PATTERSON BUSINESS CENTER

Industrial Development

5030 Patterson Avenue
Perris, CA

Preliminary Hydrology Study

January 2023

Revised: September 2023

This report has been prepared under the direction of the following Registered Civil Engineer. The undersigned attests to the technical information contained herein and the qualifications of any technical specialist providing engineering data upon which recommendations, conclusions, and decisions are based:

Registered Civil Engineer

JEFFEREY D. MEITER
No. 64696

Submitted by
Valued Engineering Inc.
600 N. Mountain Avenue, Suite C102
Upland, CA 91786

Contents

APPENDIX

1.0 INTRODUCTION

CGU Capital Management proposes to develop 4.844 acres of existing vacant land in the City of Perris, CA. The developed site will reduce the total acreage from 4.844 acres to 4.821 acres by dedication additional right-of-way along Patterson Avenue to accommodate public sidewalks and landscaping. A total of 10.7 acres will be included in the overall hydrology analysis, which includes public right-of-way flows, off-site run-on flows, and the impact of developing this undeveloped site.

The project proposes the construction of a commercial warehouse building (approximately 94,453 square-foot) along with the parking stalls to accommodate the building size on the property. Additional improvements will include sidewalk, landscape, underground detention system and driveway approaches to access the proposed site. Parkway improvement is proposed for the frontage street of Patterson Avenue. The street will also involve constructing curb and gutter to the ultimate street width of 66’ per City standards for Patterson Avenue.

2.0 PURPOSE

The purpose of the study is to quantify the 10-year and 100-year peak storm flow rates for the pre-developed and post-developed site conditions. This study will also demonstrate that the proposed on-site drainage plan is adequately sized to contain the additional runoff generated in the post-developed condition for the 100-year storm. In addition to on-site analysis, the potential impact of the off-site flows that contribute to the public right-of-way by developing this site were analyzed for pre-developed conditions and future development of underground storm drain facilities.

The proposed on-site underground detention chambers are designed to comply with the City of Perris criteria stating that post-development flows shall not exceed 90% of pre-development flows. The 100-year storm was used for the on-site underground chambers.

The pre-developed and post-developed conditions were calculated using the rational method for the 10-year and 100-year storm events, which are presented in Appendix C of this report. Soil type was determined through multiple sources, including a geotechnical investigation performed by Terracon Consultants, Inc, WebSoilSurvey (an online soil resource) and the Riverside County Stormwater and Conservation Tracking Tool. Data obtained from these soil investigations can be seen in Appendix “B” of this report.

3.0 METHODOLOGY

The analysis was performed in accordance with the Riverside County Hydrology Manual. CivilDesign software by Bonadiman was used to perform rational method calculations. The 100-year intensity and AMC III was used to simulate the pre and post-developed hydrology condition. The NOAA Atlas 14 Point Precipitation Frequency Estimates were obtained for project site by entering the project coordinates of 33.86386 (North) and -117.25440 (West).

4.0 SITE DESCRIPTION

Soil infiltration testing was performed by Terracon Consultants, Inc. Site infiltration rates of the underlying soils for this site were found to be between 0.06 and 0.07 in/hr. Site hydrologic soils group classification was determined to be group B and C through WebSoilSurvey and Riverside County Stormwater and Conservation Tracking Tool.

Existing Drainage Condition

Existing runoff for this development is delineated into five subareas that will confluence at the northeasterly corner of the development. Subareas A1-A3 include drainage from off-site stormwater draining onto the proposed development (off-site run-on). Subarea A4 includes the on-site flows and subarea F1 includes the off-site street flows (AC Pavement).

The off-site subarea A1, A2 and A3 generally drain easterly with average grade of 1%. Stormwater sheet flows across the westerly adjacent lots then comingle with the proposed development area.

Subarea A4 is a rectangular site located on the west of Patterson Avenue (see the “Pre-Developed Hydrology Map” in Appendix “D” of this report). The site generally drains from southwest to northeast with average grades of 1% to 3%. Stormwater sheet flows across the site and is released onto Patterson Avenue at the northeasterly portion of the site. Due to the pre-developed site being nearly 100% pervious infiltration will occur on-site through the existing native pervious surface.

Subarea F1 consists of the AC Pavement limits along the Patterson Avenue contributing area includes up to the centerline where a crown acts as the limits of contributing stormwater to the property frontage (see the “Pre-Developed Hydrology Map” in Appendix D of this report). Flows from this subarea start at a high point and will ultimately drain north along the westerly edge of Patterson Avenue where stormwater will confluence with the flows from Subareas A1-A3 and A4.

Proposed Drainage Condition

Proposed runoff at the site is delineated into twelve subareas. Subareas A1, A2, A3, B1, C1, C2, C3, D1, E1, E2, E3 and F1 consist of the on-site areas that will be captured, treated, and then released off-site to where stormwater will contribute to the public storm drain system. Subarea F1 consists of all contributing public right-of-way flows along the property frontage of Patterson Avenue as previously discussed in “Existing Drainage Condition”.

Subarea A1, A2 and A3 consist of the offsite area west of the proposed developed location. Stormwater from these subareas begin at a high point at the westerly of the site. The stormwater will sheet flow easterly before the proposed property, where the storm drain inlets are proposed and runoff is conveyed into the proposed 42-inch RCP in Patterson Avenue. The existing 30-inch RCP pipe in Patterson Avenue is being upsized to the 42-inch RCP to convey the increase of stormwater, see Appendix "E" for offsite hydraulics.

Subarea C1 and C2 will capture the stormwater from the northern portion of the development. The building runoff, landscaping and hardscape will contribute to the runoff. The general direction of flow for these subareas drains westerly to easterly. Stormwater runoff generated from these subareas will be captured by a storm drain inlet at the low point of the east.
Subareas B1 will capture stormwater from the northwesterly parking lot area, the drive approach along Patterson Avenue. Landscaping and hardscape will contribute to the runoff. This subarea drains southeasterly to a low point along a proposed 6" curb and gutter where the underground chambers will be constructed. Stormwater runoff generated from subarea B1 will be treated through the underground chambers along the southerly property line of the development.
Subareas C3 and D1 will capture stormwater from the northeasterly portion of the proposed development. The parking lot, landscaping, native cover and hardscape will contribute to the runoff. These subareas drain from northeasterly to southerly. The stormwater will be routed via v-gutters and storm drain inlets. Stormwater runoff generated from subareas B1, B2 and B3 will be transported to the proposed underground chambers via storm drain system to be treated along the southerly property line of the development.

Subarea E1, E2 and E3 will capture stormwater runoff from the southwesterly parking lot area, just south of the drive approach. These subareas drain northeasterly to a low point where the storm drain inlets are proposed and transfer to the proposed underground chambers via storm drain system. An outlet will be proposed at the end of the site and connect to the existing Caltrans storm drain inlet located on Caldwell Avenue.

Subarea F1 consists of the AC Pavement limits along the Patterson Avenue property frontage and extending to areas of re-development in the public right-of-way. Along Patterson Avenue the contributing area includes up to the centerline where a crown acts as the limits of contributing stormwater to the property frontage. Flows from this subarea start at a high point at the southwesterly corner of the California Avenue re-development limits and will ultimately drain east along California Avenue until Patterson Avenue and then north along the westerly edge of Patterson Avenue.

On-site flows will be released onto Patterson Avenue after the underground chambers treat the stormwater from these subareas. See the "Post-Developed Hydrology Map" in Appendix "D" of this report)

5.0 RESULTS

The following table summarizes the data and results for the 10-year and 100-year storm events for the existing condition. Calculations can be found in Appendix "C" of this report.

Existing Subareas	ACRE	Q_{10}	Q_{100}
Subarea A1	2.00	3.34 cfs	5.82 cfs
Subarea A2	2.64	4.41 cfs	7.68 cfs
Subarea A3	1.00	1.67 cfs	2.91 cfs
Subarea A4	4.82	7.40 cfs	13.79 cfs
Subarea F1	0.25	0.26 cfs	0.51 cfs
Total	10.71	17.08 cfs	30.71 cfs
Confluence**	---	16.95 cfs	30.45 cfs

** Confluence – The junction of contributing upstream flows to a final downstream single flow.

The following table summarizes the data and results for the 10-year and 100-year storm events for the proposed condition. Calculations can be found in Appendix "C" of this report.

Proposed Subareas	ACRE	Q_{10}	Confluence** Q_{10}	Q_{100}	Confluence** Q_{100}
Subarea A1	2.00	3.34 cfs	17.32 cfs	5.82 cfs	29.64 cfs
Subarea A2	2.64	4.41 cfs		7.56 cfs	
Subarea A3	1.00	1.67 cfs		2.75 cfs	
Subarea B1	1.29	2.16 cfs		3.69 cfs	
Subarea C1	2.14	3.60 cfs		6.14 cfs	
Subarea C2	0.12	0.20 cfs		0.34 cfs	
Subarea C3	0.43	0.70 cfs		1.20 cfs	
Subarea D1	0.36	0.56 cfs		0.96 cfs	
Subarea E1	0.16	0.24 cfs		0.41 cfs	
Subarea E2	0.14	0.20 cfs		0.35 cfs	
Subarea E3	0.17	0.24 cfs		0.42 cfs	
Subarea F1	0.25	0.40 cfs	0.40 cfs	0.69 cfs	0.69
Total	10.70	17.72	17.72	30.33	30.33

** Confluence – The junction of contributing upstream flows to a final downstream single flow.

On-Site Analysis

The off-site subareas A1, A2 and A3 generally drains easterly into the proposed storm drain inlets on-site. Then it will eventually drains to the existing Caltrans storm drain inlet on Caldwell Avenue via storm drain system.

On-site stormwater will be captured by underground chambers before stormwater will be released into the public right-of-way. The stormwater released will contribute to street flows along Caldwell Avenue. A maximum of 15.26 cfs will be discharged from the proposed underground chambers from all on-site flows. Mitigation will take place by basin routing in post-developed subareas through the underground detention chambers. The proposed outlet will be used for excess flows and would prevent stormwater from backing up onto the site. This outlet will be located on southeasterly portion of the property. The existing site does not retain any stormwater in the existing condition. Release flows into the city storm drain system will not exceed the 90% flow for a 100-year storm event.

A hydraulic analysis of all on-site storm drain facilities including, but not limited to, curb and gutter, v-gutters, gravel swales, underground storm drain, chambers, weirs and orifices will be performed during the "Final Hydrology Report".

Off-Site Analysis

The existing 100-year storm pre-development flows that contribute to the existing Caltrans storm drain inlet (draining southerly) is 16.82 cfs. The proposed site will reduce the flows along Caldwell Avenue to 15.14 cfs (90% of existing flows). The Offsite Storm Drain Plan – "Perris Valley Strom Drain System" for Patterson Avenue, Nandina Avenue and Western Way, prepared June 2020 includes the underground storm drainpipe along the Patterson Avenue. The nearest public facilities include Line A from Offsite Storm Drain Plan that has been built up to 300' from Harley Knox Blvd. This pipe (Line A) begins on Western Way runs southerly to the north of the proposed development, approximately at the Nandina Avenue. This line runs easterly to Patterson Avenue where it will begin heading south towards the underground storm drain proposed by Caltrans per Caltrans contract No. 08-420404.

The existing conditions for stormwater runoff transportation along the property frontage and the surrounding area flows along Patterson Avenue (northerly) via catch basins and storm drain connections. The proposed development on Patterson Avenue will mimic the existing condition by holding the longitudinal slope (north to south) and the cross slope of the Patterson Avenue Street section, approximately 2%. The on-site stormwater mitigation by developing this site will improve the upon the existing stormwater runoff condition in the public right-of-way. The existing 100-year storm pre-development flows that contribute to Patterson Avenue (draining northerly) is 16.82 cfs. The proposed site will reduce the flows along Patterson Avenue to 15.14 cfs (90% of existing flows). The existing Storm drain pipe (Line A) lies along the stretch of Line A that was analyzed to have a projected flow of 18.2 cfs for a 30-inch reinforced concrete pipe (RCP) while the on-site flow was 15.14 cfs. The existing 30-inch RCP does not have the capacity to convey the runoff from the proposed development. At the proposed lateral from the development the existing 30-inch RCP is being upsized to a 42-inch RCP to meet the hydraulic capacity with increase in runoff.

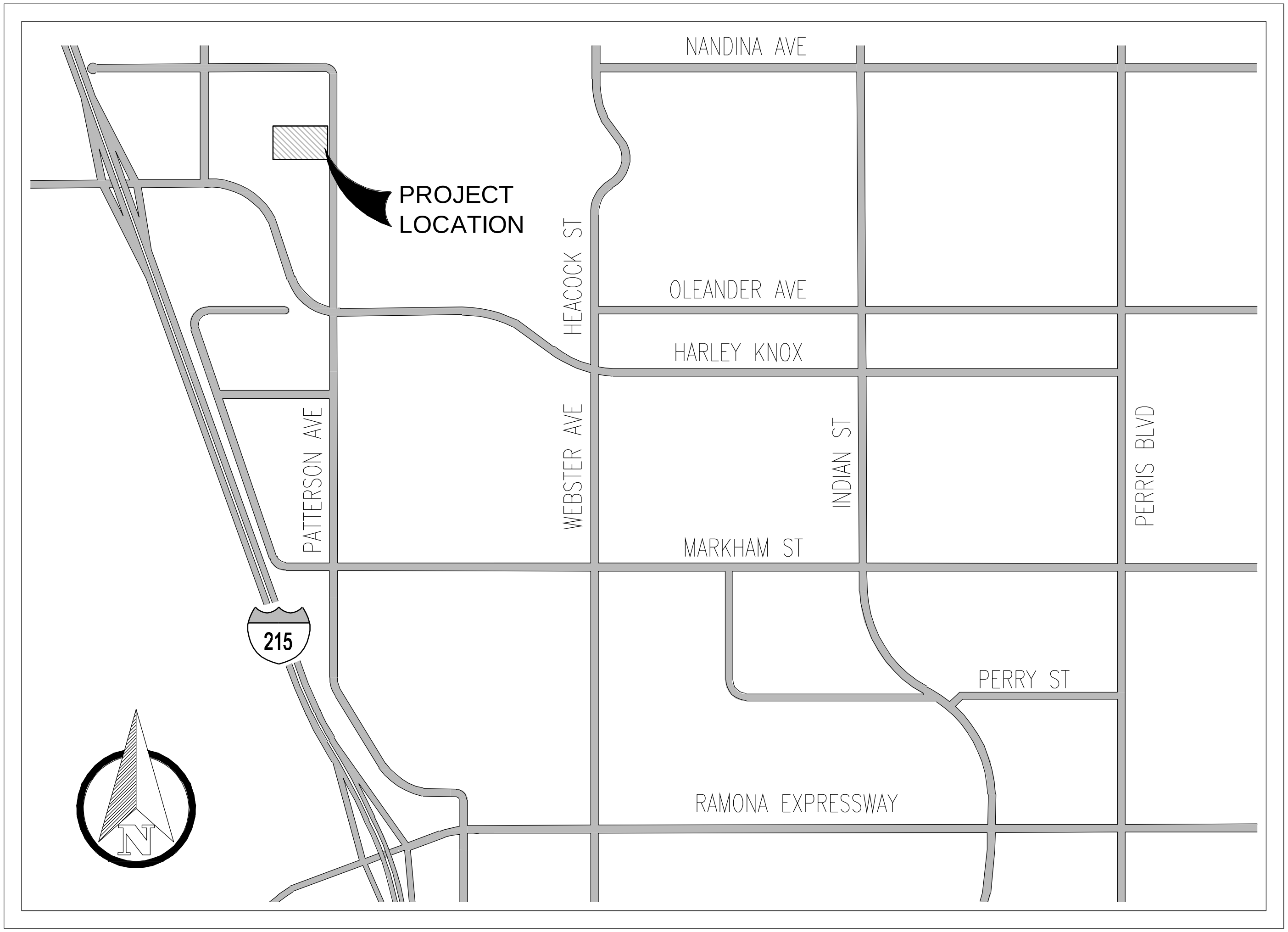
Conclusion

The proposed development does not have a significant impact on the existing drainage condition for the site by reducing the flows that will contribute along the frontage of Patterson Avenue through on-site mitigation. Due to a lack of public storm drain facilities to release treated on-site stormwater or to capture public water along Patterson Avenue. stormwater will be transported via the new 42-inch RCP storm drain system that will be constructed in place of the existing storm drainpipe (Line A) where stormwater will continue southerly towards the Harley Knox Blvd to connect the existing storm drain system constructed by Caltrans per City of Perris offsite Storm Drain Plan P8-1351.

APPENDIX “A”

REFERENCE MATERIALS

VICINITY MAP
POINT PRECIPITATION FREQUENCY ESTIMATES
SUBAREA BREAKDOWN



VICINITY MAP

NOT TO SCALE

NOAA Atlas 14, Volume 6, Version 2
Location name: Perris, California, USA*
Latitude: 33.8637°, Longitude: -117.2529°
Elevation: 1490.55 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

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

Duration	Annual exceedance probability (1/years)								
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500	1/1000
5-min	**0.101** (0.085-0.122)	**0.161** (0.134-0.195)	**0.201** (0.166-0.246)	**0.256** (0.204-0.324)	**0.299** (0.233-0.387)	**0.344** (0.261-0.457)	**0.391** (0.289-0.535)	**0.458** (0.323-0.654)	**0.512** (0.349-0.758)
10-min	**0.145** (0.121-0.175)	**0.231** (0.192-0.280)	**0.289** (0.238-0.353)	**0.366** (0.292-0.464)	**0.428** (0.334-0.554)	**0.493** (0.374-0.655)	**0.560** (0.414-0.767)	**0.656** (0.464-0.938)	**0.733** (0.500-1.09)
15-min	**0.175** (0.146-0.212)	**0.279** (0.232-0.338)	**0.349** (0.288-0.427)	**0.443** (0.353-0.562)	**0.518** (0.404-0.671)	**0.596** (0.453-0.792)	**0.678** (0.500-0.928)	**0.793** (0.561-1.13)	**0.887** (0.605-1.31)
30-min	**0.284** (0.237-0.343)	**0.451** (0.376-0.547)	**0.564** (0.466-0.690)	**0.717** (0.571-0.908)	**0.837** (0.652-1.08)	**0.963** (0.732-1.28)	**1.10** (0.809-1.50)	**1.28** (0.907-1.83)	**1.43** (0.978-2.12)
60-min	**0.384** (0.321-0.465)	**0.612** (0.509-0.742)	**0.765** (0.632-0.935)	**0.971** (0.774-1.23)	**1.13** (0.884-1.47)	**1.31** (0.992-1.74)	**1.49** (1.10-2.03)	**1.74** (1.23-2.49)	**1.94** (1.33-2.88)
2-hr	**0.561** (0.468-0.679)	**0.845** (0.703-1.02)	**1.03** (0.853-1.26)	**1.28** (1.02-1.62)	**1.48** (1.15-1.91)	**1.68** (1.27-2.23)	**1.88** (1.39-2.58)	**2.17** (1.53-3.10)	**2.39** (1.63-3.54)
3-hr	**0.688** (0.574-0.832)	**1.02** (0.847-1.23)	**1.23** (1.02-1.51)	**1.52** (1.21-1.92)	**1.74** (1.35-2.25)	**1.96** (1.49-2.61)	**2.19** (1.62-3.00)	**2.51** (1.77-3.59)	**2.76** (1.88-4.09)
6-hr	**0.956** (0.798-1.16)	**1.39** (1.16-1.69)	**1.68** (1.39-2.05)	**2.05** (1.64-2.60)	**2.34** (1.82-3.03)	**2.63** (1.99-3.49)	**2.92** (2.15-4.00)	**3.32** (2.35-4.75)	**3.64** (2.48-5.39)
12-hr	**1.24** (1.03-1.50)	**1.83** (1.53-2.22)	**2.22** (1.83-2.71)	**2.72** (2.17-3.44)	**3.10** (2.42-4.01)	**3.48** (2.65-4.63)	**3.87** (2.86-5.30)	**4.40** (3.11-6.29)	**4.81** (3.28-7.13)
24-hr	**1.59** (1.41-1.84)	**2.43** (2.14-2.81)	**2.97** (2.60-3.46)	**3.66** (3.10-4.41)	**4.19** (3.48-5.15)	**4.72** (3.83-5.95)	**5.27** (4.15-6.82)	**6.00** (4.55-8.09)	**6.57** (4.81-9.15)
2-day	**1.86** (1.64-2.14)	**2.89** (2.55-3.35)	**3.56** (3.12-4.15)	**4.43** (3.76-5.34)	**5.10** (4.23-6.27)	**5.77** (4.67-7.27)	**6.46** (5.09-8.36)	**7.38** (5.59-9.95)	**8.10** (5.93-11.3)
3-day	**1.98** (1.75-2.29)	**3.13** (2.76-3.62)	**3.88** (3.40-4.52)	**4.86** (4.11-5.85)	**5.60** (4.65-6.89)	**6.36** (5.15-8.01)	**7.14** (5.63-9.24)	**8.19** (6.20-11.0)	**9.01** (6.60-12.6)
4-day	**2.15** (1.90-2.48)	**3.43** (3.03-3.97)	**4.27** (3.74-4.97)	**5.36** (4.54-6.46)	**6.20** (5.15-7.62)	**7.06** (5.72-8.89)	**7.94** (6.26-10.3)	**9.14** (6.92-12.3)	**10.1** (7.38-14.0)
7-day	**2.33** (2.06-2.69)	**3.80** (3.36-4.40)	**4.77** (4.18-5.56)	**6.05** (5.13-7.29)	**7.04** (5.84-8.66)	**8.05** (6.52-10.1)	**9.09** (7.17-11.8)	**10.5** (7.97-14.2)	**11.6** (8.52-16.2)
10-day	**2.38** (2.11-2.75)	**3.95** (3.48-4.56)	**4.99** (4.37-5.81)	**6.37** (5.39-7.67)	**7.44** (6.17-9.14)	**8.54** (6.92-10.8)	**9.68** (7.63-12.5)	**11.2** (8.52-15.2)	**12.5** (9.14-17.4)
20-day	**2.70** (2.38-3.11)	**4.57** (4.03-5.29)	**5.85** (5.13-6.82)	**7.60** (6.43-9.15)	**8.97** (7.45-11.0)	**10.4** (8.43-13.1)	**11.9** (9.40-15.4)	**14.0** (10.6-18.9)	**15.7** (11.5-21.9)
30-day	**3.02** (2.67-3.48)	**5.15** (4.54-5.95)	**6.63** (5.81-7.73)	**8.69** (7.36-10.5)	**10.3** (8.57-12.7)	**12.1** (9.78-15.2)	**13.9** (11.0-18.0)	**16.5** (12.5-22.2)	**18.6** (13.6-25.9)
45-day	**3.47** (3.06-4.00)	**5.87** (5.18-6.79)	**7.60** (6.65-8.85)	**10.0** (8.49-12.1)	**12.0** (9.97-14.8)	**14.1** (11.5-17.8)	**16.4** (12.9-21.2)	**19.6** (14.9-26.5)	**22.3** (16.3-31.1)
60-day	**3.87** (3.42-4.46)	**6.47** (5.71-7.49)	**8.38** (7.34-9.77)	**11.1** (9.40-13.4)	**13.4** (11.1-16.4)	**15.8** (12.8-19.9)	**18.4** (14.5-23.9)	**22.3** (16.9-30.0)	**25.4** (18.6-35.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of annual maxima series (AMS).

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 annual exceedance probability) 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.

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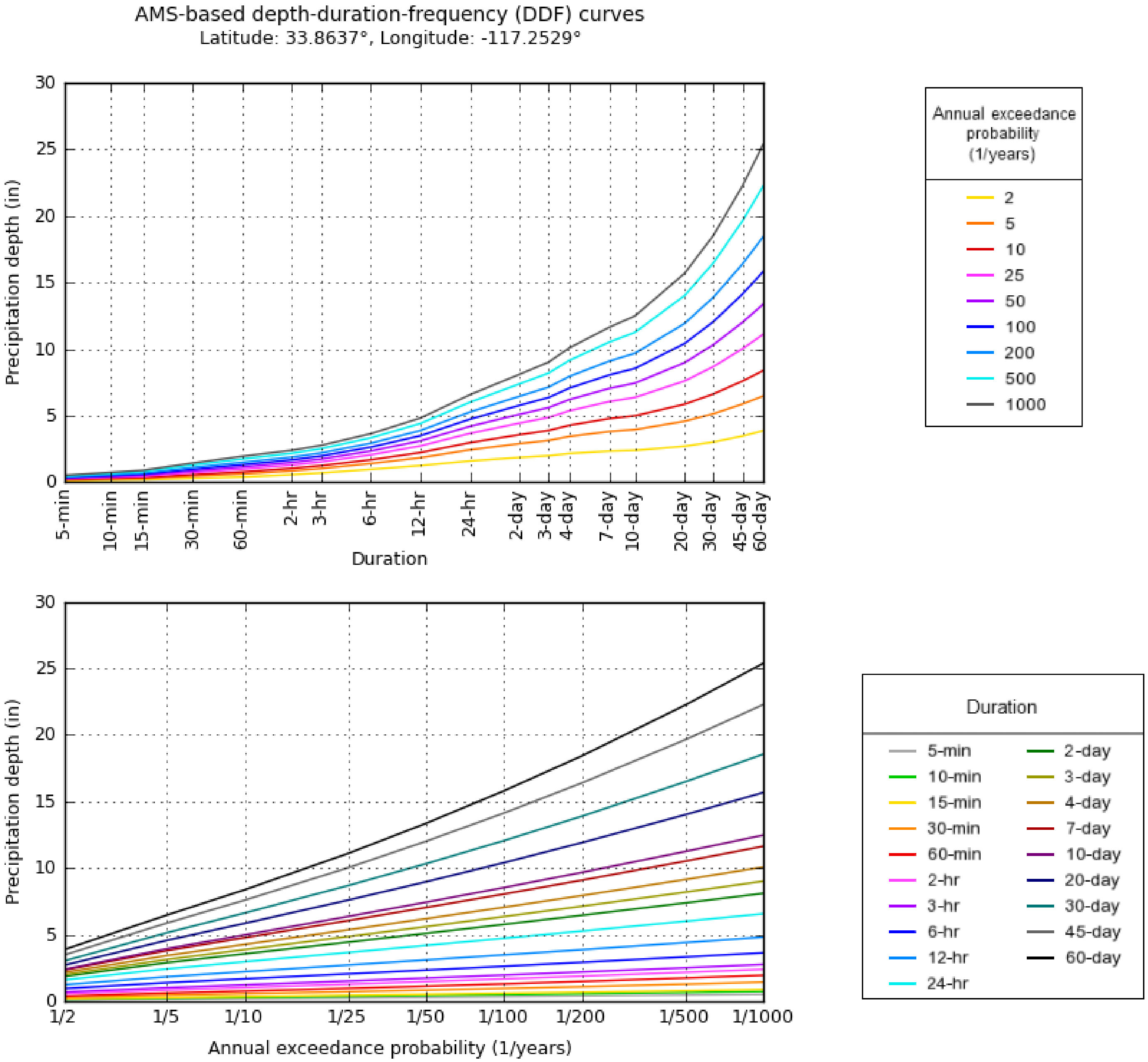
PF graphical


AMS-based depth-duration-frequency (DDF) curves
Latitude: 33.8637°, Longitude: -117.2529°

NOAA Atlas 14, Volume 6, Version 2 Created (GMT): Thu Mar 3 19:51:11 2022

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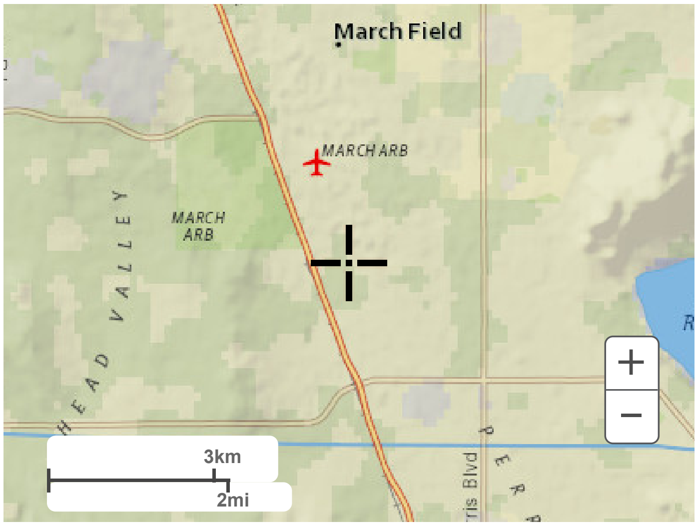
Maps & aerials

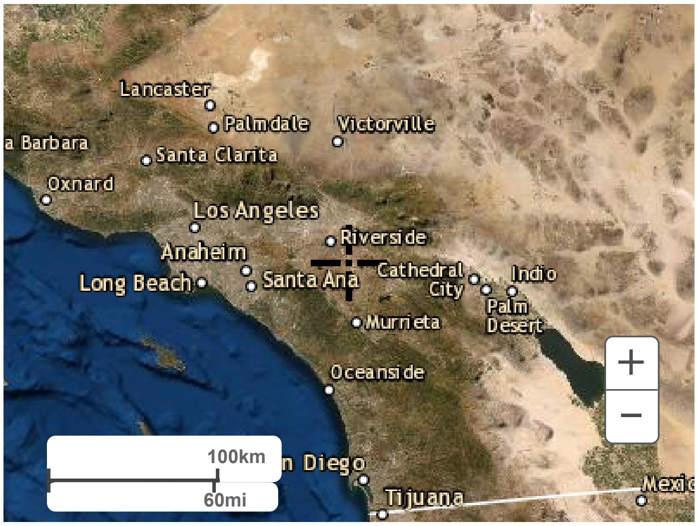
Small scale terrain



Large scale terrain

Large scale map

Large scale aerial



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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

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		FT^2	AC	%	AVERAGE CN VALUE
EXISTING CONDITION	A_T=	221008.5	5.074	---	78
	A_{PERV}=	221008.5	5.074	100.00%	
	A_{IMP}=	0	0.000	0.00%	
A1	A_T=	210018	4.821	---	78
	A_{PERV}=	210018	4.821	100.00%	
	A_{IMP}=	0	0.000	0.00%	
F1	A_T=	10990.5	0.252	---	91
	A_{PERV}=	10990.5	0.252	100.00%	
	A_{IMP}=	0	0.000	0.00%	
PROPOSED CONDITION	A_T=	220932	5.072	---	93
	A_{PERV}=	36823	0.845	16.67%	
	A_{IMP}=	184109	4.227	83.33%	
A1	A_T=	93184	2.14	---	96
	A_{PERV}=	4999	0.115	5.36%	
	A_{IMP}=	88185	2.024	94.64%	
A2	A_T=	5224	0.120	---	91
	A_{PERV}=	1308	0.030	25.04%	
	A_{IMP}=	3916	0.090	74.96%	
B1	A_T=	18896	0.434	---	91
	A_{PERV}=	4436	0.102	23.48%	
	A_{IMP}=	14460	0.332	76.52%	
B2	A_T=	15769	0.362	---	89
	A_{PERV}=	5055	0.116	32.06%	
	A_{IMP}=	10714	0.246	67.94%	
B3	A_T=	7506	0.172	---	98
	A_{PERV}=	0	0.000	0.00%	
	A_{IMP}=	7506	0.172	100.00%	
C1	A_T=	6300	0.145	---	98
	A_{PERV}=	0	0.000	0.00%	
	A_{IMP}=	6300	0.145	100.00%	
D1	A_T=	7040	0.162	---	98
	A_{PERV}=	0	0.000	0.00%	
	A_{IMP}=	7040	0.162	100.00%	
E1	A_T=	56022	1.286	---	93
	A_{PERV}=	10034	0.230	142.53%	
	A_{IMP}=	45988	1.056	653.24%	
F1	A_T=	10990.5	0.252	---	69
	A_{PERV}=	10990.5	0.252	100.00%	
	A_{IMP}=	0	0.000	0.00%	

APPENDIX “B”

SOILS INVESTIGATION

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Item	Description
Foundation Support	Engineered fill extending 2 feet below the bottom of foundations, or 5 feet below existing grades, whichever is greater.
Net Allowable Bearing pressure [1, 2] **(On-site soils or structural fill)**	2,200 psf
Minimum Foundation Dimensions	Columns: 24 inches Continuous: 18 inches
Minimum Footing Depth	18" below finished grade
Ultimate Passive Resistance [4]	350 pcf
Ultimate Coefficient of Sliding Friction [5]	0.32
Estimated Total Static Settlement from Structural Loads [2]	about 1 inch
Estimated Differential Settlement [2, 6]	About 1/2 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied.
2. Values provided are for maximum loads noted in **Project Description**. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations.
3. Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the **Earthwork**.
4. Use of passive earth pressures requires the footing forms be removed and compacted structural fill be placed against the vertical footing face. A factor of safety of 2.0 is recommended.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions. A factor of safety of 1.5 is recommended.
6. Differential settlements are as measured over a span of 40 feet.

FLOOR SLABS

DESCRIPTION	RECOMMENDATION
Interior floor system	Slab-on-grade concrete

DESCRIPTION	RECOMMENDATION
Floor slab support	Engineered fill extending 2 feet below the bottom of associated foundations, or 5 feet below existing grades, whichever is greater.
Subbase	Minimum 4-inches of Aggregate Base
Modulus of subgrade reaction	150 pounds per square inch per inch (psi/in) (The modulus was obtained based on estimates obtained from NAVFAC 7.1 design charts). This value is for a small loaded area (1 Sq. ft or less) such as for forklift wheel loads or point loads and should be adjusted for larger loaded areas.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

PAVEMENTS

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Pavement Design Parameters

Design of asphalt concrete (AC) pavements is based on the procedures outlined in the Caltrans "Highway Design Manual for Safety Roadside Rest Areas" (Caltrans, 2016). Design of Portland cement concrete (PCC) pavements are based upon American Concrete Institute (ACI) 330R-08; "Guide for Design and Construction of Concrete Parking Lots."

A correlated design R-value of 15 was used to calculate the AC pavement thickness sections. A modulus of subgrade reaction of 120 pci and a modulus of rupture of 600 psi were used for the PCC pavement designs.

The structural sections are predicated upon proper compaction of the utility trench backfills and the subgrade soils as prescribed by in **Earthwork**, with the upper 12 inches of subgrade soils and all aggregate base material brought to a minimum relative compaction of 95 percent in accordance with ASTM D 1557 prior to paving. The aggregate base should meet Caltrans requirements for Class 2 base.

The pavement designs were based upon the results of preliminary sampling and testing and should be verified by additional sampling and testing (specifically R-value testing) during construction when the actual subgrade soils are exposed. Additionally, the preliminary sections provided are minimums based on procedures previously referenced. The project civil engineer should confirm minimum Traffic Indices and sections required by local agencies or jurisdictions if applicable.

Pavement Section Thicknesses

The following table provides options for AC and PCC Sections:

Asphalt Concrete Design		
Usage	**Assumed Traffic Index**	**Recommended Structural Section**
Auto Parking Areas	5.0	3” HMA[1]/9” Class 2 AB[2]
Drive lanes	5.5	3” HMA[1]/10” Class 2 AB[2]
Truck Parking Areas	7.0	4” HMA[1]/13” Class 2 AB[2]
Truck Delivery Areas	8.0	4.5” HMA[1]/16” Class 2 AB[2]

1. HMA = hot mix asphalt
2. AB = aggregate base

Portland Cement Concrete Design			
Layer	Thickness (inches)		
	Light Duty[1]	Medium Duty[2]	Dumpster Pad[3]
PCC	5.0	6.0	7.5
Aggregate Base [4]	--	--	--

1. Car Parking and Access Lanes, Average Daily Truck Traffic (ADTT) = 1 (Category A).
2. Truck Parking Areas, Multiple Units, ADTT = 25 (Category B)
3. In areas of anticipated heavy traffic, fire trucks, delivery trucks, or concentrated loads (e.g., dumpster pads), and areas with repeated turning or maneuvering of heavy vehicles, ADTT = 700 (Category C).
4. Aggregate base is not required. Compacted on-site material is considered competent.

Recommended structural sections were calculated based on assumed TIs and our preliminary sampling and testing.

Terracon does not practice traffic engineering. We recommend that the project civil engineer or traffic engineer verify that the TIs and ADTT traffic indices used are appropriate for this project.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2 percent.
- Subgrade and pavement surfaces should have a minimum 2 percent slope to promote proper surface drainage.
- Install below pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

STORM WATER MANAGEMENT

The soil at the infiltration test locations was classified in the field using a visual/manual procedure. Soil samples from the test locations were returned to our laboratory for testing by sieve analysis. The results of the sieve analyses are attached. The infiltration velocity is presented as the infiltration rate and is summarized in the following table. The infiltration rates provided do not include safety factors.

Test Location	Test Depth (feet)[1]	Soil Type	Infiltration Rate	
			in./hr.	cm./hr.
DR-1	5	SC-SM	0.06	0.16
DR-2	5	SC-SM	0.07	0.18

1. Below existing ground surface

The above infiltration rates determined by the double-ring method are based on field test results utilizing clear water. Infiltration rates can be affected by silt buildup, debris, degree of soil saturation, site variability and other factors. The rate obtained at specific location and depth is representative of the location and depth tested and may not be representative of the entire site.

Due to the significant variation of measured infiltration rates, infiltration rate utilized in the design should be selected carefully and based on the design basin depth. The designer of the basins should also consider other possible site variability in the design. Application of an appropriate safety factor may be prudent to account for subsoil inconsistencies, possible compaction related to site grading, and potential silting of the percolating soils, depending on the application.

