Appendix F
Preliminary Hydrology and Low Impact Development Plans

PRELIMINARY HYDROLOGY STUDY
TENTATIVE TRACT MAP No. 83037
13615 & 13633 South Vermont Ave
Gardena, California 90247

Project Address:

13615 & 13633 South Vermont Ave
Gardena, CA 90247

Prepared For:

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March 2020

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Preliminary Hydrology Study
for
Tentative Tract Map No. 83037
Evergreen Project

ACKNOWLEDGEMENT AND SIGNATURE PAGE

This Preliminary Hydrology Study was prepared by C&V Consulting, Inc. under the supervision of Dane P. McDougall, P.E.

_____ _____

Dane P. McDougall, R.C.E. 80705 Date
CEO, C&V Consulting, Inc.

1.0 SITE DESCRIPTION:

The existing site conditions of the proposed development encompasses four parcels as shown on the Assessor's Parcel map, last updated in 2006, at approximately 4.14 acres. The project is bounded by The Oasis apartment complex to the north, S Vermont Ave. to the east, Villa Vermont Mobile Homes to the south, and a residential neighborhood to the west. Currently, most of the site is a plant nursery that consists of various shade structures connected by dirt and concrete paths. In the northeastern corner of the site there is also a small motel that has a small paved parking lot.

2.0 PURPOSE OF STUDY:

The preliminary hydrology study will determine the amount of stormwater runoff generated from the project site in the existing and proposed conditions. This study will anticipate whether detention or other peak flow mitigation methods will be required by comparing the proposed and existing condition peak flow rates for the 25, 50 and 100-year storm events.

3.0 EXISTING CONDITIONS:

The site generally slopes from East to West and North to South away from Vermont Ave. The site ranges in elevations from 71 to 80 feet above sea level, based on the aerial flown on 10/25/2019. The existing drainage pattern of the site is generally split into two areas: the small motel in the northeast corner of the lot and the nursery which encompasses the rest of the site. The small motel's drainage pattern generally sheet flows over the existing parking lot east to west into through a chain link fence at the parking lot's western end. Stormwater then flows onto the dirt lot of the adjacent nursery. The nursery's drainage pattern is all sheet flow over the existing developed parking lot, walkways, and planter beds. All flows from the nursery are collected so a single grate inlet catch basin located at the southwest corner of the site. This catch basin is then connected pipes that flow underneath the adjacent property and into Berendo Ave.

In the existing condition there is cross-lot drainage from the apartment complex in the north. Flows from this lot are directed with ribbon gutters to the western edge of the lot where a natural swale conveys stormwater south onto the site. This cross-lot drainage is allowed per a drainage easement along the "westerly end" of the site. This drainage easement covers all lots in the Strawberry Park Tract to the north and south of our project site. Therefore, in the current condition flows are permitted from the north to the adjacent lot in the south. In the proposed condition, these off site flows will be conveyed via a natural swale located on the western edge of the property to the existing gate inlet catch basin located at the southwest corner of the site in order to match the existing drainage pattern of the adjacent property.

Once stormwater travels through the grate inlet into Berendo Ave. it flows in the street's curb and gutter to City of Gardena owned catch basin at the dead-end cul-de-sac on Berendo Ave. These catch basins are connected to a Los Angeles County Flood Control (LACFCD) facility. This storm drain system ultimately outlets into the Dominguez Channel which is also an LACFCD Facility. Dominguez Channel then proceeds in a south westerly direction and eventually outlets into the Dominguez Channel Estuary then the Pacific Ocean.

The topographic survey was utilized to identify existing onsite high points and overall site conveyance of storm water runoff. Since all of the existing onsite stormwater runoff ultimately reaches a single location (the grate inlet in the southwestern portion of the site) the existing site was analyzed as a single drainage area to approximately quantify the runoff based on the longest hydraulic path from the most remote high point to grate inlet low point.

Refer to the "Existing Conditions Hydrology Map" located within Appendix A of this study for more information.

4.0 PROPOSED CONDITIONS:

The proposed project consists of 83-85 3-story residential townhome units over approximately 4.14 acres. The proposed development includes drive aisles, parking, landscaping, walkways, patios, and common open space areas. The site will be graded to collect runoff at one low point to control the amount of imported fill during grading and maintaining the entire site drainage pattern. The proposed development will utilize onsite catch basins, infiltration systems, and a detention vault system to capture and treat stormwater. Stormwater up to the design capture volume will be infiltrated by a proposed onsite drywell system. Larger storm events will bypass the infiltration system and overflow into a proposed swale which follows an existing drainage easement located along the western property line. Once stormwater enters this swale the existing grate inlet will convey stormwater into Berendo Ave. via the existing underground storm drain piping system. Any flows not captured by the existing grate inlet will continue south following the existing drainage pattern within the drainage easement located along the westerly edge of all lots in the Strawberry Park Tract.

Stormwater runoff will be conveyed via proposed onsite gutter and directed to one sump areas equipped with a curb inlet catch basins. The catch basin will be located at the end of the drive aisles at the western property line. There will be two other catch basins located through the site with local depressions. These catch basins will be in a flow-by condition. These catch basins will be connected by storm drain pipe to the drywell infiltration system for water quality treatment. During larger storm events, stormwater runoff will back up the drywell system which is connected to the underground detention system. Runoff will be piped through a proposed retaining wall into a swale located on the western edge of the property. For emergency overflow, runoff will spill out of the proposed curb inlet catch basin and surface flow through the wall knockouts in the adjacent retaining wall spilling into the swale. Refer to separately prepared Preliminary Grading and Utility Plans for site design information.

In order to address the cross-lot drainage discuss in Section 3.0 a drainage swale is proposed in the existing drainage easement located along the westerly property line. This swale will convey any drainage from the adjacent property to existing drainage device located at the southwestern edge of the site. Any excess flow will continue south and follow the existing drainage pattern and easement.

In an event where the proposed onsite storm drain system is at its full capacity or clogged, stormwater will pond up at the proposed onsite sump area and excess stormwater will top over the curb to continue to flow out through proposed wall knockouts in the retaining wall at the southwest corner of the site. This will then spill into the swale along the western property line where it will get intercepted by the grate inlet catch basin or continue south along the existing drainage easement.

During final engineering, water surface elevation will be analyzed and provided to verify all habitable structures will have at least a 1 foot of freeboard during the 100-year storm event.

The "Proposed Conditions Preliminary Hydrology Map" is included in Appendix A for reference.

5.0 METHODOLOGY:

The site was analyzed using the Los Angeles County Department of Public Works Hydrology Manual 2006. The initial subarea was analyzed for acreage, land-use, soil type, peak flow rate and time of concentration according to the Rational Method described in the manual.

In this preliminary hydrology study, the impervious area percentage values were conservative estimation from the LA County Hydrology Manual. During final engineering, impervious areas will be calculated in more detail to refine all peak flow rates.

In accordance with the Los Angeles County Department of Public Works Hydrology Manual all habitable structures must have a finished floor elevation to allow 1 ft of freeboard during the 100-year storm event and the drop inlet catch basin and onsite conveyance storm drain pipes will be sized to convey runoff from the 100-year storm event. Catch basin, pipe sizing and 100-year water surface elevation calculations will be provided during final engineering.

Confluence analysis and travel time considerations will be incorporated in the calculations during final engineering to reflect more accurate peak flow rate values.

6.0 RESULTS:

Hydrology Summary

	Drainage Area	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)	Tc (min)
Existing Condition	XA1	7.2818	9.5875	10.7854	7
Cross-lot Drainage	OA1	3.0158	3.6582	4.1045	7
Proposed Condition	A1	2.769	3.2884	3.9286	7
	A2	5.6929	6.8959	8.2383	7
	TOTAL	8.57	10.2	12.17	-

Percent Increase:
Δ25-year peak storm flow = 8.57/7.28 = +17.7%
Δ50-year peak storm flow = 10.20/9.59 = +6.3%
Δ100-year peak storm flow = 12.17/10.79 = +11.9%

Note: All time of concentrations indicated above refer to 100-year storm event

Refer to Appendix A & B of this report for additional information shown in the LACDPW HydroCalc output data, as well as the pre-developed and post-developed hydrology maps.

Detention Sizing

A Hydrograph was developed based on HydroCalc Program using the proposed conditions 100-year storm event flow rates.

The onsite detention required to mitigate the proposed condition peak flowrate during the 100-yr storm event to the existing 100-yr peak flowrate was calculated by utilizing the unit hydrographs generated by the HydroCalc software. The area under the unit hydrographs for all flowrates greater than the existing 100-year peak flowrate of 10.79 cfs equals the amount of detention required. The results are summarized below.

For this project we will be utilizing BioClean's Urbanpond detention system and has been sized according to their volume base sizing chart. However, as the detention requirement is only 269 cf, per the results presented in Appendix C, the detention requirement to mitigate proposed condition peak flow rate will be met by the detention provided for the proposed drywell system. This drywell system will meet the required water quality treatment while detaining more than 269 cf of stormwater. Therefore, once an orifice is sized there is no need for additional detention to mitigate post-development flows.

Orifice Sizing

Catch Sizing will be analyzed for the 100-year storm event peak flow rates and will be provided during final engineering.

Catch Basin Sizing

Catch basin Sizing will be analyzed for the 100-year storm event peak flow rates and will be provided during final engineering.

Pipe Sizing

Pipe Sizing will be analyzed using WSPG software to verify hydraulic grade line (HGL) based on the 100-year storm event peak flow rates and will be provided during final engineering for proposed onsite conveyance pipe.

100-Year Water Surface Elevations

Water surface elevations for the 100-year storm event peak flow rates will verify that the proposed finish floor elevations are set at least 1' above the water surface elevation and will be calculated and provided during final engineering.

7.0 CONCLUSIONS:

The results from this preliminary hydrology study utilizing Los Angeles County Department of Public Works Hydrology Manual 2006 demonstrate that the proposed condition stormwater peak flow for different year storm event frequencies from the subject site will increase slightly compared to the existing condition peak flow as indicated in the hydrology summary results in Section 6 of this report. This is mainly due to the increased change in impervious area based on the type of development that is proposed. This condition represents higher overall peak flow rates. During final engineering, impervious area for proposed conditions will be calculated in more detail based on the finalized

landscape plan. The proposed peak flow rates will be re-evaluated to reflect the actual proposed conditions. However, the proposed development is likely to generate higher peak flows.

The focus of the grading of the proposed site it to closely maintain the existing drainage pattern of the existing site and control and excess flows generated in the proposed condition. The proposed development will be graded to allow for a single low point on the site equipped with a curb inlet catch basin, this catch basin will be connected to the drywell system for treatment. There will be two other curb inlet catch basins located on site in a flow-by condition to reduce the amount of stormwater flowing into the sump location. The storm drain system will also have detention system to capture excess flows generated in the proposed condition. In the event the storm drain system becomes clogged, the proposed grading will facilitate emergency overflow by draining out retaining wall knockouts in the southwest corner.

8.0 DESIGN ASSUMPTIONS:

1. The property is in the City of Gardena, Los Angeles County rainfall region.

2. 100-year storm event flood level protection analysis required for habitable structures per the requirements of the Los Angeles County Department of Public Works Hydrology Manual

3. According to the Los Angeles County Department of Public Works Hydrology Manual 50-Year 24-Hour Isohyet Map 1-H1.8, the drainage area is located in Soil Group 013, the site receives 5.7 inches of rainfall over a 24-Hr storm (Q_{50}).

4. The LACDPW HydroCalc was utilized to determine the time of concentration, run-off flow rate and run-off volume for site.

5. The site was analyzed for a 25, 50 and 100-year storm events per the requirements of the January 2006 Los Angeles County Department of Public Works Hydrology Manual. The Rational Method Analysis was performed, and the appropriate calculations are provided herein.

6. The existing project site is currently a plant nursery and grocery store and is 30% impervious based on the aerial survey performed by C&V Consulting, Inc.

7. The proposed site was assumed to be approximately 86% based on the LACDPW Hydrology Manual for “Low-Rise Apartments, Condominiums, and Townhouses” land use type.

8. Detention calculations were determined using the LACDPW HydroCalc Output values for the 100-year storm event.

9.0 REFERENCES:

1. Los Angeles County Department of Public Works, “Hydrology Manual”, January 2006.

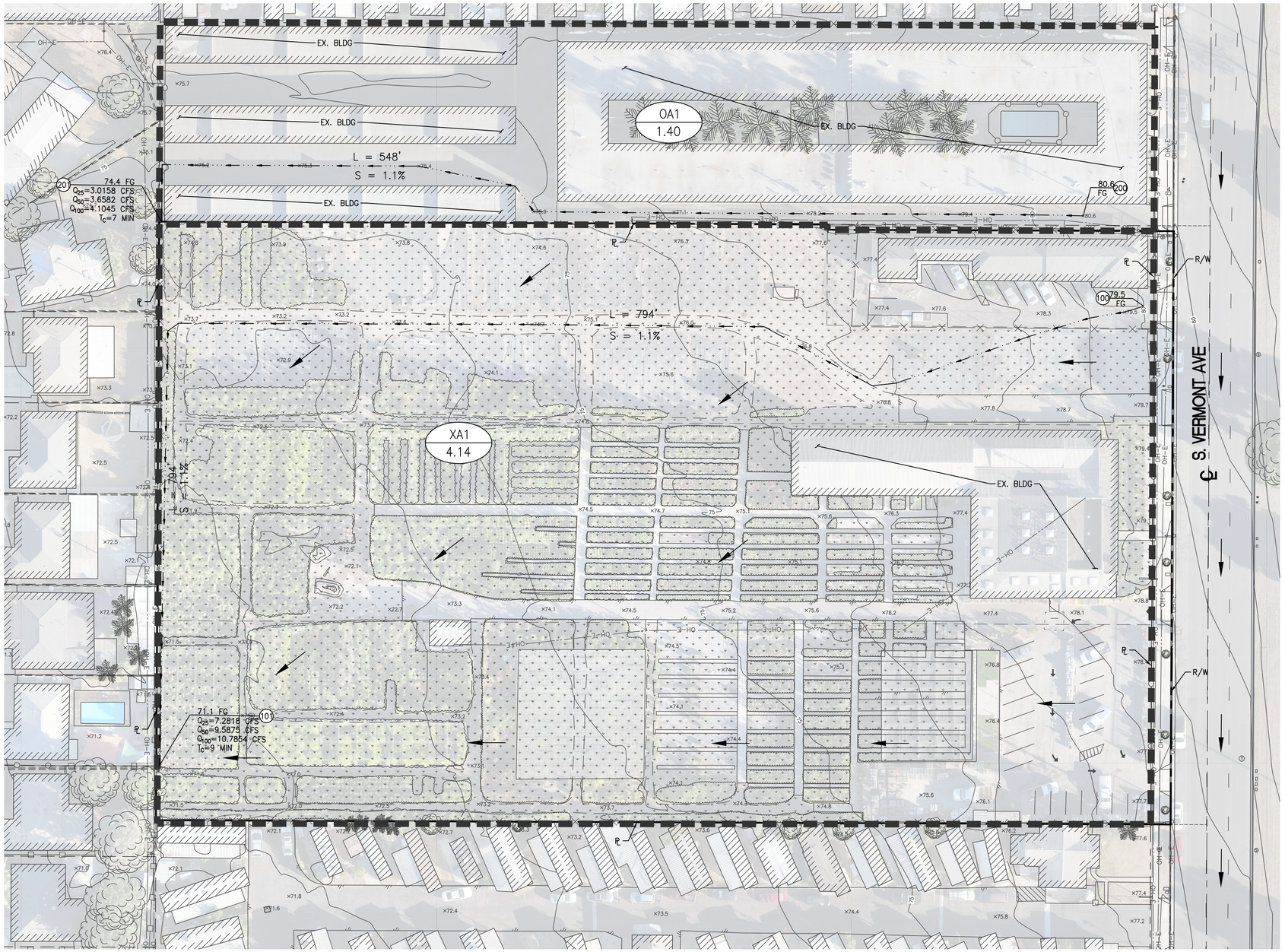
2. Los Angeles County Department of Public Works, “HydroCalc” Outputs and Data

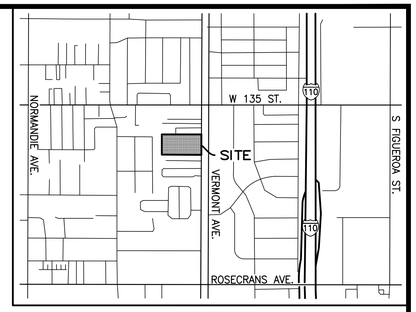
3. Hydraflow Express Extensions for Civil 3D 2019.

4. Preliminary Grading & Drainage Plan for this project by C&V Consulting, Inc. March 2020

APPENDIX A
HYDROLOGY MAPS

Existing Conditions Preliminary Hydrology Map





VICINITY MAP
N.T.S.

Pre-Developed Hydroligic Summary (On-Site)								
Area ID	Total Area (AC)	Pervious Area (AC)	Pervious (%)	Impervious Area (AC)	Impervious (%)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
XA1	4.14	2.92	0.70	1.23	0.30	7.2818	9.5875	10.7854

Pre-Developed Hydroligic Summary (Off-Site)								
Area ID	Total Area (AC)	Pervious Area (AC)	Pervious (%)	Impervious Area (AC)	Impervious (%)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
OA1	1.40	0.01	0.01	1.39	0.99	3.0158	3.6582	4.1045

LEGEND:

- XA1 / 0.93 AC — SUB-AREA NUMBER / ACREAGE
- L=XXX' — FLOW PATH LENGTH
- S=X.X' — CHANGE IN ELEVATION ALONG FLOW PATH
- SUB-AREA BOUNDARY
- FLOW PATH
- XXX.X — ELEVATION AT NODE
- Q=X.XX CFS — STORM EVENT PEAK FLOW RATE
- PERVIOUS LANDSCAPE
- SURFACE FLOW DIRECTION

SCALE: 1" = 30'

0 15 30 60

OWNER/DEVELOPER

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CITY OF GARDENA

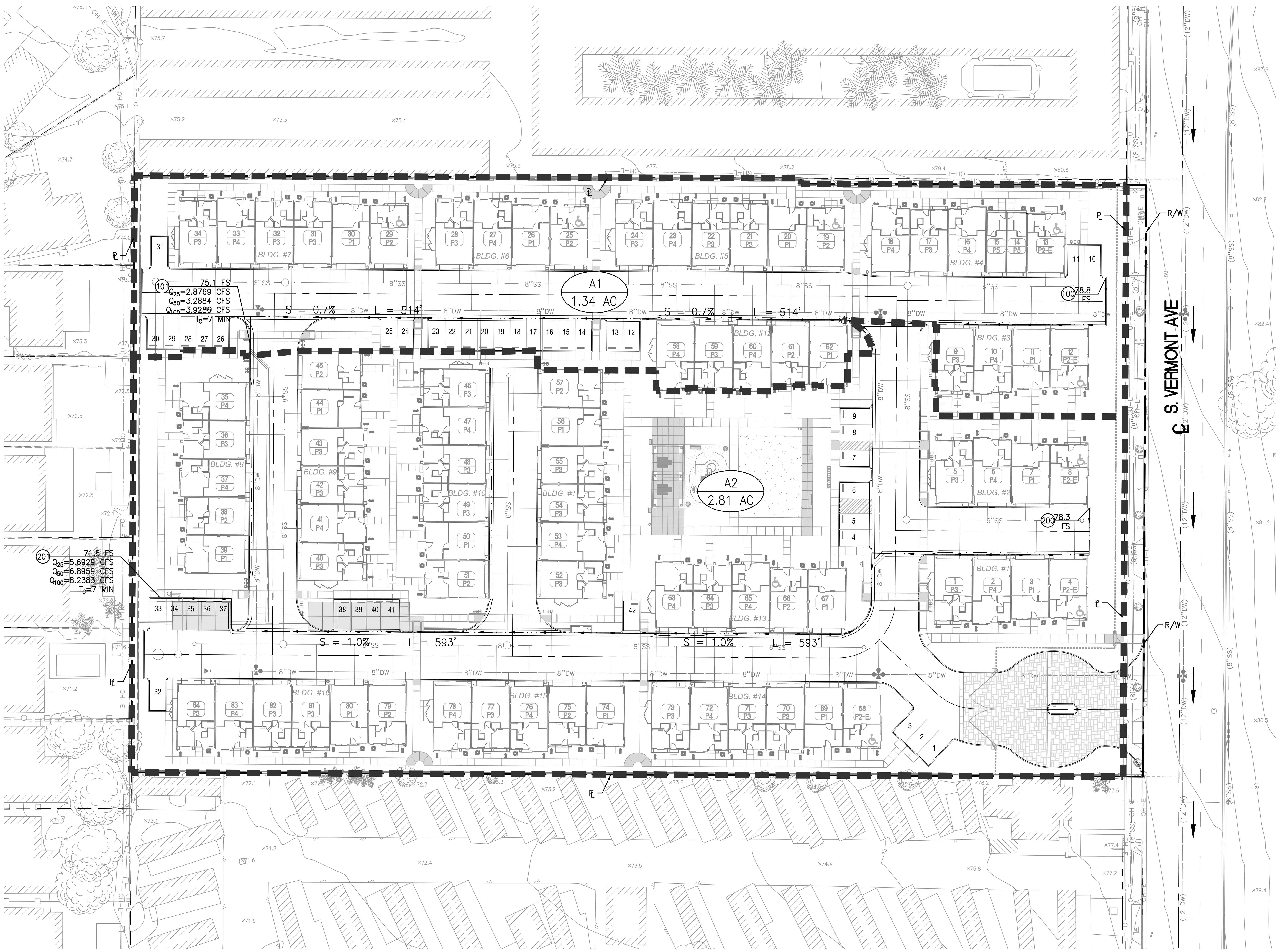
TENTATIVE TRACT MAP NO. 83037
13615-13633 SOUTH VERMONT AVE.
PRELIMINARY EXISTING CONDITIONS HYDROLOGY MAP

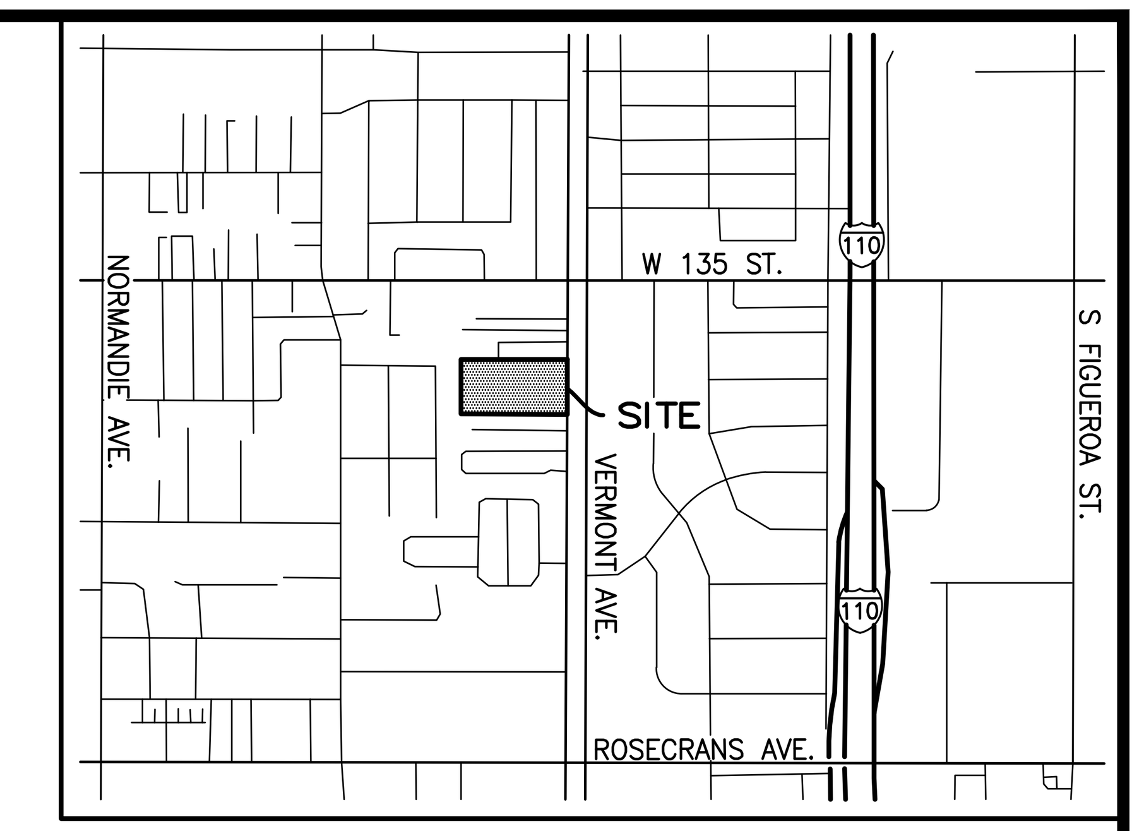
SHEET 1 OF 1

PLAN SET: PSD1
DATE: 2/13/20

P:\MELIA\GARDENA\PRELIM\EXISTING HYDRO-PRELIM.DWG
BY: ABC PEREZ 2/13/20 3:26 PM

Proposed Conditions Preliminary Hydrology Map

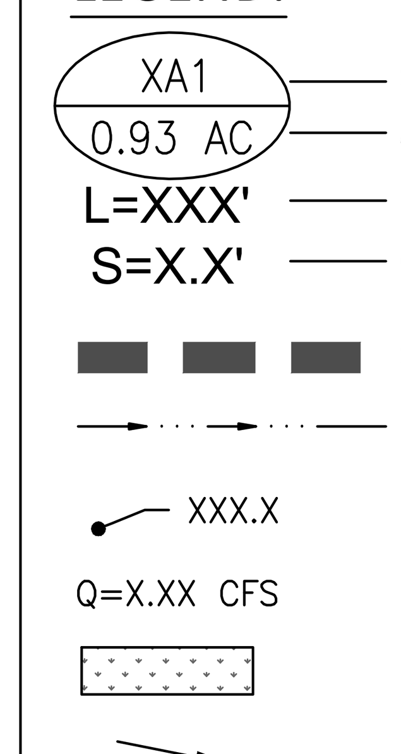




VICINITY MAP
N.T.S.

