Appendix H
Preliminary Drainage Report

1st Submittal

4/12/2024

Preliminary Drainage Report

Miro Way Industrial – Scheme 24
Rialto, California

PPD# 2023-XXXX

Prepared for:

Lewis-Hillwood Rialto Company, LLC

MIRO WAY INDUSTRIAL

Preliminary Drainage Report
PPD# 2023-XXXX

APRIL 2024 | FIRST SUBMITTAL

Prepared By:

Kimley-Horn

This Preliminary Drainage Report has been prepared by Kimley-Horn and Associates, Inc. under the direct supervision of the following Registered Civil engineer. The undersigned attests to the technical data contained in this study, and to the qualifications of technical specialists providing engineering computations upon which the recommendations and conclusions are based.

Registered Civil Engineer	04/12/2024 Date

Table of Contents

Figures

Tables

Appendices

1 INTRODUCTION

1.1 PROJECT DESCRIPTION AND PURPOSE

This Drainage Report is provided in support of the grading permit submittal for the proposed Miro Way Industrial development in Rialto, California.

The proposed project is located between North Linden Avenue and West Ayala Drive (**See Figure 1-1)** and intends to develop three warehouse buildings totaling ± 415,715 SF. The project site is approximately 23.90 acres and will include proposed landscaping, utilities, and offsite improvements. The site is currently undeveloped with an existing dirt road that will be improved as an extension of the public road, Miro Way, which is about 1,700 linear feet of planned development.

This drainage report includes the hydrologic analysis for the existing and proposed conditions, a hydraulic analysis of the onsite storm drain network, and an analysis of the proposed onsite underground chambers. The San Bernardino County Flood Control Hydrology Standards and CivilDesign (CivilD) software program will be used to analyze the site(s).

Figure 1–1 Project Location Map

2 PROJECT SETTING

2.1 TOPOGRAPHY

The existing topography generally drains from the northwest corner (elevation 1406’) to the southeast corner (elevation 1383’), with approximately 23’ of fall across the total portion of the site. Existing flows are conveyed towards North Ayala Drive where existing curb and gutter is present.

2.2 PRECIPITATION

Precipitation values for the hydrologic analysis were determined` from site specific precipitation frequency estimates published online in the NOAA Atlas 14. For this site (Rialto, California) the 100-year, 1-hour storm precipitation depth equal to 1.69 inches was used in both the storm water flow and volume calculations. The 100-year 24-hour and 2-year 24-hour Precipitation depths equal to 7.73 inches and 3.37 inches respectively were used in the volume calculations. **Appendix A** contains the site-specific tabular output from NOAA Atlas 14.

2.3 WATERSHED DESCRIPTION

The project is relatively flat, and the regional topography generally slopes from northwest to southeast. The project site is part of a larger drainage area tributary to the San Bernardino County Flood Control District Cactus Basin System and part of the Renaissance specific plan. The Cactus Basin System is a network of five detention basins that are located between Cactus Avenue and Ayala Drive. Runoff from this project will eventually flow into Cactus Basin #3. Additionally, the site is located in the East Etiwana Creek-Santa Ana River Watershed.

2.4 SOIL TYPES

The type of soil and soil conditions are major factors affecting infiltration and resultant storm water runoff. The Natural Resources Conservation Service (NRCS) has classified soils into four general hydrologic soil groups for comparing infiltration and runoff rates. The groups are based on properties that influence runoff, such as water infiltration rate, texture, natural discharge and moisture condition. The runoff potential is based on the amount of runoff at the end of a long duration storm that occurs after wetting and swelling of the soil not protected by vegetation.

Using the NRCS GIS soil data, this site was identified as predominately Tujunga loamy sand (TuB) and Tujunga gravelly loamy sand (TvC). Correlating this soil type name to the hydrologic classifications per San Bernardino Hydrology Manual Page C-48 the soil is classified as Type A soil. Group A soils typically have low runoff potential with high infiltration rates when thoroughly wetted and consist chiefly of deep, well-drained sands or gravels. **See Appendix B** for soil type classifications.

2.5 LAND USE

The project site is located within the City of Rialto's Renaissance Specific Plan and is designated as industrial/warehouse uses.

2.6 GROUNDWATER

According to Preliminary Geotechnical Investigation Report performed by Leighton and Associates, Inc., Project No. 021751-001, dated August 2006, groundwater is estimated at a depth between 300 feet and 450 feet below ground surface, and is not expected to be a concern for this project.

2.7 FEMA MAPPING

The project site is covered FEMA map number 06071C8657H. This map is generated by the FEMA Flood Insurance Rate Map (FIRM) for San Bernardino County, California, and Incorporated Areas. The site is classified as Zone X, which is an area of minimal flooding. The effective FEMA map is dated August 28, 2008, and is provided in **Appendix C.**

3 SITE CONDITIONS

3.1 EXISTING SITE CONDITIONS

Based upon survey and field observation, the vacant project site has two drainage areas with runoff generally flowing southeast towards North Ayala Drive. North Ayala Drive contains existing curb and gutter that conveys project runoff into the existing public storm drain network. Refer to the **Existing Drainage Exhibit,** provided within Appendix D, for more information.

3.2 PROPOSED SITE CONDITIONS

Two warehouse buildings are proposed as part of the project. Each building will have at least one subsurface infiltration basin that will be developed. As shown in the **Proposed Drainage Exhibit, included in Appendix D,** buildings 2 will be the only building that will utilize three subsurface infiltration basins. Stormwater will be captured and conveyed via roof drains, inlets, trench drains, and the proposed underground storm drain network that will treat and infiltrate runoff. The four proposed subsurface basins with risers/orifices will serve as a water quality BMPs and underground storage facility that will detain and mitigate peak flow rates.

BMP 1 and BMP 2, as shown in the proposed drainage exhibit, propose to discharge project 100-year overflows into the existing 78" RCP storm drain along the proposed extension of Miro Way. BMP 3 and 4, 100-year overflows will discharge into Ayala Drive via a bubbler system. Both conditions will discharge allowable flows as discussed in Section 4 below. For all water quality calculations and documentation refer to the Preliminary Water Quality Management Plan. The site hydrologic basins were delineated based on the proposed grading. Refer to the Proposed Drainage Exhibit, included within **Appendix D**.

3.3 EXISTING OFFSITE CONDITIONS

Existing sidewalk, landscape, curb and gutter, and hardscape are present in the existing offsite conditions along Linden Avenue and Ayala Drive. Both streets also contain existing catch basins that collect and convey stormwater. The project site does not collect any offsite flows from neighboring properties and are not accounted for in the provided calculations.

4 HYDROLOGIC ANALYSIS

4.1 METHODOLOGY

Runoff calculations were prepared for each Drainage Area (DA) using the Modified Rational Method and the methodology described in Section D of the San Bernardino County Hydrology Manual (August 1986). The CivilD hydrology software for San Bernardino County was used to estimate time of concentrations and 100 & 2-year peak flow rates generated from the existing and proposed conditions (see **Appendix E** and **Appendix F**).

Unit hydrographs were prepared for each DA using the methodology described in Section E of the San Bernardino County Hydrology Manual for determining the 100-year stormwater volumes. The CivilD hydrology software for San Bernardino County was used to estimate the 100-year peak flow rates and volumes over a 24-hour period for the proposed and existing conditions (see **Appendix G**). Since the existing conditions, DA 2 hydrograph comprises of the proposed DA 2, 3, and 4 hydrographs, a volume per acre and flow per acre calculation was performed to equate an accurate comparison of existing and proposed conditions. Refer to Section 5.2 for more information.

A stage-storage analysis in conjunction with the peak flow rates and volumes from CivilD hydrograph output was prepared for the purposes of sizing and analyzing the proposed underground chamber characteristics for each DA. The stage-storage analysis and the hydrographs from CivilD were imported into PondPack to determine the 100-year mitigated flow rate.

4.1.1 GEOMETRY

Drainage Basin Areas were delineated for the project site's existing and proposed drainage conditions. Existing elevations, slopes and flow paths were established from the topography available at the time of this drainage study. Proposed elevations, slopes and flow paths were based on the proposed site grading plan. These hydrologic parameters are shown for existing and proposed conditions on Hydrology Exhibits in **Appendix D**.

4.1.2 INTENSITY AND TIME OF CONCENTRATION

Rainfall depths were gathered from the NOAA Atlas 14 precipitation frequency table for the project site location. The existing conditions and proposed conditions time of concentrations were calculated within CivilD given the drainage areas characteristics. The time of concentration for proposed conditions with small drainage areas were assumed to be 5 minutes as a conservative approach which is a valid assumption given that the basins travel relatively short distances.

The time of concentration calculated from the Modified Rational Method was used to calculate the lag time necessary to develop the unit hydrographs within the CivilD software.

4.1.3 CURVE NUMBERS AND LOSS RATES

The Antecedent Moisture Condition (AMC) is a common index used to describe how saturated a soil is before the design storm occurs. AMC III, which assumes the watershed is already saturated, was used for the 100-year storm analysis. AMC I was used for the 2-year analysis and AMC II for the 10-year analysis. The San Bernardino County Hydrology Manual provides Curve Numbers of Hydrologic Soil-Cover for AMC II. These AMC II Curve Numbers can be converted to AMC III Curve Numbers manually by use of Table C.1 from the San Bernardino County Hydrology Manual. However, CivilD automatically does this conversion within the program analysis. The existing condition’s land use consists of natural barren ground cover. The proposed condition’s land use is predominantly impervious with some commercial landscaping.

Loss Rates were calculated by using the methodology presented in Section C.6 of the San Bernardino County Hydrology Manual. The Loss Rate calculation is a function of the Curve Number, Initial Abstraction and 24-hour rainfall depth, and was used to develop the unit hydrographs.

4.2 HYDROLOGIC RESULTS

Rational Method hydrologic results are summarized below for the existing conditions and proposed conditions in **Table 4-1** and **Table 4-2**. Refer to **Appendix E** and **Appendix F** for the existing and proposed conditions hydrology analysis, respectively.

Table 4–1 Existing Condition Modified Rational Method Hydrology Results Summary

Existing Conditions Rational Method Onsite Flow Rates			
DMA ID	**Area (acre)**	**Q_2 (cfs)**	**Q_{100} (cfs)**
DA 1	3.85	1.33	10.24
DA 2	1.07	0.57	3.36
DA 2.1	18.98	0.00	46.97
TOTAL	**23.90**	**1.90**	**60.57**

Table 4–2 Proposed Conditions Modified Rational Method Hydrology Results Summary

Proposed Conditions Rational Method Onsite Flow Rates			
DMA ID	**Area (acre)**	**Q_2 (cfs)**	**Q_{100} (cfs)**
DA 1.1	1.00	1.94	5.12
DA 1.2	0.63	1.22	3.23
DA 1.3	0.78	1.60	4.22
DA 1.4	0.54	1.11	2.92
DA 2.1	4.01	5.90	15.70
DA 2.2	3.85	5.66	15.07
DA 3.1	3.14	5.00	13.27
DA 3.2	4.53	6.72	18.13
DA 3.3	0.81	1.44	3.81
DA 4.1	1.48	2.81	7.40
DA 7.0	0.6	0.98	2.60
DA 7.1	0.6	0.73	2.31
DA 7.2	0.98	0.98	2.59
DA 7.3	0.95	0.73	2.31
Total	**23.90**	**36.82**	**98.68**

***DA7 are flow rates from the proposed Miro Way project and is not included in onsite basin sizing**

Below, results shown in Table 4-3 are the proposed loss rate estimation from the unit hydrograph method. Refer to Appendix G for the proposed conditions hydrology hydrograph method analysis. The CivilD computer program was used to develop these hydrographs based on the Rational Method analysis results, which was inputted into PondPack for detention routing. Table 4-4 summarizes the total mitigated outflow for the project. Refer to Section 5.2 of this report for further information on the PondPack results.

Table 4–3 Proposed Unit Hydrograph Method Loss Rate Estimation Summary

Proposed Unit Hydrograph Method Loss Rate Estimation		
Storm Event	**Average Loss Rate, $F\bar{m}$ (in/hr)**	**Average Low Loss Fraction, $\bar{Y}$**
100 Year	0.157	0.166

As aforementioned in Section 4.1, The existing conditions DA 2 which comprises of the proposed DA 2, 3, and 4 was broken down to a volume per acre calculation to equate an accurate comparison of existing and proposed conditions. As Seen in Table 4.4 below, the provided volume is less than the required volume. Thus, basin routing was performed to determine/prove that the current basin footprints and storage capacities are sufficient. Refer to Section 5.2.3 for more information.

Table 4–4 Proposed and Existing Unit Hydrograph Results

DA #	BMP ID	Storm Event	Existing Unit Hydrograph Volume (CF)	Proposed Unit Hydrograph Volume (CF)	Incremental Difference (CF)	Provided Volume (CF)
DA 1	BMP 1	100 Year	38,860	70,306	31,446	22,060
DA 2	BMP 2	100 Year	79,287	187,121	107,833	38,160
DA 3	BMP 3	100 Year	85,542	201,927	116,385	44,772
DA 4	BMP 4	100 Year	14,929	35,271	20,341	8,761
-	**Total**	**-**	**202,253**	**494,624**	**276,006**	**113,753**

5 WATER QUALITY AND LOW IMPACT DEVELOPMENT REQUIREMENTS

5.1 STORMWATER MITIGATION

5.1.1 STORMWATER TREATMENT

The proposed project will provide water quality by means of infiltration. Sediment bays are located within the underground chamber system for pretreatment of larger sediments and pollutants. The underground chambers will treat the remaining pollutants of concerns by means of infiltration. The site's 100-year peak volume will be detained by means of underground storage.

5.1.2 STORMWATER MAINTENANCE

Stormwater facilities require routine maintenance to operate efficiently. It is recommended that facilities be inspected prior to the rainy season (fall) and after each runoff producing storm event. Sediment and debris shall be removed from the pre-treatment system to maintain the systems effectiveness. The underground chambers shall be routinely inspected and sediment/debris build-up removed to maintain efficient operation of the basin.

5.2 UNDERGROUND CHAMBER

5.2.1 UNDERGROUND CHAMBER STANDARDS

The proposed underground chambers were designed using the methodology described in San Bernardino County's Technical Guidance Document for Water Quality Management Plans. This document states that:

- The Water Quality Design Capture Volume (DCV) must be drawn down within 48 hours after the basin is filled. See **Appendix L** for DCV calculations.
- An energy dissipating inlet must be provided.
- An emergency overflow pipe to control excess flows must be provided.
- A forebay settling basin or separate treatment control measure must be provided as pretreatment.

5.2.2 UNDERGROUND CHAMBER ANALYSIS

Basin Inflow Hydrographs were created using CivilD computer software for the 100-year storm events. The resulting hydrographs were manually imported into the PondPack computer software to be used for the underground chamber routing calculations. The underground chambers were sized taking underground infiltration into account.

The infiltration rate was not able in the Geotechnical Report prepared by Lewis Operating Corporation, Inc., dated August 2, 2006, see Appendix K, at the time of analysis. An infiltration rate of 2 in/hr was assumed for group A soils, resulting in design percolation rates ranging from 0.13 – 0.57 cfs as rates depend of basin footprints. With a favorable constant infiltration rate on the site, the project proposes to fully infiltrate the 100-year DCV for water quality and 100-year 24-hr volume via an underground infiltration basin. Refer to Appendix H for all chamber design details and analysis results from PondPack.

5.2.3 UNDERGROUND CHAMBER RESULTS

The proposed underground chambers will provide the entire infiltration volume required to retain the Design Capture Volume and the 100-year volume as discussed in **Section 5.2.1** above. **Table 5-1** below summarizes the four underground chambers and mitigated flows. See underground chamber routing calculations in **Appendix H** prepared with the PondPack Computer program.

Table 5–1 Underground Chamber BMP Results Summary (PondPack)

BMP ID	Storm Event	Proposed Basin Inflow (cfs)	Proposed Basin Outflow (cfs)	Max Water Surface Elevation (ft)	Max Storage Required (cf)	Total Storage Provided (cf)
BMP 1	100 Year	7.39	2.29	4.01	15,805	22,060
BMP 2	100 Year	17.29	9.85	4.31	29,338	38,160
BMP 3	100 Year	18.86	9.51	4.36	34,795	44,772
BMP 4	100 Year	3.67	1.90	3.20	4,747	8,761
Total	**100 Year**	**47.21**	**23.55**	**-**	**84,685**	**113,753**

6 HYDRAULICS ANALYSIS

6.1 HYDRAULIC ANALYSIS

6.1.1 PIPE SIZING

Hydraulic calculations for pipe and inlet sizing are to be performed for the final submittal.

6.1.2 INLET SIZING

Hydraulic calculations for pipe and inlet sizing are to be performed for the final submittal.

6.1.3 HGL ANALYSIS

Hydraulic calculations for pipe and inlet sizing are to be performed for the final submittal.

6.1.4 EMERGENCY SPILLWAY

The underground chambers provide storage for flow attenuation in the 100-year storm event. The system will be designed to provide overland relief via a gravity overflow system. For storm events greater than the 100-year peak storm, the existing 78" RCP pipe collects excess stormwater from BMP 1 and 2 and BMP 3 and 4 will bubble out into Ayala drive and conveys runoff into the existing water body located northeast of the site.

7 CONCLUSION

Per the analysis, the project proposes to capture and detain the 100-year peak volume and mitigate project outflows into the existing storm drain in Linden Avenue and Ayala Drive. The project is consistent with the allowable discharge compared to the existing condition.

APPENDICES

APPENDIX A

NOAA ALTAS 14 PRECIPITATION ESTIMATES

NOAA Atlas 14, Volume 6, Version 2
Location name: Rialto, California, USA*
Latitude: 34.1252°, Longitude: -117.3979°
Elevation: 1407 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)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.129 (0.107-0.156)	0.170 (0.141-0.207)	0.225 (0.186-0.274)	0.270 (0.222-0.332)	0.333 (0.265-0.424)	0.383 (0.298-0.498)	0.435 (0.329-0.579)	0.489 (0.360-0.671)	0.565 (0.399-0.809)	0.626 (0.426-0.928)
10-min	0.185 (0.154-0.224)	0.244 (0.203-0.296)	0.322 (0.267-0.393)	0.387 (0.318-0.476)	0.478 (0.379-0.608)	0.549 (0.427-0.713)	0.623 (0.472-0.830)	0.701 (0.516-0.961)	0.810 (0.571-1.16)	0.897 (0.611-1.33)
15-min	0.223 (0.186-0.271)	0.295 (0.245-0.358)	0.390 (0.323-0.475)	0.469 (0.385-0.576)	0.578 (0.459-0.735)	0.664 (0.516-0.863)	0.753 (0.571-1.00)	0.847 (0.624-1.16)	0.979 (0.691-1.40)	1.08 (0.739-1.61)
30-min	0.334 (0.278-0.406)	0.441 (0.367-0.536)	0.584 (0.484-0.711)	0.701 (0.577-0.862)	0.865 (0.687-1.10)	0.994 (0.773-1.29)	1.13 (0.855-1.50)	1.27 (0.934-1.74)	1.47 (1.03-2.10)	1.62 (1.11-2.41)
60-min	0.501 (0.417-0.608)	0.662 (0.550-0.804)	0.875 (0.725-1.07)	1.05 (0.865-1.29)	1.30 (1.03-1.65)	1.49 (1.16-1.94)	1.69 (1.28-2.25)	1.90 (1.40-2.61)	2.20 (1.55-3.15)	2.44 (1.66-3.61)
2-hr	0.754 (0.627-0.915)	0.979 (0.814-1.19)	1.28 (1.06-1.55)	1.52 (1.25-1.87)	1.85 (1.47-2.35)	2.11 (1.64-2.74)	2.38 (1.80-3.16)	2.65 (1.95-3.64)	3.03 (2.14-4.34)	3.33 (2.27-4.94)
3-hr	0.957 (0.796-1.16)	1.24 (1.03-1.50)	1.60 (1.33-1.95)	1.90 (1.56-2.33)	2.30 (1.83-2.93)	2.61 (2.03-3.39)	2.93 (2.22-3.90)	3.26 (2.40-4.47)	3.71 (2.62-5.31)	4.06 (2.76-6.02)
6-hr	1.40 (1.16-1.70)	1.80 (1.50-2.19)	2.32 (1.92-2.83)	2.74 (2.25-3.36)	3.30 (2.62-4.20)	3.73 (2.90-4.84)	4.16 (3.15-5.54)	4.60 (3.39-6.31)	5.20 (3.67-7.44)	5.66 (3.86-8.39)
12-hr	1.90 (1.58-2.30)	2.45 (2.04-2.98)	3.15 (2.61-3.84)	3.72 (3.06-4.57)	4.46 (3.54-5.67)	5.02 (3.90-6.52)	5.58 (4.23-7.43)	6.14 (4.52-8.42)	6.89 (4.86-9.86)	7.46 (5.08-11.1)
24-hr	2.58 (2.28-2.97)	3.37 (2.98-3.88)	4.36 (3.85-5.05)	5.16 (4.51-6.01)	6.19 (5.25-7.46)	6.97 (5.78-8.57)	7.73 (6.26-9.74)	8.50 (6.70-11.0)	9.51 (7.20-12.8)	10.3 (7.51-14.3)
2-day	3.15 (2.79-3.63)	4.21 (3.72-4.85)	5.56 (4.91-6.44)	6.65 (5.82-7.76)	8.11 (6.87-9.77)	9.21 (7.64-11.3)	10.3 (8.36-13.0)	11.4 (9.02-14.8)	12.9 (9.80-17.5)	14.1 (10.3-19.7)
3-day	3.37 (2.98-3.88)	4.58 (4.05-5.28)	6.16 (5.44-7.13)	7.46 (6.53-8.70)	9.23 (7.82-11.1)	10.6 (8.80-13.0)	12.0 (9.73-15.1)	13.5 (10.6-17.4)	15.4 (11.7-20.8)	17.0 (12.4-23.7)
4-day	3.60 (3.18-4.14)	4.94 (4.37-5.70)	6.73 (5.93-7.78)	8.20 (7.18-9.56)	10.2 (8.67-12.3)	11.8 (9.82-14.6)	13.5 (10.9-17.0)	15.2 (12.0-19.7)	17.6 (13.3-23.7)	19.5 (14.2-27.2)
7-day	4.10 (3.63-4.73)	5.70 (5.04-6.57)	7.82 (6.90-9.05)	9.59 (8.39-11.2)	12.1 (10.2-14.5)	14.0 (11.6-17.2)	16.0 (13.0-20.2)	18.1 (14.3-23.5)	21.1 (16.0-28.4)	23.4 (17.1-32.7)
10-day	4.44 (3.94-5.12)	6.20 (5.49-7.16)	8.57 (7.56-9.91)	10.5 (9.23-12.3)	13.3 (11.3-16.0)	15.5 (12.9-19.1)	17.8 (14.4-22.4)	20.2 (15.9-26.1)	23.6 (17.8-31.8)	26.3 (19.2-36.6)
20-day	5.34 (4.73-6.15)	7.53 (6.66-8.69)	10.5 (9.28-12.2)	13.0 (11.4-15.2)	16.6 (14.1-20.0)	19.4 (16.1-23.9)	22.4 (18.2-28.3)	25.7 (20.2-33.2)	30.2 (22.8-40.7)	33.9 (24.8-47.2)
30-day	6.25 (5.54-7.20)	8.84 (7.82-10.2)	12.4 (10.9-14.3)	15.4 (13.5-18.0)	19.7 (16.7-23.7)	23.2 (19.2-28.5)	26.9 (21.8-33.8)	30.8 (24.3-39.9)	36.4 (27.6-49.1)	41.0 (30.0-57.3)
45-day	7.46 (6.61-8.60)	10.5 (9.29-12.1)	14.7 (13.0-17.0)	18.3 (16.0-21.4)	23.5 (19.9-28.3)	27.7 (23.0-34.0)	32.2 (26.0-40.5)	37.0 (29.2-47.9)	44.0 (33.3-59.3)	49.7 (36.3-69.3)
60-day	8.69 (7.69-10.0)	12.1 (10.7-14.0)	16.9 (14.9-19.6)	21.0 (18.4-24.5)	27.0 (22.8-32.5)	31.8 (26.4-39.1)	37.0 (30.0-46.6)	42.7 (33.6-55.3)	50.8 (38.5-68.6)	57.6 (42.1-80.4)

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

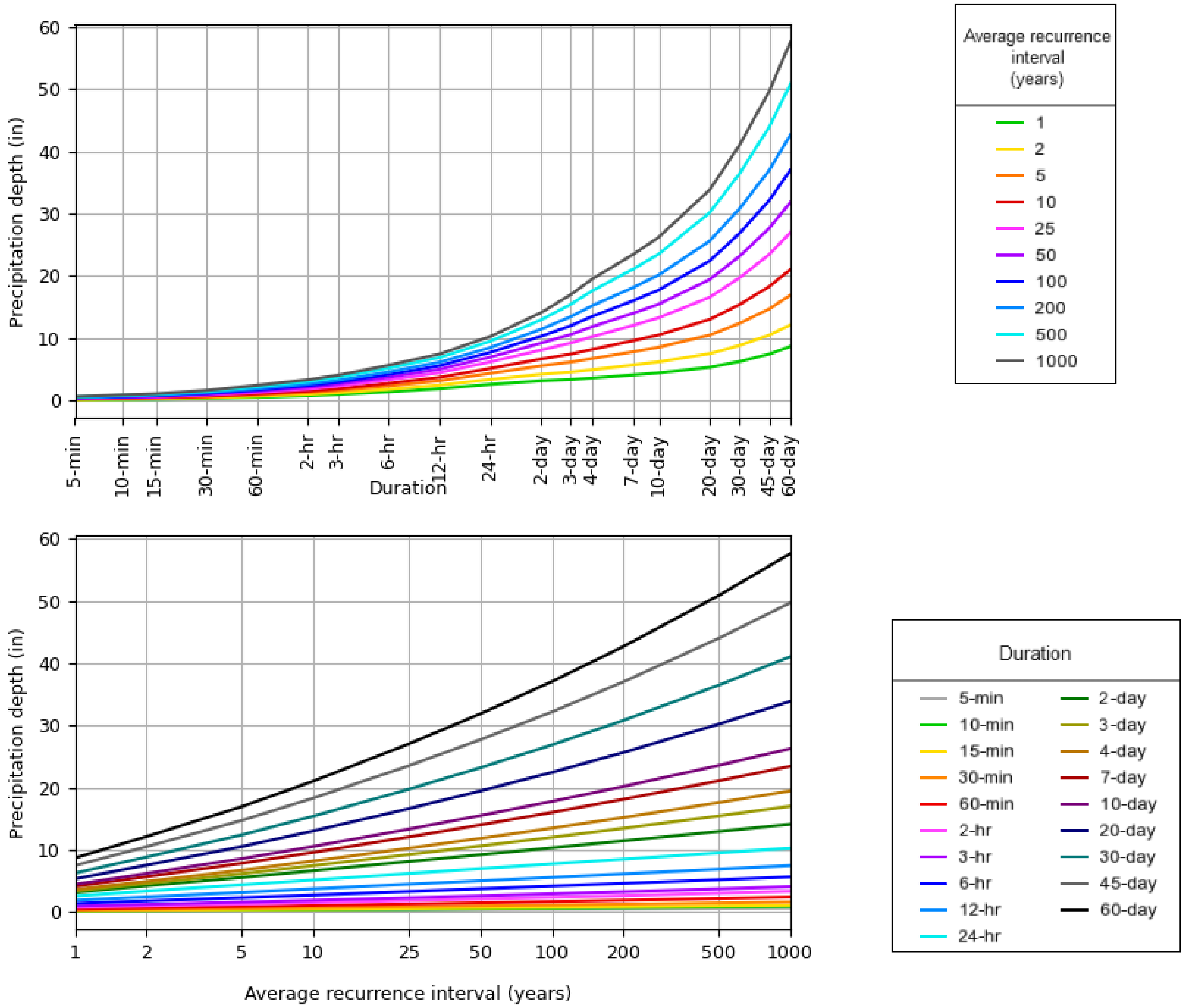
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper 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

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.1252°, Longitude: -117.3979°



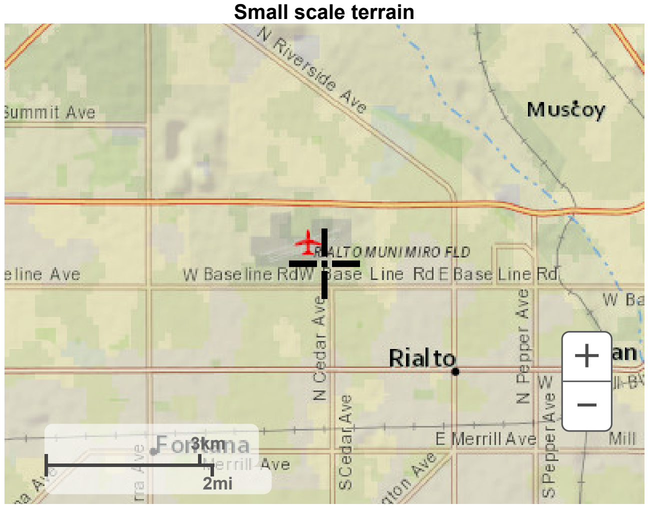
NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Tue Jul 11 16:27:32 2023

Back to Top

Maps & aerials

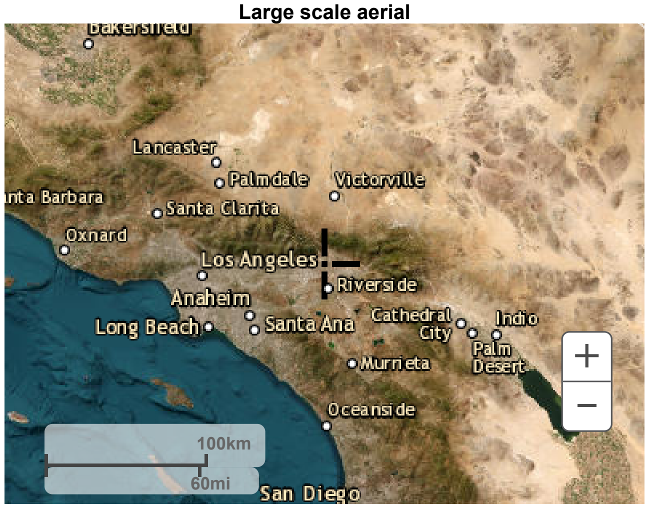
Small scale terrain



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

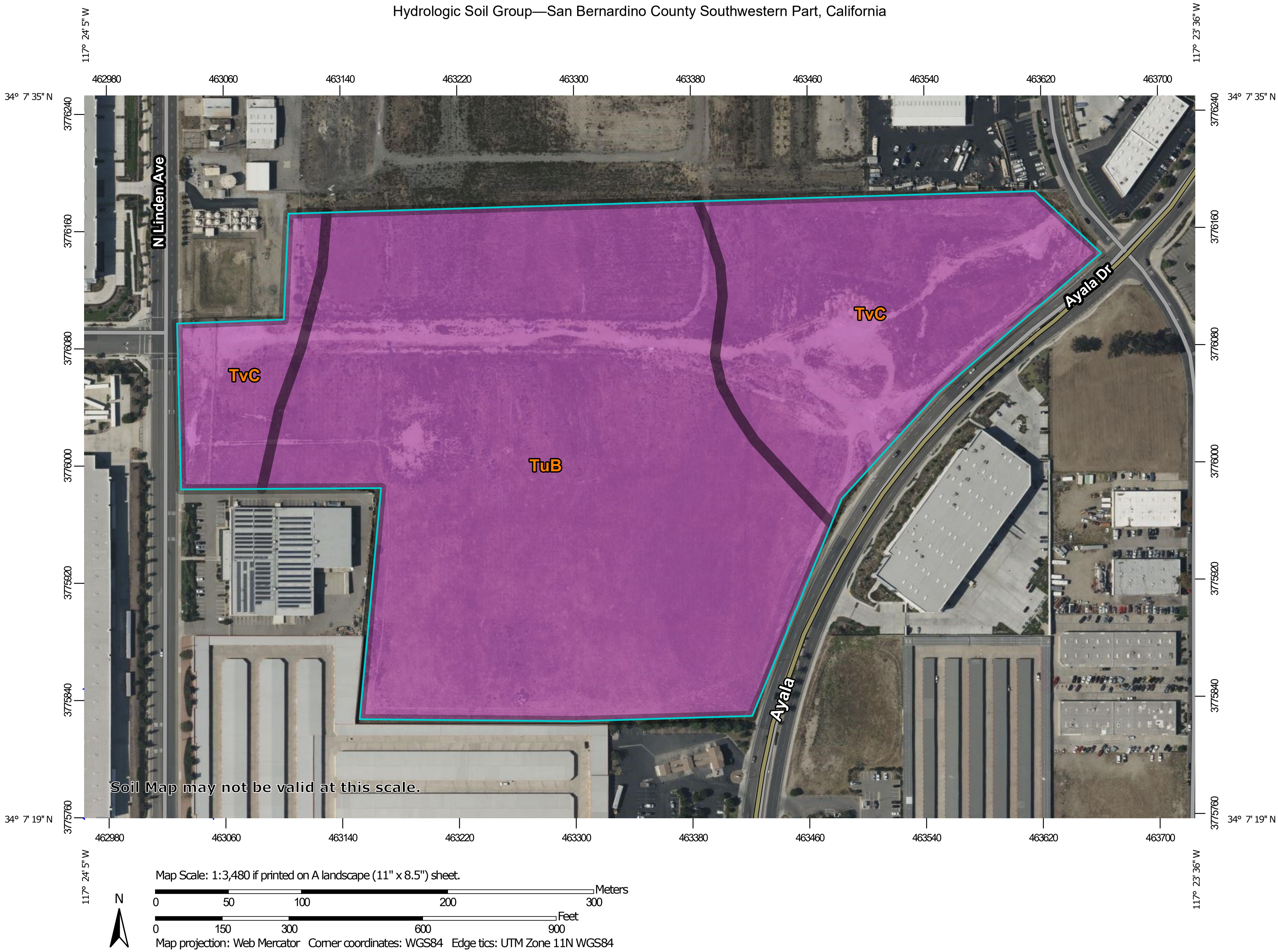
APPENDIX B

HYDROLOGIC SOIL TYPE CLASSIFICATION

TALLY	B	TENINO	B	TIGERON	A	TOMERA	D	TRENTON	D
TALMAGE	A	TENNO	D	TIGIWON	B	TOMICHI	A	TREP	B
TALMO	B	TENORIO	B	TIGRETT		TOMOKA	A/D	TRES HERMANOS	B
TALOKA	D	TENOT	C	TIGUA	D	TONASKET	B	TRETTEN	C
TALPA	D	TENRAG	B	TIJERAS	B	TONATA	C	TREVINO	D
TAMA	B	TENSAS	D	TILFORD	B	TONAWANDA	C	TREXLER	C
TAMAHA	C	TENSED	C	TILLEDA	B	TONEY	D	TRIAMI	C
TAMALCO	D	TENSLEEP	B	TILLICUM	B	TONGUE RIVER	C	TRIASSIC	
TAMBA	C/D	TEOCULLI	B	TILLMAN	C	TONINI	B	TRICON	C
TAMELY	[illegible]	TEPEE	D	TILMA	C	TONKA	C	TRIDELL	B
TAMMANY CREEK	B	TEPETE	B/D	TILSIT	C	TONKEY	D	TRIDENT	D
TAMMANY RIDGE	B	TERBIES	C	TILTON	B	TONKIN	C	TRIGO	C
TAMMS	C	TERESA	C	TIMBERG	C	TONKS	B/D	TRIMBLE	B
TAMPICO	B	TERINO	D	TIMBERLY	B	TONOPAH	B	TRIMMER	B
TANAMA	D	TERMINAL	D	TIMBLIN	D	TONOR	C	TRINCHERA	C
TANANA	D	TERMO	C	TIMENTWA	B	TONOWEK	B	TRINITY	D
TANBERG	D	TEROUGE	D	TIMKEN	D	TONRA	A	TRIOMAS	B
TANDY	C	TERRA CEIA	A/D	TIMMERMAN	B	TONSINA	B	TRIPIT	C
TANEUM	C	TERRAD	D	TIMMONS	B	TONUCO	C	TRIPLEN	B
TANEY	C	TERRERA	C	TIMPAHUTE	D	TOOLE	D	TRIPOLI	C
TANGAIR	C	TERRETON	C	TIMPANOGOS	B	TOOMES	D	TRIPP	B
TANNA	C	TERRIL	B	TIMPER	D	TOP	C	TRITON	C
TANNER	C	TERRY	B	TIMPOONEKE	B	TOPIA	D	TRIX	B
TANSEM	B	TERWILLIGER	C	TIMULA	B	TOPPENISH	B/C	TROJAN	B
TANTALUS	A	TESAJO	A	TINA	C	TOPTON		TRONMALD	D
TANWAX	D	TESCOTT	C	TINDAHAY	A	TOQUERVILLE	C	TROMP	C
TAOPI	C	TESUQUE	B	TINE	A	TOQUOP	A	TRONSEN	C
TAOS	D	TETON	A	TINGEY	B	TORBOY	B	TROOK	B
TAPIA	C	TETONIA	B	TINSLEY	A	TORCHLIGHT	C	TROPAL	D
TAPPEN	D	TETONKA	C	TINTON	A	TORDIA	D	TROSI	D
TARA	B	TETOTUM	C	TINYTOWN	B	TORHUNTA	C	TROUP	A
TARKIO	D	TEW	B/D	TIOCANO	D	TORNING	B	TROUT CREEK	C
TARKLIN	C	TEX	B	TIOGA	B	TORODA	B	TROUTDALE	B
TARPO	C	TEXLINE	B	TIPPAH	C	TORONTO	C	TROUT LAKE	C
TARRANT	D	TEZUMA	C	TIPPECANOE	B	TORPEDO LAKE	D	TROUT RIVER	A
TARRETE	D	THACKERY	B	TIPPER	A	TORREON	C	TROUTVILLE	B
TARRYALL	B	THADER	C	TIPPERARY	A	TORRES	B	TROXEL	B
TASCOSA	B	THAGE	C	TIPPIPAH	D	TORRINGTON	B	TROY	C
TASSEL	D	THANYON	A	TIPPO	C	TORRO	C	TRUCE	C
TATE	B	THATCHER	B	TIPTON	B	TORSIDO	D	TRUCKEE	C
TATIYEE	C	THATUNA	C	TIPTONVILLE	B	TORTUGAS	D	TRUCKTON	B
TATU	C	THAYNE	B	TIRO	C	TOSTON	D	TRUEFISSURE	A
TATUM	C	THEBES	B	TISBURY	B	TOTELAKE	A	TRUESDALE	C
TAUNTON	C	THEBO	D	TISCH	C	TOTEM	B	TRULL	C
TAVARES	A	THEDALUND	C	TISH TANG	B	TOTTEN	B	TRULON	B
TAWAS	A/D	THENAS	C	TITUSVILLE	C	TOUCHET	B	TRUMAN	B
TAWCAW	C	THED	C	TIVERTON	A	TOUHEY	B	TRUMBULL	D
TAYLOR	C	THERESA	B	TIVOLI	A	TOULON	B	TRUMP	D
TAYLOR CREEK	D	THERIOT	D	TIVY	C	TOURN	C	TRYON	D
TAYLORSFLAT	D	THERMAL	C	TOA	C	TOURNQUIST	B	TSCHICOMA	B
TAYLORSVILLE	C	THERMOPOLIS	D	TOBICO	D	TOURS	B	TUB	C
TAYSOM	B	THESS	B	TOBIN	B	TOUTLE	A	TUBAC	C
TAZLINA	A	THETFORD	A	TOBISH	C	TOWER	D	TUCANNON	C
TEAL	D	THIEL	A	TOBLER	B	TOWHEE	D	TUCKERMAN	D
TEALSON	C	THIOKOL	C	TOBOSA	D	TOWNER	B	TUCSON	B
TEALWHIT	C	THOENY	D	TOBY	B	TOWNLEY	C	TUCUMCARI	B
TEANAWAY	C	THOMAS	D	TOCCOA	B	TOWNSBURY	B	TUFFIT	D
TEAPO	B	THORNDALE	D	TODD	B	TOWNSEND	C	TUGHILL	D
TEAS	C	THORNDIKE	C/D	TODDLER	B	TOWSON	B	TUJUNGA	A
TEASDALE	B	THORNOCK	D	TODDVILLE	B	TOXAWAY	D	TUKEY	C
TEBO	B	THORNTON	D	TOEHEAD	C	TOY	D	TUKWILA	D
TECHICK	B	THORNWOOD	B	TOEJA	C	TOYAH	B	TULA	C
TECOLOTE	B	THOROUGHFARE	B	TOEM	C	TOZE	B	TULANA	C/D
TECUMSAH	B	THORP	C	TOGO	B	TRABUCO	C	TULARE	C/D
TEDROW	B	THORR	B	TOGUS	D	TRACK	B/C	TULAROSA	B
TEEL	B	THORREL	B	TOHONA	C	TRACY	B	TULIA	B
TEHACHAPI	D	THOW	B	TOINE	C	TRAER	C	TULLAHASSEE	C
TEHAMA	C	THREE MILE	D	TOISNOT	D	TRAIL	A	TULLER	D
TEJA	I	THROCK	C	TOIYABE	C	TRAIL CREEK	B	TULLOCK	B
TEJON	B	THUNDERBIRD	D	TOKEEN	B	TRAM	B	TULLY	C
TEKOA	C	THURBER	C	TOKUL	C	TRANSYLVANIA	B	TULUKSAK	D
TELA	B	THURLONI	C	TOLBY	A	TRAPPER	A	TUMBEZ	D
TELEFONO	C	THURLOW	C	TOLEDO	D	TRAPPIST	C	TUMEY	D
TELEPHONE	D	THURMAN	A	TOLICHA	D	TRAPPS	B	TUMITAS	B
TELFER	A	THURMONT	B	TOLKE	B	TRASK	C	TUMWATER	A
TELFERNER	D	THURSTON	B	TOLL	A	TRAVELERS	D	TUNEHEAN	D
TELIDA	D	TIAGOS	B	TOLLGATE	B	TRAVER	B/C	TUNICA	D
TELL	B	TIAK	C	TOLLHOUSE	D	TRAVESSILLA	D	TUNIS	D
TELLER	B	TIBAN	B	TOLMAN	D	TRAVIS	C	TUNITAS	B
TELLICO	B	TIBBITTS	B	TOLNA	B	TRAWICK	B	TUNKHANNOCK	A
TELLMAN	B	TICA	D	TOLO	B	TRAY	C	TUNNEL	B
TELSTAD	B	TICE	C	TOLSONA	D	TREADWAY	D	TUPELO	D
TEMESCAL	D	TICHIGAN	C	TOLSTOI	D	TREASURE	B	TUPUKNUK	D
TEMPLE	B/C	TICHNOR	D	TOLT	D	TREBLOC	D	TUQUE	B
TEMVIK	B	TICKAPOO	D	TOLTEC	C	TREGO	C	TURBEVILLE	C
TENABO	D	TICKASON	B	TOLUCA	B	TRELONA	D	TURBOTVILLE	C
TENAHA	B	TIDWELL	D	TOLVAR	B	TREMANT	B	TURBYFILL	B
TENAS	C	TIERRA	D	TOMAH	C	TREMBLES	B	TURIN	B
TENCEE	D	TIETON	B	TOMAS	B	TREMPE	A	TURK	D
TENERIFFE	C	TIFFANY	C	TOMAST	C	TREMPEALEAU	B	TURKEYSPRINGS	C
TENEX	A	TIFTON	B	TOME	B	TRENARY	B	TURLEY	C
TENIBAC	B	TIGER CREEK	B	TOMEL	D	TRENT	B	TURLIN	B

NOTES A BLANK HYDROLOGIC SOIL GROUP INDICATES THE SOIL GROUP HAS NOT BEEN DETERMINED
TWO SOIL GROUPS SUCH AS B/C INDICATES THE DRAINED/UNDRAINED SITUATION

Hydrologic Soil Group—San Bernardino County Southwestern Part, California



Map Scale: 1:3,480 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 14, Sep 6, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
TuB	Tujunga loamy sand, 0 to 5 percent slopes	A	25.5	69.2%
TvC	Tujunga gravelly loamy sand, 0 to 9 percent slopes	A	11.3	30.8%
Totals for Area of Interest			**36.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

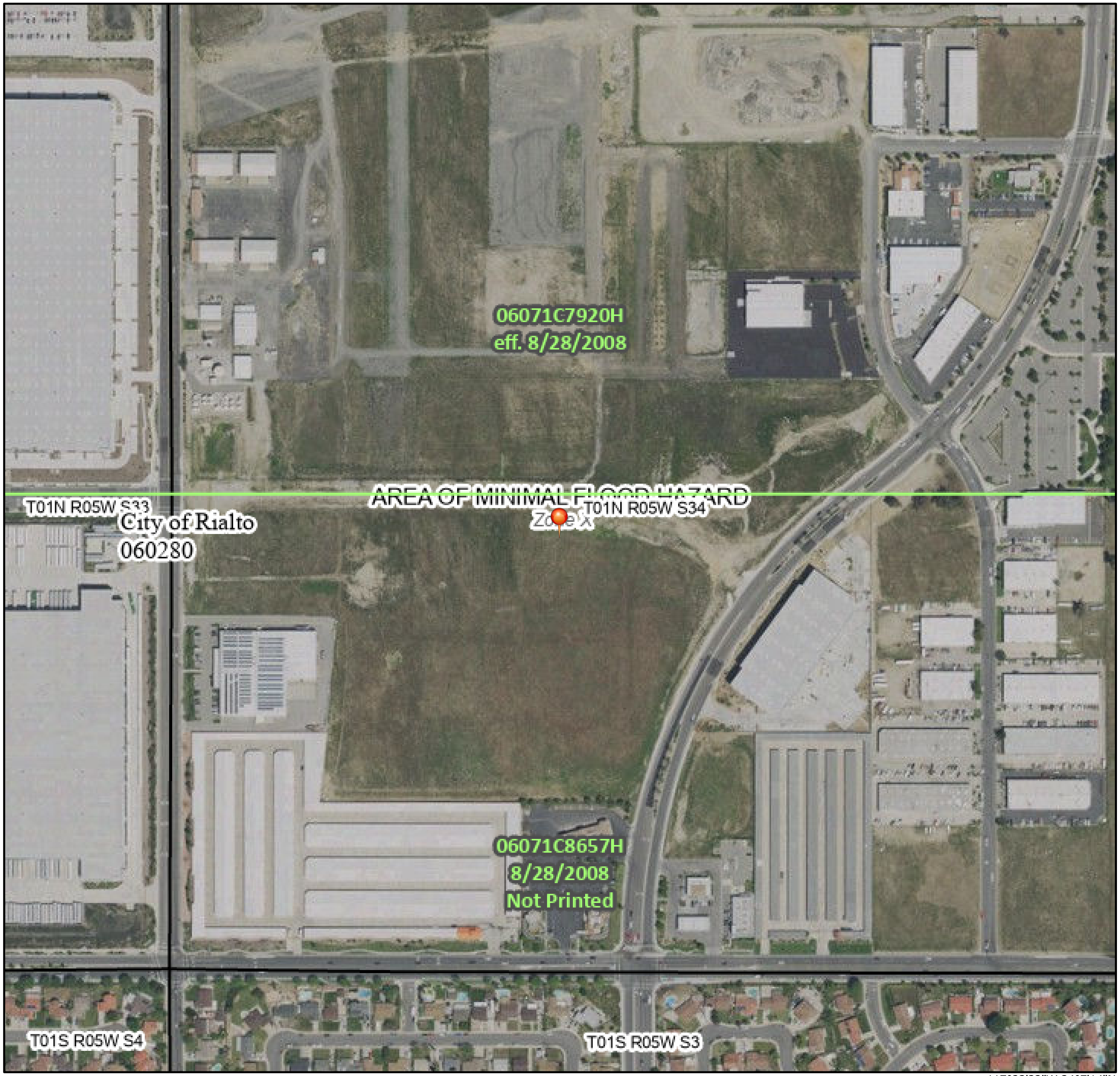
APPENDIX C

FEMA FIRMETTE

National Flood Hazard Layer FIRMette

FEMA

117°24'9"W 34°7'44"N



117°23'32"W 34°7'14"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

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
- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 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 8/17/2023 at 11:46 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.

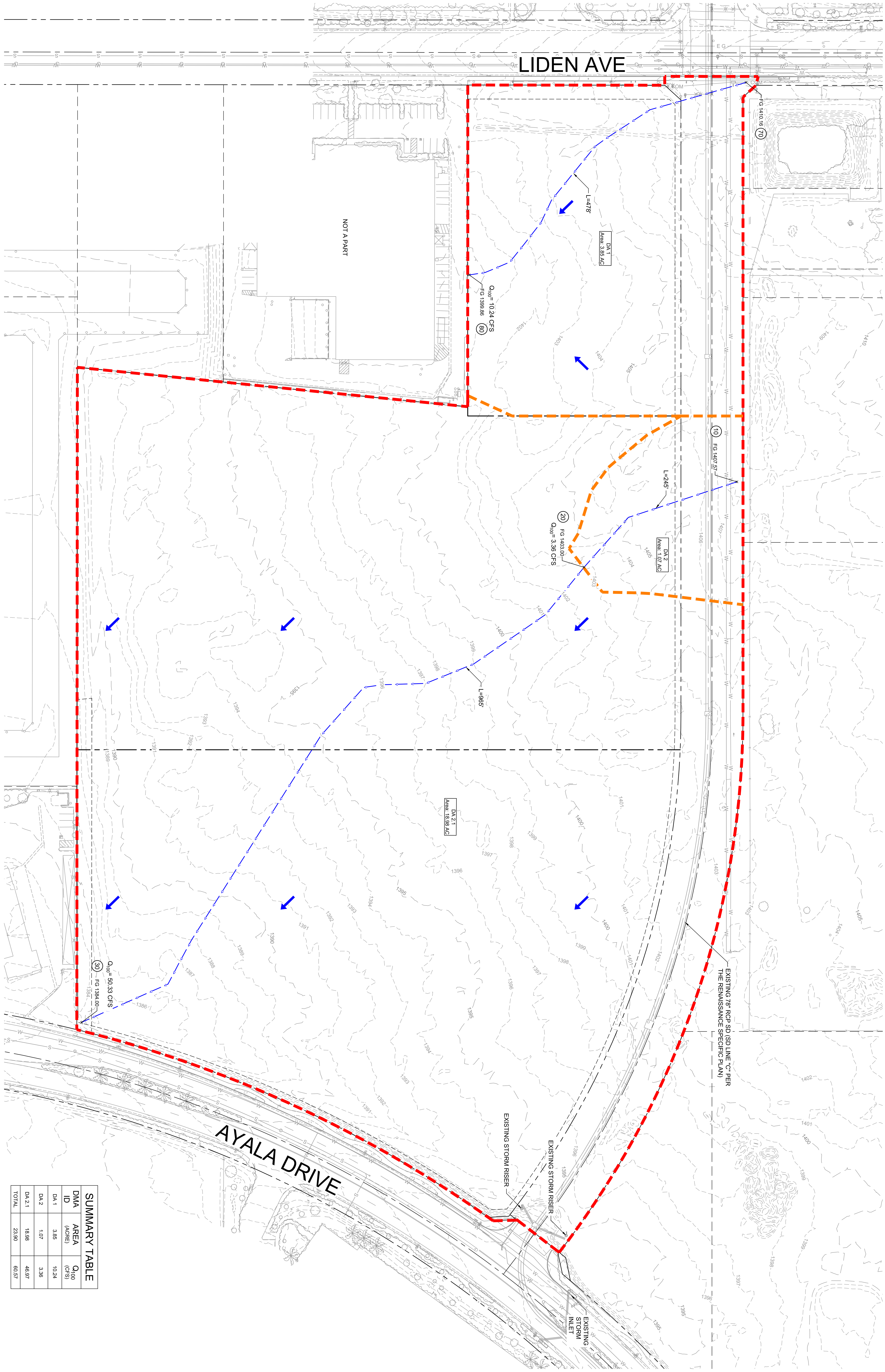
This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory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

APPENDIX D

DRAINAGE EXHIBITS

LEGEND

- DMA ID / SUB-DMA ID / ACREAGE (DA.XX, X.XX AC)
- DMA ID / SUB-DMA ID (X.XX)
- L=XX.XX' FLOW PATH LENGTH (FEET)
- OVERALL DMA BOUNDARY
- SUB-DMA BOUNDARY
- FLOWLINE
- EX MAJOR CONTOUR (1000)
- EX MINOR CONTOUR (1001)
- PROP MAJOR CONTOUR (1000)
- PROP MINOR CONTOUR (1001)
- FLOW DIRECTION



SUMMARY TABLE

DMA ID	AREA (ACRE)	Q_{100} (CFS)
DA 1	3.85	10.24
DA 2	1.07	3.36
DA 2.1	18.98	46.97
TOTAL	23.90	60.57

NORTH

GRAPHIC SCALE IN FEET
0 50 100

SHEET NUMBER 1 OF 1

MIRO WAY INDUSTRIAL
PREPARED FOR
LEWIS-HILLWOOD RIALTO COMPANY, LLC

CITY OF RIALTO CA

EXISTING DRAINAGE EXHIBIT

KHA PROJECT	095996128
DATE	4/9/2024
SCALE	AS SHOWN
DESIGNED BY	KPS
DRAWN BY	KPS
CHECKED BY	DC

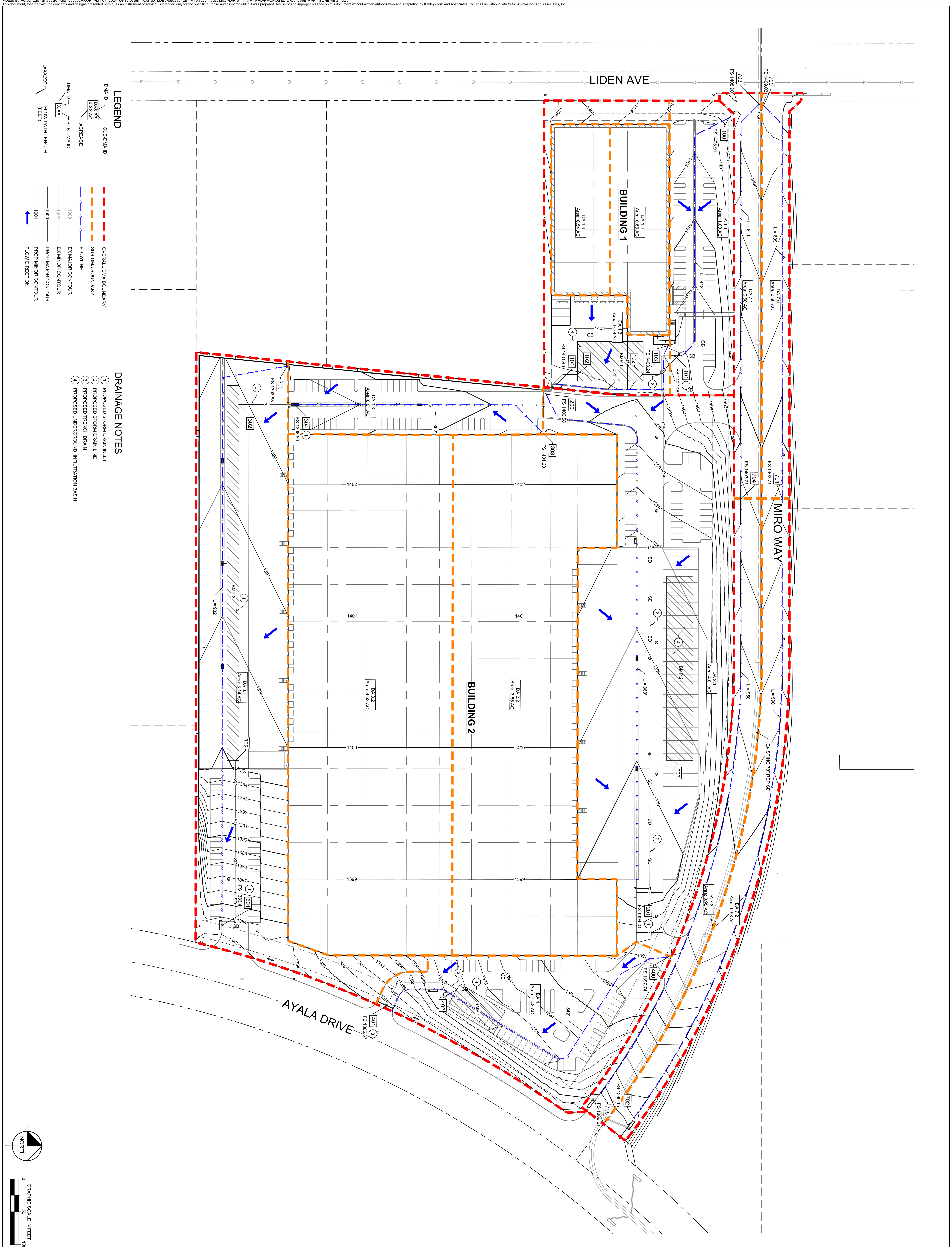
Kimley»Horn

401 B STREET, SUITE 600, SAN DIEGO, CA 92101
PHONE: 619-234-9411
WWW.KIMLEY-HORN.COM

ARISING OF THE CLIENTS DECISION TO OBTAIN BIDS, ORDER MATERIALS, OR PROCEED WITH CONSTRUCTION BEFORE KIMLEY-HORN HAS ISSUED FINAL, FULLY-APPROVED PLANS AND SPECIFICATIONS. THE CLIENT ACKNOWLEDGES THAT ALL PRELIMINARY PLANS ARE SUBJECT TO SUBSTANTIAL REVISIONS UNTIL PLANS ARE FULLY APPROVED AND ALL PERMITS OBTAINED.

No.	REVISIONS	DATE	BY

KIMLEY-HORN SHALL HAVE NO LIABILITY WHATSOEVER FOR ANY COSTS



MIRO WAY INDUSTRIAL
PREPARED FOR
LEWIS-HILLWOOD RIALTO COMPANY, LLC
CITY OF RIALTO CA

PROPOSED DRAINAGE EXHIBIT

KHA PROJECT	095996128
DATE	4/4/2024
SCALE	AS SHOWN
DESIGNED BY	KPS
DRAWN BY	KPS
CHECKED BY	DC

Kimley»Horn

© 2024 KIMLEY-HORN AND ASSOCIATES, INC.
401 B STREET, SUITE 600, SAN DIEGO, CA 92101
PHONE: 619-234-9411
WWW.KIMLEY-HORN.COM

No.	REVISIONS	DATE	BY

SHEET NUMBER
1 OF 1

APPENDIX E

EXISITING CONDITIONS HYDROLOGY AES RATIONAL METHOD RESULTS

```
                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2018 Version 9.0
        Rational Hydrology Study        Date: 02/07/24
------------------------------------------------------------------------
MIRO WAY INDUSTRIAL PROJECT - RIALTO
EXISTING CONDITION RATIONAL METHOD ANALYSIS
2-YR STORM DESIGN
BY LP 02/07/24
------------------------------------------------------------------------


Program License Serial Number 6443

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.662 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       20.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 1 = 31.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.983(In/Hr)
Initial subarea data:
Initial area flow distance =   245.000(Ft.)
Top (of initial area) elevation =  1407.570(Ft.)
Bottom (of initial area) elevation =  1403.000(Ft.)
Difference in elevation =     4.570(Ft.)
Slope =    0.01865  s(%)=       1.87
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.136 min.
Rainfall intensity =      1.576(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.339
```

```
Subarea runoff =      0.571(CFS)
Total initial stream area =        1.070(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.983(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       30.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.030(Ft.), Average velocity =   0.931(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.50
        2             40.00              0.00
        3             60.00              0.00
        4            100.00              0.50
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =      0.615(CFS)
  '     '        flow top width =     24.723(Ft.)
  '     '    velocity=    0.931(Ft/s)
  '     '        area =      0.660(Sq.Ft)
  '     '        Froude number =     1.004

Upstream point elevation =  1403.000(Ft.)
Downstream point elevation =  1384.000(Ft.)
Flow length =   965.000(Ft.)
Travel time  =   17.27 min.
Time of concentration =   31.41 min.
Depth of flow =   0.030(Ft.)
Average velocity =   0.931(Ft/s)
Total irregular channel flow =     0.615(CFS)
Irregular channel normal depth above invert elev. =   0.030(Ft.)
Average velocity of channel(s) =   0.931(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 1 = 31.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.983(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      0.000(CFS)
therefore the upstream flow rate of Q =      0.571(CFS) is being used
```

```
Rainfall intensity =      0.976(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.000
Subarea runoff =      0.000(CFS) for   18.980(Ac.)
Total runoff =      0.571(CFS)
Effective area this stream =       20.05(Ac.)
Total Study Area (Main Stream No. 1) =       20.05(Ac.)
Area averaged Fm value =    0.983(In/Hr)
Depth of flow =   0.028(Ft.), Average velocity =   0.907(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       70.000 to Point/Station       80.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 1 = 31.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.983(In/Hr)
Initial subarea data:
Initial area flow distance =   478.000(Ft.)
Top (of initial area) elevation =  1410.160(Ft.)
Bottom (of initial area) elevation =  1399.860(Ft.)
Difference in elevation =    10.300(Ft.)
Slope =    0.02155  s(%)=       2.15
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.943 min.
Rainfall intensity =      1.366(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.252
Subarea runoff =      1.326(CFS)
Total initial stream area =        3.850(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.983(In/Hr)
End of computations, Total Study Area =           23.90 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  50.0
```

```
                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2018 Version 9.0
        Rational Hydrology Study        Date: 02/06/24
------------------------------------------------------------------------
MIRO WAY INDUSTRIAL PROJECT - RIALTO
EXISTING CONDITION RATIONAL METHOD ANALYSIS
100-YR STORM DESIGN
BY LP 02/06/24
------------------------------------------------------------------------


Program License Serial Number 6443

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is  100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.690 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       20.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 3 = 70.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.532(In/Hr)
Initial subarea data:
Initial area flow distance =   245.000(Ft.)
Top (of initial area) elevation =  1407.570(Ft.)
Bottom (of initial area) elevation =  1403.000(Ft.)
Difference in elevation =     4.570(Ft.)
Slope =    0.01865  s(%)=       1.87
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.136 min.
Rainfall intensity =      4.023(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.781
```

```
Subarea runoff =      3.362(CFS)
Total initial stream area =        1.070(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.532(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      20.000 to Point/Station      30.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.231(Ft.), Average velocity =   3.022(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.50
        2             40.00              0.00
        3             60.00              0.00
        4            100.00              0.50
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =     26.879(CFS)
  '     '        flow top width =     56.972(Ft.)
  '     '    velocity=    3.022(Ft/s)
  '     '        area =      8.893(Sq.Ft)
  '     '        Froude number =     1.348

Upstream point elevation =  1403.000(Ft.)
Downstream point elevation =  1384.000(Ft.)
Flow length =   965.000(Ft.)
Travel time  =    5.32 min.
Time of concentration =   19.46 min.
Depth of flow =   0.231(Ft.)
Average velocity =   3.022(Ft/s)
Total irregular channel flow =    26.879(CFS)
Irregular channel normal depth above invert elev. =   0.231(Ft.)
Average velocity of channel(s) =   3.022(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 3 = 70.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.532(In/Hr)
Rainfall intensity =      3.321(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.756
```

```
Subarea runoff =     46.966(CFS) for   18.980(Ac.)
Total runoff =     50.327(CFS)
Effective area this stream =       20.05(Ac.)
Total Study Area (Main Stream No. 1) =       20.05(Ac.)
Area averaged Fm value =    0.532(In/Hr)
Depth of flow =   0.313(Ft.), Average velocity =   3.577(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      70.000 to Point/Station      80.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 3 = 70.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.532(In/Hr)
Initial subarea data:
Initial area flow distance =   478.000(Ft.)
Top (of initial area) elevation =  1410.160(Ft.)
Bottom (of initial area) elevation =  1399.860(Ft.)
Difference in elevation =    10.300(Ft.)
Slope =    0.02155  s(%)=       2.15
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.943 min.
Rainfall intensity =      3.487(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.763
Subarea runoff =     10.237(CFS)
Total initial stream area =        3.850(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.532(In/Hr)
End of computations, Total Study Area =           23.90 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  50.0
```

APPENDIX F

PROPOSED CONDITIONS HYDROLOGY AES RATIONAL METHOD RESULTS

```
              San Bernardino County Rational Hydrology Program

                 (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2018 Version 9.0
        Rational Hydrology Study        Date: 04/04/24
------------------------------------------------------------------------
MIRO WAY INDUSTRIAL PROJECT - RILATO
PROPOSED CONDITION RATIONAL METHOD ANALYSIS
2-YR DESIGN STORM
BY LP 04/04/24
------------------------------------------------------------------------


Program License Serial Number 6443

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.662 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 1


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Initial subarea data:
Initial area flow distance =   412.000(Ft.)
Top (of initial area) elevation =  1408.910(Ft.)
Bottom (of initial area) elevation =  1402.460(Ft.)
Difference in elevation =     6.450(Ft.)
Slope =    0.01566  s(%)=       1.57
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.761 min.
Rainfall intensity =      2.258(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.860
```

```
Subarea runoff =      1.943(CFS)
Total initial stream area =        1.000(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      101.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Time of concentration =     7.76 min.
Rainfall intensity =      2.258(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.860
Subarea runoff =      1.224(CFS) for    0.630(Ac.)
Total runoff =      3.166(CFS)
Effective area this stream =        1.63(Ac.)
Total Study Area (Main Stream No. 1) =        1.63(Ac.)
Area averaged Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1399.460(Ft.)
Downstream point/station elevation =  1398.800(Ft.)
Pipe length  =    66.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     3.166(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.166(CFS)
Normal flow depth in pipe =    8.27(In.)
Flow top width inside pipe =   11.11(In.)
Critical Depth =    9.14(In.)
Pipe flow velocity =      5.48(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =     7.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** INITIAL AREA EVALUATION ****
```

```
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Initial subarea data:
Initial area flow distance =   231.000(Ft.)
Top (of initial area) elevation =  1403.240(Ft.)
Bottom (of initial area) elevation =  1401.460(Ft.)
Difference in elevation =     1.780(Ft.)
Slope =    0.00771  s(%)=       0.77
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.095 min.
Rainfall intensity =      2.383(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.862
Subarea runoff =      1.603(CFS)
Total initial stream area =        0.780(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Time of concentration =     7.10 min.
Rainfall intensity =      2.383(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.862
Subarea runoff =      1.110(CFS) for    0.540(Ac.)
Total runoff =      2.713(CFS)
Effective area this stream =        1.32(Ac.)
Total Study Area (Main Stream No. 1) =        2.95(Ac.)
Area averaged Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      102.000
```

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1398.460(Ft.)
Downstream point/station elevation =  1398.021(Ft.)
Pipe length  =    44.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     2.713(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.713(CFS)
Normal flow depth in pipe =    7.42(In.)
Flow top width inside pipe =   11.66(In.)
Critical Depth =    8.47(In.)
Pipe flow velocity =      5.32(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =     7.23 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Initial subarea data:
Initial area flow distance =   863.000(Ft.)
Top (of initial area) elevation =  1400.580(Ft.)
Bottom (of initial area) elevation =  1394.010(Ft.)
Difference in elevation =     6.570(Ft.)
Slope =    0.00761  s(%)=       0.76
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.049 min.
Rainfall intensity =      1.734(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.848
Subarea runoff =      5.899(CFS)
Total initial stream area =        4.010(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      201.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
```

```
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Time of concentration =    12.05 min.
Rainfall intensity =      1.734(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.848
Subarea runoff =      5.663(CFS) for    3.850(Ac.)
Total runoff =     11.562(CFS)
Effective area this stream =        7.86(Ac.)
Total Study Area (Main Stream No. 1) =       10.81(Ac.)
Area averaged Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1391.010(Ft.)
Downstream point/station elevation =  1388.485(Ft.)
Pipe length  =   253.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    11.562(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    11.562(CFS)
Normal flow depth in pipe =   12.63(In.)
Flow top width inside pipe =   20.56(In.)
Critical Depth =   15.21(In.)
Pipe flow velocity =      7.65(Ft/s)
Travel time through pipe =    0.55 min.
Time of concentration (TC) =    12.60 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Initial subarea data:
Initial area flow distance =   932.000(Ft.)
Top (of initial area) elevation =  1398.880(Ft.)
```

```
Bottom (of initial area) elevation =  1383.410(Ft.)
Difference in elevation =    15.470(Ft.)
Slope =    0.01660  s(%)=       1.66
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.632 min.
Rainfall intensity =      1.870(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.852
Subarea runoff =      5.001(CFS)
Total initial stream area =        3.140(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1380.410(Ft.)
Downstream point/station elevation =  1377.730(Ft.)
Pipe length  =   267.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     5.001(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     5.001(CFS)
Normal flow depth in pipe =    9.36(In.)
Flow top width inside pipe =   14.53(In.)
Critical Depth =   10.89(In.)
Pipe flow velocity =      6.21(Ft/s)
Travel time through pipe =    0.72 min.
Time of concentration (TC) =    11.35 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      302.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Time of concentration =    11.35 min.
Rainfall intensity =      1.798(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.850
Subarea runoff =      6.719(CFS) for    4.530(Ac.)
Total runoff =     11.721(CFS)
Effective area this stream =        7.67(Ac.)
```

```
Total Study Area (Main Stream No. 1) =       18.48(Ac.)
Area averaged Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      304.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Initial subarea data:
Initial area flow distance =   392.000(Ft.)
Top (of initial area) elevation =  1401.280(Ft.)
Bottom (of initial area) elevation =  1398.500(Ft.)
Difference in elevation =     2.780(Ft.)
Slope =    0.00709  s(%)=       0.71
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.913 min.
Rainfall intensity =      2.078(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.857
Subarea runoff =      1.442(CFS)
Total initial stream area =        0.810(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      302.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1395.500(Ft.)
Downstream point/station elevation =  1384.650(Ft.)
Pipe length  =    85.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.442(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     1.442(CFS)
Normal flow depth in pipe =    3.57(In.)
Flow top width inside pipe =    5.89(In.)
Critical depth could not be calculated.
Pipe flow velocity =     11.83(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =     9.03 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      400.000 to Point/Station      401.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Initial subarea data:
Initial area flow distance =   542.000(Ft.)
Top (of initial area) elevation =  1397.740(Ft.)
Bottom (of initial area) elevation =  1385.670(Ft.)
Difference in elevation =    12.070(Ft.)
Slope =    0.02227  s(%)=       2.23
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.071 min.
Rainfall intensity =      2.206(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.859
Subarea runoff =      2.805(CFS)
Total initial stream area =        1.480(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      402.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1382.670(Ft.)
Downstream point/station elevation =  1381.361(Ft.)
Pipe length  =   131.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     2.805(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.805(CFS)
Normal flow depth in pipe =    7.59(In.)
Flow top width inside pipe =   11.57(In.)
Critical Depth =    8.62(In.)
Pipe flow velocity =      5.36(Ft/s)
Travel time through pipe =    0.41 min.
Time of concentration (TC) =     8.48 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      700.000 to Point/Station      701.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
```

```
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Initial subarea data:
Initial area flow distance =   609.000(Ft.)
Top (of initial area) elevation =  1409.030(Ft.)
Bottom (of initial area) elevation =  1403.710(Ft.)
Difference in elevation =     5.320(Ft.)
Slope =    0.00874  s(%)=       0.87
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.197 min.
Rainfall intensity =      1.917(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.853
Subarea runoff =      0.981(CFS)
Total initial stream area =        0.600(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      701.000 to Point/Station      702.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.290(Ft.), Average velocity =   1.783(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              0.77
        2             30.00              0.17
        3             32.00              0.00
        4             32.00              0.50
        5             42.00              0.70
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =      1.376(CFS)
  '     '        flow top width =      8.009(Ft.)
  '     '    velocity=    1.783(Ft/s)
  '     '        area =      0.771(Sq.Ft)
  '     '        Froude number =     1.013

Upstream point elevation =  1403.710(Ft.)
Downstream point elevation =  1390.150(Ft.)
Flow length =   990.000(Ft.)
```

```
Travel time  =    9.25 min.
Time of concentration =   19.45 min.
Depth of flow =   0.290(Ft.)
Average velocity =   1.783(Ft/s)
Total irregular channel flow =     1.376(CFS)
Irregular channel normal depth above invert elev. =   0.290(Ft.)
Average velocity of channel(s) =   1.783(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Rainfall intensity =      1.301(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.831
Subarea runoff =      0.727(CFS) for    0.980(Ac.)
Total runoff =      1.708(CFS)
Effective area this stream =        1.58(Ac.)
Total Study Area (Main Stream No. 1) =       22.35(Ac.)
Area averaged Fm value =    0.100(In/Hr)
Depth of flow =   0.307(Ft.), Average velocity =   1.869(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      703.000 to Point/Station      704.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Initial subarea data:
Initial area flow distance =   611.000(Ft.)
Top (of initial area) elevation =  1408.900(Ft.)
Bottom (of initial area) elevation =  1403.710(Ft.)
Difference in elevation =     5.190(Ft.)
Slope =    0.00849  s(%)=       0.85
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      1.909(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.853
Subarea runoff =      0.977(CFS)
```

```
Total initial stream area =        0.600(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      704.000 to Point/Station      705.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.287(Ft.), Average velocity =   1.844(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00             0.77
        2             30.00             0.17
        3             32.00             0.00
        4             32.00             0.50
        5             42.00             0.70
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =      1.372(CFS)
  '     '        flow top width =      7.835(Ft.)
  '     '    velocity=    1.844(Ft/s)
  '     '        area =      0.744(Sq.Ft)
  '     '        Froude number =     1.055

Upstream point elevation =  1403.710(Ft.)
Downstream point elevation =  1389.510(Ft.)
Flow length =   950.000(Ft.)
Travel time  =    8.58 min.
Time of concentration =   18.85 min.
Depth of flow =   0.287(Ft.)
Average velocity =   1.844(Ft/s)
Total irregular channel flow =     1.372(CFS)
Irregular channel normal depth above invert elev. =   0.287(Ft.)
Average velocity of channel(s) =   1.844(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 1 = 16.60
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.100(In/Hr)
Rainfall intensity =      1.326(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.832
```