CORROSIVITY

The following table lists the laboratory electrical resistivity (standard and as-received), chlorides, soluble sulfates, and pH testing results. These values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

Boring	Depth (feet)	Soluble Sulfate (mg/kg)	Soluble Chloride (mg/kg)	Fluoride (mg/kg)	pH	Resistivity (as-received) (Ohm-cm)	Resistivity (saturated) (Ohm-cm)
B-3	0 to 5	64	11	18	7.6	13,200	2,400

Results of soluble sulfate testing indicate samples of the on-site soils tested possess negligible sulfate concentrations when classified in accordance with Table 4.3.1 of the ACI Design Manual. Concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.

For protection against corrosion to buried metals, Terracon recommends that an experienced corrosion engineer be retained to design a suitable corrosion protection system for underground metal structures or components.

If corrosion of buried metal is critical, it should be protected using a non-corrosive backfill, wrapping, coating, sacrificial anodes, or a combination of these methods, as designed by a qualified corrosion engineer.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Terracon conducted thirteen (13) soil-testing borings. Our scope also included excavating two (2) test pits, each 5 feet deep, for double ring infiltration testing. These borings and pits were planned at the locations and to depths indicated in the table below.

Boring Nos	Boring Depth (feet) [1,2]	Location
3 (B-1 to B-3)	21 ½	Warehouse building
2 (B-4 and B-5)	51 ½	Warehouse building
3 (B-6 to B-8)	21 ½	Office buildings and loading dock
4 (B-9 to B-13)	6 ½ and 11 ½	Car/trailer Parking lots
2 (DR-1 and DR-2)	5[3]	Infiltration facility

1. Below ground surface.

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet) and approximate elevations were obtained by interpolation from the Google Earth. If elevations and a more precise boring layout are desired, we recommend borings be surveyed following completion of fieldwork.

Subsurface Exploration Procedures: We advance the borings with a truck-mounted drill rig using hollow-stem augers. Both a standard penetration test (SPT) sampler (2-inch outer diameter and 1-3/8-inch inner diameter) and a modified California ring-lined sampler (3-inch outer diameter and 2-3/8-inch inner diameter) are utilized in our investigation. The penetration resistance is recorded on the boring logs as the number of hammer blows used to advance the sampler in 6-inch increments (or less if noted). The samplers are driven with an automatic hammer that drops a 140-pound weight 30 inches for each blow. After the required seating, samplers are advanced up to 18 inches, providing up to three sets of blowcounts at each sampling interval. The sampling depths, penetration distances, and other sampling information are recorded on the field boring logs. The recorded blows are raw numbers without any corrections for hammer type (automatic vs. manual cathead) or sampler size (ring sampler vs. SPT sampler). Relatively undisturbed and bulk samples of the soils encountered are placed in sealed containers and returned to the laboratory for testing and evaluation.

We observe and record groundwater levels during drilling and sampling. For safety purposes, all borings are backfilled with auger cuttings after their completion.

The test pits for infiltration testing were excavated using a small backhoe. Soil was excavated in a 5-foot by 5-foot square area and to a depth of approximately 5 feet. The excavated material was stockpiled and used to backfill the pit upon completion of testing.

Our exploration team prepares field boring logs as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs are prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Infiltration Testing (Storm Water)

Two double-ring infiltration tests were performed at the proposed basin area within the excavated test pits. The field infiltration test program consists of the following:

Number of Test Borings	Test Pit Depth (feet) [1]	Location
2 (DR 1 and DR 2)	5	See **Exploration Plan**

1. Below ground surface

Utilizing the double-ring infiltrometer method described in ASTM D 3385, testing was performed at the locations indicated on **Exploration Plan**. Based on observations in the excavations utilized for infiltrometer testing, the soil profile within the site generally consists of silty clayey sand.

The double-ring infiltration tests were performed by driving two open aluminum rings into the bottom of excavated test pits, one inside of the other. A tamping rod was used to compact disturbed soils adjacent to the rings. The rings were partially filled with water to equal depths. The water was maintained at a constant level using a float valve and water source for each ring. The volume of water added to the inner and outer rings was recorded at timed intervals. The graduated cylinder corresponding to the inner ring is readable in increments of 25 mL. These data were used to calculate the infiltration rate of the soil. The infiltration test was performed until a relatively steady- state infiltration velocity was reached.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- Water (Moisture) Content of Soil by Mass

- Laboratory Determination of Density (Unit Weight) of Soil Specimens
- Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
- Modified Proctor test
- Hydro-consolidation
- Atterberg limits
- Corrosivity suite test

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

SITE LOCATION AND EXPLORATION PLANS

SITE LOCATION

Patterson Avenue Industrial Center ■ Perris, Riverside County, California
July 27, 2021 ■ Terracon Project No. CB215068

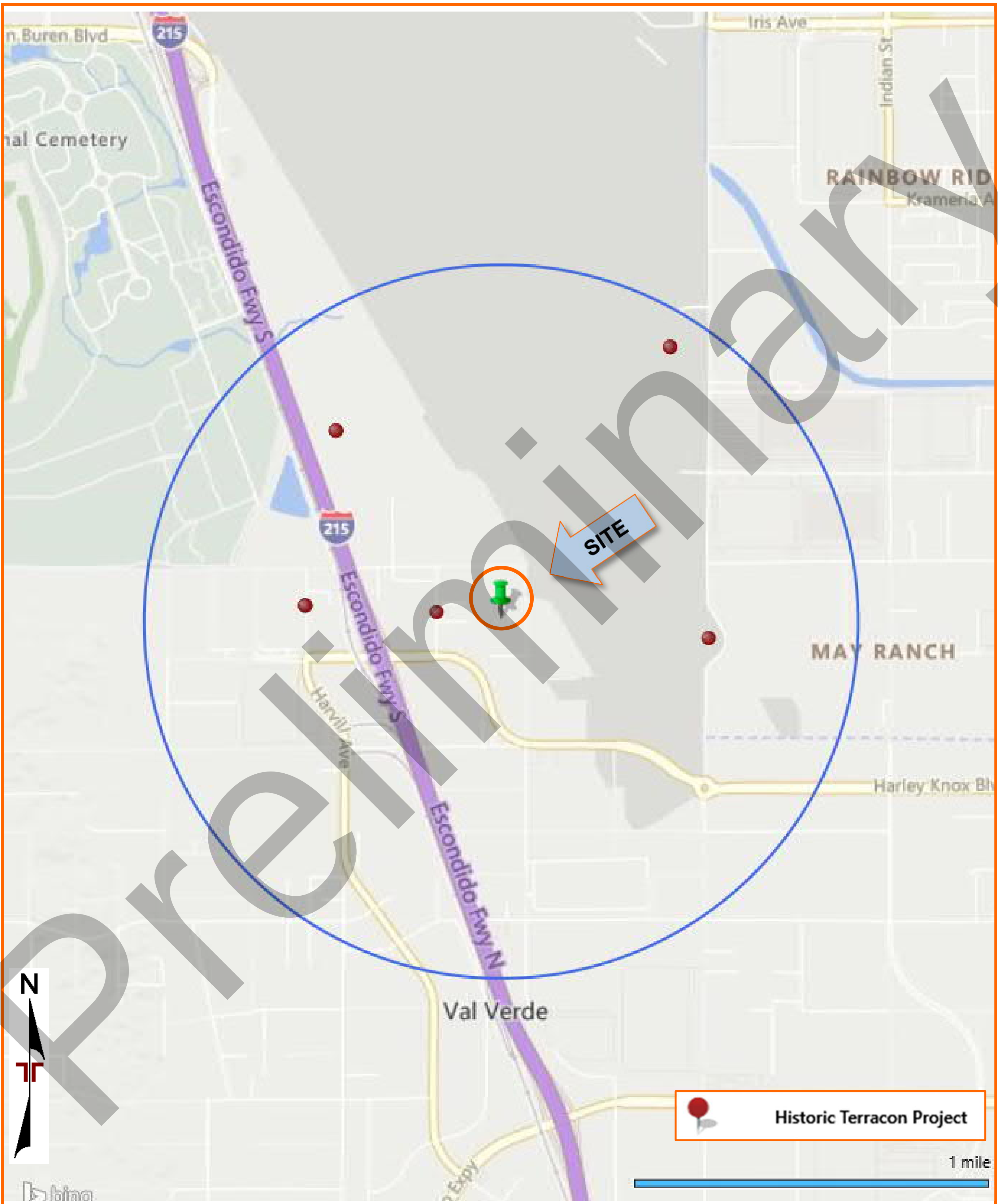


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN

Patterson Avenue Industrial Center ■ Perris, Riverside County, California

July 27, 2021 ■ Terracon Project No. CB215068

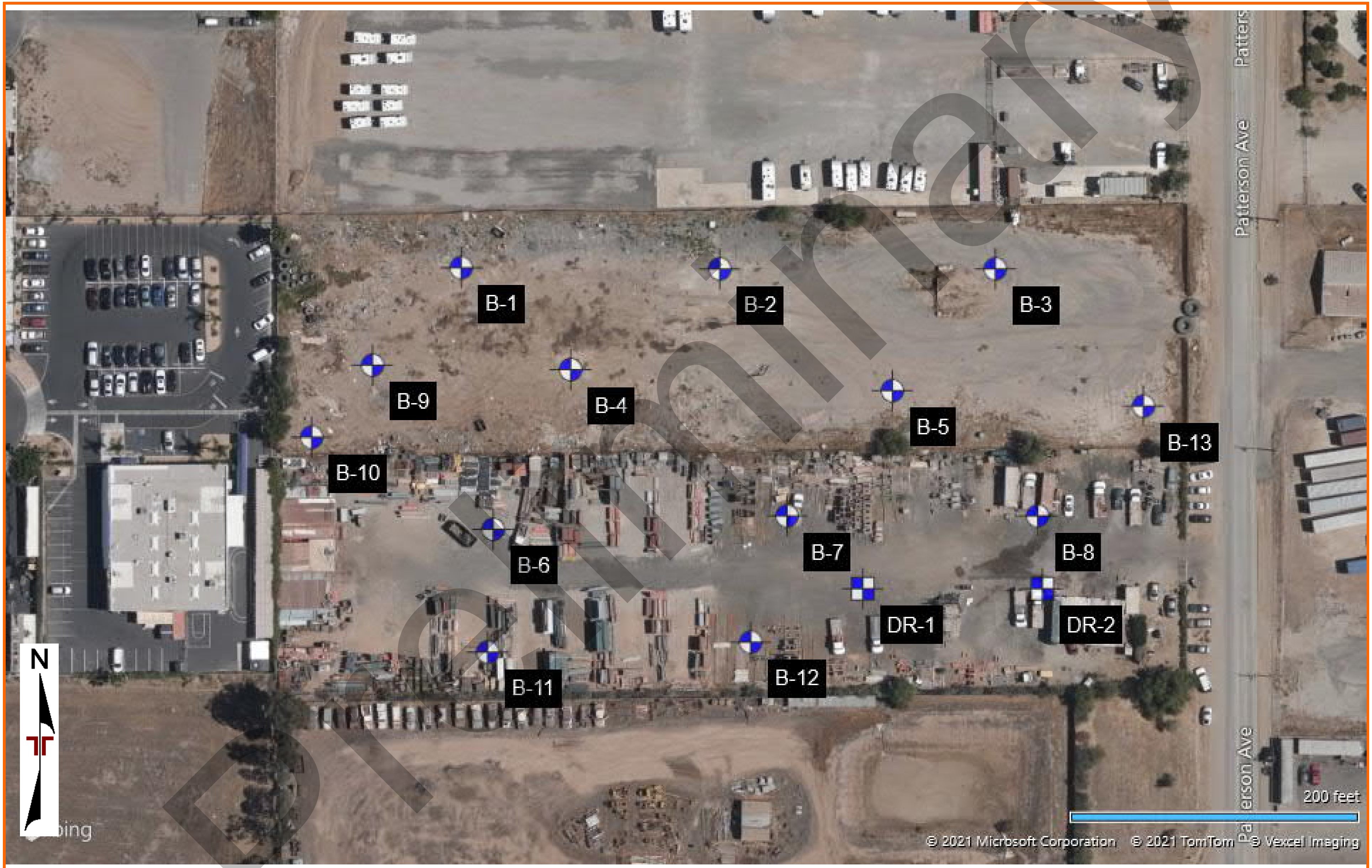


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

BORING LOG NO. B-1

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: **Patterson Ave. & Nandina Ave.**
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8644° Longitude: -117.2544°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**SANDY LEAN CLAY (CL)**, dark reddish brown, very stiff			⧓	6-9-15				8	126		
	4.5											
▨	**SILTY CLAYEY SAND (SC-SM)**, fine to coarse grained, orange, very dense	5		⧓	25-50/3"				6	116		
	medium dense			⧓	8-13-17				6	131		
	9.0											
▨	**SANDY LEAN CLAY (CL)**, grayish brown, very stiff	10		⧓	13-18-20				7	129		
	13.0											
▨	**LEAN CLAY (CL)**, orange, very stiff	15		☒	6-8-11 N=19							
	2" sandy clay lens at 16.25'											
	18.0											
▨	**SANDY SILTY CLAY (CL-ML)**, grayish brown, stiff, with mineralization	20		☒	2-6-8 N=14							
	21.5											
	Boring Terminated at 21.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-30-2021	Boring Completed: 07-30-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-2

Page 1 of 1

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8643° Longitude: -117.2538°

DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY LEAN CLAY (CL), dark reddish brown, very stiff, with mineralization			⧗	5-10-18				8	127		59
4.5	**SILTY CLAYEY SAND (SC-SM)**, orange, very dense	5		⧗	20-50/4"				9	131		42
	medium dense			⧗	11-18-21				8	127		41
	dark reddish brown	10		⧗	11-25-32				7	131		49
	grayish brown, with mineralization											
	dense, 3" silt lens at 15'	15		⧖	14-19-16 N=35							44
18.0	**SILT (ML)**, orange, stiff	20		⧖	5-7-8 N=15							26
20.8	**SILTY SAND (SM)**, fine to coarse grained, orange, medium dense											
21.5	***Boring Terminated at 21.5 Feet***											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-30-2021	Boring Completed: 07-30-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-3

PROJECT: **CGU: Patterson Avenue Industrial Center**

CLIENT: **CGU Capital Management**
San Pedro, CA

SITE: **Patterson Ave. & Nandina Ave.**
Perris, CA

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 33.8643° Longitude: -117.2531° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**SANDY LEAN CLAY (CL)**, dark reddish brown, stiff			┃								
▨				⧓	3-5-9				11	125		59
▨	4.5 **SANDY SILT (ML)**, orange, hard	5		⧓	23-50/6"				9	123		53
▨	7.0 **SILTY CLAYEY SAND (SC-SM)**, orange, dense			⧓	36-41-41				10	121		32
▨	brown	10		⧓	13-23-34				9	128		45
▨	13.0 **SANDY LEAN CLAY (CL)**, brown, very stiff, with mineralization	15		⋈	6-13-16 N=29							58
▨	hard, with 3" silty sand lens at 20' 21.5	20		⋈	10-17-23 N=40							40
	Boring Terminated at 21.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-29-2021	Boring Completed: 07-29-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB215068 CGU PATTERSON A.GPJ TERRACON_DATATEMPLATE.GDT 7/26/21

BORING LOG NO. B-4

Page 1 of 2

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 33.8642° Longitude: -117.2541° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
						TEST TYPE	COMPRESSIVE STRENGTH (tsf)	STRAIN (%)			LL-PL-PI	
	SANDY ELASTIC SILT (ML), orange, hard				9-36-50/3"				34	100		56
	4.5 **SILTY CLAYEY SAND (SC-SM)**, fine to coarse grained, orange, very dense	5			50/6"				8	105		39
	medium dense				11-13-13				7	116		40
	loose	10			7-8-9				4	114		30
	medium dense	15			6-11-14 N=25							13
	16.5 **SANDY SILTY CLAY (CL-ML)**, grayish brown, very stiff	20			3-6-12 N=18							61
	23.0 **SILTY SAND (SM)**, fine to coarse grained, grayish brown, medium dense	25	▽		4-5-6 N=11							44

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While sampling*
▽ *At completion of drilling*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-30-2021	Boring Completed: 07-30-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-4

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: **Patterson Ave. & Nandina Ave.**
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8642° Longitude: -117.2541°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND (SM), fine to coarse grained, grayish brown, medium dense *(continued)*											
			▽									
	medium to coarse grained, reddish brown, strong cementation	30		☒	8-13-16 N=29							19
		35		☒	7-11-16 N=27							17
	dense	40		☒	11-21-25 N=46							19
		45		☒	12-18-25 N=43							19
	very dense	50		☒	18-28-34 N=62							26
51.5	***Boring Terminated at 51.5 Feet***											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While sampling*

▽ *At completion of drilling*

Terracon

1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-30-2021	Boring Completed: 07-30-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-5

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: **Patterson Ave. & Nandina Ave.**
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8641° Longitude: -117.2534°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**<u>SANDY LEAN CLAY (CL)</u>**, dark reddish brown, very stiff											
				⧗	5-13-21				8	129	31-16-15	55
	4.0											
▨	**<u>SILTY CLAYEY SAND (SC-SM)</u>**, fine to coarse grained, dark reddish brown, very dense, with mineralization	5										
				⧗	15-31-50/4"				22	108		47
	orange			⧗	21-36-50/5"				7	131		48
	dense	10		⧗	15-26-37				7	129	23-16-7	45
		15		⊠	9-15-16 N=31							44
	medium dense	20		⊠	9-9-10 N=19							39
	21.5											
▨	**<u>SANDY SILTY CLAY (CL-ML)</u>**, grayish brown, stiff											
		25		⊠	3-6-8 N=14						27-20-7	59
	26.5											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-30-2021	Boring Completed: 07-30-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-5

Page 2 of 2

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8641° Longitude: -117.2534°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**SILTY SAND (SM)**, medium to coarse grained, reddish brown, dense, strong cementation *(continued)*											
▨		30		☒	12-17-24 N=41							17
▨		35		☒	13-20-25 N=45							20
▨	sandy clay lens at 36.5'		▽ ▽									
▨	very dense	40		☒	15-20-35 N=55							17
▨		45		☒	15-22-32 N=54							19
▨	51.5	50		☒	16-25-31 N=56							18
	Boring Terminated at 51.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-30-2021	Boring Completed: 07-30-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-6

Page 1 of 1

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8639° Longitude: -117.2543°

DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY SILT (ML), orange, hard, with mineralization											
				⧓	16-40-50/2"				5	97		
5.5		5		⧓	33-50/2"				6	102		
	SILTY CLAYEY SAND (SC-SM), fine to coarse grained, orange, very dense											
9.5	medium dense			⧓	17-21-23				5	134		
	SANDY SILT (ML), orange, very stiff	10										
13.0				⧓	11-10-10				4	109		
	SILTY SAND (SM), fine to medium grained, brown, medium dense											
		15		⧖	5-11-16 N=27							
21.5	grayish brown	20		⧖	4-6-10 N=16							
	Boring Terminated at 21.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-29-2021	Boring Completed: 07-29-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-7

Page 1 of 1

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8639° Longitude: -117.2536°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY SILT (ML), orange, hard, with mineralization 4.5			⧓	14-29-50/3"							55
	SILTY CLAYEY SAND (SC-SM), fine to medium grained, orange, very dense 10.0	5		⧓ ⧓	33-50/3" 23-50/5"							49 40
	SANDY SILT (ML), orange, very stiff 13.0	10		⧓	16-20-21							56
	SILTY SAND (SM), fine to medium grained, brown, medium dense 20.0	15		⊠	4-5-7 N=12							17
	SANDY SILTY CLAY (CL-ML), grayish brown, very stiff 3" silty sand lens at 20' 21.5	20		⊠	6-10-12 N=22							49
	Boring Terminated at 21.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-29-2021	Boring Completed: 07-29-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-8

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: **Patterson Ave. & Nandina Ave.**
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8639° Longitude: -117.253°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDY SILT (ML), orange, hard			⧗	12-25-23							
	4.5 **SILTY CLAYEY SAND (SC-SM)**, fine to medium grained, orange, very dense	5		⧗	31-50/3"							
				⧗	15-50/6"							
	10.0 **SANDY LEAN CLAY (CL)**, brown, very stiff	10		⧗	10-10-13							
	13.0 **SILTY SAND (SM)**, fine to coarse grained, brown, medium dense	15		⊠	6-8-13 N=21							
	16.0 **LEAN CLAY (CL)**, brown, very stiff	20		⊠	5-9-13 N=22							
	21.5 ***Boring Terminated at 21.5 Feet***											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-29-2021	Boring Completed: 07-29-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-9

Page 1 of 1

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: **Patterson Ave. & Nandina Ave.**
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8642° Longitude: -117.2546°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**SILTY SAND (SM)**, dark reddish brown, medium dense											
▨				⧗	11-11-14							46
▨		5		⧗	7-11-12							
	6.5											
	Boring Terminated at 6.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-30-2021	Boring Completed: 07-30-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-10

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.864° Longitude: -117.2547°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**SANDY LEAN CLAY (CL)**, dark reddish brown, very stiff											
				⧗	5-7-29							
	4.0											
▨	**SILTY CLAYEY SAND (SC-SM)**, orange, very dense											
		5		⧗	50/6"							
				⧗	13-27-50/6"							
	dense	10		⧗	23-26-34							
	11.5											
	Boring Terminated at 11.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-30-2021

Boring Completed: 07-30-2021

Drill Rig: B-61

Driller: California Pacific Drilling

Project No.: CB215068

BORING LOG NO. B-11

Page 1 of 1

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8636° Longitude: -117.2543°

DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
						TEST TYPE	COMPRESSIVE STRENGTH (tsf)	STRAIN (%)				
	SILTY CLAYEY SAND (SC-SM), fine to medium grained, orange, very dense, with mineralization											
					22-33-50/6"							
		5			50/6"							
7.0												
	SANDY LEAN CLAY (CL), dark reddish brown, hard											
					22-37-50/5"							
		10			15-37-42							
11.5												
	Boring Terminated at 11.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-29-2021

Boring Completed: 07-29-2021

Drill Rig: B-61

Driller: California Pacific Drilling

Project No.: CB215068

BORING LOG NO. B-12

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 33.8636° Longitude: -117.2537° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**SILTY CLAYEY SAND (SC-SM)**, fine to medium grained, reddish brown, very dense, with mineralization			⧗	17-31-50/4"							
		5		⧗	50/6"							
	9.5			⧗	19-33-44							
▥	**SANDY SILT (ML)**, reddish brown, very stiff	10		⧗	7-10-16							
	11.5 ***Boring Terminated at 11.5 Feet***											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-29-2021	Boring Completed: 07-29-2021
Drill Rig: B-61	Driller: California Pacific Drilling
Project No.: CB215068	

BORING LOG NO. B-13

Page 1 of 1

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

LOCATION See Exploration Plan

Latitude: 33.8641° Longitude: -117.2528°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**<u>SANDY LEAN CLAY (CL)</u>**, dark reddish brown, very stiff				8-9-11							
	4.0											
▨	**<u>SILTY SAND (SM)</u>**, dark reddish brown, medium dense	5			5-9-10 N=19							
	6.5											
	Boring Terminated at 6.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
6" Hollow-Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 07-30-2021

Boring Completed: 07-30-2021

Drill Rig: B-61

Driller: California Pacific Drilling

Project No.: CB215068

TEST PIT LOG NO. DR-1

Page 1 of 1

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 33.8637° Longitude: -117.2534° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
						TEST TYPE	COMPRESSIVE STRENGTH (tsf)	STRAIN (%)			LL-PL-PI	
▨	**SILTY CLAYEY SAND (SC-SM)**, orange 5.0	5		│								27
	Test Pit Terminated at 5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Test Pit Started: 07-29-2021	Test Pit Completed: 07-29-2021
Excavator: Backhoe	Operator: California Pacific Drilling
Project No.: CB215068	

TEST PIT LOG NO. DR-2

Page 1 of 1

PROJECT: CGU: Patterson Avenue Industrial Center

CLIENT: CGU Capital Management
San Pedro, CA

SITE: **Patterson Ave. & Nandina Ave.**
Perris, CA

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 33.8637° Longitude: -117.253° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST			WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS	PERCENT FINES
						TEST TYPE	COMPRESSIVE STRENGTH (tsf)	STRAIN (%)			LL-PL-PI	
▨	**SILTY CLAYEY SAND (SC-SM)**, orange 5.0	5										47
	Test Pit Terminated at 5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

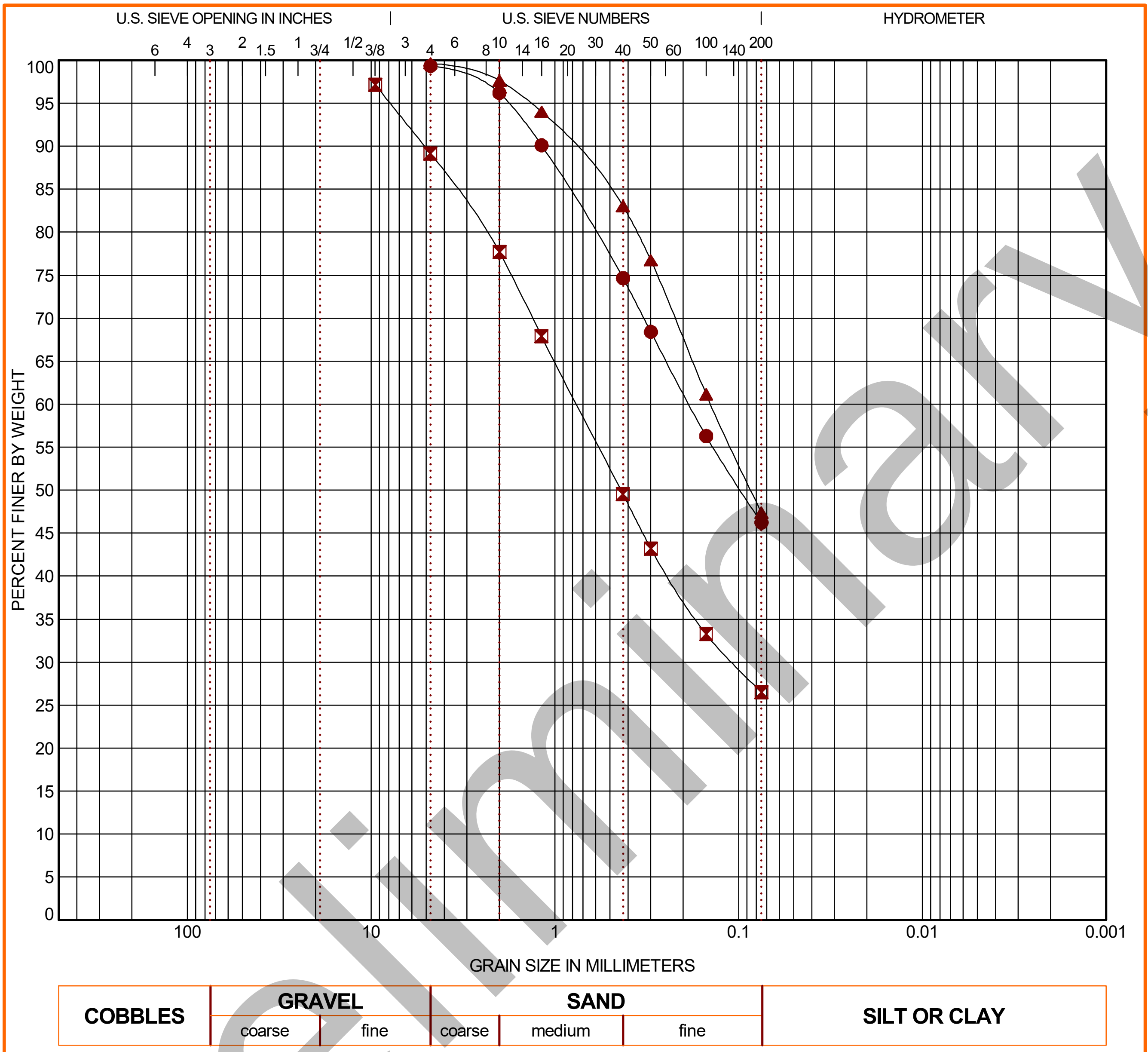
WATER LEVEL OBSERVATIONS

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Test Pit Started: 07-29-2021	Test Pit Completed: 07-29-2021
Excavator: Backhoe	Operator: California Pacific Drilling
Project No.: CB215068	

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
● B-9	0 - 5							
☒ DR-1	0 - 5							
▲ DR-2	0 - 5							

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
● B-9	0 - 5	4.75	0.185					53.1		46.2	
☒ DR-1	0 - 5	9.5	0.761	0.107			8.0	62.7		26.5	
▲ DR-2	0 - 5	4.75	0.142					52.2		47.4	

PROJECT: CGU: Patterson Avenue Industrial Center

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

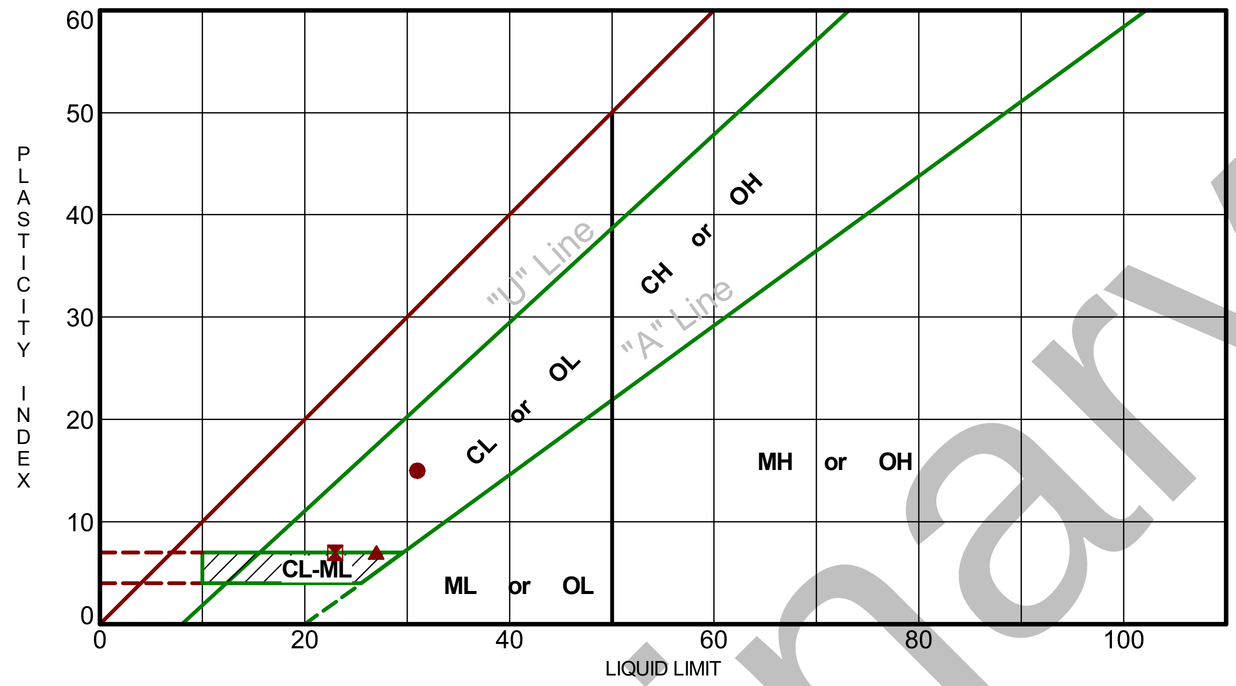
PROJECT NUMBER: CB215068

CLIENT: CGU Capital Management
San Pedro, CA

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 CB215068 CGU PATTERSON A.GPJ TERRACON_DATATEMPLATE.GDT 7/20/21

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	B-5	2.5 - 4	31	16	15	54.7	CL	SANDY LEAN CLAY
☒	B-5	10 - 11.5	23	16	7	45.4	SC-SM	SILTY, CLAYEY SAND
▲	B-5	25 - 26.5	27	20	7	59.1	CL-ML	SANDY SILTY CLAY

PROJECT: CGU: Patterson Avenue Industrial Center

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

1355 E Cooley Dr, Ste C
Colton, CA

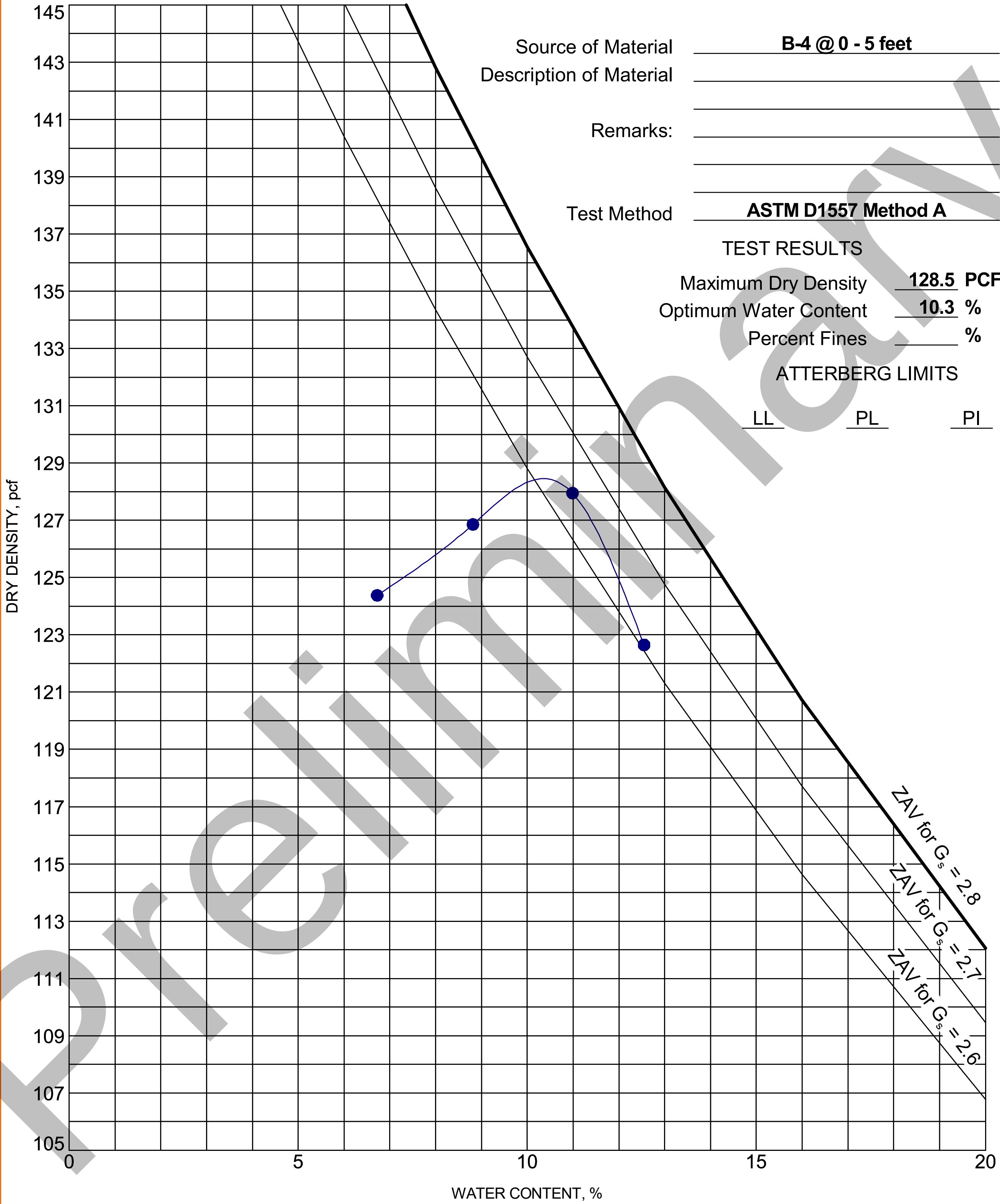
PROJECT NUMBER: CB215068

CLIENT: CGU Capital Management
San Pedro, CA

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS CB215068 CGU PATTERSON A.GPJ TERRACON_DATATEMPLATE.GDT 7/22/21

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material **B-4 @ 0 - 5 feet**

Description of Material

Remarks:

Test Method **ASTM D1557 Method A**

TEST RESULTS

Maximum Dry Density **128.5** **PCF**

Optimum Water Content **10.3** **%**

Percent Fines **%**

ATTERBERG LIMITS

LL	PL	PI

PROJECT: CGU: Patterson Avenue Industrial Center

SITE: Patterson Ave. & Nandina Ave.
Perris, CA

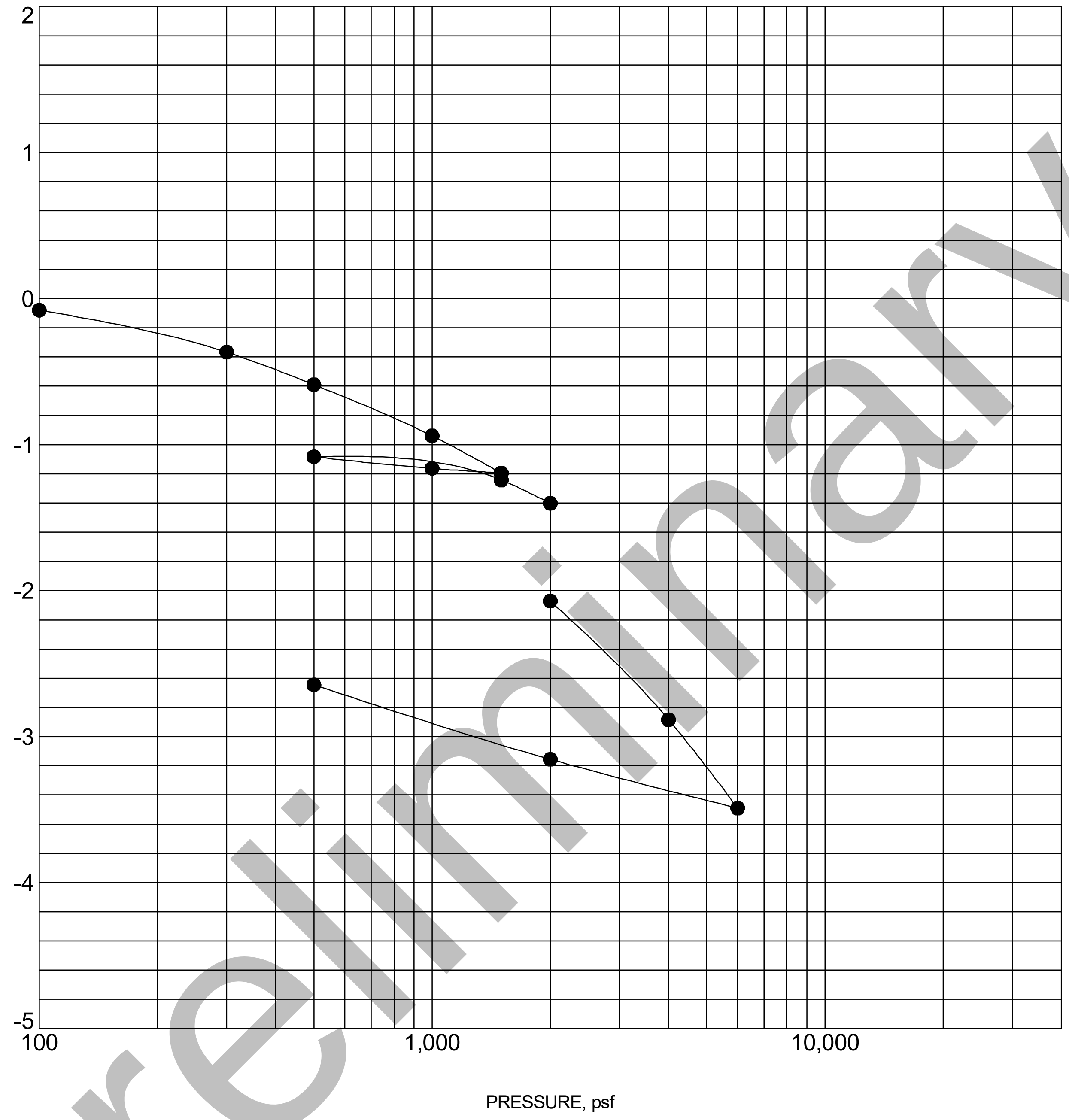
Terracon
1355 E Cooley Dr, Ste C
Colton, CA

PROJECT NUMBER: CB215068

CLIENT: CGU Capital Management
San Pedro, CA

SWELL CONSOLIDATION TEST

ASTM D2435



Specimen Identification		Classification	γ_d, pcf	WC, %
●	B-4 7.5 - 9 ft		113	6

NOTES: Saturated at surcharge pressure of 2,000 psf

PROJECT: CGU: Patterson Avenue Industrial Center	Terracon 1355 E Cooley Dr, Ste C Colton, CA	PROJECT NUMBER: CB215068
SITE: Patterson Ave. & Nandina Ave. Perris, CA		CLIENT: CGU Capital Management San Pedro, CA

TRANSMITTAL LETTER

DATE: July 21, 2021

ATTENTION: **Tom Remmel**

TO: Terracon
1355 East Cooley Drive, Suite C
Colton, CA 92324

SUBJECT: Laboratory Test Data
Patterson Ave Ind. Center
Your #CB215068, HDR Lab #21-0631LAB

COMMENTS: Enclosed are the results for the subject project.

