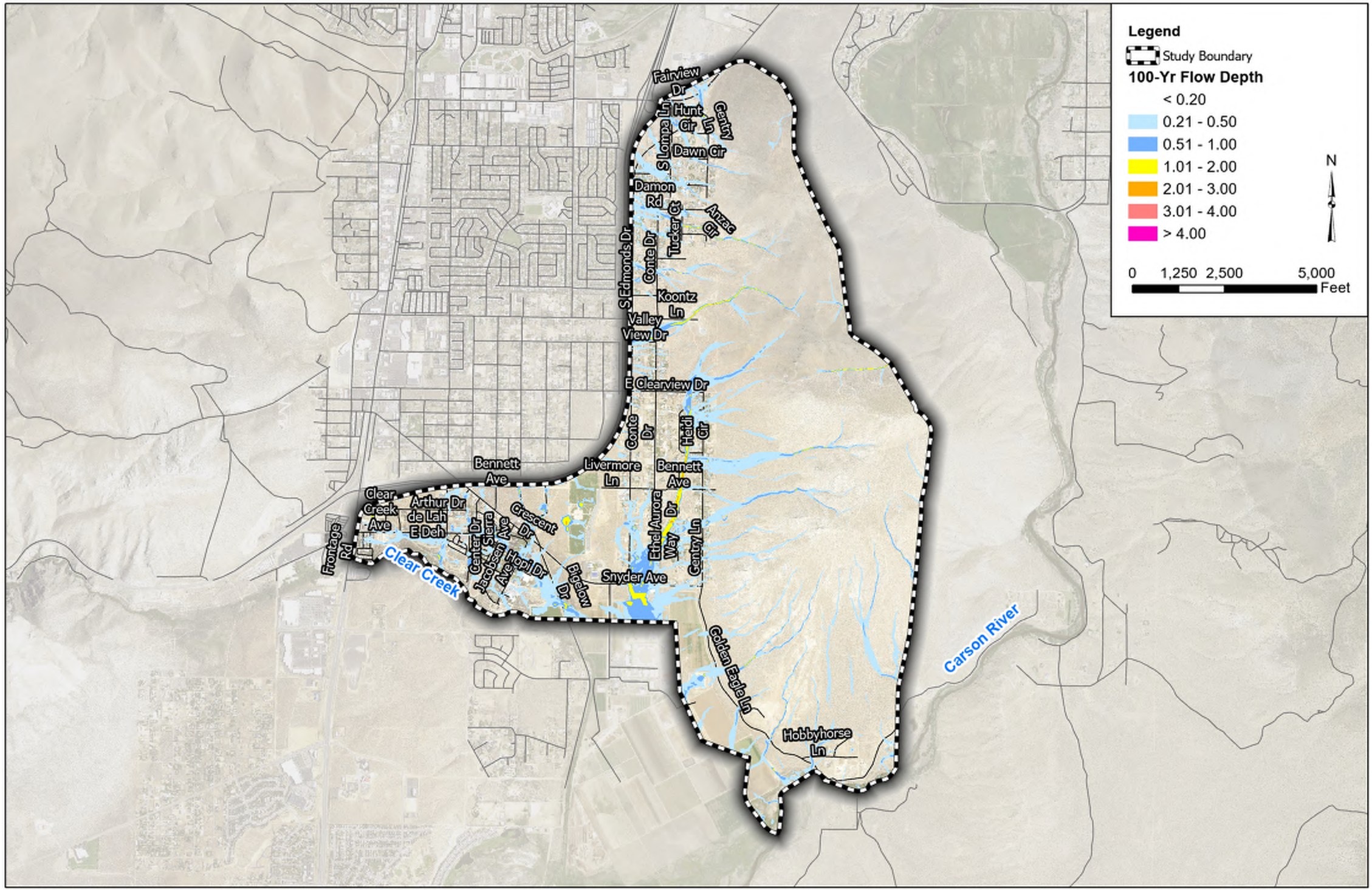
Kimley»Horn

South East Carson City ADMP
Exisiting 25-Year Velocities

PROJECT NO.
29147002

DRAWING NAME
EX 25YR VELOCITIES

FIGURE 14



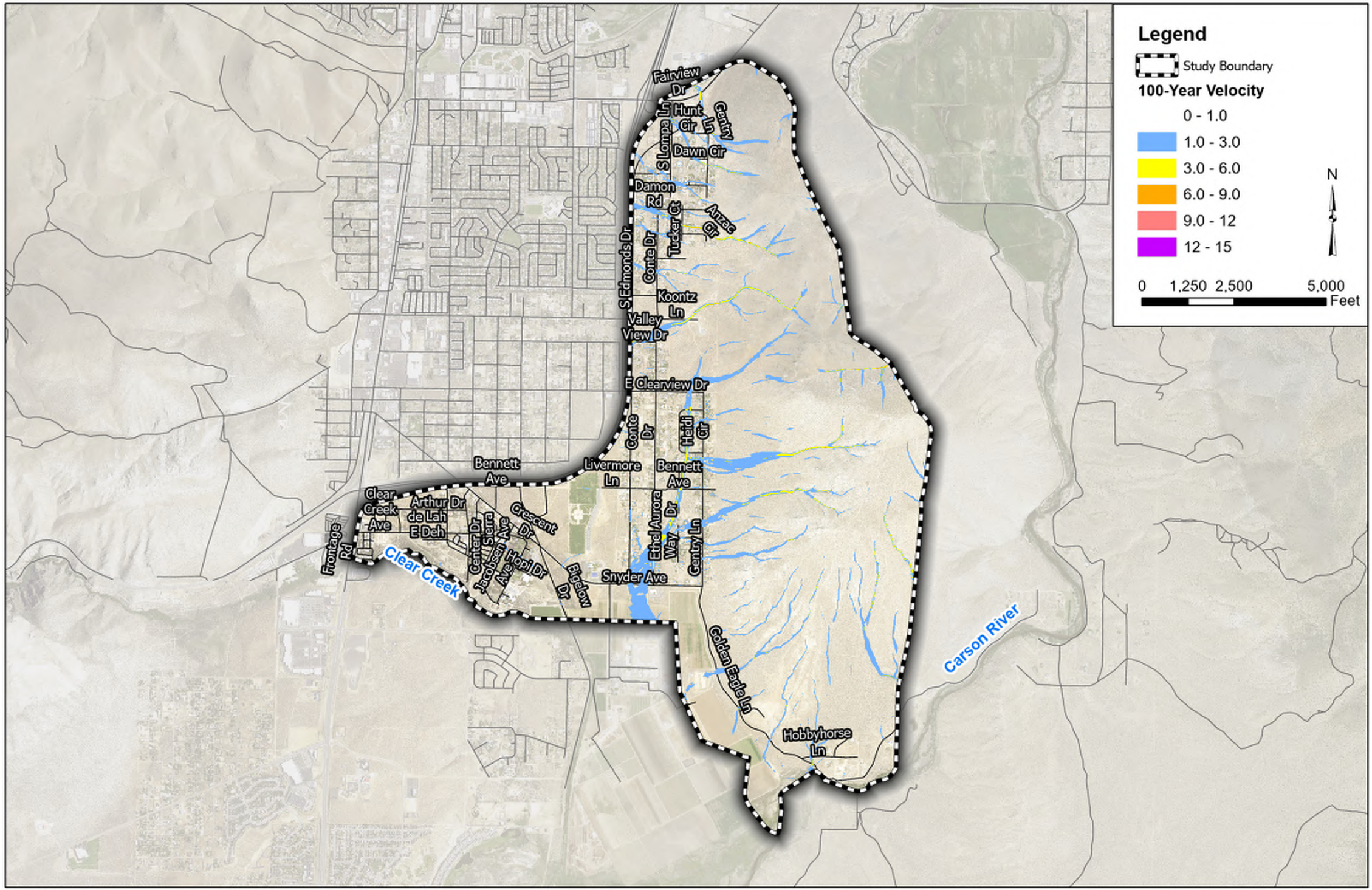
Kimley»Horn

South East Carson City ADMP
Existing 100-Year Flow Depths

PROJECT NO.
091417002

DRAWING NAME
EX 100-YR FLOW DEPTHS

FIGURE 15



Kimley»Horn

South East Carson City ADMP
Exisiting100-Year Velocities

PROJECT NO.
291417002

DRAWING NAME
EX. 100-YR VELOCITIES

FIGURE 16

6 Area Drainage Master Plan

6.1 Overview

The area drainage master plan focused on evaluating potential mitigation solutions to reduce the risk of flooding within the study boundary from a regional standpoint. Runoff from Prison Hill and runoff from the Stewart Area are the two main sources of flooding and are the main contributors to the flood prone areas identified in this study. The City provided information on historical flooding and maintenance to identify potential project locations for the area drainage master plan. The potential projects identified by the City can be seen in Figure 20 through Figure 25. Carson City also experienced flooding in the northern portion of the study area in early January 2023. Notes on the flooding and photos can be seen in Figure 26 through Figure 29. This area drainage master plan details the existing flood prone areas, watershed constraints, opportunities, and design concepts with construction cost estimates for the proposed drainage mitigation projects.

6.2 Public Meetings

6.2.1 Public Meeting #1

A virtual and in person public meeting was held on August 30, 2022, that discussed the existing drainage conditions and patterns. The flyer created for the meeting can be seen in Figure 17. Prior to the meeting, a project website (http://www.seccdrainageplan.com) was established to provide meeting and project information to residents. The website also provided the means for members of the public to submit questions and flood data. Residents were able to submit anecdotal flood evidence to the project team to be reviewed and documented as part of this study. Several residents submitted descriptions of flooding and/or photos of flooding. A summary of these flooding issues is provided in Appendix B. The detailed information provided by the public has been included in Appendix B.

Figure 17: Public Meeting #1

6.2.2 Public Meeting #2

A second public meeting was held on Tuesday August 29, 2023. This meeting was held in the study area at four different locations as shown in Figure 18. Additional details for this public meeting are shown in Figure 19. The project team met with residents at each location for approximately one hour. Each location corresponded to a specific Area of Mitigation Interest (AOMI) and mitigation alternative. Residents in attendance were given the opportunity to share any input after a short presentation by the project team including a description of the potential project identified as part of the plan. Residents in the area had experienced acute flooding over the previous winter and had detailed descriptions of flooding conditions in several locations. Many of these locations shared by residents did not correlate well with the more regional project locations being developed for the plan. Many of the flooding locations identified by residents were lot and street specific but were also widespread throughout the Prison Hill watershed. It was clear from the field meetings that residents experienced significant flooding over the 2022/2023 winter. The issues were widespread and mostly sediment and debris related, and much of the feedback and information collected included new flooding concerns not previously identified. Had this information been presented at the first public meeting, alternative development would have included these flood impacts. Feedback and data gathered at the meeting is provided in Appendix C.

Figure 18: Public Meeting #2

6.3 Flood Prone Areas

Information on flood prone areas was collected through conversations with the City and residents. Figure 20 through Figure 25 show areas identified by the City as potential project locations with existing flooding issues. Figures 26 through Figure 29 show recent flooding that has occurred. Additional flooding photos documented by Carson City residents are located in Appendix B and Appendix C with the public meeting documentation. Flooding photos provided by Carson City are located in Appendix D. Flood prone areas were developed based on the existing flow depths and velocities from the FLO-2D modeling effort and verified based on data collected from the City and residents.

Figure 19: Public Meeting #2

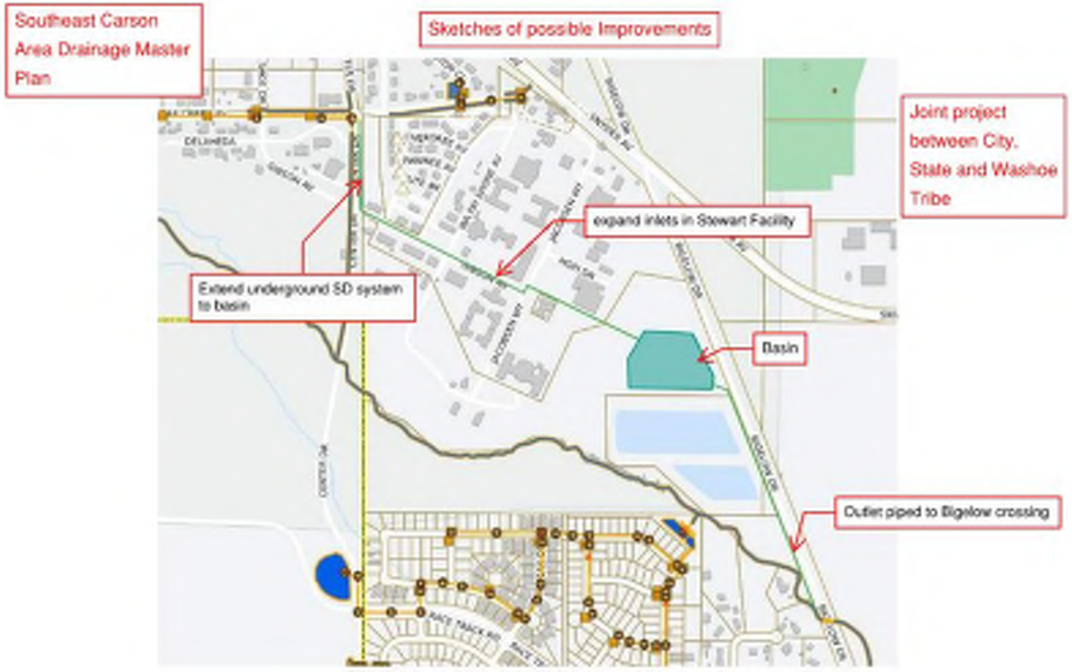


Figure 20: Project 1 Provided by Carson City

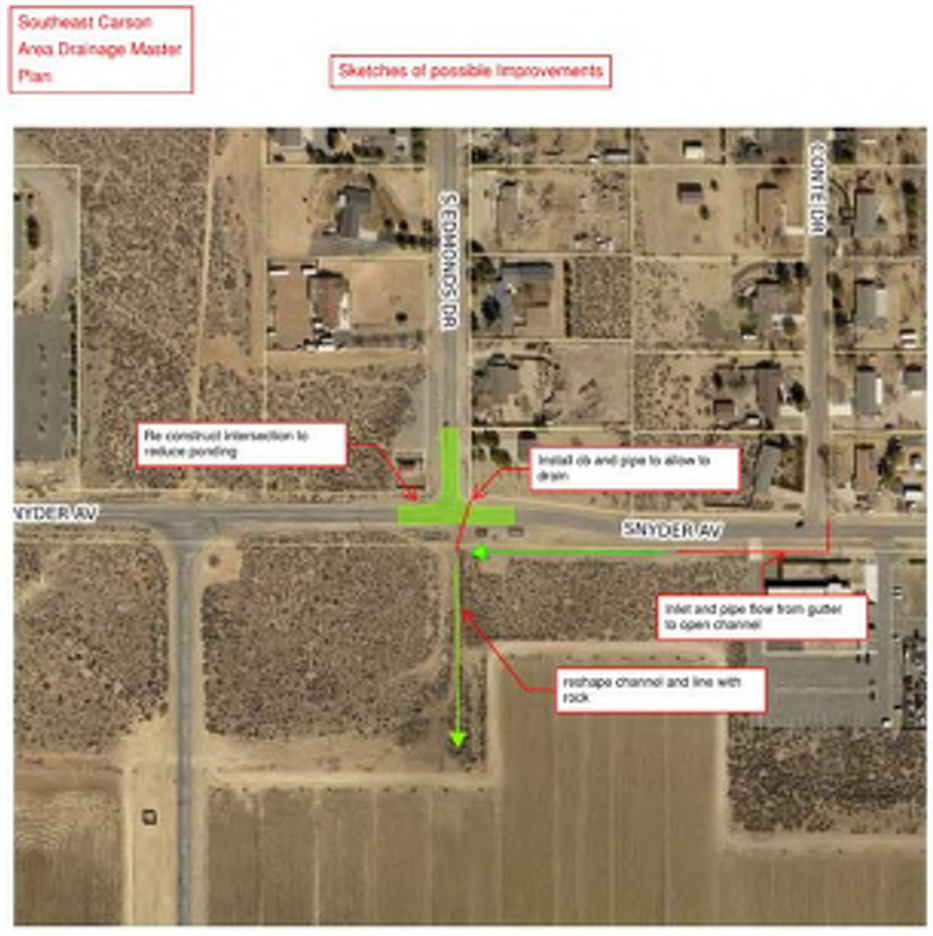


Figure 21: Project 2 Provided by Carson City

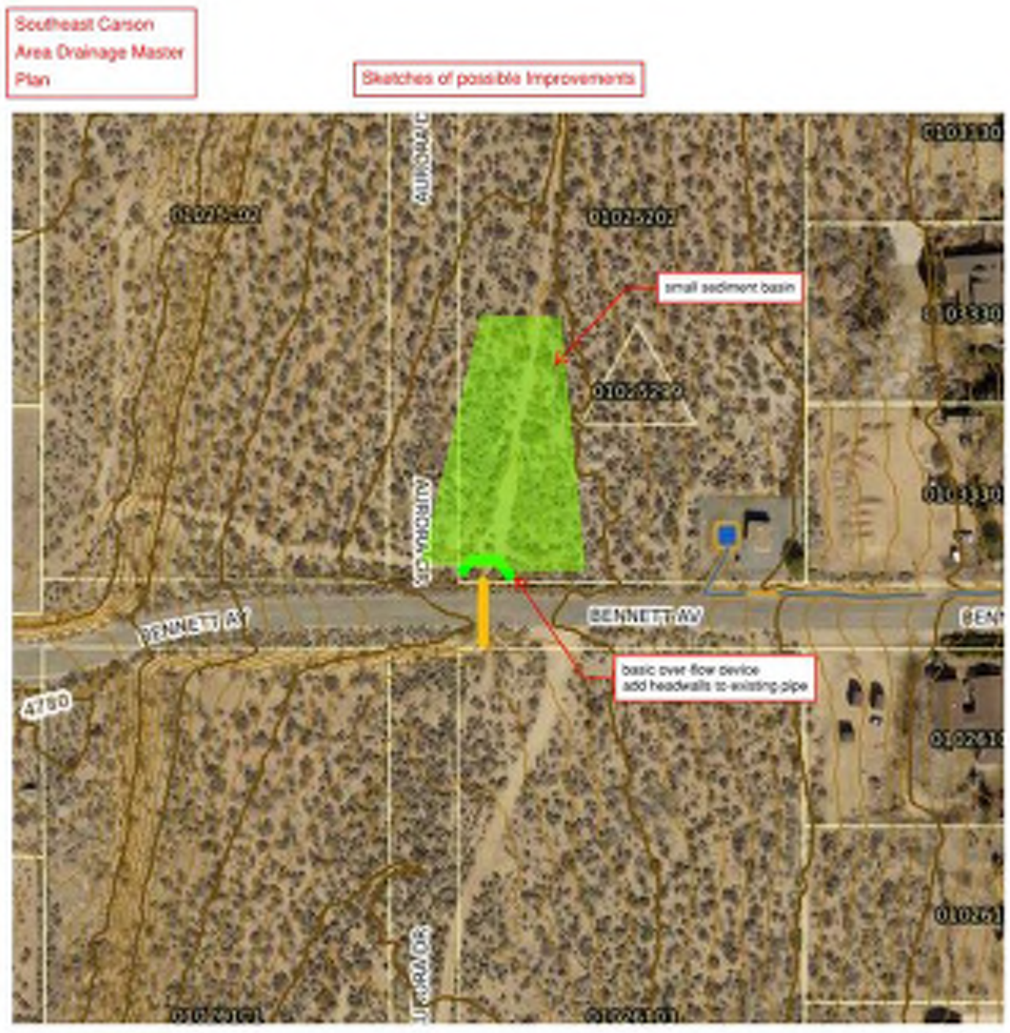


Figure 22: Project 3 Provided by Carson City

Figure 23: Project 4 Provided by Carson City

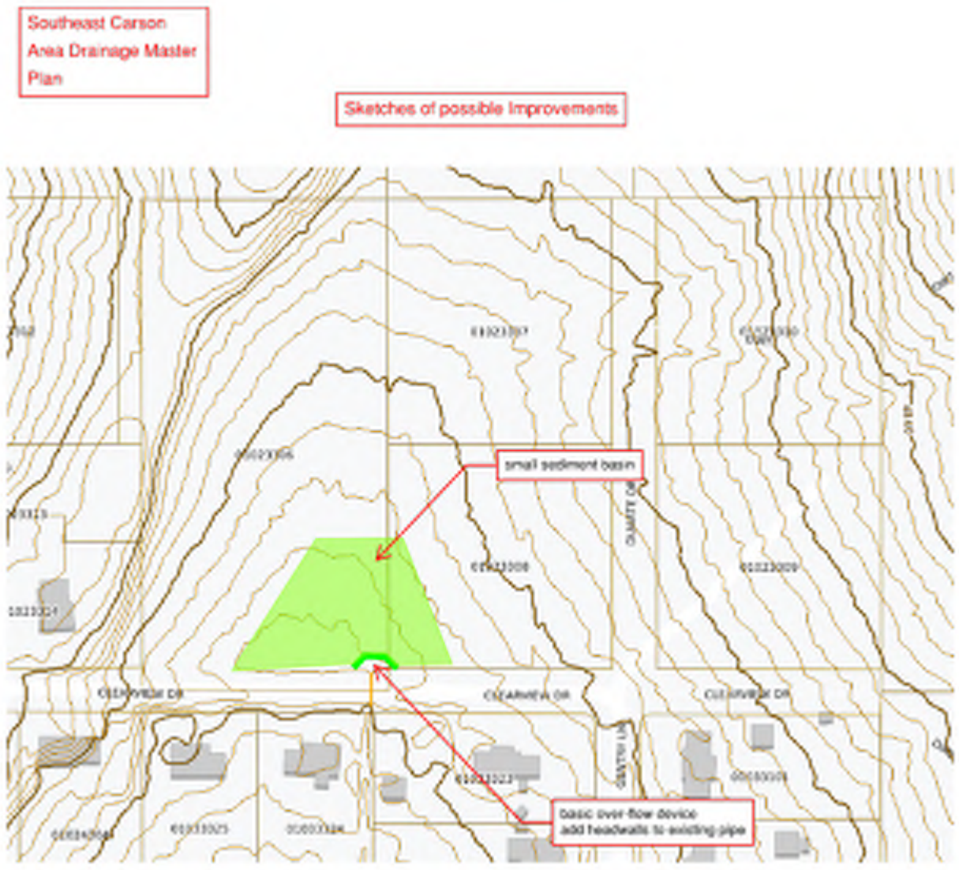


Figure 24: Project 5 Provided by Carson City

Figure 25: Project 6 Provided by Carson City

Crews dealt with flows at dead end of S. Lompa. Field investigation revealed drainages shown in orange. Drainage down to Grandville reflected on the preliminary flood hazard maps.

Damon Rd. was a problem area during early January 2023 events. Crews experienced significant flows coming down both the north and south sides of the road.

Figure 26: January 2023 Flooding Documentation Provided by Carson City

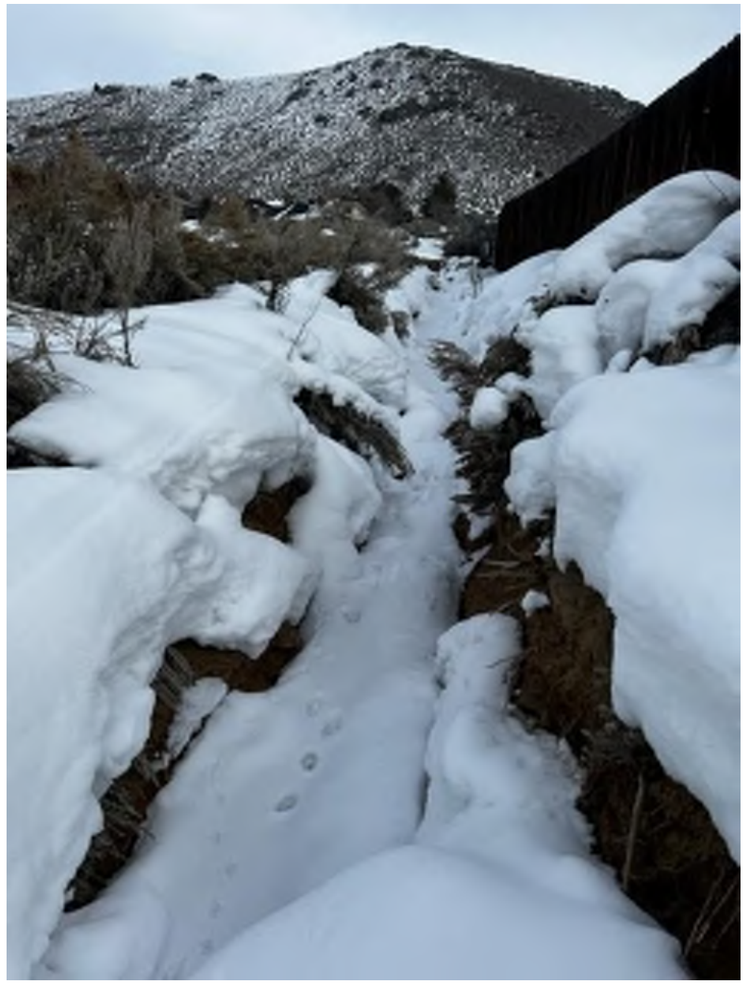


Figure 27: January 2023 Flooding: S. Lompa Lane

Figure 28: January 2023 Flooding: South Side of Damon Road

Figure 29: January 2023 Flooding: Ponding at South Edmonds Drive

6.4 Constraints

For the SECC ADMP project area, several constraints were identified during the formulation of mitigation alternatives. The largest constraint is the distributary nature of the Prison Hill watershed. Storm runoff enters developed areas downstream of Prison Hill along many varied flow paths. This makes mitigation upstream of developed areas difficult. This particular characteristic was highlighted during Public Meeting #2 (further detailed on Page 24). This public meeting was held after flooding had occurred in January/March 2023. Residents experienced significant flooding along east/west streets emanating from Prison Hill, but at various inflow points. Because of this condition, flood mitigation was focused on areas where flows accumulated within the developed areas such that potential projects would reduce flood hazards for a number of structures.

An additional constraint was the Interstate 580 (I-580) drainage system. I-580 cuts off flows downstream of Prison Hill for a significant portion of the study area. The drainage system constructed for I-580 has limited capacity as indicated by storm drain pipe stubs to the east. These connection points provide fairly limited opportunities for outfalls.

Finally, the study relied heavily on City and public input to identify flooding issues and mitigation ideas. While the first public meeting was well attended, the focus of conversation was mostly on erosion challenges from Prison Hill in areas not impacting residential areas downstream. These areas were noted, and suggested culvert improvements to convey more flow and sediment are included in the ADMP, but the focus of the plan is on mitigating flooding to structures and residents of Carson City. Additional areas were identified in Public Meeting #2 that had not been previously identified in Public Meeting #1. Due to budget constraints and the timeline of the project, these comments were not able to be incorporated into alternative development.

6.5 Opportunities

Several opportunities were identified to aid in the development of flood mitigation alternatives. The first was potentially available open space along Edmonds Drive and along a main flow path upstream of Bennett Avenue. These areas provide opportunities for sediment basins and detention basins to mitigate flood hazards. The other opportunity was the existing drainage infrastructure in the Stewart Area. This infrastructure allows for the expansion of the system into the Indian School and State facilities area with an open space outfall location adjacent to Clear Creek. It should be noted that the open space upstream of Bennett Avenue was identified later in the process as ineligible for further project consideration due to land ownership constraints.

6.6 AOMIs

Based on discussion with the City for potential projects and public input from Public Meeting #1, seven areas of mitigation interest (AOMIs) were determined to address flooding concerns. Each of the AOMIs are shown in Figure 30 and summarized in Sections 6.6.1 to 6.6.7.

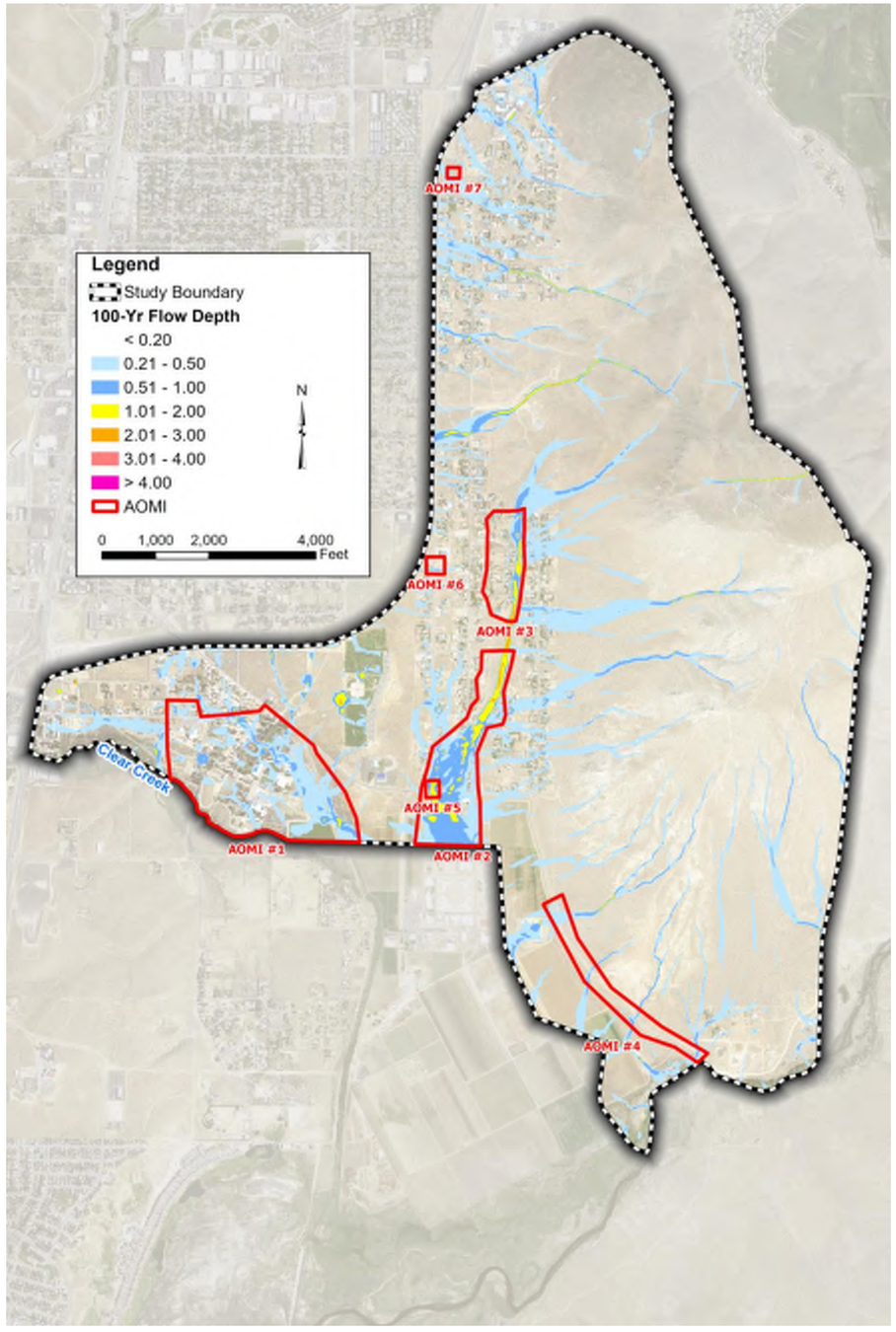
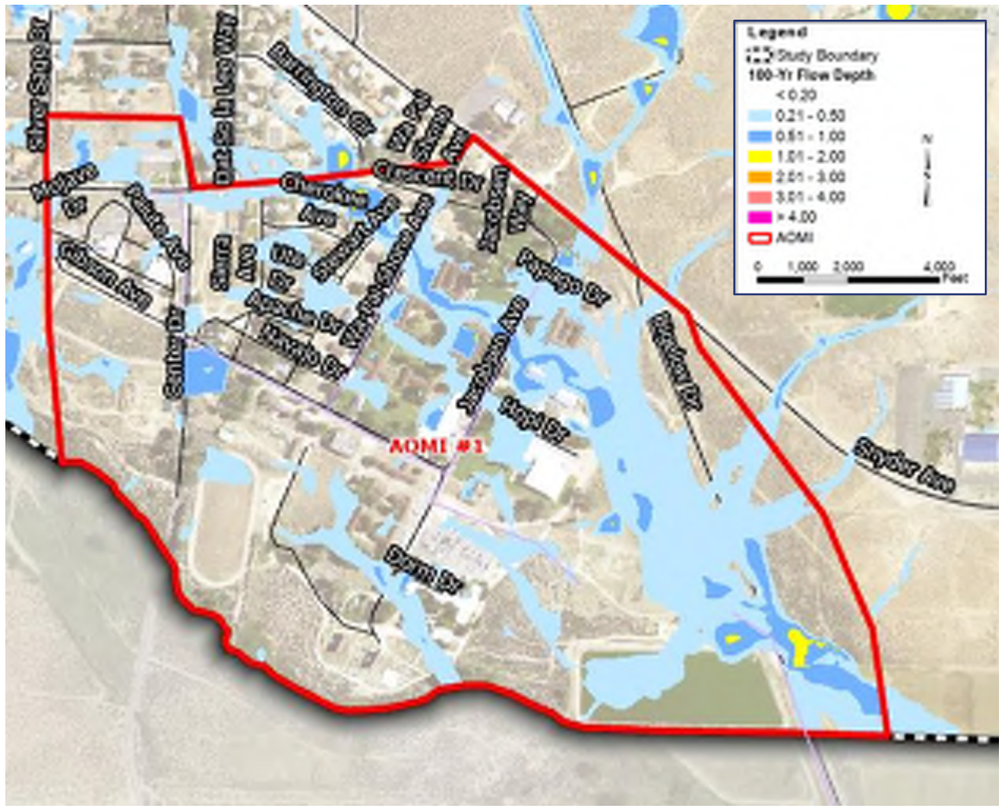


Figure 30: AOMIs



6.6.1 AOMI #1

Figure 31: AOMI #1

Location: Stewart Area

Description: Flows in the Stewart Area overtop several of the residential streets and Bigelow Drive during larger storm events. This area was identified by Carson City for improvements and is consistent with flooding identified by existing conditions modeling performed for this study.

Existing Flooding: Model results show potential flooding above the finished floor elevation (FFE) of 10 structures with depths up to 0.26 feet and estimated damages to 51 structures due to flood waters below the FFE in the 100-year, 24-hour event.

Potential Solution: Construct stormwater infrastructure within the Stewart Area and a stormwater basin adjacent to Bigelow Drive to alleviate flooding impacts to structures and residential streets.

Flood Reduction: Provide storage volume to provide attenuation for the 100-year event.

6.6.2 AOMI #2

Figure 32: AOMI #2

Location: Residential Area South of Bennett Avenue

Description: Runoff from Prison Hill collects and flows through this residential area. These conditions lead to roads overtopping and potential structure flooding during large storm events.

Existing Flooding: Model results show potential flooding above the FFE of 33 structures with depths up to 1.33 feet and estimated damages to 39 structures due to flood waters below the FFE in the 100-year, 24-hour event.

Potential Solution: Construct a stormwater detention basin north of Bennett Avenue to alleviate flooding impacts to structures and residential streets. (Note: while initially considered, this area and project were not further developed due to the environmental and technical concerns with constructing infrastructure on a historic landfill site.)

Flood Reduction: Provide storage volume to provide attenuation for the 100-year event.

6.6.3 AOMI #3

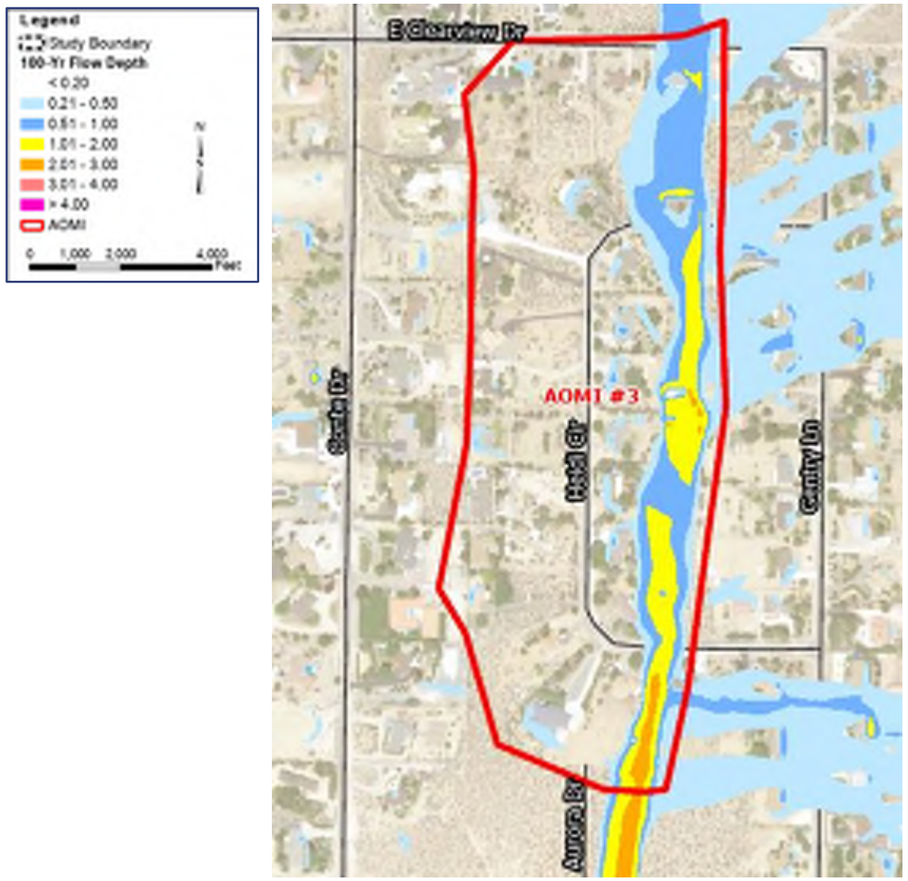


Figure 33: AOMI #3

Location: Residential Area South of East Clearview Drive

Description: Runoff from Prison Hill collects and flows through this residential area. These conditions lead to roads overtopping and potential structure flooding.

Existing Flooding: Model results show potential flooding above the FFE of 5 structures with depths up to 0.83 feet and estimated damages to 24 structures due to flood waters below the FFE in the 100-year, 24-hour event.

Potential Solution: Construct a stormwater detention basin north of East Clearview Drive to alleviate flooding impacts to structures and residential streets.

Flood Reduction: Provide storage volume to provide attenuation for the 100-year event.

6.6.4 AOMI #4

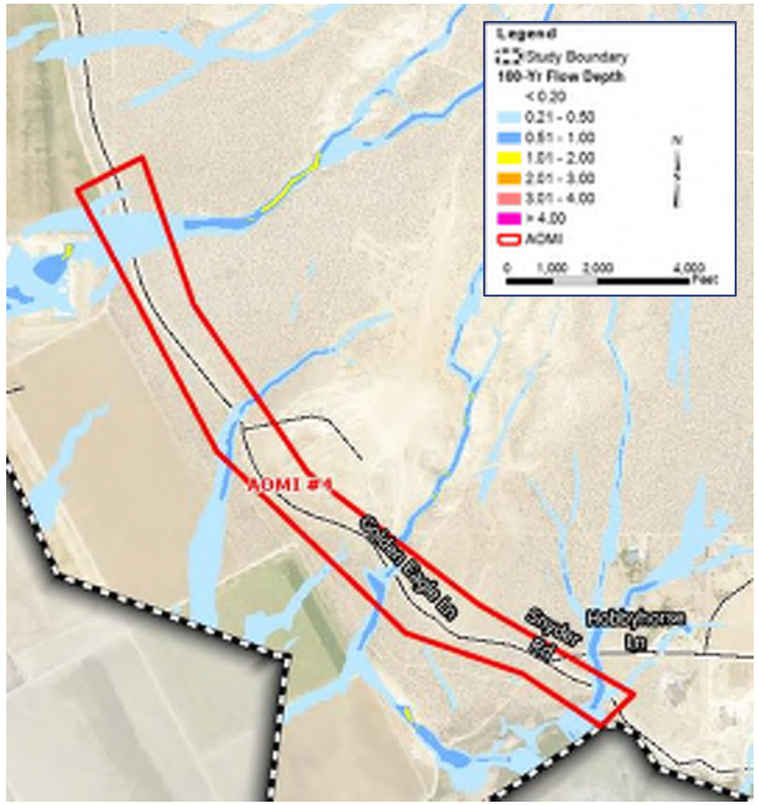


Figure 34: AOMI #4

Location: Golden Eagle Lane

Description: Runoff from Prison Hill collects and causes road overtopping at 4 locations along Golden Eagle Lane. There are existing State and City owned culverts along the road; however, these are currently undersized for the 100-year, 24-hour event. Additionally, in Public Meeting #1, residents noted that the existing culverts are damaged, causing additional issues. Figure 42 contains information on the existing ownership and the blocked culvert identified by residents.

Existing Flooding: Model results show roadway flooding ranging from 0.3 feet to 1 foot in the 100-year, 24-hour event.

Potential Solution: Construct or enlarge culverts along Golden Eagle Lane to alleviate roadway overtopping. This will require continued coordination between the City and the State to improve the culverts.

Flood Reduction: Provide pipe conveyance capacity for the 100-year event to prevent roadway overtopping up to the 100-year storm.