```
Subarea runoff =      0.733(CFS) for    0.950(Ac.)
Total runoff =      1.710(CFS)
Effective area this stream =        1.55(Ac.)
Total Study Area (Main Stream No. 1) =       23.90(Ac.)
Area averaged Fm value =    0.100(In/Hr)
Depth of flow =   0.304(Ft.), Average velocity =   1.934(Ft/s)
End of computations, Total Study Area =           23.90 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  32.0
```

```
               San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2018 Version 9.0
        Rational Hydrology Study        Date: 04/04/24
------------------------------------------------------------------------
MIRO WAY INDUSTRIAL PROJECT - RILATO
PROPOSED CONDITION RATIONAL METHOD ANALYSIS
100-YR DESIGN STORM
BY LP 04/04/24
------------------------------------------------------------------------


Program License Serial Number 6443

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.690 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   412.000(Ft.)
Top (of initial area) elevation =  1408.910(Ft.)
Bottom (of initial area) elevation =  1402.460(Ft.)
Difference in elevation =     6.450(Ft.)
Slope =    0.01566  s(%)=       1.57
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.761 min.
Rainfall intensity =      5.766(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.888
```

```
Subarea runoff =      5.118(CFS)
Total initial stream area =        1.000(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      101.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =     7.76 min.
Rainfall intensity =      5.766(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.888
Subarea runoff =      3.225(CFS) for    0.630(Ac.)
Total runoff =      8.343(CFS)
Effective area this stream =        1.63(Ac.)
Total Study Area (Main Stream No. 1) =        1.63(Ac.)
Area averaged Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1399.460(Ft.)
Downstream point/station elevation =  1398.800(Ft.)
Pipe length  =    66.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     8.343(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     8.343(CFS)
Normal flow depth in pipe =   11.45(In.)
Flow top width inside pipe =   17.32(In.)
Critical Depth =   13.43(In.)
Pipe flow velocity =      7.03(Ft/s)
Travel time through pipe =    0.16 min.
Time of concentration (TC) =     7.92 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** INITIAL AREA EVALUATION ****
```

```
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   231.000(Ft.)
Top (of initial area) elevation =  1403.240(Ft.)
Bottom (of initial area) elevation =  1401.460(Ft.)
Difference in elevation =     1.780(Ft.)
Slope =    0.00771  s(%)=       0.77
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.095 min.
Rainfall intensity =      6.084(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.888
Subarea runoff =      4.216(CFS)
Total initial stream area =        0.780(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      104.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =     7.10 min.
Rainfall intensity =      6.084(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.888
Subarea runoff =      2.919(CFS) for    0.540(Ac.)
Total runoff =      7.135(CFS)
Effective area this stream =        1.32(Ac.)
Total Study Area (Main Stream No. 1) =        2.95(Ac.)
Area averaged Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      102.000
```

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1398.460(Ft.)
Downstream point/station elevation =  1398.021(Ft.)
Pipe length  =    44.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     7.135(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     7.135(CFS)
Normal flow depth in pipe =   10.34(In.)
Flow top width inside pipe =   17.80(In.)
Critical Depth =   12.42(In.)
Pipe flow velocity =      6.79(Ft/s)
Travel time through pipe =    0.11 min.
Time of concentration (TC) =     7.20 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   863.000(Ft.)
Top (of initial area) elevation =  1400.580(Ft.)
Bottom (of initial area) elevation =  1394.010(Ft.)
Difference in elevation =     6.570(Ft.)
Slope =    0.00761  s(%)=       0.76
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.049 min.
Rainfall intensity =      4.428(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
Subarea runoff =     15.697(CFS)
Total initial stream area =        4.010(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      201.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
```

```
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =    12.05 min.
Rainfall intensity =      4.428(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.884
Subarea runoff =     15.071(CFS) for    3.850(Ac.)
Total runoff =     30.768(CFS)
Effective area this stream =        7.86(Ac.)
Total Study Area (Main Stream No. 1) =       10.81(Ac.)
Area averaged Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      203.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1391.010(Ft.)
Downstream point/station elevation =  1388.485(Ft.)
Pipe length  =   253.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    30.768(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    30.768(CFS)
Normal flow depth in pipe =   20.37(In.)
Flow top width inside pipe =   23.25(In.)
Critical Depth =   23.01(In.)
Pipe flow velocity =      9.56(Ft/s)
Travel time through pipe =    0.44 min.
Time of concentration (TC) =    12.49 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   932.000(Ft.)
Top (of initial area) elevation =  1398.880(Ft.)
```

```
Bottom (of initial area) elevation =  1383.410(Ft.)
Difference in elevation =    15.470(Ft.)
Slope =    0.01660  s(%)=       1.66
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.632 min.
Rainfall intensity =      4.773(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.885
Subarea runoff =     13.267(CFS)
Total initial stream area =        3.140(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1380.410(Ft.)
Downstream point/station elevation =  1377.730(Ft.)
Pipe length  =   267.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    13.267(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    13.267(CFS)
Normal flow depth in pipe =   13.84(In.)
Flow top width inside pipe =   19.91(In.)
Critical Depth =   16.26(In.)
Pipe flow velocity =      7.89(Ft/s)
Travel time through pipe =    0.56 min.
Time of concentration (TC) =    11.20 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      302.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Time of concentration =    11.20 min.
Rainfall intensity =      4.627(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.885
Subarea runoff =     18.134(CFS) for    4.530(Ac.)
Total runoff =     31.401(CFS)
Effective area this stream =        7.67(Ac.)
```

```
Total Study Area (Main Stream No. 1) =       18.48(Ac.)
Area averaged Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      304.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   392.000(Ft.)
Top (of initial area) elevation =  1401.280(Ft.)
Bottom (of initial area) elevation =  1398.500(Ft.)
Difference in elevation =     2.780(Ft.)
Slope =    0.00709  s(%)=       0.71
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.913 min.
Rainfall intensity =      5.306(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
Subarea runoff =      3.811(CFS)
Total initial stream area =        0.810(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      302.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1395.500(Ft.)
Downstream point/station elevation =  1384.650(Ft.)
Pipe length  =    85.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     3.811(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.811(CFS)
Normal flow depth in pipe =    5.00(In.)
Flow top width inside pipe =    8.94(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.12(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     9.01 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      400.000 to Point/Station      401.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   542.000(Ft.)
Top (of initial area) elevation =  1397.740(Ft.)
Bottom (of initial area) elevation =  1385.670(Ft.)
Difference in elevation =    12.070(Ft.)
Slope =    0.02227  s(%)=       2.23
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.071 min.
Rainfall intensity =      5.631(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
Subarea runoff =      7.396(CFS)
Total initial stream area =        1.480(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      402.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1382.670(Ft.)
Downstream point/station elevation =  1381.361(Ft.)
Pipe length  =   131.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     7.396(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     7.396(CFS)
Normal flow depth in pipe =   10.57(In.)
Flow top width inside pipe =   17.72(In.)
Critical Depth =   12.64(In.)
Pipe flow velocity =      6.85(Ft/s)
Travel time through pipe =    0.32 min.
Time of concentration (TC) =     8.39 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      700.000 to Point/Station      701.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
```

```
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   609.000(Ft.)
Top (of initial area) elevation =  1409.030(Ft.)
Bottom (of initial area) elevation =  1403.710(Ft.)
Difference in elevation =     5.320(Ft.)
Slope =    0.00874  s(%)=       0.87
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.197 min.
Rainfall intensity =      4.894(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.886
Subarea runoff =      2.601(CFS)
Total initial stream area =        0.600(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      701.000 to Point/Station      702.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.380(Ft.), Average velocity =   2.245(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00             0.77
        2             30.00             0.17
        3             32.00             0.00
        4             32.00             0.50
        5             42.00             0.70
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =      3.792(CFS)
  '     '        flow top width =     12.486(Ft.)
  '     '    velocity=    2.245(Ft/s)
  '     '        area =      1.689(Sq.Ft)
  '     '        Froude number =     1.076

Upstream point elevation =  1403.710(Ft.)
Downstream point elevation =  1390.150(Ft.)
Flow length =   990.000(Ft.)
```

```
Travel time  =    7.35 min.
Time of concentration =   17.55 min.
Depth of flow =   0.380(Ft.)
Average velocity =   2.245(Ft/s)
Total irregular channel flow =     3.792(CFS)
Irregular channel normal depth above invert elev. =   0.380(Ft.)
Average velocity of channel(s) =   2.245(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      3.534(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.880
Subarea runoff =      2.313(CFS) for    0.980(Ac.)
Total runoff =      4.914(CFS)
Effective area this stream =        1.58(Ac.)
Total Study Area (Main Stream No. 1) =       22.35(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.408(Ft.), Average velocity =   2.388(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      703.000 to Point/Station      704.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Initial subarea data:
Initial area flow distance =   611.000(Ft.)
Top (of initial area) elevation =  1408.900(Ft.)
Bottom (of initial area) elevation =  1403.710(Ft.)
Difference in elevation =     5.190(Ft.)
Slope =    0.00849  s(%)=       0.85
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.268 min.
Rainfall intensity =      4.874(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.886
Subarea runoff =      2.590(CFS)
```

```
Total initial stream area =        0.600(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.079(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      704.000 to Point/Station      705.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.375(Ft.), Average velocity =   2.319(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1             0.00             0.77
        2            30.00             0.17
        3            32.00             0.00
        4            32.00             0.50
        5            42.00             0.70
Manning's 'N' friction factor =   0.020
-----------------------------------------------------------------
Sub-Channel flow  =      3.776(CFS)
  '     '        flow top width =     12.241(Ft.)
  '     '    velocity=    2.319(Ft/s)
  '     '        area =      1.628(Sq.Ft)
  '     '        Froude number =     1.120

Upstream point elevation =  1403.710(Ft.)
Downstream point elevation =  1389.510(Ft.)
Flow length =   950.000(Ft.)
Travel time  =    6.83 min.
Time of concentration =   17.10 min.
Depth of flow =   0.375(Ft.)
Average velocity =   2.319(Ft/s)
Total irregular channel flow =     3.776(CFS)
Irregular channel normal depth above invert elev. =   0.375(Ft.)
Average velocity of channel(s) =   2.319(Ft/s)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.079(In/Hr)
Rainfall intensity =      3.590(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.880
```

```
Subarea runoff =      2.308(CFS) for    0.950(Ac.)
Total runoff =      4.898(CFS)
Effective area this stream =        1.55(Ac.)
Total Study Area (Main Stream No. 1) =       23.90(Ac.)
Area averaged Fm value =    0.079(In/Hr)
Depth of flow =   0.402(Ft.), Average velocity =   2.467(Ft/s)
End of computations, Total Study Area =          23.90 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  32.0
```

APPENDIX G

EXISTING/PROPOSED CONDITIONS HYDROLOGY AES HYDROGRAPH RESULTS

EXISTING 100-YR

```
        U n i t   H y d r o g r a p h   A n a l y s i s

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0

                Study date  04/08/24

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

San Bernardino County Synthetic Unit Hydrology Method
                Manual date - August 1986


Program License Serial Number 6443

---------------------------------------------------------------------
MIRO WAY INDUSTIAL PROJECT - RIALTO
EXISTING CONDITION UH ANALYSIS
100YR 24HR DESIGN STORM (DA 1)
BY LP 4/8/24
--------------------------------------------------------------------

        Storm Event Year = 100

        Antecedent Moisture Condition = 3

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
         (Ac.)           (hours)           (In)
Rainfall data for year 10
             3.85             1            1.05
--------------------------------------------------------------------
Rainfall data for year 2
             3.85             6            1.80
--------------------------------------------------------------------
Rainfall data for year 2
             3.85            24            3.37
--------------------------------------------------------------------
Rainfall data for year 100
```

```
             3.85           1           1.69
--------------------------------------------------------------------
Rainfall data for year 100
             3.85           6           4.16
--------------------------------------------------------------------
Rainfall data for year 100
             3.85          24           7.73
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      52.0          3.85      1.000     0.785    1.000    0.785

Area-averaged adjusted loss rate Fm (In/Hr) =  0.785

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
     3.85   1.000         32.0      52.0       9.23     0.296

Area-averaged catchment yield fraction, Y =  0.296
Area-averaged low loss fraction, Yb =  0.704
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       3.85(Ac.)
Catchment Lag time =   0.239 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 104.6025
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.785(In/Hr)
Average low loss rate fraction (Yb) = 0.704 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.625(In)
Computed peak 30-minute rainfall =  1.281(In)
Specified peak 1-hour rainfall =  1.690(In)
Computed peak 3-hour rainfall =  2.936(In)
Specified peak 6-hour rainfall =  4.160(In)
Specified peak 24-hour rainfall =  7.730(In)


Rainfall depth area reduction factors:
Using a total area of       3.85(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.625(In)
30-minute factor = 1.000    Adjusted rainfall =  1.281(In)
```

```
1-hour factor = 1.000       Adjusted rainfall =  1.690(In)
3-hour factor = 1.000       Adjusted rainfall =  2.936(In)
6-hour factor = 1.000       Adjusted rainfall =  4.160(In)
24-hour factor = 1.000      Adjusted rainfall =  7.730(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values             ((CFS))
---------------------------------------------------------------------
                (K =        15.52 (CFS))

  1               18.706                      2.903
  2               81.990                      9.822
  3               98.296                      2.531
  4              100.000                      0.265
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      4.94(In)
Total effective rainfall =      2.79(In)
Peak flow rate in flood hydrograph =      7.00(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15       0.0006      0.03   Q        |         |         |         |
  0+30       0.0035      0.14   Q        |         |         |         |
  0+45       0.0069      0.16   Q        |         |         |         |
  1+ 0       0.0104      0.17   Q        |         |         |         |
  1+15       0.0139      0.17   Q        |         |         |         |
  1+30       0.0174      0.17   Q        |         |         |         |
  1+45       0.0210      0.17   Q        |         |         |         |
  2+ 0       0.0247      0.18   QV       |         |         |         |
  2+15       0.0283      0.18   QV       |         |         |         |
  2+30       0.0320      0.18   QV       |         |         |         |
  2+45       0.0357      0.18   QV       |         |         |         |
  3+ 0       0.0395      0.18   QV       |         |         |         |
  3+15       0.0433      0.18   QV       |         |         |         |
  3+30       0.0472      0.19   Q V      |         |         |         |
  3+45       0.0511      0.19   Q V      |         |         |         |
  4+ 0       0.0550      0.19   Q V      |         |         |         |
  4+15       0.0590      0.19   Q V      |         |         |         |
```

```
 4+30       0.0630      0.19  Q V       |         |         |         |
 4+45       0.0671      0.20  Q V       |         |         |         |
 5+ 0       0.0712      0.20  Q  V      |         |         |         |
 5+15       0.0754      0.20  Q  V      |         |         |         |
 5+30       0.0796      0.20  Q  V      |         |         |         |
 5+45       0.0839      0.21  Q  V      |         |         |         |
 6+ 0       0.0882      0.21  Q  V      |         |         |         |
 6+15       0.0926      0.21  Q   V     |         |         |         |
 6+30       0.0971      0.22  Q   V     |         |         |         |
 6+45       0.1016      0.22  Q   V     |         |         |         |
 7+ 0       0.1062      0.22  Q   V     |         |         |         |
 7+15       0.1109      0.23  Q   V     |         |         |         |
 7+30       0.1156      0.23  Q    V    |         |         |         |
 7+45       0.1204      0.23  Q    V    |         |         |         |
 8+ 0       0.1253      0.24  Q    V    |         |         |         |
 8+15       0.1302      0.24  Q    V    |         |         |         |
 8+30       0.1353      0.24  Q     V   |         |         |         |
 8+45       0.1404      0.25  Q     V   |         |         |         |
 9+ 0       0.1457      0.25  |Q    V   |         |         |         |
 9+15       0.1510      0.26  |Q    V   |         |         |         |
 9+30       0.1564      0.26  |Q    V   |         |         |         |
 9+45       0.1620      0.27  |Q     V  |         |         |         |
10+ 0       0.1677      0.27  |Q     V  |         |         |         |
10+15       0.1735      0.28  |Q     V  |         |         |         |
10+30       0.1794      0.29  |Q      V |         |         |         |
10+45       0.1855      0.29  |Q      V |         |         |         |
11+ 0       0.1917      0.30  |Q      V |         |         |         |
11+15       0.1981      0.31  |Q      V |         |         |         |
11+30       0.2047      0.32  |Q       V|         |         |         |
11+45       0.2115      0.33  |Q       V|         |         |         |
12+ 0       0.2185      0.34  |Q       V|         |         |         |
12+15       0.2259      0.36  |Q        V         |         |         |
12+30       0.2341      0.40  |Q        V         |         |         |
12+45       0.2427      0.42  |Q        V         |         |         |
13+ 0       0.2517      0.43  |Q         V        |         |         |
13+15       0.2610      0.45  |Q        |V        |         |         |
13+30       0.2708      0.47  |Q        | V       |         |         |
13+45       0.2809      0.49  |Q        | V       |         |         |
14+ 0       0.2916      0.52  | Q       |  V      |         |         |
14+15       0.3029      0.55  | Q       |  V      |         |         |
14+30       0.3149      0.58  | Q       |   V     |         |         |
14+45       0.3278      0.62  | Q       |   V     |         |         |
15+ 0       0.3418      0.68  | Q       |    V    |         |         |
15+15       0.3573      0.75  | Q       |    V    |         |         |
15+30       0.3744      0.83  |  Q      |     V   |         |         |
15+45       0.3928      0.89  |  Q      |      V  |         |         |
16+ 0       0.4251      1.56  |     Q   |       V |         |         |
16+15       0.5176      4.48  |         |      Q     V     |         |
16+30       0.6622      7.00  |         |         |      Q V|         |
16+45       0.7111      2.37  |        Q|         |          V         |
```

```
   17+ 0       0.7295      0.89  |  Q      |         |         | V       |
   17+15       0.7425      0.63  | Q       |         |         |  V      |
   17+30       0.7538      0.55  | Q       |         |         |  V      |
   17+45       0.7639      0.49  |Q        |         |         |   V     |
   18+ 0       0.7732      0.45  |Q        |         |         |   V     |
   18+15       0.7817      0.41  |Q        |         |         |   V     |
   18+30       0.7891      0.36  |Q        |         |         |    V    |
   18+45       0.7959      0.33  |Q        |         |         |    V    |
   19+ 0       0.8023      0.31  |Q        |         |         |    V    |
   19+15       0.8083      0.29  |Q        |         |         |     V   |
   19+30       0.8141      0.28  |Q        |         |         |     V   |
   19+45       0.8197      0.27  |Q        |         |         |     V   |
   20+ 0       0.8250      0.26  |Q        |         |         |     V   |
   20+15       0.8301      0.25  Q         |         |         |      V  |
   20+30       0.8351      0.24  Q         |         |         |      V  |
   20+45       0.8399      0.23  Q         |         |         |      V  |
   21+ 0       0.8445      0.23  Q         |         |         |      V  |
   21+15       0.8490      0.22  Q         |         |         |      V  |
   21+30       0.8534      0.21  Q         |         |         |       V |
   21+45       0.8577      0.21  Q         |         |         |       V |
   22+ 0       0.8619      0.20  Q         |         |         |       V |
   22+15       0.8659      0.20  Q         |         |         |       V |
   22+30       0.8699      0.19  Q         |         |         |       V |
   22+45       0.8738      0.19  Q         |         |         |        V|
   23+ 0       0.8776      0.18  Q         |         |         |        V|
   23+15       0.8813      0.18  Q         |         |         |        V|
   23+30       0.8850      0.18  Q         |         |         |        V|
   23+45       0.8886      0.17  Q         |         |         |        V|
   24+ 0       0.8921      0.17  Q         |         |         |        V|
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0

Study date 04/08/24

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6443

MIRO WAY INDUSTIAL PROJECT - RIALTO
EXISTING CONDITION UH ANALYSIS (DA 2)
100YR 24HR DESIGN STORM
BY LP 4/8/24

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
20.05	1	1.05
Rainfall data for year 2		
20.05	6	1.80
Rainfall data for year 2		
20.05	24	3.37

Rainfall data for year 100

```
            20.05            1           1.69
---------------------------------------------------------------------
Rainfall data for year 100
            20.05            6           4.16
---------------------------------------------------------------------
Rainfall data for year 100
            20.05           24           7.73
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      52.0         20.05      1.000     0.785    1.000    0.785

Area-averaged adjusted loss rate Fm (In/Hr) =  0.785

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
    20.05   1.000         32.0      52.0       9.23     0.296

Area-averaged catchment yield fraction, Y =  0.296
Area-averaged low loss fraction, Yb =  0.704
Direct entry of lag time by user
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      20.05(Ac.)
Catchment Lag time =   0.259 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 96.5251
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.785(In/Hr)
Average low loss rate fraction (Yb) = 0.704 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.625(In)
Computed peak 30-minute rainfall =  1.281(In)
Specified peak 1-hour rainfall =  1.690(In)
Computed peak 3-hour rainfall =  2.936(In)
Specified peak 6-hour rainfall =  4.160(In)
Specified peak 24-hour rainfall =  7.730(In)


Rainfall depth area reduction factors:
Using a total area of      20.05(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999     Adjusted rainfall =  0.625(In)
30-minute factor = 0.999    Adjusted rainfall =  1.280(In)
```

```
1-hour factor = 0.999       Adjusted rainfall =  1.688(In)
3-hour factor = 1.000       Adjusted rainfall =  2.936(In)
6-hour factor = 1.000       Adjusted rainfall =  4.160(In)
24-hour factor = 1.000      Adjusted rainfall =  7.730(In)
----------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values            ((CFS))
----------------------------------------------------------------------
                (K =        80.83 (CFS))

  1                16.074                 12.992
  2                77.169                 49.381
  3                97.490                 16.425
  4               100.000                  2.029
----------------------------------------------------------------------
---------------------------------------------------------------------
---------------------------------------------------------------------
Total soil rain loss =      4.94(In)
Total effective rainfall =      2.79(In)
Peak flow rate in flood hydrograph =     36.03(CFS)
----------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f    H y d r o g r a p h
---------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

---------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       10.0      20.0      30.0      40.0
-----------------------------------------------------------------------
  0+15       0.0029      0.14  Q         |         |         |         |
  0+30       0.0167      0.67  Q         |         |         |         |
  0+45       0.0343      0.85  Q         |         |         |         |
  1+ 0       0.0524      0.88  Q         |         |         |         |
  1+15       0.0708      0.89  Q         |         |         |         |
  1+30       0.0893      0.90  Q         |         |         |         |
  1+45       0.1080      0.90  Q         |         |         |         |
  2+ 0       0.1268      0.91  QV        |         |         |         |
  2+15       0.1459      0.92  QV        |         |         |         |
  2+30       0.1651      0.93  QV        |         |         |         |
  2+45       0.1845      0.94  QV        |         |         |         |
  3+ 0       0.2041      0.95  QV        |         |         |         |
  3+15       0.2240      0.96  QV        |         |         |         |
  3+30       0.2440      0.97  Q V       |         |         |         |
  3+45       0.2643      0.98  Q V       |         |         |         |
  4+ 0       0.2848      0.99  Q V       |         |         |         |
  4+15       0.3055      1.00  |QV       |         |         |         |
```

```
 4+30       0.3264      1.01  |QV       |         |         |         |
 4+45       0.3476      1.03  |QV       |         |         |         |
 5+ 0       0.3691      1.04  |Q V      |         |         |         |
 5+15       0.3908      1.05  |Q V      |         |         |         |
 5+30       0.4128      1.06  |Q V      |         |         |         |
 5+45       0.4351      1.08  |Q V      |         |         |         |
 6+ 0       0.4576      1.09  |Q V      |         |         |         |
 6+15       0.4805      1.11  |Q  V     |         |         |         |
 6+30       0.5037      1.12  |Q  V     |         |         |         |
 6+45       0.5272      1.14  |Q  V     |         |         |         |
 7+ 0       0.5511      1.16  |Q  V     |         |         |         |
 7+15       0.5753      1.17  |Q  V     |         |         |         |
 7+30       0.5999      1.19  |Q   V    |         |         |         |
 7+45       0.6249      1.21  |Q   V    |         |         |         |
 8+ 0       0.6503      1.23  |Q   V    |         |         |         |
 8+15       0.6761      1.25  |Q   V    |         |         |         |
 8+30       0.7024      1.27  |Q    V   |         |         |         |
 8+45       0.7291      1.29  |Q    V   |         |         |         |
 9+ 0       0.7564      1.32  |Q    V   |         |         |         |
 9+15       0.7841      1.34  |Q    V   |         |         |         |
 9+30       0.8124      1.37  |Q    V   |         |         |         |
 9+45       0.8413      1.40  |Q     V  |         |         |         |
10+ 0       0.8708      1.43  |Q     V  |         |         |         |
10+15       0.9010      1.46  |Q     V  |         |         |         |
10+30       0.9318      1.49  |Q     V  |         |         |         |
10+45       0.9634      1.53  |Q      V |         |         |         |
11+ 0       0.9958      1.57  |Q      V |         |         |         |
11+15       1.0291      1.61  |Q      V |         |         |         |
11+30       1.0633      1.65  |Q       V|         |         |         |
11+45       1.0985      1.70  |Q       V|         |         |         |
12+ 0       1.1347      1.76  |Q       V|         |         |         |
12+15       1.1730      1.85  |Q        V         |         |         |
12+30       1.2154      2.06  | Q       V         |         |         |
12+45       1.2603      2.17  | Q       V         |         |         |
13+ 0       1.3070      2.26  | Q        V        |         |         |
13+15       1.3554      2.34  | Q       |V        |         |         |
13+30       1.4058      2.44  | Q       | V       |         |         |
13+45       1.4586      2.55  | Q       | V       |         |         |
14+ 0       1.5140      2.68  | Q       | V       |         |         |
14+15       1.5725      2.83  | Q       |  V      |         |         |
14+30       1.6348      3.02  |  Q      |   V     |         |         |
14+45       1.7017      3.23  |  Q      |   V     |         |         |
15+ 0       1.7742      3.51  |  Q      |    V    |         |         |
15+15       1.8543      3.87  |  Q      |    V    |         |         |
15+30       1.9427      4.28  |   Q     |     V   |         |         |
15+45       2.0379      4.61  |   Q     |      V  |         |         |
16+ 0       2.1967      7.69  |      Q  |       V |         |         |
16+15       2.6463     21.76  |         |          QV       |         |
16+30       3.3907     36.03  |         |         |        V|     Q   |
16+45       3.6866     14.32  |         |   Q     |         |V        |
```

```
   17+ 0       3.7917      5.09  |    Q    |         |         | V       |
   17+15       3.8601      3.31  |  Q      |         |         |  V      |
   17+30       3.9196      2.88  | Q       |         |         |  V      |
   17+45       3.9729      2.58  | Q       |         |         |   V     |
   18+ 0       4.0218      2.36  | Q       |         |         |   V     |
   18+15       4.0663      2.16  | Q       |         |         |   V     |
   18+30       4.1051      1.88  |Q        |         |         |    V    |
   18+45       4.1406      1.72  |Q        |         |         |    V    |
   19+ 0       4.1740      1.62  |Q        |         |         |    V    |
   19+15       4.2058      1.54  |Q        |         |         |     V   |
   19+30       4.2360      1.47  |Q        |         |         |     V   |
   19+45       4.2650      1.40  |Q        |         |         |     V   |
   20+ 0       4.2928      1.35  |Q        |         |         |     V   |
   20+15       4.3197      1.30  |Q        |         |         |      V  |
   20+30       4.3455      1.25  |Q        |         |         |      V  |
   20+45       4.3706      1.21  |Q        |         |         |      V  |
   21+ 0       4.3949      1.18  |Q        |         |         |      V  |
   21+15       4.4184      1.14  |Q        |         |         |      V  |
   21+30       4.4414      1.11  |Q        |         |         |       V |
   21+45       4.4637      1.08  |Q        |         |         |       V |
   22+ 0       4.4854      1.05  |Q        |         |         |       V |
   22+15       4.5067      1.03  |Q        |         |         |       V |
   22+30       4.5274      1.00  |Q        |         |         |       V |
   22+45       4.5477      0.98  Q         |         |         |        V|
   23+ 0       4.5676      0.96  Q         |         |         |        V|
   23+15       4.5870      0.94  Q         |         |         |        V|
   23+30       4.6061      0.92  Q         |         |         |        V|
   23+45       4.6248      0.91  Q         |         |         |        V|
   24+ 0       4.6431      0.89  Q         |         |         |        V|
-----------------------------------------------------------------------
```

PROPOSED 100-YR

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 04/04/24

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6443

MIRO WAY INDUSTRIAL PROJECT - RIALTO
PROPOSED CONDITION UH ANALYSIS (DA 1)
100 YR 24HR DESIGN STORM
BY LP 04/04/24

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
2.95	1	1.05
Rainfall data for year 2		
2.95	6	1.80
Rainfall data for year 2		
2.95	24	3.37

Rainfall data for year 100

```
             2.95            1            1.69
--------------------------------------------------------------------
Rainfall data for year 100
             2.95            6            4.16
--------------------------------------------------------------------
Rainfall data for year 100
             2.95           24            7.73
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      52.0          2.95      1.000     0.785    0.200    0.157

Area-averaged adjusted loss rate Fm (In/Hr) =  0.157

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
     0.59   0.200         32.0      52.0       9.23     0.296
     2.36   0.800         98.0      98.0       0.20     0.969

Area-averaged catchment yield fraction, Y =  0.834
Area-averaged low loss fraction, Yb =  0.166
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       2.95(Ac.)
Catchment Lag time =   0.103 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 241.5459
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.157(In/Hr)
Average low loss rate fraction (Yb) = 0.166 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.625(In)
Computed peak 30-minute rainfall =  1.281(In)
Specified peak 1-hour rainfall =  1.690(In)
Computed peak 3-hour rainfall =  2.936(In)
Specified peak 6-hour rainfall =  4.160(In)
Specified peak 24-hour rainfall =  7.730(In)


Rainfall depth area reduction factors:
Using a total area of       2.95(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.625(In)
```

```
30-minute factor = 1.000    Adjusted rainfall =  1.281(In)
1-hour factor = 1.000       Adjusted rainfall =  1.690(In)
3-hour factor = 1.000       Adjusted rainfall =  2.936(In)
6-hour factor = 1.000       Adjusted rainfall =  4.160(In)
24-hour factor = 1.000      Adjusted rainfall =  7.730(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values            ((CFS))
---------------------------------------------------------------------
                (K =        11.89 (CFS))

  1               56.617                    6.733
  2              100.000                    5.159
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      1.15(In)
Total effective rainfall =      6.58(In)
Peak flow rate in flood hydrograph =      7.39(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
----------------------------------------------------------------------
  0+15       0.0042      0.20  Q         |         |         |         |
  0+30       0.0116      0.36  VQ        |         |         |         |
  0+45       0.0191      0.36  VQ        |         |         |         |
  1+ 0       0.0267      0.37  VQ        |         |         |         |
  1+15       0.0344      0.37  VQ        |         |         |         |
  1+30       0.0421      0.37   Q        |         |         |         |
  1+45       0.0499      0.38  |Q        |         |         |         |
  2+ 0       0.0577      0.38  |Q        |         |         |         |
  2+15       0.0657      0.38  |Q        |         |         |         |
  2+30       0.0737      0.39  |Q        |         |         |         |
  2+45       0.0818      0.39  |QV       |         |         |         |
  3+ 0       0.0900      0.40  |QV       |         |         |         |
  3+15       0.0983      0.40  |QV       |         |         |         |
  3+30       0.1066      0.40  |QV       |         |         |         |
  3+45       0.1151      0.41  |QV       |         |         |         |
  4+ 0       0.1236      0.41  |Q V      |         |         |         |
  4+15       0.1323      0.42  |Q V      |         |         |         |
  4+30       0.1410      0.42  |Q V      |         |         |         |
```

```
 4+45       0.1499      0.43  |Q V      |         |         |         |
 5+ 0       0.1588      0.43  |Q V      |         |         |         |
 5+15       0.1679      0.44  |Q  V     |         |         |         |
 5+30       0.1771      0.44  |Q  V     |         |         |         |
 5+45       0.1864      0.45  |Q  V     |         |         |         |
 6+ 0       0.1958      0.46  |Q  V     |         |         |         |
 6+15       0.2054      0.46  |Q   V    |         |         |         |
 6+30       0.2151      0.47  |Q   V    |         |         |         |
 6+45       0.2249      0.48  |Q   V    |         |         |         |
 7+ 0       0.2349      0.48  |Q   V    |         |         |         |
 7+15       0.2451      0.49  |Q    V   |         |         |         |
 7+30       0.2554      0.50  |Q    V   |         |         |         |
 7+45       0.2658      0.51  | Q   V   |         |         |         |
 8+ 0       0.2765      0.51  | Q   V   |         |         |         |
 8+15       0.2873      0.52  | Q    V  |         |         |         |
 8+30       0.2983      0.53  | Q    V  |         |         |         |
 8+45       0.3095      0.54  | Q    V  |         |         |         |
 9+ 0       0.3209      0.55  | Q    V  |         |         |         |
 9+15       0.3326      0.56  | Q     V |         |         |         |
 9+30       0.3445      0.58  | Q     V |         |         |         |
 9+45       0.3566      0.59  | Q     V |         |         |         |
10+ 0       0.3690      0.60  | Q      V|         |         |         |
10+15       0.3817      0.61  | Q      V|         |         |         |
10+30       0.3947      0.63  | Q      V|         |         |         |
10+45       0.4080      0.64  | Q       V         |         |         |
11+ 0       0.4216      0.66  | Q       V         |         |         |
11+15       0.4356      0.68  | Q       V         |         |         |
11+30       0.4501      0.70  | Q        V        |         |         |
11+45       0.4649      0.72  | Q       |V        |         |         |
12+ 0       0.4803      0.74  | Q       |V        |         |         |
12+15       0.4973      0.82  |  Q      | V       |         |         |
12+30       0.5157      0.89  |  Q      | V       |         |         |
12+45       0.5348      0.92  |  Q      |  V      |         |         |
13+ 0       0.5546      0.96  |  Q      |  V      |         |         |
13+15       0.5752      1.00  |  Q      |   V     |         |         |
13+30       0.5967      1.04  |   Q     |   V     |         |         |
13+45       0.6192      1.09  |   Q     |    V    |         |         |
14+ 0       0.6430      1.15  |   Q     |    V    |         |         |
14+15       0.6682      1.22  |   Q     |     V   |         |         |
14+30       0.6951      1.30  |    Q    |      V  |         |         |
14+45       0.7242      1.41  |    Q    |      V  |         |         |
15+ 0       0.7561      1.54  |     Q   |       V |         |         |
15+15       0.7918      1.73  |     Q   |        V|         |         |
15+30       0.8297      1.83  |      Q  |         V         |         |
15+45       0.8733      2.11  |       Q |          V        |         |
16+ 0       0.9509      3.75  |         |    Q    |  V      |         |
16+15       1.1036      7.39  |         |         |      V Q|         |
16+30       1.2102      5.16  |         |         Q        V|         |
16+45       1.2463      1.74  |     Q   |         |         V         |
17+ 0       1.2760      1.44  |    Q    |         |         |V        |
```

```
   17+15       1.3016      1.24  |   Q     |         |         | V       |
   17+30       1.3244      1.10  |   Q     |         |         | V       |
   17+45       1.3451      1.00  |   Q     |         |         |  V      |
   18+ 0       1.3643      0.93  |  Q      |         |         |  V      |
   18+15       1.3812      0.81  |  Q      |         |         |   V     |
   18+30       1.3961      0.72  | Q       |         |         |   V     |
   18+45       1.4102      0.68  | Q       |         |         |   V     |
   19+ 0       1.4236      0.65  | Q       |         |         |    V    |
   19+15       1.4363      0.62  | Q       |         |         |    V    |
   19+30       1.4485      0.59  | Q       |         |         |    V    |
   19+45       1.4602      0.57  | Q       |         |         |     V   |
   20+ 0       1.4714      0.54  | Q       |         |         |     V   |
   20+15       1.4823      0.53  | Q       |         |         |     V   |
   20+30       1.4928      0.51  | Q       |         |         |     V   |
   20+45       1.5029      0.49  |Q        |         |         |      V  |
   21+ 0       1.5128      0.48  |Q        |         |         |      V  |
   21+15       1.5224      0.46  |Q        |         |         |      V  |
   21+30       1.5317      0.45  |Q        |         |         |      V  |
   21+45       1.5408      0.44  |Q        |         |         |       V |
   22+ 0       1.5497      0.43  |Q        |         |         |       V |
   22+15       1.5583      0.42  |Q        |         |         |       V |
   22+30       1.5668      0.41  |Q        |         |         |       V |
   22+45       1.5751      0.40  |Q        |         |         |       V |
   23+ 0       1.5832      0.39  |Q        |         |         |        V|
   23+15       1.5911      0.38  |Q        |         |         |        V|
   23+30       1.5989      0.38  |Q        |         |         |        V|
   23+45       1.6066      0.37  |Q        |         |         |        V|
   24+ 0       1.6141      0.36  |Q        |         |         |        V|
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0

Study date 04/04/24

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6443

MIRO WAY INDUSTRIAL PROJECT - RIALTO
PROPOSED CONDITION UH ANALYSIS (DA 2)
100 YR 24HR DESIGN STORM
BY LP 04/04/24

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
7.86	1	1.05
Rainfall data for year 2		
7.86	6	1.80
Rainfall data for year 2		
7.86	24	3.37

Rainfall data for year 100

```
            7.86           1          1.69
--------------------------------------------------------------------
Rainfall data for year 100
            7.86           6          4.16
--------------------------------------------------------------------
Rainfall data for year 100
            7.86          24          7.73
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      52.0          7.86      1.000     0.785    0.200    0.157

Area-averaged adjusted loss rate Fm (In/Hr) =  0.157

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
     1.57   0.200         32.0      52.0       9.23     0.296
     6.29   0.800         98.0      98.0       0.20     0.969

Area-averaged catchment yield fraction, Y =  0.834
Area-averaged low loss fraction, Yb =  0.166
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       7.86(Ac.)
Catchment Lag time =   0.161 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 155.5694
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.157(In/Hr)
Average low loss rate fraction (Yb) = 0.166 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.625(In)
Computed peak 30-minute rainfall =  1.281(In)
Specified peak 1-hour rainfall =  1.690(In)
Computed peak 3-hour rainfall =  2.936(In)
Specified peak 6-hour rainfall =  4.160(In)
Specified peak 24-hour rainfall =  7.730(In)


Rainfall depth area reduction factors:
Using a total area of       7.86(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.625(In)
```

```
30-minute factor = 1.000    Adjusted rainfall =  1.280(In)
1-hour factor = 1.000       Adjusted rainfall =  1.689(In)
3-hour factor = 1.000       Adjusted rainfall =  2.936(In)
6-hour factor = 1.000       Adjusted rainfall =  4.160(In)
24-hour factor = 1.000      Adjusted rainfall =  7.730(In)
---------------------------------------------------------------------

                        U n i t   H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values           ((CFS))
---------------------------------------------------------------------
                (K =        31.69 (CFS))

  1               36.159                 11.457
  2               95.935                 18.940
  3              100.000                  1.288
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      1.15(In)
Total effective rainfall =      6.58(In)
Peak flow rate in flood hydrograph =     17.29(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R    S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        5.0      10.0      15.0      20.0
-----------------------------------------------------------------------
  0+15       0.0071      0.35  Q         |         |         |         |
  0+30       0.0261      0.92  VQ        |         |         |         |
  0+45       0.0461      0.97  VQ        |         |         |         |
  1+ 0       0.0662      0.97  VQ        |         |         |         |
  1+15       0.0865      0.98  VQ        |         |         |         |
  1+30       0.1070      0.99  VQ        |         |         |         |
  1+45       0.1278      1.00  |VQ       |         |         |         |
  2+ 0       0.1487      1.01  |VQ       |         |         |         |
  2+15       0.1698      1.02  |VQ       |         |         |         |
  2+30       0.1911      1.03  |VQ       |         |         |         |
  2+45       0.2126      1.04  |VQ       |         |         |         |
  3+ 0       0.2344      1.05  | Q       |         |         |         |
  3+15       0.2564      1.06  | Q       |         |         |         |
  3+30       0.2786      1.08  | Q       |         |         |         |
  3+45       0.3010      1.09  | Q       |         |         |         |
  4+ 0       0.3238      1.10  | QV      |         |         |         |
  4+15       0.3467      1.11  | QV      |         |         |         |
```

```
 4+30       0.3700      1.13   | QV      |         |         |         |
 4+45       0.3935      1.14   | QV      |         |         |         |
 5+ 0       0.4173      1.15   | QV      |         |         |         |
 5+15       0.4414      1.17   | Q V     |         |         |         |
 5+30       0.4658      1.18   | Q V     |         |         |         |
 5+45       0.4905      1.20   | Q V     |         |         |         |
 6+ 0       0.5156      1.21   | Q V     |         |         |         |
 6+15       0.5410      1.23   | Q  V    |         |         |         |
 6+30       0.5667      1.25   | Q  V    |         |         |         |
 6+45       0.5929      1.26   | Q  V    |         |         |         |
 7+ 0       0.6194      1.28   | Q  V    |         |         |         |
 7+15       0.6463      1.30   | Q  V    |         |         |         |
 7+30       0.6736      1.32   | Q   V   |         |         |         |
 7+45       0.7014      1.34   | Q   V   |         |         |         |
 8+ 0       0.7296      1.37   | Q   V   |         |         |         |
 8+15       0.7583      1.39   | Q    V  |         |         |         |
 8+30       0.7875      1.41   | Q    V  |         |         |         |
 8+45       0.8173      1.44   | Q    V  |         |         |         |
 9+ 0       0.8476      1.47   | Q    V  |         |         |         |
 9+15       0.8784      1.49   | Q     V |         |         |         |
 9+30       0.9100      1.53   |  Q    V |         |         |         |
 9+45       0.9421      1.56   |  Q    V |         |         |         |
10+ 0       0.9750      1.59   |  Q     V|         |         |         |
10+15       1.0086      1.63   |  Q     V|         |         |         |
10+30       1.0430      1.66   |  Q     V|         |         |         |
10+45       1.0782      1.71   |  Q      V         |         |         |
11+ 0       1.1144      1.75   |  Q      V         |         |         |
11+15       1.1515      1.80   |  Q      V         |         |         |
11+30       1.1897      1.85   |  Q       V        |         |         |
11+45       1.2290      1.90   |  Q      |V        |         |         |
12+ 0       1.2696      1.96   |  Q      |V        |         |         |
12+15       1.3134      2.12   |   Q     | V       |         |         |
12+30       1.3619      2.35   |   Q     | V       |         |         |
12+45       1.4123      2.44   |   Q     |  V      |         |         |
13+ 0       1.4646      2.53   |    Q    |  V      |         |         |
13+15       1.5189      2.63   |    Q    |   V     |         |         |
13+30       1.5756      2.74   |    Q    |   V     |         |         |
13+45       1.6349      2.87   |    Q    |    V    |         |         |
14+ 0       1.6974      3.02   |     Q   |    V    |         |         |
14+15       1.7636      3.20   |     Q   |     V   |         |         |
14+30       1.8342      3.42   |     Q   |      V  |         |         |
14+45       1.9102      3.68   |      Q  |      V  |         |         |
15+ 0       1.9932      4.02   |       Q |       V |         |         |
15+15       2.0856      4.47   |       Q |        V|         |         |
15+30       2.1858      4.85   |        Q|         V         |         |
15+45       2.2968      5.37   |         Q          V        |         |
16+ 0       2.4738      8.57   |         |      Q  | V       |         |
16+15       2.8244     16.97   |         |         |     V   |  Q      |
16+30       3.1816     17.29   |         |         |        V|   Q     |
16+45       3.2982      5.65   |         |Q        |         V         |
```

```
   17+ 0       3.3812      4.02  |       Q |         |          V        |
   17+15       3.4518      3.41  |     Q   |         |         | V       |
   17+30       3.5141      3.02  |     Q   |         |         | V       |
   17+45       3.5707      2.74  |    Q    |         |         |  V      |
   18+ 0       3.6228      2.52  |    Q    |         |         |  V      |
   18+15       3.6695      2.26  |   Q     |         |         |   V     |
   18+30       3.7102      1.97  |  Q      |         |         |   V     |
   18+45       3.7483      1.84  |  Q      |         |         |   V     |
   19+ 0       3.7843      1.75  |  Q      |         |         |    V    |
   19+15       3.8186      1.66  |  Q      |         |         |    V    |
   19+30       3.8514      1.59  |  Q      |         |         |    V    |
   19+45       3.8829      1.52  |  Q      |         |         |     V   |
   20+ 0       3.9131      1.46  | Q       |         |         |     V   |
   20+15       3.9423      1.41  | Q       |         |         |     V   |
   20+30       3.9705      1.36  | Q       |         |         |     V   |
   20+45       3.9977      1.32  | Q       |         |         |      V  |
   21+ 0       4.0242      1.28  | Q       |         |         |      V  |
   21+15       4.0499      1.24  | Q       |         |         |      V  |
   21+30       4.0749      1.21  | Q       |         |         |      V  |
   21+45       4.0993      1.18  | Q       |         |         |       V |
   22+ 0       4.1231      1.15  | Q       |         |         |       V |
   22+15       4.1463      1.12  | Q       |         |         |       V |
   22+30       4.1690      1.10  | Q       |         |         |       V |
   22+45       4.1912      1.07  | Q       |         |         |       V |
   23+ 0       4.2129      1.05  | Q       |         |         |        V|
   23+15       4.2342      1.03  | Q       |         |         |        V|
   23+30       4.2551      1.01  | Q       |         |         |        V|
   23+45       4.2756      0.99  |Q        |         |         |        V|
   24+ 0       4.2957      0.97  |Q        |         |         |        V|
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 04/04/24

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6443

MIRO WAY INDUSTRIAL PROJECT - RIALTO
PROPOSED CONDITION UH ANALYSIS (DA 3)
100 YR 24HR DESIGN STORM
BY LP 04/04/24

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
8.48	1	1.05
Rainfall data for year 2		
8.48	6	1.80
Rainfall data for year 2		
8.48	24	3.37
Rainfall data for year 100		

```
             8.48           1           1.69
--------------------------------------------------------------------
Rainfall data for year 100
             8.48           6           4.16
--------------------------------------------------------------------
Rainfall data for year 100
             8.48          24           7.73
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      52.0          8.48      1.000     0.785    0.200    0.157

Area-averaged adjusted loss rate Fm (In/Hr) =  0.157

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
     1.70   0.200         32.0      52.0       9.23     0.296
     6.78   0.800         98.0      98.0       0.20     0.969

Area-averaged catchment yield fraction, Y =  0.834
Area-averaged low loss fraction, Yb =  0.166
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       8.48(Ac.)
Catchment Lag time =   0.149 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 167.4481
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.157(In/Hr)
Average low loss rate fraction (Yb) = 0.166 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.625(In)
Computed peak 30-minute rainfall =  1.281(In)
Specified peak 1-hour rainfall =  1.690(In)
Computed peak 3-hour rainfall =  2.936(In)
Specified peak 6-hour rainfall =  4.160(In)
Specified peak 24-hour rainfall =  7.730(In)


Rainfall depth area reduction factors:
Using a total area of       8.48(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.625(In)
```

```
30-minute factor = 1.000    Adjusted rainfall =  1.280(In)
1-hour factor = 1.000       Adjusted rainfall =  1.689(In)
3-hour factor = 1.000       Adjusted rainfall =  2.936(In)
6-hour factor = 1.000       Adjusted rainfall =  4.160(In)
24-hour factor = 1.000      Adjusted rainfall =  7.730(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values           ((CFS))
---------------------------------------------------------------------
                (K =        34.19 (CFS))

  1                39.792                 13.603
  2                97.064                 19.579
  3               100.000                  1.004
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      1.15(In)
Total effective rainfall =      6.58(In)
Peak flow rate in flood hydrograph =     18.86(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        5.0      10.0      15.0      20.0
----------------------------------------------------------------------
  0+15      0.0085      0.41  Q         |         |         |         |
  0+30      0.0292      1.00  V Q       |         |         |         |
  0+45      0.0507      1.04  V Q       |         |         |         |
  1+ 0      0.0725      1.05  V Q       |         |         |         |
  1+15      0.0944      1.06  V Q       |         |         |         |
  1+30      0.1166      1.07   VQ       |         |         |         |
  1+45      0.1389      1.08  |VQ       |         |         |         |
  2+ 0      0.1615      1.09  |VQ       |         |         |         |
  2+15      0.1842      1.10  |VQ       |         |         |         |
  2+30      0.2073      1.11  |VQ       |         |         |         |
  2+45      0.2305      1.12  |VQ       |         |         |         |
  3+ 0      0.2540      1.14  | Q       |         |         |         |
  3+15      0.2777      1.15  | Q       |         |         |         |
  3+30      0.3017      1.16  | Q       |         |         |         |
  3+45      0.3260      1.17  | Q       |         |         |         |
  4+ 0      0.3505      1.19  | QV      |         |         |         |
  4+15      0.3753      1.20  | QV      |         |         |         |
```

```
 4+30       0.4004      1.21  | QV      |         |         |         |
 4+45       0.4258      1.23  | QV      |         |         |         |
 5+ 0       0.4515      1.24  | QV      |         |         |         |
 5+15       0.4775      1.26  | Q V     |         |         |         |
 5+30       0.5038      1.28  | Q V     |         |         |         |
 5+45       0.5305      1.29  | Q V     |         |         |         |
 6+ 0       0.5576      1.31  | Q V     |         |         |         |
 6+15       0.5850      1.33  | Q  V    |         |         |         |
 6+30       0.6128      1.35  | Q  V    |         |         |         |
 6+45       0.6410      1.36  | Q  V    |         |         |         |
 7+ 0       0.6696      1.39  | Q  V    |         |         |         |
 7+15       0.6987      1.41  | Q   V   |         |         |         |
 7+30       0.7282      1.43  | Q   V   |         |         |         |
 7+45       0.7581      1.45  | Q   V   |         |         |         |
 8+ 0       0.7886      1.48  | Q   V   |         |         |         |
 8+15       0.8196      1.50  |  Q   V  |         |         |         |
 8+30       0.8512      1.53  |  Q   V  |         |         |         |
 8+45       0.8833      1.55  |  Q   V  |         |         |         |
 9+ 0       0.9160      1.58  |  Q   V  |         |         |         |
 9+15       0.9493      1.61  |  Q    V |         |         |         |
 9+30       0.9834      1.65  |  Q    V |         |         |         |
 9+45       1.0181      1.68  |  Q    V |         |         |         |
10+ 0       1.0536      1.72  |  Q     V|         |         |         |
10+15       1.0899      1.76  |  Q     V|         |         |         |
10+30       1.1270      1.80  |  Q     V|         |         |         |
10+45       1.1651      1.84  |  Q      V         |         |         |
11+ 0       1.2042      1.89  |  Q      V         |         |         |
11+15       1.2443      1.94  |  Q      V         |         |         |
11+30       1.2855      2.00  |  Q       V        |         |         |
11+45       1.3280      2.06  |   Q     |V        |         |         |
12+ 0       1.3718      2.12  |   Q     |V        |         |         |
12+15       1.4194      2.30  |   Q     | V       |         |         |
12+30       1.4719      2.54  |    Q    | V       |         |         |
12+45       1.5263      2.64  |    Q    |  V      |         |         |
13+ 0       1.5828      2.73  |    Q    |  V      |         |         |
13+15       1.6415      2.84  |    Q    |   V     |         |         |
13+30       1.7028      2.97  |    Q    |   V     |         |         |
13+45       1.7670      3.11  |     Q   |    V    |         |         |
14+ 0       1.8346      3.27  |     Q   |    V    |         |         |
14+15       1.9062      3.46  |     Q   |     V   |         |         |
14+30       1.9826      3.70  |      Q  |      V  |         |         |
14+45       2.0650      3.99  |      Q  |      V  |         |         |
15+ 0       2.1549      4.35  |       Q |       V |         |         |
15+15       2.2551      4.85  |        Q|        V|         |         |
15+30       2.3635      5.24  |         Q         V         |         |
15+45       2.4842      5.84  |         |Q         V        |         |
16+ 0       2.6809      9.52  |         |        Q|  V      |         |
16+15       3.0706     18.86  |         |         |     V   |      Q  |
16+30       3.4430     18.02  |         |         |        V|     Q   |
16+45       3.5631      5.81  |         |Q        |         V         |
```

```
   17+ 0       3.6519      4.30   |       Q |         |          V        |
   17+15       3.7274      3.66   |      Q  |         |         | V       |
   17+30       3.7944      3.24   |     Q   |         |         | V       |
   17+45       3.8551      2.94   |    Q    |         |         |  V      |
   18+ 0       3.9111      2.71   |    Q    |         |         |  V      |
   18+15       3.9611      2.42   |   Q     |         |         |   V     |
   18+30       4.0048      2.11   |   Q     |         |         |   V     |
   18+45       4.0458      1.98   |  Q      |         |         |   V     |
   19+ 0       4.0846      1.88   |  Q      |         |         |    V    |
   19+15       4.1216      1.79   |  Q      |         |         |    V    |
   19+30       4.1569      1.71   |  Q      |         |         |    V    |
   19+45       4.1907      1.64   |  Q      |         |         |     V   |
   20+ 0       4.2233      1.58   |  Q      |         |         |     V   |
   20+15       4.2547      1.52   |  Q      |         |         |     V   |
   20+30       4.2851      1.47   | Q       |         |         |     V   |
   20+45       4.3145      1.42   | Q       |         |         |      V  |
   21+ 0       4.3430      1.38   | Q       |         |         |      V  |
   21+15       4.3707      1.34   | Q       |         |         |      V  |
   21+30       4.3976      1.30   | Q       |         |         |      V  |
   21+45       4.4239      1.27   | Q       |         |         |       V |
   22+ 0       4.4495      1.24   | Q       |         |         |       V |
   22+15       4.4745      1.21   | Q       |         |         |       V |
   22+30       4.4990      1.18   | Q       |         |         |       V |
   22+45       4.5229      1.16   | Q       |         |         |       V |
   23+ 0       4.5463      1.13   | Q       |         |         |        V|
   23+15       4.5693      1.11   | Q       |         |         |        V|
   23+30       4.5918      1.09   | Q       |         |         |        V|
   23+45       4.6139      1.07   | Q       |         |         |        V|
   24+ 0       4.6356      1.05   | Q       |         |         |        V|
-----------------------------------------------------------------------
```

```
        U n i t   H y d r o g r a p h   A n a l y s i s

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0

                Study date  04/04/24

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

San Bernardino County Synthetic Unit Hydrology Method
                Manual date - August 1986


Program License Serial Number 6443

---------------------------------------------------------------------
MIRO WAY INDUSTRIAL PROJECT - RIALTO
PROPOSED CONDITION UH ANALYSIS (DA 4)
100 YR 24HR DESIGN STORM
BY LP 04/04/24
--------------------------------------------------------------------

        Storm Event Year = 100

        Antecedent Moisture Condition = 3

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)          (In)
Rainfall data for year 10
             1.48             1            1.05
--------------------------------------------------------------------
Rainfall data for year 2
             1.48             6            1.80
--------------------------------------------------------------------
Rainfall data for year 2
             1.48            24            3.37
--------------------------------------------------------------------
Rainfall data for year 100
```

```
             1.48           1           1.69
--------------------------------------------------------------------
Rainfall data for year 100
             1.48           6           4.16
--------------------------------------------------------------------
Rainfall data for year 100
             1.48          24           7.73
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      52.0          1.48      1.000     0.785    0.200    0.157

Area-averaged adjusted loss rate Fm (In/Hr) =  0.157

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
     0.30   0.200         32.0      52.0       9.23     0.296
     1.18   0.800         98.0      98.0       0.20     0.969

Area-averaged catchment yield fraction, Y =  0.834
Area-averaged low loss fraction, Yb =  0.166
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       1.48(Ac.)
Catchment Lag time =   0.108 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 232.3420
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.157(In/Hr)
Average low loss rate fraction (Yb) = 0.166 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.625(In)
Computed peak 30-minute rainfall =  1.281(In)
Specified peak 1-hour rainfall =  1.690(In)
Computed peak 3-hour rainfall =  2.936(In)
Specified peak 6-hour rainfall =  4.160(In)
Specified peak 24-hour rainfall =  7.730(In)


Rainfall depth area reduction factors:
Using a total area of      1.48(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.625(In)
```

```
30-minute factor = 1.000    Adjusted rainfall =  1.281(In)
1-hour factor = 1.000       Adjusted rainfall =  1.690(In)
3-hour factor = 1.000       Adjusted rainfall =  2.936(In)
6-hour factor = 1.000       Adjusted rainfall =  4.160(In)
24-hour factor = 1.000      Adjusted rainfall =  7.730(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values           ((CFS))
---------------------------------------------------------------------
                (K =         5.97 (CFS))

  1               54.980                 3.280
  2              100.000                 2.686
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      1.15(In)
Total effective rainfall =      6.58(In)
Peak flow rate in flood hydrograph =      3.67(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
--------------------------------------------------------------------
  0+15       0.0020      0.10  Q         |         |         |         |
  0+30       0.0058      0.18  Q         |         |         |         |
  0+45       0.0095      0.18  Q         |         |         |         |
  1+ 0       0.0133      0.18  Q         |         |         |         |
  1+15       0.0172      0.19  Q         |         |         |         |
  1+30       0.0210      0.19  QV        |         |         |         |
  1+45       0.0250      0.19  QV        |         |         |         |
  2+ 0       0.0289      0.19  QV        |         |         |         |
  2+15       0.0329      0.19  QV        |         |         |         |
  2+30       0.0369      0.19  QV        |         |         |         |
  2+45       0.0410      0.20  Q V       |         |         |         |
  3+ 0       0.0451      0.20  Q V       |         |         |         |
  3+15       0.0492      0.20  Q V       |         |         |         |
  3+30       0.0534      0.20  Q V       |         |         |         |
  3+45       0.0577      0.21  Q V       |         |         |         |
  4+ 0       0.0619      0.21  Q  V      |         |         |         |
  4+15       0.0663      0.21  Q  V      |         |         |         |
  4+30       0.0707      0.21  Q  V      |         |         |         |
```

```
  4+45        0.0751       0.21  Q  V      |         |         |         |
  5+ 0        0.0796       0.22  Q  V      |         |         |         |
  5+15        0.0842       0.22  Q   V     |         |         |         |
  5+30        0.0888       0.22  Q   V     |         |         |         |
  5+45        0.0934       0.23  Q   V     |         |         |         |
  6+ 0        0.0982       0.23  Q   V     |         |         |         |
  6+15        0.1030       0.23  Q    V    |         |         |         |
  6+30        0.1078       0.24  Q    V    |         |         |         |
  6+45        0.1128       0.24  Q    V    |         |         |         |
  7+ 0        0.1178       0.24  Q    V    |         |         |         |
  7+15        0.1229       0.25  Q     V   |         |         |         |
  7+30        0.1280       0.25  Q     V   |         |         |         |
  7+45        0.1333       0.25  |Q    V   |         |         |         |
  8+ 0        0.1386       0.26  |Q    V   |         |         |         |
  8+15        0.1440       0.26  |Q     V  |         |         |         |
  8+30        0.1496       0.27  |Q     V  |         |         |         |
  8+45        0.1552       0.27  |Q     V  |         |         |         |
  9+ 0        0.1609       0.28  |Q     V  |         |         |         |
  9+15        0.1668       0.28  |Q      V |         |         |         |
  9+30        0.1727       0.29  |Q      V |         |         |         |
  9+45        0.1788       0.29  |Q      V |         |         |         |
 10+ 0        0.1850       0.30  |Q       V|         |         |         |
 10+15        0.1914       0.31  |Q       V|         |         |         |
 10+30        0.1979       0.32  |Q       V|         |         |         |
 10+45        0.2046       0.32  |Q        V         |         |         |
 11+ 0        0.2114       0.33  |Q        V         |         |         |
 11+15        0.2184       0.34  |Q        V         |         |         |
 11+30        0.2257       0.35  |Q         V        |         |         |
 11+45        0.2331       0.36  |Q        |V        |         |         |
 12+ 0        0.2408       0.37  |Q        |V        |         |         |
 12+15        0.2493       0.41  |Q        | V       |         |         |
 12+30        0.2586       0.45  |Q        | V       |         |         |
 12+45        0.2681       0.46  |Q        |  V      |         |         |
 13+ 0        0.2781       0.48  |Q        |  V      |         |         |
 13+15        0.2884       0.50  |Q        |   V     |         |         |
 13+30        0.2992       0.52  | Q       |   V     |         |         |
 13+45        0.3105       0.55  | Q       |    V    |         |         |
 14+ 0        0.3224       0.58  | Q       |    V    |         |         |
 14+15        0.3350       0.61  | Q       |     V   |         |         |
 14+30        0.3485       0.65  | Q       |      V  |         |         |
 14+45        0.3631       0.71  | Q       |      V  |         |         |
 15+ 0        0.3790       0.77  |  Q      |       V |         |         |
 15+15        0.3969       0.86  |  Q      |        V|         |         |
 15+30        0.4159       0.92  |  Q      |         V         |         |
 15+45        0.4378       1.06  |   Q     |          V        |         |
 16+ 0        0.4762       1.86  |      Q  |         |  V      |         |
 16+15        0.5521       3.67  |         |   Q     |      V  |         |
 16+30        0.6068       2.65  |         Q         |        V|         |
 16+45        0.6250       0.88  |  Q      |         |         V         |
 17+ 0        0.6399       0.72  | Q       |         |         |V        |
```