James T. Keegan, MD
Corrosion and Lab Services Section Manager

Table 1 - Laboratory Tests on Soil Samples

Terracon
Patterson Ave Ind. Center
Your #CB215068, HDR Lab #21-0631LAB
21-Jul-21

Sample ID			B-3 @ 0-5'
Resistivity		**Units**	
as-received		ohm-cm	13,200
saturated		ohm-cm	2,400
pH			7.6
Electrical Conductivity		mS/cm	0.12
Chemical Analyses			
Cations			
calcium	Ca^{2+}	mg/kg	46
magnesium	Mg^{2+}	mg/kg	14
sodium	Na^{1+}	mg/kg	93
potassium	K^{1+}	mg/kg	6.5
ammonium	NH_4^{1+}	mg/kg	ND
Anions			
carbonate	CO_3^{2-}	mg/kg	ND
bicarbonate	HCO_3^{1-}	mg/kg	268
fluoride	F^{1-}	mg/kg	18
chloride	Cl^{1-}	mg/kg	11
sulfate	SO_4^{2-}	mg/kg	64
nitrate	NO_3^{1-}	mg/kg	36
phosphate	PO_4^{3-}	mg/kg	ND
Other Tests			
sulfide	S^{2-}	qual	na
Redox		mV	na

Resistivity per ASTM G187, pH per ASTM G51, Cations per ASTM D6919, Anions per ASTM D4327, and Alkalinity per APHA 2320-B.

Electrical conductivity in millisiemens/cm and chemical analyses were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

CGU Patterson Ave
Double Ring Infiltrometer Test Data Log (DR-1)

Job No.	**CB215068**		Test Location:	DR-1	Date	6/30/2021	Tested by:	GA	Depth:	5'	
Interval No.	Start or End	Time	Elapsed Time (min)	Total Time (min)	Inner Ring Level (cm^3)	Annular Space (cm^3)	Time (hr)	Incremental Infiltration (cm/hr)	Incremental Infiltration (in/hr)	Annular Space Incremental Infiltration (cm/hr)	Annular Space Incremental Infiltration (in/hr)
1	Start	8:35 AM	15	15.0	0	0	0.25	0.69	0.27	0.64	0.25
	End	8:50 AM			125	350					
2	Start	8:50 AM	15	30.0	0	0	0.25	0.55	0.22	0.46	0.18
	End	9:05 AM			100	250					
3	Start	9:05 AM	15	45.0	0	0	0.25	0.41	0.16	0.37	0.14
	End	9:20 AM			75	200					
4	Start	9:20 AM	15	60.0	0	0	0.25	0.41	0.16	0.27	0.11
	End	9:35 AM			75	150					
5	Start	9:35 AM	30	90.0	0	0	0.50	0.34	0.13	0.27	0.11
	End	10:05 AM			125	300					
6	Start	10:05 AM	30	120.0	0	0	0.50	0.27	0.11	0.23	0.09
	End	10:35 AM			100	250					
7	Start	10:35 AM	30	150.0	0	0	0.50	0.21	0.08	0.27	0.11
	End	11:05 AM			75	300					
8	Start	11:05 AM	30	180.0	0	0	0.50	0.27	0.11	0.27	0.11
	End	11:35 AM			100	300					
9	Start	11:35 AM	30	210.0	0	0	0.50	0.27	0.11	0.27	0.11
	End	12:05 PM			100	300					
10	Start	12:05 PM	30	240.0	0	0	0.50	0.21	0.08	0.23	0.09
	End	12:35 PM			75	250					
11	Start	12:35 PM	30	270.0	0	0	0.50	0.21	0.08	0.27	0.11
	End	1:05 PM			75	300					
12	Start	1:05 PM	30	300.0	0	0	0.50	0.14	0.05	0.23	0.09
	End	1:35 PM			50	250					
13	Start	1:35 PM	30	330.0	0	0	0.50	0.14	0.05	0.23	0.09
	End	2:05 PM			50	250					
14	Start	2:05 PM	30	360.0	0	0	0.50	0.14	0.05	0.23	0.09
	End	2:35 PM			50	250					
			Average Rate:	0.06	(Inches/hour)						
			Average Rate:	0.16	(cm/hour)						

CGU Patterson Ave
Double Ring Infiltrometer Test Data Log (DR-2)

Job No.	**CB215068**		Test Location:	DR-2	Date	6/30/2021	Tested by:	GA	Depth:	5'	
Interval No.	Start or End	Time	Elapsed Time (min)	Total Time (min)	Inner Ring Level (cm^3)	Annular Space (cm^3)	Time (hr)	Incremental Infiltration (cm/hr)	Incremental Infiltration (in/hr)	Annular Space Incremental Infiltration (cm/hr)	Annular Space Incremental Infiltration (in/hr)
1	Start	8:15 AM	15	15.0	0	0	0.25	0.41	0.16	0.46	0.18
	End	8:30 AM			75	250					
2	Start	8:30 AM	15	30.0	0	0	0.25	0.27	0.11	0.37	0.14
	End	8:45 AM			50	200					
3	Start	8:45 AM	15	45.0	0	0	0.25	0.27	0.11	0.27	0.11
	End	9:00 AM			50	150					
4	Start	9:00 AM	15	60.0	0	0	0.25	0.27	0.11	0.18	0.07
	End	9:15 AM			50	100					
5	Start	9:15 AM	30	90.0	0	0	0.50	0.21	0.08	0.23	0.09
	End	9:45 AM			75	250					
6	Start	9:45 AM	30	120.0	0	0	0.50	0.21	0.08	0.18	0.07
	End	10:15 AM			75	200					
7	Start	10:15 AM	30	150.0	0	0	0.50	0.14	0.05	0.18	0.07
	End	10:45 AM			50	200					
8	Start	10:45 AM	30	180.0	0	0	0.50	0.21	0.08	0.18	0.07
	End	11:15 AM			75	200					
9	Start	11:15 AM	30	210.0	0	0	0.50	0.14	0.05	0.14	0.05
	End	11:45 AM			50	150					
10	Start	11:45 AM	30	240.0	0	0	0.50	0.14	0.05	0.09	0.04
	End	12:15 PM			50	100					
11	Start	12:15 PM	30	270.0	0	0	0.50	0.21	0.08	0.09	0.04
	End	12:45 PM			75	100					
12	Start	12:45 PM	30	300.0	0	0	0.50	0.21	0.08	0.09	0.04
	End	1:15 PM			75	100					
13	Start	1:15 PM	30	330.0	0	0	0.50	0.14	0.05	0.05	0.02
	End	1:45 PM			50	50					
14	Start	1:45 PM	30	360.0	0	0	0.50	0.21	0.08	0.09	0.04
	End	2:15 PM			75	100					
			Average Rate:	0.07							
					(Inches/hour)						
			Average Rate:	0.18							
					(cm/hour)						

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above “A”		CL	Lean clay [K, L, M]
			$PI < 4$ or plots below “A” line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above “A” line		CH	Fat clay [K, L, M]
			PI plots below “A” line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $$Cu = D_{60}/D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

[F] If soil contains $\geq$ 15% sand, add “with sand” to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add “with organic fines” to group name.

[I] If soil contains $\geq$ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add “sandy” to group name.

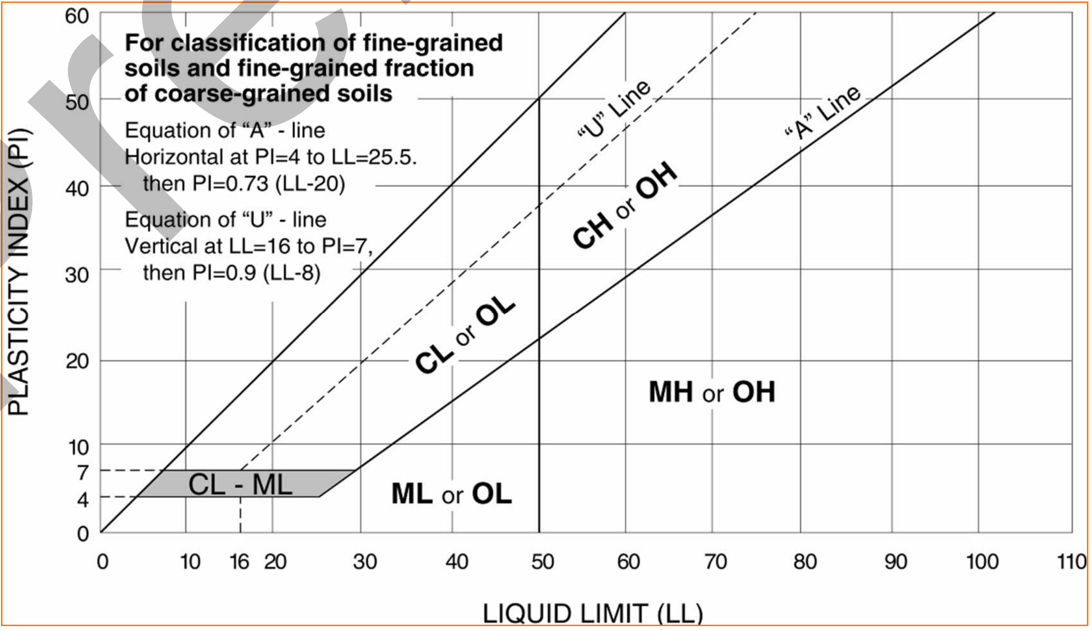
[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] $PI \geq 4$ and plots on or above “A” line.

[O] $PI < 4$ or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.



United States
Department of
Agriculture

Natural
Resources
Conservation
Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
Western Riverside Area, California

March 3, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1:15,800.

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: Western Riverside Area, California
Survey Area Data: Version 14, Sep 13, 2021

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

Date(s) aerial images were photographed: Nov 23, 2020—Feb 6, 2021

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
EpA	Exeter sandy loam, deep, 0 to 2 percent slopes	5.1	99.0%
PaA	Pachappa fine sandy loam, 0 to 2 percent slopes	0.1	1.0%
Totals for Area of Interest		**5.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Western Riverside Area, California

EpA—Exeter sandy loam, deep, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hctk
Elevation: 300 to 700 feet
Mean annual precipitation: 7 to 15 inches
Mean annual air temperature: 64 degrees F
Frost-free period: 250 to 300 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Exeter and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Exeter

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 16 inches: sandy loam
H2 - 16 to 37 inches: sandy clay loam
H3 - 37 to 50 inches: indurated
H4 - 50 to 60 inches: stratified sandy loam to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 35 to 60 inches to duripan
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R019XD029CA - LOAMY
Hydric soil rating: No

Minor Components

Greenfield

Percent of map unit: 5 percent
Hydric soil rating: No

Monserate

Percent of map unit: 5 percent
Hydric soil rating: No

Ramona

Percent of map unit: 5 percent
Hydric soil rating: No

PaA—Pachappa fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hcxn
Elevation: 1,000 feet
Mean annual precipitation: 14 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 270 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Pachappa and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pachappa

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 20 inches: fine sandy loam
H2 - 20 to 63 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare

Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: R019XD029CA - LOAMY
Hydric soil rating: No

Minor Components

Hanford

Percent of map unit: 5 percent
Hydric soil rating: No

Greenfield

Percent of map unit: 5 percent
Hydric soil rating: No

San emigdio

Percent of map unit: 5 percent
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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.

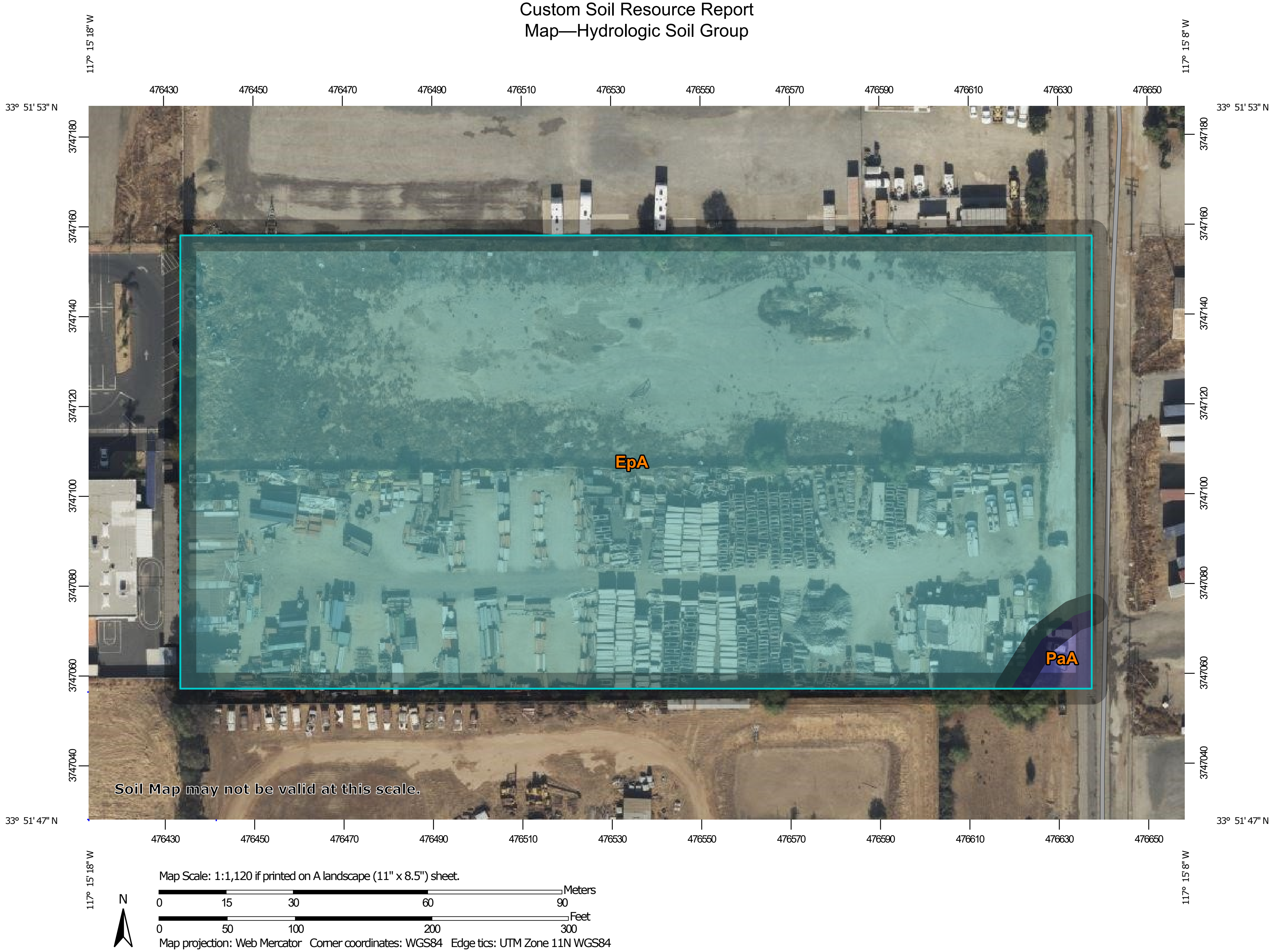
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Map—Hydrologic Soil Group



Map Scale: 1:1,120 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 1:15,800.

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: Western Riverside Area, California
Survey Area Data: Version 14, Sep 13, 2021

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

Date(s) aerial images were photographed: Nov 23, 2020—Feb 6, 2021

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
EpA	Exeter sandy loam, deep, 0 to 2 percent slopes	C	5.1	99.0%
PaA	Pachappa fine sandy loam, 0 to 2 percent slopes	B	0.1	1.0%
Totals for Area of Interest			**5.1**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Physical Soil Properties–Western Riverside Area, California														
Map symbol and soil name	**Depth**	**Sand**	**Silt**	**Clay**	**Moist bulk density**	**Saturated hydraulic conductivity**	**Available water capacity**	**Linear extensibility**	**Organic matter**	**Erosion factors**			**Wind erodibility group**	**Wind erodibility index**
										Kw	**Kf**	**T**		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
EpA—Exeter sandy loam, deep, 0 to 2 percent slopes														
Exeter	0-16	-66-	-19-	10-15- 20	1.50-1.55-1.60	4.00-9.00-14.00	0.10-0.12-0.13	0.0- 1.5- 2.9	0.5- 0.8-1.0	.20	.20	2	3	86
	16-37	-54-	-17-	22-29- 35	1.45-1.53-1.60	1.40-2.70-4.00	0.14-0.16-0.17	3.0- 4.5- 5.9	0.0- 0.0-0.0	.24	.24			
	37-50	—	—	—	—	0.00-0.00-0.01	—	—	—					
	50-60	-33-	-57-	5-10- 15	1.50-1.58-1.65	1.40-2.70-4.00	0.09-0.12-0.15	0.0- 1.5- 2.9	0.0- 0.0-0.0	.64	.64			
PaA—Pachappa fine sandy loam, 0 to 2 percent slopes														
Pachappa	0-20	-68-	-21-	8-12- 15	1.55-1.60-1.65	4.00-9.00-14.00	0.12-0.13-0.14	0.0- 1.5- 2.9	0.5- 0.8-1.0	.24	.24	5	3	86
	20-63	-41-	-37-	18-22- 25	1.45-1.50-1.55	4.00-9.00-14.00	0.14-0.16-0.17	3.0- 4.5- 5.9	0.0- 0.0-0.0	.32	.32			

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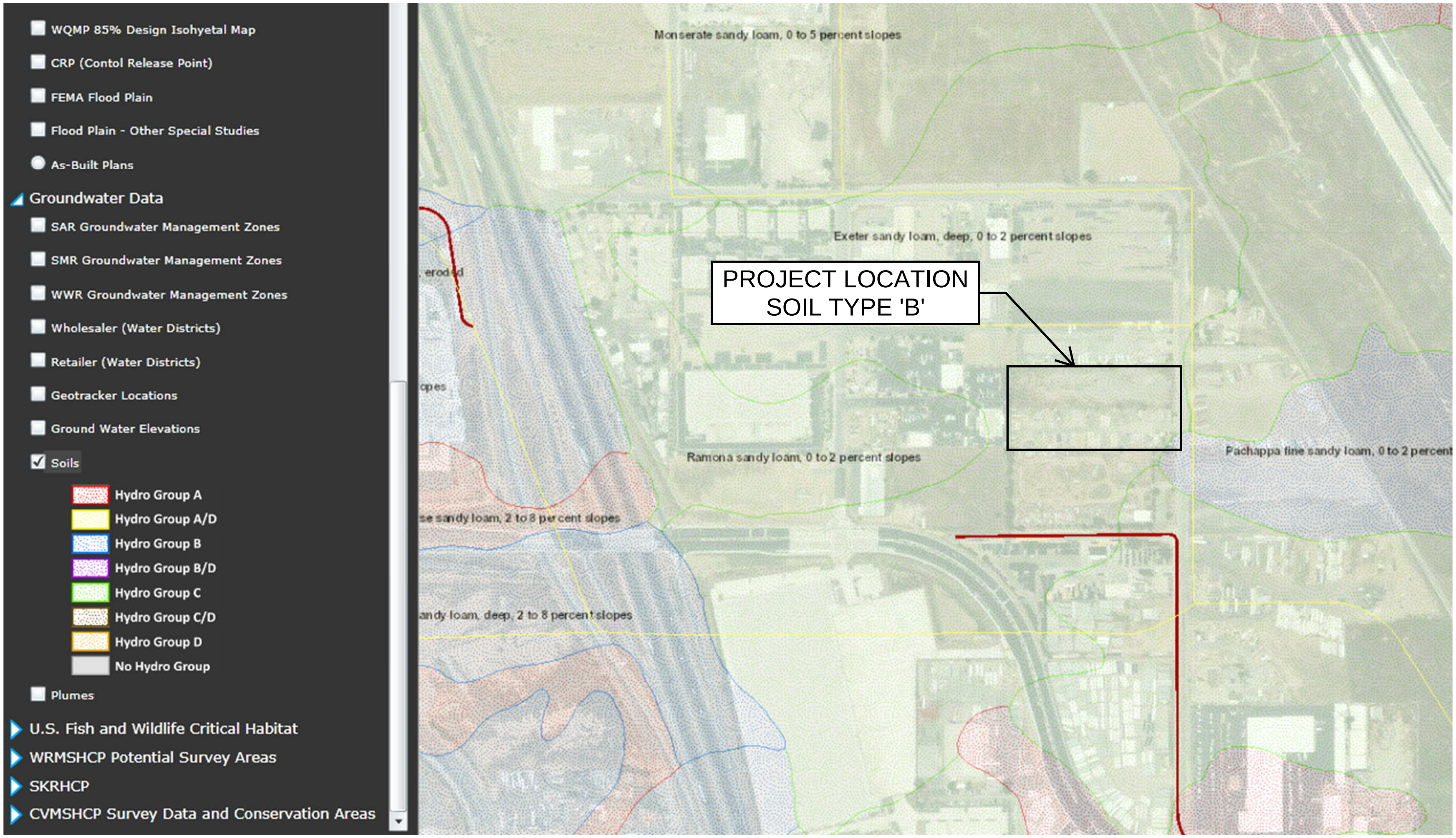
Riverside County Stormwater & Water Conservation Tracking Tool

http://rcstormwatertool.org/SWCTT


PROJECT LOCATION
SOIL TYPE 'B'

COVER TYPE DESCRIPTIONS

NATURAL COVERS -

Barren - Areas with 15 percent or less of the ground surface covered by plants or litter. It includes rockland, eroded land, and shaped or graded land. Barren land does not include fallow land.

Chaparral, Broadleaf - Areas on which the principal vegetation consists of evergreen shrubs with broad, hard, stiff leaves such as manzonita, ceanothus and scrub oak. The brush cover is usually dense or moderately dense.

Chaparral, Narrowleaf - Land on which the principal vegetation consists of diffusely branched evergreen shrubs with fine needle-like leaves such as chamise and redshank. The shrubs are usually widely spaced and low in growth. If the narrowleaf chaparral shrubs are dense and high; the land should be included with broadleaf chaparral cover.

Grass, Annual - Land on which the principal vegetation consists of annual grasses and weeds such as annual bromes, wild barley, soft chess, ryegrass and filaree.

Grass, Perennial - Areas on which the principal vegetation consists of perennial grass, either native or introduced, and which grows under normal dryland conditions. Examples are Stipa or needle grass, Harding grass and wheat grass. It does not include irrigated and meadow grasses.

Meadow - Land areas with seasonally high water table, often called cienegas. Principal vegetation consists of sod-forming grasses interspersed with other plants.

Open Brush - Principal vegetation consists of soft wood shrubs, usually grayish in color. Examples include California buckwheat, California sagebrush, black sage, white sage and purple sage. It also includes vegetation on desert facing slopes where broadleaf chaparral predominate in an open shrub cover.

Woodland - Areas on which coniferous or broadleaf trees predominate. The crown or canopy density, the amount of ground surface shaded at high noon, is at least 50 percent. Open areas may have a cover of annual or perennial grasses or of brush. Plant cover under the trees is usually sparse because of leaf or needle litter accumulation.

Woodland, Grass - Areas with an open cover of broadleaf or coniferous trees usually live oak and pines, with the intervening ground space occupied by annual grasses or weeds. The trees may occur singly or in small clumps. Canopy density,the amount of ground surface shaded at high noon,is from 20 to 50 percent.

URBAN COVERS -

Residential or Commercial Landscaping - The pervious portions of commercial establishments, single and multiple family dwellings, trailer parks and schools where the predominant land cover is lawn, shrubbery and trees.

RCFC & WCD
HYDROLOGY MANUAL

COVER TYPE DESCRIPTIONS

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
NATURAL COVERS -					
Barren		78	86	91	93
(Rockland, eroded and graded land)					
Chaparrel, Broadleaf	Poor	53	70	80	85
(Manzonita, ceanothus and scrub oak)	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf	Poor	71	82	88	91
(Chamise and redshank)	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas	Poor	63	77	85	88
(Areas with seasonally high water table,	Fair	51	70	80	84
principal vegetation is sod forming grass)	Good	30	58	72	78
Open Brush	Poor	62	76	84	88
(Soft wood shrubs - buckwheat, sage, etc.)	Fair	46	66	77	83
	Good	41	63	75	81
Woodland	Poor	45	66	77	83
(Coniferous or broadleaf trees predominate.	Fair	36	60	73	79
Canopy density is at least 50 percent)	Good	28	55	70	77
Woodland, Grass	Poor	57	73	82	86
(Coniferous or broadleaf trees with canopy	Fair	44	65	77	82
density from 20 to 50 percent)	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping	Good	32	56	69	75
(Lawn, shrubs, etc.)					
Turf	Poor	58	74	83	87
(Irrigated and mowed grass)	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow		76	85	90	92
(Land plowed but not tilled or seeded)					

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RUNOFF INDEX NUMBERS
FOR
PERVIOUS AREA

APPENDIX “C”

RATIONAL METHOD – Q_{10} & Q_{100}
PRE-DEVELOPED CONDITION

RATIONAL METHOD – Q_{10} & Q_{100}
POST-DEVELOPED CONDITION

STREET CAPACITY CALCULATIONS

```
                        Riverside County Rational Hydrology Program

        CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
                Rational Hydrology Study        Date: 10/13/22
File:1412101PRE.out

------------------------------------------------------------------------
        VALUED ENGINEERING, INC
        1412101 PATTERSON BUSINESS CENTER
        10-YEAR STORMEVENT
        PRE-DEVELOPED

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

         English (in-lb) Units used in input data file


------------------------------------------------------------------------


        Program License Serial Number 6335


------------------------------------------------------------------------
        Rational Method Hydrology Program based on
        Riverside County Flood Control & Water Conservation District
        1978 hydrology manual

        Storm event (year) =   10.00 Antecedent Moisture Condition = 2

        2 year, 1 hour precipitation =  0.384(In.)
        100 year, 1 hour precipitation =  1.310(In.)

        Storm event year =  10.0
        Calculated rainfall intensity data:
        1 hour intensity =  0.765(In/Hr)
        Slope of intensity duration curve = 0.4900





        ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
        Process from Point/Station        1.000 to Point/Station        1.100
        **** INITIAL AREA EVALUATION ****
        ______________________________________________________________________
        Initial area flow distance =   583.000(Ft.)
        Top (of initial area) elevation =  1504.500(Ft.)
        Bottom (of initial area) elevation =  1497.800(Ft.)
        Difference in elevation =     6.700(Ft.)
        Slope =    0.01149  s(percent)=       1.15
        TC = k(0.300)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =    9.361 min.
Rainfall intensity =      1.901(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.340(CFS)
Total initial stream area =        2.000(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.200 to Point/Station       1.300
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.36 min.
Rainfall intensity =      1.901(In/Hr) for a    10.0 year storm
Subarea runoff =      4.409(CFS) for      2.640(Ac.)
Total runoff =      7.749(CFS)  Total area =       4.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.300 to Point/Station       2.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.36 min.
Rainfall intensity =      1.901(In/Hr) for a    10.0 year storm
Subarea runoff =      1.670(CFS) for      1.000(Ac.)
Total runoff =      9.419(CFS)  Total area =       5.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station       2.100
**** SUBAREA FLOW ADDITION ****
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```
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.808
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  86.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Time of concentration =     9.36 min.
Rainfall intensity =      1.901(In/Hr) for a    10.0 year storm
Subarea runoff =      7.402(CFS) for      4.820(Ac.)
Total runoff =     16.820(CFS)  Total area =      10.460(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.000 to Point/Station       2.100
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     10.460(Ac.)
Runoff from this stream =     16.820(CFS)
Time of concentration =    9.36 min.
Rainfall intensity =     1.901(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.000 to Point/Station       6.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   333.000(Ft.)
Top (of initial area) elevation =  1493.690(Ft.)
Bottom (of initial area) elevation =  1493.000(Ft.)
Difference in elevation =     0.690(Ft.)
Slope =    0.00207  s(percent)=      0.21
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.620 min.
Rainfall intensity =      1.357(In/Hr) for a    10.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.776
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  86.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      0.265(CFS)
Total initial stream area =       0.252(Ac.)
Pervious area fraction = 1.000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.000 to Point/Station       6.100
**** CONFLUENCE OF MINOR STREAMS ****
```

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______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.252(Ac.)
Runoff from this stream =      0.265(CFS)
Time of concentration =   18.62 min.
Rainfall intensity =     1.357(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)



1       16.820      9.36                 1.901
2        0.265     18.62                 1.357
Largest stream flow has longer or shorter time of concentration
Qp =     16.820 + sum of
          Qa          Tb/Ta
           0.265 *    0.503 =      0.133
Qp =     16.954

Total of 2 streams to confluence:
Flow rates before confluence point:
      16.820       0.265
Area of streams before confluence:
       10.460        0.252
Results of confluence:
Total flow rate =     16.954(CFS)
Time of concentration =     9.361 min.
Effective stream area after confluence =     10.712(Ac.)
End of computations, total study area =           10.71 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.526
Area averaged RI index number =  77.0
```

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                        Riverside County Rational Hydrology Program

        CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
                Rational Hydrology Study       Date: 10/13/22
File:1412101PRE.out

------------------------------------------------------------------------
        VALUED ENGINEERING, INC
        1412101 PATTERSON BUSINESS CENTER
        100-YEAR STORMEVENT
        PRE-DEVELOPED

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

         English (in-lb) Units used in input data file


------------------------------------------------------------------------


        Program License Serial Number 6335


------------------------------------------------------------------------
        Rational Method Hydrology Program based on
        Riverside County Flood Control & Water Conservation District
        1978 hydrology manual

        Storm event (year) =  100.00 Antecedent Moisture Condition = 3

        2 year, 1 hour precipitation =  0.384(In.)
        100 year, 1 hour precipitation =  1.310(In.)

        Storm event year = 100.0
        Calculated rainfall intensity data:
        1 hour intensity =  1.310(In/Hr)
        Slope of intensity duration curve = 0.4900





        ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
        Process from Point/Station       1.000 to Point/Station       1.100
        **** INITIAL AREA EVALUATION ****
        ______________________________________________________________________
        Initial area flow distance =   583.000(Ft.)
        Top (of initial area) elevation =  1504.500(Ft.)
        Bottom (of initial area) elevation =  1497.800(Ft.)
        Difference in elevation =     6.700(Ft.)
        Slope =    0.01149  s(percent)=      1.15
        TC = k(0.300)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =    9.361 min.
Rainfall intensity =      3.256(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      5.819(CFS)
Total initial stream area =        2.000(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.200 to Point/Station       1.300
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.36 min.
Rainfall intensity =      3.256(In/Hr) for a   100.0 year storm
Subarea runoff =      7.681(CFS) for      2.640(Ac.)
Total runoff =     13.500(CFS)  Total area =       4.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.300 to Point/Station       2.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.36 min.
Rainfall intensity =      3.256(In/Hr) for a   100.0 year storm
Subarea runoff =      2.909(CFS) for      1.000(Ac.)
Total runoff =     16.409(CFS)  Total area =       5.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station       2.100
**** SUBAREA FLOW ADDITION ****
```

```
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  94.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Time of concentration =     9.36 min.
Rainfall intensity =      3.256(In/Hr) for a   100.0 year storm
Subarea runoff =     13.788(CFS) for      4.820(Ac.)
Total runoff =     30.197(CFS)  Total area =      10.460(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.000 to Point/Station       2.100
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     10.460(Ac.)
Runoff from this stream =     30.197(CFS)
Time of concentration =    9.36 min.
Rainfall intensity =     3.256(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.000 to Point/Station       6.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   333.000(Ft.)
Top (of initial area) elevation =  1493.690(Ft.)
Bottom (of initial area) elevation =  1493.000(Ft.)
Difference in elevation =     0.690(Ft.)
Slope =    0.00207  s(percent)=      0.21
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.620 min.
Rainfall intensity =      2.324(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.870
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  94.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      0.510(CFS)
Total initial stream area =       0.252(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station       6.000 to Point/Station       6.100
**** CONFLUENCE OF MINOR STREAMS ****
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______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.252(Ac.)
Runoff from this stream =      0.510(CFS)
Time of concentration =   18.62 min.
Rainfall intensity =     2.324(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       30.197      9.36                 3.256
2        0.510     18.62                 2.324
Largest stream flow has longer or shorter time of concentration
Qp =     30.197 + sum of
          Qa          Tb/Ta
           0.510 *    0.503 =      0.256
Qp =     30.453

Total of 2 streams to confluence:
Flow rates before confluence point:
      30.197       0.510
Area of streams before confluence:
       10.460        0.252
Results of confluence:
Total flow rate =     30.453(CFS)
Time of concentration =     9.361 min.
Effective stream area after confluence =     10.712(Ac.)
End of computations, total study area =           10.71 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.526
Area averaged RI index number =  77.0
```

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                    Riverside County Rational Hydrology Program

        CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
                Rational Hydrology Study       Date: 10/13/22
File:1412101PRO.out

------------------------------------------------------------------------
        VALUED ENGINEERING, INC
        1412101 PATTERSON BUSINESS CENTER
        10-YEAR STORMEVENT
        POST-DEVELOPED

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

         English (in-lb) Units used in input data file


------------------------------------------------------------------------



        Program License Serial Number 6335



------------------------------------------------------------------------
        Rational Method Hydrology Program based on
        Riverside County Flood Control & Water Conservation District
        1978 hydrology manual

        Storm event (year) =   10.00 Antecedent Moisture Condition = 2

        Standard intensity-duration curves data (Plate D-4.1)
        For the [ Perris Valley ] area used.
        10 year storm 10 minute intensity =  1.880(In/Hr)
        10 year storm 60 minute intensity =  0.780(In/Hr)
        100 year storm 10 minute intensity =  2.690(In/Hr)
        100 year storm 60 minute intensity =  1.120(In/Hr)

