PRELIMINARY SEWER REPORT

FOR

WASHOE VALLEY FIRE STATION
WASHOE VALLEY, NEVADA

Prepared for:

Truckee Meadows Fire Protection District
3663 Barron Way
Reno, NV 89511

March, 2023

Prepared by:

Wood Rodgers Inc.
1361 Corporate Boulevard
Reno, Nevada 89502
(775) 823-4068

Jillian Wilbrecht, PE

WOOD RODGERS
BUILDING RELATIONSHIPS ONE PROJECT AT A TIME

TABLE OF CONTENTS

APPENDIX

INTRODUCTION

This study represents the Preliminary Sewer Report for development of the proposed Washoe Valley Fire Station project. The purpose of this study is to address the on-site septic design for the project. The proposed septic system, as described below, is consistent with the *Washoe County District Board of Health - Sewage Wastewater, and Sanitation Regulations.* This report includes the overall design standards used to preliminarily size the septic tank, dosing tank, and leach field to support the proposed project.

PROJECT LOCATION/DESCRIPTION

The proposed project site (APN's: 050-220-61 thru -66) is approximately 5.98 ± acres in size and is located within Sections 23 and 24 in T17N, R19E, MDM, Washoe County, Nevada. Currently, the site consists of six parcels. A Reversion to Acreage Parcel Map is currently processing to combine the parcels into one for development of the project.

The project site is bounded by Highway 395 to the northwest, Lake Drive to the south, an existing commercial property to the north, and private residences to the east and west. Browns Creek is located along the west side of the project parcel. A Vicinity Map is included in the Appendix of this report for reference.

EXISTING CONDITION

The project site is currently undeveloped. There is no available sanitary sewer infrastructure to connect into within the project area.

A preliminary geotechnical study was completed by CME in February 2020. The study completed percolation tests in three test pits and identified one area near the center of the property as the recommended location for the septic disposal field. This area resulted in a percolation rate of 21.2 minutes per inch. In addition, CME also reported the depth to groundwater at that location as 7-feet below existing ground elevation. CME's study stated that a partial mound system will likely be required based on their preliminary results.

PROPOSED CONDITION

Development of the Washoe Valley Fire Station project will include construction of a 14,600± square foot fire station with apparatus bays and two 3,750± square foot metal storage buildings.

The fire station will support a crew of six and include six crew quarters (similar to a six-bedroom residential home). The project will utilize a septic system for sewerage from the site which was sized based on residential design considerations since it more similar to a residential situation than a commercial property. In general, a sewer lateral will extend from the fire station building to a septic system located just south of the developed area. The sewer system will include a septic tank, a dosing tank, a septic leach field, and a back-up septic leach field. See the Septic System Site Layout in the Appendix for reference.

CONTRIBUTIONS/DESIGN COMPONENTS

The septic system that will support the proposed project was based on the design requirements for a six-bedroom residential house. An engineered sand filter bed system will be utilized for the project. This system will be utilized to mitigate against the high groundwater observed on the project site. The site was preliminarily designed with a 1,500-gallon septic tank, a dosing tank, a leach field. The project will also include a back-up leach field located near the primary leach field as required by regulations.

CONCLUSIONS

The proposed septic sewer system discussed in this report will be designed to sufficiently serve the proposed Washoe Valley Fire Station project. All on-site facilities shall be privately owned and maintained.

REFERENCES

CME, Preliminary Geotechnical Memorandum, Truckee Meadows Fire Department (TMFD) Washoe Valley Consolidation Parcel Review, February 27, 2020.

Washoe County District Board of Health – Sewage, Wastewater, and Sanitation Regulations, May 23, 2013.

Appendix

WOOD RODGERS

BUILDING RELATIONSHIPS ONE PROJECT AT A TIME

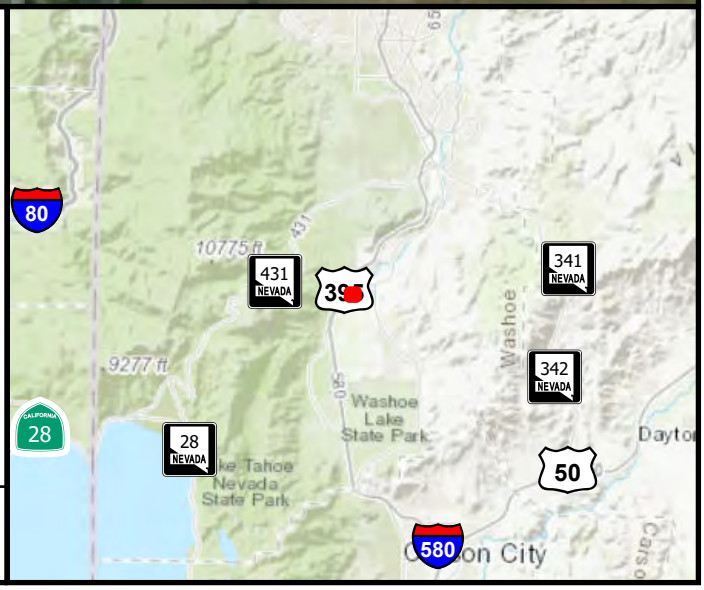
Fig. 1

Vicinity Map

Washoe Valley Fire Station

Washoe Valley, Nevada

March 2023



Prepared By: AL *Checked By:* JW

\\woodrodgers.loc\productiondata\jobs-reno\Gis\Technology\VicinityMapPDF\Pro2x\VicinityMapPDF\VicinityMapPDF.aprx

SEPTIC SYSTEM SITE LAYOUT

WASHOE VALLEY FIRE STATION

TRUCKEE MEADOWS FIRE PROTECTION DISTRICT

WASHOE COUNTY **NEVADA**

MARCH, 2023

HIGHWAY 395
(EXISTING/NDOT)

BROWNS CREEK

FIRE STATION
BUILDING

APPARATUS
BAYS

RESERVE
APPARATUS/TIRES
(METAL BUILDING)

WILDLAND
(METAL
BUILDING)

SS

SEPTIC TANK

DOSING TANK

BACK-UP SEPTIC
LEACH FIELD

SEPTIC LEACH FIELD

100' SEPTIC
SETBACK

PROJECT BOUNDARY
(TYP.)

N

60' 30' 0 60'

SCALE: 1" = 60'

WOOD RODGERS
BUILDING RELATIONSHIPS ONE PROJECT AT A TIME
1361 Corporate Boulevard
Reno, NV 89502
Tel 775.823.4068
Fax 775.823.4066

J:\Jobs\8754_TMFPD_Station_Reloc_005 Washoe Valley Consolidated Station_OA\Planning\Studies\Sewer\EXH_Septic Layout.dwg 3/6/2023 9:42 PM Jillian Wilbrecht

PRELIMINARY DRAINAGE REPORT

FOR

WASHOE VALLEY FIRE STATION
WASHOE VALLEY, NEVADA

Prepared for:

Truckee Meadows Fire Protection District
3663 Barron Way
Reno, NV 89511

March, 2023

Prepared by:

Wood Rodgers Inc.
1361 Corporate Boulevard
Reno, Nevada 89502
(775) 823-4068

Jillian Wilbrecht, P.E.

WOOD RODGERS
BUILDING RELATIONSHIPS ONE PROJECT AT A TIME

TABLE OF CONTENTS

APPENDICES

INTRODUCTION

This study represents the Preliminary Drainage Report for development of the proposed Washoe Valley Fire Station project. The purpose of this study is to address the drainage issues that result from development of the existing property in accordance with Washoe County development standards, the *Truckee Meadows Regional Design Manual* (TMRDM), and sound design and engineering practices. This report includes the overall hydrologic analysis for existing and proposed conditions and the design parameters for on-site stormwater management facilities.

PROJECT LOCATION/DESCRIPTION

The proposed project site (APN's: 050-220-61 thru -66) is approximately 5.98 ± acres in size and is located within Sections 23 and 24 in T17N, R19E, MDM, Washoe County, Nevada. Currently, the site consists of six parcels. A Reversion to Acreage Parcel Map is currently processing to combine the parcels into one for development of the project.

The project site is bounded by Highway 395 to the northwest, Lake Drive to the south, an existing commercial property to the north, and private residences to the east and west. Browns Creek is located along the west side of the project parcel. A Vicinity Map is included in Appendix A of this report for reference.

Development of the site will include a 14,600± square foot fire station with apparatus bays and two 3,750± square foot metal storage buildings with drive aisles, paved parking, walkways, and landscaping to support the project.

EXISTING CONDITIONS

In its existing condition, the site is divided into two hydrologic basins, E-01 and E-02. Basin E-01 encompasses the majority of the eastern side of the property. Stormwater falling on the site sheet flows toward the east parcel line where it enters an existing drainage swale along the northeast property line. Stormwater then crosses the existing driveway of the neighboring parcel and is conveyed east along the unpaved access road. Stormwater continues east where it reports to Little Washoe Lake.

Basin E-02 is located along the west side of the project property along Browns Creek. Stormwater

falling on the existing Browns Creek is conveyed south toward an existing culvert that crosses Lake Drive. Stormwater from Browns Creek continues eastward where it is discharged into Little Washoe Lake.

The existing basins and flowpaths can be found in Appendix B.

FEMA Flood Hazard Information

The project site is located on FEMA Flood Insurance Rate Map (FIRM) number 32031C3333G. Per the map, the entire site is located within FEMA Flood Zone 'X', which is defined as areas outside the 0.2% (500-year) annual chance floodplain. As the site is Zone 'X', there are no base flood elevations for the site. The FEMA FIRMette is provided in Appendix A.

PROPOSED CONDITION

Proposed development of the site will create two hydrologic basins, P-01 and P-02, similar to the existing condition. Stormwater falling on Basin P-01 will report to gutters within the developed area. Stormwater will then discharge to a riprap apron located on the east side of the project area to return the stormwater to a sheet flow condition. From the riprap apron, stormwater will sheet flow eastward in the same manner as the existing condition and ultimately report to Little Washoe Lake in the same manner.

Basin P-02 will be unchanged from the existing E-02 condition.

The proposed hydrologic basins and flowpaths can be found in Appendix B.

HYDROLOGIC ANALYSIS

The hydrologic analysis included in this report consists of preliminary peak runoff flow computations for the existing and proposed conditions. The 5-year and 100-year storm events were modeled per the TMRDM, and the results are shown in the table below.

The 5-year and 100-year storm event runoff flow rates for the existing and proposed hydrologic basins were analyzed using the Rational Method, per the TMRDM. Rational Method flow rate calculation input includes rainfall frequency, runoff coefficients, and drainage areas.

Rainfall intensities were required to complete the preliminary hydrologic analysis for the site. Precipitation intensity estimates were taken from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 1, Version 5 which provides rainfall information for a given longitude and latitude. It was determined that the site latitude and longitude are 39.3254° and -119.8085°, respectively. Rainfall intensities were interpolated for both the 5-year and 100-year storm events. Intensity numbers are included in Appendix B of this report.

Runoff coefficients (C-values) were estimated using standard C-value estimates published in the TMRDM based on surface characteristics. A copy of the Runoff Coefficient table is included in Appendix B of this report.

Results of the hydrologic analysis for the existing and proposed conditions for the 5-year and 100-year storm events are presented in Appendix B. Results from the calculations are summarized in the following table:

Table 1: Existing vs. Proposed Flow Results

	Existing Condition				Proposed Condition			
Discharge Location	Basin	Area (AC)	5-yr Flow (cfs)	100-yr Flow (cfs)	Basin	Area (AC)	5-yr Flow (cfs)	100-yr Flow (cfs)
East Property Line	E1	5.23	1.6	9.2	P1	5.23	2.9	10.8
Browns Creek	E2	0.75	0.2	1.3	P2	0.75	0.2	1.3
	Total	**5.98**	**1.8**	**10.5**	**Total**	**5.98**	**3.1**	**12.1**

Development of the project site results in a 5-year and 100-year runoff increase of 1.3 cfs and 1.6 cfs, respectively.

HYDRAULICS / PROPOSED DRAINAGE FACILITIES

The proposed storm drainage system generally consists of sheet flow from the building roofs, site hardscape, and landscape areas into on-site gutters. The entire site drains to the east corner of the developed area, where it is discharged through a curb cut into a riprap rock apron. The riprap apron will return the stormwater to a sheet flow condition. Stormwater will sheet flow east across the property where it will enter a ditch located on the adjacent property and continue east and be discharged into Little Washoe Lake.

As noted in Table 1 above, the increase in runoff due to development is minimal, and due to the project's location low in the watershed and close to the ultimate discharge point of Little Washoe

Lake, detention is not proposed. It is generally considered beneficial in these circumstances to allow the relatively minor increase in runoff from the smaller local system to discharge prior to the peak flows of the larger upstream watershed.

CONCLUSIONS

The drainage facilities proposed with the Washoe Valley Fire Station project site have been preliminarily designed to capture and perpetuate the design storm event flows with the use of drainage swales and gutters to existing drainage pathways. The conveyance of flows is in conformance with State of Nevada drainage statutes, the *Truckee Meadows Regional Drainage Manual*, and Washoe County Development code. There will not be negative impacts to the adjacent or downstream properties as a result of development due to the implementation of the proposed stormwater management system.

REFERENCES

Washoe County Development Code, July 3, 2015.

Federal Emergency Management Agency, Flood Insurance Rate Map for Washoe County, Nevada, Exported February 3, 2023.

Truckee Meadows Regional Drainage Manual, April 30, 2009.

Appendix A - General Figures

WOOD RODGERS

BUILDING RELATIONSHIPS ONE PROJECT AT A TIME

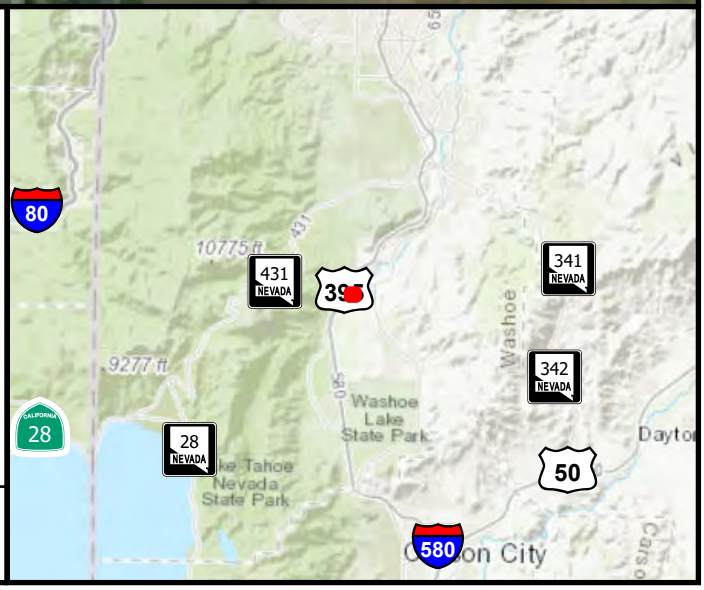
Fig. 1

Vicinity Map

Washoe Valley Fire Station

Washoe Valley, Nevada

March 2023



Prepared By: AL *Checked By:* JW

\\woodrodgers.loc\productiondata\jobs-reno\Gis\Technology\VicinityMapPDF\Pro2x\VicinityMapPDF\VicinityMapPDF.aprx

National Flood Hazard Layer FIRMette

FEMA

119°48'48"W 39°19'44"N

119°48'11"W 39°19'16"N

0 250 500 1,000 1,500 2,000 Feet 1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/3/2023 at 11:51 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Appendix B - Hydrologic Design and Analysis

NOAA Atlas 14, Volume 1, Version 5
Location name: Washoe Valley, Nevada, USA*
Latitude: 39.3254°, Longitude: -119.8085°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**1.32** (1.13-1.56)	**1.64** (1.43-1.94)	**2.18** (1.86-2.58)	**2.70** (2.28-3.19)	**3.55** (2.90-4.20)	**4.32** (3.43-5.18)	**5.22** (4.00-6.37)	**6.32** (4.64-7.90)	**8.09** (5.56-10.4)	**9.71** (6.32-12.7)
10-min	**1.00** (0.864-1.19)	**1.25** (1.08-1.48)	**1.66** (1.42-1.97)	**2.06** (1.73-2.42)	**2.69** (2.21-3.20)	**3.28** (2.61-3.95)	**3.98** (3.05-4.85)	**4.81** (3.53-6.01)	**6.16** (4.24-7.90)	**7.39** (4.82-9.70)
15-min	**0.828** (0.716-0.980)	**1.04** (0.896-1.22)	**1.38** (1.17-1.63)	**1.70** (1.44-2.00)	**2.23** (1.83-2.64)	**2.71** (2.16-3.26)	**3.28** (2.52-4.00)	**3.98** (2.92-4.97)	**5.09** (3.50-6.53)	**6.10** (3.98-8.02)
30-min	**0.558** (0.482-0.660)	**0.696** (0.602-0.824)	**0.926** (0.790-1.10)	**1.15** (0.966-1.35)	**1.50** (1.23-1.78)	**1.83** (1.45-2.20)	**2.21** (1.70-2.70)	**2.68** (1.97-3.35)	**3.43** (2.36-4.40)	**4.11** (2.68-5.40)
60-min	**0.346** (0.298-0.409)	**0.431** (0.373-0.509)	**0.574** (0.489-0.678)	**0.709** (0.598-0.836)	**0.929** (0.763-1.10)	**1.13** (0.900-1.36)	**1.37** (1.05-1.67)	**1.66** (1.22-2.07)	**2.12** (1.46-2.72)	**2.54** (1.66-3.34)
2-hr	**0.229** (0.202-0.262)	**0.284** (0.252-0.325)	**0.362** (0.317-0.412)	**0.428** (0.371-0.488)	**0.528** (0.446-0.605)	**0.616** (0.508-0.716)	**0.718** (0.574-0.848)	**0.850** (0.658-1.05)	**1.08** (0.796-1.37)	**1.29** (0.914-1.69)
3-hr	**0.184** (0.165-0.208)	**0.230** (0.207-0.260)	**0.286** (0.254-0.323)	**0.331** (0.293-0.374)	**0.393** (0.342-0.447)	**0.447** (0.382-0.513)	**0.506** (0.424-0.587)	**0.593** (0.487-0.700)	**0.737** (0.587-0.924)	**0.871** (0.676-1.14)
6-hr	**0.131** (0.116-0.147)	**0.163** (0.145-0.184)	**0.201** (0.178-0.227)	**0.231** (0.203-0.261)	**0.269** (0.233-0.306)	**0.298** (0.255-0.342)	**0.327** (0.275-0.378)	**0.361** (0.297-0.424)	**0.412** (0.331-0.491)	**0.458** (0.361-0.575)
12-hr	**0.086** (0.076-0.097)	**0.108** (0.096-0.122)	**0.136** (0.120-0.153)	**0.157** (0.138-0.177)	**0.185** (0.160-0.211)	**0.206** (0.176-0.237)	**0.228** (0.192-0.265)	**0.250** (0.206-0.294)	**0.279** (0.224-0.335)	**0.302** (0.237-0.369)
24-hr	**0.056** (0.050-0.063)	**0.070** (0.062-0.079)	**0.088** (0.079-0.100)	**0.103** (0.092-0.117)	**0.124** (0.109-0.141)	**0.141** (0.122-0.161)	**0.158** (0.136-0.182)	**0.177** (0.150-0.205)	**0.202** (0.167-0.237)	**0.222** (0.180-0.264)
2-day	**0.033** (0.029-0.038)	**0.041** (0.036-0.048)	**0.053** (0.046-0.061)	**0.062** (0.054-0.072)	**0.076** (0.065-0.088)	**0.086** (0.073-0.101)	**0.097** (0.082-0.115)	**0.109** (0.090-0.130)	**0.125** (0.101-0.151)	**0.138** (0.109-0.170)
3-day	**0.026** (0.023-0.030)	**0.033** (0.029-0.038)	**0.042** (0.037-0.049)	**0.050** (0.044-0.058)	**0.062** (0.054-0.071)	**0.071** (0.061-0.082)	**0.081** (0.069-0.094)	**0.092** (0.077-0.107)	**0.107** (0.087-0.127)	**0.119** (0.095-0.143)
4-day	**0.022** (0.020-0.026)	**0.028** (0.025-0.032)	**0.037** (0.033-0.042)	**0.044** (0.039-0.051)	**0.055** (0.048-0.063)	**0.063** (0.055-0.073)	**0.073** (0.062-0.084)	**0.083** (0.070-0.096)	**0.097** (0.080-0.114)	**0.109** (0.088-0.130)
7-day	**0.015** (0.013-0.017)	**0.019** (0.017-0.022)	**0.025** (0.022-0.029)	**0.030** (0.027-0.035)	**0.038** (0.033-0.043)	**0.043** (0.037-0.050)	**0.050** (0.042-0.057)	**0.056** (0.047-0.065)	**0.066** (0.054-0.077)	**0.073** (0.060-0.087)
10-day	**0.012** (0.010-0.014)	**0.015** (0.013-0.017)	**0.020** (0.018-0.023)	**0.024** (0.021-0.028)	**0.030** (0.026-0.034)	**0.034** (0.029-0.039)	**0.039** (0.033-0.045)	**0.044** (0.037-0.051)	**0.051** (0.042-0.059)	**0.056** (0.046-0.066)
20-day	**0.008** (0.007-0.009)	**0.010** (0.009-0.011)	**0.013** (0.011-0.015)	**0.015** (0.013-0.017)	**0.019** (0.016-0.021)	**0.021** (0.018-0.024)	**0.024** (0.021-0.027)	**0.027** (0.023-0.031)	**0.030** (0.026-0.035)	**0.033** (0.028-0.039)
30-day	**0.006** (0.005-0.007)	**0.008** (0.007-0.009)	**0.010** (0.009-0.011)	**0.012** (0.011-0.014)	**0.015** (0.013-0.017)	**0.016** (0.014-0.019)	**0.019** (0.016-0.021)	**0.021** (0.018-0.024)	**0.023** (0.020-0.027)	**0.026** (0.021-0.030)
45-day	**0.005** (0.004-0.005)	**0.006** (0.005-0.007)	**0.008** (0.007-0.009)	**0.010** (0.008-0.011)	**0.011** (0.010-0.013)	**0.013** (0.011-0.015)	**0.014** (0.012-0.016)	**0.016** (0.014-0.018)	**0.018** (0.015-0.020)	**0.019** (0.016-0.022)
60-day	**0.004** (0.004-0.005)	**0.005** (0.005-0.006)	**0.007** (0.006-0.008)	**0.008** (0.007-0.009)	**0.010** (0.008-0.011)	**0.011** (0.009-0.012)	**0.012** (0.010-0.014)	**0.013** (0.011-0.015)	**0.014** (0.012-0.017)	**0.015** (0.013-0.018)

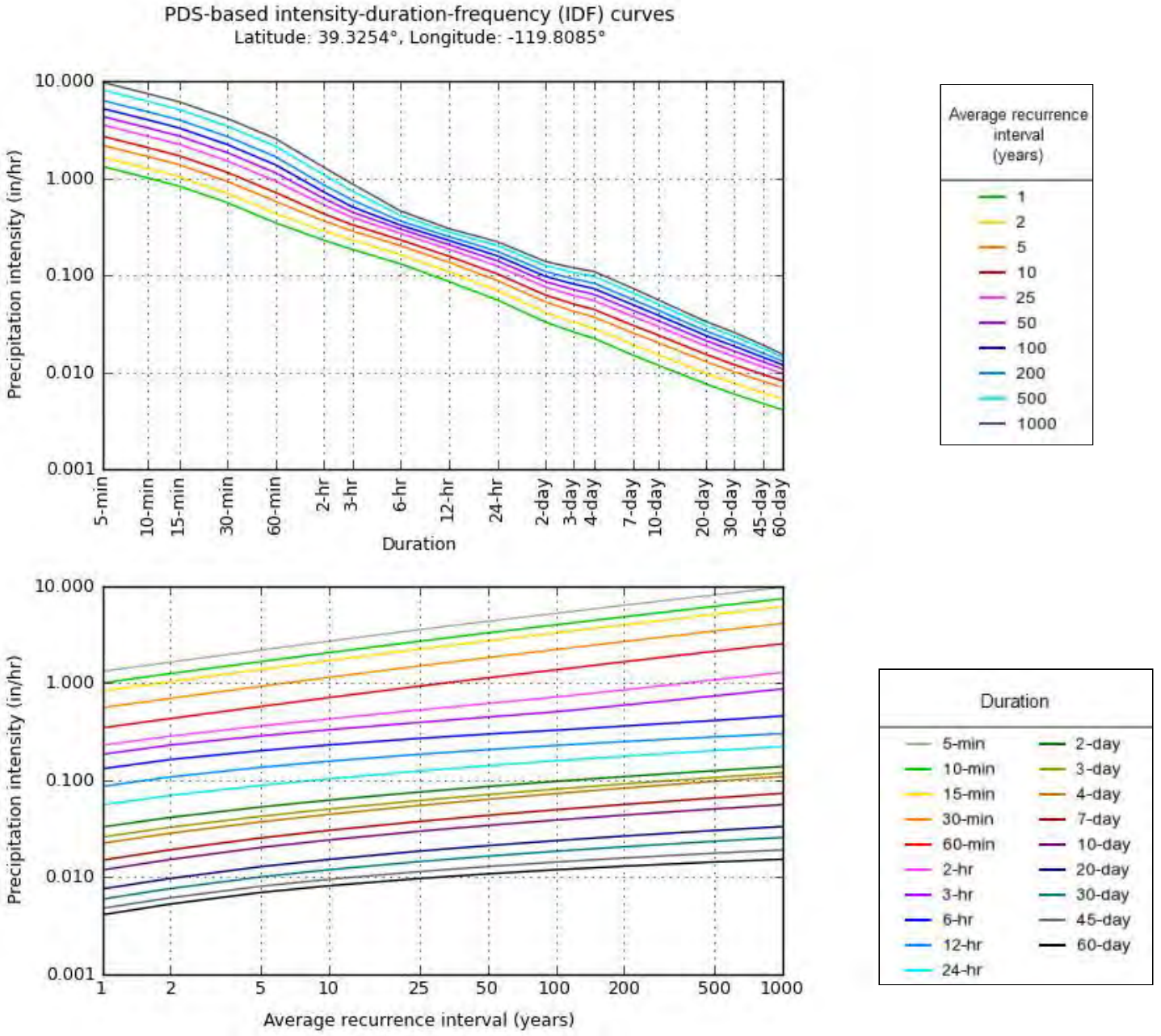
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