Post-Developed Hydroligic Summary								
Area ID	Total Area (AC)	Pervious Area (AC)	Pervious (%)	Impervious Area (AC)	Impervious (%)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
A1	1.34	0.19	0.14	1.15	0.86	2.8769	3.2884	3.9286
A2	2.81	0.39	0.14	2.41	0.86	5.6929	6.8959	8.2383
TOTAL	**4.14**	**0.58**	**0.14**	**3.56**	**0.86**	**8.57**	**10.18**	**12.17**

LEGEND:



SUB-AREA NUMBER
ACREAGE
FLOW PATH LENGTH
CHANGE IN ELEVATION ALONG FLOW PATH
SUB-AREA BOUNDARY
FLOW PATH
ELEVATION AT NODE
STORM EVENT PEAK FLOW RATE
PERVIOUS LANDSCAPE
SURFACE FLOW DIRECTION

SCALE: 1" = 30'
0 15 30 60

OWNER/DEVELOPER

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CITY OF GARDENA

TENTATIVE TRACT MAP NO. 83037
13615-13633 SOUTH VERMONT AVE.
PRELIMINARY PROPOSED CONDITIONS HYDROLOGY MAP

SHEET 1 OF 1

APPENDIX B
HYDROLOGY CALCULATIONS

Existing, Off-Site, & Proposed Conditions Hydrology Calculations (25-year Storm Event)

Peak Flow Hydrologic Analysis

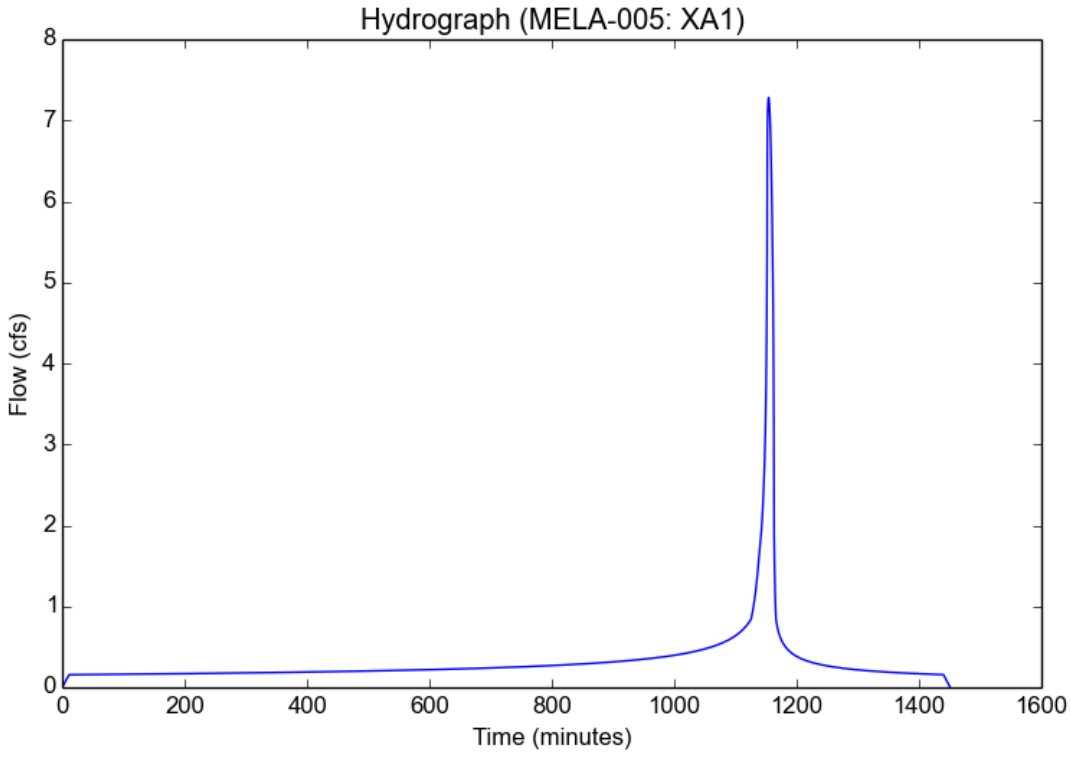
File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - XA1, 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	XA1
Area (ac)	4.14
Flow Path Length (ft)	794.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.3
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.0613
Undeveloped Runoff Coefficient (Cu)	0.8333
Developed Runoff Coefficient (Cd)	0.8533
Time of Concentration (min)	11.0
Clear Peak Flow Rate (cfs)	7.2818
Burned Peak Flow Rate (cfs)	7.2818
24-Hr Clear Runoff Volume (ac-ft)	0.6647
24-Hr Clear Runoff Volume (cu-ft)	28952.2471



Peak Flow Hydrologic Analysis

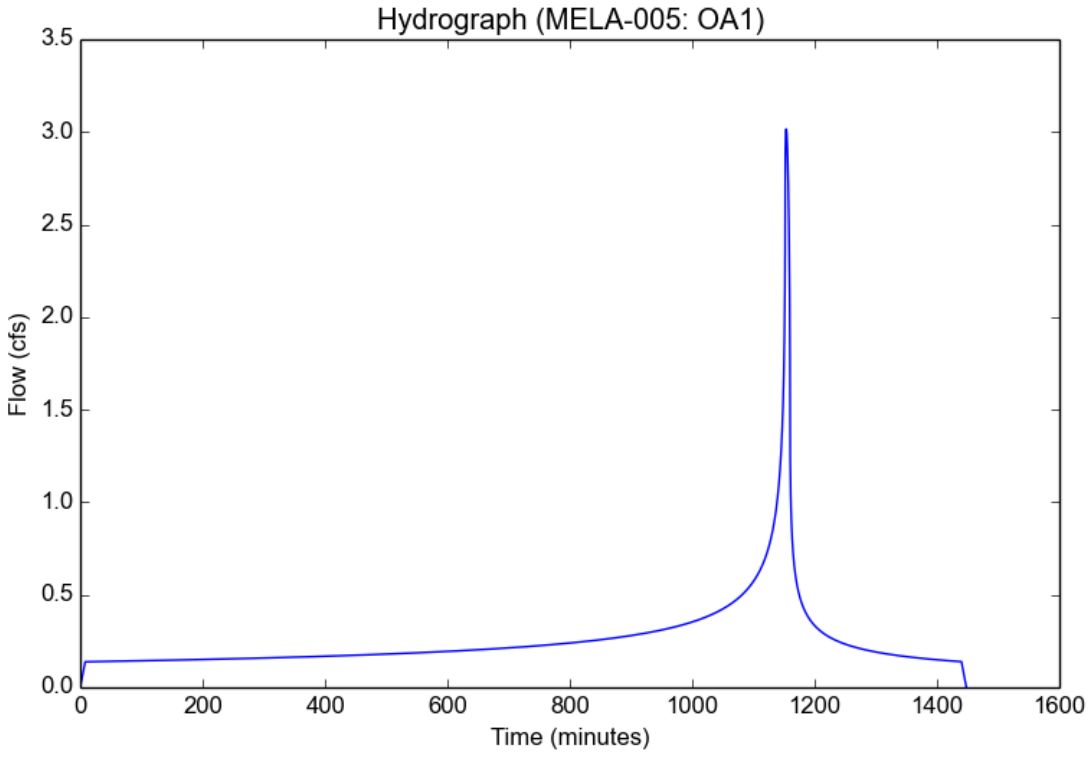
File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - OA1, 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	OA1
Area (ac)	1.4
Flow Path Length (ft)	548.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.99
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.3941
Undeveloped Runoff Coefficient (Cu)	0.877
Developed Runoff Coefficient (Cd)	0.8998
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	3.0158
Burned Peak Flow Rate (cfs)	3.0158
24-Hr Clear Runoff Volume (ac-ft)	0.5169
24-Hr Clear Runoff Volume (cu-ft)	22516.5921



Peak Flow Hydrologic Analysis

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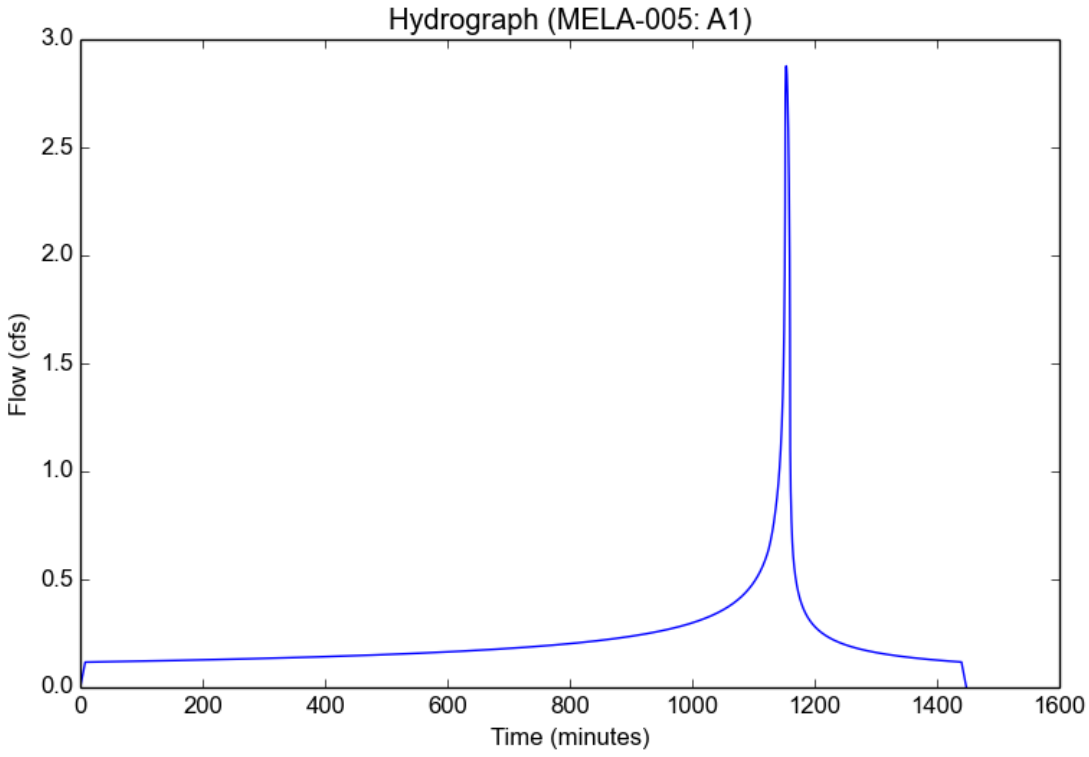
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	A1
Area (ac)	1.34
Flow Path Length (ft)	514.0
Flow Path Slope (vft/hft)	0.007
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.86
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.3941
Undeveloped Runoff Coefficient (Cu)	0.877
Developed Runoff Coefficient (Cd)	0.8968
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	2.8769
Burned Peak Flow Rate (cfs)	2.8769
24-Hr Clear Runoff Volume (ac-ft)	0.4421
24-Hr Clear Runoff Volume (cu-ft)	19258.4788



Peak Flow Hydrologic Analysis

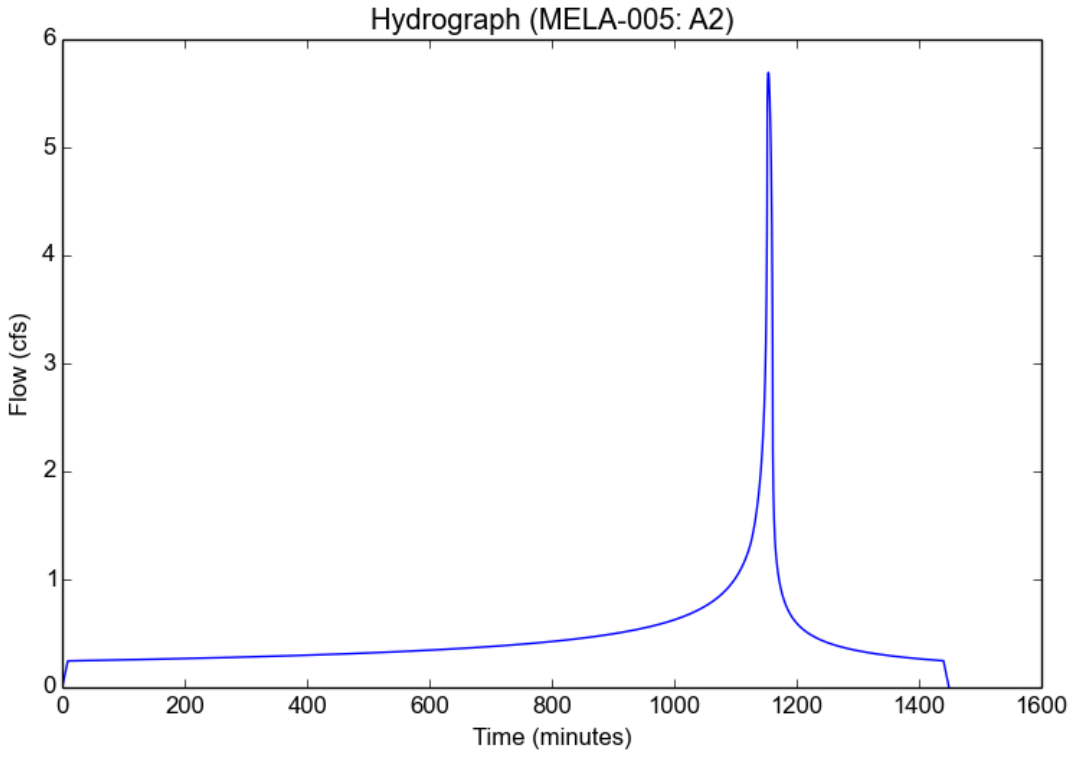
File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - A2, 25yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	A2
Area (ac)	2.81
Flow Path Length (ft)	593.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.86
Soil Type	13
Design Storm Frequency	25-yr
Fire Factor	0
LID	False

Output Results

Modeled (25-yr) Rainfall Depth (in)	5.0046
Peak Intensity (in/hr)	2.2651
Undeveloped Runoff Coefficient (Cu)	0.8601
Developed Runoff Coefficient (Cd)	0.8944
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	5.6929
Burned Peak Flow Rate (cfs)	5.6929
24-Hr Clear Runoff Volume (ac-ft)	0.9271
24-Hr Clear Runoff Volume (cu-ft)	40384.1399



Existing, Off-Site, & Proposed Conditions Hydrology Calculations (50-year Storm Event)

Peak Flow Hydrologic Analysis

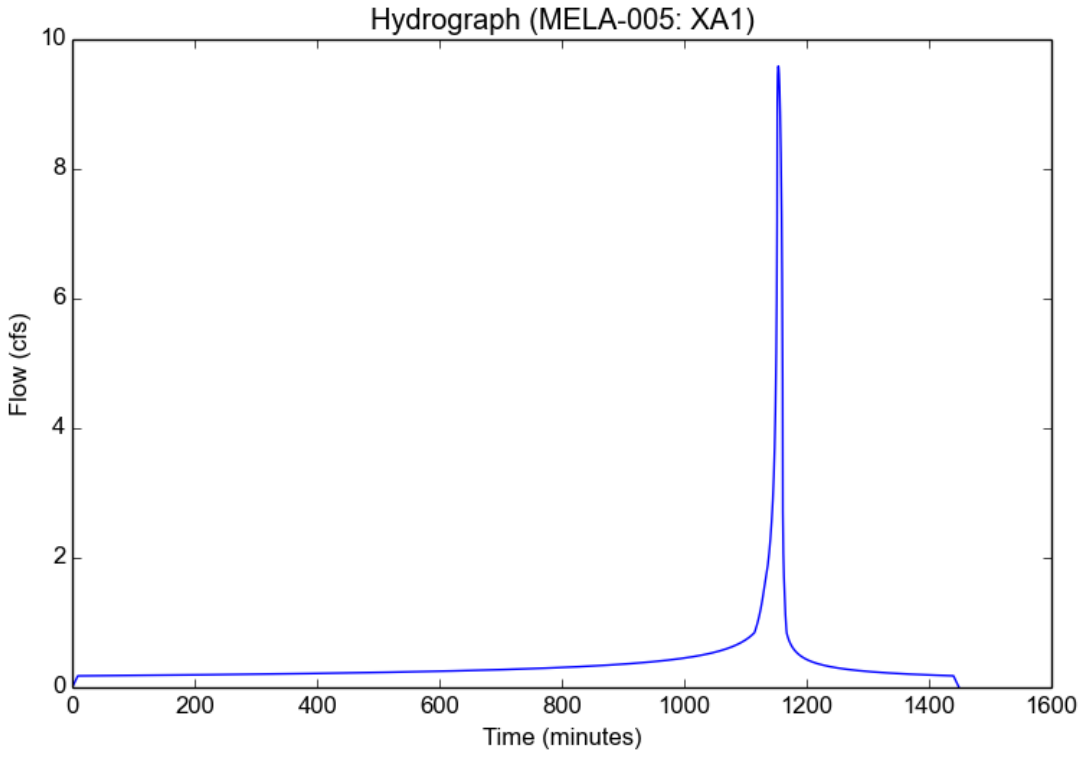
File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - XA1, 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	XA1
Area (ac)	4.14
Flow Path Length (ft)	794.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.3
Soil Type	13
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.7
Peak Intensity (in/hr)	2.5799
Undeveloped Runoff Coefficient (Cu)	0.8966
Developed Runoff Coefficient (Cd)	0.8976
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	9.5875
Burned Peak Flow Rate (cfs)	9.5875
24-Hr Clear Runoff Volume (ac-ft)	0.773
24-Hr Clear Runoff Volume (cu-ft)	33672.462



Peak Flow Hydrologic Analysis

File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - OA1, 50yr.pdf
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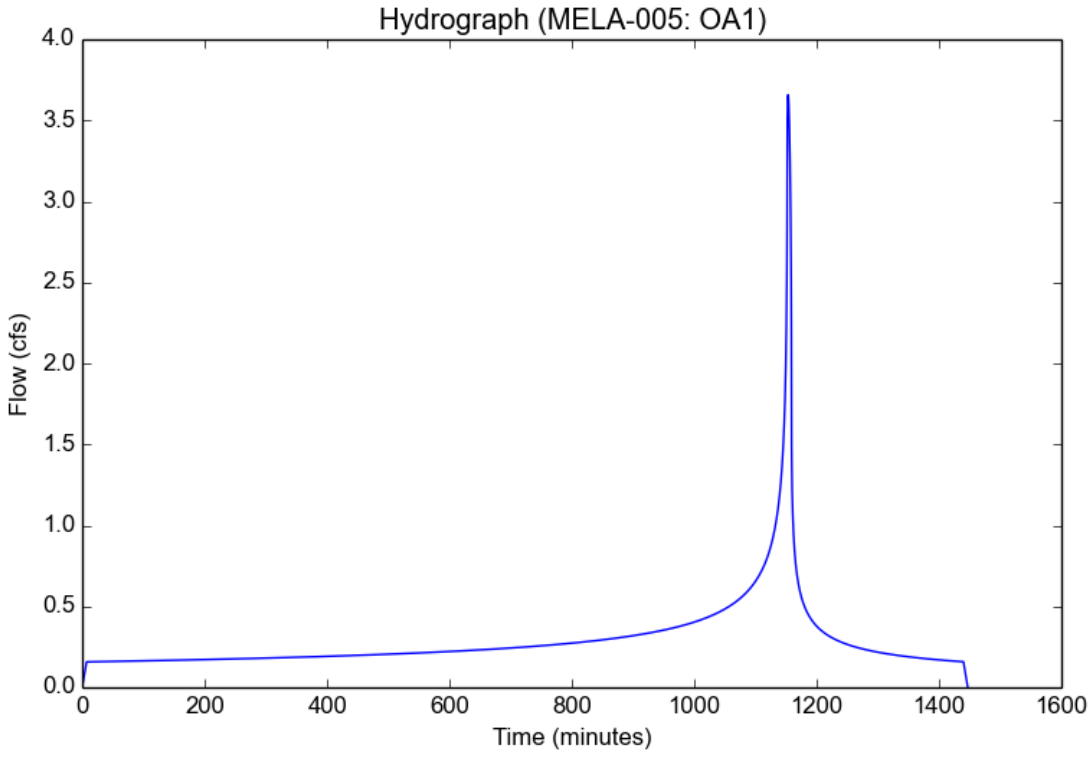
Project Name	MELA-005
Subarea ID	OA1
Area (ac)	1.4
Flow Path Length (ft)	548.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.99
Soil Type	13
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.7
Peak Intensity (in/hr)	2.9033
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	3.6582
Burned Peak Flow Rate (cfs)	3.6582
24-Hr Clear Runoff Volume (ac-ft)	0.5888
24-Hr Clear Runoff Volume (cu-ft)	25648.362



Peak Flow Hydrologic Analysis

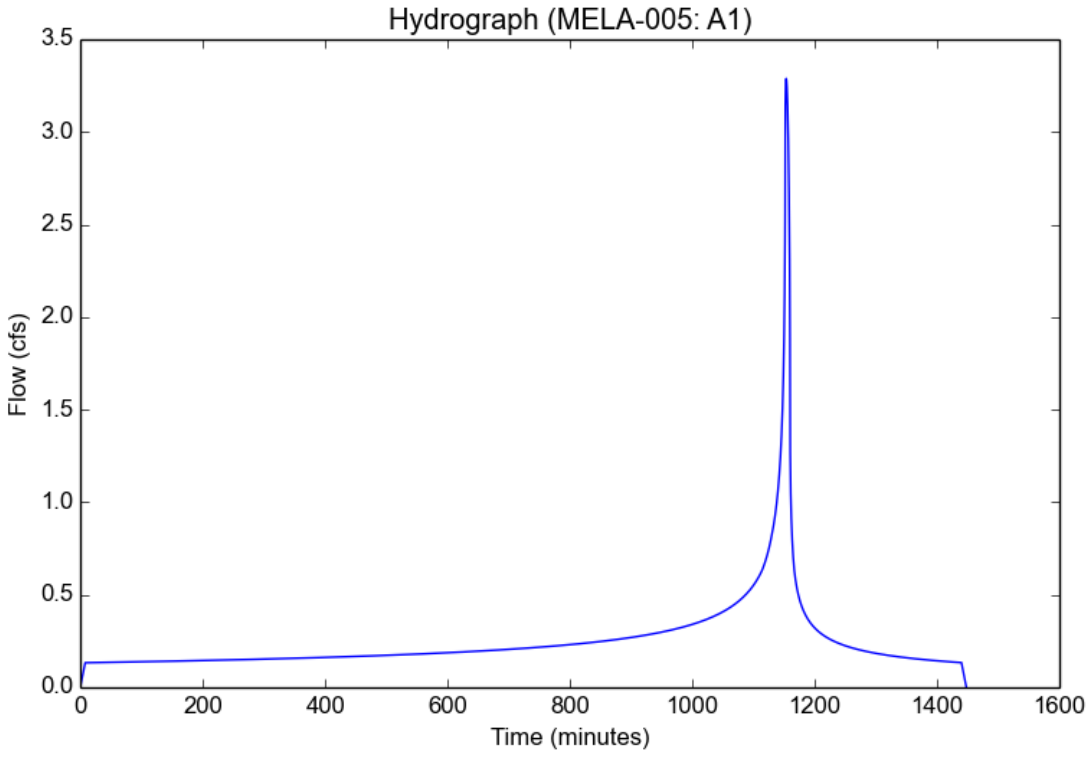
File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - A1, 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	A1
Area (ac)	1.34
Flow Path Length (ft)	514.0
Flow Path Slope (vft/hft)	0.007
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.86
Soil Type	13
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.7
Peak Intensity (in/hr)	2.7267
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	3.2884
Burned Peak Flow Rate (cfs)	3.2884
24-Hr Clear Runoff Volume (ac-ft)	0.5045
24-Hr Clear Runoff Volume (cu-ft)	21976.8913