        Storm event year =  10.0
        Calculated rainfall intensity data:
        1 hour intensity =  0.780(In/Hr)
        Slope of intensity duration curve = 0.4900




        ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
        Process from Point/Station       1.000 to Point/Station       1.100
        **** INITIAL AREA EVALUATION ****
        ______________________________________________________________________
        Initial area flow distance =   583.000(Ft.)
        Top (of initial area) elevation =  1504.500(Ft.)
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```
Bottom (of initial area) elevation =  1497.800(Ft.)
Difference in elevation =     6.700(Ft.)
Slope =    0.01149  s(percent)=      1.15
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.361 min.
Rainfall intensity =      1.938(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.407(CFS)
Total initial stream area =        2.000(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.100 to Point/Station       1.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1496.800(Ft.)
Downstream point/station elevation =  1496.000(Ft.)
Pipe length  =   105.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.407(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.407(CFS)
Normal flow depth in pipe =    8.41(In.)
Flow top width inside pipe =   14.89(In.)
Critical Depth =    8.94(In.)
Pipe flow velocity =      4.81(Ft/s)
Travel time through pipe =    0.36 min.
Time of concentration (TC) =     9.72 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.200 to Point/Station       1.300
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.72 min.
Rainfall intensity =      1.903(In/Hr) for a    10.0 year storm
Subarea runoff =      4.412(CFS) for      2.640(Ac.)
Total runoff =      7.819(CFS)  Total area =       4.640(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.300 to Point/Station       1.500
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1496.000(Ft.)
Downstream point/station elevation =  1495.600(Ft.)
Pipe length  =   196.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.819(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =     7.819(CFS)
Normal flow depth in pipe =   15.73(In.)
Flow top width inside pipe =   22.81(In.)
Critical Depth =   11.94(In.)
Pipe flow velocity =      3.58(Ft/s)
Travel time through pipe =    0.91 min.
Time of concentration (TC) =    10.64 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.400 to Point/Station       1.500
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.64 min.
Rainfall intensity =      1.821(In/Hr) for a    10.0 year storm
Subarea runoff =      1.598(CFS) for      1.000(Ac.)
Total runoff =      9.417(CFS)  Total area =       5.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.500 to Point/Station      30.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1495.600(Ft.)
Downstream point/station elevation =  1483.820(Ft.)
Pipe length  =   622.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.417(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     9.417(CFS)
Normal flow depth in pipe =   10.58(In.)
Flow top width inside pipe =   17.72(In.)
Critical Depth =   14.22(In.)
Pipe flow velocity =      8.71(Ft/s)
Travel time through pipe =    1.19 min.
Time of concentration (TC) =    11.83 min.
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.000 to Point/Station      30.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.640(Ac.)
Runoff from this stream =      9.417(CFS)
Time of concentration =   11.83 min.
Rainfall intensity =     1.729(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station      10.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   610.000(Ft.)
Top (of initial area) elevation =  1498.500(Ft.)
Bottom (of initial area) elevation =  1492.000(Ft.)
Difference in elevation =     6.500(Ft.)
Slope =    0.01066  s(percent)=      1.07
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.677 min.
Rainfall intensity =      1.907(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.161(CFS)
Total initial stream area =        1.290(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station       2.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   467.000(Ft.)
Top (of initial area) elevation =  1498.500(Ft.)
Bottom (of initial area) elevation =  1495.500(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.00642  s(percent)=      0.64
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.622 min.
Rainfall intensity =      1.912(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
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```
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.595(CFS)
Total initial stream area =        2.140(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.100 to Point/Station        2.200
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.62 min.
Rainfall intensity =      1.912(In/Hr) for a    10.0 year storm
Subarea runoff =      0.202(CFS) for      0.120(Ac.)
Total runoff =      3.797(CFS)  Total area =       2.260(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.200 to Point/Station        2.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1495.500(Ft.)
Downstream point/station elevation =  1493.460(Ft.)
Pipe length  =   206.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.797(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.797(CFS)
Normal flow depth in pipe =    8.30(In.)
Flow top width inside pipe =   14.92(In.)
Critical Depth =    9.46(In.)
Pipe flow velocity =      5.46(Ft/s)
Travel time through pipe =    0.63 min.
Time of concentration (TC) =    10.25 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.200 to Point/Station        2.300
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
```

```
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.25 min.
Rainfall intensity =      1.854(In/Hr) for a    10.0 year storm
Subarea runoff =      0.700(CFS) for      0.430(Ac.)
Total runoff =      4.497(CFS)  Total area =       2.690(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.300 to Point/Station      10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1493.460(Ft.)
Downstream point/station elevation =  1492.000(Ft.)
Pipe length  =   269.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.497(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     4.497(CFS)
Normal flow depth in pipe =   11.61(In.)
Flow top width inside pipe =   12.54(In.)
Critical Depth =   10.31(In.)
Pipe flow velocity =      4.41(Ft/s)
Travel time through pipe =    1.02 min.
Time of concentration (TC) =    11.27 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.000 to Point/Station       3.100
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.877
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    11.27 min.
Rainfall intensity =      1.770(In/Hr) for a    10.0 year storm
Subarea runoff =      0.559(CFS) for      0.360(Ac.)
Total runoff =      5.056(CFS)  Total area =       3.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.100 to Point/Station      10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1493.200(Ft.)
Downstream point/station elevation =  1492.000(Ft.)
Pipe length  =   253.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =     5.056(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.056(CFS)
```

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Normal flow depth in pipe =   12.26(In.)
Flow top width inside pipe =   16.78(In.)
Critical Depth =   10.39(In.)
Pipe flow velocity =      3.95(Ft/s)
Travel time through pipe =    1.07 min.
Time of concentration (TC) =    12.34 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       4.000 to Point/Station       4.100
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.876
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    12.34 min.
Rainfall intensity =      1.693(In/Hr) for a    10.0 year storm
Subarea runoff =      0.237(CFS) for      0.160(Ac.)
Total runoff =      5.293(CFS)  Total area =       3.210(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       4.100 to Point/Station      10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1493.560(Ft.)
Downstream point/station elevation =  1492.000(Ft.)
Pipe length  =   207.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =     5.293(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.293(CFS)
Normal flow depth in pipe =   10.78(In.)
Flow top width inside pipe =   17.64(In.)
Critical Depth =   10.65(In.)
Pipe flow velocity =      4.79(Ft/s)
Travel time through pipe =    0.72 min.
Time of concentration (TC) =    13.06 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       4.200 to Point/Station       4.300
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.876
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
```

```
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    13.06 min.
Rainfall intensity =      1.647(In/Hr) for a    10.0 year storm
Subarea runoff =      0.202(CFS) for      0.140(Ac.)
Total runoff =      5.495(CFS)  Total area =       3.350(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.300 to Point/Station       10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1493.090(Ft.)
Downstream point/station elevation =  1492.000(Ft.)
Pipe length  =   113.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.495(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     5.495(CFS)
Normal flow depth in pipe =   10.78(In.)
Flow top width inside pipe =   13.49(In.)
Critical Depth =   11.40(In.)
Pipe flow velocity =      5.82(Ft/s)
Travel time through pipe =    0.32 min.
Time of concentration (TC) =    13.38 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.400 to Point/Station        4.500
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.876
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    13.38 min.
Rainfall intensity =      1.627(In/Hr) for a    10.0 year storm
Subarea runoff =      0.242(CFS) for      0.170(Ac.)
Total runoff =      5.738(CFS)  Total area =       3.520(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.500 to Point/Station       10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1492.530(Ft.)
Downstream point/station elevation =  1492.000(Ft.)
Pipe length  =   192.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.738(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     5.738(CFS)
```

```
Normal flow depth in pipe =   12.82(In.)
Flow top width inside pipe =   20.48(In.)
Critical Depth =   10.58(In.)
Pipe flow velocity =      3.73(Ft/s)
Travel time through pipe =    0.86 min.
Time of concentration (TC) =    14.24 min.


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1492.000(Ft.)
Downstream point/station elevation =  1491.500(Ft.)
Pipe length  =    89.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.738(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.738(CFS)
Normal flow depth in pipe =   11.40(In.)
Flow top width inside pipe =   17.35(In.)
Critical Depth =   11.10(In.)
Pipe flow velocity =      4.86(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =    14.54 min.


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       30.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1491.500(Ft.)
Downstream point/station elevation =  1483.820(Ft.)
Pipe length  =   182.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.738(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     5.738(CFS)
Normal flow depth in pipe =    8.00(In.)
Flow top width inside pipe =   11.31(In.)
Critical Depth =   11.37(In.)
Pipe flow velocity =     10.32(Ft/s)
Travel time through pipe =    0.29 min.
Time of concentration (TC) =    14.84 min.


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       30.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      3.520(Ac.)
Runoff from this stream =      5.738(CFS)
Time of concentration =   14.84 min.
Rainfall intensity =     1.547(In/Hr)
Summary of stream data:
```

```
Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        9.417     11.83                 1.729
2        5.738     14.84                 1.547
Largest stream flow has longer or shorter time of concentration
Qp =      9.417 + sum of
          Qa          Tb/Ta
           5.738 *    0.797 =      4.574
Qp =     13.991

Total of 2 streams to confluence:
Flow rates before confluence point:
       9.417      5.738
Area of streams before confluence:
        5.640       3.520
Results of confluence:
Total flow rate =     13.991(CFS)
Time of concentration =    11.826 min.
Effective stream area after confluence =      9.160(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1483.820(Ft.)
Downstream point/station elevation =  1482.500(Ft.)
Pipe length  =   385.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.991(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    13.991(CFS)
Normal flow depth in pipe =   17.79(In.)
Flow top width inside pipe =   25.60(In.)
Critical Depth =   15.61(In.)
Pipe flow velocity =      5.03(Ft/s)
Travel time through pipe =    1.28 min.
Time of concentration (TC) =    13.10 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   333.000(Ft.)
Top (of initial area) elevation =  1493.690(Ft.)
Bottom (of initial area) elevation =  1493.000(Ft.)
Difference in elevation =     0.690(Ft.)
Slope =    0.00207  s(percent)=      0.21
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.539 min.
Rainfall intensity =      1.829(In/Hr) for a    10.0 year storm
```

```
COMMERCIAL subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      0.401(CFS)
Total initial stream area =        0.250(Ac.)
Pervious area fraction = 0.100
End of computations, total study area =           10.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  69.0
```

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                        Riverside County Rational Hydrology Program

        CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
                Rational Hydrology Study        Date: 10/13/22
File:1412101PRO.out

------------------------------------------------------------------------
        VALUED ENGINEERING, INC
        1412101 PATTERSON BUSINESS CENTER
        100-YEAR STORMEVENT
        POST-DEVELOPED

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

         English (in-lb) Units used in input data file


------------------------------------------------------------------------


        Program License Serial Number 6335


------------------------------------------------------------------------
        Rational Method Hydrology Program based on
        Riverside County Flood Control & Water Conservation District
        1978 hydrology manual

        Storm event (year) =  100.00 Antecedent Moisture Condition = 3

        2 year, 1 hour precipitation =  0.384(In.)
        100 year, 1 hour precipitation =  1.310(In.)

        Storm event year = 100.0
        Calculated rainfall intensity data:
        1 hour intensity =  1.310(In/Hr)
        Slope of intensity duration curve = 0.4900




        ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
        Process from Point/Station        1.000 to Point/Station        1.100
        **** INITIAL AREA EVALUATION ****
        ______________________________________________________________________
        Initial area flow distance =   583.000(Ft.)
        Top (of initial area) elevation =  1504.500(Ft.)
        Bottom (of initial area) elevation =  1497.800(Ft.)
        Difference in elevation =     6.700(Ft.)
        Slope =    0.01149  s(percent)=       1.15
        TC = k(0.300)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =    9.361 min.
Rainfall intensity =      3.256(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      5.819(CFS)
Total initial stream area =        2.000(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.100 to Point/Station       1.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1496.800(Ft.)
Downstream point/station elevation =  1496.000(Ft.)
Pipe length  =   105.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.819(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.819(CFS)
Normal flow depth in pipe =   10.41(In.)
Flow top width inside pipe =   17.78(In.)
Critical Depth =   11.18(In.)
Pipe flow velocity =      5.49(Ft/s)
Travel time through pipe =    0.32 min.
Time of concentration (TC) =     9.68 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.200 to Point/Station       1.300
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.68 min.
Rainfall intensity =      3.203(In/Hr) for a   100.0 year storm
Subarea runoff =      7.555(CFS) for      2.640(Ac.)
Total runoff =     13.374(CFS)  Total area =      4.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.300 to Point/Station       1.500
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
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____________________________________________________________________
Upstream point/station elevation =  1496.000(Ft.)
Downstream point/station elevation =  1495.600(Ft.)
Pipe length  =   196.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.374(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    13.374(CFS)
Normal flow depth in pipe =   21.14(In.)
Flow top width inside pipe =   22.26(In.)
Critical Depth =   15.25(In.)
Pipe flow velocity =      4.01(Ft/s)
Travel time through pipe =    0.82 min.
Time of concentration (TC) =    10.49 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.400 to Point/Station       1.500
**** SUBAREA FLOW ADDITION ****
____________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.49 min.
Rainfall intensity =      3.078(In/Hr) for a   100.0 year storm
Subarea runoff =      2.750(CFS) for      1.000(Ac.)
Total runoff =     16.124(CFS)  Total area =       5.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.500 to Point/Station      30.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
____________________________________________________________________
Upstream point/station elevation =  1495.600(Ft.)
Downstream point/station elevation =  1483.820(Ft.)
Pipe length  =   622.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    16.124(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    16.124(CFS)
Normal flow depth in pipe =   13.43(In.)
Flow top width inside pipe =   20.17(In.)
Critical Depth =   17.77(In.)
Pipe flow velocity =      9.92(Ft/s)
Travel time through pipe =    1.05 min.
Time of concentration (TC) =    11.54 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.000 to Point/Station      30.000
**** CONFLUENCE OF MINOR STREAMS ****
```

```
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.640(Ac.)
Runoff from this stream =     16.124(CFS)
Time of concentration =   11.54 min.
Rainfall intensity =     2.938(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station      10.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   610.000(Ft.)
Top (of initial area) elevation =  1498.500(Ft.)
Bottom (of initial area) elevation =  1492.000(Ft.)
Difference in elevation =     6.500(Ft.)
Slope =    0.01066  s(percent)=      1.07
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.677 min.
Rainfall intensity =      3.203(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.692(CFS)
Total initial stream area =       1.290(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station       2.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   467.000(Ft.)
Top (of initial area) elevation =  1498.500(Ft.)
Bottom (of initial area) elevation =  1495.500(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.00642  s(percent)=      0.64
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.622 min.
Rainfall intensity =      3.212(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      6.142(CFS)
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Total initial stream area =        2.140(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       2.100 to Point/Station       2.200
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.62 min.
Rainfall intensity =      3.212(In/Hr) for a   100.0 year storm
Subarea runoff =      0.344(CFS) for      0.120(Ac.)
Total runoff =      6.486(CFS)  Total area =       2.260(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.200 to Point/Station       2.300
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1495.500(Ft.)
Downstream point/station elevation =  1493.460(Ft.)
Pipe length  =   206.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.486(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     6.486(CFS)
Normal flow depth in pipe =   10.27(In.)
Flow top width inside pipe =   17.82(In.)
Critical Depth =   11.83(In.)
Pipe flow velocity =      6.23(Ft/s)
Travel time through pipe =    0.55 min.
Time of concentration (TC) =    10.17 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.200 to Point/Station       2.300
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.17 min.
Rainfall intensity =      3.125(In/Hr) for a   100.0 year storm
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```
Subarea runoff =      1.201(CFS) for      0.430(Ac.)
Total runoff =      7.687(CFS)  Total area =      2.690(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.300 to Point/Station      10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1493.460(Ft.)
Downstream point/station elevation =  1492.000(Ft.)
Pipe length  =   269.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.687(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     7.687(CFS)
Normal flow depth in pipe =   14.65(In.)
Flow top width inside pipe =   14.01(In.)
Critical Depth =   12.90(In.)
Pipe flow velocity =     4.99(Ft/s)
Travel time through pipe =    0.90 min.
Time of concentration (TC) =    11.07 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station       3.100
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    11.07 min.
Rainfall intensity =      2.999(In/Hr) for a   100.0 year storm
Subarea runoff =      0.964(CFS) for      0.360(Ac.)
Total runoff =      8.651(CFS)  Total area =      3.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.100 to Point/Station      10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1493.200(Ft.)
Downstream point/station elevation =  1492.000(Ft.)
Pipe length  =   253.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =     8.651(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     8.651(CFS)
Normal flow depth in pipe =   15.80(In.)
Flow top width inside pipe =   18.13(In.)
Critical Depth =   13.11(In.)
Pipe flow velocity =     4.46(Ft/s)
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Travel time through pipe =    0.95 min.
Time of concentration (TC) =    12.02 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        4.100
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    12.02 min.
Rainfall intensity =      2.880(In/Hr) for a   100.0 year storm
Subarea runoff =      0.412(CFS) for      0.160(Ac.)
Total runoff =      9.063(CFS)  Total area =       3.210(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.100 to Point/Station       10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1493.560(Ft.)
Downstream point/station elevation =  1492.000(Ft.)
Pipe length  =   207.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =     9.063(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     9.063(CFS)
Normal flow depth in pipe =   13.70(In.)
Flow top width inside pipe =   20.00(In.)
Critical Depth =   13.44(In.)
Pipe flow velocity =      5.45(Ft/s)
Travel time through pipe =    0.63 min.
Time of concentration (TC) =    12.65 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.200 to Point/Station        4.300
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    12.65 min.
Rainfall intensity =      2.809(In/Hr) for a   100.0 year storm
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```
Subarea runoff =      0.351(CFS) for      0.140(Ac.)
Total runoff =      9.414(CFS)  Total area =       3.350(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.300 to Point/Station       10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1493.090(Ft.)
Downstream point/station elevation =  1492.000(Ft.)
Pipe length  =   113.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.414(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     9.414(CFS)
Normal flow depth in pipe =   13.50(In.)
Flow top width inside pipe =   15.59(In.)
Critical Depth =   14.22(In.)
Pipe flow velocity =      6.62(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    12.93 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.400 to Point/Station        4.500
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    12.93 min.
Rainfall intensity =      2.778(In/Hr) for a   100.0 year storm
Subarea runoff =      0.422(CFS) for      0.170(Ac.)
Total runoff =      9.835(CFS)  Total area =       3.520(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.500 to Point/Station       10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1492.530(Ft.)
Downstream point/station elevation =  1492.000(Ft.)
Pipe length  =   192.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.835(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =     9.835(CFS)
Normal flow depth in pipe =   16.64(In.)
Flow top width inside pipe =   22.13(In.)
Critical Depth =   13.46(In.)
Pipe flow velocity =      4.23(Ft/s)
```

```
Travel time through pipe =    0.76 min.
Time of concentration (TC) =    13.69 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1492.000(Ft.)
Downstream point/station elevation =  1491.500(Ft.)
Pipe length  =    89.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.835(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =     9.835(CFS)
Normal flow depth in pipe =   14.58(In.)
Flow top width inside pipe =   19.35(In.)
Critical Depth =   14.01(In.)
Pipe flow velocity =      5.52(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =    13.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       30.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1491.500(Ft.)
Downstream point/station elevation =  1483.820(Ft.)
Pipe length  =   182.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.835(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     9.835(CFS)
Normal flow depth in pipe =    9.61(In.)
Flow top width inside pipe =   14.39(In.)
Critical Depth =   14.16(In.)
Pipe flow velocity =     11.84(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =    14.22 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       30.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      3.520(Ac.)
Runoff from this stream =      9.835(CFS)
Time of concentration =   14.22 min.
Rainfall intensity =     2.653(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)
```

```
1       16.124     11.54                 2.938
2        9.835     14.22                 2.653
Largest stream flow has longer or shorter time of concentration
Qp =     16.124 + sum of
          Qa          Tb/Ta
           9.835 *    0.812 =      7.984
Qp =     24.107

Total of 2 streams to confluence:
Flow rates before confluence point:
      16.124       9.835
Area of streams before confluence:
        5.640       3.520
Results of confluence:
Total flow rate =     24.107(CFS)
Time of concentration =    11.540 min.
Effective stream area after confluence =      9.160(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       40.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1483.820(Ft.)
Downstream point/station elevation =  1482.500(Ft.)
Pipe length  =   385.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    24.107(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    24.107(CFS)
Normal flow depth in pipe =   24.70(In.)
Flow top width inside pipe =   22.88(In.)
Critical Depth =   20.06(In.)
Pipe flow velocity =      5.58(Ft/s)
Travel time through pipe =    1.15 min.
Time of concentration (TC) =    12.69 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.100
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   333.000(Ft.)
Top (of initial area) elevation =  1493.690(Ft.)
Bottom (of initial area) elevation =  1493.000(Ft.)
Difference in elevation =     0.690(Ft.)
Slope =    0.00207  s(percent)=       0.21
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.539 min.
Rainfall intensity =      3.072(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
```

```
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      0.686(CFS)
Total initial stream area =        0.250(Ac.)
Pervious area fraction = 0.100
End of computations, total study area =           10.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