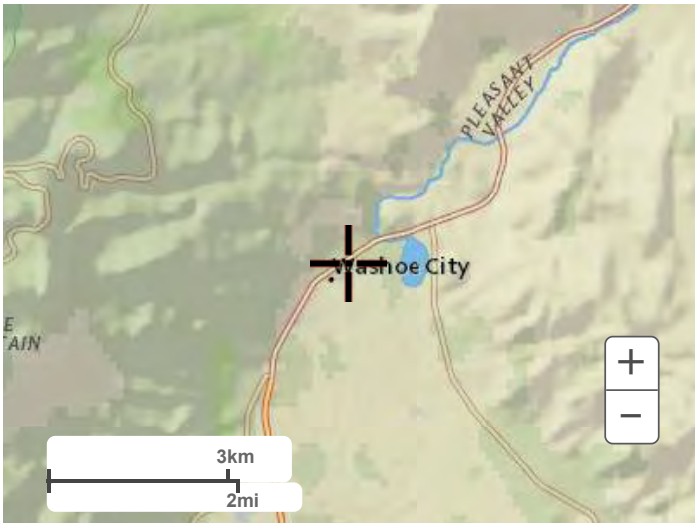
NOAA Atlas 14, Volume 1, Version 5

Created (GMT): Wed Mar 1 18:14:06 2023

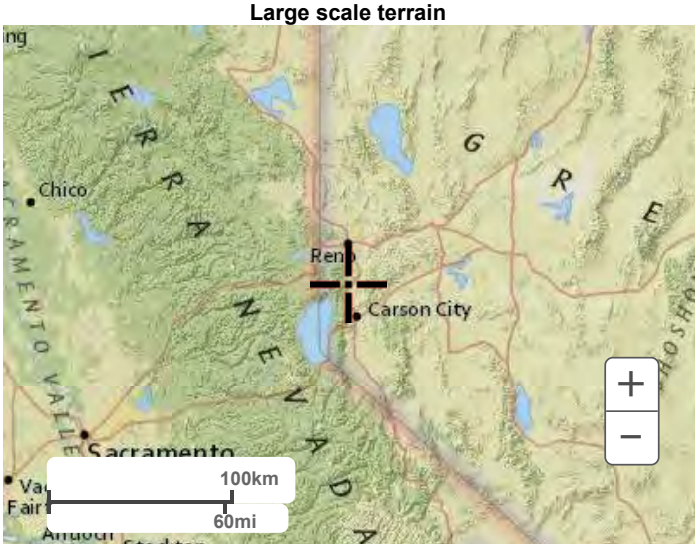
Back to Top

Maps & aerials

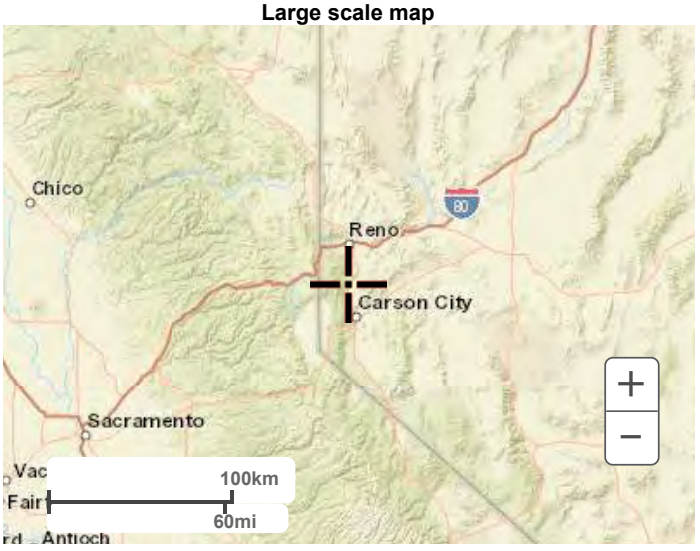
Small scale terrain



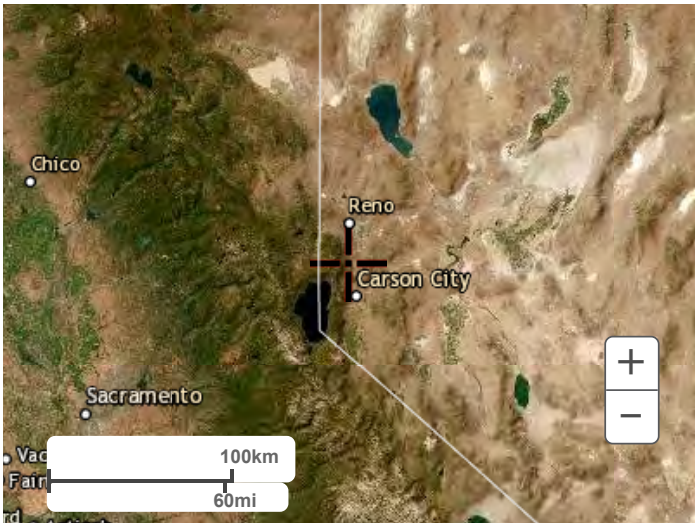
Large scale terrain



Large scale map



Large scale aerial



Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

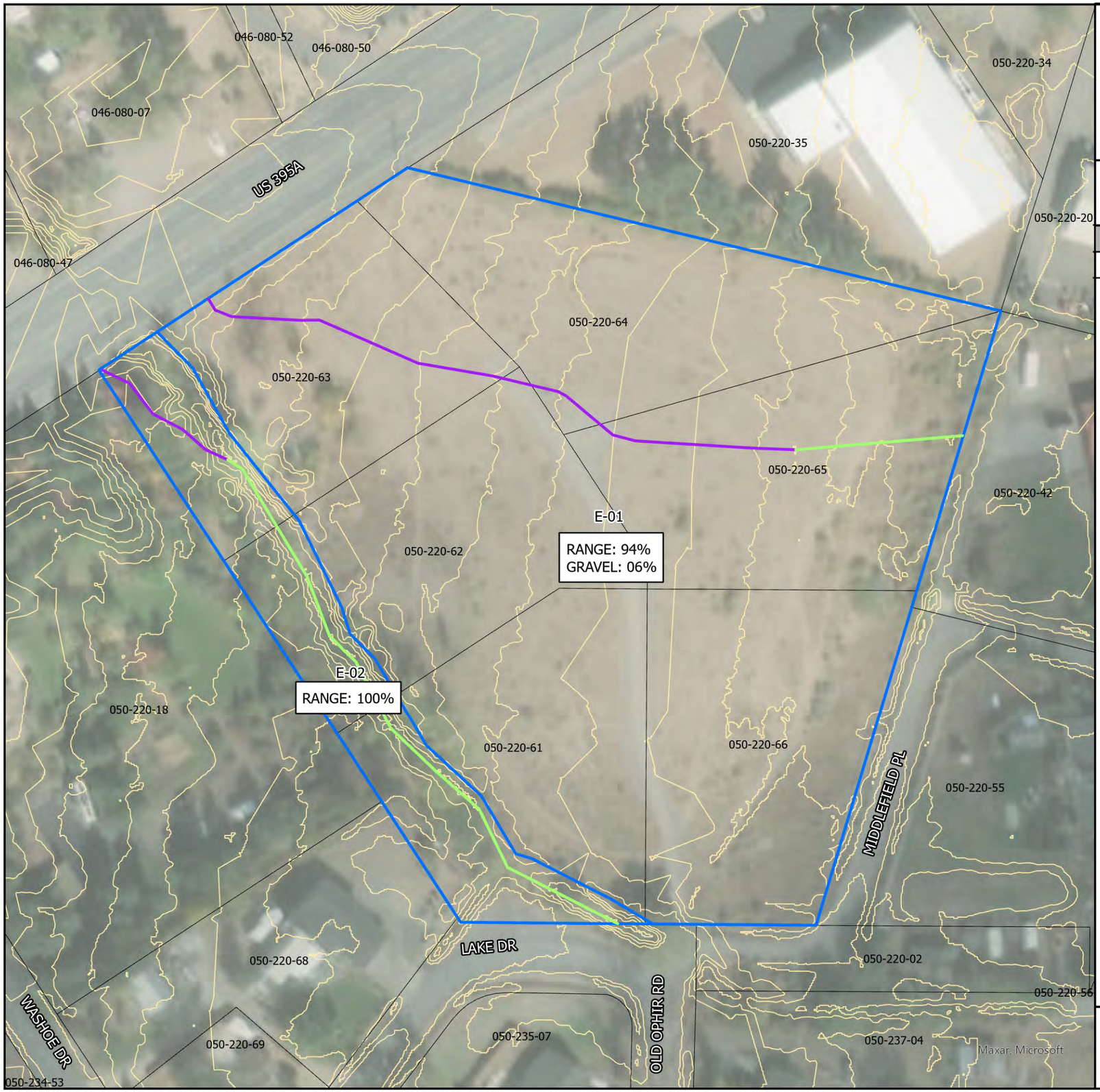
Disclaimer

RATIONAL FORMULA METHOD
RUNOFF COEFFICIENTS

Land Use or Surface Characteristics	Aver. % Impervious Area	Runoff Coefficients 5-Year (C_g)	Runoff Coefficients 100-Year (C_{100})
Business/Commercial:			
Downtown Areas	85	.82	.85
Neighborhood Areas	70	.65	.80
Residential:			
(Average Lot Size)			
⅛ Acre or Less (Multi-Unit)	65	.60	.78
¼ Acre	38	.50	.65
⅛ Acre	30	.45	.60
½ Acre	25	.40	.55
1 Acre	20	.35	.50
Industrial:	72	.68	.82
Open Space:			
(Lawns, Parks, Golf Courses)	5	.05	.30
Undeveloped Areas:			
Range	0	.20	.50
Forest	0	.05	.30
Streets/Roads:			
Paved	100	.88	.93
Gravel	20	.25	.50
Drives/Walks:	95	.87	.90
Roof:	90	.85	.87

Notes:

1. Composite runoff coefficients shown for Residential, Industrial, and Business/Commercial Areas assume irrigated grass landscaping for all pervious areas. For development with landscaping other than irrigated grass, the designer must develop project specific composite runoff coefficients from the surface characteristics presented in this table.



Existing Hydrologic Basins
Washoe Valley Fire Station
Washoe Valley
March 2023

Basin
FlowType
Sheet
Channel

Basin Name	Area (ac.)	C_{5yr}	C_{100yr}	I_{5yr}	I_{100yr}	Q_{5yr}	Q_{100yr}
E-01	5.23	0.20	0.50	1.47	3.51	1.6	9.2
E-02	0.75	0.20	0.50	1.47	3.52	0.2	1.3

WOOD RODGERS
BUILDING RELATIONSHIPS ONE PROJECT AT A TIME
1361 Corporate Boulevard
Reno, NV 89502
Tel: 775.823.4068
Fax: 775.823.4066

0 100 200
FEET
NORTH

Project: Washoe Valley Fire Station
Project Location: Washoe Valley

Time of Concentration Table, Existing 5-year storm event

Drainage Basin	Drainage Area (AC)	Weighted Average C-Factor 5-Year	Overland			Channelized Flow				Gutter Flow				Total (Ti+Tt)	Urbanized Basins Check	Final	NOAA ATLAS 14 Rainfall Intensity	Rational Flow
			Li (ft)	S ft/ft)	Ti (min)	Ls(ft)	S ft/ft)	V(ft/s)	Tt1 (min)	Lt (ft)	S (ft/ft)	V (ft/s)	Tt2 (min)	Tc (min)	Tc*(min)	Tc (min)	(in/hour)	Q5-year (cfs)
E-01	5.23	0.20	474.1	0.021	27.4	127.3	0.002	0.7	3.2					30.6	13.3	13.3	1.47	1.6
E-02	0.75	0.20	119.2	0.034	11.9	476.3	0.010	1.6	4.9					16.8	13.3	13.3	1.47	0.2

Prepared: 3/1/2023

Project: Washoe Valley Fire Station
Project Location: Washoe Valley

Time of Concentration Table, Existing 100-year storm event

Drainage Basin	Drainage Area (AC)	Weighted Average C-Factor 100-Year	Overland			Channelized Flow				Gutter Flow				Total (Ti+Tt)	Urbanized Basins Check	Final	NOAA ATLAS 14 Rainfall Intensity	Rational Flow
			Li (ft)	S ft/ft)	Ti (min)	Ls(ft)	S ft/ft)	V(ft/s)	Tt1 (min)	Lt (ft)	S (ft/ft)	V (ft/s)	Tt2 (min)	Tc (min)	Tc*(min)	Tc (min)	(in/hour)	Q100-year (cfs)
E-01	5.23	0.50	474.1	0.021	27.4	127.3	0.002	0.7	3.2					30.6	13.3	13.3	3.51	9.2
E-02	0.75	0.50	119.2	0.034	11.9	476.3	0.010	1.6	4.9					16.8	13.3	13.3	3.52	1.3

Prepared: 3/1/2023

Proposed Hydrologic Basins
Washoe Valley Fire Station
Washoe Valley
March 2023

Proposed Contours 1ft
Basin
FlowType
Gutter
Sheet
Channel

Basin Name	Area (ac.)	C_{5yr}	C_{100yr}	I_{5yr}	I_{100yr}	Q_{5yr}	Q_{100yr}
P-01	5.23	0.38	0.60	1.45	3.45	2.9	10.8
P-02	0.75	0.20	0.50	1.47	3.52	0.2	1.3

WOOD RODGERS
BUILDING RELATIONSHIPS ONE PROJECT AT A TIME
1361 Corporate Boulevard
Reno, NV 89502
Tel: 775.823.4068
Fax: 775.823.4066

0 50 100
FEET

NORTH

Project: Washoe Valley Fire Station
Project Location: Washoe Valley

Time of Concentration Table, Proposed 5-year storm event

Drainage Basin	Drainage Area (AC)	Weighted Average C-Factor 5-Year	Overland			Channelized Flow				Gutter Flow				Total (Ti+Tt)	Urbanized Basins Check	Final	NOAA ATLAS 14 Rainfall Intensity	Rational Flow
			Li (ft)	S ft/ft)	Ti (min)	Ls(ft)	S ft/ft)	V(ft/s)	Tt1 (min)	Lt (ft)	S (ft/ft)	V (ft/s)	Tt2 (min)	Tc (min)	Tc*(min)	Tc (min)	(in/hour)	Q5-year (cfs)
P-01	5.23	0.38	123.3	0.008	15.7	9.1	0.202	7.3	0.0	400.0	0.008	1.9	3.6	37.3	13.8	13.8	1.45	2.9
P-02	0.75	0.20	119.2	0.034	11.9	476.3	0.010	1.6	4.9					16.8	13.3	13.3	1.47	0.2

Prepared: 3/2/2023

Project: Washoe Valley Fire Station
Project Location: Washoe Valley

Time of Concentration Table, Proposed 100-year storm event

Drainage Basin	Drainage Area (AC)	Weighted Average C-Factor 100-Year	Overland			Channelized Flow				Gutter Flow				Total (Ti+Tt)	Urbanized Basins Check	Final	NOAA ATLAS 14 Rainfall Intensity	Rational Flow
			Li (ft)	S ft/ft)	Ti (min)	Ls(ft)	S ft/ft)	V(ft/s)	Tt1 (min)	Lt (ft)	S (ft/ft)	V (ft/s)	Tt2 (min)	Tc (min)	Tc*(min)	Tc (min)	(in/hour)	Q100-year (cfs)
P-01	5.23	0.60	123.3	0.008	15.7	9.1	0.202	7.3	0.0	400.0	0.008	1.9	3.6	37.3	13.8	13.8	3.45	10.8
P-02	0.75	0.50	119.2	0.034	11.9	476.3	0.010	1.6	4.9					16.8	13.3	13.3	3.52	1.3

Prepared: 3/2/2023

TRAFFIC IMPACT STUDY

for

Truckee Meadows Fire Protection District

Washoe Valley Station

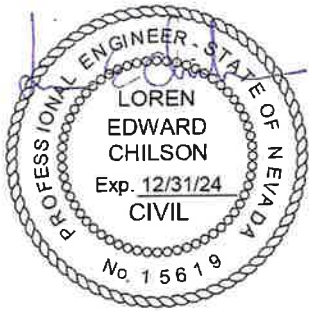
March 7, 2023

PREPARED FOR:

Wood Rodgers, Inc.

PREPARED BY:

HEADWAY TRANSPORTATION



Loren E Chilson

Digitally signed by Loren E Chilson
Date: 2023.03.07 11:26:03 -08'00'

Headway Transportation, LLC
5482 Longley Lane, Suite B, Reno, Nevada 89511
775.322.4300
www.HeadwayTransportation.com

YOUR QUESTIONS ANSWERED QUICKLY

Why did you perform this study?

This Traffic Impact Study evaluates the potential traffic impacts associated with the proposed Truckee Meadows Fire Protection District (TMFPD) Washoe Valley Station in Reno, NV. This study was undertaken to determine the existing and future traffic conditions, quantify traffic volumes generated by the proposed project, identify potential impacts, and develop recommendations to mitigate impacts, if any are found. This study also evaluates access spacing requirements on US 395A.

What does the project consist of?

The project consists of a new safety service facility and fire station on parcels APN 050-220-61 through 66 in Washoe Valley. The site is located on US 395A (Carson-Reno Highway/S. Virginia Street/Old US 395) just north of the intersection with Washoe Drive.

How much traffic will the project generate?

The proposed project is anticipated to generate 60 Daily trips, 6 AM peak hour trips, and 6 PM peak hour trips.

Are there any traffic impacts?

The study intersections will operate within the LOS policy in all scenarios. The addition of project traffic is minor and has no significant impact on the overall intersection operations. Traffic interruptions due to emergency response events would be sporadic and are not expected to significantly impact operations.

What are the recommendations?

It is recommended that a hybrid Type 4 / 5 approach be utilized with full access using the existing center two-way left-turn lane at the proposed location. An advanced active warning system (Emergency Vehicle sign W11-8 with beacons) should be permitted and would not significantly impact operations on US 395A or Washoe Drive. Any advanced warning systems / equipment, including power and lighting, will be owned and maintained by TMFPD.

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

This Traffic Impact Study evaluates the potential traffic impacts associated with the proposed Truckee Meadows Fire Protection District (TMFPD) Washoe Valley Station in Reno, NV. This study was undertaken to determine the existing and future (20-year horizon) traffic conditions, quantify traffic volumes generated by the proposed project, identify potential impacts, and develop recommendations to mitigate impacts, if any are found. This study also evaluates access requirements for the site and additional safety features.

Proposed Project

The project consists of a new safety service facility and fire station facility on parcels APN 050-220-61 through 66 in Washoe Valley. The site is located on US 395A (Carson-Reno Highway/S. Virginia Street/Old US 395) just north of the intersection with Washoe Drive. The project site location and the study intersections are shown in **Figure 1**, and a preliminary site plan is shown in **Figure 2**.

Study Area and Evaluated Scenarios

The following intersections are included in this study:

- US 395A / Washoe Drive
- US 395A / Project Driveway

This study includes analysis of both the weekday AM and PM peak hours as these are the periods of time in which peak traffic is anticipated to occur for regular day to day operations, such as the arrival and dismissal of staff (shift changes).

The evaluated scenarios are:

- Existing Conditions
- Existing Plus Project Conditions
- Future Year (20-year horizon background) Conditions
- Future Year (20-year horizon background) Plus Project Conditions

HEADWAY TRANSPORTATION

NO SCALE

- Project Site

(#) - Study Intersection

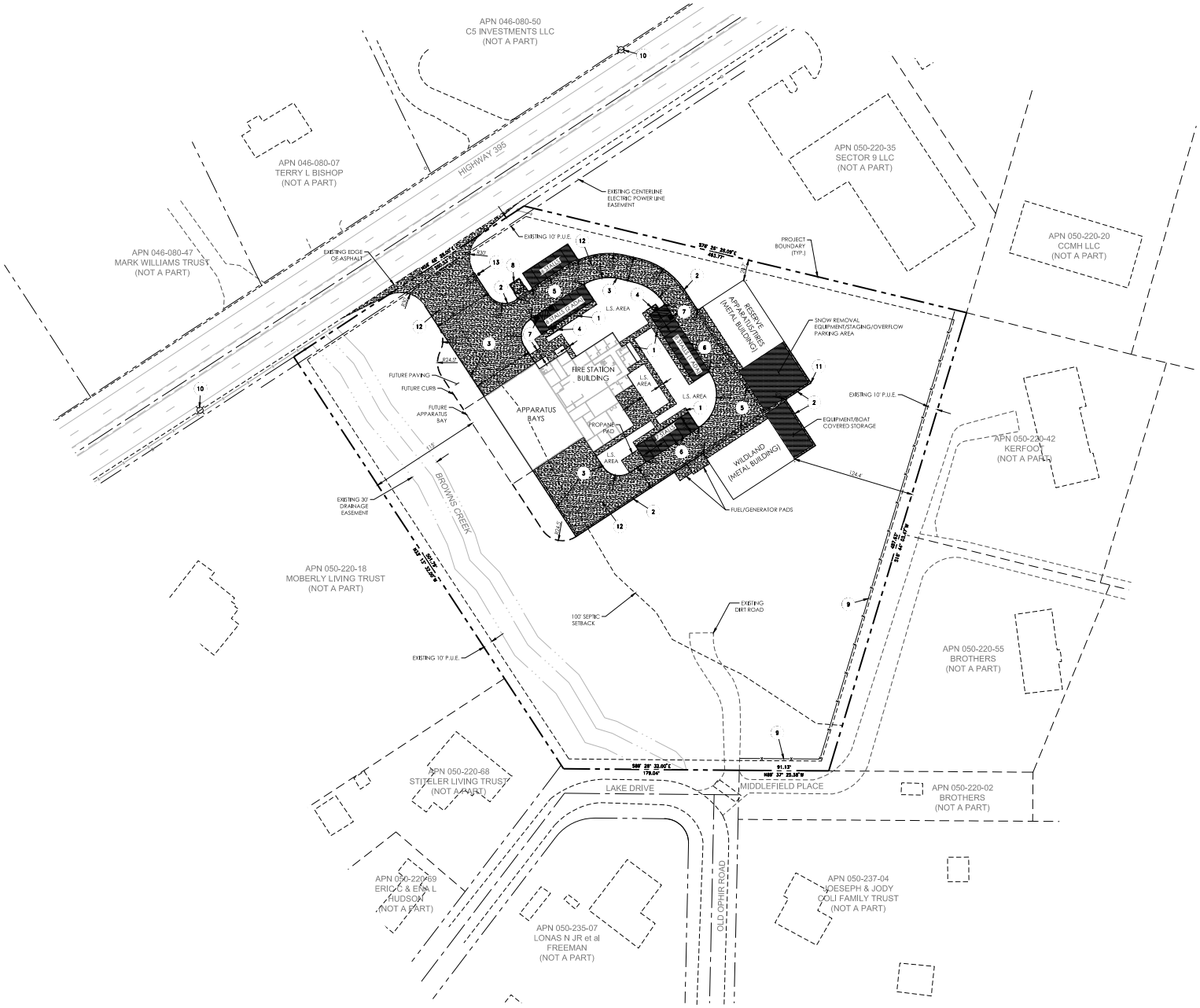
Figure 1

TMFPD Washoe Valley Station
Traffic Impact Study
Project Location

WASHOE VALLEY FIRE STATION

SPECIAL USE PERMIT

PRELIMINARY SITE PLAN



NO SCALE

Figure 2

TMFPD Washoe Valley Station
Traffic Impact Study
Preliminary Site Plan

ANALYSIS METHODOLOGY

Level of service (LOS) is a term commonly used by transportation practitioners to measure and describe the operational characteristics of intersections, roadway segments, and other facilities. This term equates seconds of delay per vehicle at intersections to letter grades "A" through "F" with "A" representing optimum conditions and "F" representing breakdown or over capacity flows.

Intersections

Intersection level of service methodology is established in the *Highway Capacity Manual (HCM) 6th Edition*, published by the Transportation Research Board (TRB). The methodology for signalized intersections determines the level of service by comparing the average control delay for the overall intersection to the delay thresholds in **Table 1**. Level of service at unsignalized (side-street stop controlled) intersections is determined by comparing the average control delay for the worst movement/approach to the delay thresholds in **Table 1.**

Table 1: Level of Service Definition for Intersections

Level of Service	Brief Description	Average Delay (seconds per vehicle)	
		Signalized Intersections	Unsignalized Intersections
A	Free flow conditions.	< 10	< 10
B	Stable conditions with some affect from other vehicles.	10 to 20	10 to 15
C	Stable conditions with significant affect from other vehicles.	20 to 35	15 to 25
D	High density traffic conditions still with stable flow.	35 to 55	25 to 35
E	At or near capacity flows.	55 to 80	35 to 50
F	Over capacity conditions.	> 80	> 50

Source: *Highway Capacity Manual, 6th Edition*

Level of service calculations were performed for the study intersections using the Synchro 11 software package, with analysis and results reported in accordance with the current *HCM* methodology.

Level of Service Policies

Nevada Department of Transportation

The Nevada Department of Transportation (NDOT) *Traffic Impact Study Requirements* publication states:

> *Level of service "C" will be the design objective for capacity and under no circumstances will less than level of service "D" be accepted for site and non-site traffic.*

Regional Transportation Commission

The Regional Transportation Commission's (RTC) *2050 Regional Transportation Plan (RTP)* establishes level of service criteria for regional roadway facilities in the City of Reno, City of Sparks, and Washoe County. The current Level of Service policy is:

> *"All regional roadway facilities projected to carry less than 27,000 ADT at the latest RTP horizon – LOS D or better."*
>
> *"All regional roadway facilities projected to carry 27,000 or more ADT at the latest RTP horizon – LOS E or better."*
>
> *"All intersections shall be designed to provide a level of service consistent with maintaining the policy level of service of the intersecting corridors".*

The roadways within the study area are projected to carry less than 27,000 ADT at the latest *RTP* horizon.