```
   17+15       0.6528       0.62  | Q       |         |         | V       |
   17+30       0.6643       0.55  | Q       |         |         | V       |
   17+45       0.6747       0.50  | Q       |         |         |  V      |
   18+ 0       0.6843       0.47  |Q        |         |         |  V      |
   18+15       0.6928       0.41  |Q        |         |         |   V     |
   18+30       0.7003       0.36  |Q        |         |         |   V     |
   18+45       0.7074       0.34  |Q        |         |         |   V     |
   19+ 0       0.7141       0.32  |Q        |         |         |    V    |
   19+15       0.7205       0.31  |Q        |         |         |    V    |
   19+30       0.7266       0.30  |Q        |         |         |    V    |
   19+45       0.7325       0.28  |Q        |         |         |     V   |
   20+ 0       0.7381       0.27  |Q        |         |         |     V   |
   20+15       0.7436       0.26  |Q        |         |         |     V   |
   20+30       0.7488       0.25  |Q        |         |         |     V   |
   20+45       0.7539       0.25  Q         |         |         |      V  |
   21+ 0       0.7589       0.24  Q         |         |         |      V  |
   21+15       0.7637       0.23  Q         |         |         |      V  |
   21+30       0.7684       0.23  Q         |         |         |      V  |
   21+45       0.7729       0.22  Q         |         |         |       V |
   22+ 0       0.7774       0.22  Q         |         |         |       V |
   22+15       0.7817       0.21  Q         |         |         |       V |
   22+30       0.7860       0.21  Q         |         |         |       V |
   22+45       0.7901       0.20  Q         |         |         |       V |
   23+ 0       0.7942       0.20  Q         |         |         |        V|
   23+15       0.7982       0.19  Q         |         |         |        V|
   23+30       0.8021       0.19  Q         |         |         |        V|
   23+45       0.8060       0.19  Q         |         |         |        V|
   24+ 0       0.8097       0.18  Q         |         |         |        V|
-----------------------------------------------------------------------
```

APPENDIX H

UNDERGROUND CHAMBER ANALYSIS, PONDPACK HYDROGRAPH RESULTS

100 Year Stream Rialto

Project Summary	
Title	Stream Rialto
Engineer	
Company	Kimley-Horn
Date	11/2/2021

Notes

Table of Contents

100 Year Stream Rialto

Subsection: User Notifications

User Notifications?	No user notifications generated.

100 Year Stream Rialto

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)
DA 1	Post-Development 100 YEAR	0	69,993.000	975.000	7.39

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)
O-1	Post-Development 100 YEAR	0	44,107.000	1,005.000	2.12

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
BMP 1 (IN)	Post-Development 100 YEAR	0	70,083.000	975.000	7.39	(N/A)	(N/A)
BMP 1 (OUT)	Post-Development 100 YEAR	0	44,107.000	1,005.000	2.12	4.01	15,805.000

100 Year Stream Rialto

Subsection: Read Hydrograph Scenario: Post-Development 100 YEAR
Label: DA 1

Peak Discharge	7.39 ft³/s
Time to Peak	975.000 min
Hydrograph Volume	69,993.000 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
15.000	0.20	0.36	0.36	0.37	0.37
90.000	0.37	0.38	0.38	0.38	0.39
165.000	0.39	0.40	0.40	0.40	0.41
240.000	0.41	0.42	0.42	0.43	0.43
315.000	0.44	0.44	0.45	0.46	0.46
390.000	0.47	0.48	0.48	0.49	0.50
465.000	0.51	0.51	0.52	0.53	0.54
540.000	0.55	0.56	0.58	0.59	0.60
615.000	0.61	0.63	0.64	0.66	0.68
690.000	0.70	0.72	0.74	0.82	0.89
765.000	0.92	0.96	1.00	1.04	1.09
840.000	1.15	1.22	1.30	1.41	1.54
915.000	1.73	1.83	2.11	3.75	7.39
990.000	5.16	1.74	1.44	1.24	1.10
1,065.000	1.00	0.93	0.81	0.72	0.68
1,140.000	0.65	0.62	0.59	0.57	0.54
1,215.000	0.53	0.51	0.49	0.48	0.46
1,290.000	0.45	0.44	0.43	0.42	0.41
1,365.000	0.40	0.39	0.38	0.38	0.37
1,440.000	0.36	(N/A)	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Addition Summary | Scenario: Post-Development 100 YEAR
Label: O-1

Summary for Hydrograph Addition at 'O-1'

Upstream Link	Upstream Node
Outlet-1	BMP 1

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-1	44,107.160	1,005.000	2.12
Flow (In)	O-1	44,107.160	1,005.000	2.12

100 Year Stream Rialto

Subsection: Time vs. Elevation Scenario: Post-Development 100 YEAR
Label: BMP 1 (IN)

Time vs. Elevation (ft)

Output Time increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	0.00	0.03	0.12	0.22	0.30
75.000	0.37	0.43	0.47	0.51	0.55
150.000	0.59	0.63	0.67	0.72	0.76
225.000	0.81	0.86	0.91	0.96	1.01
300.000	1.04	1.06	1.07	1.08	1.09
375.000	1.10	1.11	1.12	1.12	1.13
450.000	1.13	1.14	1.14	1.15	1.16
525.000	1.16	1.17	1.17	1.18	1.19
600.000	1.20	1.20	1.21	1.22	1.23
675.000	1.24	1.25	1.27	1.28	1.30
750.000	1.33	1.36	1.38	1.41	1.44
825.000	1.47	1.50	1.54	1.58	1.64
900.000	1.71	1.81	1.92	2.04	2.30
975.000	3.02	3.80	4.01	3.86	3.68
1,050.000	3.47	3.26	3.06	2.85	2.64
1,125.000	2.44	2.26	2.08	1.91	1.75
1,200.000	1.61	1.49	1.40	1.33	1.27
1,275.000	1.23	1.20	1.18	1.16	1.14
1,350.000	1.13	1.11	1.10	1.10	1.09
1,425.000	1.08	1.07	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Time vs. Volume Scenario: Post-Development 100 YEAR
Label: BMP 1

Time vs. Volume (ft³)

Output Time increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)
0.000	0.000	81.000	294.000	531.000	728.000
75.000	891.000	1,023.000	1,134.000	1,231.000	1,321.000
150.000	1,415.000	1,514.000	1,618.000	1,726.000	1,834.000
225.000	1,946.000	2,063.000	2,185.000	2,311.000	2,435.000
300.000	2,541.000	2,620.000	2,680.000	2,726.000	2,767.000
375.000	2,800.000	2,828.000	2,855.000	2,878.000	2,899.000
450.000	2,921.000	2,944.000	2,965.000	2,984.000	3,005.000
525.000	3,027.000	3,051.000	3,076.000	3,105.000	3,137.000
600.000	3,168.000	3,197.000	3,230.000	3,265.000	3,301.000
675.000	3,342.000	3,387.000	3,435.000	3,484.000	3,557.000
750.000	3,667.000	3,784.000	3,895.000	4,004.000	4,113.000
825.000	4,225.000	4,347.000	4,493.000	4,675.000	4,902.000
900.000	5,187.000	5,552.000	5,971.000	6,479.000	7,735.000
975.000	11,123.000	14,827.000	15,805.000	15,098.000	14,225.000
1,050.000	13,268.000	12,281.000	11,299.000	10,317.000	9,333.000
1,125.000	8,386.000	7,506.000	6,697.000	5,964.000	5,326.000
1,200.000	4,781.000	4,319.000	3,952.000	3,675.000	3,466.000
1,275.000	3,306.000	3,180.000	3,083.000	3,006.000	2,943.000
1,350.000	2,891.000	2,846.000	2,806.000	2,770.000	2,741.000
1,425.000	2,716.000	2,691.000	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Elevation vs. Volume Curve Scenario: Post-Development 100 YEAR
Label: BMP 1

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ft^3)
0.00	0.000
1.00	2,400.000
2.00	6,297.600
3.00	11,030.200
4.00	15,762.800
5.00	19,660.500
6.00	22,060.500

100 Year Stream Rialto

Subsection: Outlet Input Data Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

Requested Pond Water Surface Elevations	
Minimum (Headwater)	0.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	6.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Stand Pipe	Riser - 1	Forward	TW	6.00	6.00
Orifice-Circular	Orifice - 1	Forward	TW	1.00	6.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Outlet Input Data   Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

Structure ID: Riser - 1
Structure Type: Stand Pipe

Number of Openings	1
Elevation	6.00 ft
Diameter	36.0 in
Orifice Area	7.1 ft²
Orifice Coefficient	0.600
Weir Length	9.42 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	True

Structure ID: Orifice - 1
Structure Type: Orifice-Circular

Number of Openings	3
Elevation	1.00 ft
Orifice Diameter	4.0 in
Orifice Coefficient	0.600

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances

Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

100 Year Stream Rialto

Subsection: Individual Outlet Curves | Scenario: Post-Development 100 YEAR
Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	0.00	(N/A)	0.00
2.00	0.00	(N/A)	0.00
2.50	0.00	(N/A)	0.00
3.00	0.00	(N/A)	0.00
3.50	0.00	(N/A)	0.00
4.00	0.00	(N/A)	0.00
4.50	0.00	(N/A)	0.00
5.00	0.00	(N/A)	0.00
5.50	0.00	(N/A)	0.00
6.00	0.00	(N/A)	0.00

Computation Messages
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
Weir: H =0ft

100 Year Stream Rialto

Subsection: Individual Outlet Curves
Scenario: Post-Development 100 YEAR
Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	0.73	(N/A)	0.00
2.00	1.15	(N/A)	0.00
2.50	1.45	(N/A)	0.00
3.00	1.71	(N/A)	0.00
3.50	1.92	(N/A)	0.00
4.00	2.12	(N/A)	0.00
4.50	2.30	(N/A)	0.00
5.00	2.47	(N/A)	0.00
5.50	2.62	(N/A)	0.00
6.00	2.77	(N/A)	0.00

Computation Messages
HW & TW below invert
HW & TW below invert
Upstream HW & DNstream TW < Inv.El
H =.33
H =.83
H =1.33
H =1.83
H =2.33
H =2.83
H =3.33
H =3.83
H =4.33
H =4.83

100 Year Stream Rialto

Subsection: Composite Rating Curve Scenario: Post-Development 100 YEAR
Label: Composite Outlet Structure - 1

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	0.73	(N/A)	0.00
2.00	1.15	(N/A)	0.00
2.50	1.45	(N/A)	0.00
3.00	1.71	(N/A)	0.00
3.50	1.92	(N/A)	0.00
4.00	2.12	(N/A)	0.00
4.50	2.30	(N/A)	0.00
5.00	2.47	(N/A)	0.00
5.50	2.62	(N/A)	0.00
6.00	2.77	(N/A)	0.00

Contributing Structures
None Contributing
None Contributing
None Contributing
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Riser - 1 + Orifice - 1

100 Year Stream Rialto

Subsection: Elevation-Volume-Flow Table (Pond) Scenario: Post-Development 100 YEAR
Label: BMP 1

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.28 ft³/s

Initial Conditions	
Elevation (Water Surface, Initial)	0.00 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	15.000 min

Elevation (ft)	Outflow (ft³/s)	Storage (ft³)	Area (acres)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
0.00	0.00	0.000	0.000	0.00	0.00	0.00
0.50	0.00	1,200.000	0.000	0.28	0.28	2.95
1.00	0.00	2,400.000	0.000	0.28	0.28	5.61
1.50	0.73	4,348.800	0.000	0.28	1.01	10.67
2.00	1.15	6,297.600	0.000	0.28	1.43	15.42
2.50	1.45	8,663.900	0.000	0.28	1.73	20.99
3.00	1.71	11,030.200	0.000	0.28	1.99	26.50
3.50	1.92	13,396.500	0.000	0.28	2.20	31.97
4.00	2.12	15,762.800	0.000	0.28	2.40	37.43
4.50	2.30	17,711.650	0.000	0.28	2.58	41.94
5.00	2.47	19,660.500	0.000	0.28	2.75	46.44
5.50	2.62	20,860.500	0.000	0.28	2.90	49.26
6.00	2.77	22,060.500	0.000	0.28	3.05	52.07

100 Year Stream Rialto

Subsection: Pond Infiltration Hydrograph Scenario: Post-Development 100 YEAR
Label: BMP 1 (INF)

Peak Discharge	0.28 ft³/s
Time to Peak	555.000 min
Hydrograph Volume	23,285.197 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.02	0.07	0.12	0.17
75.000	0.21	0.24	0.26	0.28	0.28
150.000	0.28	0.28	0.28	0.28	0.28
225.000	0.28	0.28	0.28	0.28	0.28
300.000	0.28	0.28	0.28	0.28	0.28
375.000	0.28	0.28	0.28	0.28	0.28
450.000	0.28	0.28	0.28	0.28	0.28
525.000	0.28	0.28	0.28	0.28	0.28
600.000	0.28	0.28	0.28	0.28	0.28
675.000	0.28	0.28	0.28	0.28	0.28
750.000	0.28	0.28	0.28	0.28	0.28
825.000	0.28	0.28	0.28	0.28	0.28
900.000	0.28	0.28	0.28	0.28	0.28
975.000	0.28	0.28	0.28	0.28	0.28
1,050.000	0.28	0.28	0.28	0.28	0.28
1,125.000	0.28	0.28	0.28	0.28	0.28
1,200.000	0.28	0.28	0.28	0.28	0.28
1,275.000	0.28	0.28	0.28	0.28	0.28
1,350.000	0.28	0.28	0.28	0.28	0.28
1,425.000	0.28	0.28	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Level Pool Pond Routing Summary   Scenario: Post-Development 100 YEAR
Label: BMP 1 (IN)

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.28 ft³/s

Initial Conditions	
Elevation (Water Surface, Initial)	0.00 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	15.000 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	7.39 ft³/s	Time to Peak (Flow, In)	975.000 min
Infiltration (Peak)	0.28 ft³/s	Time to Peak (Infiltration)	120.000 min
Flow (Peak Outlet)	2.12 ft³/s	Time to Peak (Flow, Outlet)	1,005.000 min

Elevation (Water Surface, Peak)	4.01 ft
Volume (Peak)	15,804.736 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	70,083.000 ft³
Volume (Total Infiltration)	23,537.000 ft³
Volume (Total Outlet Outflow)	44,107.000 ft³
Volume (Retained)	2,390.000 ft³
Volume (Unrouted)	-49.000 ft³
Error (Mass Balance)	0.1 %

100 Year Stream Rialto

Subsection: Pond Routed Hydrograph (total out) Scenario: Post-Development 100 YEAR
Label: BMP 1 (OUT)

Peak Discharge	2.12 ft^3/s
Time to Peak	1,005.000 min
Hydrograph Volume	44,107.160 ft^3

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
270.000	0.00	0.01	0.05	0.08	0.10
345.000	0.12	0.14	0.15	0.16	0.17
420.000	0.18	0.19	0.19	0.20	0.21
495.000	0.22	0.23	0.23	0.24	0.25
570.000	0.26	0.28	0.29	0.30	0.31
645.000	0.32	0.34	0.35	0.37	0.39
720.000	0.40	0.43	0.47	0.52	0.56
795.000	0.60	0.64	0.68	0.73	0.76
870.000	0.80	0.85	0.91	0.99	1.08
945.000	1.17	1.34	1.71	2.04	2.12
1,020.000	2.07	1.99	1.91	1.82	1.73
1,095.000	1.63	1.53	1.42	1.31	1.20
1,170.000	1.08	0.94	0.82	0.72	0.58
1,245.000	0.48	0.40	0.34	0.29	0.25
1,320.000	0.23	0.20	0.18	0.17	0.15
1,395.000	0.14	0.13	0.12	0.11	(N/A)

100 Year Stream Rialto

Subsection: Pond Inflow Summary Scenario: Post-Development 100 YEAR
Label: BMP 1 (IN)

Summary for Hydrograph Addition at 'BMP 1'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	DA 1

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	DA 1	69,993.000	975.000	7.39
Flow (In)	BMP 1	70,083.000	975.000	7.39

100 Year Stream Rialto

Subsection: Diverted Hydrograph | Scenario: Post-Development 100 YEAR

Label: Outlet-1

Peak Discharge	2.12 ft³/s
Time to Peak	1,005.000 min
Hydrograph Volume	44,107.160 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
270.000	0.00	0.01	0.05	0.08	0.10
345.000	0.12	0.14	0.15	0.16	0.17
420.000	0.18	0.19	0.19	0.20	0.21
495.000	0.22	0.23	0.23	0.24	0.25
570.000	0.26	0.28	0.29	0.30	0.31
645.000	0.32	0.34	0.35	0.37	0.39
720.000	0.40	0.43	0.47	0.52	0.56
795.000	0.60	0.64	0.68	0.73	0.76
870.000	0.80	0.85	0.91	0.99	1.08
945.000	1.17	1.34	1.71	2.04	2.12
1,020.000	2.07	1.99	1.91	1.82	1.73
1,095.000	1.63	1.53	1.42	1.31	1.20
1,170.000	1.08	0.94	0.82	0.72	0.58
1,245.000	0.48	0.40	0.34	0.29	0.25
1,320.000	0.23	0.20	0.18	0.17	0.15
1,395.000	0.14	0.13	0.12	0.11	(N/A)

100 Year Stream Rialto

Index

100 Year Stream Rialto

Project Summary	
Title	Stream Rialto
Engineer	
Company	Kimley-Horn
Date	11/2/2021

Notes

Table of Contents

100 Year Stream Rialto

Subsection: User Notifications

User Notifications?	No user notifications generated.

100 Year Stream Rialto

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)
DA 2	Post-Development 100 YEAR	0	186,498.000	990.000	17.29

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)
O-2	Post-Development 100 YEAR	0	136,288.000	1,005.000	9.32

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
BMP 2 (IN)	Post-Development 100 YEAR	0	186,656.000	990.000	17.29	(N/A)	(N/A)
BMP 2 (OUT)	Post-Development 100 YEAR	0	136,288.000	1,005.000	9.32	4.31	29,338.000

100 Year Stream Rialto

Subsection: Read Hydrograph　　Scenario: Post-Development 100 YEAR
Label: DA 2

Peak Discharge	17.29 ft^3/s
Time to Peak	990.000 min
Hydrograph Volume	186,498.000 ft^3

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
15.000	0.35	0.92	0.97	0.97	0.98
90.000	0.99	1.00	1.01	1.02	1.03
165.000	1.04	1.05	1.06	1.08	1.09
240.000	1.10	1.11	1.13	1.14	1.15
315.000	1.17	1.18	1.20	1.21	1.23
390.000	1.25	1.26	1.28	1.30	1.32
465.000	1.34	1.37	1.39	1.41	1.44
540.000	1.47	1.49	1.53	1.56	1.59
615.000	1.63	1.66	1.71	1.75	1.80
690.000	1.85	1.90	1.96	2.12	2.35
765.000	2.44	2.53	2.63	2.74	2.87
840.000	3.02	3.20	3.42	3.68	4.02
915.000	4.47	4.85	5.37	8.57	16.97
990.000	17.29	5.65	4.02	3.41	3.02
1,065.000	2.74	2.52	2.26	1.97	1.84
1,140.000	1.75	1.66	1.59	1.52	1.46
1,215.000	1.41	1.36	1.32	1.28	1.24
1,290.000	1.21	1.18	1.15	1.12	1.10
1,365.000	1.07	1.05	1.03	1.01	0.99
1,440.000	0.97	(N/A)	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Addition Summary Scenario: Post-Development 100 YEAR
Label: O-2

Summary for Hydrograph Addition at 'O-2'

Upstream Link	Upstream Node
Outlet-2	BMP 2

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-2	136,287.722	1,005.000	9.32
Flow (In)	O-2	136,287.722	1,005.000	9.32

100 Year Stream Rialto

Subsection: Time vs. Elevation	Scenario: Post-Development 100 YEAR
Label: BMP 2 (IN)

Time vs. Elevation (ft)

Output Time increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	0.00	0.03	0.15	0.30	0.43
75.000	0.53	0.62	0.72	0.82	0.92
150.000	1.01	1.06	1.09	1.11	1.12
225.000	1.13	1.14	1.14	1.15	1.15
300.000	1.15	1.16	1.16	1.17	1.17
375.000	1.17	1.18	1.18	1.19	1.19
450.000	1.20	1.20	1.21	1.21	1.22
525.000	1.23	1.23	1.24	1.25	1.25
600.000	1.26	1.27	1.28	1.29	1.30
675.000	1.31	1.32	1.33	1.35	1.37
750.000	1.40	1.44	1.47	1.50	1.53
825.000	1.56	1.60	1.65	1.70	1.76
900.000	1.84	1.94	2.04	2.15	2.38
975.000	3.09	4.07	4.31	3.76	3.25
1,050.000	2.82	2.46	2.19	2.00	1.81
1,125.000	1.65	1.53	1.44	1.38	1.34
1,200.000	1.30	1.28	1.25	1.24	1.22
1,275.000	1.21	1.20	1.19	1.18	1.17
1,350.000	1.16	1.16	1.15	1.14	1.14
1,425.000	1.13	1.12	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Time vs. Volume Scenario: Post-Development 100 YEAR
Label: BMP 2

Time vs. Volume (ft³)

Output Time increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)
0.000	0.000	141.000	624.000	1,255.000	1,776.000
75.000	2,204.000	2,604.000	3,014.000	3,432.000	3,860.000
150.000	4,272.000	4,589.000	4,785.000	4,910.000	4,995.000
225.000	5,056.000	5,100.000	5,134.000	5,164.000	5,193.000
300.000	5,218.000	5,243.000	5,269.000	5,296.000	5,322.000
375.000	5,349.000	5,379.000	5,408.000	5,436.000	5,467.000
450.000	5,500.000	5,534.000	5,572.000	5,613.000	5,652.000
525.000	5,693.000	5,739.000	5,784.000	5,833.000	5,887.000
600.000	5,941.000	5,998.000	6,058.000	6,122.000	6,193.000
675.000	6,267.000	6,347.000	6,431.000	6,521.000	6,653.000
750.000	6,873.000	7,119.000	7,330.000	7,524.000	7,726.000
825.000	7,954.000	8,218.000	8,524.000	8,887.000	9,319.000
900.000	9,844.000	10,506.000	11,269.000	12,111.000	14,046.000
975.000	19,842.000	27,691.000	29,338.000	25,279.000	21,155.000
1,050.000	17,571.000	14,674.000	12,492.000	10,886.000	9,604.000
1,125.000	8,563.000	7,763.000	7,166.000	6,740.000	6,436.000
1,200.000	6,207.000	6,032.000	5,891.000	5,774.000	5,676.000
1,275.000	5,589.000	5,511.000	5,444.000	5,382.000	5,323.000
1,350.000	5,270.000	5,221.000	5,173.000	5,131.000	5,091.000
1,425.000	5,052.000	5,015.000	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Elevation vs. Volume Curve Scenario: Post-Development 100 YEAR
Label: BMP 2

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ft^3)
0.00	0.000
1.00	4,176.000
2.00	10,913.900
3.00	19,080.100
4.00	27,246.300
5.00	33,984.200
6.00	38,160.200

100 Year Stream Rialto

Subsection: Outlet Input Data Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

Requested Pond Water Surface Elevations	
Minimum (Headwater)	0.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	6.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	Orifice - 2	Forward	TW	2.00	6.00
Stand Pipe	Riser - 1	Forward	TW	6.00	6.00
Orifice-Circular	Orifice - 1	Forward	TW	1.00	6.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Outlet Input Data | Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

Structure ID: Riser - 1
Structure Type: Stand Pipe

Number of Openings	1
Elevation	6.00 ft
Diameter	36.0 in
Orifice Area	7.1 ft²
Orifice Coefficient	0.600
Weir Length	9.42 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	True

Structure ID: Orifice - 1
Structure Type: Orifice-Circular

Number of Openings	4
Elevation	1.00 ft
Orifice Diameter	6.0 in
Orifice Coefficient	0.600

Structure ID: Orifice - 2
Structure Type: Orifice-Circular

Number of Openings	2
Elevation	2.00 ft
Orifice Diameter	6.0 in
Orifice Coefficient	0.600

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances

Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft

100 Year Stream Rialto

Subsection: Outlet Input Data　　Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

Convergence Tolerances	
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	0.00	(N/A)	0.00
2.00	0.00	(N/A)	0.00
2.50	0.00	(N/A)	0.00
3.00	0.00	(N/A)	0.00
3.50	0.00	(N/A)	0.00
4.00	0.00	(N/A)	0.00
4.50	0.00	(N/A)	0.00
5.00	0.00	(N/A)	0.00
5.50	0.00	(N/A)	0.00
6.00	0.00	(N/A)	0.00

Computation Messages
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
Weir: H =0ft

100 Year Stream Rialto

Subsection: Individual Outlet Curves — Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	1.89	(N/A)	0.00
2.00	3.27	(N/A)	0.00
2.50	4.23	(N/A)	0.00
3.00	5.00	(N/A)	0.00
3.50	5.67	(N/A)	0.00
4.00	6.27	(N/A)	0.00
4.50	6.81	(N/A)	0.00
5.00	7.32	(N/A)	0.00
5.50	7.79	(N/A)	0.00
6.00	8.24	(N/A)	0.00

Computation Messages
HW & TW below invert
HW & TW below invert
Upstream HW & DNstream TW < Inv.El
H =.25
H =.75
H =1.25
H =1.75
H =2.25
H =2.75
H =3.25
H =3.75
H =4.25
H =4.75

100 Year Stream Rialto

Subsection: Individual Outlet Curves　　Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 2 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	0.00	(N/A)	0.00
2.00	0.00	(N/A)	0.00
2.50	0.95	(N/A)	0.00
3.00	1.64	(N/A)	0.00
3.50	2.11	(N/A)	0.00
4.00	2.50	(N/A)	0.00
4.50	2.84	(N/A)	0.00
5.00	3.13	(N/A)	0.00
5.50	3.41	(N/A)	0.00
6.00	3.66	(N/A)	0.00

Computation Messages
HW & TW below invert
HW & TW below invert
HW & TW below invert
HW & TW below invert
Upstream HW & DNstream TW < Inv.El
H =.25
H =.75
H =1.25
H =1.75
H =2.25
H =2.75
H =3.25
H =3.75

100 Year Stream Rialto

Subsection: Composite Rating Curve | Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	1.89	(N/A)	0.00
2.00	3.27	(N/A)	0.00
2.50	5.17	(N/A)	0.00
3.00	6.64	(N/A)	0.00
3.50	7.78	(N/A)	0.00
4.00	8.77	(N/A)	0.00
4.50	9.65	(N/A)	0.00
5.00	10.45	(N/A)	0.00
5.50	11.20	(N/A)	0.00
6.00	11.90	(N/A)	0.00

Contributing Structures
None Contributing
None Contributing
None Contributing
Orifice - 1
Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Riser - 1 + Orifice - 1

100 Year Stream Rialto

Subsection: Elevation-Volume-Flow Table (Pond) Scenario: Post-Development 100 YEAR
Label: BMP 2

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.54 ft³/s

Initial Conditions	
Elevation (Water Surface, Initial)	0.00 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	15.000 min

Elevation (ft)	Outflow (ft³/s)	Storage (ft³)	Area (acres)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
0.00	0.00	0.000	0.000	0.00	0.00	0.00
0.50	0.00	2,088.000	0.000	0.54	0.54	5.18
1.00	0.00	4,176.000	0.000	0.54	0.54	9.82
1.50	1.89	7,544.950	0.000	0.54	2.43	19.20
2.00	3.27	10,913.900	0.000	0.54	3.81	28.07
2.50	5.17	14,997.000	0.000	0.54	5.71	39.04
3.00	6.64	19,080.100	0.000	0.54	7.18	49.58
3.50	7.78	23,163.200	0.000	0.54	8.32	59.80
4.00	8.77	27,246.300	0.000	0.54	9.31	69.86
4.50	9.65	30,615.250	0.000	0.54	10.19	78.22
5.00	10.45	33,984.200	0.000	0.54	10.99	86.51
5.50	11.20	36,072.200	0.000	0.54	11.74	91.90
6.00	11.90	38,160.200	0.000	0.54	12.44	97.24

100 Year Stream Rialto

Subsection: Pond Infiltration Hydrograph Scenario: Post-Development 100 YEAR
Label: BMP 2 (INF)

Peak Discharge	0.54 ft³/s
Time to Peak	525.000 min
Hydrograph Volume	45,352.493 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.04	0.16	0.32	0.46
75.000	0.54	0.54	0.54	0.54	0.54
150.000	0.54	0.54	0.54	0.54	0.54
225.000	0.54	0.54	0.54	0.54	0.54
300.000	0.54	0.54	0.54	0.54	0.54
375.000	0.54	0.54	0.54	0.54	0.54
450.000	0.54	0.54	0.54	0.54	0.54
525.000	0.54	0.54	0.54	0.54	0.54
600.000	0.54	0.54	0.54	0.54	0.54
675.000	0.54	0.54	0.54	0.54	0.54
750.000	0.54	0.54	0.54	0.54	0.54
825.000	0.54	0.54	0.54	0.54	0.54
900.000	0.54	0.54	0.54	0.54	0.54
975.000	0.54	0.54	0.54	0.54	0.54
1,050.000	0.54	0.54	0.54	0.54	0.54
1,125.000	0.54	0.54	0.54	0.54	0.54
1,200.000	0.54	0.54	0.54	0.54	0.54
1,275.000	0.54	0.54	0.54	0.54	0.54
1,350.000	0.54	0.54	0.54	0.54	0.54
1,425.000	0.54	0.54	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Level Pool Pond Routing Summary — Scenario: Post-Development 100 YEAR

Label: BMP 2 (IN)

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.54 ft^3/s

Initial Conditions	
Elevation (Water Surface, Initial)	0.00 ft
Volume (Initial)	0.000 ft^3
Flow (Initial Outlet)	0.00 ft^3/s
Flow (Initial Infiltration)	0.00 ft^3/s
Flow (Initial, Total)	0.00 ft^3/s
Time Increment	15.000 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	17.29 ft^3/s	Time to Peak (Flow, In)	990.000 min
Infiltration (Peak)	0.54 ft^3/s	Time to Peak (Infiltration)	75.000 min
Flow (Peak Outlet)	9.32 ft^3/s	Time to Peak (Flow, Outlet)	1,005.000 min

Elevation (Water Surface, Peak)	4.31 ft
Volume (Peak)	29,337.730 ft^3

Mass Balance (ft^3)	
Volume (Initial)	0.000 ft^3
Volume (Total Inflow)	186,656.000 ft^3
Volume (Total Infiltration)	45,838.000 ft^3
Volume (Total Outlet Outflow)	136,288.000 ft^3
Volume (Retained)	4,289.000 ft^3
Volume (Unrouted)	-240.000 ft^3
Error (Mass Balance)	0.1 %

100 Year Stream Rialto

Subsection: Pond Routed Hydrograph (total out) Scenario: Post-Development 100 YEAR

Label: BMP 2 (OUT)

Peak Discharge	9.32 ft^3/s
Time to Peak	1,005.000 min
Hydrograph Volume	136,287.721 ft^3

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
135.000	0.00	0.05	0.23	0.34	0.41
210.000	0.46	0.49	0.52	0.54	0.55
285.000	0.57	0.58	0.60	0.61	0.63
360.000	0.64	0.66	0.67	0.69	0.71
435.000	0.72	0.74	0.76	0.78	0.81
510.000	0.83	0.85	0.88	0.90	0.93
585.000	0.96	0.99	1.02	1.06	1.09
660.000	1.13	1.17	1.22	1.27	1.32
735.000	1.39	1.51	1.65	1.77	1.88
810.000	1.96	2.06	2.17	2.29	2.44
885.000	2.62	2.83	3.11	3.44	3.83
960.000	4.73	6.85	8.89	9.32	8.29
1,035.000	7.22	6.10	5.02	4.01	3.26
1,110.000	2.74	2.31	1.98	1.68	1.44
1,185.000	1.27	1.14	1.04	0.96	0.90
1,260.000	0.84	0.79	0.75	0.71	0.68
1,335.000	0.64	0.61	0.59	0.56	0.54
1,410.000	0.51	0.49	0.47	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Pond Inflow Summary Scenario: Post-Development 100 YEAR
Label: BMP 2 (IN)

Summary for Hydrograph Addition at 'BMP 2'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	DA 2

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	DA 2	186,498.000	990.000	17.29
Flow (In)	BMP 2	186,655.500	990.000	17.29

100 Year Stream Rialto

Subsection: Diverted Hydrograph Scenario: Post-Development 100 YEAR
Label: Outlet-2

Peak Discharge	9.32 ft³/s
Time to Peak	1,005.000 min
Hydrograph Volume	136,287.721 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
135.000	0.00	0.05	0.23	0.34	0.41
210.000	0.46	0.49	0.52	0.54	0.55
285.000	0.57	0.58	0.60	0.61	0.63
360.000	0.64	0.66	0.67	0.69	0.71
435.000	0.72	0.74	0.76	0.78	0.81
510.000	0.83	0.85	0.88	0.90	0.93
585.000	0.96	0.99	1.02	1.06	1.09
660.000	1.13	1.17	1.22	1.27	1.32
735.000	1.39	1.51	1.65	1.77	1.88
810.000	1.96	2.06	2.17	2.29	2.44
885.000	2.62	2.83	3.11	3.44	3.83
960.000	4.73	6.85	8.89	9.32	8.29
1,035.000	7.22	6.10	5.02	4.01	3.26
1,110.000	2.74	2.31	1.98	1.68	1.44
1,185.000	1.27	1.14	1.04	0.96	0.90
1,260.000	0.84	0.79	0.75	0.71	0.68
1,335.000	0.64	0.61	0.59	0.56	0.54
1,410.000	0.51	0.49	0.47	(N/A)	(N/A)

100 Year Stream Rialto

Index

100 Year Stream Rialto

Project Summary	
Title	Stream Rialto
Engineer	
Company	Kimley-Horn
Date	11/2/2021

Notes

Table of Contents

100 Year Stream Rialto

Subsection: User Notifications

User Notifications?	No user notifications generated.

100 Year Stream Rialto

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft^3)	Time to Peak (min)	Peak Flow (ft^3/s)
DA 3	Post-Development 100 YEAR	0	201,240.000	975.000	18.86

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft^3)	Time to Peak (min)	Peak Flow (ft^3/s)
O-3	Post-Development 100 YEAR	0	147,585.000	1,005.000	9.40

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft^3)	Time to Peak (min)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft^3)
BMP 3 (IN)	Post-Development 100 YEAR	0	201,424.000	975.000	18.86	(N/A)	(N/A)
BMP 3 (OUT)	Post-Development 100 YEAR	0	147,585.000	1,005.000	9.40	4.36	34,795.000

100 Year Stream Rialto

Subsection: Read Hydrograph
Scenario: Post-Development 100 YEAR
Label: DA 3

Peak Discharge	18.86 ft³/s
Time to Peak	975.000 min
Hydrograph Volume	201,240.000 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
15.000	0.41	1.00	1.04	1.05	1.06
90.000	1.07	1.08	1.09	1.10	1.11
165.000	1.12	1.14	1.15	1.16	1.17
240.000	1.19	1.20	1.21	1.23	1.24
315.000	1.26	1.28	1.29	1.31	1.33
390.000	1.35	1.36	1.39	1.41	1.43
465.000	1.45	1.48	1.50	1.53	1.55
540.000	1.58	1.61	1.65	1.68	1.72
615.000	1.76	1.80	1.84	1.89	1.94
690.000	2.00	2.06	2.12	2.30	2.54
765.000	2.64	2.73	2.84	2.97	3.11
840.000	3.27	3.46	3.70	3.99	4.35
915.000	4.85	5.24	5.84	9.52	18.86
990.000	18.02	5.81	4.30	3.66	3.24
1,065.000	2.94	2.71	2.42	2.11	1.98
1,140.000	1.88	1.79	1.71	1.64	1.58
1,215.000	1.52	1.47	1.42	1.38	1.34
1,290.000	1.30	1.27	1.24	1.21	1.18
1,365.000	1.16	1.13	1.11	1.09	1.07
1,440.000	1.05	(N/A)	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Addition Summary Scenario: Post-Development 100 YEAR
Label: O-3

Summary for Hydrograph Addition at 'O-3'

Upstream Link	Upstream Node
Outlet-3	BMP 3

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-3	147,584.591	1,005.000	9.40
Flow (In)	O-3	147,584.591	1,005.000	9.40

100 Year Stream Rialto

Subsection: Time vs. Elevation Scenario: Post-Development 100 YEAR
Label: BMP 3 (IN)

Time vs. Elevation (ft)

Output Time increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	0.00	0.03	0.14	0.29	0.41
75.000	0.51	0.60	0.69	0.78	0.88
150.000	0.98	1.04	1.08	1.10	1.12
225.000	1.13	1.14	1.15	1.16	1.16
300.000	1.17	1.17	1.18	1.18	1.19
375.000	1.19	1.19	1.20	1.20	1.21
450.000	1.22	1.22	1.23	1.23	1.24
525.000	1.24	1.25	1.26	1.27	1.27
600.000	1.28	1.29	1.30	1.31	1.32
675.000	1.33	1.35	1.36	1.38	1.40
750.000	1.43	1.47	1.50	1.53	1.57
825.000	1.61	1.65	1.70	1.75	1.82
900.000	1.90	2.00	2.10	2.20	2.45
975.000	3.16	4.11	4.36	3.87	3.44
1,050.000	3.03	2.69	2.40	2.18	2.00
1,125.000	1.82	1.68	1.57	1.48	1.42
1,200.000	1.37	1.33	1.30	1.27	1.26
1,275.000	1.24	1.22	1.21	1.20	1.19
1,350.000	1.18	1.17	1.17	1.16	1.15
1,425.000	1.15	1.14	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Time vs. Volume   Scenario: Post-Development 100 YEAR
Label: BMP 3

Time vs. Volume (ft³)

Output Time increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)
0.000	0.000	167.000	710.000	1,406.000	1,991.000
75.000	2,475.000	2,921.000	3,375.000	3,839.000	4,311.000
150.000	4,793.000	5,214.000	5,516.000	5,723.000	5,863.000
225.000	5,961.000	6,036.000	6,095.000	6,141.000	6,181.000
300.000	6,219.000	6,254.000	6,292.000	6,327.000	6,361.000
375.000	6,398.000	6,436.000	6,472.000	6,510.000	6,553.000
450.000	6,596.000	6,638.000	6,684.000	6,732.000	6,782.000
525.000	6,832.000	6,884.000	6,939.000	7,001.000	7,066.000
600.000	7,135.000	7,208.000	7,286.000	7,365.000	7,450.000
675.000	7,542.000	7,642.000	7,751.000	7,866.000	8,029.000
750.000	8,289.000	8,584.000	8,844.000	9,098.000	9,377.000
825.000	9,684.000	10,024.000	10,408.000	10,854.000	11,386.000
900.000	12,025.000	12,824.000	13,735.000	14,748.000	17,090.000
975.000	23,955.000	32,848.000	34,795.000	30,768.000	26,565.000
1,050.000	22,700.000	19,375.000	16,670.000	14,523.000	12,796.000
1,125.000	11,399.000	10,293.000	9,414.000	8,715.000	8,181.000
1,200.000	7,788.000	7,490.000	7,256.000	7,068.000	6,914.000
1,275.000	6,784.000	6,671.000	6,572.000	6,486.000	6,408.000
1,350.000	6,335.000	6,270.000	6,209.000	6,152.000	6,100.000
1,425.000	6,051.000	6,005.000	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Elevation vs. Volume Curve   Scenario: Post-Development 100 YEAR
Label: BMP 3

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ft^3)
0.00	0.000
1.00	4,896.000
2.00	12,802.000
3.00	22,386.200
4.00	31,970.300
5.00	39,876.300
6.00	44,772.300

100 Year Stream Rialto

Subsection: Outlet Input Data Scenario: Post-Development 100 YEAR
Label: Composite Outlet Structure - 1

Requested Pond Water Surface Elevations	
Minimum (Headwater)	0.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	6.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	Orifice - 2	Forward	TW	2.00	6.00
Stand Pipe	Riser - 1	Forward	TW	6.00	6.00
Orifice-Circular	Orifice - 1	Forward	TW	1.00	6.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Outlet Input Data — Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

Structure ID: Riser - 1 Structure Type: Stand Pipe	
Number of Openings	1
Elevation	6.00 ft
Diameter	36.0 in
Orifice Area	7.1 ft²
Orifice Coefficient	0.600
Weir Length	9.42 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	True

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	4
Elevation	1.00 ft
Orifice Diameter	6.0 in
Orifice Coefficient	0.600

Structure ID: Orifice - 2 Structure Type: Orifice-Circular	
Number of Openings	2
Elevation	2.00 ft
Orifice Diameter	6.0 in
Orifice Coefficient	0.600

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft

100 Year Stream Rialto

Subsection: Outlet Input Data　　Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

Convergence Tolerances	
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

100 Year Stream Rialto

Subsection: Individual Outlet Curves | Scenario: Post-Development 100 YEAR
Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	0.00	(N/A)	0.00
2.00	0.00	(N/A)	0.00
2.50	0.00	(N/A)	0.00
3.00	0.00	(N/A)	0.00
3.50	0.00	(N/A)	0.00
4.00	0.00	(N/A)	0.00
4.50	0.00	(N/A)	0.00
5.00	0.00	(N/A)	0.00
5.50	0.00	(N/A)	0.00
6.00	0.00	(N/A)	0.00

Computation Messages
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
Weir: H =0ft

100 Year Stream Rialto

Subsection: Individual Outlet Curves Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

100 Year Stream Rialto

Subsection: Individual Outlet Curves   Scenario: Post-Development 100 YEAR
Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	1.89	(N/A)	0.00
2.00	3.27	(N/A)	0.00
2.50	4.23	(N/A)	0.00
3.00	5.00	(N/A)	0.00
3.50	5.67	(N/A)	0.00
4.00	6.27	(N/A)	0.00
4.50	6.81	(N/A)	0.00
5.00	7.32	(N/A)	0.00
5.50	7.79	(N/A)	0.00
6.00	8.24	(N/A)	0.00

Computation Messages
HW & TW below invert
HW & TW below invert
Upstream HW & DNstream TW < Inv.El
H =.25
H =.75
H =1.25
H =1.75
H =2.25
H =2.75
H =3.25
H =3.75
H =4.25
H =4.75

100 Year Stream Rialto

Subsection: Individual Outlet Curves | Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 2 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	0.00	(N/A)	0.00
2.00	0.00	(N/A)	0.00
2.50	0.95	(N/A)	0.00
3.00	1.64	(N/A)	0.00
3.50	2.11	(N/A)	0.00
4.00	2.50	(N/A)	0.00
4.50	2.84	(N/A)	0.00
5.00	3.13	(N/A)	0.00
5.50	3.41	(N/A)	0.00
6.00	3.66	(N/A)	0.00

Computation Messages
HW & TW below invert
HW & TW below invert
HW & TW below invert
HW & TW below invert
Upstream HW & DNstream TW < Inv.El
H =.25
H =.75
H =1.25
H =1.75
H =2.25
H =2.75
H =3.25
H =3.75

100 Year Stream Rialto

Subsection: Composite Rating Curve Scenario: Post-Development 100 YEAR
Label: Composite Outlet Structure - 1

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	1.89	(N/A)	0.00
2.00	3.27	(N/A)	0.00
2.50	5.17	(N/A)	0.00
3.00	6.64	(N/A)	0.00
3.50	7.78	(N/A)	0.00
4.00	8.77	(N/A)	0.00
4.50	9.65	(N/A)	0.00
5.00	10.45	(N/A)	0.00
5.50	11.20	(N/A)	0.00
6.00	11.90	(N/A)	0.00

Contributing Structures
None Contributing
None Contributing
None Contributing
Orifice - 1
Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Orifice - 1
Orifice - 2 + Riser - 1 + Orifice - 1

100 Year Stream Rialto

Subsection: Elevation-Volume-Flow Table (Pond)　　Scenario: Post-Development 100 YEAR
Label: BMP 3

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.57 ft^3/s

Initial Conditions	
Elevation (Water Surface, Initial)	0.00 ft
Volume (Initial)	0.000 ft^3
Flow (Initial Outlet)	0.00 ft^3/s
Flow (Initial Infiltration)	0.00 ft^3/s
Flow (Initial, Total)	0.00 ft^3/s
Time Increment	15.000 min

Elevation (ft)	Outflow (ft^3/s)	Storage (ft^3)	Area (acres)	Infiltration (ft^3/s)	Flow (Total) (ft^3/s)	2S/t + O (ft^3/s)
0.00	0.00	0.000	0.000	0.00	0.00	0.00
0.50	0.00	2,448.000	0.000	0.57	0.57	6.01
1.00	0.00	4,896.000	0.000	0.57	0.57	11.45
1.50	1.89	8,849.000	0.000	0.57	2.46	22.12
2.00	3.27	12,802.000	0.000	0.57	3.84	32.29
2.50	5.17	17,594.100	0.000	0.57	5.74	44.84
3.00	6.64	22,386.200	0.000	0.57	7.21	56.95
3.50	7.78	27,178.250	0.000	0.57	8.35	68.75
4.00	8.77	31,970.300	0.000	0.57	9.34	80.38
4.50	9.65	35,923.300	0.000	0.57	10.22	90.05
5.00	10.45	39,876.300	0.000	0.57	11.02	99.64
5.50	11.20	42,324.300	0.000	0.57	11.77	105.82
6.00	11.90	44,772.300	0.000	0.57	12.47	111.96

100 Year Stream Rialto

Subsection: Pond Infiltration Hydrograph   Scenario: Post-Development 100 YEAR
Label: BMP 3 (INF)

Peak Discharge	0.57 ft³/s
Time to Peak	525.000 min
Hydrograph Volume	47,834.987 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.04	0.17	0.33	0.46
75.000	0.57	0.57	0.57	0.57	0.57
150.000	0.57	0.57	0.57	0.57	0.57
225.000	0.57	0.57	0.57	0.57	0.57
300.000	0.57	0.57	0.57	0.57	0.57
375.000	0.57	0.57	0.57	0.57	0.57
450.000	0.57	0.57	0.57	0.57	0.57
525.000	0.57	0.57	0.57	0.57	0.57
600.000	0.57	0.57	0.57	0.57	0.57
675.000	0.57	0.57	0.57	0.57	0.57
750.000	0.57	0.57	0.57	0.57	0.57
825.000	0.57	0.57	0.57	0.57	0.57
900.000	0.57	0.57	0.57	0.57	0.57
975.000	0.57	0.57	0.57	0.57	0.57
1,050.000	0.57	0.57	0.57	0.57	0.57
1,125.000	0.57	0.57	0.57	0.57	0.57
1,200.000	0.57	0.57	0.57	0.57	0.57
1,275.000	0.57	0.57	0.57	0.57	0.57
1,350.000	0.57	0.57	0.57	0.57	0.57
1,425.000	0.57	0.57	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Level Pool Pond Routing Summary — Scenario: Post-Development 100 YEAR
Label: BMP 3 (IN)

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.57 ft³/s

Initial Conditions	
Elevation (Water Surface, Initial)	0.00 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	15.000 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	18.86 ft³/s	Time to Peak (Flow, In)	975.000 min
Infiltration (Peak)	0.57 ft³/s	Time to Peak (Infiltration)	75.000 min
Flow (Peak Outlet)	9.40 ft³/s	Time to Peak (Flow, Outlet)	1,005.000 min

Elevation (Water Surface, Peak)	4.36 ft
Volume (Peak)	34,795.398 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	201,424.000 ft³
Volume (Total Infiltration)	48,348.000 ft³
Volume (Total Outlet Outflow)	147,585.000 ft³
Volume (Retained)	5,190.000 ft³
Volume (Unrouted)	-302.000 ft³
Error (Mass Balance)	0.1 %

100 Year Stream Rialto

Subsection: Pond Routed Hydrograph (total out) Scenario: Post-Development 100 YEAR
Label: BMP 3 (OUT)

Peak Discharge	9.40 ft³/s