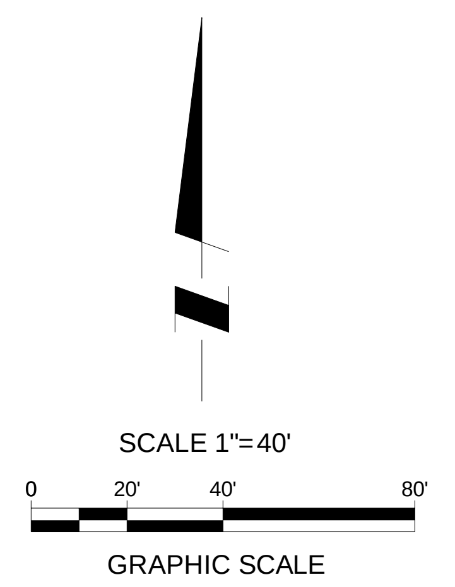
Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  69.0
```

APPENDIX “D”

HYDROLOGY MAPS

PRE-DEVELOPED HYDROLOGY

SUBAREA	ACRE	Q_{10}	Q_{100}
A1	2.00	3.34	5.82
A2	2.64	4.41	7.68
A3	1.00	1.67	2.91
A4	4.82	7.40	13.79
F1	0.25	0.26	0.51
TOTAL	10.71	17.08	30.71
CONFLUENCE	---	16.95	30.45



LEGEND

▬	BASIN BOUNDARY
978.61 ⑧	DENOTES NODE No. and FG ELEVATION
FL	FLOW LENGTH
A	BASIN AREA
→	FLOW PATTERN
— · —	HYDROLOGIC SOIL GROUP

VALUED
ENGINEERING, INC
CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING
600 N. MOUNTAIN AVE, STE C102, UPLAND, CA 91786
PHONE: (909) 982-4601

CITY OF PERRIS
PRE-DEVELOPED HYDROLOGY MAP
PATTERSON BUSINESS CENTER

SHEET
1
OF 2 SHEET

POST-DEVELOPED HYDROLOGY

SUBAREA	ACRE	Q_{10}	Confluenced Q_{10}	Q_{100}	Confluenced Q_{100}
A1	2.00	3.34	17.320	5.82	29.640
A2	2.64	4.41		7.56	
A3	1.00	1.67		2.75	
B1	1.29	2.16		3.69	
C1	2.14	3.60		6.14	
C2	0.12	0.20		0.34	
C3	0.43	0.70		1.20	
D1	0.36	0.56		0.96	
E1	0.16	0.24		0.41	
E2	0.14	0.20		0.35	
E3	0.17	0.24		0.42	
F1	0.25	0.40	0.400	0.69	0.690
TOTAL	**10.70**	**17.72**		**30.33**	

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PHONE: (909) 982-4601

CITY OF PERRIS
PRE-DEVELOPED HYDROLOGY MAP
PATTERSON BUSINESS CENTER

SHEET
2
OF 2 SHEET

APPENDIX “E”

OFF-SITE HYDROLOGY

RIVERSIDE COUNTY FLOOD CONTROL AND
WATER CONSERVATION DISTRICT
RIVERSIDE, CALIFORNIA

MASTER DRAINAGE PLAN
FOR THE
PERRIS VALLEY AREA

ZONE 4

JULY 1987
REVISED JUNE 1991

KENNETH L. EDWARDS
CHIEF ENGINEER

MASTER DRAINAGE PLAN

for the

PERRIS VALLEY AREA

April 1987

Prepared by:

J. F. Davidson Associates, Inc.
Municipal Engineering Division
3426 Tenth Street
Riverside, CA 92501

(714)787-0580

Amended by:

Riverside County Flood Control
and Water Conservation District

June 1991

PERRIS VALLEY

MASTER DRAINAGE PLAN

TABLE OF CONTENTS

PERRIS VALLEY

MASTER DRAINAGE PLAN

SECTION I - PURPOSE

The purpose of this report is to investigate and evaluate the drainage problems of the Perris Valley area and prepare an updated master drainage plan. Currently, there are two master plans servicing this area, and they are Lower Perris Valley Master Drainage Plan adopted in May 1985 and Perris Valley Master Drainage Plan adopted in July 1987. For simplicity, these plans are replaced by this updated master plan.

Presently, Perris Valley area is subject to inundation during medium size storm events. A major task in this study is to develop a drainage system plan that will allow orderly development within the study area. The plan considers existing physical barriers, existing contour directions, and ultimate land uses in developing the size of the storm drain facilities.

The plan will serve as a guide to long term construction scheduling of primary drainage facilities and assist in the locating and sizing of local drainage facilities to be constructed by developers and others within the area. It is believed that this plan presents a reasonable method of transporting projected flows to the only major collection facility available, the Perris Valley Channel.

Until all of the facilities proposed in this plan are constructed and the Perris Valley Channel is upgraded from an interim channel to its ultimate size as shown in the Master Drainage Plan for the Perris Valley Channel, the current flood plain limit designations presented in Flood Insurance Rate Maps (FIRM) should still be considered when proposed developments encroach in those areas. Those developments should still be required to provide adequate floodproofing measures.

SECTION II - SCOPE

The tributary drainage area covered by this plan consists of approximately 38 square miles, with topographical relief ranging from steep mountain terrain to very mild sloping valley terrain. The scope of this Master Drainage Plan includes:

1. Determination of the quantity and points of concentration of storm runoff in the area.
2. The preparation of drainage area maps.
3. Determination of the location, size, and capacity of the proposed drainage facilities.

4. Investigation of alternative routes and methods as a basis for selecting the most effective plan.

5. Preparation of supporting cost estimates.

The tributary drainage area is located in the unincorporated portions of Riverside County and within both the City of Perris and the City of Moreno Valley city limits (see Exhibit A).

SECTION III - GENERAL DISCUSSION

The proposed drainage plan will involve the construction of a retention basin, major open channels and a network of underground storm drains. The system will transport flows that develop west of the Atchinson Topeka and Santa Fe Railroad (AT&SF RR) tracks and flows generated east of the I-215 Freeway to the Perris Valley Channel. The latter facility will then transport this stormwater along with other tributary flows southerly to the San Jacinto River.

Currently, only a few facilities are proposed to service the area west of the I-215 Freeway. However, rapid development in this area has necessitated additional facilities. Also the recent adoption of the Master Drainage Plan for the Perris Valley Channel has allowed for the inclusion of facilities adjacent to the channel.

Future improvements to the Perris Valley Channel and the San Jacinto River will eliminate the existing flood plain north of Nuevo Road in addition to lowering the flood elevation south of Nuevo Road along the Perris Valley Channel. These future limits are used as hydraulic controls throughout this study. (See Figure No. 1.)

A diversion of flows at the easterly intersection of I-215 and San Jacinto Avenue is incorporated in this Master Plan. This facility is indicated on Exhibit A and will be a part of the planned San Jacinto River improvements. Those flows historically traveling along San Jacinto Avenue will be captured at this point and diverted southerly.

Line "B" was extended under the 1987 study and will be a major collector of flows occurring north of Oleander Avenue. Alternative studies concerning the alignment of Line "B" along the I-215 were done to identify impacts of two (2) existing property owners-March Air Force Base (AFB) and the Arlington National Cemetery (Veterans Administration).

Due to a future air museum project along the east side of the I-215 and associated restrictions with air space around the landing strips on March AFB, the proposed channel was aligned west of the I-215 and adjacent to the AT&SF RR. Two alternatives for this facility encompass, (1) a rectangular channel section through the VA property and connecting to a major crossing at the I-215 Freeway, and (2) a rectangular and trapezoidal channel section through the VA property to the latter crossing. The second alternative was chosen for this Master Plan.

Large portions of the study area between the I-215 Freeway and the Perris Valley Channel are susceptible to flooding during periods of medium storm activity. This is attributed to the relatively flat terrain and sheet flow condition that presently exists.

Current interest in developing the area has led to increasing concerns by existing residents and by the City of Perris in how to best direct projected storm runoffs to adequate facilities. The lack of such facilities has greatly hampered the development of the area and any increase in subdivision activity may subject the existing community to serious flooding.

The Master Drainage Plan presented herein provides a method of collecting and conveying storm runoff through the study area. This proposed Plan will also enable the City of Perris and Moreno Valley to develop drainage projects which could be supported by prospective developers or by other available funding sources.

SECTION IV - CRITERIA

Most of the underground storm drains proposed in this plan are located in existing or proposed street rights-of-way. Runoff from a 10-year storm is allowed to accumulate in the streets until it reaches projected top of curb elevations. From this point, the plan proposes to collect water in an underground drain to convey at least the 10-year storm runoff to a 100-year outlet downstream.

Streets are allowed to carry 100-year flows to projected right-of-way limits. If flows exceeded this criteria, the residual amount over the right-of-way limit was included in the accompanying underground drain. However, 100-year flows are to be included in the underground drain wherever local sumps are proposed in order to meet the minimum street grade.

Open channels are proposed to carry a collective portion of the 100-year storm runoff and eventually discharges them into the Perris Valley Channel. All open channels were assumed to be concrete-lined in generating conservative travel time information. Channel alignments were established within vacant land areas as much as possible and would correspond to existing and proposed developments within the study area. The bisecting of vacant property was avoided as much as possible so that full use could be realized. Wherever feasible, proposed facilities have been placed underground.

The alignments of all storm drains and open channels are based on existing developments, existing street patterns, hydraulic efficiency, the ability to drain tributary areas, and future land uses. Minor realignments of the drainage facilities may be possible during final design stages.

SECTION V -HYDROLOGY DEVELOPMENT

The hydrologic development for the study area consisted of two methods, the unit hydrograph method and the rational method.

The rational method was used to determine the 10-year and 100-year peak discharges generated from small watersheds. This method was used primarily for sizing local underground facilities. Synthetic unit hydrographs were utilized for large areas that were tributary to the proposed drainage facilities. Methodology and supportive data for the rational and synthetic unit hydrograph hydrologies can be found in the "Riverside County Flood Control and Water Conservation District Hydrology Manual", dated April 1978.

Projected land uses for the study area were based on the District's assumed development patterns and data obtained from the City of Perris Planning Department, the County of Riverside Planning Department, and the City of Moreno Valley. The ultimate land use assumptions used throughout the plan can be viewed at the Riverside County Flood Control and Water Conservation District office. If development varies substantially from the indicated land uses, revisions to the drainage plan may become necessary. If, however, development continues as predicted with only minor deviations, the runoff quantities and approximate facility locations should prove to be adequate.

SECTION VI - EXISTING DRAINAGE FACILITIES

There are relatively few existing drainage facilities within the study area and they consist mainly of culvert crossings and earthen channels.

Numerous culvert crossings under the I-215 Freeway and railroad tracks transmit flows overland to the Perris Valley Channel. Due to the limited capacity of these culverts, they were generally ignored in system planning. Instead, fewer but larger culverts were proposed for the ultimate system. In doing so, the number of major collection channels required were minimized in providing a cost effective plan. It was assumed that local collection drains on the westerly side of the freeway, in the form of open channels and/or underground drains, would intercept flows tributary to those culverts and transmit them to major collection channels easterly of the freeway.

SECTION VII - RECOMMENDED DRAINAGE IMPROVEMENTS

The recommended improvements are shown on the enclosed map in the back of report. Supporting data for the facilities shown herein are available for review upon request.

SECTION VIII - ALTERNATIVE STUDIES

Several alternatives were developed and studied during the generation of the Perris Valley Master Drainage Plan. Those alternatives considered the use of underground pipes and boxes rather than open concrete and grass channels; different alignment schemes for open channel systems; and hydraulic considerations.

SECTION IX - ESTIMATED COSTS

The Master Plan presented herein is an accumulation of the preferred features of all of the alternatives studied. This Plan presents an economical drainage facility system while creating the least impact on the existing character of development within the study area.

The majority of underground facilities are proposed to be within existing or proposed street rights-of-way. Right-of-way acquisitions will be required for any proposed open channels constructed on private land.

Storm drain facility costs were developed from current construction data from the Riverside County Flood Control District.

All prices tabulated herein were adjusted to reflect present 1991 cost levels and are shown in Table I, "COST SUMMARY". These costs include right of way and 31% for engineering, administration and contingencies.

SECTION X - CONCLUSIONS

Based on the studies and investigations made for this report, it is concluded that:

1. The Perris Valley area has suffered distinct flooding problems in the past, and the damages incurred are expected to increase as much of the area converts from predominately agricultural uses to industrial and residential uses.

2. A drainage system is required to safely convey storm runoff through the area to the Perris Valley Channel.

3. The existing flood plain designation along the Perris Valley Channel should be considered intact until such a time that the latter is improved to ultimate conditions.

4. The proposed Plan indicated herein will lend itself to a stage construction program as funds are available.

5. The total cost of the recommended improvements, including right-of-way, engineering, contingencies, and administration is estimated to be $142,832,000.

SECTION XI - RECOMMENDATIONS

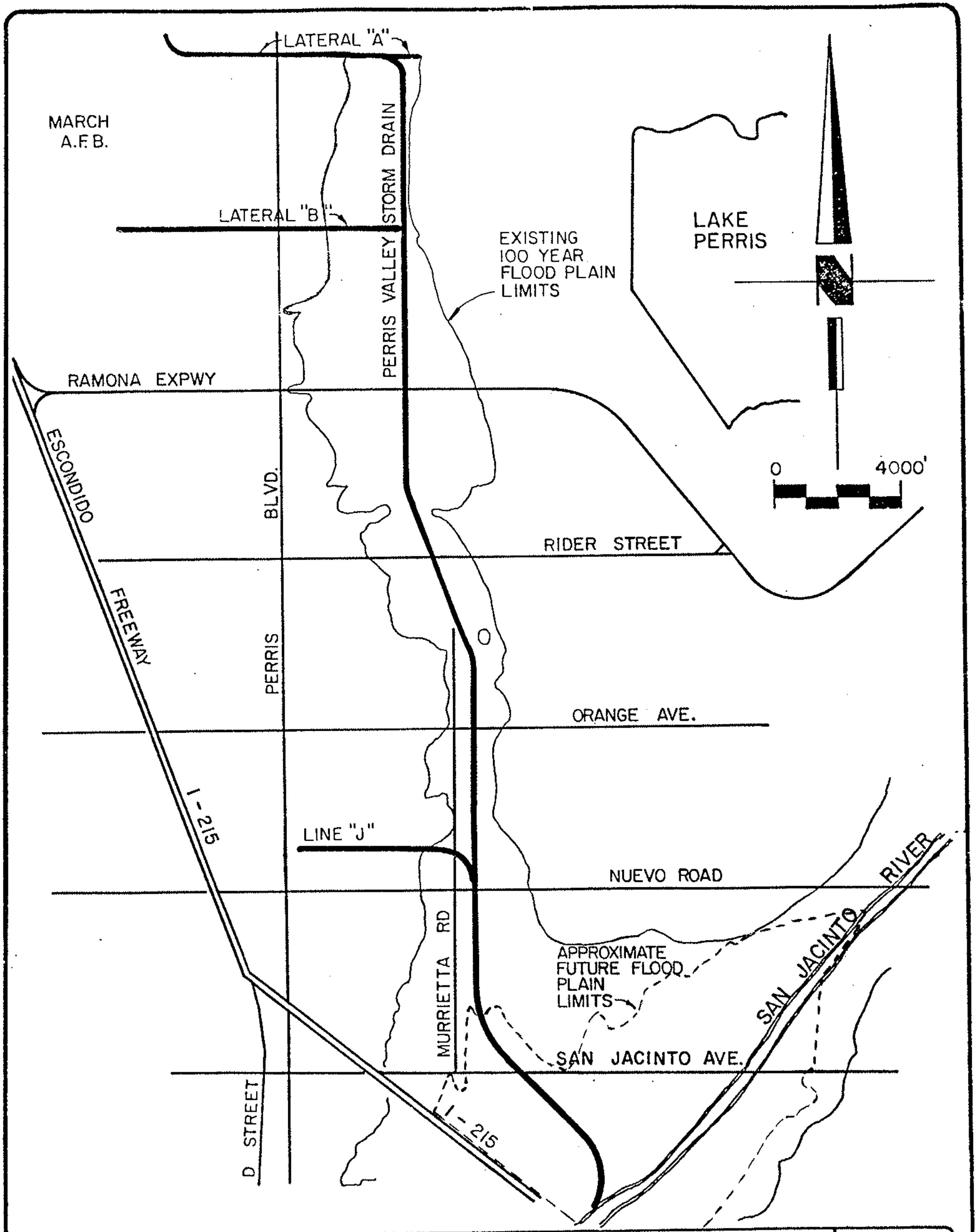
It is recommended that:

1. The Perris Valley Master Drainage Plan, as set forth herein, be adopted by the Perris City Council and the Riverside County Flood Control and Water Conservation District's Board of Supervisors.

2. The Perris Valley Master Drainage Plan, as set forth herein, shall replace the currently adopted Lower Perris Valley Master Drainage Plan.

3. The Master Drainage Plan as set forth herein be used as a guide for all future developments in the study area and that such developments be required to conform to the Plan insofar as much as possible.

4. The right-of-way required for the Plan be protected from encroachment.



J. F. DAVIDSON ASSOCIATES CIVIL ENGINEERS - SURVEYORS - PLANNERS	PERRIS VALLEY STORM DRAIN FLOOD PLAIN LIMITS	FIGURE 1

Perris Valley Master Drainage Plan

Table I: Cost Summary

Facility Designation	Construction Cost	Right of Way Cost	Total Cost
Lateral A-1	120,000	--0--	120,000
Line B	9,669,000	3,193,000	12,862,000
Line B-1	601,000	295,000	896,000
Line B-2	1,363,000	636,000	1,999,000
Line B-3	820,000	477,000	1,297,000
Lateral B-1	1,648,000	--0--	1,648,000
Lateral B-1.1	3,63,000	--0--	363,000
Lateral B-1.2	314,000	--0--	314,000
Lateral B-2	1,212,000	--0--	1,212,000
Lateral B-2.1	298,000	--0--	298,000
Lateral B-2.2	205,000	--0--	205,000
Lateral B-3	1,086,000	--0--	1,086,000
Lateral B-3.1	637,000	--0--	637,000
Lateral B-3.2	444,000	--0--	444,000
Lateral B-3.3	488,000	--0--	488,000
Lateral B-5	1,421,000	--0--	1,421,000
Lateral B-5.1	371,000	--0--	371,000
Lateral B-6	568,000	--0--	568,000
Lateral B-6.1	308,000	--0--	308,000
Lateral B-7	932,000	--0--	932,000
Lateral B-7.1	268,000	--0--	268,000
Lateral B-7.2	110,000	--0--	110,000
Lateral B-8	611,000	--0--	611,000
Lateral B-9	138,000	--0--	138,000
Line C	861,000	495,000	1,356,000
Line D	2,520,000	904,000	3,424,000
Lateral D-1	281,000	--0--	281,000
Lateral D-2	299,000	--0--	299,000
Lateral D-3	299,000	--0--	299,000

Perris Valley Master Drainage Plan

Table I: Cost Summary

Facility Designation	Construction Cost	Right of Way Cost	Total Cost
Line E	5,222,000	2,666,000	7,888,000
Lateral E-1	315,000	--0--	315,000
Lateral E-2	309,000	--0--	309,000
Lateral E-3	262,000	--0--	262,000
Lateral E-4	751,000	--0--	751,000
Lateral E-5	243,000	--0--	243,000
Lateral E-6	464,000	--0--	464,000
Lateral E-7	451,000	--0--	451,000
Lateral E-8	908,000	178,000	1,086,000
Lateral E-9	618,000	--0--	618,000
Lateral E-9.1	338,000	--0--	338,000
Lateral E-10	1,708,000	--0--	1,708,000
Lateral E-11	268,000	--0--	268,000
Lateral E-12	492,000	--0--	492,000
Lateral E-13	424,000	--0--	424,000
Line F	3,559,000	--0--	3,559,000
Lateral F-1	670,000	--0--	670,000
Lateral F-2	703,000	--0--	703,000
Lateral F-3	857,000	--0--	857,000
Lateral F-3.1	264,000	--0--	264,000
Lateral F-4	653,000	--0--	653,000
Line G	875,000	689,000	1,564,000
Lateral G-1	2,370,000	--0--	2,370,000
Lateral G-2	730,000	--0--	730,000
Line H	3,839,000	1,155,000	4,994,000
Lateral H-1	927,000	--0--	927,000
Lateral H-2	98,000	--0--	98,000
Lateral H-3	358,000	--0--	358,000
Lateral H-4	100,000	--0--	100,000
Lateral H-5	973,000	--0--	973,000
Lateral H-6	122,000	--0--	122,000
Lateral H-7	240,000	--0--	240,000
Lateral H-8	596,000	--0--	596,000

Perris Valley Master Drainage Plan

Table I: Cost Summary

Facility Designation	Construction Cost	Right of Way Cost	Total Cost
Lateral H-9	156,000	--0--	156,000
Lateral H-10	1,017,000	--0--	1,017,000
Lateral H-10.1	312,000	--0--	312,000
Lateral H-11	1,229,000	--0--	1,229,000
Lateral H-11.1	547,000	--0--	547,000
Lateral H-12	2,488,000	--0--	2,488,000
Line J	3,010,000	227,000	3,237,000
Lateral J-1	1,503,000	--0--	1,503,000