Hence, LOS "D" was used as the threshold criteria for this analysis and the criteria is for overall intersection operations. Traffic engineering practitioners recognize that LOS E/F conditions for the side street approach, during the peak hour(s), does not indicate an intersection failure or the need for mitigation. This condition (LOS E/F for a minor side-street approach) commonly exists throughout urban and suburban areas and is manageable in most cases.

EXISTING CONDITIONS

Roadway Facilities

A brief description of the key roadways in the study area is provided below:

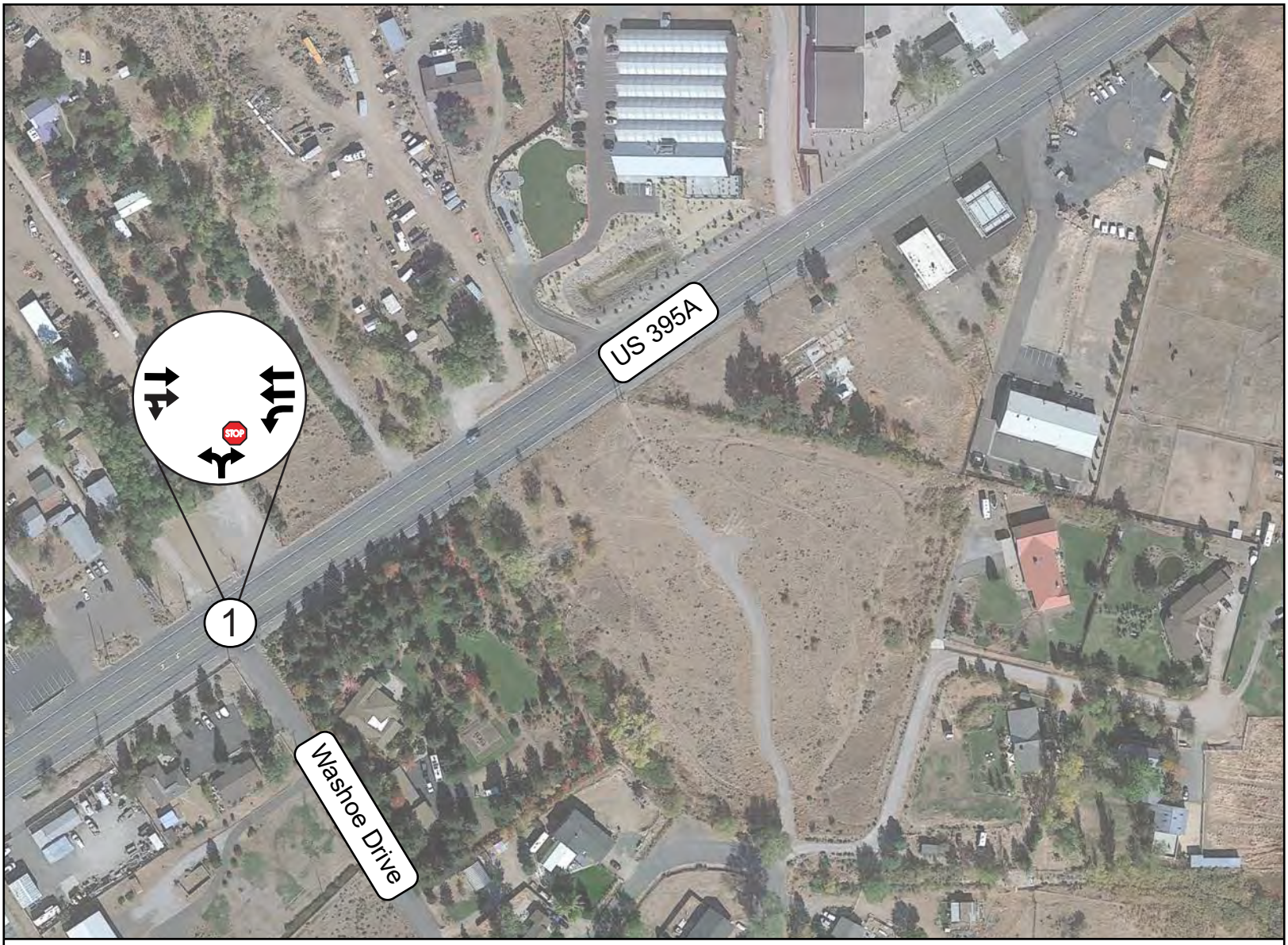
US 395A (Carson-Reno Highway/S. Virginia Street/Old US 395) was previously the main highway between Reno and Carson City prior to the completion of Interstate 580 in the year 2012. Since the I-580 completion, the roadway Average Annual Daily Traffic (AADT) near the site has decreased from over 29,000 vehicles per day (vpd) in 2011 to less than 3,350 vpd since 2012. US 395A in the project vicinity is classified as a Minor Arterial by NDOT. US 395A near the site is five lanes, two lanes in each direction with a center two-way left-turn lane. Bicycle lanes exist in both directions. The posted speed limit is 50 mph.

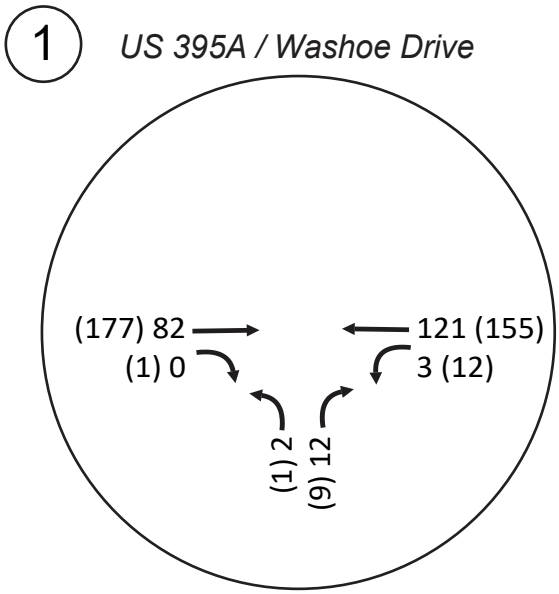
Crash History

Five-year vehicle crash data within the proximity of the proposed project intersection was obtained by NDOT on February 7, 2023. No crashes were reported in the last five years of available data. The email correspondence from NDOT is in **Appendix A**.

Traffic Volumes

Weekday AM (7:00 to 9:00 AM) and PM (3:00 to 5:00 PM) peak period turning movement and mainline counts were collected at the US 395A/Washoe Drive intersection in February 2023, with schools in regular session. The PM peak hour period (3:00 to 5:00 PM) was selected as NDOT's Traffic Records Information Access (TRINA) showed higher volumes than your typical (4:00 to 6:00 PM) period. The traffic data sheets are provided in **Appendix B.** The existing AM and PM peak hour intersection turning movement and mainline volumes are shown on **Figure 3**.





HEADWAY TRANSPORTATION

NO SCALE

AM Peak Hour Volume (PM Peak Hour Volume)

(#) - Study Intersection STOP - Stop

Figure 3

TMFPD Washoe Valley Station
Traffic Impact Study

Existing Lane Configurations, Controls, and Traffic Volumes

Intersection Level of Service

Level of service calculations were performed using the existing traffic volumes, lane configurations, and traffic controls. The results are presented in **Table 2** and the calculation sheets are provided in **Appendix C**.

Table 2: Existing Intersection Level of Service

Int. ID	Intersection	Control	AM		PM	
			Delay[1]	LOS	Delay[1]	LOS
1	Washoe Drive/US 395A	Side Street Stop				
	Overall Intersection		0.7	A	0.5	A
	Washoe Drive					
	Northbound Approach		8.8	A	9.0	A
	US 395A					
	Westbound Left		7.4	A	7.6	A

Notes: 1. Delay is reported in seconds per vehicle for the overall intersection and the worst approach/movement for side street stop-controlled intersections.
Source: Headway Transportation, 2023

As shown in **Table 2,** the US 395A/Washoe Drive intersection currently operates within the level of service policy.

PROJECT CONDITIONS

Trip Generation

Trip generation rates from the Institute of Transportation Engineers' (ITE) *Trip Generation Manual, 11th Edition* were used to develop trip generation estimates for the project. The rates for land use 575 "Fire and Rescue Station" were used to determine the number of new trips generated. The land use is described as:

> *A fire and rescue station is a building that houses emergency services equipment, firefighting apparatus, and the individuals that provide emergency firefighting services. Other services sometimes offered through fire and rescue stations include emergency medical, hazardous materials, rescue, safety training, and fire prevention services.*

The data was limited, and the sample size was small; therefore, the higher rate of trip generation was used for a conservative estimate. The proposed fire station project consists of approximately 11,700 square feet. **Table 3** shows the Daily, AM peak hour, and PM peak hour trip generation estimates.

Table 3: Trip Generation Estimates

Land Use (ITE Code)	Units[1]	Trips				
		Daily[2]	AM In/Out[3]	Total AM[3]	PM In/Out	Total PM
Fire and Rescue Station (575)	11.7 (ksf)	60	4 / 2	6	2 / 4	6

Notes: 1. ksf= kilo square feet; 2. Daily rates are not provided and were calculated by estimating the PM peak hour trips as 10% of the daily trips. 3. AM Peak Hour rates are not provided. The AM is determined utilizing the PM peak hour and assuming a reverse directional distribution.
Source: Headway Transportation, 2023

As shown in **Table 3**, the proposed project is anticipated to generate approximately 60 Daily trips, 6 AM peak hour trips, and 6 PM peak hour trips.

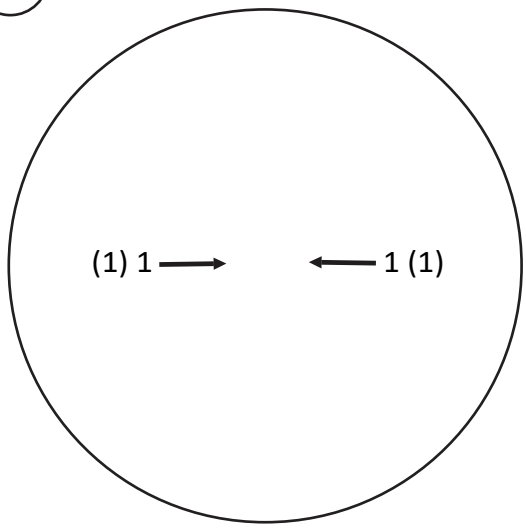
Trip Distribution and Assignment

Traffic generated by the project was distributed to the road network based on the location of the project site relative to locations of major activity centers and the zones for emergency response. The following percentages were used for distributing the project traffic:

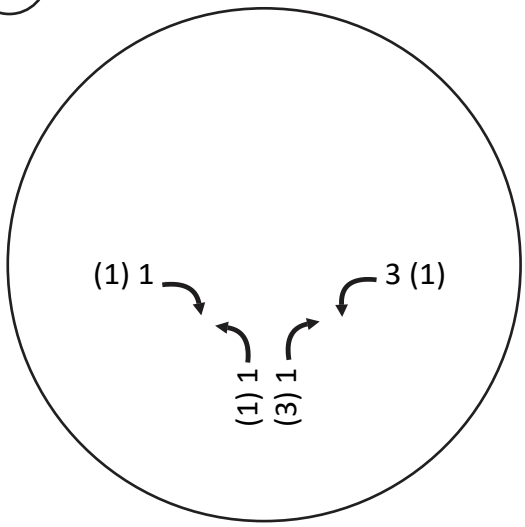
- 70% to/from the north via US 395A
- 30% to/from the south via US 395A

The project trip assignment is shown on **Figure 4**.

1 *US 395A / Washoe Drive*



2 *US 395A / Site Driveway*



HEADWAY TRANSPORTATION

NO SCALE

AM Peak Hour Volume (PM Peak Hour Volume)

- Project Site
(#) - Study Intersection
XX% - Trip Distribution

Figure 4

TMFPD Washoe Valley Station
Traffic Impact Study

Project Trip Distribution & Assignment

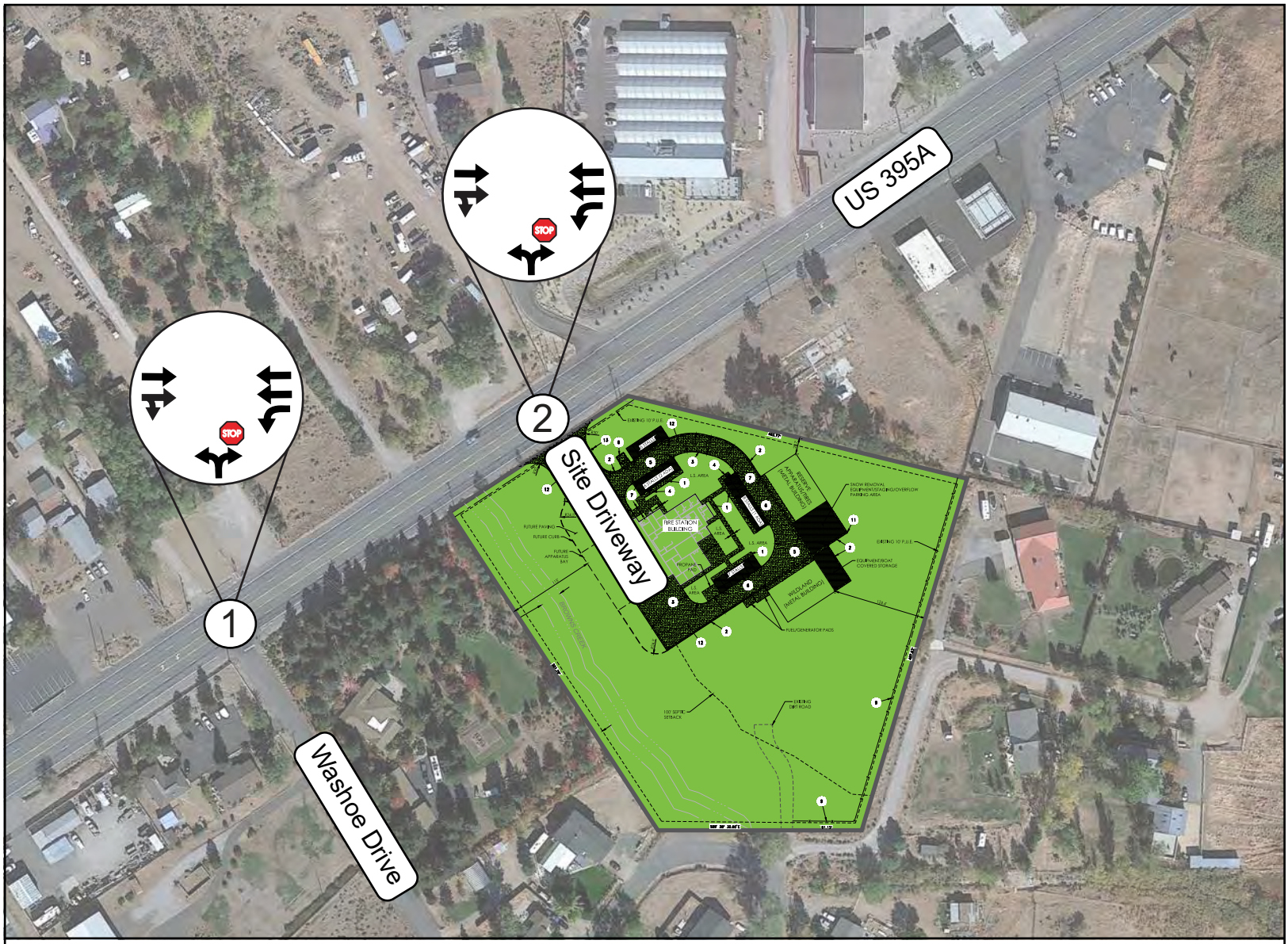
Project Access

The preliminary site plan in (**Figure 2)** illustrates one access point on US 395A approximately 470' north of Washoe Drive. The driveway location does not technically meet the spacing requirements set forth in *the 2017 NDOT Access Management System and Standards (AMSS).* The spacing for a full-access driveway on a Minor Arterial is 1,320'. A *Design Deviation Letter* will be provided under sperate cover to NDOT outlining the need, justification, and operation for the driveway placement and approach type modification.

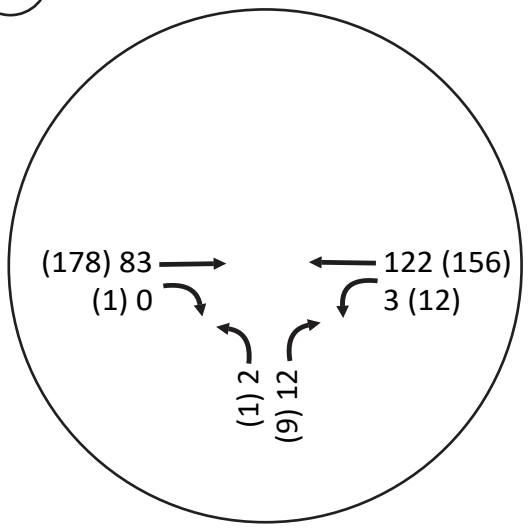
EXISTING PLUS PROJECT CONDITIONS

Traffic Volumes

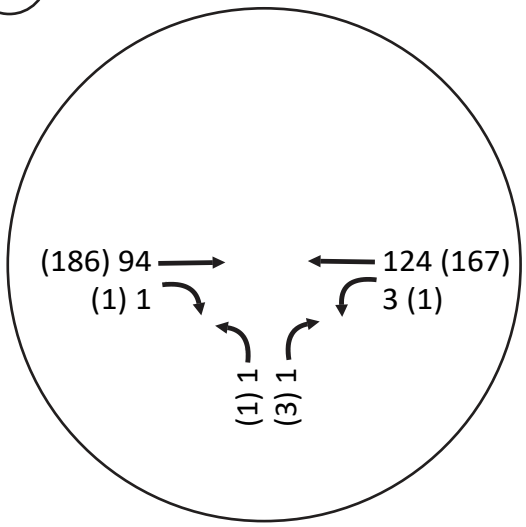
Existing Plus Project traffic volumes were developed by adding the project generated trips (**Figure 4**) to the existing traffic volumes (**Figure 3**) and are shown on **Figure 5**.



1 *US 395A / Washoe Drive*



2 *US 395A / Site Driveway*



HEADWAY TRANSPORTATION

NO SCALE

AM Peak Hour Volume (PM Peak Hour Volume)

- Project Site
(#) - Study Intersection
STOP - Stop

Figure 5

TMFPD Washoe Valley Station
Traffic Impact Study

Existing Plus Project Lane Configurations, Controls, and Traffic Volumes

Intersection Level of Service Analysis

Table 4 shows the level of service analysis summary for the Existing Plus Project conditions and the detailed calculation sheets are provided in **Appendix D**.

Table 4: Existing Plus Project Intersection Level of Service

Int. ID	Intersection	Control	AM		PM	
			Delay[1]	LOS	Delay[1]	LOS
1	Washoe Drive/US 395A	Side Street Stop				
	Overall Intersection		0.7	A	0.5	A
	Washoe Drive					
	Northbound Approach		8.8	A	9.0	A
	US 395A					
	Westbound Left		7.4	A	7.6	A
2	Project Site Driveway/US 395A	Side Street Stop				
	Overall Intersection		0.2	A	0.1	A
	Project Site Driveway					
	Northbound Approach		9.2	A	9.2	A
	US 395A					
	Westbound Left		7.5	A	7.6	A

Notes: 1. Delay is reported in seconds per vehicle for the overall intersection and the worst approach/movement for side street stop-controlled intersections.
Source: Headway Transportation, 2023

As shown in **Table 4**, all study intersections operate within the level of service policy. The addition of project trips has no significant impact at the study intersections.

FUTURE YEAR CONDITIONS

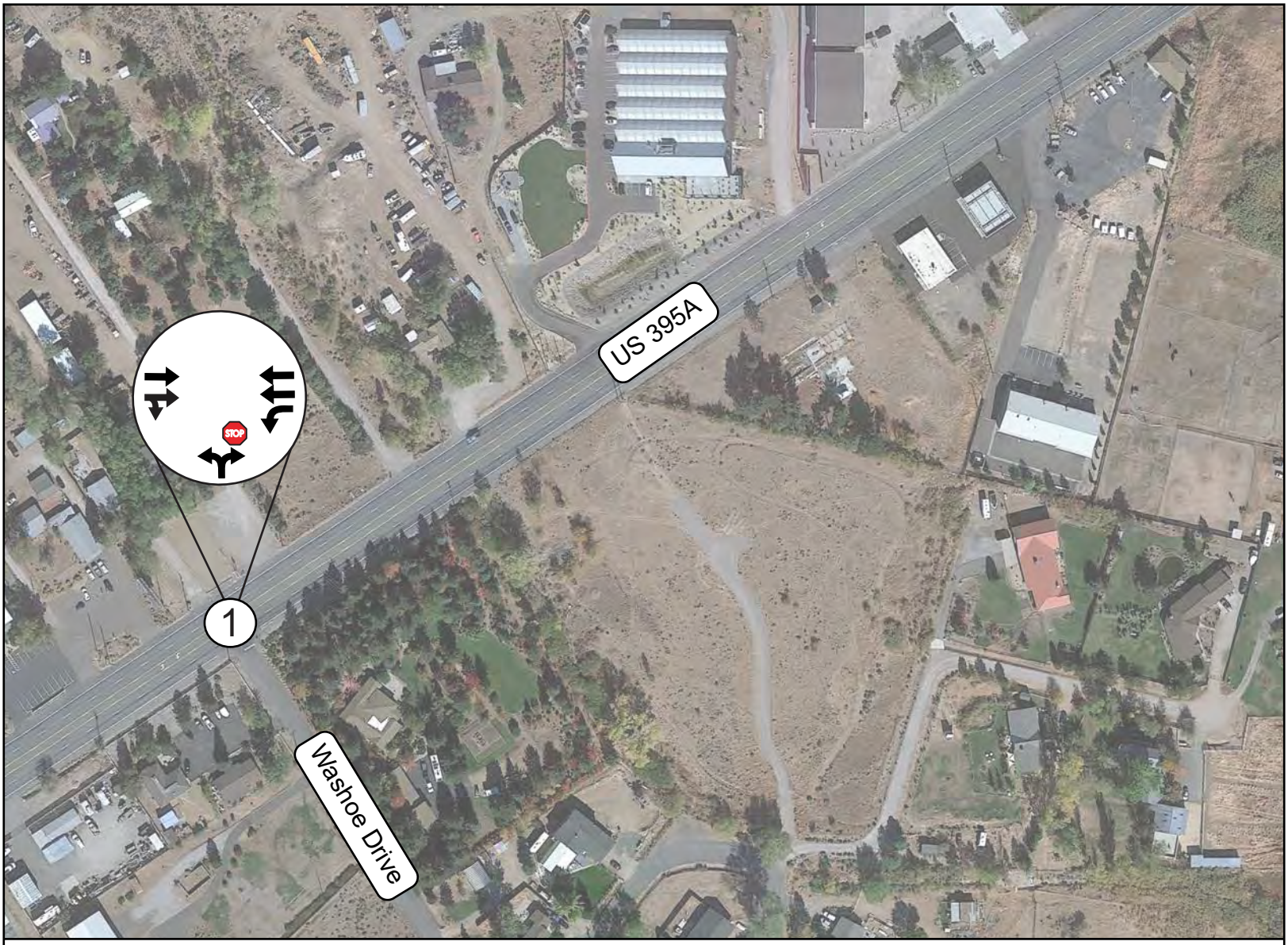
Traffic Volumes

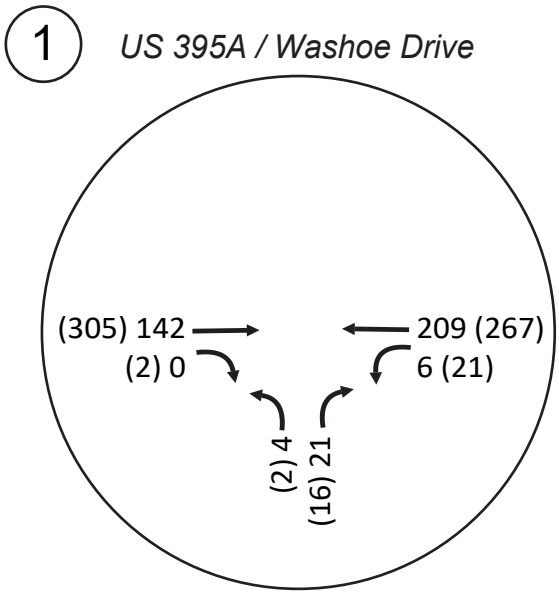
Future year (20-year horizon) traffic volumes were developed using an exponential annual growth rate to provide a baseline for assessing potential impacts on the future transportation system. The growth rate was developed using the RTC's regional travel demand model. **Table 5** shows the projected Annual Average Daily Traffic (AADT) volumes and growth rates.

Table 5: RTC Model Growth Rates

Location -->	US 395A Near Project Site
Travel Demand Model Volumes	
2020 RTC Model 2040 RTC Model	479 969
Exponential Growth % per year	3.6%
20 Year Growth Factor	1.72

As shown in **Table 5,** the exponential growth is approximately 3.6 percent per year, or 72 percent over 20 years – a growth factor of 1.72. **Figure 6** shows the Future Year (20-year horizon) traffic volumes at the study intersections.





HEADWAY TRANSPORTATION

NO SCALE

AM Peak Hour Volume (PM Peak Hour Volume)

(#) - Study Intersection STOP - Stop

Figure 6

TMFPD Washoe Valley Station
Traffic Impact Study

Future Year Lane Configurations, Controls, and Traffic Volumes

Intersection Level of Service Analysis

Table 6 shows the Future Year (20-year horizon) conditions level of service summary and the detailed calculation sheets are provided in **Appendix E**.