Peak Flow Hydrologic Analysis

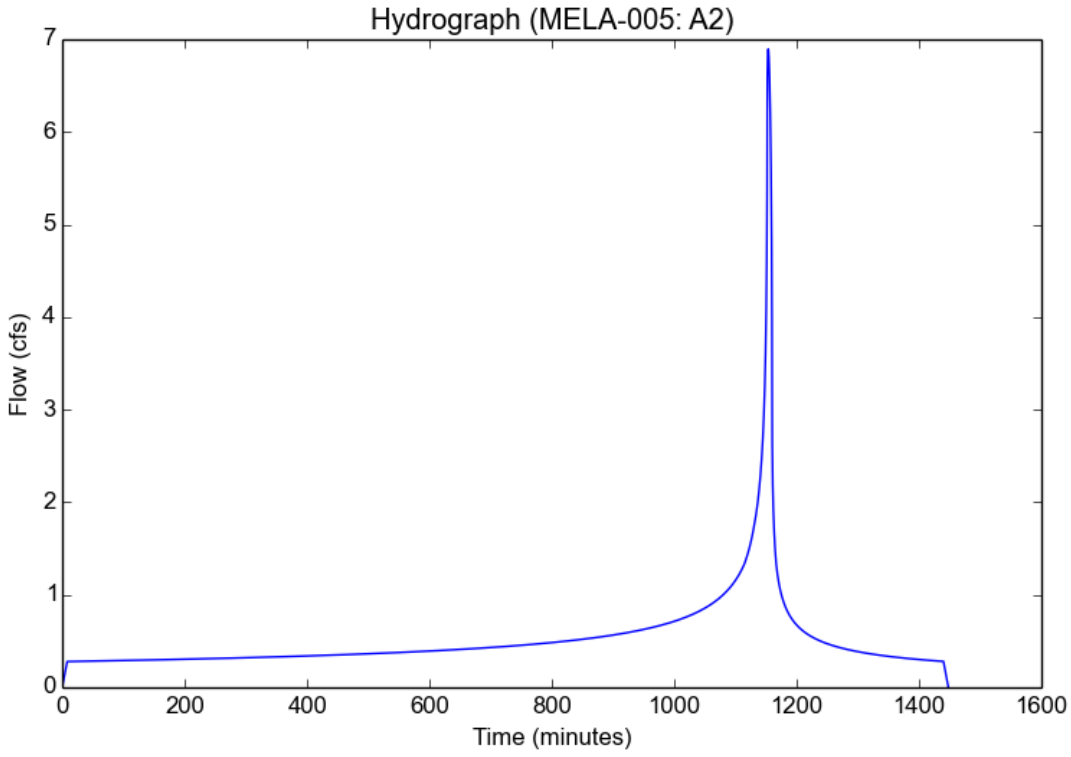
File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - A2, 50yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	A2
Area (ac)	2.81
Flow Path Length (ft)	593.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.86
Soil Type	13
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	5.7
Peak Intensity (in/hr)	2.7267
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	8.0
Clear Peak Flow Rate (cfs)	6.8959
Burned Peak Flow Rate (cfs)	6.8959
24-Hr Clear Runoff Volume (ac-ft)	1.058
24-Hr Clear Runoff Volume (cu-ft)	46085.869



Existing, Off-Site, & Proposed Conditions Hydrology Calculations (100-year Storm Event)

Peak Flow Hydrologic Analysis

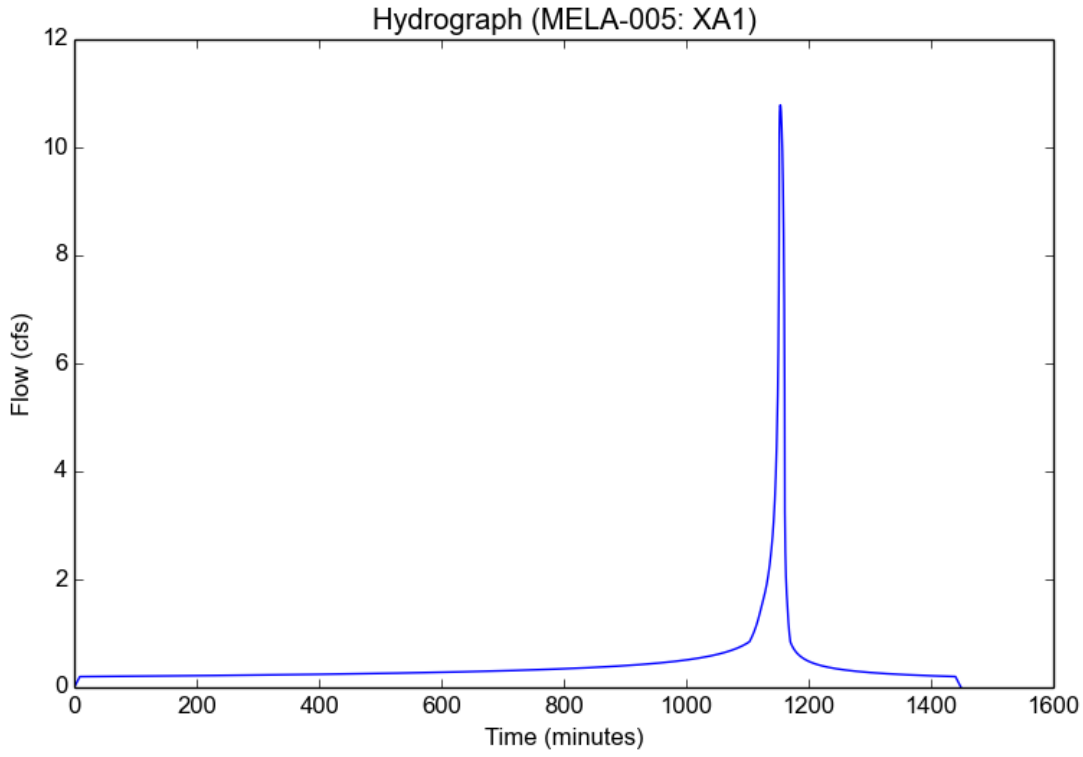
File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - XA1, 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	XA1
Area (ac)	4.14
Flow Path Length (ft)	794.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.3
Soil Type	13
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	6.3954
Peak Intensity (in/hr)	2.8946
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	9.0
Clear Peak Flow Rate (cfs)	10.7854
Burned Peak Flow Rate (cfs)	10.7854
24-Hr Clear Runoff Volume (ac-ft)	0.8835
24-Hr Clear Runoff Volume (cu-ft)	38483.7784



Peak Flow Hydrologic Analysis

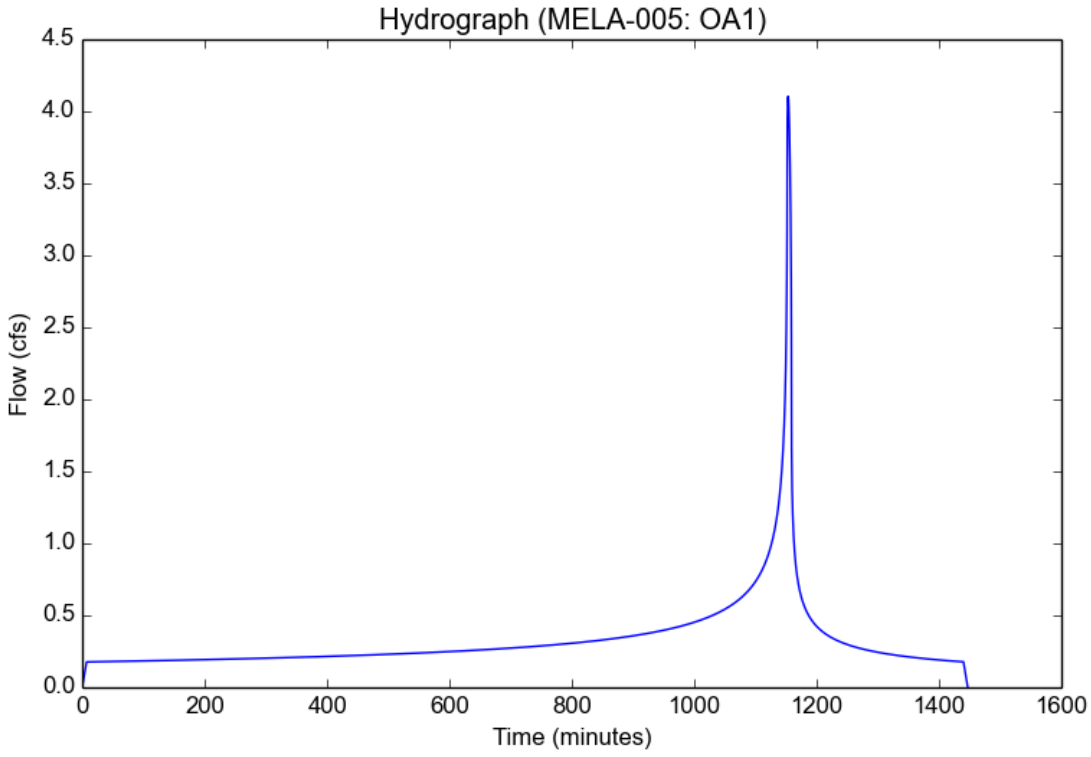
File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - OA1, 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	OA1
Area (ac)	1.4
Flow Path Length (ft)	548.0
Flow Path Slope (vft/hft)	0.011
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.99
Soil Type	13
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	6.3954
Peak Intensity (in/hr)	3.2575
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	4.1045
Burned Peak Flow Rate (cfs)	4.1045
24-Hr Clear Runoff Volume (ac-ft)	0.6607
24-Hr Clear Runoff Volume (cu-ft)	28780.7318



Peak Flow Hydrologic Analysis

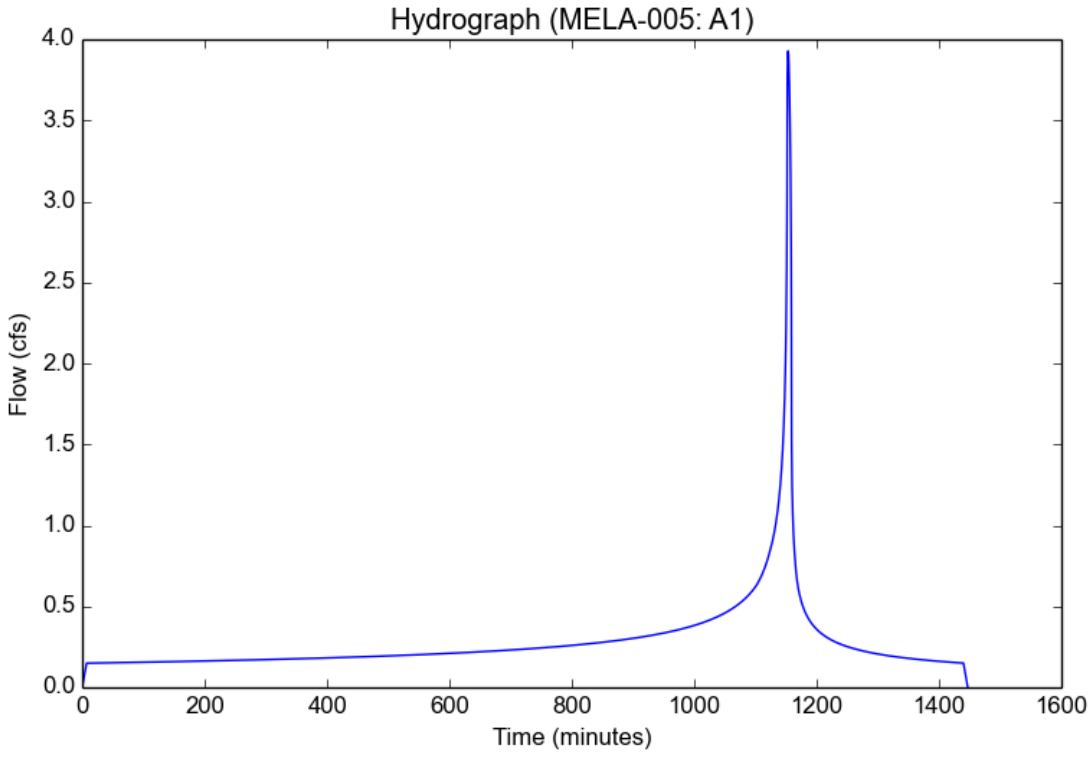
File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - A1, 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	A1
Area (ac)	1.34
Flow Path Length (ft)	514.0
Flow Path Slope (vft/hft)	0.007
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.86
Soil Type	13
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	6.3954
Peak Intensity (in/hr)	3.2575
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	3.9286
Burned Peak Flow Rate (cfs)	3.9286
24-Hr Clear Runoff Volume (ac-ft)	0.567
24-Hr Clear Runoff Volume (cu-ft)	24700.0917



Peak Flow Hydrologic Analysis

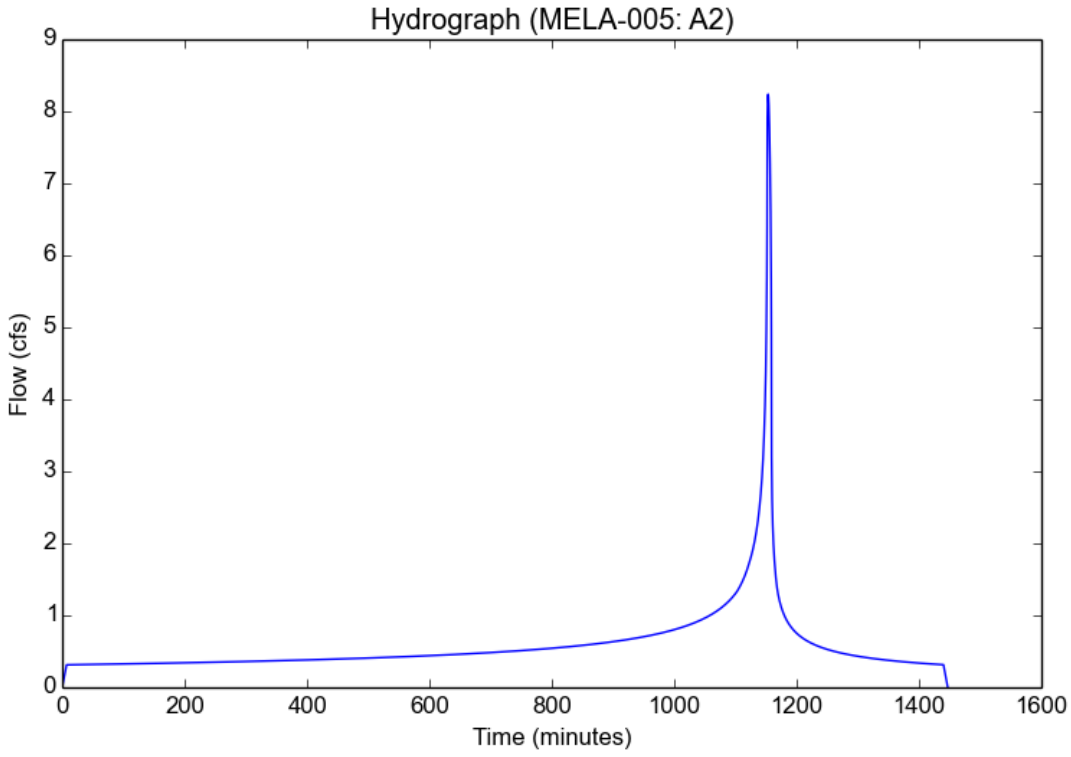
File location: P:/M/MELA-005/Admin/Reports/Hydrology/Appendix B - Hydrology Calculations (Hydro Calc)/MELA-005 - A2, 100yr.pdf
Version: HydroCalc 1.0.3

Input Parameters

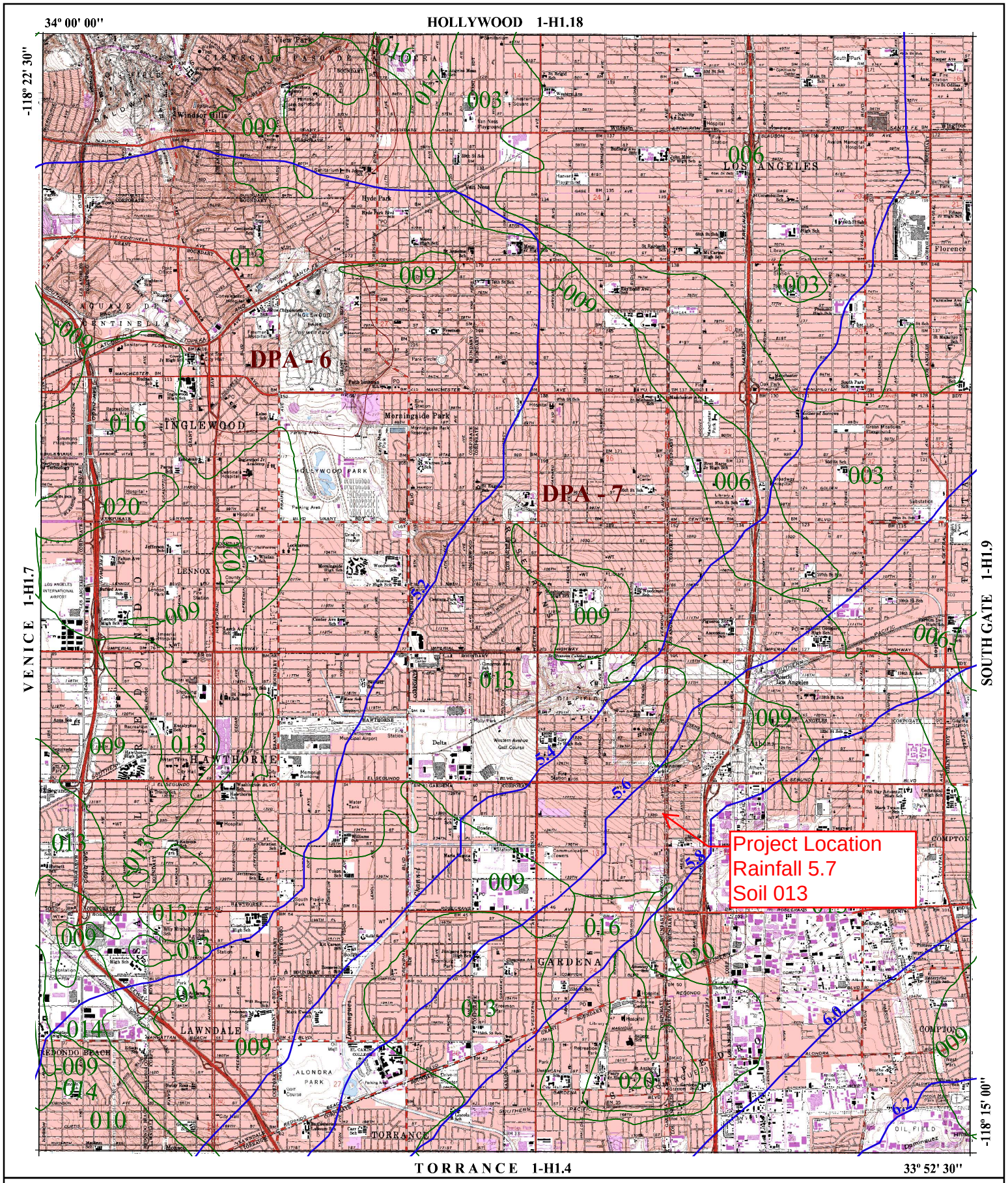
Project Name	MELA-005
Subarea ID	A2
Area (ac)	2.81
Flow Path Length (ft)	593.0
Flow Path Slope (vft/hft)	0.01
50-yr Rainfall Depth (in)	5.7
Percent Impervious	0.86
Soil Type	13
Design Storm Frequency	100-yr
Fire Factor	0
LID	False

Output Results

Modeled (100-yr) Rainfall Depth (in)	6.3954
Peak Intensity (in/hr)	3.2575
Undeveloped Runoff Coefficient (Cu)	0.9
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	8.2383
Burned Peak Flow Rate (cfs)	8.2383
24-Hr Clear Runoff Volume (ac-ft)	1.1891
24-Hr Clear Runoff Volume (cu-ft)	51796.4609



APPENDIX C
Isohyet



016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

N W E S

1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

INGLEWOOD
50-YEAR 24-HOUR ISOHYET

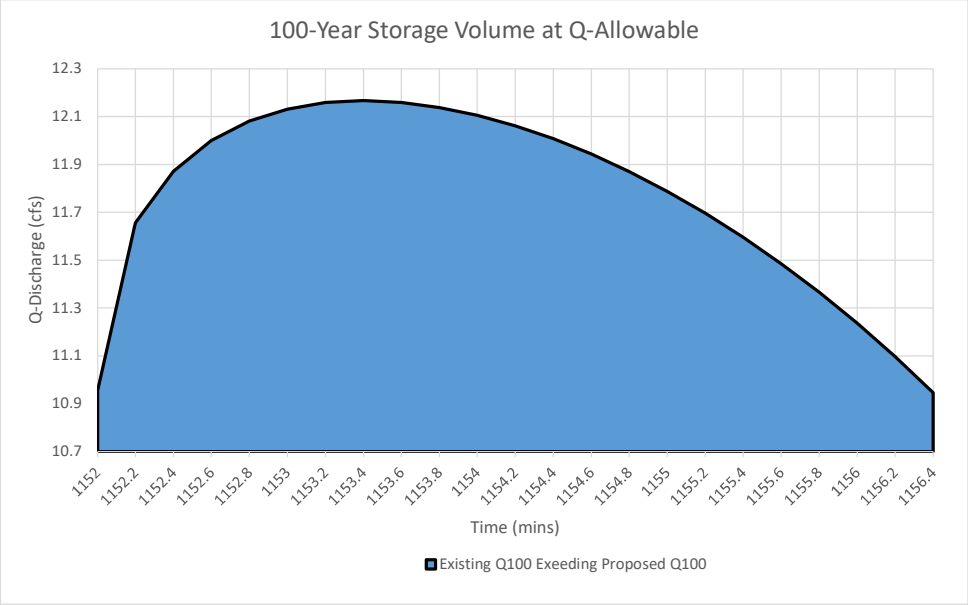
1-H1.8

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

APPENDIX D
Hydraulic Calculations

Q-100 HydroCalc Outputs based on Existing Q100 = **10.79**

	Subarea				
	A1	A1			
Time (mins)	Q100 (CFS)	Q100 (CFS)	Total Q100 (cfs)	▲Q100 (cfs)	Area Under Curve
1152	3.511051564	7.444485271	10.95553684	0.17013684	0.104082552
1152.2	3.735565772	7.920522916	11.65608869	0.87068869	0.19571681
1152.4	3.804722799	8.067156611	11.87187941	1.08647941	0.230149579
1152.6	3.845916576	8.154499807	12.00041638	1.21501638	0.251150827
1152.8	3.872028004	8.209863887	12.08189189	1.29649189	0.264308366
1153	3.888084108	8.243907658	12.13199177	1.34659177	0.271995133
1153.2	3.896662705	8.262096863	12.15875957	1.37335957	0.275489966
1153.4	3.899284414	8.267655674	12.16694009	1.38154009	0.275571911
1153.6	3.896925325	8.262653696	12.15957902	1.37417902	0.272751891
1153.8	3.89024676	8.248493131	12.13873989	1.35333989	0.267380877
1154	3.879712194	8.226156682	12.10586888	1.32046888	0.259706654
1154.2	3.865652264	8.196345403	12.06199767	1.27659767	0.249906136
1154.4	3.848303305	8.159560391	12.0078637	1.22246370	0.238104834
1154.6	3.827831223	8.11615342	11.94398464	1.15858464	0.224389053
1154.8	3.804346706	8.066359182	11.87070589	1.08530589	0.208813681
1155	3.77791497	8.010315951	11.78823092	1.00283092	0.191407122
1155.2	3.748561831	7.948078468	11.6966403	0.91124030	0.172174268
1155.4	3.716277148	7.879625231	11.59590238	0.81050238	0.151097992
1155.6	3.681016176	7.804861365	11.48587754	0.70047754	0.128139426
1155.8	3.642699093	7.723617625	11.36631672	0.58091672	0.103237106
1156	3.601208741	7.635645601	11.23685434	0.45145434	0.076304943
1156.2	3.556386378	7.540608711	11.09699509	0.31159509	0.047228821
1156.4	3.508025023	7.438068094	10.94609312	0.16069312	0.016069312
				Total	**4.475177259**
				Volume (cf)	**269**