6.6.5 AOMI #5

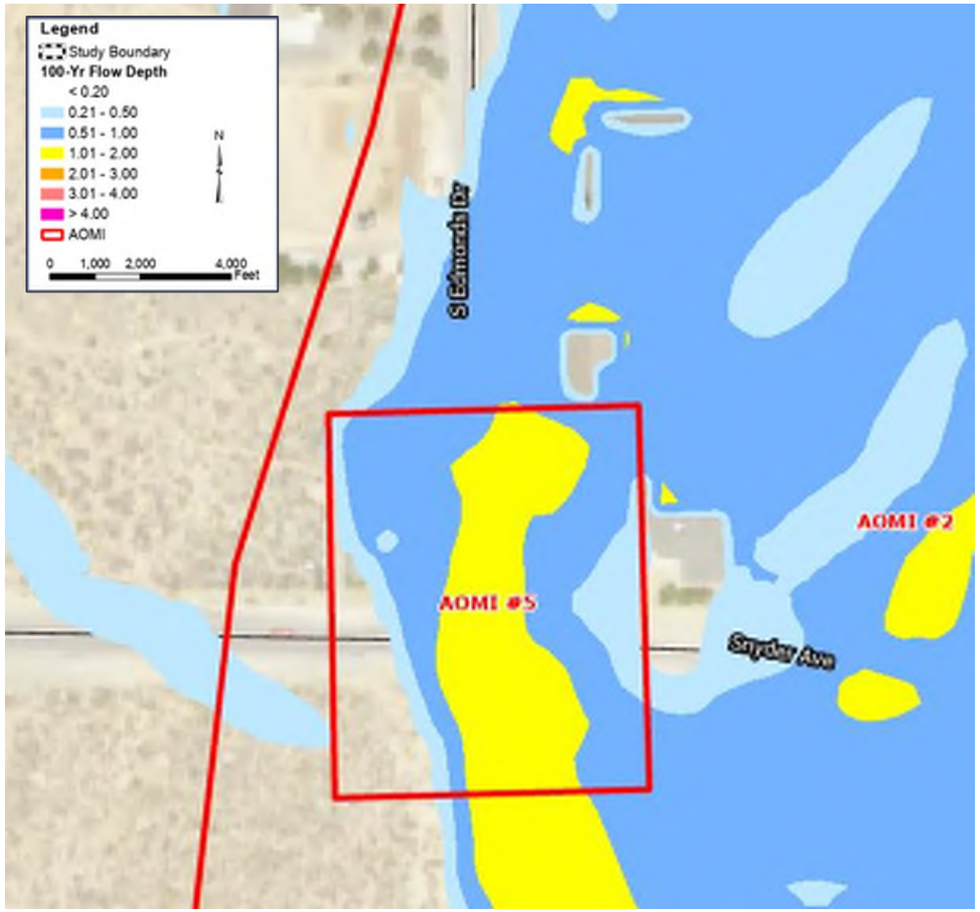


Figure 35: AOMI #5

Location: Intersection of South Edmonds Drive and Snyder Avenue

Description: Runoff from Prison Hill collects and flows through this residential area. These conditions lead to ponding road overtopping at Snyder Avenue.

Existing Flooding: Model results show roadway flooding with a depth of approximately 1.5 feet for the 100-year, 24-hour event.

Potential Solution: Reprofile road and construct pipes at intersection of South Edmonds Avenue and Snyder Avenue to alleviate roadway overtopping and help with potential localized structure flooding.

Flood Reduction: Provide pipe conveyance capacity for the 100-year event to prevent roadway overtopping up to the 100-year storm.

6.6.6 AOMI #6

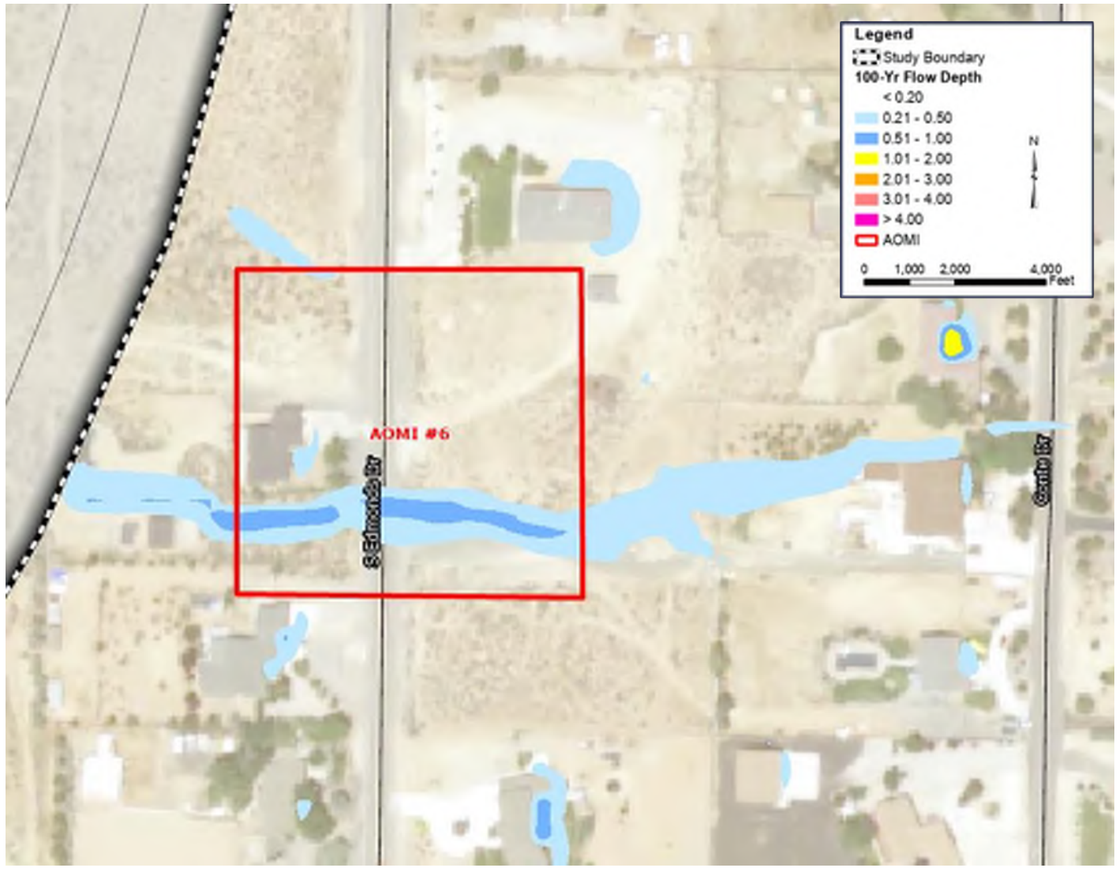


Figure 36: AOMI #6

Location: South Edmonds Drive

Description: Runoff from the residential area to the east causes overtopping at South Edmonds Drive and can cause structure flooding west of South Edmonds Drive.

Existing Flooding: Model results show roadway flooding with a depth of approximately 0.5 feet for the 100-year, 24-hour event.

Potential Solution: Connect to existing I-580 pipes along South Edmonds Drive to help alleviate roadway flooding and potential structure impacts.

Flood Reduction: Provide capacity to route flows from existing pipe at Conte Drive to the existing I-580 pipes.

6.6.7 AOMI #7

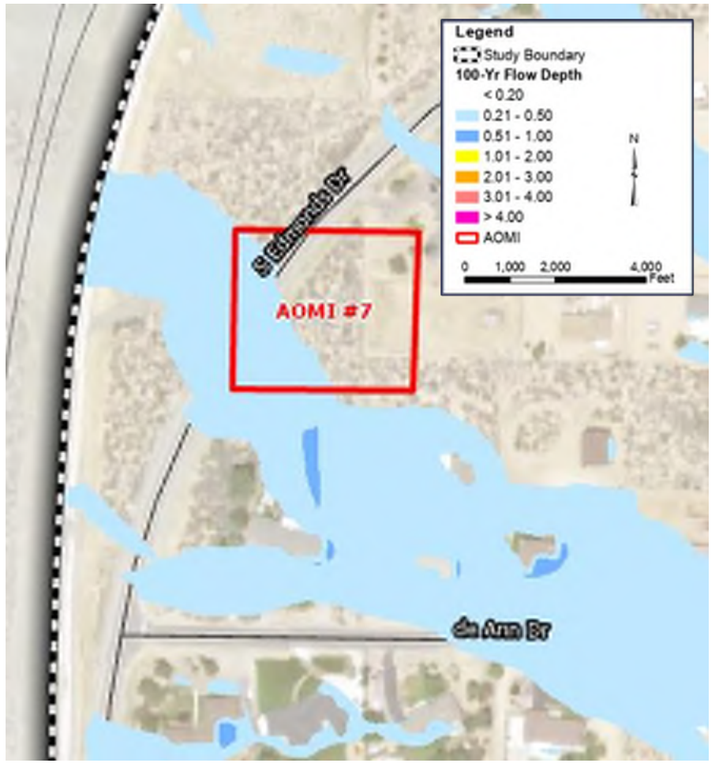


Figure 37: AOMI #7

Location: South Edmonds Drive

Description: This area receives sediment and debris from runoff and was identified by Carson City as a potential project location. In general, there are existing sediment issues documented throughout the watershed.

Potential Solution: Construct a sediment basin south of South Edmonds Drive. This project will serve as a maintenance project rather than flood control and will provide a reduction in sediment to the culvert on South Edmonds Drive and downstream.

6.7 Recommended Projects

After discussions with the City and input from the public meetings, it was determined that the preliminary solutions developed for the AOMIs were appropriate for project recommendations. After an evaluation of the preliminary cost estimate, it was determined that the following projects would be recommended for cost-benefit analysis to determine funding eligibility through FEMA grant opportunities. Each project will be subject to potential land acquisition costs and environmental/historic review to include the National Environmental Protection Act (NEPA) process if partially or fully federally funded.

AOMI #1: Clear Creek Basin – This basin is proposed to accommodate volume produced from the 100-year storm. Proposed storm drainage pipes will route water from the Stewart area to the proposed basin. Any volume beyond the designed capacity is intended to outfall to Clear Creek. The design concept for the Clear Creek Basin is shown in Figure 38 and Figure 39. The land for this project is currently owned by the State. This will add additional cost to the project total.

AOMI #3: East Clearview Drive Basin – This basin is proposed to accommodate volume produced from the 100-year storm and is positioned along the main flow path through the residential area just north of East Clearview Drive. The basin is intended to capture and retain flows from Prison Hill to prevent flooding of structures and roads downstream of East Clearview Drive to south of Heidi Circle. The design concept for the East Clearview Drive Basin is shown in Figure 40 and Figure 41. The land for this project is currently owned by the City.

Basins AOMIs 1-3 were sized to contain the 100-year 24-hour hydrograph. Basin size should be maximized with design refinement, and it is likely that the basins could be configured to operate as detention basins with positive outflow. If basins are ultimately configured as retention basins, soil conditions should be assessed such that drain times meet City requirements. The proposed basin locations were evaluated based on open space and City owned property. The volume calculated for each of the basins is shown in the table below.

Table 6: Runoff Volumes

Storm Event	AOMI #1: Clear Creek Basin (AC-ft)	AOMI #3: E Clearview Dr Basin (AC-ft)
10-year, 24-hour	5.41	3.99
25-year, 24-hour	8.06	6.08
100-year, 24-hour	12.72	9.35
Design Volume	13.17	9.48

The following projects are also recommended; however, a cost-benefit analysis using the FEMA's BCA Toolkit was not completed because these projects do not have a significant reduction in structure flooding and constitute more maintenance-oriented projects. A benefit cost ratio (BCR) of greater than 1 is typically required for FEMA grants. These projects would not meet this requirement; however, FEMA recently changed some grant requirements such that projects less than $500k may qualify for funding with BCRs less than 1.

AOMI #4: Golden Eagle Lane Pipes – Four pipe locations are proposed along Golden Eagle Lane to accommodate flows for the 100-year storm event and prevent overtopping of the road. This includes replacement of some existing pipes and construction of new pipes. The design concept for this project is shown in Figure 42, Figure 43, and Figure 44. There are currently pipes owned by the City and some

owned by the State. The replacement of the State-owned culverts will require continued coordination between the City and the State to address road overtopping issues at this location.

AOMI #5: Snyder Avenue Pipes – This project is intended to convey the 100-year flow under Snyder Avenue and South Edmonds Drive. The project will involve regrading along Snyder Avenue and South Edmonds Drive to prevent overtopping at the intersection. The proposed pipes will discharge south to an existing ditch which will be regraded and lined with rip rap to accommodate flow. The design concept for this project is shown in Figure 45 and Figure 46. This project is proposed on land currently owned by the City.

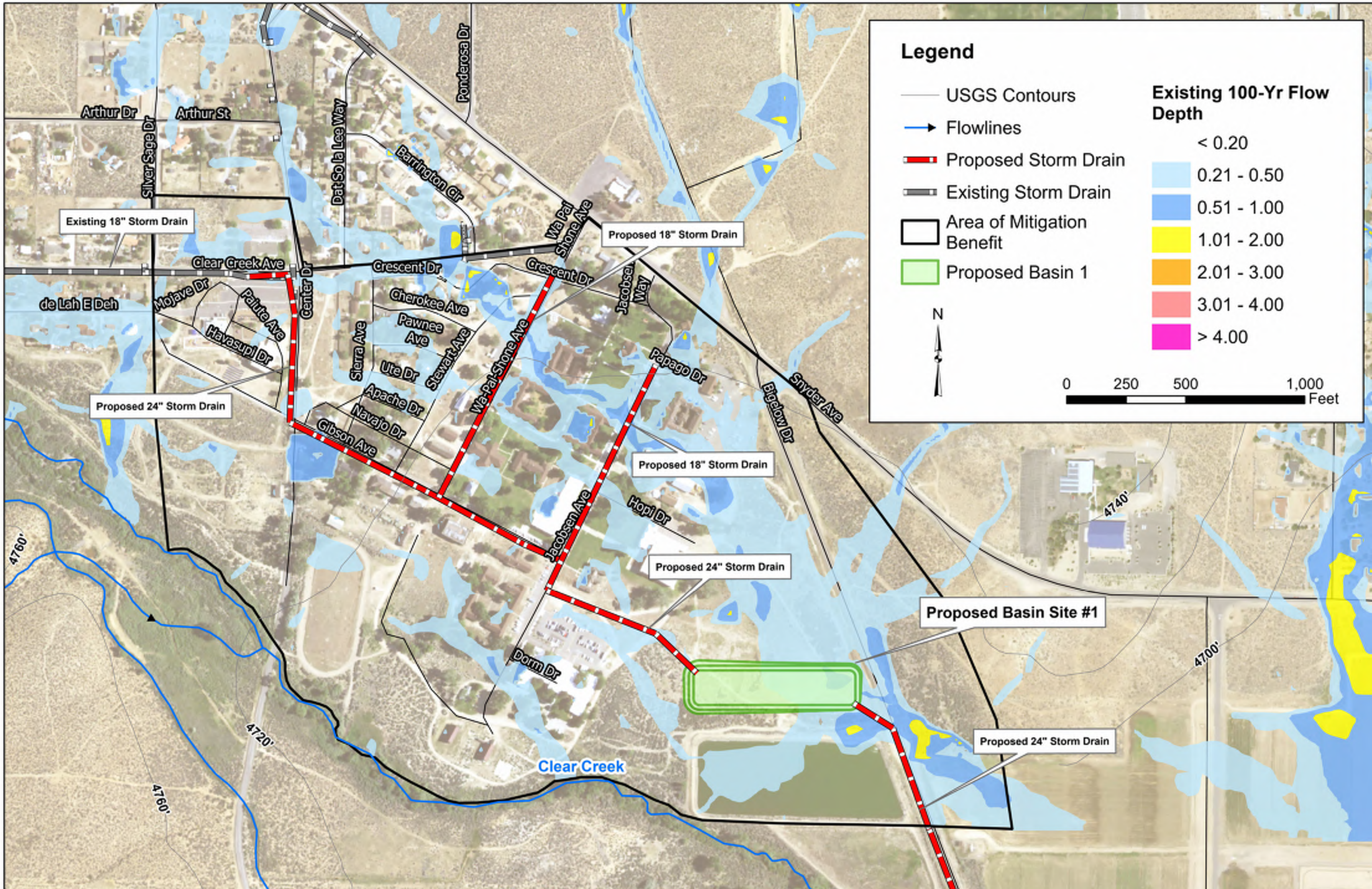
AOMI #6: South Edmonds Drive Pipes – This project is intended to connect existing storm infrastructure from Conte Drive to convey flow across South Edmonds Drive. This will help route flows around the two residential properties west of South Edmonds Drive. The design concept for this project is shown in Figure 47 and Figure 48. This project is proposed on land owned by Nevada Department of Transportation (NDOT) and BLM. This will require additional coordination and cost for project implementation.

AOMI #7: Sedimentation Basin – This project is intended to capture sediment and debris based on available land space. The design concept for this project is shown in Figure 49 and Figure 50. This project is proposed on land owned by BLM. This will require additional coordination and cost for project implementation.

The estimated cost for each project including design, permitting, and construction is summarized in Table 7. A detailed cost breakdown is provided in Appendix E.

Table 7: Preliminary Cost Estimate

Item	AOMI #1	AOMI #3	AOMI #4	AOMI #5	AOMI #6	AOMI #7
Design and Permitting	$ 594,000	$246,000	$168,000	$120,000	$132,000	$120,000
Construction	$ 3.2 M	$ 1.4 M	$230,000	$374,000	$314,000	$125,000
Land *(Ownership)*	TBD *State Lands*	*Carson City*	TBD *State of Nevada/ Carson City*	*Carson City*	TBD *NDOT/ BLM*	TBD *BLM*
Total	$ 3.8 M	$ 1.6 M	$398,000	$494,000	$446,000	$245,000



Kimley»Horn

© 2023 KIMLEY-HORN AND ASSOCIATES, INC.
Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE(H): 1"=
SCALE(V):
DESIGNED BY: CTH
DRAWN BY: DBK
CHECKED BY: GSB
DATE: 07/2023

Southeast Carson City ADP
Initial Design Concept Map
Clear Creek Basin

PROJECT NO. 291417002
DRAWING NAME DESIGN CONCEPT

FIGURE 38

GRAPHIC SCALE IN FEET
0 25 50 100

Approximate Earthwork Quantities:
Bank Cut Vol = 36,800 CY
Bank Fill Vol = 0 CY

NORTH

NO.	REVISION	DATE

Kimley»Horn

7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

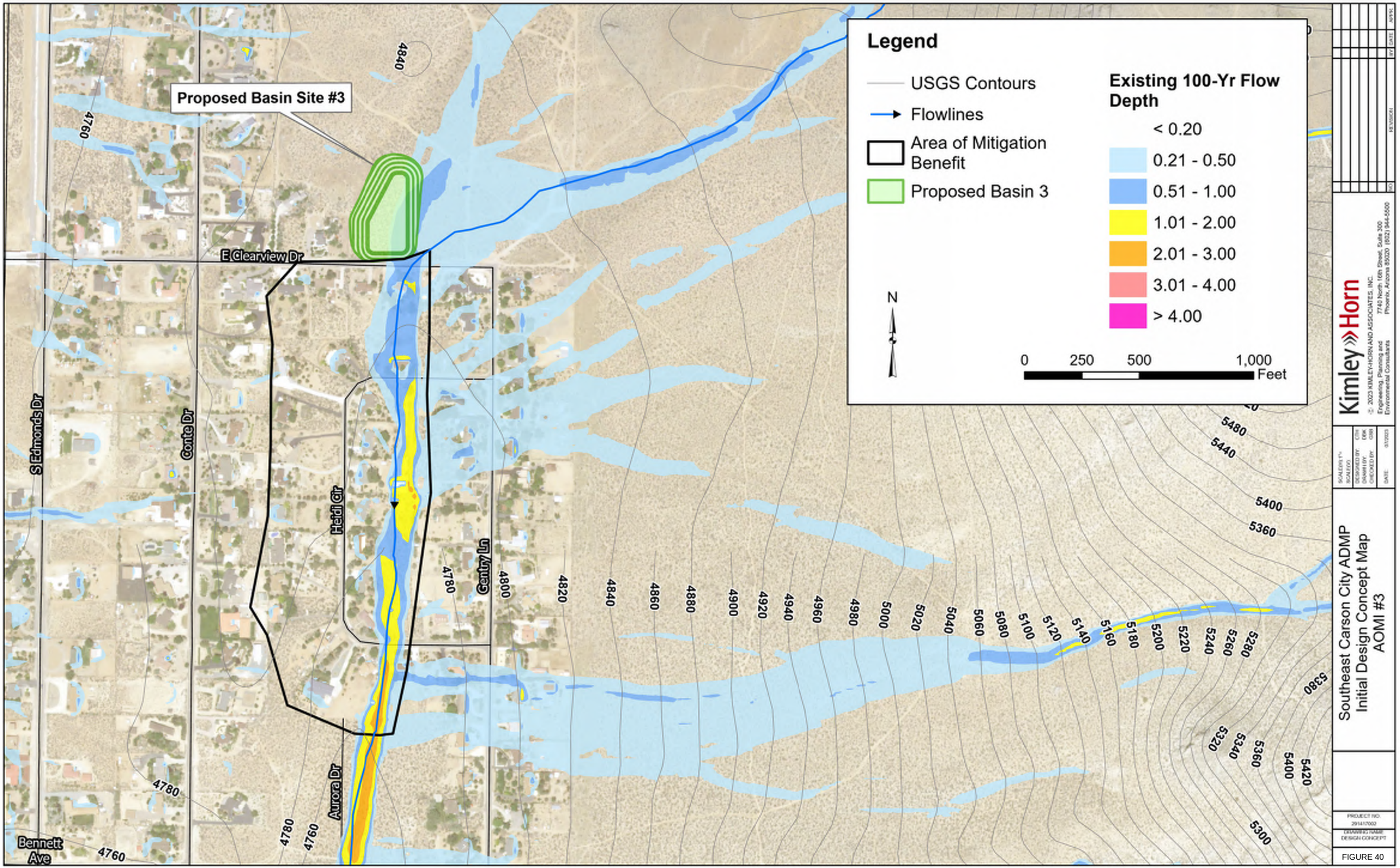
SCALE (H): 1"=250'
SCALE (V): NONE
DESIGNED BY: ATC
DRAWN BY: RDK
CHECKED BY: ATC
DATE: 05/2023

Southeast Carson City ADMP
Clear Creek Basin 15% Plan

PROJECT NO.
291417002

DRAWING NAME
SE Carson Basin

39



Kimley»Horn

7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500
Engineering, Planning and Environmental Consultants

Southeast Carson City ADMP
Initial Design Concept Map
AOMI #3

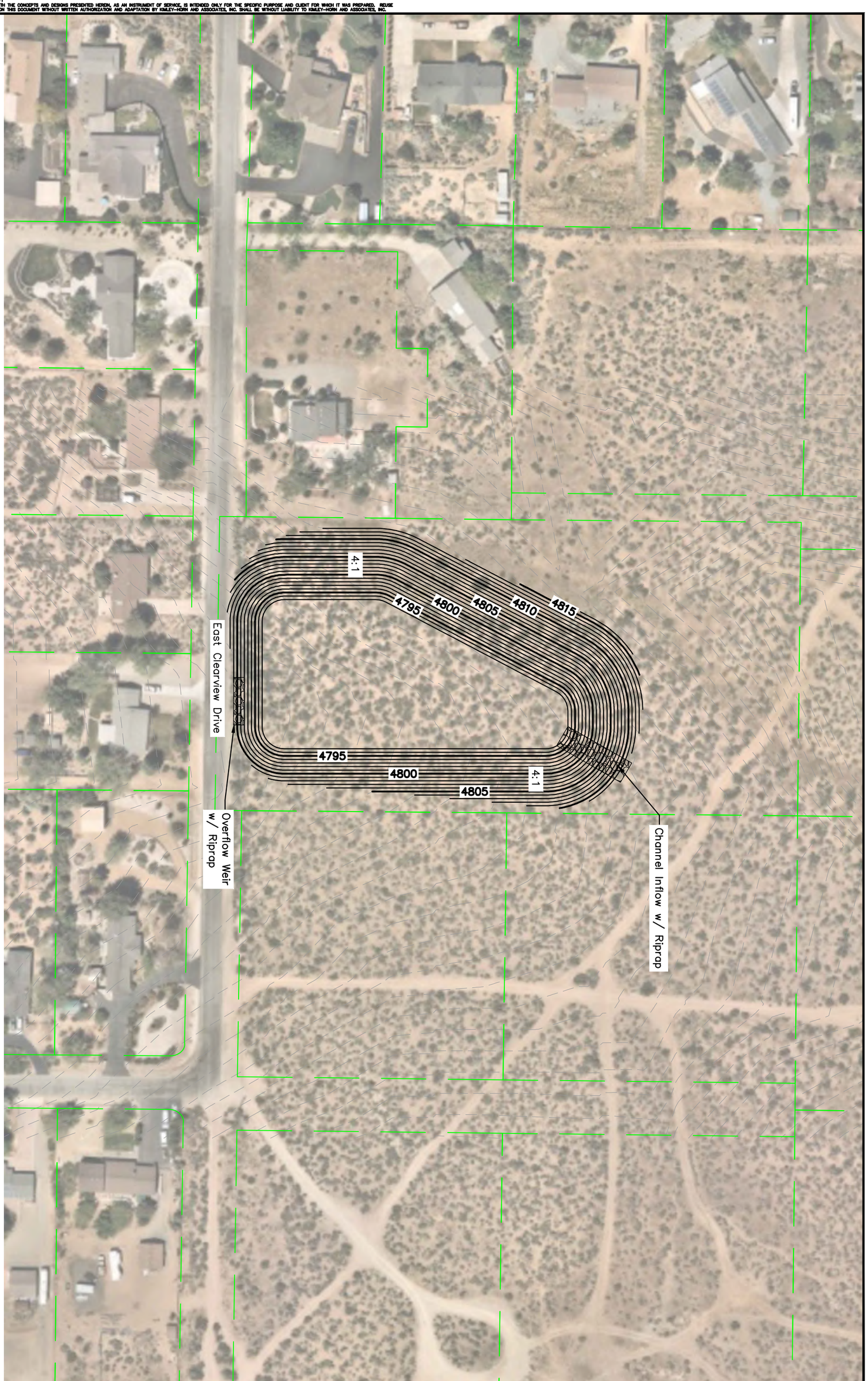
PROJECT NO.
291417002

DRAWING NAME
DESIGN CONCEPT

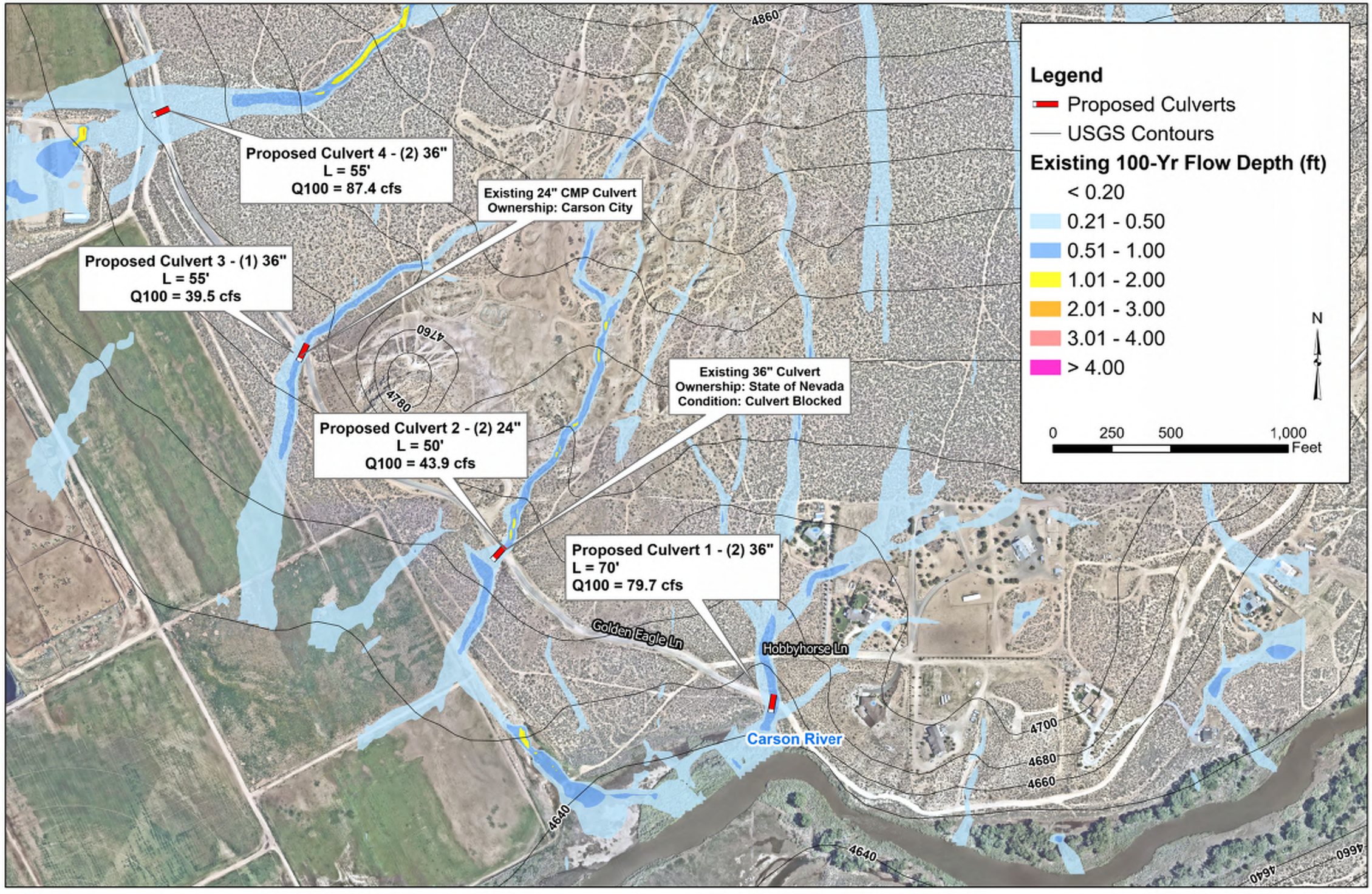
FIGURE 40

GRAPHIC SCALE IN FEET
0 25 50 100

Approximate Earthwork Quantities:
Bank Cut Vol = 40,500 CY
Bank Fill Vol = 0 CY



41	PROJECT NO. 291417002 DRAWING NAME SE Carson Basin		Southeast Carson City ADMP E Clearview Dr Basin 15% Plan	SCALE (H): 1"=250 SCALE (V): NONE DESIGNED BY: ATC DRAWN BY: RDK CHECKED BY: ATC DATE: 05/2023	Kimley»Horn © 2023 KIMLEY-HORN AND ASSOCIATES, INC. 7740 North 16th Street, Suite 300 Phoenix, Arizona 85020 (602) 944-5500	NO. REVISION DATE



Kimley»Horn

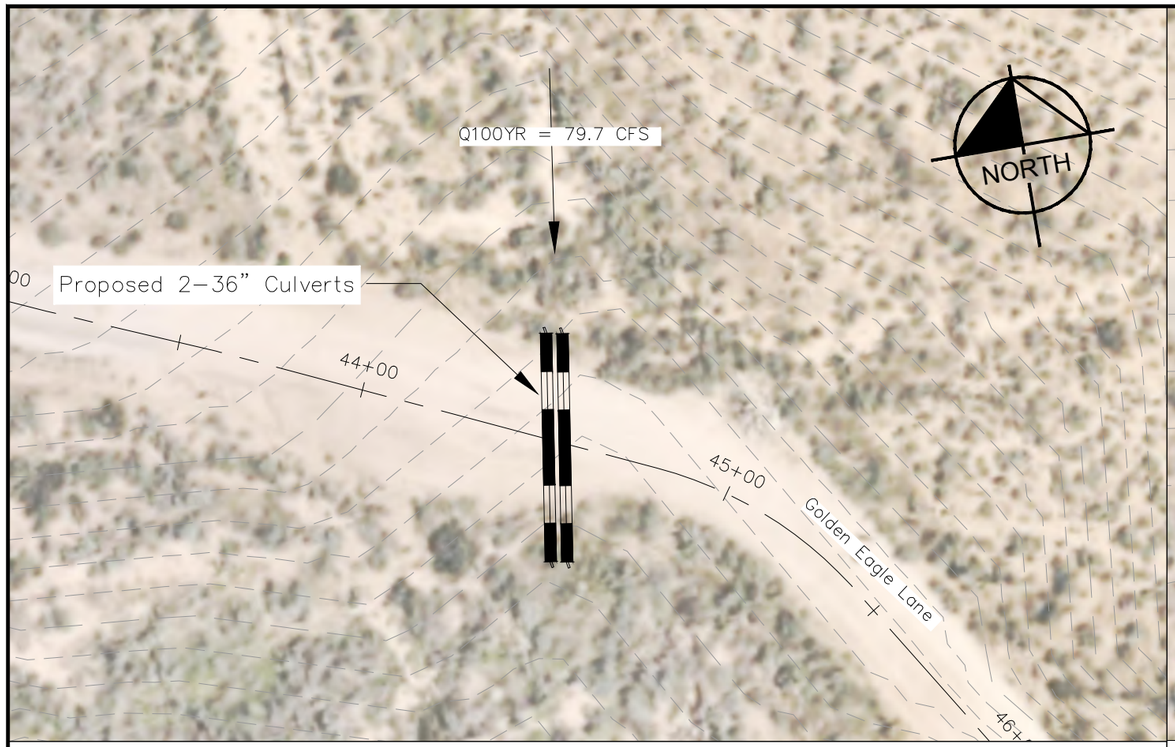
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500
Engineering, Planning and Environmental Consultants

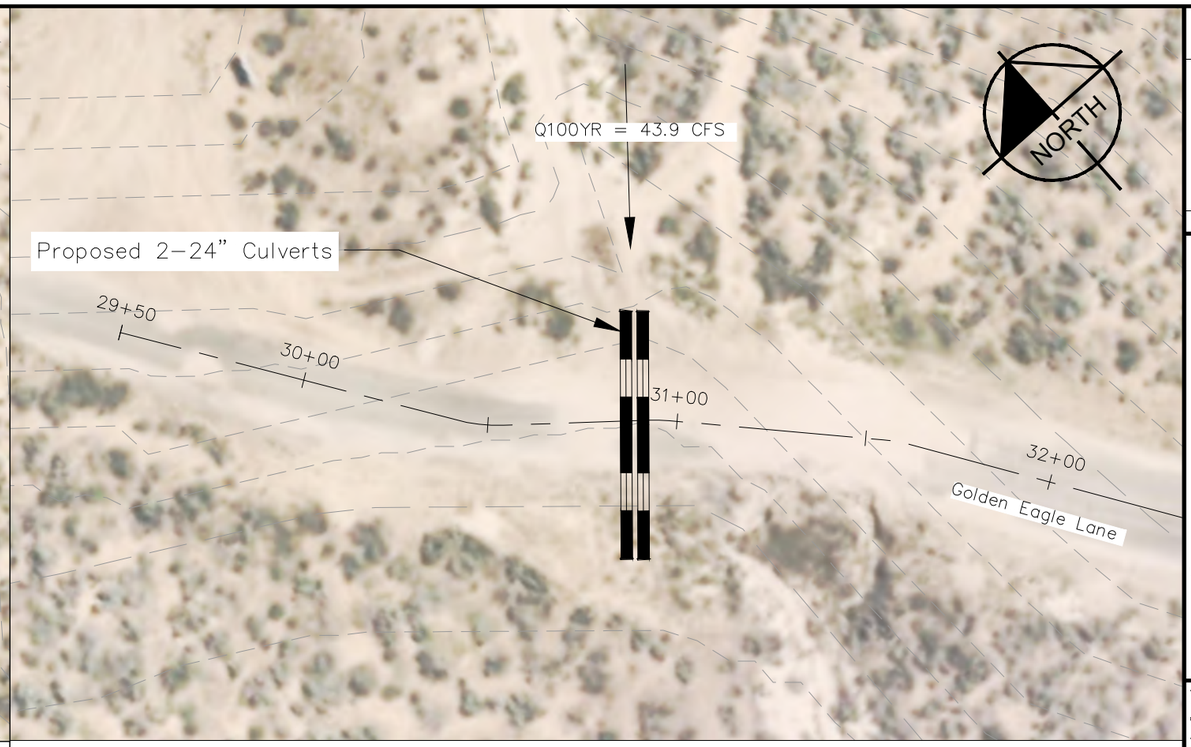
Southeast Carson City ADMP
Initial Design Concept Map
AOMI #4

PROJECT NO.
291417002

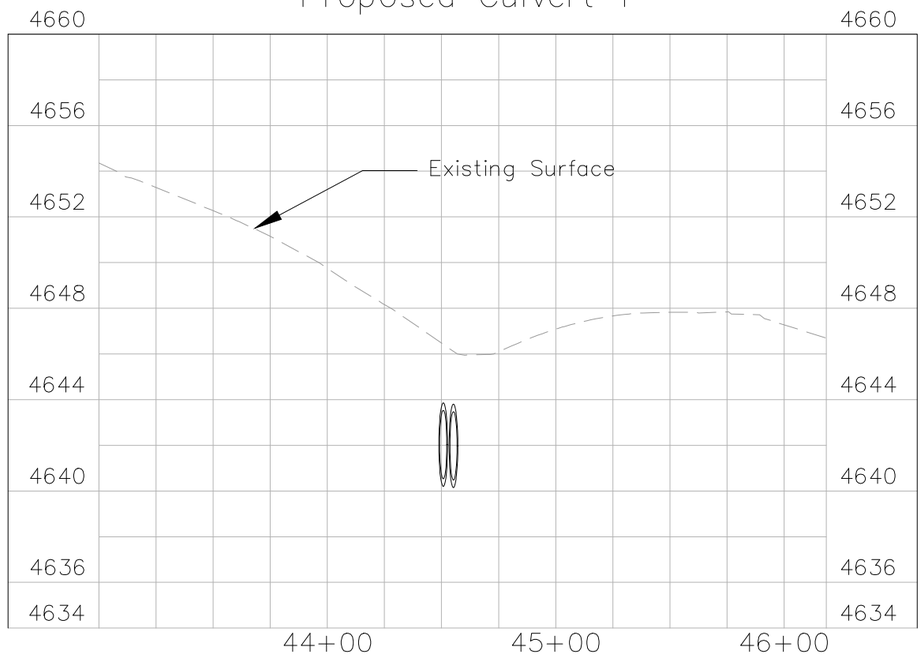
DRAWING NAME
DESIGN CONCEPT

FIGURE 42

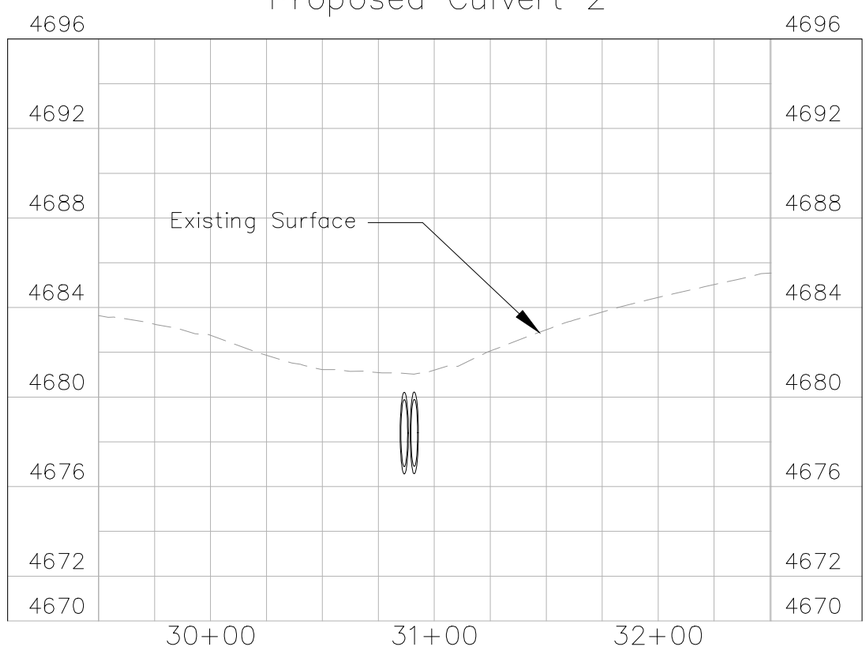




Proposed Culvert 1



Proposed Culvert 2



GRAPHIC SCALE IN FEET
0 20 40 80

NO.	REVISION	DATE

Kimley»Horn

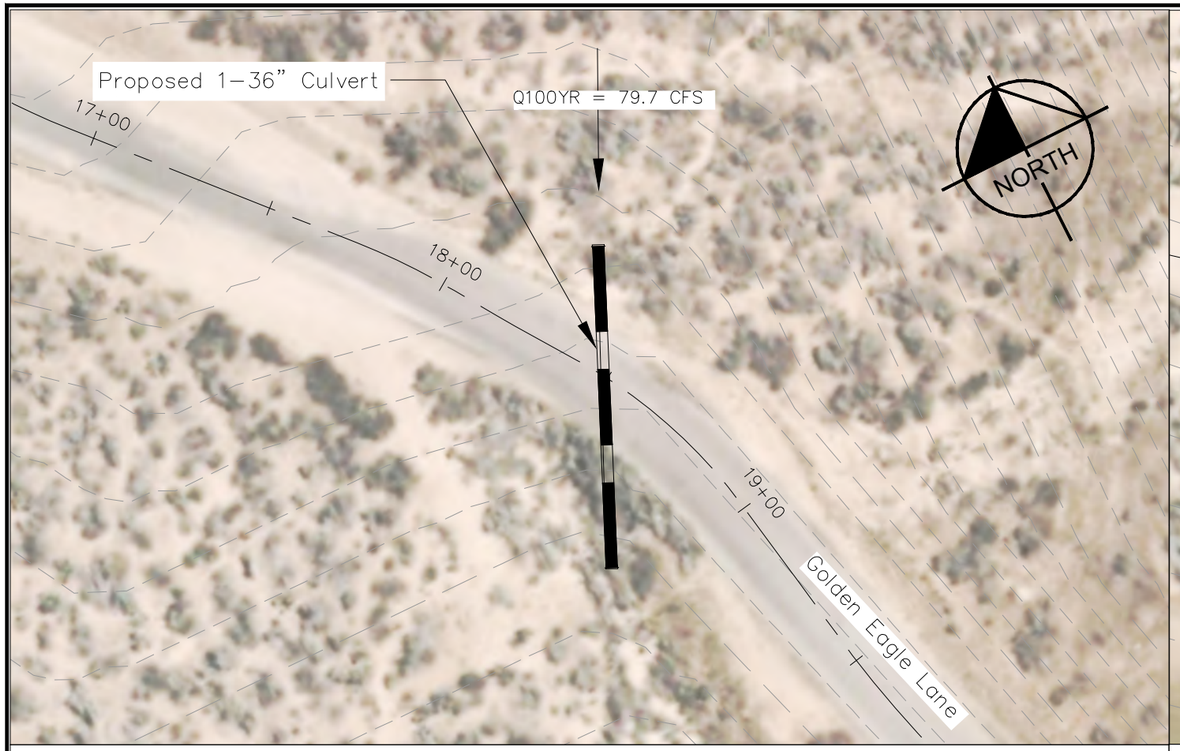
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