Table 6: Future Year Intersection Level of Service

Int. ID	Intersection	Control	AM		PM	
			Delay[1]	LOS	Delay[1]	LOS
1	Washoe Drive/US 395A	Side Street Stop				
	Overall Intersection		0.7	A	0.6	A
	Washoe Drive					
	Northbound Approach		9.2	A	9.6	A
	US 395A					
	Westbound Left		7.6	A	8.0	A

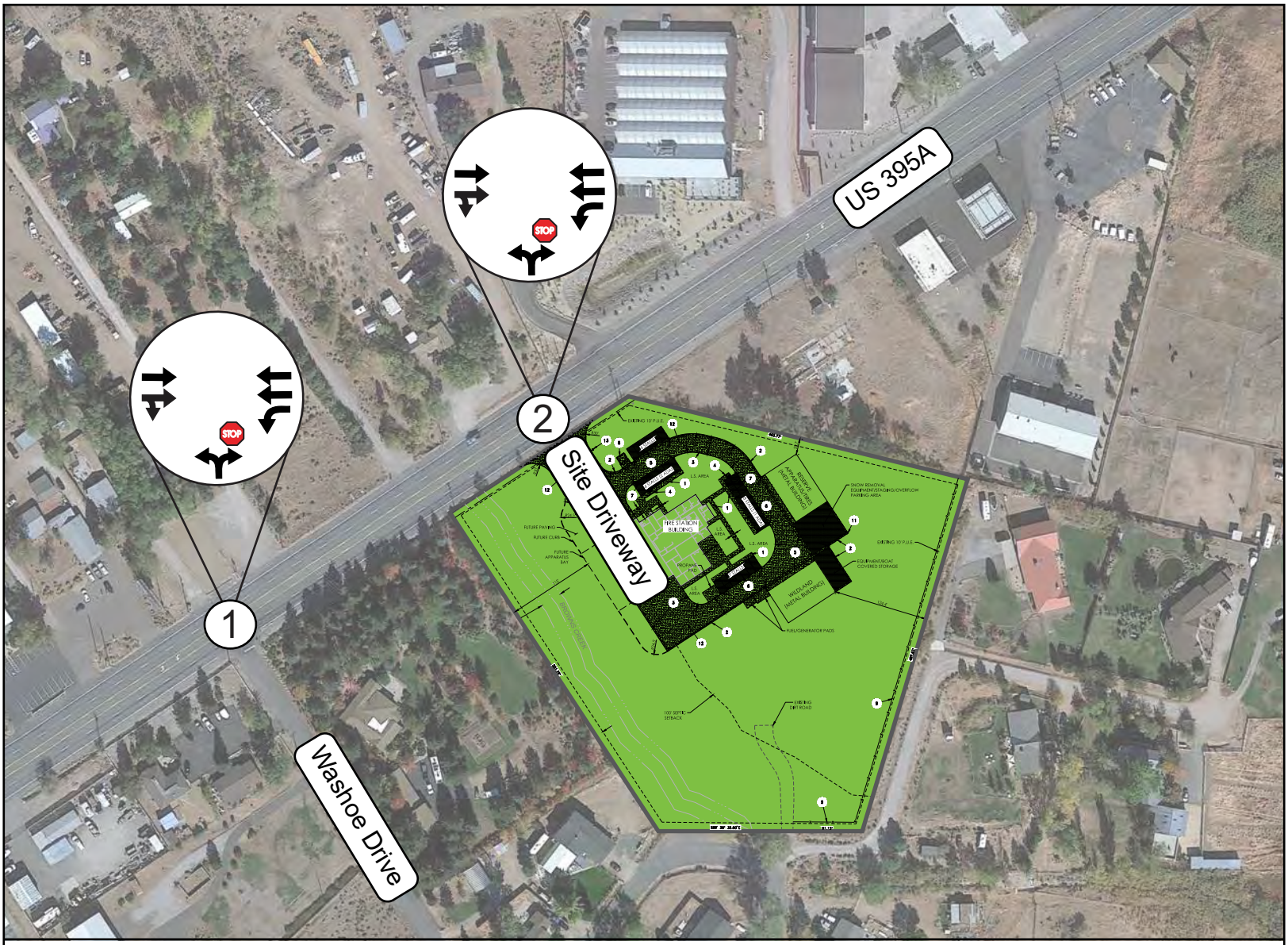
Notes: 1. Delay is reported in seconds per vehicle for the overall intersection and the worst approach/movement for side street stop-controlled intersections.
Source: Headway Transportation, 2023

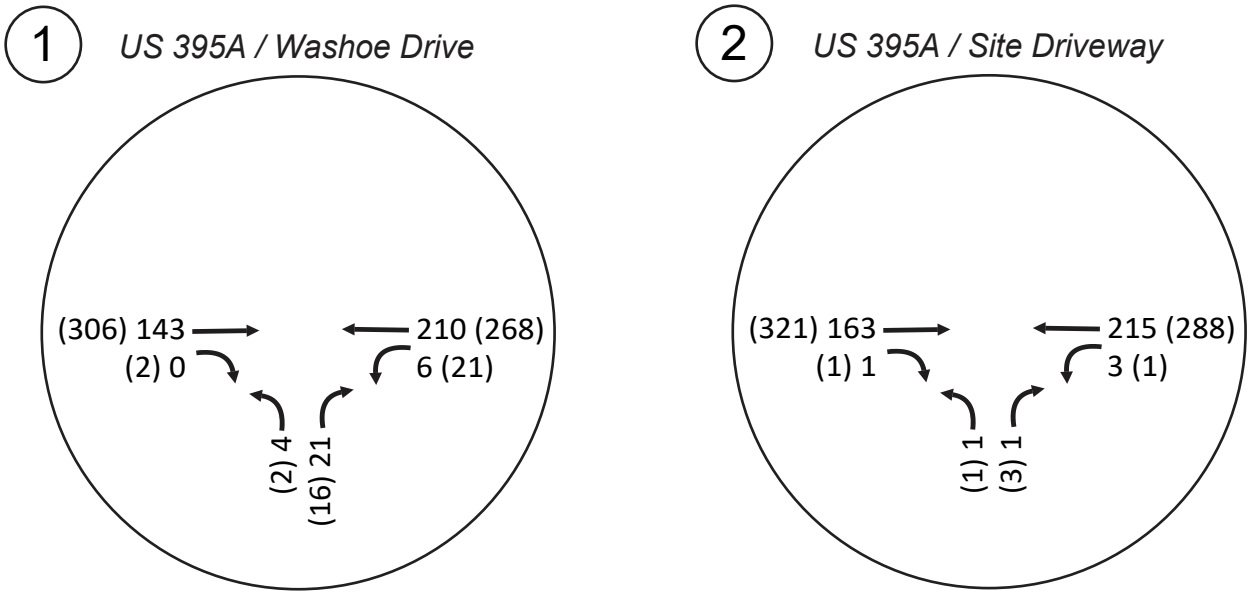
As shown in **Table 6**, the study intersection operates within the level of service policy in the Future Conditions.

FUTURE YEAR PLUS PROJECT CONDITIONS

Traffic Volumes

Future Plus Project traffic volumes were developed by adding the project generated trips (**Figure 4**) to the Future Year traffic volumes (**Figure 6**) and are shown on **Figure 7**.





HEADWAY TRANSPORTATION

NO SCALE

AM Peak Hour Volume (PM Peak Hour Volume)

- Project Site
(#) - Study Intersection
STOP - Stop

Figure 7

TMFPD Washoe Valley Station
Traffic Impact Study

Future Year Plus Project Lane Configurations, Controls, and Traffic Volumes

Intersection Level of Service Analysis

The level of service results for the Future Year Plus Project conditions are presented in **Table 7** and the calculation sheets are provided in **Appendix F**.

Table 7: Future Year Plus Project Intersection Level of Service

Int. ID	Intersection	Control	AM		PM	
			Delay[1]	LOS	Delay[1]	LOS
1	Washoe Drive/US 395A	Side Street Stop				
	Overall Intersection		0.7	A	0.6	A
	Washoe Drive					
	Northbound Approach		9.2	A	9.6	A
	US 395A					
	Westbound Left		7.6	A	8.0	A
2	Project Site Driveway/US 395A	Side Street Stop				
	Overall Intersection		0.1	A	0.1	A
	Project Site Driveway					
	Northbound Approach		9.6	A	9.9	A
	US 395A					
	Westbound Left		7.6	A	8.0	A

Notes: 1. Delay is reported in seconds per vehicle for the overall intersection and the worst approach/movement for side street stop-controlled intersections.
Source: Headway Transportation, 2023

As shown in **Table 7**, all study intersections are shown to operate within level of service policy. The addition of project trips had insignificant impact at the study intersections.

SITE DRIVEWAY RECOMMENDATION

It is recommended that the proposed development use a hybrid Type 4 / 5 approach and that site driveway operate as side-street stop control with full access utilizing the two-way left-turn lane. A right turn deceleration lane is not warranted based on the right turn volume per *NDOT AMSS.*

SAFETY INTERSECTION ENHANCEMENTS

It is recommended that the proposed development install an advanced active warning system (Emergency Vehicle sign W11-8 with beacons) in each direction of US 395A, per NDOT standards. Emergency events occur sporadically; this system will help warn road users that an emergency vehicle will exit the site driveway. The installation of this system would not significantly impact the operations on US 395A or Washoe Drive.

It is recommended for that lighting be constructed to help illuminate the approach location as well as illuminate the TMFPD vehicles entering / exiting.

Any advanced warning system / equipment, including lighting and power supply costs, would be owned and maintained by the TMFPD. Systems installed within NDOT right-of-way will require an Occupancy Permit.

ACCESS MANAGEMENT & DEVIATIONS

US 395A in the project vicinity is classified as a Minor Arterial by NDOT. The posted speed limit on US 395 A is 50 miles per hour (mph) in the project vicinity. Driveway spacing for Minor Arterials over 40 mph per *the NDOT 2017 Access Management System & Standards (AMSS)* are:

- 350'- 600' – Right-In/Right-Out Only.
- 660' – Left-In/Right-In/Right-Out Only.
- 1,320' – Unsignalized Intersection/Roundabout.
- 2,640' – Signalized Intersection.

A design deviation letter for access spacing and approach type modifications will be required given field constraints and accommodations to the TMFPD emergency service facility. A deviation letter will be provided to NDOT under sperate cover in addition to the traffic impact study.

CONCLUSIONS

The following is a list of key findings:

- The proposed project consists of a new safety service facility and fire station on parcels APN 050-220-61 through 66 in Washoe Valley. The site is located on US 395A (Carson-Reno Highway/S. Virginia Street/ Old US 395) just north of the intersection with Washoe Drive.
- The proposed project is anticipated to generate 60 Daily trips, 6 AM peak hour trips, and 6 PM peak hour trips.
- A *Design Deviation* letter addressed to the NDOT District 2 Engineer will be provided for access spacing and approach type modification due to the proposed access technically not meeting NDOT Access Management System and Standards (AMSS*)*.
- Under Existing Plus Project and Future Year Plus Project conditions, the study intersections are expected to operate within level of service policy. The addition of the project traffic does not have any significant impact on the studied intersection nor require capacity improvements or mitigations.
- Warning signs and flashing beacons are proposed at the facility driveway. Advanced warning system / equipment, including power and lighting, would be owned, and maintained by the TMFPD. An advanced active warning system would not significantly impact operations on US 395A or Washoe Drive.

Appendix A
NDOT Crash Data

HEADWAY TRANSPORTATION

Diego Gonzalez

From: Choi, Monica <mchoi@dot.nv.gov>
Sent: Tuesday, February 7, 2023 3:49 PM
To: Diego Gonzalez
Subject: RE: New NDOT/Local Crash Data Request Submitted

Hi Diego,

No crashes are found within this area.

Please let me know if you have any further questions.

Thank you,

Monica Emmerich-Choi
Transportation Planner/Analyst
Nevada Department of Transportation
o 775.888.7830
e mchoi@dot.nv.gov | w dot.nv.gov

From: Diego Gonzalez <dgonzalez@headwaytransportation.com>
Sent: Tuesday, February 7, 2023 12:01 PM
To: Choi, Monica <mchoi@dot.nv.gov>
Subject: RE: New NDOT/Local Crash Data Request Submitted

Hi Monica,

Is possible to condense the crash data between Washoe Dr (County Road) and MM 9? Or if no crashes are present within this area, a simple reply stating “no crashes are found within this area” would be greatly appreciated.

Thank you,

Diego Gonzalez
Traffic Engineer / Planner 1

Headway Transportation, LLC
5482 Longley Lane, Suite B
Reno, NV 89511
NV 775.322.4300 | CA 530.897.0199

From: CrashInfoRequests <crashinforequests@dot.nv.gov>
Sent: Friday, January 27, 2023 12:53 PM
To: Diego Gonzalez <dgonzalez@headwaytransportation.com>
Subject: RE: New NDOT/Local Crash Data Request Submitted

Hello,

We do not have linework for private drives, so I was unable to pull data for up to Washoe Bar Rd. I have instead provided data for the segment between Washoe Dr and Old Washoe Dr.

Please let me know if you have any questions.

Thank you,

For all data requests, please use our **Online Crash Data Request Submission Form**.

Also, please explore our **Traffic Safety Engineering GeoHub**.

Monica Emmerich-Choi
Transportation Planner/Analyst
Nevada Department of Transportation
o 775.888.7830
e mchoi@dot.nv.gov | w dot.nv.gov

From: 0365powerapps <O365powerapps@dot.nv.gov>
Sent: Wednesday, January 25, 2023 3:04 PM
To: CrashInfoRequests <crashinforequests@dot.nv.gov>
Subject: New NDOT/Local Crash Data Request Submitted
Importance: Low

A new Crash Data Request was submitted and is ready to be processed. Please see below for details of this specific request.

Use the following links to review the request in the Request Reviewer app and/or view all requests within the NDOT Crash Data Request Database.

View New Crash Request in Reviewer App
NDOT Crash Data Request Database (Excel Table)

Request Info

Request ID: Gonzalezndot_local--2023-01-25T23:03:44.7053245Z
Request Type: NDOT Local/Engineering
Requested Date: Tuesday, January 10, 2023 4:45:00 PM
Request Period: 5year
Request Data Type: locationspecific
Area Type: streetsegment
Highway/Street Name: Old US 395A
Beginning Street Name/Mile Post: Washoe Dr.
End Street Name/Mile Post: Washoe Bar Rd
Request Purpose:
Additional Comments: 5-Year Crash Data on Old US395A (both directions) between Washoe Dr and Washoe Bar Rd.

Requestor Contact Info

Name: Diego Gonzalez
Email: dgonzalez@headwaytransportation.com
Phone: 775-322-4300
Address: 5482 Longley Lane, Suite B
City: Reno
State: NV
ZIP: 89511

Please contact CrashInfoRequests@dot.nv.gov with questions or concerns regarding your request.

Appendix B
Traffic Count Data Sheets

HEADWAY TRANSPORTATION

395A @ Washoe Dr AM
0 0
Thursday, February 2, 2023

AM Peak Hour

Time	Southbound						Westbound						Northbound						Eastbound						VEHICLE TOTAL
	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	
7:30 AM	0	1	40	0	0	*41*	0	1	0	4	0	*5*	0	0	25	0	0	*25*	0	0	0	0	0	*0*	**71**
7:45 AM	0	1	27	0	0	*28*	0	0	0	3	0	*3*	0	0	19	0	0	*19*	0	0	0	0	0	*0*	**50**
8:00 AM	0	0	23	0	0	*23*	0	0	0	1	0	*1*	0	0	22	0	0	*22*	0	0	0	0	0	*0*	**46**
8:15 AM	0	1	31	0	0	*32*	0	1	0	4	0	*5*	0	0	16	0	0	*16*	0	0	0	0	0	*0*	**53**
Peak Hour Total	0	3	121	0	0	*124*	0	2	0	12	0	*14*	0	0	82	0	0	*82*	0	0	0	0	0	*0*	**220**
PHF	0.000	0.750	0.756	0.000	0.000	*0.756*	0.000	0.500	0.000	0.750	0.000	*0.700*	0.000	0.000	0.820	0.000	0.000	*0.820*	0.000	0.000	0.000	0.000	0.000	*0.000*	**0.775**

PM Peak Hour

Time	Southbound						Westbound						Northbound						Eastbound						VEHICLE TOTAL
	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	
12:00 PM	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	**0**
12:15 PM	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	**0**
12:30 PM	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	**0**
12:45 PM	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	**0**
Peak Hour Total	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	**0**
PHF	0.000	0.000	0.000	0.000	0.000	*0.000*	0.000	0.000	0.000	0.000	0.000	*0.000*	0.000	0.000	0.000	0.000	0.000	*0.000*	0.000	0.000	0.000	0.000	0.000	*0.000*	**0.000**

Total Vehicles On Leg			407		
Vehicles Entering Intersection	213		Vehicles Exiting Intersection	194	
Southbound					
Cars	0	200	4	0	0
Heavy	0	9	0	0	0
Total	**0**	**209**	**4**	**0**	**0**

Total Vehicles on Leg 0	Vehicles Entering Intersection 0	**Eastbound**	Cars	Heavy	**Total**
			0	0	**0**
			0	0	**0**
	Vehicles Exiting Intersection 0		0	0	**0**
			0	0	**0**
			0	0	**0**

Daily Volumes

Cars	Heavy	**Total**	**Westbound**	Vehicles Entering Intersection 30	Total Vehicles on Leg 37
28	0	**28**			
0	0	**0**			
2	0	**2**		Vehicles Exiting Intersection 7	
0	0	**0**			
0	0	**0**			

Cars	0	0	0	164	3
Heavy	0	0	0	2	0
Total	**0**	**0**	**0**	**166**	**3**
Northbound					
Vehicles Entering Intersection	169		Vehicles Exiting Intersection	211	
Total Vehicles On Leg			380		

395A @ Washoe Drive
0 0
Thursday, February 2, 2023

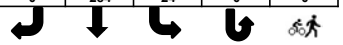
AM Peak Hour

Time	Southbound						Westbound						Northbound						Eastbound						VEHICLE TOTAL
	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	
12:00 AM	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	**0**
12:15 AM	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	**0**
12:30 AM	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	**0**
12:45 AM	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	**0**
Peak Hour Total	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	0	0	0	0	0	*0*	**0**
PHF	0.000	0.000	0.000	0.000	0.000	*0.000*	0.000	0.000	0.000	0.000	0.000	*0.000*	0.000	0.000	0.000	0.000	0.000	*0.000*	0.000	0.000	0.000	0.000	0.000	*0.000*	**0.000**

PM Peak Hour

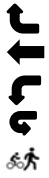
Time	Southbound						Westbound						Northbound						Eastbound						VEHICLE TOTAL
	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	U Turns	Left Turns	Straight Through	Right Turns	Crosswalk Crossings	*Vehicle Approach Total*	
3:00 PM	0	1	39	0	0	*40*	0	0	0	1	0	*1*	0	0	48	1	0	*49*	0	0	0	0	0	*0*	**90**
3:15 PM	0	1	31	0	0	*32*	0	1	0	5	0	*6*	0	0	44	0	0	*44*	0	0	0	0	0	*0*	**82**
3:30 PM	0	5	39	0	0	*44*	0	0	0	2	0	*2*	0	0	49	0	0	*49*	0	0	0	0	0	*0*	**95**
3:45 PM	0	5	46	0	0	*51*	0	0	0	1	0	*1*	0	0	33	0	0	*33*	0	0	0	0	0	*0*	**85**
Peak Hour Total	0	12	155	0	0	*167*	0	1	0	9	0	*10*	0	0	174	1	0	*175*	0	0	0	0	0	*0*	**352**
PHF	0.000	0.600	0.842	0.000	0.000	*0.819*	0.000	0.250	0.000	0.450	0.000	*0.417*	0.000	0.000	0.888	0.250	0.000	*0.893*	0.000	0.000	0.000	0.000	0.000	*0.000*	**0.926**

Total Vehicles On Leg		656			
Vehicles Entering Intersection	308	Vehicles Exiting Intersection	348		
Southbound					
Cars	0	283	23	0	0
Heavy	0	1	1	0	0
Total	**0**	**284**	**24**	**0**	**0**

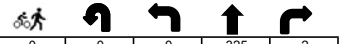


Total Vehicles on Leg 0	Vehicles Entering Intersection 0	**Eastbound**	Cars	Heavy	**Total**
			0	0	**0**
			0	0	**0**
	Vehicles Exiting Intersection 0		0	0	**0**
			0	0	**0**
			0	0	**0**

Daily Volumes



Cars	Heavy	**Total**	**Westbound**	Vehicles Entering Intersection 15	Total Vehicles on Leg 41
14	0	**14**			
0	0	**0**			
1	0	**1**		Vehicles Exiting Intersection 26	
0	0	**0**			
0	0	**0**			



Cars	0	0	0	325	2
Heavy	0	0	0	9	0
Total	**0**	**0**	**0**	**334**	**2**
Northbound					
Vehicles Entering Intersection	336	Vehicles Exiting Intersection	285		
Total Vehicles On Leg		621			

Appendix C
Existing LOS Calculations

HEADWAY TRANSPORTATION

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	82	0	3	121	2	12
Future Vol, veh/h	82	0	3	121	2	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	76	76	76	76	76	76
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	108	0	4	159	3	16

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	108	0	196	54
Stage 1	-	-	-	-	108	-
Stage 2	-	-	-	-	88	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1480	-	774	1002
Stage 1	-	-	-	-	904	-
Stage 2	-	-	-	-	925	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1480	-	772	1002
Mov Cap-2 Maneuver	-	-	-	-	769	-
Stage 1	-	-	-	-	904	-
Stage 2	-	-	-	-	922	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	8.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	960	-	-	1480	-
HCM Lane V/C Ratio	0.019	-	-	0.003	-
HCM Control Delay (s)	8.8	-	-	7.4	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	177	1	12	155	1	9
Future Vol, veh/h	177	1	12	155	1	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	190	1	13	167	1	10

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	191	0	301	96
Stage 1	-	-	-	-	191	-
Stage 2	-	-	-	-	110	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1380	-	666	942
Stage 1	-	-	-	-	822	-
Stage 2	-	-	-	-	902	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1380	-	660	942
Mov Cap-2 Maneuver	-	-	-	-	690	-
Stage 1	-	-	-	-	822	-
Stage 2	-	-	-	-	894	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	9
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	909	-	-	1380	-
HCM Lane V/C Ratio	0.012	-	-	0.009	-
HCM Control Delay (s)	9	-	-	7.6	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Appendix D
Existing Plus Project LOS Calculations

HEADWAY TRANSPORTATION

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	83	0	3	122	2	12
Future Vol, veh/h	83	0	3	122	2	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	76	76	76	76	76	76
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	109	0	4	161	3	16

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	109	0	198	55
Stage 1	-	-	-	-	109	-
Stage 2	-	-	-	-	89	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1479	-	772	1000
Stage 1	-	-	-	-	903	-
Stage 2	-	-	-	-	924	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1479	-	770	1000
Mov Cap-2 Maneuver	-	-	-	-	767	-
Stage 1	-	-	-	-	903	-
Stage 2	-	-	-	-	921	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	8.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	958	-	-	1479	-
HCM Lane V/C Ratio	0.019	-	-	0.003	-
HCM Control Delay (s)	8.8	-	-	7.4	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	94	1	3	124	1	1
Future Vol, veh/h	94	1	3	124	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	76	76	76	76	76	76
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	124	1	4	163	1	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	125	0	215	63
Stage 1	-	-	-	-	125	-
Stage 2	-	-	-	-	90	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1459	-	754	988
Stage 1	-	-	-	-	887	-
Stage 2	-	-	-	-	923	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1459	-	752	988
Mov Cap-2 Maneuver	-	-	-	-	755	-
Stage 1	-	-	-	-	887	-
Stage 2	-	-	-	-	920	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	856	-	-	1459	-
HCM Lane V/C Ratio	0.003	-	-	0.003	-
HCM Control Delay (s)	9.2	-	-	7.5	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	178	1	12	156	1	9
Future Vol, veh/h	178	1	12	156	1	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	191	1	13	168	1	10

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	192	0	302	96
Stage 1	-	-	-	-	192	-
Stage 2	-	-	-	-	110	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1379	-	665	942
Stage 1	-	-	-	-	822	-
Stage 2	-	-	-	-	902	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1379	-	659	942
Mov Cap-2 Maneuver	-	-	-	-	689	-
Stage 1	-	-	-	-	822	-
Stage 2	-	-	-	-	894	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	9
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	909	-	-	1379	-
HCM Lane V/C Ratio	0.012	-	-	0.009	-
HCM Control Delay (s)	9	-	-	7.6	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	186	1	1	167	1	3
Future Vol, veh/h	186	1	1	167	1	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	200	1	1	180	1	3

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	201	0	293	101
Stage 1	-	-	-	-	201	-
Stage 2	-	-	-	-	92	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1368	-	674	935
Stage 1	-	-	-	-	813	-
Stage 2	-	-	-	-	921	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1368	-	673	935
Mov Cap-2 Maneuver	-	-	-	-	696	-
Stage 1	-	-	-	-	813	-
Stage 2	-	-	-	-	920	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	861	-	-	1368	-
HCM Lane V/C Ratio	0.005	-	-	0.001	-
HCM Control Delay (s)	9.2	-	-	7.6	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Appendix E
Future Year LOS Calculations

HEADWAY TRANSPORTATION

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	142	0	6	209	4	21
Future Vol, veh/h	142	0	6	209	4	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	76	76	76	76	76	76
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	187	0	8	275	5	28

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	187	0	341	94
Stage 1	-	-	-	-	187	-
Stage 2	-	-	-	-	154	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1385	-	629	944
Stage 1	-	-	-	-	826	-
Stage 2	-	-	-	-	858	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1385	-	625	944
Mov Cap-2 Maneuver	-	-	-	-	668	-
Stage 1	-	-	-	-	826	-
Stage 2	-	-	-	-	853	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	885	-	-	1385	-
HCM Lane V/C Ratio	0.037	-	-	0.006	-
HCM Control Delay (s)	9.2	-	-	7.6	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	305	2	21	267	2	16
Future Vol, veh/h	305	2	21	267	2	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	328	2	23	287	2	17