Lateral J-2	132,000	--0--	132,000
Lateral J-3	212,000	--0--	212,000
Lateral J-4	119,000	--0--	119,000
Lateral J-5	108,000	--0--	108,000
Lateral J-6	751,000	--0--	751,000
Lateral J-7	934,000	--0--	934,000
Lateral J-7.1	240,000	--0--	240,000
Lateral J-8	663,000	--0--	663,000
Lateral J-9	2,340,000	--0--	2,340,000
Lateral J-9.1	535,000	--0--	535,000
Lateral J-9.2	115,000	--0--	115,000
Line K	2,392,000	736,000	3,128,000
Lateral K-3	541,000	--0--	541,000
Lateral K-6	931,000	--0--	931,000
Lateral K-13	188,000	--0--	188,000
Lateral K-14	1,168,000	--0--	1,168,000
Lateral K-15	330,000	--0--	330,000
Lateral K-16	214,000	--0--	214,000
Lateral K-17	122,000	--0--	122,000
Lateral K-18	127,000	--0--	127,000
Lateral K-19	276,000	--0--	276,000
Lateral K-20	891,000	--0--	891,000
Lateral K-21	352,000	--0--	352,000
Lateral K-22	430,000	--0--	430,000

Perris Valley Master Drainage Plan

Table I: Cost Summary

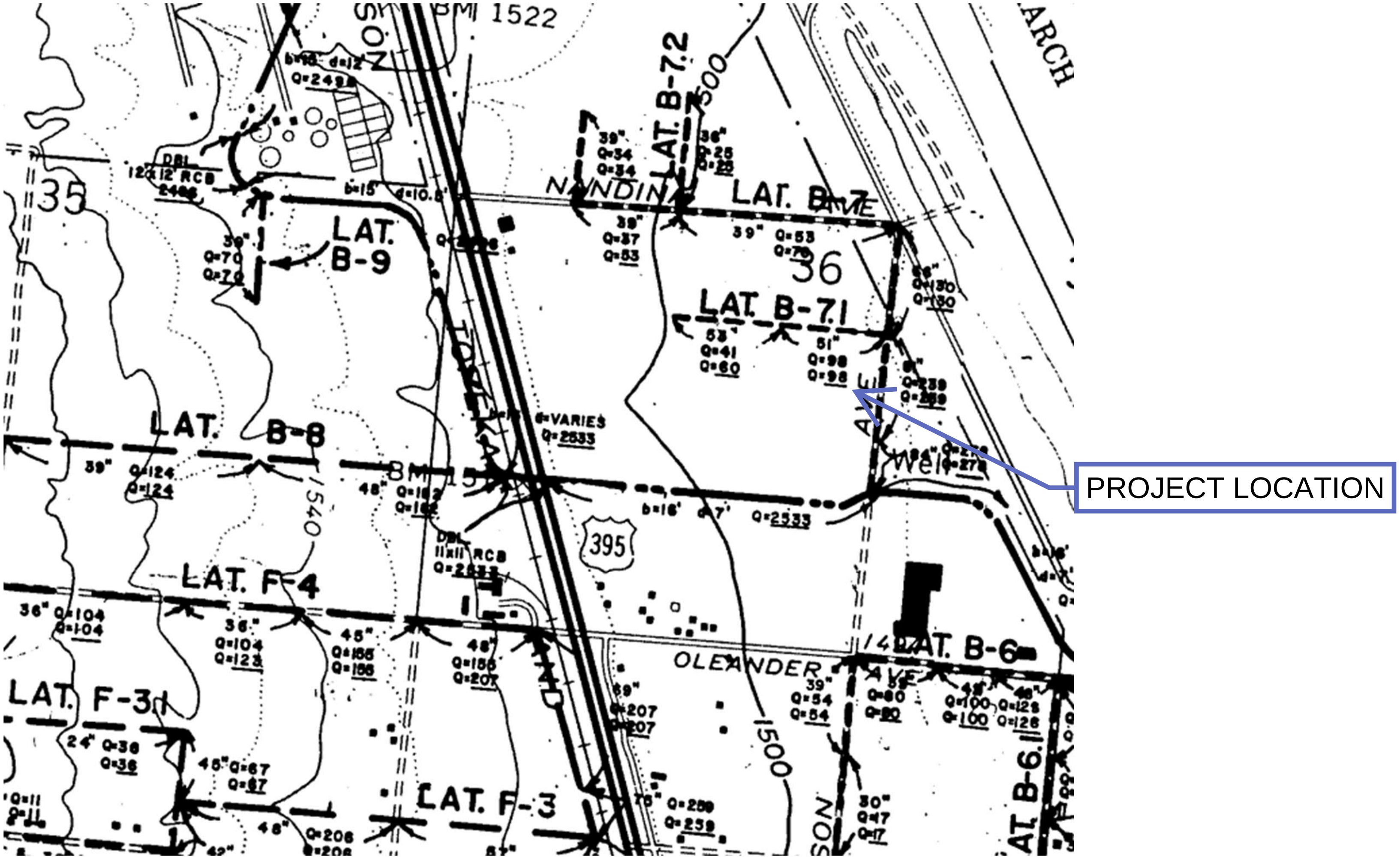
Facility Designation	Construction Cost	Right of Way Cost	Total Cost
Lateral K-23	223,000	--0--	223,000
Lateral K-24	114,000	--0--	114,000
Line L	692,000	--0--	692,000
Lateral L-1	124,000	--0--	124,000
Line M	911,000	32,000	943,000
Lateral M-1	366,000	--0--	366,000
Lateral M-2	268,000	--0--	268,000
Lateral M-2.1	216,000	--0--	216,000
Lateral M-3	209,000	--0--	209,000
Line N	1,511,000	--0--	1,511,000
Lateral N-1	117,000	--0--	117,000
Lateral N-2	108,000	--0--	108,000
Line O	1,080,000	--0--	1,080,000
Line P	231,000	--0--	231,000
Lateral P-1	69,000	--0--	69,000
Lateral P-2	373,000	--0--	373,000
Lateral P-3	650,000	--0--	650,000
Lateral P-4	508,000	--0--	508,000
Lateral P-5	534,000	--0--	534,000
Line Q	703,000	413,000	1,116,000
Lateral Q-2	806,000	--0--	806,000
Lateral Q-3	719,000	--0--	719,000
Line R	1,663,000	--0--	1,663,000
Line S	3,306,000	--0--	3,306,000
Lateral S-3	707,000	--0--	707,000
Line T	1,753,000	216,000	1,969,000

Perris Valley Master Drainage Plan

Table I: Cost Summary

Facility Designation	Construction Cost	Right of Way Cost	Total Cost
Lateral T-2	752,000	--0--	752,000
Lateral T-3	652,000	--0--	652,00
Line U	1,670,000	834,000	2,504,000
Lateral U-1	278,000	--0--	278,000
Lateral V-1	1,404,000	--0--	1,404,000
Lateral V-2	695,000	--0--	695,000
Lateral V-3	509,000	--0--	509,000
Lateral V-5	266,000	--0--	266,000
Line A-A	818,000	--0--	818,000
Line A-B	911,000	--0--	911,000
Line A-C	550,000	--0--	550,000
Line A-D	167,000	--0--	167,000
Line A-E	228,000	--0--	228,000
Line A-F	137,000	--0--	137,000
Line A-G	142,000	--0--	142,000
Line A-H	778,000	--0--	778,000
Line A-J	2,437,000	--0--	2,437,000
Line A-K	1,130,000	--0--	1,130,000
Line A-L	838,000	--0--	838,000
Line A-M	730,000	--0--	730,000
Line A-N	2,314,000	--0--	2,314,000
Line A-O	1,051,000	--0--	1,051,000
Line A-P	572,000	--0--	572,000
Line A-Q	785,000	--0--	785,000
Line A-R	905,000	--0--	905,000
Line A-S	902,000	192,000	1,094,000
Line A-T	347,000	--0--	347,000
Seaton Basin	1,855,000	4,375,000	6,230,000
Total Master Plan Cost	$125,119,000	$17,713,000	$142,832,000

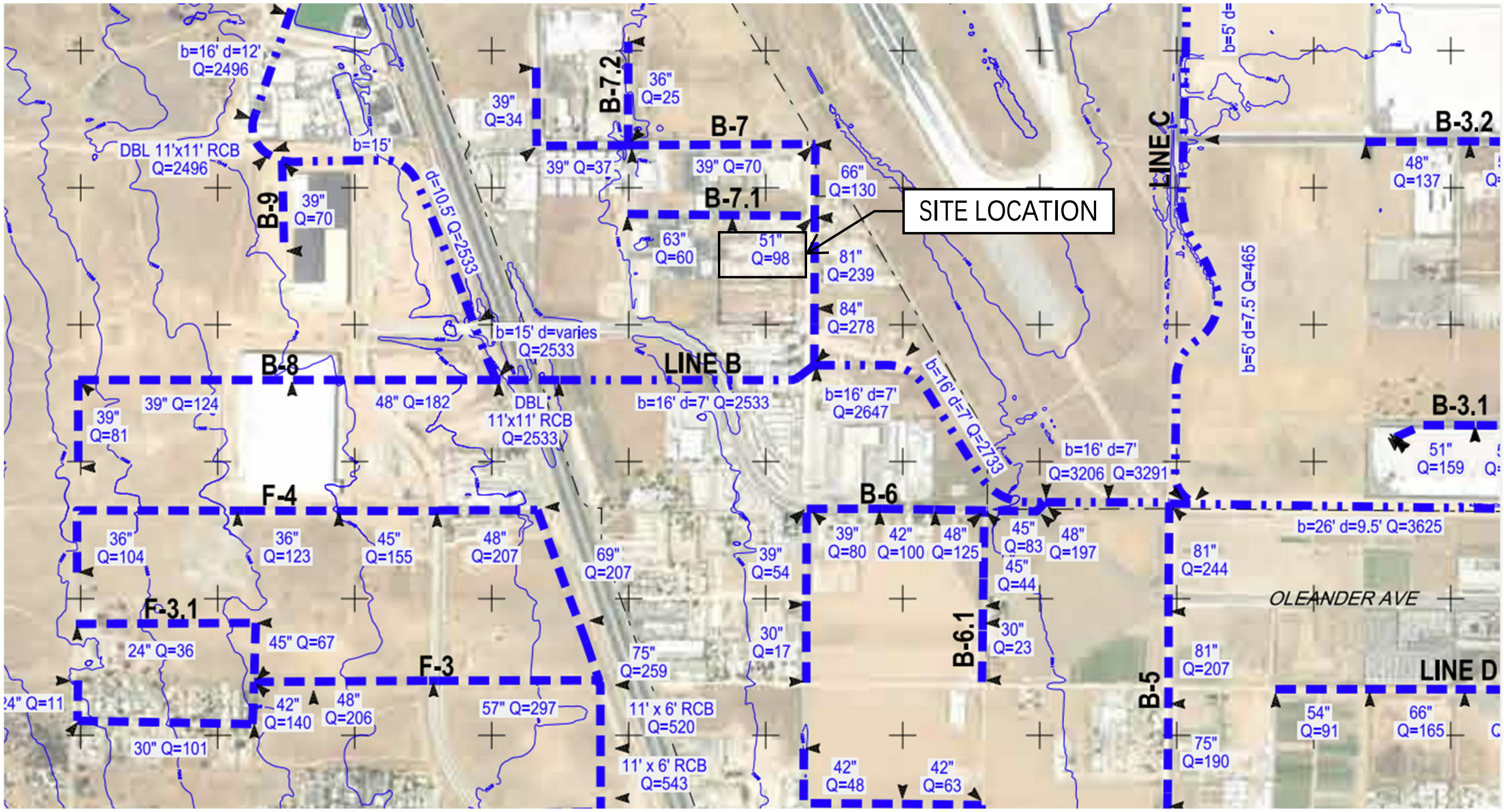
1. Construction cost includes 31% for engineering and contingency



“PERRIS VALLEY MDP LATERAL B-7”

LOCATION SHOWN ON ABOVE MAP

ALONG PATTERSON AVE FROM ORLEANDER TO NANDINA AVENUE



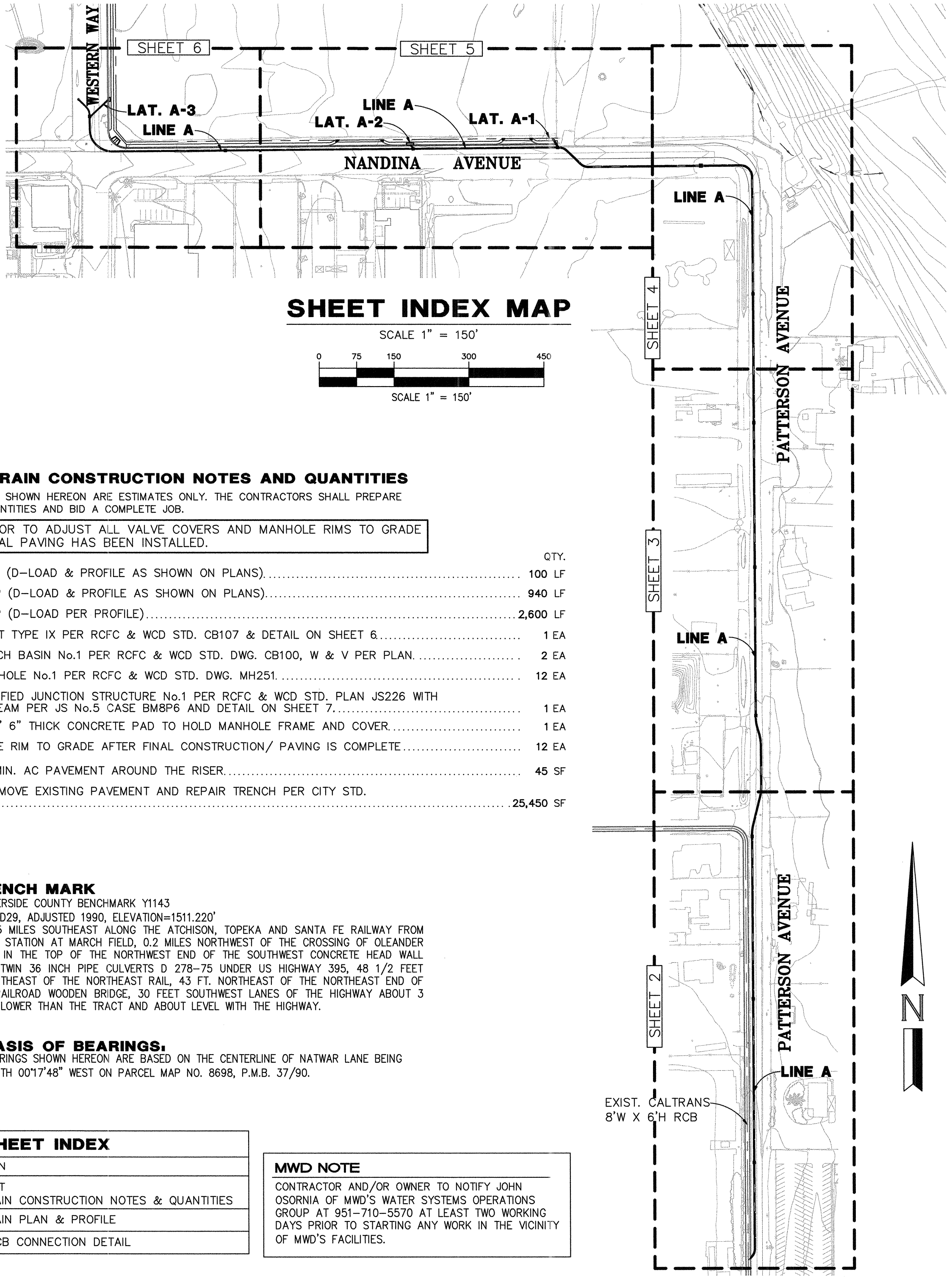
"PERRIS VALLEY MDP LINE B"
LOCATION SHOWN ON ABOVE EXHIBIT
ALONG PATTERSON AVE FROM HARLEY KNOX BLVD/NANDINA AVE

OFFSITE STORM DRAIN PLANS
FOR
PATTERSON AVENUE, NANDINA AVENUE & WESTERN WAY
CITY OF PERRIS, CALIFORNIA
DPR 19-00003

GENERAL NOTES

1. THE CONTRACTOR SHALL CONSTRUCT THE FLOOD CONTROL IMPROVEMENTS SHOWN ON THE DRAWINGS IN CONFORMANCE WITH THE REQUIREMENTS OF THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT'S M.O.U STANDARD SPECIFICATIONS DATED JUNE 24, 2008, AND THE DISTRICT'S STANDARD MANUAL. FOR THE LATEST DRAWINGS OF THE STANDARD MANUAL, PLEASE REFER TO THE "PUBLICATIONS AND RECORDS" PAGE FOUND ON THE DISTRICT'S WEBSITE.
2. CONTACT THE ENCROACHMENT PERMIT ENGINEER AT 951.955.1266 IF AN ENCROACHMENT PERMIT IS REQUIRED FROM THE DISTRICT. AFTER THE PERMIT IS ISSUED THE DISTRICT MUST BE NOTIFIED ONE WEEK PRIOR TO CONSTRUCTION.
3. CONTACT CONSTRUCTION MANAGEMENT AT 951.955.1288 IF CONSTRUCTION INSPECTION WILL BE PERFORMED BY THE DISTRICT. THE DISTRICT MUST BE NOTIFIED TWENTY DAYS (20) PRIOR TO CONSTRUCTION.
4. ALL STATIONING REFERS TO CENTERLINE OF CONSTRUCTION UNLESS OTHERWISE NOTED.
5. STATIONING FOR LATERALS AND CONNECTOR PIPE REFER TO THE CENTERLINE INTERSECTION STATIONS.
6. FORTY-EIGHT HOURS BEFORE EXCAVATION, CALL UNDERGROUND SERVICE ALERT 1.800.227.2600.
7. ALL ELEVATIONS SHOWN ARE IN FEET AND DECIMALS THEREOF BASED ON THE NATIONAL GEODETIC VERTICAL DATUM (NGVD 29).
8. ALL COORDINATES ARE SHOWN IN FEET AND DECIMALS THEREOF BASED ON AN ASSUMED COORDINATE SYSTEM.
9. ALL CROSS SECTIONS ARE TAKEN LOOKING DOWNSTREAM.
10. ELEVATIONS OF UTILITIES ARE APPROXIMATE UNLESS OTHERWISE NOTED.
11. UNLESS OTHERWISE SPECIFIED, MINIMUM STREET RECONSTRUCTION SHALL BE 4" TYPE "B" HOT MIX ASPHALT OVER 6" CLASS 2 AGGREGATE BASE OR AS SPECIFIED BY THE ENGINEER.
12. OPENINGS RESULTING FROM THE CUTTING OR PARTIAL REMOVAL OF EXISTING CULVERTS, PIPES OR SIMILAR STRUCTURES TO BE ABANDONED SHALL BE SEALED WITH 6" OF CLASS "B" CONCRETE.
13. PIPE CONNECTED TO THE MAINLINE PIPE SHALL CONFORM TO JUNCTION STRUCTURE NO. 4 (JS 229) UNLESS OTHERWISE NOTED.
14. PIPE BEDDING SHALL CONFORM TO THE DISTRICTS STANDARD DRAWING NO. M815
15. "V" IS THE DEPTH OF CATCH BASINS MEASURED FROM THE TOP OF CURB TO INVERT OF CONNECTOR PIPE.
16. CATCH BASINS SHALL BE LOCATED SO THAT LOCAL DEPRESSION SHALL BEGIN AT EXISTING CURB RETURN JOINT, UNLESS OTHERWISE SPECIFIED.
17. ALL CURBS, GUTTERS, SIDEWALKS, DRIVEWAYS AND OTHER EXISTING IMPROVEMENTS TO BE RECONSTRUCTED IN KIND AND AT THE SAME ELEVATION AND LOCATION AS THE EXISTING IMPROVEMENTS UNLESS OTHERWISE NOTED.
18. STANDARD DRAWINGS CALLED FOR ON THE PLAN AND PROFILE SHALL CONFORM TO DISTRICT STANDARD DRAWINGS UNLESS NOTED OTHERWISE.
19. THE CONTRACTOR IS REQUIRED TO CALL ALL UTILITY AGENCIES REGARDING TEMPORARY SHORING AND SUPPORT REQUIREMENTS FOR THE VARIOUS UTILITY LINES SHOWN ON THESE PLANS.
20. DURING ROUGH GRADING OPERATIONS AND PRIOR TO CONSTRUCTION OF PERMANENT DRAINAGE STRUCTURES, TEMPORARY DRAINAGE CONTROL SHOULD BE PROVIDED TO PREVENT PONDING WATER AND DAMAGE TO ADJACENT PROPERTIES.
21. APPROVAL OF THESE PLANS BY THE DISTRICT DOES NOT RELIEVE THE DEVELOPER'S ENGINEER OF RESPONSIBILITY FOR THE ENGINEERING DESIGN. IF FIELD CHANGES ARE REQUIRED, IT WILL BE THE RESPONSIBILITY OF THE DESIGN ENGINEER TO MAKE THE NECESSARY CORRECTIONS.
22. THE CONTRACTOR OR DEVELOPER SHALL SECURE ALL REQUIRED ENCROACHMENT AND/OR STATE AND FEDERAL REGULATORY PERMITS PRIOR TO THE COMMENCEMENT OF ANY WORK.
23. THE CONCRETE COATING ON THE INSIDE OF ALL REINFORCED CONCRETE PIPES OR STRUCTURES MUST BE INCREASED TO PROVIDE A MINIMUM OF 1-1/2 INCHES OVER THE REINFORCING AND INCREASED TO A MINIMUM OF 3-1/2 INCHES OVER REINFORCING FOR BOX CULVERT, WHEN DESIGN VELOCITIES EXCEED 20 FEET PER SECOND. THE CONCRETE DESIGN STRENGTH IN THESE REACHES SHALL BE F'C=5,000 PSI FOR VELOCITIES EXCEEDING 20 FEET PER SECOND AND F'C=6,000 PSI FOR VELOCITIES EXCEEDING 30 FEET PER SECOND.
24. CONSTRUCTION JOINTS FOR CALTRANS STANDARD REINFORCED CONCRETE BOX SHALL BE PLACED ACCORDING TO THE DISTRICT STANDARD DRAWING NO. BOX 401.
25. VIDEO OF STORM DRAINAGE SHALL BE SUBMITTED TO THE CITY ENGINEER FOR REVIEW AND APPROVAL PRIOR TO PAVEMENT CAPPING OR CONCRETING.

SHEET INDEX MAP



STORM DRAIN CONSTRUCTION NOTES AND QUANTITIES

THE QUANTITIES SHOWN HEREON ARE ESTIMATES ONLY. THE CONTRACTORS SHALL PREPARE THEIR OWN QUANTITIES AND BID A COMPLETE JOB.

NOTE: A. CONTRACTOR TO ADJUST ALL VALVE COVERS AND MANHOLE RIMS TO GRADE AFTER FINAL PAVING HAS BEEN INSTALLED.

		QTY.
D7	INSTALL 18" RCP (D-LOAD & PROFILE AS SHOWN ON PLANS)	100 LF
D9	INSTALL 24" RCP (D-LOAD & PROFILE AS SHOWN ON PLANS)	940 LF
D10	INSTALL 30" RCP (D-LOAD PER PROFILE)	2,600 LF
D48	CONSTRUCT INLET TYPE IX PER RCFC & WCD STD. CB107 & DETAIL ON SHEET 6	1 EA
D56	CONSTRUCT CATCH BASIN No.1 PER RCFC & WCD STD. DWG. CB100, W & V PER PLAN	2 EA
D58	CONSTRUCT MANHOLE No.1 PER RCFC & WCD STD. DWG. MH251	12 EA
D59	CONSTRUCT MODIFIED JUNCTION STRUCTURE No.1 PER RCFC & WCD STD. PLAN JS226 WITH SPECIAL EDGE BEAM PER JS No.5 CASE BM8P6 AND DETAIL ON SHEET 7	1 EA
D70	CONSTRUCT 6'X6' 6" THICK CONCRETE PAD TO HOLD MANHOLE FRAME AND COVER	1 EA
D81	ADJUST MANHOLE RIM TO GRADE AFTER FINAL CONSTRUCTION/ PAVING IS COMPLETE	12 EA
D130	CONSTRUCT 4" MIN. AC PAVEMENT AROUND THE RISER	45 SF
D131	SAWCUT AND REMOVE EXISTING PAVEMENT AND REPAIR TRENCH PER CITY STD. ON SHEET 1	25,450 SF

BENCH MARK

RIVERSIDE COUNTY BENCHMARK Y1143
NGVD29, ADJUSTED 1990, ELEVATION=1511.220'
3.05 MILES SOUTHEAST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE STATION AT MARCH FIELD, 0.2 MILES NORTHWEST OF THE CROSSING OF OLEANDER RD. IN THE TOP OF THE NORTHWEST END OF THE SOUTHWEST CONCRETE HEAD WALL OF TWIN 36 INCH PIPE CULVERTS D 278-75 UNDER US HIGHWAY 395, 48 1/2 FEET NORTHEAST OF THE NORTHEAST RAIL, 43 FT. NORTHEAST OF THE NORTHEAST END OF A RAILROAD WOODEN BRIDGE, 30 FEET SOUTHWEST LANES OF THE HIGHWAY ABOUT 3 FT. LOWER THAN THE TRACT AND ABOUT LEVEL WITH THE HIGHWAY.

BASIS OF BEARINGS:

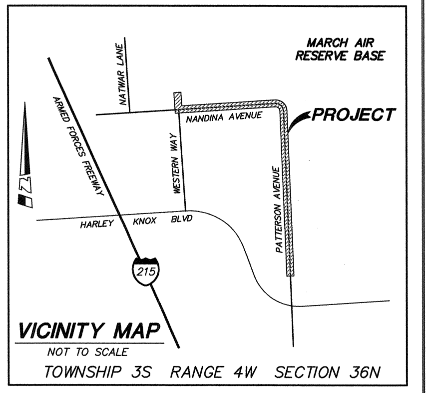
BEARINGS SHOWN HEREON ARE BASED ON THE CENTERLINE OF NATWAR LANE BEING NORTH 00°17'48" WEST ON PARCEL MAP NO. 8698, P.M.B. 37/90.

SHEET INDEX

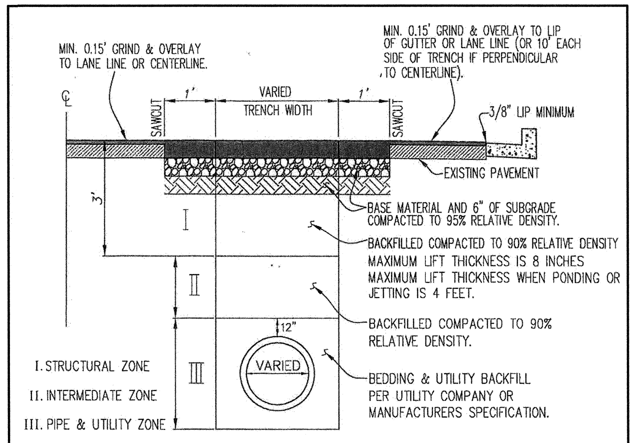
SHEET NO.	DESCRIPTION
1	TITLE SHEET STORM DRAIN CONSTRUCTION NOTES & QUANTITIES
2-6	STORM DRAIN PLAN & PROFILE
7	PIPE TO RCB CONNECTION DETAIL

MWD NOTE

CONTRACTOR AND/OR OWNER TO NOTIFY JOHN OSORNIA OF MWD'S WATER SYSTEMS OPERATIONS GROUP AT 951-710-5570 AT LEAST TWO WORKING DAYS PRIOR TO STARTING ANY WORK IN THE VICINITY OF MWD'S FACILITIES.



VICINITY MAP
NOT TO SCALE
TOWNSHIP 3S RANGE 4W SECTION 36N



NOTES:

1. STREET STRUCTURAL SECTION TO BE AS FOLLOWS:
   A.C. SURFACING = MATCH EXISTING THICKNESS + ONE INCH.
   BASE = MATCH EXISTING THICKNESS (MUST USE CLASS II BASE)
   IN NO CASE SHALL THE STRUCTURAL SECTION SHALL BE LESS THAN 3" OVER 6" CLASS II BASE. CITY MAY ALSO SPECIFY STRUCTURAL SECTION FOR ROADWAY IN CERTAIN SITUATIONS.
2. WHEN A FIRM FOUNDATION IS NOT ENCOUNTERED DUE TO SOFT, SPONGY OR OTHER UNSUITABLE MATERIAL, SUCH MATERIAL SHALL BE REMOVED TO THE LIMITS DIRECTED BY THE INSPECTOR, AND THE RESULTING EXCAVATION BACKFILLED WITH CLASS II BASE.
3. CONTRACTOR TO PROVIDE INSPECTOR COPY OF COMPACTION REPORTS PRIOR TO PAVING.
4. FOR SIGNIFICANT AND MAJOR ROADWAYS, THE SECTIONS SHALL BE AS APPROVED BY THE CITY ENGINEER ON A CASE BY CASE BASIS.

CITY OF PERRIS
CITY STANDARD
UTILITY TRENCH SURFACE REPAIR
SCALE: NONE
APPROVED BY:
CITY ENGINEER DATE: 01/24/18
STD. NO. N/A

D131 TRENCH SURFACE REPAIR
NOT TO SCALE

ABBREVIATIONS

AP	ANGLE POINT
BC	BEGIN CURVE
BEG.	BEGIN
VC	VERTICAL CURVE
TP	TOP OF PAVEMENT
TC	TOP OF CURB
EC	END CURVE
EL	ELEVATION
EXIST.	EXISTING
FL	FLOWLINE
FG	FINISH GRADE
FS	FINISH SURFACE
CF	CURB FACE
CONC.	CONCRETE
GB	GRADE BREAK
HP	HIGH POINT
INV	INVERT ELEVATION
TG	TOP OF GRATE
CB	CATCH BASIN
RD	ROOF DRAIN
RCFC & WCD.	RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
LD	LOCAL DEPRESSION
MH	MANHOLE
EP	EDGE OF PAVEMENT
COTG	CLEANOUT TOP OF GRATE
SMH	SEWER MANHOLE
STD.	STANDARD
LAT.	LATERAL
R	RIDGE LINE
P.I.P.	PROTECT IN PLACE
PROP.	PROPOSED
CL	CENTERLINE
DWG.	DRAWING
DWY.	DRIVEWAY
WS EL.	WATER SURFACE ELEVATION
—1000—	PROPOSED CONTOUR
—1000—	EXISTING CONTOUR
⟸	DIRECTION OF FLOW

CIVIL ENGINEER

HUITT-ZOLLARS, INC.
3990 CONCOURS, SUITE 330
ONTARIO, CALIFORNIA 91764
PHONE: (909) 941-7799

OWNER/DEVELOPER

IPT PERRIS DC III, LLC
C/O BLACK CREEK GROUP
4675 MACARTHUR COURT, SUITE 625
NEWPORT BEACH, CA 92660
PHONE: (949) 795-6272
CONTACT: MR. CHRIS SANFORD
EMAIL: chris.sanford@blackcreekgroup.com

UTILITY COMPANIES NOTIFICATIONS:

CONTRACTOR SHALL NOTIFY THE FOLLOWING UTILITIES OR AGENCIES 48 HOURS PRIOR TO STARTING CONSTRUCTION OR EXCAVATION

ROAD:	RIVERSIDE COUNTY ROAD (CONSTRUCTION INSPECTION)	951-955-6885
WATER:	EASTERN MUNICIPAL WATER DISTRICT (FIELD ENGINEERING DEPARTMENT)	951-928-3777 X4830
SEWER:	EASTERN MUNICIPAL WATER DISTRICT	951-928-3777 X4830
CITY:	CITY OF PERRIS	951-943-6504
FLOOD:	RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT	951-955-1266
GAS:	SOUTHERN CALIFORNIA GAS COMPANY	310-328-1631
ELECTRIC:	SOUTHERN CALIFORNIA EDISON	951-928-8257
TELEPHONE:	VERIZON	800-483-3000
CABLE:	TIME WARNER	951-652-0020

UNAUTHORIZED CHANGES AND USES

CAUTION: THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS.

WDID NO. 833C389590

Underground Service Alert
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TWO WORKING DAYS BEFORE YOU DIG

NOTE:
WORK CONTAINED WITHIN THESE PLANS SHALL NOT COMMENCE UNTIL AN ENCROACHMENT PERMIT AND/OR A GRADING PERMIT HAS BEEN ISSUED.

THE PRIVATE ENGINEER SIGNING THESE PLANS IS RESPONSIBLE FOR ASSURING THE ACCURACY AND ACCEPTABILITY OF THE DESIGN HEREON. IN THE EVENT OF DISCREPANCIES ARISING AFTER CITYY APPROVAL OR DURING CONSTRUCTION, THE PRIVATE ENGINEER SHALL BE RESPONSIBLE FOR DETERMINING AN ACCEPTABLE SOLUTION AND REVISING THE PLANS FOR APPROVAL BY THE CITY.

MARK	BY	DATE	REVISIONS	APPR.	DATE
ENGINEER				CITY	

CITY OF PERRIS
APPROVED BY:
Stuart E. McKibbin 6-24-2020
CITY ENGINEER DATE

NO. 67512
EXPIRATION 6-30-2021
JOHNNY MURAD

PREPARED UNDER THE SUPERVISION OF:
JOHNNY MURAD DATE 06-15-20
R.C.E. NO. 67512 EXP. DATE 06-30-21

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS, SUITE 330 * ONTARIO, CALIFORNIA 91764 * (909) 941-7799

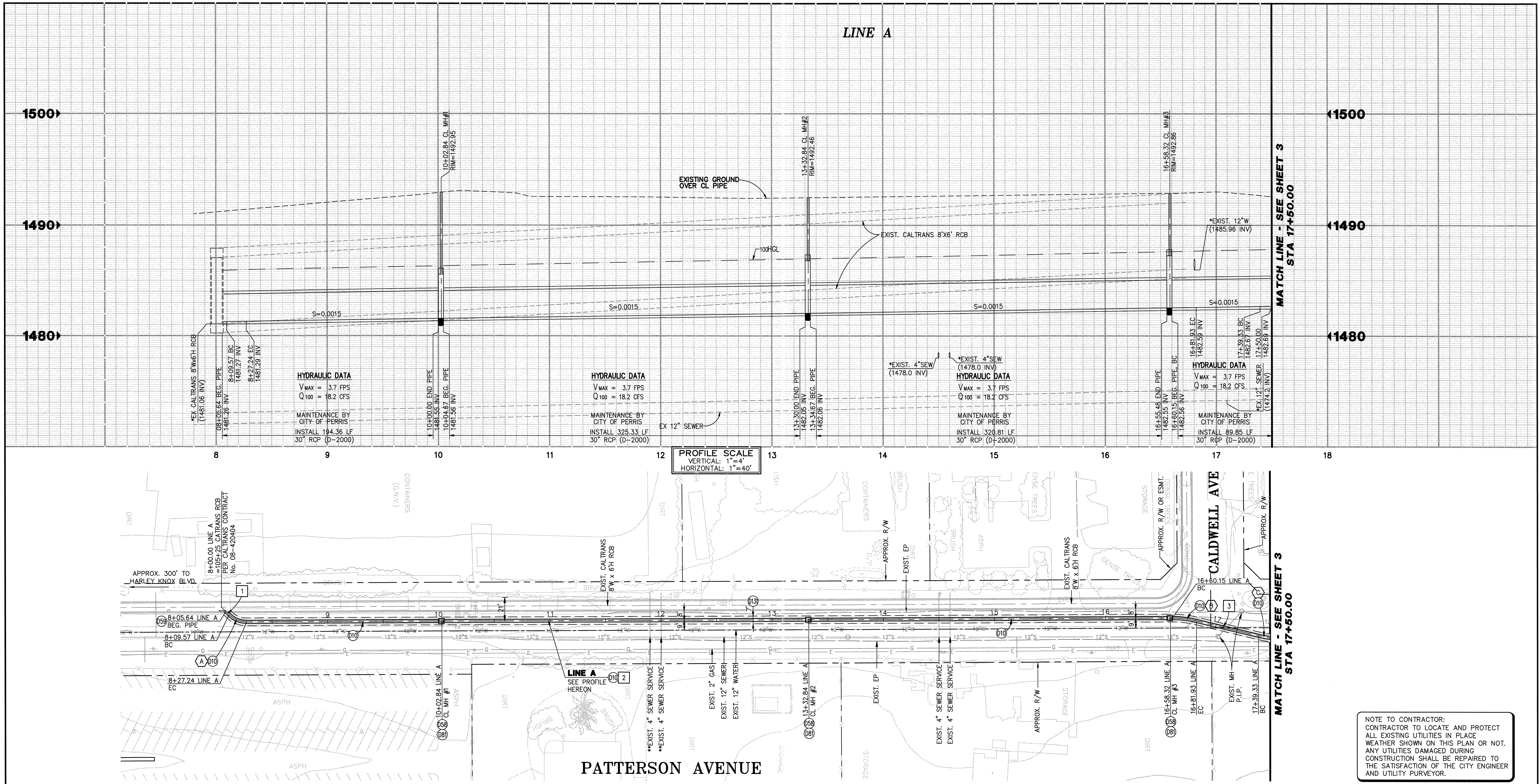
SCALE HORIZ: 1"=40' DATE
DESIGNED BY: M.G. DRAWN BY: H-Z STAFF CHECKED BY: J.M.

CITY OF PERRIS
OFFSITE STORM DRAIN PLANS
TITLE SHEET
DPR19-00003

SHEET NO. 1
OF 7 SHTS

FOR:
W.O.
CITY FILE NO. P8-1351

H:\proj\R310152.01 - Black Creek - Western Way Industrial\05 Design\05.1 DWG's\Storm-Drain\LDRN01.dwg, Layout: 01, Jun 02 2020 2:30pm



☐	BEARING	DISTANCE
COURSE DATA		
1	N44°45'03"E	9.57'
2	N00°14'57"W	832.91'
3	N13°36'56"E	57.40'

⬡	Δ	R	L	T
CURVE DATA				
A	45°00'00"	22.50'	17.67'	9.32'
B	13°51'54"	90.00'	21.78'	10.94'
***C	13°51'54"	90.00'	21.78'	10.94'

***TOTAL CURVE

STORM DRAIN CONSTRUCTION NOTES

- (D10) INSTALL 30" RCP (D-LOAD PER PROFILE)
- (D58) CONSTRUCT MANHOLE No.1 PER RCFC & WCD STD. DWG. MH251
- (D59) CONSTRUCT MODIFIED JUNCTION STRUCTURE No.1 PER RCFC & WCD STD. PLAN JS226 WITH SPECIAL EDGE BEAM PER JS No.5 CASE BM8P6 AND DETAIL ON SHEET 7.
- (D81) ADJUST MANHOLE RIM TO GRADE AFTER FINAL CONSTRUCTION/ PAVING IS COMPLETE
- (D131) SAWCUT AND REMOVE EXISTING PAVEMENT AND REPAIR TRENCH PER CITY STD. ON SHEET 1

0 20 40 80 120
SCALE 1" = 40'

NOTE TO CONTRACTOR:
CONTRACTOR TO LOCATE AND PROTECT ALL EXISTING UTILITIES IN PLACE WEATHER SHOWN ON THIS PLAN OR NOT. ANY UTILITIES DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED TO THE SATISFACTION OF THE CITY ENGINEER AND UTILITY PURVEYOR.

* NOTE:
HORIZONTAL AND VERTICAL LOCATIONS TO BE VERIFIED IN THE FIELD AND ENGINEER NOTIFIED OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

**NOTE:
SEWER SERVICE LATERAL WAS POTHOLED BUT NOT FOUND.

WDID NO. 833C389590

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MARK	BY	DATE	REVISIONS	APPR.	DATE
ENGINEER				CITY	

CITY OF PERRIS
APPROVED BY:
Stuart E McKibbin 6-24-2020
CITY ENGINEER DATE

JOHNNY MURAD
NO. 67512
EXPIRATION 6-30-2021
CIVIL

PREPARED UNDER THE SUPERVISION OF:
JOHNNY MURAD DATE 06-15-20
R.C.E. NO. 67512 EXP. DATE 06-30-21

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS, SUITE 330 * ONTARIO, CALIFORNIA 91764 * (909) 941-7799

SCALE HORIZ: 1"=40' DATE
DESIGNED BY: M.G. DRAWN BY: H-Z STAFF CHECKED BY: J.M.

CITY OF PERRIS
OFFSITE STORM DRAIN PLANS
PATTERSON AVENUE
SD STA. 8+00.00 TO STA. 17+50.00

SHEET NO. 2 OF 7 SHTS

FOR:
W.O.
CITY FILE NO. P8-1351

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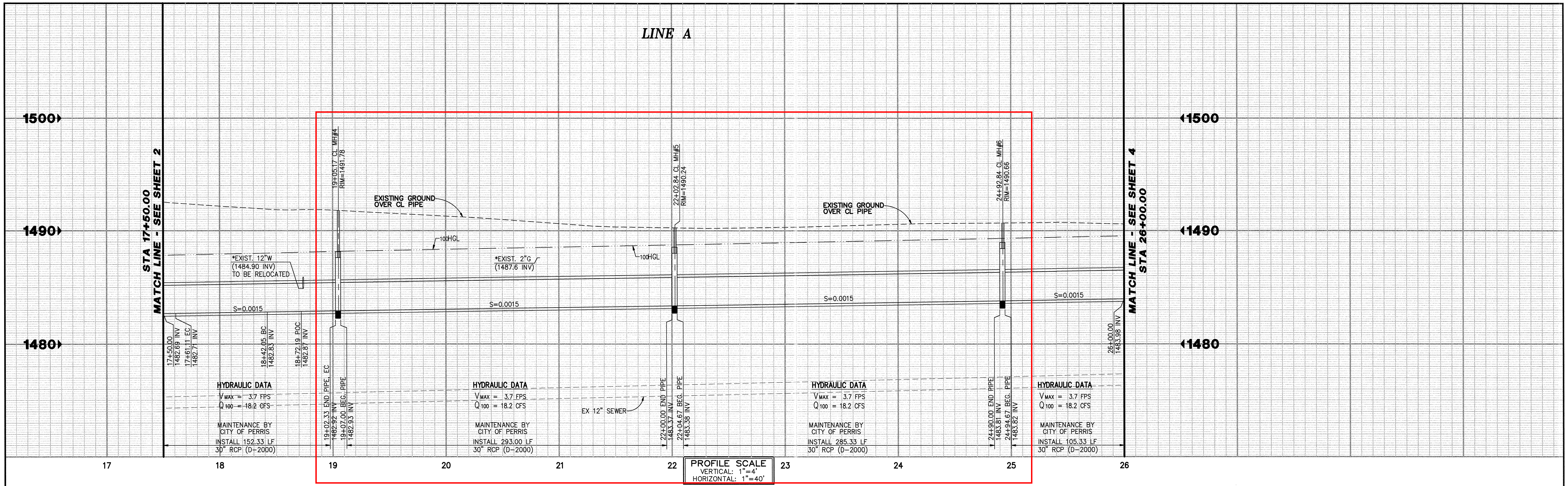
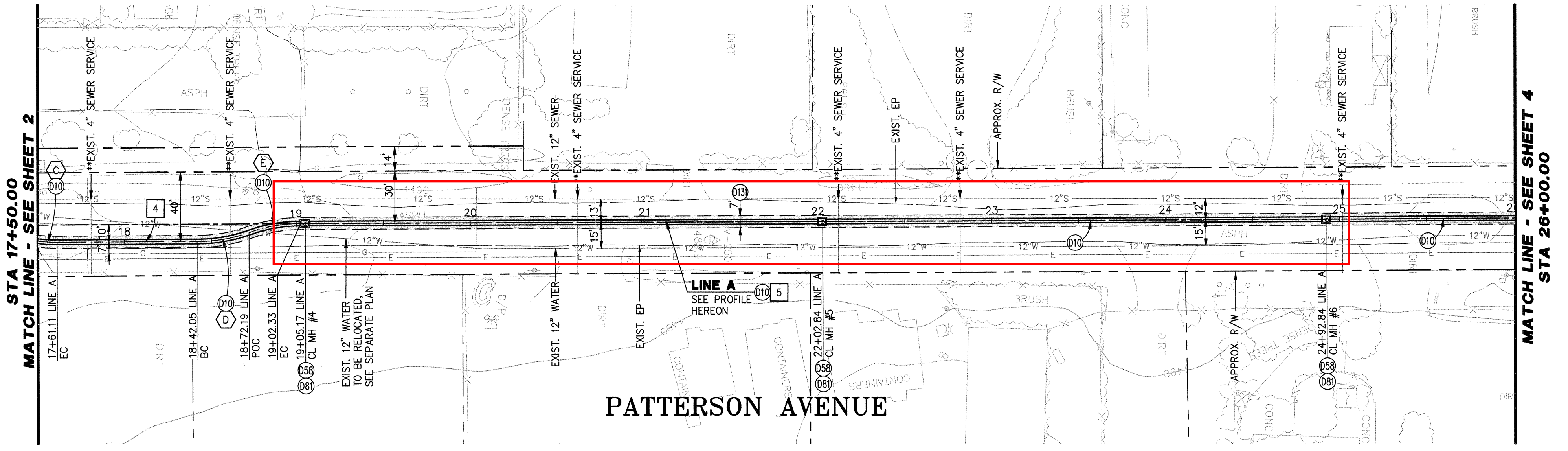


STORM DRAIN CONSTRUCTION NOTES

D10	INSTALL 30" RCP (D-LOAD PER PROFILE)
D58	CONSTRUCT MANHOLE No.1 PER RCFC & WCD STD. DWG. MH251
D81	ADJUST MANHOLE RIM TO GRADE AFTER FINAL CONSTRUCTION/ PAVING IS COMPLETE
D131	SAWCUT AND REMOVE EXISTING PAVEMENT AND REPAIR TRENCH PER CITY STD. ON SHEET 1



NOTE TO CONTRACTOR:
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**NOTE:
SEWER SERVICE LATERAL WAS POTHOLED BUT NOT FOUND.

COURSE DATA

☐	BEARING	DISTANCE
4	N00°14'57"W	80.94'
***5	N00°14'57"W	1085.02'

***TOTAL LENGTH

CURVE DATA

⬡	Δ	R	L	T
***C	13°51'54"	90.00'	21.78'	10.94'
D	19°11'17"	90.00'	30.14'	15.21'
E	19°11'17"	90.00'	30.14'	15.21'

***TOTAL CURVE

N

0 20 40 80 120
SCALE 1" = 40'

WDID NO. 833C389590

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811
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TWO WORKING DAYS BEFORE YOU DIG

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MARK	BY	DATE	REVISIONS	APPR.	DATE
	ENGINEER			CITY	

CITY OF PERRIS
APPROVED BY:
Stuart E McKibbin 6-24-2020
CITY ENGINEER DATE

NO. 67512
EXPIRATION 6-30-2021

PREPARED UNDER THE SUPERVISION OF:
DATE 06-15-20
JOHNNY MURAD
R.C.E. NO. 67512 EXP. DATE 06-30-21

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS, SUITE 330 * ONTARIO, CALIFORNIA 91764 * (909) 941-7799

SCALE HORIZ: 1"=40' DATE
DESIGNED BY: M.G. DRAWN BY: H-Z STAFF CHECKED BY: J.M.

CITY OF PERRIS
OFFSITE STORM DRAIN PLANS
PATTERSON AVENUE
SD STA. 17+50.00 TO STA. 26+00.00

SHEET NO. 3 OF 7 SHTS

FOR:
W.O.
CITY FILE NO. P8-1351