Urbanpond Storage Calculations			
Depth of Module (FT)	**Module Storage (CF)**	**Total Required Storage (CF)**	**Required Number of Modules (LF)**
6	357	269	1
7	417		1
8	477		1

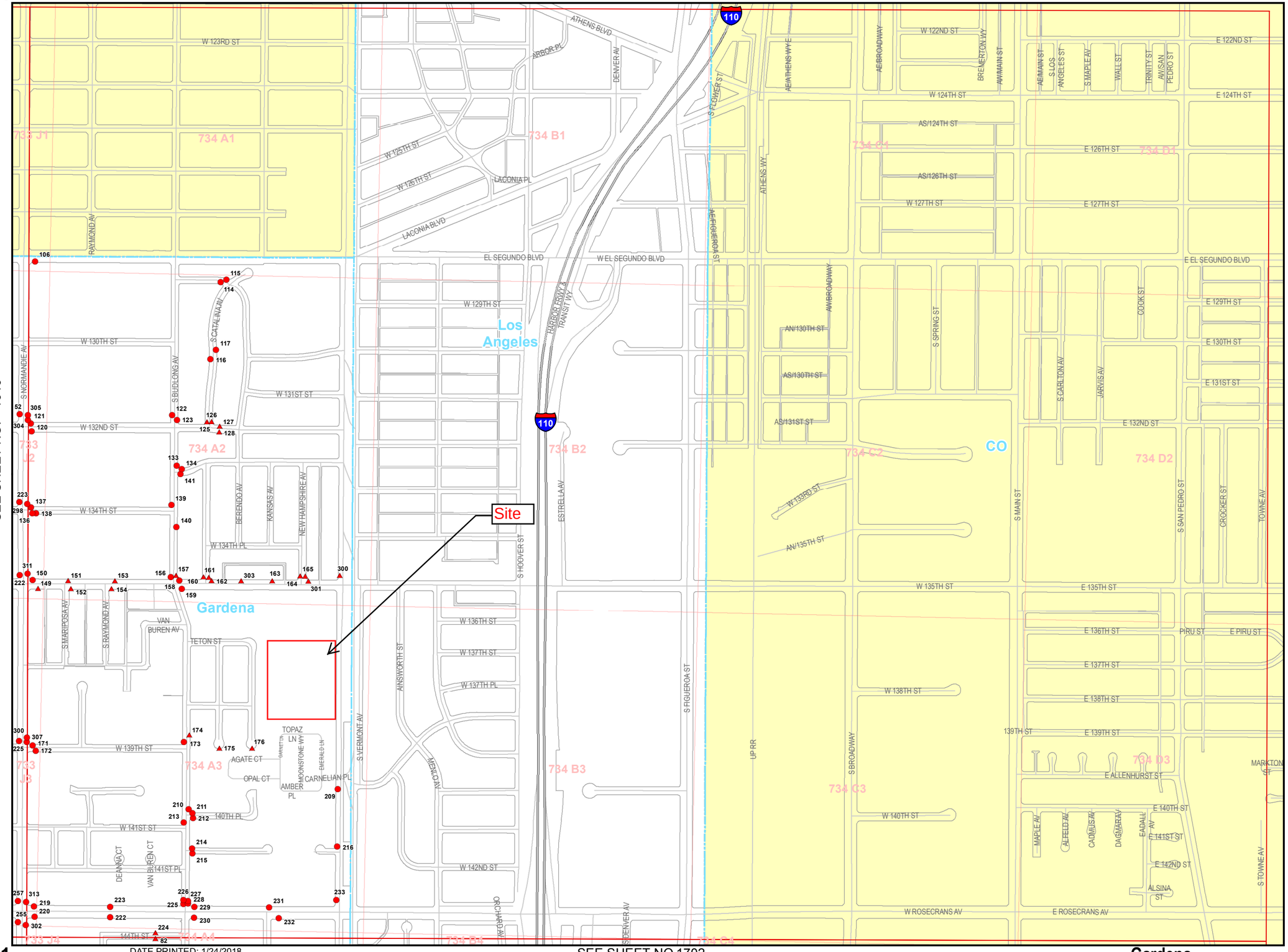
APPENDIX E
As-builts & References

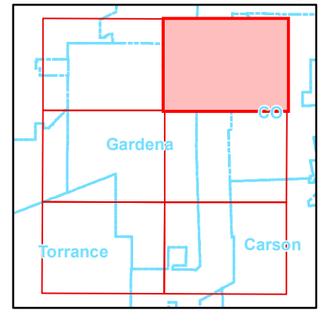
SEE SHEET NO. 1700

1701

SEE SHEET NO. 1646

SEE SHEET NO. 1756





THIS MAP IS INTENDED FOR USE ONLY AS OPERATIONS MAP BY LOS ANGELES COUNTY CONSTRUCTION DIVISION. LOS ANGELES COUNTY EXPRESSLY DISCLAIMS ANY LIABILITY FOR ANY INACCURACIES WHICH MAY BE PRESENT IN THIS MAP.

N
W E
S

CATCH BASINS

- ▲ CITY
- ● LACFCD
- ■ UNKNOWN

NUMBER OF CATCH BASINS TO BE CLEANED ON THIS PAGE:

Gardena
CITY: 23
LACFCD: 45

TOTAL : 68

PRELIMINARY LOW IMPACT DEVELOPMENT PLAN (LID)

Prepared for:
Melia Homes
Attention: Chad Brown
8951 Research Dr. #100
Irvine, CA 92618

Property:
Tentative Tract 83037
13615 & 13633 South Vermont Ave.
Gardena, California
APN: 6115-019-042, -043, -044 & -045

Prepared by:
C&V Consulting, Inc.
6 Orchard, Suite 200
Lake Forest, California 92630
(949) 916-3800
Contact: Mr. Dane P. McDougall, P.E.

Preparation Date:
March 2020

Receipt of WDID

To be provided prior to final approval

Notice of Intent

To be provided prior to final approval

Table of Contents

SECTION PAGE

List of Figures

List of Appendices

Owner/Developer
Approval and Certification
of the
Low Impact Development Plan

Project Name: **Evergreen Project**

Project Number: **Tract 83037**

Project Address: **13615 & 13633 South Vermont Ave.**

This Preliminary Low Impact Development Plan (LID) for the **13615 & 13633 South Vermont Ave.** development has been prepared for City Ventures by C&V Consulting, Inc. It is intended to comply with the requirements of the City of Gardena's Conditions of Approval.

The undersigned is authorized to approve implementation of provisions of this plan as appropriate, and will strive to have the plan carried out by successors consistent with the County of Los Angeles Low Impact Development Plan and the intent of the NPDES storm water requirements.

"I certify under penalty of law that this document and all attachments were prepared under my jurisdiction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathered the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Owner/Developer Signature Date

Owner/Developer's Name and Title Telephone Number

Section 200

A. Contact Information/List of Responsible Parties

The homeowner's association (HOA) contact information is:

Contact: TBD
Phone: TBD
The Homeowner's Association

The HOA shall have primary responsibility and significant authority for the implementation, maintenance, and inspection of the property Best Management Practices (BMPs). Duties include, but are not limited to:

- Implementing all elements of the Low Impact Development Plan, including but not limited to:
  - Implementation of prompt and effective erosion and sediment control measures
  - Implementing all non-storm water management, and materials and waste management activities, such as: monitoring, discharges, general site clean-up; vehicle and equipment cleaning, spill control; ensuring that nothing other than storm water enters the storm drain system, etc.
- Pre-storm inspections
- Storm event inspections
- Post-storm inspections
- Routine inspections as described in the Low Impact Development Plan
- Ensuring elimination of all unauthorized discharges
- The HOA shall be assigned authority to mobilize crews in order to make immediate repairs to the control measures.
- Coordinate all of the necessary corrections/repairs are made immediately, and that the project complies with the Low Impact Development Plan at all times.
- Managing and report any Illicit Connections or Illegal Discharges.

Section 300

A. References

The following documents are made a part of this Low Impact Development Plan by reference:

- Project plans and specifications for Tentative Tract No. 823037, prepared by C&V Consulting, Inc.
- State Water Resources Control Board (SWRCB) Order No. 2013-0001-DWQ, February 5, 2013.
- National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity.
- California Stormwater BMP Handbook – Construction, November 2009.
- California Stormwater BMP Handbook – New Development and Redevelopment, January 2003.
- County of Los Angeles Department of Public Works L.I.D. Standards Manual, February 2014

Section 400 – Body of LID Plan

A. Objectives

This Low Impact Development (LID) Plan has eight main objectives:

- Determination of the peak storm water runoff discharge rate.
- Conserve natural and landscaped areas.
- Minimize storm water pollutants of concern.
- Protect slopes & channels.
- Provide storm drain system stenciling & signage
- Properly design trash storage areas.
- Provide proof of ongoing BMP maintenance.
- Design standards for structural or treatment control BMPs.

B. Vicinity Map

The existing site conditions of the proposed development encompasses four parcels as shown on the Assessor's Parcel map, last updated in 2006, at approximately 4.14 acres. The project is bounded by The Oasis apartment complex to the north, S Vermont Ave. to the east, Villa Vermont Mobile Homes to the south, and a residential neighborhood to the west. Currently, most of the site is a plant nursery that consists of various shade structures connected by dirt and concrete paths. In the northeastern corner of the site there is also a small motel that has a small paved parking lot. (See Figures 1 & 2 for a Location Map of the project site)

C. Project Background and Description

The 4.14 acre site is located on the west side of S. Vermont Ave. south of W135th St., in the City of Gardena, California. The site is located at 13615 & 13633 S. Vermont Ave. The site is rectangular in shape and consists of 2 lots. The largest of the 2 lots is an existing nursery consisting of various dirt and concrete walks and planting beds. The nursery lot also has a large structure that acts as the main facility for the rest of the nursery. The other lot is a small motel in the northest corner of the lot. The motel lot has a small asphalt concrete parking lot and a small motel building on it.

The proposed project consists of 83-85 3-story residential townhome units over the approximately 4.14 acre site. Associated improvements such as curb & gutter, drive aisles, and parking areas are included. A recreation/open space area is proposed in the middle of site. The existing pavement/parking areas and other miscellaneous leftover improvements within the property will be demolished while conflicting utilities will be relocated. A drywell infiltration system will be proposed to treat runoff.

The pre-developed condition has 70% (2.92 acres) pervious area and 30% (1.23 acres) impervious area. The proposed development condition is assumed to have 14% (0.58 acres) pervious area and 86% (3.56 acres) impervious area.

Various site design principles and source control BMPs have been implemented into the project in addition to those listed in Section G, Tables 1 and 2. These additional principles/BMPs include: The consideration and use of an infiltration device for treatment; Design of site to overflow to the drainage easement along the western property line which ultimately drains into Berendo Ave; Conservation of native soil and planting if feasible. New vegetation shall be native or drought tolerant; Surface flow patterns in the proposed condition were maintained as closely as possible to the existing condition; imperverious area minimized as only 30% of the existing site is impervious. The proposed condition increases pervious area by adding planted landscaping to areas such as open space and adjacent to parking/sidewalk; Roads and sidewalks were kept to the allowable minimum per City of Gardena standards; Additional tree native and/or drought tolerant tree planting in comparison to the existing condition which had close to no onsite trees; and the Implementation of Integrated Best Management practices.

D. Existing Site Drainage Condition

The site generally slopes from East to West and North to South away from Vermont Ave. The site ranges in elevations from 71 to 80 feet above sea level, based on the aerial flown on 10/25/2019. The existing drainage pattern of the site is generally split into two areas: the small motel in the northeast corner of the lot and the nursery which encompasses the rest of the site. The small motel's drainage pattern generally sheet flows over the existing parking lot east to west into through a chain link fence at the parking lot's western end. Stormwater then flows onto the dirt lot of the adjacent nursery. The nursery's drainage pattern is all sheet flow over the existing developed parking lot, walkways, and planter beds. All flows from the nursery are collected so a single grate inlet catch basin located at the southwest corner of the site. This catch basin is then connected pipes that flow underneath the adjacent property and into Berendo Ave.

In the existing condition there is cross-lot drainage from the apartment complex in the north. Flows from this lot are directed with ribbon gutters to the western edge of the lot where a natural swale conveys stormwater south onto the site. These off-site flows are allowed by the existing drainage easement along the westerly property line. In the proposed condition, these off site flows will be conveyed via a natural swale located on the western edge of the property to the existing gate inlet catch basin located at the southwest corner of the site in order to match the existing drainage pattern of the adjacent property.

E. LID Project Types, Characteristics, & Activities

This proposed development of 83 dwelling units is subject to the Los Angeles Regional Water Quality Control Board NPDES Permit requirement for the LID under the "Designated Projects - Redevelopment category which is defined in the County of Los Angeles LID Manual as "projects that result in creation or addition or replacement of either more than 5,000 ft^2 or more of impervious surface on a site that was previously developed."

F. Pollutant Source Identification and BMP Selection

The following is a list of materials to be used in the daily activities at the project site, which will potentially contribute to pollutants, other than sediment, to storm water runoff. Source Control Practices for each activity are identified below:

Pollutants generated per Table 2-1 of the California Stormwater BMP Handbook for New Development and Redevelopment:

From the Attached Residential Development Priority Project category, the project has potential pollutants of Pathogens, Oxygen Demanding Substances, Oil and Grease. Anticipated pollutants are Nutrients, Pesticides, Sediments, Trash and Debris.

From the Parking Lots Priority Project category, the project has potential pollutants of Nutrients, Pesticides, Sediments, and Oxygen Demanding Substances. Anticipated pollutants are Heavy Metals, Trash and Debris, and Oil and Grease

The Best Management Practices (BMPs) that have been selected for implementation on this project are detailed in the following sections.

G. Structural BMPs

The County of Los Angeles LID Standards Manual lists preference for selection of BMPs which includes retention-based stormwater quality control measures, biofiltration, vegetation-based storm quality control measures, and/or treatment-based stormwater quality control measures. This project has selected retention-based stormwater quality control measure in the form of a drywell with a pretreatment chamber.

As infiltration is the primary mechanism for reducing stormwater runoff for all retention-based stormwater quality control measures, this mechianism was selected for the site. Additionally, roof gutters will discharge to landscape areas using splash blocks when possible creating a passive bio treatment in small planter areas prior to interception by an area drain system, catch basin, and storm drain system. All runoff from the site is tributary to the proposed onsite drywell infiltration system. Harvest and reuse measures were also considered as infeasible for this type of development due to the size of the buildings and the number of downspouts for each building. The cost of providing cisterns and pumps throughout the site would be cost prohibitive and is only effective during the rainy season.

The implementation of a drywell is considered as a retention-based storm quality measure and uses infiltration as the primary mechanism to treat stormwater. A drywell was selected for their reduced footprint and ability to maximize the infiltration surface area with minimal footprint.

Structural BMPs shall be installed by Melia Homes, the developer, through the construction and development of the project; planting and irrigation systems shall be designed by licensed landscape architects and installed by qualified contractors to specifications and standards of the City of Gardena. The structural BMPs used for this project are summarized below.

Project proponents shall implement site design concepts that achieve each of the following:

- Minimize Storm Water Pollutants of Concern
- Peak Storm Water Runoff Discharge Rate

The following tables identify the source control and treatment BMPs and how each is implemented to achieve each site design concept.

Table-1: Site Design BMPs

BMP	TECHNIQUE	INCLUDED? YES	INCLUDED? NO	BRIEF DESCRIPTION OF METHOD
SD-10	Site Design & Landscape Planning	X		
SD-11	Roof Runoff Controls	X		
SD-12	Efficient Irrigation	X		
SD-13	Storm Drain Signage	X		
SD-20	Pervious Pavements		X	Site design does not allow for this BMP.
SD-21	Alternative Building Materials		X	Not Applicable
SD-30	Fueling Areas		X	Not Applicable
SD-31	Maintenance Bays & Docks		X	Not Applicable
SD-32	Trash Storage Areas		X	Not Applicable
SD-33	Vehicle Washing Areas		X	Not Applicable
SD-34	Outdoor Material Storage Areas		X	Not Applicable
SD-35	Outdoor Work Areas		X	Not Applicable
SD-36	Outdoor Processing Areas		X	Not Applicable

Roof Runoff Controls
All roof runoff will be collected and directed to splash blocks then onto grass or vegetated swales before discharging to the street or storm drain system. Area drains within the onsite landscaping between buildings within DMA 1 will flow to onsite drywell infiltration system where flows will be treated.

Efficient Irrigation
As part of the design of all common area landscape irrigation shall employ water conservation principals, including, but not limited to, such provisions as water sensors, programmable irrigation times (for short cycles), etc., will be used. Such common areas will be maintained by the HOA.

Storm Drain Signage
Storm Drain Signage will be provided on all proposed on-site catch basins to prevent residence from discarding pollutants to the storm drain system and potentially obstructing the proposed BMP treatment facility. The placard or stencil will indicate the ultimate destination of the runoff entering the device. This stencil shall be weatherproof and visible at all times. The HOA will be responsible for maintaining the signage after the construction is completed. See Appendix D for an example.

Table-2: Source Control BMPs

BMP	TECHNIQUE	INCLUDED? YES	INCLUDED? NO	BRIEF DESCRIPTION OF METHOD
S-1	Storm Drain Message and Signage	X		
S-2	Outdoor Material Storage Area		X	Not Applicable
S-3	Outdoor Trash Storage and Waste Handling Area		X	No Trash Enclosures
S-4	Outdoor Loading/Unloading Dock Area		X	No Loading Dock Areas
S-5	Outdoor Vehicle/Equipments Repair/Maintenance Area		X	No Maintenance Bays
S-6	Outdoor Vehicle/Equipments/Accessory Washing Area		X	No Wash Areas
S-7	Fuel and Maintenance Area		X	No Fueling Areas
S-8	Landscape Irrigation Practices	X		
S-9	Building Materials Selection	X		
S-10	Animal Care and Handling Facilities		X	No Animal Care Facility
S-11	Outdoor Horticulture Areas		X	Not Applicable

Storm Drain Message and Signage
Storm Drain Signage will be provided on all proposed on-site catch basins to prevent residence from discarding pollutants to the storm drain system and potentially obstructing the proposed BMP treatment facility. The placard or stencil will indicate the ultimate destination of the runoff entering the device. This stencil shall be weatherproof and visible at all times. The HOA will be responsible for maintaining the signage after the construction is completed. See Appendix B for an example.

Landscape Irrigation Processes
Management programs will be designed and established by the HOA, who will maintain the common areas within the project site. These programs will include how to mitigate the potential dangers of fertilizer and pesticide usage (refer to the Maintenance and Frequency Table).

Ongoing maintenance will be consistent with the State of California Model- Water Efficient Landscape Ordinance. Fertilizer and pesticide usage shall be consistent with County Management Guidelines for use of Fertilizers and Pesticides.

Building Materials Selection
Material selection will minimize the use of copper, galvanized metals and other materials that could add significant amounts of harmful pollutants to stormwater runoff.

Table-3: Stormwater Quality Control BMPs

BMP	NAME	INCLUDED?		IF NOT APPLICABLE, STATE BRIEF REASON
		YES	NO	
RET-1	Bioretention		X	Used alternative method – RET-4
RET-2	Infiltration Basin		X	Used alternative method – RET-4
RET-3	Infiltration Trench		X	Used alternative method – RET-4
RET-4	Drywell	X		
RET-5	Permeable Pavement without an Underdrain		X	Space not avaible for BMP
RET-6	Rain Barrel/Cistern		X	Used alternative method – RET-4
BIO-1	Biofiltration		X	Used alternative method – RET-4
VEG-1	Green Roof		X	Space not availbe for BMP
VEG-2	Stormwater Planter		X	Used alternative method – RET-4
VEG-3	Tree-Well Filter		X	Used alternative method – RET-4
VEG-4	Vegetated Swales		X	Space not avaible for BMP
VEG-5	Vegetaded Filter Strip		X	Space not avaible for BMP
T-1	Sand Filter		X	Space not avaible for BMP
T-2	Constructed Wetland		X	This is not a wetland area/ development
T-3	Extended Detention Basin		X	Space not avaible for BMP
T-4	Wet Pond		X	This is not a wetland area/ development
T-5	Permeable Pavement with an Underdrain		X	Space not avaible for BMP,

RET-4 Drywell
Storm water will enter the drywell unit via curb openings throughout the site and flow via pipe directly onto specially designed pretreatment chamber. The pretreatment chamber is designed intercept the majority of the first flows during a rain event and reduce the impact of sediment and debris on the system. After the pretreatment chamber fills up stormwater will flow into the main

drywell system where it will be infiltrated. A detention system located upstream of the drywell will have a high-flow bypass inlet for flows greater than the 85th percentile storm event. See Appendix A for drywell sizing calculations.

H. Non-Structural BMPs

Non-structural BMPs are generally managerial, educational, inspection and/ or maintenance oriented. These items consist of educating employees and occupants, developing and implementing HOA guidelines, implementing BMPs and enforcing Code requirements. Non-structural BMPs used for this project are summarized below:

Education for Employees and Occupants

Practical informational materials will be provided to occupants, the HOA and employees on general good housekeeping practices that contribute to protection of storm water quality. Among other things, these materials will describe the use of chemicals (including household type) that should be limited to the property, with no discharge of specified wastes via hosing or other direct discharge to gutters, catch basins and storm drains.

This program must be maintained, enforced, and updated periodically by the HOA. Educational materials including, but not limited to, the materials included in the Appendix F of this plan will be made available to the employees and contractors of the HOA.

Activity Restrictions

Activities on this site will be limited to activities related to residential living. The Conditions, Covenants, and Restrictions (CC&Rs) will outline the activities that are restricted on the property. Such activities related to the LID include car washing, car maintenance and disposal of used motor fluids, pet waste cleanup, and trash container areas.

Common Area Landscape Management

Management programs will be designed and established by the HOA, who will maintain the common areas within the project site. These programs will include how to mitigate the potential dangers of fertilizer and pesticide usage, require that fertilizer and pesticide usage shall be consistent with City and County guidelines, discuss utilization of water-efficient landscaping practices, require that maintenance be consistent with any Los Angeles county water conservation resolutions or City of Whittier equivalent, and detail the proper disposal of landscape wastes. Ongoing maintenance will be consistent with the State of California Model Water-Efficient Landscape Ordinance. Fertilizer and pesticide usage shall be consistent with County Management Guidelines for use of Fertilizers and Pesticides.

Common Area Litter Control

The HOA will be required to implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water. The HOA may also contract with their landscape maintenance firm to provide this service during regularly scheduled maintenance, which should consist of litter patrol, emptying of trash receptacles in common areas, and noting trash disposal violations and reporting the violations to the HOA for remediation.

Street Sweeping in Private Streets and Parking Lots
The HOA shall have all streets and parking lots swept on a weekly basis. This procedure will be intensified around October 15th of each year prior to and throughout rain storm period.

Drainage Facility Inspection & Maintenance
The HOA will be responsible for implementing each of the BMPs detailed in this plan. The HOA will also be responsible for cleaning and maintaining the BMPs on a regular basis. Refer to Appendix G for the Operation and Maintenance Plan. Refer to Appendix B for site specific drainage BMP information.

Title 22 CC&R Compliance
The HOA will comply with this Regulation as part of the development's CC&Rs. CC&Rs will be prepared as a separate document and reviewed by the City's Attorney.

Uniform Fire Code Implementation
The HOA will comply with this Code as part of the development's CC&Rs. CC&Rs will be prepared as a separate document and reviewed by the City's Attorney

Employee Training/Education Program
A training program will be established as it would apply to future employees, contractors, and homeowners of the HOA to inform and train in maintenance activities regarding the impact of dumping oil, paints, solvents, or other potentially harmful chemicals into storm drains; the proper use of fertilizers and pesticides in landscaping maintenance practices; and the impacts of littering and improper water disposal.

The HOA (or a hired firm) will conduct the training program which will include targeted training sessions with specific construction disciplines (landscaping, concrete finishers, painters, etc.). See Appendix F for examples of educational materials that will be provided to the Employees.