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	330	0	519	165
Stage 1	-	-	-	-	329	-
Stage 2	-	-	-	-	190	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1226	-	486	850
Stage 1	-	-	-	-	701	-
Stage 2	-	-	-	-	823	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1226	-	477	850
Mov Cap-2 Maneuver	-	-	-	-	557	-
Stage 1	-	-	-	-	701	-
Stage 2	-	-	-	-	807	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	803	-	-	1226	-
HCM Lane V/C Ratio	0.024	-	-	0.018	-
HCM Control Delay (s)	9.6	-	-	8	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Appendix F
Future Year Plus Project LOS Calculations

HEADWAY TRANSPORTATION

Intersection	
Int Delay, s/veh	0.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	143	0	6	210	4	21
Future Vol, veh/h	143	0	6	210	4	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	76	76	76	76	76	76
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	188	0	8	276	5	28

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	188	0	342	94
Stage 1	-	-	-	-	188	-
Stage 2	-	-	-	-	154	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1384	-	628	944
Stage 1	-	-	-	-	825	-
Stage 2	-	-	-	-	858	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1384	-	624	944
Mov Cap-2 Maneuver	-	-	-	-	667	-
Stage 1	-	-	-	-	825	-
Stage 2	-	-	-	-	853	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	885	-	-	1384	-
HCM Lane V/C Ratio	0.037	-	-	0.006	-
HCM Control Delay (s)	9.2	-	-	7.6	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	163	1	3	215	1	1
Future Vol, veh/h	163	1	3	215	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	190	1	3	250	1	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	191	0	322	96
Stage 1	-	-	-	-	191	-
Stage 2	-	-	-	-	131	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1380	-	647	942
Stage 1	-	-	-	-	822	-
Stage 2	-	-	-	-	881	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1380	-	646	942
Mov Cap-2 Maneuver	-	-	-	-	681	-
Stage 1	-	-	-	-	822	-
Stage 2	-	-	-	-	879	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	791	-	-	1380	-
HCM Lane V/C Ratio	0.003	-	-	0.003	-
HCM Control Delay (s)	9.6	-	-	7.6	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	306	2	21	268	2	16
Future Vol, veh/h	306	2	21	268	2	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	336	2	23	295	2	18

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	338	0	531	169
Stage 1	-	-	-	-	337	-
Stage 2	-	-	-	-	194	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1218	-	478	845
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	820	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1218	-	469	845
Mov Cap-2 Maneuver	-	-	-	-	551	-
Stage 1	-	-	-	-	695	-
Stage 2	-	-	-	-	804	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	9.6
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	798	-	-	1218	-
HCM Lane V/C Ratio	0.025	-	-	0.019	-
HCM Control Delay (s)	9.6	-	-	8	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	321	1	1	288	1	3
Future Vol, veh/h	321	1	1	288	1	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	353	1	1	316	1	3

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	354	0	514	177
Stage 1	-	-	-	-	354	-
Stage 2	-	-	-	-	160	-
Critical Hdwy	-	-	4.14	-	6.84	6.94
Critical Hdwy Stg 1	-	-	-	-	5.84	-
Critical Hdwy Stg 2	-	-	-	-	5.84	-
Follow-up Hdwy	-	-	2.22	-	3.52	3.32
Pot Cap-1 Maneuver	-	-	1201	-	490	835
Stage 1	-	-	-	-	681	-
Stage 2	-	-	-	-	852	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1201	-	490	835
Mov Cap-2 Maneuver	-	-	-	-	561	-
Stage 1	-	-	-	-	681	-
Stage 2	-	-	-	-	851	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	9.9
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	744	-	-	1201	-
HCM Lane V/C Ratio	0.006	-	-	0.001	-
HCM Control Delay (s)	9.9	-	-	8	-
HCM Lane LOS	A	-	-	A	-
HCM 95th %tile Q(veh)	0	-	-	0	-

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

300 Sierra Manor Drive, Suite 1
Reno, NV 89511

February 27, 2020
Project No: 2556

Mr. William H. Hoffman, P.E.
Poggemeyer Design Group
1575 Delucchi Lane, Suite 110
Reno, Nevada 89502

RE: **DRAFT Preliminary Geotechnical Memorandum**
Truckee Meadows Fire Department (TMFD) Washoe Valley Consolidation Parcel Review
Washoe City, Washoe County, Nevada

Dear Mr. Hoffman,

Construction Materials Engineers, Inc (CME) is pleased to submit the preliminary results of our initial phased preliminary geotechnical/percolation investigation for the proposed Truckee Meadows Fire Department Washoe Valley Consolidation parcel review. The subject property is located in Washoe City near the north end of Washoe Valley.

1.0 SCOPE OF WORK

Since the project is in the preliminary planning phases, a phased scope of work will be completed as follows:

Current Phase

- **Phase 1 (Preliminary Geotechnical Memorandum):** This letter presents the results of our phase 1 investigation. Phase 1 work consists of identify potential geologic hazards (faults, liquefaction potential, shallow groundwater, potential for compressible/expansive soils) and provides a list of general construction concerns (percolation rate, excavation difficulties, soil instabilities, dewatering, remedial earthwork). This letter should be reviewed by the client and owner to determine the precursors associated with the economic feasibility of the project and if a Phase 2 investigation shall be conducted.

Future Phases

- **Phase 2 (Preliminary Geotechnical Investigation Report):** Phase 2 will be the preliminary geotechnical investigation to provide preliminary geotechnical design recommendations. This phase of work will be completed following the initial client/design team review of the Preliminary Geotechnical Memorandum (Phase 1).

- **Phase 3 (Design Level Geotechnical Investigation):** Phase 3 is the final geotechnical investigation. This scope of work will be determined once the proposed structure layout and design elements of the project have been developed. Additional subsurface exploration, laboratory testing, and percolation testing may be required for this scope of work.

2.0 PROJECT DESCRIPTION

The project is currently in the conceptual phases and parcel acquisition is not 100 percent complete. Currently Poggemeyer Design Group is assisting Washoe County in performing due diligence activities to determine if the following Washoe County Assessor Parcel Numbers (APN's) can be economically developed as a Fire Station: APN's 050-220-61, -62, -63, -64, -65, and -66. An aerial image showing the approximate limits of the subject site is included as Figure 1 (Preliminary Site Plan).

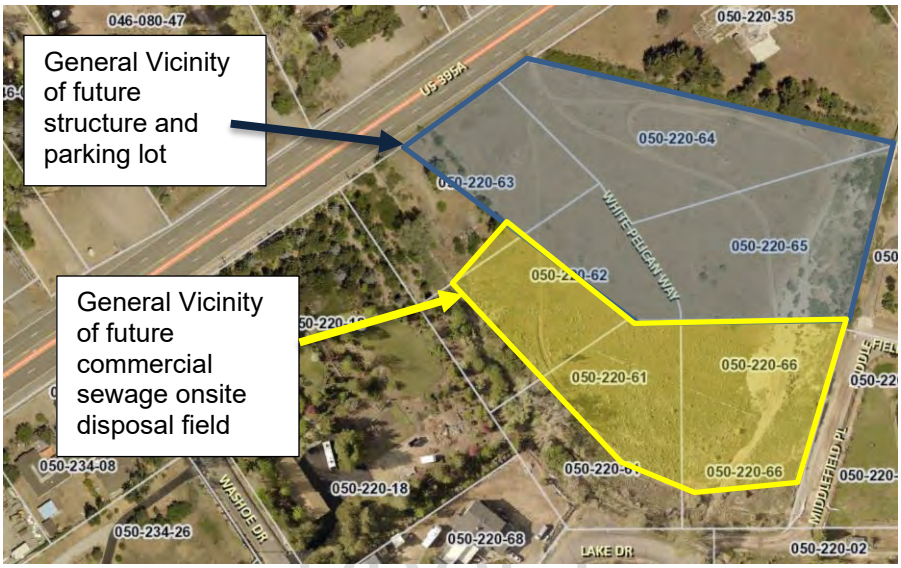


Figure 1: Preliminary Site Plan (N.T.S.)

Based on conversations with Poggemyer Design Group and Washoe County, subsurface conditions at the current parcel site are unknown and potential geotechnical design and/or construction constraints need to be developed to determine if purchase of the properties will facilitate the need of the Truckee Meadows Fire Departments request for future development as a Fire Station.

3.0 SITE CONDITONS

The subject property is located toward the north end of Washoe Valley along the base of the eastern flank of the Carson Range. The property is bounded by US 395A to the northwest, Steamboat Creek to the southwest, and residential properties along the remaining property boundaries.

The property is currently undeveloped and the majority of the site consists of a large open field with low-lying grasses and sparsely located bushes. Medium to large trees are sparsely located along the perimeters of the property. The property gentle slopes in a predominant northwesterly to southeasterly direction with a gradient of 1 to 2 percent. Based on the Washoe County Quick Map, the total elevation differential across the site is about 10 feet.

Access to the site from US 395A is via West Washoe Drive connecting into Lake Drive.

4.0 SUBSURFACE EXPLORATION

The property was explored using both test pit excavations (predominately to assess the viability of an onsite sewage disposal field) and vertical test borings (to assess a deeper soil profile and liquefaction potential at the site). A description of each exploration method performed is included as Sections 4.1 (Test Pits) and 4.2 (Vertical Test Borings). A Field Exploration Location Map is presented as Plate A-1.

Elevations shown on the exploration logs were obtained via Google Earth and should be considered approximate. The exploration locations included in this report should be considered accurate only to the degree implied by the methods used.

4.1 TEST PITS

Four test pits were excavated to depths of 7 to 10 feet bgs in February 2020. The test pits were excavated using a rubber tire, John Deere 310SG backhoe, equipped with a 24-inch wide bucket.

Following completion of the excavation, the test pit was backfilled with the excavated spoils. Test pit backfill was loosely placed and not compacted to the standards typically required for properly placed structural fill[1].

4.2 VERTICAL TEST BORINGS

The proposed site was explored in February 2020 by drilling two test borings to a depth of 15 and 40 feet below the existing ground surface. The borings were drilled using a truck-mounted Gefco SS15 soil sampling drill rig with 6-inch-outside-diameter (O.D.), 3-1/4-inch-inside-diameter (I.D.) continuous-flight augers to a depth of 5 feet where the exploration methodology switched to mud rotary drilling methods consisting of advancing a 3⅞-inch mud rotary bit with a water/bentonite drilling fluid. The rotary bit decreases sample disturbance at the bottom of the borehole and the drilling fluid prevents sloughing of the borehole sidewalls.

The native soils were sampled in-place every 2 to 5 feet using a standard 2-inch OD split-spoon sampler driven by a standard 140-pound drive hammer with a 30-inch stroke. The number of blows to drive the sampler the final 12 inches of an 18-inch penetration into undisturbed soil is an indication of the density and consistency of the material (Standard Penetration Test (SPT) - ASTM D 1586).

Due to the relatively small diameter of the sampler, the maximum particle size that could be recovered was approximately 1¼ inches. Soil classifications presented on the boring logs may not, therefore, adequately represent the actual quantity or presence of gravels, cobbles, or boulders. Additionally, any stratification lines on the logs represent the approximate boundary between soil types and the transition should be considered gradual.

[1] **Warning:** Structures and or slabs constructed over loosely placed back-fill may experience significant settlement and/or differential settlement. Removal and recompaction of back-fill may be required prior to construction over these areas.

4.3 MATERIAL CLASSIFICATION

Soils were examined and classified during exploration in general accordance with ASTM D 2488 (Description and Identification of Soils). During exploration, representative bulk samples were placed in sealed plastic bags and returned to our laboratory for testing. Upon completion of laboratory testing, additional soil classification and verification of the field classifications were subsequently performed in accordance with the Unified Soil Classification System (USCS), as presented in ASTM D 2487. Test Pit and Boring logs (Plate A-2) and a USCS chart (Plate A-3 - Graphic Soils Classification Chart) is presented in Appendix A.

4.4 PERCOLATION TESTING

Percolation testing was performed within Test Pits TP-1, TP-2, and TP-3 at benched locations at the depths noted on the percolation test logs (included as Plates D-1).

Percolation test preparation included hand excavation of the test hole to a depth of about 14-inches and placing approximately 2-inches of gravel at the bottom to prevent scour. A perforated PVC liner approximately 4-inches in nominal diameter was placed in the center of the excavated percolation test hole.

Percolation testing was completed in general accordance with Chapter 444 of the Nevada Administration Code (NAC). Correction calculations were performed to adjust for the percolation test hole diameter and PVC liner. A summary of percolation test results is included as Table 1 (Percolation Test Information).

Table 1: Percolation Test Information

Test ID	Test Pit Depth (ft)	Groundwater Depth (ft)	Percolation Test ID	Approximate Percolation Test Depth (ft)	Field Percolation Rate (min/in)	Corrected Percolation Rate (min/in)[1]
TP-1	10	7	P-1a	3	>120	
			P-1b	5		
TP-2	8.5	7	P-2a	3	>120	
			P-2b	5	10	21.2
TP-3	7	6	P-3a	2 ½	>120	

NOTES:
1) Correction calculations were completed, refer to Plates A-2 (Percolation Test Results)
2) NDEP Guidance Manual 1.0 notes that the soil percolation rate shall be faster than 120 min/in. Additionally, bottom of trenches and beds shall be at least 4 ft. above highest expected groundwater elevation.

5.0 LABORATORY TESTING

Representative samples of significant soil types will be tested in the laboratory as to index properties, such as moisture content, grain size distribution and plasticity. These index properties are indicative of mechanical behavior of the soils.

Soil chemistry testing on representative near surface soil sample(s) will also be performed to determine corrosion potential.

6.0 GEOLOGIC AND GENERAL SOIL CONDITIONS

Based on a review of the two regional published Geologic Maps:

- Geologic Map of the Washoe City Quadrangle, R.W Tabor and S. Ellen, 1975, the subject property is located in undifferentiated sand deposits **(Qsu)**. These deposits consist of a combination of windblown sands, alluvial outwash, and slope wash.

- Geologic map of the Washoe City Quadrangle, Chad W. Carlson at el, 2019, the subject property is located in two different geologic units: Young alluvial-fan deposits **(Qfy),** located toward the north to central portions of the property, consisting of broad anastomosing fans emanating from channels along the western margins of Washoe valley. Toward the south end of the property, lacustrine deposits **(Ql)** are mapped consisting of a mixture of predominantly beach sand and eolian sands deposits interbedded with fan deposits. Figure 2 shows an excerpt of the geologic map.

In general, the geologic conditions are complex and influenced by the following four geomorphic processes:

- Alluvial fan deposits originating from the hillsides along the western margins of Washoe valley;

- Eolian (windblown) sands;

- Beach (shoreline) deposits originating from pluvial Washoe Lake having a high stand of 5080 feet, or about 20 feet above the existing ground surface;

- Floodplain and slope wash deposits originating from Steamboat Creek and braided stream deposits.

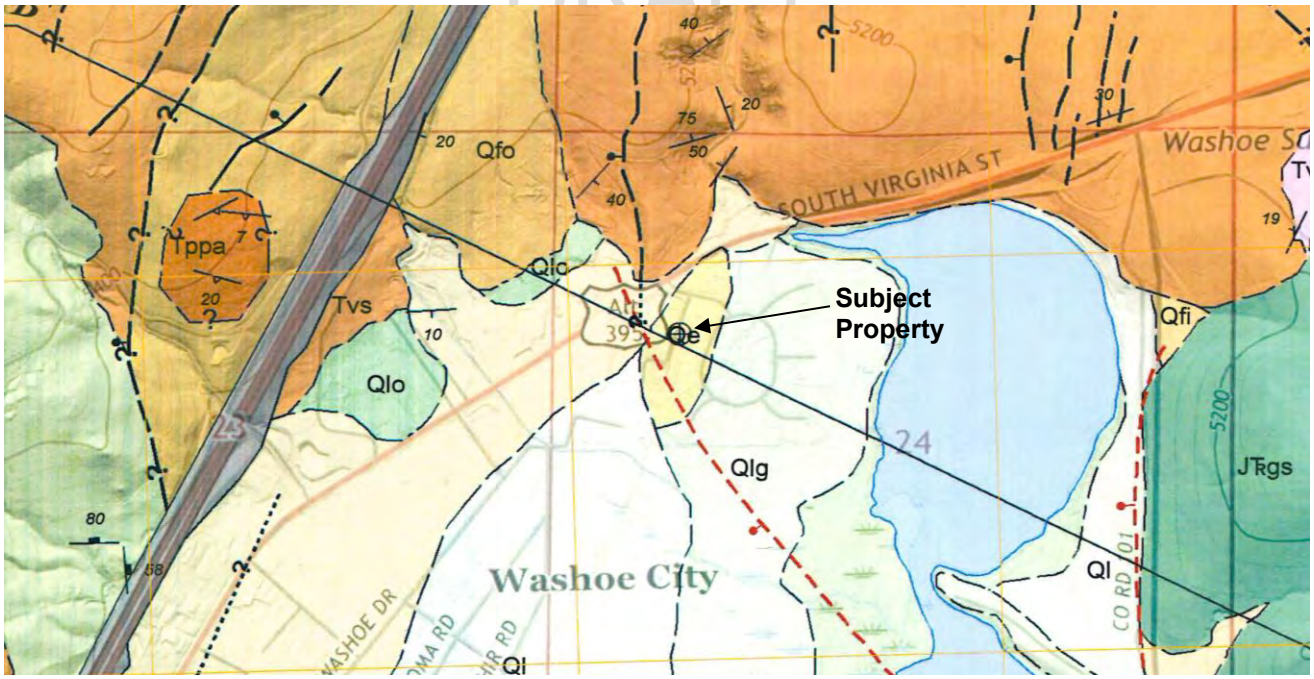


Figure 2: Excerpt of Geologic Map of Washoe Quadrangle

6.1 GEOLOGIC PROFILE ENCOUNTERED

The geologic profile is complex and reflects the multitude of geomorphic processes that have impacted this site. The uppermost soils encountered throughout this site are classified as either clayey sands **(SC)** or silty, clayey sands **(SC-SM)** exhibiting low plasticity characteristics. Below a depth of 4 to 5 feet, several different soil types were encountered depending on the location within the subject property. Toward the northwest portion of the property, near US 395, the soil profile contains increased clay fines, being predominantly clayey sands **(SC)** to the depth of exploration. Based on SPT blow counts, the relative density of this soil profile is loose to medium dense.

Toward the northeastern portion of property, the soil profile generally has an increased granular soil content with a denser relative density. Non-plastic silty sands **(SM)** were encountered from a depth of 4 to 11.5 feet exhibiting a medium dense relativity density. Below 11.5 feet, clayey sands **(SC)** were encountered to the depth of exploration.

6.1 GROUNDWATER

Groundwater was encountered within the exploration locations ranging in depth from 6 to 7 ½ feet below existing grade.

7.0 SEISMICALLY RELATED GEOLOGIC HAZARDS

7.1 FAULTING

The Western United States is a region of moderate to intense seismicity related movement of the crustal masses (plate tectonics). The most active regions outside of Alaska are along the San Andreas Fault zone of western California and the Wasatch Front in Salt Lake City.

Figure 3: Overview Map Showing the Great Basin
(N.T.S)

The Wasatch Front in Salt Lake City, Utah, forms the eastern boundary of the Basin and Range physiographic province, and the eastern form of the Sierra Nevada Mountains, which is the western margin of the province. The subject site is located northwest of the Pah Rah Range and east of the Sierra Nevada.

To determine the location of mapped earthquake faulting trending through or near the project site, a review of the following published information was completed:

1) USGS Website: *Earthquake Hazards Program Quaternary Faults in Google Earth (refer to Figure 4)*;
2) The Nevada Bureau of Mines (NBMG) Interactive Fault Map (https://gisweb.unr.edu/QuaternaryFaults/).

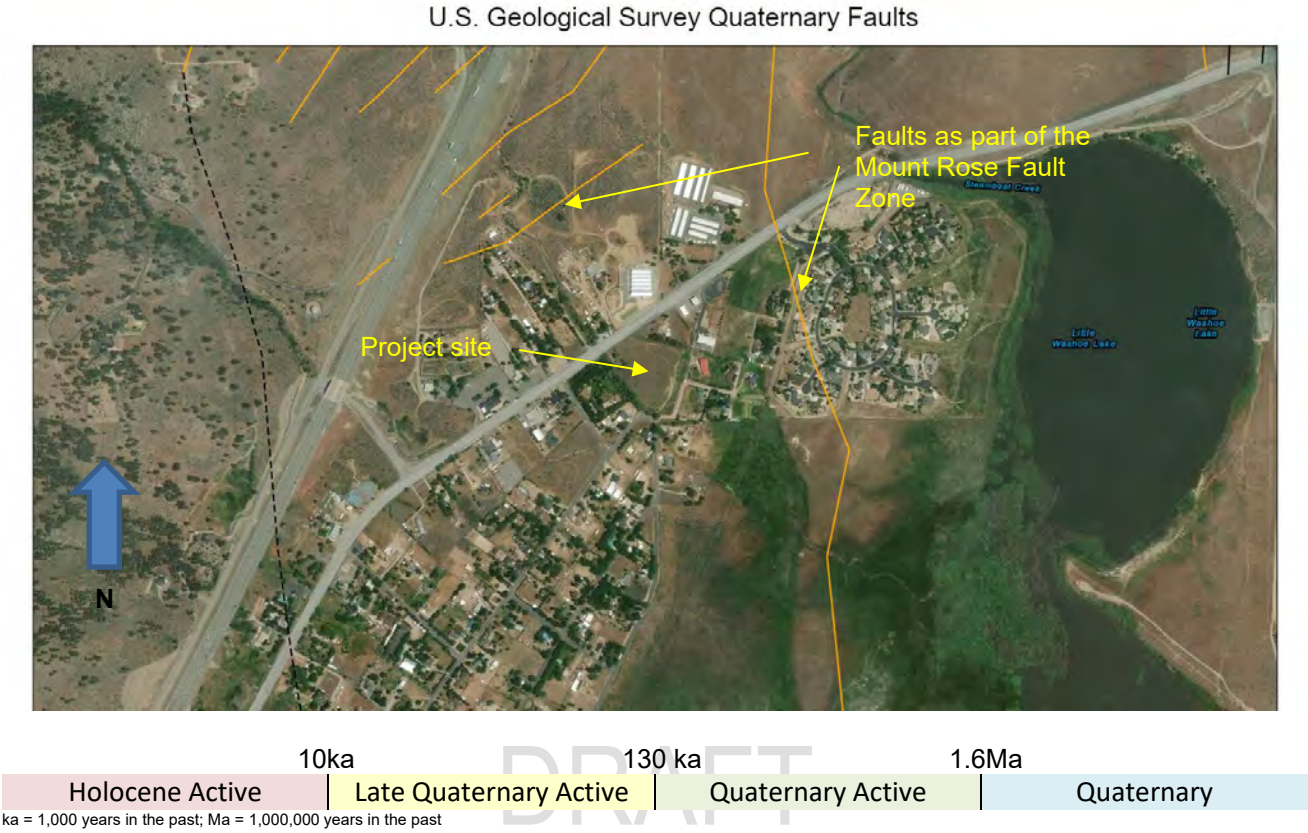


Figure 4: Excerpt of the Fault Map and Activity Timeline

Quaternary earthquake fault evaluation criterion has been formulated by a professional committee for the State of Nevada Seismic Safety Council, 2006. Faults that have shown movement more recently (e.g. Holocene Active) pose a more significant potential for surface rupture hazard. Faults with demonstrable movement in the past 1.6 million years are considered to be Late Quaternary-active faults or Quaternary faults.

No mapped faults traverse the proposed project site. However, the subject property is surrounded by mapped fault traces located less than ½ mile east and ½ mile north of the site. The latest fault ruptures that have been mapped along these faults is less than 15 Ka[2] and are considered Holocene Active. These faults are part of the Mount Rose Fault zone, which is a major fault structure that lies at the base of Carson Range extending from near Minden, Nevada to the North Reno Area.

7.2 LIQUEFACTION

Liquefaction is defined as a nearly complete loss of soil shear strength occurring during an earthquake, as cyclic shear stresses generate excessive pore water pressure between the soil grains. Soil liquefaction susceptibility depends on several factors including subsurface soil profile, ground water table, relative density, ground acceleration, and duration of shaking.

[2] Ka=1,000 years

Soil types most susceptible to liquefaction include loose to medium dense cohesionless sands, soft to stiff non-plastic to low plastic silts, or any combination of silt-sand mixtures lying below the groundwater table. Liquefaction is generally limited to depths of 50 feet or less below the existing ground surface.

Because of shallow groundwater conditions and presence of medium dense silty sands below the groundwater table, an analysis of soil liquefaction potential was completed in accordance with 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils; and subsequent updated recommendations by Idriss I.M. and Boulanger R.W. (2006). The primary updated recommendations include modifications to the empirical equations that determine the stress reduction coefficient (r_d) and overburden correction factor (K_δ). Other revisions include the magnitude scaling factor (MSF) and cyclic resistance ratio (CRR). Each of these recommended changes were incorporated in our analysis. The primary factors to evaluate soil liquefaction potential are presented in Sections 7.2.1 to 7.2.9

7.2.1 STRESS REDUCTION FACTOR (R_D)

The stress reduction factor coefficient is a parameter that describes the ratio of cyclic stresses of a flexible soil column to the cyclic stresses for a rigid soil column. The NCEER workshop guidelines are based on the stress reduction factor determined by an average curve for a range of earthquake ground motions and soil profiles as a function with depth. The coefficient has a maximum value of 1.0 and decreases with soil depth. The revised equation recommended by Idriss and Boulanger is a function of soil depth and earthquake magnitude instead of an average value.

7.2.2 CYCLIC RESISTANCE RATIO (CRR)

The CRR is based on a relationship between the cyclic stress ratio causing liquefaction and $(N_1)_{60}$ values for a M_w 7.5 earthquake (Seed et al, 1982). Soils with fines content >5 % have an increased resistance to soil liquefaction. A graph was developed showing the relationship between the cyclic stress ratio and $(N_1)_{60}$ values that show boundaries of non-liquefiable/liquefiable soils represented by percent fines curves. Since the NCEER workshop, several investigators including Cetin et al (2000) have re-examined and expanded the SPT case database. The original database included 125 cases of liquefaction/no-liquefaction from 19 earthquakes. Cetin included an additional 67 cases of liquefaction/no-liquefaction from 12 earthquakes. Several of the additional cases showed soil liquefaction within non-liquefiable zones that are shown on the graph produced by the NCEER workshop. Based on this information, the fines content curves were adjusted to reflect the new data sets. Idriss and Boulanger subsequently developed new empirical equations to determine CRR based on these revised curves.