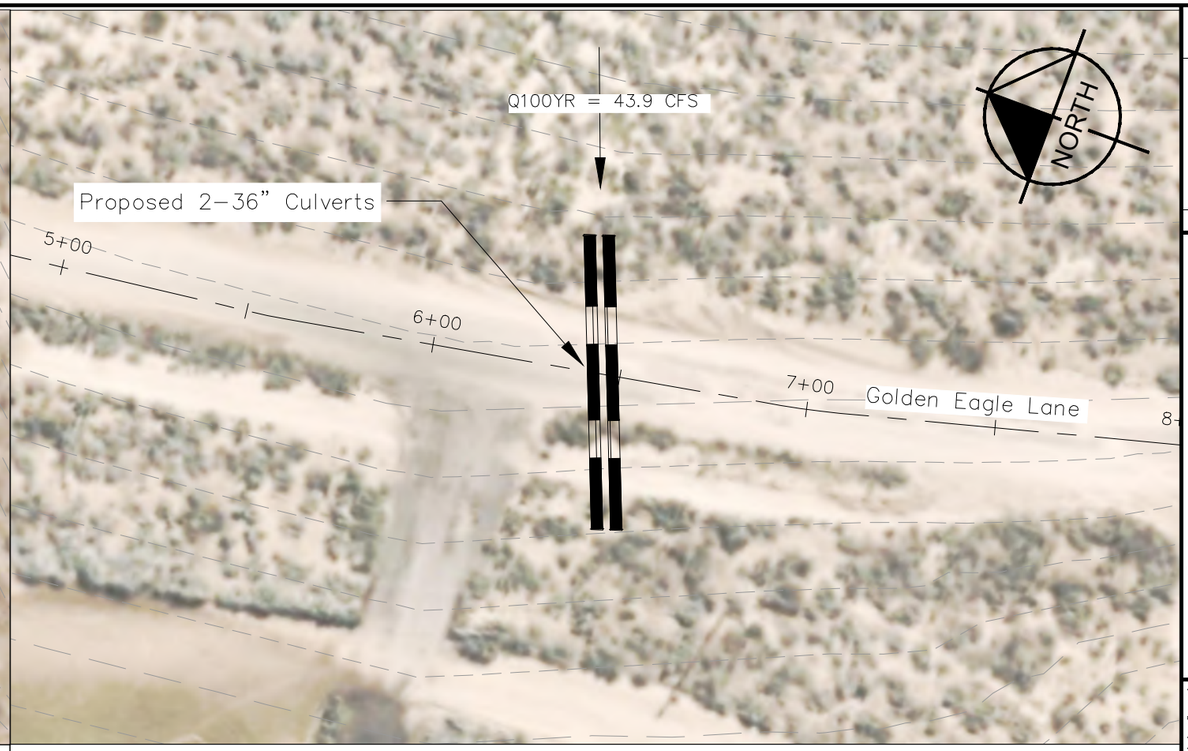
SCALE (H): 1"=40'
SCALE (V): NONE
DESIGNED BY: CTH
DRAWN BY: AKM
CHECKED BY: GSB
DATE: 09/2023

Southeast Carson City ADMP
Golden Eagle Lane Profile

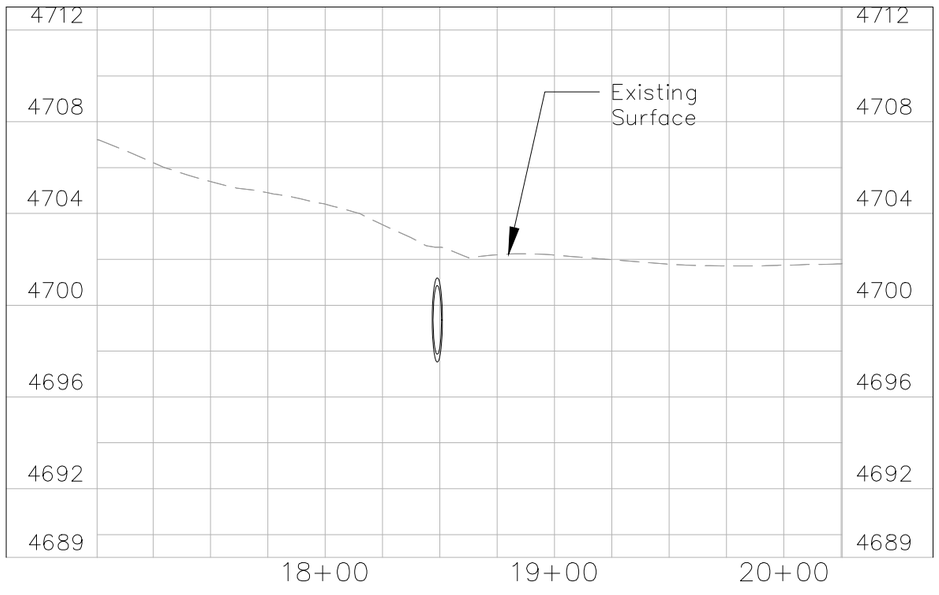
PROJECT NO.
291417002

DRAWING NAME
Storm Pipes

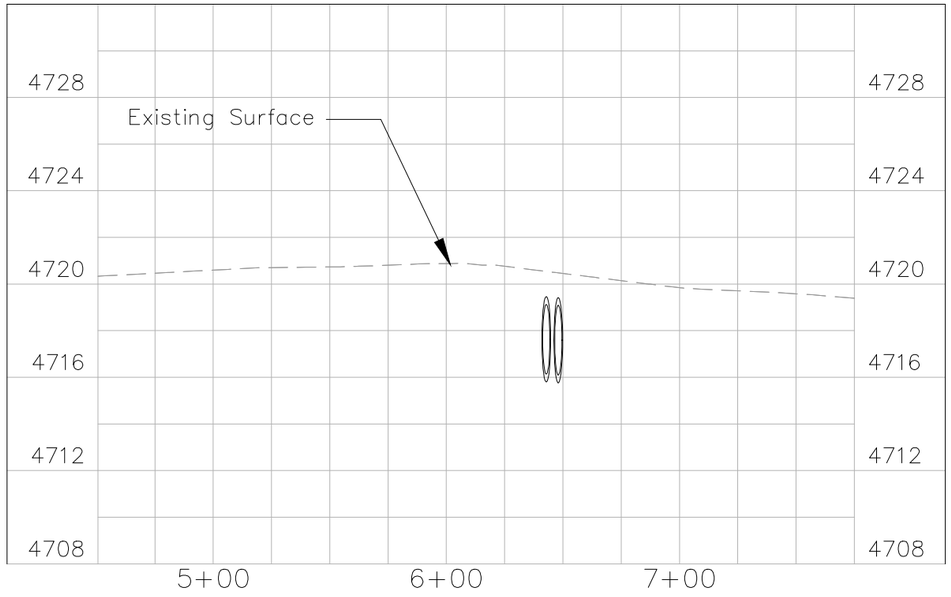




Proposed Culvert 3



Proposed Culvert 4



GRAPHIC SCALE IN FEET
0 20 40 80

NO.	REVISION	DATE

Kimley»Horn

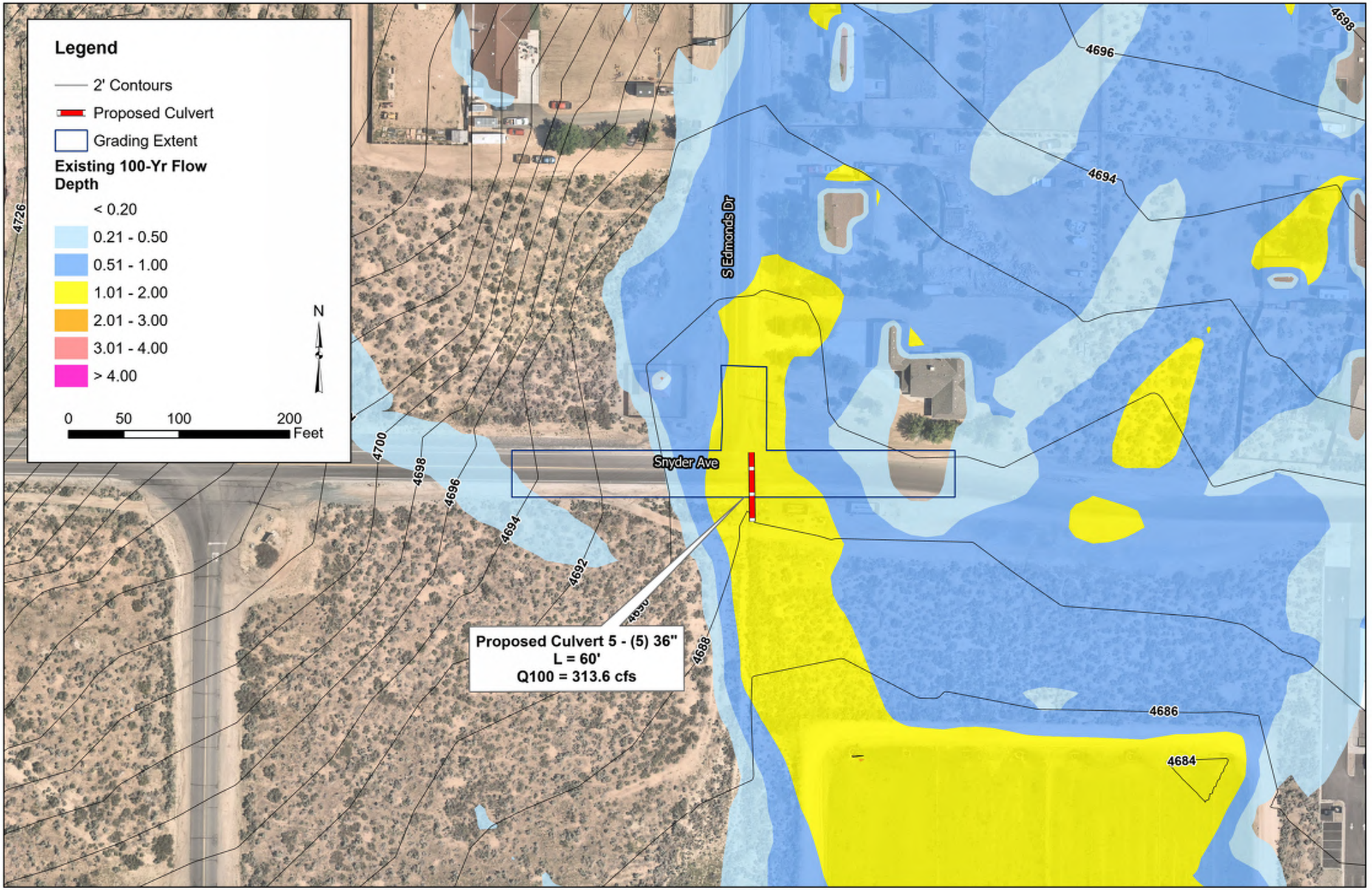
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE (H): 1"=40'
SCALE (V): NONE
DESIGNED BY: CTH
DRAWN BY: AKM
CHECKED BY: GSB
DATE: 10/2023

Southeast Carson City ADMP
Golden Eagle Lane Profile

PROJECT NO.
291417002

DRAWING NAME
Storm Pipes



Kimley»Horn

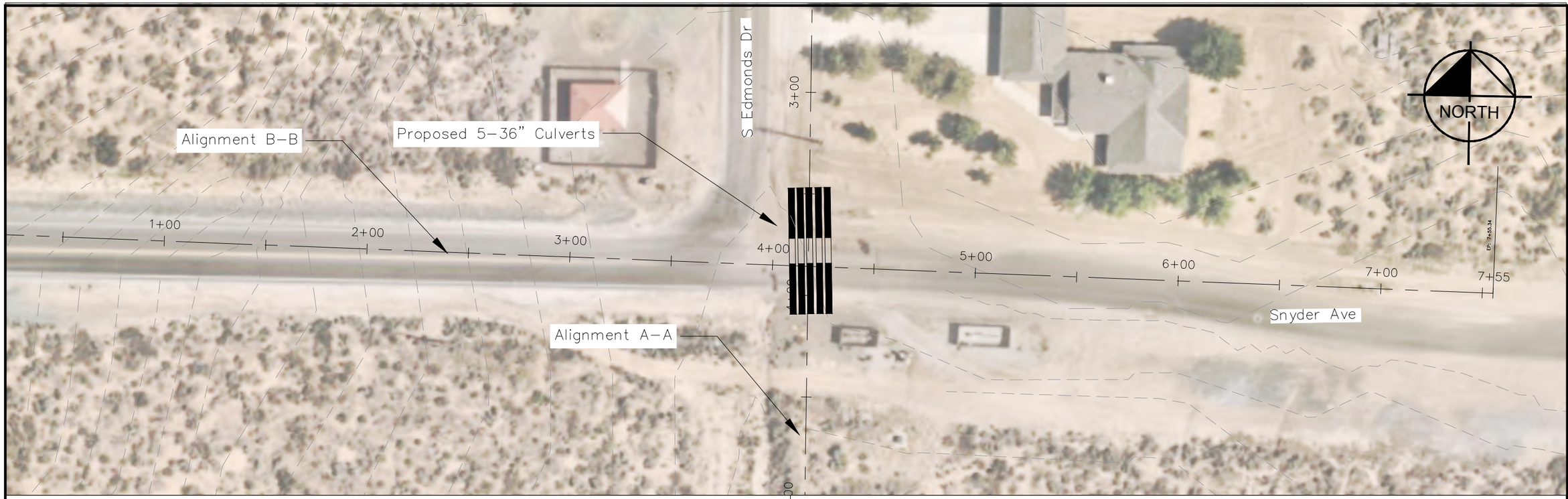
Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

Southeast Carson City ADMP
Initial Design Concept Map
AOMI #5

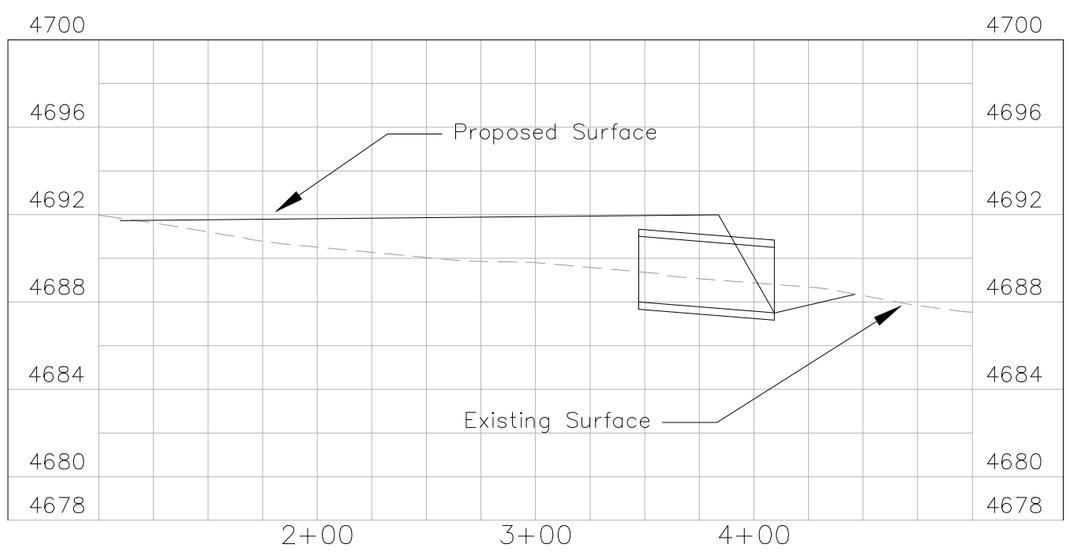
PROJECT NO.
291417002

DRAWING NAME
DESIGN CONCEPT

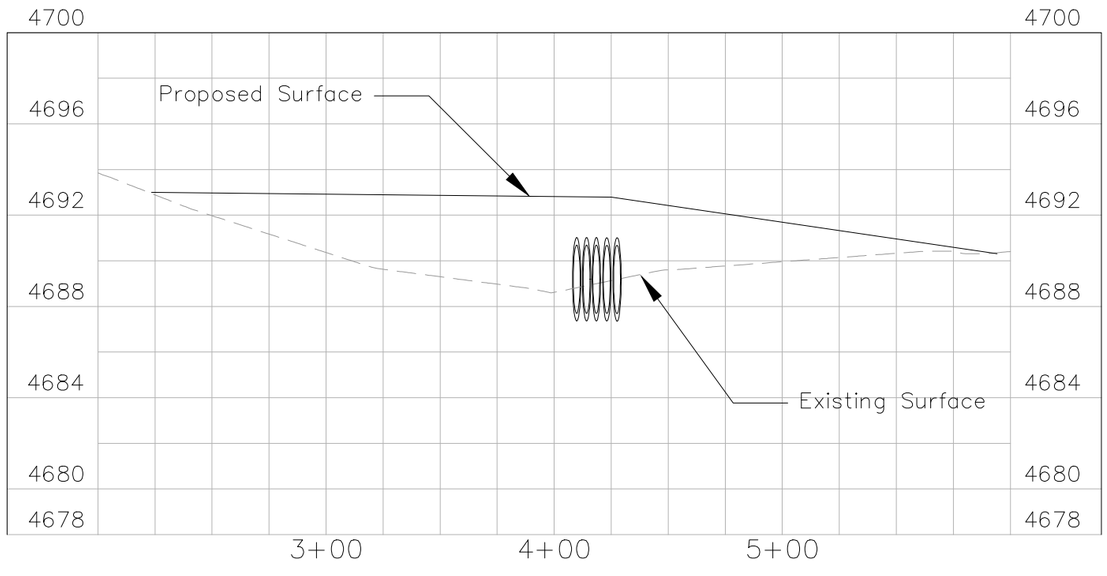
FIGURE 45



Section A–A



Section B–B



GRAPHIC SCALE IN FEET
0 25 50 100

NO.	REVISION	DATE

Kimley»Horn

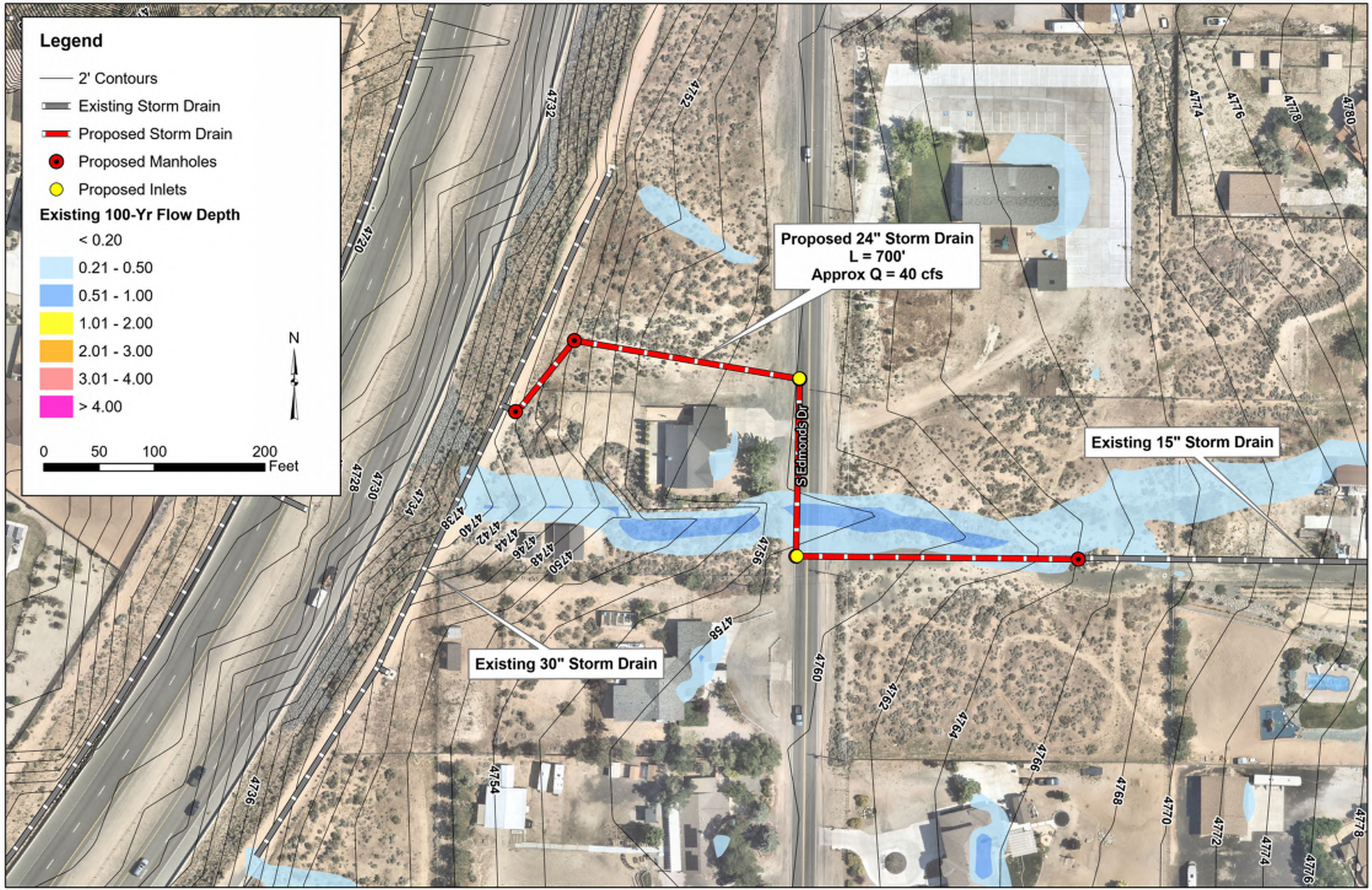
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE (H): 1"=40'
SCALE (V): NONE
DESIGNED BY: CTH
DRAWN BY: AKM
CHECKED BY: GSB
DATE: 10/2023

Southeast Carson City ADMP
Snyder Ave Profile

PROJECT NO.
291417002

DRAWING NAME
Storm Pipes



Kimley»Horn

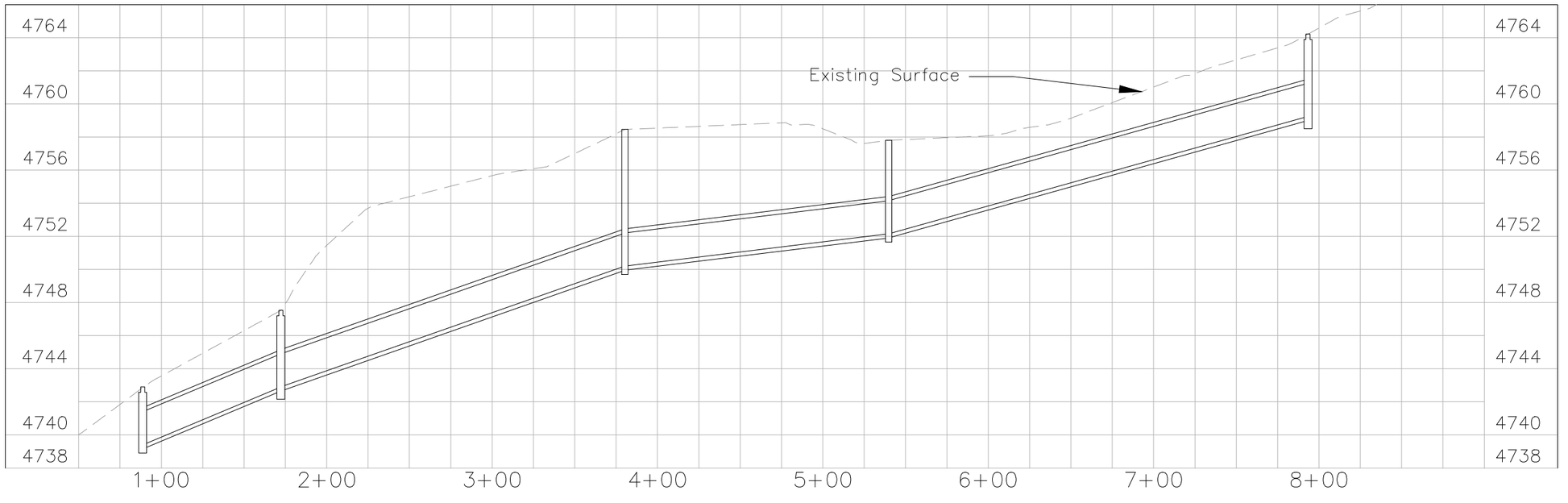
Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

Southeast Carson City ADMP
Initial Design Concept Map
AOMI #6

PROJECT NO
291417002

DRAWING NAME
DESIGN CONCEPT

FIGURE 47



GRAPHIC SCALE IN FEET
0 25 50 100

NO.	REVISION	DATE

Kimley»Horn

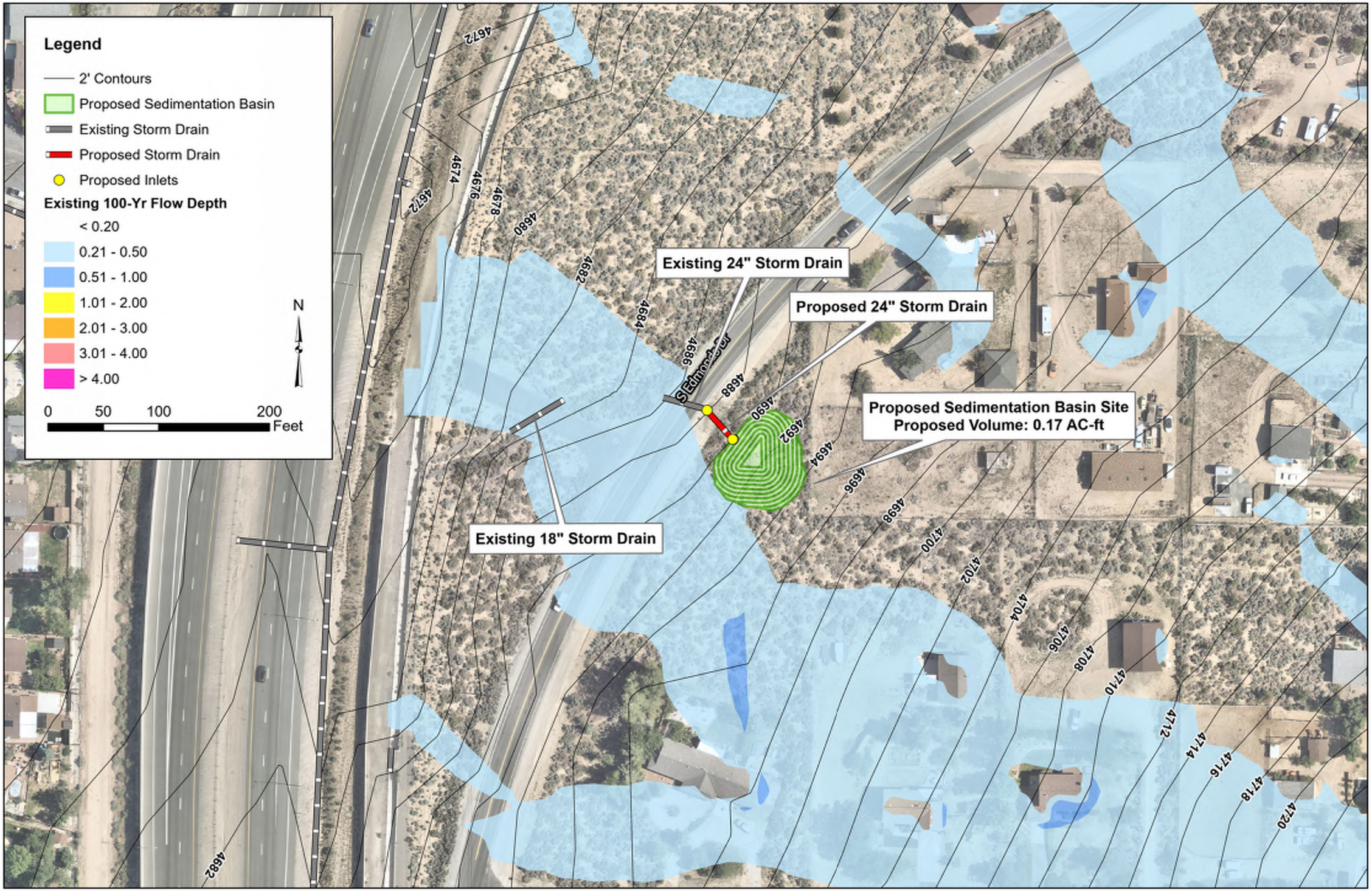
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE (H): 1"=40'
SCALE (V): NONE
DESIGNED BY: CTH
DRAWN BY: AKM
CHECKED BY: GSB
DATE: 10/2023

Southeast Carson City ADMP
South Edmonds Drive Profile

PROJECT NO.
291417002

DRAWING NAME
Storm Pipes



Kimley»Horn

Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

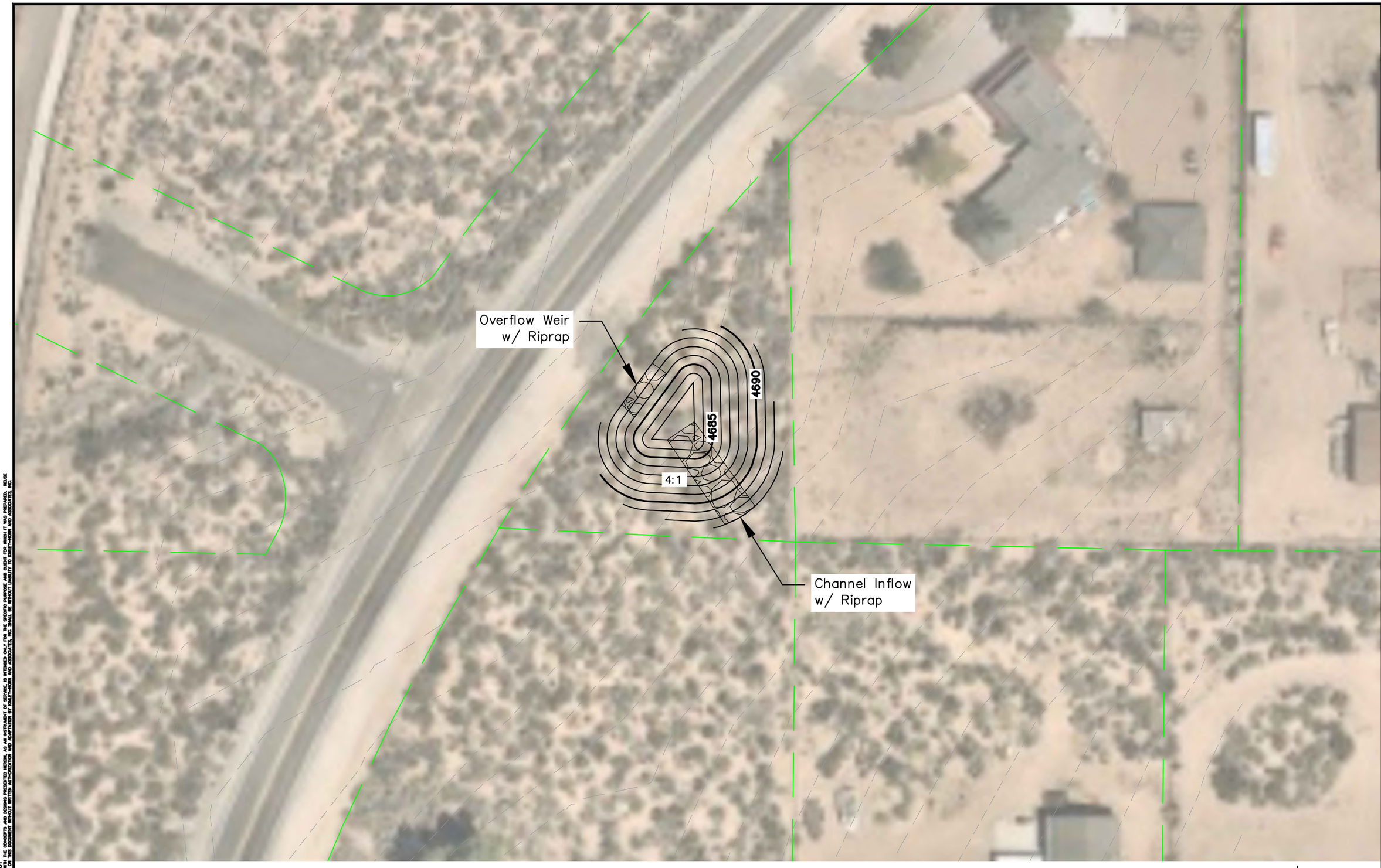
SCALE: AS SHOWN
DESIGNED BY: CSH
DRAWN BY: DBK
CHECKED BY: CBR
DATE: 08/29/23

Southeast Carson City ADMP
Initial Design Concept Map
AOMI #7

PROJECT NO. 291417002

DRAWING NAME: DESIGN CONCEPT

FIGURE 49



GRAPHIC SCALE IN FEET
0 10 20 40

Approximate Earthwork Quantities:
Bank Cut Vol = 750 CY
Bank Fill Vol = 0 CY

NORTH

NO.	REVISION	DATE

Kimley»Horn

7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE (H): 1"=250'
SCALE (V): NONE
DESIGNED BY: ATC
DRAWN BY: RDK
CHECKED BY: ATC
DATE: 05/2023

Southeast Carson City ADMP
Sedimentation Basin 15% Plan

PROJECT NO.
291417002

DRAWING NAME
SE Carson Basin

7 Benefit Cost Analysis

A benefit cost analysis (BCA) was conducted in accordance with FEMA's BCA Toolkit (Version 6.0) to evaluate the fiscal benefits of the proposed projects. In order to be eligible for FEMA grant funding, projects must have a BCR greater than 1. The total mitigation benefit associated with the project implementation includes reduction of flooding potential to structures as well as social benefits. The mitigation benefit is compared to the cost of construction and annual maintenance to understand the overall BCR. Costs used to calculate the BCR are adjusted using discount rates to adjust totals to present day value. For this project, the standard 7% discount rate was applied; however, FEMA will allow a 3% discount rate to apply for grants for projects in disadvantaged communities or other challenges which yields a higher BCR. AOMIs 1 and 3 are expected to mitigate up to the 100-year storm event and will have direct benefit to nearby structures as well as some social benefit; therefore, these projects were included in the BCA. Per FEMA's BCA Toolkit, standard benefits were evaluated per building structure based on pre- and post- project flow depths. Post project flow depths were assumed to result in no damage to nearby structures based on the design storm event. The social benefits are based on the total number of residents. Table 8 is a summary of the benefit cost ratio and the detailed FEMA output can be seen in Appendix F. The benefits are listed in present day dollars.

Table 8 : Benefit Cost Ratio

AOMI	1	3
Number of Properties Impacted	130	24
Approximate Population	299	55
Social Benefit	$1.4 Million	$256,669
Standard Mitigation Benefit	$6.5 Million	$3.1 Million
Total Mitigation Project Benefit	$7.8 Million	$3.4 Million
Construction Cost	$3.8 Million	$1.6 Million
Annual Maintenance Cost	$4,000	$2,000
Total Mitigation Project Cost	$3.8 Million	$1.6 Million
Benefit Cost Ratio	2.03	2.08

8 Conclusion

The SECC ADMP developed a detailed two-dimensional FLO-2D model that used recent LiDAR terrain, and current hydrologic and hydraulic methodologies to define existing flood hazard conditions for the 10-, 25-, 100-year storm events. Existing condition results were presented to residents in the study area for validation. Residents were also queried for any additional anecdotal flood data. Results from these analyses, discussions with the City, and public input were used to define flood prone areas.

Based on available land and opportunity within the study area, seven Areas of Mitigation Interest were identified, and flood mitigation alternatives developed for six. This will provide substantial improvements in a large portion of the study area. Conceptual plans and costs were developed for these locations.

The next step in advancing flood mitigation projects would be to further the design and analyses of each flood mitigation alternative either through a design concept report or a FEMA scoping project via a BRIC grant. This process would refine the hydrologic and hydraulic analyses, conduct required environmental evaluations, and advance the plans and cost closer to construction document level.

It should also be noted that based on the information collected during the second public meeting, there is significant justification for additional study of the area focusing on mitigation of flooding and sediment accumulation from Prison Hill impacting individual lots, roadside conveyance, and street intersections. The intent of a potential additional study phase could be identifying means of more effectively conveying and/or storing sediment in the residential areas east of South Edmonds Drive upstream, through, and adjacent to individual parcels.

9 References

FCDMC. (2016, May). FLO-2D Verification Report.

FLO-2D. (2023). Build No 20.07.22.

HDR. (2010, June). Hydrologic Analysis for Carson City Restudy.

Manhard. (2010, March). SW Carson City Regional Hydrologic Analysis Final Report.

NRCS. (2022, September). SSURGO Database for Carson City Area, Nevada.

USBR. (1988, December). Downstream Hazard Classification Guidelines.

USDA NRCS. (1986, June). Urban Hydrology for Small Watersheds.

USGS and DAS. (2017). NV Reno Carson Urban LiDAR B17 Survey Report.

USGS. (n.d.). *National Topographic Map*. From https://apps.nationalmap.gov/viewer/

WRC. (1997, April 28). Hydrologic Analysis US 395 Byopass Freeway.

Appendices

Appendix A: USGS LiDAR Survey Report

Appendix B: Public Meeting #1

Appendix C: Public Meeting #2

Appendix D: Flooding Documentation Photos

Appendix E: Engineers Opinion of Probable Cost

Appendix F: FEMA Benefit Cost Analysis

Appendix G: Electronic Files

Appendix A: USGS LiDAR Survey Report

NV Reno Carson Urban Lidar 2017 B17

SURVEY REPORT

USGS Contract: G16PC00044

Task Order Number: G17PD01257

Government Point-of-Contact (POC)

Organization: USGS/NGTOC

Telephone: (573) 308-3756

Address: Gail Dunn

1400 Independence Road, MS 663

Rolla, MO 65401

Contractor Point-of-Contact (POC)

Address: Digital Aerial Solutions, LLC

Telephone: (813) 628-0788

ATTN: Joshua Helton (VP)

4027 Crescent Park Drive

Riverview, FL 33578

Table of Contents

OVERVIEW

Digital Aerial Solutions, LLC (DAS) with contract number G16PC00044 was contracted by the USGS/NGTOC under task order number G17PD01257 collect a high resolution LiDAR data set covering 1534 square miles affecting Carson City, Douglas, Lyon, Sierra, Storey and Washoe counties in Nevada. Each of these categories was spread out as evenly as possible throughout the Area of Interest (AOI). The survey was completed using the Global Positioning System (GPS). Each observation was identified in the field and surveyed utilizing GPS receivers, collecting GNSS and GLONASS information and utilizing a Leica Smart-Net RTK network. In accordance with section C.1.b.(viii) of the task order, the spatial reference system used was:

Spatial Reference System:

Coordinate System:	Universal Transverse Mercator 11 North
Horizontal Datum:	North American Datum 1983 of (2011)
Vertical Datum:	North American Vertical Datum of 1988
Units:	Meters
Geoid Model:	Geoid 12B

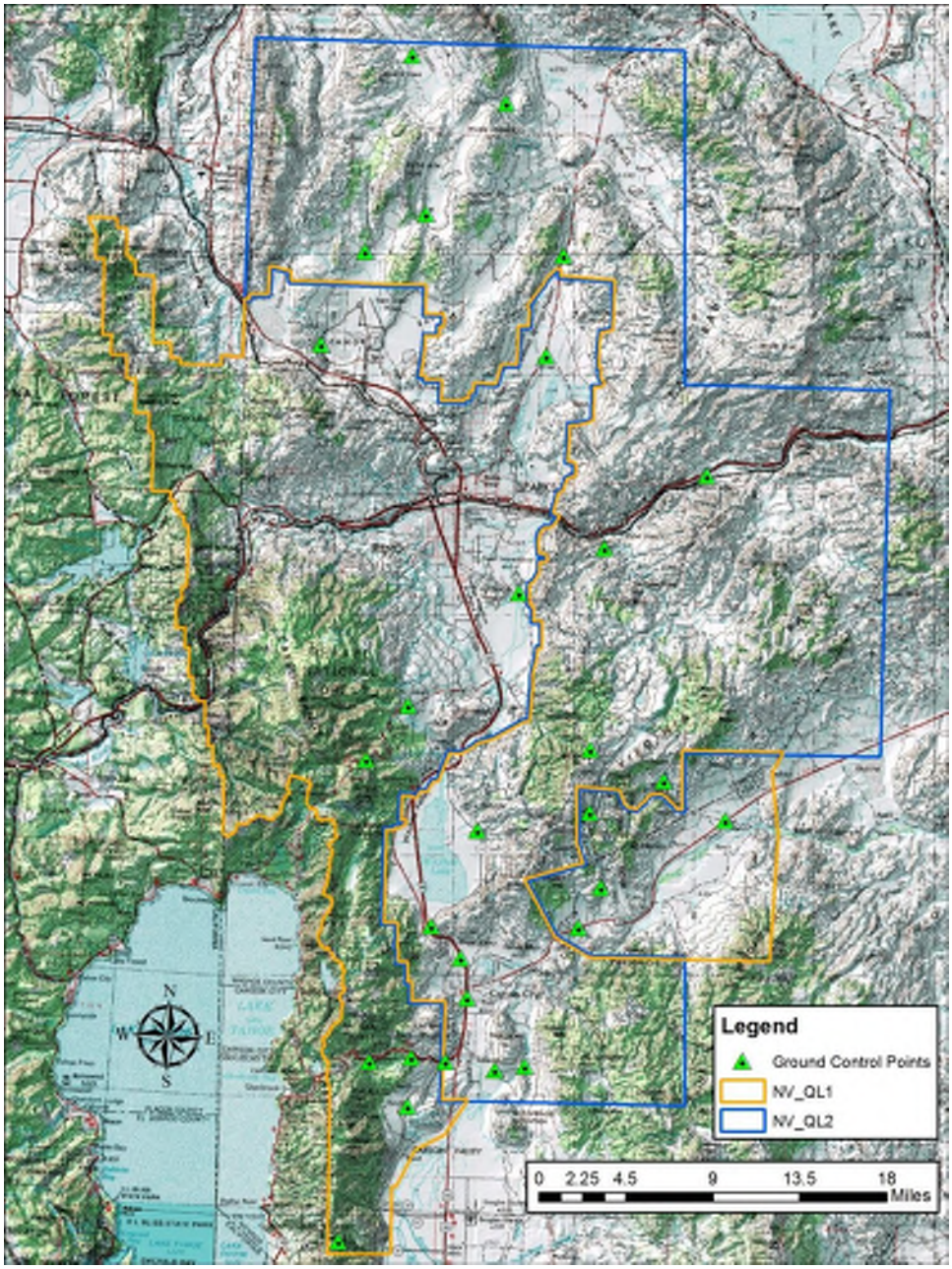
Section C.1.b.(ix) of the task order outlines the ground control minimum requirements and specifications for this LiDAR project. 30 Supplemental ground control points were collected and used to support the airborne GPS solution and positional accuracy. DAS also collected more than the required number of Non-Vegetated Vertical Accuracy (NVA) and Vegetated Vertical Accuracy (VVA) Quality Checkpoints as stated in the task order. These checkpoints serve as an independent delivery to the client and were not incorporated into the vertical solution.