The project's O&M will include provisions for future employee training programs conducted on a yearly based prior to the rainy season.

l. BMP Maintenance, Inspection, and Repair

Inspections will be conducted as follows:

- Annually prior to the start of the rainy season (Oct. 1st- May 31st)
- Every (1) month during rainy season
- At any other time(s) or intervals of time specified in the contract documents

An inspection form shall be completed at least once per year prior to the start of the rainy season. This inspection check sheet (see Appendix G) shall be included in this report and kept onsite at all times. The check sheet should be filled out completely and clearly indicate any BMPs that are in need of repair or maintenance. These repairs and/ or maintenance procedures shall be carried out at the soonest possible time.

A legible log shall be kept on site to record the inspection of the storm water pollution abatement control measures. The record must contain the following information: (i) type of maintenance activities or source-control practices; (ii) date the activities are completed; and (iii) the name of the operator performing the activities. During transfer of ownership/operation of the facility, the current owner must notify the new owner/operator of the BMPs and the associated maintenance activities that also transfer to the new owner/operator of the property. See Appendix G.

J. Inspection, Maintenance, and Responsibility for BMPs

The following tables list the post-construction BMPs (routine non-structural and structural), the required ongoing maintenance, the inspection and maintenance frequency, the inspection criteria, and the entity or party responsible for implementation, maintenance, and/or inspection.

Table-4: Non-Structural BMP Maintenance Responsibility/Frequency Matrix

BMP	RESPONSIBILITY	FREQUENCY
Homeowner/ Business owner Education, Activity Restrictions	HOA will provide educational materials. Those materials and responsibilities must be passed onto subsequent property owners.	Continuous. CC&Rs to be provided to homeowners at the time they purchase the property and updates provided by the HOA as they occur.
Common Area Landscape Management	HOA will appoint a landscape maintenance contractor	Monthly during regular maintenance and use with management guidelines for use of fertilizers and pesticides.
Parking Areas and Drives Management	HOA will appoint a landscape maintenance contractor	The Drives Aisles are to be swept on a routine scheduled basis to facilitate the pickup of trash and debris (plant or otherwise) and to remove excessive oil, grease and build-up. During sweeping, debris is to be removed from the parking areas and drives and then scrubbed and rinsed. This sweeping schedule will be at a minimum occurrence of once a week and as necessary to rid / reduce active pollutants from the pavement areas. This maintenance requirement will be listed in the Convent, Conditions and Restrictions (CC&Rs) of this project. These CC&Rs will be recorded to the property at the County Recorder's Office and be included on the final Title report of these properties.
Litter Control by Sweeping	HOA will appoint a landscape maintenance contractor.	Weekly inspection of trash receptacles to ensure that lids are closed and pick up any excess trash on the ground, noting trash disposal violations to the HOA for remediation.

BMP	RESPONSIBILITY	FREQUENCY
Employee Training	HOA will appoint a landscape contractor after construction.	Monthly for maintenance personnel and employees to include the educational materials contained in the approved LID.
Common Area Catch Basin Inspection & Cleaning	HOA will appoint a landscape maintenance contractor for common areas and storm drain facilities.	Inspect basins once a month. Clean debris and silt in bottom of catch basins as needed. Intensified on or about October 15th each year or prior to the first 24-hour storm event, whichever occurs first. Refer to Appendix E.

Table-5: Structural BMP Maintenance Responsibility/Frequency Matrix

BMP	RESPONSIBILITY	FREQUENCY
Common Area Efficient Irrigation	HOA will appoint a landscape contractor after construction	Once a week, in conjunction with maintenance activities. Verify that runoff minimizing landscape design continues to function by checking that water sensors are functioning properly, that irrigation heads are adjusted properly to eliminate overspray to hardscape areas, and to verify that irrigation timing and cycle lengths are adjusted in accordance with water demands, given time of year, weather and day or night time temperatures.
Common Area Runoff Efficient Landscape Design	HOA will appoint a landscaping contractor	Once a week in conjunction with maintenance activities and prior to finalizing any replanting schemes. Verify that plants continue to be grouped according to similar water requirements in order to reduce excess irrigation runoff.
Catch Basin Stenciling	HOA	A warning stencil will be painted on top and in view with the words: "No-Dumping – Drains to Ocean" At all catch basin, drain inlets draining to the street or storm drain system. See Appendix "B" (example). Once every 6 months, inspect for restenciling needs. Re-stencil as needed immediately.
Maxwell Plus Drywell System	HOA	Maxwell Plus Drywell System maintenance will conform to manufacturer's specifications. Please see additional information in Appendix C
Stormwater Detention System	HOA	Stormwater detention system maintenance will conform to manufacturer's specifications.

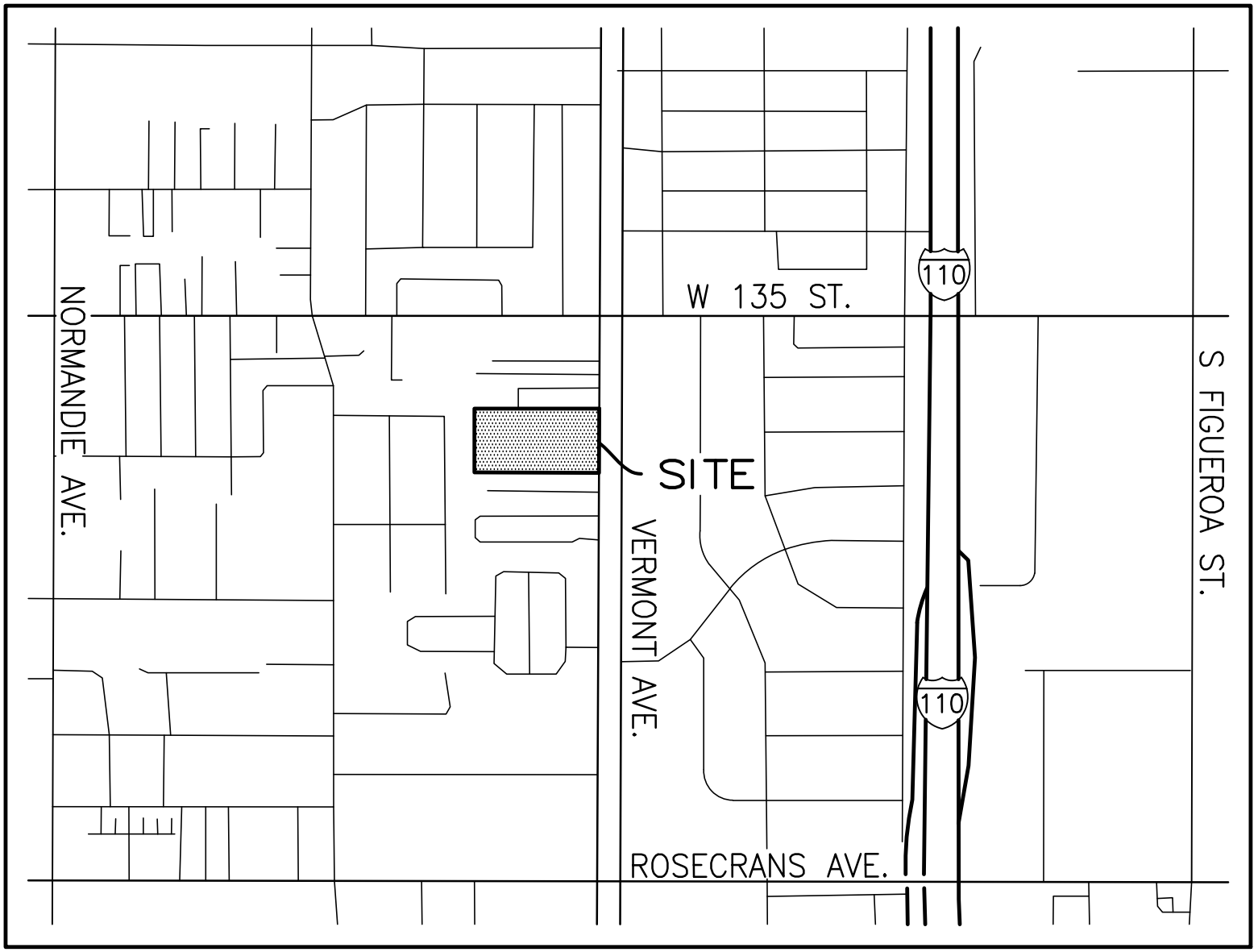
K. Operation/Maintenance Funding after Project Completion

The post-construction BMPs as described above will be funded and maintained by:

The Homeowner's Association

Maintenance and requirements of the maintenance for the properties will be listed in the Convent, Conditions and Restrictions (CC&Rs) of this project and will be the responsibility of the property owner at all times. These CC&Rs will be recorded to the property at the County Recorder's Office and be included on the Title report of these properties.

Figure -1:
Project Vicinity Map



VICINITY MAP

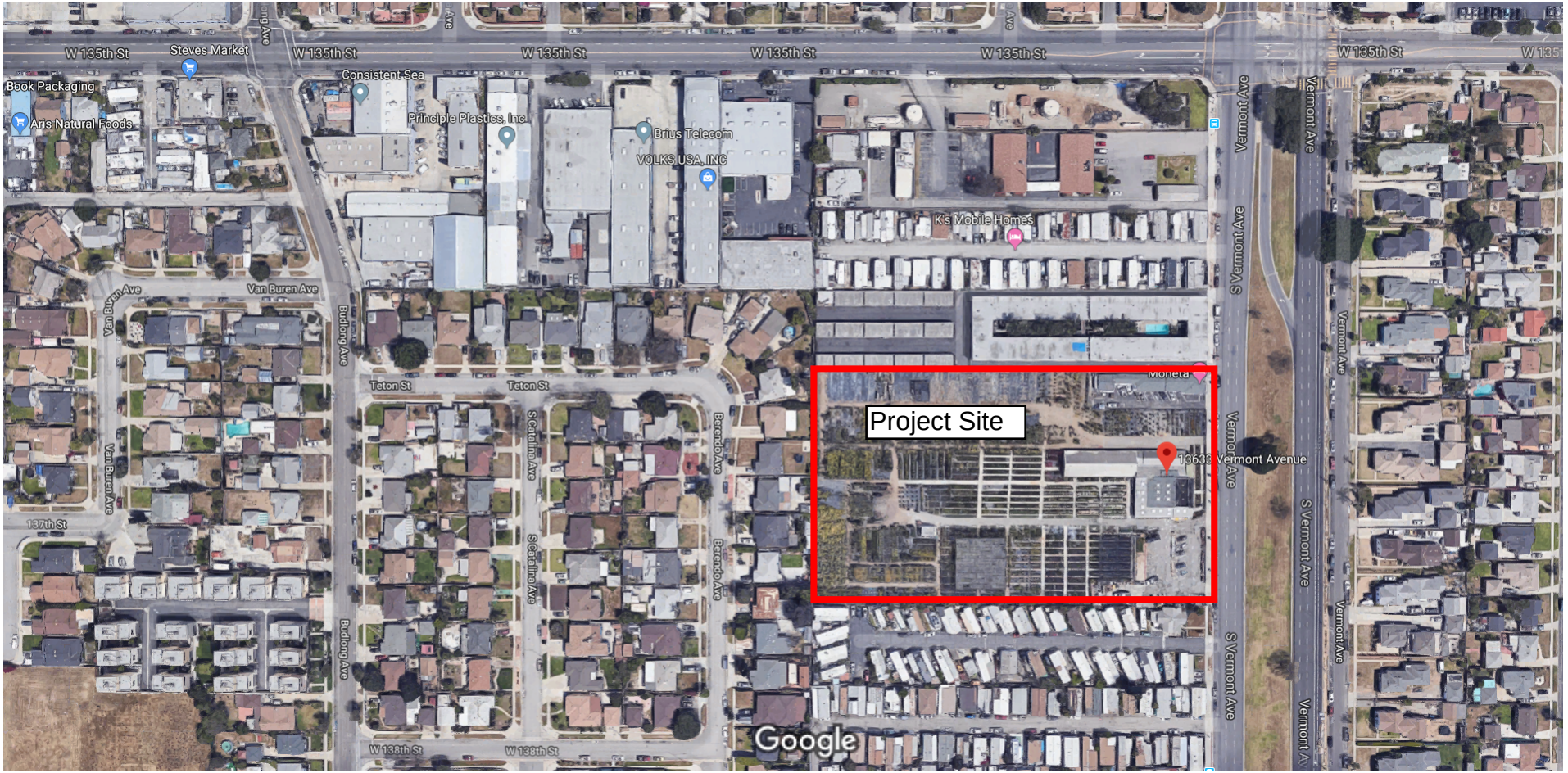
NOT TO SCALE

Figure -2:
Project Location Map

Google Maps

13633 Vermont Ave

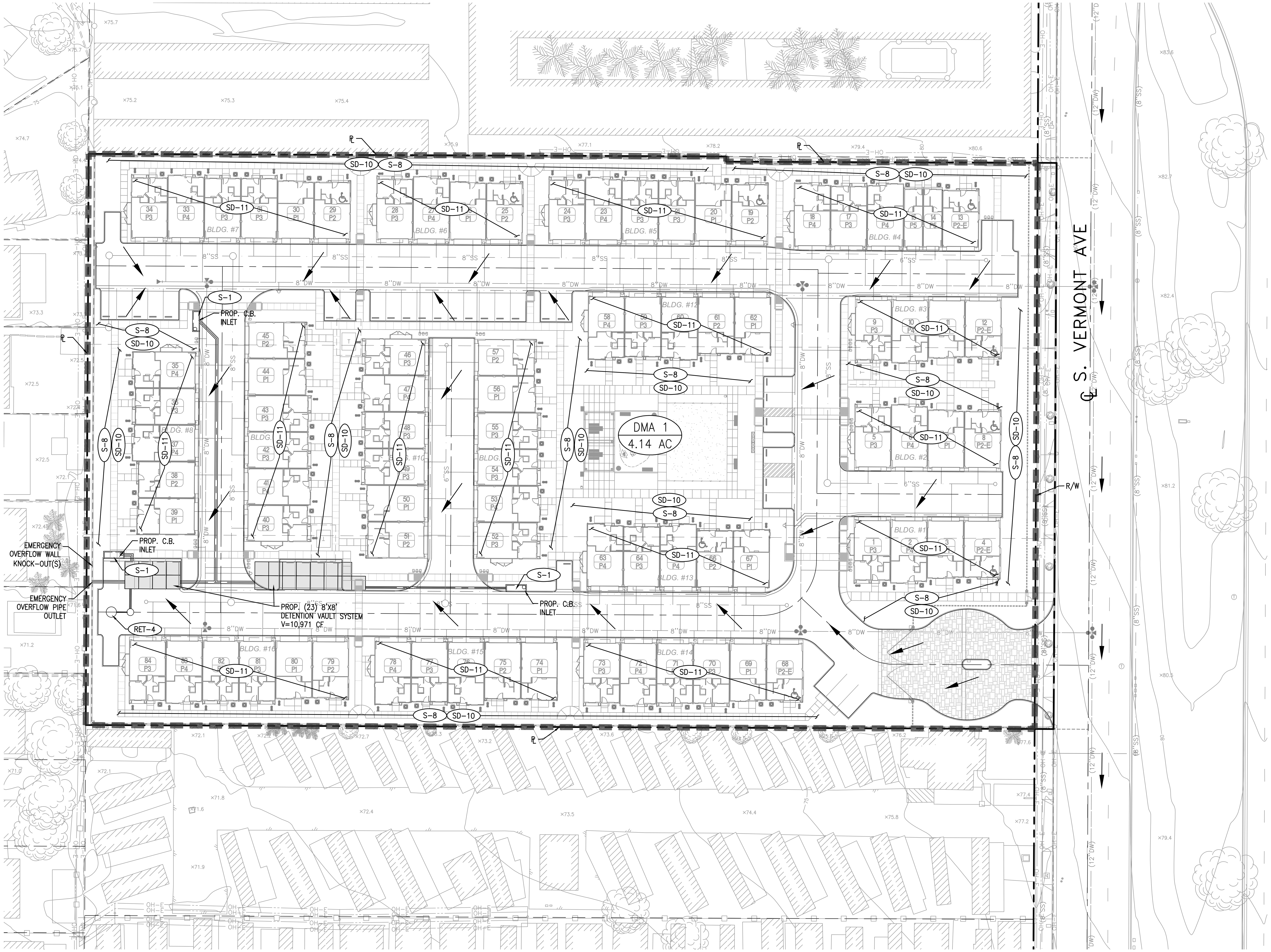
MELA-005

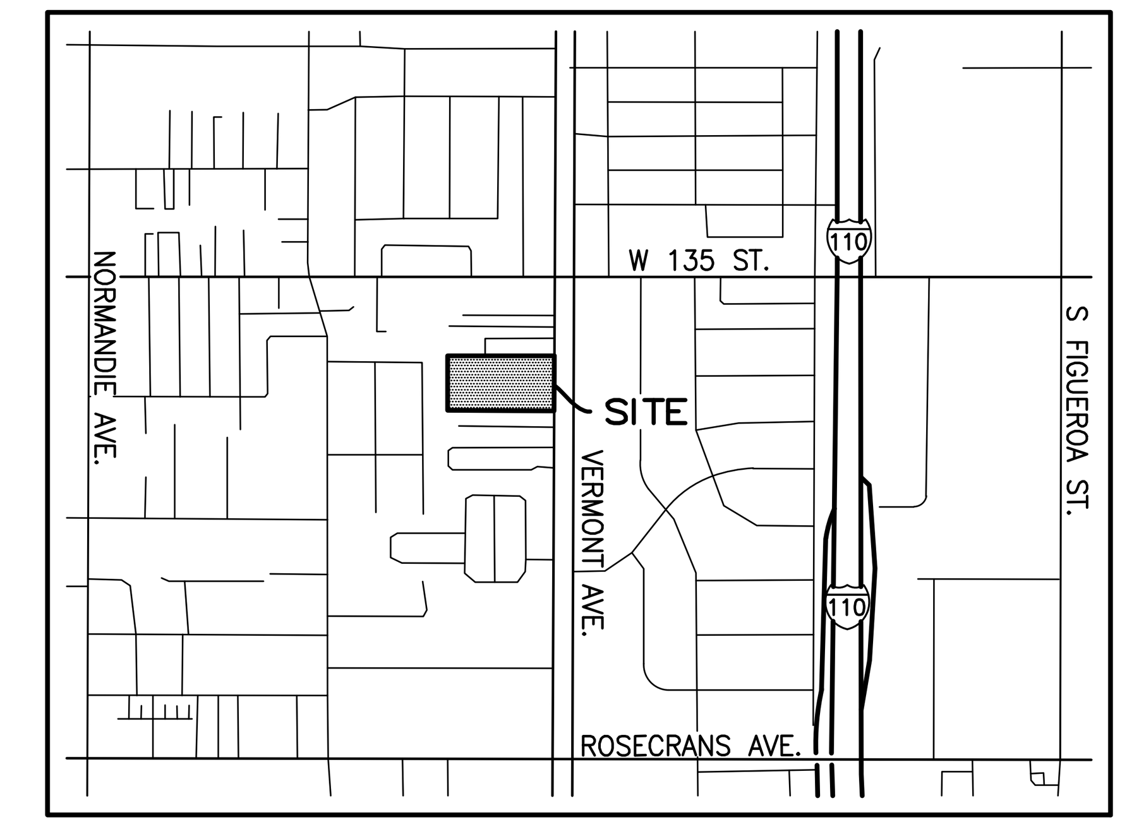


Imagery ©2019 Google, Imagery ©2019 Maxar Technologies, U.S. Geological Survey, USDA Farm Service Agency, Map data ©2019 100 ft

NORTH

Figure -3:
BMP Exhibit





BEST MANGEMENT PRACTICES (BMPS):

- SD-10 — SITE DESIGN AND LANDSCAPE PLANTING
- SD-11 — ROOF RUNOFF CONTROLS
- S-1 — STORM DRAIN SIGNAGE
- S-8 — LANDSCAPE IRRIGATION PRACTICES
- RET-4 — DRYWELL

LEGEND:

- A1 — SUB-AREA NUMBER
- 2.60 AC — ACREAGE
- EXISTING RIGHT OF WAY/ PROPERTY LINE
- DRAINAGE FLOW ARROW
- DRAINAGE MANAGEMENT AREA BOUNDARY

SCALE: 1" = 30'

0 15 30 60

OWNER/DEVELOPER	PREPARED BY:		
MELIA HOMES MELIA HOMES 8951 RESEARCH DR. #100 IRVINE, CA 92618 (949) 759-4367	C&V CONSULTING, INC. CIVIL ENGINEERING LAND PLANNING & SURVEYING 6 ORCHARD, SUITE 200 LAKE FOREST, CA 92630 T. 949.916.3800 F. 949.916.3805 CVC-INC.NET REGISTERED PROFESSIONAL ENGINEER DANE P. MCDOUGALL C 80705 CIVIL STATE OF CALIFORNIA	CITY OF GARDENA TENTATIVE TRACT MAP NO. 83037 13615-13633 SOUTH VERMONT AVE. PRELIMINARY BMP EXHIBIT	SHEET 1 OF 1

PLAN SET: PS01 DATE: 3/4/20

Figure -4:
Impaired Waters

COUNTY OF LOS ANGELES

LOS ANGELES RIVER WATERSHED

Los Angeles River Watershed

PACIFIC OCEAN

PROJECT SITE

ORANGE

MILES
0 1 2 4

LEGEND

- LOS ANGELES RIVER WATERSHED
- UNINCORPORATED AREA
- DAM / LAKE / RESERVOIR
- MAJOR RIVER
- MAJOR CHANNEL

Data contained in this map is produced in whole or part from the Los Angeles County Department of Public Works' digital database.