7.2.3 OVERBURDEN CORRECTION FACTOR (K_Δ)

The overburden correction factor accounts for the effect of overburden stresses on CRR. This factor is a function of relative density and overburden pressure. The revised equation recommended by Idriss and Boulanger provides a direct correlation between corrected SPT blow counts and relative density. Idriss and Boulanger also recommend that K_δ is ≤ 1.

7.2.4 PROBABLE MAGNITUDE OF THE DESIGN EARTHQUAKE

The dominant moment magnitude earthquake is from the Mount Rose Fault Zone with an earthquake moment magnitude (M_w) of 6.85. Earthquake moment magnitude is based on an earthquake deaggregation analysis completed for the site (Unified Hazard Tool, 2014).

7.2.5 ESTIMATE OF THE MAXIMUM HORIZONTAL GROUND ACCELERATION

As required by IBC (2018), the minimum horizontal ground acceleration (peak) to use for design should have a 2 percent probability of being exceeded for a 50-year period. This horizontal ground acceleration is 1.0g and was obtained from the Seismic Parameters provided in Section 8.0. This is an exceptional high ground acceleration value and reflects the site location in respect to the Mount Rose Fault Zone.

7.2.6 GROUNDWATER LEVEL

Groundwater was encountered ranging from 6 to 7 ½ feet below the existing ground surface. Soil liquefaction analysis was completed based on a groundwater depth of 6 feet.

7.2.7 SOIL PROFILE INDEX PROPERTIES

Soil profile index properties include particle sizing (percent by dry weight exceeding the #200 sieve) and plasticity index properties. Particle sizing is used to correct blow counts for soil liquefaction analysis, while plasticity index is used to determine if the soil is susceptible to liquefaction. Soils containing plastic fines will have a higher resistance to soil liquefaction than clean sands.

Boulanger (2006) recommends that liquefaction be reserved for soils that exhibit “sand-like” behavior and depending on plasticity properties the term “clay-like” behavior be used for soils not prone to soil liquefaction. The plastic index threshold boundary for fine-grained soil layers exhibiting “clay-like” soil behavior is a plastic index ≥ 7. In Boring B-1, soils predominantly are classified as possessing “clay-like” soil behavior.

7.2.8 FIELD BLOW COUNTS (SPT)

SPT blow counts are the standard in determining the subsurface soil profile and soil density for liquefaction analysis. SPT blow counts are based on $(N_1)_{60}$ values, which represents the blow count corrected for effective overburden pressures at a hammer efficiency of 60 percent. The correction factor for overburden pressure (C_n) is given in AASHTO (2010) as $C_n = 0.77 \log_{10} (40/ \delta'_{vo})$, where δ'_{vo} is in ksf.

The hammer efficiency is assumed at 80 percent. Therefore, a correction factor of 1.33 was applied to the SPT blow count to normalize them to a hammer efficiency of 60 percent. Based on the recommendations from the NCEER workshop, a correction factor of 1.2 was also applied when using a sampler without liners.

Idriss and Boulanger recommend that when determining the overburden correction factor (K_δ), the maximum $(N_1)_{60}$ value should be 37 because higher values are not compatible with their equation. Using this maximum $(N_1)_{60}$ value will not increase the potential for soil liquefaction, as $(N_1)_{60}$ values above 30 generally signify non-liquefiable soils.

7.2.9 SOIL LIQUEFACTION RESULTS

Based on the calculated FOS values, the overall potential for soil liquefaction is low, mostly due to the clay content of the native soils. However, a potential for soil liquefaction exists in Boring B-1 at a depth between 15 to 18 feet bgs. This soil horizon contained sporadic 1 to 2-inch-thick lenses of poorly graded sand that may be susceptible to soil liquefaction. However, due to the limited thickness of these soil lenses and overburden pressures, the settlement due to soil liquefaction is considered negligible.

Soil liquefaction results are presented in Appendix C.

8.0 SEISMIC DESIGN PARAMETERS

Seismic design parameters are based on the provisions listed under the 2018 IBC. A default Site Class D can be used for the project design. Table 2 (Seismic Design Parameters (2018 IBC)) provides a summary of seismic design parameters for a Site Classification of D (Default). A copy of the Seismic Hazards Report is provided in Appendix C.

Table 2: Seismic Design Parameters (2018 IBC)

Approximate Latitude of Site		39.325293°
Approximate Longitude of Site		-119.808058°
Site Class Selected for this Site		$D_{Default}$
Risk Category		IV
S_S	Spectral Response Acceleration at Short Period (0.2 sec.)	2.183
S_1	Spectral Response Acceleration at 1-second Period	0.769
F_a	Site amplification factor at Short Period (0.2 sec.)	1.0
F_v	Site amplification factor at 1-second Period	1.7
S_{DS}	Design Spectral Response Acceleration at Short Period (0.2 sec.)	1.455
S_{D1}	Design Spectral Response Acceleration at 1-second Period	0.872
S_{MS}	Site-modified spectral acceleration value at Short Period (0.2 sec.)	2.183
S_{M1}	Site-modified spectral acceleration value at 1-second Period	1.31
T_L	Long-period transition period in seconds	6
PGA	MCE_G peak ground acceleration	0.942
PGA_M	Site modified peak ground acceleration	1.037

NOTES:
1. A default Site Classification D may be used if it is known that the site is not located within a Site Class E or F.
2. Per ASCE 7-16 Section 11.4.3, F_a shall not be less than 1.2.
3. See requirements for Site Specific Ground Motions in Section 11.4.8 of ASCE 7.
4. Reference https://seismicmaps.org/

9.0 DISCUSSION AND RECOMMENDATIONS

It is our opinion that the subject property is amenable to development with the following comments:

- The preferred building location is within the northeast portion of the site, as shown on the Field Exploration Location Map (Plate A-1). Based on our current exploration, this location overlies denser, more granular soils that would provide better support capabilities for the structure. Additional exploration to define this area will be completed with subsequent phases of this investigation.

- The potential for liquefaction at the site was assessed as part of this preliminary exploration is considered very low with calculated settlements of less than 0.1 inches.

- Based on the site topography, it is assumed that fill thicknesses will be 4 feet or less. Near surface soils are granular exhibiting low plasticity characteristics and can be used as structural fill.

- The groundwater table is high, ranging from 6 to 7.5 feet bgs. Because of the high groundwater table, cut areas limited in depth, especially in the building areas. Trenching for underground utilities may require dewatering and trench wall instabilities are a potential. Drain rock bedding will likely be required encapsulated with a geotextile.

- Deeper cut areas may experience unstable soils due to higher soil moisture contents. Soils may have to be removed and replaced with stabilizing fill and a geotextile.

- Based on the percolation test results, the most suitable location for the leach field is test pit TP-2. Special design considerations will need to be taken to comply with groundwater offsets. In addition, the upper 4 feet of the soil profile within the limits of Test Pit TP-2 will need to be removed and replaced with engineered fill. Additional percolation testing and design considerations will be provided in a later report.

Sincerely,

CONSTRUCTION MATERIALS ENGINEERS, INC.

Stella Hardy, P.E.
Geotechnical Project Manager
shardy@cmenv.com
Direct: 775-737-7569

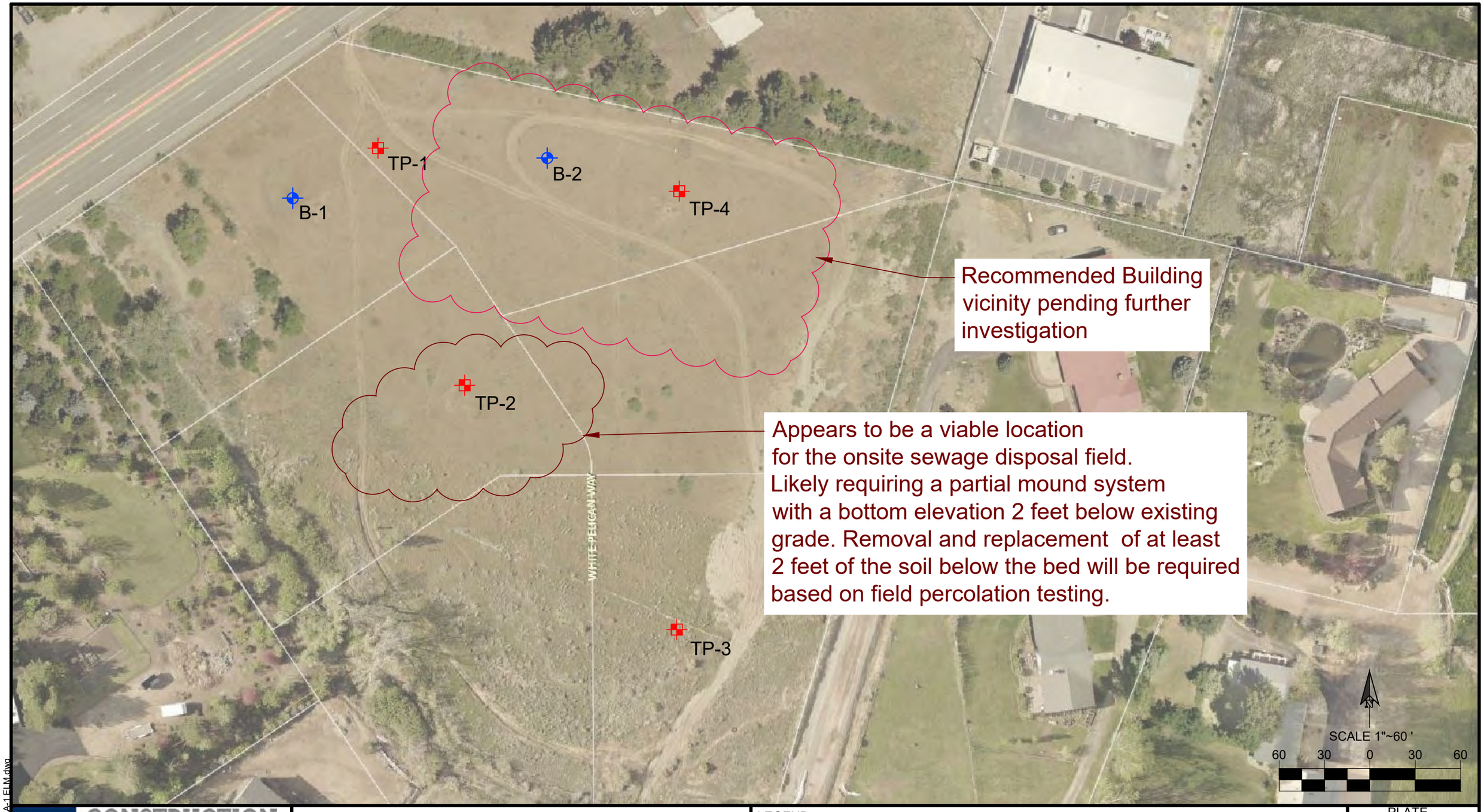
V:\Active\2556\report\Draft\DRAFT Preliminary Geo Memorandum - TMFD Consolidation 2-27-2020.docx

Attachments:

Plate A-1	Exploration Location Map
Plate A-2	Exploration Logs (Test Pit and Boring)
Plate A-3	Soil Classification Chart
Plate B-1	Grainsize Analysis
Plate C-1	Liquefaction Analysis Summary
Plate D-1	Percolation Test Results

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

APPENDIX A



CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, NV 89511

POGGEMEYER DESIGN GROUP
TMFD CONSOLIDATION
EXPLORATION LOCATION MAP
WASHOE VALLEY, NEVADA
PROJECT NO.: 2556 DATE:2/24/2020

LEGEND
APPROXIMATE TEST PIT LOCATION
APPROXIMATE BORING LOCATION

PLATE
A-1

V:\Active\2556\AutoCAD\A-1 ELM.dwg

LOG OF TEST BORING NO. B-1

PROJECT TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION
PROJECT NO. 2556
CLIENT POGGEMEYER
LOGGED BY ANH
LOCATION NORTH WEST OF PROPERTY
DATE 2/20/2020
SURFACE ELEVATION 5065 (FT)
ELEVATION METHOD GOOGLE EARTH
DRILLING CONTRACTOR PC EXPLORATION
DRILL RIG GEFCO SS15
BORING TYPE HSA/MUD ROTARY
HAMMER TYPE AUTOMATIC 140 lbs
BACKFILL METHOD BENTONITE CHIPS/

Elevation (ft)	Graphic Log	Moisture	Drilling Method	USCS	Visual Description	Depth (ft)	Sample	Sample Type	Sample No.	Blow Counts	Blow Counts (per foot)	Recovery (in.)	%-200	Liquid Limit	Plasticity Index	Pocket Pen. (tsf)	Dry Density (pcf)	Moisture Content %	Remarks
5065		SL. MOIST		SC	0.0-24.0 CLAYEY SAND: mostly fine to medium sand; some medium plasticity fines; dark brown.	0														
5062.5						2.5		S	1A	7 14 20	34	12								
5060		MOIST				5		S	1B	3 6 9	15	18								
		WET																		
5057.5				SC	NOTE: Switch to Mud Rotary drilling at 7.5 FT following sample 1C.	7.5		S	1C	4 3 7	10	18	31.9	33	16			17.2		
5055						10		S	1D	3 5 6	11	18								
5052.5				SC	NOTE: Color change to greenish brown.	12.5		S	1E	7 6 3	9	7	27.0	31	8			28.5		
5050					NOTE: Sporadic 1 to 2 inch thick lenses or poorly graded sand.	15				5										

GROUNDWATER

	DEPTH	HOUR	DATE
▽	7½	9:00 AM	2/20/20
▼			

SAMPLE TYPE

A - Drill Cuttings B - Bulk Sample
R - 3" O.D. 2.42" I.D. Ring Sample
S - 2" O.D. 1.38" I.D. Sampler
U - 3" O.D. 2.42" I.D. Tube Sample
T - 3" O.D. Thin-Walled Shelby Tube

NOTES

Elevation on boring log is approximate.
All blow counts are uncorrected.
NE = not encountered.

PLATE NO.: A-2a

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

LOG OF TEST BORING NO. B-1

PROJECT TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION
PROJECT NO. 2556 **DATE** 2/20/2020
CLIENT POGGEMEYER **SURFACE ELEVATION** 5065 (FT)
LOGGED BY ANH **ELEVATION METHOD** GOOGLE EARTH
LOCATION NORTH WEST OF PROPERTY

DRILLING CONTRACTOR PC EXPLORATION
DRILL RIG GEFCO SS15
BORING TYPE HSA/MUD ROTARY
HAMMER TYPE AUTOMATIC 140 lbs
BACKFILL METHOD BENTONITE CHIPS/

Elevation (ft)	Graphic Log	Moisture	Drilling Method	USCS	Visual Description	Depth (ft)	Sample	Sample Type	Sample No.	Blow Counts	Blow Counts (per foot)	Recovery (in.)	%-200	Liquid Limit	Plasticity Index	Pocket Pen. (tsf)	Dry Density (pcf)	Moisture Content %	Remarks
								S	1F	6 6	12	18							
5047.5				SC	NOTE: Increase fine sand content.	17.5		S	1G	4 4 6	10	18	47.4	32	14			26.7	
5045						20		S	1H	5 6 12	18	10							
5042.5		WET		SC		22.5		S	1I	5 5 7	12	14	35.3	36	17			22.9	
5040				SC	24.0-28.0 CLAYEY SAND: mostly fine sand; some low plasticity fines; strong brown.	25		S	1J	9 14 19	33	10							
5037.5		WET				27.5													
5035				SP-SC	28.0-33.0 POORLY GRADED SAND WITH CLAY: mostly fine to coarse sand; few low plasticity fines; brown.	30		S	1K	13 18	38	8							

GROUNDWATER

	DEPTH	HOUR	DATE
▽	7½	9:00 AM	2/20/20
▼			

SAMPLE TYPE

A - Drill Cuttings B - Bulk Sample
R - 3" O.D. 2.42" I.D. Ring Sample
S - 2" O.D. 1.38" I.D. Sampler
U - 3" O.D. 2.42" I.D. Tube Sample
T - 3" O.D. Thin-Walled Shelby Tube

NOTES

Elevation on boring log is approximate.
All blow counts are uncorrected.
NE = not encountered.

PLATE NO.: A-2a

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

LOG OF TEST BORING NO. B-1

PROJECT TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION
PROJECT NO. 2556 **DATE** 2/20/2020
CLIENT POGGEMEYER **SURFACE ELEVATION** 5065 (FT)
LOGGED BY ANH **ELEVATION METHOD** GOOGLE EARTH
LOCATION NORTH WEST OF PROPERTY

DRILLING CONTRACTOR PC EXPLORATION
DRILL RIG GEFCO SS15
BORING TYPE HSA/MUD ROTARY
HAMMER TYPE AUTOMATIC 140 lbs
BACKFILL METHOD BENTONITE CHIPS/

Elevation (ft)	Graphic Log	Moisture	Drilling Method	USCS	Visual Description	Depth (ft)	Sample	Sample Type	Sample No.	Blow Counts	Blow Counts (per foot)	Recovery (in.)	%-200	Liquid Limit	Plasticity Index	Pocket Pen. (tsf)	Dry Density (pcf)	Moisture Content %	Remarks
5032.5		WET				32.5				20									
				SC	33.0-41.5 CLAYEY SAND: mostly fine to coarse sand; little low plasticity fines; brown.														
5030						35		S	1L	15 19 16	35	12							
5027.5						37.5													
5025						40		S	1M	10 20 20	40	12							
					TERMINATED AT 41.5 BGS. FREE WATER ENCOUNTERED AT 7.5 FT.														
5022.5						42.5													
5020						45													

GROUNDWATER

	DEPTH	HOUR	DATE
▽	7½	9:00 AM	2/20/20
▼			

SAMPLE TYPE

A - Drill Cuttings B - Bulk Sample
R - 3" O.D. 2.42" I.D. Ring Sample
S - 2" O.D. 1.38" I.D. Sampler
U - 3" O.D. 2.42" I.D. Tube Sample
T - 3" O.D. Thin-Walled Shelby Tube

NOTES

Elevation on boring log is approximate.
All blow counts are uncorrected.
NE = not encountered.

PLATE NO.: A-2a

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

LOG OF TEST BORING NO. B-2

PROJECT TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION
PROJECT NO. 2556
CLIENT POGGEMEYER
LOGGED BY ANH
LOCATION NORTH EAST OF PROPERTY
DATE 2/20/2020
SURFACE ELEVATION 5062 (FT)
ELEVATION METHOD GOOGLE EARTH
DRILLING CONTRACTOR PC EXPLORATION
DRILL RIG GEFCO SS15
BORING TYPE HSA/MUD ROTARY
HAMMER TYPE AUTOMATIC 140 lbs
BACKFILL METHOD BENTONITE CHIPS/

Elevation (ft)	Graphic Log	Moisture	Drilling Method	USCS	Visual Description	Depth (ft)	Sample	Sample Type	Sample No.	Blow Counts	Blow Counts (per foot)	Recovery (in.)	%-200	Liquid Limit	Plasticity Index	Pocket Pen. (tsf)	Dry Density (pcf)	Moisture Content %	Remarks
5062		SL. MOIST		SC	0.0-4.0 CLAYEY SAND: mostly fine to medium sand; some low to medium plasticity fines; dark brown.	0													
5059.5		MOIST				2.5		S	2A	4 11 17	28	12							
				SM	4.0-11.5 SILTY SAND: mostly fine to coarse sand; few nonplastic fines; brown.														
5057						5		S	2B	7 9 12	21	8							
5054.5		WET		SM	NOTE: Continuous sampling beginning at 7.5 FT BGS.	7.5		S	2C	7 11 11	22	10	12.3	NV	NP			14.6	
5052						10		S	2D	7 7 8	15	18							
				SM				S	2E	9 12 16	28	18	13.4	NV	NP			13.5	
				SC	11.5-16.5 CLAYEY SAND: mostly fine to coarse sand; little low plasticity fines; brown.														
5049.5						12.5		S	2F	9 14 15	29	14							
								S	2G	6 14 21	35	14							
5047						15				11									

GROUNDWATER

	DEPTH	HOUR	DATE
▽	8.5	1:00 PM	2/20/20
▼			

SAMPLE TYPE

A - Drill Cuttings B - Bulk Sample
R - 3" O.D. 2.42" I.D. Ring Sample
S - 2" O.D. 1.38" I.D. Sampler
U - 3" O.D. 2.42" I.D. Tube Sample
T - 3" O.D. Thin-Walled Shelby Tube

NOTES

Elevation on boring log is approximate.
All blow counts are uncorrected.
NE = not encountered.

PLATE NO.: A-2b

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

LOG OF TEST BORING NO. B-2

PROJECT TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION
PROJECT NO. 2556
CLIENT POGGEMEYER
LOGGED BY ANH
LOCATION NORTH EAST OF PROPERTY
DATE 2/20/2020
SURFACE ELEVATION 5062 (FT)
ELEVATION METHOD GOOGLE EARTH
DRILLING CONTRACTOR PC EXPLORATION
DRILL RIG GEFCO SS15
BORING TYPE HSA/MUD ROTARY
HAMMER TYPE AUTOMATIC 140 lbs
BACKFILL METHOD BENTONITE CHIPS/

Elevation (ft)	Graphic Log	Moisture	Drilling Method	USCS	Visual Description	Depth (ft)	Sample	Sample Type	Sample No.	Blow Counts	Blow Counts (per foot)	Recovery (in.)	%-200	Liquid Limit	Plasticity Index	Pocket Pen. (tsf)	Dry Density (pcf)	Moisture Content %	Remarks
								S	2H	14 16	30	48							
					TERMINATED AT 16.5 BGS. FREE WATER ENCOUNTERED AT 8.5 FT.															
5044.5						17.5													
5042						20													
5039.5						22.5													
5037						25													
5034.5						27.5													
5032						30													

GROUNDWATER

	DEPTH	HOUR	DATE
▽	8.5	1:00 PM	2/20/20
▼			

SAMPLE TYPE

A - Drill Cuttings B - Bulk Sample
R - 3" O.D. 2.42" I.D. Ring Sample
S - 2" O.D. 1.38" I.D. Sampler
U - 3" O.D. 2.42" I.D. Tube Sample
T - 3" O.D. Thin-Walled Shelby Tube

NOTES

Elevation on boring log is approximate.
All blow counts are uncorrected.
NE = not encountered.