Glossary of Terms

Term		Definition
ATTN	-	Attention
BG	-	Bare-Ground Checkpoint (see NVA)
CO	-	Colorado, USA
CTRL	-	Control
DAS	-	Digital Aerial Solutions, LLC
Ellip	-	Ellipsoid Height
FIPS	-	Federal Information Processing Standard
FL	-	Florida
GPS	-	Global Positioning Systems
HVEG	-	High Vegetation(see VVA)
ID	-	Identification
LVEG	-	Low Vegetation (see VVA)
LiDAR	-	Light Detection and Ranging
MVEG	-	Medium Vegetation (see VVA)
NAD83	-	North American Datum of 1983
NAVD88	-	North American Vertical Datum of 1988
NGS	-	National Geodetic Survey
NGTOC	-	National Geospatial Technical Operations Center
NVA	-	Non-Vegetated Vertical Accuracy
Ortho	-	Orthometric Height
POC	-	Point of Contact
PT	-	Pavement(see NVA)
RTK	-	Real Time Kinematics
SD	-	Sand(see NVA)
USGS	-	United States Geological Survey
VP	-	Vice President
VVA	-	Vegetated Vertical Accuracy

Supplemental Ground Control

The Map shows the overall distribution of the Supplemental Ground Control throughout the AOI. The following tables contain a list of the control using Easting, Northing, and Orthometric height. The coordinate system displayed is UTM 11N, NAD83 (2011), NAVD88, Geoid 12B and using Meters for measurement.



Appendix B: Public Meeting #1

Post Card
Flyer
Social Media Graphics
Press Release
Yard Signs
Sign-In Sheet
Presentation
Virtual Meeting Summary
Emails
Maps With Public Comment

Appendix B: Post Card

COMMUNITY
INFORMATION MEETING

SOUTHEAST CARSON CITY AREA DRAINAGE MASTER PLAN

Residents and property owners are invited to learn about the **Southeast Carson City Area Drainage Master Plan** and share your input and comments on future drainage infrastructure with drainage experts at our **virtual** or **in-person** information meeting!

VIRTUAL MEETING

TIME: **Tuesday, August 30, 2022 | 12:00-1:00 pm**
LOCATION: **https://tinyurl.com/SEccdrainageplan**
or scan the QR code with your phone to join

IN-PERSON MEETING

TIME: **Tuesday, August 30, 2022 | 5:00-6:30 pm***
LOCATION: **Carson City Sheriff's Office Ormsby Room**
ADDRESS: **911 East Musser Street, Carson City**

**Open house beginning at 5:00 pm with a short presentation at 6:00 pm*

Carson City Sheriff's Office Ormsby Room
911 East Musser Street
Carson City, NV 89701

FEMA

Please share your input and comments via email, phone, or website:

EMAIL: **info@SEccdrainageplan.com**
PHONE: **775-887-2305**
WEBSITE: **http://www.SEccdrainageplan.com**

Appendix B: Flyer

COMMUNITY
INFORMATION MEETING

SOUTHEAST CARSON CITY AREA DRAINAGE MASTER PLAN

Residents and property owners are invited to learn about the **Southeast Carson City Area Drainage Master Plan** and share your input and comments on future drainage infrastructure with drainage experts at our **virtual** or **in-person** information meeting!

FEMA

VIRTUAL MEETING

TIME: **Tuesday, August 30, 2022 | 12:00-1:00 pm**
LOCATION: **tinyurl.com/SEccdrainageplan**
or scan the QR code with your phone to join

IN-PERSON MEETING

TIME: **Tuesday, August 30, 2022 | 5:00-6:30 pm***
LOCATION: **Carson City Sheriff's Office Ormsby Room**
ADDRESS: **911 East Musser Street, Carson City**

**Open house beginning at 5:00 pm with a short presentation at 6:00 pm*

Please share your input and comments via email, phone, or website.

EMAIL: **info@SEccdrainageplan.com**
PHONE: **775-887-2305**
WEBSITE: **http://www.seccdrainageplan.com**

COMMUNITY
INFORMATION MEETING

SOUTHEAST CARSON CITY AREA DRAINAGE MASTER PLAN

Residents and property owners are invited to learn about the **Southeast Carson City Area Drainage Master Plan** and share your input and comments on future drainage infrastructure with drainage experts at our **virtual** or **in-person** information meeting!

VIRTUAL MEETING

TIME: **Tuesday, August 30, 2022 | 12:00-1:00 pm**
LOCATION: **tinyurl.com/SEccdrainageplan**
or scan the QR code with your phone to join

IN-PERSON MEETING

TIME: **Tuesday, August 30, 2022 | 5:00-6:30 pm***
LOCATION: **Carson City Sheriff's Office Ormsby Room**
ADDRESS: **911 East Musser Street, Carson City**

**Open house beginning at 5:00 pm with a short presentation at 6:00 pm*

Please share your input and comments via email, phone, or website.

EMAIL: **info@SEccdrainageplan.com**
PHONE: **775-887-2305**
WEBSITE: **http://www.seccdrainageplan.com**

Appendix B: Social Media Graphics

VIRTUAL COMMUNITY INFORMATION MEETING

FEMA

SOUTHEAST CARSON CITY

AREA DRAINAGE MASTER PLAN

Tuesday, August 30 from 12:00-1:00 pm

At the virtual meeting, a short presentation will begin at 12:00 pm and will conclude the presentation with a Q&A.

Visit
http://www.seccdrainageplan.com
to learn more and register now!

IN-PERSON COMMUNITY INFORMATION MEETING

FEMA

SOUTHEAST CARSON CITY

AREA DRAINAGE MASTER PLAN

Tuesday, August 30 from 5:00-6:30 pm

Open house will begin at 5:00 pm followed with a short presentation at 6:00 pm. We will conclude the presentation with a Q&A.

Visit
http://www.seccdrainageplan.com
to learn more and register now!

Appendix B: Press Release

FOR RELEASE ON AUGUST 27, 2022

Date: August 24, 2022
Contact: Robb Fellows, Carson City Floodplain Manager
Email: RFellows@carson.org

PUBLIC WORKS
3505 Butti Way
Carson City, NV 89701
(775) 887-2355

Public Kickoff Meeting about Southeast Carson City Area Drainage Master Plan

Carson City, NV—Carson City Public Works, in conjunction with the Carson Water Subconservancy District (CWSD), is hosting a virtual and in-person public open house about the Area Drainage Master Plan in Southeast Carson City on August 30, 2022. The virtual meeting will be held from 12:00 pm – 1:00 pm. Join at https://tinyurl.com/SEccdrainageplan or use the QR code below. The in-person public open house will be held from 5:00 pm – 6:30 pm, at the Carson City Sheriff's Office, Ormsby Room at 911 E Musser Street, Carson City, NV.

The goal of this project is to take a comprehensive look at the area to develop a plan that identifies flooding challenges and potential alternatives and their costs. At this this public meeting, residents will have the opportunity to hear about the project, its methodology, and identify cost effective alternatives to reduce flooding in the area. The open house meeting will begin at 5:00 to 6:00 pm with a short presentation starting at 6:00 pm. Residents will be able to view maps and are invited identify areas they experience flooding. There will also be the opportunity to see a watershed model demonstration during the open house portion of the meeting.

Location: 911 E Musser Street, Ormsby Room, Carson City, NV 89701

Residents are invited to preview the presentation. Residents are also invited to submit photos and comments about their flooding experience in this area at this website: (Kimley Horn create website).

For more information about this meeting, contact the Stormwater Hotline of Carson City Public Works at **(775) 887-2302 or stormwaterhotline@carson.org.**

Scan the QR code with your phone to join the virtual meeting

Appendix B: Yard Signs

COMMUNITY
INFORMATION MEETING

SOUTHEAST CARSON CITY AREA DRAINAGE MASTER PLAN

CARSON CITY PUBLIC WORKS

CARSON WATER SUBCONSERVANCY DISTRICT

THE GREAT SEAL OF THE MUNICIPALITY OF CARSON CITY, NEVADA FOUNDED 1858 CC

U.S. DEPARTMENT OF HOMELAND SECURITY

FEMA

- DATA COLLECTION
- EXISING CONDITIONS FLOOD HAZARDS ANALYSES
- PROPOSED CONDITIONS FLOOD HAZARD ANALYSES
- PUBLIC INPUT
- DESIGN CONCEPT REPORT/PLAN

SCAN WITH YOUR PHONE!

Email: info@SEccdrainageplan.com | Phone: 775-887-2305 | Website: http://www.seccdrainage.com

Appendix B: Sign-In Sheet

Sign In Sheet

Southeast Carson City Area Drainage Plan Virtual Information Meeting

Name	Address	Mobile Phone Number (xxx-xxx-xxxx)	Email	How did you hear about the virtual meeting?
REX ALLEN JENNINGS	[redacted]			NEWSPAPER
DAVE PATTERSON	[redacted]			MAILER
DAVE MCTEER ELIZABETH JOHNSON	[redacted]			POSTCARD
Bonnie Barnett	[redacted]			post card
Alyson Rogers / Billy Dunn	[redacted]			Postcard.
Donna Iversen	[redacted]			CWSD email
Norman Chamberlin	[redacted]			Postcard
Jack & Karen Radday	[redacted]			Received card- mail
Diana McVeigh	[redacted]			✓ ✓ ✓
JAMES H. Wheeler III	[redacted]			post CARD mailer
KAREN CRANDALL	[redacted]			al. POST CARD
MICHAEL ZOLA	[redacted]			" "
Paul Sinnott	[redacted]			" "

[redacted]

Robyn Orloff	[redacted]	[redacted]	[redacted]	email on post card
Sue Farcello	[redacted]	[redacted]	[redacted]	NO Emile —
Lila Halpern	[redacted]	[redacted]	[redacted]	

Virtual Meeting Sign-In Sheet
Southeast Carson City Area Drainage Master Plan

	Name	Address	Phone	Email	How did you hear about this meeting?						
Count	Open-Ended Response	Open-Ended Response	Open-Ended Response	Open-Ended Response	Postcard	Yard sign	Email	Flyer	Word of mouth (i.e. from your neighbor, friends, or family)	Press release	Social Media
1	James H. Wheeler III	[redacted]	[redacted]	[redacted]	Postcard						
2	Jim Wheeler	[redacted]									
3	Gregg Berggren	[redacted]	[redacted]	[redacted]	Postcard		Email				
4	Shirley Faiella	[redacted]	[redacted]	[redacted]	Postcard						
5	David L. McTeer	[redacted]	[redacted]	[redacted]	Postcard						
6	Doug Martin	[redacted]	[redacted]	[redacted]				Flyer			
7	Robyn Orloff	[redacted]	[redacted]	[redacted]	Postcard		Email				
8	Jeanne Cooley	[redacted]	[redacted]	[redacted]	Postcard						
9	Adam Woodrum	[redacted]	[redacted]	[redacted]	Postcard						
10	Tom Grundy	[redacted]	[redacted]	[redacted]	Postcard						
11	Tanya Sullivan	[redacted]		[redacted]			Email				
12	Dan										
13	Dave										
14	Deborah Hilderbrand										
15	Eric Yount										
16	Faiella Shirley										
17	George Ruiz										
18	Jcool										
19	John E. Neill										
20	Kenneth Cruz										
21	Mike Kellog										
22	Randy Rice										
23	Thoma										
24	Sherry Griffin Grundy										
25	Tom Young										

Appendix B: Presentation

SOUTHEAST CARSON CITY

AREA DRAINAGE MASTER PLAN

FEMA

SUPPORTED BY:

Carson City Public Works
Carson Water Subconservancy District
FEMA

Southeast Carson City
Area Drainage Master Plan

Study Area Map

Project Stakeholders

- Residents – 522 unique addresses
- Washoe Tribe
- Northern Nevada Corrections Center
- Pete Livermore Sports Complex (Edmonds Fields)
- State of Nevada
- Stewart Indian School Cultural Center
- Carson City Open Space
- NDOT

Project Purpose

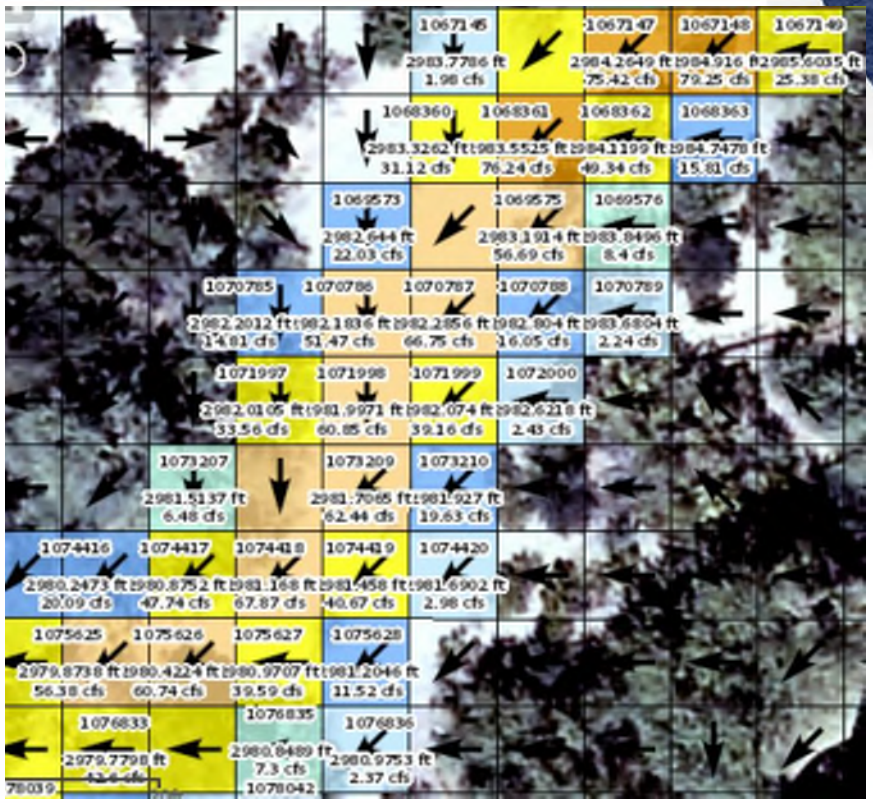
- Project will more accurately define flood hazards, including nuisance flooding, in the area
- Build on hydrologic and hydraulic studies
- Reduce flood hazards and increase community resiliency in the future

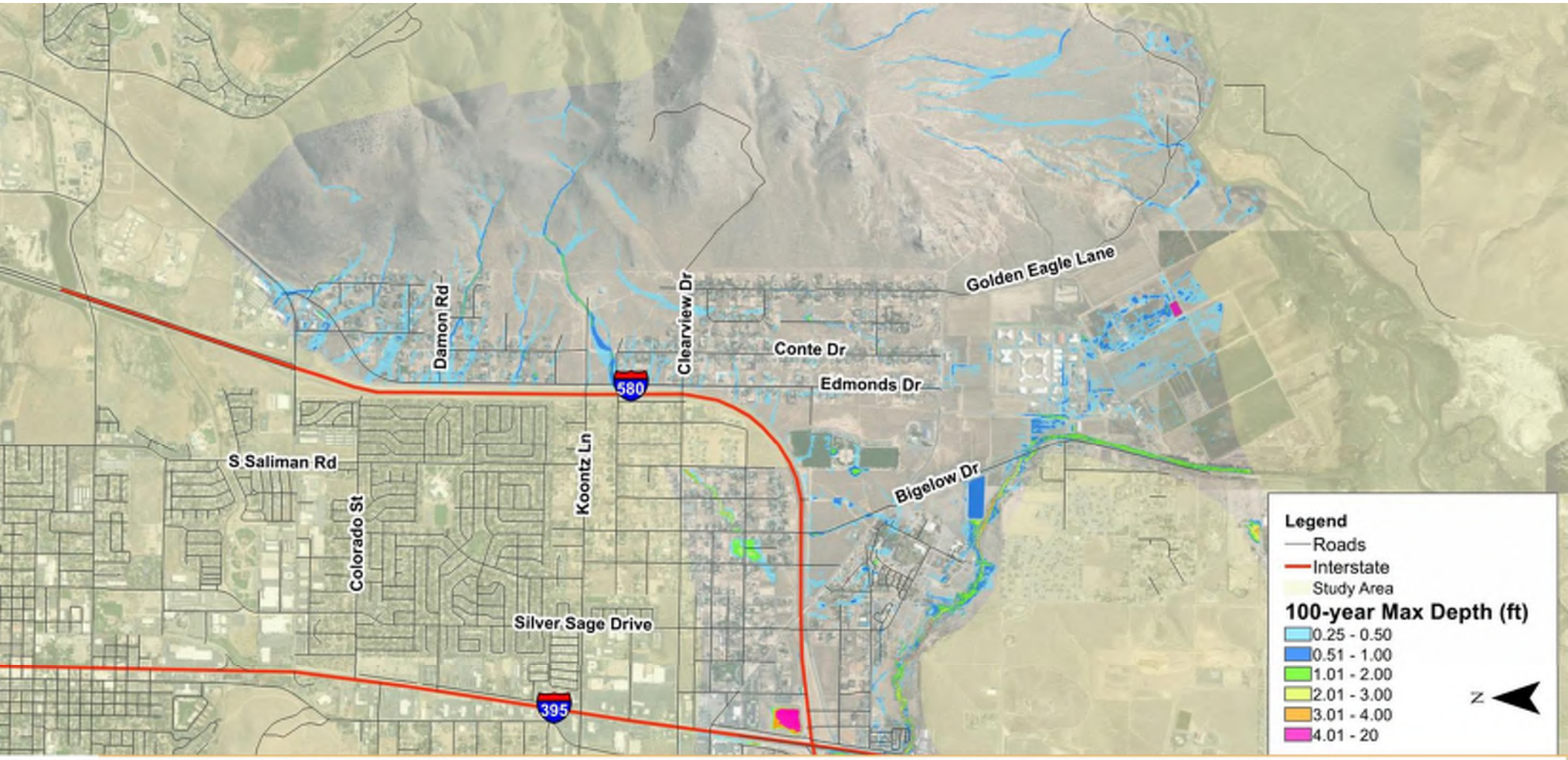
Project Goals

- Identify mitigation solutions for areas impacted by flood flows and erosion
- Formulate a plan to mitigate flooding with cost-effective infrastructure
- Reduce flood hazards for residents

Comprehensive Hydrology & Hydraulic Model

- Grids
  - Study area is divided into 15’ x 15’ grids
  - Water depths
  - Velocities
  - Flows & flow direction
- Models
  - Can be revised & updated
  - Use for Design & Planning new development and infrastructure
- End Users
  - City
  - Engineers
  - Homeowners





Southeast Carson City
Area Drainage Master Plan

Preliminary Flood Hazards Overview

Southeast Carson City
Area Drainage Master Plan

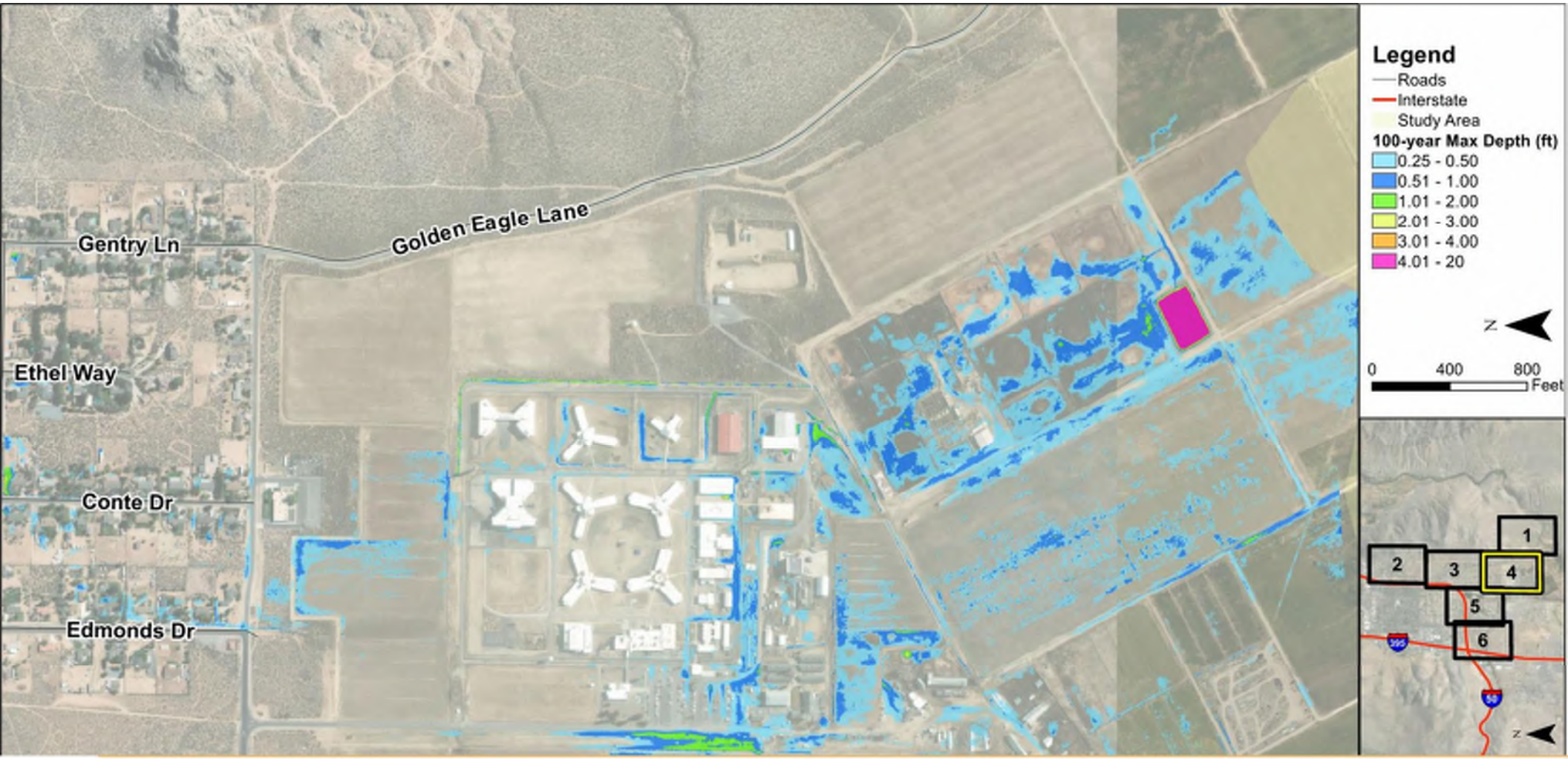
Preliminary Flood Hazards Overview (1 of 6)

Southeast Carson City
Area Drainage Master Plan

Preliminary Flood Hazards Overview (2 of 6)

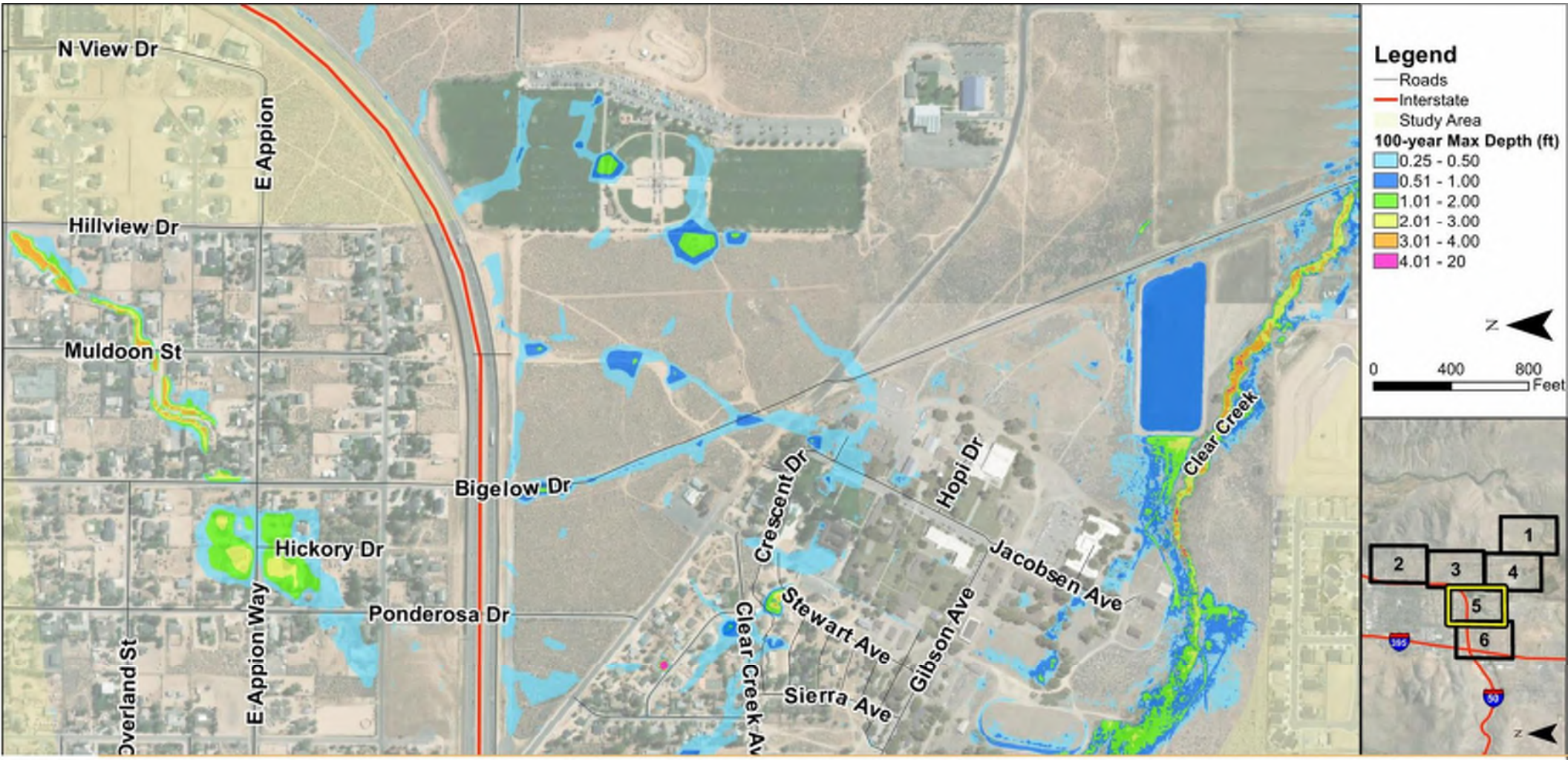
Southeast Carson City
Area Drainage Master Plan

Preliminary Flood Hazards Overview (3 of 6)



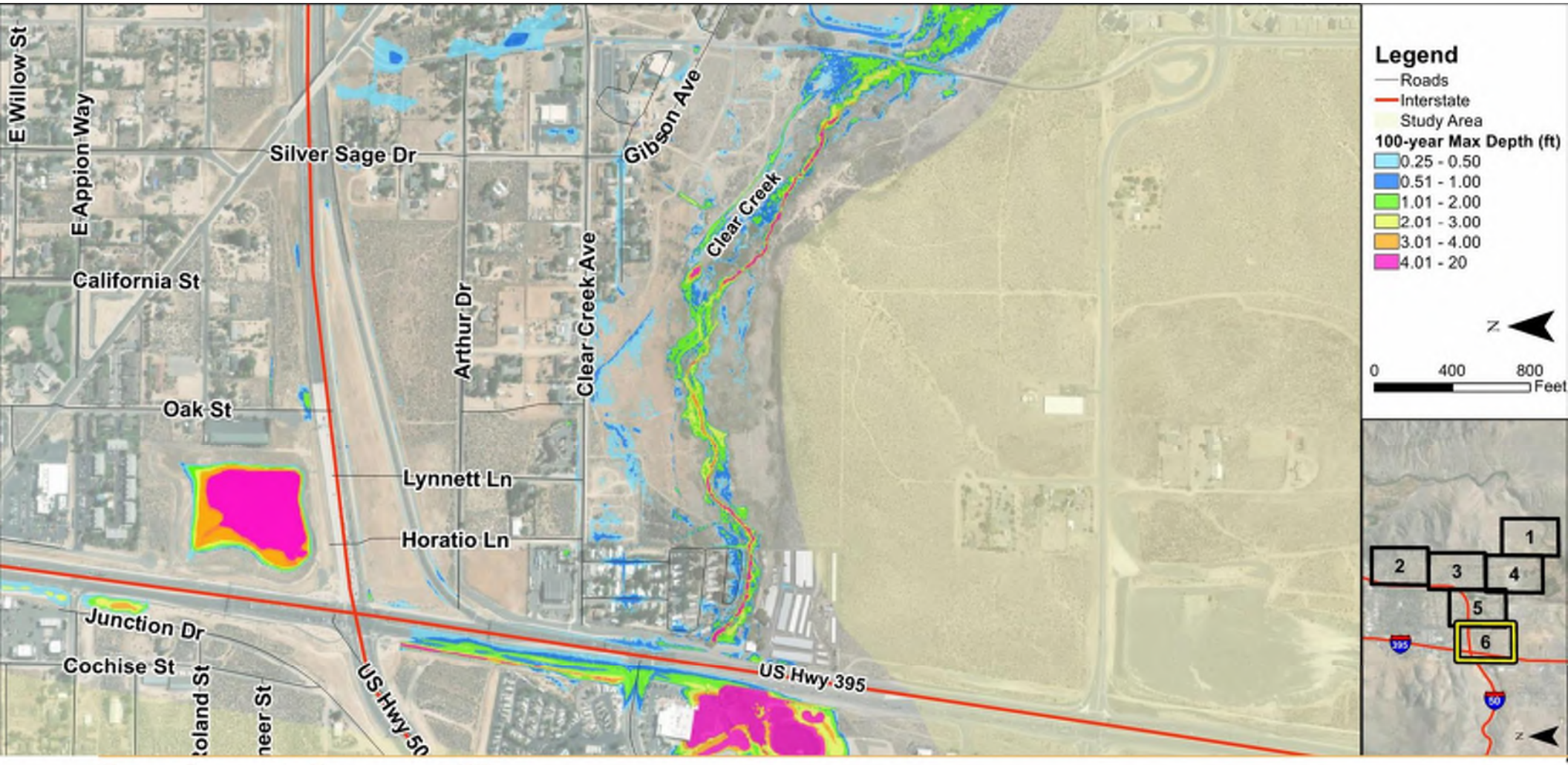
Southeast Carson City
Area Drainage Master Plan

Preliminary Flood Hazards Overview (4 of 6)



Southeast Carson City
Area Drainage Master Plan

Preliminary Flood Hazards Overview (5 of 6)



Southeast Carson City Area Drainage Master Plan

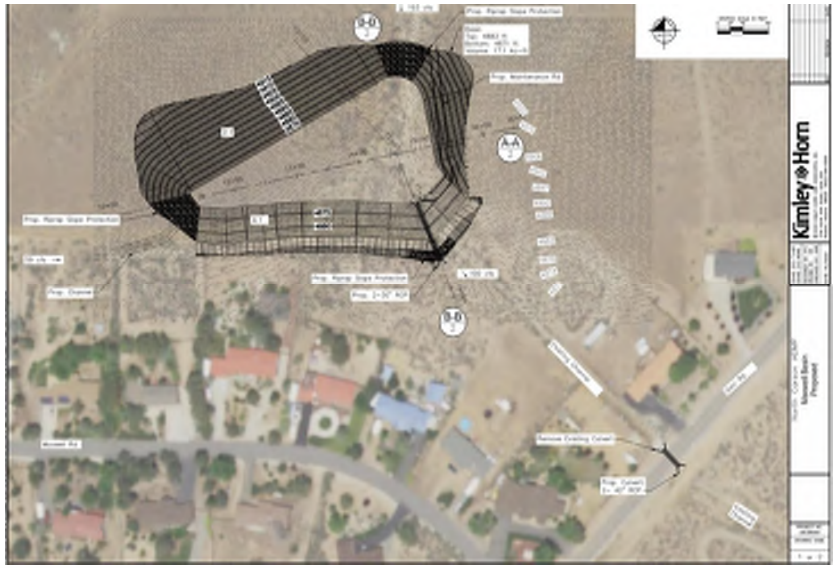
Preliminary Flood Hazards Overview (6 of 6)

Identify Hazards & Risks

- Houses, buildings, and undeveloped areas with high flood risk
  - 30% of all flood insurance claims are outside of mapped floodplains
  - Flood insurance even outside SFHA's
- Hazardous road crossings
  - Reinforces what residents likely know
  - Repetition helps risk awareness
- High erosion and sediment deposition hazards
  - City, utilities, and homeowners can use for planning
  - Public Works coordinates with Open Space on issues that affect City infrastructure

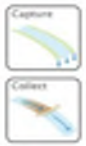
Solutions & Recommendations

- Regional structural solutions
  - Large areas
  - Benefits vs cost
- Local solutions
- Solutions for individual property owners



Other Potential End Products

- Flood risk reduction tools and techniques



Basin

Basins are depressions in the landscape that retain storm runoff. Me

Uses

- Collect excess water
- Collect sediment
- Supplement irrigation
- Encourage infiltration
- Addresses erosion hazards, sediment deposition, and structure flooding

Considerations

- Be mindful of where runo
- Basins in slow draining sc are not recommended
- Soil amendment may be than 36 hours to prevent
- Permit may be required

Berm

Berms are mounds of soil that help slow and divert the flow and dire maintenance.

Uses

- Slow water flow
- Divert water flow
- Direct runoff
- Addresses erosion hazards and structure flooding

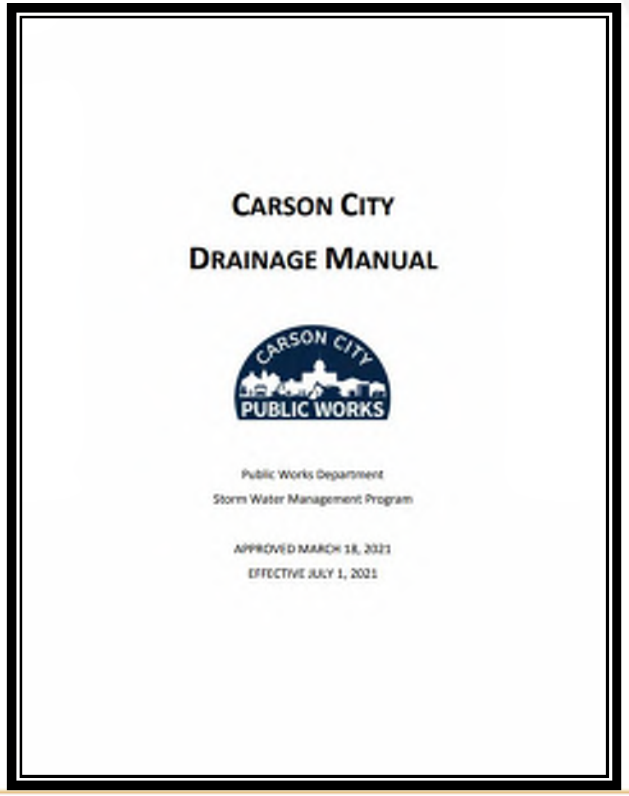
Considerations

- Guide runoff toward basi flow can spread and slow
- Berms can be strengthen along the banks and addi
- Costs vary, depending on
- Permit may be required

Tools for Residents

https://www.carson.org/home/showpublisheddocument/76280/637624691903200000

http://carsonsw.org/useful-links/



Next Steps

- Finish H&H Modeling
- Develop Implementable Conceptual Solutions
- Present to Stakeholders
- Finalize in Design Concept Report
- Present to CC and CWSD Boards

Project Schedule

- **August 30, 2022** – Public Meeting to present initial results and solicit public input

- **Spring 2023** – Follow-up Public Meeting to present propose mitigation solutions (projects)

- **Fall 2023** – Final and present to Board of Supervisors

Funding Options for Construction

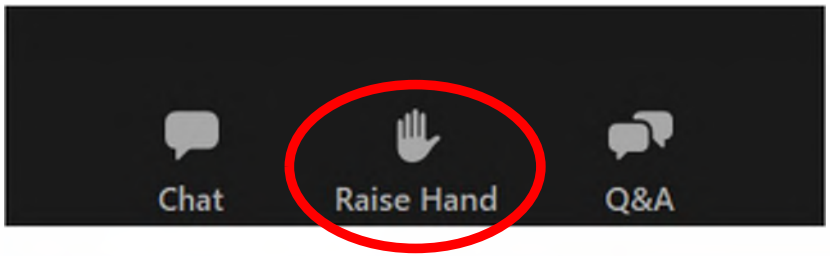
- With Board Approval:
  - Develop grant application for FEMA funding for construction
  - Carson City CIP

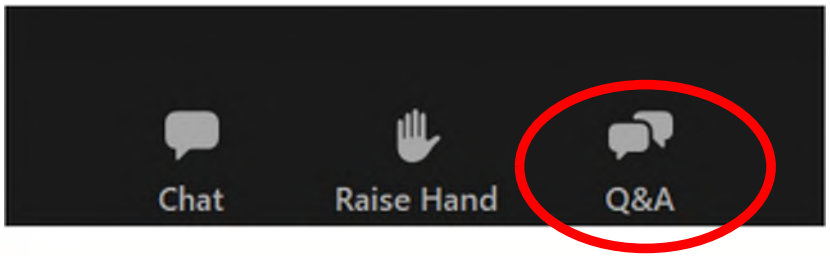
Contact Us

- Website: http://www.SEccdrainageplan.com
- Email: info@SEccdrainageplan.com
- Phone: 775-887-2305 (CC Stormwater Hotline)
- Mailing Address: 3505 Butti Way, Carson City, NV 89701

Q&A (virtual setting)

- If you would like to ask a question verbally, please use the “Raise Hand” button located on the bottom of your screen to notify us of a question
- Questions can also be asked in the chat. To access the chat, press the “Q&A” button at the bottom of the screen.





Q&A

Appendix B: Virtual Meeting Summary

Virtual Public Meeting Summary

Meeting Information:

Project Name:	Southeast Carson City Area Drainage Master Plan
Location:	Zoom Webinar
Date:	Tuesday, August 30, 2022
Time:	1 pm – 2 pm
Number of Attendees:	28

Notification Efforts:

- 522 Postcards
- Social Media Posts
- Email Notifications
- Flyers
- Yard Signs
- Press Release
- Website

Presentation Topics (see attached presentation):

- Project Partners
- Project Purpose
- Project Goals
- Study Area
- Initial Study Results
- Next Steps

Media Coverage:

n/a

Media Results:

n/a

Area Representation:

Carson City Residents
Carson City Public Works
Carson Water Subconservancy District

Project Team Attendees:

Team:

Robb Fellows, Carson City Public Works
Brianna Greenlaw, Carson City Public Works
Geoff Brownell, Kimley-Horn
Amalia Andrews, Kimley-Horn
Abbey McCarthy, Kimley-Horn
Brenda Soto, Kimley-Horn

Summary of Comments:

Questions and comments were gathered during the meeting, verbally and using the Q&A chat in zoom. Questions and comments were addressed by the project team during the virtual community meeting.