Time to Peak	1,005.000 min
Hydrograph Volume	147,584.592 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
150.000	0.00	0.15	0.30	0.40	0.46
225.000	0.51	0.55	0.57	0.60	0.61
300.000	0.63	0.65	0.67	0.68	0.70
375.000	0.72	0.74	0.75	0.77	0.79
450.000	0.81	0.83	0.85	0.88	0.90
525.000	0.93	0.95	0.98	1.01	1.04
600.000	1.07	1.11	1.14	1.18	1.22
675.000	1.27	1.31	1.36	1.42	1.50
750.000	1.62	1.76	1.89	1.98	2.07
825.000	2.18	2.30	2.44	2.59	2.78
900.000	3.00	3.28	3.64	4.04	4.97
975.000	7.01	8.96	9.40	8.52	7.64
1,050.000	6.71	5.72	4.81	3.96	3.27
1,125.000	2.78	2.40	2.09	1.83	1.57
1,200.000	1.38	1.24	1.13	1.04	0.96
1,275.000	0.90	0.85	0.80	0.76	0.72
1,350.000	0.69	0.66	0.63	0.60	0.58
1,425.000	0.55	0.53	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Pond Inflow Summary Scenario: Post-Development 100 YEAR
Label: BMP 3 (IN)

Summary for Hydrograph Addition at 'BMP 3'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	DA 3

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	DA 3	201,240.000	975.000	18.86
Flow (In)	BMP 3	201,424.500	975.000	18.86

100 Year Stream Rialto

Subsection: Diverted Hydrograph Scenario: Post-Development 100 YEAR
Label: Outlet-3

Peak Discharge	9.40 ft³/s
Time to Peak	1,005.000 min
Hydrograph Volume	147,584.592 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
150.000	0.00	0.15	0.30	0.40	0.46
225.000	0.51	0.55	0.57	0.60	0.61
300.000	0.63	0.65	0.67	0.68	0.70
375.000	0.72	0.74	0.75	0.77	0.79
450.000	0.81	0.83	0.85	0.88	0.90
525.000	0.93	0.95	0.98	1.01	1.04
600.000	1.07	1.11	1.14	1.18	1.22
675.000	1.27	1.31	1.36	1.42	1.50
750.000	1.62	1.76	1.89	1.98	2.07
825.000	2.18	2.30	2.44	2.59	2.78
900.000	3.00	3.28	3.64	4.04	4.97
975.000	7.01	8.96	9.40	8.52	7.64
1,050.000	6.71	5.72	4.81	3.96	3.27
1,125.000	2.78	2.40	2.09	1.83	1.57
1,200.000	1.38	1.24	1.13	1.04	0.96
1,275.000	0.90	0.85	0.80	0.76	0.72
1,350.000	0.69	0.66	0.63	0.60	0.58
1,425.000	0.55	0.53	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Index

100 Year Stream Rialto

Project Summary	
Title	Stream Rialto
Engineer	
Company	Kimley-Horn
Date	11/2/2021

Notes

Table of Contents

100 Year Stream Rialto

Subsection: User Notifications

User Notifications?	No user notifications generated.

100 Year Stream Rialto

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)
DA 4	Post-Development 100 YEAR	0	35,118.000	975.000	3.67

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)
O-4	Post-Development 100 YEAR	0	23,260.000	990.000	1.79

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ft³)	Time to Peak (min)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft³)
BMP 4 (IN)	Post-Development 100 YEAR	0	35,163.000	975.000	3.67	(N/A)	(N/A)
BMP 4 (OUT)	Post-Development 100 YEAR	0	23,260.000	990.000	1.79	3.20	4,747.000

100 Year Stream Rialto

Subsection: Read Hydrograph Scenario: Post-Development 100 YEAR

Label: DA 4

Peak Discharge	3.67 ft^3/s
Time to Peak	975.000 min
Hydrograph Volume	35,118.000 ft^3

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
15.000	0.10	0.18	0.18	0.18	0.19
90.000	0.19	0.19	0.19	0.19	0.19
165.000	0.20	0.20	0.20	0.20	0.21
240.000	0.21	0.21	0.21	0.21	0.22
315.000	0.22	0.22	0.23	0.23	0.23
390.000	0.24	0.24	0.24	0.25	0.25
465.000	0.25	0.26	0.26	0.27	0.27
540.000	0.28	0.28	0.29	0.29	0.30
615.000	0.31	0.32	0.32	0.33	0.34
690.000	0.35	0.36	0.37	0.41	0.45
765.000	0.46	0.48	0.50	0.52	0.55
840.000	0.58	0.61	0.65	0.71	0.77
915.000	0.86	0.92	1.06	1.86	3.67
990.000	2.65	0.88	0.72	0.62	0.55
1,065.000	0.50	0.47	0.41	0.36	0.34
1,140.000	0.32	0.31	0.30	0.28	0.27
1,215.000	0.26	0.25	0.25	0.24	0.23
1,290.000	0.23	0.22	0.22	0.21	0.21
1,365.000	0.20	0.20	0.19	0.19	0.19
1,440.000	0.18	(N/A)	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Addition Summary Scenario: Post-Development 100 YEAR
Label: O-4

Summary for Hydrograph Addition at 'O-4'

Upstream Link	Upstream Node
Outlet-4	BMP 4

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-4	23,259.565	990.000	1.79
Flow (In)	O-4	23,259.565	990.000	1.79

100 Year Stream Rialto

Subsection: Time vs. Elevation Scenario: Post-Development 100 YEAR
Label: BMP 4 (IN)

Time vs. Elevation (ft)

Output Time increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	0.00	0.04	0.15	0.27	0.36
75.000	0.44	0.50	0.56	0.61	0.67
150.000	0.73	0.79	0.85	0.92	0.98
225.000	1.02	1.04	1.05	1.05	1.05
300.000	1.06	1.06	1.06	1.06	1.07
375.000	1.07	1.07	1.07	1.07	1.08
450.000	1.08	1.08	1.08	1.09	1.09
525.000	1.09	1.10	1.10	1.10	1.11
600.000	1.11	1.12	1.12	1.13	1.13
675.000	1.14	1.14	1.15	1.16	1.17
750.000	1.19	1.21	1.22	1.24	1.25
825.000	1.27	1.29	1.31	1.33	1.36
900.000	1.39	1.44	1.49	1.56	1.82
975.000	2.52	3.20	3.13	2.66	2.24
1,050.000	1.87	1.57	1.38	1.28	1.22
1,125.000	1.18	1.15	1.14	1.13	1.12
1,200.000	1.11	1.10	1.09	1.09	1.08
1,275.000	1.08	1.07	1.07	1.06	1.06
1,350.000	1.06	1.05	1.05	1.05	1.04
1,425.000	1.04	1.04	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Time vs. Volume | Scenario: Post-Development 100 YEAR
Label: BMP 4

Time vs. Volume (ft³)

Output Time increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)	Volume (ft³)
0.000	0.000	40.000	144.000	257.000	345.000
75.000	419.000	480.000	534.000	588.000	642.000
150.000	696.000	755.000	818.000	881.000	944.000
225.000	996.000	1,025.000	1,037.000	1,042.000	1,044.000
300.000	1,048.000	1,052.000	1,054.000	1,058.000	1,063.000
375.000	1,065.000	1,069.000	1,074.000	1,076.000	1,080.000
450.000	1,084.000	1,086.000	1,090.000	1,095.000	1,100.000
525.000	1,105.000	1,111.000	1,116.000	1,121.000	1,126.000
600.000	1,132.000	1,140.000	1,150.000	1,157.000	1,163.000
675.000	1,172.000	1,182.000	1,192.000	1,203.000	1,223.000
750.000	1,256.000	1,285.000	1,307.000	1,328.000	1,349.000
825.000	1,374.000	1,403.000	1,433.000	1,468.000	1,514.000
900.000	1,570.000	1,640.000	1,716.000	1,821.000	2,222.000
975.000	3,486.000	4,747.000	4,619.000	3,739.000	2,952.000
1,050.000	2,309.000	1,842.000	1,555.000	1,397.000	1,298.000
1,125.000	1,236.000	1,198.000	1,174.000	1,157.000	1,141.000
1,200.000	1,125.000	1,112.000	1,101.000	1,093.000	1,087.000
1,275.000	1,078.000	1,071.000	1,065.000	1,059.000	1,054.000
1,350.000	1,049.000	1,043.000	1,038.000	1,033.000	1,027.000
1,425.000	1,025.000	1,021.000	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Elevation vs. Volume Curve | Scenario: Post-Development 100 YEAR

Label: BMP 4

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ft^3)
0.00	0.000
1.00	960.000
2.00	2,506.700
3.00	4,380.400
4.00	6,254.200
5.00	7,800.800
6.00	8,760.800

100 Year Stream Rialto

Subsection: Outlet Input Data Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

Requested Pond Water Surface Elevations	
Minimum (Headwater)	0.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	6.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Stand Pipe	Riser - 1	Forward	TW	6.00	6.00
Orifice-Circular	Orifice - 1	Forward	TW	1.00	6.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Outlet Input Data Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

Structure ID: Riser - 1 Structure Type: Stand Pipe	
Number of Openings	1
Elevation	6.00 ft
Diameter	36.0 in
Orifice Area	7.1 ft²
Orifice Coefficient	0.600
Weir Length	9.42 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	True

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	3
Elevation	1.00 ft
Orifice Diameter	4.0 in
Orifice Coefficient	0.600

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

100 Year Stream Rialto

Subsection: Individual Outlet Curves　　Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	0.00	(N/A)	0.00
2.00	0.00	(N/A)	0.00
2.50	0.00	(N/A)	0.00
3.00	0.00	(N/A)	0.00
3.50	0.00	(N/A)	0.00
4.00	0.00	(N/A)	0.00
4.50	0.00	(N/A)	0.00
5.00	0.00	(N/A)	0.00
5.50	0.00	(N/A)	0.00
6.00	0.00	(N/A)	0.00

Computation Messages
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
HW & TW < Inv.El.=6.000
Weir: H =0ft

100 Year Stream Rialto

Subsection: Individual Outlet Curves Scenario: Post-Development 100 YEAR

Label: Composite Outlet Structure - 1

100 Year Stream Rialto

Subsection: Individual Outlet Curves　　Scenario: Post-Development 100 YEAR
Label: Composite Outlet Structure - 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	0.73	(N/A)	0.00
2.00	1.15	(N/A)	0.00
2.50	1.45	(N/A)	0.00
3.00	1.71	(N/A)	0.00
3.50	1.92	(N/A)	0.00
4.00	2.12	(N/A)	0.00
4.50	2.30	(N/A)	0.00
5.00	2.47	(N/A)	0.00
5.50	2.62	(N/A)	0.00
6.00	2.77	(N/A)	0.00

Computation Messages
HW & TW below invert
HW & TW below invert
Upstream HW & DNstream TW < Inv.El
H =.33
H =.83
H =1.33
H =1.83
H =2.33
H =2.83
H =3.33
H =3.83
H =4.33
H =4.83

100 Year Stream Rialto

Subsection: Composite Rating Curve Scenario: Post-Development 100 YEAR
Label: Composite Outlet Structure - 1

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
0.00	0.00	(N/A)	0.00
0.50	0.00	(N/A)	0.00
1.00	0.00	(N/A)	0.00
1.50	0.73	(N/A)	0.00
2.00	1.15	(N/A)	0.00
2.50	1.45	(N/A)	0.00
3.00	1.71	(N/A)	0.00
3.50	1.92	(N/A)	0.00
4.00	2.12	(N/A)	0.00
4.50	2.30	(N/A)	0.00
5.00	2.47	(N/A)	0.00
5.50	2.62	(N/A)	0.00
6.00	2.77	(N/A)	0.00

Contributing Structures
None Contributing
None Contributing
None Contributing
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Orifice - 1
Riser - 1 + Orifice - 1

100 Year Stream Rialto

Subsection: Elevation-Volume-Flow Table (Pond) Scenario: Post-Development 100 YEAR
Label: BMP 4

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.13 ft³/s

Initial Conditions	
Elevation (Water Surface, Initial)	0.00 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	15.000 min

Elevation (ft)	Outflow (ft³/s)	Storage (ft³)	Area (acres)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
0.00	0.00	0.000	0.000	0.00	0.00	0.00
0.50	0.00	480.000	0.000	0.13	0.13	1.20
1.00	0.00	960.000	0.000	0.13	0.13	2.26
1.50	0.73	1,733.350	0.000	0.13	0.86	4.71
2.00	1.15	2,506.700	0.000	0.13	1.28	6.85
2.50	1.45	3,443.550	0.000	0.13	1.58	9.24
3.00	1.71	4,380.400	0.000	0.13	1.84	11.57
3.50	1.92	5,317.300	0.000	0.13	2.05	13.87
4.00	2.12	6,254.200	0.000	0.13	2.25	16.15
4.50	2.30	7,027.500	0.000	0.13	2.43	18.05
5.00	2.47	7,800.800	0.000	0.13	2.60	19.93
5.50	2.62	8,280.800	0.000	0.13	2.75	21.15
6.00	2.77	8,760.800	0.000	0.13	2.90	22.37

100 Year Stream Rialto

Subsection: Pond Infiltration Hydrograph — Scenario: Post-Development 100 YEAR

Label: BMP 4 (INF)

Peak Discharge	0.13 ft^3/s
Time to Peak	540.000 min
Hydrograph Volume	10,882.219 ft^3

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
0.000	0.00	0.01	0.04	0.07	0.09
75.000	0.11	0.13	0.13	0.13	0.13
150.000	0.13	0.13	0.13	0.13	0.13
225.000	0.13	0.13	0.13	0.13	0.13
300.000	0.13	0.13	0.13	0.13	0.13
375.000	0.13	0.13	0.13	0.13	0.13
450.000	0.13	0.13	0.13	0.13	0.13
525.000	0.13	0.13	0.13	0.13	0.13
600.000	0.13	0.13	0.13	0.13	0.13
675.000	0.13	0.13	0.13	0.13	0.13
750.000	0.13	0.13	0.13	0.13	0.13
825.000	0.13	0.13	0.13	0.13	0.13
900.000	0.13	0.13	0.13	0.13	0.13
975.000	0.13	0.13	0.13	0.13	0.13
1,050.000	0.13	0.13	0.13	0.13	0.13
1,125.000	0.13	0.13	0.13	0.13	0.13
1,200.000	0.13	0.13	0.13	0.13	0.13
1,275.000	0.13	0.13	0.13	0.13	0.13
1,350.000	0.13	0.13	0.13	0.13	0.13
1,425.000	0.13	0.13	(N/A)	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Level Pool Pond Routing Summary   Scenario: Post-Development 100 YEAR
Label: BMP 4 (IN)

Infiltration	
Infiltration Method (Computed)	Constant
Infiltration Rate (Constant)	0.13 ft³/s

Initial Conditions	
Elevation (Water Surface, Initial)	0.00 ft
Volume (Initial)	0.000 ft³
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	15.000 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	3.67 ft³/s	Time to Peak (Flow, In)	975.000 min
Infiltration (Peak)	0.13 ft³/s	Time to Peak (Infiltration)	90.000 min
Flow (Peak Outlet)	1.79 ft³/s	Time to Peak (Flow, Outlet)	990.000 min

Elevation (Water Surface, Peak)	3.20 ft
Volume (Peak)	4,746.763 ft³

Mass Balance (ft³)	
Volume (Initial)	0.000 ft³
Volume (Total Inflow)	35,163.000 ft³
Volume (Total Infiltration)	10,999.000 ft³
Volume (Total Outlet Outflow)	23,260.000 ft³
Volume (Retained)	878.000 ft³
Volume (Unrouted)	-26.000 ft³
Error (Mass Balance)	0.1 %

100 Year Stream Rialto

Subsection: Pond Routed Hydrograph (total out) Scenario: Post-Development 100 YEAR
Label: BMP 4 (OUT)

Peak Discharge	1.79 ft³/s
Time to Peak	990.000 min
Hydrograph Volume	23,259.565 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
210.000	0.00	0.03	0.06	0.07	0.08
285.000	0.08	0.08	0.09	0.09	0.09
360.000	0.10	0.10	0.10	0.11	0.11
435.000	0.11	0.12	0.12	0.12	0.13
510.000	0.13	0.14	0.14	0.15	0.15
585.000	0.16	0.16	0.17	0.18	0.19
660.000	0.19	0.20	0.21	0.22	0.23
735.000	0.25	0.28	0.31	0.33	0.35
810.000	0.37	0.39	0.42	0.45	0.48
885.000	0.52	0.57	0.64	0.71	0.78
960.000	0.99	1.47	1.79	1.76	1.53
1,035.000	1.30	1.04	0.79	0.56	0.41
1,110.000	0.32	0.26	0.22	0.20	0.19
1,185.000	0.17	0.16	0.14	0.13	0.13
1,260.000	0.12	0.11	0.10	0.10	0.09
1,335.000	0.09	0.08	0.08	0.07	0.07
1,410.000	0.06	0.06	0.06	(N/A)	(N/A)

100 Year Stream Rialto

Subsection: Pond Inflow Summary Scenario: Post-Development 100 YEAR
Label: BMP 4 (IN)

Summary for Hydrograph Addition at 'BMP 4'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	DA 4

Node Inflows

Inflow Type	Element	Volume (ft^3)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	DA 4	35,118.000	975.000	3.67
Flow (In)	BMP 4	35,163.000	975.000	3.67

100 Year Stream Rialto

Subsection: Diverted Hydrograph Scenario: Post-Development 100 YEAR
Label: Outlet-4

Peak Discharge	1.79 ft³/s
Time to Peak	990.000 min
Hydrograph Volume	23,259.565 ft³

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 15.000 min
Time on left represents time for first value in each row.

Time (min)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
210.000	0.00	0.03	0.06	0.07	0.08
285.000	0.08	0.08	0.09	0.09	0.09
360.000	0.10	0.10	0.10	0.11	0.11
435.000	0.11	0.12	0.12	0.12	0.13
510.000	0.13	0.14	0.14	0.15	0.15
585.000	0.16	0.16	0.17	0.18	0.19
660.000	0.19	0.20	0.21	0.22	0.23
735.000	0.25	0.28	0.31	0.33	0.35
810.000	0.37	0.39	0.42	0.45	0.48
885.000	0.52	0.57	0.64	0.71	0.78
960.000	0.99	1.47	1.79	1.76	1.53
1,035.000	1.30	1.04	0.79	0.56	0.41
1,110.000	0.32	0.26	0.22	0.20	0.19
1,185.000	0.17	0.16	0.14	0.13	0.13
1,260.000	0.12	0.11	0.10	0.10	0.09
1,335.000	0.09	0.08	0.08	0.07	0.07
1,410.000	0.06	0.06	0.06	(N/A)	(N/A)

100 Year Stream Rialto

Index

CONTECH ENGINEERED SOLUTIONS

Date: 4/4/2024
Project Name: BMP 1 - 49295 (4-4-2024 16-42-19)

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. **This tool is only applicable for rectangular shaped systems.**

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	98.0	Backfill Porosity (%):	40%	System Diameter (in):	48
Out-to-out width (ft):	58.0	Depth Above Pipe (in):	12.0	Pipe Spacing (in):	24
Number of Manifolds (ea):	2.0	Depth Below Pipe (in):	12.0	Incremental Analysis (in):	12
Number of Barrels (ea):	10.0	Width At Ends (ft):	1.0	System Invert (Elevation):	0.2
		Width At Sides (ft):	1.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	0.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	2,400.0
1.00	1.20	0.0	0.0	2,400.0	2,400.0	2,400.0	2,400.0	0.0%	2,400.0
2.00	2.20	2,496.0	2,496.0	1,401.6	3,801.6	3,897.6	6,297.6	39.6%	4,511.7
3.00	3.20	3,887.7	6,383.7	844.9	4,646.5	4,732.6	11,030.2	57.9%	4,838.4
4.00	4.20	3,887.7	10,271.4	844.9	5,491.4	4,732.6	15,762.8	65.2%	4,511.7
5.00	5.20	2,496.0	12,767.4	1,401.6	6,893.0	3,897.6	19,660.5	64.9%	2,400.0
6.00	6.20	0.0	12,767.4	2,400.0	9,293.0	2,400.0	22,060.5	57.9%	2,400.0

CONTECH ENGINEERED SOLUTIONS

Date: 4/5/2024
Project Name: BMP 2 - 49298 (4-5-2024 15-28-32)

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. **This tool is only applicable for rectangular shaped systems.**

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	288.0	Backfill Porosity (%):	40%	System Diameter (in):	48
Out-to-out width (ft):	34.0	Depth Above Pipe (in):	12.0	Pipe Spacing (in):	24
Number of Manifolds (ea):	1.0	Depth Below Pipe (in):	12.0	Incremental Analysis (in):	12
Number of Barrels (ea):	6.0	Width At Ends (ft):	1.0	System Invert (Elevation):	0
		Width At Sides (ft):	1.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	4,176.0
1.00	1.00	0.0	0.0	4,176.0	4,176.0	4,176.0	4,176.0	0.0%	4,176.0
2.00	2.00	4,269.8	4,269.8	2,468.1	6,644.1	6,737.9	10,913.9	39.1%	7,788.4
3.00	3.00	6,650.4	10,920.2	1,515.9	8,159.9	8,166.2	19,080.1	57.2%	8,347.2
4.00	4.00	6,650.4	17,570.5	1,515.9	9,675.8	8,166.2	27,246.3	64.5%	7,788.4
5.00	5.00	4,269.8	21,840.4	2,468.1	12,143.9	6,737.9	33,984.2	64.3%	4,176.0
6.00	6.00	0.0	21,840.4	4,176.0	16,319.9	4,176.0	38,160.2	57.2%	4,176.0

CONTECH ENGINEERED SOLUTIONS

Date:	4/5/2024
Project Name:	BMP 3 - 49348 (4-5-2024 15-41-21)
City / County:	
State:	
Designed By:	
Company:	
Telephone:	

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. **This tool is only applicable for rectangular shaped systems.**

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	678.0	Backfill Porosity (%):	40%	System Diameter (in):	48
Out-to-out width (ft):	16.0	Depth Above Pipe (in):	12.0	Pipe Spacing (in):	24
Number of Manifolds (ea):	2.0	Depth Below Pipe (in):	12.0	Incremental Analysis (in):	12
Number of Barrels (ea):	3.0	Width At Ends (ft):	1.0	System Invert (Elevation):	0
		Width At Sides (ft):	1.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	4,896.0
1.00	1.00	0.0	0.0	4,896.0	4,896.0	4,896.0	4,896.0	0.0%	4,896.0
2.00	2.00	5,016.7	5,016.7	2,889.3	7,785.3	7,906.0	12,802.0	39.2%	9,140.2
3.00	3.00	7,813.6	12,830.3	1,770.6	9,555.9	9,584.2	22,386.2	57.3%	9,796.8
4.00	4.00	7,813.6	20,643.9	1,770.6	11,326.5	9,584.2	31,970.3	64.6%	9,140.2
5.00	5.00	5,016.7	25,660.5	2,889.3	14,215.8	7,906.0	39,876.3	64.4%	4,896.0
6.00	6.00	0.0	25,660.5	4,896.0	19,111.8	4,896.0	44,772.3	57.3%	4,896.0

CONTECH ENGINEERED SOLUTIONS

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Date: 4/4/2024
Project Name: BMP 4 - 49301 (4-4-2024 16-54-16)

City / County:
State:

Designed By:
Company:
Telephone:

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. **This tool is only applicable for rectangular shaped systems.**

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	78.0	Backfill Porosity (%):	40%	System Diameter (in):	48
Out-to-out width (ft):	28.0	Depth Above Pipe (in):	12.0	Pipe Spacing (in):	24
Number of Manifolds (ea):	1.0	Depth Below Pipe (in):	12.0	Incremental Analysis (in):	12
Number of Barrels (ea):	5.0	Width At Ends (ft):	1.0	System Invert (Elevation):	0
		Width At Sides (ft):	1.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	960.0
1.00	1.00	0.0	0.0	960.0	960.0	960.0	960.0	0.0%	960.0
2.00	2.00	977.8	977.8	568.9	1,528.9	1,546.7	2,506.7	39.0%	1,787.2
3.00	3.00	1,522.9	2,500.7	350.8	1,879.7	1,873.8	4,380.4	57.1%	1,915.2
4.00	4.00	1,522.9	4,023.6	350.8	2,230.5	1,873.8	6,254.2	64.3%	1,787.2
5.00	5.00	977.8	5,001.4	568.9	2,799.4	1,546.7	7,800.8	64.1%	960.0
6.00	6.00	0.0	5,001.4	960.0	3,759.4	960.0	8,760.8	57.1%	960.0

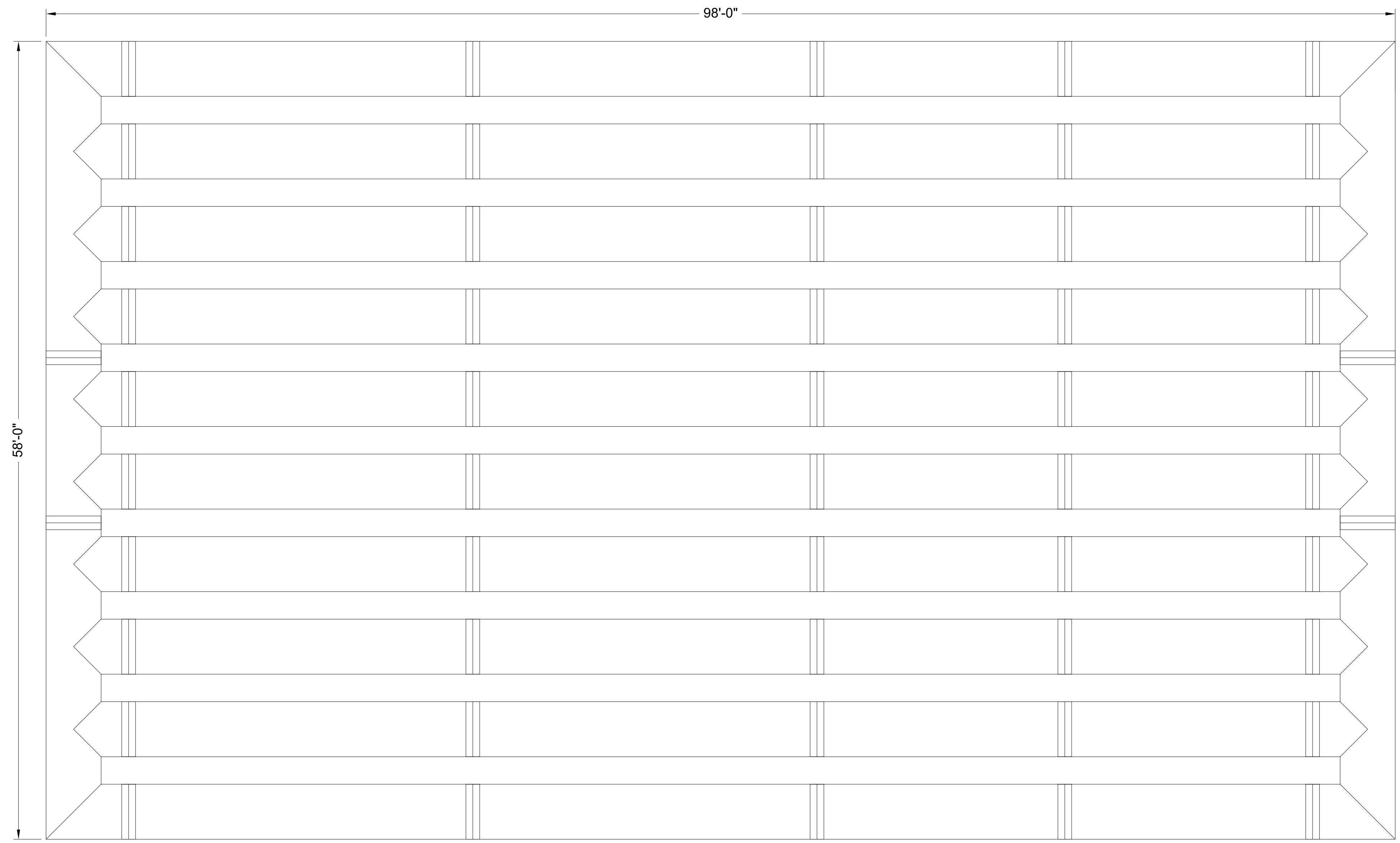
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 1,016 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = N/A
- PIPE STORAGE VOLUME = 12,767 CF
- BACKFILL STORAGE VOLUME = 9,293 CF
- TOTAL STORAGE PROVIDED = 22,060 CF

PIPE DETAILS
- DIAMETER = 48"
- CORRUGATION = 2 2/3x1/2
- GAGE = 16
- COATING = ALT2
- WALL TYPE = SOLID
- BARREL SPACING = 24"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 12"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 12"



ASSEMBLY
SCALE: 1" = 10'

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

C:\EXPORTS\TEMPLATES\NEW\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH®
CMP DETENTION SYSTEMS

CONTECH
DYODS
DRAWING

DYO49295 Miro Way
BMP 1
Rialto, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
34165	49295	4/4/2024

DESIGNED:	DRAWN:
DYO	DYO
CHECKED:	**APPROVED:**
DYO	DYO

SHEET NO.: 1

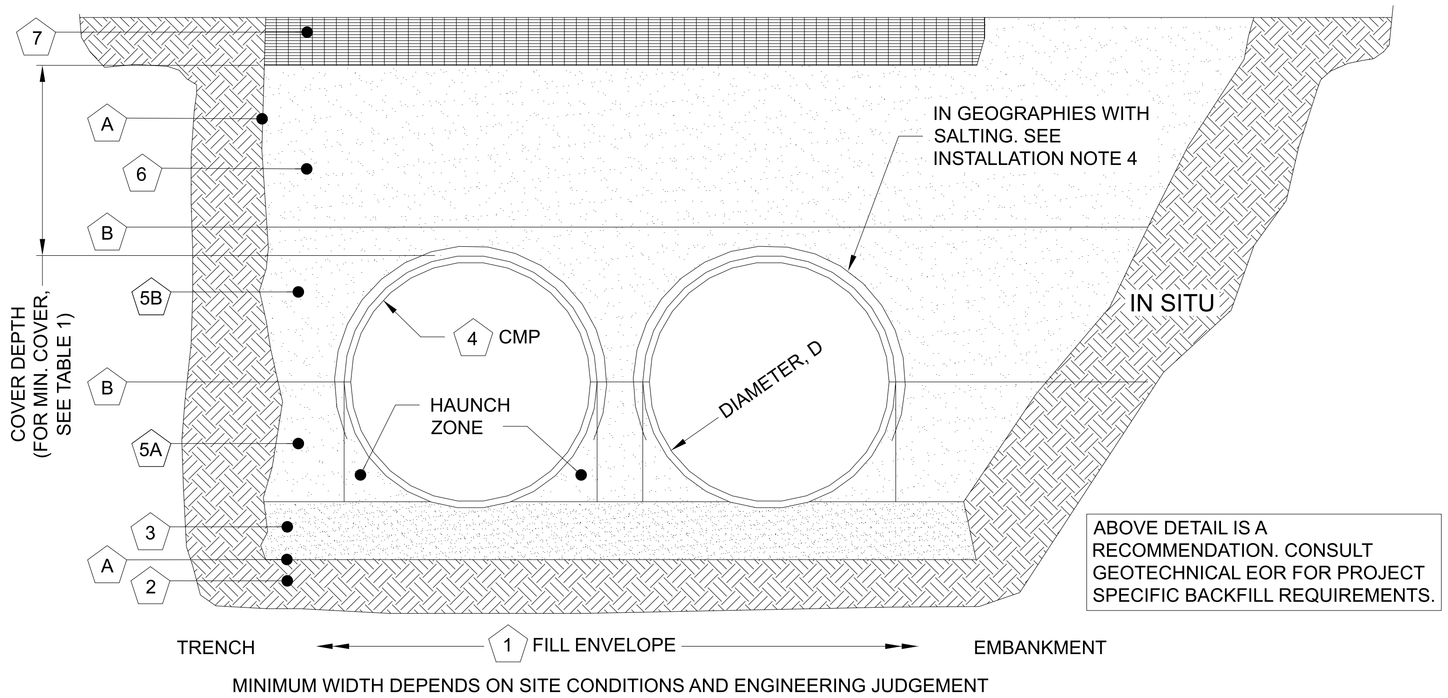


TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT
- ULTRAFLO ALSO AVAILABLE FOR SIZES 18" - 120" WITH 3/4"x 3/4"x 7 1/2" CORRUGATION

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. BACKFILL USING CONTROLLED LOW-STRENGTH MATERIAL (CLSM, "FLASH FILL" OR "FLOWABLE FILL") MAY BE USED WHEN THE SPACING BETWEEN THE PIPES WILL NOT ALLOW FOR PLACEMENT AND ADEQUATE COMPACTION OF THE BACKFILL. CONTACT CONTECH FOR FURTHER EVALUATION.
4. IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, A GEOMEMBRANE BARRIER IS RECOMMENDED OVER THE UPPER HALF OF THE PIPE. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

TABLE 2: SOLID STANDARD

CMP DETENTION AND CMP DRAINAGE STANDARD BACKFILL SPECIFICATIONS

	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** OR PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** (APPROVED REGIONAL EQUIVALENTS INCLUDE CA-7)	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE FOUNDATION SOILS CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
4	CORRUGATED METAL PIPE			
5A	CRITICAL BACKFILL	**AASHTO M 145: A-1, A-2, A-3** *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A THREE LIFT (24") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WELL GRADED GRANULAR MATERIAL WHICH MAY CONTAIN SMALL AMOUNTS OF SILT OR CLAY AND MAXIMUM PARTICLE SIZE OF 3" (PER AASHTO 26.3.8.1 AND 12.4-1.3).	
5B	BACKFILL	**AASHTO M 145: A-1, A-2, A-3**		
6	COVER MATERIAL	UP TO MIN. COVER - SEE 5A AND 5B ABOVE ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROAD BASE MATERIAL WITHIN MIN COVER LIMITS	
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
B	OPTIONAL GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:

- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

* APPROVED REGIONAL EQUIVALENTS FOR SECTION 5A INCLUDE CA-7, MIDOT 2G, 34G, OR 21AA STONE OR GRAVEL; #8; #57; MIDOT 6A, 2G, 3G, 34G.

MANUFACTURER RECOMMENDED BACKFILL

NOT TO SCALE

C:\EXPORTS\TEMPLATES\NEW\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

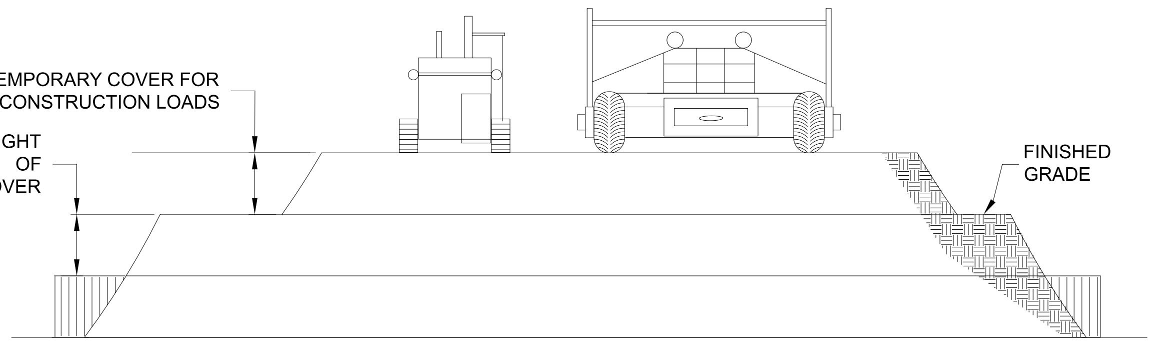
CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

DYO49295 Miro Way
BMP 1
Rialto, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
34165	49295	4/4/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

POLYMER COATED: AASHTO M-245 OR ASTM A-762

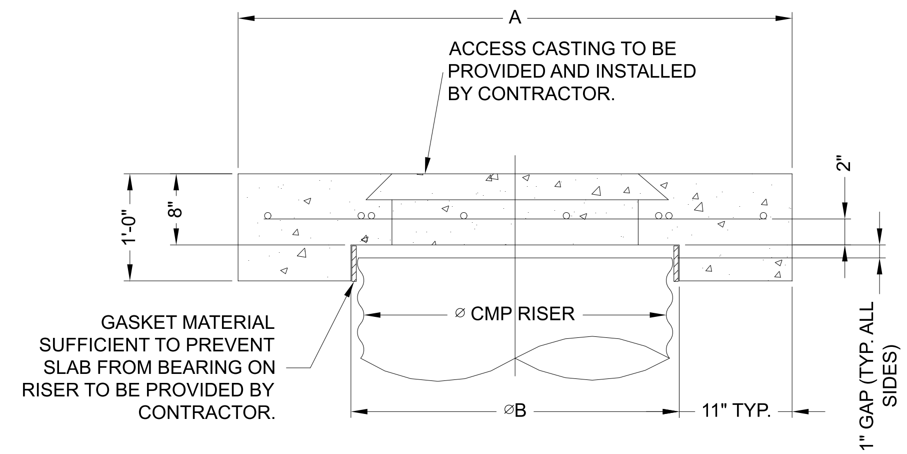
ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

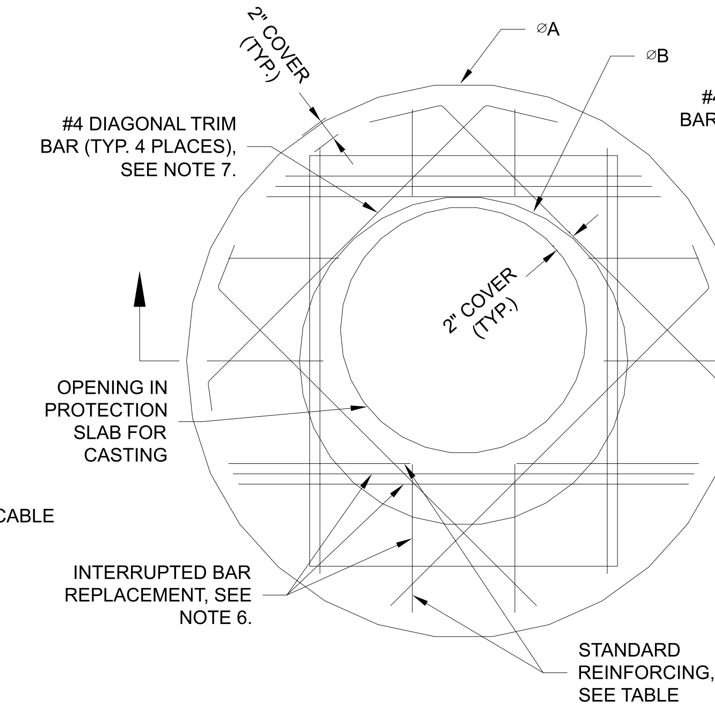


SECTION VIEW

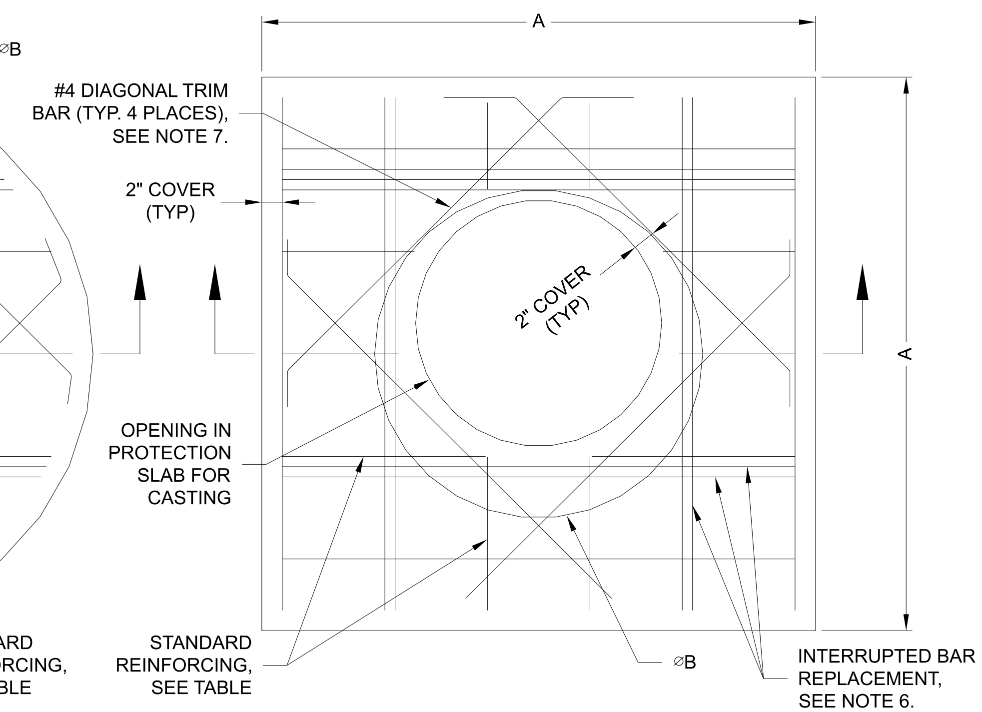
REINFORCING TABLE

⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

DATE	REVISION DESCRIPTION	BY

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH® CMP DETENTION SYSTEMS
CONTECH **DYODS** DRAWING

DYO49295 Miro Way
BMP 1
Rialto, CA
DETENTION SYSTEM

PROJECT No.: 34165	SEQ. No.: 49295	DATE: 4/4/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

C:\EXPORTS\TEMPLATES\NEW\CMP_V8.DWG 10/18/2019 10:02 AM

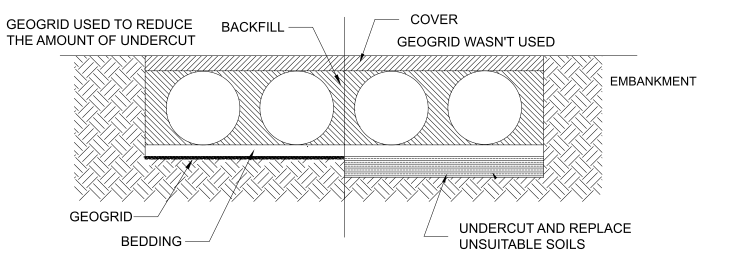
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

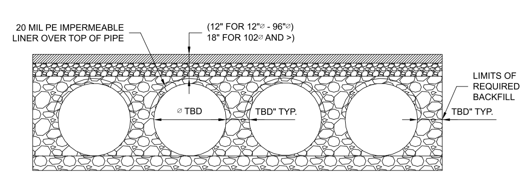


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

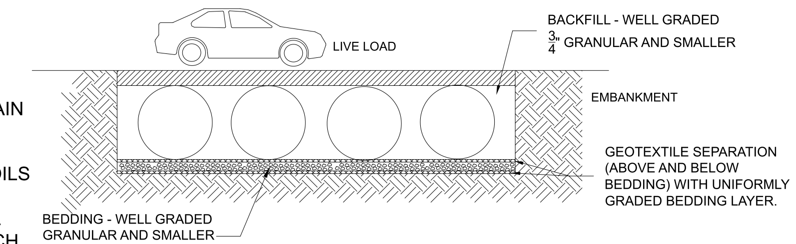
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

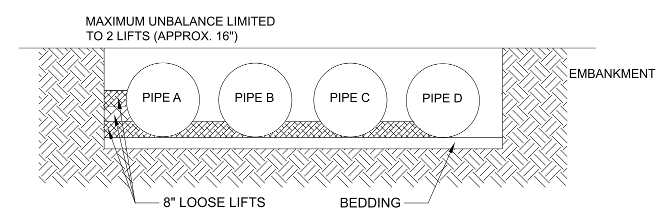
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



BACKFILL PLACEMENT

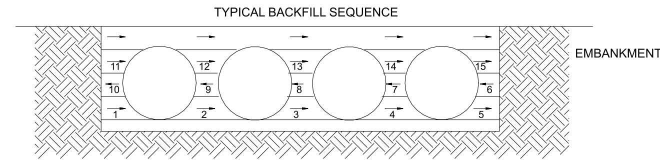
MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.



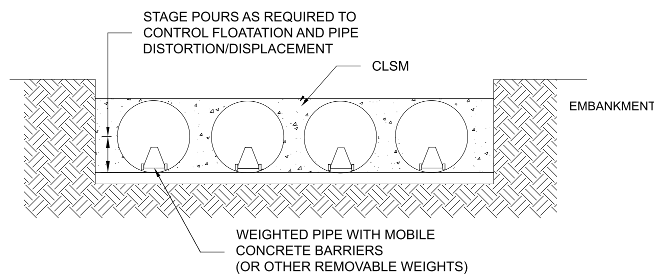
IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.

TYPICAL BACKFILL SEQUENCE



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

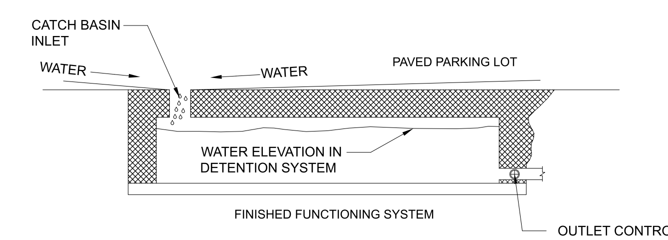


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

C:\EXPORTS\TEMPLATES\NEW\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO49295 Miro Way
BMP 1
Rialto, CA
DETENTION SYSTEM

PROJECT No.: 34165	SEQ. No.: 49295	DATE: 4/4/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

PROJECT SUMMARY

CALCULATION DETAILS

- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 1,738 LF

STORAGE SUMMARY

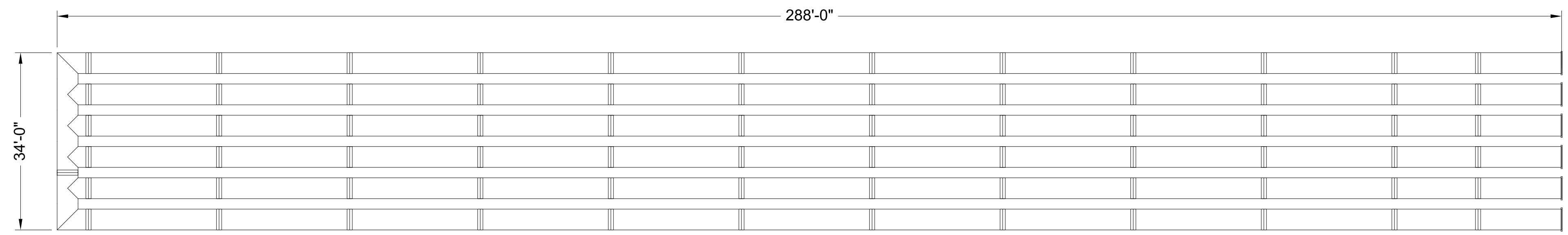
- STORAGE VOLUME REQUIRED = N/A
- PIPE STORAGE VOLUME = 21,840 CF
- BACKFILL STORAGE VOLUME = 16,320 CF
- TOTAL STORAGE PROVIDED = 38,160 CF

PIPE DETAILS

- DIAMETER = 48"
- CORRUGATION = 2 2/3x1/2
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 24"

BACKFILL DETAILS

- WIDTH AT ENDS = 12"
- ABOVE PIPE = 12"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 12"



NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY

SCALE: 1" = 30'

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO49298 Miro Way
BMP 2
Rialto, CA
DETENTION SYSTEM

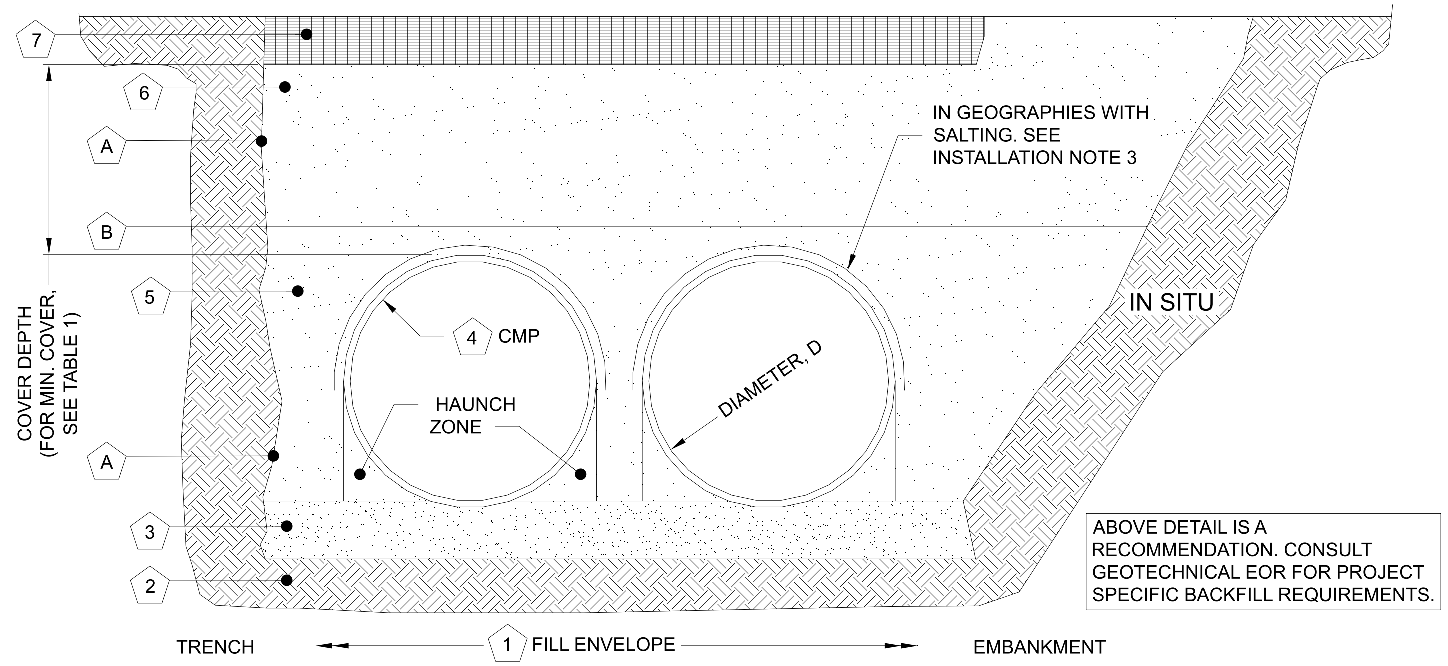
PROJECT No.: 34168	SEQ. No.: 49298	DATE: 4/5/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

C:\EXPORTS\TEMPLATES\CMP_V8.DWG 10/18/2019 10:02 AM

TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.



MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, A GEOMEMBRANE BARRIER IS RECOMMENDED OVER THE UPPER HALF OF THE PIPE. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

TABLE 2: PERFORATED STANDARD

CMP RETENTION STANDARD BACKFILL SPECIFICATIONS

	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** - PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57**	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE OPEN GRADED GRANULAR BEDDING CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
4	CORRUGATED METAL PIPE			
5	BACKFILL	FREE-DRAINING, ANGULAR, NATURALLY OCCURRING WASHED-STONE PER **AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** OR APPROVED EQUAL *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WHERE CONVENTIONAL COMPACTION TESTING IS NOT PRACTICAL, THE MATERIAL SHALL BE MECHANICALLY COMPACTED UNTIL NO FURTHER YIELDING OF MATERIAL IS OBSERVED UNDER THE COMPACTOR. **IN AREAS WITH HIGH WATER TABLE FLUCTUATIONS THAT INTERACT WITH THE PIPE ZONE, CONSIDER INSTALLING A GEOTEXTILE SEPARATION LAYER TO PREVENT SOIL MIGRATION.	
6	COVER MATERIAL	UP TO MIN. COVER - **AASHTO M 145: A-1, A-2, A-3** ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROADBASE MATERIAL WITHIN MIN COVER LIMITS	
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
B	GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:
- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

* APPROVED REGIONAL EQUIVALENTS FOR SECTION 5 INCLUDE CA-7, MIDOT 6AA, 6A, OR 5G, PROVIDED THEY MEET THE PARTICLE SIZES INDICATED.

MANUFACTURER RECOMMENDED BACKFILL

NOT TO SCALE

C:\EXPORTS\TEMPLATES\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

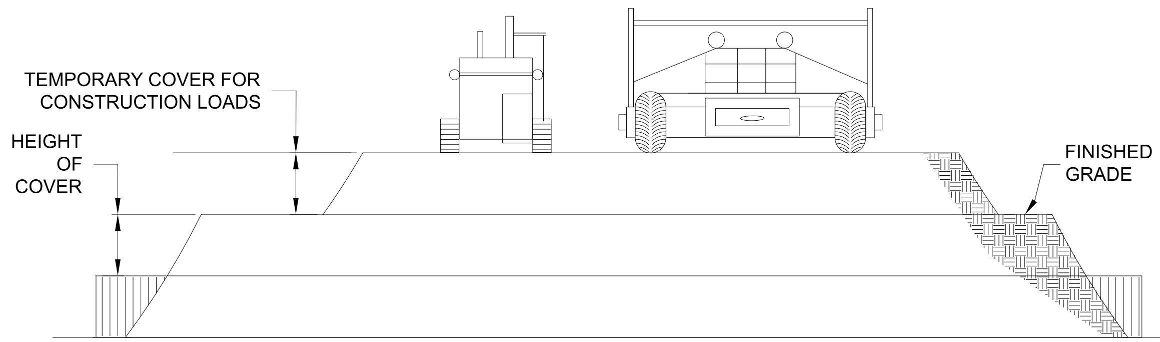
CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO49298 Miro Way
BMP 2
Rialto, CA
DETENTION SYSTEM

PROJECT No.: 34168	SEQ. No.: 49298	DATE: 4/5/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

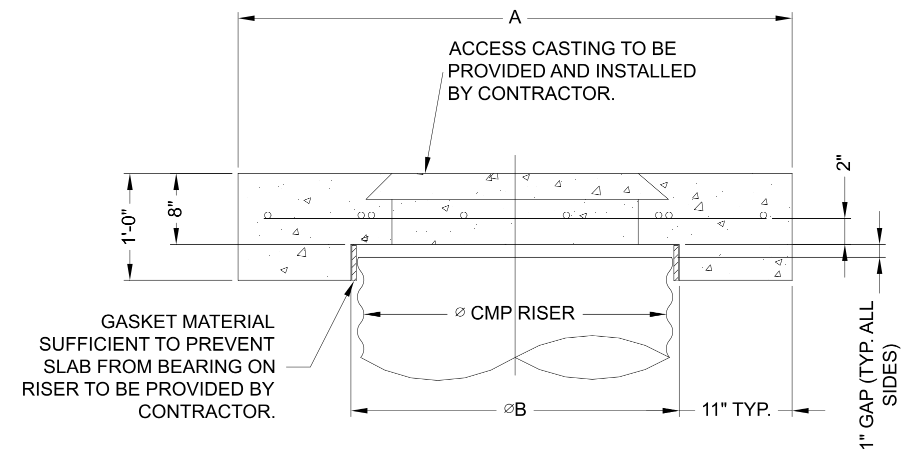
POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

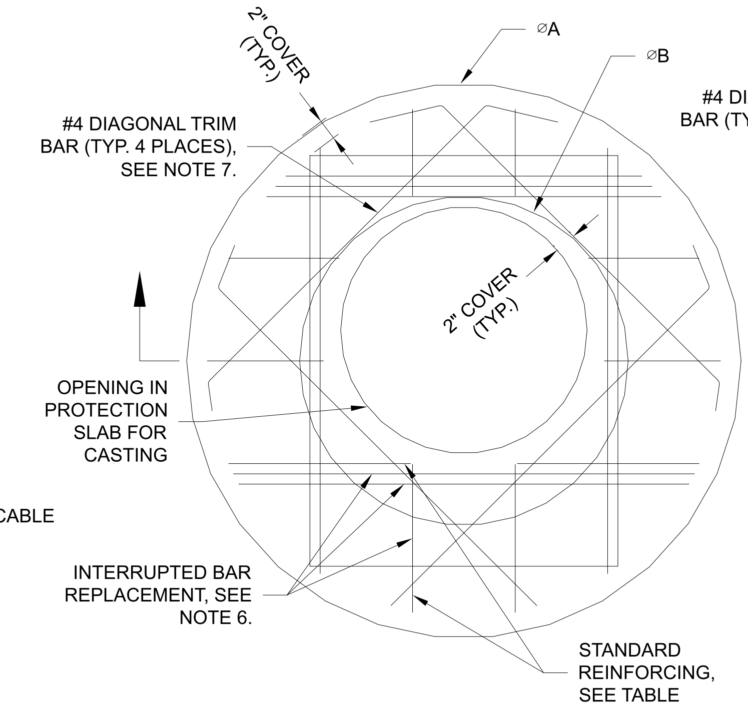


SECTION VIEW

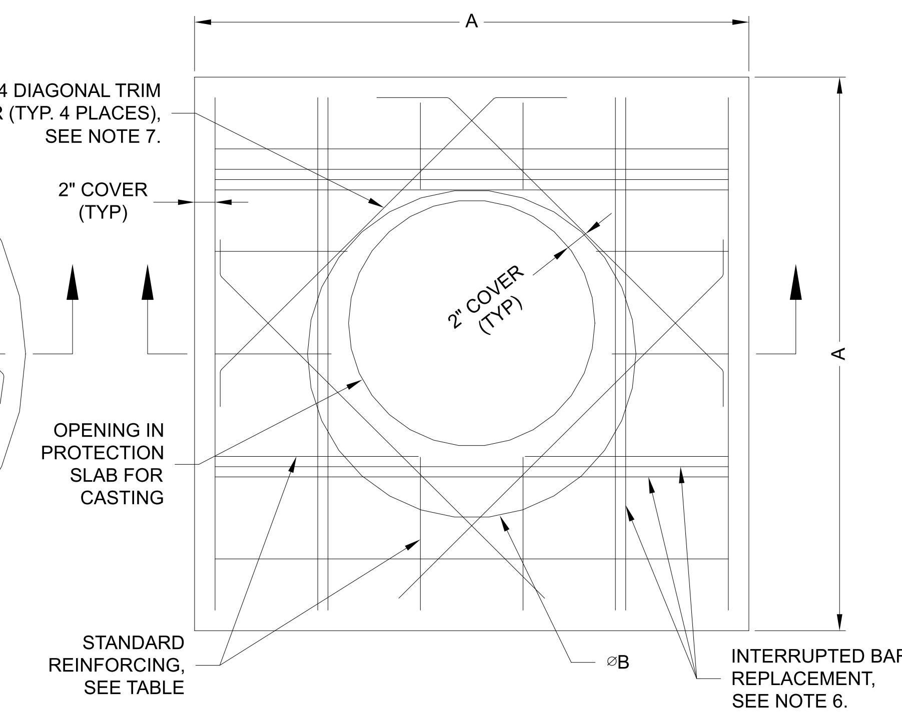
REINFORCING TABLE

⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

C:\EXPORTS\TEMPLATES\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH® CMP DETENTION SYSTEMS
CONTECH **DYODS** DRAWING

DYO49298 Miro Way
BMP 2
Rialto, CA
DETENTION SYSTEM

PROJECT No.: 34168	SEQ. No.: 49298	DATE: 4/5/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET No.: 1		

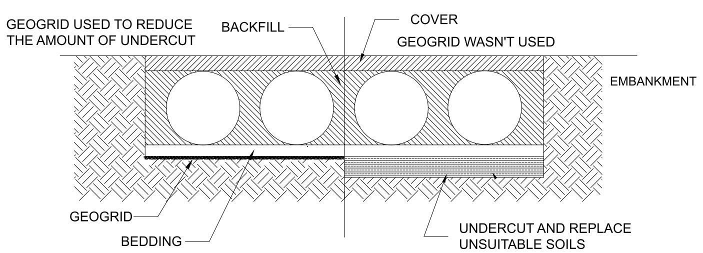
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

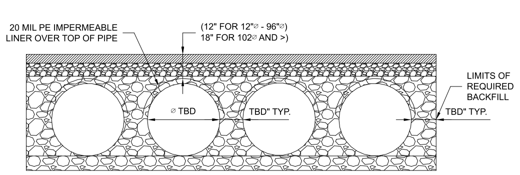


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

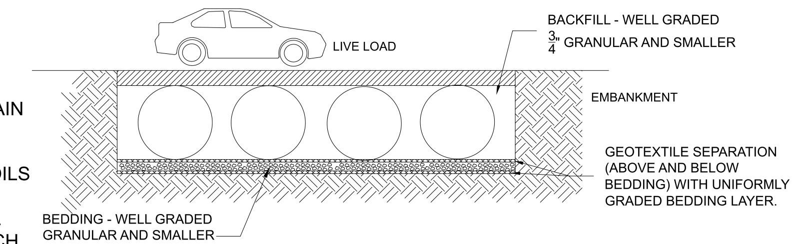
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

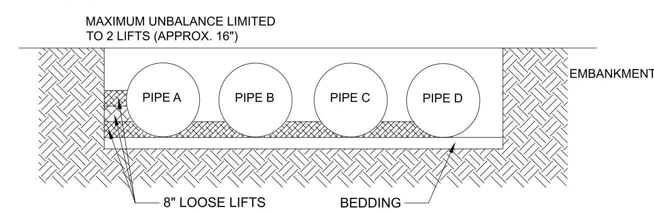
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



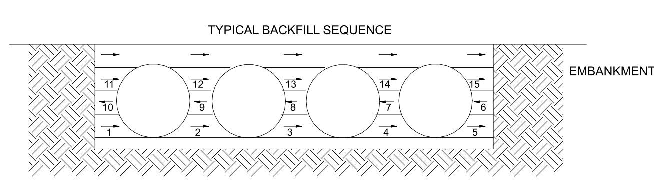
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.

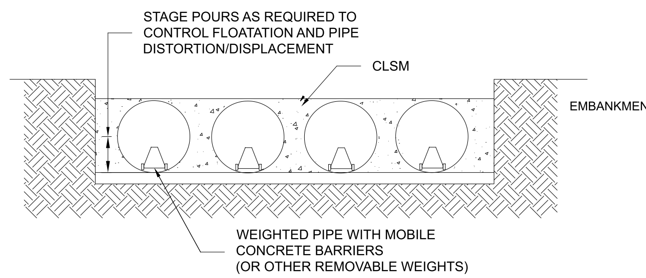


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

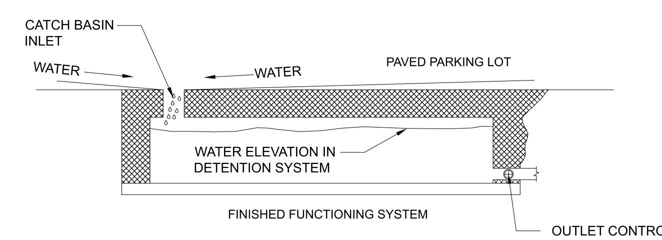


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO49298 Miro Way
BMP 2
Rialto, CA
DETENTION SYSTEM

PROJECT No.: 34168	SEQ. No.: 49298	DATE: 4/5/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

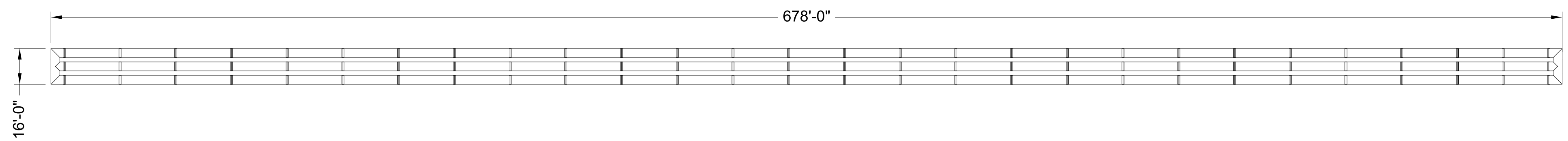
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 2,042 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = N/A
- PIPE STORAGE VOLUME = 25,661 CF
- BACKFILL STORAGE VOLUME = 19,112 CF
- TOTAL STORAGE PROVIDED = 44,772 CF

PIPE DETAILS
- DIAMETER = 48"
- CORRUGATION = 2 2/3x1/2
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 24"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 12"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 12"



ASSEMBLY
SCALE: 1" = 70'

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

DATE	REVISION DESCRIPTION	BY

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH® CMP DETENTION SYSTEMS

CONTECH
DYODS
DRAWING

DYO49348 Miro Way
BMP 3
Rialto, CA
DETENTION SYSTEM

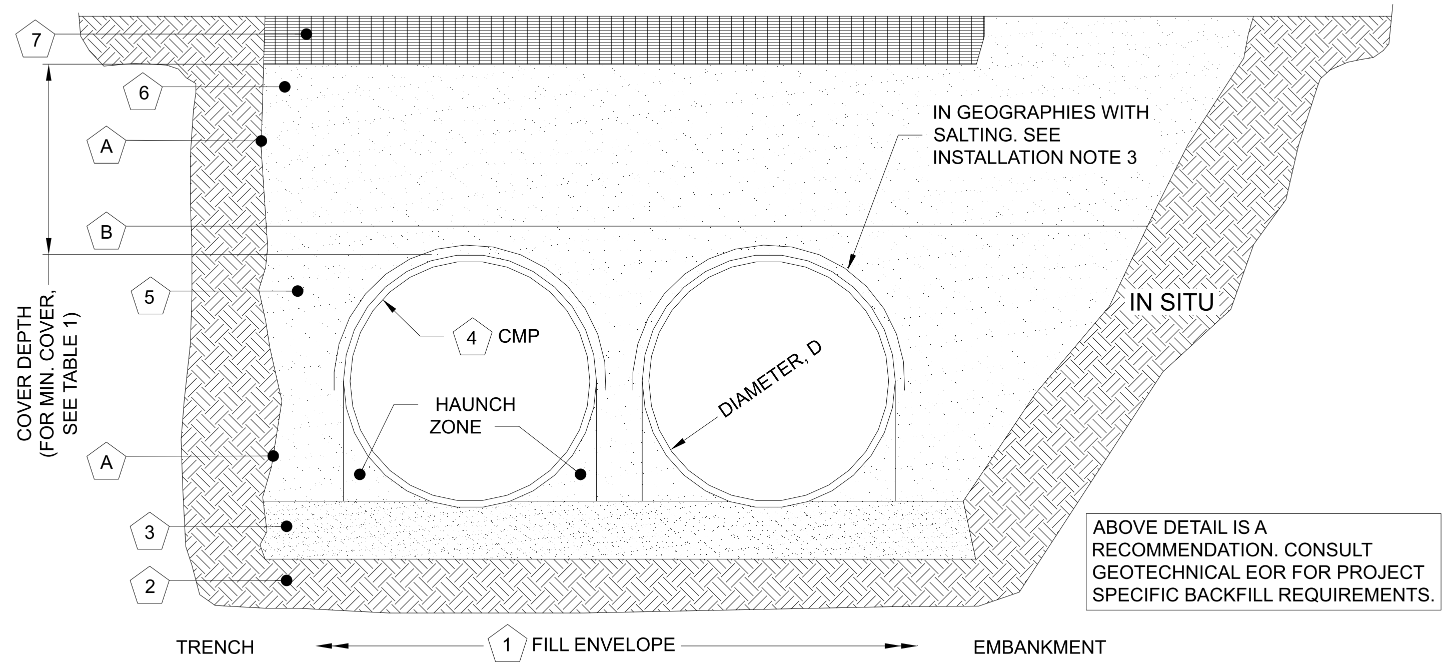
PROJECT No.:	SEQ. No.:	DATE:
34169	49348	4/5/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

C:\EXPORTS\TEMPLATES\CMP_V8.DWG 10/18/2019 10:02 AM

TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.



MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, A GEOMEMBRANE BARRIER IS RECOMMENDED OVER THE UPPER HALF OF THE PIPE. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

TABLE 2: PERFORATED STANDARD

CMP RETENTION STANDARD BACKFILL SPECIFICATIONS

	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** - PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57**	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE OPEN GRADED GRANULAR BEDDING CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
4	CORRUGATED METAL PIPE			
5	BACKFILL	FREE-DRAINING, ANGULAR, NATURALLY OCCURRING WASHED-STONE PER **AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** OR APPROVED EQUAL *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WHERE CONVENTIONAL COMPACTION TESTING IS NOT PRACTICAL, THE MATERIAL SHALL BE MECHANICALLY COMPACTED UNTIL NO FURTHER YIELDING OF MATERIAL IS OBSERVED UNDER THE COMPACTOR. **IN AREAS WITH HIGH WATER TABLE FLUCTUATIONS THAT INTERACT WITH THE PIPE ZONE, CONSIDER INSTALLING A GEOTEXTILE SEPARATION LAYER TO PREVENT SOIL MIGRATION.	
6	COVER MATERIAL	UP TO MIN. COVER - **AASHTO M 145: A-1, A-2, A-3** ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROADBASE MATERIAL WITHIN MIN COVER LIMITS	
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
B	GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:
- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

* APPROVED REGIONAL EQUIVALENTS FOR SECTION 5 INCLUDE CA-7, MIDOT 6AA, 6A, OR 5G, PROVIDED THEY MEET THE PARTICLE SIZES INDICATED.

MANUFACTURER RECOMMENDED BACKFILL

NOT TO SCALE

C:\EXPORTS\TEMPLATES\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

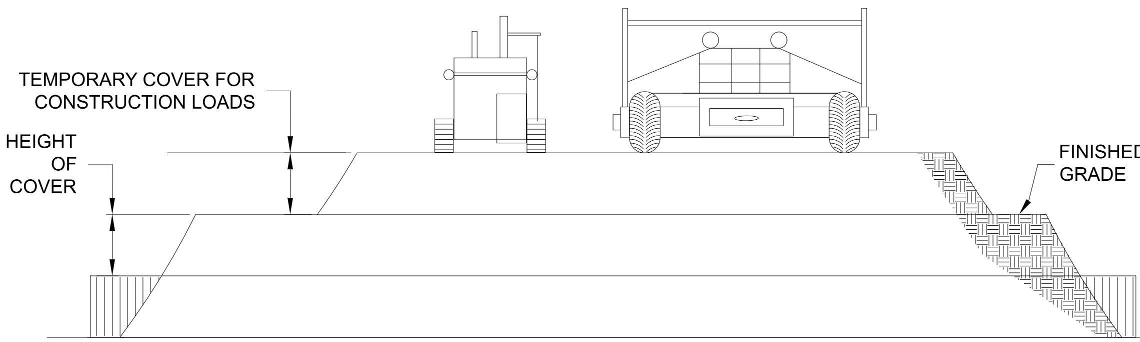
CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

DYO49348 Miro Way
BMP 3
Rialto, CA
DETENTION SYSTEM

PROJECT No.: 34169	SEQ. No.: 49348	DATE: 4/5/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		



CONSTRUCTION LOADS

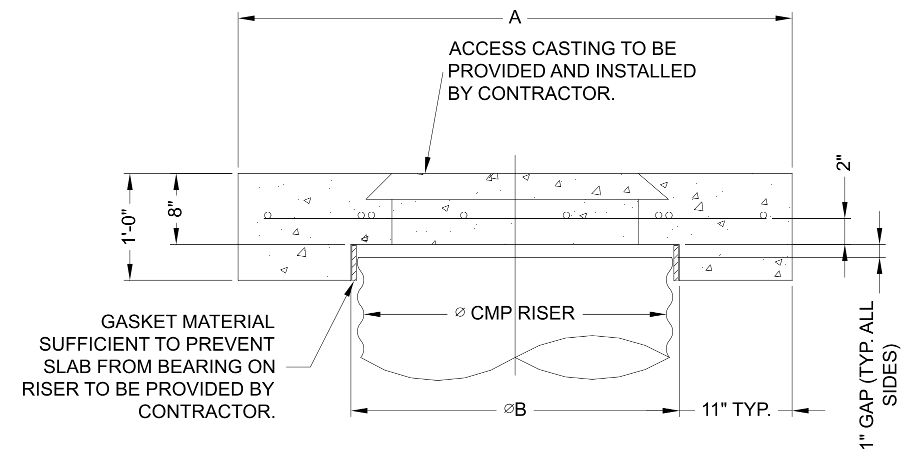
FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

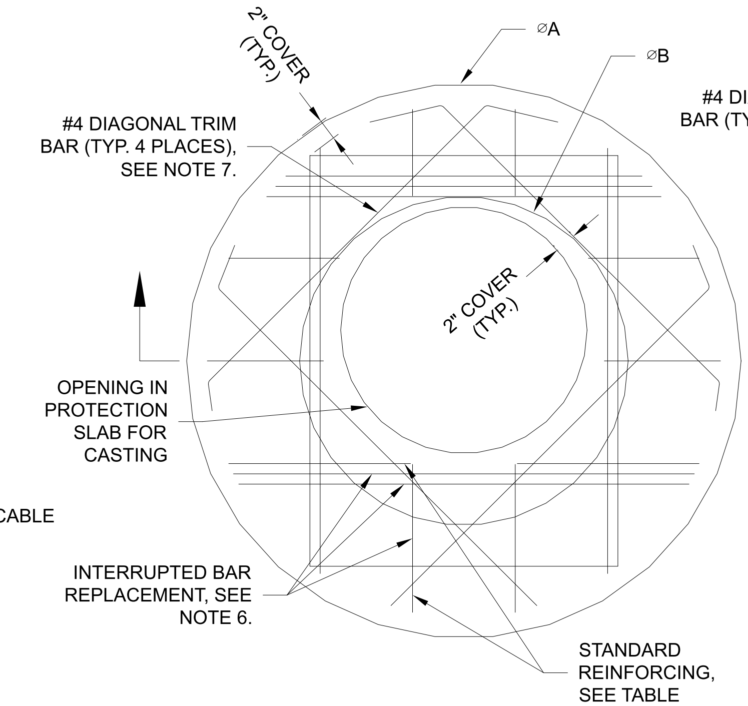


SECTION VIEW

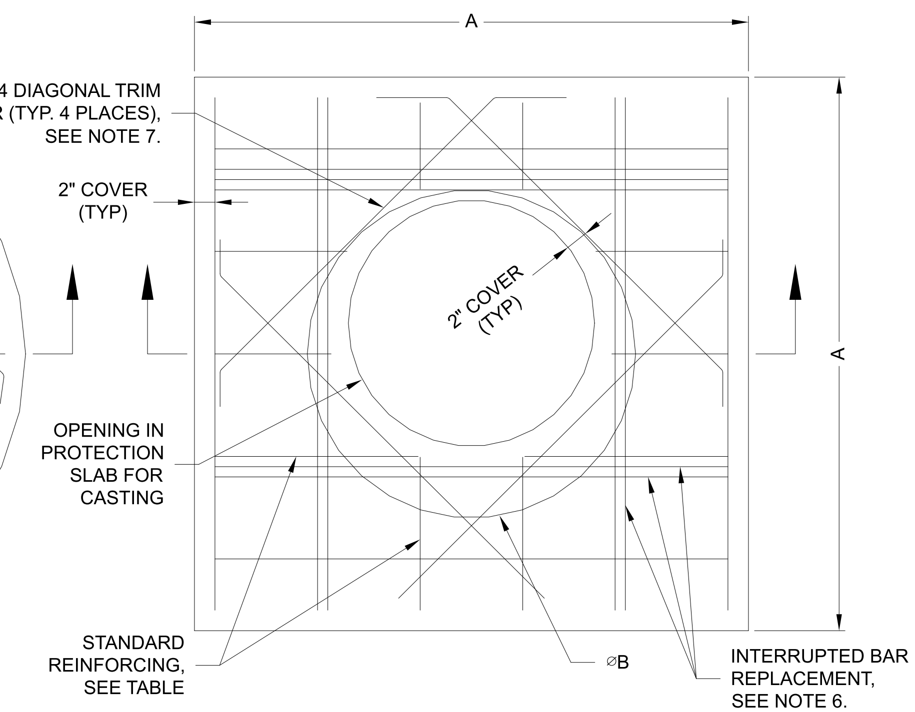
⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

REINFORCING TABLE

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

C:\EXPORTS\TEMPLATES\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH **DYODS** DRAWING

DYO49348 Miro Way
BMP 3
Rialto, CA
DETENTION SYSTEM

PROJECT No.: 34169	SEQ. No.: 49348	DATE: 4/5/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

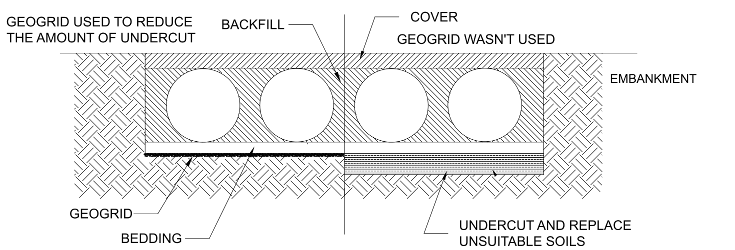
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

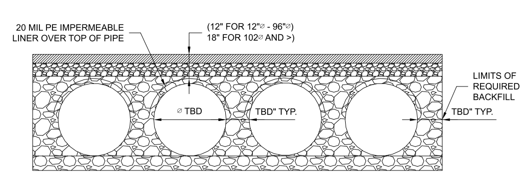


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

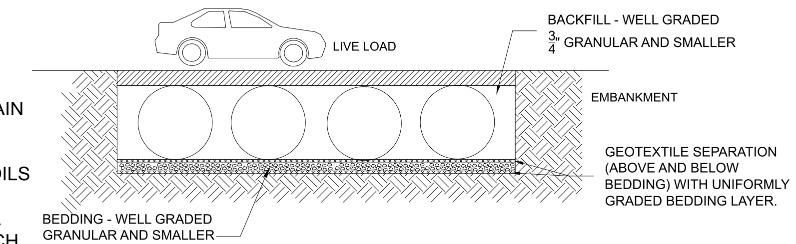
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

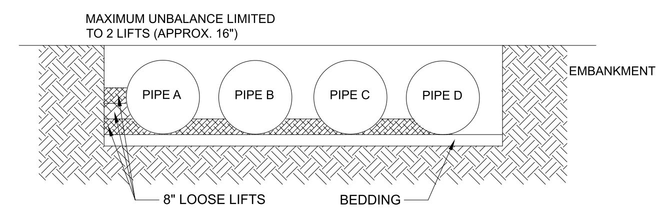
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



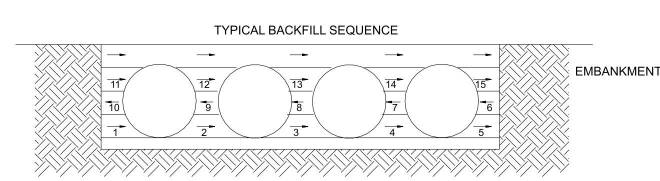
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.

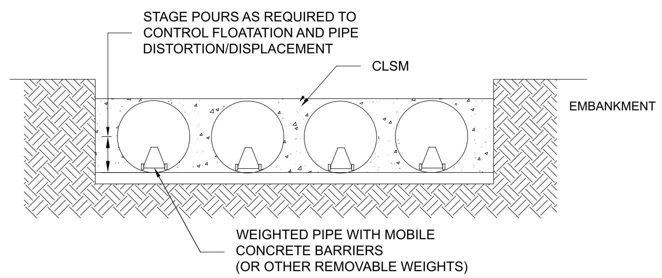


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

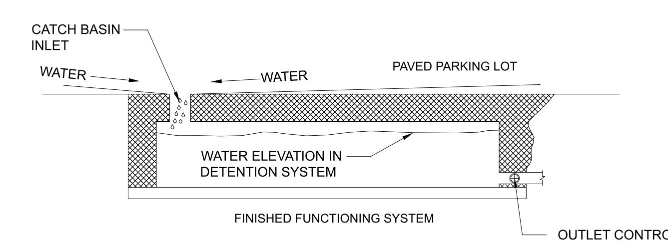


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

DYO49348 Miro Way
BMP 3
Rialto, CA
DETENTION SYSTEM

PROJECT No.: 34169	SEQ. No.: 49348	DATE: 4/5/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

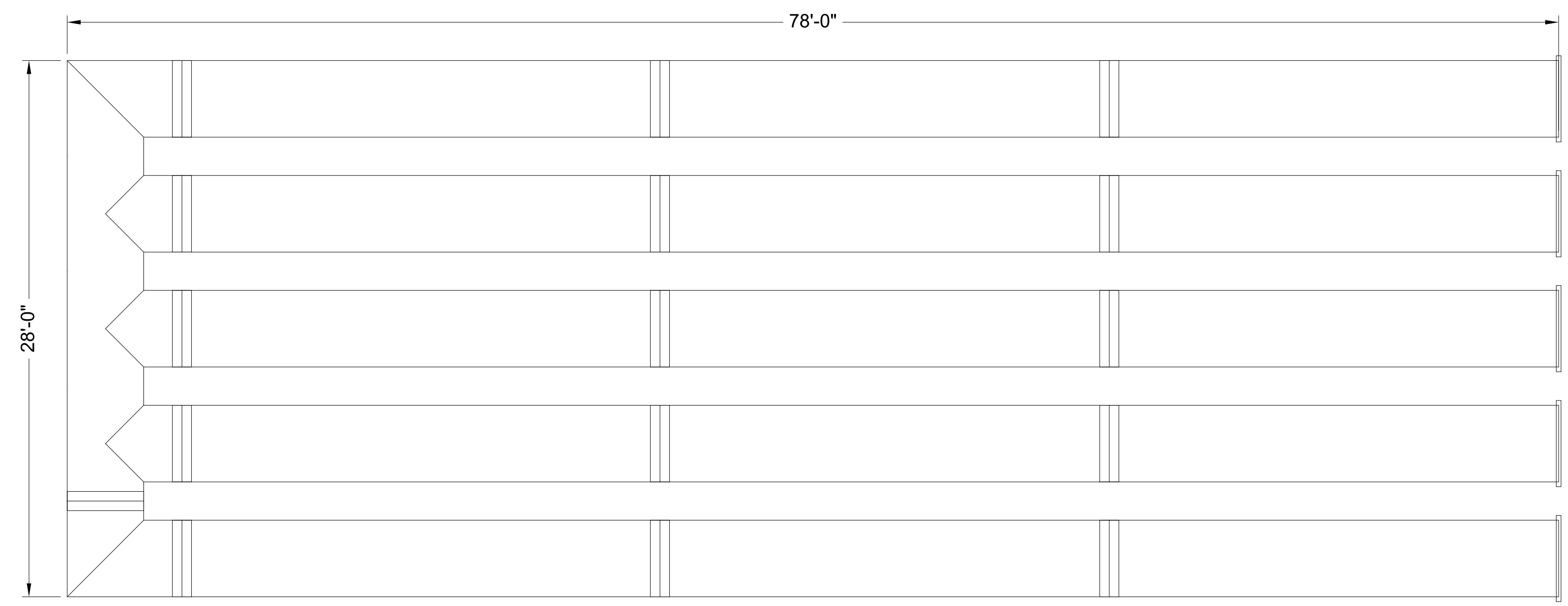
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 398 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = N/A
- PIPE STORAGE VOLUME = 5,001 CF
- BACKFILL STORAGE VOLUME = 3,759 CF
- TOTAL STORAGE PROVIDED = 8,761 CF

PIPE DETAILS
- DIAMETER = 48"
- CORRUGATION = 2 2/3x1/2
- GAGE = 16
- COATING = ALT2
- WALL TYPE = SOLID
- BARREL SPACING = 24"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 12"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 12"



ASSEMBLY
SCALE: 1" = 10'

NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

C:\EXPORTS\TEMPLATES\NEW\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

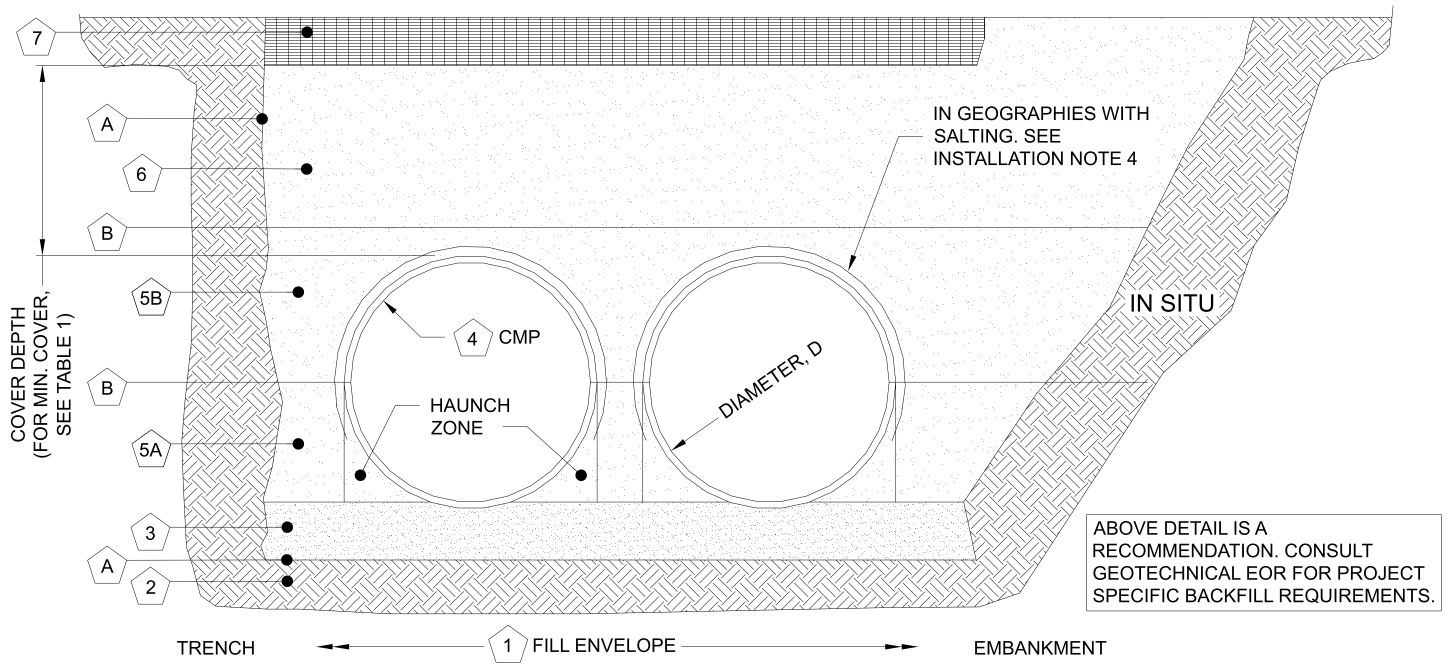
DYO49301 Miro Way
BMP 4
Rialto, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
34171	49301	4/4/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT
- ULTRAFLO ALSO AVAILABLE FOR SIZES 18" - 120" WITH 3/4"x 3/4"x 7 1/2" CORRUGATION



MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. BACKFILL USING CONTROLLED LOW-STRENGTH MATERIAL (CLSM, "FLASH FILL" OR "FLOWABLE FILL") MAY BE USED WHEN THE SPACING BETWEEN THE PIPES WILL NOT ALLOW FOR PLACEMENT AND ADEQUATE COMPACTION OF THE BACKFILL. CONTACT CONTECH FOR FURTHER EVALUATION.
4. IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, A GEOMEMBRANE BARRIER IS RECOMMENDED OVER THE UPPER HALF OF THE PIPE. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

TABLE 2: SOLID STANDARD

CMP DETENTION AND CMP DRAINAGE STANDARD BACKFILL SPECIFICATIONS

	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** OR PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** (APPROVED REGIONAL EQUIVALENTS INCLUDE CA-7)	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE FOUNDATION SOILS CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
4	CORRUGATED METAL PIPE			
5A	CRITICAL BACKFILL	**AASHTO M 145: A-1, A-2, A-3** *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A THREE LIFT (24") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WELL GRADED GRANULAR MATERIAL WHICH MAY CONTAIN SMALL AMOUNTS OF SILT OR CLAY AND MAXIMUM PARTICLE SIZE OF 3" (PER AASHTO 26.3.8.1 AND 12.4-1.3).	
5B	BACKFILL	**AASHTO M 145: A-1, A-2, A-3**		
6	COVER MATERIAL	UP TO MIN. COVER - SEE 5A AND 5B ABOVE ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROAD BASE MATERIAL WITHIN MIN COVER LIMITS	
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
B	OPTIONAL GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:

- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

* APPROVED REGIONAL EQUIVALENTS FOR SECTION 5A INCLUDE CA-7, MIDOT 2G, 34G, OR 21AA STONE OR GRAVEL; #8; #57; MIDOT 6A, 2G, 3G, 34G.

MANUFACTURER RECOMMENDED BACKFILL

NOT TO SCALE

C:\EXPORTS\TEMPLATES\NEW\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

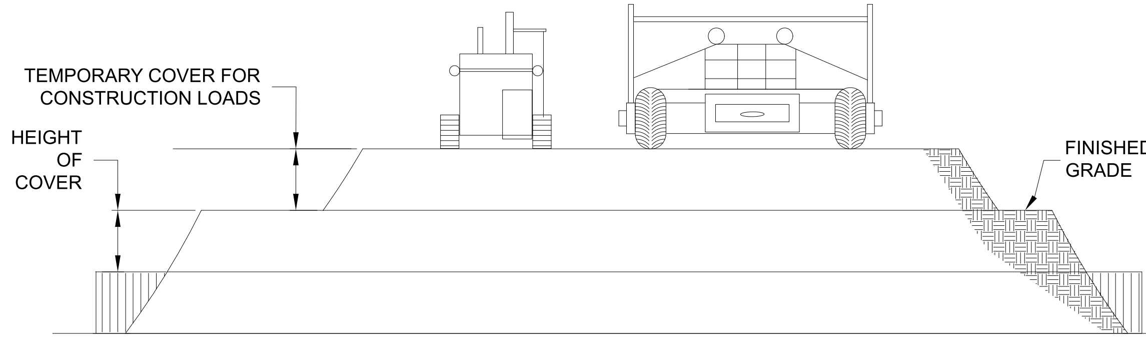
CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

DYO49301 Miro Way
BMP 4
Rialto, CA
DETENTION SYSTEM

PROJECT No.: 34171	SEQ. No.: 49301	DATE: 4/4/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		



CONSTRUCTION LOADS

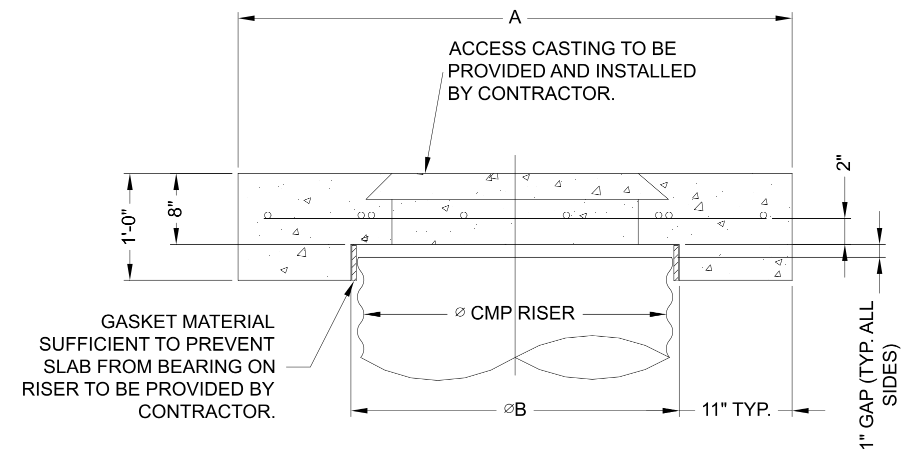
FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

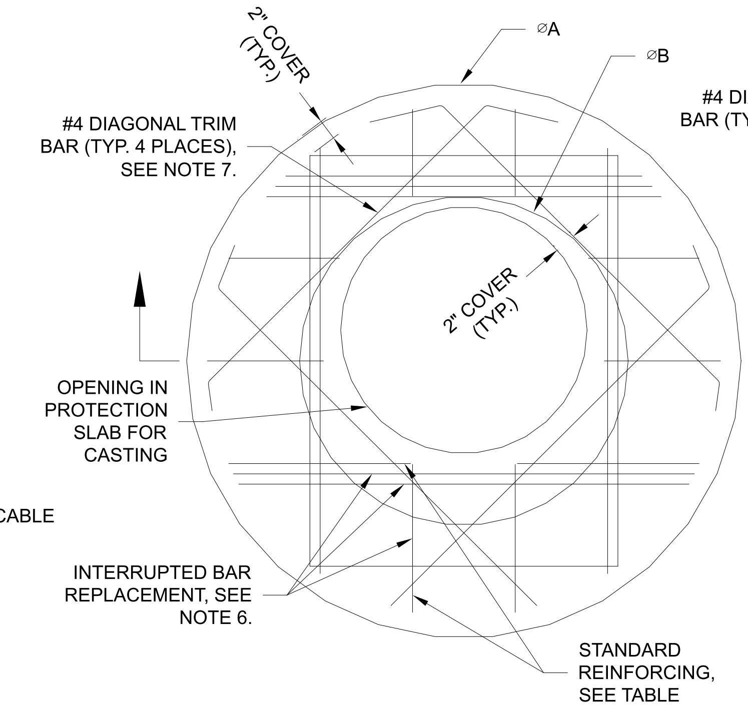


SECTION VIEW

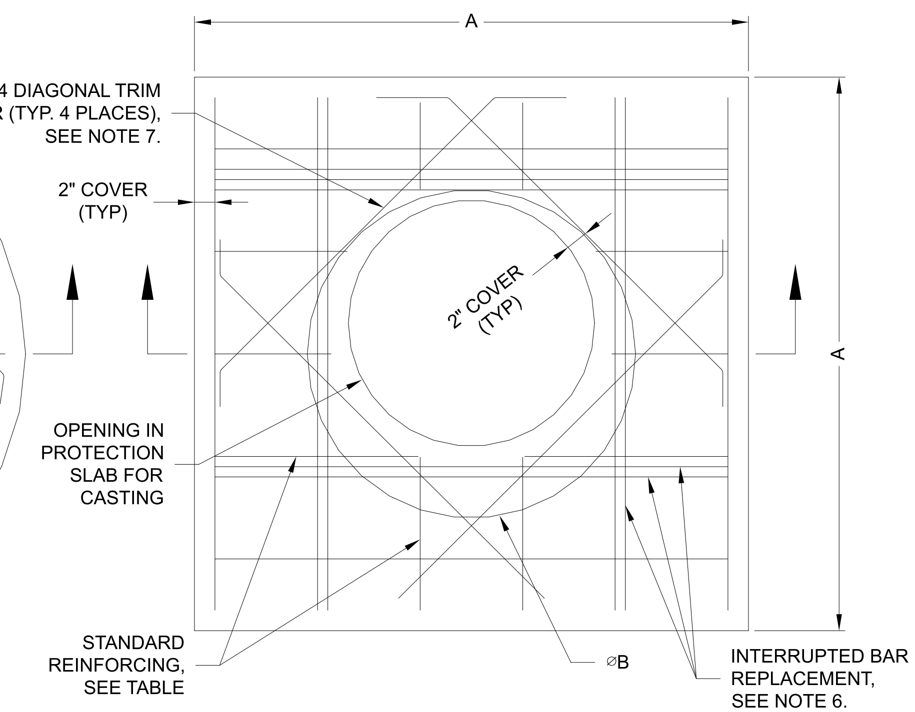
REINFORCING TABLE

⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

C:\EXPORTS\TEMPLATES\NEW\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

DYO49301 Miro Way
BMP 4
Rialto, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
34171	49301	4/4/2024
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

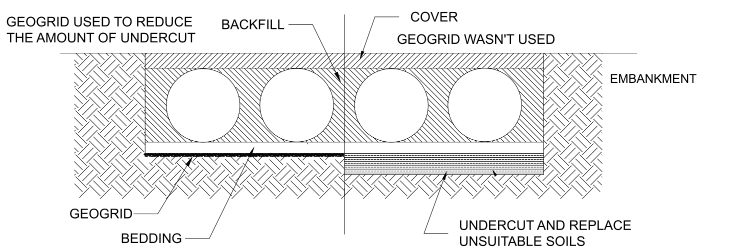
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

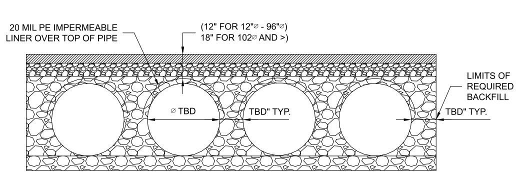


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

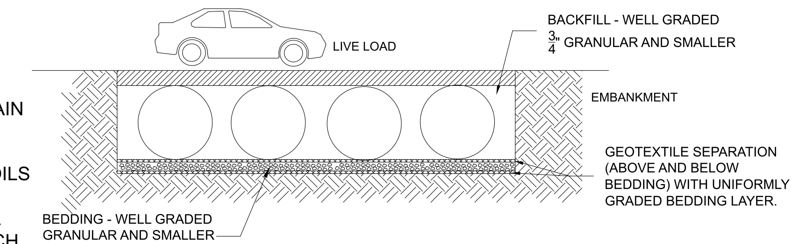
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

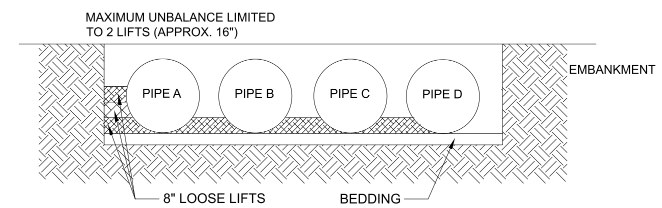
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



BACKFILL PLACEMENT

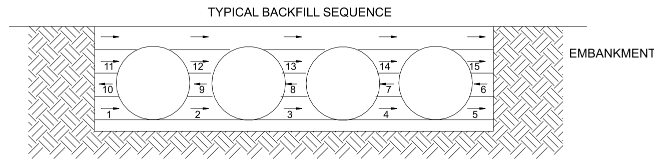
MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.



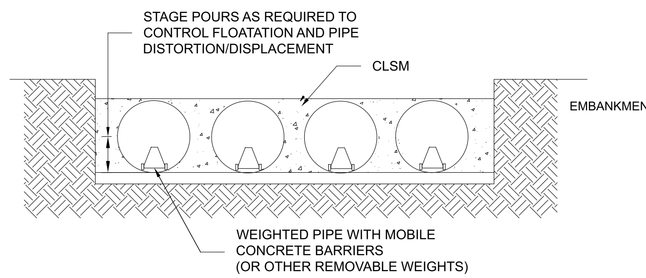
IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.

TYPICAL BACKFILL SEQUENCE



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

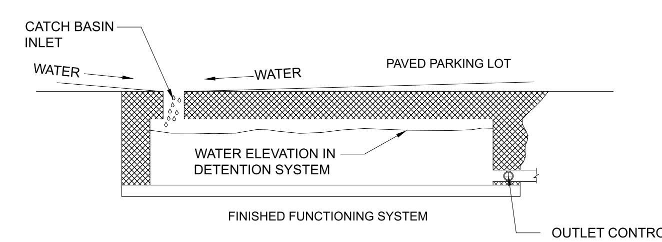


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

C:\EXPORTS\TEMPLATES\NEW\CMP_V8.DWG 10/18/2019 10:02 AM

DATE	REVISION DESCRIPTION	BY

ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CMP DETENTION SYSTEMS

CONTECH
DYODS
DRAWING

DYO49301 Miro Way
BMP 4
Rialto, CA
DETENTION SYSTEM

PROJECT No.: 34171	SEQ. No.: 49301	DATE: 4/4/2024
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

APPENDIX I

FLOWMASTER PIPE AND INLET SIZING RESULTS

TBD

APPENDIX J

STORMCAD HGL ANALYSIS

TBD

APPENDIX K

RESULTS OF INFILTRATION TESTING

PRELIMINARY GEOTECHNICAL INVESTIGATION FOR DUE DILIGENCE PURPOSES, PROPOSED 600-ACRE RESIDENTIAL AND COMMERCIAL DEVELOPMENT, RIALTO AIRPORT AND ADJACENT PROPERTY TO THE NORTH AND EAST, EAST OF ALDER AVENUE AND SOUTH OF THE 210 FREEWAY, RIALTO, CALIFORNIA

Prepared for:

LEWIS OPERATING CORPORATION
1156 North Mountain Avenue
Upland, California 91785-0670

Project No. 021751-001

August 2, 2006

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

August 2, 2006

Project No. 021751-001

To: Lewis Operating Corporation
1156 North Mountain Avenue
Upland, California 91785-0670

Attention: Mr. Isaac Shikuma

Subject: Preliminary Geotechnical Investigation for Due Diligence Purposes, Proposed 600-Acre Residential and Commercial Development, Rialto Airport and Adjacent Property to the North and East, East of Alder Avenue and South of the 210 Freeway, Rialto, California