PLATE NO.: A-2b

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

LOG OF TEST PIT NO. TP-1

PROJECT TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION
PROJECT NO. 2556
CLIENT POGGEMEYER
LOGGED BY: ANH
LOCATION NORTH END OF PARCEL

DATE 2/19/20
SURFACE ELEVATION 5064 (FT)
ELEVATION METHOD GOOGLE EARTH

EQUIPMENT TYPE DEERE 310SG
BUCKET WIDTH 24 INCHES
SURFACE LENGTH 8 (FT)
SURFACE WIDTH 2 (FT)

Elevation (ft)	USCS	Graphic Log	Moisture	Visual Description	Depth bgs (ft)	Sample	Sample Type	Sample No.	%-200	Liquid Limit	Plasticity Index	Moisture Content %	Remarks
5062.5	SC		MOIST	0.0-3.0 CLAYEY SAND: mostly fine to coarse sand; little medium plasticity fines; dark brown.	0								
	SC				2.5	X	B	1A	27.1	27	11	11.8	
5060	SC		MOIST	3.0-10.0 CLAYEY SAND: mostly fine to coarse sand; some low plasticity fines; green to brown.	5	X	B	1B					
5057.5				NOTE: Seepage observed on sidewall @ 7.0 FT BGS.	7.5								
5055					10								
5052.5				TEST PIT TERMINATED AT 10 FEET BGS. FREE WATER ENCOUNTERED @ 10 FEET, SEEPAGE OBSERVED @ 7 FEET	12.5								
5050					15								

GROUNDWATER

	DEPTH	HOUR	DATE
▽	7'	8:30 AM	2/19/20
▼			

SAMPLE TYPE

B - Bulk Sample

NOTES

Elevation on test pit log is approximate.
NE = not encountered
bgs = Below Existing Ground Surface

PLATE NO.: A-2c

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

LOG OF TEST PIT NO. TP-2

PROJECT TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION
PROJECT NO. 2556
CLIENT POGGEMEYER
LOGGED BY: ANH
LOCATION CENTER OF PARCEL

DATE 2/19/20
SURFACE ELEVATION 5061 (FT)
ELEVATION METHOD GOOGLE EARTH

EQUIPMENT TYPE DEERE 310SG
BUCKET WIDTH 24 INCHES
SURFACE LENGTH 7 (FT)
SURFACE WIDTH 2 (FT)

Elevation (ft)	USCS	Graphic Log	Moisture	Visual Description	Depth bgs (ft)	Sample	Sample Type	Sample No.	%-200	Liquid Limit	Plasticity Index	Moisture Content %	Remarks
5060	SC-SM SC-SM		MOIST	0.0-4.0 SILTY, CLAYEY SAND: mostly fine to medium sand; little low plasticity fines; dark brown.	0								
					2.5	X	B	2A	23.3	23	7	10.9	
5057.5													
	SP-SC		MOIST	3.0-8.5 POORLY GRADED SAND WITH CLAY: mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.	5	X	B	2B					
5055													
				NOTE: Water seepage from sidewalls and 7.0 FT BGS.	7.5								
5052.5				TEST PIT TERMINATED AT 8½ FEET BGS. FREE WATER ENCOUNTERED AT 8½ FEET, SEEPAGE OBSERVED AT 7 FEET									
					10								
5050													
					12.5								
5047.5													
					15								

GROUNDWATER

	DEPTH	HOUR	DATE
▽	7'	9:00 AM	2/19/20
▼			

SAMPLE TYPE

B - Bulk Sample

NOTES

Elevation on test pit log is approximate.
NE = not encountered
bgs = Below Existing Ground Surface

PLATE NO.: A-2d

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

LOG OF TEST PIT NO. TP-3

PROJECT TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION
PROJECT NO. 2556
CLIENT POGGEMEYER
LOGGED BY: ANH
LOCATION SOUTHERN END OF PARCEL

DATE 2/19/20
SURFACE ELEVATION 5060 (FT)
ELEVATION METHOD GOOGLE EARTH

EQUIPMENT TYPE DEERE 310SG
BUCKET WIDTH 24 INCHES
SURFACE LENGTH 8 (FT)
SURFACE WIDTH 2 (FT)

Elevation (ft)	USCS	Graphic Log	Moisture	Visual Description	Depth bgs (ft)	Sample	Sample Type	Sample No.	%-200	Liquid Limit	Plasticity Index	Moisture Content %	Remarks
5060	SC		MOIST	0.0-3.0 CLAYEY SAND: mostly fine to medium sand; some medium plasticity fines; dark brown.	0								
5057.5					2.5	X	B	3A					
	SM		MOIST	3.0-7.0 SILTY SAND : mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.									
5055					5	X	B	3B					
▽				NOTE: Seepage observed along sidewall @ 6 FT BGS.	▽								
5052.5				TEST PIT TERMINATED AT 7 FT BGS. FREE WATER ENCOUNTERED AT 7 FEET, SEEPAGE OBSERVED AT 6 FEET.	7.5								
5050					10								
5047.5					12.5								
5045					15								

GROUNDWATER

	DEPTH	HOUR	DATE
▽	6'	10:00 AM	2/19/20
▼			

SAMPLE TYPE

B - Bulk Sample

NOTES

Elevation on test pit log is approximate.
NE = not encountered
bgs = Below Existing Ground Surface

PLATE NO.: A-2

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

LOG OF TEST PIT NO. TP-4

PROJECT TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION
PROJECT NO. 2556
CLIENT POGGEMEYER
LOGGED BY: ANH
LOCATION EAST END OF PARCEL
DATE 2/19/20
SURFACE ELEVATION 5061 (FT)
ELEVATION METHOD GOOGLE EARTH
EQUIPMENT TYPE DEERE 310SG
BUCKET WIDTH 24 INCHES
SURFACE LENGTH 8 (FT)
SURFACE WIDTH 2 (FT)

Elevation (ft)	USCS	Graphic Log	Moisture	Visual Description	Depth bgs (ft)	Sample	Sample Type	Sample No.	%-200	Liquid Limit	Plasticity Index	Moisture Content %	Remarks
5060	SC		MOIST	0.0-2.5 CLAYEY SAND: mostly fine to medium sand; some medium plasticity fines; dark brown.	0		B	2A					
5057.5	SC		MOIST	2.5-5.0 CLAYEY SAND: mostly fine to medium sand; some low plasticity fines; dark brown.	2.5								
5055	SM		MOIST	5.0-8.5 SILTY SAND: mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.	5		B	2B					
				NOTE: Seepage observed on sidewall @ 7 FT BGS.	7.5								
5052.5				TEST PIT TERMINATED AT 8.0 FT BGS. FREE WATER ENCOUNTERED AT 8 FEET, SEEPAGE OBSERVED AT 7 FEET	10								
5050					12.5								
5047.5					15								

GROUNDWATER

	DEPTH	HOUR	DATE
▽	7	8:30 AM	2/21/20
▼			

SAMPLE TYPE

B - Bulk Sample

NOTES

Elevation on test pit log is approximate.
NE = not encountered
bgs = Below Existing Ground Surface

PLATE NO.: A-2e

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

SOIL CLASSIFICATION CHART

PLATE A-3

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL CLASSIFICATION NAMES
Course grained soils (More than 50% of the material is larger than No. 200 sieve size)	Gravel and gravelly soils	Clean gravels		GW	Well-graded gravels, gravel-sand mixtures, few or no fines
				GP	Poorly-graded gravels, gravel-sand mixtures, few or no fines
		Gravels with fines		GM	Silty gravels, gravel-sand-silt mixtures
				GC	Clayey gravels, gravel-sand-clay mixtures
	Sand and sandy soils	Clean sands		SW	Well-graded sands, gravelly sands, few or no fines
				SP	Poorly-graded sands, gravelly sands, few or no fines
		Sands with fines		SM	Silty sands, sand-silt mixtures
				SC	Clayey sands, sand-clay mixtures
Fine grained soils (More than 50% of the material is smaller than No. 200 sieve size)	Silts and clays	Liquid Limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
				OL	Organic silts and organic silt-clays of low plasticity
		Liquid Limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
				CH	Inorganic clays of medium to high plasticity
				OH	Organic clays of medium to high plasticity
				PT	Peat or other highly organic soils

NOTES:
1. Dual classifications may occur (e.g. SP-SM, CL-ML, GP-GC)

SOIL SAMPLE TYPES

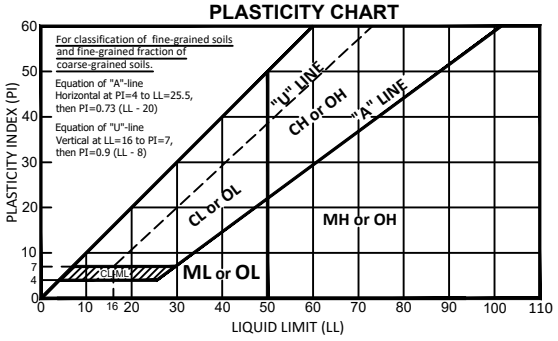
B	Bulk Sample	
S	Standard Penetration Test (2.0" OD, 1.42" ID)	
U	California Modified Sampler (3.0" OD, 2.42" ID)	
T	Thin walled Shelby Tube (3.0" OD)	
R	Rock Core	

GROUNDWATER SYMBOLS

Water level during drilling

Water level after drilling

PLASTICITY CHART



PARTICLE ANGULARITY

Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular	Particles are similar to angular, but have rounded edges
Subrounded	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded	Particles have smoothly curved sides and no edges

PARTICLE SHAPE

Flat	Particles with width/thickness > 3
Elongated	Particles with length/width > 3
Flat and Elongated	Particles meet criteria for both flat and elongated

MOISTURE

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

Weak	Crumbles or breaks with handling or light finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

APPARENT DENSITY OF COHESIONLESS SOIL

	SPT (1.4" ID) N_{60}
Very Loose	< 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	> 50

Based on 60% energy ratio (ER_i). $N_{60} = N_{measured} * (ER_i/60)$

California Modified Sampler can be corrected to SPT by multiplying by 0.62

CONSISTENCY OF COHESIVE SOIL

	SPT (1.4"ID) N_{60}	Unconfined Compressive Strength (psf)	Pocket Penetrometer (tsf)
Very Soft	0 - 1	< 500	< 0.25
Soft	2 - 4	500 - 1,000	0.25 - 0.5
Medium Stiff	5 - 8	1,000 - 2,000	0.5 - 1.0
Stiff	9 - 15	2,000 - 4,000	1.0 - 2.0
Very Stiff	16 - 30	4,000 - 8,000	2.0 - 4.0
Hard	31 - 60	8,000 - 16,000	> 4.0
Very Hard	> 60	> 16,000	

PARTICLE SIZE, Ps

Boulders		Ps > 12"
Cobbles		3" < Ps ≤ 12"
Gravel	coarse	$\frac{3}{4}$" < Ps ≤ 3"
	fine	$\frac{1}{5}$" < Ps ≤ $\frac{3}{4}$"
Sand	coarse	$\frac{1}{16}$" < Ps ≤ $\frac{1}{5}$"
	medium	$\frac{1}{64}$" < Ps ≤ $\frac{1}{16}$"
	fine	$\frac{1}{300}$" < Ps ≤ $\frac{1}{64}$"
Fines		Ps ≤ $\frac{1}{300}$"

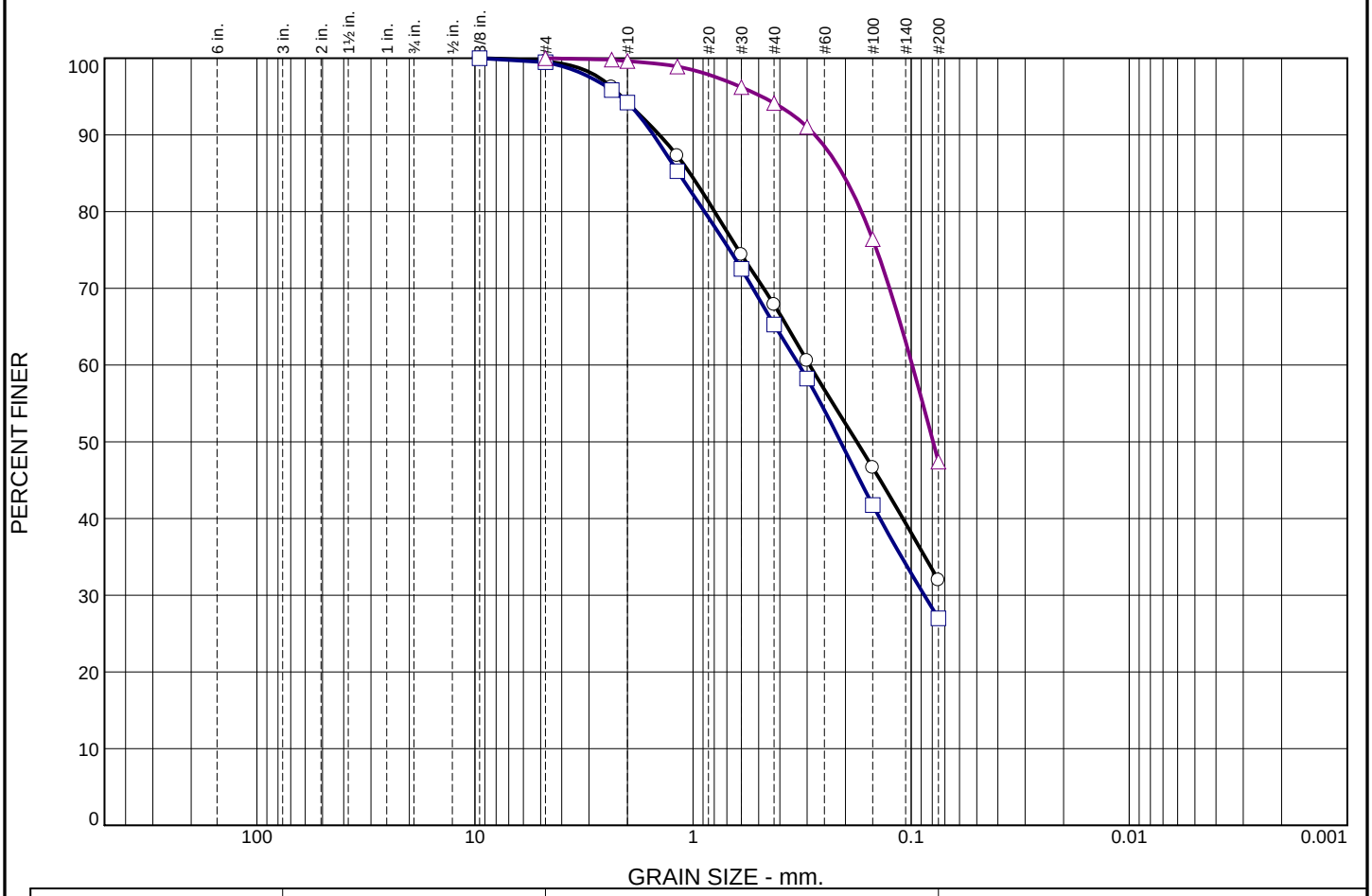
PERCENT OF SOIL, Pp

Trace	Pp < 5%
Few	5 ≤ Pp ≤ 15%
Little	15 ≤ Pp ≤ 30%
Some	30 ≤ Pp ≤ 50%
Mostly	50 ≤ Pp ≤ 100%

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

APPENDIX B

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.4	5.4	26.3	36.0	31.9	
□	0.0	0.0	0.5	5.3	28.9	38.3	27.0	
△	0.0	0.0	0.0	0.4	5.5	46.7	47.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	33	17	1.0329	0.2920	0.1775					
□	31	23	1.1628	0.3263	0.2106	0.0870				
△	32	18	0.2066	0.0988	0.0793					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Clayey Sand	2/25/20	SC	17.2
□ Clayey Sand	2/25/20	SC	28.5
△ Clayey Sand	2/25/20	SC	26.7

Project No. 2556 **Client:** POGGEMEYER

Project: TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION

○ **Source of Sample:** B-1 **Depth:** 7.5 **Sample Number:** 1C

□ **Source of Sample:** B-1 **Depth:** 12.5 **Sample Number:** 1E

△ **Source of Sample:** B-1 **Depth:** 17.5 **Sample Number:** 1G

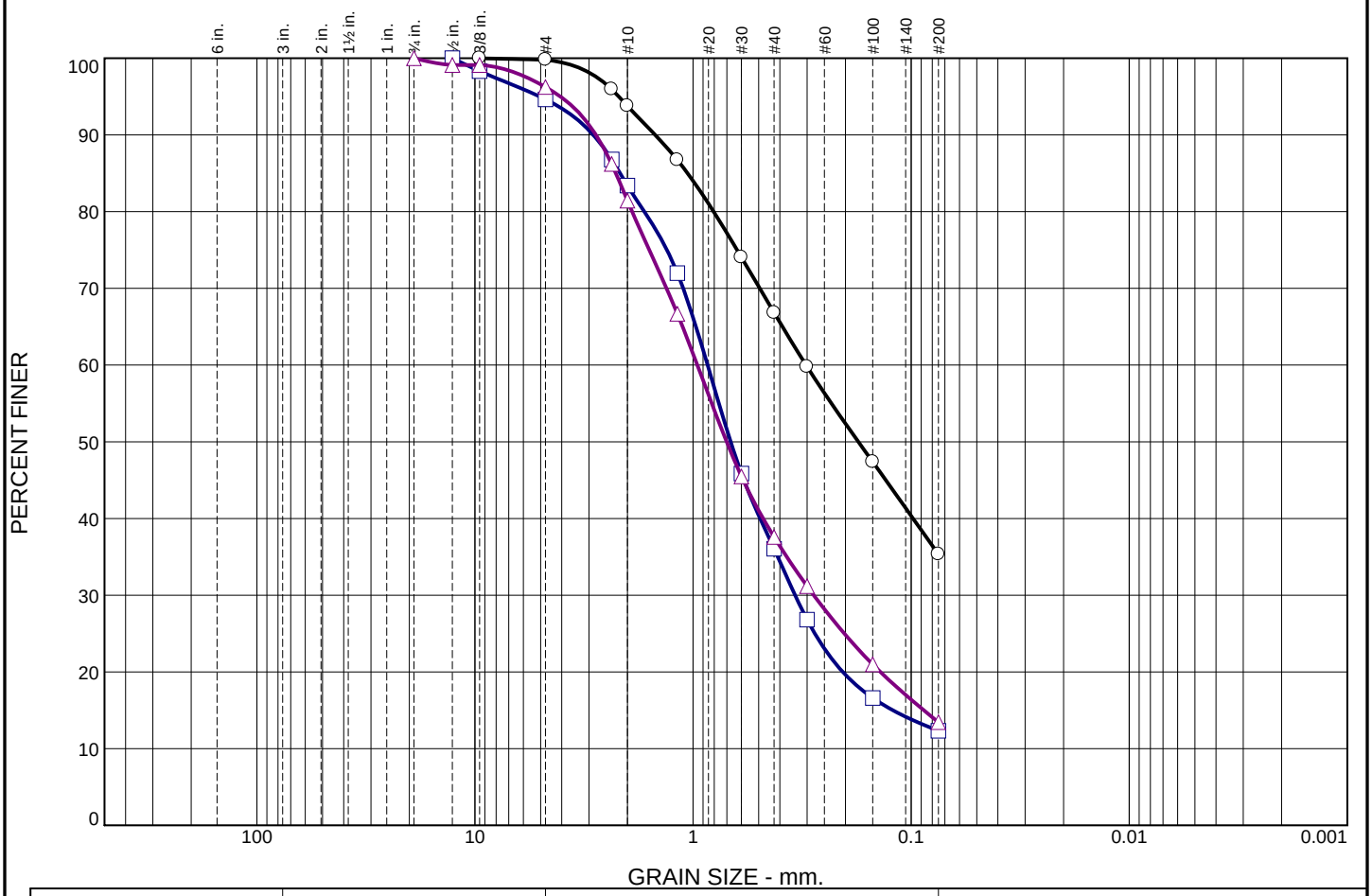
CME CONSTRUCTION MATERIALS ENGINEERS, INC.

Remarks:

PLATE B-1a

Tested By: MP **Checked By:** AH

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.2	6.0	27.0	31.5	35.3	
□	0.0	0.0	5.4	11.2	47.3	23.8	12.3	
△	0.0	0.0	3.8	14.8	43.8	24.2	13.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	36	19	1.0590	0.3033	0.1746					
□	NV	NP	2.1612	0.8578	0.6723	0.3404	0.1213			
△	NV	NP	2.2588	0.9558	0.7014	0.2797	0.0874			

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Clayey Sand	2/25/20	SC	22.9
□ Silty Sand	2/25/20	SM	14.6
△ Silty Sand	2/25/20	SM	13.5

Project No. 2556 **Client:** POGGEMEYER

Project: TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION

○ **Source of Sample:** B-1 **Depth:** 22.5 **Sample Number:** 1I

□ **Source of Sample:** B-2 **Depth:** 7.5 **Sample Number:** 2C

△ **Source of Sample:** B-2 **Depth:** 10.5 **Sample Number:** 2E

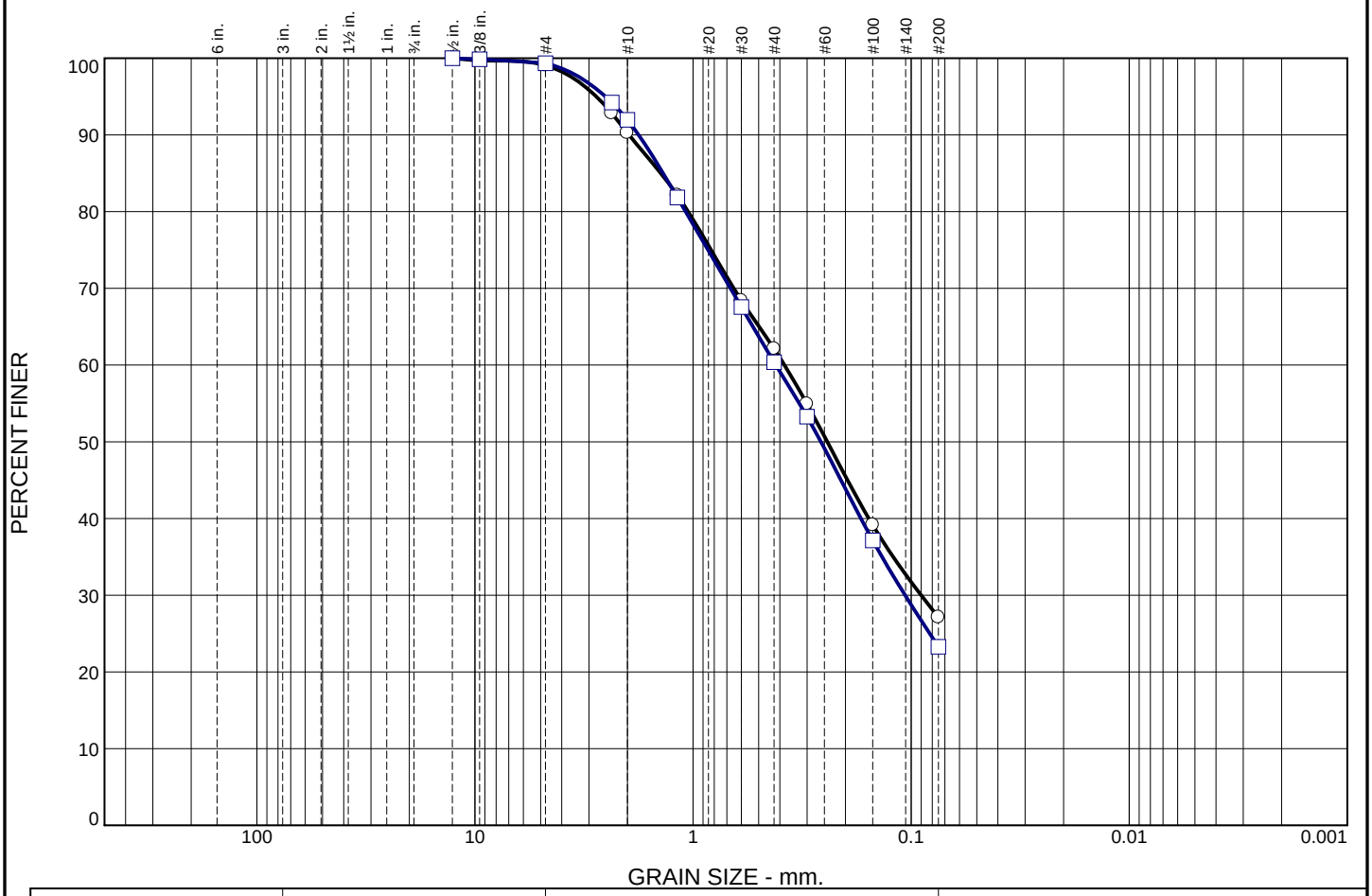
CME CONSTRUCTION MATERIALS ENGINEERS, INC.

Remarks:

PLATE B-1b

Tested By: MP **Checked By:** GM

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.9	8.8	28.2	35.0	27.1	
□	0.0	0.0	0.7	7.3	31.6	37.1	23.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	27	16	1.4051	0.3810	0.2424	0.0899				
□	23	16	1.3717	0.4173	0.2592	0.1066				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ Clayey Sand	2/25/20	SC	11.8
□ Silty, Clayey Sand	2/25/20	SC-SM	10.9

Project No. 2556 **Client:** POGGEMEYER

Project: TRUCKEE MEADOWS FIRE DEPARTMENT - CONSOLIDATION

○ **Source of Sample:** TP-1 **Depth:** 1 **Sample Number:** 1A

□ **Source of Sample:** TP-2 **Depth:** 1 **Sample Number:** 2A

Remarks:

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

PLATE B-1c

Tested By: MP **Checked By:** AH

CONSTRUCTION MATERIALS ENGINEERS, INC.

APPENDIX C

LIQUEFACTION EVALUATION SUMMARY SHEET

Project: Consolidated TMFD- Washoe Valley
Job No. 2556
Date 2/24/2020
Engineer RAR

Earthquake and SPT Inputs:

SPT ER =	80	%	Estimated Based on automatic hammer
EQ(M_w)mag =	6.85	Mw	USGS 2014 Earthquake Deaggregation Data
peak ground acceleration (ah)=	1.00	g	ASCE 7-16 (osphd Earthquake Hazards Program)

Shaded column headings Indicate Input

Boring No.	USCS Soil Classification	Depth to Water ft	Sample Depth ft	Uncorrected SPT Blow Counts N	Plasticity Index[3] %	Fines Content %	Unit Weight of Soil pcf	δv psf	δv'$_0$ psf	C_n	$(N_1)_{60}$	$(N_1)_{60r}$	r_d	ΔN_1	N_1	$(N_1)_{60\text{-}cs}$	CRR	K_m	K_o	CRR_C	CSR	F.O.S_1	*ACC*	Y_{lim}	F_α	Y_{max}	ΔH	ε_v	ΔS inches
B-1	**SC**	6	3	34	16	31.9	115.0	345	345	1.59	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SC**	6	5.5	15	16	31.9	115.0	633	633	1.39	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SC**	6	8	10	16	31.9	115.0	920	795	1.31	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	4.30	0.00	0.00
B-1	**SC**	6	10.5	11	16	31.9	115.0	1208	927	1.26	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	0.70	0.00	0.00
B-1	**SC**	6	13	9	8	47.4	115.0	1495	1058	1.21	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SC**	6	15.5	12	8	47.4	115.0	1783	1190	1.18	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SC**	6	18	10	8	47.4	115.0	2070	1321	1.14	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SC**	6	20.5	18	17	22.9	115.0	2358	1453	1.11	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SC**	6	23	12	17	22.9	115.0	2645	1584	1.08	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SC**	6	25.5	33	17	22.9	115.0	2933	1716	1.05	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SP-SC**	6	28	34	11	15	115.0	3220	1847	1.03	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SP-SC**	6	30.5	38	11	15	115.0	3508	1979	1.01	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SC**	6	35.5	35	8	47.4	115.0	4083	2242	0.96	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-1	**SC**	6	40.5	40	8	47.4	115.0	4658	2505	0.93	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
																							TOTAL ANTICIPATED SETTLEMENT$_2$:						0.00

Designates soil layers that are potentially liquefiable located below the water table.