Questions, Comments and Answers:

Questions:

1. Is the use of septic in the area a factor in these types of studies? Is it possible that a recommendation may be made to change septic areas over to sewer instead?

   Response by Robb Fellows: A septic issue is a separate issue than a storm drain issue. In the near future, there is a program that will be completing what the City had started years ago – to convert people from septic to sewer because the ground water is being affected by the septic systems. Certainly, how that affects the ground water is much different than storm water runoff – this is not a part of this study.

2. Is there a drainage expert in the department that can come view a 1-acre of land can come and view the property and tell us what I need to do to mitigate erosion? Part of the land was cleared before we bought it. We're certainly willing to see what we need to do but are seeking expert advice.

   Response by Robb Fellows: That is a service that the City provides to the residents. If you would call the HOT line (775-887-2305) number to set up a time to come out to your property and look and see what's going on and give some advice and options on some things that will help you with erosion and different issues that might be happening in your property.

3. Who do we call to find out the progress on transferring from septic to sewer?

   Response by Robb Fellows: Call the HOT line (775-887-2305). We can get you in touch with people depending on what your question is. Call us and we'll get you to the right person.

4. When would you like specific ideas?

Response by Geoff Brownell: Anytime. You can share via email, website, we'd love to hear from you. That information will be collected, catalogued and will be very useful as we formulate design ideas. In addition, any pictures of flooding, ponding, rainfall, streams going through your property, whatever it is, is extremely useful for us.

5. Could you address the drainage through the ephemeral stream washes, after storms, down to Golden Eagle Lane from Snyder to past the OHV area -- and the progressive impacts of OHV use in the area.

   Response by Robb Fellows: The study area does include that area of Golden Eagle Lane. There will be information about the types of storm peak flow numbers that can be used to sized culverts and other structures that may be contemplated. Those values will be figured out. There may be some projects that come out of this for that area as well. Anything that can be provided on actual happenings will be useful to include in the study area.

6. There has been damage to Golden Eagle Lane as a result of that water/sedimentation flow, especially at the bottom of the OHV Staging Area (Off the Trailer Wash). The culvert is blocked so sediment/sand/water flow over the road -- eroding the road and the land below, on the way to the river. Head cut erosion etc. Issues for the neighbors coming and going from their homes. This ephemeral stream wash allows cross country riding upstream -- damaging soil and vegetation - causing more erosion soil run off. Will the culvert be fixed, to allow flow through it -- so less damage and impacts to the road there (entrance/exit to neighbors beyond)? Several of us have requested a site visit at this area. Would public works and the Consultants arrange a meeting?

   Response by Robb Fellows: Call to set up a meeting. The public works team can meet.

   Response by Geoff Brownell: We will be looking at the flow conditions in every drainage per the existing conditions – whether that's a compromised or natural condition – that will be part of the analysis and we will certainly identify where culverts are undersized and where they can be upsized to improve events. We're going to be looking at this entire area and consider all this input.

   Comments:

   Jim Wheeler, Carson City Resident: Have drainage feature and easement on my property. Have easement with sewer and storm drain line also surface feature am adjacent to City surface feature on BLM land fronted on Edmonds. Will need to review and examine my {historic} surface drainage feature on my property.

   Robyn Orloff, Carson City Resident: We might invite NV State Lands in on the discussion and site visit here -- it is NV State Land?

Attachments:

- Postcard
- Social Media Posts
- Flyer
- Yard Sign
- Press Release
- Virtual Sign-in sheet
- Project Presentation

Appendix B: Emails

From: [redacted]
Subject: ADMP SE Carson
Date: August 28, 2022 at 5:04 PM
To: info@seccdrainageplan.com info@SEccdrainageplan.com

Hi there,
I don't see any report that I can comment on? — just notification of the meeting?
Is there something I can read and review — in order to comment?

https://www.cwsd.org/wp-content/uploads/2022/08/SECC-Carson-City_Flyer_82422.pdf

WebPage.pdf

Comment in general:

Will you be discussing the erosion on the Prison Hill Recreation Area, and its impacts? The PH area sits within the SI ADMP you are studying?

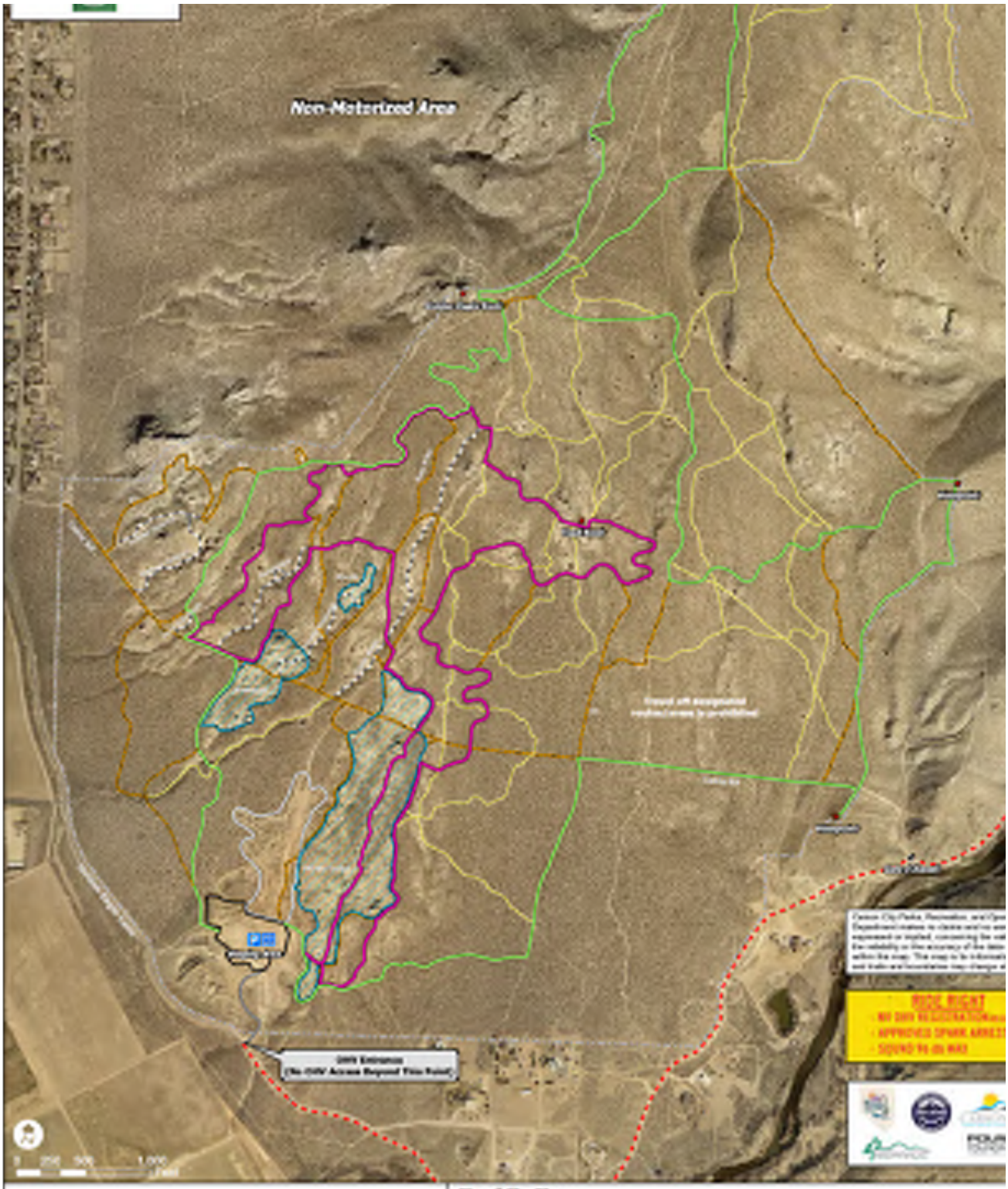
1). We are getting water from the ? Prison Hill Creek? — which comes down through the Clearview Area and into a ditc that runs south thru the Heidi Circle, under Bennett, and
into the properties at the south end of Ethel Way. It is an ephemeral stream creek that flows heavy when the rain is enough to finally saturate the sand, causing episode surface water flows.
Ultimately this ephemeral stream goes into/through several properties, on Ethel Way — with varying degrees of impact and damage.
This has been addressed downstream from the corner of Hudson and Conte: curbing put in to direct the water/protect t properties.

Add to it, the water flow down from Prison Hill at Bennett St and westward — that goes into the culvert at the low point, flow into the Ethel St properties.

And add the water flow off the Hill, in the south section — the flow down Snyder (the dirt section that NV State Lands owns) - gullies and rills etc in that dirt section —- joined by water in
the east ditch of Snyder, coming off all the washes (described below) of the OHV area — then out onto the paved Snyc Rd heading west — to join the flow from the Ethel properties,
to pool (combined) at Conte/Edmonds.

2). Follow south on Golden Eagle Lane, from the cluster mailboxes at Snyder/Gentry, there are several areas where the ephemeral streams from the OHV area drain down to Golden Eagle Lane
(into the Clear Creek Watershed — which goes on to communicate with Carson River watershed?). You can see the main washes quite prominently in your map on the flyer:
Once is Enough, Gunslinger, Headlight/Deathwall convergence, and Off the Trailer. I have attached a map of the OHV area which names these routes. Note that these 'main' washes all
receive tributaries from the SW slope above them. Also note that all these washes and Open Skills Riding areas that envelope them, are designated for OHV riding — and heavily used by
Rock Crawlers -- 6' wide heavy wide deeply treaded tires, impactful machines grind up these washes, 'constructing' the routes as they go. LID? (Low Impact Development/Design?).

https://www.carson.org/home/showpublisheddocument/80521/637895987768970000



Road-To-Know

Ride Right: Nevada OHV Registration (required), spark arrestor, and 96db max sound.

Dawn to Dusk use only; NO camping and NO fires; Pack It In, Pack It Out.

Stay on designated routes/areas. Motorcycles allowed on Double Track and Wheeler routes.

Cross country travel prohibited.

Don't Crush the Brush; vegetation provides habitat for small animals and stabilizes soils.

Respect the trails, the land, and the rights of others. RIDE RESPONSIBLY!

Non-Emergency Dispatch (775) 887-2677, Emergency 911

Map Date: May 4,

3). Note there are **3 'Open Skills Areas' also called 'Open Ride' areas: Headlight, Ghost, and Off the Trailer. These areas allow/invite cross country riding per the definitions given by the Consultant, NOHVCC, in the Management Plan and Grant Applications and updat** Some of which are quoted below (#6)—
for your understanding of the Open Skills/Ride Areas — and impact on the soil/vegetation. The OHV trail map shows these areas, outlined in blue. Total of 32 acres +/-.
Plus the enlarged Sand Lot area which is all sand — and ridden as an MX area, bermed, deep sand. Not sure where all that sand goes, when rain hits hard.

Headlight Open Skills Area was recently expanded Summer/Fall 2021, to include the lower 2 acres, which was documented in October 2021 to be 'intact soil and vegetation'.
The Power Point went on to acknowledge (IMHO, reading it) that vegetation holds the Hill together — and destruction o soil and sand will cause more erosion. Confirmed by a discussion with one of the NV Soil Engineers. The Headlight wash(ridden in its entirety) is joined by the Death Wall Wash (which is designated single track in lower, and Crawler in upper).
Their conjoined riding-impacted 'complex' flows out to Golden Eagle Lane — bringing water/sand/sediment out to the road. Nature certainly has an effect — but the added riding IN the washes must exacerbate the erosion and effect downstream? Golden Eagle Lane (eroded, potholes) sho the effects.

Off the Trailer Open Skills Area is 23 acres, 6 of which was documented as intact soil/vegetation in the October 2021 study.

Since riding is allowed anywhere in these 'Open Skills'/'Open Ride' areas, all the soil and vegetation are vulnerable — a destruction of them yields more erosion, and adverse effects downstream?

4). Note that **Headlight** and **Ghost Open Skills Area**s envelope most of the Headlight Wash — and the 'Double Waterfall' trail runs IN the Headlight wash between Ghost and Headlight Open Skills Areas. Deathwall Wash joins Headlight Wash at their lower reaches. As stated above, Deathwall Wash is ridden in its entirety from top to bottom.
As is the entire length of the Headlight Wash — from its headwaters down its entire length, almost to Golden Eagle Lan
The lower Headlight wash (below the Open Skills Area) is designated for single track, coming in from the slope above.There are fall line trails into and out of Death Wall/Ghost and Headlight, in several areas.
In other words, the entire washes are being ridden from top to bottom (with unauthorized riding in the wash in the upper slopes — as are many of its tributaries being ridden, above and into the main Headlight Wash). Doesn't all this riding add to the already erosion prone wash — riding on the fall lines in and ou of it, and in the wash floor/banks/slopes along its length?
Ultimately bringing water and sediment out onto Golden Eagle Lane.

Are any Professional Engineering and Soil/Hydrology studies required for this project — to evaluate the effects downstream/downslope -- on roads and neighbors, from the invited impactful use upstream?/upslope?

5). The area below the **Off the Trailer Open Skills Areas** is the most impacted, because of the recreation and construction upstream and along the wash (numerous drainage gullies constructed to direct the water off the adjacent roads and Staging Area into the Off the Trailer wash) — plus the consequences downstream of the blocked culvert at Golden Eagle Lane (since at least 2017, further impacted the construction and water diversion into it, upstream which started in 2019).
The water/sediment flow across Golden Eagle Lane has eroded the road and caused significant headcuts and gullies in the property downstream, on its rush downstream towards the Carson River.

6). Note that the Open Skills Areas and ephemeral stream washes are not all 'bedrock controlled' (IMHO from my boot on the ground — and dirt bike riding — exploring every single trail):
much of the environs are sandy (some deep sand areas), and sandy banks and slopes, and fall line trails in and out of t washes and Open Skills Areas. The entire SW slope is a series of washes originating on the slope below Golden Eagle Rock: and many are sandy!
This slope is very dynamic, after a good rain. Once the sand is finally saturated, the water flows as surface water — through the entire system — over pour offs/waterfalls, in channels, all heading down to Golden Eagle Lane — often high volume and velocity (per my videos). And so much sand throughout the West Basin (and entire Hill — including the washes and Open Ride Areas) that I can run barefoot (not in Rattlesnake season!) — and I often get stuck on my dirt bike (tires auger in, have to lift the bike out of the pit the wheels make).

7). There was finally construction of rock dams and basins to address this issue/ephemeral streams and erosion/effects on road downstream (acknowledging it exists) — but these features
have not yet been challenged by an adequate rain.
And what about LID? Low Impact Design/Development? In such a sandy erodible slope, is it wise to put 6' wide impactful rock crawlers up ephemeral stream washes (which perhaps the
Consultant thought were roads — light lines on the map could be roads or washes — when these routes were initially designated in the ephemeral stream washes). And is it wise to invite
all OHVs into Open Ride Areas — where they can crush the brush and soil, per the definitions below? There are so many opportunities for riding on this Hill — and I LOVE being out on
the double and single track trails AND in the Open Riding Areas! And MANY are sustainable and curvilinear trails that a NOT on fall lines or washes or sandy slopes. Why not observe
proper soil and slope and vegetation protection, throughout — to minimize adverse effects downstream on the roads (and ? Neighbors on Hobby Horse and Golden Eagle Lane?)……and at the bottom of Snyder…….How can the intact vegetation and soil be identified and protected?

8). DEFINITIONS within the OHV project (Management Plan, emails, update reports and Grant apps): "Open Skills Areas" invite riding across any of the terrain
within the boundaries of the Open Skill Area (paraphrasing).

> **. "Erosion and vegetation loss are two huge issues at Prison Hill. Vehicles travelling cross-country are crushing critical vegetation that holds soil, provides wildlife habitat, and adds to our visual enjoyment of the area….."**

Contradicted by another statement:

> **There are three open areas that allow cross-country travel. All are signed with boundary sings that face the open area.**

"Some of the many enhancements include development of a Tot-Lot, a Beginner Area, several new trails, including a fun ride called Toads Loop which passes next to a namesake rock, and designation **of three "open ride" areas**. There are opportunities for dirt bikes, trials bikes, rock crawlers, jeeps, and ATV's.

> "Cross country travel was prominent across the recreation area, and needed to be limited, which is the intent of the open area".

> "Open areas are an area where riders are not confined to a trail corridor, but rather ha a set area where they can traverse the terrain as long as they don't go outside the defined boundary. By marking this boundary we again decide where the riders can access obstacles, and reduce the spread of user created trails and obstacles. Some OHV users are not looking for a trail experience, and these type of areas meet their needs"

> .

NV OHV Grant App 2020, page 11 of 9:
"……**35 acres that will be open to use** by rock crawlers, trials bike riders, etc **who are not looking for a trail experience…"…..**

More definitions of "open" in the NOHVCC Management Plan, October 2018, page 16, #10: "Definition of open, closed, restricted trails (if needed), and open areas.
Defining trails and areas will increase rider safety, minimize environmental impacts, reduce user conflict, and identify the appropriate use.
a). Open: No limitation on the type or use of motorized recreation
b). Restricted: Uses limited to existing or designated roads and trails
c). Closed: Areas that are closed to motorized recreation
d). Open Area: Cross country travel is permitted and OHVS are not restricted to designated route".

d). "Open Area" Cross country travel is permitted and OHVs are not restricted to designated roads."

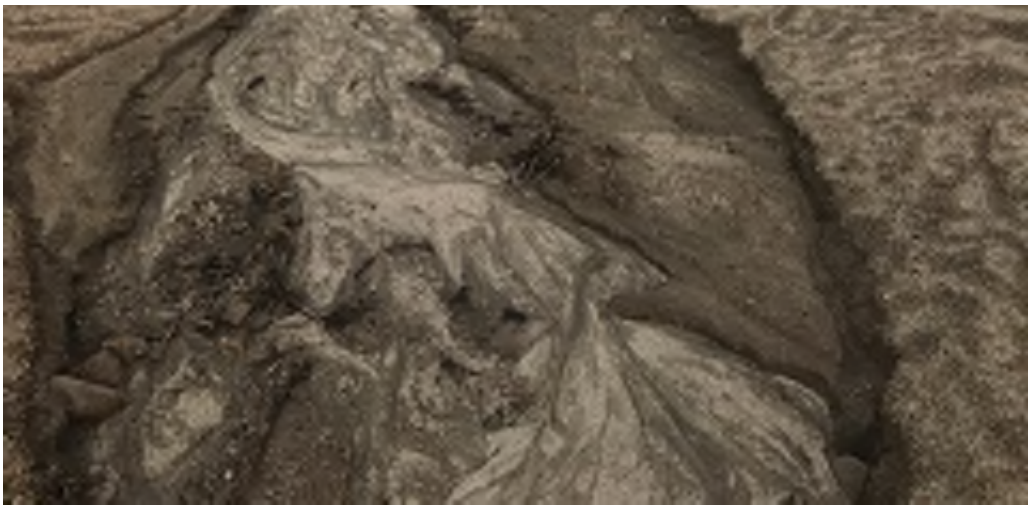
9). Also note that an ADA/AASHTO trail (road) is planned to be built along the foothills of ALL of this SE ADMP propert
From the Staging Area to Koontz Lane: behind all the homes on Gentry (beyond the already mowed down wide fire break lane) — and along Golden Eagle Lane from Gentry to Staging Area. And ultimately from the Staging Area across /above the Hobby Horse and Golden Eagle Neighborhoods, to the Carson River (down the steep east facing slope) — and on to the Mexican Dam. The portion in your ADMP area (Staging Area to Koontz), has already been grant funded SNPLMA ($2M+). It is projected to be a 10-12' road (per AASHTO) with ? 3' shoulders (per the same caliber classifie road that goes from the 5th St Trailhead to Silver Saddle Ranch — go take a look). Erosion features? By necessity — put it in --- acres and miles of intact soil and sagebrush will be mowed down (in the Conservation Easement PH propert — to put in this hard pack road. It will be crossing all the washes of the SW slope/West Basin. What is the plan, to prevent more run off downstream? And perhaps per LID — one might suggest a simple trail, vs a road? Is this an appropriate area for an ADA and/or
AAHSTO road? Per my conversation with a SNPLMA contact person, the project can be reevaluated at any time and money/plans redistributed — if there is any change in the original grant request (from Carson City — based on professional or public input).

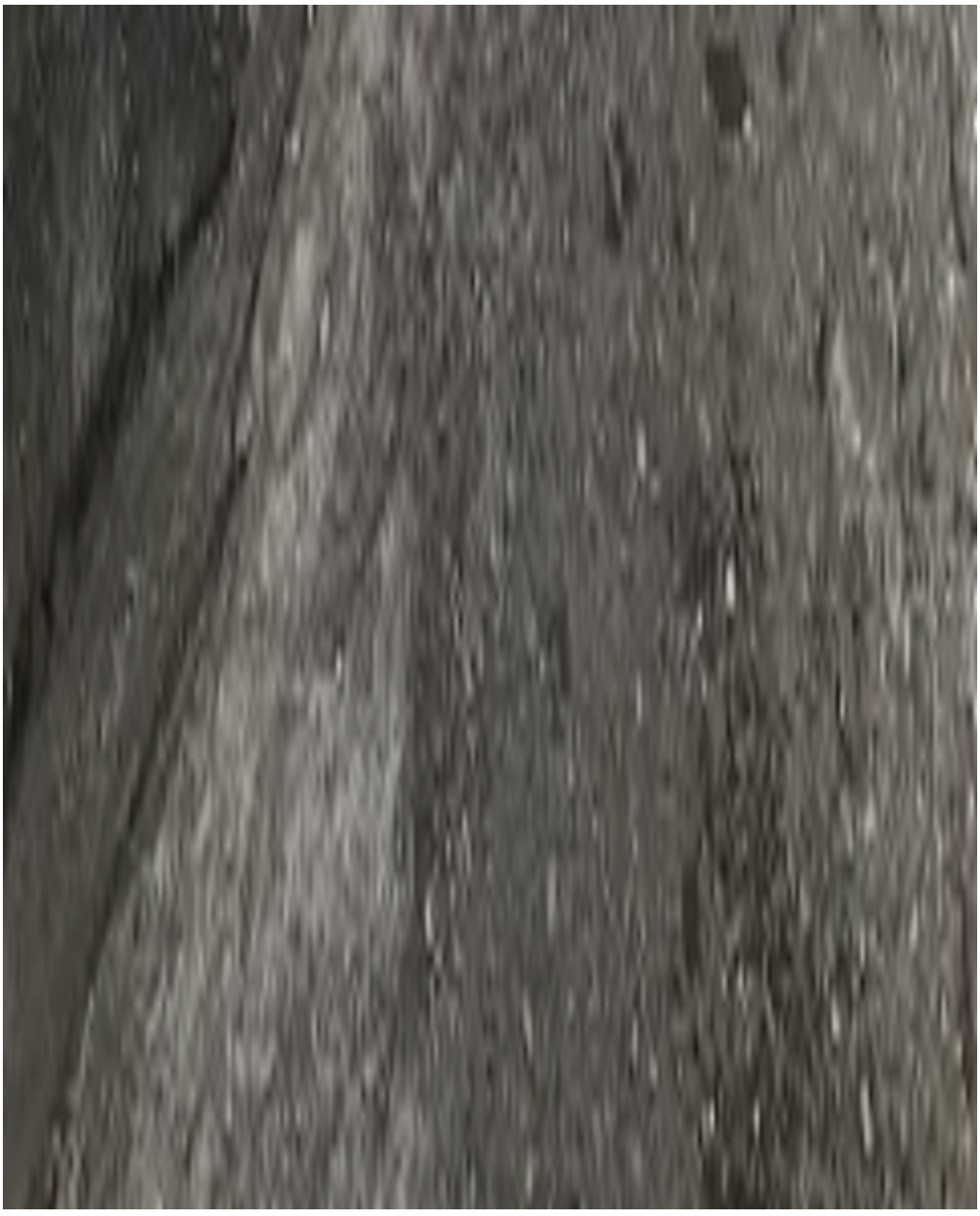
The Prison Hill Recreation Area is a complex evolving project. It seems like it can have an effect downstream — with significant rain — bringing water and sediment to Golden Eagle Lane, and ?
Gentry properties, and Hobby Horse/Golden Eagle properties? I realize the above is a lot of information — maybe you are already aware of it all — but easier to talk with a map in front of us — and via a
Site Visit (boots on the ground) into the heart of this area. Often some of the features are not seen in a City motor-tour have contacted you (per TC to the Consultant of this project) without any response.
I hope to speak with you on Tuesday.

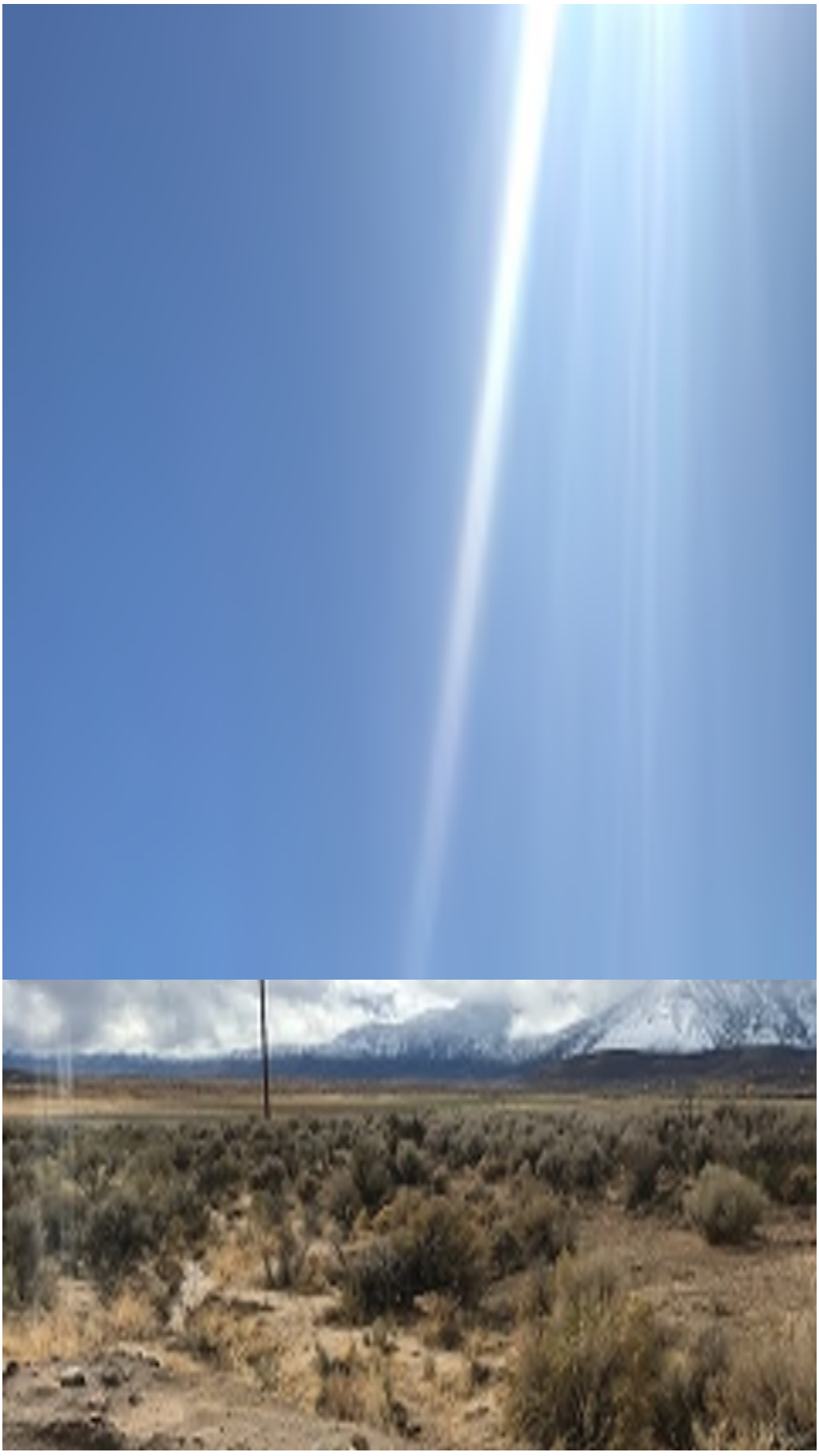
Below are some photos (AND VIDEOS) of the Rock Crawler Routes (in the washes) — and travel roads and trails — a Open Areas (cross country riding) — after rain, and when dry.
Seems to me that the erosion caused by riding in the washes and cross country, have an effect downstream on the Golden Eagle Lane and neighbors? More than just nature causes?
All the photos are of the formally designated trails and areas. Know that I love this area — it is a real asset to Carson City citizens. I run / mountain bike/ hike/ explore/ picnic / run my dogs/
and dirt bike (motorbike) here. I am learning to dirt bike here! So many fun opportunities and trail choices, from easy t difficult. Much of the trail design is sustainable — while being
challenging and fun! But I wonder if putting riders/ trails in some of the below areas, is contributing to more run off/sedimentation/and damage to roads ultimately?

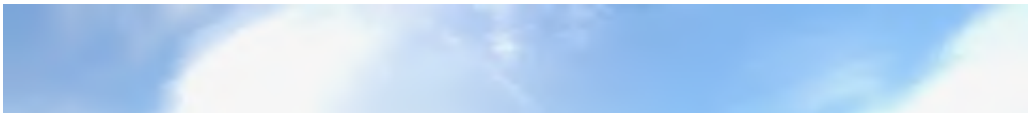
Thank you,

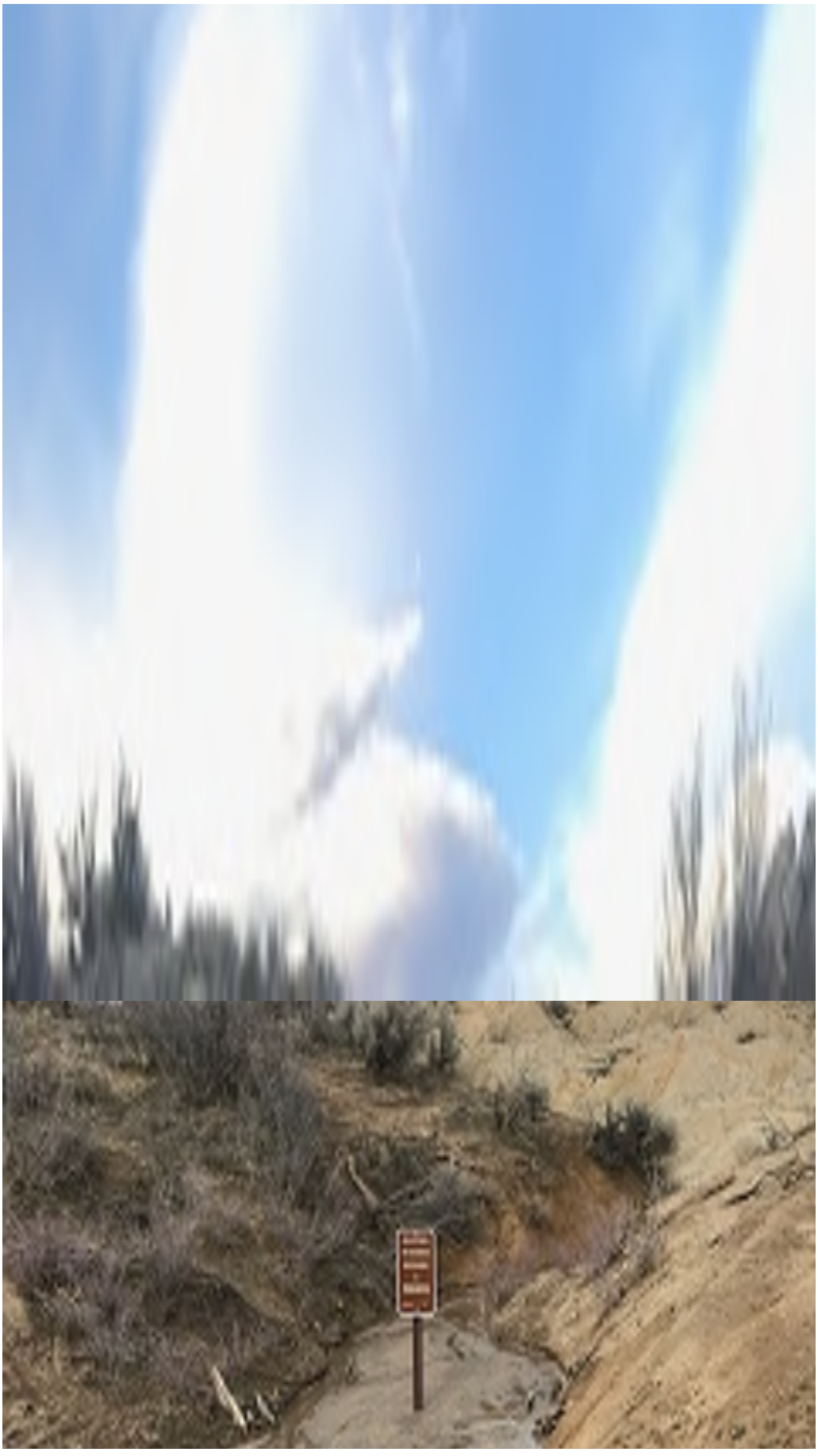
[redacted]



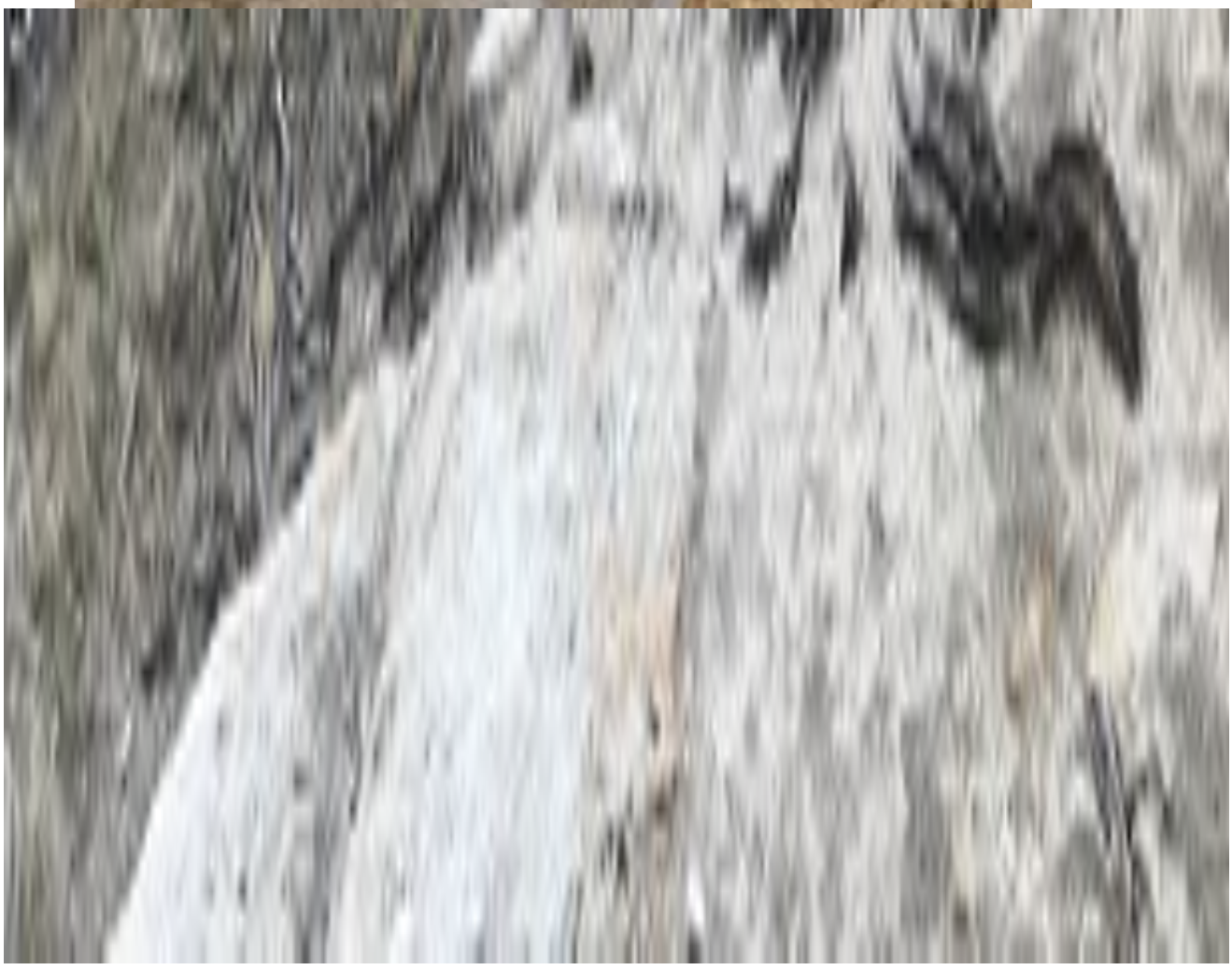


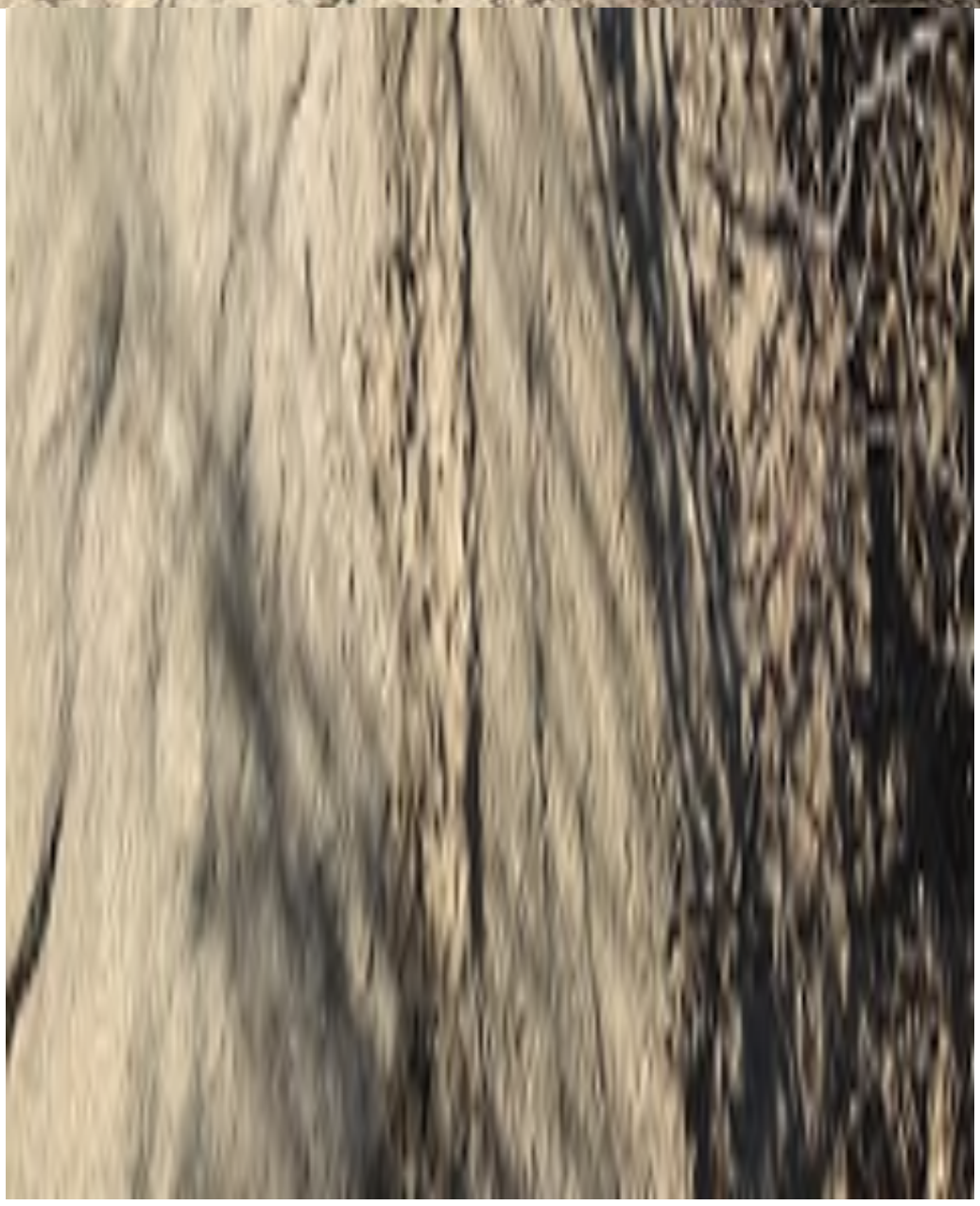


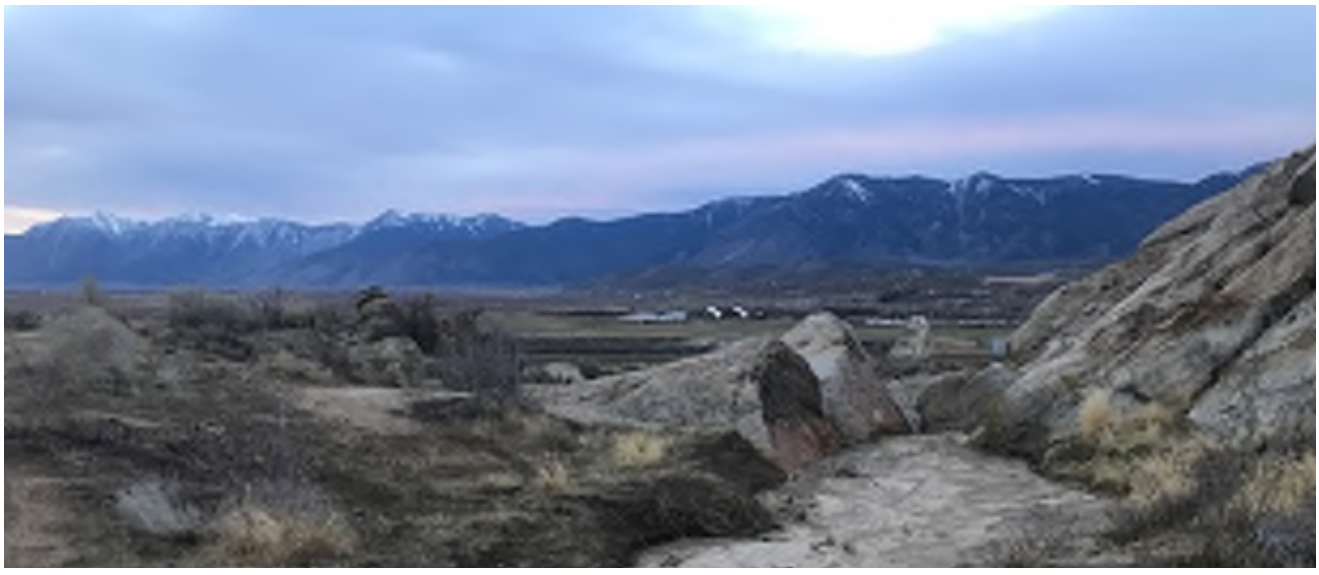


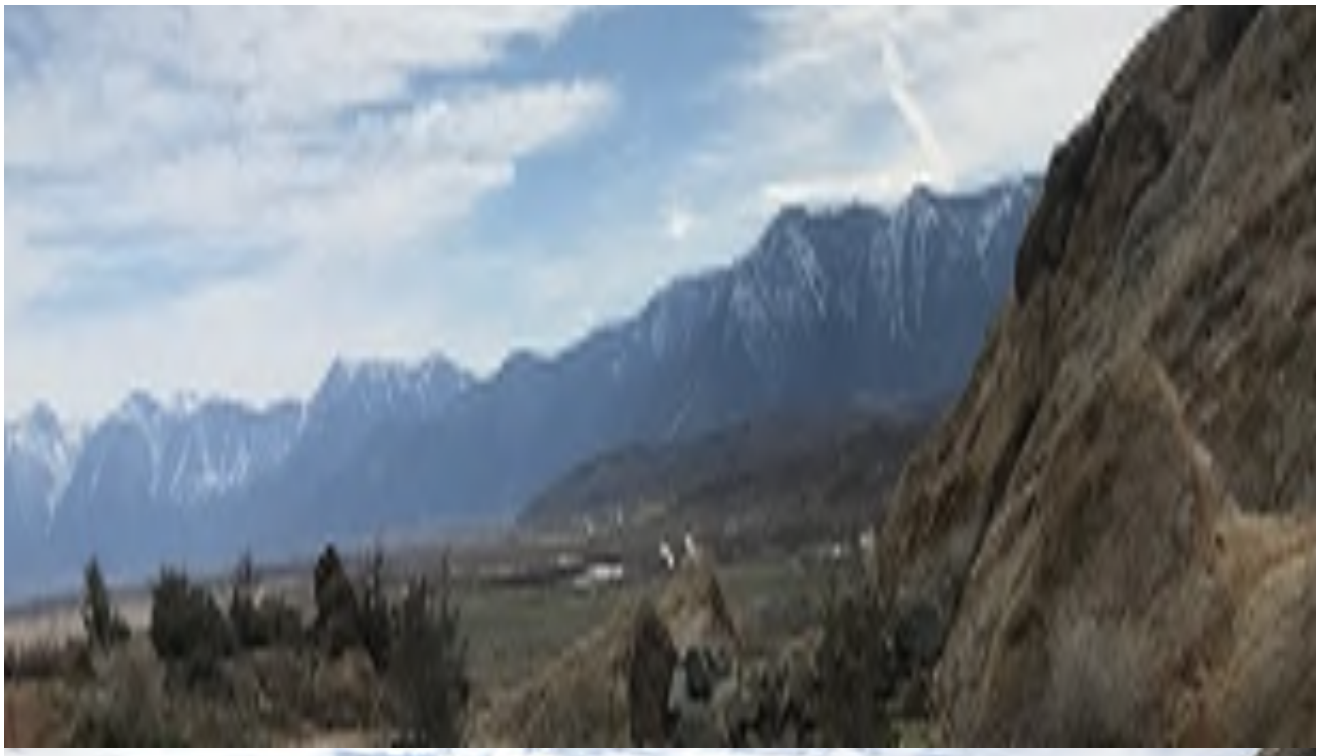



BEWARE









User of all the Prison Hill Recreation Area — on 2 feet, and 2 wheels (motorized and non)

[redacted]

From: SE Carson City Drainage Plan <info@seccdrainageplan.com>
Sent: Tuesday, August 30, 2022 1:02 PM
To: [redacted]
Subject: Fwd: Lower Off the Trailer flooding 10.24.2021 and December 2020?
Attachments: IMG_6884.JPG

Categories: External

---------- Forwarded message ---------
From: [redacted]
Date: Sun, Aug 28, 2022 at 6:50 PM
Subject: Lower Off the Trailer flooding 10.24.2021 and December 2020?
To: info@seccdrainageplan.com <info@seccdrainageplan.com>

Please add these photos to my comments. Off the Trailer ephemeral stream flow after rain or snow, onto Golden Eagle Lane.
Thank you!