Appendix A:
Volume and Flow Rate Calculations and Hydrologic Report

Peak Flow Hydrologic Analysis

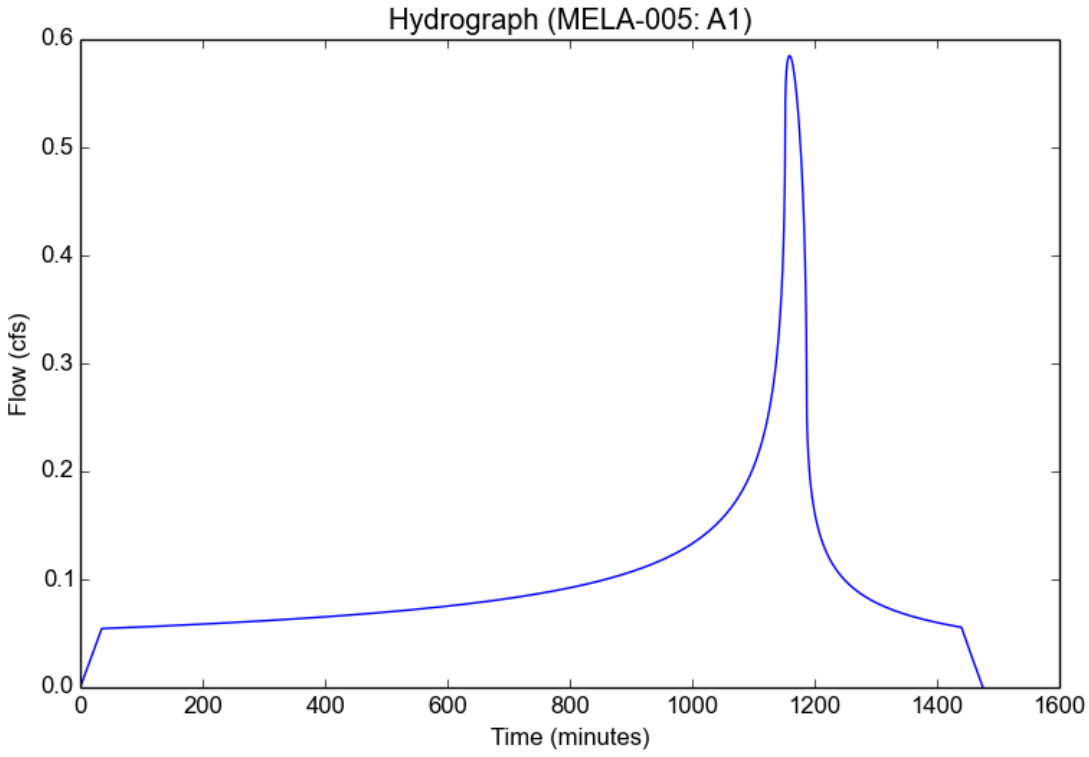
File location: P:/M/MELA-005/Admin/Reports/LID/PRE/Appendix A - Calcs/MELA-005 - A1, 0.75in.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	A1
Area (ac)	4.14
Flow Path Length (ft)	593.0
Flow Path Slope (vft/hft)	0.01
0.75-inch Rainfall Depth (in)	0.75
Percent Impervious	0.86
Soil Type	13
Design Storm Frequency	0.75 inch storm
Fire Factor	0
LID	True

Output Results

Modeled (0.75 inch storm) Rainfall Depth (in)	0.75
Peak Intensity (in/hr)	0.1793
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.788
Time of Concentration (min)	35.0
Clear Peak Flow Rate (cfs)	0.5849
Burned Peak Flow Rate (cfs)	0.5849
24-Hr Clear Runoff Volume (ac-ft)	0.2022
24-Hr Clear Runoff Volume (cu-ft)	8808.4021



Peak Flow Hydrologic Analysis

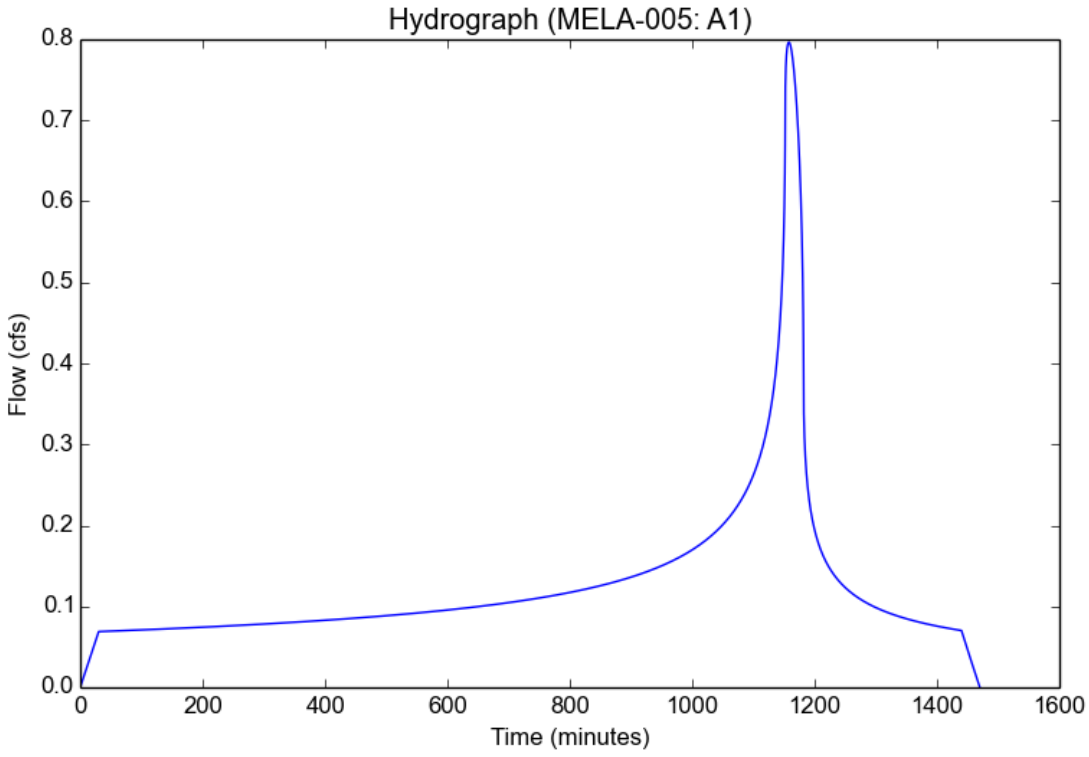
File location: P:/M/MELA-005/Admin/Reports/LID/PRE/Appendix A - Calcs/MELA-005 - A1, 85percent.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MELA-005
Subarea ID	A1
Area (ac)	4.14
Flow Path Length (ft)	593.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	0.95
Percent Impervious	0.86
Soil Type	13
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.95
Peak Intensity (in/hr)	0.2442
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.788
Time of Concentration (min)	30.0
Clear Peak Flow Rate (cfs)	0.7966
Burned Peak Flow Rate (cfs)	0.7966
24-Hr Clear Runoff Volume (ac-ft)	0.2561
24-Hr Clear Runoff Volume (cu-ft)	11157.2625



Appendix B:
Site BMPs

Site Design & Landscape Planning SD-10

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

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barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.
- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

S-1: Storm Drain Message and Signage

Purpose

Waste material dumped into storm drain inlets can adversely impact surface and ground waters. In fact, any material discharged into the storm drain system has the potential to significantly impact downstream receiving waters. Storm drain messages have become a popular method of alerting and reminding the public about the effects of and the prohibitions against waste disposal into the storm drain system. The signs are typically stenciled or affixed near the storm drain inlet or catch basin. The message simply informs the public that dumping of wastes into storm drain inlets is prohibited and/or that the drain ultimately discharges into receiving waters.

General Guidance

- The signs must be placed so they are easily visible to the public.
- Be aware that signs placed on sidewalk will be worn by foot traffic.

Design Specifications

- Signs with language and/or graphical icons that prohibit illegal dumping, must be posted at designated public access points along channels and streams within the project area. Consult with Los Angeles County Department of Public Works (LACDPW) staff to determine specific signage requirements for channels and streams.
- Storm drain message markers, placards, concrete stamps, or stenciled language/icons (e.g., “No Dumping – Drains to the Ocean”) are required at all storm drain inlets and catch basins within the project area to discourage illegal or inadvertent dumping. Signs should be placed in clear sight facing anyone approaching the storm drain inlet or catch basin from either side (see Figure D-1 and Figure D-2). LACDPW staff should be contacted to determine specific requirements for types of signs and methods of application. A stencil can be purchased for a nominal fee from LACDPW Building and Safety Office by calling (626) 458-3171. All storm drain inlet and catch basin locations must be identified on the project site map.

Maintenance Requirements

Legibility and visibility of markers and signs should be maintained (e.g., signs should be repainted or replaced as necessary). If required by LACDPW, the owner/operator or homeowner’s association shall enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards and signs.

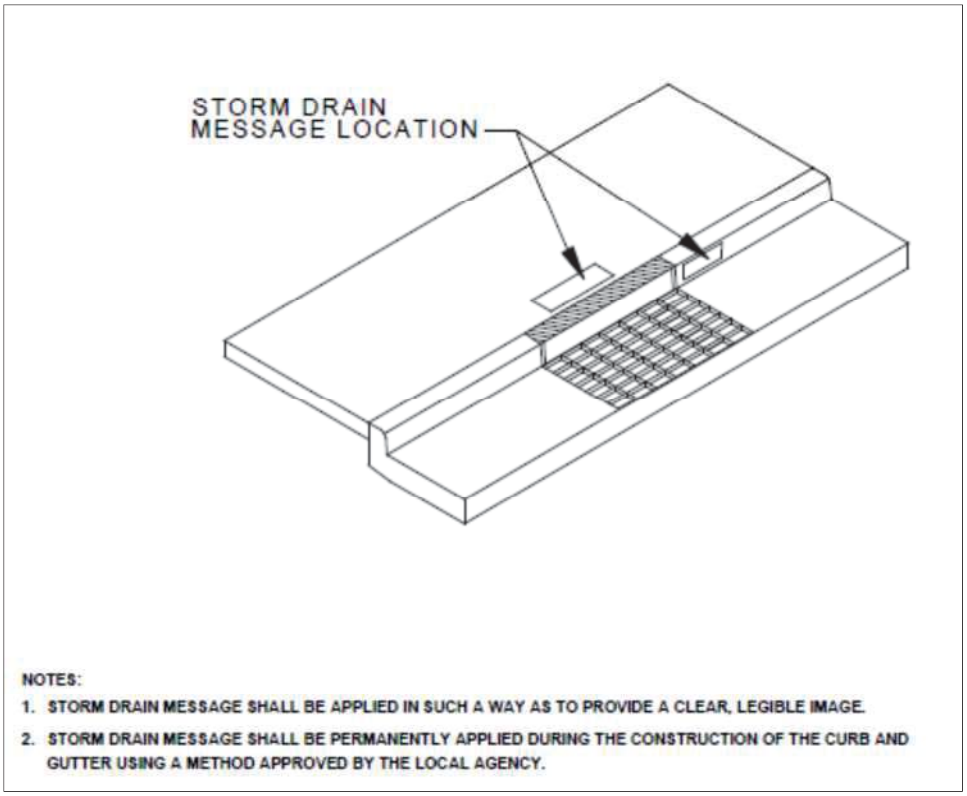


Figure D-1. Storm Drain Message Location – Curb Type Inlet

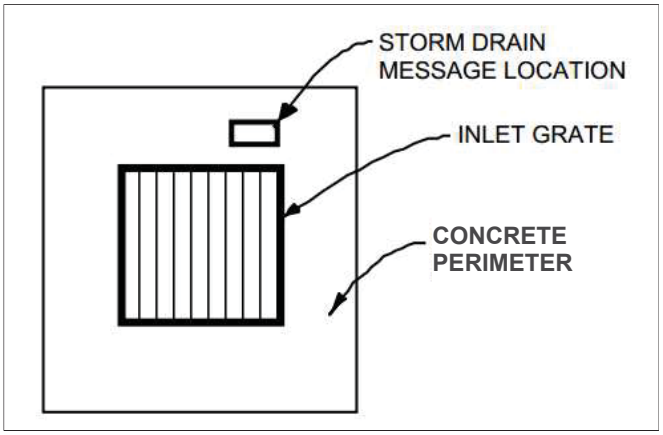


Figure D-2. Storm Drain Message Location – Catch Basin/Area Type Inlet

S-8: Landscape Irrigation Practices

Purpose

Irrigation runoff provides a pathway for pollutants (i.e., nutrients, bacteria, organics, sediment) to enter the storm drain system. By effectively irrigating, less runoff is produced resulting in less potential for pollutants to enter the storm drain system.

General Guidance

- Do not allow irrigation runoff from the landscaped area to drain directly to storm drain system.
- Minimize use of fertilizer, pesticides, and herbicides on landscaped areas.
- Plan sites with sufficient landscaped area and dispersal capacity (e.g., ability to receive irrigation water without generating runoff).
- Consult a landscape professional regarding appropriate plants, fertilizer, mulching applications, and irrigation requirements (if any) to ensure healthy vegetation growth.

Design Specifications

- Choose plants that minimize the need for fertilizer and pesticides.
- Group plants with similar water requirements and water accordingly.
- Use mulch to minimize evaporation and erosion.
- Include a vegetative boundary around project site to act as a filter.
- Design the irrigation system to only water areas that need it.
- Install an approved subsurface drip, pop-up, or other irrigation system.[1] The irrigation system should employ effective energy dissipation and uniform flow spreading methods to prevent erosion and facilitate efficient dispersion.
- Install rain sensors to shut off the irrigation system during and after storm events.
- Include pressure sensors to shut off flow-through system in case of sudden pressure drop. A sudden pressure drop may indicate a broken irrigation head or water line.
- If the hydraulic conductivity in the soil is not sufficient for the necessary water application rate, implement soil amendments to avoid potential geotechnical hazards (i.e., liquefaction, landslide, collapsible soils, and expansive soils).

[1] If alternative distribution systems (e.g., spray irrigation) are approved, the County will establish guidelines to implement these new systems.

- For sites located on or within 50 feet of a steep slope (15% or greater), do not irrigate landscape within three days of a storm event to avoid potential geotechnical instability.[2]
- Implement Integrated Pest Management practices.

For additional guidelines and requirements, refer to the Los Angeles County Department of Health Services.

Maintenance Requirements

Maintain irrigation areas to remove trash and debris and loose vegetation. Rehabilitate areas of bare soil. If a rain or pressure sensor is installed, it should be checked periodically to ensure proper function. Inspect and maintain irrigation equipment and components to ensure proper functionality. Clean equipment as necessary to prevent algae growth and vector breeding. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

[2] As determined by the City of Los Angeles, Building and Safety Division

S-9: Building Materials Selection

Purpose

Building materials can potentially contribute pollutants of concern to stormwater runoff through leaching. For example, metal buildings, roofing, and fencing materials may be significant sources of metals in stormwater runoff, especially due to acidic precipitation. The use of alternative building materials can reduce pollutant sources in stormwater runoff by eliminating compounds that can leach into stormwater runoff. Alternative building materials may also reduce the need to perform maintenance activities (i.e., painting) that involve pollutants of concern, and may reduce the volume of stormwater runoff. Alternative materials are available to replace lumber and paving.

Design Specifications

Lumber

Decks and other house components constructed using pressure-treated wood that is typically treated using arsenate, copper, and chromium compounds are hazardous to the environment. Pressure-treated wood may be replaced with cement-fiber or vinyl.

Roofs, Fencing, and Metals

Minimizing the use of copper and galvanized (zinc-coated) metals on buildings and fencing can reduce leaching of these pollutants into stormwater runoff. The following building materials are conventionally made of galvanized metals:

- Metal roofs;
- Chain-link fencing and siding; and
- Metal downspouts, vents, flashing, and trim on roofs.

Architectural use of copper for roofs and gutters should be avoided. As an alternative to copper and galvanized materials, coated metal products are available for both roofing and gutter application. Vinyl-coated fencing is an alternative to traditional galvanized chain-link fences. These products eliminate contact of bare metal with precipitation or stormwater runoff, and reduce the potential for stormwater runoff contamination. Roofing materials are also made of recycled rubber and plastic.

Green roofs may be an option. Green roofs use vegetation such as grasses and other plants as an exterior surface. The plants reduce the velocity of stormwater runoff and absorb water to reduce the volume of stormwater runoff. One potential problem with using green roofs in the Los Angeles County area is the long, hot and dry summers, which may kill the plants if they are not watered. See the Green Roof Fact Sheet (RET-7) in Appendix E.

Pesticides

The use of pesticides around foundations can be reduced through the use of alternative barriers. Sand barriers can be applied around foundations to deter termites, as they cannot tunnel through sand. Metal shields also block termites from tunneling. Additionally, diatomaceous earth can be used to repel or kill a wide variety of other pests.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., signs) must be maintained by the owner/operator as required by local codes and ordinances. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

RET-4: Dry Well

Description

A dry well is a bored, drilled, or driven shaft or hole whose depth is greater than its width. A dry well may either be a small excavated pit filled with aggregate or a prefabricated storage chamber or pipe segment. Dry well design and function are similar to infiltration trenches in that they are designed to temporarily store and subsequently infiltrate stormwater runoff. In particular, dry wells can be used to reduce the volume of stormwater runoff from building roofs. While generally not a significant source of stormwater runoff pollution, roofs are one of the most important sources of new or increased stormwater runoff volume from land development sites. Dry wells can be used to indirectly enhance water quality by reducing the volume of stormwater runoff to be treated by other downstream stormwater quality control measures.

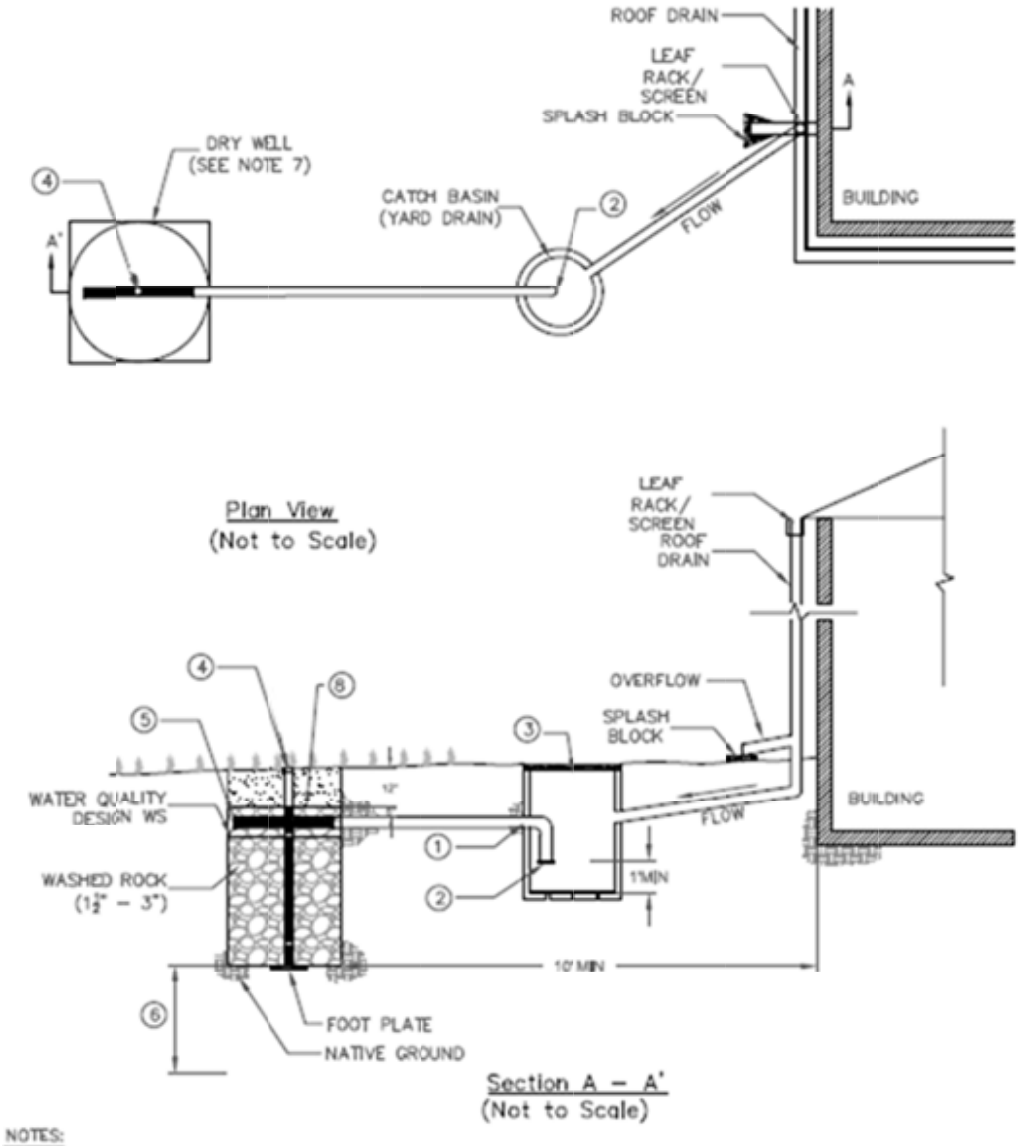
A schematic of a typical dry well is presented in Figure E-4.

LID Ordinance Requirements

Dry wells can be used to meet the on-site retention requirements of the LID Ordinance. Dry wells will prevent pollutants in the SWQDv from being discharged off-site.

Advantages

- Requires minimal space to install
- Low installation costs
- Provide groundwater recharge
- Reduces peak stormwater runoff flows during small storm events



NOTES:

① MINIMUM 4" – 6" DIAMETER PVC PIPE. INSTALL AT FLAT SLOPE.

② INSTALL FINE MESH SCREEN AT INLET TO DRY WELL. SET INLET ELEVATION AT 1' MINIMUM ABOVE CATCH BASIN BOTTOM.

③ CATCH BASIN (YARD DRAIN) INSTALLED WITH A SOLID LID FLUSH WITH GROUND SURFACE.

④ 4–6" VERTICAL PERFORATED PVC INSPECTION WELL WITH SCREW LID (NUT DOWN) FLUSH WITH GROUND SURFACE.

⑤ CAP END OF 4–6" HORZONTAL PERFORATED PVC DISPERSION PIPE.

⑥ MINIMUM 10' ABOVE SEASONAL HIGH GROUNDWATER TABLE AND 3' ABOVE BEDROCK.

⑦ DRY WELL CONFIGURATION MAY VARY (E.G. PRE-FAB MAY BE CIRCULAR).

⑧ CHOKING STONE LAYER SHALL BE PLACED ON TOP OF THE DRY WELL TO SEPARATE IT FROM THE TOPSOIL AND PREVENT CLOGGING.

Figure E-4. Dry Well Schematic

Disadvantages

- Is not appropriate for areas with low permeability soils or high groundwater levels
- May not be appropriate for industrial sites or locations with contaminated soils or where spills may occur because of the potential threat to groundwater contamination
- Cannot receive untreated stormwater runoff except from rooftops
- Requires complete reconstruction for failed dry wells
- Is not suitable for fill sites or on steep slopes

General Constraints and Implementation Considerations

- Dry wells can be integrated into open space buffers and other landscape areas.
- The potential for groundwater contamination must be carefully considered,. Dry wells are not suitable for sites that:
    - Use or store chemicals or hazardous materials, unless they are prevented from entering the well; or
    - Un-remediated “brownfield sites” where there is known groundwater or soil contamination
- Dry wells should be sited away from tree drip lines and kept free of vegetation.
- If the corrected in-situ infiltration rate exceed 2.4 in/hr, then stormwater runoff may need to be fully-treated with an upstream stormwater quality control measure prior to infiltration to protect groundwater quality.
- Dry wells cannot be located on sites with a slope greater than 20 percent (5:1).
- Pretreatment to remove sediment is required to protect dry wells from high sediment loads.
- If a yard drain is proposed as part of the design, it must be designed so that any standing water in the catch basin will infiltrate within 96 hours.
- If possible, the entire tributary area of the dry well should be stabilized before construction begins. If this is not possible, all flows should be diverted around the dry well to protect it from sediment loads during construction or the top two inches of soil from the dry well bottom should be removed after the site has been stabilized. Excavated material should be stored such that it cannot be washed back into the dry well if a storm occurs during construction.
- The equipment used to construct the dry well should have extra wide low-pressure tires. Construction traffic should not enter the dry well because it can compact soil, which reduces infiltration capacity. If heavy equipment is used on the base of the dry well, the infiltrative capacity may be restored by tilling or aerating prior to placing the infiltrative bed.

- Clean, washed gravel should be placed in the excavated dry well in lifts and lightly compacted with a plate compactor. Use of unwashed gravel can result in clogging.
- A geomembrane liner should be installed generously with overlapping seams on sides, bottom, and one foot below the surface of the dry well.
- Once construction is complete, stabilize the entire tributary area to the dry well before allowing stormwater runoff to enter it.
- An observation well must be installed to check water levels, retention time, and evidence of clogging.
- Accessibility for maintenance during dry and wet weather conditions must be provided.

Design Specifications

The following sections provide design specifications for dry wells.

Geotechnical

Due to the potential to contaminate groundwater, cause slope instability, impact surrounding structures, and potential for insufficient infiltration capacity, an extensive geotechnical site investigation must be conducted during the site planning process to verify site suitability for a dry well. All geotechnical investigations must be performed according to the most recent GMED Policy GS 200.1. Soil infiltration rates and the groundwater table depth must be evaluated to ensure that conditions are satisfactory for proper operation of a dry well. The project applicant must demonstrate through infiltration testing, soil logs, and the written opinion of a licensed civil engineer that sufficiently permeable soils exist on-site to allow the construction of a properly functioning dry well.

Dry wells are appropriate for soils with a minimum corrected in-situ infiltration rate of 0.3 in/hr. The geotechnical report must determine if the proposed project site is suitable for a dry well and must recommend a design infiltration rate (see “Design Infiltration Rate” under the “Sizing” section). The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move through the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Pretreatment

Pretreatment is important for all structural stormwater quality control measures, but it is particularly important for retention facilities. Pretreatment refers to design features that provide settling of large particles before stormwater runoff enters a stormwater quality control measure in order to reduce the long-term maintenance burden. Pretreatment should be provided to reduce the sediment load entering a dry well in order to maintain the infiltration rate of the dry well. To ensure that dry wells are effective, the project applicant must incorporate pretreatment devices that provide sediment reduction (e.g.,

vegetated swales, vegetated filter strips, sedimentation manholes, and proprietary devices).

Setbacks

Dry wells must be sited following the setbacks from the most recent GMED Policy GS 200.1.

Geometry

- Dry well configurations vary, but generally have length and width top dimensions close to a square. Prefabricated dry wells are often circular.
- The filter bed media layers must have the following composition and thickness, unless they are prefabricated dry wells:
    - Top layer: 2 inches of pea gravel
    - Middle layer: 3 to 5 feet of washed 2- to 6-inch gravel; void spaces should be approximately 30 to 40 percent
    - Bottom layer: 6 inches of sand or geomembrane liner equivalent.
- Gravel media and prefabricated dry wells have porosities of 30 to 40 percent and 80 to 95 percent, respectively.
- If a dry well receives stormwater runoff from an underground pipe (i.e., stormwater runoff does not enter the top of the dry well from the ground surface), a fine mesh screen should be installed at the inlet. The inlet elevation should be 18 inches below the ground surface (i.e., below 12 inches of surface soil and 6 inches of dry well media).