In accordance with your authorization, Leighton and Associates, Inc. has conducted this due-diligence-level preliminary geotechnical investigation for the proposed 600-acre combined residential and commercial development at the Rialto Municipal Airport and adjoining private property to the northwest and east, located east of Alder Avenue and south of the 210 Freeway in Rialto, California. The purpose of this investigation was to evaluate the general geotechnical conditions at the site, to evaluate whether there are major geotechnical or geologic issues at the site that would have significant impact to site development, and to provide preliminary geotechnical recommendations for design and construction for due diligence purposes. We have used the APN maps and detailed air photos provided by you in preparation of this report.

Our original field investigation at the Rialto Airport and adjacent property was conducted in August of 2005. However, at that time approximately 60 acres of private property were not accessible to us. Recently, 50 acres of that property (the Leiske and FJA Winery Properties) became accessible for field investigation. At the time of this report, one 10-acre parcel is not yet available for access (the area shaded in green on Figure 2). Interpolation of site conditions in this non-accessible area, based on data obtained from nearby borings and test pits, has been performed for due-diligence purposes. However, to confirm that our findings are representative,

10532 Acacia Street ▪ Suite B-6 ▪ Rancho Cucamonga, CA 91730
909.484.2205 ▪ Fax 909.484.2170 ▪ www.leightongeo.com

for this 10-acre parcel, additional borings and/or test pits should be performed when site access becomes available.

Based upon our investigation, the proposed development is feasible from a geotechnical viewpoint, provided our recommendations are incorporated in the design and construction of the project. The most significant geotechnical issues at the site are related to compressible soils and strong seismic shaking. Partial removal of the upper compressible soil will be required to provide uniform support of the proposed improvements. This report presents our findings, conclusions, and preliminary geotechnical recommendations for the project. Additional geotechnical review, evaluation and/or investigation may be required based on final development plans.

We appreciate the opportunity to work with you on this project. If you have any questions, or if we can be of further service, please call us at your convenience.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

Siva K. Sivathasan, Ph. D., GE 2708
Associate Engineer

PROFESSIONAL GEOLOGIST
PHILIP A. BUCHIARELLI
No. 1715
CERTIFIED
ENGINEERING
GEOLOGIST
EXP 1-31-09
STATE OF CALIFORNIA

Philip A. Buchiarelli, CEG 1715
Principal Geologist

Reviewed by:

David C. Smith, RCE 46222
Vice President/Principal Engineer

DAG/KS/PB/DCS/anl

Distribution: (4) Addressee
(1) Madole and Associates
Attention: Mr. Tom Miketree

TABLE OF CONTENTS

Section | Page

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Site Location and Project Description

The site is comprised of the existing Rialto Municipal Airport property, largely undeveloped private property to the northwest, and an approximately 5-acre parcel to the east. The site is roughly bounded on the north by the 210 Freeway (currently under construction, formerly Highland Avenue), mostly undeveloped land to the south, Ayala Drive to the east, and Alder Avenue to the west. A few commercial buildings border the site to the south and southeast, including a large commercial storage facility east of Linden Avenue and a furniture warehouse east of Laurel lane, among others. Miro Way to the south forms part of the southern site boundary.

We understand that the Rialto Airport property as well as the subject adjacent private property will be developed for a mixed-use residential and commercial development. No development plans are available at this time, however, we anticipate that the project will include single-family and/or multi-family residential housing, commercial warehouse-type structures similar to other commercial structures recently completed in the area, and perhaps retail development.

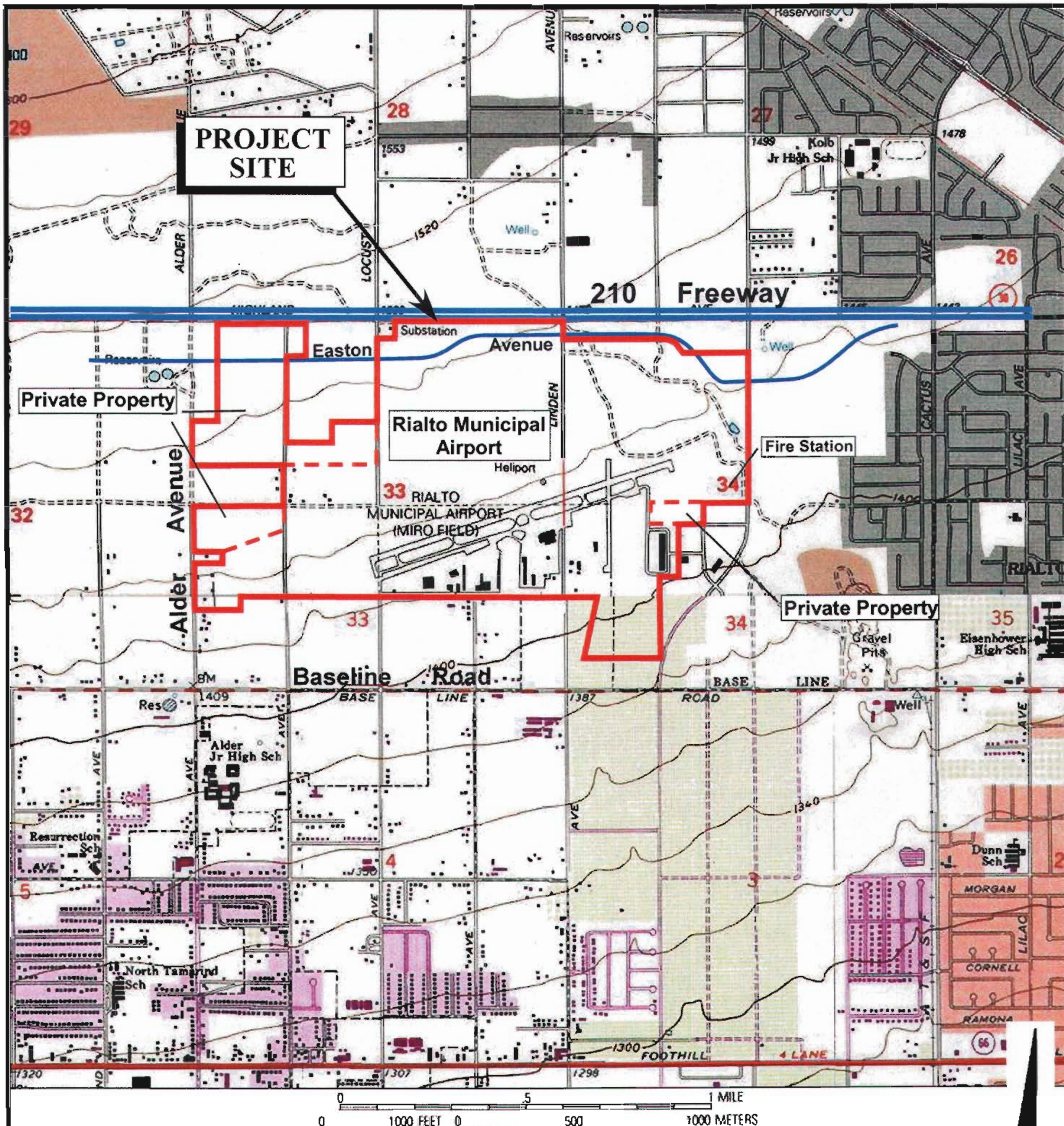
1.2 Purpose of Investigation

The purpose of this study has been to evaluate the general geotechnical conditions at the site, to identify significant geotechnical or geologic issues that would impact site development, and to provide preliminary geotechnical recommendations for design and construction.

1.3 Scope of Investigation

Approximately 60 acres of private property were not accessible to us during our initial investigation in 2005. Recently, 50 acres of that property (the Leiske and FJA Winery Properties) became accessible for field investigation (the recently accessible areas are shaded in yellow on the *Geotechnical Map*, Figure 2). At the time of this report, one 10-acre parcel is not yet available for access (the area shaded in green on Figure 2). The scope of our investigation has included the following tasks:

- Background Review - A background review of readily available, relevant, in-house geotechnical literature, and aerial photographs was performed.



Map created with TOPO!® ©2003 National Geographic (www.nationalgeographic.com/topo)

BASE MAP: USGS Devore and Fontana 7.5-Minute Quadrangle Topographic Maps

Leighton

PROPOSED 600-ACRE RESIDENTIAL AND COMMERCIAL DEVELOPMENT Southwest of the 210 Freeway and Alder Avenue, Including the Rialto Municipal Airport, Rialto, California	**SITE LOCATION MAP**	PROJECT NO. **021751-001** DATE **July 2006** Figure 1

- Pre-field Investigation Activities - We coordinated with airport officials and Underground Service Alert (USA) to have existing underground utilities located and marked prior to our subsurface investigation.

- Field Investigation - Our field investigation consisted of borings and test pit excavations. Due to restricted site access, our 2005 field investigation was limited to the airport property and approximately 23 acres of private property. In July of 2006, an additional 50 acres of private property became accessible for field work (the area shaded in yellow on Figure 2, *Geotechnical Map)*. At the time of this report, one 10-acre parcel (APN 0240-22-08) was not yet accessible (the area shaded in green on Figure 2).

  Hollow-stem Auger Borings
  A total of twenty-four hollow-stem auger borings (B-1 through B-24) were drilled, logged, and sampled at representative locations throughout the site. Eighteen of these borings (B-1 through B-18) were drilled in late 2005, and the remaining six borings (B-19 through B-24) were drilled in July 2006 after additional site access was granted. The borings were excavated to depths ranging from 3 to 21½ feet below the existing ground surface. Each boring was logged by a member of our technical staff. Relatively undisturbed soil samples were obtained at selected depth intervals within most of the borings using a Modified California Ring Sampler (obtaining relatively undisturbed ring samples was not always feasible due to the coarse, dry nature of the soil encountered). Standard Penetration Tests (SPT) were conducted at selected depths within the borings and samples were obtained. Bulk samples of representative soil types were also obtained from the borings. Logs of the geotechnical borings are provided in Appendix B. Boring locations are shown on the accompanying *Geotechnical Map*, Figure 2.

  Backhoe Test Pits
  Twenty backhoe test pits were excavated and logged at representative locations throughout the site to a maximum depth of 12 feet below the existing ground surface. Each test pit was logged by a member of our technical staff. Representative bulk samples of soil were obtained from the test pits. Approximate test pit locations are shown on the accompanying *Geotechnical Map*, Figure 2.

- Laboratory Tests - Laboratory tests were conducted on selected relatively undisturbed and bulk soil samples obtained during our field investigation. The laboratory testing program was designed to evaluate the engineering characteristics of the onsite soil.

Results of the laboratory testing are presented in Appendix C. The laboratory tests conducted during this investigation include:

- In situ moisture content and dry density
- Sieve analysis
- Consolidation
- R-value
- Maximum dry density and optimum moisture content
- Water-soluble sulfate
- Resistivity, chloride content and pH

• Engineering Analysis - The data obtained from our background review and field exploration was evaluated and analyzed in order to provide the conclusions and preliminary recommendations in the following sections.

• Report Preparation - The results of our geotechnical investigation have been summarized in this report, presenting our findings, conclusions and preliminary recommendations.

2.0 FINDINGS

2.1 Site Conditions

The roughly 509-acre Rialto Municipal Airport is currently an operational airport serving mostly small, private aircraft. The airport is largely undeveloped in the northern region (north, west, and east of the runway), with some westerly areas regularly being used for off-road racing. The runway and associated taxiways run diagonally through the lower 1/3 of the site. South of the runway are several paved areas with buildings, hangars, and warehouses. We understand that many of these southerly areas are currently leased by both private and public entities. In addition, a County Fire Station is located on airport property, west of Ayala Drive and north of Leiske Drive. The southernmost portion of the site has recently been used for agriculture.

The majority of the approximately 88 acres of private property is located to the north and west of the airport; a 5-acre private parcel is located east of the airport, north of Leiske Drive. The northeastern private properties are largely undeveloped and are currently covered with a thick cover of native grasses, brush, and mature trees, particularly heavy in the north. Illegal dumping has been rampant in northeastern areas, as attested to by the abundance of trash and debris scattered throughout the properties. Numerous dirt roads cross these private properties, which presumably function as firebreaks. These dirt roads have allowed for heavy vehicle access in areas that would have otherwise been inaccessible due to heavy concentrations of brush and trees. Compared to the northeast properties, the eastern 5-acre parcel is sparsely vegetated.

Taken as a whole, the roughly 600-acre site is relatively flat, draining gently to the south. Plant growth currently consists of an assortment of native grasses and brush, very heavy in some areas, as well as a fair number of mature trees occurring mostly in the north and west (off the airport property). Easton Avenue runs east-west through the northern quarter of the site.

2.2 Air Photo Review

We have reviewed historic aerial photographs for evidence of previous site use. In 1938, the site was essentially undeveloped and in a relatively natural state, with the exception of a few dirt roads crossing the site (including what would later become Linden Avenue). Much of the area surrounding the site appears to have been used for agriculture at that time. By 1953, a rough dirt runway appears at the southeast portion of the site. Some of the site was being used for agriculture at this time, and a few small structures were present on what are now known as Alder Avenue and Laurel Avenue. Several structures were present in the southern-most portion of the site on what would later become a vineyard. These structures are assumed to be associated with the then fledgling airport. In 1977, the runway had been moved to its present location and paved. Agriculture in the northern portion of the site had ceased. Additionally, the buildings in the southern-most area had been replaced with vineyards. Several new hangar-type buildings were present at the airport, and the areas outside of the airport had been extensively plowed. Several more structures were present near Alder Avenue and Laurel Avenue, although the area was still largely vacant. A small house was present at the northeast corner of the site, surrounded by trees. During this time, the area surrounding the site was still dominated by agriculture, although some tract housing can be seen to the east. Ayala Drive was also present at this time. In 1985, several new buildings were present on the airport property, including the Sheriff's facility, and the runway had been extended somewhat. The power station just south of Highland Avenue was also present, and additional dirt roads had been cut on the western portion of the site. In 1995, the runway had been modified to include an additional taxiway. Several new hangars had been constructed on the eastern portion of the site. The house on the northeastern portion of the site was gone, although the trees remained. The southern portion of the site continued to be used for agriculture. In 2002, the site appeared much as it does today. By this time, most of the surrounding area to the north, south, and east had been converted to tract housing. Easton Street and the 210 Freeway are not present in the air photographs until sometime after 2002.

2.3 Site Geology

The site is located in the northern Peninsular Ranges Geomorphic Province of southern California within the central portion of the San Bernardino Valley. This is a geologically complex area where the relatively northwest-moving Peninsular Range Province meets the relatively south-moving Transverse Ranges Province. The San Bernardino Valley in the site vicinity is underlain by alluvial sediments eroded from granitic rocks in the local mountains. Strike-slip faults, such as the San Jacinto Fault Zone, dominate the structure of the Peninsular Ranges. The trace of the active San Andreas Fault System, approximately 10½ kilometers to the northeast, separates the valley from the rugged San Bernardino Mountains. The active San Jacinto Fault Zone is present about 2 kilometers to the northeast, and the active Cucamonga fault is located about 6½ kilometers to the northwest. The San Andreas, San Jacinto, and Cucamonga faults have experienced significant activity in the recent geologic past.

Based on available regional geologic maps, the site and surroundings are underlain by young alluvial fan deposits of the Lytle Creek fan, consisting of unconsolidated, gray, sand and silty sand with cobbles and boulders (Morton, 2003, Morton and Matti, 2001). These deposits have been eroded from the adjacent mountains and have been transported to the site. Cretaceous-age granitic basement rock is expected to underlay the alluvial soil at depth.

2.4 Subsurface Soil Conditions

Based upon our review of pertinent geotechnical literature and our current subsurface exploration, the site is underlain by alluvial fan deposits. The soil encountered within our exploratory borings and test pits generally consisted of loose to medium dense sand with non-plastic silt and gravel, and occasional cobble- and boulder-size constituents. Rock greater than 8 inches in largest dimension comprised roughly 5 to 10 percent of the soil mass encountered across the site, and comprised as much as 15 to 20 percent locally. Rocks greater than 12 inches generally comprise less than 2 percent of the soil mass across the site. Very little soil variability was observed across the site, although the soils encountered do appear to become slightly coarser toward the north and the east. We expect the soil will increase in density with depth. Soils were generally dry to slightly moist. The near-surface soils encountered had relatively low moisture content (dry to damp) which did not increase significantly with depth. The moisture content of the upper 10 feet ranged from less than 1 percent to 4 percent, and was typically on the order of 2 percent.

Approximately 2 to 3 feet of artificial fill was identified in Test Pit TP-12 (just east of the north-south runway), but was not encountered in any of our other borings or test pits. The fill in this area is probably associated with construction of nearby flatwork (runways, tarmac, etc.). Artificial fill is likely to be present locally throughout the site, particularly near developed areas and other areas that have been subject to grading in the past. Relatively deep artificial fill will likely be associated with buried underground structures such as septic systems and underground storage tanks. In addition, we understand that a relatively deep excavation (on the order of 20 to 30 feet) was excavated as part of an environmental investigation of suspected leaking underground fuel tanks (Richard Scanlan, 2005, personal communication). This excavation resulted in the removal of the tanks. The exact depth and lateral extent of this excavation is not known, however the approximate location of the deep removals is indicated on the *Geotechnical Map,* Figure 2.

2.4.1 Compressible and Collapsible Soil

Soil compressibility refers to a soil's potential for settlement when subjected to increased loads, such as from a fill surcharge or structures. Based on our investigation, the upper 5 feet of soil is generally considered to be slightly compressible.

Collapse potential refers to the potential settlement of a soil under existing loads upon being wetted. The coarse, loose nature of the subsurface soil precluded us from obtaining a relatively undisturbed soil sample suitable for collapse testing. However, based on the type of soil encountered and our experience in the area, the potential for significant collapse is considered low.

2.4.2 Expansive Soils

Based on the type of encountered soil (sand and gravel with trace non-plastic silt) and our experience in the area, the soils exposed at pad grade are expected to exhibit a very low expansion potential.

2.4.3 Sulfate Content

Water-soluble sulfates in soil can react adversely with concrete. However, concrete in contact with soil containing sulfate concentrations of less than 0.10 percent are considered to have negligible sulfate exposure (UBC, 1997 edition, Chapter 19).

Five near-surface soil samples were tested for soluble sulfate content. The result of these tests indicated a sulfate content of 0.01 or less percent by weight, indicating negligible sulfate exposure. As such, the soils exposed at pad grade are not expected to pose a significant potential for sulfate reaction with concrete.

2.4.4 Resistivity, Chloride and pH

Soil corrosivity to ferrous metals can be estimated by the soil's pH level, electrical resistivity, and chloride content. In general, soil having a minimum resistivity less than 2,000 ohm-cm is considered corrosive. Soil with a chloride content of 500 ppm or more is considered corrosive to ferrous metals.

As a screening for potentially corrosive soil, five representative soil samples were tested for minimum resistivity, chloride content, and pH level. The tests indicated chloride contents generally on the order of 51 ppm, pH values ranging from 5.3 to 5.9, and minimum resistivities ranging from 6,200 to 35,000 ohm-cm. Based on the test results, the majority of the onsite soil is considered mildly corrosive to ferrous metals. However, laboratory test results for one sample collected from the EJA property (Boring B-20, Bag-1 at 0-5 feet) indicated a chloride content of 730 ppm, indicating that the soil tested is severely corrosive to ferrous metals.

2.5 Groundwater

Based on our review of regional groundwater data (CDWR, 2000), groundwater is expected to be on the order of 300 feet below the ground surface in the general site vicinity. USGS groundwater monitoring wells located nearby have recently recorded groundwater depths on the order of 450 feet below existing grade (Richard Scanlan, 2005, Personal Communication). As such, groundwater is not expected to be a constraint to the proposed development.

2.6 Faulting and Seismicity

The two principal seismic considerations for most sites in southern California are surface rupture along active fault traces and damage to structures due to seismically induced ground shaking. An active fault is one that has moved in the Holocene (last 11,000 years). The closest mapped potentially active fault is the San Jacinto Fault Zone, located approximately 2 kilometers northeast of the site. The San Jacinto Fault Zone is a right-lateral, strike-slip fault with an average slip rate of 12 mm pear year (±6 mm) and a maximum moment magnitude of 6.7 Mw (Cao et al, 2003). Other known regional active faults that could affect the site include the Cucamonga, San Andreas, and Cleghorn, among others. The largest and most active fault in southern California, the San Andreas Fault System, is located approximately 10½ kilometers northeast of the site.

No active or potentially active faults have been previously mapped across the project site and the site is not located within a current Alquist-Priolo Earthquake Fault Zone (CGS, 2000). The potential for fault ground rupture at the site is considered very low.

The site is likely to be subjected to strong ground shaking during the life of the project (Petersen and Wesnousky, 1994, Petersen et al., 1996). To evaluate the ground motion and a peak level of ground acceleration that the project is likely to experience, we utilized a probabilistic analysis approach. The probabilistic approach to forecasting future ground motion at the site estimates the expected peak ground acceleration level that has a 10 percent probability of exceedance over the approximate lifetime of the project (commonly assumed at 50 years). This approach takes into account the historical seismicity of the region, the nature of nearby active faults, their distance to the site, records of previous historical earthquakes, and the site-specific response characteristics (Petersen et al., 1996).

The computer program FRISKSP (Blake, 2000) was used for the analysis. Attenuation relationships used in the computer analysis were developed by Abrahamson and Silva (1997) for soil, Campbell (1997 and 2000) for alluvium, and Sadigh et al. (1997) for deep soil deposits. The analysis indicated an average value for peak horizontal ground acceleration (PHGA) with a 10 percent probability of exceedance in 50 years of 0.96g. Hazard deaggregation indicates that the predominant earthquake magnitude is approximately 6.5 (Mw) at a distance on the order of 2 kilometers.

PHGA for the site was also estimated using California Geologic Survey (CGS) Probabilistic Seismic Hazards Mapping Ground Motion data (CGS, 2003), which utilizes a probabilistic seismic hazard analysis approach based on currently available earthquake and fault information. Based on information from the CGS, the PHGA with a 10 percent probability of being exceeded in 50 years is estimated to be approximately 0.86g.

2.7 Secondary Seismic Hazards

Liquefaction Potential

Liquefaction is the loss of soil strength or stiffness due to a buildup of excess pore-water pressure during strong ground shaking. Liquefaction is associated primarily with loose (low density), granular, saturated soil. Effects of severe liquefaction can include sand boils, excessive settlement, bearing capacity failures, and lateral spreading.

Regional groundwater maps and groundwater data indicate that shallow groundwater conditions do not exist locally, nor have they existed historically. As such, the site is not considered susceptible to liquefaction.

Seismically Induced Settlement

During a strong seismic event, seismically induced settlement can occur within loose to moderately dense, dry or saturated granular soil. Settlement caused by ground shaking can be non-uniformly distributed, resulting in differential settlement.

We have evaluated the potential for seismically induced settlement using the simplified method set forth by Tokimatsu and Seed (1987). Based on this preliminary study, the potential total settlement resulting from seismic loading is estimated to be less than 1 inch. Differential settlement due to seismic loading is expected to be on the order of ½ inch over a horizontal distance of 40 feet.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon this study, we conclude that the proposed residential and commercial development is feasible from a geotechnical standpoint. No severe geologic or soil-related hazards or constraints that would preclude development of the site have been found during the course of this study. However, additional geotechnical review, evaluation and investigation may be required based on the final development plans.

3.1 General Earthwork and Grading

All grading should be performed in accordance with the General Earthwork and Grading Specifications presented in Appendix D, unless specifically revised or amended below or by future recommendations based on final development plans.

Site Preparation

Prior to construction, the site should be cleared of vegetation, trash, and debris. Trees and heavy brush should be removed and grubbed out, and the excavations should be backfilled with compacted fill. Any underground obstructions onsite should be removed. The resulting cavities should be properly backfilled and compacted. Efforts should be made to locate any existing utility lines. Those lines should be removed or rerouted if they interfere with the proposed construction, and the resulting cavities should be properly backfilled and compacted. A high-pressure jet fuel line and several water lines presently cross the site; we assume that these lines will be protected in place. In addition, any uncontrolled or undocumented artificial fill should be removed.

Overexcavation and Recompaction

To reduce the potential for adverse differential settlement of the proposed structures, the underlying subgrade soil should be prepared in such a manner that a uniform response to the applied loads is achieved. The soil within residential pads should be overexcavated and recompacted to a minimum depth of 2 feet below the bottom of footings or 3 feet below the existing grade, whichever is greater. Remedial grading in areas where commercial/retail structures are planned should be based on the size and types of structures planned. However, for initial planning purposes the soil within pads intended to support commercial/retail structures should be overexcavated and recompacted to a minimum depth of 3 feet below the bottom of footings or 4 feet below the existing grade, whichever is greater. The overexcavation and recompaction should extend a minimum lateral distance of 4 feet from the footings. Local conditions may require that deeper overexcavation be performed; such areas should be evaluated by Leighton and Associates during grading.

Areas outside the overexcavation limits of the pads planned for asphalt or concrete pavement and flatwork and areas to receive fill should be overexcavated or scarified to a minimum depth of 12 inches below the existing ground surface or 12 inches below the proposed finish grade, whichever is deeper.

After completion of the overexcavation, and prior to fill placement, the exposed surfaces should be scarified to a minimum depth of 6 inches, moisture-conditioned to or slightly above optimum moisture content, and recompacted to a minimum 90 percent relative compaction.

Fill Placement and Compaction

The onsite soil is generally suitable for use as compacted structural fill, provided it is free of debris, significant organic material, and oversized material. Any soil to be placed as fill, whether onsite or imported material, should be accepted by Leighton and Associates.

All fill soil should be placed in thin, loose lifts, moisture-conditioned, as necessary, to optimum moisture content or slightly above, and compacted to a minimum 90 percent relative compaction as determined by ASTM Test Method D1557. Aggregate base for pavement should be compacted to a minimum of 95 percent relative compaction.

Oversized Materials

It is anticipated that significant quantities of oversized material (particles greater than 12 inches) requiring special handling for disposal may be encountered locally during construction. Oversize material between 12 inches and 24 inches may be placed in areas of deep fill at depths below anticipated excavations (i.e. footings, pools, utility trenches, future developments, etc). Material greater than 24 inches should be disposed of, either as landscape material or by removal from the site. Alternatively, oversize material may be crushed and mixed with soil to be used as fill. Specific recommendations for placing oversized material should be provided during the grading and foundation plan review stage and again during grading based on field conditions.

When placing fill with significant quantities or rock, it is essential that complete flooding occurs during grading to wash finer particles of soil into the voids between the rock.

Shrinkage and Subsidence

The change in volume of excavated and recompacted soil varies according to soil type and location. This volume change is represented as a percentage increase (bulking) or decrease (shrinkage) in volume of fill after removal and recompaction. Subsidence occurs as natural ground is moisture-conditioned and densified to receive fill. Field and laboratory data used in our calculations included laboratory-measured maximum dry densities for soil types encountered at the subject site and the measured in-place densities of soils encountered. We estimate the following earth volume changes will occur during grading:

Shrinkage	Approximately 5 to 10 percent
Subsidence	Approximately 0.1 foot

The level of fill compaction, variations in the dry density of the existing soils and other factors influence the amount of volume change. Some adjustments to earthwork volume should be anticipated during grading of the site.

3.2 Foundations

Based on our preliminary investigation and our experience in the region, conventional shallow or post-tensioned slab foundations may be used to support the loads of one- to three-story, frame-type structures. Commercial/retail structures may be supported on conventional shallow spread footings. Overexcavation and recompaction of the footing subgrade soil should be performed as detailed in Section 3.1. For planning purposes, a very low soil expansion potential may be assumed. The soil Expansion Index should be evaluated near the end of grading.

Conventional Shallow Foundations

Based on our preliminary investigation, the footings for 1-story residential structures should have a minimum embedment depth of 12 inches, with a minimum width of 24 and 12 inches for isolated and continuous footings, respectively. The footings for 2- to 3-story residential structures and commercial/retail buildings should have a minimum embedment depth of 18 inches, with a minimum width of 24 and 15 inches for isolated and continuous footings, respectively.

An allowable bearing capacity of 2,500 psf may be used for preliminary design, based on the minimum embedment depth and width. The allowable bearing value may be increased by 300 psf per foot increase in depth or width to a maximum allowable bearing pressure of 4,500 psf. The allowable bearing pressure is for the total dead load and frequently applied live loads.

The soil resistance available to withstand lateral loads on a shallow foundation is a function of the frictional resistance along the base of the footing and the passive resistance that may develop as the face of the structure tends to move into the soil. The frictional resistance between the base of the foundation and the subgrade soil may be computed using a coefficient of friction of 0.35. The passive resistance may be computed using an equivalent fluid pressure of 350 pounds per cubic foot (pcf), assuming there is constant contact between the footing and undisturbed soil.

The allowable bearing pressure and coefficient of friction values may be increased by one third when considering loads of short duration, such as those imposed by wind and seismic forces.

Footing reinforcement should be designed by the structural engineer.

Post-Tensioned Slab Foundations

As an alternative to conventional spread footings, post-tension slab foundation systems can be used. Post-tension slab foundations should be designed by the project structural engineer. The following table provides post-tension slab design information for soil with a very low expansion potential.

Post-Tension Foundation Design Recommendations		
Very Low Expansion		
Edge Moisture Variation Distance, e_m	Center Lift	5.5 feet
	Edge Lift	2.5 feet
Differential Swell, Y_m	Center Lift	1.0 inch
	Edge Lift	0.4 inch
Modulus of subgrade Reaction		120 pci

Exterior footings (thickened edges) should have a minimum depth of 12 inches below the lowest adjacent soil grade and a minimum width of 12 inches. These footings may be designed for a maximum allowable bearing pressure of 2,500 pounds per square foot. The allowable bearing capacity may be increased by one-third for short-term loading.

These recommendations are based on preliminary data. Additional testing of the soil present near finish grade should be conducted near the end of grading for final foundation design information. Local agencies, the structural engineer or the Uniform Building Code may have requirements that are more stringent.

Foundation Settlement

The recommended allowable bearing capacity is generally based on a total allowable, post construction settlement of 1 inch. Differential settlement is estimated at ½ inch over a horizontal distance of 30 feet. Since settlement is a function of footing size and contact bearing pressure, differential settlement can be expected between adjacent columns or walls where a large differential loading condition exists. These settlement estimates should be reevaluated by Leighton and Associates when foundation plans for the proposed structures become available.

3.3 Slab-On-Grade

Concrete slabs subjected to special loads should be designed by the structural engineer. Where conventional light floor loading conditions exist, the following minimum recommendations, which are based on a very low soil expansion potential, should be used:

- A minimum slab thickness of 4 inches (nominal). Reinforcement steel should be designed by the structural engineer, but as a minimum should be No. 3 rebar placed at 24 inches on center for conventional slabs-on-grade. Reinforcement should be positioned within the middle third of the slab thickness.

- A moisture barrier consisting of 10-mil Visqueen (or equivalent) placed below slabs where moisture-sensitive floor coverings or equipment is planned. The moisture barrier should be covered with a minimum of 2 inches of sand.

- The subgrade soil should be moisture conditioned to at least optimum moisture content to a minimum depth of 12 inches prior to placing the moisture barrier, steel, post-tensioned cables, or concrete.

The use of reinforcement or post-tensioned cables in slabs and foundations can generally reduce the potential for concrete cracking. However, minor cracking of the concrete as it cures, due to drying and shrinkage, is normal and should be expected. Cracking is often aggravated by a high water/cement ratio, high concrete temperature at the time of placement, small nominal aggregate size, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. The use of low slump concrete can reduce the potential for shrinkage cracking.

Moisture barriers can retard, but not eliminate moisture vapor movement from the underlying soils up through the slab. Floor covering manufacturers should be consulted for specific recommendations.

3.4 Seismic Design Parameters

Seismic parameters presented in this report should be considered during project design. In order to reduce the effects of ground shaking produced by regional seismic events, seismic design should be performed in accordance with the most recent edition of the Uniform Building Code (UBC). The following data should be considered for the seismic analysis of the subject site:

Seismic Design Parameters	
Seismic Source	San Jacinto Fault
Distance	Approximately 2 km
Seismic Source Type (UBC, Table 16-U):	B
Seismic Zone Factor, Z (UBC, Table 16-I):	0.4
Soil Profile Type (UBC, 16-J):	S_D
Near-Source Factor N_a (UBC, Table 16-S):	1.3
Source Factor N_v (UBC, Table 16-T):	1.6

3.5 Retaining Walls

We recommend that retaining walls be backfilled with onsite, low expansive soil and constructed with a backdrain in accordance with the recommendations provided on Figure 3 (rear of text). Using expansive soil as retaining wall backfill will result in higher lateral earth pressures exerted on the wall. Based on these recommendations, the following parameters may be used for the design of conventional retaining walls up to 6 feet tall:

Leighton

Static Equivalent Fluid Weight (pcf)	
Conditions	Level Backfill
Active	35
At-Rest	55
Passive	350 (Maximum of 3,500 psf)

The above values do not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design.

Cantilever walls that are designed to yield at least 0.001H, where H is equal to the wall height, may be designed using the active condition. Rigid walls and walls braced at the top should be designed using the at-rest condition.

Passive pressure is used to compute soil resistance to lateral structural movement. In addition, for sliding resistance, a frictional resistance coefficient of 0.35 may be used at the concrete and soil interface. The lateral passive resistance should be taken into account only if it is ensured that the soil providing passive resistance, embedded against the foundation elements, will remain intact with time.