[redacted]

From: SE Carson City Drainage Plan <info@seccdrainageplan.com>
Sent: Tuesday, August 30, 2022 1:02 PM
To: [redacted]
Subject: Fwd: Videos of ephemeral stream water flow in washes of ADMP #1

Categories: External

---------- Forwarded message ---------
From: [redacted]
Date: Sun, Aug 28, 2022 at 6:53 PM
Subject: Videos of ephemeral stream water flow in washes of ADMP #1
To: info@seccdrainageplan.com <info@seccdrainageplan.com>

Attachments available until Sep 27, 2022
I will send the videos separately otherwise they don't go through?
I hope you got my main comment via PDF, re my concerns?
Please confirm?

Click to Download
IMG_9765.MOV
18.7 MB

Click to Download
IMG_3241.MOV
9.6 MB

Click to Download
IMG_3245.MOV
6.2 MB

[redacted]

From: SE Carson City Drainage Plan <info@seccdrainageplan.com>
Sent: Tuesday, August 30, 2022 1:02 PM
To: [redacted]
Subject: Fwd: Videos of ephemeral stream water flow in washes of ADMP #2
Attachments: IMG_3241.MOV

Categories: External

> You don't often get email from info@seccdrainageplan.com. Learn why this is important

---------- Forwarded message ---------
From: [redacted]
Date: Sun, Aug 28, 2022 at 6:53 PM
Subject: Videos of ephemeral stream water flow in washes of ADMP #2
To: info@seccdrainageplan.com <info@seccdrainageplan.com>

[redacted]

From: [redacted]
Sent: Tuesday, August 30, 2022 1:16 PM
To: 'Brownell, Geoffrey'; 'rfellows@carson.org'
Cc: Andrews, Amalia
Subject: Southeast Carson City ADMP - Website User Emails - Robyn Orloff
Attachments: Fwd: Comments: ADMP meeting Tuesday August 30; Fwd: Lower Off the Trailer flooding 10.24.2021 and December 2020?; Fwd: Videos of ephemeral stream water flow in washes of ADMP #1; Fwd: Videos of ephemeral stream water flow in washes of ADMP #2

Geoff and Robb,

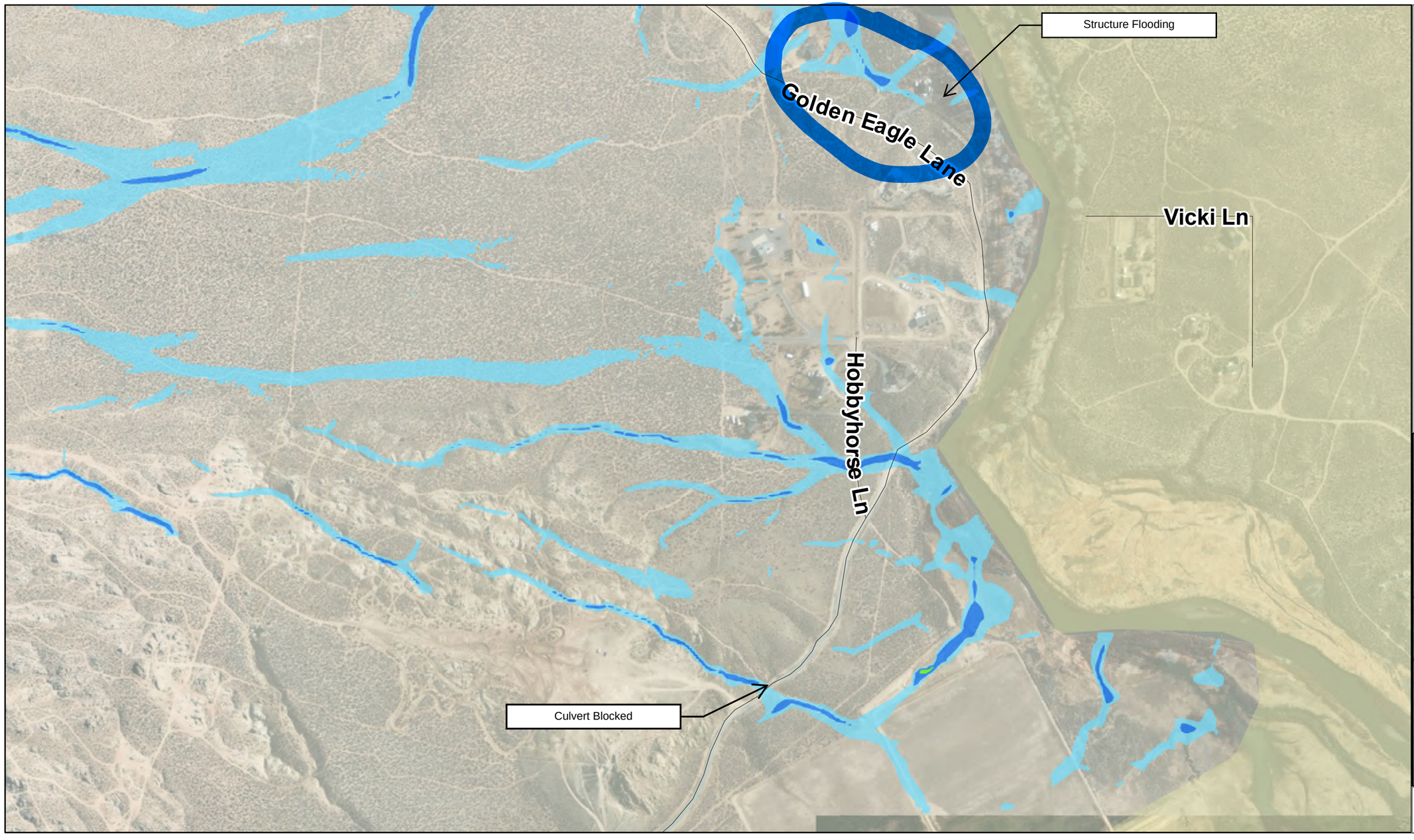
The attached emails were sent to our project email by [redacted] one of our virtual meeting attendees today. Please let me know if there is anything else we can do on our end.

Thanks,

[redacted]

Proud to be one of FORTUNE's 100 Best Companies to Work For

Appendix B: Maps With Public Comment



Legend

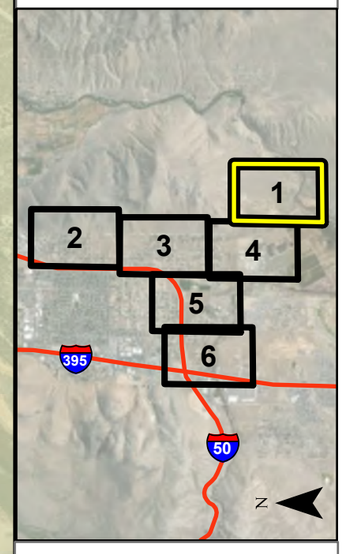
- Roads
- Interstate
- Study Area

100-year Max Depth (ft)

- 0.25 - 0.50
- 0.51 - 1.00
- 1.01 - 2.00
- 2.01 - 3.00
- 3.01 - 4.00
- 4.01 - 20

N

0 400 800 Feet



Sheet 1 of 6

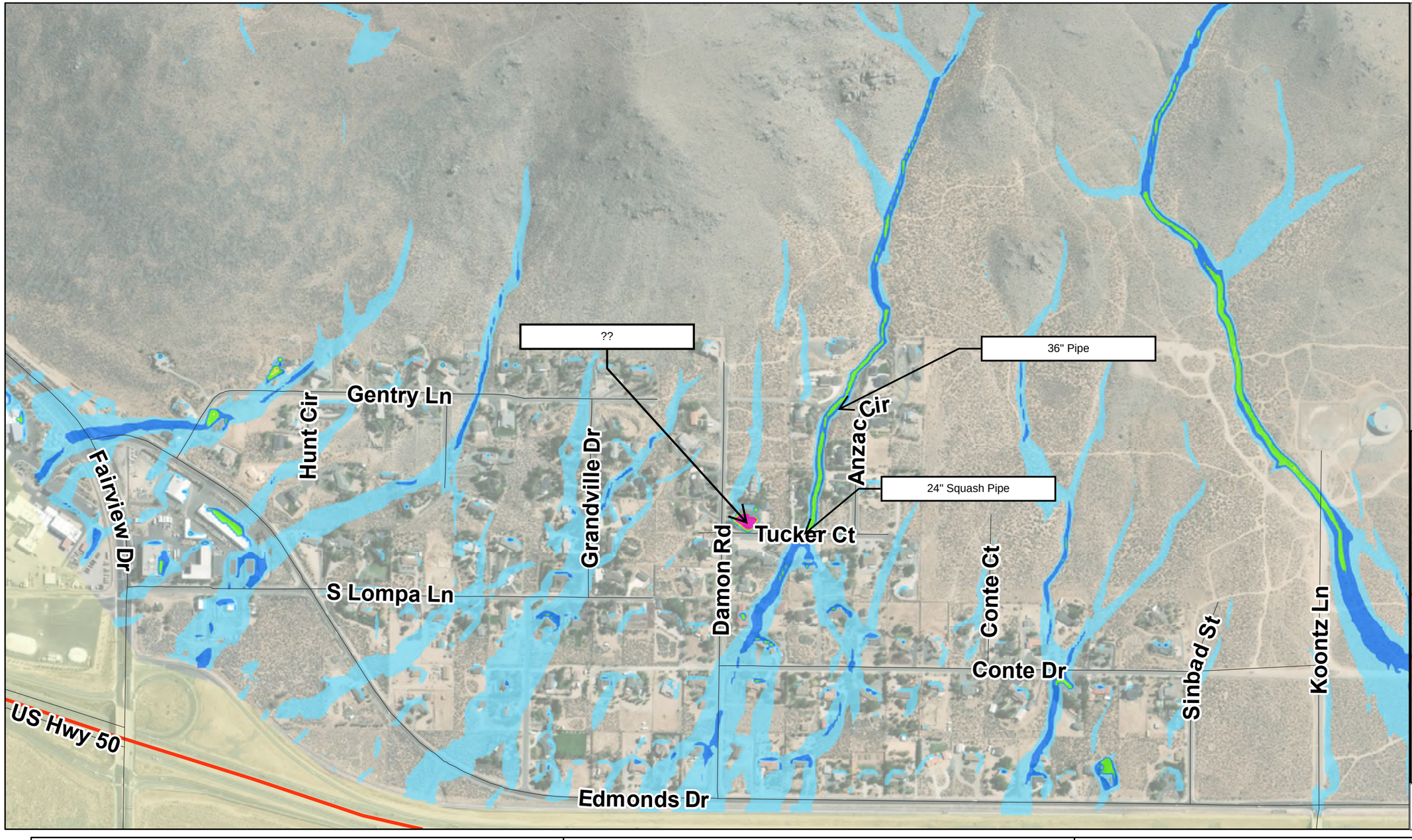
Kimley»Horn
Expect More. Experience Better.

Southeast Carson City Area Drainage Master Plan

Carson City, NV

Preliminary Flood Hazards: Southeast Carson City

Last Revised: 08/22



Legend

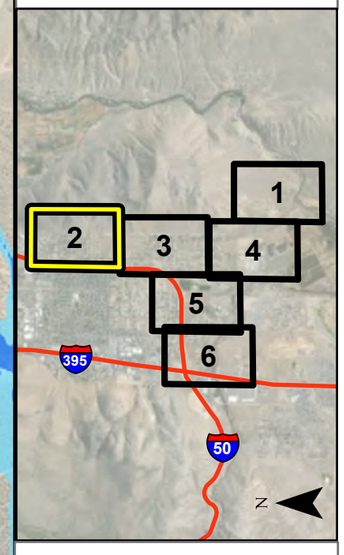
- Roads
- Interstate
- Study Area

100-year Max Depth (ft)

- 0.25 - 0.50
- 0.51 - 1.00
- 1.01 - 2.00
- 2.01 - 3.00
- 3.01 - 4.00
- 4.01 - 20

N

0 400 800 Feet



Sheet 2 of 6

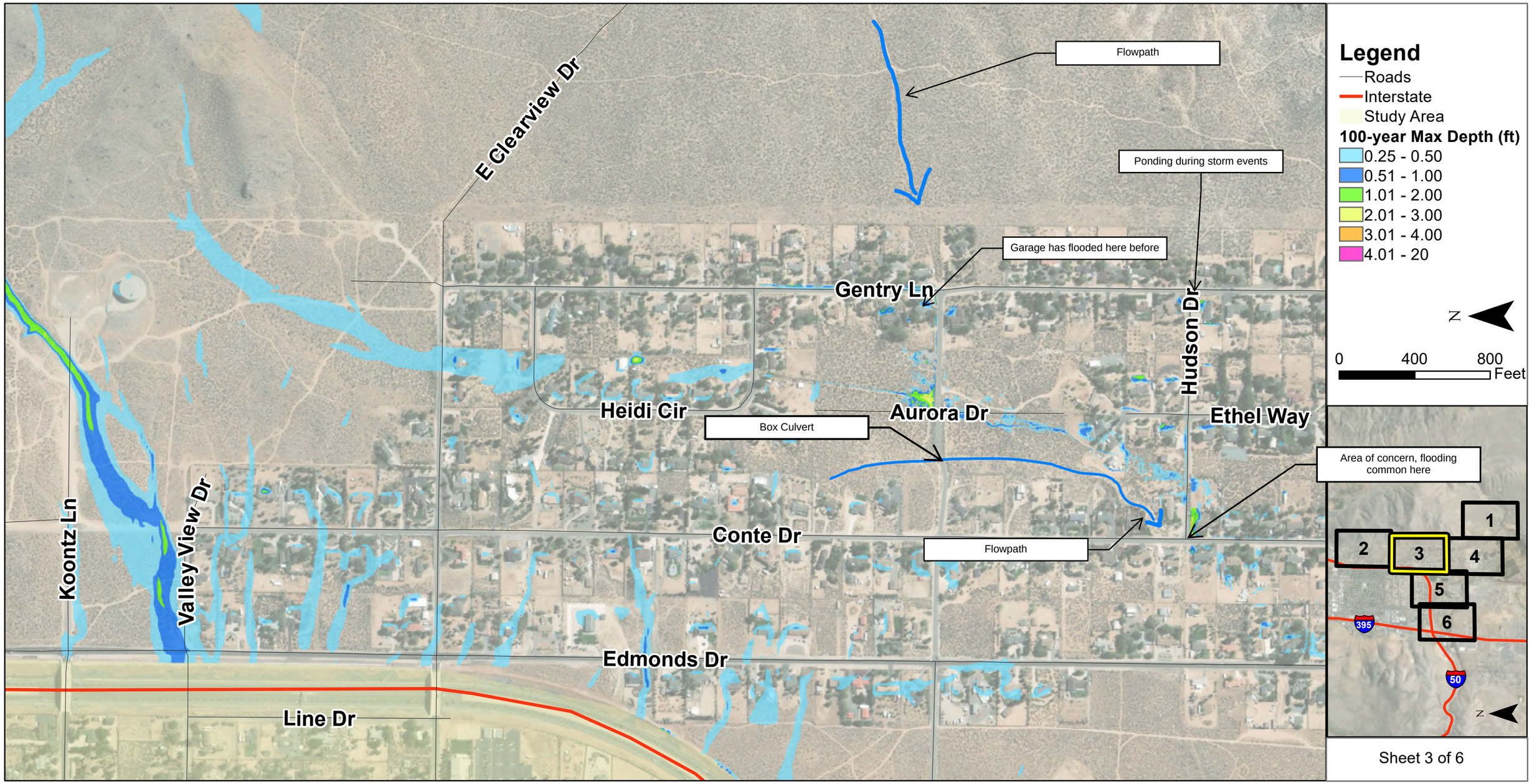
Kimley»Horn
Expect More. Experience Better.

Southeast Carson City Area Drainage Master Plan

Carson City, NV

Preliminary Flood Hazards: Southeast Carson City

Last Revised: 08/22



Sheet 3 of 6

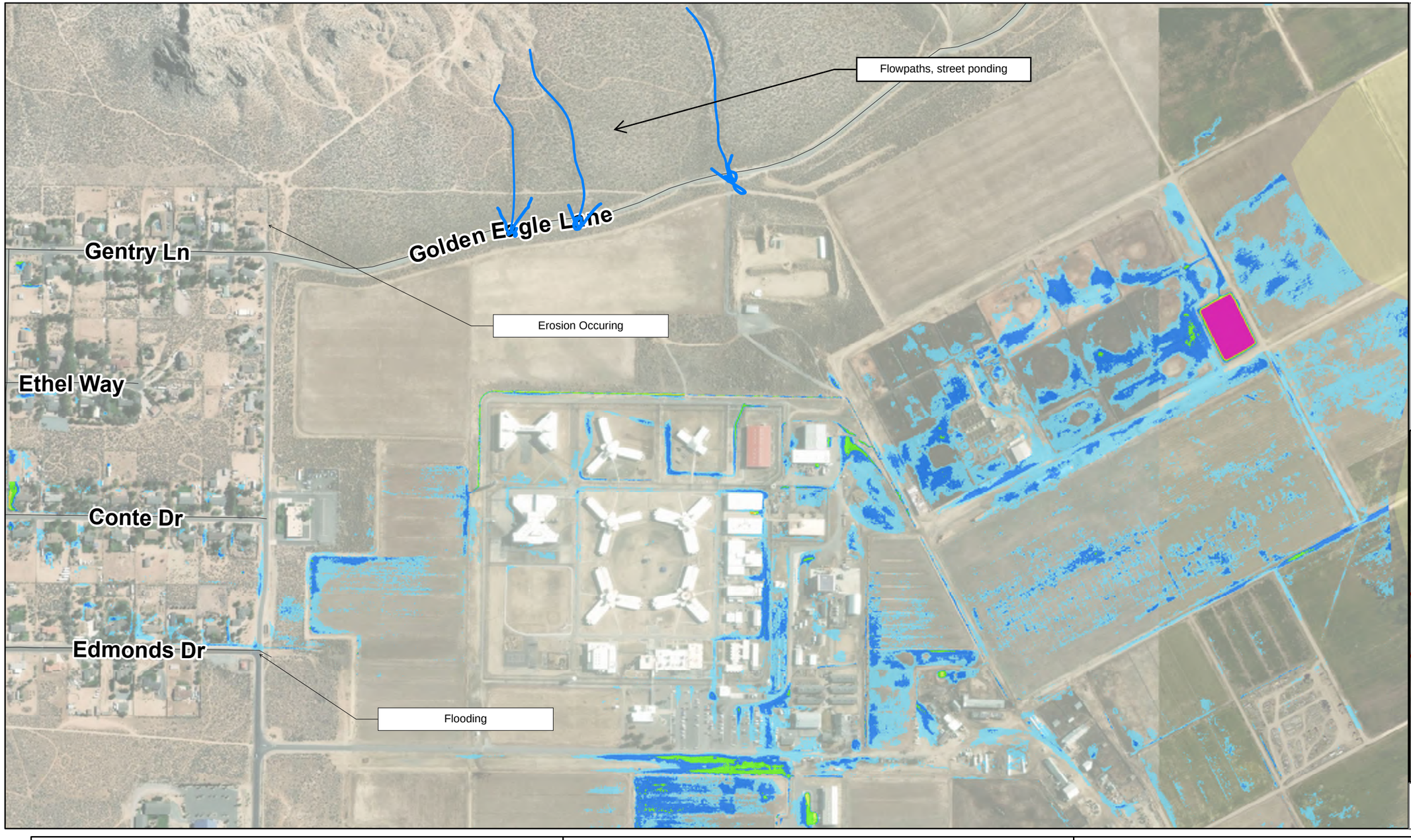
Kimley»Horn
Expect More. Experience Better.

Southeast Carson City Area Drainage Master Plan

Carson City, NV

Preliminary Flood Hazards: Southeast Carson City

Last Revised: 08/22



Legend

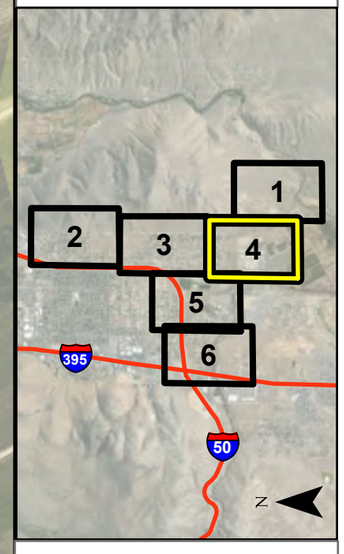
- Roads
- Interstate
- Study Area

100-year Max Depth (ft)

- 0.25 - 0.50
- 0.51 - 1.00
- 1.01 - 2.00
- 2.01 - 3.00
- 3.01 - 4.00
- 4.01 - 20

N

0 400 800 Feet



Sheet 4 of 6

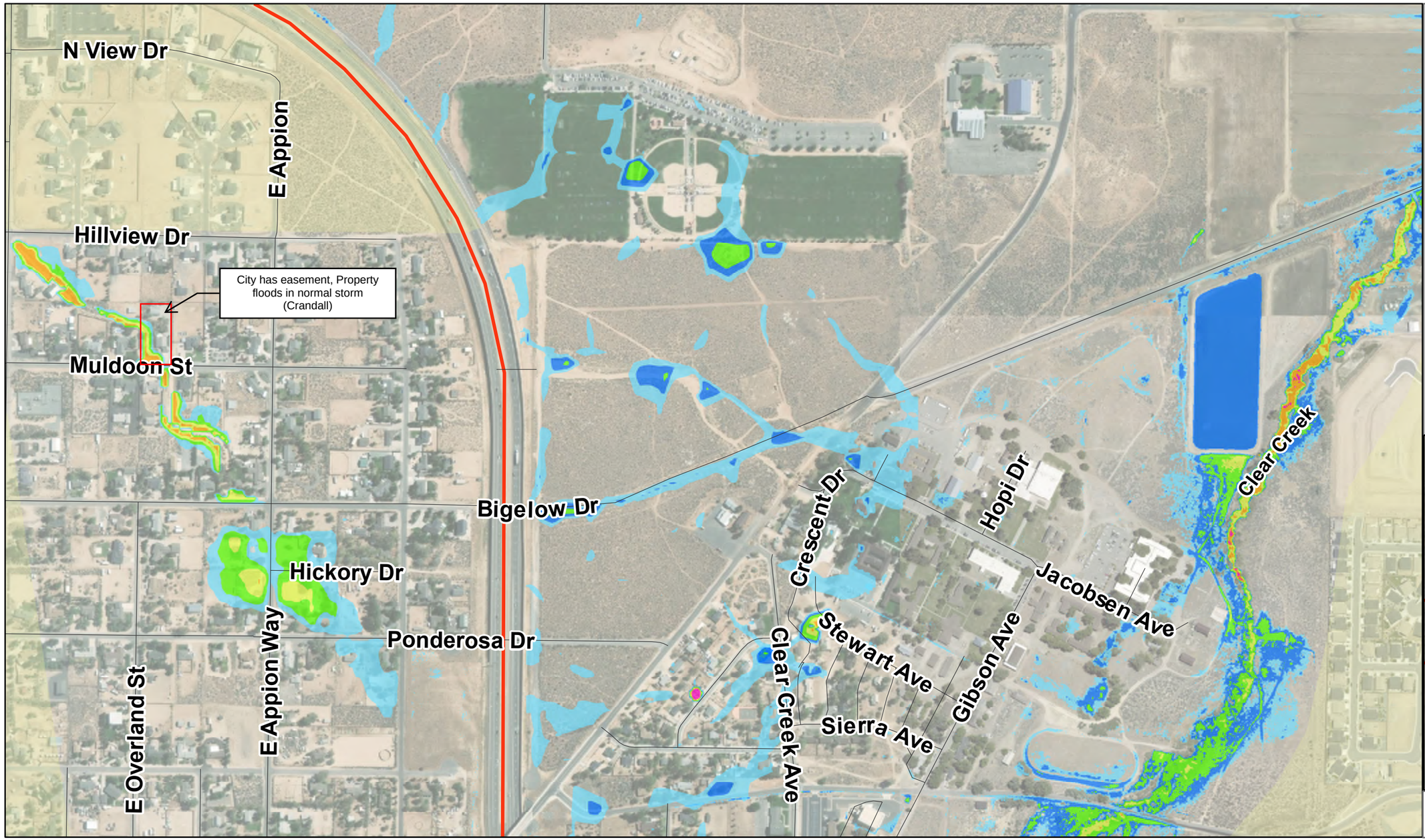
Kimley»Horn
Expect More. Experience Better.

Southeast Carson City Area Drainage Master Plan

Carson City, NV

Preliminary Flood Hazards: Southeast Carson City

Last Revised: 08/22



Sheet 5 of 6

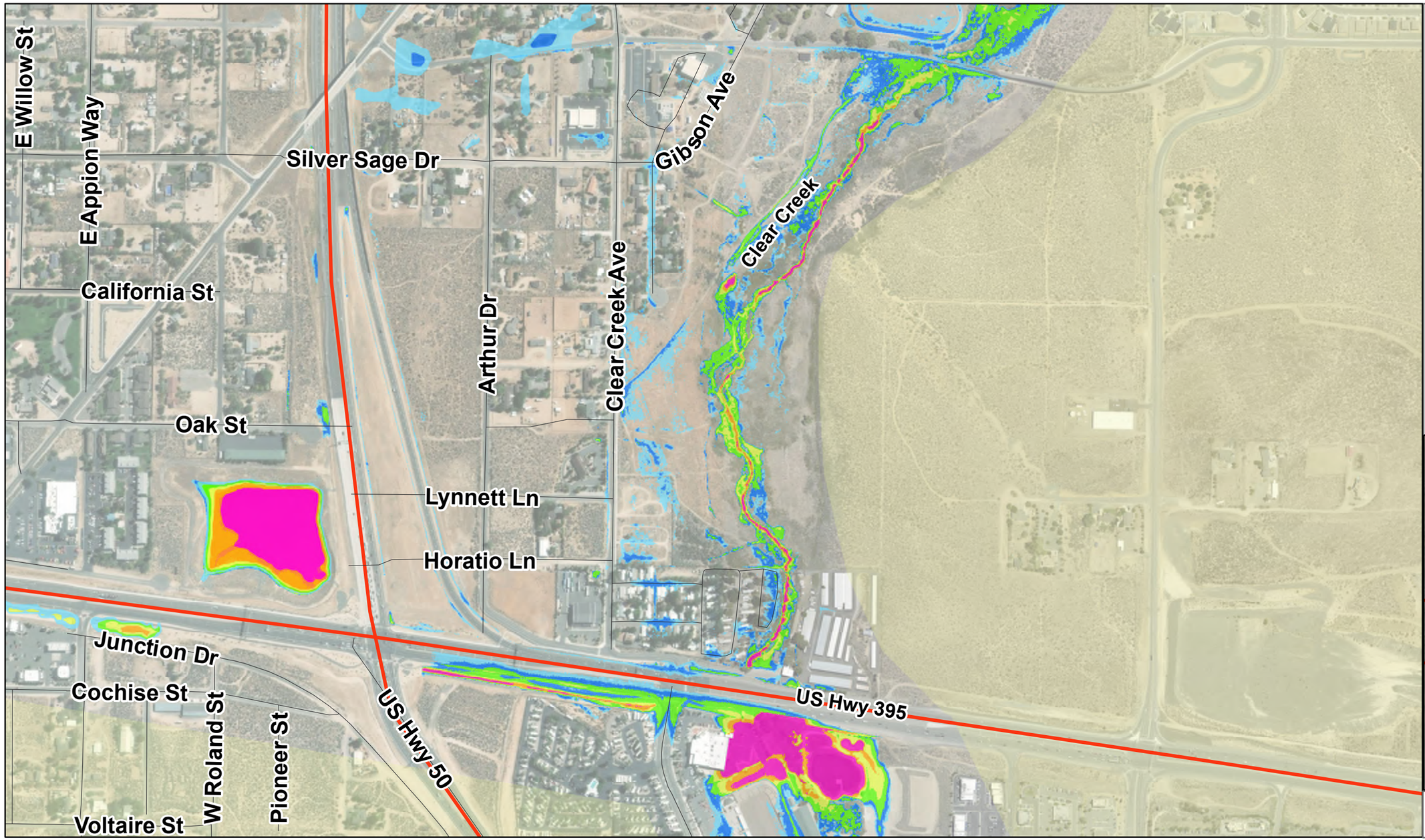
Kimley»Horn
Expect More. Experience Better.

Southeast Carson City Area Drainage Master Plan

Carson City, NV

Preliminary Flood Hazards: Southeast Carson City

Last Revised: 08/22



Legend

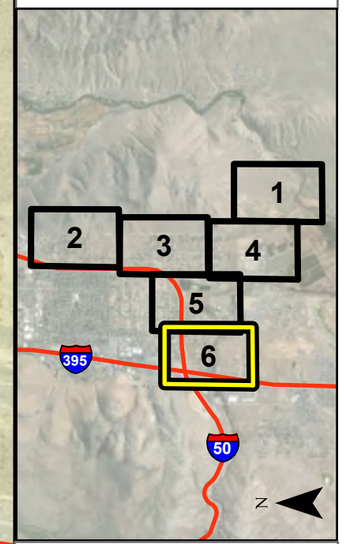
- Roads
- Interstate
- Study Area

100-year Max Depth (ft)

- 0.25 - 0.50
- 0.51 - 1.00
- 1.01 - 2.00
- 2.01 - 3.00
- 3.01 - 4.00
- 4.01 - 20

N

0 400 800 Feet



Sheet 6 of 6

Kimley»Horn
Expect More. Experience Better.

Southeast Carson City Area Drainage Master Plan

Carson City, NV

Preliminary Flood Hazards: Southeast Carson City

Last Revised: 08/22

Appendix C: Public Meeting #2

Mailer
Sign-In Sheet
Public Comment Spreadsheet
Emails
Maps With Public Comment

Appendix C: Mailer

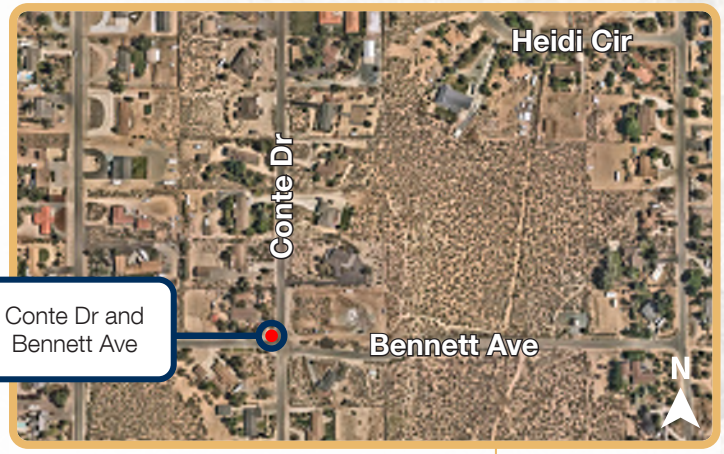
AUGUST 29, 2023 OUTREACH LOCATIONS

Location:
Clear Creek Ave & Silver Sage Area

Timeframe:
3:00 - 4:00 PM

Location:
North Gentry/S Lompa/Conte area between Fairview and Sinbad

Timeframe:
4:00 - 5:00 PM



Location:
South Gentry/Conte area from Valley View to Snyder

Timeframe:
5:00 - 6:00 PM

Location:
Snyder Ave & Golden Eagle Ln

Timeframe:
6:00 - 7:00 PM

If you are unavailable at the date and time for your area, but still want to meet with City staff, please contact us by the email or phone number listed below.

Please meet us there or share your input and comments via email, phone, or website:

EMAIL:
info@SEccdrainageplan.com

PHONE:
775-887-2305

WEBSITE:
www.seccdrainageplan.com

SOUTHEAST CARSON CITY AREA DRAINAGE MASTER PLAN

AUGUST 29, 2023
RESIDENT OUTREACH FOR ALTERNATIVE SOLUTIONS

Carson Water Subconservancy District (CWSD) & Carson City Public Works hired Kimley-Horn to complete the Southeast Carson City Area Drainage Master Plan. The team has identified the potential for flooding in your neighborhood as the result of runoff from Prison Hill and surrounding areas. We would like to present alternative solutions to mitigating flooding and hear your concerns.

Representatives from Carson City Public Works, CWSD, and Kimley-Horn will be in your neighborhood on **Tuesday, August 29th,** at the times and locations shown inside this brochure.

Appendix C: Sign-In Sheet

(c)

Email group when presented to BOS

Name	Phone # or Address
Karen / MLH Flaim	[redacted]
Street & Property Flooding	
Sandra Danforth	[redacted]
Fred + Shirley Suwe	[redacted]
Dana Danforth	[redacted]
CULLEN SHIFFRIN	[redacted]

Shifrin
Shiffrin

③-17

Name	Address/Phone	Comments
KATHLEEN UNZICKER	[redacted]	
DUTCH AROUND NEW TRAIL		
David Hopkins	[redacted]	
Jeff Dodge	[redacted]	
Chad Cooley	[redacted]	
DAVE MCTAGGART	[redacted]	
Gabriel Sandoval	[redacted]	
RYAN EKLUND	[redacted]	
Nikki & Harry Butz	[redacted]	
Brent & Hallie Murphy	[redacted]	
Dave & Pam Petersen	[redacted]	
Sally Duvall	[redacted]	
Nick & Courtney Maher	[redacted]	

comments.

our house [redacted]
was affected by poor drainage during the 2022 winter. and our front planter box and ~~easement~~ have been destroyed and remain ~~unr~~ unrepaired
The city has fixed the west end of our driveway but east, uphill, is eroded and will be costly to fix. We've tried contacting multiple people at The city about this. so we hope something will come of it.

email: [redacted]

phone: [redacted]

COMMENTS:

PLEASE REPAIR DITCH ALONG DAMON EAST OF EDMUNDS!

Ditchers along Damon Dug up by City last winter - they said would repair in Summer - Come repair - [redacted]

Name Address Phone #

[redacted]

DON PARENTS

DAVID THOMAS

[redacted]

GEORGE RUIZ

[redacted]

CORAL NEWTON

[redacted]

STEVE FULLER

[redacted]

Norm Chamberlin
[redacted]

CHARLES HARRIS
[redacted]

[redacted]

Tom GRUNDY
[redacted]

D. SHELDON
[redacted]

Name	Address	Phone #
Claudia Wish	[redacted]	
Ralph Thimes		
DAVID PATTERSON		
John Sheldon		
DAVE BENTEL		

Appendix C: Public Comment Spreadsheet

Southeast Carson City Area Drainage Plan
Outreach 8/29/2023

Name	Address	Phone Number	Email	Comments
Karen and Mitt Flaim	[redacted]	[redacted]		Street and Property Flooding
Sandra Danforth	[redacted]	[redacted]	[redacted]	
Fred and Shirley Suwe	[redacted]	[redacted]	[redacted]	
Dana Danforth	[redacted]	[redacted]		
Cullen Shiffrin	[redacted]	[redacted]		
Karen Unzicker	[redacted]	[redacted]		Put ditch around new trail
David Hopkins	[redacted]	[redacted]		
Jeff Dodge	[redacted]	[redacted]		
Chad Cooley	[redacted]	[redacted]		
Dave McTeer	[redacted]	[redacted]		
Garbiel Sandoval				"Ditches along Damon dug up by the City last winter - they said would repair in summer - come repair"
Ryan Eklund	[redacted]	[redacted]		
Nikki and Harry Butz	[redacted]	[redacted]		
Brent and Hallie Murphy	[redacted]	[redacted]		
Dave and Pam Petersen	[redacted]	[redacted]		
Sally Duvall	[redacted]	[redacted]		
Nick and Courtney Maher				"Our house [redacted] was affected by poor drainage during the 2022 winter and our front planter box and easement have been destroyed and remain unrepaired. The City has fixed the west end of our driveway but east, uphill is eroded and will be costly to fix. We've tried contacting multiple people at the City about this so we hope something will come of it."
Unknown				"Please repair ditch along Damon East of Edmonds!"
Don Parents		[redacted]		
David Thomas	[redacted]	[redacted]		
George Ruiz	[redacted]	[redacted]		
Coral Newton	[redacted]	[redacted]		
Steve Fuller	[redacted]	[redacted]		
Norm Chamberlin	[redacted]	[redacted]		
Charles Harris	[redacted]	[redacted]		
Dolores and Rick Bailey	[redacted]	[redacted]		
Tom Grundy	[redacted]	[redacted]		
D. Sheldon	[redacted]	[redacted]		
Claudia Wish	[redacted]	[redacted]		
Ralph Thomas	[redacted]	[redacted]		
David Peterson	[redacted]	[redacted]		
John Sheridan	[redacted]	[redacted]		
Dave Bentel	[redacted]	[redacted]	[redacted]	

Appendix C: Emails

[redacted]

From: [redacted]
Sent: Tuesday, September 12, 2023 10:05 AM
To: Brianna Greenlaw
Subject: Drainage above golden eagle lane

At unmarked blue shaded between culvert 2 and 3 —
0.21?