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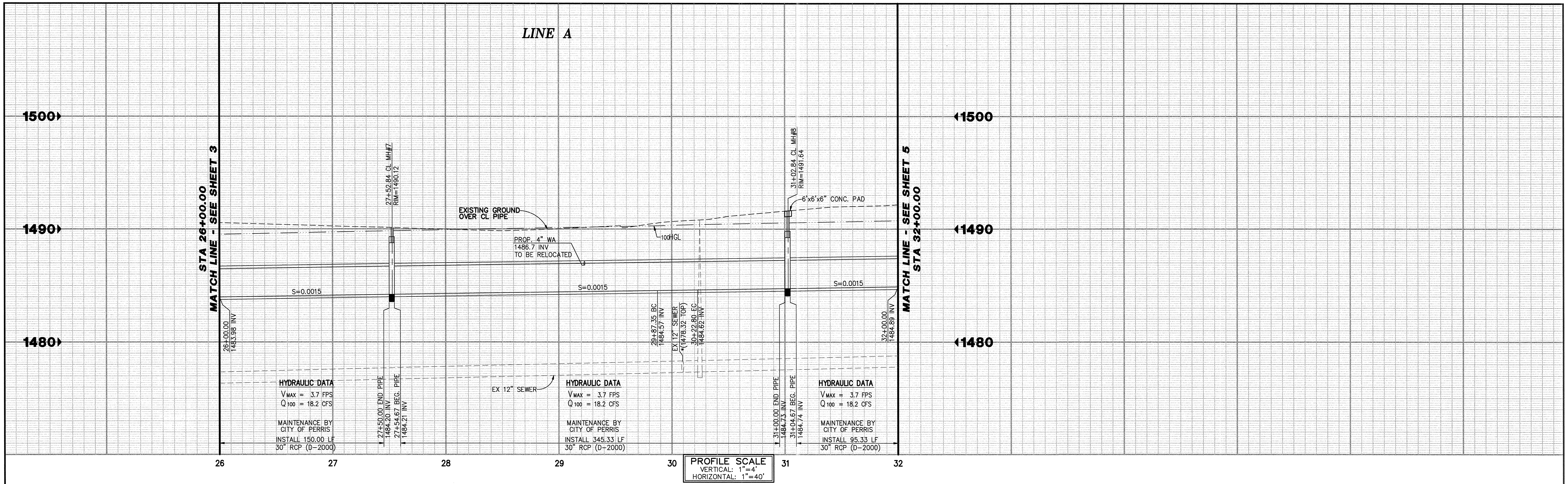
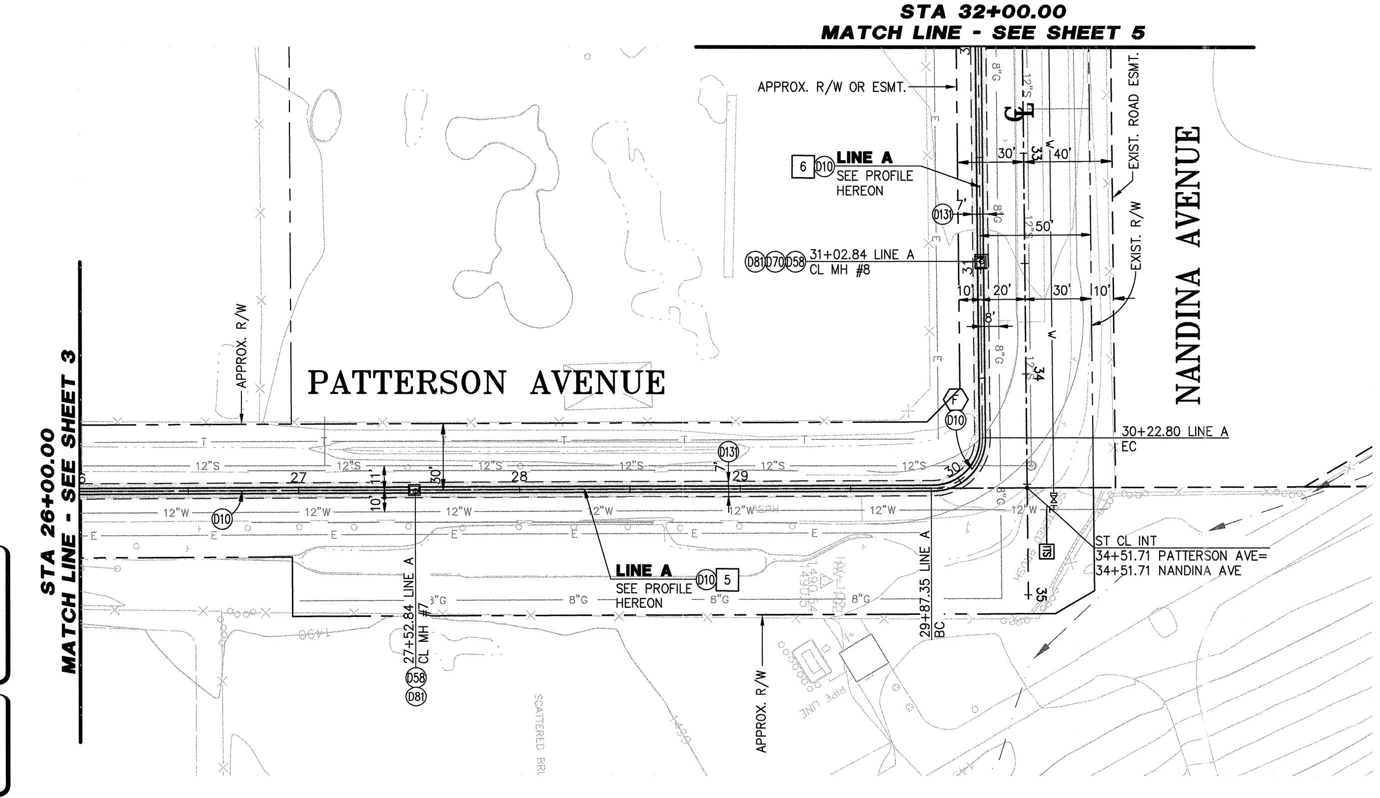


PROFILE SCALE
VERTICAL: 1"=4'
HORIZONTAL: 1"=40'



NOTE TO CONTRACTOR:
CONTRACTOR TO LOCATE AND PROTECT ALL EXISTING UTILITIES IN PLACE WEATHER SHOWN ON THIS PLAN OR NOT. ANY UTILITIES DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED TO THE SATISFACTION OF THE CITY ENGINEER AND UTILITY PURVEYOR.

* NOTE:
HORIZONTAL AND VERTICAL LOCATIONS TO BE VERIFIED IN THE FIELD AND ENGINEER NOTIFIED OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

STORM DRAIN CONSTRUCTION NOTES

D10	INSTALL 30" RCP (D-LOAD PER PROFILE)
D58	CONSTRUCT MANHOLE No.1 PER RCFC & WCD STD. DWG. MH251
D70	CONSTRUCT 6'X6' 6" THICK CONCRETE PAD TO HOLD MANHOLE FRAME AND COVER
D81	ADJUST MANHOLE RIM TO GRADE AFTER FINAL CONSTRUCTION/ PAVING IS COMPLETE
D131	SAWCUT AND REMOVE EXISTING PAVEMENT AND REPAIR TRENCH PER CITY STD. ON SHEET 1

COURSE DATA

☐	BEARING	DISTANCE
***5	N00°14'57"W	1085.02'
***6	N89°28'53"E	305.91'

***TOTAL LENGTH

CURVE DATA

⬡	△	R	L	T
F	90°16'10"	22.50'	35.45'	22.61'

N

0 20 40 80 120
SCALE 1" = 40'

WDID NO. 833C389590

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NOTE:
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MARK	BY	DATE	REVISIONS	APPR.	DATE
ENGINEER				CITY	

CITY OF PERRIS
APPROVED BY:
Stuart C McKibbin 6-24-2020
CITY ENGINEER DATE

NO. 67512
EXPIRATION
6-30-2021

PREPARED UNDER THE SUPERVISION OF:
DATE 06-15-20
JOHNNY MURAD
R.C.E. NO. 67512 EXP. DATE 06-30-21

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS, SUITE 330 * ONTARIO, CALIFORNIA 91764 * (909) 941-7799

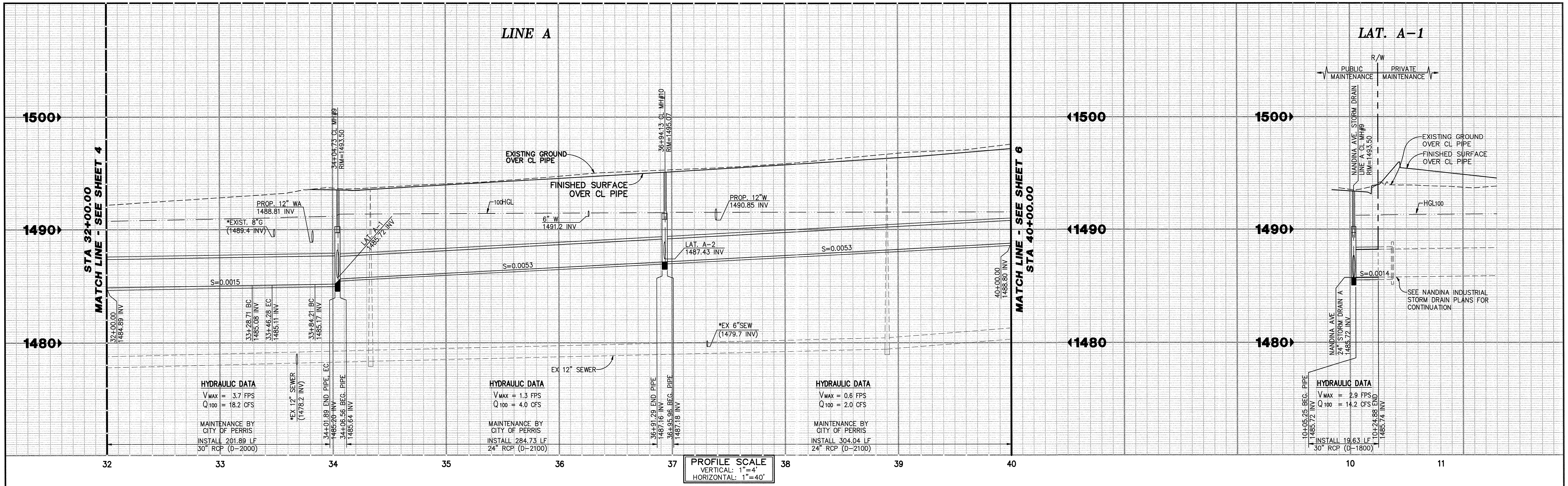
SCALE HORIZ: 1"=40' DATE
DESIGNED BY: M.G. DRAWN BY: H-Z STAFF CHECKED BY: J.M.

CITY OF PERRIS
OFFSITE STORM DRAIN PLANS
PATTERSON & NANDINA AVENUE
SD STA.26+00.00 TO STA. 32+00.00

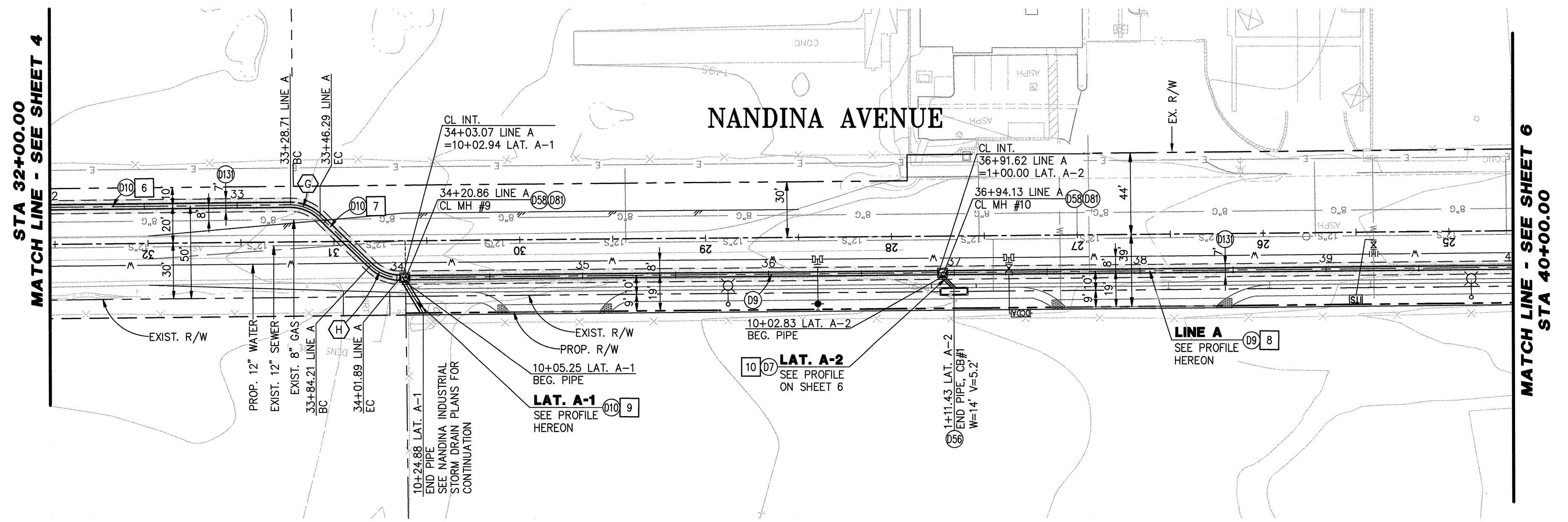
SHEET NO. 4
OF 7 SHTS

FOR:
W.O.
CITY FILE NO. P8-1351

H:\proj\R310152.01 - Black Creek - Western Way Industrial\05 Design\05.1 DWG's\Storm-Drain\LRN2-06.dwg, Layout: 04, Jun 02 2020 2:40pm



PROFILE SCALE
VERTICAL: 1"=4'
HORIZONTAL: 1"=40'



STORM DRAIN CONSTRUCTION NOTES

- (D7) INSTALL 18" RCP (D-LOAD & PROFILE AS SHOWN ON PLANS)
- (D9) INSTALL 24" RCP (D-LOAD & PROFILE AS SHOWN ON PLANS)
- (D10) INSTALL 30" RCP (D-LOAD PER PROFILE)
- (D56) CONSTRUCT CATCH BASIN No.1 PER RCFC & WCD STD. DWG. CB100, W & V PER PLAN
- (D58) CONSTRUCT MANHOLE No.1 PER RCFC & WCD STD. DWG. MH251
- (D81) ADJUST MANHOLE RIM TO GRADE AFTER FINAL CONSTRUCTION/ PAVING IS COMPLETE
- (D131) SAWCUT AND REMOVE EXISTING PAVEMENT AND REPAIR TRENCH PER CITY STD. ON SHEET 1

NOTE TO CONTRACTOR:
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* NOTE:
HORIZONTAL AND VERTICAL LOCATIONS TO BE VERIFIED IN THE FIELD AND ENGINEER NOTIFIED OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.

COURSE DATA

☐	BEARING	DISTANCE
***6	N89°28'53"E	305.91'
7	N45°31'07"W	37.93'
***8	N89°28'53"E	894.51'
9	N00°31'07"W	24.88'
10	N45°31'07"W	11.43'

***TOTAL LENGTH

CURVE DATA

⬡	△	R	L	T
G	44°45'01"	22.50'	17.57'	9.26'
H	45°00'29"	22.50'	17.68'	9.26'

0 20 40 80 120
SCALE 1" = 40'

WDID NO. 833C389590

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MARK	BY	DATE	REVISIONS	APPR.	DATE
ENGINEER				CITY	

CITY OF PERRIS
APPROVED BY:
Stuart E McKibbin 6-24-2020
CITY ENGINEER DATE

NO. 67512
EXPIRATION 6-30-2021
JOHNNY MURAD

PREPARED UNDER THE SUPERVISION OF:
JOHNNY MURAD DATE 06-15-20
R.C.E. NO. 67512 EXP. DATE 06-30-21

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS, SUITE 330 * ONTARIO, CALIFORNIA 91764 * (909) 941-7799

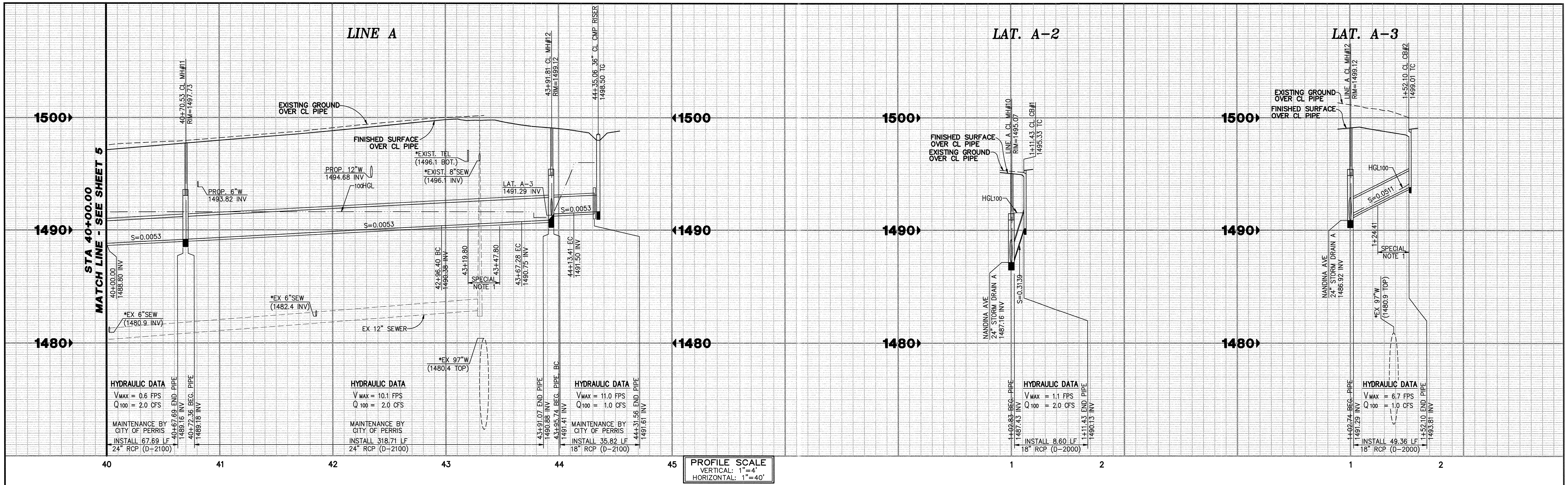
SCALE HORIZ: 1"=40' DATE
DESIGNED BY: M.G. DRAWN BY: H-Z STAFF CHECKED BY: J.M.

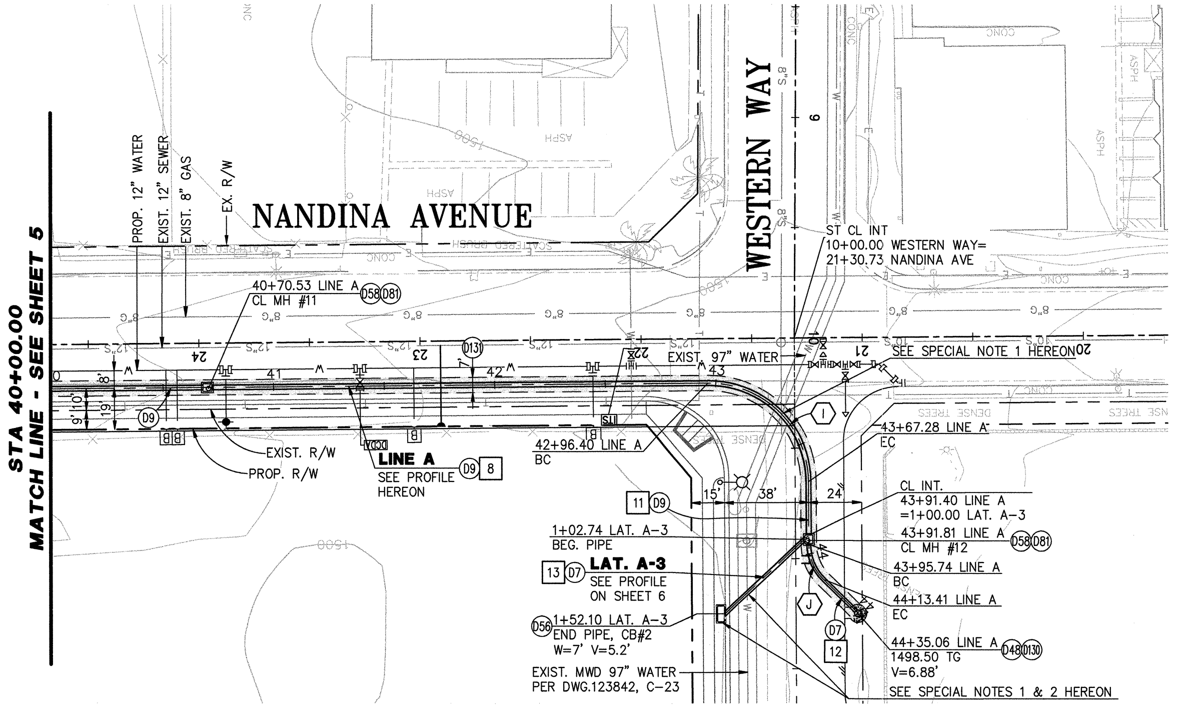
CITY OF PERRIS
OFFSITE STORM DRAIN PLANS
NANDINA AVENUE
SD STA. 32+00.00 TO STA. 40+00.00

SHEET NO. 5
OF 7 SHTS

FOR:
W.O.
CITY FILE NO. P8-1351

H:\proj\NR310152.01 - Black Creek - Western Way Industrial\05 Design\05.1 DWG's\Storm-Drain\LDRN2-06.dwg, Layout: 05, Jun 02 2020 2:40pm





SPECIAL NOTES

1. PROVIDE SECONDARY CONTAINMENT AT THE WMD WATER LINE CROSSING BY WRAPPING THE RCP USING AN IMPERMEABLE LINER, LIKE A POLYETHYLENE POND LINER 24 MIL (PPL-24) BY BTL INC. OVERLAP 6-INCHES AT THE TOP AND EXTEND 10-FEET BEYOND THE MWD EDGE OF PIPE.
2. PROVIDE SECONDARY CONTAINMENT AT THE CATCH BASIN USING A 360-DEGREE OR HDPE FUSION-WELDED INTERIOR LINING.

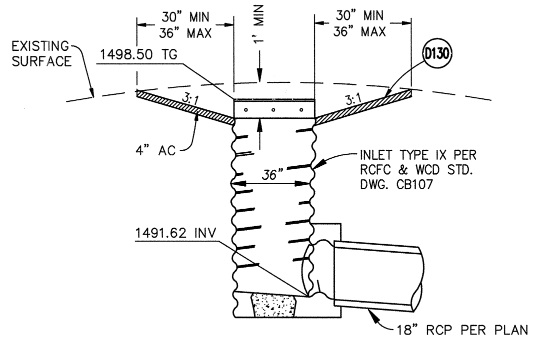
COURSE DATA

☐	BEARING	DISTANCE
***8	N89°28'53"E	894.51'
11	N00°16'37"W	28.46'
12	N45°16'37"W	21.65'
13	N46°40'13"E	52.10'

***TOTAL LENGTH

CURVE DATA

⬡	△	R	L	T
I	90°14'29"	45.00'	70.88'	45.19'
J	45°00'00"	22.50'	17.67'	9.32'

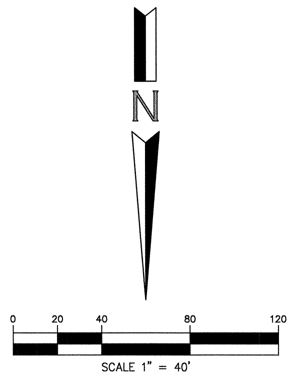


D48 CMP INLET WITH GRATE

NOT TO SCALE

STORM DRAIN CONSTRUCTION NOTES

- (D7) INSTALL 18" RCP (D-LOAD & PROFILE AS SHOWN ON PLANS)
- (D9) INSTALL 24" RCP (D-LOAD & PROFILE AS SHOWN ON PLANS)
- (D48) CONSTRUCT INLET TYPE IX PER RCFC & WCD STD. CB107 & DETAIL ON SHEET 6
- (D56) CONSTRUCT CATCH BASIN No.1 PER RCFC & WCD STD. DWG. CB100, W & V PER PLAN
- (D58) CONSTRUCT MANHOLE No.1 PER RCFC & WCD STD. DWG. MH251
- (D81) ADJUST MANHOLE RIM TO GRADE AFTER FINAL CONSTRUCTION/ PAVING IS COMPLETE
- (D130) CONSTRUCT 4" MIN. AC PAVEMENT AROUND THE RISER
- (D131) SAWCUT AND REMOVE EXISTING PAVEMENT AND REPAIR TRENCH PER CITY STD. ON SHEET 1



SCALE 1" = 40'

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WDID NO. 833C389590

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MARK	BY	DATE	REVISIONS	APPR.	DATE
ENGINEER				CITY	

CITY OF PERRIS
APPROVED BY:
Stuart E McKibb 6-24-2020
CITY ENGINEER DATE

NO. 67512
EXPIRATION 6-30-2021
CIVIL

PREPARED UNDER THE SUPERVISION OF:
JOHNNY MURAD DATE 06-15-20
R.C.E. NO 67512 EXP. DATE 06-30-21

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS, SUITE 330 * ONTARIO, CALIFORNIA 91764 * (909) 941-7799

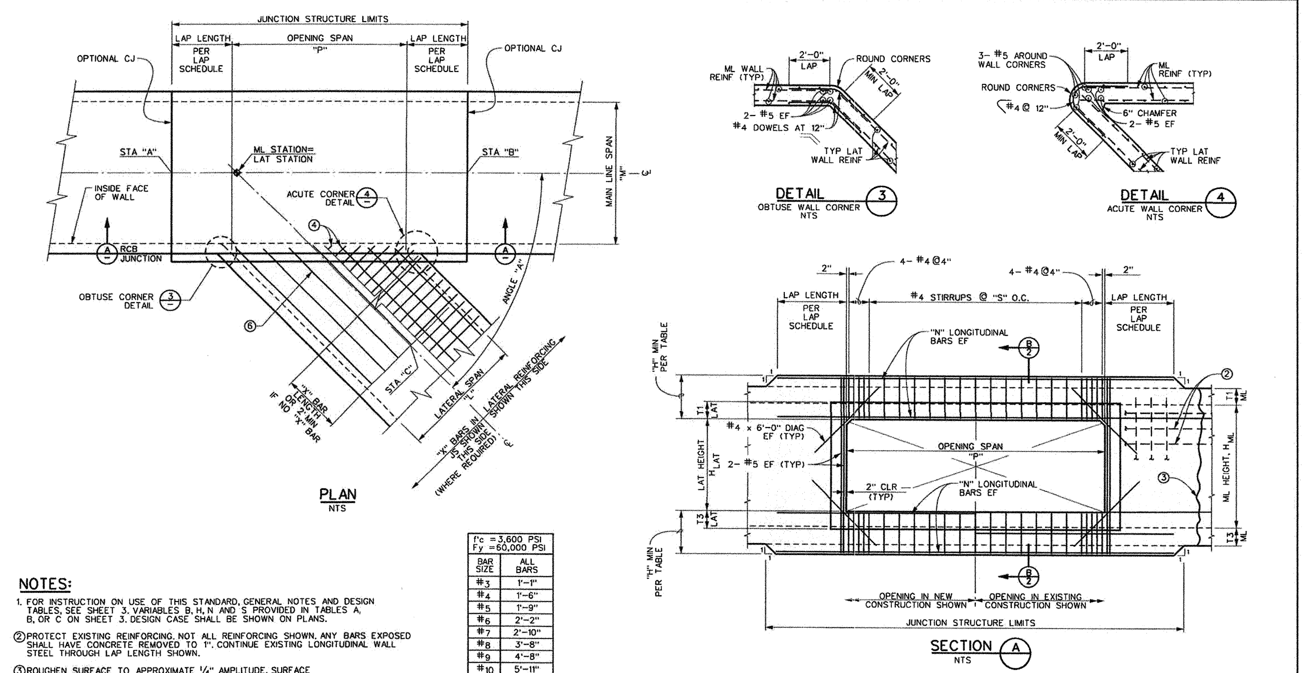
SCALE HORIZ: 1"=40' DATE
DESIGNED BY: M.G. DRAWN BY: H-Z STAFF CHECKED BY: J.M.

CITY OF PERRIS
OFFSITE STORM DRAIN PLANS
NANDINA AVENUE
SD STA. 40+00.00 TO STA. 44+35.06

SHEET NO. 6
OF 7 SHTS

FOR:
W.O.
CITY FILE NO. P8-1351

H:\proj\R310152.01 - Black Creek - Western Way Industrial\05 Design\05.1 DWG's\Storm-Drain\LBRN2-06.dwg, Layout: 06, Jun 02 2020 2:40pm



NOTES:

1. FOR INSTRUCTION ON USE OF THIS STANDARD, GENERAL NOTES AND DESIGN TABLES, SEE SHEET 3. VARIABLES B, H, N AND S PROVIDED IN TABLES A, B, OR C ON SHEET 3. DESIGN CASE SHALL BE SHOWN ON PLANS.

② PROTECT EXISTING REINFORCING. NOT ALL REINFORCING SHOWN. ANY BARS EXPOSED SHALL HAVE CONCRETE REMOVED TO 1". CONTINUE EXISTING LONGITUDINAL WALL STEEL THROUGH LAP LENGTH SHOWN.

③ ROUGHEN SURFACE TO APPROXIMATE 1/4" AMPLITUDE. SURFACE SHALL BE CLEANED AND FREE OF LAITANCE.

④ CUT LATERAL REINFORCING WHERE INTERSECTS WITH INSIDE OF MAINLINE RCB WALL, MAINTAIN 1½" CLEAR FROM INSIDE FACE.

5. ABBREVIATIONS SHALL BE AS DEFINED:

ML	MAIN LINE
LAT	LATERAL
T1	DECK THICKNESS PER CALTRANS STANDARD PLANS OR PROJECT DRAWINGS
T3	INVERT THICKNESS PER CALTRANS STANDARD PLANS OR PROJECT DRAWINGS

⑥ "X" BAR, SEE TABLE ON SHEET 3 AND DETAIL 1 ON SHEET 2.

f'c =3,600 PSI
Fy =60,000 PSI

BAR SIZE	ALL BARS
#3	1'-1"
#4	1'-6"
#5	1'-9"
#6	2'-2"
#7	2'-10"
#8	3'-8"
#9	4'-8"
#10	5'-11"
#11	7'-3"

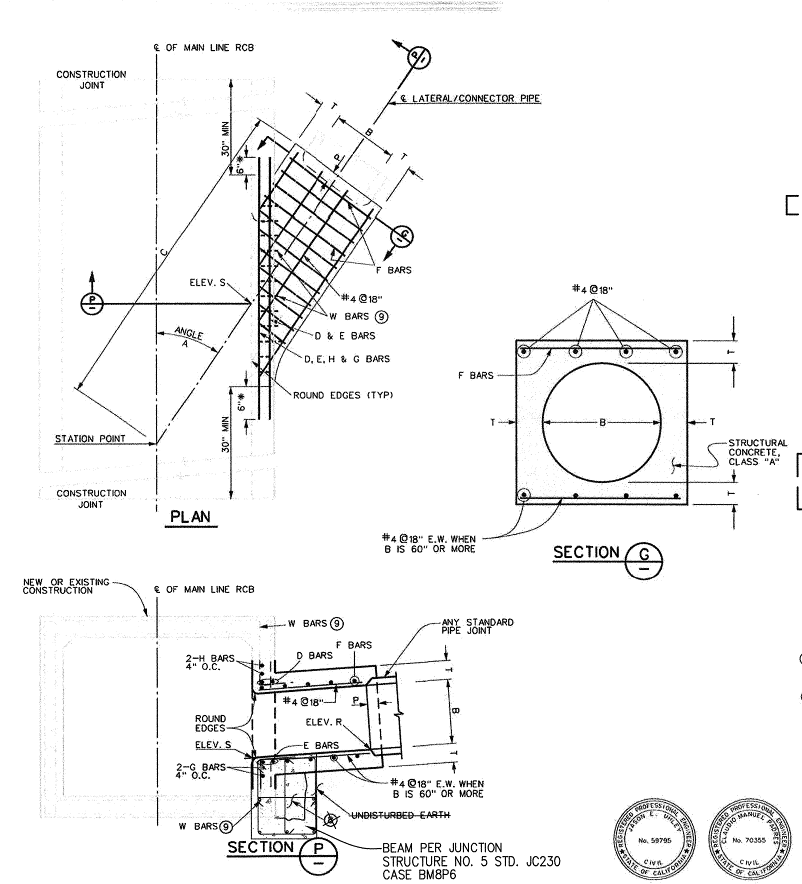
LAP SCHEDULE

Michael Baker
INTERNATIONAL
14725 ALTON PARKWAY
IRVINE, CALIFORNIA 92618-2027
949.472.3505 • FAX 949.472.8373

No. 55232

RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
APPROVED BY: GENERAL MANAGER-CHIEF ENGINEER DATE: 08/2015 R.C.E. NO. 32336
APPROVED BY: CHIEF, DESIGN & CONSTRUCTION DATE: 08/2015 R.C.E. NO. 44684

JUNCTION STRUCTURE
NO. 5
STANDARD DRAWING NUMBER JS230
SHEET 1 OF 3



BEAM PER JUNCTION STRUCTURE NO. 5 STD. JC230 CASE BM8P6

TABLES
FOR DIMENSIONS AND BAR SIZES

B (INCHES)	T (INCHES)	P (INCHES)
12	5	5
15	5	
18	5	
21	5	
24	5¼	
27	5½	
30	6	
33	6¼	
36	6½	
39	7	
#5		D,E,H AND G BARS
#4 @6"		F BARS

B (INCHES)	T (INCHES)	P (INCHES)
42	7½	5
45	7¾	
48	8	
51	8½	
54	9	
57	9¼	
60	9½	
63	10	
66	10¼	
69	10¾	
72	11	
78	11¾	
84	12½	
#6		D,E,H AND G BARS
#5 @6"		F BARS

B (INCHES)	T (INCHES)	P (INCHES)
90	13¼	5
96	14	
102	15½	8
108	16	
114	16½	
120	17	
126	17	
132	17½	
138	17½	
144	18	
#7		D,E,H AND G BARS
#6 @6"		F BARS

NOTES

1. FOR NEW CAST-IN-PLACE CONSTRUCTION, JUNCTION STRUCTURE SHALL BE POURED MONOLITHICALLY WITH MAIN LINE STORM DRAIN, MANHOLE, OR TRANSITION.
2. THE NEED FOR AN EDGE BEAM AND/OR ADDITIONAL REINFORCEMENT SHALL BE INVESTIGATED BY THE ENGINEER FOR ANY ONE OF THE FOLLOWING CONDITIONS:
   a. ANGLE A IS LESS THAN 30°
   b. TOP OF INLET PIPE IS LESS THAN 6" BELOW THE SOFFIT.
   c. FLOW LINE OF INLET PIPE IS LESS THAN 7" ABOVE THE FLOOR OF THE MAIN LINE AT THE INSIDE FACE.
3. VALUES FOR A, B, C, ELEV. R, AND ELEV. S SHALL BE SPECIFIED ON PROJECT DRAWINGS. VALUES FOR T ARE SHOWN IN TABLES HEREIN.
4. STATIONS SPECIFIED ON DRAWINGS APPLY AT THE INTERSECTION OF CENTER LINES OF MAIN LINE AND LATERALS, UNLESS OTHERWISE NOTED.
5. UNLESS OTHERWISE SHOWN, ALL REINFORCING STEEL SHALL BE NEW STRAIGHT, DEFORMED STEEL BARS AND SHALL BE KEPT 1½" CLEAR FROM INSIDE FACE OF CONCRETE.
6. WHERE DESIGN VELOCITIES EXCEED 20 FT/SEC, CONCRETE COVER ON THE INSIDE FACE SHALL BE INCREASED TO PROVIDE ADDITIONAL COVER OVER THE REINFORCED STEEL AS SPECIFIED ON THE PROJECT DRAWINGS.
7. FLOOR OF STRUCTURE SHALL BE STEEL-TROWELED TO THE SPRING LINE.

⑧ PLACE CLASS B CONCRETE, OR COMPACT SOIL UNDER STRUCTURE TO RELATIVE DENSITY REQUIRED BY SPECIFICATIONS. FILL MAY BE OMITTED IF STRUCTURE IS LAID ON UNDISTURBED EARTH TO MAIN LINE WALL.

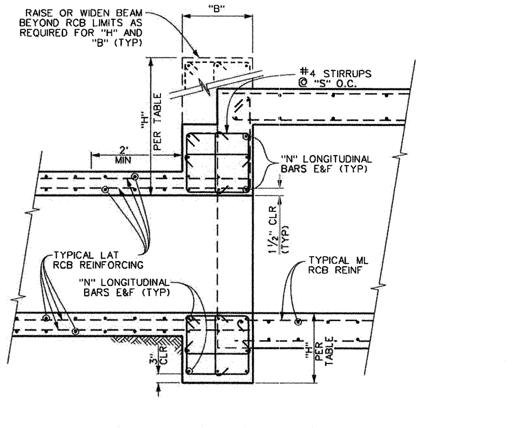
⑨ W BARS ARE MAIN LINE WALL STEEL (INTERIOR CURTAIN), AND SHALL BE CUT IN CENTER OF OPENING AND BENT INTO TOP AND BOTTOM OF JUNCTION STRUCTURE.

* LIMITS OF EXISTING CONSTRUCTION REMOVAL.

No. 59795
No. 70355

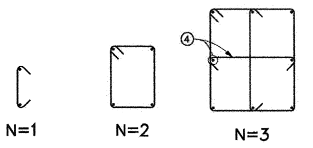
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
APPROVED BY: GENERAL MANAGER-CHIEF ENGINEER DATE: 7-2-2019 R.C.E. NO. 59795
APPROVED BY: CHIEF, DESIGN & CONSTRUCTION DATE: 7-2-2019 R.C.E. NO. 70355

JUNCTION STRUCTURE
NO. 1
STANDARD DRAWING NUMBER JS226
SHEET 1 OF 1



N>1, WITHOUT "X" BARS
NTS

TYPICAL SECTION Ⓑ/1
BEAM SECTION
SEE NOTE ⑤
NTS



NOTES:

1. VARIABLES B, H, N AND S PROVIDED IN ~~TABLES A, B OR C ON SHEET 3.~~ TABLE B HEREON.

② DEPTH OF THICKENED SLAB SHALL MATCH THE MAIN LINE DECK OR INVERT, WHICHEVER IS GREATER.

③ CUT LATERAL REINFORCING OF MAINLINE RCB WALL TO MAINTAIN 1½" CLEAR FROM INSIDE FACE.

④ OMIT HORIZONTAL TIES AND BARS WHERE TIE IS WITHIN LATERAL SLAB, INVERT OR THICKENED EDGE.

⑤ SAMPLE CONFIGURATIONS OF LATERAL, MAIN LINE AND JUNCTION STRUCTURE GEOMETRIES ARE SHOWN. PLEASE NOTE THE POSITION OF THE LATERAL TO THE MAINLINE MAY VARY, SUCH AS MATCHING OR OFFSET INVERT ELEVATIONS, AND MATCHING OR OFFSET TOP SLAB ELEVATIONS. REINFORCING STEEL SHOP DRAWINGS SHOWING SPECIFIC GEOMETRY AND REINFORCING SHALL BE SUBMITTED TO THE DISTRICT FOR REVIEW AND APPROVAL.

6. ABBREVIATIONS SHALL BE AS DEFINED:

ML	MAIN LINE
LAT	LATERAL
T1	DECK THICKNESS PER CALTRANS STANDARD PLANS OR PROJECT DRAWINGS
T3	INVERT THICKNESS PER CALTRANS STANDARD PLANS OR PROJECT DRAWINGS

⑦ "X" BAR, SEE ~~TABLE ON SHEET~~ 3 AND DETAIL 1. TABLE B HEREON.

JUNCTION STRUCTURE NO. 5 BEAM DESIGN

DESIGN NOTES

DESIGN SPECIFICATIONS:
AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 2012 (SIXTH EDITION) WITH CALIFORNIA AMENDMENTS (AASHTO-CA BDS-6)

LOADING:
LIVE LOAD: (AASHTO LRFD 3.6.1.2)
HL-93 CONSISTS OF DESIGN TRUCK OR DESIGN TANDEM AND DESIGN LANE LOAD.

IMPACT FACTOR: (APPLY TO ROOF SLAB ONLY)
IM = 33(1.0-0.125DE) = 33 at 2-FT Fill, 0 OTHERWISE (AASHTO LRFD 3.6.2.2)
DE = MINIMUM DEPTH OF EARTH COVER

EARTH LOAD:
VERTICAL EARTH PRESSURE: 140 pcf

LOAD FACTORS:
AASHTO LRFD TABLE 3.4.1.1 & TABLE 3.4.1.2
STRENGTH I: U=1.35 (DC+EV) + 1.75 (LL+IM+LS)
STRENGHT IV: U=1.50(DC+EV)

STRENGTH REDUCTION FACTORS:
Ø = 0.90 SHEAR & MOMENT

UNIT STRESSES:
f'c = 3,600 psi
fy = 60,000 psi

SHEAR:

$V_c = (0.0676\sqrt{f_c'} + 4.6\ \frac{A_s}{b d_e}\ \frac{V_u d_e}{M_u})\ b \times d_e$ (Kips)

$V_c \leq 0.126\sqrt{f_c'}\ b \times d_e$ (Kips)

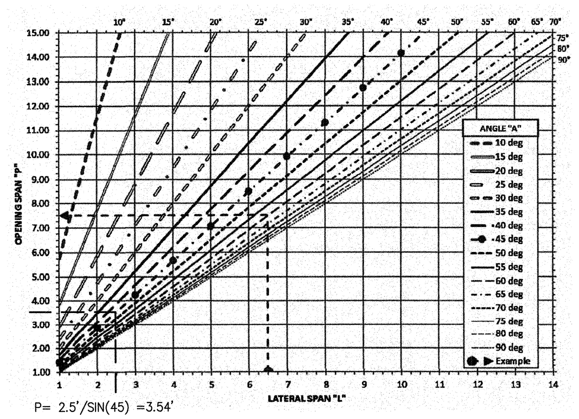
V_c SHALL NOT BE LESS THAN $0.0948\sqrt{f_c'}\ b \times d_e$ FOR FRAME MEMBERS AND $0.0791\ \sqrt{f_c'}\ b \times d_e$ FOR SIMPLY SUPPORTED MEMBERS.

STRUCTURAL GENERAL NOTES

1. VERIFY ALL DIMENSIONS AND JOB SITE CONDITIONS PRIOR TO THE FABRICATION OF ANY MATERIAL.
2. THESE NOTES AND DETAILS ARE INTENDED TO WORK WITH CALTRANS STANDARD PLANS D80, D81 AND D82 BUT MAY BE USED FOR OTHER RCB DESIGNS AND GEOMETRIES UPON APPROVAL FROM THE PROJECT ENGINEER OF RECORD, AND AS REFERENCED BY PROJECT DRAWINGS.
3. THE PROJECT ENGINEER OF RECORD IS RESPONSIBLE FOR CHECKING THE PROPOSED IMPROVEMENTS ARE WITHIN THE DESIGN LIMITATIONS AND VARIABLES PRESENTED HEREIN.

STANDARD DRAWINGS NOTES FOR DESIGN TABLES

1. FOR DEFINITION OF LATERAL SPAN ("L") AND SKEW ("A") AS USED IN THE FOLLOWING NOMOGRAPH, SEE PLAN ON SHEET 1 HERON.
2. THE ENGINEER SHALL SPECIFY THE CONSTRUCTION CONDITION BY DESIGN COVER (TABLE A, B, OR C) AND MAXIMUM MAIN LINE SPAN ("M") AND OPENING SPAN ("P").
   EXAMPLE
   MAIN LINE SPAN, ("M")=9'-0", EARTH COVER=8'-0",
   OPENING SPAN ("P")=7'-8", LATERAL SPAN ("L")=6'6" WITH 60° SKEW
   WOULD SPECIFY:
   "CONSTRUCT JS NO.5 PER DISTRICT STD. JS230 DESIGN CASE BM10P8".
3. TO ESTIMATE OPENING SPAN BASED ON LATERAL SPAN AND SKEW, SEE "NOMOGRAPH FOR OPENING SPAN" BELOW.
4. BEAM WIDTH SHALL BE AS SPECIFIED OR MATCH MAIN LINE WALL WIDTH, WHICHEVER IS LARGER.
5. BEAM DEPTH SHALL BE AS SPECIFIED OR MATCH MAIN LINE DECK OR INVERT THICKNESS, WHICHEVER IS LARGER.



P= 2.5'/SIN(45) =3.54'

EQUATION
P = L / SIN (A)

"P" SPAN NOMOGRAPH

TABLE B

EARTH COVER = 2'-1" TO 10'-0"						
DESIGN CASE	B (in)	H (in)	N (--)	BAR SIZE	S (in)	"X" BAR
BM4P2	6	9	1	6	6	N/A
BM4P4	8	10	1	6	6	N/A
BM4P6	12	12	2	6	6½	N/A
BM5P2	6	9	1	6	6	N/A
BM5P4	6	10	1	6	5½	N/A
BM5P6	12	12	2	6	6½	N/A
BM5P8	12	14	2	7	8	N/A
BM6P3	6½	9	1	6	5	N/A
BM6P4	6½	10	1	7	5½	N/A
BM6P6	12	12	2	7	6½	N/A
BM6P8	12	14	2	8	8	N/A
BM6P9	12	14½	2	9	8	N/A
BM7P3	6½	9	1	6	5	N/A
BM7P4	6½	12	1	7	6½	N/A
BM7P6	12	12	2	7	6½	N/A
BM7P8	12	14	2	8	8	N/A
BM7P10	12	17	2	9	9½	N/A
BM8P4	6½	12	1	7	6½	N/A
BM8P6	12	14	2	8	8	N/A
BM8P8	12	16	2	8	9	N/A
BM8P10	12	18	2	9	10	N/A
BM8P12	18	18	4	8	10	N/A
BM10P4	12	12	2	6	6½	#7 @10"
BM10P6	12	14	2	7	8	#7 @10"
BM10P8	12	16	3	7	9	#7 @10"
BM10P10	18	18	4	7	10	#7 @10"
BM10P12	18	20	4	8	11½	#7 @10"
BM10P14	18	22	4	9	11½	#7 @10"
BM10P15	18	24	4	9	11½	#7 @10"
BM12P4	12	12	2	6	6½	#7 @9"
BM12P6	12	14	3	7	8	#7 @9"
BM12P8	12	18	3	7	10	#7 @9"
BM12P10	18	20	4	7	11½	#7 @9"
BM12P12	18	22	4	8	11½	#7 @9"
BM12P14	18	24	4	9	11½	#7 @9"
BM12P15	18	26	4	9	11½	#7 @9"
BM14P4	12	14	2	6	8	#8 @9"
BM14P6	12	14	3	7	8	#8 @9"
BM14P8	12	18	3	8	10	#8 @9"
BM14P10	18	20	4	8	11½	#8 @9"
BM14P12	18	22	4	9	11½	#8 @9"
BM14P14	18	24	4	10	11½	#8 @9"
BM14P15	18	26	4	10	11½	#8 @9"

M=8', EARTH COVER 3'-5'
P=3.54' , L=30" [2.5'], A=45DEG

WDID NO. 833C389590

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NOTE:
WORK CONTAINED WITHIN THESE PLANS SHALL NOT COMMENCE UNTIL AN ENCROACHMENT PERMIT AND/OR A GRADING PERMIT HAS BEEN ISSUED.

THE PRIVATE ENGINEER SIGNING THESE PLANS IS RESPONSIBLE FOR ASSURING THE ACCURACY AND ACCEPTABILITY OF THE DESIGN HEREON. IN THE EVENT OF DISCREPANCIES ARISING AFTER CITYY APPROVAL OR DURING CONSTRUCTION, THE PRIVATE ENGINEER SHALL BE RESPONSIBLE FOR DETERMINING AN ACCEPTABLE SOLUTION AND REVISING THE PLANS FOR APPROVAL BY THE CITY.

MARK	BY	DATE	REVISIONS	APPR.	DATE
ENGINEER				CITY	

CITY OF PERRIS
APPROVED BY:
Stuart E. McKibbin 6.24.2020
CITY ENGINEER DATE

JOHNNY MURAD
NO. 67512
EXPIRATION 6-30-2021
CIVIL

PREPARED UNDER THE SUPERVISION OF:
JOHNNY MURAD DATE 06-15-20
R.C.E. NO. 67512 EXP. DATE 06-30-21

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS, SUITE 330 * ONTARIO, CALIFORNIA 91764 * (909) 941-7799

SCALE HORIZ: 1"=40'
DATE
DESIGNED BY: M.G.
DRAWN BY: H-Z STAFF
CHECKED BY: J.M.

CITY OF PERRIS
OFFSITE STORM DRAIN PLANS
PIPE TO RCB CONNECTION DETAIL

SHEET NO. 7
OF 7 SHTS

FOR:
W.O.
CITY FILE NO. **P8-1351**

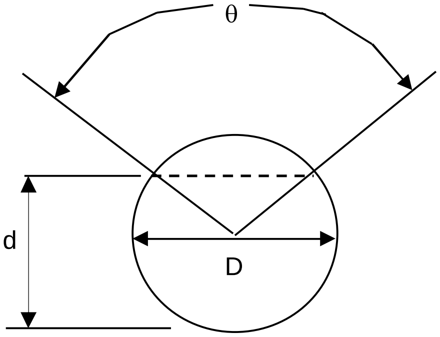
H:\projJ\R310152.01 - Black Creek - Western Way Industrial\05 Design\05.1 DWG's\Storm-Drain\LDRN07.dwg, Layout: 07, Jun 16 2020 10:25am

MANNING'S EQUATION FOR PIPE FLOW

Project: 1412101 Location: PV MDP STORM DRAIN PIPE, 30-INCH RCP @ 0.15%

By: KWW Date: 09/01/23

Chk. By: Date:



INPUT

D=	30	inches
d=	30	inches
n=	0.013	mannings coeff
θ=	0.0	degrees
S=	0.0015	slope in/in

pl

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

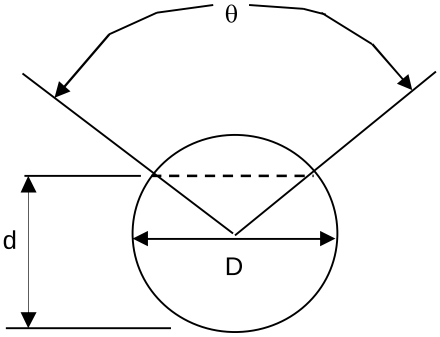
			Solution to Mannings Equation	
Area,ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
4.91	7.85	0.63	3.24	15.89

Manning's n-values	
PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

Design Q:	18.2 CFS
Check Capacity:	**NOT O.K.**

MANNING'S EQUATION FOR PIPE FLOW

Project: 1412101 Location: 42-INCH RCP @ 0.15%
By: KWW Date: 09/01/23
Chk. By: Date:



INPUT

D= 42 inches
d= 42 inches
n= 0.01 mannings coeff
θ= 0.0 degrees
S= 0.0015 slope in/in

pl

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P
A=cross sectional area
P=wetted perimeter
S=slope of channel
n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

Q=V x A

Solution to Mannings Equation

$Area, ft^2$	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
9.62	11.00	0.88	5.27	50.66

Manning's n-values

PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

Design Q:	48.53 CFS