In addition to the above lateral forces due to retained earth, surcharge due to improvements, such as an adjacent structure or traffic loading, should be considered in the design of the retaining wall. Loads applied within a 1:1 projection from the surcharging structure on the stem of the wall should be considered in the design.

A soil unit weight of 120 pcf may be assumed for calculating the actual weight of the soil over the wall footing.

Retaining wall footings should have a minimum width of 12 inches and a minimum embedment of 12 inches below the lowest adjacent grade. An allowable bearing capacity of 2,500 psf may be used for retaining wall footing design, based on the minimum footing width and depth. This bearing value may be increased by 300 psf per foot increase in width or depth to a maximum allowable bearing pressure of 4,500 psf. Retaining walls constructed at, or near the top of slopes, or mid-slope walls should have minimum depth of embedment such that there is a minimum of 7 feet (measured horizontally) between the bottom, outside edge of the footing and the face of the descending slope.

3.6 Pavement Design

Based on the design procedures outlined in the current Caltrans Highway Design Manual, and a preliminary design R-value of 60 for the subgrade, preliminary flexible pavement section recommendations are presented in the following table for the Traffic Indices indicated. Final pavement design should be based on the Traffic Index determined by the project civil engineer and R-value testing conducted near the completion of street grading.

PAVEMENT SECTION THICKNESS		
Traffic Index	Asphaltic Concrete (AC) Thickness (feet)	Class 2 Aggregate Base (AB) Thickness (feet)
6 or less	0.25	0.35
7	0.30	0.35

If the pavement is to be constructed prior to construction of the structures, we recommend that the full depth of the pavement section be placed in order to support heavy construction traffic.

All pavement construction should be performed in accordance with the Standard Specifications for Public Works Construction. Field inspection and periodic testing, as needed during placement of the base course materials, should be undertaken to ensure that the requirements of the standard specifications are fulfilled. Prior to placement of aggregate base, the subgrade soil should be processed to a minimum depth of 6 inches, moisture-conditioned, as necessary, and recompacted to a minimum of 90 percent relative compaction. Aggregate base should be moisture conditioned, as necessary, and compacted to a minimum of 95 percent relative compaction.

3.7 Temporary Excavations

All temporary excavations, including utility trenches, retaining wall excavations, etc. should be performed in accordance with project plans, specifications and all OSHA requirements.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the slope, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing structure should be properly shored to maintain support of the structure.

Typical cantilever shoring should be designed based on the active fluid pressure presented in the retaining wall section. If excavations are braced at the top and at specific design intervals, the active pressure may then be approximated by a rectangular soil pressure distribution with the pressure per foot of width equal to 21H, where H is equal to the depth of the excavation being shored.

During construction, the soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor should be responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and the geotechnical engineer should be maintained to facilitate construction while providing safe excavations.

3.8 Trench Backfill

Utility-type trenches onsite can be backfilled with the onsite material, provided it is free of debris and oversized material. Prior to backfilling the trench, pipes should be bedded and shaded in a granular material that has a sand equivalent of 30 or greater. The sand should extend 12 inches above the top of the pipe. The bedding/shading sand should be densified in-place by jetting. The native backfill should be placed in loose layers, moisture conditioned, as necessary, and mechanically compacted using a minimum standard of 90 percent relative compaction.

3.9 Surface Drainage

Surface drainage should be designed to be directed away from foundations and toward approved drainage devices or streets. Irrigation of landscaping should be controlled to maintain, as much as possible, a consistent moisture content sufficient to provide healthy plant growth without overwatering.

3.10 Cement Type and Corrosion Protection

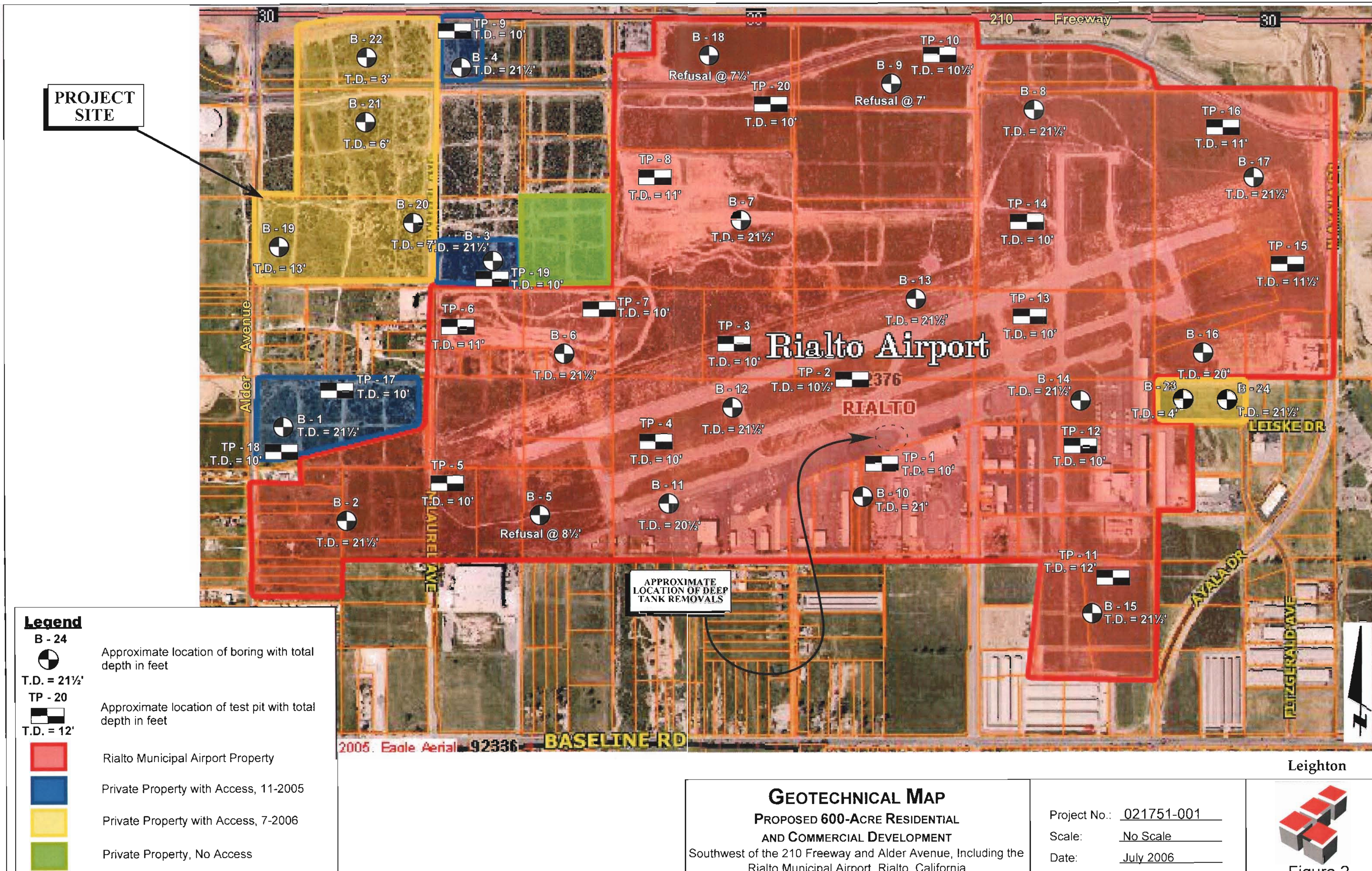
Based on the results of laboratory testing, concrete structures in contact with the onsite soil will have negligible exposure to water-soluble sulfates in the soil. Common Type II cement may be used for concrete construction onsite and the concrete should be designed in accordance with Table 19-A-4 of the Uniform Building Code.

Based on our laboratory testing, the onsite soil is considered mildly corrosive to ferrous metals. The corrosion information presented in this report should be provided to your underground utility subcontractors.

3.11 Additional Geotechnical Investigation and Services

The preliminary geotechnical recommendations presented in this report are based on subsurface conditions as interpreted from limited subsurface explorations and limited laboratory testing. The preliminary geotechnical recommendations provided in this report are based on information available at the time the report was prepared and may change as plans are developed. In addition, approximately 65 acres were not accessible to us during this investigation. As such, additional geotechnical investigation and analysis will be required based on final development plans and available site access. Leighton and Associates should review the site and grading plans when available and comment further on the geotechnical aspects of the project. Geotechnical observation and testing should be conducted during excavation and all phases of grading operations. The conclusions and preliminary recommendations presented herein should be reviewed and verified by Leighton and Associates during construction and revised accordingly if geotechnical conditions encountered vary from our preliminary findings and interpretations. Geotechnical observation and testing should be provided:

- After completion of site clearing.
- During overexcavation of compressible soil.
- During compaction of all fill materials.
- After excavation of all footings and prior to placement of concrete.
- During utility trench backfilling and compaction.
- During pavement subgrade and base preparation.
- When any unusual conditions are encountered.



Leighton

GEOTECHNICAL MAP

PROPOSED 600-ACRE RESIDENTIAL AND COMMERCIAL DEVELOPMENT

Southwest of the 210 Freeway and Alder Avenue, Including the Rialto Municipal Airport, Rialto, California

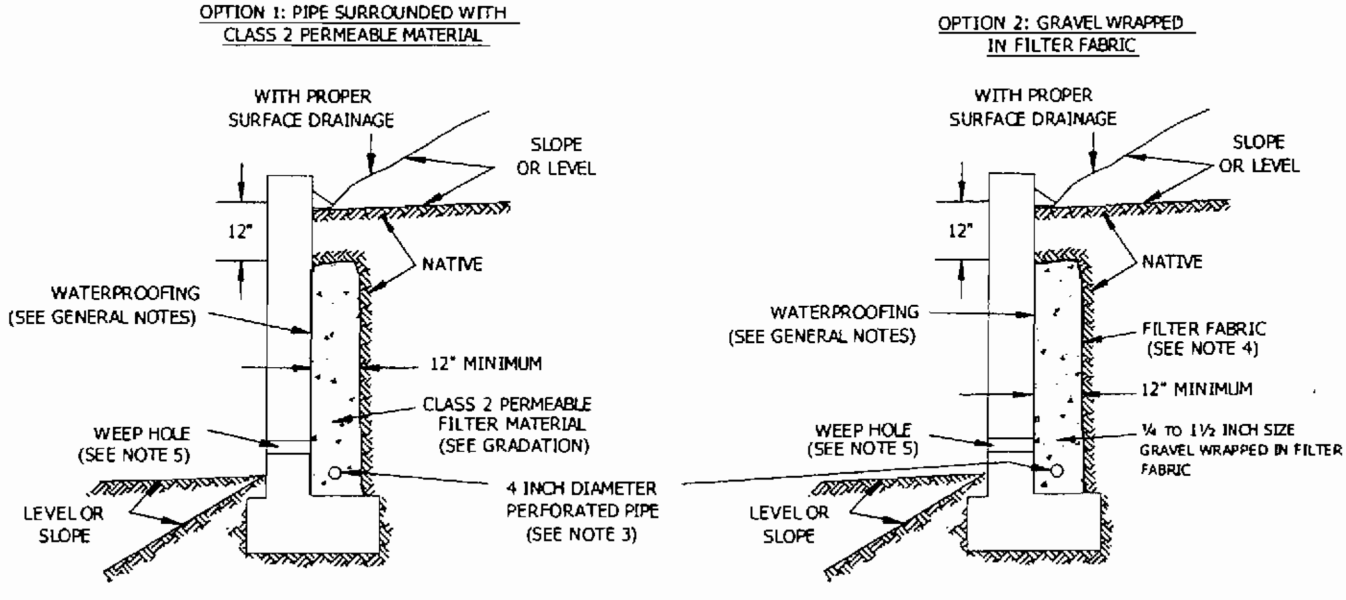
Project No.: 021751-001

Scale: No Scale

Date: July 2006

Figure 2

SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum

*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)

*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:

1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

Figure 3

APPENDIX A

APPENDIX A

References

Abrahamson, N. A. and Silva, W. J., 1997, Empirical Response Spectral Attenuation Relations for Shallow Crustal Earthquakes: Seismological Research Letters, Volume 68, No. 1, pp. 94-127.

Blake, T. F., 2000, FRISKSP, A Computer Program for the Probabilistic Estimation of Peak Acceleration and Uniform Hazard Spectra Using 3-D Faults as Earthquake Sources, Version 4.00, User's Manual.

California Division of Mines and Geology (CDMG), 1998, *Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada,* to be used with the 1997 Uniform Building Code, International Conference of Building Officials, February 1998.

________, 2000, CD-ROM containing digital images of Official Maps of Alquist-Priolo Earthquake Fault Zones that affect the Southern Region, DMG CD 2000-003 2000.

California Department of Water Resources (CDWR), 2000, Water Data Library (WDL) home page, http://well.water.ca.gov/.

Campbell, K. W., 1997, Empirical Near-Source Attenuation Relationships for Horizontal and Vertical Components of Peak Ground Acceleration, Peak Ground Velocity, and Pseudo-Absolute Acceleration Response Spectra: Seismological Research Letters, Volume 68, No. 1, pp. 154-179.

________, 2000, Erratum, Empirical Near-Source Attenuation Relationships for Horizontal and Vertical Components of Peak Ground Acceleration, Peak Ground Velocity, and Pseudo-Absolute Acceleration Response Spectra: Seismological Research Letters, Volume 71, No. 3, pp. 352-354.

________, 2003, Seismic Shaking Hazards in California, Based on the USGS/CGS Probabilistic Seismic Hazards Assessment (PSHA) Model, 2002 (revised April 2003), *CGS website*, http://www.consrv.ca.gov/cgs/rghm/pshamap/pshamain.html.

Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C.J., 2003, The Revised 2002 California Probabilistic Seismic Hazard Maps, dated June 2003, 11p. Accessible at http://www.consrv.ca.gov/cgs/rghm/psha/index.htm

International Conference of Building Officials (ICBO), 1997, Uniform Building Code, Volume II - Structural Engineering Design Provisions.

Morton, D.M., 2003, Preliminary Geologic Map of the Fontana 7.5' Quadrangle, San Bernardino County, California, U.S. Geological Survey Open-File Report 03-418, digital version 1.0.

Morton, D. M., and Matti, J. C., 2001, Geologic Map of the Devore 7.5' Quadrangle, San Bernardino County, California, USGS Open File Report 01-173, digital version 1.0.

Morton, D. M., and Miller, F. K., 2003, Preliminary digital geologic map of the San Bernardino 30' x 60' Quadrangle, Southern California, version 1.0: U.S. Geological Survey Open-File Report 03-293.

Petersen, M. D., Bryant, W. A., Cramer, C. H., Cao, T., Reichle, M. S., Frankel, A. D., Lienkaemper, J. J., McCrory, P. A., and Schwartz, D. P., 1996, Probabilistic Seismic Hazard Assessment for the State of California: California Division of Mines and Geology Open-File Report 96-08; U.S. Geological Survey Open File-Report 96-706.

Petersen, M. D. and Wesnousky, S. G., 1994, Fault Slip Rates and Earthquake Histories for Active Faults in Southern California: Seismological Society of America Bulletin, Volume 84, No. 5, pp. 1608-1649.

Public Works Standard, Inc., 2002, Greenbook, Standard Specifications for Public Works Construction: BNI Building News, Anaheim, California, 471 p.

Sadigh, K., Chang, C. Y., Egan, J. A., Makdisi, F., and Young R. R., 1997, "Attenuation Relations for Shallow Crustal Earthquakes Based on California Strong Motion Data" *Seismological Research Letters*, Vol 68, No. 1, January/February, pp. 180-189.

Tokimatsu, K., Seed, H. B., 1987, "Evaluation of Settlements in Sands Due to Earthquake Shaking," *Journal of the Geotechnical Engineering*, American Society of Civil Engineers, Vol. 113, No. 8, pp. 861-878.

Uniform Building Code (UBC), 1997 Edition.

United States Geologic Survey (USGS), 1980, Topographic Map of the Fontana 7.5-Minute Quadrangle, San Bernardino County, California, released 1967, photo-revised 1980.

United States Geologic Survey (USGS), 1988, Topographic Map of the Devore 7.5-Minute Quadrangle, San Bernardino County, California, released 1966, photo-revised 1988.

Aerial Photographs Reviewed

Date	Flight	Frame	Scale	Agency
06/03/1938	AXL-42	N/A	N/A	USDA
01/31/1953	N/A	N/A	N/A	USDA
09/19/1977	N/A	N/A	N/A	Teledyne
01/18/1985	N/A	N/A	N/A	Aerial Map Industries
02/25/1986	C-450	151	1:24,000	SBCFC
10/07/1995	N/A	N/A	N/A	USGS
06/06/2002	N/A	N/A	N/A	USGS

APPENDIX B

GEOTECHNICAL BORING LOG B-1

Date 8-26-05 **Sheet** 1 **of** 1

Project Lewis / Rialto **Project No.** 021751-001

Drilling Co. 2R Drilling **Type of Rig** CME 75

Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"

Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By DAG

Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			B-1					@ 0' Silty SAND, light brown, dry, fine grained, non-plastic, scattered rounded gravel to 3 inches, trace cobble to 10 inches	SA 44:44:12 MD CR
				R-1	20 30 33		1.1	SW-SM	@ 2½' SAND with silt and gravel, light brown, dry, fine to coarse grained, dense, subangular gravel to 2 inches, rock fragments, non-plastic silt	
	5			R-2	14 32 50/6"		1.1	SW-SM	@ 5' SAND with silt and gravel, light brown, slightly moist, fine to coarse grained, very dense	
	10			R-3	25 13 50/4½"	118.9	2.3	SW-SM	@ 10' SAND with silt and gravel, moderate brown, moist, fine to coarse grained, very dense, gravel to 3 inches, cobble fragments, non-plastic silt	
	15			S-1	15 33 40			SW	@ 15' SAND with gravel, moderate yellowish brown, moist, fine to coarse grained, very dense, rounded gravel to 1 inch, some non-plastic silt	
	20			S-2	10 12 14			SW-SM	@ 20' SAND with silt and gravel, moderate yellowish brown, moist, fine to coarse grained, dense, gravel to 1 inch, non-plastic silt	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-2

Date 8-26-05 | **Sheet** 1 **of** 1
Project Lewis / Rialto | **Project No.** 021751-001
Drilling Co. 2R Drilling | **Type of Rig** CME 75
Hole Diameter 8" | **Drive Weight** 140 lb Automatic Hammer | **Drop** 30"
Elevation Top of Hole ' | **Location** See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' Silty SAND, light brown, dry, fine grained, non-plastic silt, scattered gravel on surface	
				R-1	10 14 16	117.9	1.9	SW	@ 2½' SAND with gravel, light brown, slightly moist, fine to coarse grained, medium dense, rounded gravel to 1 inch, trace non-plastic silt	
	5			R-2	25 45 50/5½"	135.6	3.2	SW	@ 5' SAND with gravel, light brown, slightly moist, fine to coarse grained, very dense, rounded gravel to 3 inches, trace clay	
	10			R-3	20 43 50/4"		2.5	SW-SM	@ 10' SAND with silt and gravel, moderate yellowish brown, moist, fine to coarse grained very dense, subrounded gravel to ½ inch, non-plastic silt	
	15			S-1	9 24 45			SW-SM	@ 15' SAND with silt and gravel, moderate yellowish brown, moist, fine to coarse grained, very dense, rounded gravel to 1 inch, non-plastic silt, some fractured gravel	
	20			S-2	15 18 26			SW-SM	@ 20' SAND with silt and gravel, moderate yellowish brown, moist, fine to coarse grained, very dense, rounded gravel to 1 inch, non-plastic silt	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-3

Date 8-26-05 | Sheet 1 of 1
Project Lewis / Rialto | Project No. 021751-001
Drilling Co. 2R Drilling | Type of Rig CME 75
Hole Diameter 8" | Drive Weight 140 lb Automatic Hammer | Drop 30"
Elevation Top of Hole ' | Location See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' Silty SAND, light brown, dry, fine grained, non-plastic silt, trace gravel to 1 inch	
				R-1	8 12 19				@ 2½' No recovery	
	5			R-2	16 43 50/6"				@ 5' No recovery	
	10			R-3	50/5"				@ 10' No recovery	
	15			S-1	5 5 3			SM	@ 15' Silty SAND, moderate brown, moist, fine grained, medium dense, low to non-plastic silt, some medium and coarse sand, trace fine gravel	
	20			S-2	10 33 41			SP-SM	@ 20' SAND with silt and gravel, moderate brown, moist, fine to medium grained, very dense, gravel to 1 inch, some coarse sand, fractured rock, non-plastie silt	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-4

Date 8-26-05 | Sheet 1 of 1
Project Lewis / Rialto | Project No. 021751-001
Drilling Co. 2R Drilling | Type of Rig CME 75
Hole Diameter 8" | Drive Weight 140 lb Automatic Hammer | Drop 30"
Elevation Top of Hole ' | Location See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			B-1				SM	@ 0' Silty SAND, light brown, slightly moist, fine grained, non-plastic, some medium sand, scattered gravel on surface	RV
				R-1	17 19 46		2.1	SW-SM	@ 2½' SAND with silt and gravel, light brown, moist, fine to coarse grained, dense, gravel to 3 inches, non-plastic silt	
	5			R-2	36 50/5"		1.7	SW-SM	@ 5' SAND with silt and gravel, light brown, moist, fine to coarse grained, very dense, gravel to 3 inches, non-plastic silt	
	10			R-3	23 50/6"	126.8	1.9	SW-SM	@ 10' SAND with silt and gravel, light brown, moist, fine to coarse grained, very dense, angular gravel to 3 inches, non-plastic silt	
	15			S-1	5 13 7			SW-SM	@ 15' SAND with silt and gravel, light brown, moist, fine to coarse grained, dense, angular gravel to 3 inches, non-plastic silt	
								ML	@ 16½' Sandy SILT, moderate brown, moist, low to non-plastic, stiff, fine sand, micaceous	
	20			S-2	17 24 50/6"			SW-SM	@ 20' SAND with silt and gravel, moderate brown, moist, fine to coarse grained, very dense, subrounded to subangular gravel to 1 inch, non-plastic silt	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-5

Date 8-26-05 **Sheet** 1 **of** 1
Project Lewis / Rialto **Project No.** 021751-001
Drilling Co. 2R Drilling **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By TDL
Sampled By TDL

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			B-1					@ 0' Silty SAND, light brown, slightly moist, fine grained, non-plastic silt	
				R-1	7 20 24		1.8	SM	@ 2½' Silty SAND, light brown, slightly moist, fine grained, dense, non-plastic silt	
	5			R-2	32 26 31		0.8	SW	@ 5' SAND with gravel, pale brown, dry, fine to coarse grained, gravel to 2 inches, dense, cobble fragments	
	10								Refusal at 8½ feet No groundwater Boring backfilled with soil cuttings	
	15									
	20									
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-6

Date 8-26-05 | Sheet 1 of 1
Project Lewis / Rialto | Project No. 021751-001
Drilling Co. 2R Drilling | Type of Rig CME 75
Hole Diameter 8" | Drive Weight 140 lb Automatic Hammer | Drop 30"
Elevation Top of Hole ' | Location See Geotechnical Map

Logged By TDL
Sampled By TDL

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' Silty SAND, light brown, moist, fine grained, non-plastic silt	
				R-1	27 22 39		2.2	SW-SM	@ 2½' SAND with silt and gravel, moderate yellowish brown, moist, fine to coarse grained, dense, gravel to 3 inches, non-plastic silt	
	5			R-2	14 20 16		1.9	SW-SM	@ 5' SAND with silt and gravel, moderate yellowish brown, moist, fine to coarse grained, dense, gravel to 3 inches, some cobble to 4 inches, non-plastic silt	
	10			R-3	48 36 50/6"	124.3	1.8	SW	@ 10' SAND with gravel, brown, moist, fine to coarse grained, very dense, gravel to 3 inches	
	15			S-1	6 14 15		2.7	SW	@ 15' SAND with gravel, brown, moist, fine to coarse grained, dense, angular gravel to 1 inch	
	20			S-2	12 21 50/5½"		3.8	SW	@ 20' SAND with gravel, brown, moist, fine to coarse grained, very dense, gravel up to 2 inches	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-7

Date 8-26-05 **Sheet** 1 **of** 1
Project Lewis / Rialto **Project No.** 021751-001
Drilling Co. 2R Drilling **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By TDL
Sampled By TDL

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' Silty SAND, yellowish brown, slightly moist, fine grained, non-plastic silt	
				R-1	10 13 16				@ 2½' No recovery	
	5			R-2	19 25 30		1.5	SW	@ 5' SAND with gravel, dark yellowish brown, slightly moist, fine to coarse grained, dense, gravel to 3 inches, cobble fragments	
	10			R-3	11 50/5½"		0.7	SW	@ 10' SAND with gravel, dark brown, slight moist, fine to coarse grained, very dense, gravel to 3 inches	
	15			S-1	18 32 20			SW	@ 15' SAND with gravel, dark brown, moist, fine to coarse grained, dense, angular gravel to 1 inch	
	20			S-2	13 23 50/5"			SW-SM	@ 20' SAND with silt and gravel, moderate brown, moist, fine to coarse grained, very dense, gravel to 1 inch	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-8

Date 8-26-05 | Sheet 1 of 1

Project Lewis / Rialto | Project No. 021751-001

Drilling Co. 2R Drilling | Type of Rig CME 75

Hole Diameter 8" | Drive Weight 140 lb Automatic Hammer | Drop 30"

Elevation Top of Hole ' | Location See Geotechnical Map

Logged By TDL

Sampled By TDL

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' Silty SAND, light brown, dry, fine grained, some gravel, non-plastic silt	
				R-1	16 27 27			SW-SM	@ 2½' SAND with silt and gravel, pale brown, dry to slightly moist, fine to coarse grained, dense, gravel to 3 inches	
	5			R-2	9 25 25		1.7	SW-SM	@ 5' SAND with silt and gravel, moderate yellowish brown, dry to slightly moist, fine to coarse grained, dense, gravel to 3 inches	
	10			R-3	4 6 12		4.0	SW-SM	@ 10' SAND with silt and gravel, moderate yellowish brown, moist, fine to coarse grained, dense, gravel to 2 inches	
	15			S-1	8 10 19		4.6	SW-SM	@ 15' SAND with silt and gravel, moderate yellowish brown, moist, fine to coarse grained, dense, fine gravel	
	20			S-2	15 20 24			SM	@ 20' Silty SAND, moderate brown, moist, fine to coarse grained, very dense, some gravel, non-plastic silt	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-9

Date 8-26-05 **Sheet** 1 **of** 1

Project Lewis / Rialto **Project No.** 021751-001

Drilling Co. 2R Drilling **Type of Rig** CME 75

Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"

Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By TDL

Sampled By TDL

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			B-1					@ 0' Silty SAND, dark brown, dry to slightly moist, fine grained, non-plastic silt	SA 7:64:29 RV CR
				R-1	14 20 37		1.4	SM	@ 2½' Silty SAND with gravel, brown, slightly moist, fine to coarse grained, dense, gravel to 1 inch	
	5			R-2	22 34 42		1.5	SM	@ 5' Silty SAND with gravel, moderate brown, moist, fine to coarse grained, very dense, gravel to 2 inches	
									Refusal at 7 feet No groundwater Boring backfilled with soil cuttings	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-10

Date 8-29-05 **Sheet** 1 **of** 1
Project Lewis / Rialto **Project No.** 021751-001
Drilling Co. Martin Drilling Corporation **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' Silty SAND, moderate yellowish brown, slightly moist, fine grained, non-plastic silt, scattered gravel to 2 inches on surface	
				R-1	4 18 25	115.3	2.2	SW-SM	@ 2½' SAND with silt and gravel, moderate yellowish brown, moist, fine to medium grained, dense, rounded gravel to 3 inches, non-plastic silt	
	5			R-2	13 20 35		2.3	SW	@ 5' SAND with gravel, moderate yellowish brown, moist, fine to coarse grained, dense, rounded gravel to 3 inches	
	10			R-3	21 34 40	128.5	2.2	SW	@ 10' SAND with gravel, moderate brown, moist, fine to coarse grained, rounded gravel to 2 inches, very dense, trace non-plastic silt	
	15			S-1	2 5 6			SM	@ 15' Silty SAND, moderate brown, moist, fine grained, trace rounded gravel to ½ inch, medium dense, non-plastic silt	
	20			S-2	8 50/6"			SW-SM	@ 20' SAND with silt and gravel, moderate yellowish brown, moist, fine to medium grained, very dense, subangular gravel to 2 inches, non-plastic silt	
									Total depth 21 feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-11

Date 8-29-05 **Sheet** 1 **of** 1
Project Lewis / Rialto **Project No.** 021751-001
Drilling Co. Martin Drilling Corporation **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole ' **Location** See Geotechnical Map

DESCRIPTION
Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Description	Type of Tests
	0								@0' ASPHALT, 1½ inches asphalt (poor condition), no base @ 1½" Silty SAND, dark yellowish brown, moist, fine grained, non-plastic silt, tracc gravel to 1 inch	
				R-1	12 17 18		2.2	SW-SM	@ 2½' SAND with silt and gravel, moderate yellowish brown, moist, fine to coarse grained, medium dense, subangular gravel to 3 inches, cobble fragments, non-plastic silt	
	5			R-2	9 17 29		1.3	SW	@ 5' SAND with gravel, moderate yellowish brown, moist, medium to coarse grained, dense, rounded granitic gravel to 2 inehes	
	10			R-3	50/3"				@ 10' No recovery	
	15			S-1	29 50/5½"		3.1	SW	@ 15' SAND with gravel, abundant fractured gravel and cobble	
	20			S-2	50/6"			SW	@ 20' SAND with gravel, light brown, moist, abundant gravel	
									Total depth 20½ feet No groundwater Boring backfilled with soil cuttings and patched with cold asphalt	
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-12

Date 8-29-05 **Sheet** 1 **of** 1

Project Lewis / Rialto **Project No.** 021751-001

Drilling Co. Martin Drilling Corporation **Type of Rig** CME 75

Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"

Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By DAG

Sampled By DAG

Graphic Log: N S

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0		B-1				SM	@ 0' Silty SAND, moderate yellowish brown, moist, fine grained, non-plastic silt	MD
			R-1	11 29 50/6"			SM	@ 2½' Silty SAND, moderate yellowish brown, moist, fine grained, very dense, non-plastic silt	
							SW	@ 3½' SAND with gravel, light brown, moist, fine to coarse grained, gravel to 3 inches	
	5		R-2	23 29 27	122.4	1.7	SW	@ 5' SAND with gravel, light brown, moist, fine to coarse grained, dense, grades to gravel	
	10		R-3	16 50/6"		1.9	SW-SM	@ 10' SAND with silt and gravel, light brown, moist, fine to coarse grained, very dense, subrounded gravel to 4 inches, non-plastic silt	
	15		S-1	50/5½"		1.1	SW	@ 15' SAND with gravel, light brown, fine grained, very dense, rock fragments	
	20		S-2	22 25 29			SW-SM	@ 20' SAND with silt and gravel, light brown, moist, fine to coarse grained, very dense, gravel to ½ inches, trace cobble fragments, non-plastic silt	
								Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25								
	30								

SAMPLE TYPES:

S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:

DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-13

Date 8-29-05 **Sheet** 1 **of** 1
Project Lewis / Rialto **Project No.** 021751-001
Drilling Co. Martin Drilling Corporation **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By: DAG
Sampled By: DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' Silty SAND, moderate orange brown, slightly moist, fine grained, non-plastic silt, scattered gravel to 4 inches on surface	
				R-1	23 50/5½"		1.1	SW-SM	@ 2½' SAND with silt and gravel, light brown, slightly moist, fine to coarse grained, very dense, angular gravel to 3 inches, non-plastic silt	
	5			R-2	11 26 43		1.2	SW-SM	@ 5' SAND with silt and gravel, light brown, moist, fine to medium grained, some coarse sand, very dense, abundant rounded gravel to 2 inches, non-plastie silt	
	10			R-3	6 14 17	126.6	3.4	SW	@ 10' SAND with gravel, moderate brown, moist, fine to medium grained, some coarse sand, medium dense, gravel to 2 inches	
	15			S-1	12 14 19			SW	@ 15' SAND with gravel, moderate yellowish brown, moist, fine to medium grained, some coarse sand, very dense, rounded gravel to 1 inch, trace non-plastie silt	
	20			S-2	18 20 26			SW	@ 20' SAND with gravel, moderate yellowish brown, moist, fine to medium grained, some coarse sand, very dense, rounded gravel to 1 inch, trace non-plastic silt	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-14

Date 8-29-05 | Sheet 1 of 1
Project Lewis / Rialto | Project No. 021751-001
Drilling Co. Martin Drilling Corporation | Type of Rig CME 75
Hole Diameter 8" | Drive Weight 140 lb Automatic Hammer | Drop 30"
Elevation Top of Hole ' | Location See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' SAND with silt and gravel, light brown, dry, fine grained, gravel to 2 inches, non-plastic silt, scattered gravel and cobble to 6 inches	
				R-1	7 18/6"				@ 2½' No recovery	
	5			R-2	23 32 49		0.7	SW-SM	@ 5' SAND with silt and gravel, light brown, moist, fine to medium grained, some coarse sand, very dense, non-plastic silt, rounded gravel and fractured rock to 3 inches	
	10			R-3	40 50/6"				@ 10' No recovery	
	15			S-1	33 50/6"			SW-SM	@ 15' SAND with silt and gravel, light brown, moist, fine to medium grained, very dense, gravel to 1 inch, sample not collected	
	20			S-2	17 33 35			SP-SM	@ 20' SAND with silt and gravel, light brown, moist, fine to coarse grained, very dense, gravel and fractured rock to 2 inches, non-plastic silt	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-15

Date 8-29-05 **Sheet** 1 **of** 1
Project Lewis / Rialto **Project No.** 021751-001
Drilling Co. Martin Drilling Corporation **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			B-1					@ 0' Silty SAND, light brown, dry, fine grained, non-plasticity silt, some fine gravel	SA 30:56:14 CR
				R-1	8 20 32		1.1	SM	@ 2½' Silty SAND with gravel, moderate yellowish brown, slightly moist, fine to medium grained, some coarse sand, dense, gravel up to 1½ inch, non-plastic silt	
	5			R-2	19 26 27		1.2	SW-SM	@ 5' SAND with silt and gravel, moderate yellowish brown, slightly moist, fine to medium grained, some coarse sand, dense, gravel to 3 inches, non-plastic silt	
	10			R-3	11 25 37	131.3	1.8	SW	@ 10' SAND with gravel, moderate yellowish brown, moist, fine to coarse grained, dense, rounded gravel to 2 inches, trace non-plastic silt	
	15			S-1	14 17 30			SW-SM	@ 15' SAND with silt and gravel, light brown, moist, fine to coarse grained, very dense, gravel to 1 inch, fractured rock	
	20			S-2	15 27 28			SW	@ 20' SAND with gravel, moderate yellowish brown, moist, fine to medium grained, some coarse sand, very dense, gravel to ½ inch, trace non-plastic silt	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-16

Date	8-29-05	**Sheet**	1 **of** 1
Project	Lewis / Rialto	**Project No.**	021751-001
Drilling Co.	Martin Drilling Corporation	**Type of Rig**	CME 75
Hole Diameter	8"	**Drive Weight**	140 lb Automatic Hammer
Drop	30"		
Elevation Top of Hole	'	**Location**	See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' SAND with silt and gravel, moderate yellowish brown, slightly moist, fine to medium grained, gravel to 2 inches, scattered cobble and boulder to 2 feet dia. on surface	
				R-1	9 14 19		1.6	SW-SM	@ 2½' SAND with silt and gravel, moderate yellowish brown, moist, fine to coarse grained, medium dense, rounded gravel to 2 inches, non-plastic silt	
	5			R-2	17 23 26	125.5	1.6	SW	@ 5' SAND with gravel, moderate yellowish brown, moist, fine to coarse grained, dense, subrounded gravel to 3 inches	
	10			R-3	50/4"				@ 10' No recovery	
	15			S-1	50/5½"				@ 15' No recovery	
	20			S-2	25/2"				@ 20' No recovery	
									Total depth 20 feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-17

Date 8-29-05 **Sheet** 1 **of** 1
Project Lewis / Rialto **Project No.** 021751-001
Drilling Co. Martin Drilling Corporation **Type of Rig** CME 75
Hole Diameter 8" **Drive Weight** 140 lb Automatic Hammer **Drop** 30"
Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' SAND with gravel, abundant subrounded gravel and cobble on surface to 8 inches	
				R-1	25 50/4½"		1.0	GW	@ 2½' Sandy GRAVEL, subrounded to subangular gravel to 3 inches, fine to medium grained sandy matrix, decomposed granitic clast, fractured rock, very dense	
	5			R-2	18 28 36		2.2	SW	@ 5' SAND with gravel, moderate yellowish brown, moist, fine to coarse grained, dense, gravel to 1½ inches	
	10			R-3	16 50/6"	121.3	2.8	SW	@ 10' SAND with gravel, moderate yellowish brown, moist, fine to coarse grained, very dense, rounded gravel to 2 inches	
	15			S-1	10 17 24			SW-SM	@ 15' SAND with silt and gravel, moderate yellowish brown, moist, fine to medium grained, some coarse sand, very dense, gravel to 1 inch, fractured rocks, non-plastic silt	
	20			S-2	18 34 32			SW-SM	@ 20' SAND with silt and gravel, moderate yellowish brown, moist, fine to medium grained, some coarse sand, very dense, gravel to ½ inch, fractured rocks, non-plastic silt	
									Total depth 21½ feet No groundwater Boring backfilled with soil cuttings	
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-18

Date 8-29-05 | Sheet 1 of 1
Project Lewis / Rialto | Project No. 021751-001
Drilling Co. Martin Drilling Corporation | Type of Rig CME 75
Hole Diameter 8" | Drive Weight 140 lb Automatic Hammer | Drop 30"
Elevation Top of Hole ' | Location See Geotechnical Map

Logged By DAG
Sampled By DAG

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' SAND with gravel, light brown, dry, scattered rounded gravel and cobble to 12 inches, most < 8 inches	
				R-1	9 17 24			SW	@ 2½' SAND with gravel, light brown, slightly moist, fine to coarse grained, dense, rounded gravel to 2 inches	
	5			R-2	50/6"					
									@ 5½' Refusal (move hole 3 feet over) @ 7' Refusal	
									Refusal at 5½ feet, move hole over 3 feet Refusal at 7 feet No groundwater Boring backfilled with soil cuttings	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG B-19

Date 7-12-06 **Sheet** 1 **of** 1

Project Lewis FJA Rialto **Project No.** 021751-002

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" **Drive Weight** 140 lbs. Automatic Hammer **Drop** 30"

Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By Kaustav Bose

Sampled By Kaustav Bose

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								@ 0' **Alluvium (Qal):** Silty SAND, fine to coarse sand, trace sub-rounded gravel to 1½ inch, non-plastic fines, loose, dry, very pale orange	
				R-1	19 32 50/1"		0.7	SM	@ 2½' SAND with silt and gravel, fine to medium grained, some coarse sand, 10 percent non-plastic silt, 26 percent sub-rounded gravel to 2 inches, very dense, dry, very pale orange	SA
	5			R-2	15 17 24		1.8	SM	@ 5' Silty SAND with gravel, fine to medium grained, some coarse sand, non-plastic fines, some fine to medium angular gravel to 2½ inches, dense, grayish yellow green, dry	
	10			R-3	16 34 50/2"	131.0	3.1	SP	@ 10' Gravelly SAND, trace non-plastic fines, fine to coarse grained, fine to medium angular gravel, very dense, slightly moist, grayish yellow green	
									@ 13' Rounded gravel to 3 inches in soil cuttings, difficult drilling, refusal at 13 feet	
									Refusal at 13 Feet **No Groundwater Encountered** **Boring Backfilled With Soil Cuttings**	
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

GEOTECHNICAL BORING LOG B-20

Date 7-12-06 | Sheet 1 of 1
Project Lewis FJA Rialto | Project No. 021751-002
Drilling Co. Redman Drilling | Type of Rig CME-75
Hole Diameter 8" | Drive Weight 140 lbs. Automatic Hammer | Drop 30"
Elevation Top of Hole ' | Location See Geotechnical Map

Logged By Kaustav Bose
Sampled By Kaustav Bose

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			Bag-1					@ 0' **Alluvium (Qal):** Silty SAND, fine to coarse sand, trace sub-rounded gravel to 1½ inch, non-plastic fines, loose, dry, very pale orange	MD CR
				R-1	13 10 10		0.6	SM	@ 2½' Silty SAND with gravel, trace non-plastic fines, fine to coarse grained, fine to medium sub-rounded gravel to 1½ inches, medium dense, dry, yellowish gray	
	5			R-2	32 50/2"				@ 5' No Recovery, coarse angular gravel greater than 3 inches blocked sampler at the tip	
									@ 7' Gravel to 2 inches in cuttings, difficult drilling, refusal at 7 feet	
									Refusal at 7 Feet **No Groundwater Encountered** **Boring Backfilled With Soil Cuttings**	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

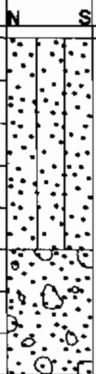
TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON

GEOTECHNICAL BORING LOG B-21

Date	7-12-06	**Sheet**	1 **of** 1
Project	Lewis FJA Rialto	**Project No.**	021751-002
Drilling Co.	Redman Drilling	**Type of Rig**	CME-75
Hole Diameter	8"	**Drive Weight**	140 lbs. Automatic Hammer — **Drop** 30"
Elevation Top of Hole	'	**Location**	See Geotechnical Map

Logged By Kaustav Bose
Sampled By Kaustav Bose



Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			B-1					@ 0' **Alluvium (Qal):** Silty SAND, fine to coarse sand, trace sub-rounded gravel to 1½ inch, non-plastic fines, loose, dry, very pale orange	
				R-1	13 10 10		1.3	SM	@ 2½' Silty SAND with gravel, non-plastic fines, fine to medium grained, trace coarse sand, fine to medium rounded gravel to 1½ inches, medium dense, dry, greenish gray	
									@ 3' to 4' Fine to medium rounded gravel to 2½ inches, drilling get tougher	
	5			R-2	32 50/2"		1.9	SM	@ 5' Silty SAND with gravel, non-plastic fines, fine to coarse grained, fine to medium rounded gravel to 1 inch, medium dense, dry, greenish gray	
									@ 7' Fine to medium angular gravel to 2 inches in cuttings, difficult drilling, refusal at 8 feet	
									Refusal at 8 Feet **No Groundwater Encountered** **Boring Backfilled With Soil Cuttings**	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON

GEOTECHNICAL BORING LOG B-22

Date 7-12-06 **Sheet** 1 **of** 1
Project Lewis FJA Rialto **Project No.** 021751-002
Drilling Co. Redman Drilling **Type of Rig** CME-75
Hole Diameter 8" **Drive Weight** 140 lbs. Automatic Hammer **Drop** 30"
Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By Kaustav Bose
Sampled By Kaustav Bose

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			B-1					@ 0' **Alluvium (Qal):** Silty SAND, fine to coarse sand, trace sub-rounded gravel to 1½ inch, non-plastic fines, loose, dry, very pale orange	
				R-1	17 34 29		1.4	SM	@ 2½' Silty SAND with gravel, trace non-plastic fines, fine to medium grained, some coarse sand, fine to medium sub-angular gravel to 1¼ inches, dense, dry, greenish yellowish gray	
	5			R-2	15 50/2"				@ 5' No Recovery, soil too gravelly to be retained in sampler	
									@ 7' Angular chips of basaltic rock in cutting to 3 inches, difficult drilling, refusal at 6 feet	
									Refusal at 7 Feet **No Groundwater Encountered** **Boring Backfilled With Soil Cuttings**	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON

GEOTECHNICAL BORING LOG B-23

Date 7-12-06 **Sheet** 1 **of** 1
Project Lewis Leiske Rialto **Project No.** 021751-003
Drilling Co. Redman Drilling **Type of Rig** CME-75
Hole Diameter 8" **Drive Weight** 140 lbs. Automatic Hammer **Drop** 30"
Elevation Top of Hole ' **Location** See Geotechnical Map

Logged By Kaustav Bose
Sampled By Kaustav Bose