39°6′11″ N 119°43′58″ W

Sent from my iPhone

[redacted]

From: [redacted]
Sent: Tuesday, September 12, 2023 10:16 AM
To: Brianna Greenlaw
Cc: [redacted]
Subject: Continuation of drainage below golden eagle lane

39°6′10″ N 119°43′58″ W
I discussed this drainage in my post to you sent last night…

Forked drainage below golden eagle at culvert to west—- and road run off gulley to its east, from golden eagle and down staging area entrance road.
Make sense. Didn't know if it was important to add to ADMP drainage map in this location?

Thank you! Brianna, I really wish you would come out for a visit. Just an hour or two side walk. I still have questions about the rock check dams. The Carson City municipal code 12.18 says one thing… And Open Space says another… And they don't agree 😉…. Meanwhile, sedimentation is flowing over the dams and downstream. In many of the check, Damm's that are constructed along the washes. If not an ADMP concern, maybe we could discuss it from a Public Works Stormwater vantage point?

Culvert

Sent from my iPhone

[redacted]

From: [redacted]
Sent: Tuesday, September 12, 2023 10:22 AM
To: Brianna Greenlaw
Cc: [redacted]
Subject: Culvert 2

In case you want photos!!!!

Looking south

Looking north.

Sent from my iPhone

[redacted]

From: [redacted]
Sent: Tuesday, September 12, 2023 10:26 AM
To: Brianna Greenlaw
Subject: Correction: Re: Culvert 3

Sorry don't have map in front of me.

Sent from my iPhone

> On Sep 12, 2023, at 10:22 AM, Robyn Orloff <robyn.orloff@icloud.com> wrote:
>
> In case you want photos!!!!
>
> Looking south
> <IMG_2512.JPG>
>
>
> <IMG_2511.JPG>
>
>
>
> Looking north.
> <IMG_2510.JPG>
>
>
>
> <IMG_2509.JPG>
>
>
>
> <IMG_2508.JPG>
>
>
> Sent from my iPhone

[redacted]

[redacted]
Sent: Friday, September 1, 2023 1:32 PM
To: Brianna Greenlaw <BGreenlaw@carson.org>
Subject: Center Drive and Arthur Street

Hi Brianna,

It was nice meeting with all of you on August 29th at the corner of Silver Sage and Clear Creek Avenue. I am following-up with a photo and comments about the issues we are having on Center Drive.

During the winter 2022/2023 and in June 2023, our street flooded. As I explained to the representative of Kimley-Horn, we have the water coming down Arthur Street adding to the flooding issue on Center Drive.

I believe the City is planning on putting sewer down Arthur Street next year. I do not know how these plans involve the drainage issues we are having now, but possibly needs looking into.

I have more pictures if you are interested but thought this gives you an idea of the situation.

Please give me a call if you have any questions at [redacted] or my cell [redacted] Leave a message because I am outside most of the time. I am very interested on what happens on this issue so any comments you might have would be greatly appreciated. My father is 88 years old and I am looking out for his welfare and our family home.

Thank you for your attention on this issue.

[redacted]

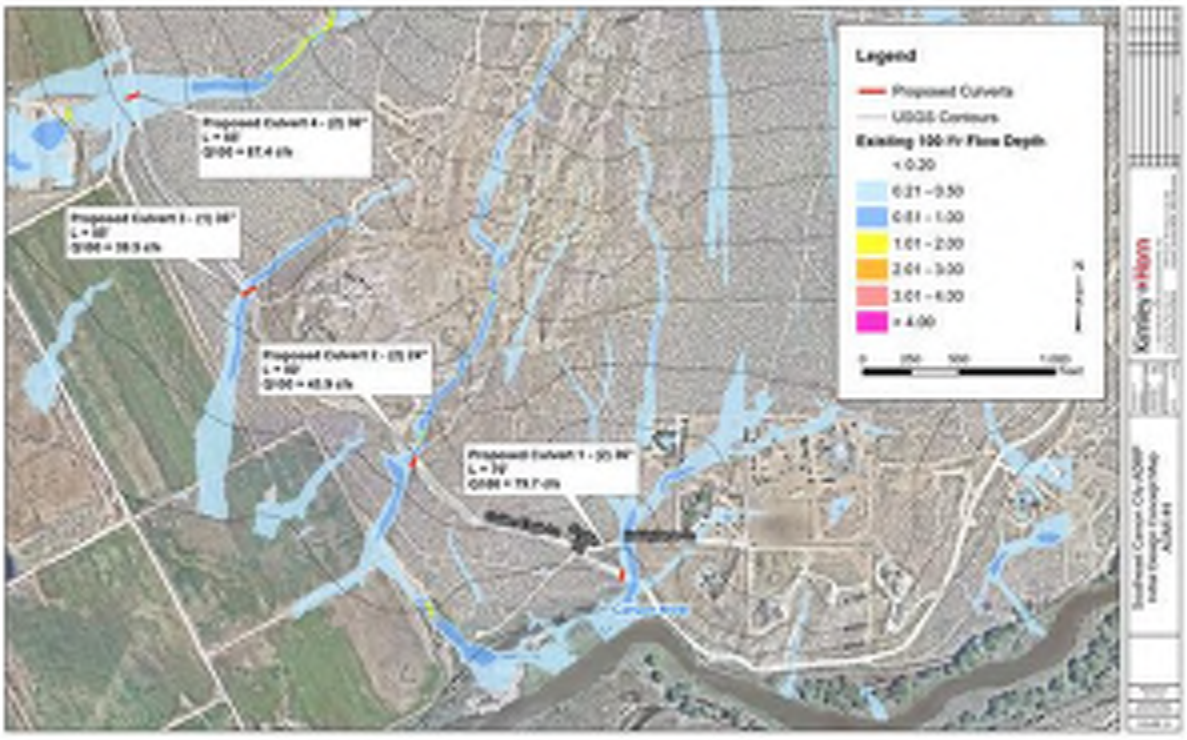
Sent from Mail for Windows

From: [redacted]
Sent: Monday, September 11, 2023 9:55 PM
To: Brianna Greenlaw <BGreenlaw@carson.org>
Subject: Comments for SE ADMP Proposed Pipe Golden Eagle Lane Map

---

Hi again Brianna, Amanda, and Geoff,

Below OHV map again, for reference — overlay on the ADMP map, to match up the OHV trails/areas with the ADMP blue-shaded drainages:



The ADMP shows the Culvert 4 blue shaded drainage flowing west across Golden Eagle Lane and beyond. But no blue shaded drainage

heading south. However, on the ground, we saw a heavy flow turning south at the entrance road to the shooting range — to travel on

Golden Eagle Lane and on the west shoulder dirt trail. The flow then turned sharp west, to go off the west side of Golden Eagle Lane,

eroding the road and carving out a 4-5' drop-off into a wide gully heading south (not blue shaded) carrying water and sand down and

through Carson City and NV State Lands. Certainly a public safety hazard. This drop off was filled in with rock (by Open Space) —

which was soon breached by thunderstorm water/sand downflow in that Culvert 4 Headlight and Death Walls wash drainage. Then filled

in with sand (by Open Space).

We observed that this wide gulley from the Culvert 4 drainage, gets progressively deeper (at least 0.21 - .0.50+) as it flows south from Golden Eagle Lane.

It eventually communicates with the next blue shaded drainage (Culvert 3) which flows on the north side of the Staging Area — and per our observations,

collects water and sand rushing off the 20 acre Sand Lot freestyle cross country riding area/Staging Area/and Tiny Tot and Beginners Loops. Then flows

through a culvert under Golden Eagle Lane and SW into the Culvert 4 drainage. This confluence of drainages Culvert 3 and 4, then continues SW in the

blue shaded lower drainage of Culvert 3. We walked the entirety of both Culvert 3 and 4 drainages — from the top down --- and then their confluence

below Golden Eagle Lane —in the water and on their shoulders, after the storm that cut in the drop off. So had a good sense of their course and depth.

See photos below, as I walked south (but looking back upstream, north) in drainage culvert #4 from Golden Eagle Lane/stop sign at turn into Prison, to
the Golden Eagle Lane drop off and beyond to confluence with #3:

Sand dumped over the rock fix, at the GoldenEagle drop off.

Here, looking south, in the Culvert 4 drainage

2). There is already a culvert under Golden Eagle Lane, in place at 'Proposed Culvert 3'. Noted in the report?

3). There is also a culvert at the depicted drainage (not numbered) between Culvert #3 and Culvert #2: I believe Dave Bentel mentioned this to you.

This drainage has a small containment basin and some ? lead ditches into it, where it begins uphill (where the two fingers are drawn). Was the culvert

noted in the report? This area accepts water/soil drainage from the Staging Area,Trials Riding Area, Crystal Hill, and OHV Staging entrance

road above it.

4). Re Culvert #2, as Dave Bentel and Cullen Shiffrin pointed out: the water/sand flow here is SIGNIFICANT and per our empirical observations, is as much

or more than even the Headlight/Deathwall culvert flow #4. More of a 'functional' obstruction in Golden Eagle Lane, for neighbors driving to/from home,

for sure. But it is not identified as such?: less cfs and no yellow drainage depth compared w/Culvert 4.

As you know, the culvert here has been blocked for years — even prior to the Signs of Change 1 and 2 Construction Project Fall 2019 - Winter 2020
(first construction project in the OHV area).

And perhaps we should acknowledge that this entire ADMP blue shaded drainage area is 23 acres, designated for OHV riding (Open Area Riding = 'cross country
free style riding anywhere on the terrain within the boundary signs' by any and all OHVs). Progressive disturbance/disruption of islands of intact soil and vegetation
— as well as mobilizing large areas of already disturbed soil. The adverse effects downstream i.e. amount of sand deposited on Golden Eagle Lane, eroding
the road, and causing the degree of head cut and gullying downstream towards and into the River, is evidence of the heavy water/sand flow from use above?

And, as the diagram shows, the flow from this Open Area and confluence with the wash system southeast of it — is ultimately bringing sediment into the River.
Is this a problem?
(Sediment into the river was also documented by Dave Bentel, who lives in the area.)

Thank you for your time and consideration,

[redacted]

From: [redacted]
Sent: Monday, September 11, 2023 9:06 PM
To: Brianna Greenlaw <BGreenlaw@carson.org>
Cc: [redacted]
Subject: Comments for SE ADMP Proposed Basin #2 map

Hi Brianna, Amanda, and Geoff,

Below are my public comments re features that I did not see on the SE ADMP maps specific to the OHV area: from Snyder Ave through the OHV Staging Area/Off the Trailer Open Area (east side of Staging Area). Please include my comments in the public outreach venue.

I am including the OHV trails map — so you can reference the OHV trails and areas, that correspond to your identified blue-shaded Proposed Basin #2 and Proposed Pipe (Golden Eagle Lane) maps. I think in my discussion, I have accurately identified the OHV trails/areas with the corresponding ADMP blue drainage areas.

If you overlay the trails map on the ADMP identified blue shaded drainages, you will see that most of the ADMP drainages are populated by OHV Crawler Routes,

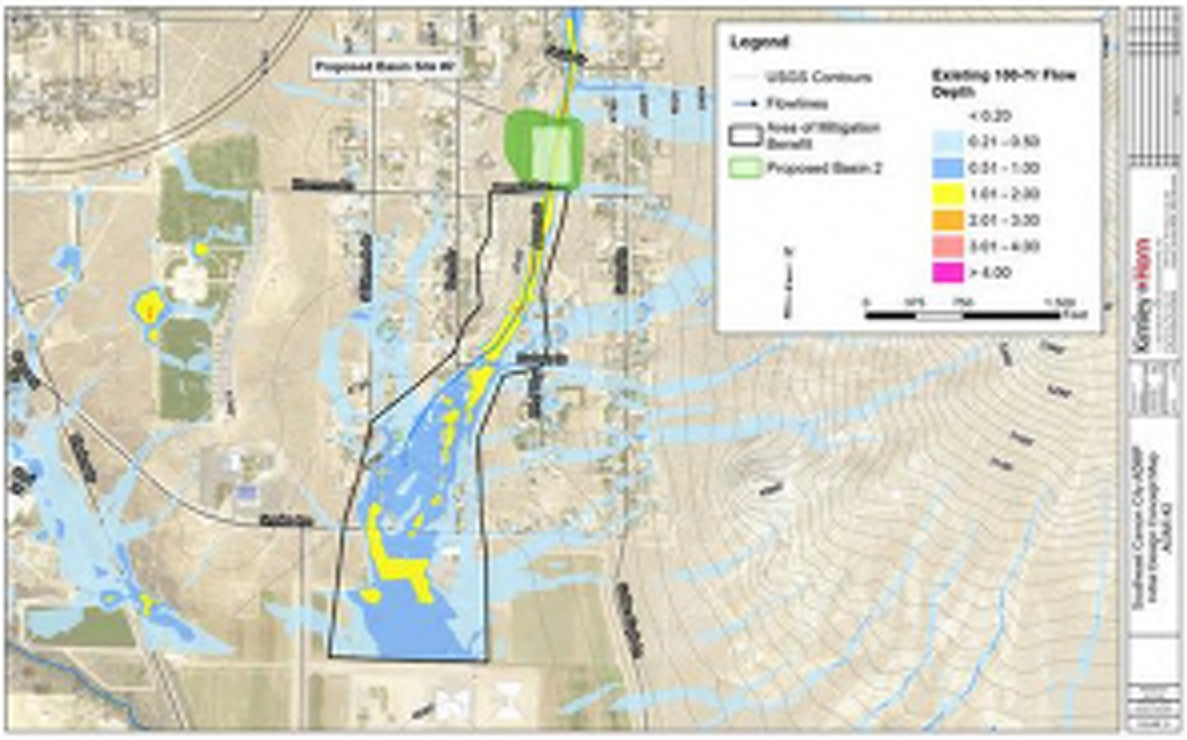
Open Areas, single and double track roads and trails. My question is: does the OHV (motorized) use in the ADMP blue-shaded areas cause more impacts
on the land and Infrastructure and structures, than 'just nature'? And if so, is it valuable to re-consider use — to close or re-route or re-engineer some
of the more impactful OHV trails/areas/uses to modify/mitigate/moderate damage -- rather than just put in more erosion control features, to try to absorb a designated disruptive use in a sensitive area?

Of course, it is important to know the characteristics of each different OHV (weight, dimensions, width/length, tire size, articulations etc), and the specific features of the trails/roads they travel (width, topography, substrate — water/sand/rock), and the specific definitions and use designations of Open Area/ Sand Lot Area/ Crawler vs Wheeler vs Trials vs 2 track vs 4 track roads/trails/ dirt bike - UTV - ATV - SxS - motocross bike etc etc ----- in order to understand impacts of OHV use on the land and in the drainages where they travel! And IMHO best to see all this and know it ON THE GROUND.

However, the above discussion is probably not even applicable for the ADMP in the OHV area — if the benefits (in dollars) would not be greater than the cost (in dollars).

But perhaps we can have this discussion separately, using the information gained in the ADMP study — applying it to the OHV area — in a combined cooperative effort between Public Works and Open Space (and NV State Lands) — to address adverse impacts downstream, on Carson City (and NV State Lands) natural resources and infrastructure — exacerbated by OHV recreational use or construction upstream, in the blue-shaded problematic drainage areas identified in the ADMP study. And then discuss trail solutions, to address/minimize the impacts. No problems — only solutions.

Proposed Basin #2 Map (below):



1). The above map does not identify the drainage (no blue shading) flowing down the NV State section of Snyder Avenue (the dirt terminus of the road) —
coming off the Prison Hill Open Area? A neighbor did mention this flow on dirt Snyder (drew it in on your maps?) at the ADMP
on-site tour August 29.

Gulleys / ditches are evident in this dirt section of Snyder Ave, from Cable Road heading downstream. Water and sand pour down this road
during/after precipitation. Gulleys and rills are evident (wind eroding them away) on the slope above this Cable Rd/Snyder intersection --- and can
be followed up to their source (?) in the first wash in the OHV area (that drains the south side of the big outcropping there at the nonOHV/OHV fence
boundary and the north side of D1 Wheeler/Crawler Route). This wash and slope are not drawn in, blue shaded, on the ADMP map (maybe the flow is
below the threshold to be included?).

This drainage flows through the dirt section of Snyder Ave — and out onto Golden Eagle Lane (leaving sediment deposits
in the road along the way) — then continues down Snyder (and its shoulders) to the 'Edmonds Pond' at Edmonds Drive.

2). The 3rd and 4th drainages contain the 'Once is Enough' and 'Gunslinger" Crawler Routes (respectively). The ADMP map show the 'Once is Enough'
drainage crossing the Cable Rd, the diagonal State Lands Rd, and Golden Eagle Lane and into State land. The end of 'Gunslinger' wash is cut off —
but its course mirrors 'Once is Enough' on the ground. Both drainages deposit deep sand fans at their respective wash terminuses on Golden

Eagle Lane, and carry sand/water into/across that road and down into Prison property.

Question: are these 2 drainages responsible for the gully/ditch in the lower end of the NV State diagonal road, below where

they cross the road? (photos below). Maybe some of their flow splits south down the dirt road here?

The road is not mapped as a drainage, despite the depth of the gully/ditch being at least .21 to .50+, carrying water and sand out to Golden Eagle Lane.

Below photo -- looking up the gulley in the diagonal NV State Lands Road. 'Once is Enough' and 'Gunslinger' washes cross the road, at the head of the gulley:

Below photo, looking down the diagonal NV State Lands Rd (Golden Eagle Lane is visible at end of the road):

The large sand outflow down the dirt road, to Golden Eagle Lane, was plowed back into a big pile at the 'mouth' (terminus) of this State road, per photo below. Odd? When it rains again, won't this sand pile be 'redistributed' into Golden Eagle Lane and beyond --- and added to by more water/sediment flow down this dirt road? The other 4 big sand piles on Golden Eagle Lane were also plowed back up into their point of outflow (mouths of the washes): Once is Enough, Gunslinger, Headlight, and Off the Trailer. What is the BMP/SWPPP/general CC Public Works and State guidelines for clearing roads of sand deposits from upstream?

See next post for comments on the Proposed Pipe Line (Golden Eagle) map.

Thank you,

[redacted]

Appendix C: Maps With Public Comment

Sheet 1 of 6

Kimley»Horn
Expect More. Experience Better.

Southeast Carson City Area Drainage Master Plan

Carson City, NV

Preliminary Flood Hazards: Southeast Carson City

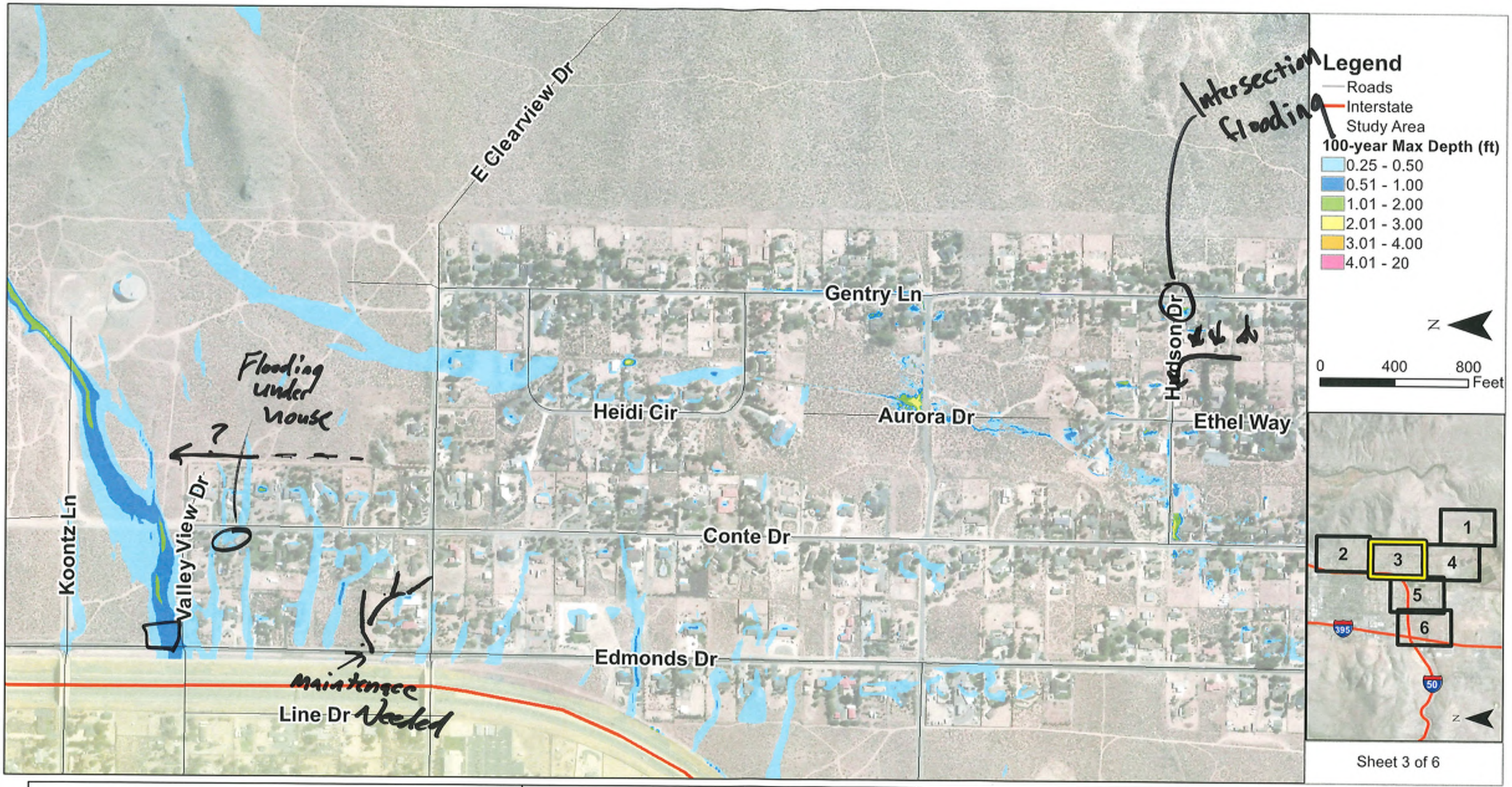
Sheet 2 of 6

Kimley»Horn
Expect More. Experience Better.

Southeast Carson City Area Drainage Master Plan

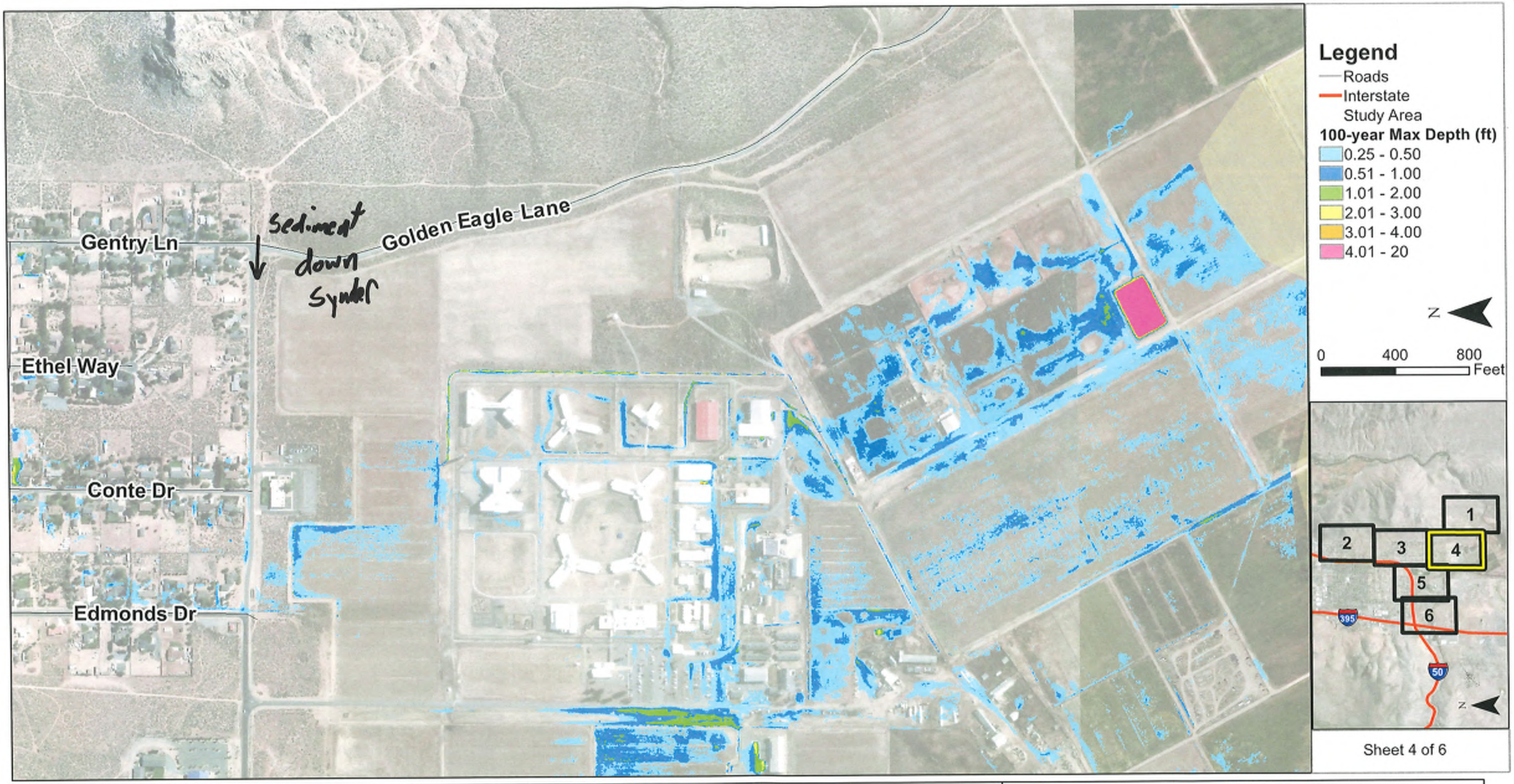
Carson City, NV

Preliminary Flood Hazards: Southeast Carson City



Sheet 3 of 6

Kimley»Horn Expect More. Experience Better.	Southeast Carson City Area Drainage Master Plan	Carson City, NV
	Preliminary Flood Hazards: Southeast Carson City	

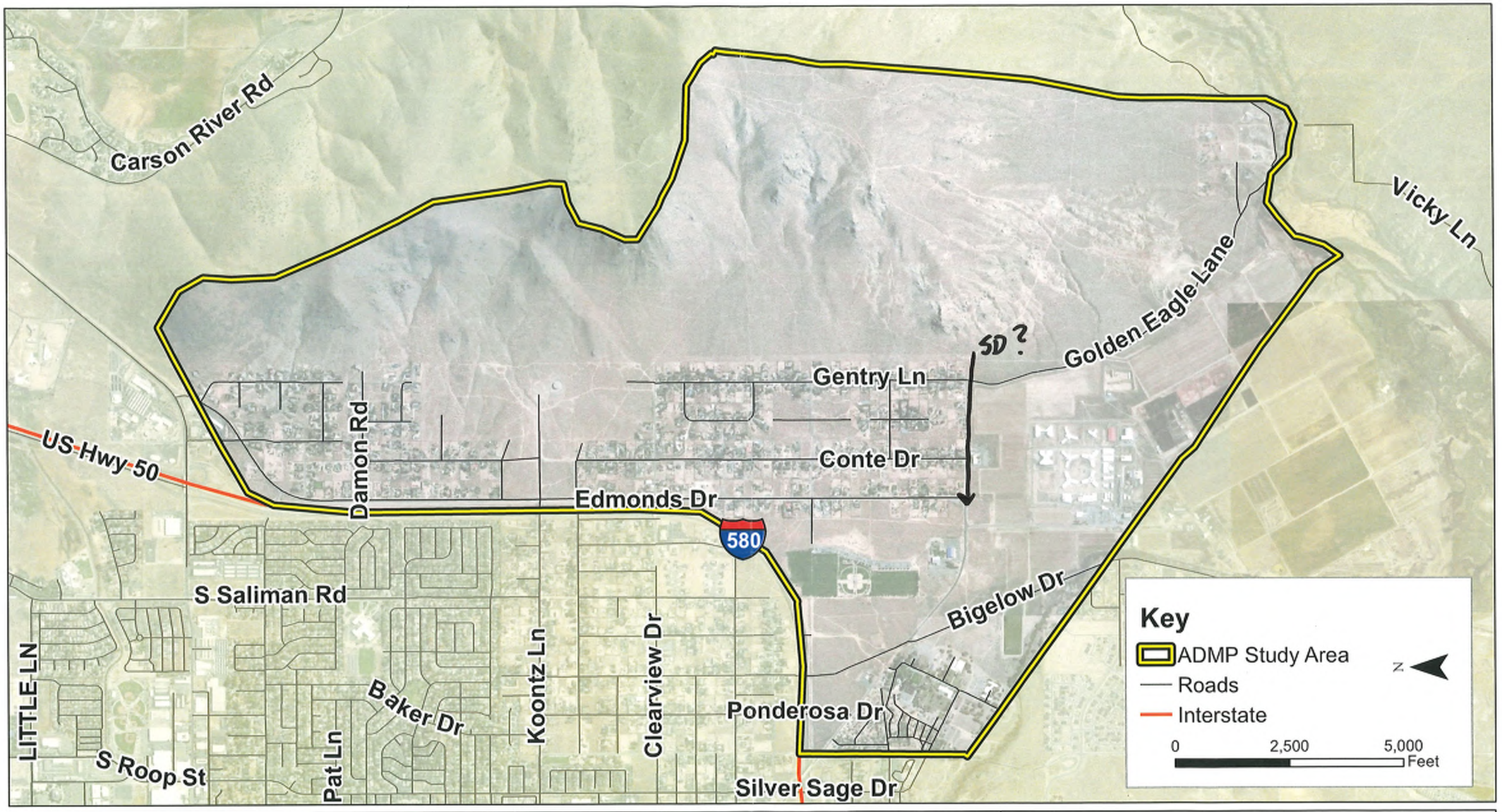


Sheet 4 of 6

Kimley»Horn
Expect More. Experience Better.

Southeast Carson City Area Drainage Master Plan	Carson City, NV

Preliminary Flood Hazards: Southeast Carson City



Kimley»Horn
Expect More. Experience Better.

Southeast Carson City Area Drainage Master Plan	Carson City, NV
Study Area Map	

Arthur Dr Arthur St

(Western NV Supply Drainage)

Flooding at Cul-de-sac

Flooding

Flooding Along the Road

Silver Sage Dr

Iter Dr

Dat So la Lee Way

Barrington Cir

Clear Creek Ave

de Lah E Deh

Mojave Dr

Paiute Ave

Havasupi Dr

Crescent Dr

Cherokee Ave

Pawnee Ave

Ute Dr

Sierra Ave

Apache Dr

Stewart Ave

Navajo Dr

Gibson Ave

Wa-Pai-Shone Ave

Crescent Dr

Jacobsen Way

Snyder Ave

Papago Dr

4720'

4740'

4720'

Hopi Dr

Jacobsen Ave

Dorm Dr

Bigelow Dr

Proposed Basin Site #1

4700'

4760'

Clear Creek

4800'

Legend

- USGS Contours
- Flowlines
- Proposed Storm Drain
- Existing Storm Drain
- Area of Mitigation Benefit
- Proposed Basin 1

Existing 100-Yr Flow Depth

- < 0.20
- 0.21 - 0.50
- 0.51 - 1.00
- 1.01 - 2.00
- 2.01 - 3.00
- 3.01 - 4.00
- > 4.00

N

0 100 200 400 Feet

Kimley»Horn

7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500
Engineering, Planning and Environmental Consultants

SCALE(H):1"= 250
SCALE(V):
DESIGNED BY: CTH
DRAWN BY: DBK
CHECKED BY: GSB
DATE: 07/2023

Southeast Carson City ADMP
Initial Design Concept Map
AOMI #1

PROJECT NO.
291417002

DRAWING NAME
DESIGN CONCEPT

1

Proposed Basin Site #2

Great Idea!

Legend

- USGS Contours
- Flowlines
- Proposed Storm Drain
- Area of Mitigation Benefit
- Proposed Basin 2

Existing 100-Yr Flow Depth

- < 0.20
- 0.21 - 0.50
- 0.51 - 1.00
- 1.01 - 2.00
- 2.01 - 3.00
- 3.01 - 4.00
- > 4.00

N

0 140 280 560 Feet

Livermore Ln
Bennett Ave
Conte Dr
Aurora Dr
S Edmonds Dr
Gentry Ln
Hudson Dr
Ethel Way
Snyder Ave
Golden Eagle Ln
Papago Dr
Hopi Dr
Bigelow Dr

4780'
4860'
4880'
5020'
5140'
5160'
5180'
5080'
5100'
5120'
4900'
4740'
4720'
4800'
4820'
4960'
4840'
4760'
4920'
4700'
4680'

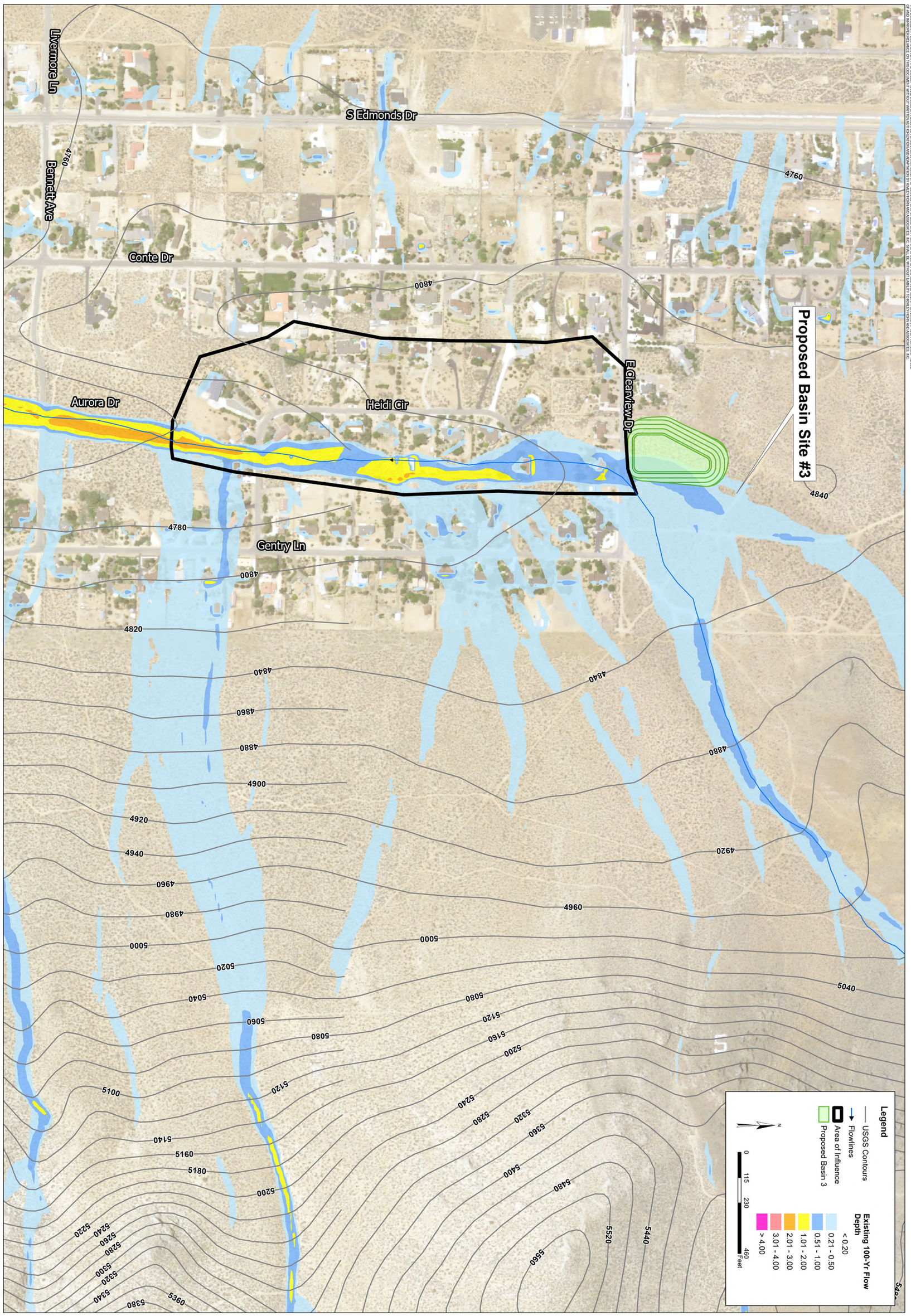
Kimley»Horn
© 2023 KIMLEY-HORN AND ASSOCIATES, INC.
Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

SCALE(H):1"= 250 SCALE(V):		
DESIGNED BY:	CTH	
DRAWN BY:	DBK	
CHECKED BY:	GSB	
DATE:	07/2023	

Southeast Carson City ADMP
Initial Design Concept Map
AOMI #2

PROJECT NO.
291417002

DRAWING NAME
DESIGN CONCEPT



3	DESIGN CONCEPT	PROJECT NO. 291417002	Southeast Carson City ADMP Initial Design Concept Map AOMI #3	SCALE(H):1"= 250 SCALE(V): DESIGNED BY: CTH DRAWN BY: DBK CHECKED BY: GSB DATE: 07/2023	Kimley»Horn		

Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

Legend

- Proposed Culverts
- USGS Contours

Existing 100-Yr Flow Depth

- < 0.20
- 0.21 - 0.50
- 0.51 - 1.00
- 1.01 - 2.00
- 2.01 - 3.00
- 3.01 - 4.00
- > 4.00

N

0 95 190 380 Feet

Proposed Culvert 4 - (2) 36"
L = 55'
Q100 = 87.4 cfs

Proposed Culvert 3 - (1) 36"
L = 55'
Q100 = 39.5 cfs

Proposed Culvert 2 - (2) 24"
L = 50'
Q100 = 43.9 cfs

36"

Most H2O of the 4 proposed culverts

Proposed Culvert 1 - (2) 36"
L = 70'
Q100 = 79.7 cfs

Golden Eagle

4840 4800 4780 4760 4740 4720 4700 4680 4660 4640

Hobbyhorse Ln

Carson River

Golden Eagle Ln

Kimley»Horn
© 2023 KIMLEY-HORN AND ASSOCIATES, INC.
Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

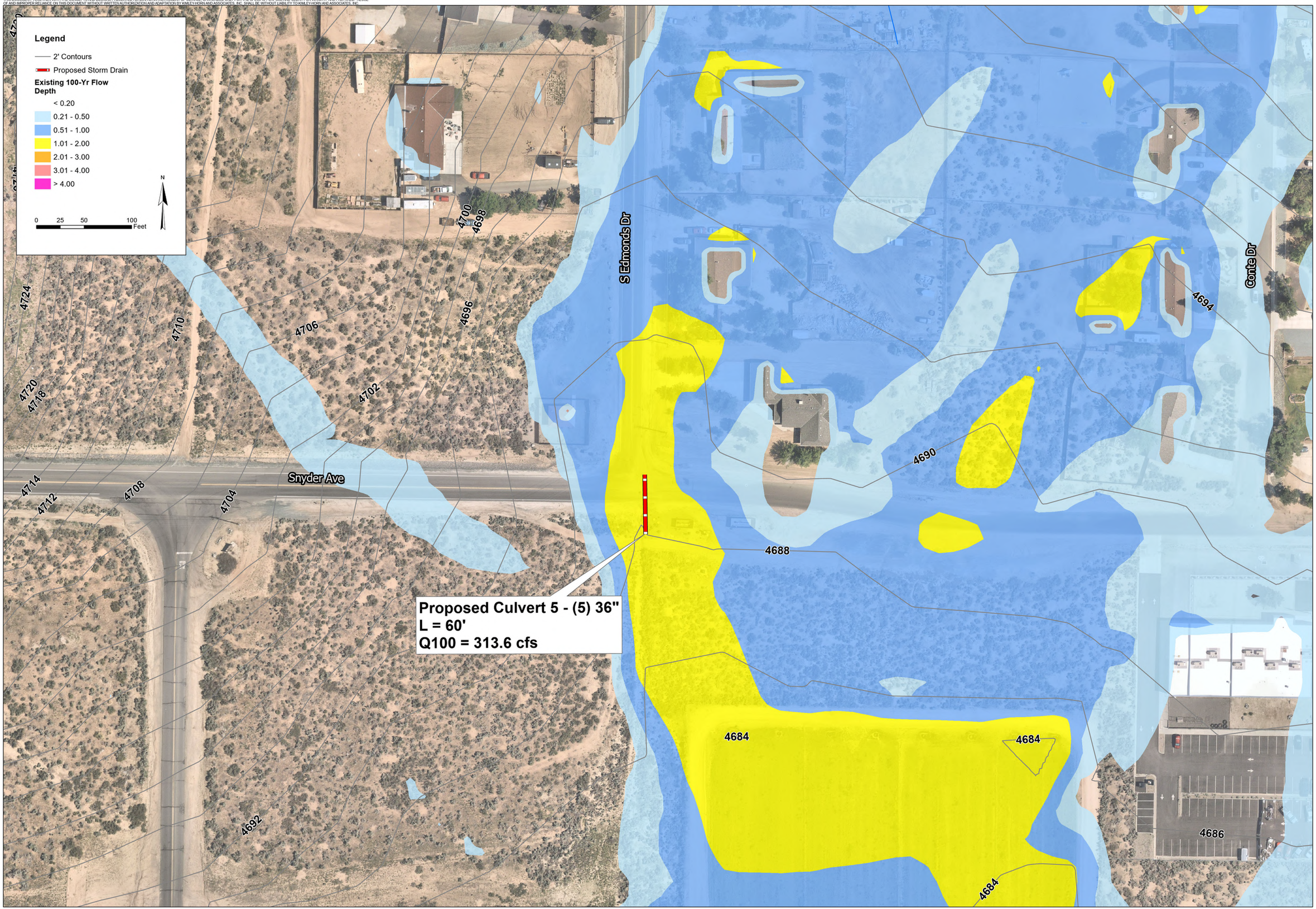
SCALE(H):1"=
SCALE(V):
DESIGNED BY: CTH
DRAWN BY: DBK
CHECKED BY: GSB
DATE: 08/2023