Sizing

Dry wells are sized using a simple sizing method where the SWQDv must be completely infiltrated within 96 hours. Dry wells provide stormwater runoff storage in the voids of the rock fill.

Step 1: Determine the SWQDv

Dry wells must be designed to capture and retain the SWQDv (see Section 6 for SWQDv calculation procedures).

Step 2: Determine the design infiltration rate

Determine the corrected in-situ infiltration rate (f_{design}) of the native soil using the procedures described in the most recent GMED Policy GS 200.1.

Step 3: Calculate the surface area

Determine the required size of the infiltration surface by assuming the SWQDv will fill the available void spaces of the gravel storage layer. The maximum depth of stormwater runoff that can be infiltrated within the maximum retention time (96 hrs) is calculated using the following equation:

$$d_{max} = \frac{f_{design}}{12} \times t$$

Where:

d_{max} = Maximum depth of water that can be infiltrated within the required drawdown time [ft];
f_{design} = Design infiltration rate [in/hr]; and
t = Maximum retention time (max 96 hrs) [hr].

Select the dry well depth (d_t) such that:

$$d_t \leq \frac{d_{max}}{n_t}$$

Where:

d_t = Depth of dry well fill [ft];
d_{max} = Maximum depth of water that can be infiltrated within the maximum retention time [ft]; and
n_t = Dry well fill porosity.

Calculate the infiltrating surface area (bottom of the dry well) required:

$$A = \frac{SWQDv}{d_t \times n_t}$$

Where:

A = Surface area of the bottom of the dry well [ft^2];
SWQDv = Stormwater quality design volume [ft^3]; and
d_t = Depth of dry well fill [ft]; and
n_t = Dry well fill porosity.

Flow Entrance and Energy Dissipation

Energy dissipation controls, constructed of sound materials such as stones, concrete, or proprietary devices that are rated to withstand the energy of the influent flow, must be installed at the inlet to the dry well. Consult with LACDPW for the type and design of energy dissipation structure.

Drainage

The specifications for designing drainage systems for dry wells are presented below:

- The bottom of dry well must be native soil that is over-excavated at least one foot in depth with the soil replaced uniformly without compaction. Amending the excavated soil with two to four inches (~15 to 30 percent) of coarse sand is recommended.
- The use of vertical piping, either for distribution or infiltration enhancement, is prohibited. This application may be classified as a Class V Injection Well per 40 CFR Part 146.5(e)(4).
- The infiltration capacity of the subsurface layers should be sufficient to ensure a maximum retention time of 96 hours. An observation well must be installed to allow observation of retention time.

Hydraulic Restriction Layer

The entire infiltrative area, including the side walls must lined with a geomembrane liner to prevent soil from migrating into the top layer and reducing storage capacity. The specifications of the geomembrane liner are presented in Table E-7. The entire well area, including the sides, must be lined with a geomembrane liner prior to placing the media bed. Provide generous overlap at the seams.

Table E-7. Geomembrane Liner Specifications for Dry Wells

Parameter	Test Method	Specifications
Material		Nonwoven geomembrane liner
Unit weight		8 oz/yd^3 (minimum)
Filtration rate		0.08 in/sec (minimum)
Puncture strength	ASTM D-751 (Modified)	125 lbs (minimum)
Mullen burst strength	ASTM D-751	400 lb/in^2 (minimum)
Tensile strength	AST D-1682	300 lbs (minimum)
Equiv. opening size	US Standard Sieve	No. 80 (minimum)

Observation Well

The observation well is a vertical section of perforated PVC pipe, four- to six-inch diameter, installed flush with the top of the dry well on a footplate and with a locking, removable cap. The observation well is needed to monitor the infiltration rate in dry well and is useful for marking the location of the dry well.

Vegetation

- Dry wells must be kept free of vegetation.

- Trees and other large vegetation should be planted away from dry well such that drip lines do not overhang the infiltration area.

Restricted Construction Materials

Use of pressure-treated wood or galvanized metal at or around a dry well is prohibited.

Maintenance Access

The dry well must be safely accessible during wet and dry weather conditions if it is publicly-maintained. If the dry well becomes plugged and fails, access is needed to excavate the dry well and replace the filter bed media. To prevent damage and compaction, access must able to accommodate a backhoe working at "arm's length" from the dry well.

Maintenance Requirements

Maintenance and regular inspections are important for proper function of dry wells. The following are general maintenance requirements:

- Conduct regular inspection and routine maintenance for pretreatment devices.
- Inspect dry well and its observation well frequently to ensure that water infiltrates into the subsurface completely within maximum retention time of 96 hours. If water is present in the observation well more than 96 hours after a major storm, the dry well may be clogged. Maintenance activities triggered by a potentially clogged facility include:
    - Check for debris/sediment accumulation and remove sediment (if any) and evaluate potential sources of sediment and vegetative or other debris (e.g., embankment erosion, channel scour, overhanging trees, etc). If suspected upstream sources are outside of the County's jurisdiction, additional pretreatment operations (e.g., trash racks, vegetated swales, etc.) may be necessary.
    - Assess the condition of the top aggregate layer for sediment buildup and crusting. Remove the top layer of pea gravel and replace. If slow draining conditions persist, the entire dry well may need to be excavated and replaced.
- Eliminate standing water to prevent vector breeding.
- Remove and dispose of trash and debris as needed, but at least prior to the beginning of the wet season.

A summary of potential problems that may need to be addressed by maintenance activities is presented in Table E-8.

The County requires execution of a maintenance agreement to be recorded by the property owner for the on-going maintenance of any privately-maintained stormwater

quality control measures. The property owner is responsible for compliance with the maintenance agreement. A sample maintenance agreement is presented in Appendix H.

Table E-8. Dry Well Troubleshooting Summary

Problem	Conditions When Maintenance Is Needed	Maintenance Required
Trash and Debris	Trash and debris > 5 ft^3/1,000 ft^2	Remove and dispose of trash and debris.
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Remove any evidence of visual contamination.
Erosion/Sediment Accumulation	Undercut or eroded areas at inlet structures	Repair eroded areas and re-grade if necessary.
	Accumulation of sediment, debris, and oil/grease in pretreatment devices	Remove sediment, debris, and/or oil/grease.
	Accumulation of sediment, debris, and oil/grease on surface or inlet	Remove sediment, debris, and/or oil/grease.
Water Drainage Rate	Standing water, or by inspection of observation wells	Remove the top layer of the dry well bottom and replace if necessary.

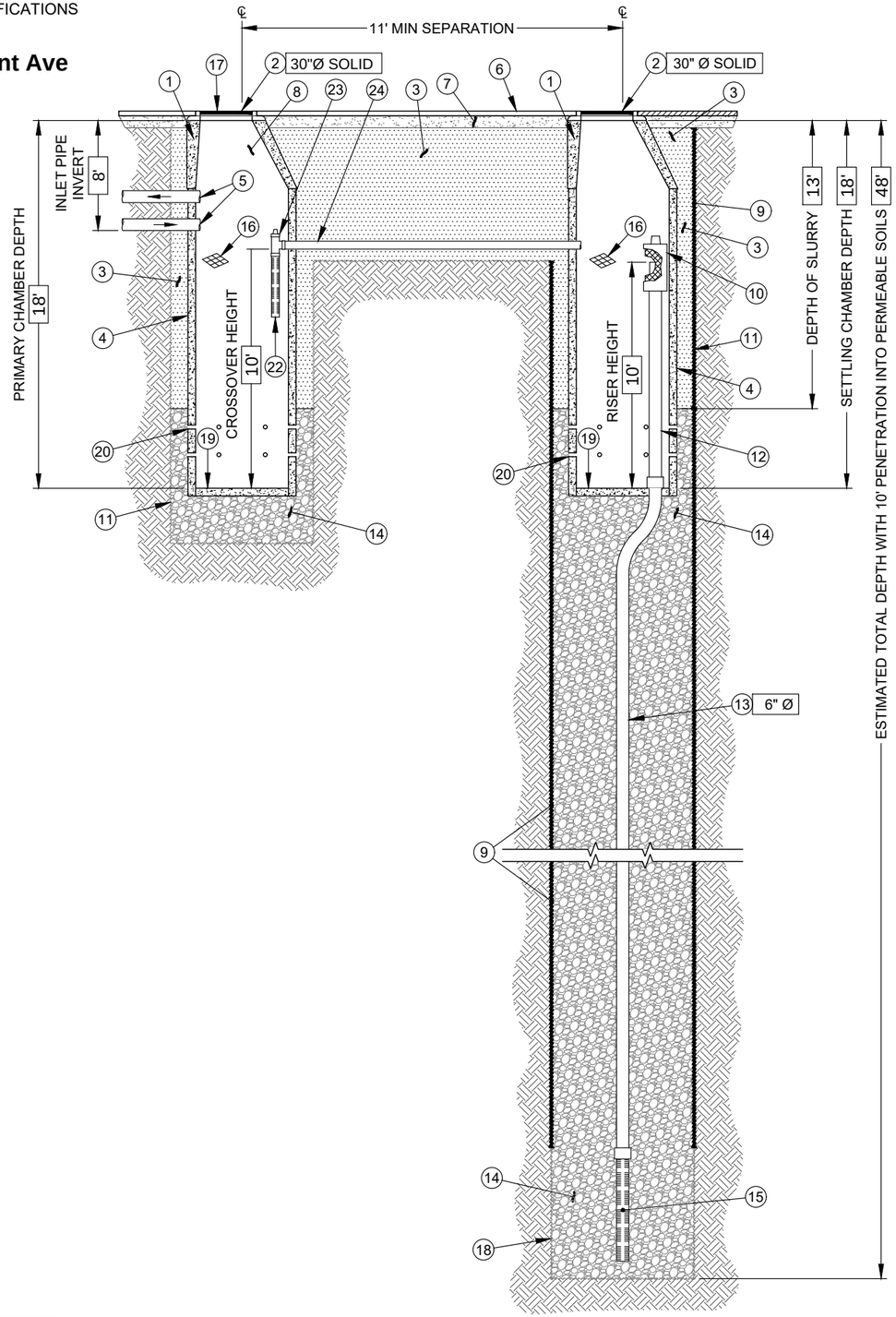
Appendix C:
Torrent Resources MaxWell Plus Drywell System Information

The MaxWell® Plus

DRAINAGE SYSTEM DETAILS AND SPECIFICATIONS

Evergreen

13615 & 13633 South Vermont Ave



ITEM NUMBERS

1. **MANHOLE CONE** - MODIFIED FLAT BOTTOM.
2. **BOLTED RING & GRATE/COVER** - DIAMETER & TYPE AS SHOWN. CLEAN CAST IRON WITH WORDING **"STORM WATER ONLY"** IN RAISED LETTERS. **BOLTED IN 2 LOCATIONS** AND SECURED TO CONE WITH MORTAR. RIM ELEVATION ±0.02' OF PLANS.
3. **STABILIZED BACKFILL** - TWO-SACK SLURRY MIX.
4. **PRE-CAST LINER -** 4000 PSI CONCRETE 48" ID. X 54" OD. **CENTER IN HOLE** AND ALIGN SECTIONS **TO MAXIMIZE BEARING SURFACE.**
5. **INLET PIPE (BY OTHERS). SEE SEPARATE PLAN FOR INVERT ELEVATIONS.**
6. **GRADED BASIN OR PAVING** (BY OTHERS).
7. **COMPACTED BASE MATERIAL**, IF REQUIRED (BY OTHERS).
8. **FREEBOARD DEPTH VARIES** WITH INLET PIPE ELEVATION. INCREASE PRIMARY AND SECONDARY CHAMBER DEPTHS AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE RISER PIPE.
9. **NON-WOVEN GEOTEXTILE SLEEVE** - MIRAFI 140 NL. MIN. 6 FT Ø. HELD APPROX. 10 FEET OFF THE BOTTOM OF EXCAVATION.
10. **PUREFLO® DEBRIS SHIELD** - ROLLED 16 GA. STEEL X 24" LENGTH WITH VENTED ANTI-SIPHON AND INTERNAL 0.265" MAX. SWO FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH. **FUSION BONDED EPOXY COATED**.
11. **MIN. 6' Ø DRILLED SHAFT.**
12. **RISER PIPE** - SCH. 40 PVC MATED TO DRAINAGE PIPE AT BASE SEAL.
13. **DRAINAGE PIPE** - ADS HIGHWAY GRADE OR SCH. 40 PVC WITH TRI-A COUPLER. SUSPEND PIPE DURING BACKFILL OPERATIONS. DIAMETER AS NOTED.
14. **ROCK** - WASHED, SIZED BETWEEN 3/8" AND 1-1/2".
15. **FLOFAST® DRAINAGE SCREEN** - SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. WITH TRI-B COUPLER. OVERALL LENGTH VARIES, UP TO 120" WITH TRI-B COUPLER.
16. **ABSORBENT** - HYDROPHOBIC PETROCHEMICAL SPONGE. MIN. 128 OZ. CAPACITY. TYPICAL, 2 PER CHAMBER.
17. **FABRIC SEAL** - U.V. RESISTANT GEOTEXTILE - **TO BE REMOVED BY CUSTOMER** AT PROJECT COMPLETION. GRATED ONLY.
18. **MIN. 6' Ø DRILLED SHAFT.**
19. **BASE SEAL** - CONCRETE SLURRY.
20. **6 PERFORATIONS MINIMUM PER FOOT, 2 ROWS MINIMUM.**
21. NOT USED.
22. **INTAKE SCREEN** - 4" Ø SCH. 40 PVC 0.120" MODIFIED SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/ FT. 48" OVERALL LENGTH WITH TRI-CEND CAP.
23. **VENTED ANTI-SIPHON INTAKE WITH FLOW REGULATOR.**
24. **CONNECTOR PIPE** - 4" Ø SCH. 40 PVC.

DETAIL : PL-6-SS-CA	REVISED BY: EMP		
DRAWN ON: 05-23-19	REVISED DATE: 2/12/2020	SCALE: N.T.S	

Manufactured and Installed by

TORRENT RESOURCES

An evolution of McGuckin Drilling

www.torrentresources.com

CALIFORNIA 909-829-0740

ARIZONA 602-268-0785

THERE'S A LOT MORE TO US BELOW THE SURFACE.

The watermark for drainage solutions.

TORRENT RESOURCES

DEPTH OF EXPERIENCE.

Since 1972, Torrent Resources has set the standard in the design and construction of water drainage systems. In fact, the company revolutionized the industry with its exclusive, patented MaxWell™ Systems – products unmatched in efficiency and reliability by any other type of stormwater disposal application. Today, more than 40,000 MaxWell drywells have been installed throughout the western United States.

Formerly known as McGuckin Drilling, the company changed its name to Torrent Resources to better reflect the continual evolution of its products and services. Innovative and creative solutions to address customer needs, coupled with ongoing research and development, have helped Torrent remain at the forefront of drainage system technology.

Today, Torrent's unique ability to react to changing market conditions, and provide strong engineering and product development solutions, has led to their recognition as being much more than a drilling company. Torrent is now considered "the industry source" for drainage resource management.

COMPANY ACCOMPLISHMENTS

First licensed as a drainage contractor, Torrent Resources has evolved into a full-service solutions partner to address ever-growing customer needs in New Mexico, Nevada, California, and Arizona, the company's corporate headquarters.

The Original MaxWell™ In 1974, Torrent created the first truly engineered drywell – a cost-effective drainage system that was developed for high-volume applications, revolutionizing the drainage industry.

The MaxWell™ III The next evolution was a performance model with higher flow rates, plus full settling and filtering ability. It was ideal for medium to high volume stormwater applications, and depths up to 120 feet or greater with no increase in cost.

The Maxwell™ IV Currently the industry standard for draining landscaped developments and paved areas in most municipalities. It also incorporates the latest refinements in pre-treatment technology.

The MaxWell™ Plus Designed for draining large paved surfaces, nuisance water and other demanding municipal applications. This drainage system also integrates more comprehensive pre-treatment technology with higher capacity and control capabilities.

The Envibro™ System Specifically created for environmentally sensitive properties, this system is ideal for handling the processing and disposal of surface water runoff from service stations, industrial sites and sites requiring special drainage applications.

The Torrent Partnership Industry expertise has made Torrent a valued partner not only in site development and drainage system design, but also in complex retention and municipal recharge programs.

Meeting schedules and maintaining budgets.

"The professional staff is responsive to our needs in the field as well as during the pre-construction phase. They always make the greatest effort to meet our schedules and maintain the project budget."

Michael J. Mongelli
hardison/downey construction, inc.
Phoenix, Arizona

CURRENT KNOWLEDGE.

Torrent Resources has set industry standards through its extensive knowledge of site geology and drainage technology.

The company has developed a comprehensive geological database detailing soil conditions on every boring and excavation completed since 1975. These geological logs are used for profiling, and are cross-referenced to map books and installation information. At any given site, Torrent can provide invaluable data to civil engineers to accurately predict drilling conditions and expected overall depth of wells. This knowledge allows for system design and pricing that is best suited to client needs. Years of experience in the field have made Torrent a valued partner in site development and drainage system design. Where specialized solutions are required, the Torrent team is often called upon to provide a customized approach.

Expertise in the planning stage is equaled only by the company's commitment to quality control in the construction phase. Each system's internal components are manufactured and installed exclusively by Torrent's team of drainage specialists, using state-of-the-art materials, construction techniques and equipment.

OUR DEVELOPMENT PROCESS

Research and Design Torrent works in collaboration with civil engineers to develop comprehensive drainage systems for a variety of sites.

Engineering Through geological profiling, Torrent can recommend the right system at the right price.

Budgeting Extensive knowledge of drilling conditions, coupled with a wide variety of system applications, ensure a cost-effective solution.

Application Assistance Depending on soil conditions and disposal needs, Torrent will recommend a standard drainage system or a custom design.

Implementation Pre-fabricated components are constructed in a controlled shop environment and are installed exclusively by experienced crewmembers.

Testing Torrent offers the constant head percolation testing of finished wells, providing site-specific, real-world disposal data.

Maintenance and Services Inspection and maintenance services are offered on all products, including a comprehensive written report, and if needed, recommendations for cleaning or repair.

Professional, thorough and timely.

"Standard Pacific of Arizona, Inc. has contracted 100% of our projects with Torrent Resources for the past 7 years and we have found them to be very thorough, professional and timely in all aspects of their contracts."

Bruce Schroeder
Vice President of Land Development
Standard Pacific of Arizona, Inc.

SERVICE, PURE AND SIMPLE.

Commercial. Retail. Industrial. Residential. No matter what type of site drainage is needed, Torrent is committed to delivering a job "done right." That's why "close enough" is never good enough. Every stage of the drainage system process must flow with accuracy – from a thorough technical analysis of the project to the right combination of drainage features to precise installation. Excellence demonstrated every step of the way is a company promise. This system approach also affords Torrent the flexibility to apply innovative solutions to the toughest assignments.

Superior customer service.

"Sun State Builders has had the privilege of working with Torrent Resources for several years. We find their work to be of excellent quality and their customer service is superior. We look forward to utilizing their services in all of our projects in the future."

Andrea Vallas
Assistant Project Manager
Sun State Builders

We always come through.

"We have had the opportunity to work with Torrent on many levels, and they have always come through for us. They even came to our company to train our managers as to what should be done as far as maintenance, what to look for on a routine inspection, how the system operates, the individual components, etc."

Linda S. Moore
Special Projects Manager
Associated Asset Management
Phoenix, Arizona

BOTTOMLESS INNOVATION.

Solving problems, protecting investments.

"The Maxwell Plus system installation was completed on the day it was scheduled. Percolation testing proved the system would accommodate in excess of 200% of the theoretical requirement! Not only did the MaxWell Plus system solve the problem; we attribute it to saving our investment!"

John E. Plount / J.E. Plount and Company, Inc. / Upland, California

Specialized market needs have led to innovative solutions at Torrent Resources:

Recharge Programs Torrent specializes in cost-effective systems that utilize surplus water from many sources as a beneficial component of a valuable community resource. To help supplement existing water supplies, Torrent has been at the forefront of the development of recharge programs for numerous municipalities. Limitless quantities of allocated and reclaimed water are stored in underground aquifers for reuse elsewhere – simply by implementing a high-tech, high-capacity gravity recharge system that works 24/7, 365 days each year.

Evaluation of Outdated Drainage Systems Existing sites that have been impacted by industrial processes may have outdated drainage systems. In these situations, Torrent can provide an evaluation, as well as remediation efforts and site redesign to conform to current regulatory standards.

Pattern Drilling/Soil Remediation Torrent has been instrumental in the development of pattern drilling, a highly efficient method of remediation for sites with soil contamination. A process of systematically drilling, evaluating and replacing contaminated soil with stabilized backfill, it provides for precise, complete removal of the contaminated soil envelope. Success is achieved in a variety of site conditions by using enhanced soil stabilization techniques.

Environmental Applications Understanding the need to provide for proper pretreatment of urban runoff has led Torrent to be actively involved with various government agencies, such as the Arizona Department of Environmental Quality and the California Regional Water Quality Control Boards. Torrent volunteers its time and expertise to contribute real-world experience and solutions that positively impact industry guidelines and regulations. For example, Torrent has partnered with the Maricopa Association of Governments and local municipalities to address drainage quality issues and provide support toward improvements in Best Management Practices and product application. Furthermore, to answer the specialized need for effective treatment of surface water runoff at sites impacted by industrial activities, Torrent has developed the Envibro™ drainage system. Utilizing a combination of advanced materials and processes, industrial by-products such as fuel and oil are trapped and separated from water prior to disposal.

UNIQUE APPLICATIONS

• Torrent was the key partner for the City of Scottsdale pilot recharge program, a 10-year project that led to full implementation of over 65 of the company's recharge wells at the ***Scottsdale Water Campus***. Each well adds over one acre-foot of water a day to the municipality's future water supply.

• The ***Ford Proving Grounds*** in Arizona routinely tests different fuels and then flushes the automotive tanks. Torrent's Envibro™ system catches and treats the runoff, removing the fuel before it drains into a retention area.

• Instead of a traditional retention basin, the ***Lakes at La Quinta*** in California are used to collect and retain storm water. In order to keep the water at an acceptable level, Torrent partnered with the project engineer to design a drainage control system utilizing MaxWells to dissipate the excess water. The lakes are ringed with these drainage control systems, allowing the water to remain at an acceptable level without negatively impacting the development.

• After the first Gulf War, ***Marine Corps. base housing*** was increased at 29 Palms near Palm Springs, California. Torrent worked with the general contractor, Actus/Sundt, to install a comprehensive on-site wastewater system. Torrent managed and engineered resources to fast-track the high-volume project in order to meet a three-month deadline. Approximately 152 wastewater disposal systems were installed, including 2.5 miles of precast concrete liner – accomplishing completion of a large-scope project and aggressive deadline that had never been attempted before.

WATERTIGHT SOLUTIONS.

Industry Services

Site Drainage Systems
- Stormwater Drywells
- French Drains
- Piping
- Drainage Appurtenances
- Pump Systems

Technical Analysis
- Design Review
- Percolation Testing
- Geologic Database
- ADEQ Drywell Registration

Recharge Systems
- Municipal/Private Recharge Wells
- Injection Wells & Galleries

Environmental Applications
- Pattern-Drilled Soils/ UST Remediation
- Drainage Rehabilitation
- Drywell Abandonments
- OSHA HAZMAT Certified

Drainage Renovation
- Problem Assessment
- Site Redesign/Modification
- System Retrofit

Drainage Maintenance
- Preventive Maintenance
- Service Contracts
- Drywell Cleaning

CASE STUDIES

• Cities in the ***high-desert areas of California*** have large nuisance water flows inundating their stormwater systems. Significant quantities of nuisance water run continuously in storm gutters, filling a development's retention basins with sediment and water. One of these cities, Palmdale, needed a ***system to dispose of the nuisance water*** without being overwhelmed or deluged by the storm flows. Torrent designed a system that let naturally occurring stormwater pass, but caught, treated and disposed of the lower-volume nuisance water. Torrent's MaxWell Plus drainage system was modified to be used for this application by providing a specialized inlet structure and metering device, and then installing it at intervals along the flow path. The nuisance flow was contained and effectively drained, allowing the storm water system to function normally. This system is now the standard for the region.

• Civil engineers originally overdesigned the ***Intel plant*** in Chandler, Arizona, with 50 drainage systems. The design was based on falling head test criteria that was commonplace at the time, but inaccurate. Torrent recommended conducting a revised analysis of the site to the engineers and the developer using a MaxWell Type III drywell. After performing a constant head percolation test, it was determined that the number of drywells on the site could be reduced to just 25 systems, ***saving Intel approximately $135,000.*** The old testing method went by the wayside, and Torrent's solution became today's industry standard.