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			Bag-1 R-1	7 21 25		1.1	SM	@ 0' **Alluvium (Qal):** Silty SAND, fine to coarse sand, trace rounded gravel to 4 inches, non-plastic fines, loose, dry, pale grayish brown @ 2' Silty SAND with gravel, non-plastic fines, fine to medium grained, fine to medium angular gravel to 2 inches, medium dense, dry, yellowish gray @ 3' Fine to medium angular gravel to 2 inches in cuttings, broken pieces of basaltic rock to 6 inches, difficult drilling, refusal at 3 feet	MD
	5								**Total Depth = 4 feet** **No Groundwater Encountered** **Boring Backfilled With Soil Cuttings**	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
Col COLLAPSE
CR CORROSION
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE

LEIGHTON

GEOTECHNICAL BORING LOG B-24

Date 7-12-06 | Sheet 1 of 1
Project Lewis Leiske Rialto | Project No. 021751-003
Drilling Co. Redman Drilling | Type of Rig CME-75
Hole Diameter 8" | Drive Weight 140 lbs. Automatic Hammer | Drop 30"
Elevation Top of Hole ' | Location See Geotechnical Map

Logged By Kaustav Bose
Sampled By Kaustav Bose

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per Six Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0			Bag-1					@ 0' **Alluvium (Qal):** Silty SAND, fine to coarse sand, trace rounded gravel to 4 inches, non-plastic fines, loose, dry, pale grayish brown	CR
				R-1	18 26 35	112.2	2.0	SM	@ 2' Silty SAND with gravel, fine to medium sand, trace coarse sand, non-plastic, fine to medium rounded gravel less than 1½ inch, medium dense, light yellowish brown, gray	DS
	5			R-2	20 30 37			SM	@ 5' Silty SAND with gravel, fine to medium sand, trace coarse sand, non-plastic, fine to medium rounded gravel less than 1½ inch, medium dense, light yellowish brown, gray	
	10			R-3	24 36 41	116.9	3.9	SM	@ 10' Silty SAND with gravel, fine to medium grained, trace coarse sand, non-plastic fines, rounded gravel to 1 inch, dense, tan, dry	
	15			R-4	23 50/4"	122.5	4.1	SM	@ 15' Silty SAND with gravel, fine to coarse sand, traces of broken pieces of gravel, fragmented granite, fine to medium rounded gravel to 1½ inches, very dense, yellow grayish brown, dry	
	20			R-5	13 50/5"	126.8	3.5	ML	@20' Sandy SILT, fine to medium sand, trace coarse sand, non-plastic fines, trace fine to medium sub-rounded gravel to 1 inch, very dense, light greenish brown, dry to slightly moist	
									Total Depth = 21½ feet **No Groundwater Encountered** **Boring Backfilled With Soil Cuttings**	
	25									
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- Col COLLAPSE
- CR CORROSION
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE

LEIGHTON

Test Pit TP-1

Date Excavated: September 1, 2005 | Logged By: TDL

Location: Lewis / Rialto Airport | Sampled By: TDL

Depth (feet) Top	Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	1.0	SM	Silty SAND, olive brown, slightly moist, fine to medium grained, slightly cemented, gravel to 2.5 inches, rootlets.	Alluvium	B-1	0-1		
					B-2	1-5		
1.0	10.0	SW	Gravelly SAND with cobble and boulder, yellowish brown, dry to slightly moist, fine to coarse grained, subrounded gravel up to 3 inches, become moist below 5 feet. Matrix: 30% - 40% 3" - 8" 10% - 15% 8" - 12" 1% - 5% 12" - 18"					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-2

Date Excavated: September 1, 2005 | Logged By: TDL

Location: Lewis / Rialto Airport | Sampled By: TDL

Depth (feet) Top	Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	2.0	SM	Silty SAND, olive brown, dry to slightly moist, fine to medium grained, some subrounded gravel to 3 inches, slightly cemented, trace cobble, rootlets.	Alluvium	B-1	2-6		
2.0	6.5	SM	Silty SAND, olive brown, moist, fine grained, trace coarse subrounded gravel to 3.5 inches, slightly cemented, rootlets.					
6.5	10.5	SW	SAND with gravel, brown, moist, fine to coarse grained, subrounded gravel to 3 inches, subrounded cobble to 8 inches. Matrix: 30% - 40% 3" - 8" 10% - 15% 8" - 12" 1% - 5% 12" - 18"					

Total Depth: 10.5 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-3

Date Excavated: September 1, 2005 Logged By: TDL

Location: Lewis / Rialto Airport Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results Sample Number	Test Results Depth (feet)	Test Results Density, Dry (pcf)	Test Results Moisture (%)
0.0	4.5	SW	SAND with gravel, brown, dry, fine to coarse grained, fine to coarse subrounded gravel, weakly cemented, rootlets. Matrix: 40% - 45% 3" - 8" 15% - 25% 8" - 12" 5% - 10% 12" - 18"	Alluvium				
4.5	8.5	SW-SM	SAND with silt and gravel, brown, dry, fine to coarse grained, fine to coarse subrounded gravel, weakly cemented, rootlets. Matrix: 40% - 45% 3" - 8" 15% - 25% 8" - 12" 5% - 10% 12" - 18"					
8.5	10.0	SW-SM	SAND with silt and gravel, brown, dry to slightly moist, fine to coarse grained, slightly cemented, fine to coarse gravel.					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-4

Date Excavated: September 1, 2005 Logged By: TDL

Location: Lewis / Rialto Airport Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results Sample Number	Test Results Depth (feet)	Test Results Density, Dry (pcf)	Test Results Moisture (%)
0.0	3.5	SM	Silty SAND with Gravel, brown, dry, fine to medium grained, some coarse grained, gravel up to 3 inches, rootlets. Matrix: 5% - 10% 3" - 8" 0% - 1% 8" - 12" 0% - 1% 12" - 18"	Alluvium	B-1	3.5-10		
3.5	10.0	SW	Gravelly SAND, yellowish brown, slightly moist, fine to coarse grained, fine to coarse subrounded gravel, some silt. Matrix: 30% - 40% 3" - 8" 5% - 10% 8" - 12" 0% - 5% 12" - 18"					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-5

Date Excavated: September 1, 2005 — Logged By: TDL

Location: Lewis / Rialto Airport — Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results: Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	2.0	SP-SM	SAND with silt and gravel, brown, dry, fine grained, medium to coarse subrounded gravel, some cobbles, some boulders, rootlets.	Alluvium				
2.0	10.0	SW	Gravelly SAND with trace silt, light brown, slightly moist to dry, fine to coarse grained, fine to coarse subrouned gravel, rootlets. Matrix: 20% - 35% 3"- 8" 10% - 15% 8" - 12" 1% - 5% 12" - 18"					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-6

Date Excavated: September 1, 2005 — Logged By: TDL

Location: Lewis / Rialto Airport — Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results: Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	4.5	SM	Silty SAND, brown, dry, fine to medium grained, some coarse grained, trace gravel to 2 inches, non-plastic silt, rootlets.	Alluvium				
4.5	6.0	SW-SM	SAND wit silt and gravel, yellowish brown, slightly moist, fine to coarse grained, fine to coarse subrounded gravel, some silt. Matrix: 20% - 30% 3"- 8" 5% - 10% 8" - 12" 0% - 2% 12" - 18"					
6.0	11.0	SW	SAND with gravel, yellowish brown, slightly moist, fine to coarse grained, fine to coarse gravel. Matrix: 20% - 30% 3"- 8" 5% - 10% 8" - 12" 0% - 2% 12" - 18"					

Total Depth: 11 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-7

Date Excavated: September 1, 2005 | Logged By: TDL

Location: Lewis / Rialto Airport | Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results Sample Number	Test Results Depth (feet)	Test Results Density, Dry (pcf)	Test Results Moisture (%)
0.0	2.0	SM	Silty SAND, brown, dry, fine to medium grained, some subrounded gravel to 3 inches, some cobbles to 8 inches, some boulder to 18 inches, rootlets.	Alluvium				
2.0	10.0	SW	SAND with gravel, yellowish brown, slightly moist, fine to coarse grained, fine to coarse subrounded gravel, become moist below 5 feet.					
			Matrix:					
			20% - 30% 3"- 8"					
			10% - 15% 8" - 12"					
			1% - 5% 12" - 18"					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-8

Date Excavated: September 1, 2005 | Logged By: TDL

Location: Lewis / Rialto Airport | Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results Sample Number	Test Results Depth (feet)	Test Results Density, Dry (pcf)	Test Results Moisture (%)
0.0	0.8	SM	Silty SAND, brown, dry, fine to medium grained, some gravel to 3 inches, trace cobble, rootlets.	Alluvium	B-1	0.8-6		
0.8	6.0	SW	SAND with gravel, brown, moist, fine to coarse grained, fine to coarse gravel, rootlets.					
			Matrix:					
			20% - 25% 3"- 8"					
			5% - 10% 8" - 12"					
			0% - 2% 12" - 18"					
6.0	11.0	SW	SAND wit gravel, brown, highly moist, fine to coarse grained, fine to coarse gravel, rootlets.					
			Matrix:					
			20% - 25% 3"- 8"					
			5% - 10% 8" - 12"					
			0% - 2% 12" - 18"					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-9

Date Excavated: September 1, 2005 | Logged By: TDL

Location: Lewis / Rialto Airport | Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results: Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	2.0	SM	Silty SAND, brown, dry, fine to medium grained, trace subrounded gravel to 3 inches, weakly cemented, rootlets.	Alluvium	B-1	0-2		
2.0	3.0	SM	Silty SAND, brown, dry, fine to medium grained, some coarse grained, weakly cemented, some coarse gravel, some cobbles to 8 inches, rootlets.					
3.0	10.0	SW	SAND with gravel, moderate brown, slightly moist to dry, fine to coarse grained, fine to coarse gravel. Matrix: 20% - 30% 3" - 8" 10% - 15% 8" 12" 1% - 5% 12" - 18"					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-10

Date Excavated: September 1, 2005 | Logged By: TDL

Location: Lewis / Rialto Airport | Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results: Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	4.5	SM	Silty SAND, brown, dry, fine to medium grained, trace coarse gravel to 3 inches, rootlets.	Alluvium				
4.5	6.5	SW	SAND with gravel, moderate brown, slightly moist, fine to coarse grained, fine to coarse subrounded gravel. Matrix: 10% - 15% 3" - 8" 1% - 2% 8" - 12"					
6.5	10.5	SW	SAND with gravel, moderate brown, moist to highly moist, fine to coarse grained, fine to coarse subrounded Matrix: 10% - 15% 3" - 8" 1% - 2% 8" - 12"					

Total Depth: 10.5 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-11

Date Excavated: September 2, 2005 | Logged By: TDL

Location: Lewis / Rialto Airport | Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results Sample Number	Test Results Depth (feet)	Test Results Density, Dry (pcf)	Test Results Moisture (%)
0.0	2.0	SM	Silty SAND, brown, dry, fine to medium grained, some subrounded gravel to 3 inches, non-plastic silt, rootlets.	Alluvium	B-1	10-12		
2.0	3.5	SW-SM	SAND with silt and gravel, dry, fine to coarse grained, brown, fine to coarse gravel, some cobble to 5 inches. Matrix: 10% - 15% 3" - 8" 2% - 5% 8" 12" 0% - 2% 12" - 18"					
3.5	10.0	SW	SAND with gravel, yellowish brown, moist, fine to coarse grained, fine to coarse gravel. Matrix: 10% - 15% 3" - 8" 2% - 5% 8" 12" 0% - 2% 12" - 18"					
10.0	12.0	SC	Clayey SAND, brown, wet, fine grained, trace coarse grained, non-plastic clay.					

Total Depth: 12 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-12

Date Excavated: September 2, 2005 | Logged By: TDL

Location: Lewis / Rialto Airport | Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results Sample Number	Test Results Depth (feet)	Test Results Density, Dry (pcf)	Test Results Moisture (%)
0.0	2.5	SM	Silty SAND, brown, dry, fine to medium grained, some gravel to 3 inches, 0.5 inch of asphalt, 1inch of base, rootlets.	Afu	B-1 B-2	6-10 6-10		
2.5	6.0	SW	SAND with gravel, pale brown, dry, fine to medium grained, fine to coarse gravel. Matrix: 20% - 25% 3" - 8" 5% - 15% 8" - 12"	Alluvium				
6.0	10.0	SP	WEST: SAND, pale brown, highly moist, fine to medium grained, some coarse grained, some gravel to 2 inches.					
		SC-SM	EAST: Silty SAND / Clayey SAND, reddish brown, very moist, fine to medium grained, trace coarse grained, some gravel up to 2 inches.					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-13

Date Excavated: September 2, 2005 Logged By: TDL

Location: Lewis / Rialto Airport Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results: Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	2.0	SM	Silty SAND, brown, dry, fine to medium grained, some subrounded gravel to 3 inches, some cobbles to 8 inches, rootlets.	Alluvium				
2.0	9.0	SW	SAND with gravel, gray brown, slightly moist to moist, fine to coarse grained, fine to coarse gravel, become moist below 6 feet. Matrix: 30% - 35% 3" - 8" 10% - 15% 8" - 12" 1% - 2% 12" - 18"					
9.0	10.0	SM	Silty SAND, reddish brown, highly moist, fine to coarse grained, some gravel to 2 inches, some cobble to 8 inches.					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-14

Date Excavated: September 2, 2005 Logged By: TDL

Location: Lewis / Rialto Airport Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results: Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	2.5	SM	Silty SAND, brown, dry, weakly cemented, fine to medium grained, some subrounded gravel to 2 inches, rootlets.	Alluvium				
2.5	4.0	SW-SM	SAND with silt and gravel, brown, dry, fine to medium grained, fine to coarse subrounded gravel, some cobbles.					
4.0	10.0	SW	SAND with gravel, gray brown, dry, fine to coarse grained, fine to coarse gravel, subangular to subrounded gravel. Matrix: 20% - 30% 3" - 8" 1% - 5% 8" - 12"					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-15

Date Excavated: September 2, 2005 Logged By: TDL

Location: Lewis / Rialto Airport Sampled By: TDL

Depth (feet) Top	Bottom	Soil symbol (USCS)	Description	Geologic Unit	Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	2.0	SM	Silty SAND, brown, dry, fine to medium grained, some coarse grained, some subrounded gravel to 2 inches, rootlets.	Alluvium				
2.0	3.5	SW-SM	SAND with silt and gravel, moderate brown, dry, fine to coarse grained, fine to coarse gravel, some cobbles to 5 inches.					
3.5	11.5	SW	SAND with gravel, brown, dry, fine to coarse grained, fine to coarse gravel, become moist below 5 feet. Matrix: 10% - 15% 3" - 8" 1% - 5% 8" - 12"					

Total Depth: 11.5 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-16

Date Excavated: September 2, 2005 Logged By: TDL

Location: Lewis / Rialto Airport Sampled By: TDL

Depth (feet) Top	Bottom	Soil symbol (USCS)	Description	Geologic Unit	Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	2.5	SW-SM	SAND with silt and gravel, brown, dry, fine to coarse grained, fine to coarse gravel, rootlets.	Alluvium				
2.5	11.0	SW	SAND with gravel, gray brown, dry to slightly moist, fine to coarse grained, fine to coarse subrounded gravel, rootlets, become moist below 6 feet. Matrix: 15% - 20% 3" - 8" 2% - 5% 8" - 12" 0% - 1% 12" - 18"					

Total Depth: 11 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-17

Date Excavated: September 2, 2005 | Logged By: TDL

Location: Lewis / Rialto Airport | Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results: Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	2.0	SW-SM	SAND with silt and gravel, gray brown, dry, fine to medium grained, some coarse sand, medium to coarse subrounded gravel, rootlets. Matrix: 15% - 20% 3" - 8" 5% - 10% 8" - 12" 1% - 2% 12" - 18"	Alluvium				
2.0	10.0	SW	SAND with gravel, brown, slightly moist to moist, fine to coarse grained, fine to coarse gravel, become moist below 3 feet. Matrix: 15% - 25% 3" - 8" 5 % - 10% 8" - 12" 1% - 2% 12" - 18"					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-18

Date Excavated: September 2, 2005 | Logged By: TDL

Location: Lewis / Rialto Airport | Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results: Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	2.5	SM	Silty SAND with gravel, dark brown, dry, fine to medium grained, some coarse grained, gravel up to 3 inches, rootlets.	Alluvium				
2.5	7.0	SW	SAND with gravel, gray brown to brown, dry to slightly moist, fine to coarse grained, fine to coarse subrounded gravel. Matrix: 20% - 25% 3" - 8" 5% - 10% 8" - 12" 0% -2% 12" - 18"					
7.0	10.0	SW-SM	SAND with silt and gravel, light brown, moist, fine to coarse grained, fine to coarse gravel, non-plastic silt. Matrix: 20% - 25% 3" - 8" 1% - 5% 8" - 12"					

Total Depth: 10 feet
No groundwater encountered.
Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-19

Date Excavated: September 2, 2005 — Logged By: TDL

Location: Lewis / Rialto Airport — Sampled By: TDL

Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results: Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	2.5	SM	Silty SAND, brown, dry, fine to medium grained, some	Alluvium				
			subrounded gravel to 3 inches, few cobbles to 8 inches,					
			rootlets.					
2.5	10.0	SW	SAND with gravel, gray brown, dry, fine to coarse					
			grained, fine to coarse gravel, become moist below 7.5					
			feet.					
			Matrix:					
			20% - 25% 3" - 8"					
			5 % - 10% 8" - 12"					
			0% - 1% 12" - 18"					

Total Depth: 10 feet

No groundwater encountered.

Test pit backfilled, tamped with bucket, wheel rolled at surface.

Test Pit TP-20

Date Excavated: September 2, 2005 — Logged By: TDL

Location: Lewis / Rialto Airport — Sampled By: TDL

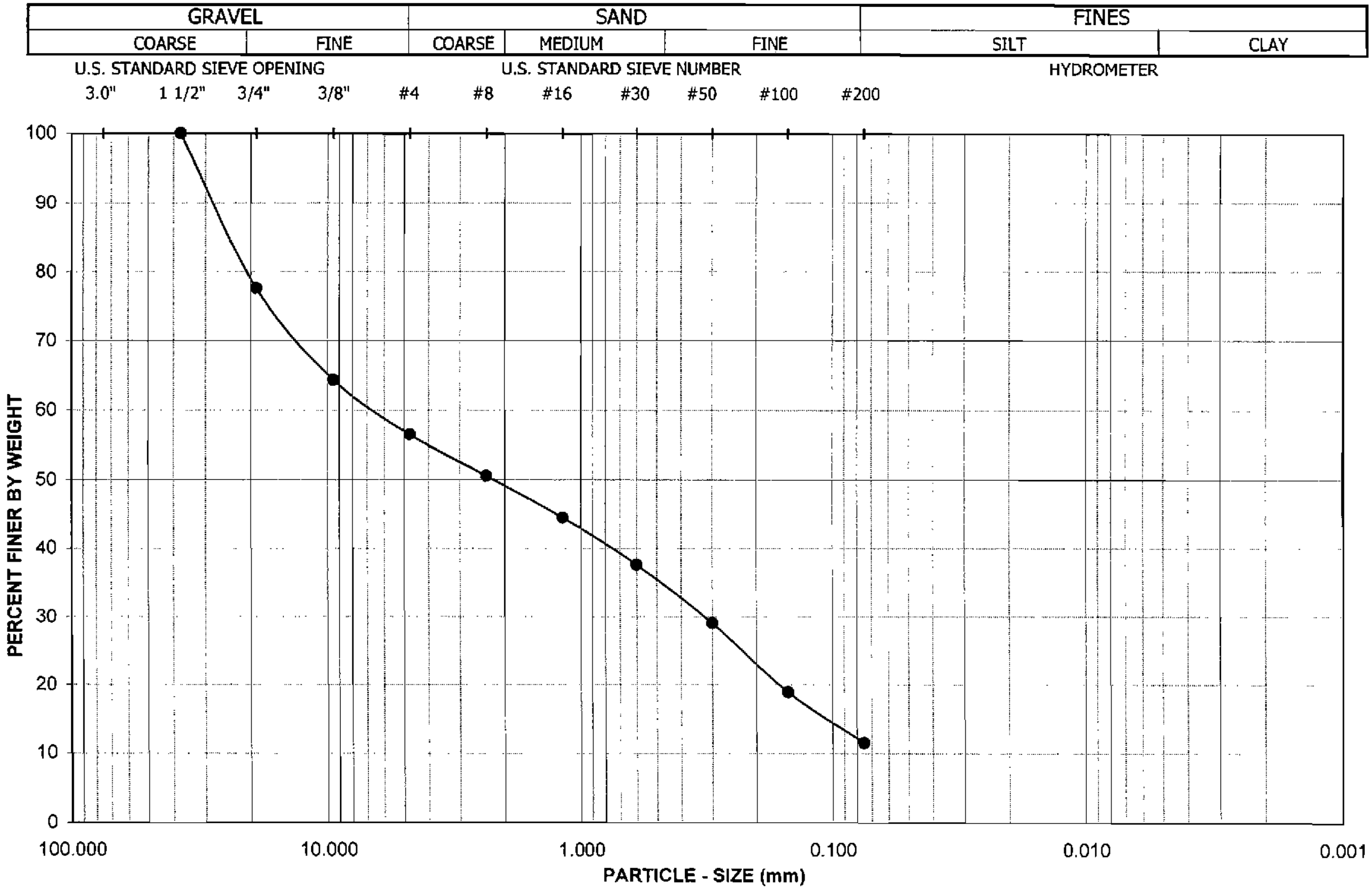
Depth (feet) Top	Depth (feet) Bottom	Soil symbol (USCS)	Description	Geologic Unit	Test Results: Sample Number	Depth (feet)	Density, Dry (pcf)	Moisture (%)
0.0	1.5	SM	Silty SAND, brown, dry, fine to medium grained, some	Alluvium				
			gravel up to 3 inches, rootlets.					
1.5	3.5	SW	SAND with gravel, gray brown, dry, fine to coarse					
			grained, fine to coarse gravel, subangular to subrounded					
			gravel.					
			Matrix:					
			10% - 15% 3" - 8"					
			1% - 5% 8" - 12"					
			0% -1% 12" - 18"					
7.0	10.0	SW	SAND with gravel, gray brown, moist, fine to coarse					
			grained, fine to coarse gravel, subangular to subrounded					
			gravel, become highly moist to wet below 7 feet.					
			Matrix:					
			10% - 15% 3" - 8"					
			1% - 5% 8" - 12"					
			0% -1% 12" - 18"					

Total Depth: 10 feet

No groundwater encountered.

Test pit backfilled, tamped with bucket, wheel rolled at surface.

APPENDIX C



Project Name: Lewis / Rialto

Project No.: 021751-001

Exploration No.: B-1

Sample No.: B-1

Depth (feet): 0-5

Soil Type : (SP-SM)g

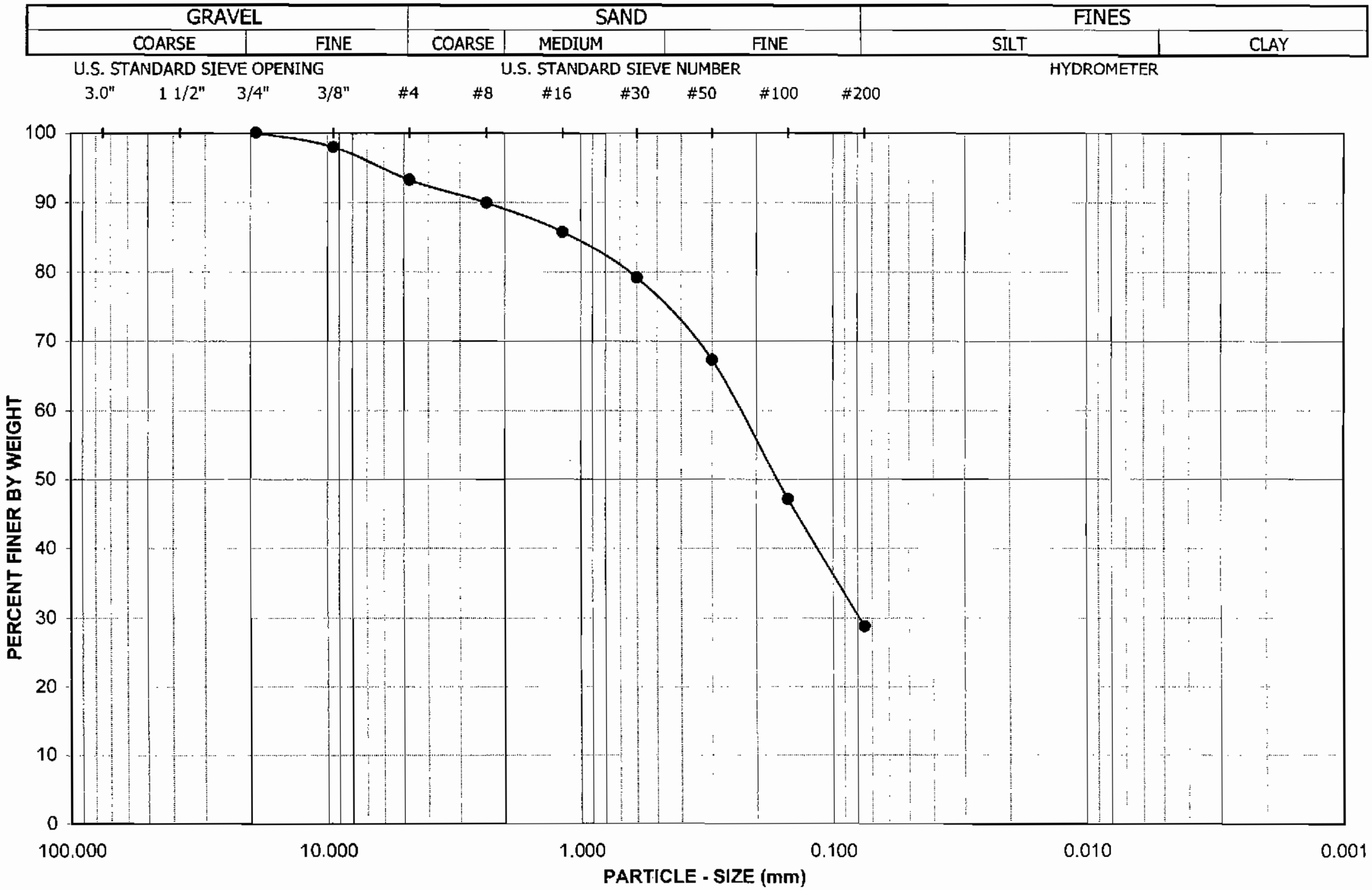
Soil Identification: Olive Poorly-graded Sand with Silt and Gravel (SP-SM)g

GR:SA:FI : (%) 44 : 44 : 12

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-05



Project Name: Lewis / Rialto

Project No.: 021751-001

Exploration No.: B-9 Sample No.: B-1

Depth (feet): 0-5 Soil Type : (SM)

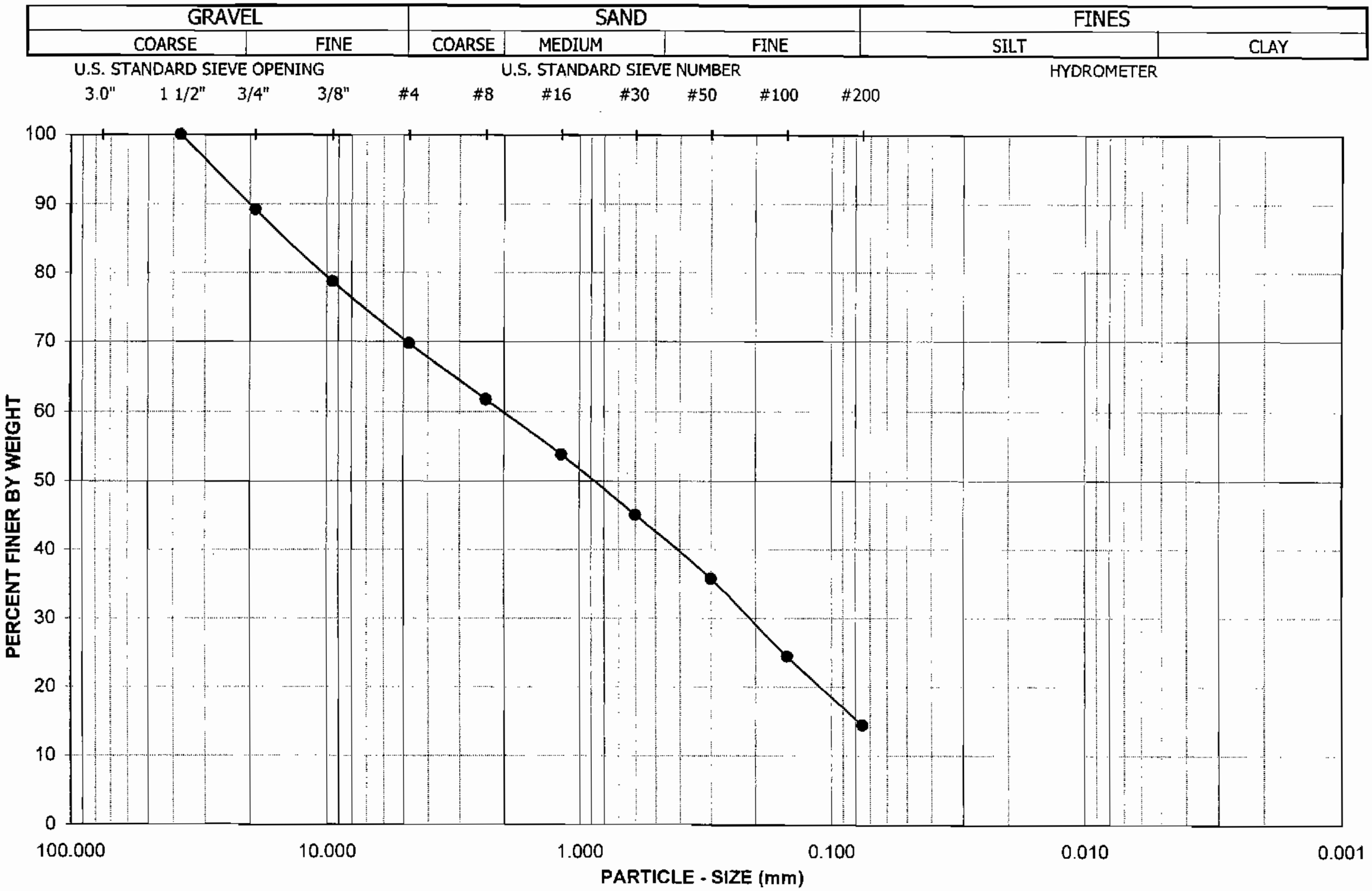
Soil Identification: Olive Brown Silty Sand (SM)

GR:SA:FI : (%) 7 : 64 : 29

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Sep-05



Project Name: Lewis / Rialto

Project No.: 021751-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

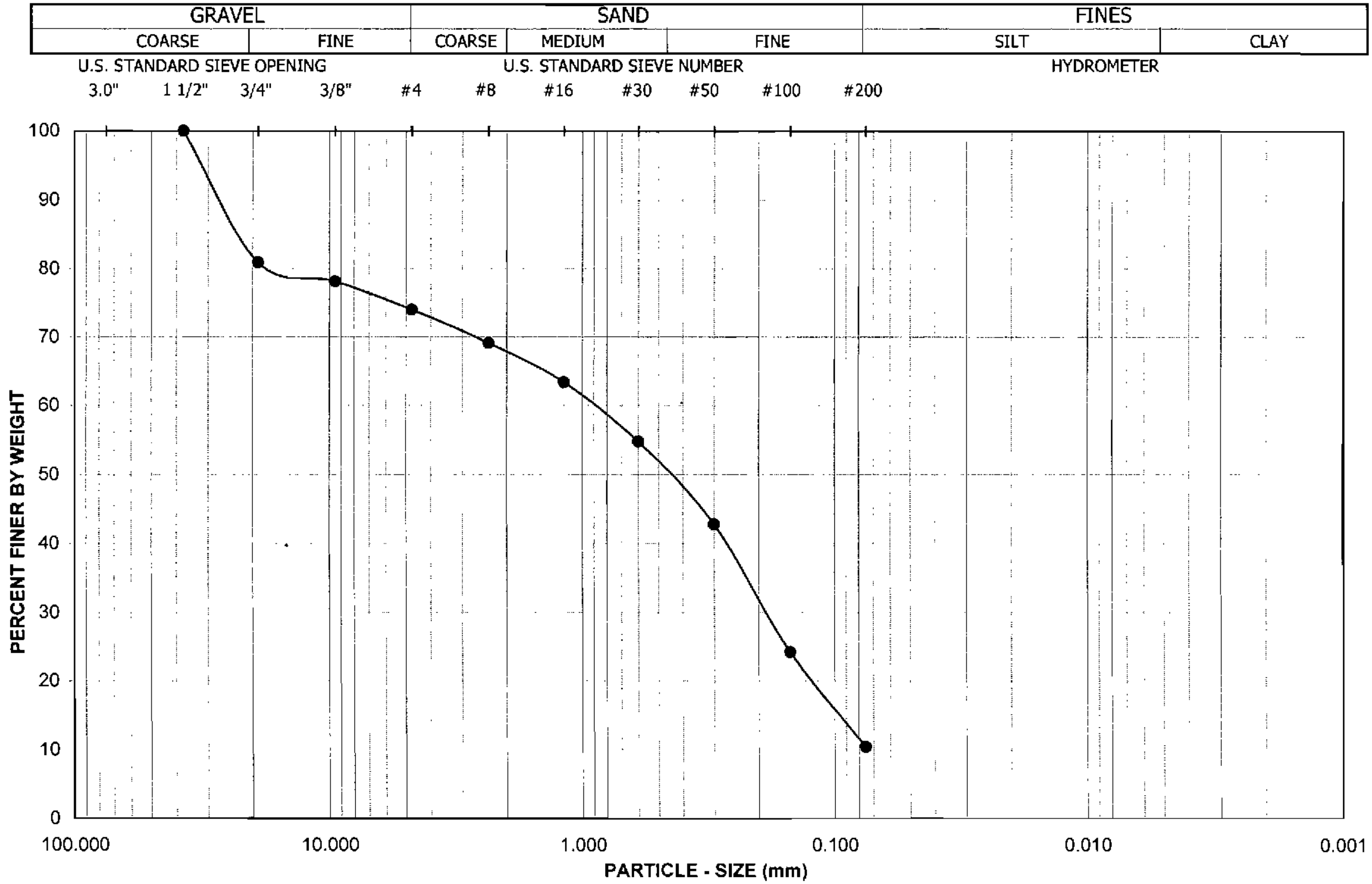
Exploration No.: B-15 Sample No.: B-1

Depth (feet): 0-5 Soil Type : (SM)g

Soil Identification: Olive Brown Silty Sand with Gravel (SM)g

GR:SA:FI : (%) 30 : 56 : 14

Sep-05



Project Name: Lewis EJA Rialto

Project No.: 021751-002

Exploration No.: B-19   Sample No.: R-1

Depth (feet): 2.0   Soil Type : (SP-SM)g

Soil Identification: Olive brown poorly graded sand with silt and gravel (SP-SM)g

GR:SA:FI : (%)   26 : 64 : 10

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jul-06

MODIFIED PROCTOR COMPACTION TEST
ASTM D 1557

Leighton

Project Name:	Lewis / Rialto	Tested By :	GEB	Date:	09/09/05
Project No.:	021751-001	Input By :	JHW	Date:	09/20/05
Boring No.:	B-1	Depth (ft.)	0-5		
Sample No. :	B-1				
Soil Identification:	Olive Poorly-graded Sand with Silt and Gravel (SP-SM)g				

Preparation Method:	X	Moist
		Dry
Compaction Method	X	Mechanical Ram
		Manual Ram

Scalp Fraction (%)	
#3/4	12.5
#3/8	
#4	

Rammer Weight (lb.) = 10.0
Height of Drop (in.) = 18.0
Mold Volume (ft^3) 0.07514

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	7373.0	7541.0	7711.0	7701.0		
Weight of Mold (g)	2812.0	2812.0	2812.0	2812.0		
Net Weight of Soil (g)	4561.0	4729.0	4899.0	4889.0		
Wet Weight of Soil + Cont. (g)	1408.60	1149.20	1120.80	1266.30		
Dry Weight of Soil + Cont. (g)	1385.80	1108.50	1058.70	1169.10		
Weight of Container (g)	73.90	82.50	76.60	76.80		
Moisture Content (%)	1.74	3.97	6.32	8.90		
Wet Density (pcf)	133.8	138.7	143.7	143.4		
Dry Density (pcf)	131.5	133.5	135.2	131.7		

Maximum Dry Density (pcf) 135.0
Optimum Moisture Content (%) 6.5
Corrected Dry Density (pcf) 138.5
Corrected Moisture Content (%) 6.0

☐ **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

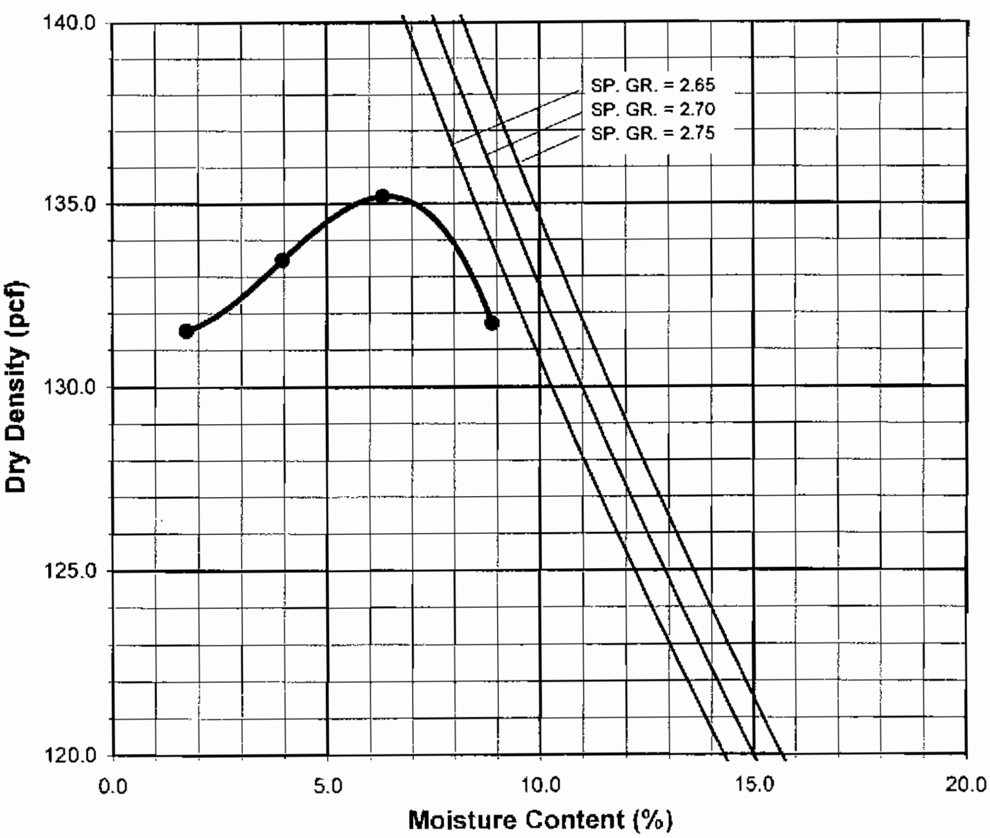
☐ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

☒ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
44:44:12
GR:SA:FI

Atterberg Limits:

LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST
ASTM D 1557

Leighton

Project Name:	Lewis / Rialto	Tested By :	GEB	Date:	09/19/05
Project No.:	021751-001	Input By :	JHW	Date:	09/20/05
Boring No.:	B-12	Depth (ft.)	0-5		
Sample No. :	B-1				
Soil Identification:	Brown Silty Sand with Gravel (SM)g				

Preparation Method:	X	Moist
		Dry
Compaction Method	X	Mechanical Ram
		Manual Ram

Scalp Fraction (%)	
#3/4	10.9
#3/8	
#4	

Rammer Weight (lb.) = 10.0
Height of Drop (in.) = 18.0
Mold Volume (ft³) 0.07514

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	7495.0	7713.0	7613.0			
Weight of Mold (g)	2812.0	2812.0	2812.0			
Net Weight of Soil (g)	4683.0	4901.0	4801.0			
Wet Weight of Soil + Cont. (g)	1124.10	1138.30	1236.10			
Dry Weight of Soil + Cont. (g)	1076.20	1065.40	1135.60			
Weight of Container (g)	76.00	73.40	74.50			
Moisture Content (%)	4.79	7.35	9.47			
Wet Density (pcf)	137.4	143.8	140.9			
Dry Density (pcf)	131.1	134.0	128.7			

Maximum Dry Density (pcf) 134.0
Optimum Moisture Content (%) 7.0
Corrected Dry Density (pcf) 137.0
Corrected Moisture Content (%) 6.5

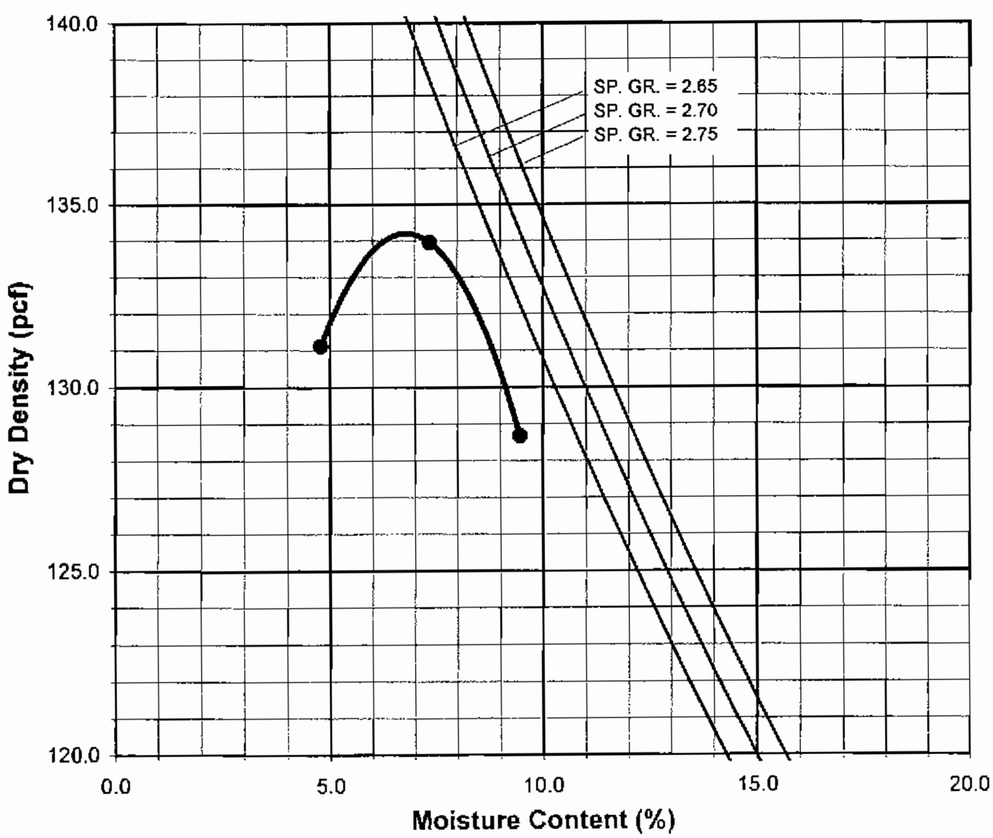
☐ **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☐ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

☒ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:
GR:SA:FI

Atterberg Limits:
LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Leighton

Project Name:	Lewis EJA Rialto	Tested By :	GEB	Date:	07/24/06
Project No.:	021751-002	Input By :	LF	Date:	07/25/06
Boring No.:	B-20	Depth (ft.)	0-5		
Sample No. :	Bag-1				
Soil Identification:	Brown silty sand with gravel (SM)g				

Preparation Method:	X	Moist
		Dry
Compaction Method	X	Mechanical Ram
		Manual Ram

Scalp Fraction (%)	
#3/4	23.0
#3/8	
#4	

Rammer Weight (lb.) = 10.0

Height of Drop (in.) = 18.0

Mold Volume (ft³) 0.07514

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	7017.0	7285.0	7486.0	7417.0		
Weight of Mold (g)	2812.0	2812.0	2812.0	2812.0		
Net Weight of Soil (g)	4205.0	4473.0	4674.0	4605.0		
Wet Weight of Soil + Cont. (g)	547.20	599.60	656.10	862.80		
Dry Weight of Soil + Cont. (g)	532.80	570.50	611.30	789.90		
Weight of Container (g)	77.10	75.90	76.50	76.20		
Moisture Content (%)	3.16	5.88	8.38	10.21		
Wet Density (pcf)	123.4	131.2	137.1	135.1		
Dry Density (pcf)	119.6	123.9	126.5	122.6		

Maximum Dry Density (pcf) 126.5

Optimum Moisture Content (%) 8.0

Corrected Dry Density (pcf) 134

Corrected Moisture Content (%) 6.5

☐ **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☐ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

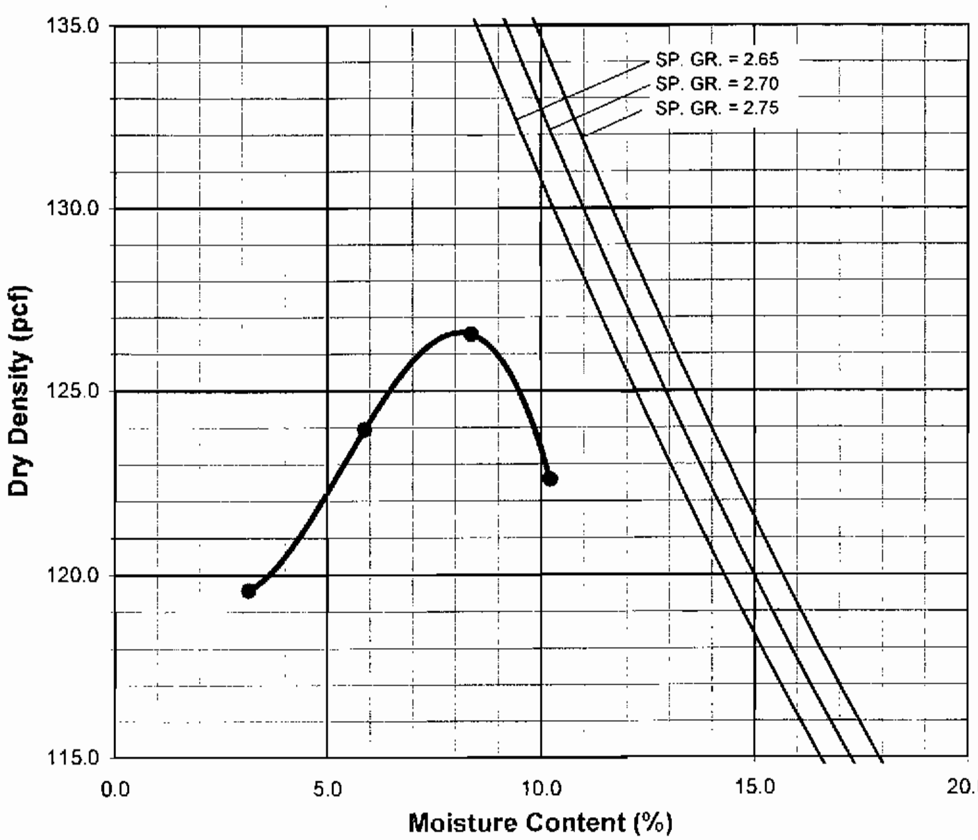
☒ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST
ASTM D 1557

Leighton

Project Name:	Lewis EJA Rialto	Tested By :	GEB	Date:	07/24/06
Project No.:	021751-003	Input By :	LF	Date:	07/25/06
Boring No.:	B-23	Depth (ft.)	0-5		
Sample No. :	Bag-1				
Soil Identification:	Brown silty sand with gravel (SM)g				

Preparation Method:	X	Moist
		Dry
Compaction Method	X	Mechanical Ram
		Manual Ram

Scalp Fraction (%)	
#3/4	35.0
#3/8	
#4	

Rammer Weight (lb.) = 10.0
Height of Drop (in.) = 18.0
Mold Volume (ft^3) 0.07514

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	7297.0	7503.0	7427.0			
Weight of Mold (g)	2812.0	2812.0	2812.0			
Net Weight of Soil (g)	4485.0	4691.0	4615.0			
Wet Weight of Soil + Cont. (g)	822.90	760.40	782.70			
Dry Weight of Soil + Cont. (g)	782.10	709.60	715.30			
Weight of Container (g)	72.80	75.10	76.80			
Moisture Content (%)	5.75	8.01	10.56			
Wet Density (pcf)	131.6	137.6	135.4			
Dry Density (pcf)	124.4	127.4	122.5			

Maximum Dry Density (pcf) 127.5

Optimum Moisture Content (%) 8.0

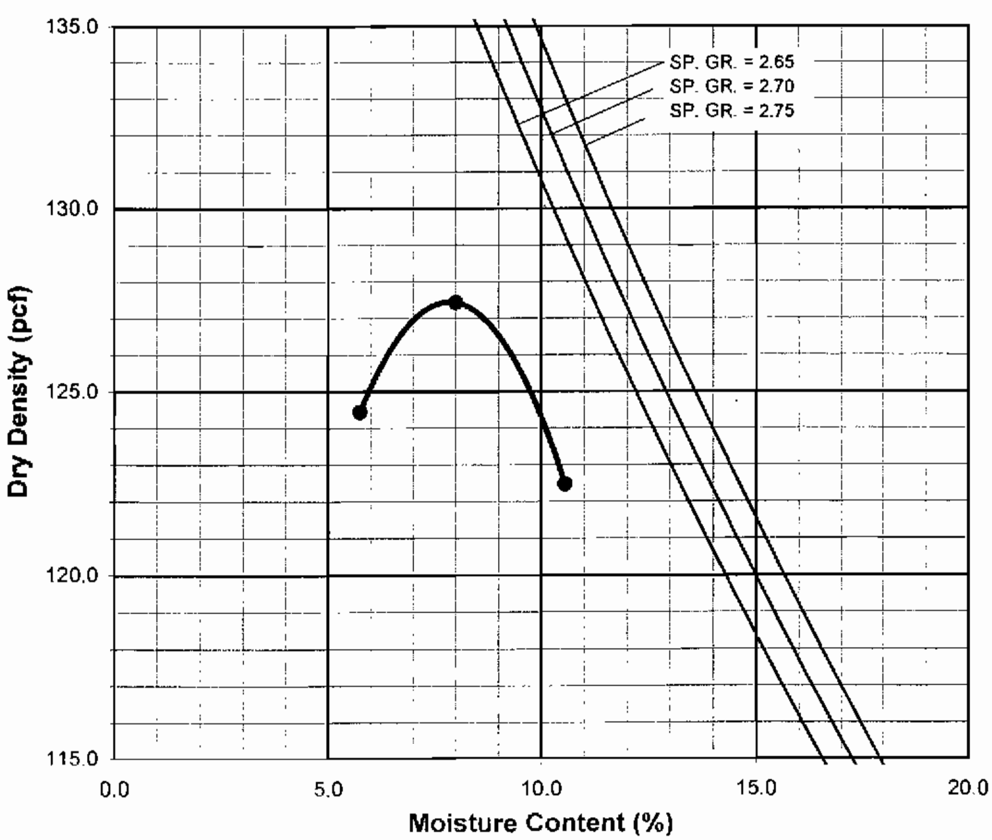
Corrected Dry Density (pcf) 139.5

Corrected Moisture Content (%) 5.5

☐ **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☐ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

☒ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%



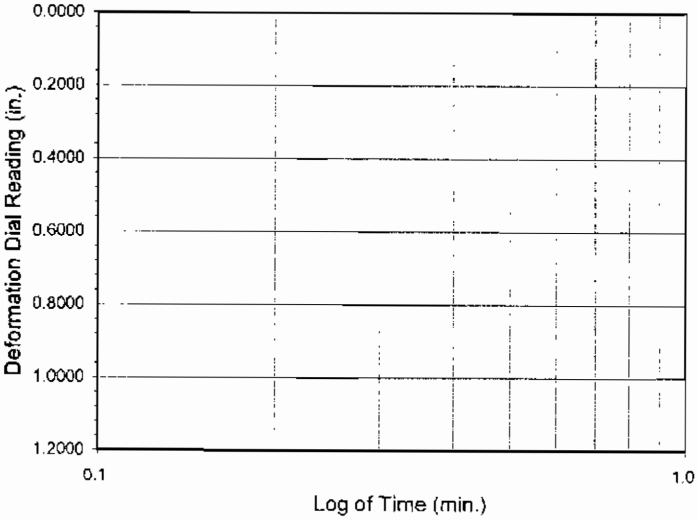
Particle-Size Distribution:

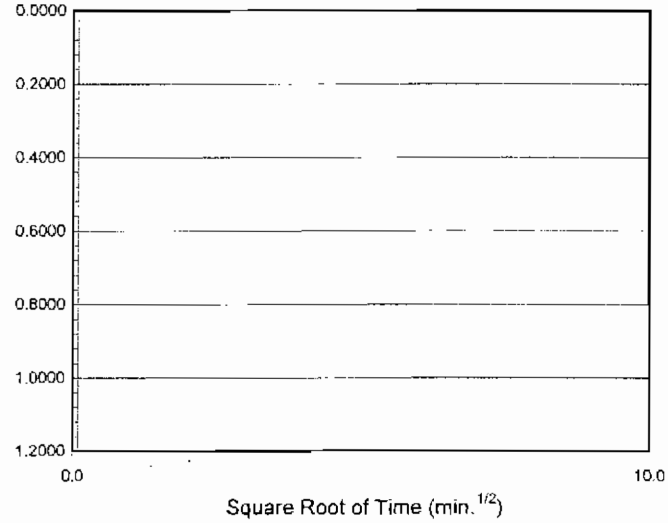
GR:SA:FI

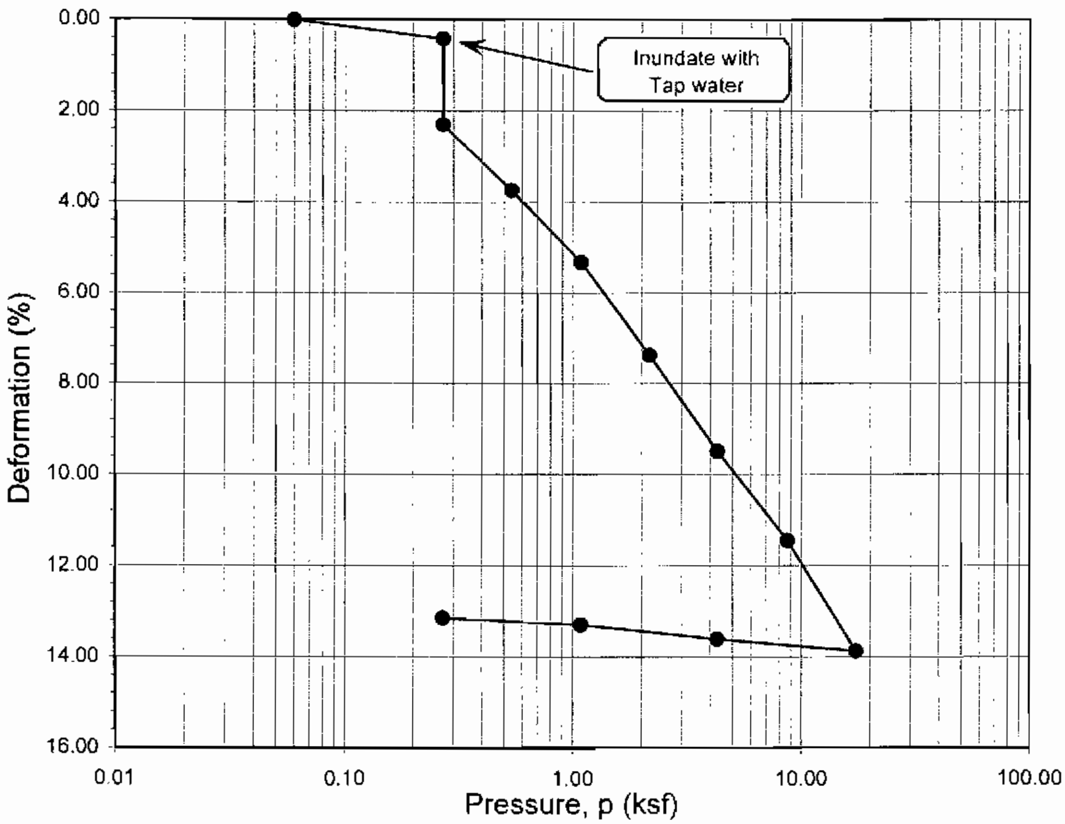
Atterberg Limits:

LL,PL,PI

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
B-24	**R-1**	**2**	**2.0**	**11.3**	**114.4**	**129.1**	**0.473**	**0.280**	**11**	**100**

Soil Identification: Brown silty sand with gravel (SM)g

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
(ASTM D 2435)

Project No.: 021751-003

Lewis EJA Rialto

07-06

Leighton

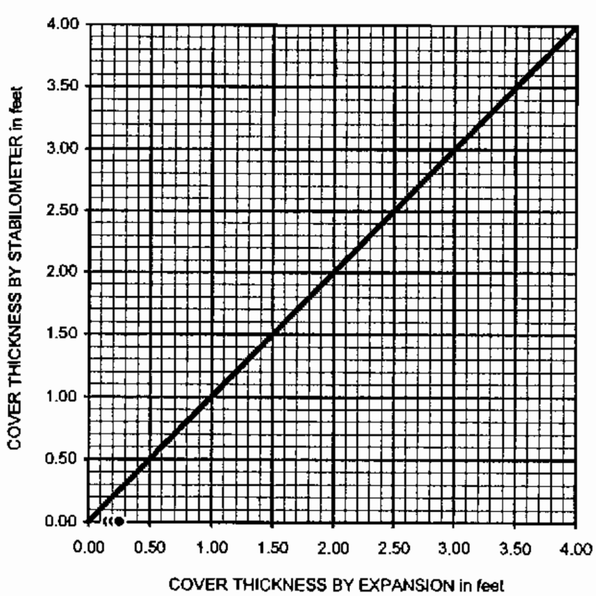
R-VALUE TEST RESULTS

PROJECT NAME:	Lewis / Rialto	PROJECT NUMBER:	021751-001
SAMPLE NUMBER:	B-1	SAMPLE LOCATION:	B-4 0-5'
SAMPLE DESCRIPTION:	SM	TECHNICIAN:	SCF
		DATE SAMPLED	8/26/2005

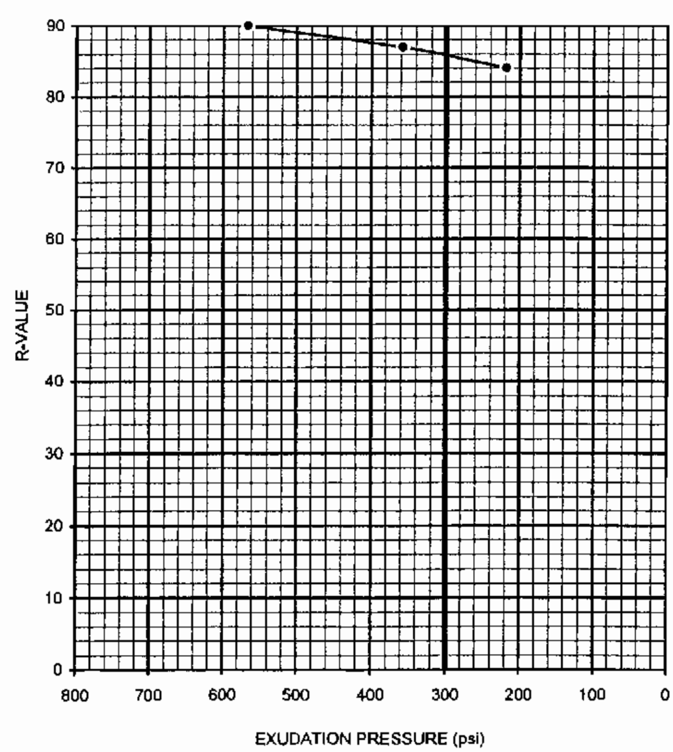
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	7.7	8.1	8.5
HEIGHT OF SAMPLE, Inches	2.45	2.50	2.51
DRY DENSITY, pcf	129.4	130.7	130.7
COMPACTOR PRESSURE, psi	350	350	350
EXUDATION PRESSURE, psi	566	357	218
EXPANSION, Inches x 10exp-4	0	0	0
STABILITY Ph 2,000 lbs (160 psi)	12	15	18
TURNS DISPLACEMENT	3.52	3.59	3.69
R-VALUE UNCORRECTED	90	87	84
R-VALUE CORRECTED	90	87	84

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.16	0.21	0.26
EXPANSION PRESSURE THICKNESS, ft.	0.00	0.00	0.00

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	100
R-VALUE BY EXUDATION:	86
EQUILIBRIUM R-VALUE:	86

Leighton

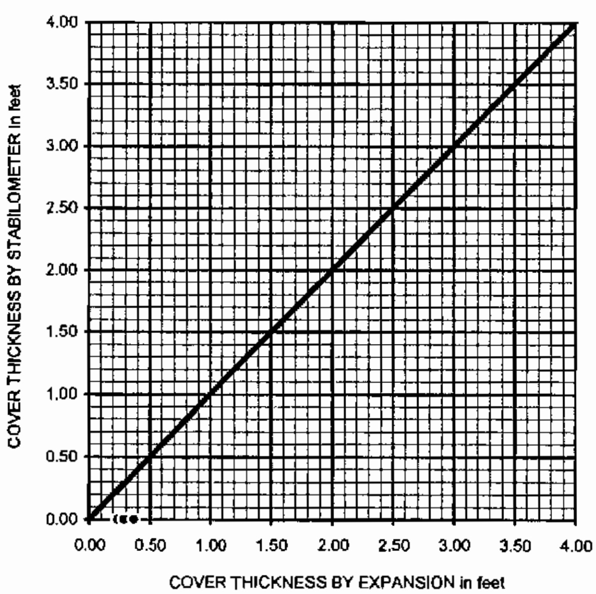
R-VALUE TEST RESULTS

PROJECT NAME:	Lewis / Rialto	PROJECT NUMBER:	021751-001
SAMPLE NUMBER:	B-1	SAMPLE LOCATION:	B-9 0-5'
SAMPLE DESCRIPTION:	SM	TECHNICIAN:	SCF
		DATE SAMPLED	8/26/2005

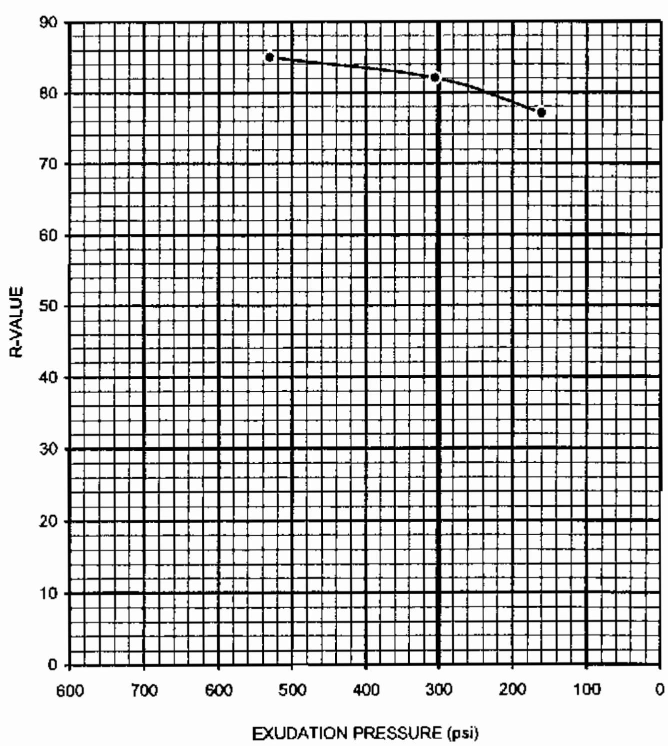
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	10.1	10.5	11.0
HEIGHT OF SAMPLE, Inches	2.45	2.57	2.43
DRY DENSITY, pcf	119.7	119.7	120.2
COMPACTOR PRESSURE, psi	350	350	350
EXUDATION PRESSURE, psi	530	304	160
EXPANSION, Inches x 10exp-4	0	0	0
STABILITY Ph 2,000 lbs (160 psi)	17	20	24
TURNS DISPLACEMENT	3.62	3.79	3.93
R-VALUE UNCORRECTED	85	82	78
R-VALUE CORRECTED	85	82	77

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.24	0.29	0.37
EXPANSION PRESSURE THICKNESS, ft.	0.00	0.00	0.00

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	100
R-VALUE BY EXUDATION:	82
EQUILIBRIUM R-VALUE:	82

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Leighton

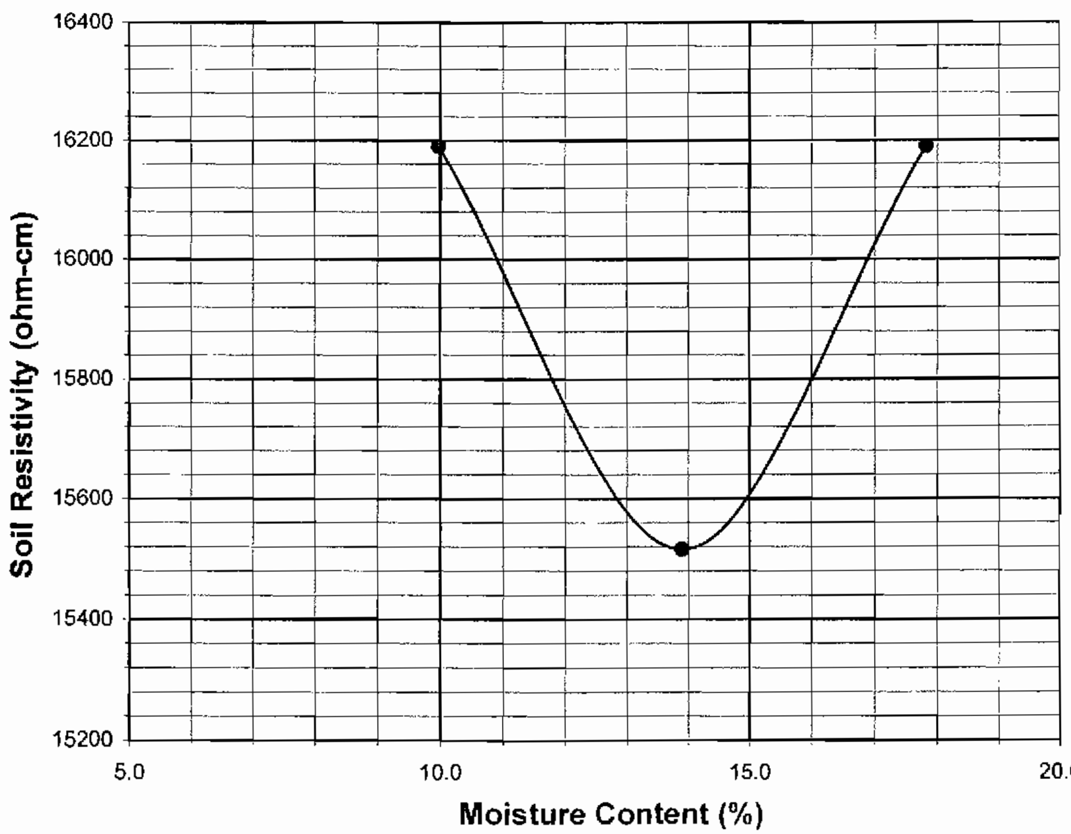
Project Name: Lewis / Rialto
Project No. : 021751-001
Boring No.: B-1
Sample No. : B-1
Soil Identification: Olv (SP-SM)g

Tested By : VJ Date: 09/09/05
Data Input By: JHW Date: 09/20/05
Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	9.97	2400	16190
2	150	13.90	2300	15516
3	200	17.83	2400	16190
4				
5				

Moisture Content (%) (MCi)	2.12
Wet Wt. of Soil + Cont. (g)	230.18
Dry Wt. of Soil + Cont. (g)	226.80
Wt. of Container (g)	67.26
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
15516	**13.9**	**88**	**51**	**5.90**	**21.2**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

Project Name: Lewis / Rialto | Tested By : VJ | Date: 09/13/05

Project No. : 021751-001 | Data Input By: JHW | Date: 09/20/05

Boring No.: B-9 | Depth (ft.) : 0-5

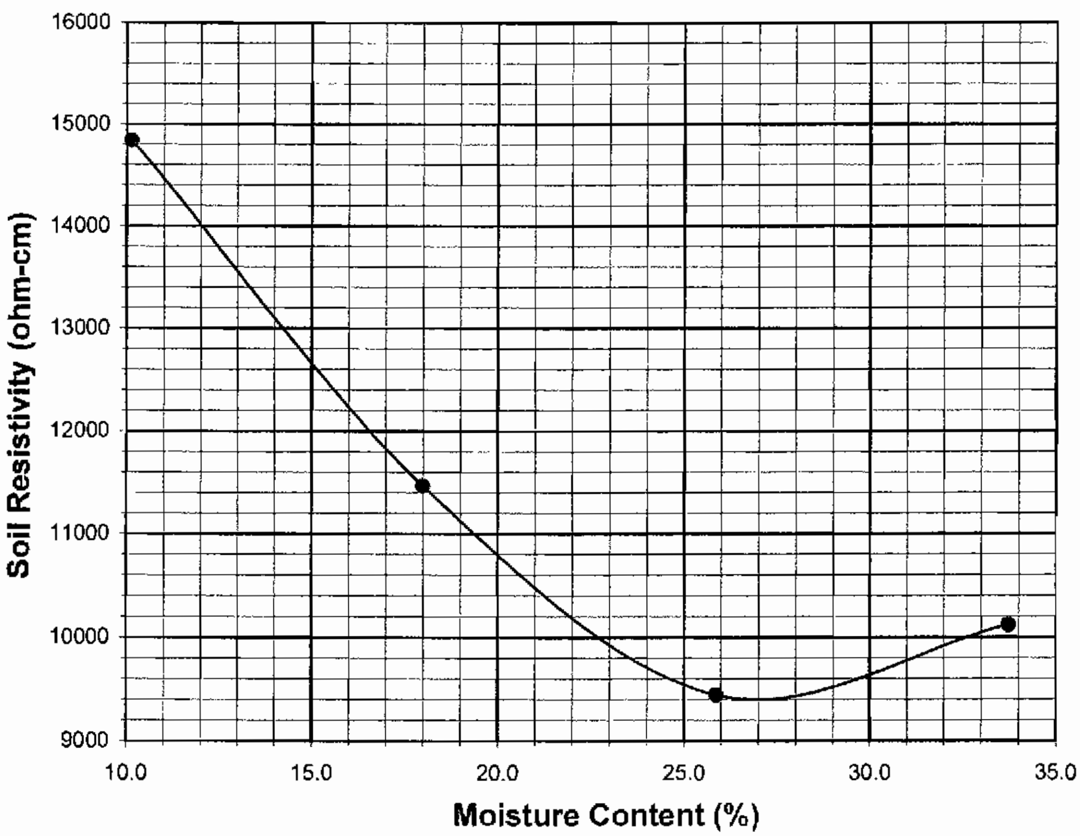
Sample No. : B-1

Soil Identification: Olv Brn (SM)

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	10.13	2200	14841
2	200	18.00	1700	11468
3	300	25.87	1400	9444
4	400	33.74	1500	10119
5				

Moisture Content (%) (MCi)	2.27
Wet Wt. of Soil + Cont. (g)	219.61
Dry Wt. of Soil + Cont. (g)	216.23
Wt. of Container (g)	67.21
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
9400	27.0	80	51	5.59	21.1



Leighton

SOIL RESISTIVITY TEST

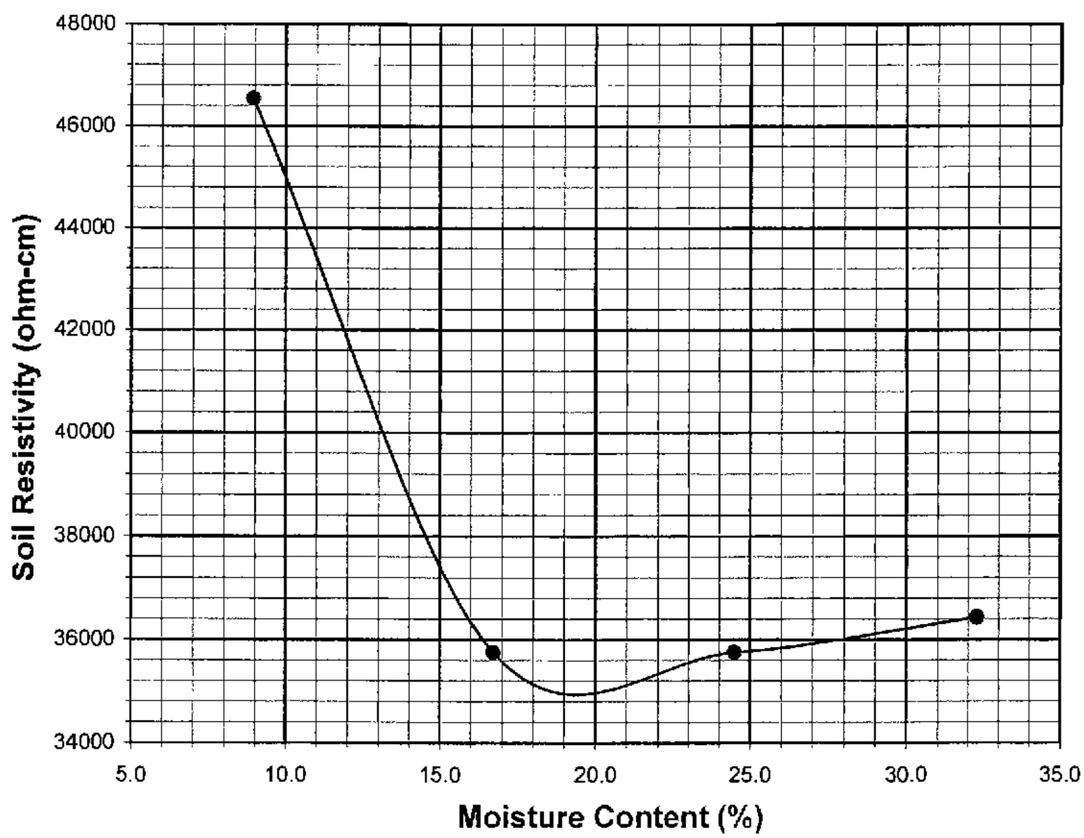
DOT CA TEST 532 / 643

Project Name:	Lewis / Rialto	Tested By :	VJ	Date:	09/13/05
Project No. :	021751-001	Data Input By:	JHW	Date:	09/20/05
Boring No.:	B-15	Depth (ft.) :	0-5		
Sample No. :	B-1				
Soil Identification:	Olv Brn (SM)g				

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	8.94	6900	46547
2	200	16.72	5300	35754
3	300	24.50	5300	35754
4	400	32.29	5400	36428
5				

Moisture Content (%) (MCi)	1.16
Wet Wt. of Soil + Cont. (g)	234.50
Dry Wt. of Soil + Cont. (g)	232.69
Wt. of Container (g)	76.59
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
35000	**19.5**	**75**	**51**	**5.77**	**20.8**



Leighton

SOIL RESISTIVITY TEST

DOT CA TEST 532 / 643

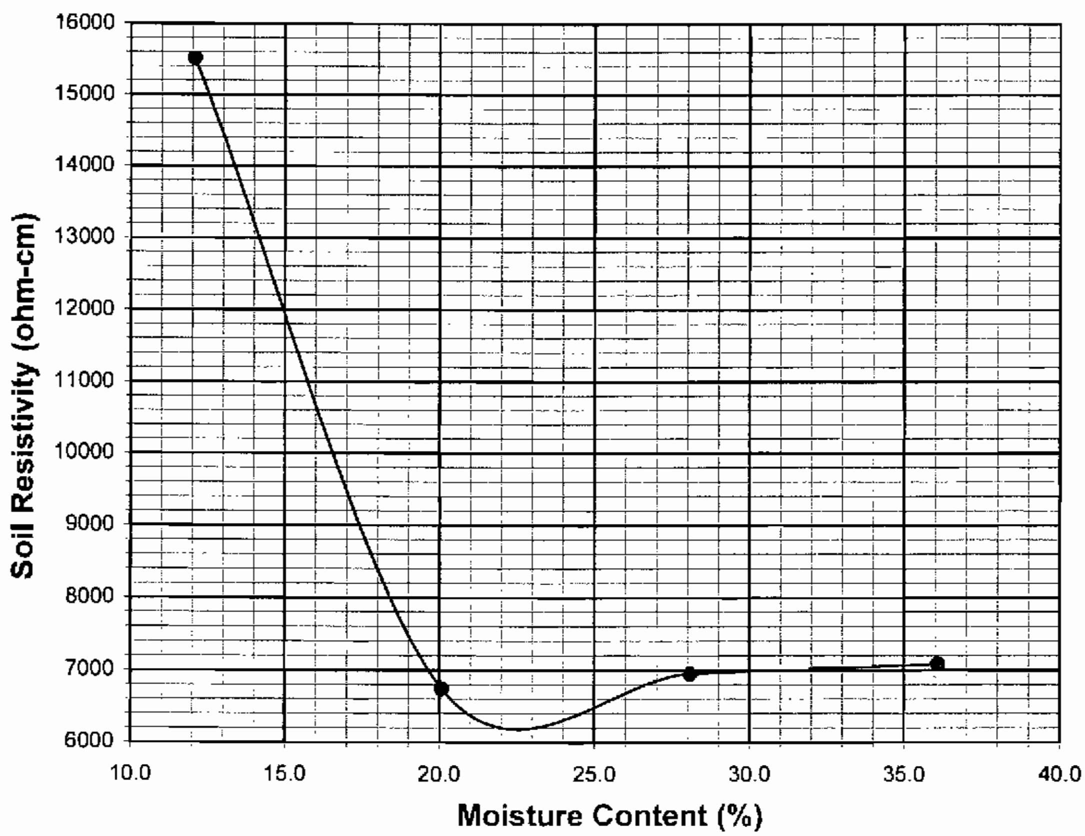
Project Name: Lewis EJA Rialto
Project No. : 021751-002
Boring No.: B-20
Sample No. : Bag-1
Soil Identification: (SM)g

Tested By : VJ Date: 07/24/06
Data Input By: LF Date: 07/26/06
Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	12.08	2300	15516
2	200	20.09	1000	6746
3	300	28.09	1030	6948
4	400	36.10	1050	7083
5				

Moisture Content (%) (MCi)	4.08
Wet Wt. of Soil + Cont. (g)	235.88
Dry Wt. of Soil + Cont. (g)	228.98
Wt. of Container (g)	59.66
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
6200	**22.5**	**94**	**730**	**5.79**	**21.0**



SOIL RESISTIVITY TEST
DOT CA TEST 532 / 643

Leighton

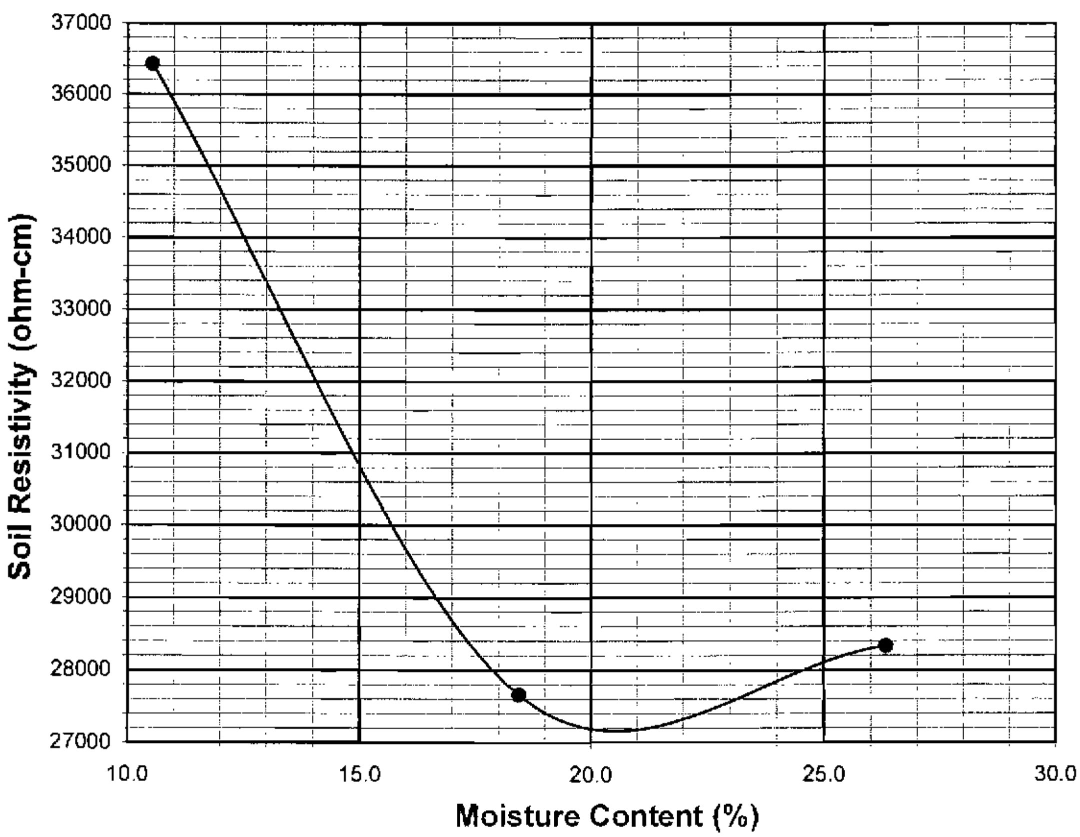
Project Name: Lewis EJA Rialto
Project No. : 021751-003
Boring No.: B-24
Sample No. : Bag-1
Soil Identification: (GP-GM)s

Tested By : VJ Date: 07/18/06
Data Input By: LF Date: 07/21/06
Depth (ft.) : 0-5

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	100	10.54	5400	36428
2	200	18.44	4100	27659
3	300	26.33	4200	28333
4				
5				

Moisture Content (%) (MCi)	2.64
Wet Wt. of Soil + Cont. (g)	200.26
Dry Wt. of Soil + Cont. (g)	196.63
Wt. of Container (g)	59.34
Container No.	
Initial Soil Wt. (g) (Wt)	1300.00
Box Constant	6.746
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532 / 643	
27200	**20.5**	**106**	**51**	**5.32**	**20.8**



APPENDIX D

APPENDIX D

LEIGHTON AND ASSOCIATES, INC.

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

Table of Contents

1.0 General

1.1 Intent: These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record: Prior to commencement of work, the owner shall employ the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The

Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing: Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation: In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching: Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas: All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General: Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import: If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers: Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning: Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).

4.3 Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes: In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.

4.5 Compaction Testing: Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing: Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 Safety: The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 Bedding and Backfill: All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.3 Lift Thickness: Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

7.4 Observation and Testing: The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

APPENDIX L

WQMP DCV CALCULATIONS

Miro Way Industrial (Scheme 24) - Design Capture Volume (DCV) Calculations

BMP 1 DMA 1

Total Site (SF)	Total Pervious Area (SF)	Total Impervious Area (SF)	Imp% (Total Site)	Rainfall depth (2 yr - 1 hr)
128502	30414	98088	0.76	0.662

Runoff Coefficient (RC)	6 hours precipitation (P6)	Design Capture Volume (ft^3)
0.56	0.980	11496

BMP 2 DMA 2

Total Site (SF)	Total Pervious Area (SF)	Total Impervious Area (SF)	Imp% (Total Site)	Rainfall depth (2 yr - 1 hr)
342381.6	47,756	294625.6	0.86	0.662

Runoff Coefficient (RC)	6 hours precipitation (P6)	Design Capture Volume (ft^3)
0.68	0.980	37068

BMP 3 DMA 3

Total Site (SF)	Total Pervious Area (SF)	Total Impervious Area (SF)	Imp% (Total Site)	Rainfall depth (2 yr - 1 hr)
369388.8	37,308	332080.8	0.90	0.662

Runoff Coefficient (RC)	6 hours precipitation (P6)	Design Capture Volume (ft^3)
0.73	0.980	43169

BMP 4 DMA 4

Total Site (SF)	Total Pervious Area (SF)	Total Impervious Area (SF)	Imp% (Total Site)	Rainfall depth (2 yr - 1 hr)
64468.8	25889	38579.8	0.60	0.662

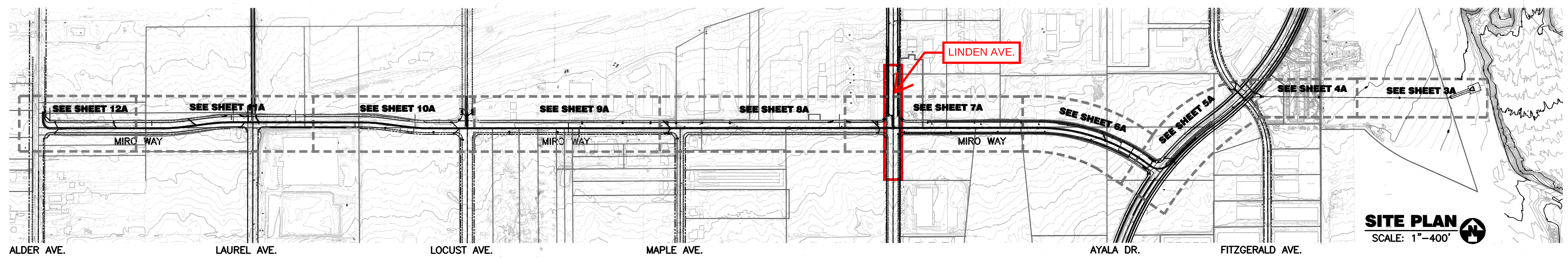
Runoff Coefficient (RC)	6 hours precipitation (P6)	Design Capture Volume (ft^3)
0.41	0.980	4215

APPENDIX M

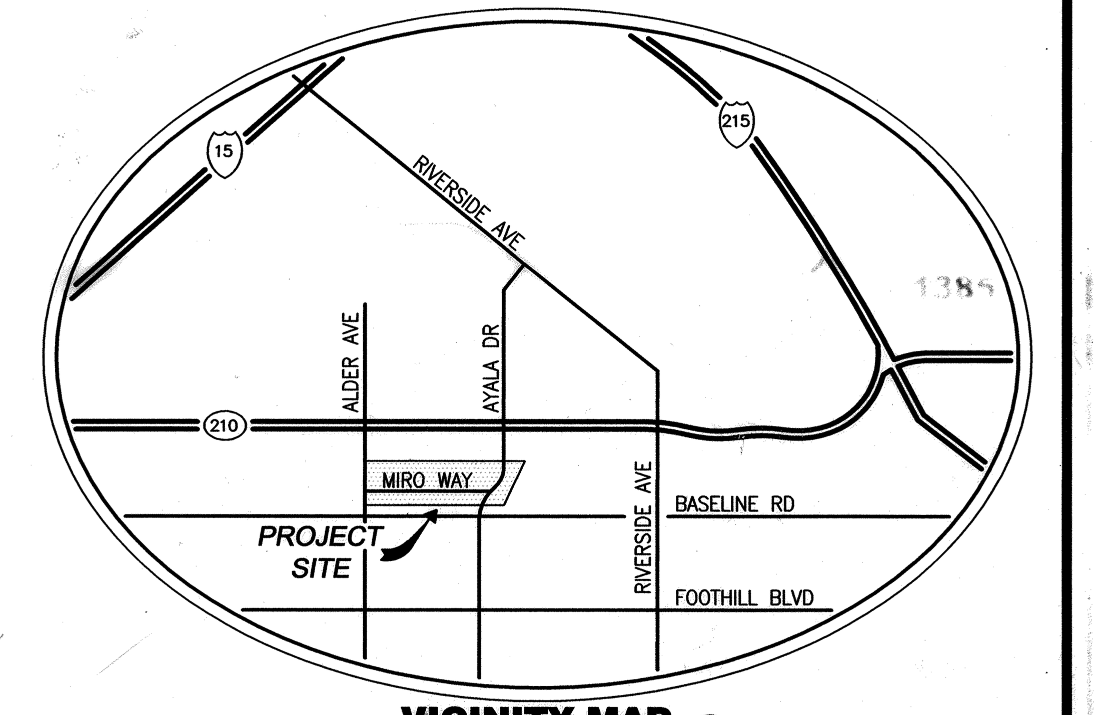
STORM DRAIN AS-BUILT

CITY OF RIALTO

MIRO WAY STORM DRAIN IMPROVEMENT PLAN



SITE PLAN
SCALE: 1"–400'



VICINITY MAP
NTS

GENERAL STORM DRAIN NOTES

1. THE CONSTRUCTION OF ALL IMPROVEMENTS SHALL CONFORM TO THESE PLANS, THE REQUIREMENTS OF THE CITY OF RIALTO STANDARD SPECIFICATIONS AND TO THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION "GREEN BOOK", LATEST EDITION.
2. CONSTRUCTION PERMITS SHALL BE OBTAINED FROM THE CITY OF RIALTO PUBLIC WORKS DEPARTMENT PRIOR TO START OF ANY WORK WITHIN THE CITY LIMITS.
3. STATIONING REFERS TO THE CENTERLINES OF STORM DRAINS EXCEPT WHERE NOTED OTHERWISE.
4. CONSTRUCTION INSPECTION WILL BE PERFORMED BY THE CITY OF RIALTO. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS AND SHALL NOTIFY THE CITY INSPECTORS (909) 820-2532 HOURS PRIOR TO STARTING FOR CONSTRUCTION AND PRIOR TO REQUIRING INSPECTION.
5.
6. ALL EXPOSED CONCRETE SURFACES SHALL CONFORM IN GRADE, COLOR AND FINISH TO ALL ADJOINING CURBS AND SIDEWALK.
7. STATIONING FOR LATERALS AND CONNECTOR PIPE REFER TO THE CENTERLINE – CENTERLINE INTERSECTION STATION.
8. STATE LAW (SB 3019) REQUIRES THE CONTRACTOR TO CONTACT UNDERGROUND SERVICE ALERT AND OBTAIN AN IDENTIFICATION NUMBER PRIOR TO THE ISSUANCE OF THE CITY'S ENCROACHMENT PERMIT. THE CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT TWO FULL WORKING DAYS (48 HOURS MINIMUM) IN ADVANCE OF ANY CONSTRUCTION ACTIVITIES, INCLUDING PAVEMENT REMOVAL, EXCAVATION AND AC OVERLAY, WHICH COULD AFFECT ANY UNDERGROUND UTILITY.
9. ALL ELEVATIONS SHOWN ARE IN FEET AND DECIMALS THEREOF BASED ON CITY OF RIALTO BENCH MARK AND DATUM.
10. ELEVATIONS OF UTILITIES ARE APPROXIMATE UNLESS OTHERWISE NOTED.
11. IF ANY EXISTING UTILITIES OR ANY OTHER FACILITIES CONFLICT WITH THE PROPOSED IMPROVEMENTS, WORK SHALL STOP AND THE ENGINEER OF RECORD NOTIFIED IMMEDIATELY.
12. CONTRACTOR SHALL POTHOLE AT TIE-IN STATIONS AND AT ANY OTHER POINTS OF POTENTIAL CONFLICTS WITH UNDERGROUND FACILITIES BEFORE STARTING CONSTRUCTION.
13. BACKFILL MATERIAL TO HAVE A SAND EQUIVALENT (S.E.) OF 30 (MIN.) AND MINIMUM COMPACTION OF 90%. ALL TRENCH BACKFILL SHALL BE DONE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS OF THE CITY OF RIALTO AND STANDARD DRAWING NO. 64.
14. BACKFILL TO BE IN 8" LIFTS IF TRENCH BOTTOM AND SIDES HAVE A S.E. LESS THAN 20.
15. NO TRENCH MAY BE LEFT OPEN OVERNIGHT UNLESS AUTHORIZED IN WRITING BY THE CITY ENGINEER.
16. TRENCHES SHALL HAVE SHAPED BEDDING WITH THE TOP 12" OVER PIPE BEING COLORED SAND, UNLESS OTHERWISE NOTED ON PLANS. COLOR TO BE APPROVED BY THE FIELD INSPECTOR.
17. NO CONCRETE SHALL BE PLACED UNTIL THE FORMS AND REINFORCING STEEL HAS BEEN PLACED, INSPECTED AND APPROVED.
18. EXISTING UNDERGROUND UTILITIES ARE AS PER THE AVAILABLE RECORDS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE ACTUAL LOCATION AND ELEVATION IN THE FIELD.
19. THE WALL AND FACES OF ALL EXCAVATIONS GREATER THAN FIVE (5) FEET IN DEPTH SHALL BE EFFECTIVELY GUARDED BY A SHORING SYSTEM, SLOPING OF THE GROUND OR OTHER EQUIVALENT MEANS. TRENCHES LESS THAN FIVE (5) FEET IN DEPTH SHALL ALSO BE GUARDED WHEN EXAMINATION INDICATES HAZARDOUS GROUND MOVEMENT MAY BE EXPECTED.
20. THE CONTRACTOR(S) SHALL ALSO OBTAIN A PERMIT TO PERFORM EXCAVATION OR TRENCH WORK AS DESCRIBED IN NOTE 18 ABOVE FROM CAL/OSHA.
21. "V" IS THE DEPTH OF INLET OF CATCH BASINS MEASURED FROM THE TOP OF CURB TO INVERT OUTLET OF CONNECTOR PIPE.
22. THE CONTRACTOR SHALL DETERMINE THE TRUE LOCATION OF ANY UNDERGROUND UTILITY PRIOR TO LAYING ANY LINES WHICH ARE TO CONNECT TO THE EXISTING SEWER OR STORM DRAINS.
23. IF CAST IN PLACE PIPE (CIPP) WERE USED IN LIEU OF R.C.P. A SOILS REPORT MUST BE SUBMITTED TO THE CITY OF RIALTO.
24. CATCH BASINS SHALL BE LOCATED SO THAT LOCAL DEPRESSIONS SHALL BEGIN AT EXISTING CURB RETURN OR JOINT UNLESS OTHERWISE SPECIFIED.
25. ALL MANHOLES SHALL BE CONSTRUCTED 6" BELOW PAVEMENT GRADE AND BROUGHT TO FINISH GRADE BY THE PAVING CONTRACTOR AFTER PAVEMENT IS IN PLACE. ELEVATIONS SHOWN ON PROFILE AS TOP OF MANHOLE (RIM) ARE APPROXIMATE ONLY AND NOT TO BE USED FOR SETTING OF MANHOLE RING.
26. IMMEDIATELY FOLLOWING REMOVAL OF EXISTING PAVEMENT OR DIKE OR CURB AND/OR GUTTER, THE CONTRACTOR SHALL DILIGENTLY PURSUE THAT PORTION OF WORK TO COMPLETION.

(CONTINUED) GENERAL STORM DRAIN NOTES

27. NOTICE TO CONTRACTOR: THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. APPROVAL OF THESE PLANS BY THE CITY OF RIALTO DOES NOT CONSTITUTE A REPRESENTATION AS TO THE ACCURACY OR COMPLETENESS OF THE LOCATION OR EXISTENCE OR NON-EXISTENCE OF ANY UNDERGROUND UTILITY PIPES OR STRUCTURES WITHIN THE LIMITS OF THIS PROJECT. THE CONTRACTOR IS REQUIRED TO TAKE ALL DUE PRECAUTIONARY MEANS TO PROTECT THE UTILITY LINES NOT OF RECORD OR NOT SHOWN ON THESE PLANS.
28. IF DURING CONSTRUCTION, GROUND WATER IS ENCOUNTERED, A SYSTEM APPROVED BY THE CITY ENGINEER SHALL BE INSTALLED TO DEWATER SAID AREA AT THE DIRECTION OF THE SOILS ENGINEER.
29. NO TRENCH BACKFILL SHALL TAKE PLACE WITHOUT PRIOR APPROVAL OF THE CITY'S INSPECTOR.
30. AS-BUILT PLANS SHALL BE PROVIDED TO THE CITY BY THE CONTRACTOR.