Southeast Carson City ADMP
Initial Design Concept Map
AOMI #4

PROJECT NO.
291417002

DRAWING NAME
DESIGN CONCEPT

4



Kimley»Horn
© 2023 KIMLEY-HORN AND ASSOCIATES, INC.
Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

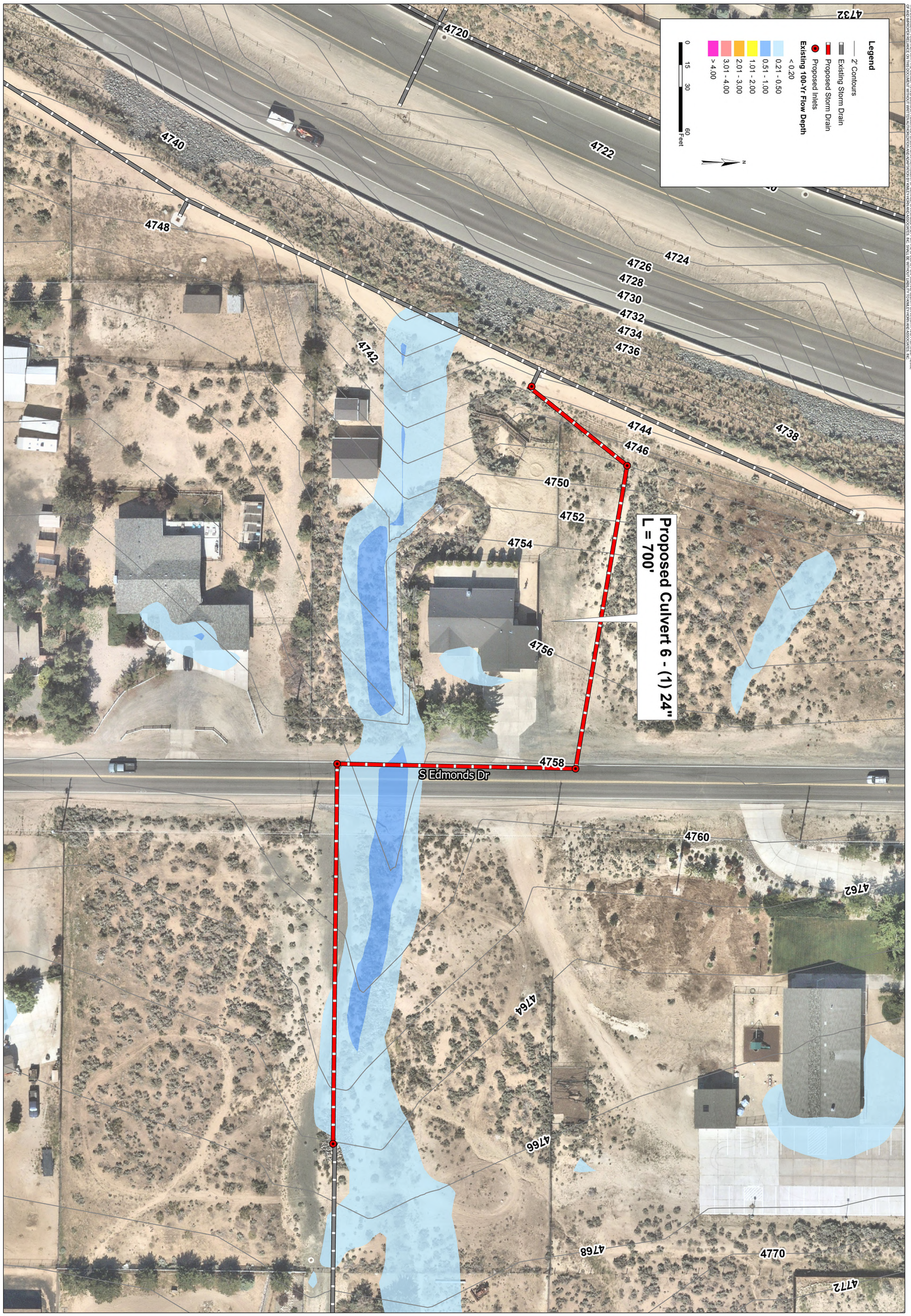
SCALE(H):1"=	
SCALE(V):	
DESIGNED BY:	CTH
DRAWN BY:	DBK
CHECKED BY:	GSB
DATE:	08/2023

Southeast Carson City ADMP
Initial Design Concept Map
AOMI #5

PROJECT NO.
291417002

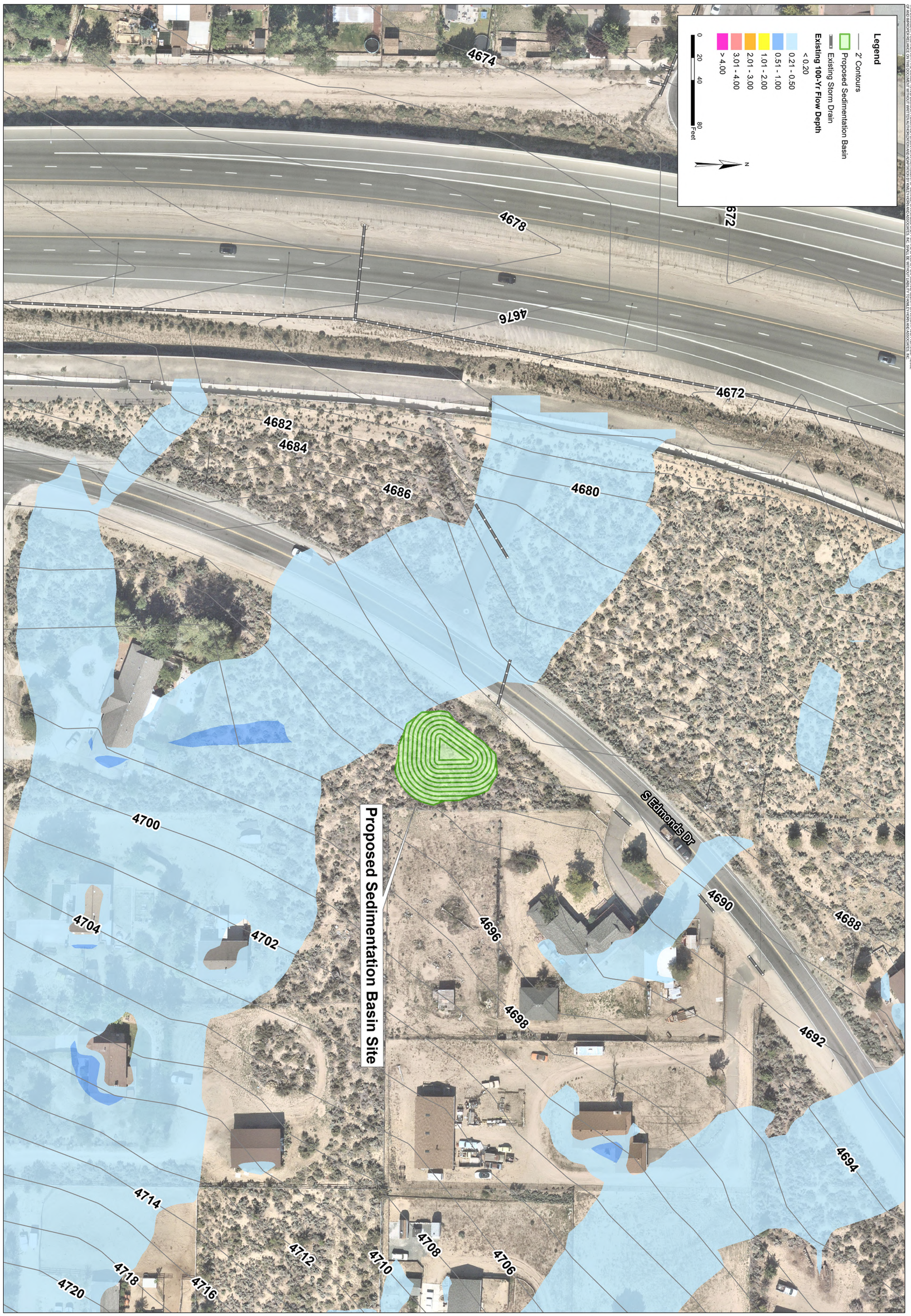
DRAWING NAME
DESIGN CONCEPT

5



6	DESIGN CONCEPT	PROJECT NO. 291417002	Southeast Carson City ADMP Initial Design Concept Map AOMI #6	SCALE(H):1"= SCALE(V): DESIGNED BY: CTH DRAWN BY: DBK CHECKED BY: GSB DATE: 08/2023	Kimley»Horn		

Engineering, Planning and Environmental Consultants
7740 North 16th Street, Suite 300
Phoenix, Arizona 85020 (602) 944-5500

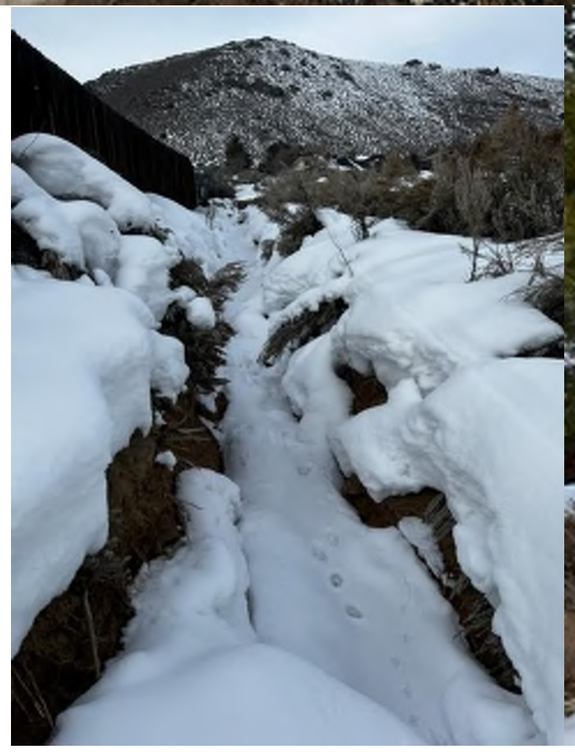


7	DESIGN CONCEPT	PROJECT NO. 291417002	Southeast Carson City ADMP Initial Design Concept Map AOMI #7	SCALE(H):1"= SCALE(V): DESIGNED BY: CTH DRAWN BY: DBK CHECKED BY: GSB DATE: 08/2023	Kimley»Horn © 2023 KIMLEY-HORN AND ASSOCIATES, INC. Engineering, Planning and Environmental Consultants 7740 North 16th Street, Suite 300 Phoenix, Arizona 85020 (602) 944-5500

Appendix D: Flooding Documentation Photos

January 2023 Storm


STOP



March 2023 Storm


HUDSON DR
HUDSON DR
HUDSON DR
HUDSON DR


Area 1
Area 2

Appendix E: Engineers Opinion of Probable Cost

Kimley»Horn

Project: ***Southeast Carson ADMP***
Location **AOMI #1: Clear Creek Basin**
Level of Protection **100-year**
Designed by: **CTH** Date: 11/1/2023
Checked by: **GSB** Date: 11/1/2023

Item Description	Unit	Unit Price	Qty	Cost
DESIGN				
Design Concept Report	LS	$ 75,000	1	$ 75,000
Final Design	LS	$ 300,000	1	$ 300,000
Design Sub-Total				$ 375,000
Contingency (20%)				$ 75,000
Design Total				$ 450,000
PERMITTING				
FEMA	LS	$ 80,000	1	$ 80,000
Environmental	LS	$ 40,000	1	$ 40,000
Permitting Sub-Total				$ 120,000
Contingency (20%)				$ 24,000
Permitting Total				$ 144,000
CONSTRUCTION				
Miscellaneous Removals	LS	$ 150,000	1	$ 150,000
Clear and Grub	AC	$ 17,000	5	$ 85,000
Basin Earthwork	CY	$ 15.0	36,800	$ 552,000
Riprap	SF	$ 5	650	$ 4,000
Inlets	EA	$ 4,000	18	$ 72,000
18'' RCP	LF	$ 140	950	$ 133,000
24'' RCP	LF	$ 150	1,950	$ 293,000
30'' RCP	LF	$ 170	2,450	$ 417,000
Landscape Seeding and Revegetation	SF	$ 1	218,000	$ 175,000
Pavement Replacement	SY	$ 50	4,700	$ 235,000
Utility Coordination	LS	$ 30,000	1	$ 30,000
Construction Sub-Total				$ 2,146,000
Miscellaneous Construction Costs (30%)[1]				$ 644,000
Contingency (20%)				$ 429,000
Construction Total				$ 3,219,000
LAND				
To be determined by appraisal				
TOTAL PROJECT COST				3,813,000

(1) Includes Mobilization, Traffic Control, Construction Staking, Quality Control, SWPPP, and Construction Management

* Cost does not include acquisition

Kimley»Horn

Project: ***Southeast Carson ADMP***
Location **AOMI #2: Bennett Ave Basin**
Level of Protection **100-year**
Designed by: **CTH** Date: 11/1/2023
Checked by: **GSB** Date: 11/1/2023

Item Description	Unit	Unit Price	Qty	Cost
DESIGN				
Design Concept Report	LS	$ 35,000	1	$ 35,000
Final Design	LS	$ 150,000	1	$ 150,000
Design Sub-Total				$ 185,000
Contingency (20%)				$ 37,000
Design Total				$ 222,000
PERMITTING				
Environmental	LS	$ 20,000	1	$ 20,000
Permitting Sub-Total				$ 20,000
Contingency (20%)				$ 4,000
Permitting Total				$ 24,000
CONSTRUCTION				
Miscellaneous Removals	LS	$ 75,000	1	$ 75,000
Outfall	LS	$ 16,000	1	$ 16,000
Clear and Grub	AC	$ 17,000	10	$ 165,000
Basin Earthwork	CY	$ 15.0	125,000	$ 1,875,000
Riprap	SF	$ 5	2,400	$ 12,000
Landscape Seeding and Revegetation	SF	$ 1	436,000	$ 349,000
Construction Sub-Total				$ 2,492,000
Miscellaneous Construction Costs (30%)[1]				$ 748,000
Contingency (20%)				$ 498,000
Construction Total				$ 3,738,000
TOTAL PROJECT COST				3,984,000

(1) Includes Mobilization, Traffic Control, Construction Staking, Quality Control, SWPPP, and Construction Management

Kimley»Horn

Project: ***Southeast Carson ADMP***
Location **AOMI #3: E Clearview Dr Basin**
Level of Protection **100-year**
Designed by: **CTH** Date: 11/1/2023
Checked by: **GSB** Date: 11/1/2023

Item Description	Unit	Unit Price	Qty	Cost
DESIGN				
Design Concept Report	LS	$ 35,000	1	$ 35,000
Final Design	LS	$ 150,000	1	$ 150,000
Design Sub-Total				$ 185,000
Contingency (20%)				$ 37,000
Design Total				$ 222,000
PERMITTING				
Environmental	LS	$ 20,000	1	$ 20,000
Permitting Sub-Total				$ 20,000
Contingency (20%)				$ 4,000
Permitting Total				$ 24,000
CONSTRUCTION				
Miscellaneous Removals	LS	$ 75,000	1	$ 75,000
Clear and Grub	AC	$ 17,000	4	$ 68,000
Basin Earthwork	CY	$ 15.0	40,500	$ 608,000
Riprap	SF	$ 5	2,800	$ 14,000
Landscape Seeding and Revegetation	SF	$ 1	175,000	$ 140,000
Construction Sub-Total				$ 905,000
Miscellaneous Construction Costs (30%)[1]				$ 272,000
Contingency (20%)				$ 181,000
Construction Total				$ 1,358,000
TOTAL PROJECT COST				1,604,000

(1) Includes Mobilization, Traffic Control, Construction Staking, Quality Control, SWPPP, and Construction Management

Kimley»Horn

Project: ***Southeast Carson ADMP***
Location **AOMI #4: Golden Eagle Ln Pipes**
Level of Protection **100-year**
Designed by: **CTH** Date: 11/1/2023
Checked by: **GSB** Date: 11/1/2023

Item Description	Unit	Unit Price	Qty	Cost
DESIGN				
Design Concept Report	LS	$ 15,000	1	$ 15,000
Final Design	LS	$ 75,000	1	$ 75,000
Design Sub-Total				$ 90,000
Contingency (20%)				$ 18,000
Design Total				$ 108,000
PERMITTING				
FEMA	LS	$ 40,000	1	$ 40,000
Environmental	LS	$ 10,000	1	$ 10,000
Permitting Sub-Total				$ 50,000
Contingency (20%)				$ 10,000
Permitting Total				$ 60,000
CONSTRUCTION				
Miscellaneous Removals	LS	$ 35,000	1	$ 35,000
Clear and Grub	AC	$ 17,000	0.1	$ 2,000
Riprap	SF	$ 5	40	$ 1,000
24'' RCP	LF	$ 150	100	$ 15,000
36" RCP	LF	$ 240	305	$ 74,000
Landscape Seeding and Revegetation	SF	$ 1	4,400	$ 4,000
Pavement Replacement	SY	$ 50	140	$ 7,000
Utility Coordination	LS	$ 15,000	1	$ 15,000
Construction Sub-Total				$ 153,000
Miscellaneous Construction Costs (30%)[1]				$ 46,000
Contingency (20%)				$ 31,000
Construction Total				$ 230,000
TOTAL PROJECT COST				398,000

(1) Includes Mobilization, Traffic Control, Construction Staking, Quality Control, SWPPP, and Construction Management

Kimley»Horn

Project: ***Southeast Carson ADMP***
Location **AOMI #5: Snyder Ave Pipes**
Level of Protection **100-year**
Designed by: **CTH** Date: 11/1/2023
Checked by: **GSB** Date: 11/1/2023

Item Description	Unit	Unit Price	Qty	Cost
DESIGN				
Design Concept Report	LS	$ 15,000	1	$ 15,000
Final Design	LS	$ 75,000	1	$ 75,000
Design Sub-Total				$ 90,000
Contingency (20%)				$ 18,000
Design Total				$ 108,000
PERMITTING				
Environmental	LS	$ 10,000	1	$ 10,000
Permitting Sub-Total				$ 10,000
Contingency (20%)				$ 2,000
Permitting Total				$ 12,000
CONSTRUCTION				
Miscellaneous Removals	LS	$ 35,000	1	$ 35,000
Clear and Grub	AC	$ 17,000	0.3	$ 5,000
Fill	CY	$ 25	3,000	$ 75,000
36'' RCP	LF	$ 240	300	$ 72,000
Landscape Seeding and Revegetation	SF	$ 1	8,100	$ 7,000
Pavement Replacement	SY	$ 50	800	$ 40,000
Utility Coordination	LS	$ 15,000	1	$ 15,000
Construction Sub-Total				$ 249,000
Miscellaneous Construction Costs (30%)[1]				$ 75,000
Contingency (20%)				$ 50,000
Construction Total				$ 374,000
TOTAL PROJECT COST				494,000

(1) Includes Mobilization, Traffic Control, Construction Staking, Quality Control, SWPPP, and Construction Management

Kimley»Horn

Project: ***Southeast Carson ADMP***
Location **AOMI #6: South Edmonds Drive Pipe**
Level of Protection **100-year**
Designed by: **CTH** Date: 11/1/2023
Checked by: **GSB** Date: 11/1/2023

Item Description	Unit	Unit Price	Qty	Cost
DESIGN				
Design Concept Report	LS	$ 15,000	1	$ 15,000
Final Design	LS	$ 75,000	1	$ 75,000
Design Sub-Total				$ 90,000
Contingency (20%)				$ 18,000
Design Total				$ 108,000
PERMITTING				
Environmental	LS	$ 10,000	1	$ 10,000
NDOT	LS	$ 10,000	1	$ 10,000
Permitting Sub-Total				$ 20,000
Contingency (20%)				$ 4,000
Permitting Total				$ 24,000
CONSTRUCTION				
Miscellaneous Removals	LS	$ 35,000	1	$ 35,000
Clear and Grub	AC	$ 17,000	0.3	$ 5,000
Inlets	EA	$ 4,000	2	$ 8,000
Manholes	EA	$ 4,000	3	$ 12,000
24'' RCP	LF	$ 150	750	$ 113,000
Landscape Seeding and Revegetation	SF	$ 1	11,000	$ 9,000
Pavement Replacement	SY	$ 50	230	$ 12,000
Utility Coordination	LS	$ 15,000	1	$ 15,000
Construction Sub-Total				$ 209,000
Miscellaneous Construction Costs (30%)[1]				$ 63,000
Contingency (20%)				$ 42,000
Construction Total				$ 314,000
TOTAL PROJECT COST				446,000

(1) Includes Mobilization, Traffic Control, Construction Staking, Quality Control, SWPPP, and Construction Management

Kimley»Horn

Project: ***Southeast Carson ADMP***
Location **AOMI #7: Sedimentation Basin**
Level of Protection **100-year**
Designed by: **CTH** Date: 11/1/2023
Checked by: **GSB** Date: 11/1/2023

Item Description	Unit	Unit Price	Qty	Cost
DESIGN				
Design Concept Report	LS	$ 15,000	1	$ 15,000
Final Design	LS	$ 75,000	1	$ 75,000
Design Sub-Total				$ 90,000
Contingency (20%)				$ 18,000
Design Total				$ 108,000
PERMITTING				
Environmental	LS	$ 10,000	1	$ 10,000
Permitting Sub-Total				$ 10,000
Contingency (20%)				$ 2,000
Permitting Total				$ 12,000
CONSTRUCTION				
Miscellaneous Removals	LS	$ 35,000	1	$ 35,000
Clear and Grub	AC	$ 17,000	0.3	$ 6,000
Basin Earthwork	CY	$ 15.0	750	$ 12,000
Inlets	EA	$ 4,000	2	$ 8,000
24'' RCP	LF	$ 150	30	$ 5,000
Riprap	SF	$ 5	1,000	$ 5,000
Landscape Seeding and Revegetation	SF	$ 1	14,000	$ 12,000
Construction Sub-Total				$ 83,000
Miscellaneous Construction Costs (30%)[1]				$ 25,000
Contingency (20%)				$ 17,000
Construction Total				$ 125,000
LAND				
To be determined by appraisal				
TOTAL PROJECT COST				245,000

(1) Includes Mobilization, Traffic Control, Construction Staking, Quality Control, SWPPP, and Construction Management

* Cost does not include acquisition

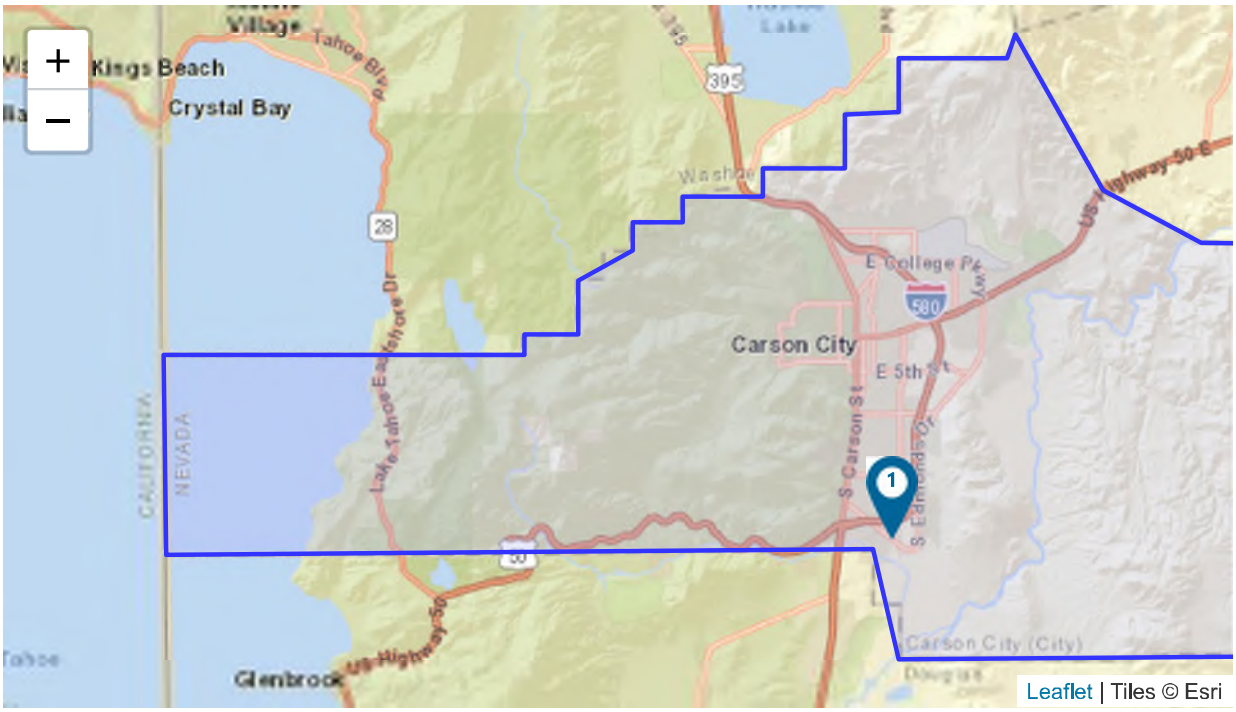
Appendix F: FEMA Benefit Cost Analysis

Benefit-Cost Calculator

V.6.0 (Build 20231011.1703 | Release Notes)

Benefit-Cost Analysis

Project Name: Southeast Carson City Area Drainage Master Plan AOMI #1 Clear Creek Basin



				Using 7% Discount Rate			Using 3% Discount Rate (For BRIC and FMA only)			
Map Marker	Mitigation Title	Property Type	Hazard	Benefits (B)	Costs (C)	BCR (B/C)	Benefits (B)	Costs (C)	BCR (B/C)	
1	Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701		DFA - Riverine Flood	$ 7,843,890	$ 3,869,785	2.03	$ 14,897,665	$ 3,931,807	3.79	
TOTAL (SELECTED)				**$ 7,843,890**	**$ 3,869,785**	**2.03**	**$ 14,897,665**	**$ 3,931,807**	**3.79**	
TOTAL				**$ 7,843,890**	**$ 3,869,785**	**2.03**	**$ 14,897,665**	**$ 3,931,807**	**3.79**	

Property Configuration

Property Title:	Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701
Property Location:	89701, Carson City, Nevada
Property Coordinates:	39.116494999787065, -119.75420499209045
Hazard Type:	Riverine Flood
Mitigation Action Type:	Drainage Improvement
Property Type:	Residential Building
Analysis Method Type:	Professional Expected Damages

Cost Estimation

Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701

Project Useful Life (years):	75
Project Cost:	$3,813,000
Number of Maintenance Years:	75 Use Default:Yes
Annual Maintenance Cost:	$4,000

Damage Analysis Parameters - Damage Frequency Assessment

Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701

Year of Analysis was Conducted:	2023
Year Property was Built:	2023
Analysis Duration:	75 Use Default: *No*

Professional Expected Damages Before Mitigation

Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701

	OTHER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Damages ($)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
10	3,616,775	0	0	0	0	0	3,616,775
25	3,932,805	0	0	0	0	0	3,932,805
100	4,432,388	0	0	0	0	0	4,432,388

Annualized Damages Before Mitigation

Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
10	3,616,775	226,289
25	3,932,805	125,254
100	4,432,388	44,323
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	11,981,968	395,866

Professional Expected Damages After Mitigation

Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701

	OTHER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Damages ($)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
10	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0

Annualized Damages After Mitigation

Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
10	0	0
25	0	0
100	0	0
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	0	0

Standard Benefits - Ecosystem Services

Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701

Total Project Area (acres):	3.8
Percentage of Urban Green Open Space:	100.00%
Percentage of Rural Green Open Space:	0.00%
Percentage of Riparian:	0.00%
Percentage of Coastal Wetlands:	0.00%
Percentage of Inland Wetlands:	0.00%
Percentage of Forests:	0.00%
Percentage of Coral Reefs:	0.00%
Percentage of Shellfish Reefs:	0.00%
Percentage of Beaches and Dunes:	0.00%
Expected Annual Ecosystem Services Benefits:	$59,056

Additional Benefits - Social

Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701

Number of Workers:	75
Expected Annual Social Benefits:	$1,385,657

Comments

-

Number of Workers:

299 residents (2.3 people per household. 130 households) 75 work (25% of residents)

Benefits-Costs Summary

Drainage Improvement @ Snyder Ave, Carson City, Nevada, 89701

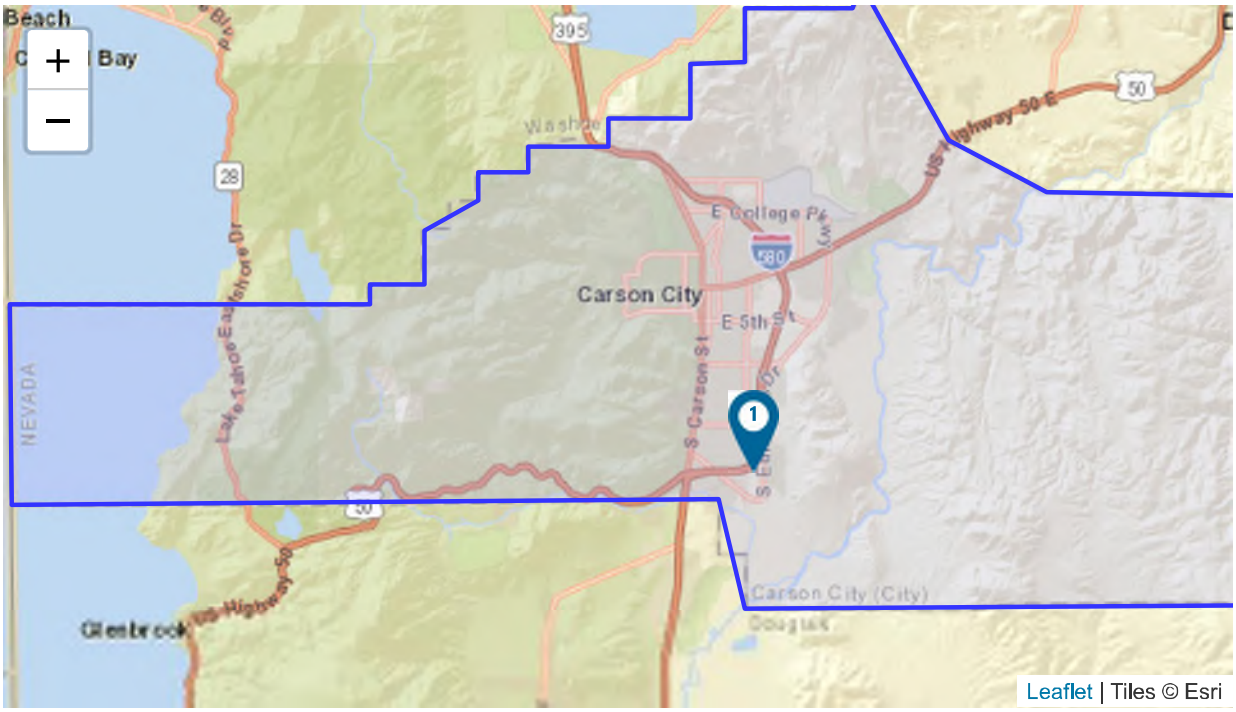
Total Standard Mitigation Benefits:	$6,458,233
Total Social Benefits:	$1,385,657
Total Mitigation Project Benefits:	$7,843,890
Total Mitigation Project Cost:	$3,869,785
Benefit Cost Ratio - Standard:	1.67
Benefit Cost Ratio - Standard + Social:	2.03

Benefit-Cost Calculator

V.6.0 (Build 20231011.1703 | Release Notes)

Benefit-Cost Analysis

Project Name: Southeast Carson City Area Drainage Master Plan AOMI #2 Bennett Ave Basin



				Using 7% Discount Rate			Using 3% Discount Rate (For BRIC and FMA only)			
Map Marker	Mitigation Title	Property Type	Hazard	Benefits (B)	Costs (C)	BCR (B/C)	Benefits (B)	Costs (C)	BCR (B/C)	
1	Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701		DFA - Riverine Flood	$ 7,699,288	$ 4,012,393	1.92	$ 15,648,960	$ 4,043,404	3.87	
TOTAL (SELECTED)				**$ 7,699,288**	**$ 4,012,393**	**1.92**	**$ 15,648,960**	**$ 4,043,404**	**3.87**	
TOTAL				**$ 7,699,288**	**$ 4,012,393**	**1.92**	**$ 15,648,960**	**$ 4,043,404**	**3.87**	

Property Configuration

Property Title:	Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701
Property Location:	89701, Carson City, Nevada
Property Coordinates:	39.1211500154441, -119.74868500593523
Hazard Type:	Riverine Flood
Mitigation Action Type:	Drainage Improvement
Property Type:	Residential Building
Analysis Method Type:	Professional Expected Damages

Cost Estimation

Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701

Project Useful Life (years):	75
Project Cost:	$3,984,000
Number of Maintenance Years:	75 Use Default:Yes
Annual Maintenance Cost:	$2,000

Damage Analysis Parameters - Damage Frequency Assessment

Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701

Year of Analysis was Conducted:	2023
Year Property was Built:	2023
Analysis Duration:	75 Use Default: *No*

Professional Expected Damages Before Mitigation

Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701

	OTHER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Damages ($)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
10	3,079,312	0	0	0	0	0	3,079,312
25	3,939,353	0	0	0	0	0	3,939,353
100	5,376,663	0	0	0	0	0	5,376,663

Annualized Damages Before Mitigation

Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
10	3,079,312	208,973
25	3,939,353	138,067
100	5,376,663	53,766
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	12,395,328	400,806

Professional Expected Damages After Mitigation

Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701

	OTHER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Damages ($)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
10	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0

Annualized Damages After Mitigation

Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
10	0	0
25	0	0
100	0	0
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	0	0

Standard Benefits - Ecosystem Services

Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701

Total Project Area (acres):	7.2
Percentage of Urban Green Open Space:	100.00%
Percentage of Rural Green Open Space:	0.00%
Percentage of Riparian:	0.00%
Percentage of Coastal Wetlands:	0.00%
Percentage of Inland Wetlands:	0.00%
Percentage of Forests:	0.00%
Percentage of Coral Reefs:	0.00%
Percentage of Shellfish Reefs:	0.00%
Percentage of Beaches and Dunes:	0.00%
Expected Annual Ecosystem Services Benefits:	$111,895

Additional Benefits - Social

Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701

Number of Workers:	23
Expected Annual Social Benefits:	$420,798

Comments

-

Number of Workers:

90 residents (2.3 people per household . 39 households) 23 work (25% of residents)

Benefits-Costs Summary

Drainage Improvement @ Bennett Ave, Carson City, Nevada, 89701

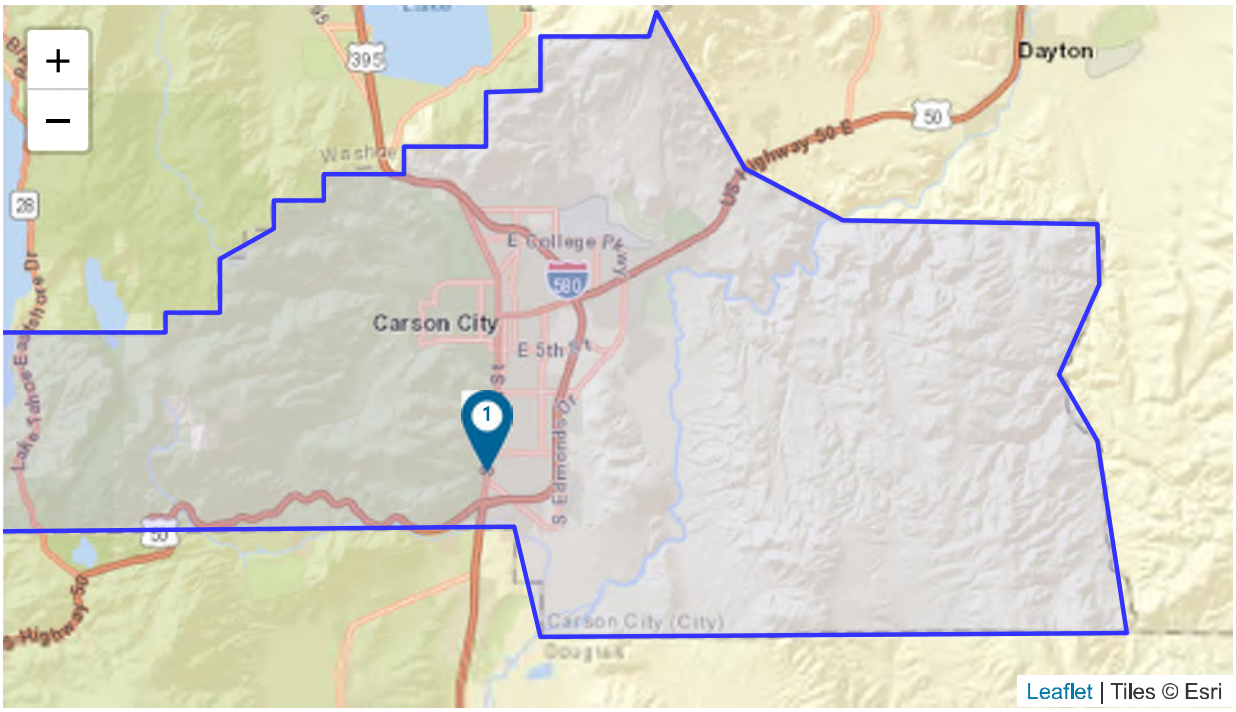
Total Standard Mitigation Benefits:	$7,278,490
Total Social Benefits:	$420,798
Total Mitigation Project Benefits:	$7,699,288
Total Mitigation Project Cost:	$4,012,393
Benefit Cost Ratio - Standard:	1.81
Benefit Cost Ratio - Standard + Social:	1.92

Benefit-Cost Calculator

V.6.0 (Build 20231011.1703 | Release Notes)

Benefit-Cost Analysis

Project Name: Southeast Carson City Area Drainage Master Plan AOMI#3 E Clearview Dr Basin



				Using 7% Discount Rate			Using 3% Discount Rate (For BRIC and FMA only)			
Map Marker	Mitigation Title	Property Type	Hazard	Benefits (B)	Costs (C)	BCR (B/C)	Benefits (B)	Costs (C)	BCR (B/C)	
1	Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701		DFA - Riverine Flood	$ 3,399,398	$ 1,632,393	2.08	$ 6,831,932	$ 1,663,404	4.11	
TOTAL (SELECTED)				**$ 3,399,398**	**$ 1,632,393**	**2.08**	**$ 6,831,932**	**$ 1,663,404**	**4.11**	
TOTAL				**$ 3,399,398**	**$ 1,632,393**	**2.08**	**$ 6,831,932**	**$ 1,663,404**	**4.11**	

Property Configuration

Property Title:	Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701
Property Location:	89701, Carson City, Nevada
Property Coordinates:	39.12840499269237, -119.7703549916718
Hazard Type:	Riverine Flood
Mitigation Action Type:	Drainage Improvement
Property Type:	Residential Building
Analysis Method Type:	Professional Expected Damages

Cost Estimation

Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701

Project Useful Life (years):	75
Project Cost:	$1,604,000
Number of Maintenance Years:	75 Use Default:Yes
Annual Maintenance Cost:	$2,000

Damage Analysis Parameters - Damage Frequency Assessment

Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701

Year of Analysis was Conducted:	2023
Year Property was Built:	2023
Analysis Duration:	75 Use Default: *No*

Professional Expected Damages Before Mitigation

Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701

	OTHER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Damages ($)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
10	1,623,524	0	0	0	0	0	1,623,524
25	1,787,526	0	0	0	0	0	1,787,526
100	2,019,807	0	0	0	0	0	2,019,807

Annualized Damages Before Mitigation

Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
10	1,623,524	102,213
25	1,787,526	57,004
100	2,019,807	20,198
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	5,430,857	179,415

Professional Expected Damages After Mitigation

Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701

	OTHER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Damages ($)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
10	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0

Annualized Damages After Mitigation

Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
10	0	0
25	0	0
100	0	0
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	0	0

Standard Benefits - Ecosystem Services

Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701

Total Project Area (acres):	2.7
Percentage of Urban Green Open Space:	100.00%
Percentage of Rural Green Open Space:	0.00%
Percentage of Riparian:	0.00%
Percentage of Coastal Wetlands:	0.00%
Percentage of Inland Wetlands:	0.00%
Percentage of Forests:	0.00%
Percentage of Coral Reefs:	0.00%
Percentage of Shellfish Reefs:	0.00%
Percentage of Beaches and Dunes:	0.00%
Expected Annual Ecosystem Services Benefits:	$41,961

Additional Benefits - Social

Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701

Number of Workers:	14
Expected Annual Social Benefits:	$256,669

Benefits-Costs Summary

Drainage Improvement @ E Clearview Dr, Carson City, Nevada, 89701

Total Standard Mitigation Benefits:	$3,142,729
Total Social Benefits:	$256,669
Total Mitigation Project Benefits:	$3,399,398
Total Mitigation Project Cost:	$1,632,393
Benefit Cost Ratio - Standard:	1.93
Benefit Cost Ratio - Standard + Social:	2.08