Check Capacity:	**O.K.**

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
6	4	50.000	-89.989	MH	30.33	0.00	0.00	0.0	1486.11	2.00	1487.11	24	Cir	0.011	1.00	0.00	PR 24 IN LAT
5	4	167.000	-0.385	MH	18.20	0.00	0.00	0.0	1483.11	0.15	1483.36	30	Cir	0.011	1.00	0.00	EX 30 IN RCP
4	3	1033.000	-53.146	MH	0.00	0.00	0.00	0.0	1481.56	0.15	1483.11	42	Cir	0.011	1.00	0.00	PR 42 IN RCP
3	1	197.000	54.221	MH	0.00	0.00	0.00	0.0	1481.26	0.15	1481.56	42	Cir	0.011	0.83	0.00	PR 42 IN RCP
2	1	150.000	1.329	MH	100.00	0.00	0.00	0.0	1481.26	0.15	1481.49	72X96	Box	0.011	1.00	0.00	EX 8x6 RCB
1	End	150.000	-0.690	MH	0.00	0.00	0.00	0.0	1481.03	0.15	1481.26	72X96	Box	0.011	0.84	0.00	EX 8x6 RCB

Project File: __1412101 PUBLIC SD RCB.stm	Number of lines: 6	Date: 9/1/2023

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
6	PR 24 IN JUN	Manhole	0.00	Cir	4.00	4.00	24	Cir	1487.11			
5	EX 30 IN JUN	Manhole	0.00	Cir	4.00	4.00	30	Cir	1483.36			
4	EX 30 IN JUN	Manhole	0.00	Cir	4.00	4.00	42	Cir	1483.11	30 24	Cir Cir	1483.11 1486.11
3	EX 30 IN JUN	Manhole	0.00	Cir	4.00	4.00	42	Cir	1481.56	42	Cir	1481.56
2	EX 8x6 RCB J	Manhole	0.00	Cir	4.00	4.00	72x96	Box	1481.49			
1	EX 8x6 RCB J	Manhole	0.00	Cir	4.00	4.00	72x96	Box	1481.26	72x96 42	Box Cir	1481.26 1481.26

Project File: __1412101 PUBLIC SD RCB.stm | Number of Structures: 6 | Run Date: 9/1/2023

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
6	PR 24 IN LAT	30.33	24	Cir	50.000	1486.11	1487.11	2.000	1487.28	1488.89	0.75	1488.89	4	Manhole
5	EX 30 IN RCP	18.20	30	Cir	167.000	1483.11	1483.36	0.150	1485.72*	1486.05*	0.21	1486.26	4	Manhole
4	PR 42 IN RCP	48.53	42	Cir	1033.000	1481.56	1483.11	0.150	1484.12	1485.30	0.42	1485.72	3	Manhole
3	PR 42 IN RCP	48.53	42	Cir	197.000	1481.26	1481.56	0.152	1483.49	1483.79	0.33	1484.12	1	Manhole
2	EX 8x6 RCB	100.0	72x96	Box	150.000	1481.26	1481.49	0.153	1484.51	1484.54	0.26	1484.80	1	Manhole
1	EX 8x6 RCB	148.5	72x96	Box	150.000	1481.03	1481.26	0.153	1483.23	1483.82	0.68	1484.51	End	Manhole

Project File: __1412101 PUBLIC SD RCB.stm

Number of lines: 6

Run Date: 9/1/2023

NOTES: Known Qs only ; *Surcharged (HGL above crown).

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
6	4	50.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	30.33	94.32	9.41	24	2.00	1486.11	1487.11	1487.28	1488.89	0.00	0.00	PR 24 IN
5	4	167.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	18.20	15.87	3.71	30	0.15	1483.11	1483.36	1485.72	1486.05	0.00	0.00	EX 30 IN
4	3	103.000	0.00	0.00	0.00	0.00	0.00	0.0	0.8	0.0	48.53	164.1	4.71	42	0.15	1481.56	1483.11	1484.12	1485.30	0.00	0.00	PR 42 IN
3	1	197.000	0.00	0.00	0.00	0.00	0.00	0.0	4.2	0.0	48.53	165.3	5.07	42	0.15	1481.26	1481.56	1483.49	1483.79	0.00	0.00	PR 42 IN
2	1	150.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	100.03	363.7	3.97	72 x 96 b	0.15	1481.26	1481.49	1484.51	1484.54	0.00	0.00	EX 8x6
1	End	150.000	0.00	0.00	0.00	0.00	0.00	0.0	4.8	0.0	148.53	363.7	7.83	72 x 96 b	0.15	1481.03	1481.26	1483.23	1483.82	0.00	0.00	EX 8x6

Project File: __1412101 PUBLIC SD RCB.stm	Number of lines: 6	Run Date: 9/1/2023

NOTES:Known Qs only ; c = cir e = ellip b = box

MyReport

Line No.	Area Dn (sqft)	Area Up (sqft)	Byp Ln No	Coeff C1 (C)	Coeff C2 (C)	Coeff C3 (C)	Capac Full (cfs)	Crit Depth (ft)	Cross Sl, Sw (ft/ft)	Cross Sl, Sx (ft/ft)	Curb Len (ft)	Defl Ang (Deg)	Depth Dn (ft)	Depth Up (ft)	DnStm Ln No	Drng Area (ac)	Easting X (ft)	EGL Dn (ft)	EGL Up (ft)	Energy Loss (ft)	
6	2.55	4.38	n/a	0.20	0.50	0.90	94.32	1.78	....	....	....	-89.989	1.17	1.78**	4	0.00	1477.84	1488.03	1489.64	0.000	
5	4.91	4.91	n/a	0.20	0.50	0.90	15.87	1.44	....	....	....	-0.385	2.50	2.50	4	0.00	1644.50	1485.93	1486.26	0.329	
4	11.52	9.32	n/a	0.20	0.50	0.90	164.07	1.85	....	....	....	-53.146	2.56	2.19	3	0.00	1477.50	1484.40	1485.72	1.312	
3	9.56	9.57	n/a	0.20	0.50	0.90	165.31	1.85	....	....	....	54.221	2.23	2.23	1	0.00	444.52	1483.89	1484.19	0.299	
2	25.99	24.40	n/a	0.20	0.50	0.90	363.75	1.69	....	....	....	1.329	3.25	3.05	1	0.00	477.42	1484.74	1484.80	0.061	
1	17.63	20.51	n/a	0.20	0.50	0.90	363.75	2.20	....	....	....	-0.690	2.20	2.56	Outfall	0.00	327.43	1484.34	1484.64	0.302	

Project File: __1412101 PUBLIC SD RCB.stm	Number of lines: 6	Date: 9/1/2023

NOTES: ** Critical depth

MyReport

Flow Rate (cfs)	Sf Ave (ft/ft)	Sf Dn (ft/ft)	Grate Area (sqft)	Grate Len (ft)	Grate Width (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	Gutter Depth (ft)	Gutter Slope (ft/ft)	Gutter Spread (ft)	Gutter Width (ft)	HGL Dn (ft)	HGL Up (ft)	HGL Jnct (ft)	HGL Jmp Dn (ft)	HGL Jmp Up (ft)	Incr CxA	Incr Q (cfs)	Inlet Depth (ft)	Inlet Eff (%)
30.33	0.000	0.000	....	....	....	0.00	0.00	....	....	....	....	1487.28	1488.89	1488.89	....	....	0.00	30.33	....	....
18.20	0.197	0.197	....	....	....	0.00	0.00	....	....	....	....	1485.72	1486.05	1486.26	....	....	0.00	18.20	....	....
48.53	0.127	0.091	....	....	....	0.00	0.00	....	....	....	....	1484.12	1485.30	1485.72	....	....	0.00	0.00	....	....
48.53	0.152	0.152	....	....	....	0.00	0.00	....	....	....	....	1483.49	1483.79	1484.12	....	....	0.00	0.00	....	....
100.00	0.041	0.037	....	....	....	0.00	0.00	....	....	....	....	1484.51	1484.54	1484.80	....	....	0.00	100.00	....	....
148.53	0.201	0.244	....	....	....	0.00	0.00	....	....	....	....	1483.23	1483.82	1484.51	....	....	0.00	0.00	....	....

Project File: __1412101 PUBLIC SD RCB.stm

Number of lines: 6

Date: 9/1/2023

NOTES: ** Critical depth

MyReport

Inlet ID	Inlet Loc	(ft)	Inlet Time (min)	i Sys (in/hr)	i Inlet (in/hr)	Invert Dn (ft)	Invert Up (ft)	Jump Loc (ft)	Jump Len (ft)	Vel Hd Jmp Dn (ft)	Vel Hd Jmp Up (ft)	J-Loss Coeff	Junct Type	Known Q (cfs)	Cost RCP	Cost CMP	Cost PVC	
PR 24 IN JUNC	Sag		0.0	0.00	0.00	1486.11	1487.11	....	....	0.00	0.00	1.00 z	MH	30.33	1,900	1,710	1,615	
EX 30 IN JUNC	Sag		0.0	0.00	0.00	1483.11	1483.36	....	....	0.00	0.00	1.00	MH	18.20	6,780	6,102	5,763	
EX 30 IN JUNC	Sag		0.0	0.00	0.00	1481.56	1483.11	....	....	0.00	0.00	1.00	MH	0.00	47,618	42,856	40,475	
EX 30 IN JUNC	Sag		0.0	0.00	0.00	1481.26	1481.56	....	....	0.00	0.00	0.83	MH	0.00	9,162	8,246	7,788	
EX 8x6 RCB JUNC	Sag		0.0	0.00	0.00	1481.26	1481.49	....	....	0.00	0.00	1.00 z	MH	100.00	9,850	8,865	8,373	
EX 8x6 RCB JUN	Sag		0.0	0.00	0.00	1481.03	1481.26	....	....	0.00	0.00	0.84 z	MH	0.00	9,850	8,865	8,373	

Project File: __1412101 PUBLIC SD RCB.stm

Number of lines: 6

Date: 9/1/2023

NOTES: Known Qs only. ; ** Critical depth

MyReport

Line ID	Line Length (ft)	Line Size (in)	Line Slope (%)	Line Type	Local Depr (in)	n-val Gutter	n-val Pipe	Minor Loss (ft)	Northing Y (ft)	Pipe Travel (min)	Q Byp (cfs)	Q Capt (cfs)	Q Carry (cfs)	Line Rise (in)	Runoff Coeff (C)	Line Span (in)	Area A1 (ac)	Area A2 (ac)	Area A3 (ac)	Tc (min)	Throat Ht (in)
PR 24 IN LAT	50.000	24	2.00	Cir	....	....	0.011	0.75	54.85	0.09	....	....	....	24	0.00	24	0.00	0.00	0.00	0.0	....
EX 30 IN RCP	167.000	30	0.15	Cir	....	....	0.011	0.21	4.85	0.75	....	....	....	30	0.00	30	0.00	0.00	0.00	0.0	....
PR 42 IN RCP	1033.000	42	0.15	Cir	....	....	0.011	0.42	4.85	3.41	....	....	....	42	0.00	42	0.00	0.00	0.00	0.8	....
PR 42 IN RCP	197.000	42	0.15	Cir	....	....	0.011	0.33	11.80	0.65	....	....	....	42	0.00	42	0.00	0.00	0.00	4.2	....
EX 8x6 RCB	150.000	72 x 96	0.15	Box	....	....	0.011	0.26	168.55	1.20	....	....	....	72	0.00	96	0.00	0.00	0.00	0.0	....
EX 8x6 RCB	150.000	72 x 96	0.15	Box	....	....	0.011	0.68	170.22	0.81	....	....	....	72	0.00	96	0.00	0.00	0.00	4.8	....

Project File: __1412101 PUBLIC SD RCB.stm

Number of lines: 6

Date: 9/1/2023

NOTES: ** Critical depth

MyReport

Total Area (ac)	Total CxA	Total Runoff (cfs)	Vel Ave (ft/s)	Vel Dn (ft/s)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Vel Up (ft/s)	Cover Dn (ft)	Cover Up (ft)	Storage (cft)
0.00	0.00	0.00	9.41	11.88	0.75	0.75	6.93	n/a	n/a	173.20
0.00	0.00	0.00	3.71	3.71	0.21	0.21	3.71	n/a	n/a	819.60
0.00	0.00	0.00	4.71	4.21	0.28	0.42	5.21	n/a	n/a	10760.21
0.00	0.00	0.00	5.07	5.08	0.40	0.40	5.07	n/a	n/a	1884.18
0.00	0.00	0.00	3.97	3.85	0.23	0.26	4.10	n/a	n/a	3779.15
0.00	0.00	0.00	7.83	8.43	1.10	0.82	7.24	n/a	n/a	2860.33

Project File: __1412101 PUBLIC SD RCB.stm	Number of lines: 6	Date: 9/1/2023

NOTES: ** Critical depth

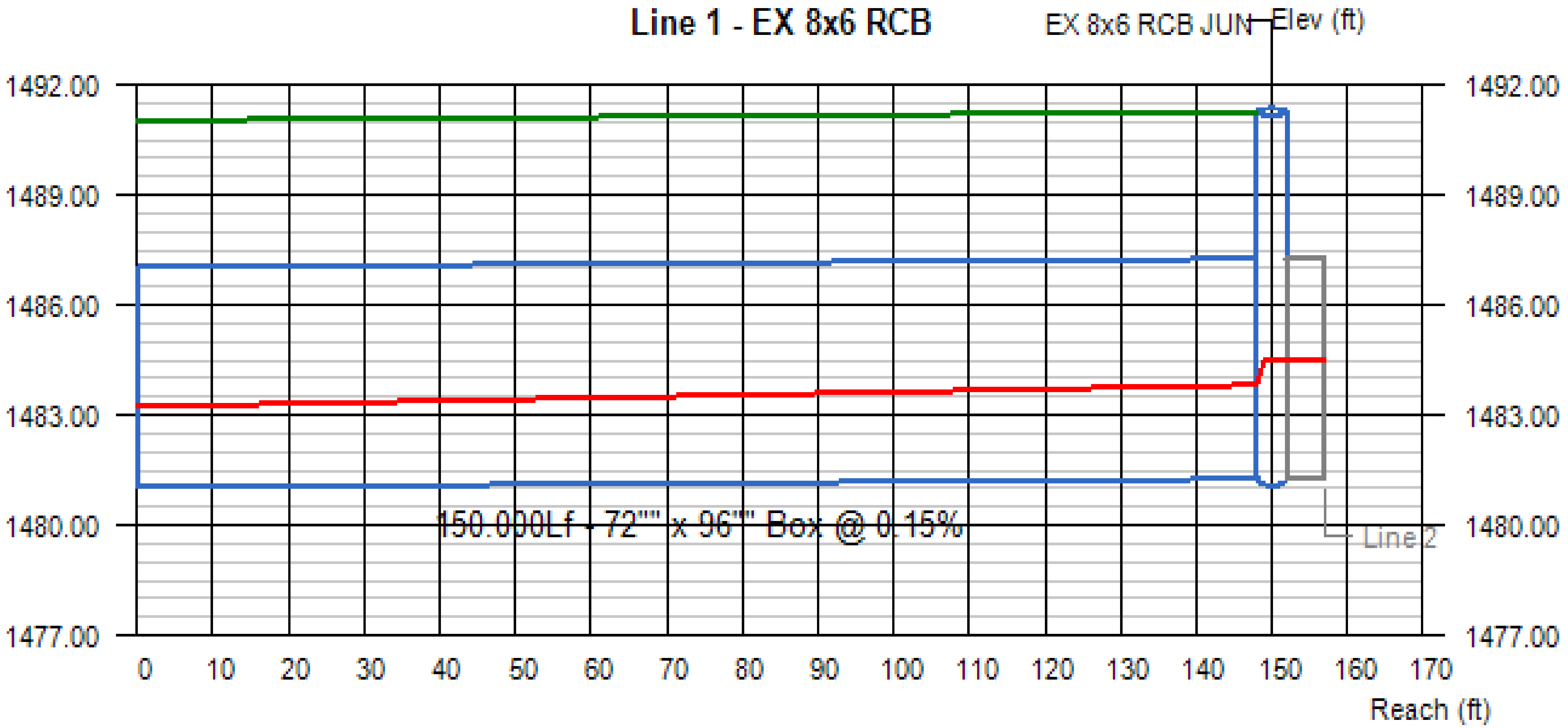
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
(1)	(in) (2)	(cfs) (3)	Invert elev (ft) (4)	HGL elev (ft) (5)	Depth (ft) (6)	Area (sqft) (7)	Vel (ft/s) (8)	Vel head (ft) (9)	EGL elev (ft) (10)	Sf (%) (11)	(ft) (12)	Invert elev (ft) (13)	HGL elev (ft) (14)	Depth (ft) (15)	Area (sqft) (16)	Vel (ft/s) (17)	Vel head (ft) (18)	EGL elev (ft) (19)	Sf (%) (20)	Ave Sf (%) (21)	Enrgy loss (ft) (22)	(K) (23)	(ft) (24)
6	24	30.33	1486.11	1487.28	1.17*	2.55	11.88	0.75	1488.03	0.000	50.000	1487.11	1488.89	1.78**	4.38	6.93	0.75	1489.64	0.000	0.000	n/a	1.00	0.75
5	30	18.20	1483.11	1485.72	2.50	4.91	3.71	0.21	1485.93	0.197	167.000	1483.36	1486.05	2.50	4.91	3.71	0.21	1486.26	0.197	0.197	0.329	1.00	0.21
4	42	48.53	1481.56	1484.12	2.56	11.52	4.21	0.28	1484.40	0.091	1033.000	1483.11	1485.30	2.19	9.32	5.21	0.42	1485.72	0.163	0.127	1.312	1.00	0.42
3	42	48.53	1481.26	1483.49	2.23*	9.56	5.08	0.40	1483.89	0.152	197.000	1481.56	1483.79	2.23	9.57	5.07	0.40	1484.19	0.151	0.152	0.299	0.83	0.33
2	72 96 B	100.0	1481.26	1484.51	3.25	25.99	3.85	0.23	1484.74	0.037	150.000	1481.49	1484.54	3.05	24.40	4.10	0.26	1484.80	0.044	0.041	0.061	1.00	0.26
1	72 96 B	148.5	1481.03	1483.23	2.20	17.63	8.43	1.10	1484.34	0.244	150.000	1481.26	1483.82	2.56	20.51	7.24	0.82	1484.64	0.158	0.201	0.302	0.84	0.68

Project File: __1412101 PUBLIC SD RCB.stm	Number of lines: 6	Run Date: 9/1/2023

Notes: * Normal depth assumed; ** Critical depth. ; c = cir e = ellip b = box

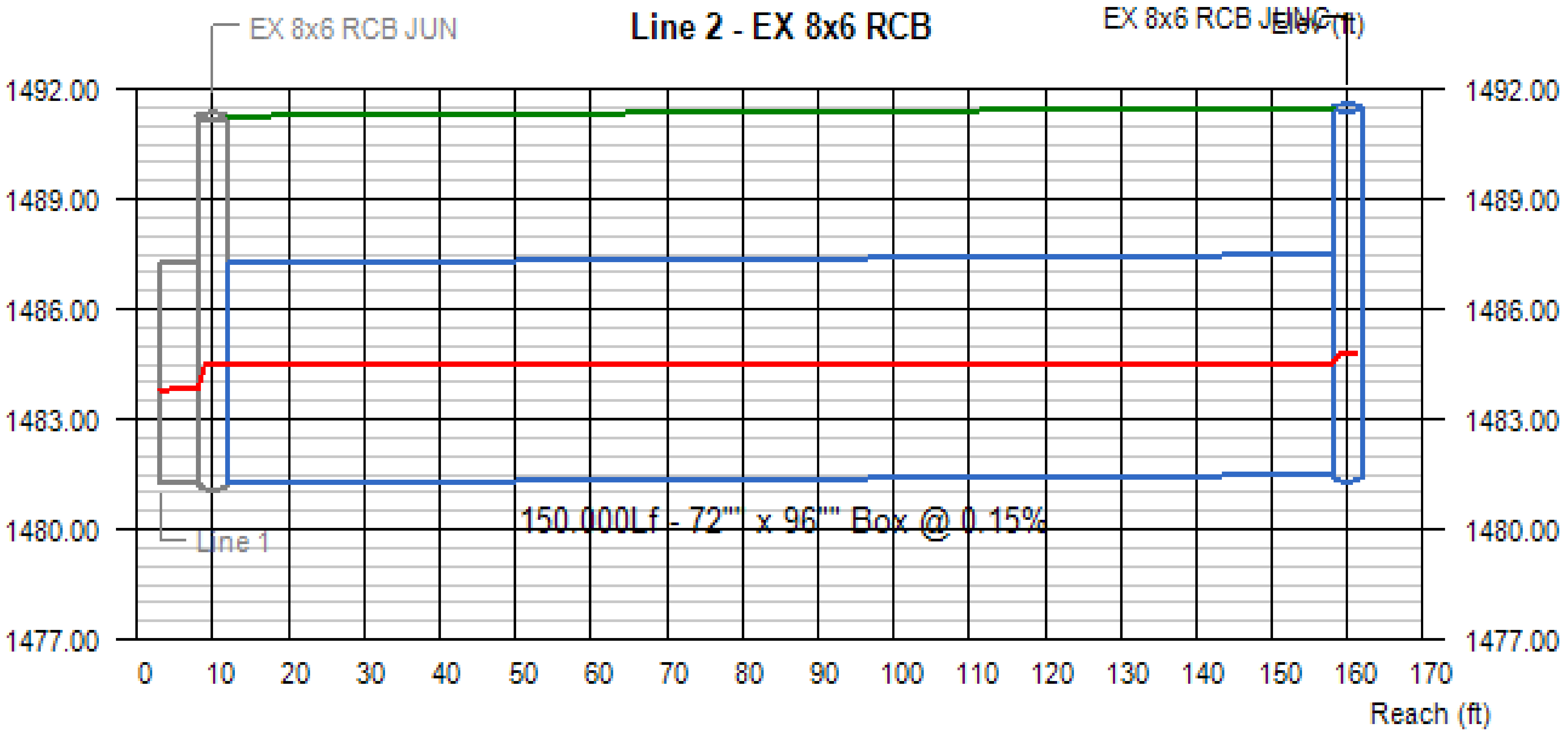
Line Profile (Line 1) - EX 8x6 RCB



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
1	148.53	1481.03	1481.26	2.20	2.56	3.25	1483.23	1483.82	1484.51	8.43	7.24	4.00	4.00

Project File:	No. Lines: 6	Run Date: 9/1/2023

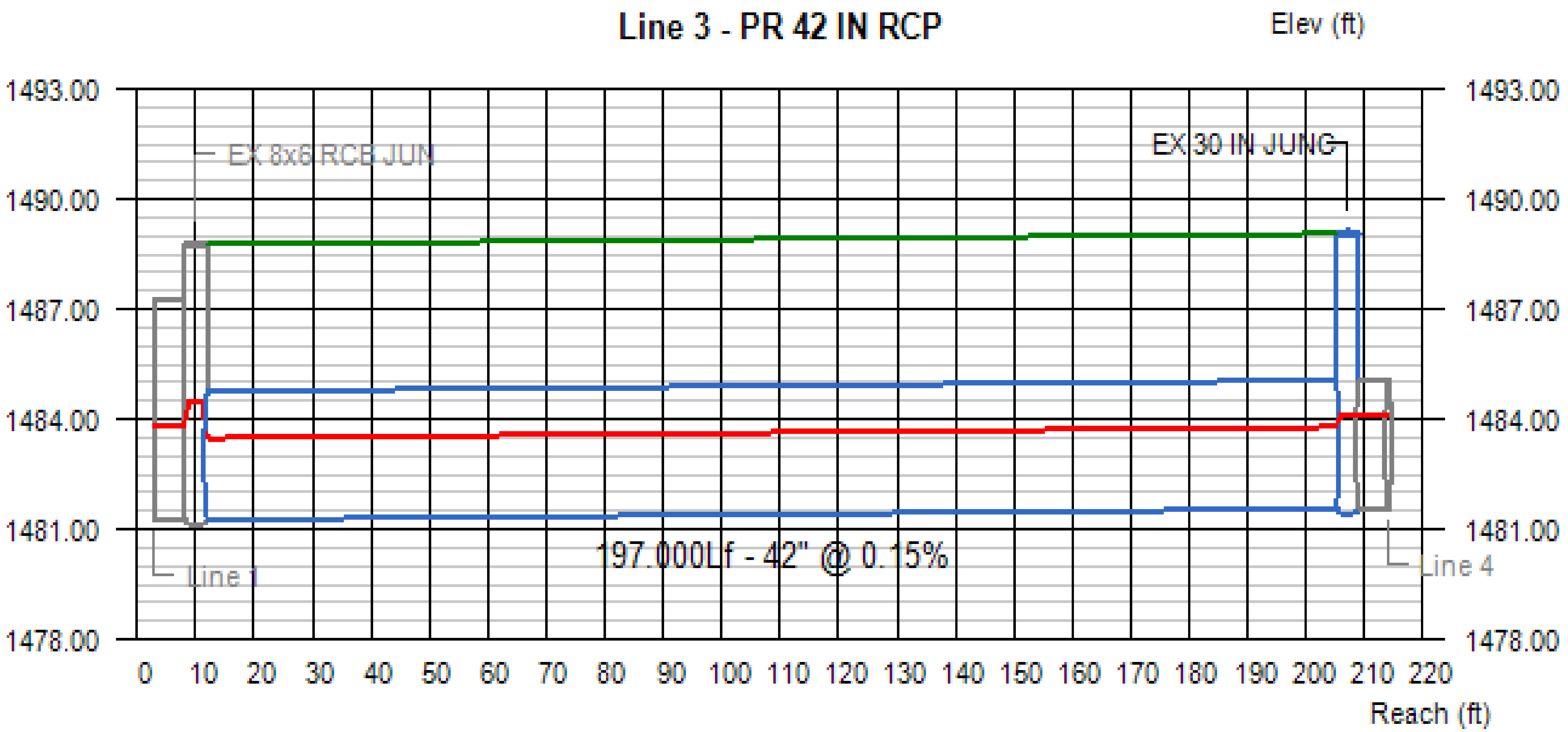
Line Profile (Line 2) - EX 8x6 RCB



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
2	100.00	1481.26	1481.49	3.25	3.05	3.31	1484.51	1484.54	1484.80	3.85	4.10	4.00	4.00

Project File:	No. Lines: 6	Run Date: 9/1/2023

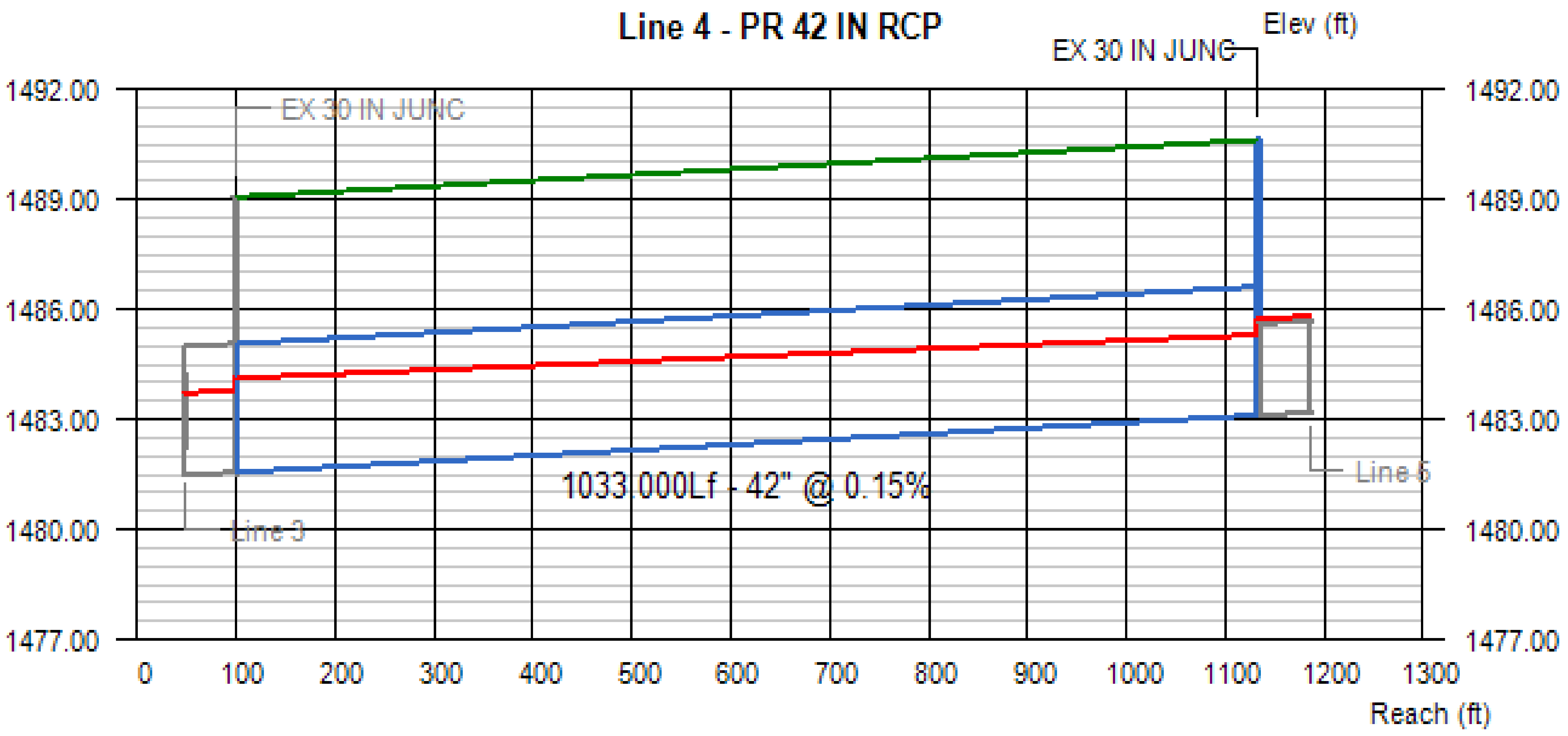
Line Profile (Line 3) - PR 42 IN RCP



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
3	48.53	1481.26	1481.56	2.23	2.23	2.56	1483.49	1483.79	1484.12	5.08	5.07	4.00	4.00

Project File:	No. Lines: 6	Run Date: 9/1/2023

Line Profile (Line 4) - PR 42 IN RCP



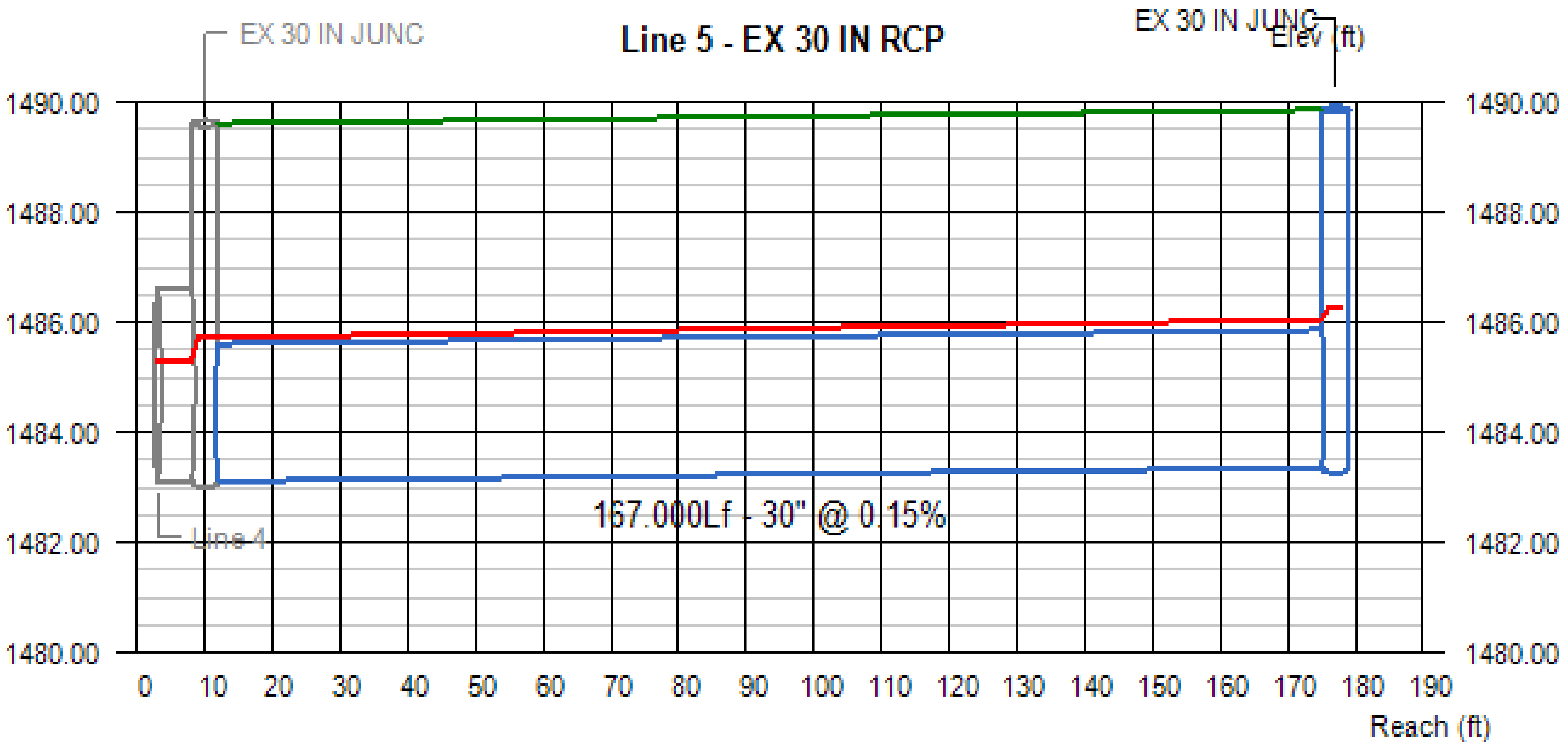
Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
4	48.53	1481.56	1483.11	2.56	2.19	2.61	1484.12	1485.30	1485.72	4.21	5.21	4.00	4.00

Project File:

No. Lines: 6

Run Date: 9/1/2023

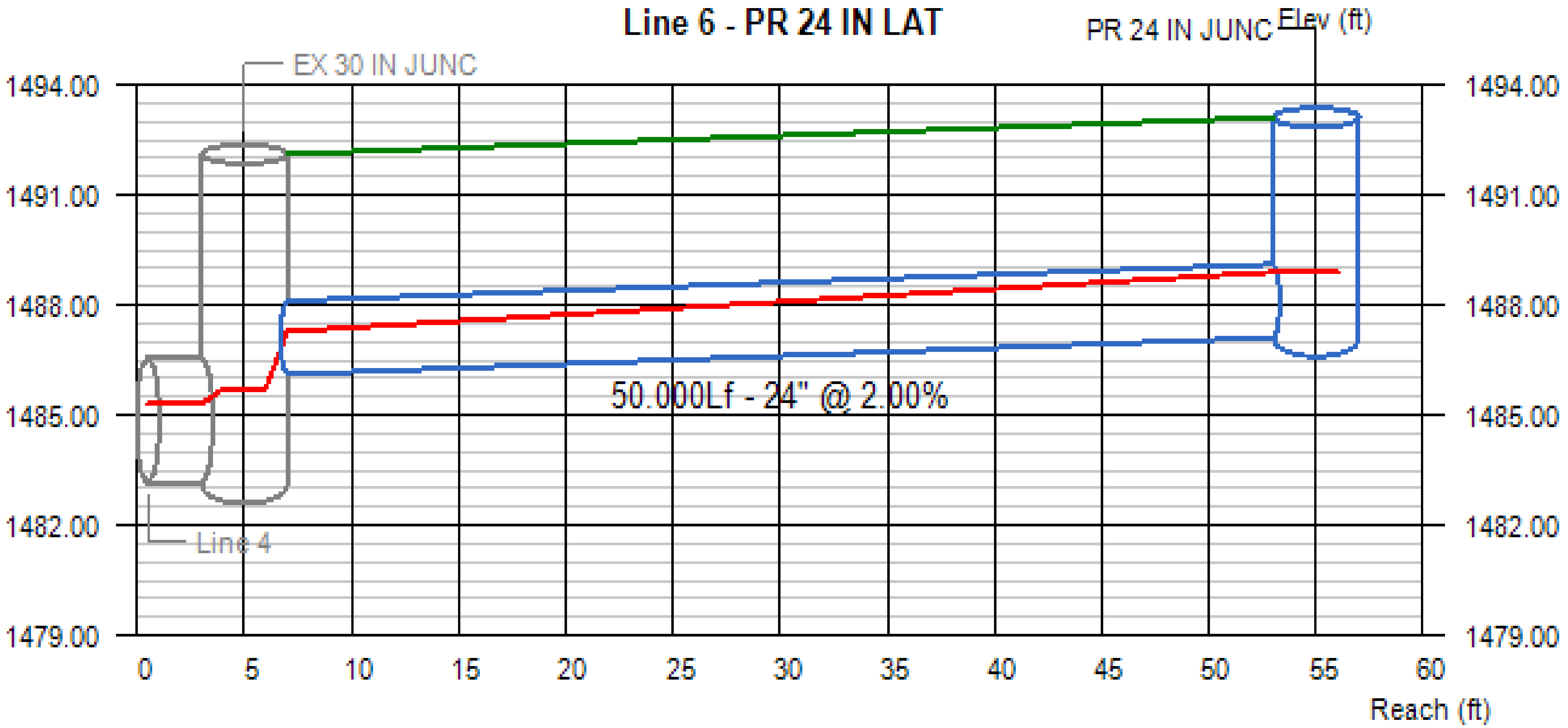
Line Profile (Line 5) - EX 30 IN RCP



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
5	18.20	1483.11	1483.36	2.50	2.50	2.90	1485.72	1486.05	1486.26	3.71	3.71	4.00	4.00

Project File: | No. Lines: 6 | Run Date: 9/1/2023

Line Profile (Line 6) - PR 24 IN LAT



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
6	30.33	1486.11	1487.11	1.17	1.78	1.78	1487.28	1488.89	1488.89	11.88	6.93	4.00	4.00

Project File: | No. Lines: 6 | Run Date: 9/1/2023

Show

Manning's n Values

Reference tables for Manning's n values for Channels, Closed Conduits Flowing Partially Full, and Corrugated Metal Pipes.

Manning's n for Channels (Chow, 1959).

Type of Channel and Description	**Minimum**	**Normal**	**Maximum**
Natural streams - minor streams (top width at floodstage < 100 ft)			
1. Main Channels			
a. clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
b. same as above, but more stones and weeds	0.030	0.035	0.040
c. clean, winding, some pools and shoals	0.033	0.040	0.045
d. same as above, but some weeds and stones	0.035	0.045	0.050
e. same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
f. same as "d" with more stones	0.045	0.050	0.060
g. sluggish reaches, weedy, deep pools	0.050	0.070	0.080
h. very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
2. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
a. bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
b. bottom: cobbles with large boulders	0.040	0.050	0.070
3. Floodplains			
a. Pasture, no brush			
1.short grass	0.025	0.030	0.035
2. high grass	0.030	0.035	0.050
b. Cultivated areas			
1. no crop	0.020	0.030	0.040
2. mature row crops	0.025	0.035	0.045
3. mature field crops	0.030	0.040	0.050
c. Brush			
1. scattered brush, heavy weeds	0.035	0.050	0.070
2. light brush and trees, in winter	0.035	0.050	0.060
3. light brush and trees, in summer	0.040	0.060	0.080
4. medium to dense brush, in winter	0.045	0.070	0.110
5. medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. dense willows, summer, straight	0.110	0.150	0.200
2. cleared land with tree stumps, no sprouts	0.030	0.040	0.050
3. same as above, but with heavy growth of sprouts	0.050	0.060	0.080
4. heavy stand of timber, a few down trees, little	0.080	0.100	0.120

undergrowth, flood stage below branches			
5. same as 4. with flood stage reaching branches	0.100	0.120	0.160
4. Excavated or Dredged Channels			
a. Earth, straight, and uniform			
1. clean, recently completed	0.016	0.018	0.020
2. clean, after weathering	0.018	0.022	0.025
3. gravel, uniform section, clean	0.022	0.025	0.030
4. with short grass, few weeds	0.022	0.027	0.033
b. Earth winding and sluggish			
1. no vegetation	0.023	0.025	0.030
2. grass, some weeds	0.025	0.030	0.033
3. dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. earth bottom and rubble sides	0.028	0.030	0.035
5. stony bottom and weedy banks	0.025	0.035	0.040
6. cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. no vegetation	0.025	0.028	0.033
2. light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. smooth and uniform	0.025	0.035	0.040
2. jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. dense weeds, high as flow depth	0.050	0.080	0.120
2. clean bottom, brush on sides	0.040	0.050	0.080
3. same as above, highest stage of flow	0.045	0.070	0.110
4. dense brush, high stage	0.080	0.100	0.140
5. Lined or Constructed Channels			
a. Cement			
1. neat surface	0.010	0.011	0.013
2. mortar	0.011	0.013	0.015
b. Wood			
1. planed, untreated	0.010	0.012	0.014
2. planed, creosoted	0.011	0.012	0.015
3. unplaned	0.011	0.013	0.015
4. plank with battens	0.012	0.015	0.018
5. lined with roofing paper	0.010	0.014	0.017
c. Concrete			
1. trowel finish	0.011	0.013	0.015
2. float finish	0.013	0.015	0.016
3. finished, with gravel on bottom	0.015	0.017	0.020
4. unfinished	0.014	0.017	0.020
5. gunite, good section	0.016	0.019	0.023
6. gunite, wavy section	0.018	0.022	0.025
7. on good excavated rock	0.017	0.020	

8. on irregular excavated rock	0.022	0.027	
d. Concrete bottom float finish with sides of:			
1. dressed stone in mortar	0.015	0.017	0.020
2. random stone in mortar	0.017	0.020	0.024
3. cement rubble masonry, plastered	0.016	0.020	0.024
4. cement rubble masonry	0.020	0.025	0.030
5. dry rubble or riprap	0.020	0.030	0.035
e. Gravel bottom with sides of:			
1. formed concrete	0.017	0.020	0.025
2. random stone mortar	0.020	0.023	0.026
3. dry rubble or riprap	0.023	0.033	0.036
f. Brick			
1. glazed	0.011	0.013	0.015
2. in cement mortar	0.012	0.015	0.018
g. Masonry			
1. cemented rubble	0.017	0.025	0.030
2. dry rubble	0.023	0.032	0.035
h. Dressed ashlar/stone paving	0.013	0.015	0.017
i. Asphalt			
1. smooth	0.013	0.013	
2. rough	0.016	0.016	
j. Vegetal lining	0.030		0.500

Manning's n for Closed Conduits Flowing Partly Full (Chow, 1959).

Type of Conduit and Description	**Minimum**	**Normal**	**Maximum**
1. Brass, smooth:	0.009	0.010	0.013
2. Steel:			
Lockbar and welded	0.010	0.012	0.014
Riveted and spiral	0.013	0.016	0.017
3. Cast Iron:			
Coated	0.010	0.013	0.014
Uncoated	0.011	0.014	0.016
4. Wrought Iron:			
Black	0.012	0.014	0.015
Galvanized	0.013	0.016	0.017
5. Corrugated Metal:			
Subdrain	0.017	0.019	0.021
Stormdrain	0.021	0.024	0.030
6. Cement:			
Neat Surface	0.010	0.011	0.013
Mortar	0.011	0.013	0.015
7. Concrete:			
Culvert, straight and free of debris	0.010	0.011	0.013
Culvert with bends, connections, and some debris	0.011	0.013	0.014
Finished	0.011	0.012	0.014
Sewer with manholes, inlet, etc., straight	0.013	0.015	0.017
Unfinished, steel form	0.012	0.013	0.014
Unfinished, smooth wood form	0.012	0.014	0.016

Unfinished, rough wood form	0.015	0.017	0.020
8. Wood:			
Stave	0.010	0.012	0.014
Laminated, treated	0.015	0.017	0.020
9. Clay:			
Common drainage tile	0.011	0.013	0.017
Vitrified sewer	0.011	0.014	0.017
Vitrified sewer with manholes, inlet, etc.	0.013	0.015	0.017
Vitrified Subdrain with open joint	0.014	0.016	0.018
10. Brickwork:			
Glazed	0.011	0.013	0.015
Lined with cement mortar	0.012	0.015	0.017
Sanitary sewers coated with sewage slime with bends and connections	0.012	0.013	0.016
Paved invert, sewer, smooth bottom	0.016	0.019	0.020
Rubble masonry, cemented	0.018	0.025	0.030

Manning's n for Corrugated Metal Pipe (AISI, 1980).

Type of Pipe, Diameter and Corrugation Dimension	**n**
1. Annular 2.67 x 1/2 inch (all diameters)	0.024
2. Helical 1.50 x 1/4 inch	
8" diameter	0.012
10" diameter	0.014
3. Helical 2.67 x 1/2 inch	
12" diameter	0.011
18" diameter	0.014
24" diameter	0.016
36" diameter	0.019
48" diameter	0.020
60" diameter	0.021
4. Annular 3x1 inch (all diameters)	0.027
5. Helical 3x1 inch	
48" diameter	0.023
54" diameter	0.023
60" diameter	0.024
66" diameter	0.025
72" diameter	0.026
78" diameter and larger	0.027
6. Corrugations 6x2 inches	
60" diameter	0.033
72" diameter	0.032
120" diameter	0.030
180" diameter	0.028

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