31. ALL CATCH BASINS WITHIN THE TRACT BOUNDARY WHERE STORM WATER IS AN INFLOW TO THE BASIN SHALL HAVE A WATER QUALITY INSERT INSTALLED AS PART OF THE CATCH BASIN. THE INSERT SHALL BE A FLO-GAR +PLUS CATCH BASIN FILTER INSERT BY KRISTAR ENTERPRISES INC. OR APPROVAL EQUAL.

CONSTRUCTION INSPECTION HOURS
7:00 A.M. TO 5:00 P.M. MONDAY THROUGH THURSDAY

PRIVATE ENGINEER'S NOTICE TO CONTRACTOR

1. ALL AVAILABLE RECORDS FROM THE CITY AND UTILITY COMPANIES INVOLVED HAVE BEEN INVESTIGATED AND ALL KNOWN UTILITY CONDUITS AND SUBSTRUCTURES ARE SHOWN HEREON. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE ALL UTILITY CONDUITS AND SUBSTRUCTURES SHOWN OR NOT SHOWN ON THESE PLANS BY "POT HOLING" PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL BEAR THE TOTAL EXPENSE OF REPAIR AND/OR REPLACEMENT OF SAID UTILITY CONDUITS AND SUBSTRUCTURES DAMAGED BY HIS OPERATION IN CONNECTION WITH THE LIMITS OF THIS PROJECT. THE CONTRACTOR IS TO NOTIFY THE ENGINEER OF OR RECORD IMMEDIATELY WITH ANY DISCREPANCIES. COMMENCEMENT OF WORK INDICATES ACCEPTANCE OF ALL EXISTING UTILITIES SHOWN OR NOT SHOW BY THE CONTRACTOR.
2. EXISTING UTILITIES SHALL BE MAINTAINED IN-PLACE BY THE CONTRACTOR, UNLESS OTHERWISE NOTED. RELOCATION OR REMOVAL OF ANY EXISTING UTILITIES NOT COVERED BY THESE PLANS SHALL BE PERFORMED BY OR UNDER THE DIRECTION OF THE RESPECTIVE UTILITY OWNERS AT THE EXPENSE OF THE DEVELOPER.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PRESERVATION OF ALL, IF ANY, EXISTING SURVEY MONUMENTS.
4. THE CONTRACTOR SHALL POSSESS A VALID STATE CONTRACTOR'S LICENSE AND SHALL BE REQUIRED TO POSSESS A VALID CITY BUSINESS LICENSE WHILE PERFORMING WORK ON THIS PROJECT.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL REQUIRED PERMITS PRIOR TO COMMENCEMENT OF ANY WORK COVERED BY THESE PLANS.
6. THE CONTRACTOR(S) AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING THE SAFETY OF ALL PERSONS AND PROPERTY. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO WORKING HOURS.
7. THE CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE OWNER AND ENGINEER OF RECORD HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPT FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER AND/OR THE ENGINEER OF RECORD.
8. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL DIMENSIONS AND CONDITIONS SHOWN HEREON AT THE JOB SITE PRIOR TO ANY CONSTRUCTION. THE ENGINEER OF RECORD SHALL BE NOTIFIED OF ANY DISCREPANCIES. REVISIONS TO THE PLAN SHALL BE APPROVED BY THE ENGINEER IN WRITING PRIOR TO IMPLEMENTATION.
9. UNAUTHORIZED CHANGES & USES: THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CITY AGENCY

CITY OF RIALTO
ROBERT G. EISENBEISZ
335 W. RIALTO AVE.
RIALTO, CA 92376

TEL: 909.421.4986
FAX: 909.421.7204

GEOTECHNICAL ENGINEER

LEIGHTON AND ASSOCIATES, INC
A LEIGHTON GROUP COMPANY
10532 ACACIA STREET SUITE B-6
RANCHO CUCAMONGA, CA, 91730

TEL: 909.484.2205
FAX: 909.484.2170

CIVIL ENGINEER

TTG
TMAD TAYLOR & GAINES
901 VIA PIEMONTE SUITE 400
ONTARIO, CA 91764

TEL: 909.477.6915
FAX: 909.477.6916

SURVEYOR'S NOTE:

THE BEARING SHOWN HEREON ARE BASED ON THE LINE BETWEEN THE C 1/4 CORNER & S 1/4 CORNER OF SECTION 34, T1N, R5W, SBM, BEING NORTH 00°03'40" WEST AS SHOWN ON PARCEL MAP NO. 5020, PMB 47/74-76, [R1], RECORDS OF SAN BERNARDINO COUNTY

UTILITES

TIME WARNER	888.892.2253
AT&T UVERSE	888.511.1885
SOUTHERN CALIFORNIA EDISON	800.684.8123
SOUTHERN CALIFORNIA GAS COMPANY	800.427.2000
AT&T	888.507.8853
EDCO DISPOSAL	909.877.1596
VEOLIA – WATER	909.820.0400
VEOLIA – SEWER	909.820.0400
WEST VALLEY WATER DISTRICT	909.875.1804

EMERGENCY NUMBERS

FIRE/MEDICAL EMERGENCY	909.820.2501
POLICE	909.820.2550
BUILDING & SAFETY	909.820.2505

TOPOGRAPHY SURVEY

DON READ CORPORATION
501 MERCURY LANE
BREA, CA 92821

TEL: 714.529.9599
FAX: 714.529.2537

DATE FLOWN: 11-17-2004
NUMBER: 04138

LIST OF ABBREVIATIONS

APN	ASSESSORS PARCEL NUMBER
BC	BEGIN CURVE
CB	CATCH BASIN
℄	CENTERLINE
C/G	CURB AND GUTTER
CFS	CUBIC FEET PER SECOND
CONC	CONCRETE
DW	DOMESTIC WATER
DWG	DRAWING
EC	END OF CURVE
ESMT	EASEMENT
ECR	END CURB RETURN
ELEV	ELEVATION
EP	EDGE OF PAVEMENT
FPS	FEET PER SECOND
FG	FINISH GRADE
F.O.H.	FRONT OF HEADWALL
FL	FLOWLINE ELEVATION
FS	FINISH SURFACE
FT	FEET
GB	GRADE BREAK
HORIZ	HORIZONTAL
INT	INTERSECTION
L	LENGTH
LF	LINEAR FEET
LT	LEFT
MAX	MAXIMUM
MH	MANHOLE
MIN	MINIMUM
NO.	NUMBER
NTS	NOT TO SCALE
OC	ON CENTER
O.C.	ON CURVE
PI	POINT OF INTERSECTION
PRC	POINT OF REVERSE CURVATURE
PROP	PROPOSED
PVI	POINT OF VERTICAL INTERSECTION
R	RADIUS
RCP	REINFORCED CONCRETE PIPE
RET	RETAINING
RT	RIGHT
R/W	RIGHT OF WAY
SD	STORM DRAIN
SF	SQUARE FEET
SS	SANITARY SEWER
ST	STREET
STA	STATION
STD	STANDARD
STR	STRUCTURE
TC	TOP OF CURB
TYP	TYPICAL

NOTE:

1. STORM DRAIN PIPE BEDDING PER L.A. COUNTY DEPARTMENT OF PUBLIC WORK STANDARD PLAN 3080-2, CASE 3, PER DETAIL SEE SHEET 15
2. STORM DRAIN PIPE D-LOADS BASED UPON BEDDING CASE 3 & SOIL DENSITY OF 140 PCF PER L.A. COUNTY FLOOD CONTROL DISTRICT STRUCTURAL DESIGN MANUAL

NO WORK TO BE COMPLETED WITHIN SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT (SBCFCD) RIGHT OF WAY UNTIL SUCH TIME THAT SBCFCD HAS REVIEWED AND APPROVED THE PROPOSED CONNECTION AND ISSUED A SBCFCD SIGNED PERMIT.

LEGEND

— — —	ROADWAY CENTERLINE
— — —	PROPERTY – R/W LINE
— · · —	PROP. HYDRAULIC GRADE LINE
300+00	PIPELINE CENTERLINE STATION
— W —	PROP. DOMESTIC WATER LINE
— S —	PROP. SANITARY SEWER LINE
—(CS)—	CONVEYANCE SYSTEM
	STORM DRAIN LINE
	SEWER MANHOLE
	STORM SEWER MANHOLE
	SAWCUT/TRENCHING AREA

SHEET INDEX

TITLE SHEET	1A
DETAIL SHEET	2
LINE – "C" STA 9+85.44 TO 17+50	3A
LINE – "C" STA 17+50 TO 24+00	4A
LINE – "C" STA 24+00 TO 32+00	5A
LINE – "C" STA 32+00 TO 40+50	6A
LINE – "C" STA 40+50 TO 51+50	7A
LINE – "C" STA 51+50 TO 63+00	8A
LINE – "C" STA 63+00 TO 74+50	9A
LINE – "C" STA 74+50 TO 84+50	10A
LINE – "C" STA 84+50 TO 95+50	11A
LINE – "C" STA 95+50 TO 101+91.64	12A
LATERAL "C-6" TO "C-9"	13A
LATERAL "C-10" TO "C-15"	14A
LATERAL "C-16" TO "C-20", "C-23"	15A
LATERAL "C-1" TO "C-5", "C-24"	16A

BASIS OF BEARINGS

THE BEARINGS SHOWN HEREON ARE BASED ON THE LINE BETWEEN THE C 1/4 CORNER & S 1/4 CORNER OF SECTION 34, T1N, R5W, SBM, BEING NORTH 00°03'40" WEST AS SHOWN ON PARCEL MAP NO. 5020, PMB 47/74-76, [R1], RECORDS OF SAN BERNARDINO COUNTY

NOTE:

ALL JUNCTION STRUCTURE PER SPPWC STD PLAN 332-2 ARE CASE 1.

NOTE:

CONTRACTOR TO VERIFY QUANTITIES.

CONSTRUCTION NOTES

		QTY.
1	CONSTRUCT 24" REINFORCED CONCRETE PIPE (RCP)	705 LF
2	CONSTRUCT 30" REINFORCED CONCRETE PIPE (RCP)	208 LF
3	CONSTRUCT 18" REINFORCED CONCRETE PIPE (RCP)	122 LF
4	CONSTRUCT 42" REINFORCED CONCRETE PIPE (RCP)	112 LF
5	CONSTRUCT 48" REINFORCED CONCRETE PIPE (RCP)	404 LF
6	CONSTRUCT 54" REINFORCED CONCRETE PIPE (RCP)	48 LF
7	CONSTRUCT 60" REINFORCED CONCRETE PIPE (RCP)	1619 LF
8	CONSTRUCT 66" REINFORCED CONCRETE PIPE (RCP)	932 LF
9	CONSTRUCT 84" REINFORCED CONCRETE PIPE (RCP)	2134 LF
10	CONSTRUCT 78" REINFORCED CONCRETE PIPE (RCP)	4214 LF
11	NOT IN USE	
12	CONSTRUCT 30" CSP RISER PIPE 14 GA. PER DETAIL ON SHEET 5A	2 EA
13	CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 332-2 (PIPE ø ≤ 24")	10 EA
14	INSTALL CATCH BASIN FILTER INSERT PER KRISTAR ENTERPRISES PRODUCTS, TYPE FLO-GAR + PLUS	21 EA
15	CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")	17 EA
16	CONSTRUCT MANHOLE PER SPPWC STD PLAN 322-2 (LARGE SIDE INLET)	5 EA
17	CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD PLAN 300-3 WITH 4" LOCAL DEPRESSION PER SPPWC STD PLAN 313-3 CASE A "W" AND "V" AS INDICATED ON DRAWING	21 EA
18	CONSTRUCT MANHOLE PER SPPWC STD PLAN 321-2 (PIPE 33" ≥ ø)	2 EA
19	CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 331-3 (INLET PIPE ø >24")	2 EA
20	CONSTRUCT MANHOLE SHAFT SAFETY LEDGE PER SPPWC STD PLAN 330-2	4 EA
21	CONSTRUCT ENDWALL AND WARPED WINGWALLS PER CALTRANS 2010 STANDARD PLAN D86B-SEE SHEET 2	1 EA
22	INSTALL GROUT RIP-RAP PER DETAILS SEE SHEET 2	3395 CFT
23	CONSTRUCT A BRICK AND MORTAR PLUG PER DETAILS SEE SHEET 15	9 EA
24	SAWCUT AC PAVEMENT	4350 LF
25	REPLACE PAVEMENT PER CITY OF RIALTO STD. NO. 64	16154 SF
26	CONSTRUCT CONCRETE COLLAR PER SPPWC STD PLAN 380-4	11 EA
27	REMOVE BRICK AND MORTAR PLUG AND JOIN EXISTING SD PIPE	0 EA
28	INSTALL SLOPED PROTECTION BARRIER PER SPPWC STD PLAN 360-2	3 EA
29	INSTALL A MODIFIED TRANSITION STRUCTURE PER SPPWC STD PLAN 340-2, 12A	1 EA
30	INSTALL 5' HIGH CHAIN LINK FENCE PER SPPWC STD PLAN 600-3	60 LF
31	CONSTRUCT GRATING CATCH BASIN PER SPPWC STD PLAN 304-3, V=7.5'	1 EA
32	CONSTRUCT PIPE ANCHORS PER SPPWC STD PLAN 221-2.	2 EA
33	CONSTRUCT INTERIM CATCH BASIN CONDITION, SEE DETAIL ON SHEET 16.	6 EA
34	REMOVE AND DISPOSE OF INTERFERING PORTIONS OF EXISTING WATER LINE	650 LF
35	CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 340-2	1 EA

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
CALL:TOLL FREE
1-800
227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED QUANTITIES AND ADDED CONSTRUCTION NOTES 12, 29 AND 35. REVISED SHEET INDEX NUMBER.	RG	06/10/2015

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER
CHARLES WILBUR LOCKMAN
No. 42485
Exp. 03/31/16
CIVIL
STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — DATE 7/1/2015
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — DATE 7/2/15
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — DATE 7/9/15

TTG
TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com
Project No. 0011.103.00

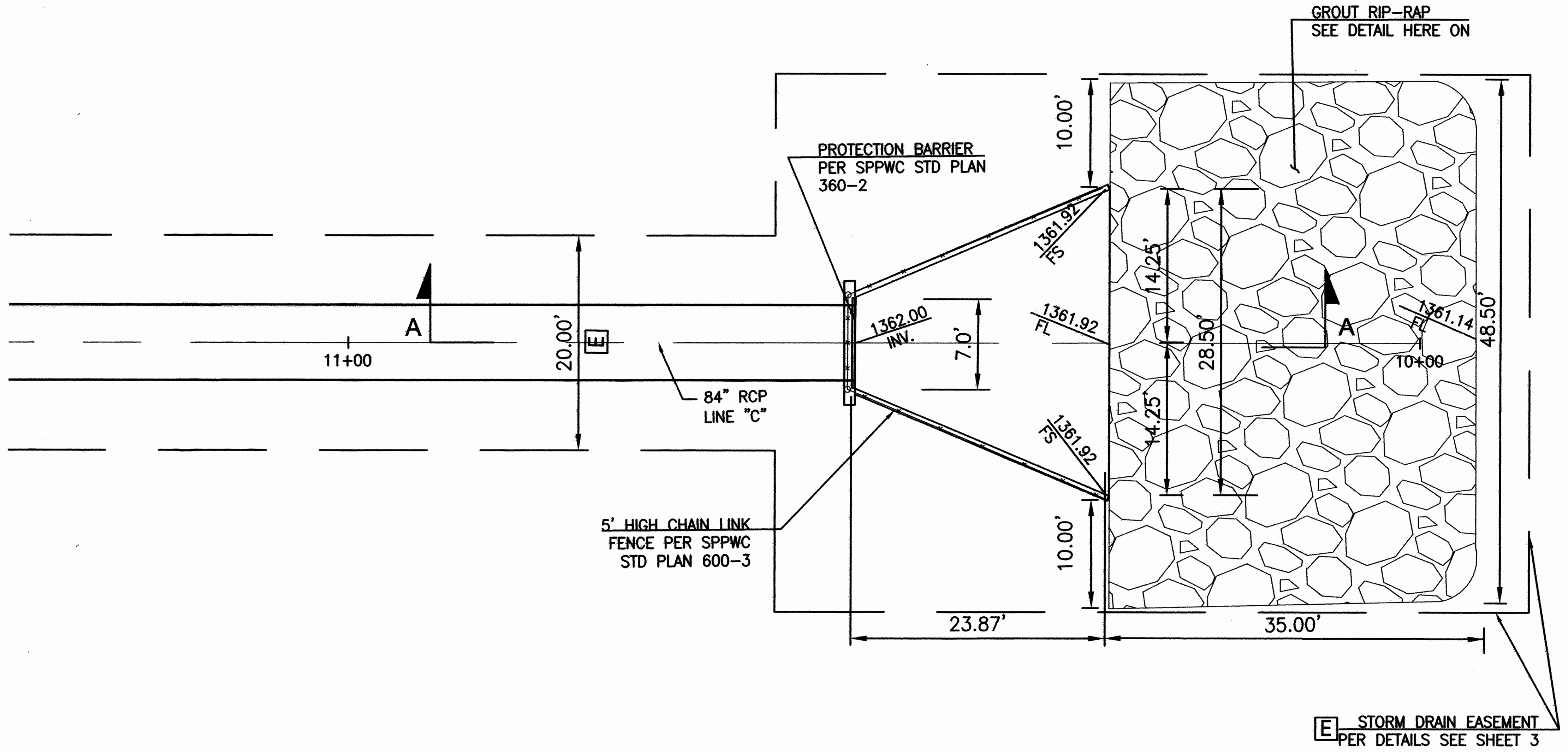
BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN
FROM ALDER AVENUE TO CACTUS BASIN
TITLE SHEET

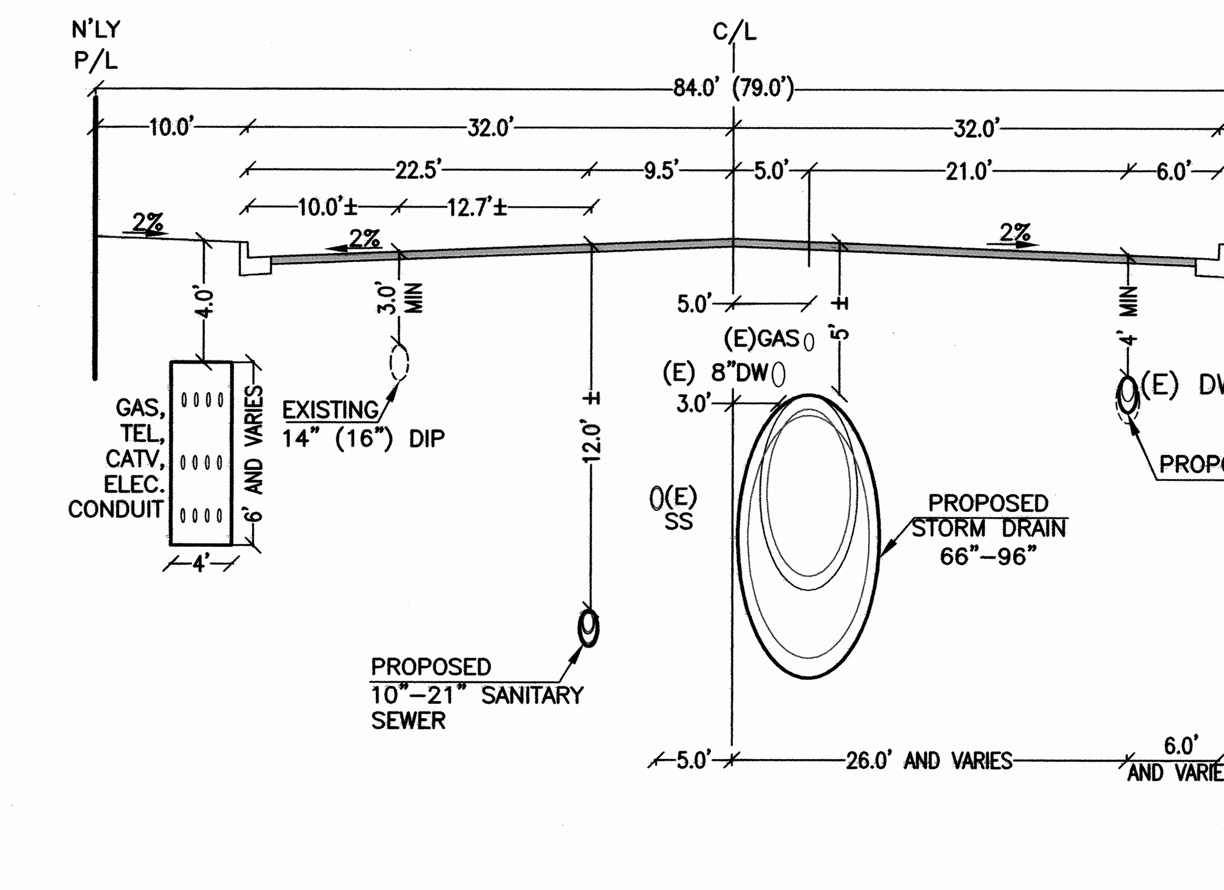
1A OF 16 SHEETS

FOR: CITY OF RIALTO
PLAN No. ______

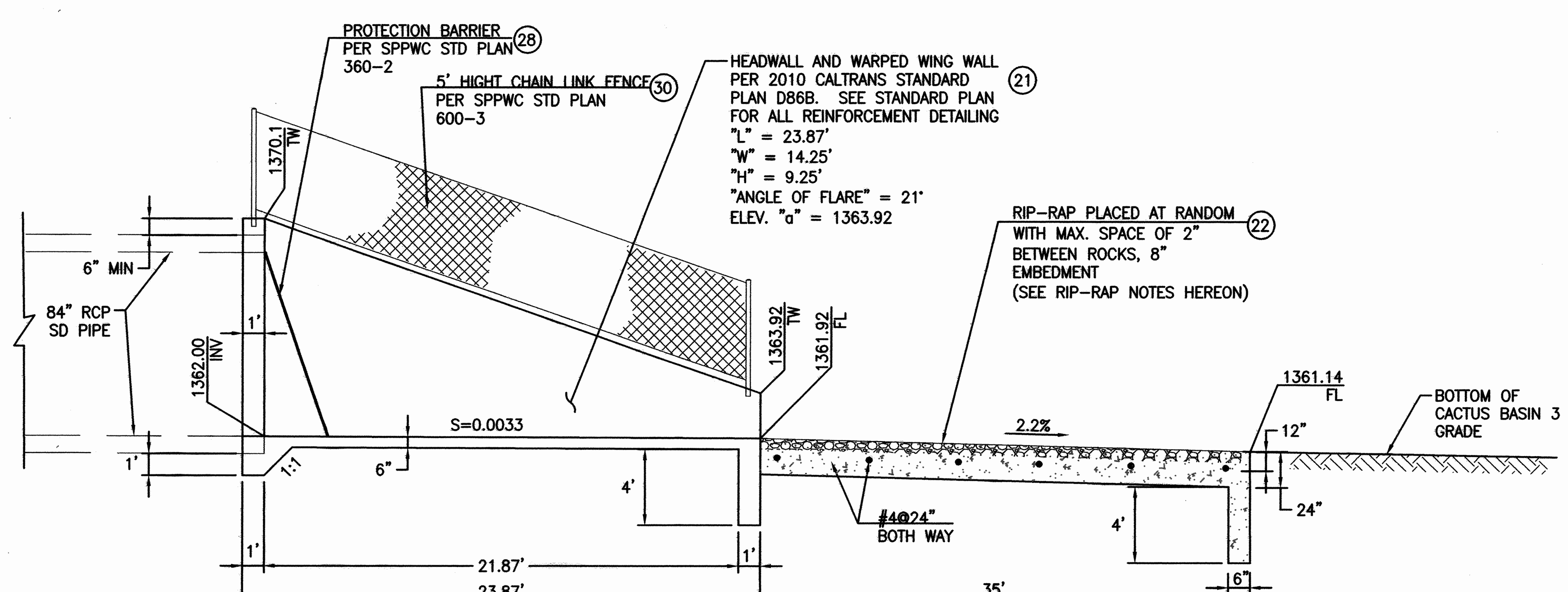
N:\60.CAD\TMAD Projects\2011\0011.103.00\Improvement Plans\Combined SBND and TTG\Storm Drain\Revision 1\sdC1a-A-Revised.dwg – LAST PLOTTED ON Wed 07/01/15 – 10:12AM BY cmoua



OUTLET STRUCTURE PLAN
SCALE: 1"=10'



TYPICAL SECTION - MIRO WAY
NOT TO SCALE
A
-



SECTION A-A
SCALE: 1"=5'

OUTLET STRUCTURE & RIP-RAP DETAILS (21)(22)
NOT TO SCALE

CONSTRUCTION NOTES

(21) CONSTRUCT ENDWALL AND WARPED WINGWALLS PER CALTRANS 2010 STANDARD PLAN D86B SEE SHEET 2

(22) INSTALL GROUT RIP-RAP PER DETAILS SEE DETAILS HEREON

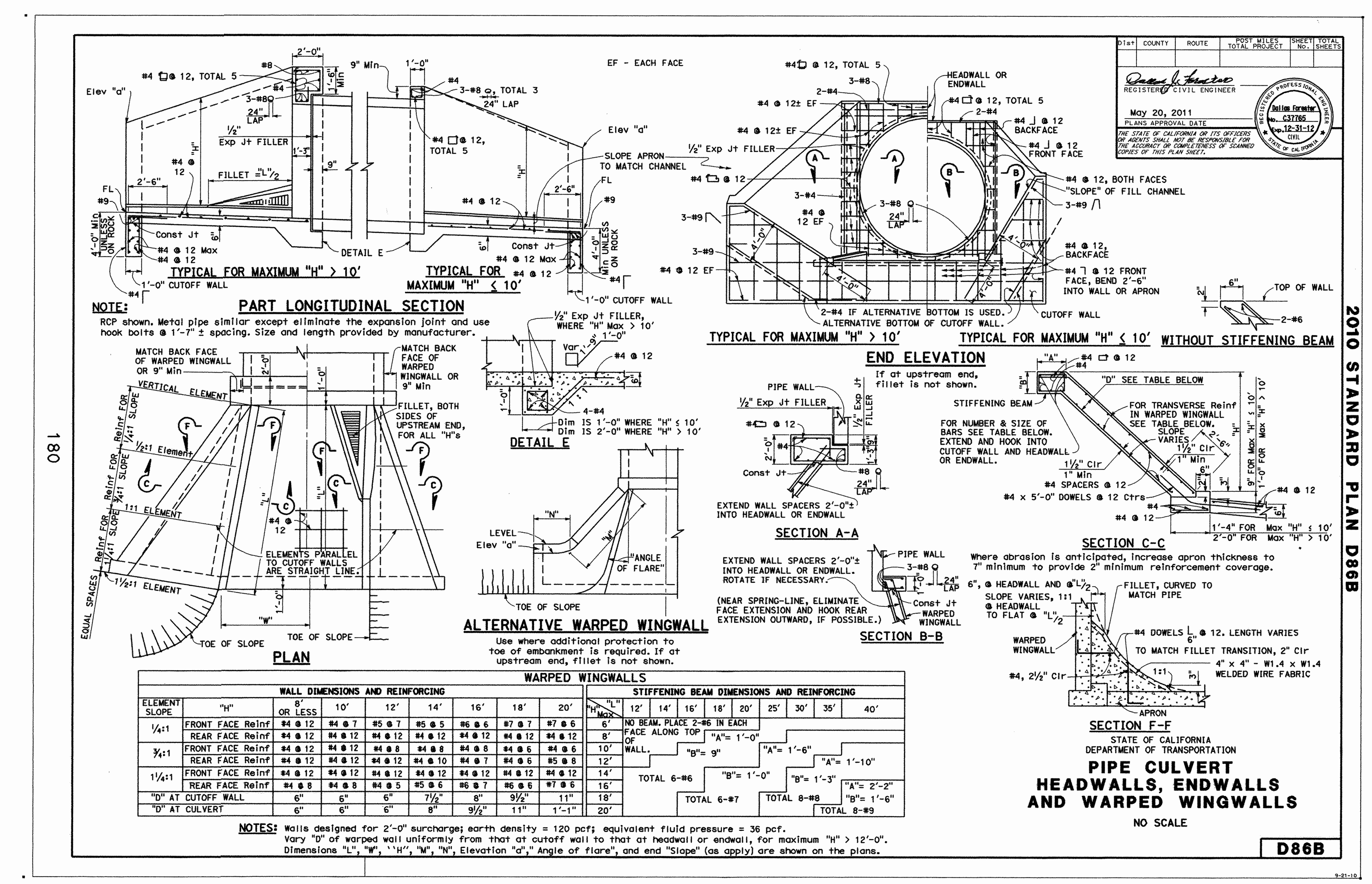
(28) INSTALL SLOPED PROTECTION BARRIER PER SPPWC STD PLAN 360-2

(30) INSTALL 5' HIGH CHAIN LINK FENCE PER SPPWC STD PLAN 600-3

E VARIABLE WIDTH STORM DRAIN EASEMENT TO THE CITY OF RIALTO, DETAILS SEE SHEET 3.

RIP-RAP NOTES:

1. ROCKS FOR GROUTED RIP-RAP SHALL BE GOOD QUALITY BROKEN CONCRETE AND/OR RIVER RUN ROCK. THE SMALLEST DIMENSION SHALL NOT BE LESS THAN 6 INCHES AND THE LARGES DIMENSION SHALL NOTE EXCEED 24 INCHES.
2. THERE SHALL BE A GROUT BED OF AT LEAST 2 INCHES BENEATH THE FIRST LAYER OF ROCKS. ALL THE VOIDS BETWEEN THE ROCKS SHALL BE FILLED WITH GROUT. MINIMUM SPACE BETWEEN ROCKS SHALL BE 2 INCHES.
3. SURFACE ROCKS SHALL BE IMBEDDED FROM 1/2 TO 2/3 OF THEIR MINIMUM DIMENSION.
4. CONCRETE MAY BE SUBSTITUTED FOR GROUT



Return to Table of Contents

(21)

UNDERGROUND SERVICE ALERT
CALL:TOLL FREE
1-800
227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 2/10/14 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 02/10/15 DATE
APPROVED BY:
GIANFRANCO LAURIE, ACTING CITY ENGINEER, RCE 80532 — 2-13-15 DATE

TTG
TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com
Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN
FROM ALDER AVENUE TO CACTUS BASIN
DETAIL SHEET

FOR:
CITY OF RIALTO

PLAN No.

2 OF 16 SHEETS

STORM DRAIN C/L

CURVE TABLE

CURVE	Δ	RADIUS	LENGTH	TANGENT
1	21°08'00"	90.00	33.20	16.79

STORM DRAIN EASEMENT

LINE TABLE

LINE	LENGTH	BEARING
L2	70.40'	N69°20'09"E
L3	70.40'	N69°20'09"E
L4	15.00'	N20°39'51"W
L5	15.00'	N20°39'51"W
L6	147.88'	N69°20'09"E
L7	146.89'	N69°20'09"E
L8	20.00'	S17°49'36"E

CONSTRUCTION NOTES

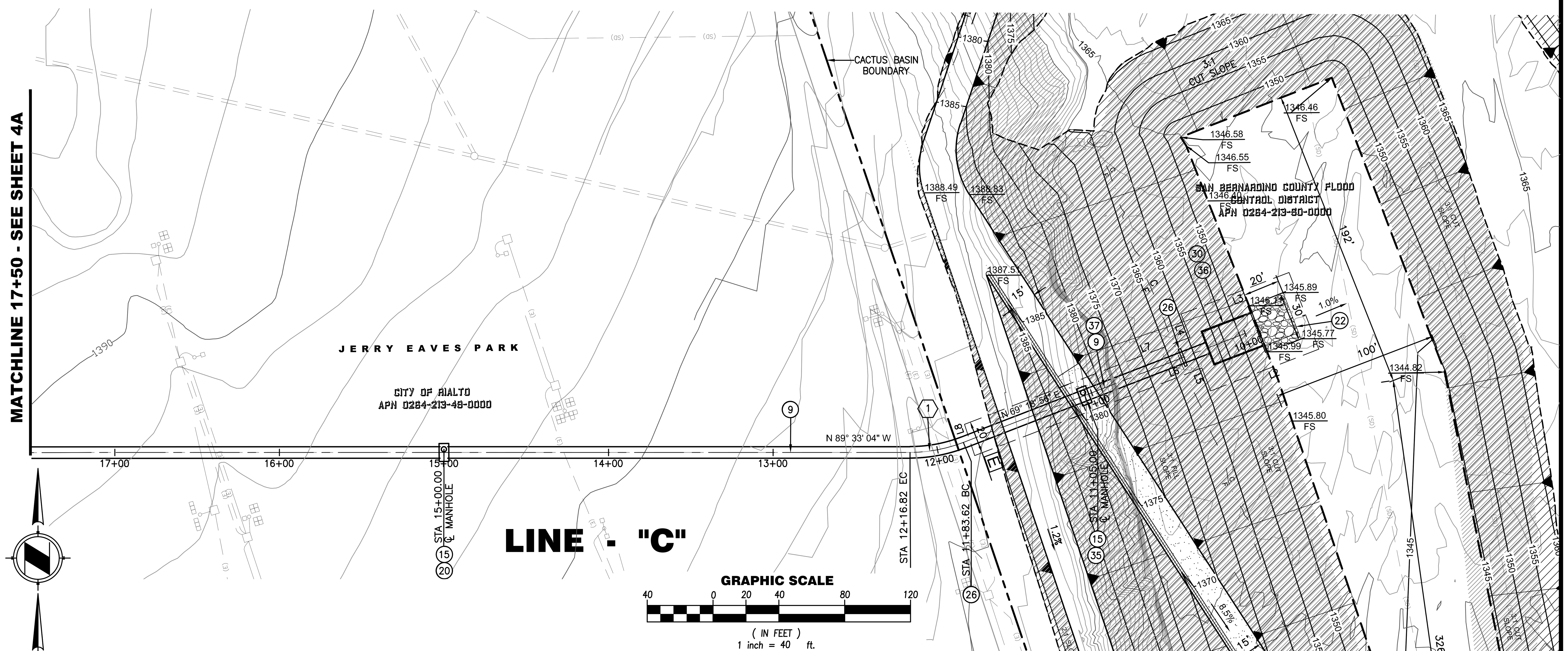
9. CONSTRUCT 84" REINFORCED CONCRETE PIPE (RCP)
15. CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")
20. CONSTRUCT MANHOLE SHAFT SAFETY LEDGE PER SPPWC STD PLAN 330-2
21. ~~CONSTRUCT ENDWALL AND WARPED WINGWALLS PER CALTRANS 2010 STANDARD PLAN D86B-SEE SHEET 2~~
22. INSTALL WxLxH=30'x20'x1' GROUT RIP-RAP PER DETAILS SEE HEREON
26. CONSTRUCT CONCRETE COLLAR PER SPPWC STD PLAN 380-4
30. 5' HIGH CHAIN LINK FENCE PER SPPWC STD PLAN 600-3
35. INSTALL MANHOLE FRAME PER SPPWC STD. PLAN 630-3 WITH GRATE OPEN MANHOLE COVER PER CALTRANS STD. PLAN RSP D77B OR EQUAL'S APPROVAL
36. CONSTRUCT ENERGY DISSIPATOR-IMPACT BASIN PER DETAILS SPPWC STD PLAN NO. 384-3, WIDTH = 22'
37. CONSTRUCT 84" RCP WITH VELOCITY CONTROL RING PER SPPWC STD PLAN 383-2

STORM DRAIN EASEMENT NOTES:

E VARIABLE WIDTH STORM DRAIN EASEMENT TO THE CITY OF RIALTO PER SEPARATE DOCUMENT

RIP-RAP NOTES:

1. ROCKS FOR GROUTED RIP-RAP SHALL BE GOOD QUALITY BROKEN CONCRETE AND/OR RIVER RUN ROCK. THE SMALLEST DIMENSION SHALL NOT BE LESS THAN 6 INCHES AND THE LARGES DIMENSION SHALL NOTE EXCEED 24 INCHES.
2. THERE SHALL BE A GROUT BED OF AT LEAST 2 INCHES BENEATH THE FIRST LAYER OF ROCKS. ALL THE VOIDS BETWEEN THE ROCKS SHALL BE FILLED WITH GROUT. MINIMUM SPACE BETWEEN ROCKS SHALL BE 2 INCHES.
3. SURFACE ROCKS SHALL BE IMBEDDED FROM 1/2 TO 2/3 OF THEIR MINIMUM DIMENSION.
4. CONCRETE MAY BE SUBSTITUTED FOR GROUT



UNDERGROUND SERVICE ALERT
CALL:TOLL FREE
1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 5/20/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — DATE

TTG
TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com
Project No. 0011.103.00

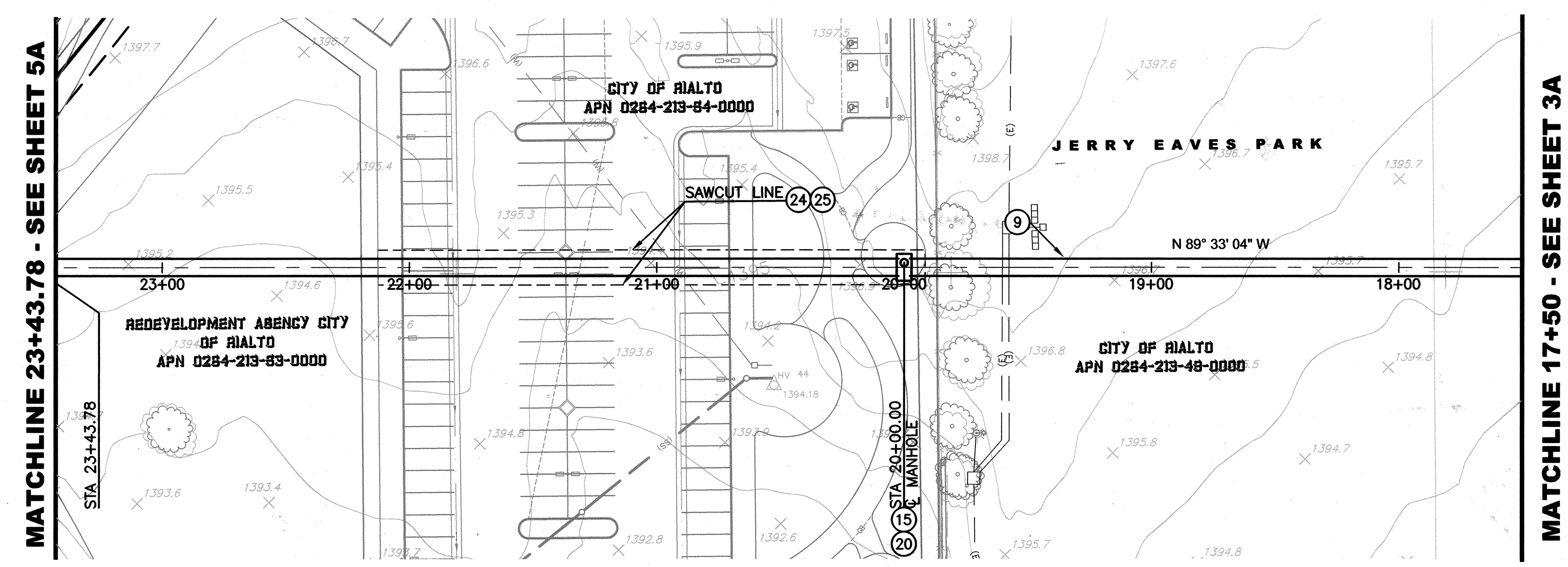
BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN FROM ALDER AVENUE TO CACTUS BASIN
LINE - C
STA. 90+00.00 ~ STA. 17+50.00

FOR: CITY OF RIALTO

PLAN No.

3B OF 16 SHEETS



CONSTRUCTION NOTES

9. CONSTRUCT 84" REINFORCED CONCRETE PIPE (RCP)
15. CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")
20. CONSTRUCT MANHOLE SHAFT SAFETY LEDGE PER SPPCW STD PLAN 330-2
24. SAWCUT AC PAVEMENT
25. REPLACE PAVEMENT PER CITY OF RIALTO STD. NO. 64

NOTE

REMOVE/REPLACE CURB, SIDEWALK, RIBBON GUTTER IN KIND AS NEEDED.

LINE - "C"

GRAPHIC SCALE
40 0 20 40 80 120
(IN FEET)
1 inch = 40 ft.

UNDERGROUND SERVICE ALERT
CALL:TOLL FREE 1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED STORM DRAIN PROFILE, DISCHARGE AND VELOCITY.		06/10/15

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 7/2/15 DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — 7/9/15 DATE

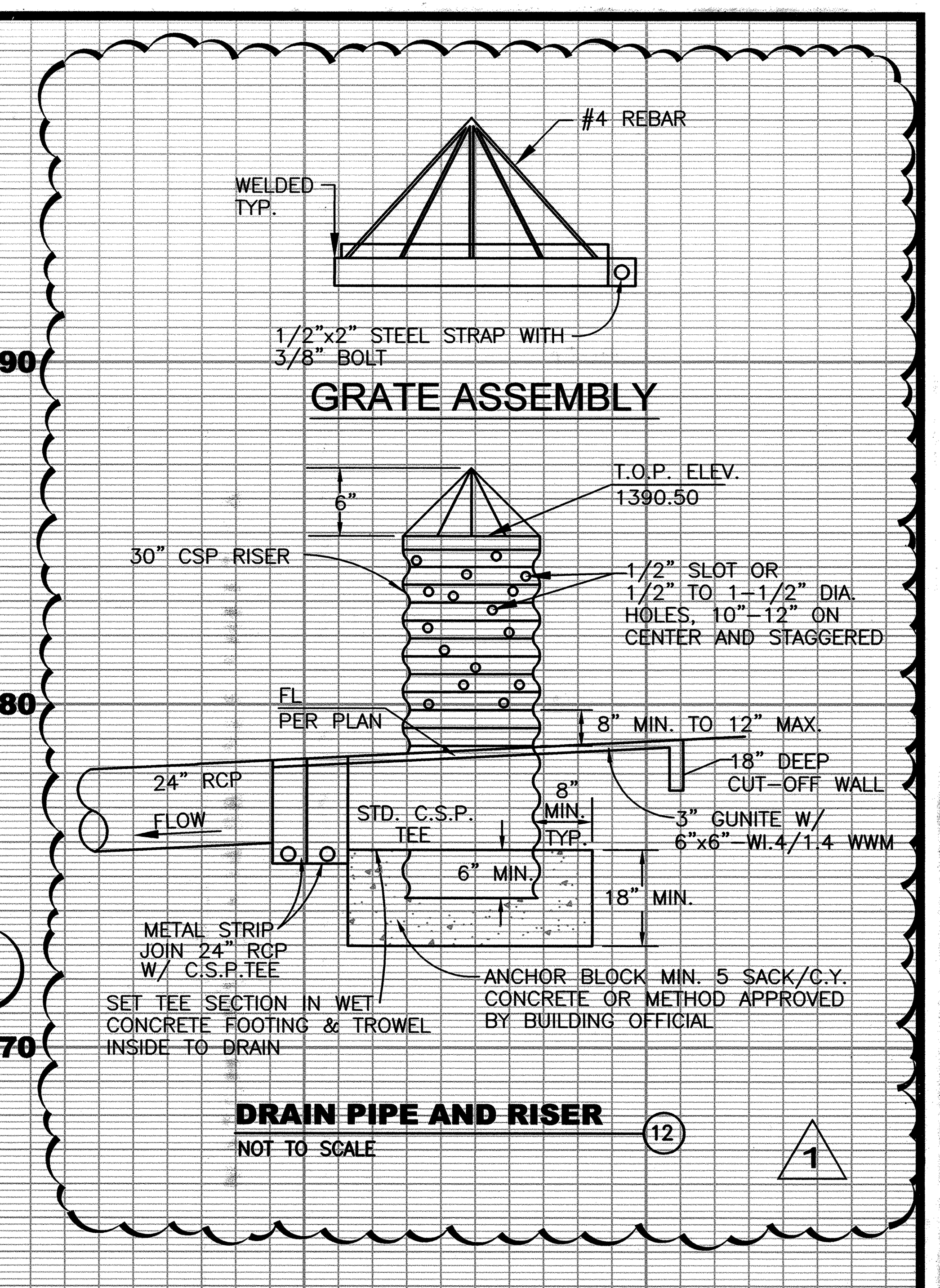
TTG TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com Project No. 0011.103.00

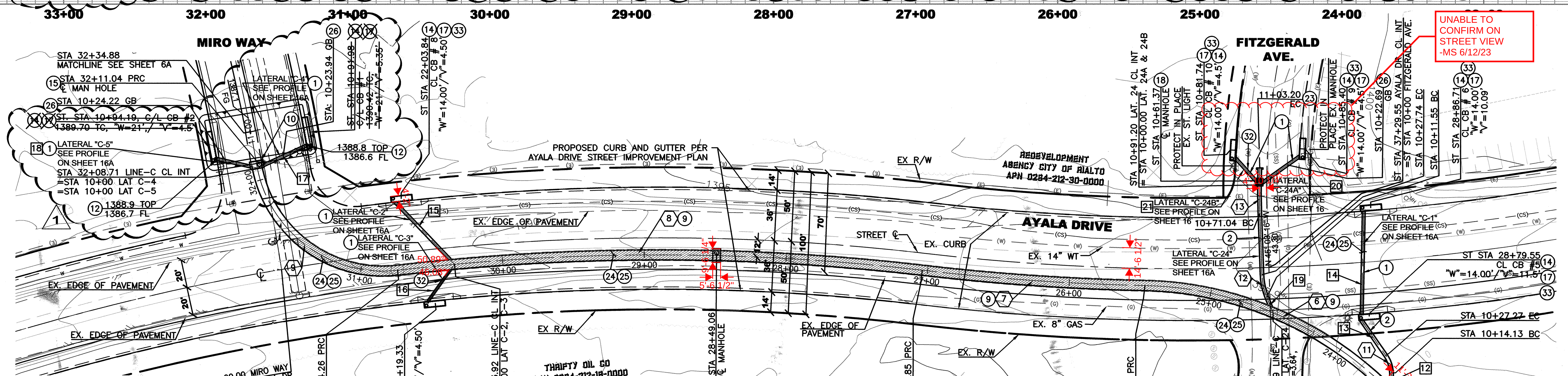
BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN FROM ALDER AVENUE TO CACTUS BASIN
LINE - "C"
STA. 17+50.00 ~ STA. 23+43.78

FOR: CITY OF RIALTO
PLAN No.

4A OF 16 SHEETS





STORM DRAIN C/L

CURVE TABLE				
NO.	DELTA	RADIUS	LENGTH	TANGENT
6	42° 22' 40"	250'	184.91'	96.91'
7	05° 35' 00"	1612'	157.09'	78.61'
8	13° 21' 52"	1588'	370.41'	186.05'
9	87° 04' 43"	90'	136.78'	85.52'
11	33° 27' 04"	22.50'	13.14'	6.76'
12	20° 36' 34"	45.00'	16.19'	8.18'
13	03° 38' 55"	505.00'	32.16	16.09'

STORM DRAIN C/L

LINE TABLE		
NO.	LENGTH	BEARING
12	14.13'	N44° 20' 58"W
13	30.21'	N77° 59' 30"W
14	73.25'	N41° 58' 35"W
15	61.33'	N86° 40' 56"W
16	32.70'	N07° 00' 17"W
17	38.40'	N22° 01' 53"E
18	29.40'	N60° 13' 56"E
19	11.55'	N65° 39' 50"W
20	34.71'	N11° 21' 25"E
21	25.44'	N84° 46' 20"W
22	18.33'	N89° 33' 04"W

GRAPHIC SCALE
40 0 20 40 80 120
(IN FEET)
1 inch = 40 ft.

CONSTRUCTION NOTES

1. CONSTRUCT 24" REINFORCED CONCRETE PIPE (RCP)
2. CONSTRUCT 30" REINFORCED CONCRETE PIPE (RCP)
9. CONSTRUCT 84" REINFORCED CONCRETE PIPE (RCP)
10. CONSTRUCT 78" REINFORCED CONCRETE PIPE (RCP)
12. CONSTRUCT 30" CSP RISER PIPE 14 GA. SEE PER DETAIL ON SHEET 5A
13. ~~CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD~~ PLAN 332-2 (PIPE ø ≤ 24")
14. INSTALL CATCH BASIN FILTER INSERT PER KRISTAR ENTERPRISES PRODUCTS, TYPE FLO-GAR + PLUS
15. CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")
16. CONSTRUCT MANHOLE PER SPPWC STD PLAN 322-2 (LARGE SIDE INLET)
17. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD PLAN 300-3 WITH 4" L.D. PER SPPWC STD PLAN 313-3 CASE A "W" AND "V" AS INDICATED ON DRAWING
18. CONSTRUCT MANHOLE PER SPPWC STD PLAN 321-2 (PIPE 33" ≥ø)
19. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 331-3 (INLET PIPE ø >24")
20. CONSTRUCT MANHOLE SHAFT SAFETY LEDGE PER SPPWC STD PLAN 330-2
23. CONSTRUCT A BRICK AND MORTAR PLUG PER DETAILS SEE SHEET 15
24. SAWCUT AC PAVEMENT
25. REPLACE PAVEMENT PER CITY OF RIALTO STD. NO. 64
26. CONSTRUCT CONCRETE COLLAR PER SPPWC STD PLAN 380-4
32. CONSTRUCT PIPE ANCHORS PER SPPWC STD PLAN 221-2.
33. CONSTRUCT INTERIM CATCH BASIN CONDITION, SEE DETAIL ON SHEET 16.

LINE - "C"

NOTE

HGL IS BASED ON ASSUMED COUNTY WATER SURFACE ELEVATION OF 1394.2' IN CACTUS BASIN 4 AS SHOWN IN THE RENAISSANCE SPECIFIC PLAN DRAINAGE STUDY BY ENCOMPASS ASSOCIATES, INC. DATED JANUARY 10, 2013

* D-LOADS BASED UPON CASE III BEDDING DESIGN DENSITY OF 140 PCF PER LOS ANGELES COUNTY FLOOD CONTROL DISTRICT STRUCTURAL DESIGN MANUAL

UNDERGROUND SERVICE ALERT
CALL:TOLL FREE 1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED DISCHARGE AND VELOCITY.		06/30/15
1	REVISED STORM DRAIN PROFILE & REMOVE NOTE NO. 20 FROM STA. 28+49.06		06/10/15
1	ADDED DRAIN PIPE AND RISER DETAIL, CONSTRUCTION NOTE 12, AND NOTE 14 AND 17 TO BE REMOVED AT MIRO WAY		06/10/15

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF: 7/1/2015
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING: 7/2/15
CARLETON W. LOCKWOOD, JR, RCE 45935 DATE
APPROVED BY: 7/9/15
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 DATE

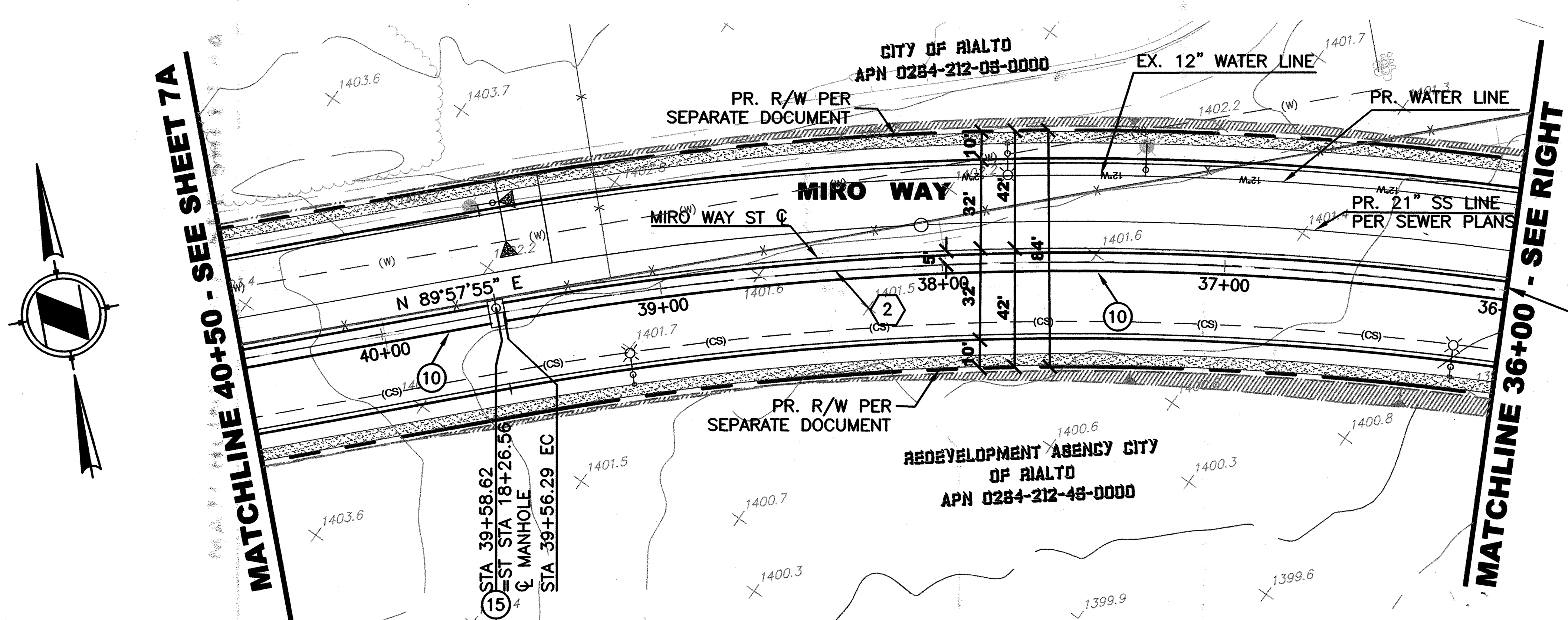
TTG TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com Project No. 0011.103.00

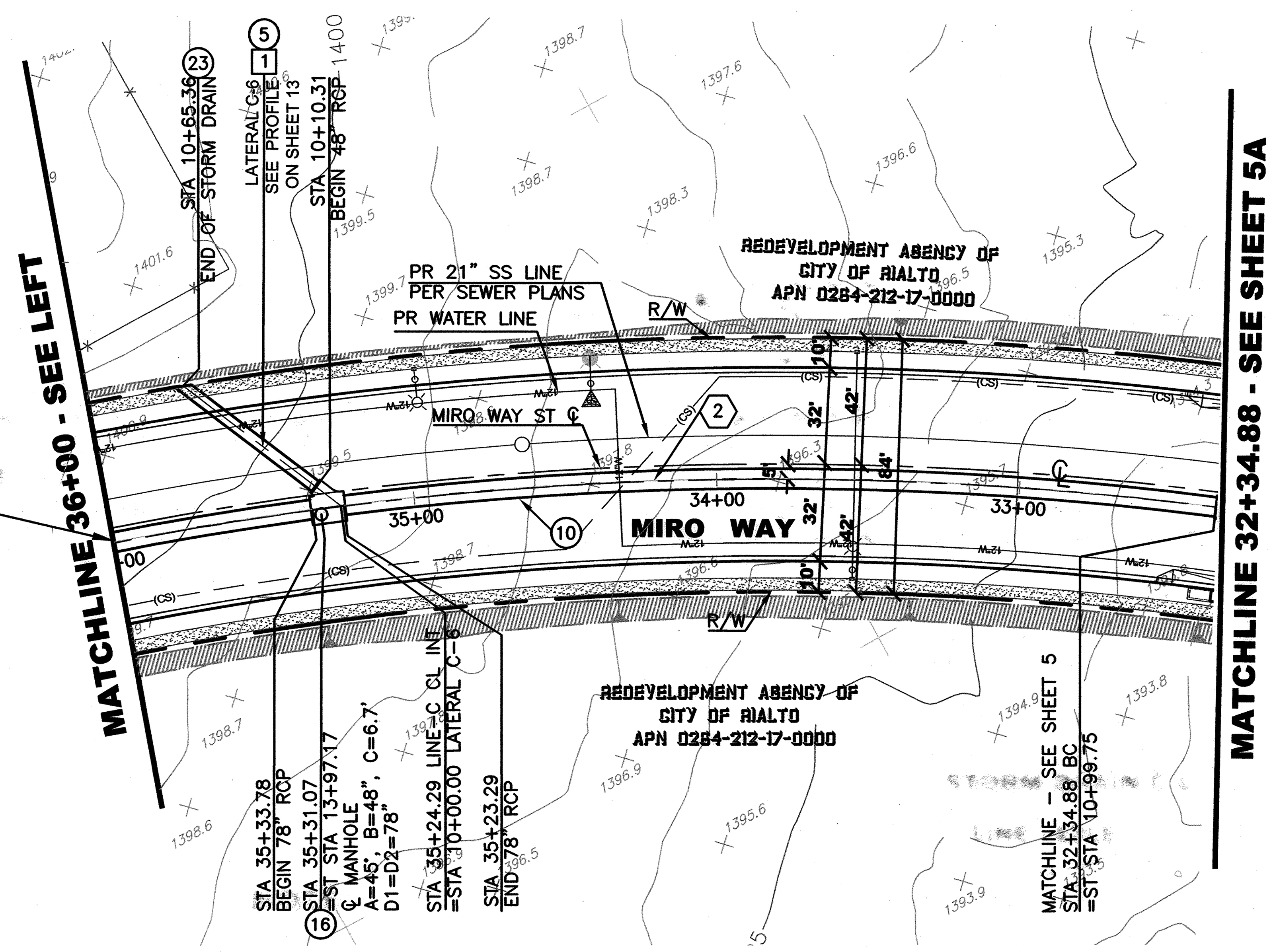
BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN FROM ALDER AVENUE TO CACTUS BASIN
LINE - "C"
STA. 23+43.78 ~ STA. 32+34.88

FOR: CITY OF RIALTO
PLAN No.

5A OF 16 SHEETS





LINE - "C"

STORM DRAIN C/L

LINE TABLE

LINE	LENGTH	Δ
1	65.36'	N23°45'39"W

STORM DRAIN C/L

CURVE TABLE

CURVE	Δ	RADIUS	LENGTH	TANGENT
2	35°14'26"	1141	721.41	373.23

GRAPHIC SCALE

40 0 20 40 80 120

(IN FEET)
1 inch = 40 ft.

CONSTRUCTION NOTES

5. CONSTRUCT 48" REINFORCED CONCRETE PIPE (RCP)
10. CONSTRUCT 78" REINFORCED CONCRETE PIPE (RCP)
14. INSTALL CATCH BASIN FILTER INSERT PER KRISTAR ENTERPRISES PRODUCTS, TYPE FLO-GAR + PLUS
15. CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")
16. CONSTRUCT MANHOLE PER SPPWC STD PLAN 322-2 (LARGE SIDE INLET)
17. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD PLAN 300-3 WITH 4" L.D. PER SPPWC STD PLAN 313-3 CASE A "W" AND "V" AS INDICATED ON DRAWING
23. CONSTRUCT A BRICK AND MORTAR PLUG PER DETAILS SEE SHEET 15

UNDERGROUND SERVICE ALERT
CALL:TOLL FREE
1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED STORM DRAIN PROFILE, DISCHARGE AND VELOCITY		06/10/15

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 7/2/15 DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — 7/9/15 DATE

TTG TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN FROM ALDER AVENUE TO CACTUS BASIN
LINE - "C"
STA. 32+00.00 ~ STA. 40+50.00

FOR: CITY OF RIALTO

PLAN No.

6A of 16 SHEETS

LINE - "C"

CONSTRUCTION NOTES

1. CONSTRUCT 24" REINFORCED CONCRETE PIPE (RCP)
2. CONSTRUCT 30" REINFORCED CONCRETE PIPE (RCP)
4. CONSTRUCT 42" REINFORCED CONCRETE PIPE (RCP)
10. CONSTRUCT 78" REINFORCED CONCRETE PIPE (RCP)
13. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 332-2 (PIPE ø ≤ 24")
14. INSTALL CATCH BASIN FILTER INSERT PER KRISTAR ENTERPRISES PRODUCTS, TYPE FLO-GAR + PLUS
15. CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")
16. CONSTRUCT MANHOLE PER SPPWC STD PLAN 322-2 (LARGE SIDE INLET)
17. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD PLAN 300-3 WITH 4" L.D. PER SPPWC STD PLAN-313-3 CASE A
18. CONSTRUCT MANHOLE PER SPPWC STD PLAN 321-2 (PIPE 33" ≥ø)
19. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 331-3 (INLET PIPE ø >24")
23. CONSTRUCT A BRICK AND MORTAR PLUG PER DETAILS SEE SHEET 15
24. SAWCUT AC PAVEMENT
25. REPLACE PAVEMENT PER CITY OF RIALTO STD. NO. 64
26. CONSTRUCT CONCRETE COLLAR PER SPPWC STD PLAN 380-4

DISPOSITION NOTE:

[1] - PROTECT IN PLACE

NOTE

CONTRACTOR TO COORDINATE WITH FONTANA WATER COMPANY REGARDING WATER LINE CROSSINGS AT THE STORM DRAIN LATERALS.

SANITARY SEWER LINE TO BE PROTECTED IN PLACE UNTIL AN ALTERNATE APPROVED MEANS OF SEWER DISPOSAL IS IN PLACE.

STORM DRAIN C/L

LINE TABLE

LINE	LENGTH	BEARING
3	78.77'	N00°02'18"W
7	23.25'	S00°01'13"E
8	66.46'	N45°01'13"W
9	28.30'	S315°37'34"W

GRAPHIC SCALE
40 0 20 40 80 120
(IN FEET)
1 inch = 40 ft.

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
CALL:TOLL FREE
1-800
227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED DISCHARGE AND VELOCITY		06/30/15

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER
CHARLES WILBUR LOCKMAN
No. 42485
Exp. 03/31/16
CIVIL
STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 7/2/15 DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — 7/9/15 DATE

TTG
TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com
Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN
FROM ALDER AVENUE TO CACTUS BASIN
LINE - "C"
STA. 45+50.00 ~ STA.51+50.00

FOR:
CITY OF RIALTO

PLAN No.

7A
OF 16 SHEETS

N:\60.CAD\TMAD Projects\2011\0011.103.00\Improvement Plans\Combined SBNO and TTG\Storm Drain\Revision 1\sdC7sd-A-Revised.dwg

STORM DRAIN C/L LINE TABLE		
LINE	LENGTH	Δ
10	19.41'	S00°00'00"E
11	33.00'	S33°42'34"E
12	66.46'	N45°01'13"W

NOTE

CONTRACTOR TO COORDINATE WITH FONTANA WATER COMPANY REGARDING WATER LINE CROSSINGS AT THE STORM DRAIN LATERALS.

SANITARY SEWER LINE TO BE PROTECTED IN PLACE UNTIL AN ALTERNATE APPROVED MEANS OF SEWER DISPOSAL IS IN PLACE.

CONSTRUCTION NOTES

1. CONSTRUCT 24" REINFORCED CONCRETE PIPE (RCP)
4. CONSTRUCT 42" REINFORCED CONCRETE PIPE (RCP)
10. CONSTRUCT 78" REINFORCED CONCRETE PIPE (RCP)
13. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 332-2 (PIPE ø ≤ 24")
14. INSTALL CATCH BASIN FILTER INSERT PER KRISTAR ENTERPRISES PRODUCTS, TYPE FLO-GAR + PLUS
15. CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")
16. CONSTRUCT MANHOLE PER SPPWC STD PLAN 322-2 (LARGE SIDE INLET)
17. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD PLAN 300-3 WITH 4" L.D. PER SPPWC STD PLAN 313-3 CASE A
23. CONSTRUCT A BRICK AND MORTAR PLUG PER DETAILS SEE SHEET 15
24. SAWCUT AC PAVEMENT
25. REPLACE PAVEMENT PER CITY OF RIALTO STD. NO. 64
26. CONSTRUCT CONCRETE COLLAR PER SPPWC STD PLAN 380-4
34. REMOVE AND DISPOSE OF INTERFERING PORTIONS OF EXISTING WATER LINE

DISPOSITION NOTE:

1 - PROTECT IN PLACE

GRAPHIC SCALE

40 0 20 40 80 120

(IN FEET)
1 inch = 40 ft.

UNDERGROUND SERVICE ALERT
CALL:TOLL FREE 1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED LATERAL "C-13" & CATCH BASIN DEPTH, DISCHARGE AND VELOCITY		06/10/15

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 7/2/15 DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — 7/9/15 DATE

TTG TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com
Project No. 0011.103.00

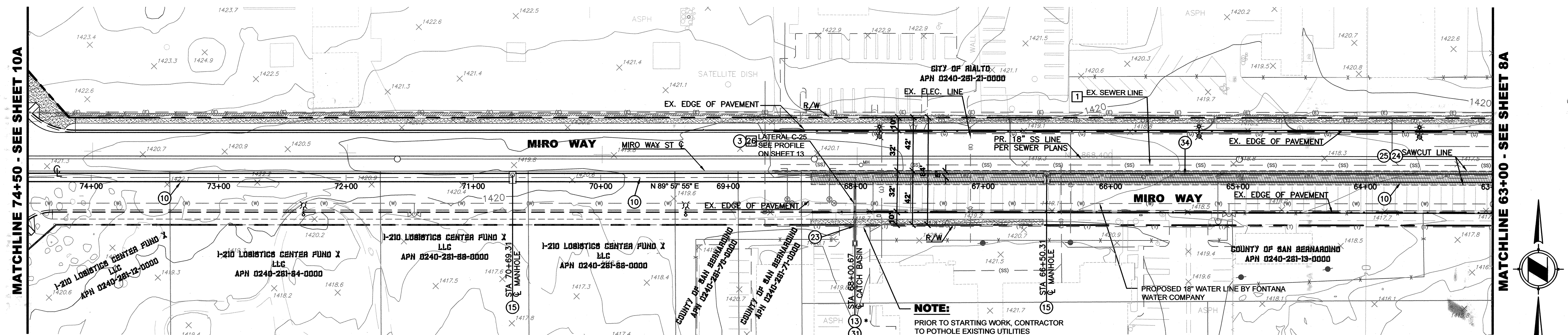
BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN FROM ALDER AVENUE TO CACTUS BASIN
LINE - "C"
STA. 51+50.00 ~ STA. 63+00.00

FOR: CITY OF RIALTO

PLAN No.

8A OF 16 SHEETS



LINE - "C"

CONSTRUCTION NOTES

(3) CONSTRUCT 18" REINFORCED CONCRETE PIPE (RCP)

(10) CONSTRUCT 78" REINFORCED CONCRETE PIPE (RCP)

(13) CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 332-2 (PIPE ø ≤ 24")

(15) CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")

(23) CONSTRUCT A BRICK AND MORTAR PLUG PER DETAILS SEE SHEET 15

(24) SAWCUT AC PAVEMENT

(25) REPLACE PAVEMENT PER CITY OF RIALTO STD. NO. 64

(31) CONSTRUCT GRATING CATCH BASIN PER SPPWC STD PLAN 304-3, V=7.5'

(34) REMOVE AND DISPOSE OF INTERFERING PORTIONS OF EXISTING WATER LINE

LINE TABLE

LINE	LENGTH	Δ
26	49.30'	N00°01'13"W

DISPOSITION NOTE:

1 - PROTECT IN PLACE

NOTE

CONTRACTOR TO COORDINATE WITH FONTANA WATER COMPANY REGARDING WATER LINE CROSSINGS AT THE STORM DRAIN LATERALS.

SANITARY SEWER LINE TO BE PROTECTED IN PLACE UNTIL AN ALTERNATE APPROVED MEANS OF SEWER DISPOSAL IS IN PLACE.

* CONTRACTOR TO COORDINATE WITH PROPERTY OWNER ON INSTALLATION OF ON SITE IMPROVEMENTS.

GRAPHIC SCALE

40 0 20 40 80 120

(IN FEET)
1 inch = 40 ft.

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
CALL:TOLL FREE
1-800
227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED DISCHARGE AND VELOCITY	CWL	06/30/15

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER
CHARLES WILBUR LOCKMAN
No. 42485
Exp. 03/31/16
CIVIL
STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 7/2/15 DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — 7/9/15 DATE

TTG
TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com
Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

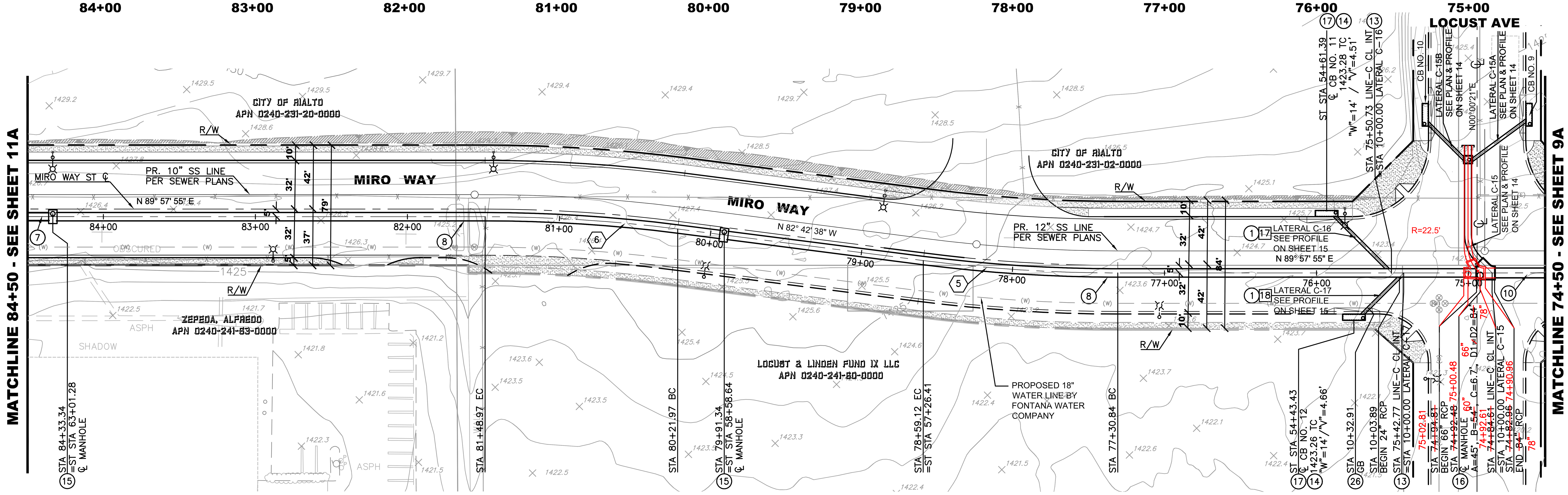
CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN FROM ALDER AVENUE TO CACTUS BASIN
LINE - "C"
STA. 63+00.00 ~ STA. 74+50.00

FOR:
CITY OF RIALTO

PLAN No.

9A
OF 16 SHEETS

N:\60.CAD\TMAD Projects\2011\0011.103.00\Improvement Plans\Combined SBNO and TTG\Storm Drain\Revision 1\sdC9sd-A-Revised.dwg - LAST PLOTTED ON Wed 07/01/15 - 10:39AM BY cmoua



STORM DRAIN C/L

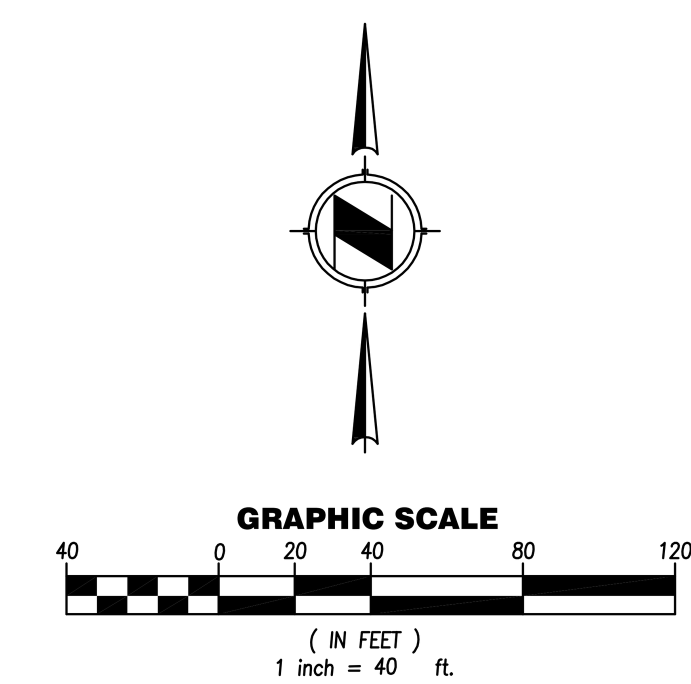
LINE TABLE

LINE	LENGTH	Δ
17	52.68'	N45°01'18"W
18	38.54'	N44°58'42"E

STORM DRAIN C/L

CURVE TABLE

CURVE	Δ	RADIUS	LENGTH	TANGENT
5	07°18'48"	1005.0	128.28	64.23
6	07°18'48"	995.0	127.00	63.59



CONSTRUCTION NOTES

1. CONSTRUCT 24" REINFORCED CONCRETE PIPE (RCP)
7. CONSTRUCT 60" REINFORCED CONCRETE PIP (RCP)
8. CONSTRUCT 66" REINFORCED CONCRETE PIPE (RCP)
10. CONSTRUCT 78" REINFORCED CONCRETE PIPE (RCP)
13. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 332-2 (PIPE ø ≤ 24")
14. INSTALL CATCH BASIN FILTER INSERT PER KRISTAR ENTERPRISES PRODUCTS, TYPE FLO-GAR + PLUS
15. CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")
16. CONSTRUCT MANHOLE PER SPPWC STD PLAN 322-2 (LARGE SIDE INLET)
17. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD PLAN 300-3 WITH 4" L.D. PER SPPWC STD PLAN 313-3 CASE A "W" AND "V" AS INDICATED ON DRAWING
26. CONSTRUCT CONCRETE COLLAR PER SPPWC STD PLAN 380-4

NOTE

CONTRACTOR TO COORDINATE WITH FONTANA WATER COMPANY REGARDING WATER LINE CROSSINGS AT THE STORM DRAIN LATERALS.

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
CALL:TOLL FREE
1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED DISCHARGE AND VELOCITY	TTG	06/30/15

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — DATE

TTG
TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com

Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO

MIRO WAY STORM DRAIN IMPROVEMENT PLAN FROM ALDER AVENUE TO CACTUS BASIN

LINE - "C"

STA. 74+50.00 ~ STA. 84+50.00

FOR: CITY OF RIALTO

PLAN No.

CONSTRUCTION NOTES

1. CONSTRUCT 24" REINFORCED CONCRETE PIPE (RCP)
6. CONSTRUCT 54" REINFORCED CONCRETE PIPE (RCP)
7. CONSTRUCT 60" REINFORCED CONCRETE PIP (RCP)
13. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 332-2 (PIPE ø ≤ 24")
14. INSTALL CATCH BASIN FILTER INSERT PER KRISTAR ENTERPRISES PRODUCTS, TYPE FLO-GAR + PLUS
15. CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")
17. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD PLAN 300-3 WITH 4" L.D. PER SPPWC STD PLAN 313-3 CASE A "W" AND "V" AS INDICATED ON DRAWING
19. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 331-3 (INLET PIPE ø >24")
23. CONSTRUCT A BRICK AND MORTAR PLUG PER DETAILS SEE SHEET 15
24. SAWCUT AC PAVEMENT
25. REPLACE PAVEMENT PER CITY OF RIALTO ~~STD. NO. 64~~
35. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 340-2

STORM DRAIN C/L — LINE TABLE

LINE	LENGTH	Δ
19	37.23'	N00°01'25"W
~~20~~	~~37.65'~~	~~S43°36'23"W~~
21	12.72'	N45°21'30"W
22	6.00'	N00°00'00"E

STORM DRAIN C/L — CURVE TABLE

CURVE	Δ	RADIUS	LENGTH	TANGENT
7	7°18'48"	995.00'	127.00'	63.59'
8	7°18'48"	1005.00'	128.28'	64.23'
9	22°40'45"	45'	35.62'	18.80'

LINE - "C"

DISPOSITION NOTES

1. PROTECT IN PLACE

P. POTHOLE EXISTING CROSSING UTILITIES AND REPORT FINDINGS TO ENGINEER AT LEAST 14 DAYS PRIOR TO TRENCH EXCAVATION.

NOTE:

* POTHOLE ELEVATION BASED ON POTHOLE DONE BY JUNE 05, 2014 ABOUT 10' SOUTH OF STORM DRAIN CROSSING.

CONTRACTOR TO COORDINATE WITH FONTANA WATER COMPANY REGARDING WATER LINE CROSSINGS AT THE STORM DRAIN LATERALS.

\# POTHOLE ELEVATION BASED ON POTHOLE DONE ON JUNE 02, 2015 ABOUT 15.5' NORTH OF STORM DRAIN CROSSING.

GRAPHIC SCALE

40 0 20 40 80 120

(IN FEET)
1 inch = 40 ft.

UNDERGROUND SERVICE ALERT
CALL BEFORE YOU DIG
CALL:TOLL FREE
1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED DISCHARGE AND VELOCITY.		06/30/15
1	UPDATED LATERAL C-18 AND CATCH BASIN LOCATION, ADDED CONSTRUCTION NOTE 35.		06/10/15
1	RELOCATE LATERAL C-20 TO STA 96+66.78, ADD LATERAL C-26; REVISED CATCH BASIN DEPTH		06/10/15

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 7/2/15 DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — 7/9/15 DATE

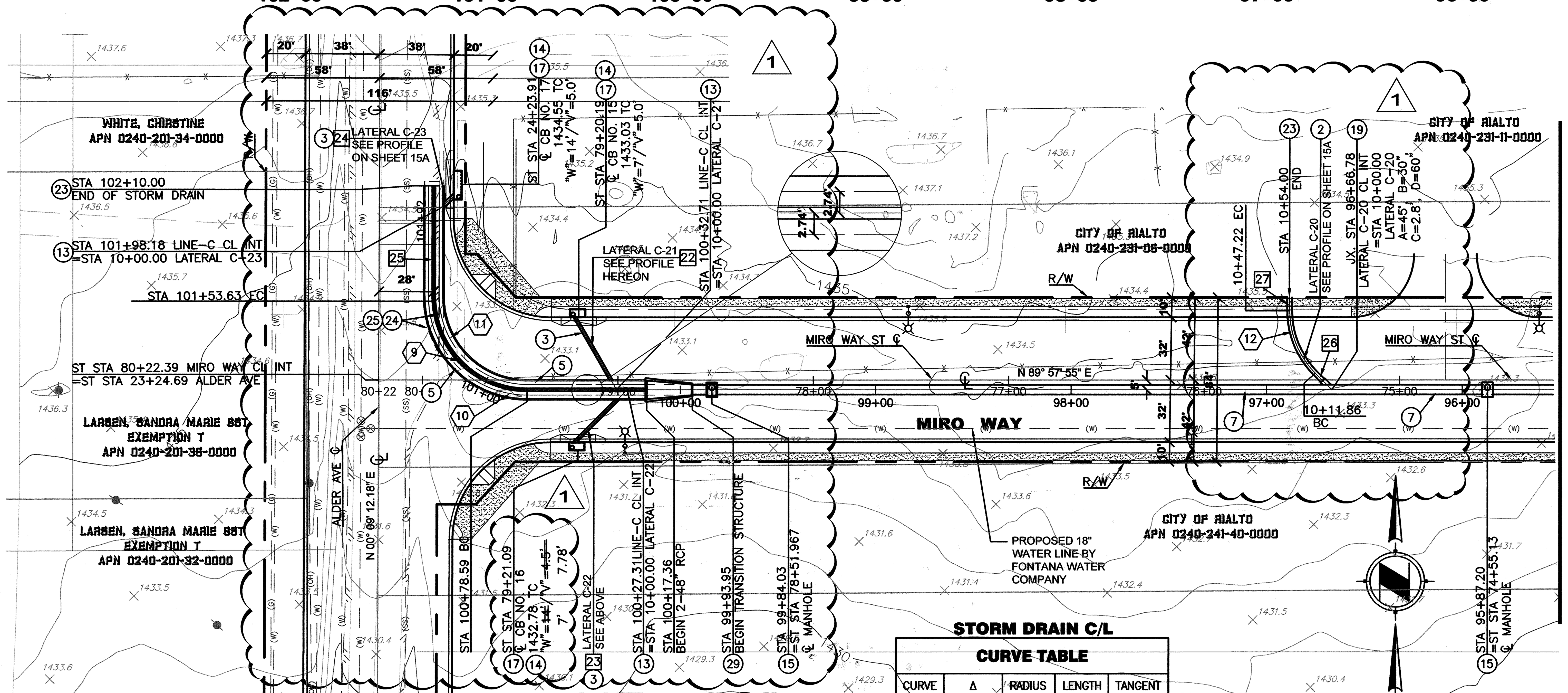
TTG
TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN FROM ALDER AVENUE TO CACTUS BASIN
LINE - "C"
STA. 84+50.00 ~ STA. 95+50.00

FOR: CITY OF RIALTO

PLAN No.



LINE - "C"

NOTE

CONTRACTOR TO COORDINATE WITH FONTANA WATER COMPANY REGARDING WATER LINE CROSSINGS AT THE STORM DRAIN LATERALS.

STORM DRAIN C/L

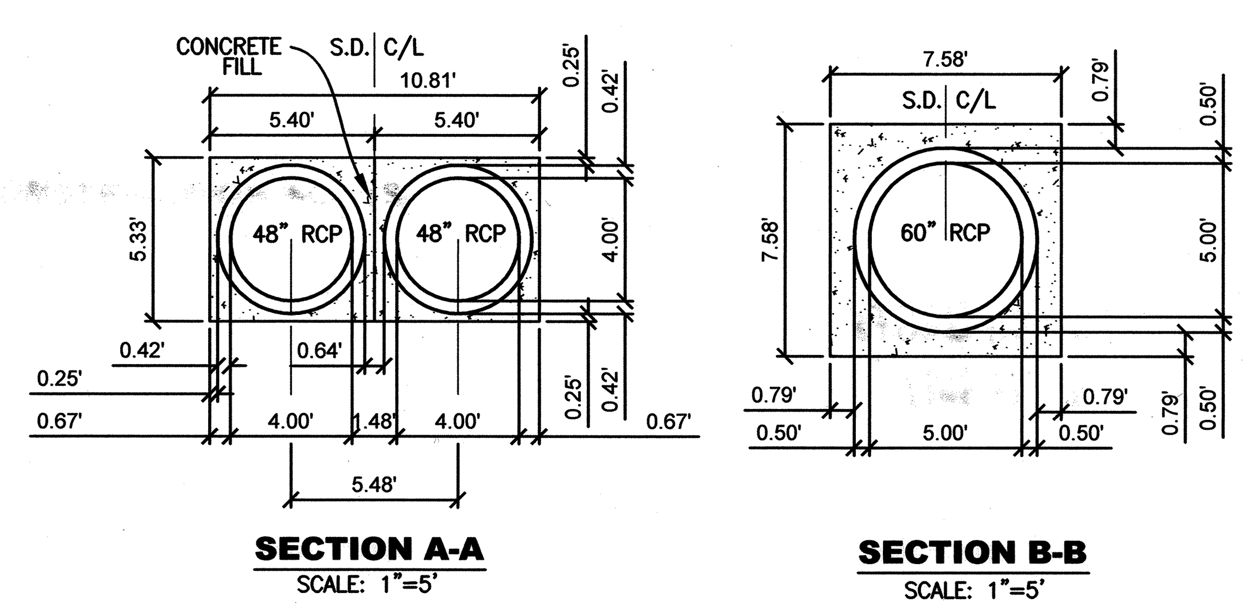
CURVE TABLE

CURVE	Δ	RADIUS	LENGTH	TANGENT
9	90°03'52"	47.74'	75.04'	47.79'
10	90°03'52"	50.47'	79.34'	50.53'
11	90°03'52"	45.00'	70.74'	45.05'
12	22°30'43"	45.00'	35.36'	18.65'

GRAPHIC SCALE

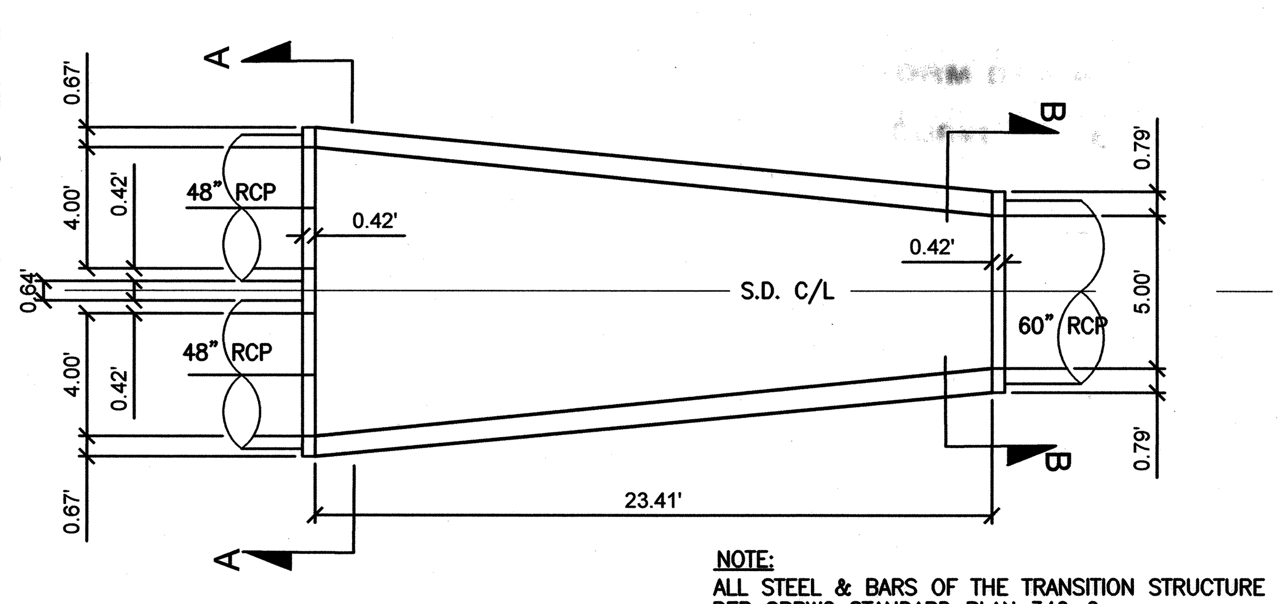
40 0 20 40 80 120

(IN FEET)
1 inch = 40 ft.



SECTION A-A
SCALE: 1"=5'

SECTION B-B
SCALE: 1"=5'



NOTE:
ALL STEEL & BARS OF THE TRANSITION STRUCTURE PER SPPWC STANDARD PLAN 340-2

TRANSITION STRUCTURE DETAILS (29)
SCALE: 1"=5'

CONSTRUCTION NOTES

1. CONSTRUCT 24" REINFORCED CONCRETE PIPE (RCP)
2. CONSTRUCT 30" REINFORCED CONCRETE PIPE (RCP)
3. CONSTRUCT 18" REINFORCED CONCRETE PIPE (RCP)
5. CONSTRUCT 48" REINFORCED CONCRETE PIPE (RCP)
7. CONSTRUCT 60" REINFORCED CONCRETE PIP (RCP)
13. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 332-2 (PIPE ø ≤ 24")
14. INSTALL CATCH BASIN FILTER INSERT PER KRISTAR ENTERPRISES PRODUCTS, TYPE FLO-GAR + PLUS
15. CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")
17. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD PLAN 300-3 WITH 4" L.D. PER SPPWC STD PLAN 313-3 CASE A "W" AND "V" AS INDICATED ON DRAWING
19. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 331-3 (INLET PIPE ø >24")
23. CONSTRUCT A BRICK AND MORTAR PLUG PER DETAILS SEE SHEET 15
24. SAWCUT AC PAVEMENT
25. REPLACE PAVEMENT PER CITY OF RIALTO STD. NO. 64
29. INSTALL A MODIFIED TRANSITION STRUCTURE PER SPPWC STD PLAN 340-2, SEE DETAIL HEREON

STORM DRAIN C/L

LINE TABLE

LINE	LENGTH	BEARING
22	42.97'	N30°01'32"W
23	38.59'	N44°58'35"E
24	10.13'	N48°27'06"E
25	38.37'	N00°09'12"E
26	11.86'	N45°01'25"W
27	6.78'	N00°00'00"E

UNDERGROUND SERVICE ALERT
CALL:TOLL FREE
1-800
227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED DISCHARGE AND VELOCITY.		06/30/15
1	REVISED CATCH BASINS LOCATIONS, NOTES, LATERAL "C-22" AND ADDED LATERAL "C-20"		06/10/15

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER
CHARLES WILBUR LOCKMAN
No. 42485
Exp. 03/31/16
CIVIL
STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 7/2/15 DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — 7/9/15 DATE

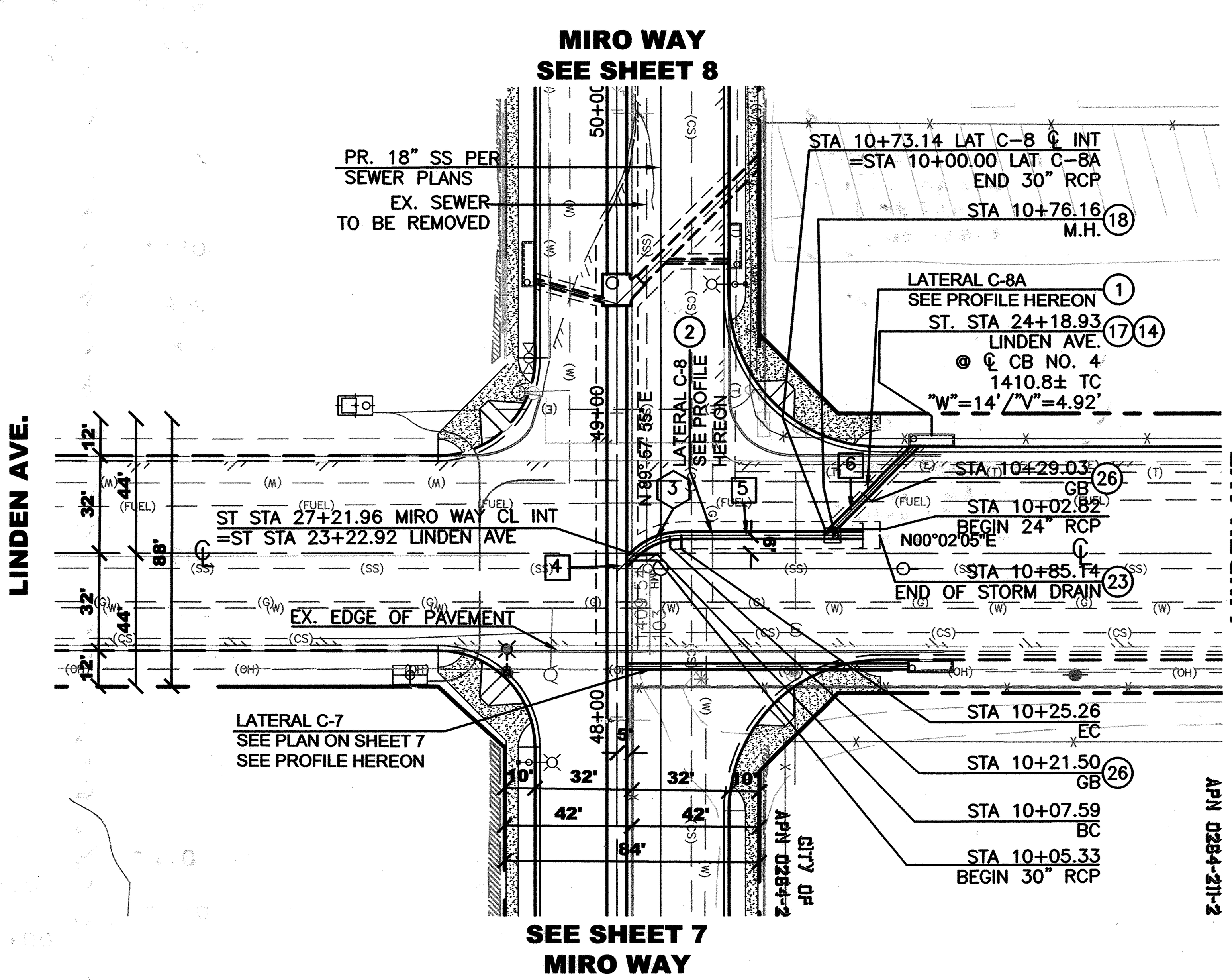
TTG
TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN
FROM ALDER AVENUE TO CACTUS BASIN
LINE - "C"
STA. 95+50.00 ~ STA. 101+92.00

FOR:
CITY OF RIALTO

PLAN No.



CONSTRUCTION NOTES

1. CONSTRUCT 24" REINFORCED CONCRETE PIPE (RCP)
2. CONSTRUCT 30" REINFORCED CONCRETE PIPE (RCP)
3. CONSTRUCT 18" REINFORCED CONCRETE PIPE (RCP)
14. INSTALL CATCH BASIN FILTER INSERT PER KRISTAR ENTERPRISES PRODUCTS, TYPE FLO-GAR + PLUS
17. CONSTRUCT CURB OPENING CATCH BASIN PER SPPWC STD PLAN 300-3 WITH 4" L.D. PER SPPWC STD PLAN 313-3 CASE A "W" AND "V" AS INDICATED ON DRAWING
18. CONSTRUCT MANHOLE PER SPPWC STD PLAN 321-2 (PIPE 33" ≥ ø)
19. CONSTRUCT JUNCTION STRUCTURE PER SPPWC STD PLAN 331-3 (INLET PIPE ø >24")
23. CONSTRUCT A BRICK AND MORTAR PLUG PER DETAILS SEE SHEET 15
24. SAWCUT AC PAVEMENT
25. REPLACE PAVEMENT PER CITY OF RIALTO STD. NO. 64
26. CONSTRUCT CONCRETE COLLAR PER SPPWC STD PLAN 380-4

STORM DRAIN C/L
LINE TABLE

LINE	LENGTH	Δ
4	7.59'	N45°00'21"W
5	59.88'	N00°00'00"W
6	37.12'	N45°00'00"W

STORM DRAIN C/L
CURVE TABLE

CURVE	Δ	RADIUS	LENGTH	TANGENT
3	45°00'21"	22.5	17.67	9.32

GRAPHIC SCALE
40 0 20 40 80 120
(IN FEET)
1 inch = 40 ft.

UNDERGROUND SERVICE ALERT
CALL:TOLL FREE
1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED DISCHARGE AND VELOCITY		06/30/15

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 7/2/15 DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — 7/9/15 DATE

TTG TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN FROM ALDER AVENUE TO CACTUS BASIN
LAT. "C-6" ~ "C-9" & "C-25" PROFILES

FOR: CITY OF RIALTO
PLAN No.

13A OF 16 SHEETS

LATERAL "C-10" & "C-11"
(SEE PLAN ON SHEET 7)

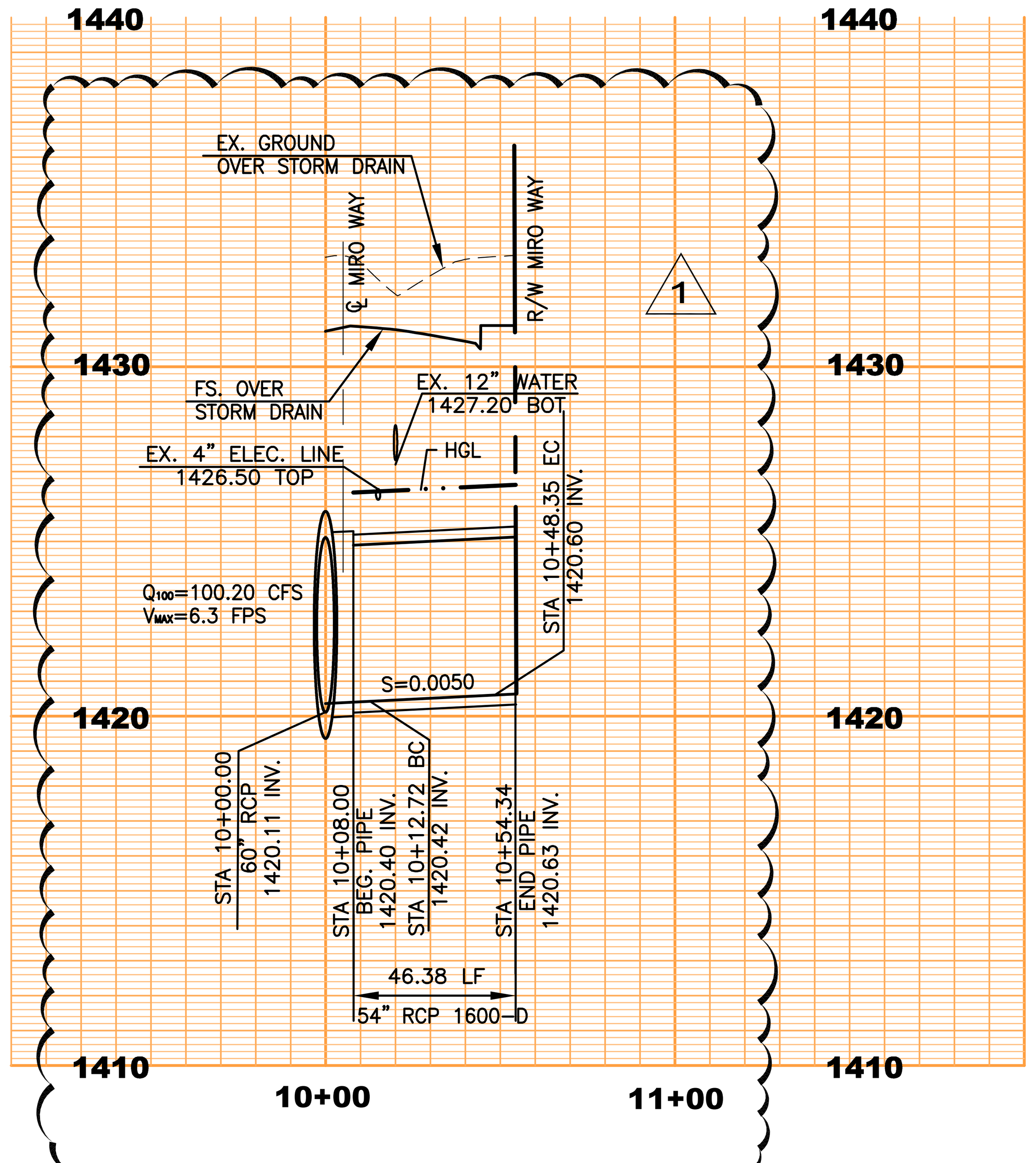
LATERAL "C-12"
(SEE PLAN ON SHEET 8)

LATERAL "C-13" & "C-14"
(SEE PLAN ON SHEET 8A)

LATERAL "C-15"
(SEE PLAN HEREON)

LATERAL "C-15B" & "C-15A"
(SEE PLAN HEREON)

PROFILE SCALE
HORIZ. 1"=40'
VERT. 1"=4'



LATERAL "C-26"
(SEE PLAN ON SHEET11A)

STORM DRAIN C/L

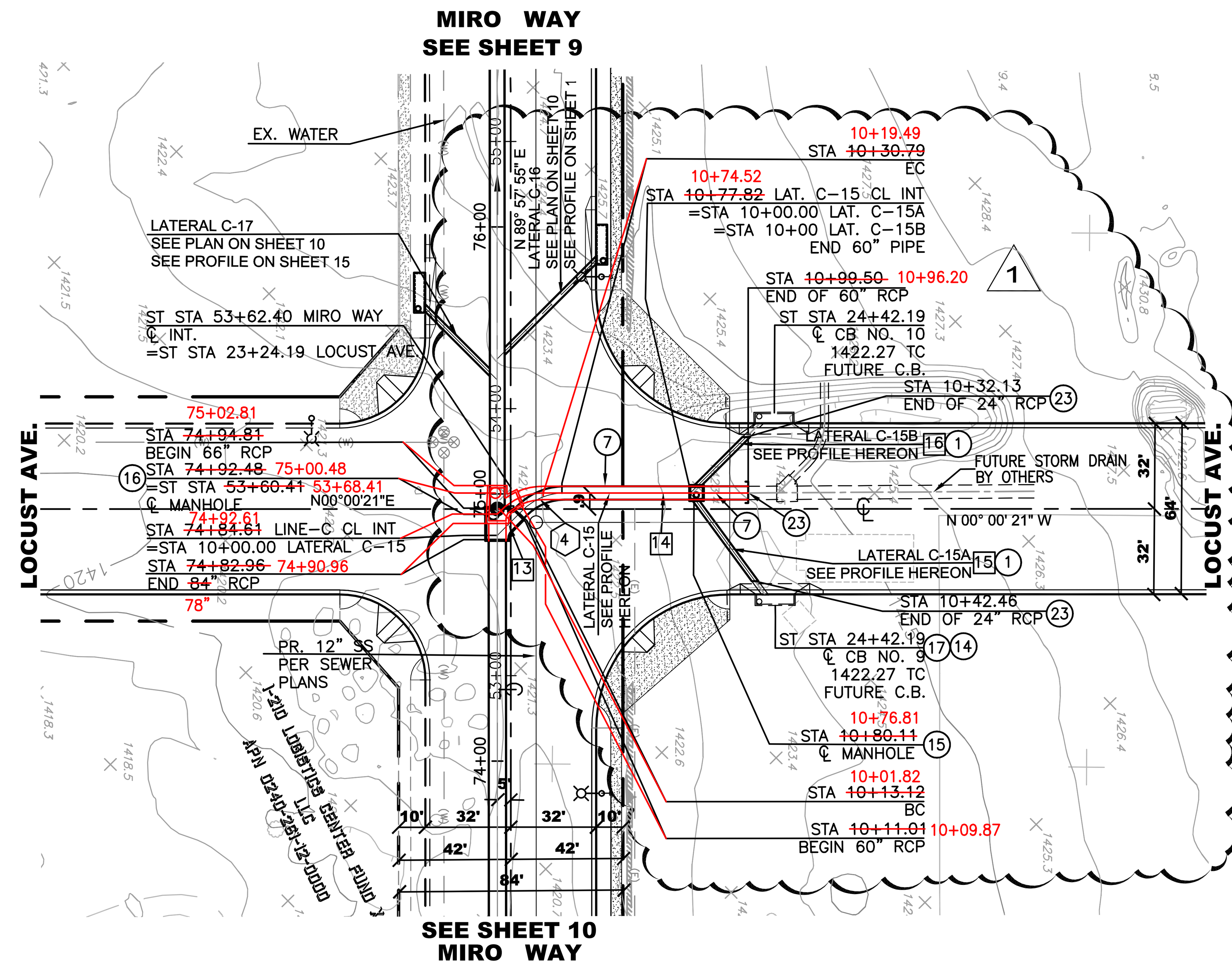
LINE TABLE

LINE	LENGTH	Δ
13	~~13.42'~~ 1.82'	N45°00'21"W
14	~~68.70'~~ 76.70'	N00°00'00"E
15	42.46'	N53°41'24"E
16	32.13'	N45°00'00"W

STORM DRAIN C/L

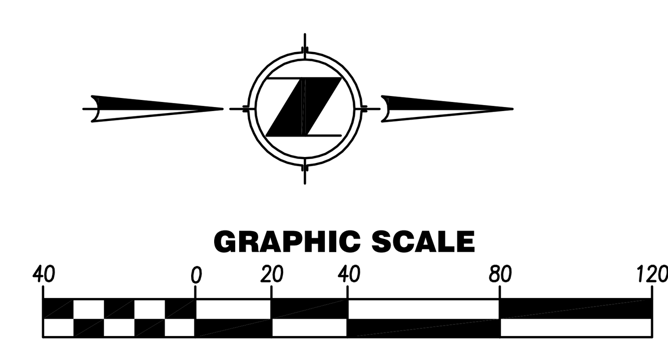
CURVE TABLE

CURVE	Δ	RADIUS	LENGTH	TANGENT
4	45°00'21"	22.5'	17.67'	9.32'



CONSTRUCTION NOTES

1. CONSTRUCT 24" REINFORCED CONCRETE PIPE (RCP)
7. CONSTRUCT 60" REINFORCED CONCRETE PIP (RCP)
15. CONSTRUCT MANHOLE PER SPPWC STD PLAN 320-2 (PIPE ø ≥ 36")
16. CONSTRUCT MANHOLE PER SPPWC STD PLAN 322-2 (LARGE SIDE INLET)
23. CONSTRUCT A BRICK AND MORTAR PLUG PER DETAILS SEE SHEET 15



GRAPHIC SCALE
(IN FEET)
1 inch = 40 ft.

UNDERGROUND SERVICE ALERT
CALL:TOLL FREE
1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED DISCHARGE AND VELOCITY.	TTG	06/30/2015
1	REVISED LATERAL C-10, C-13, C-15, C-15A, AND C-15B, ADDED LATERAL "C-26"	TTG	06/10/2015

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — DATE

TTG
TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

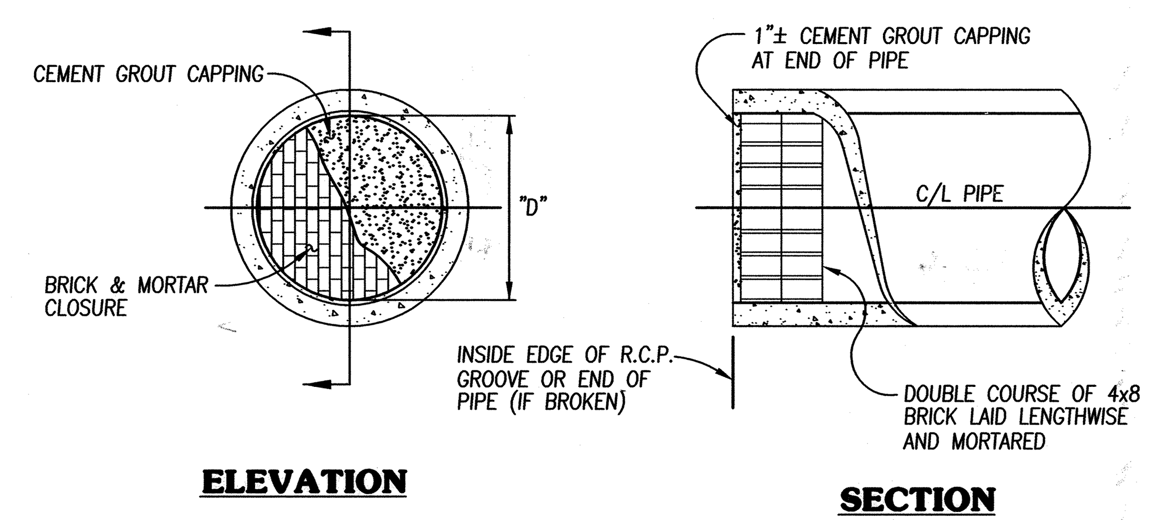
CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN
FROM ALDER AVENUE TO CACTUS BASIN
LAT. "C-10" ~ "C-15A" & "C-26" PROFILES

FOR: CITY OF RIALTO

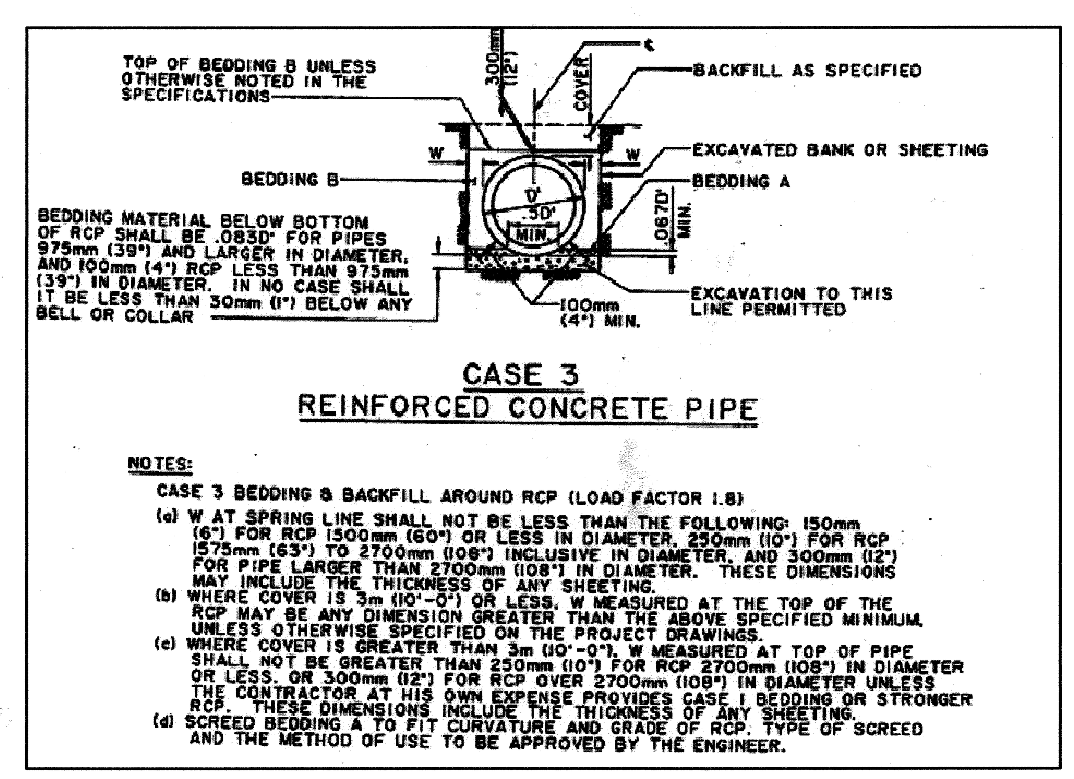
14B OF 16 SHEETS

PLAN No.

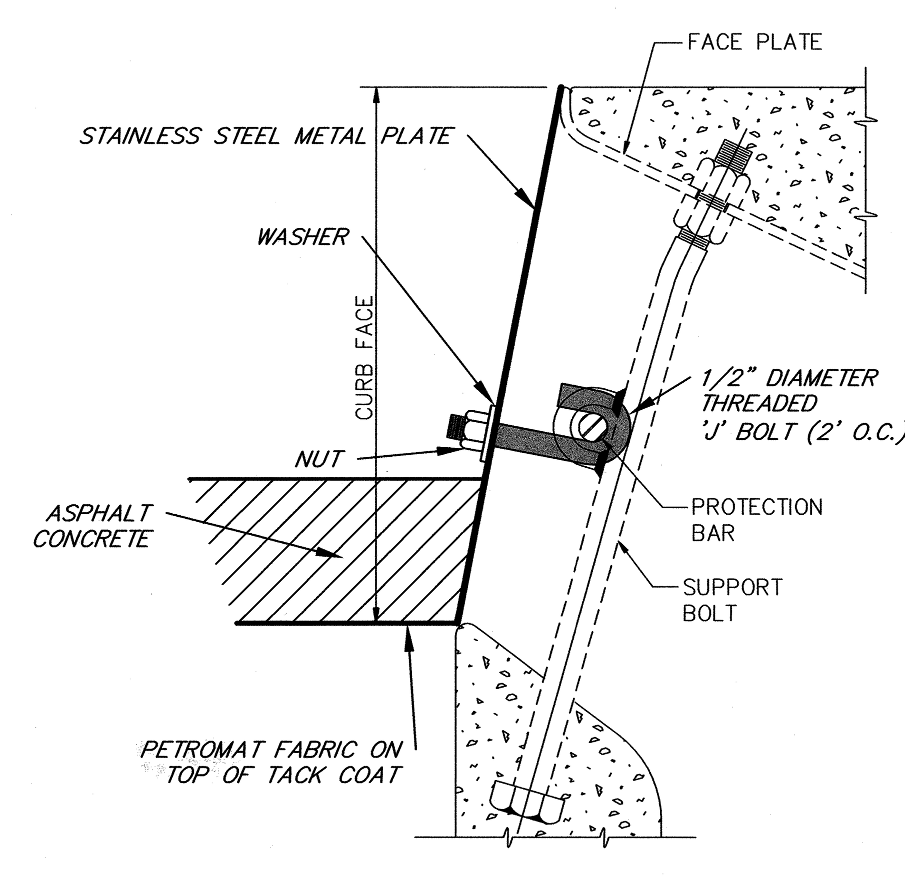
PROFILE SCALE
HORIZ. 1"=40'
VERT. 1"=4'



(23) **BRICK AND MORTAR PLUG**
NOT TO SCALE



STORM DRAIN PIPE BEDDING DETAIL
NOT TO SCALE



DETAIL OF 'J' BOLT ATTACHMENT
NOT TO SCALE

NOTE

HGL IS BASED ON ASSUMED COUNTY WATER SURFACE ELEVATION OF 1370.5' IN CACTUS BASIN 3

* D-LOADS BASED UPON CASE III BEDDING DESIGN DENSITY OF 140 PCF PER LOS ANGELES COUNTY FLOOD CONTROL DISTRICT STRUCTURAL DESIGN MANUAL

GRAPHIC SCALE
40 0 20 40 80 120
(IN FEET)
1 inch = 40 ft.

UNDERGROUND SERVICE ALERT
CALL:TOLL FREE
1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE
1	REVISED LATERAL "C-19", "C-20", "C-23" & "C-18". REVISED DISCHARGE AND VELOCITY.		06/10/2015

DESIGNED BY: CWL DRAWN BY: JC/SG CHECKED BY: CWL

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/16 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/16 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 7/2/15 DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/ CITY ENGINEER, RCE 54931 — 7/9/15 DATE

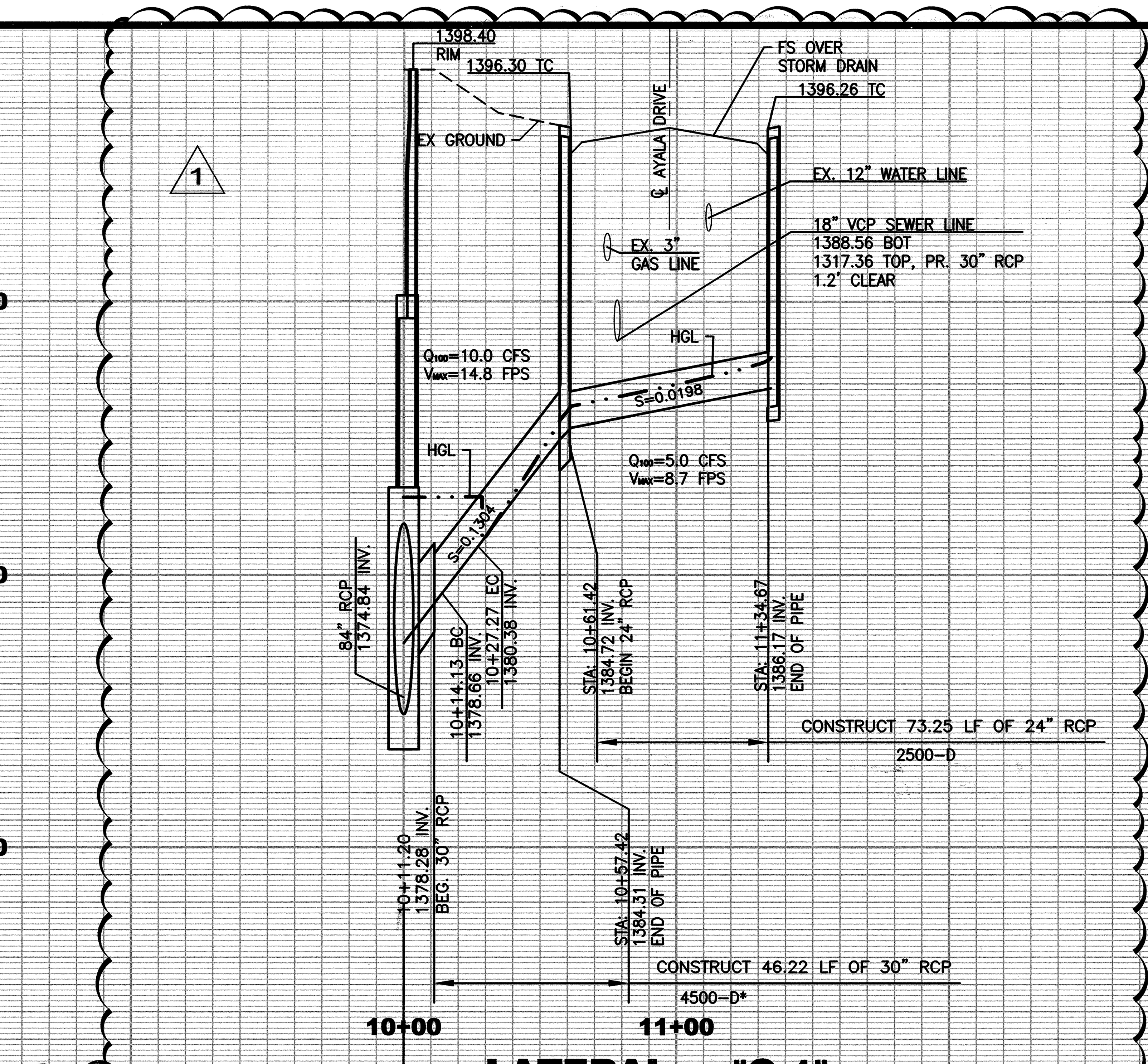
TTG TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
DESCRIPTION: FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

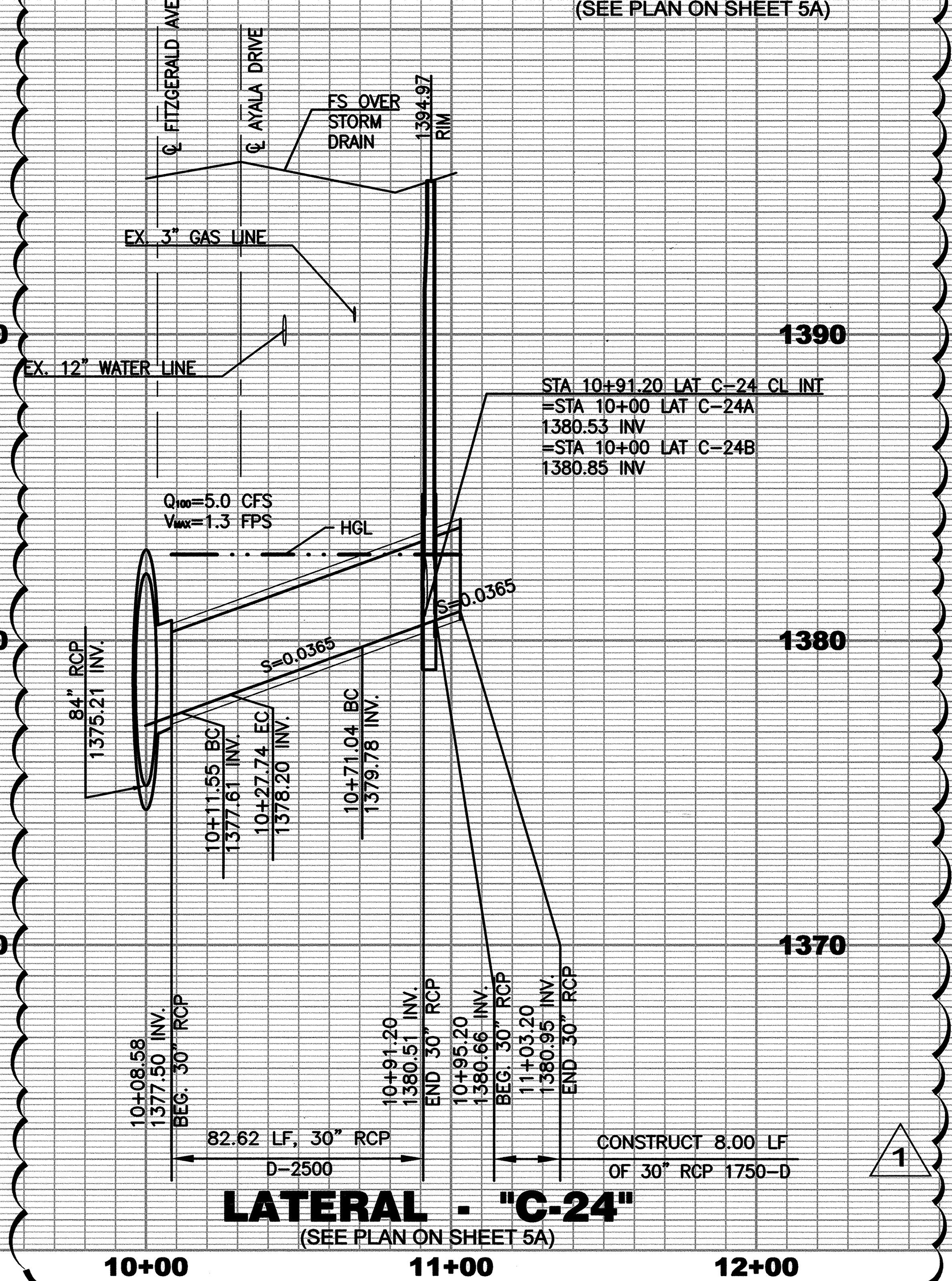
CITY OF RIALTO
MIRO WAY STORM DRAIN IMPROVEMENT PLAN
FROM ALDER AVENUE TO CACTUS BASIN
LAT. "C-16" ~ "C20", "C-23"
PROFILES

15A OF 16 SHEETS

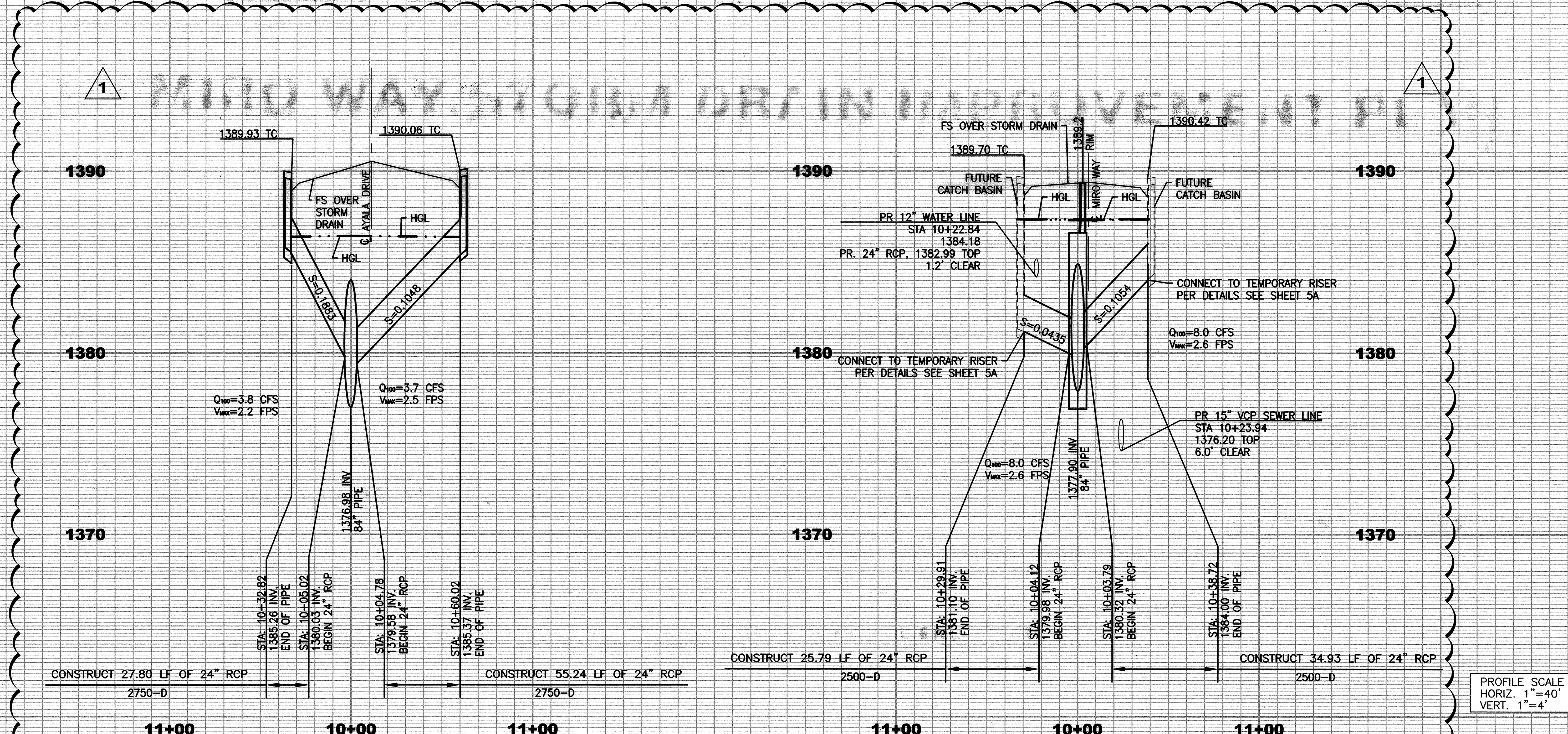
FOR: CITY OF RIALTO
PLAN No.



LATERAL - "C-1"
(SEE PLAN ON SHEET 5A)



LATERAL - "C-24"
(SEE PLAN ON SHEET 5A)

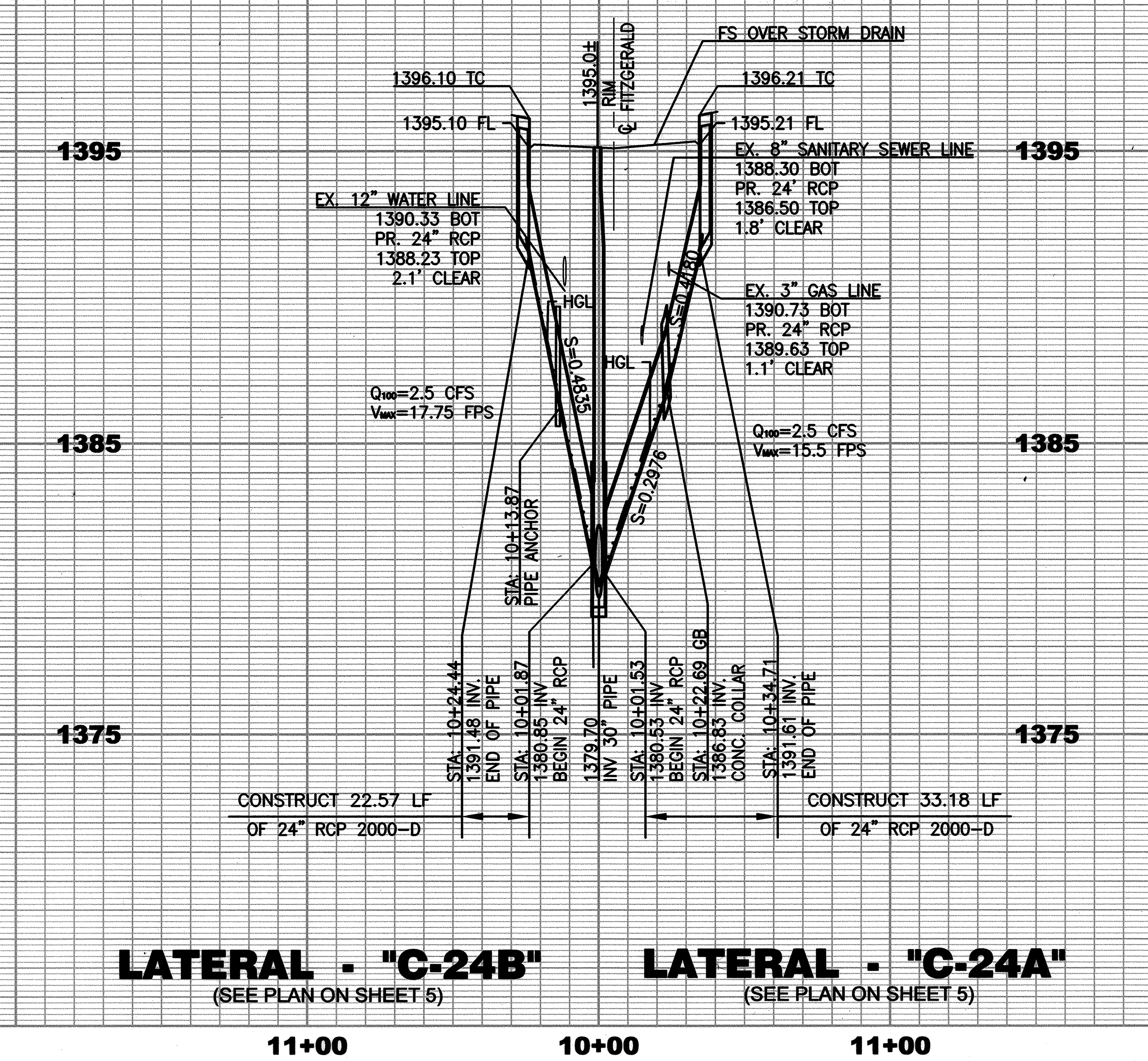


LATERAL - "C-3"
(SEE PLAN ON SHEET 5A)

LATERAL - "C-2"
(SEE PLAN ON SHEET 5A)

LATERAL - "C-5"
(SEE PLAN ON SHEET 5A)

LATERAL - "C-4"
(SEE PLAN ON SHEET 5A)

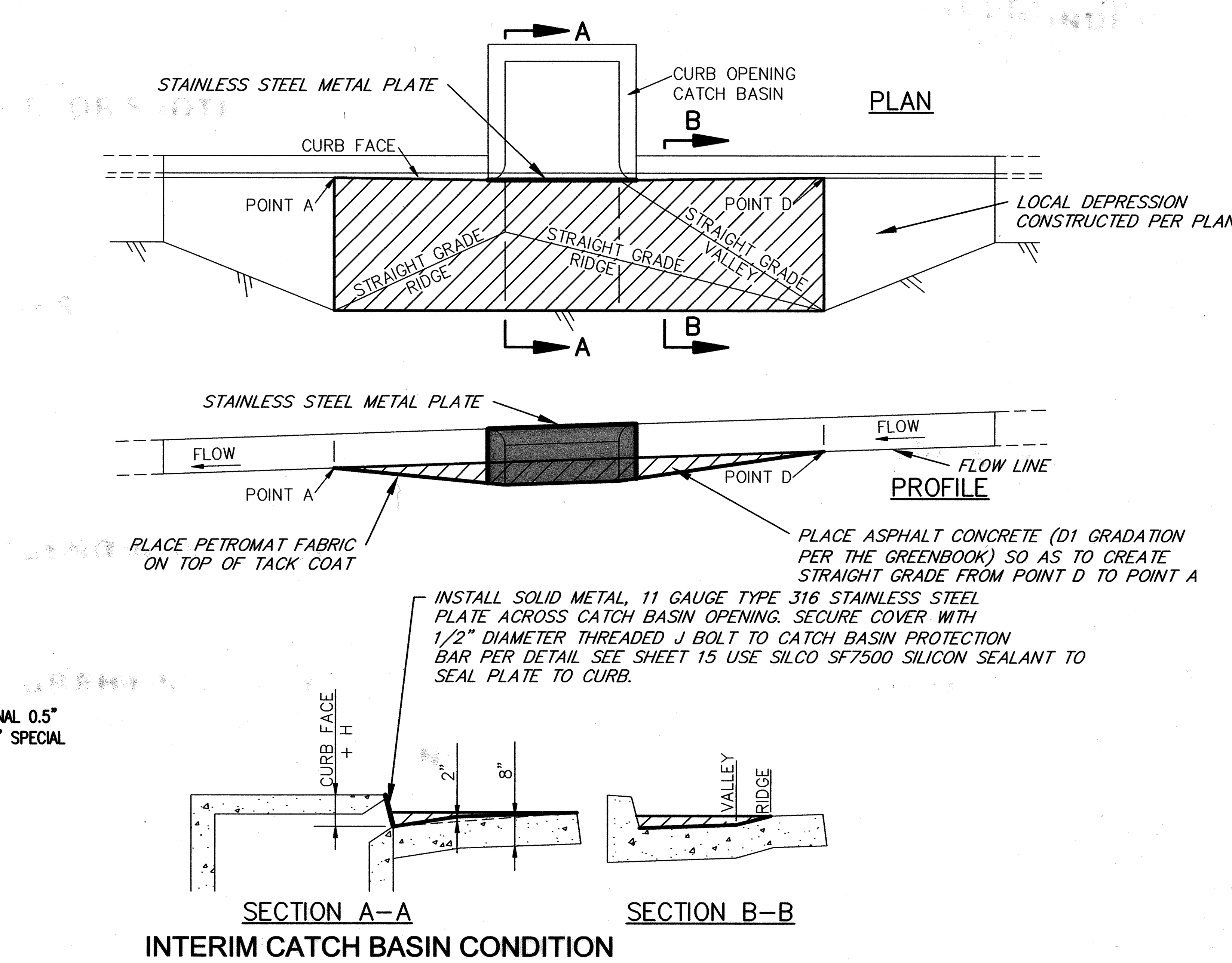


LATERAL - "C-24B"
(SEE PLAN ON SHEET 5)

LATERAL - "C-24A"
(SEE PLAN ON SHEET 5)

NOTE

* WHERE VELOCITY EXCEEDS 20 FPS ADD ADDITIONAL 0.5" CONCRETE OVER INVERT STEEL FOR A TOTAL 1.25" SPECIAL RCP WALL



INTERIM CATCH BASIN CONDITION
NOT TO SCALE

UNDERGROUND SERVICE ALERT
CALL:TOLL FREE 1-800 227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK		APPR.	DATE
1	REVISED STORM DRAIN PROFILES, DISCHARGE AND VELOCITY.		06/10/15

DESIGNED BY: DRAWN BY: CHECKED BY:

SEAL-DESIGN ENGINEER
REGISTERED PROFESSIONAL ENGINEER CHARLES WILBUR LOCKMAN No. 42485 Exp. 03/31/14 CIVIL STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
CHARLES WILBUR LOCKMAN, RCE 42485, EXP. 03/31/14 — 7/1/2015 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR, RCE 45935 — 7/2/15 DATE
APPROVED BY:
MARCUS FULLER, CITY ENGINEER, RCE 57271 — 7/9/15 DATE

TTG TMAD TAYLOR & GAINES
901 Via Piemonte, Suite 400
Ontario, California 91764
Phone: 909.477.6915 Fax: 909.477.6916
www.ttgcorp.com Project No. 0011.103.00

BENCH MARK: CITY B.M. No. 061-88, CAL TRANS B.M. No. 19-C-88 ELEVATION=1466.765
FD CAL-TRANS BRASS DISC SET IN TOP OF CURB @ END NORTHWEST RETURN 32 FT. NORTH OF CENTERLINE CASMALIA STREET 67 FT. WEST OF CENTERLINE AYALA AVE. (USG&SG DATUM OF 1929)

CITY OF RIALTO
MIRO WAY
STORM DRAIN IMPROVEMENT PLAN
LATERAL - "C-1" ~ "C-5" & "C-24", "C-24A", "C-24B" PROFILE

FOR: CITY OF RIALTO

16A of 16 SHEETS

PLAN No.

DESIGN PRINT