1. N.L.-Not Liquefiable based on material type and plasticity

2. Liquefaction Analysis based on EERI, Soil Liquefaction During Earthquakes, by Idriss and Boulanger (2006)

3. N.P.=Non-plastic

Notations:

δv	total overburden pressure	**$(N_1)_{60\text{-}cs}$**	Clean sand equivalent blows	**Ɣlim**	limiting shear strain
δv'$_0$	effective overburden pressure	**CRR**	Critical Resistance Ratio	**Fα**	parameter defining max. shear strain for a given FOS
C_n	Overburden SPT correction factor	**K_m**	Earthquake magnitude Correction Factor	**Ɣmax**	Maximum Shear Strain
CSR	Critical Stress Ratio	**K_o**	Stress Level Correction Factor	**ΔH**	Layer thickness (feet)
$(N_1)_{60}$	corrected blow counts	**CRR_C**	Corrected Cylic Resistance Ratio	**εv**	vertical Reconsolidation Strain
$(N1)_{60r}$	Reduces $(N_1)_{60}$ values to a recommended maximum of 37	**F.O.S**	Factor of Safety	**ΔS**	Total Estimate Settlement (inches)
r_d	stress reduction factor	**ACC**	Acceleration to Induce Liquefaction		

CME CONSTRUCTION MATERIALS ENGINEERS INC.
6980 SIERRA CENTER PARWAY, SUITE 90 RENO, NEVADA 89511

Poggemeyer

TMFG Washoe Valley Consolidation

Washoe City, NEVADA

PROJECT No.: 2556 **Date: 02/24/2020**

PLATE

C-1a

LIQUEFACTION EVALUATION SUMMARY SHEET

Project: Consolidated TMFD- Washoe Valley
Job No. 2556
Date 2/24/2020
Engineer RAR

Earthquake and SPT Inputs:

SPT ER =	80	%	Estimated Based on automatic hammer
EQ(M_w)mag =	6.85	Mw	USGS 2008 Earthquake Deaggregation Data
peak ground acceleration (ah)=	1.00	g	ASCE 7-16 (USGS Earthquake Hazards Program)

Shaded column headings Indicate Input

Boring No.	USCS Soil Classification	Depth to Water ft	Sample Depth ft	Uncorrected SPT Blow Counts N	Plasticity Index[3] %	Fines Content %	Unit Weight of Soil pcf	δv psf	δv'$_0$ psf	C_n	$(N_1)_{60}$	$(N_1)_{60r}$	r_d	ΔN_1	N_1	$(N_1)_{60\text{-}cs}$	CRR	K_m	K_o	CRR_C	CSR	F.O.S$_1$	*ACC*	Y_{lim}	F_α	Y_{max}	ΔH	ε_v	ΔS inches
B-2	**SC**	6	3	28	11	27.1	115.0	345	345	1.59	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-2	**SM**	6	5.5	21	N.P.	12.3	115.0	633	633	1.39	N.A.	N.A.	0.989	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-2	**SM**	6	8	22	N.P.	12.3	115.0	920	795	1.31	42.3	37.0	0.980	2.25	39.2	44.5	3.26	1.19	1.00	3.87	0.62	6.23	5.25	0.00	-1.15	0.00	4.30	0.00	0.00
B-2	**SM**	6	9.5	15	N.P.	13	115.0	1093	874	1.28	30.7	30.7	0.974	2.54	33.2	33.2	0.79	1.19	1.00	0.94	0.67	1.41	1.19	0.03	-0.31	0.02	0.70	0.00	0.02
B-2	**SM**	6	11	28	N.P.	13.4	115.0	1265	953	1.25	56.0	37.0	0.967	2.71	39.7	58.7	3.76	1.19	1.00	4.46	0.70	6.35	5.35	0.00	-2.31	0.00	2.50	0.00	0.00
B-2	**SC**	6	12.5	29	8	27	115.0	1438	1032	1.22	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-2	**SC**	6	14	35	8	27	115.0	1610	1111	1.20	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
B-2	**SC**	6	15.5	30	8	27	115.0	1783	1190	1.18	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	1.19	N.A.	N.A.	N.A.	N.L.	N.A.	0.00	0.00	0.00	2.50	0.00	0.00
																											TOTAL ANTICIPATED SETTLEMENT$_2$:		0.02

Designates soil layers that are potentially liquefiable located below the water table.

1. N.L.-Not Liquefiable based on material type and plasticity

2. Liquefaction Analysis based on EERI, Soil Liquefaction During Earthquakes, by Idriss and Boulanger (2006)

3. N.P.=Non-plastic

Notations:

δv	total overburden pressure	$(N_1)_{60\text{-}cs}$	Clean sand equivalent blows	Ylim	limiting shear strain
δv'$_0$	effective overburden pressure	CRR	Critical Resistance Ratio	Fα	parameter defining max. shear strain for a given FOS
C_n	Overburden SPT correction factor	K_m	Earthquake magnitude Correction Factor	Ymax	Maximum Shear Strain
CSR	Critical Stress Ratio	K_o	Stress Level Correction Factor	ΔH	Layer thickness (feet)
$(N_1)_{60}$	corrected blow counts	CRR_C	Corrected Cylic Resistance Ratio	εv	vertical Reconsolidation Strain
$(N1)_{60r}$	Reduces $(N_1)_{60}$ values to a recommended maximum of 37	F.O.S	Factor of Safety	ΔS	Total Estimate Settlement (inches)
r_d	stress reduction factor	ACC	Acceleration to Induce Liquefaction		

CME CONSTRUCTION MATERIALS ENGINEERS INC.
6980 SIERRA CENTER PARWAY, SUITE 90 RENO, NEVADA 89511

Poggemeyer
TMFD Consolidated
Washoe City, NEVADA

PROJECT No.: 2556 **Date: 02/24/2020**

PLATE
C-1b

CME CONSTRUCTION MATERIALS ENGINEERS, INC.

APPENDIX D

TEST RESULTS - PERCOLATION TEST 1A

PROJECT: TMFD CONSOLIDATION **PROJECT NO: 2556**
CLIENT: POGGEMEYER DESIGN GROUP

COMMENTS:

Percolation testing was completed inside test pit **TP-1** on a bench located at a depth of about **3.0** feet below the existing ground surface within **clayey sand (SC)**. The percolation test hole included a **4 1/4 inch O.D. (4 I.D.)** perforated PVC sleeve with a 4**.6 inch** O.D. gravel filled hole. The soil at the tested location met the requirements for a "**SLOW** test". Calculations to correct the field percolation rate have been completed to adjust for the gravel pack, hole diameter, and PVC sleeve.

LOG OF TEST PIT TP-1

Depth	Description
0	0.0 - 3.0: CLAYEY SAND (SC); mostly fine to medium sand; some medium plasticity fines; dark brown.
	3.0 - 10.0: CLAYEY SAND (SC); mostly fine to coarse sand; some low plasticity fines; green to brown.
5	
	TOTAL DEPTH: 10 ft
	GROUNDWATER: 7 ft
10	
15	

DATE OF TESTING:	2/20/2020
SURFACE ELEVATION	-
DEPTH TO TEST?	3.0 FT
PRESOAK TESTING:	YES (2/19/2019)
Time at Start of Testing:	9:20 AM

TIME OF REFILL	INTERVAL	DEPTH OF WATER	DROP IN WATER	PERCOLATION RATE
	MINUTES	INCHES	INCHES	MINUTES/INCH
9:20 AM		Initial Depth: 6"		
9:50 AM	30	Refill to 6"	1/2	60.0
10:20 AM	30	Refill to 6"	1/4	120.0
10:50 AM	30	Refill to 6"	1/2	60.0
11:20 AM	30	Refill to 6"	1/4	120.0
11:50 AM	30	Refill to 6"	1/8	240.0
12:20 PM	30	Refill to 6"	1/8	240.0
12:50 PM	30	Refill to 6"	1/8	240.0
Stabilized Rate:			**1/8**	**240.0**

Notes:

FIELD PERCOLATION RATE = >120 min/inch

CORRECTED PERCOLATION RATE = >120 min/inch

CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511

TMFD CONSOLIDATION
PERCOLATION TEST RESULTS
WASHOE VALLEY, NEVADA

PLATE

D-1a

GRAVEL CORRECTION CALCULATION - PERCOLATION TEST 1A

PROJECT: TMFD CONSOLIDATION **PROJECT NO: 2556**
CLIENT: POGGEMEYER DESIGN GROUP

Oliveieri-Roche Correction for the Ratio of Perc Hole Volume to Wetted Area

h =	average height of water in hole during test	**h =**	3.1	inches
d =	diameter of test hole	**d =**	4.6	inches
r =	radius of test hole	**r =**	2.3	inches
CF =	correction factor for perc hole volume to wetted area	**CF =**	1.81	

$$= \frac{(6h / (6+2h))}{(rh / (r+2h))}$$

Void Space Calculation

V_1 =	volume of container	V_1 =	1620	mL
V_2 =	volume of voids	V_2 =	760	mL
X =	void space	**X =**	0.47	

$$= \frac{V2}{V1}$$

Correction for use of perforated pipe + gravel

R_1 =	radius to the outside diameter of perforated pipe	R_1 =	2.125	inches
r =	radius of test hole	**r =**	2.3	inches
X =	void space in gravel	**X =**	0.47	
h =	average height of water in hole during test	**h =**	3.1	inches
V =	volume of hole below **h** without gravel and liner	**V =**	50.90	in^3
V_p =	volume inside perforated pipe	V_p =	43.45	in^3
V_g =	volume of voids within gravel	V_g =	3.50	in^3
V_{pg} =	volume of voids due to pipe and gravel	V_{pg} =	46.94	in^3
AF =	adjustment factor due to gravel	**AF =**	1.08	

Percolation Correct Calculation

CF =	correction factor for perc hole volume to we	**CF =**	1.81	
AF =	adjustment factor due to gravel	**AF =**	1.08	
FPR =	field percolation rate	**FPR =**	>120	min/inch
CPR =	corrected percolation rate	**CPR =**	######	min/inch
	= FPR*CF*AF			

CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511

TMFD CONSOLIDATION
PERCOLATION TEST RESULTS
WASHOE VALLEY, NEVADA

PLATE
D-1b

TEST RESULTS - PERCOLATION TEST 1B

PROJECT: TMFD CONSOLIDATION **PROJECT NO: 2556**
CLIENT: POGGEMEYER DESIGN GROUP

COMMENTS:

Percolation testing was completed inside test pit **TP-1** on a bench located at a depth of about 5**.0** feet below the existing ground surface within **clayey sand (SC)**. The percolation test hole included a **4 1/4 inch O.D. (4 I.D.)** perforated PVC sleeve with a 4**.5 inch** O.D. gravel filled hole. The soil at the tested location met the requirements for a "**SLOW** test". Calculations to correct the field percolation rate have been completed to adjust for the gravel pack, hole diameter, and PVC sleeve.

LOG OF TEST PIT TP-1

Depth	Description
0	0.0 - 3.0: CLAYEY SAND (SC); mostly fine to medium sand; some medium plasticity fines; dark brown.
	3.0 - 10.0: CLAYEY SAND (SC); mostly fine to coarse sand; some low plasticity fines; green to brown.
5	
	TOTAL DEPTH: 10 ft
	GROUNDWATER: 6 ft
10	
15	

DATE OF TESTING:	2/20/2020
SURFACE ELEVATION	-
DEPTH TO TEST?	5.0 FT
PRESOAK TESTING:	YES (2/19/2019)
Time at Start of Testing:	9:22 AM

TIME OF REFILL	INTERVAL	DEPTH OF WATER	DROP IN WATER	PERCOLATION RATE
	MINUTES	INCHES	INCHES	MINUTES/INCH
9:22 AM		Initial Depth: 6"		
9:52 AM	30	Refill to 6"	1/4	120.0
10:22 AM	30	Refill to 6"	1/4	120.0
10:52 AM	30	Refill to 6"	1/4	120.0
11:22 AM	30	Refill to 6"	1/4	120.0
11:52 AM	30	Refill to 6"	1/8	240.0
12:22 PM	30	Refill to 6"	1/8	240.0
12:52 PM	30	Refill to 6"	1/8	240.0
Stabilized Rate:			**1/8**	**240.0**

Notes:

FIELD PERCOLATION RATE = >120 min/inch

CORRECTED PERCOLATION RATE = >120 min/inch

CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511

TMFD CONSOLIDATION
PERCOLATION TEST RESULTS
WASHOE VALLEY, NEVADA

PLATE

D-2c

GRAVEL CORRECTION CALCULATION - PERCOLATION TEST 1B

PROJECT: TMFD CONSOLIDATION **PROJECT NO: 2556**
CLIENT: POGGEMEYER DESIGN GROUP

Oliveieri-Roche Correction for the Ratio of Perc Hole Volume to Wetted Area

h =	average height of water in hole during test	**h =**	3.1	inches
d =	diameter of test hole	**d =**	4.5	inches
r =	radius of test hole	**r =**	2.3	inches
CF =	correction factor for perc hole volume to wetted area	**CF =**	1.84	

$$= \frac{(6h / (6+2h))}{(rh / (r+2h))}$$

Void Space Calculation

V_1 =	volume of container	V_1 =	1620	mL
V_2 =	volume of voids	V_2 =	760	mL
X =	void space	**X =**	0.47	

$$= \frac{V2}{V1}$$

Correction for use of perforated pipe + gravel

R_1 =	radius to the outside diameter of perforated pipe	R_1 =	2.125	inches
r =	radius of test hole	**r =**	2.3	inches
X =	void space in gravel	**X =**	0.47	
h =	average height of water in hole during test	**h =**	3.1	inches
V =	volume of hole below **h** without gravel and liner	**V =**	48.71	in^3
V_p =	volume inside perforated pipe	V_p =	43.45	in^3
V_g =	volume of voids within gravel	V_g =	2.47	in^3
V_{pg} =	volume of voids due to pipe and gravel	V_{pg} =	45.91	in^3
AF =	adjustment factor due to gravel	**AF =**	1.06	

Percolation Correct Calculation

CF =	correction factor for perc hole volume to we	**CF =**	1.84	
AF =	adjustment factor due to gravel	**AF =**	1.06	
FPR =	field percolation rate	**FPR =**	>120	min/inch
CPR =	corrected percolation rate	**CPR =**	######	min/inch
	= FPR*CF*AF			

CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511

TMFD CONSOLIDATION
PERCOLATION TEST RESULTS
WASHOE VALLEY, NEVADA

PLATE
D-2d

TEST RESULTS - PERCOLATION TEST 2A

PROJECT: TMFD CONSOLIDATION **PROJECT NO: 2556**
CLIENT: POGGEMEYER DESIGN GROUP

COMMENTS:

Percolation testing was completed inside test pit **TP-2** on a bench located at a depth of about **3.0** feet below the existing ground surface within **clayey sand (SC)**. The percolation test hole included a **4 1/4 inch O.D. (4 I.D.)** perforated PVC sleeve with a **6.0 inch** O.D. gravel filled hole. The soil at the tested location met the requirements for a "**SLOW** test". Calculations to correct the field percolation rate have been completed to adjust for the gravel pack, hole diameter, and PVC sleeve.

LOG OF TEST PIT TP-2

Depth	Description
0	0.0 - 4.0: CLAYEY SAND (SC); mostly fine to medium sand; some medium plasticity fines; dark brown.
	4.0 - 8.5: POORLY GRADED SAND WITH CLAY (SP-SC); mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.
5	
	TOTAL DEPTH: 8.5 ft
	GROUNDWATER: 7 ft
10	
15	

DATE OF TESTING: 2/20/2020
SURFACE ELEVATION -
DEPTH TO TEST? 3.0 FT
PRESOAK TESTING: YES (2/19/2019)
Time at Start of Testing: 9:30 AM

TIME OF REFILL	INTERVAL	DEPTH OF WATER	DROP IN WATER	PERCOLATION RATE
	MINUTES	INCHES	INCHES	MINUTES/INCH
9:30 AM		Initial Depth: 6"		
10:00 AM	30	Refill to 6"	1/16	480.0
10:30 AM	30	Refill to 6"	1/16	480.0
11:00 AM	30	Refill to 6"	1/16	480.0
11:30 AM	30	Refill to 6"	1/16	480.0
12:00 PM	30	Refill to 6"	1/8	240.0
12:30 PM	30	Refill to 6"	1/4	120.0
1:00 PM	30	Refill to 6"	1/4	120.0
Stabilized Rate:			**1/4**	**120.0**

Notes:

FIELD PERCOLATION RATE = 120.0 min/inch
CORRECTED PERCOLATION RATE = 235.5 min/inch

CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511

TMFD CONSOLIDATION
PERCOLATION TEST RESULTS
WASHOE VALLEY, NEVADA

PLATE
D-1f

GRAVEL CORRECTION CALCULATION - PERCOLATION TEST 2A

PROJECT: TMFD CONSOLIDATION **PROJECT NO: 2556**
CLIENT: POGGEMEYER DESIGN GROUP

Oliveieri-Roche Correction for the Ratio of Perc Hole Volume to Wetted Area

h =	average height of water in hole during test	**h =**	3.1	inches
d =	diameter of test hole	**d =**	4.5	inches
r =	radius of test hole	**r =**	2.3	inches
CF =	correction factor for perc hole volume to wetted area	**CF =**	1.85	

$$= \frac{(6h / (6+2h))}{(rh / (r+2h))}$$

Void Space Calculation

V_1 =	volume of container	V_1 =	1620	mL
V_2 =	volume of voids	V_2 =	760	mL
X =	void space	**X =**	0.47	

$$= \frac{V2}{V1}$$

Correction for use of perforated pipe + gravel

R_1 =	radius to the outside diameter of perforated pipe	R_1 =	2.125	inches
r =	radius of test hole	**r =**	2.3	inches
X =	void space in gravel	**X =**	0.47	
h =	average height of water in hole during test	**h =**	3.1	inches
V =	volume of hole below **h** without gravel and liner	**V =**	49.70	in^3
V_p =	volume inside perforated pipe	V_p =	44.33	in^3
V_g =	volume of voids within gravel	V_g =	2.52	in^3
V_{pg} =	volume of voids due to pipe and gravel	V_{pg} =	46.85	in^3
AF =	adjustment factor due to gravel	**AF =**	1.06	

Percolation Correct Calculation

CF =	correction factor for perc hole volume to we	**CF =**	1.85	
AF =	adjustment factor due to gravel	**AF =**	1.06	
FPR =	field percolation rate	**FPR =**	120.0	min/inch
CPR =	corrected percolation rate	**CPR =**	235.5	min/inch
=	**FPR*CF*AF**			

CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511

TMFD CONSOLIDATION
PERCOLATION TEST RESULTS
WASHOE VALLEY, NEVADA

PLATE
D-1g

TEST RESULTS - PERCOLATION TEST 2B

PROJECT: TMFD CONSOLIDATION **PROJECT NO: 2556**
CLIENT: POGGEMEYER DESIGN GROUP

COMMENTS:

Percolation testing was completed inside test pit **TP-2** on a bench located at a depth of about 5**.0** feet below the existing ground surface within **poorly graded sand with clay (SP-SC)**. The percolation test hole included a **4 1/4 inch O.D. (4 I.D.)** perforated PVC sleeve with a **4.5 inch** O.D. gravel filled hole. The soil at the tested location met the requirements for a "**SLOW** test". Calculations to correct the field percolation rate have been completed to adjust for the gravel pack, hole diameter, and PVC sleeve.

LOG OF TEST PIT TP-2

Depth	Description
0	0.0 - 4.0: CLAYEY SAND (SC); mostly fine to medium sand; some medium plasticity fines; dark brown.
	4.0 - 8.5: POORLY GRADED SAND WITH CLAY (SP-SC); mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.
5	
	TOTAL DEPTH: 8.5 ft
	GROUNDWATER: 7 ft
10	
15	

DATE OF TESTING: 2/20/2020
SURFACE ELEVATION -
DEPTH TO TEST? 5.0 FT
PRESOAK TESTING: YES (2/19/2019)
Time at Start of Testing: 9:32 AM

TIME OF REFILL	INTERVAL	DEPTH OF WATER	DROP IN WATER	PERCOLATION RATE
	MINUTES	INCHES	INCHES	MINUTES/INCH
9:32 AM		Initial Depth: 6"		
10:02 AM	30	Refill to 6"	3 1/8	9.6
10:32 AM	30	Refill to 6"	3 1/2	8.6
11:02 AM	30	Refill to 6"	3 1/2	8.6
11:32 AM	30	Refill to 6"	3 1/8	9.6
12:02 PM	30	Refill to 6"	2 1/2	12.0
12:32 PM	30	Refill to 6"	3	10.0
1:02 PM	30	Refill to 6"	3	10.0
Stabilized Rate:			**3**	**10.0**

Notes:

FIELD PERCOLATION RATE = 10.0 min/inch
CORRECTED PERCOLATION RATE = 21.2 min/inch

CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511

TMFD CONSOLIDATION
PERCOLATION TEST RESULTS
WASHOE VALLEY, NEVADA

PLATE
D-1h

GRAVEL CORRECTION CALCULATION - PERCOLATION TEST 2B

PROJECT: TMFD CONSOLIDATION **PROJECT NO: 2556**
CLIENT: POGGEMEYER DESIGN GROUP

Oliveieri-Roche Correction for the Ratio of Perc Hole Volume to Wetted Area

h =	average height of water in hole during test	**h =**	4.5	inches
d =	diameter of test hole	**d =**	4.5	inches
r =	radius of test hole	**r =**	2.3	inches
CF =	correction factor for perc hole volume to wetted area	**CF =**	2.00	

$$= \frac{(6h / (6+2h))}{(rh / (r+2h))}$$

Void Space Calculation

V_1 =	volume of container	V_1 =	1620	mL
V_2 =	volume of voids	V_2 =	760	mL
X =	void space	**X =**	0.47	

$$= \frac{V2}{V1}$$

Correction for use of perforated pipe + gravel

R_1 =	radius to the outside diameter of perforated pipe	R_1 =	2.125	inches
r =	radius of test hole	**r =**	2.3	inches
X =	void space in gravel	**X =**	0.47	
h =	average height of water in hole during test	**h =**	4.5	inches
V =	volume of hole below **h** without gravel and liner	**V =**	71.57	in^3
V_p =	volume inside perforated pipe	V_p =	63.84	in^3
V_g =	volume of voids within gravel	V_g =	3.63	in^3
V_{pg} =	volume of voids due to pipe and gravel	V_{pg} =	67.47	in^3
AF =	adjustment factor due to gravel	**AF =**	1.06	

Percolation Correct Calculation

CF =	correction factor for perc hole volume to we	**CF =**	2.00	
AF =	adjustment factor due to gravel	**AF =**	1.06	
FPR =	field percolation rate	**FPR =**	10.0	min/inch
CPR =	corrected percolation rate	**CPR =**	21.2	min/inch
	= FPR*CF*AF			

CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511

TMFD CONSOLIDATION
PERCOLATION TEST RESULTS
WASHOE VALLEY, NEVADA

PLATE
D-1i

TEST RESULTS - PERCOLATION TEST 3

PROJECT: TMFD CONSOLIDATION **PROJECT NO: 2556**
CLIENT: POGGEMEYER DESIGN GROUP

COMMENTS:

Percolation testing was completed inside test pit **TP-3** on a bench located at a depth of about **2.5** feet below the existing ground surface within **clayey sand (SC)**. The percolation test hole included a **4 1/4 inch O.D. (4 I.D.)** perforated PVC sleeve with a **6.0 inch** O.D. gravel filled hole. The soil at the tested location met the requirements for a "**SLOW** test". Calculations to correct the field percolation rate have been completed to adjust for the gravel pack, hole diameter, and PVC sleeve.

LOG OF TEST PIT TP-3

Depth	Description
0	0.0 - 3.0: CLAYEY SAND (SC); mostly fine to medium sand; some medium plasticity fines; dark brown.
	3.0 - 7.0: POORLY GRADED SAND WITH CLAY (SP-SC); mostly fine to coarse sand; few low plasticity fines; trace fine subangular gravel; strong brown.
5	
	TOTAL DEPTH: 7ft
	GROUNDWATER: 6ft
10	
15	

DATE OF TESTING: 2/20/2020
SURFACE ELEVATION -
DEPTH TO TEST? 2.5 FT
PRESOAK TESTING: YES (2/19/2019)
Time at Start of Testing: 9:35 AM

TIME OF REFILL	INTERVAL	DEPTH OF WATER	DROP IN WATER	PERCOLATION RATE
	MINUTES	INCHES	INCHES	MINUTES/INCH
9:35 AM		Initial Depth: 6"		
10:05 AM	30	Refill to 6"	1/16	480.0
10:35 AM	30	Refill to 6"	1/16	480.0
11:05 AM	30	Refill to 6"	1/8	240.0
11:35 AM	30	Refill to 6"	1/8	240.0
12:05 PM	30	Refill to 6"	1/8	240.0
12:35 PM	30	Refill to 6"	1/8	240.0
1:05 PM	30	Refill to 6"	1/8	240.0
Stabilized Rate:			**1/8**	**240.0**

Notes:

FIELD PERCOLATION RATE = >120 min/inch
CORRECTED PERCOLATION RATE = >120 min/inch

CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511

TMFD CONSOLIDATION
PERCOLATION TEST RESULTS
WASHOE VALLEY, NEVADA

PLATE
D-1j

GRAVEL CORRECTION CALCULATION - PERCOLATION TEST 3

PROJECT: TMFD CONSOLIDATION **PROJECT NO: 2556**
CLIENT: POGGEMEYER DESIGN GROUP

Oliveieri-Roche Correction for the Ratio of Perc Hole Volume to Wetted Area

h =	average height of water in hole during test	**h =**	3.1	inches
d =	diameter of test hole	**d =**	4.5	inches
r =	radius of test hole	**r =**	2.3	inches
CF =	correction factor for perc hole volume to wetted area	**CF =**	1.84	

$$= \frac{(6h / (6+2h))}{(rh / (r+2h))}$$

Void Space Calculation

V_1 =	volume of container	V_1 =	1620	mL
V_2 =	volume of voids	V_2 =	760	mL
X =	void space	**X =**	0.47	

$$= \frac{V2}{V1}$$

Correction for use of perforated pipe + gravel

R_1 =	radius to the outside diameter of perforated pipe	R_1 =	2.125	inches
r =	radius of test hole	**r =**	2.3	inches
X =	void space in gravel	**X =**	0.47	
h =	average height of water in hole during test	**h =**	3.1	inches
V =	volume of hole below **h** without gravel and liner	**V =**	48.71	in^3
V_p =	volume inside perforated pipe	V_p =	43.45	in^3
V_g =	volume of voids within gravel	V_g =	2.47	in^3
V_{pg} =	volume of voids due to pipe and gravel	V_{pg} =	45.91	in^3
AF =	adjustment factor due to gravel	**AF =**	1.06	

Percolation Correct Calculation

CF =	correction factor for perc hole volume to we	**CF =**	1.84	
AF =	adjustment factor due to gravel	**AF =**	1.06	
FPR =	field percolation rate	**FPR =**	>120	min/inch
CPR =	corrected percolation rate	**CPR =**	######	min/inch
	= FPR*CF*AF			

CME CONSTRUCTION MATERIALS ENGINEERS INC.
300 Sierra Manor Drive, Suite 1
Reno, Nevada 89511

TMFD CONSOLIDATION
PERCOLATION TEST RESULTS
WASHOE VALLEY, NEVADA

PLATE
D-1k