• Freeway Commerce Center in Tempe, Arizona, home to the Fiesta Inn, tended to stay wet and marshy for extended periods, and had been ***considered unbuildable*** due to problems with drainage. Torrent installed a total of 50 MaxWell Type I drainage systems to successfully convert this 658-acre development into ***valuable retail property.***

The watermark for drainage solutions.

TORRENT RESOURCES

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Phoenix Arizona 85040-1391

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An evolution of McGuckin Drilling

Torrent Resources Incorporated
AZ Lic. ROC070465 A, ROC047067 B-4; ADWR 363
CA Lic. 528080 A, C-42, HAZ
NV Lic. 0035350 A
NM Lic. 90504 GF04

OPERATION AND MAINTENANCE OF *MaxWell*® DRYWELL

The Operation and Maintenance Format will include the following key components:

1.) Inspection Guidelines:

New installations

Newly installed systems should receive a thorough visual examination following the first several significant rainfall events. This assessment will assure that there is no standing water, and that runoff or nuisance water flows are being eliminated within the allowable 48 hour draw-down timeframe.

Ongoing Operations

At a minimum, the drainage structures should be inspected annually, and within 48 hours following a significant storm event to ensure that there is no standing water in the chambers.

2.) Maintenance Format:

After the first 12-months of entering service, it is recommended that an initial cleaning be undertaken. This will help to establish the amount of accumulated particulate matter and debris to be expected on a yearly basis. Thereafter, the systems should receive inspection at least annually, and cleaning should be undertaken when the evaluation reveals that 15% or more of the original chamber volume is occupied by silt and sediment.

During the maintenance operation, all screens and filters should be serviced and the floating absorbent blankets replaced, along with the geo-textile fabric at the bottom of the chambers. Should repair be needed, descriptions of deficiencies and estimated costs for suggested corrections should be provided. The above information shall be submitted in writing to the Owner at the conclusion of the maintenance service. Replacement is recommended for drywells that no longer dispose of ponded water within 48 hours after cleaning.

3.) Maintenance Records:

A written log shall be kept on-site of all inspections and maintenance performed on the drainage systems.

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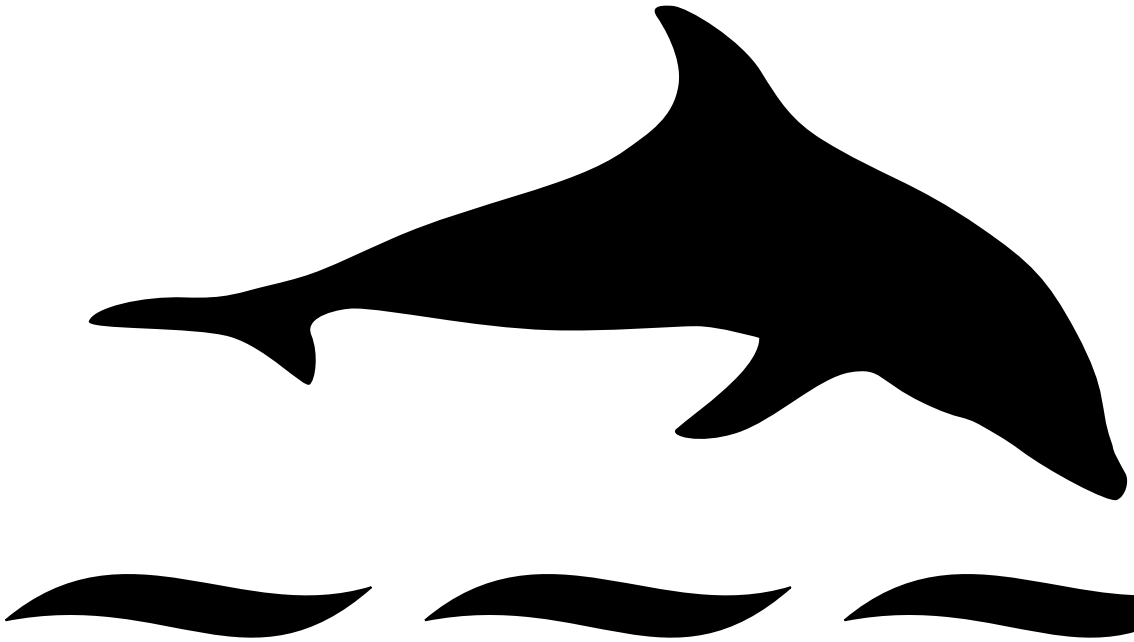
NV Lic. 0035350 A - *NM Lic.* 90504 GF04

An evolution of McGuckin Drilling

Appendix D:
"NO DUMPING – DRAINS TO OCEAN" Stencil Examples

Sample Stencil 1

NO DUMPING



DRAINS TO OCEAN

Sample Stencil 2

Appendix E:
Catch Basin Cleaning

OPERATION & MAINTENANCE PLAN
FOR FILTER INSERT

The maintenance program will include the following key components:

1. **REGULAR SWEEPING AND REMOVAL OF DEBRIS:**
   Vehicle parking lot will be swept on a regular basis. Sediment and debris (litter, leaves, papers and cans, etc.) within the area, especially around the drainage inlet, will be collected and removed. The frequency of sweeping will be based on the amount of sediment and debris generated.

2. **REGULAR INSPECTIONS:**
   The catch basin, downspout, or trench drain filter insert will be inspected on a regular basis. The frequency of inspection will be based on pollutant loading, amount of debris, leaves, etc., and amount of runoff. At a minimum, there will be three inspections per year.

3. **CONDUCT OF THE VISUAL INSPECTION:**
   a. Broom sweep around the inlet and remove the inlet grate.
   b. Inspect the filter liner for serviceability. If called for, the filter body will be replaced.
   c. Check the condition of the adsorbent pouches and visually check the condition of the enclosed adsorbent. If the surface of the granules is more than 50% coated with a dark gray or black substance, the pouches will be replaced with new ones.
   d. Check for loose or missing nuts (on some models) and gaps between the filter and the inlet wall, which would allow bypass of the filter during low flows.
   e. The filter components will be replaced in the inlet and the grate replaced.

4. **CLEANING OUT THE FILTER INSERT:**
   Regardless of the model of filter insert, the devices must be cleaned out on a recurring basis. The manufacturer recommends at least three cleanings per year – more in high exposure areas. For the Flo-Gard+Plus filters, the filter must be cleaned when the solids level reaches close to the fullel tip.
   a. The Standard Filter, in most cases, can be cleaned out by removing the device from the inlet and dumping the contents into a DOT approved drum for later disposal. If the oil-absorbant pouches need to be changed, the time to change them is immediately after dumping and before the filter is replaced in the inlet.
   b. Because of weight, method of installation and so forth, some filter inserts will be cleaned with the aid of a vactor truck. If necessary, the oil-absorbant pouches will be changed after the pollutants have been removed and as the filter is being returned to service.

5. **MAINTENANCE LOG:**
   Keep a log of all inspections and maintenance performed on the catch basins, trench drains, and filter inserts. Keep this log on-site.

CATCH BASIN MAINTENANCE RECORD

SITE INFORMATION	
Contact:	Phone: ( )
Project Name:	
Address:	
Filter No. & Model:	

SERVICE INFORMATION		
Date of Service:	By:	
☐ Inspection	☐ Clean Debris	☐ Clean Silt/Sediment
☐ Replace Pouch	☐ Replace Rock	☐ Repair/Replace Parts
Comments:		
Approval Signature:		

SITE INFORMATION	
Contact:	Phone: ( )
Project Name:	
Address:	
Filter No. & Model:	

SERVICE INFORMATION		
Date of Service:	By:	
☐ Inspection	☐ Clean Debris	☐ Clean Silt/Sediment
☐ Replace Pouch	☐ Replace Rock	☐ Repair/Replace Parts
Comments:		
Approval Signature:		

CATCH BASIN MAINTENANCE RECORD

SITE INFORMATION		
Contact:	Phone: ( )	
Project Name:		
Address:		
Filter No. & Model:		

SERVICE INFORMATION		
Date of Service:	By:	
☐ Inspection	☐ Clean Debris	☐ Clean Silt/Sediment
☐ Replace Pouch	☐ Replace Rock	☐ Repair/Replace Parts
Comments:		
Approval Signature:		

SITE INFORMATION		
Contact:	Phone: ( )	
Project Name:		
Address:		
Filter No. & Model:		

SERVICE INFORMATION		
Date of Service:	By:	
☐ Inspection	☐ Clean Debris	☐ Clean Silt/Sediment
☐ Replace Pouch	☐ Replace Rock	☐ Repair/Replace Parts
Comments:		
Approval Signature:		

Appendix F:
General Education Materials

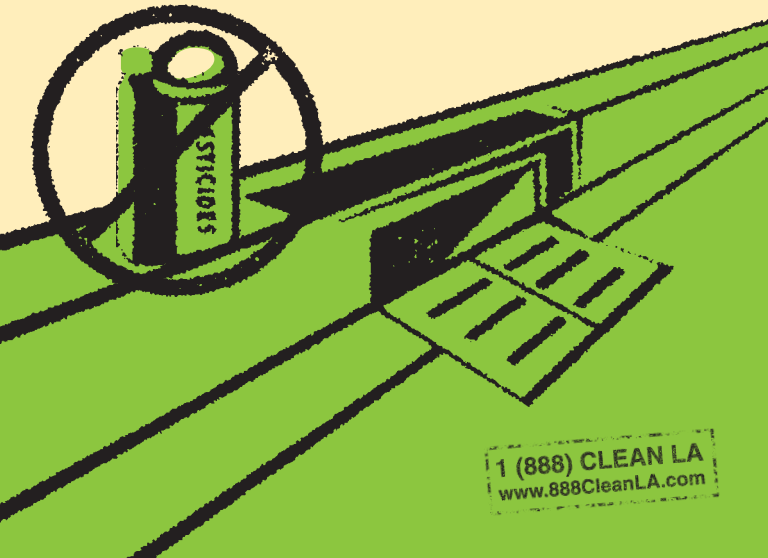
A Yard is a Terrible Thing to Waste!

Storm drains are for rain…**not yard waste.**

Residential yard waste represents about **13 percent** of the total waste generated in L.A. County.

Pesticides, fertilizer and yard waste such as leaves and mowed grass wash from the ground and streets into storm drains and flow straight to the ocean — **untreated**.

Remember to use pesticides and fertilizer wisely and pick-up yard waste.



Tips For Yard Care:

L.A. County residents can help solve the stormwater pollution problem by taking these easy steps…

- Do not over-fertilize and do not use fertilizer or pesticides near ditches, gutters or storm drains.
- Do not use fertilizer or pesticides before a rain.
- Follow the directions on the label carefully.
- Use pesticides sparingly — more is not better. "Spot" apply, rather than "blanket" apply.
- When watering your lawn, use the least amount of water possible so it doesn't run into the street carrying pesticides and other chemicals with it.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides or fertilizer, make sure they are in a sealed, water-proof container in a covered area to prevent runoff.
- Do not blow, sweep, hose or rake leaves or other yard trimmings into the street, gutter or storm drain.

PROJECT Pollution PREVENTION

A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids, recyclable products, or household hazardous wastes into the street or gutter. Take them to your local auto repair station, recycling center or a household hazardous waste roundup.

...they're not recycling centers.

1(888)CLEAN LA
www.888CleanLA.com

Recycling Tips:

You can help keep your community clean, protect our area waterways and make the beaches safe for ocean swimmers by putting recyclable materials where they belong — at a recycling center or household hazardous waste roundup. Never throw or pour anything into the streets or gutters...

- When changing vehicle fluids – transmission, hydraulic and motor oil, brake and radiator fluid – drain them into a drip pan to avoid spills. Do not combine these fluids. Do not dispose of them in the street, gutter or in the garbage. It is illegal.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visit www.888CleanLA.com for the location of a center that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Other materials that should be taken to a household hazardous waste Roundup are: paint and paint-related materials, household cleaners, batteries, pesticides and fertilizers, pool chemicals, and aerosol products.
- Aluminum, glass, plastic and newspapers should be placed in your curbside recycling bin or taken to a local recycling center.

Printed on recycled paper

PROJECT Pollution PREVENTION

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids, recyclable products, or household hazardous wastes into the street or gutter. Take them to your local auto repair station, recycling center or a household hazardous waste roundup.

...they're not recycling centers.

1(888)CLEAN LA
www.888CleanLA.com

Recycling Tips:

You can help keep your community clean, protect our area waterways and make the beaches safe for ocean swimmers by putting recyclable materials where they belong — at a recycling center or household hazardous waste roundup. Never throw or pour anything into the streets or gutters...

- When changing vehicle fluids – transmission, hydraulic and motor oil, brake and radiator fluid – drain them into a drip pan to avoid spills. Do not combine these fluids. Do not dispose of them in the street, gutter or in the garbage. It is illegal.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visit www.888CleanLA.com for the location of a center that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Other materials that should be taken to a household hazardous waste Roundup are: paint and paint-related materials, household cleaners, batteries, pesticides and fertilizers, pool chemicals, and aerosol products.
- Aluminum, glass, plastic and newspapers should be placed in your curbside recycling bin or taken to a local recycling center.

Printed on recycled paper

PROJECT Pollution PREVENTION

Storm Drains are for Rain...

Stormdrains take runoff directly to creeks and the ocean without treatment. Pool chemicals can harm our natural creeks and waterways. Anything going into our stormdrains that isn't rainwater contributes to stormwater pollution, which contaminates our creeks and ocean, kills marine life and causes beach closures.

...not pool chemicals

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

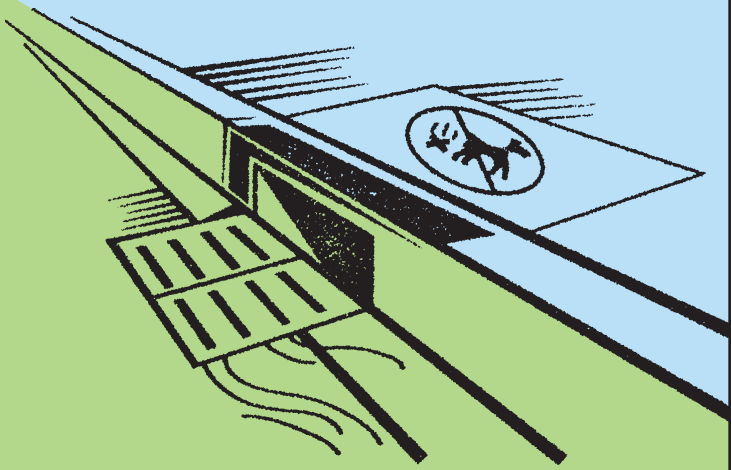
Swimming Pool Tips

Follow these simple steps to prevent stormwater pollution...

- Make sure all chemicals are dissipated before draining a pool or spa
- Do not drain pools within 5 days of adding chemicals
- Never backwash a filter into the street or stormdrain
- Cleanup chemical spills with absorbent, don't wash it down the drain
- Dispose of leftover chemicals and paints through a licensed hazardous waste disposal provider

PROJECT Pollution PREVENTION

Pick Up After Your Pooch!



Storm drains are for rain…
they're not pooper scoopers.

L.A. County residents walk a dog without picking up the droppings more than **62,000** times per month.

Disease-causing dog waste washes from the ground and streets into storm drains and flows straight to the ocean — untreated.

Remember to bring a bag and clean up after your dog.

1 (888) CLEAN LA
www.888CleanLA.com

Tips for Dog Owners:

Dog owners can help solve the stormwater pollution problem by taking these easy steps…

- Clean up after your dog every single time.
- Take advantage of the complimentary waste bags offered in dispensers at local parks.
- Ensure you always have extra bags in your car so you are prepared when you travel with your dog.
- Carry extra bags when walking your dog and make them available to other pet owners who are without.
- Teach children how to properly clean up after a pet. Encourage them to throw the used bags in the nearest trash receptacle if they are away from home.
- Put a friendly message on the bulletin board at the local dog park to remind pet owners to clean up after their dogs.
- Tell friends and neighbors about the ill effects of animal waste on the environment. Encourage them to clean up after their pets as well.

PROJECT Pollution PREVENTION

Storm Drains are for Rain...

More than 200,000 times each month, lawns and gardens throughout LA County are sprayed with pesticides. Overwatering or rain causes pesticides on leaves and grass to flow into the storm drain and to the ocean — untreated.

Please use pesticides wisely, not before a rain, and water carefully.

...not pesticides.

1(888)CLEAN LA
www.888CleanLA.com

Pesticide Tips:

You can keep your lawn and garden green and at the same time solve the pollution problem by taking these easy steps...

- Never dispose of lawn or garden chemicals in storm drains. This is called illegal dumping. Take them to a household hazardous waste roundup. Call 1(888)CLEAN LA or visit www.888CleanLA.com to locate a roundup or collection facility near you.
- More is not better. Use pesticides sparingly. "Spot" apply, rather than "blanket" apply.
- Read labels! Use only as directed.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides, make sure they are in a sealed, water-proof container that cannot leak.
- When watering your lawn, use the least amount of water possible so it doesn't run into the street and carry pesticide chemicals with it. Don't use pesticides before a rain storm. You will not only lose the pesticide, but also will be harming the environment.

PROJECT Pollution PREVENTION

Printed on recycled paper

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- When watering your lawn, use the least amount of water possible so it doesn't run into the street and carry pesticide chemicals with it. Don't use pesticides before a rain storm. You will not only lose the pesticide, but also will be harming the environment.

PROJECT Pollution PREVENTION

Printed on recycled paper

Don't Paint the Town Red!

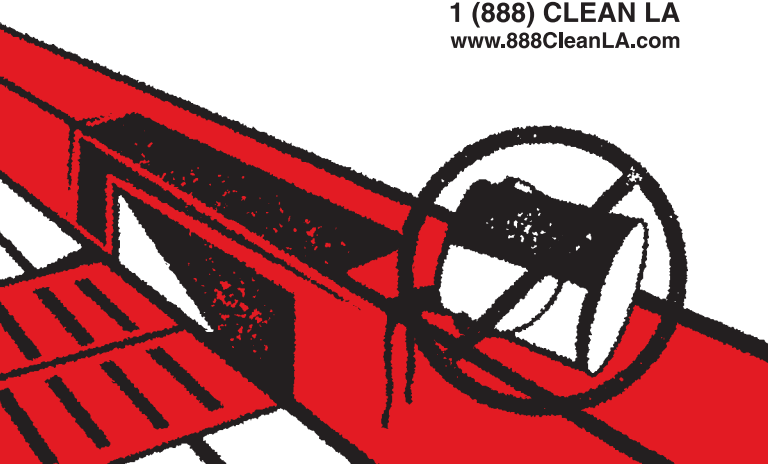
Storm drains are for rain…
they're not for paint disposal.

More than **197,000** times each month, L.A. County residents wash their dirty paint brushes under an outdoor faucet.

This dirty rinse water flows into the street, down the storm drain and straight to the ocean — **untreated**.

Remember to clean water-based paint brushes in the sink, rinse oil-based paint brushes with paint thinner, and take old paint and paint-related products to a Household Hazardous Waste/E-Waste collection event.

1 (888) CLEAN LA
www.888CleanLA.com



Tips for Paint Clean-Up:

L.A. County residents can help solve the stormwater pollution problem by taking these easy steps when working with paint and paint-related products…

- Never dispose of paint or paint-related products in the gutters or storm drains. This is called illegal dumping. Take them to a Household Hazardous Waste/E-Waste collection event. Call 1 (888) CLEAN LA or visit www.888CleanLA.com to locate an event near you.
- Buy only what you need. Reuse leftover paint for touch-ups or donate it to a local graffiti abatement program. Recycle or use excess paint.
- Clean water-based paint brushes in the sink.
- Oil-based paints should be cleaned with paint thinner. Filter and reuse paint thinner. Set the used thinner aside in a closed jar to settle-out paint particles.
- Store paints and paint-related products in rigid, durable and watertight containers with tight-fitting covers.

PROJECT Pollution PREVENTION

A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Are You a Litter Bug and Don't Know It?

Take our quiz!

Have you ever...

- Dropped a cigarette butt or trash on the ground?
- Failed to pick up after your dog while out on a walk?
- Overwatered your lawn after applying fertilizers/pesticides?
- Disposed of used motor oil in the street, gutter or garbage?

If you answered **yes** to any of these actions, then **YOU ARE A LITTER BUG**!

Each of these behaviors contribute to stormwater pollution, which contaminates our ocean and waterways, kills marine life and causes beach closures.

You can become part of the solution!
To find out how, flip this card over.

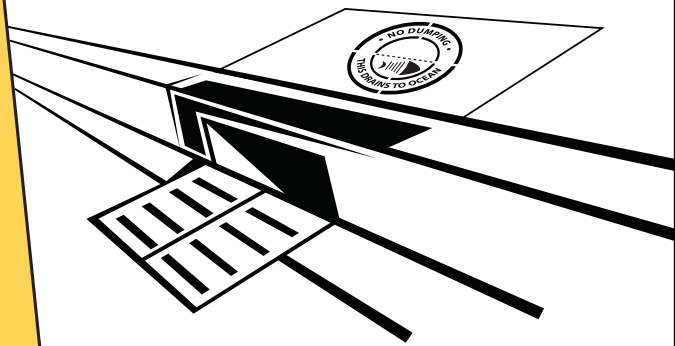
For more information, call or visit:

1 (888) CLEAN LA
www.888CleanLA.com

PROJECT Pollution PREVENTION

Follow these simple steps to prevent stormwater pollution:

- Put your garbage where it belongs — in the trash can.
- Pick up after your dog when out on a walk.
- Reduce pesticide and fertilizer use; don't overwater after application or apply if rain is forecast.
- Dispose of used motor oil at an oil recycling center or at a free Household Hazardous Waste/E-Waste collection event.



A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Good Cleaning Practices

Managing FATS, OIL and GREASE

POST IN CLEANUP/WORK AREA

THE RIGHT WAY

1 Wipe pots, pans, and work areas prior to washing.

2 Dispose of food waste directly into the trash.

3 Collect waste oil and store for recycling.

4 Clean mats inside over a utility sink. Use dry clean up for spills.

THE WRONG WAY

1 Do not pour cooking residue directly into the drain.

2 Avoid using the garbage disposal. Place greasy food in the trash.

3 Do not pour waste oil directly into the drain, parking lot or street.

4 Do not wash floor mats outside where water will run off directly into the storm drain.
Do not rinse spills into the street.

For more information call **(888) CLEAN LA** or visit **www.888CleanLA.com**

PUBLIC WORKS

County of Los Angeles Department of Public Works

environmental health

SANITATION DISTRICTS OF LOS ANGELES COUNTY

www.lacsd.org

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1(888)CLEAN LA
www.888CleanLA.com

...not automotive fluids.

Car Care Tips:

You can keep your car running smoothly and efficiently, and at the same time help prevent stormwater pollution by taking these easy steps...

- When changing vehicle fluids — motor oil, transmission, brake and radiator fluids — drain them into separate drip pans to avoid spills. Do not combine these fluids. Do not dispose of these fluids in the street, gutter or garbage. It is illegal.
- If a spill occurs, use kitty litter, sawdust or cornmeal for cleanup. Do not hose or rinse with water.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visitwww.888CleanLA.com for the location of an auto parts store or gas station that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Regularly check and maintain your car to keep it running safely and efficiently. Water runoff from streets, parking lots and driveways picks up oil and grease drippings, asbestos from brake linings, zinc from tires and organic compounds and metals from spilled fuels and carries them to the ocean.

PROJECT Pollution PREVENTION

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PROJECT Pollution PREVENTION

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Appendix G:
Operation and Maintenance Plan

To be provided during Final Engineering

Appendix H:
Preliminary Percolation Report

ALBUS-KEEFE & ASSOCIATES, INC
GEOTECHNICAL CONSULTANTS

March 4, 2020
J.N.: 2848.00

Mr. Chris Borland
Melia Homes
8951 Research Drive
Irvine, California 92618

Subject: **Percolation Study, Proposed Residential Development, 13633 Vermont Avenue, Gardena, California.**

Dear Mr. Borland,

Pursuant to your request, ***Albus-Keefe & Associates, Inc***. has completed a geotechnical investigation of the site for evaluation of the percolation characteristics of the site soils. The scope of this investigation consisted of the following:

- Exploratory drilling, soil sampling, and percolation test well installation
- Field percolation testing
- Laboratory testing of selected soil samples
- Engineering analysis of the data
- Preparation of this report

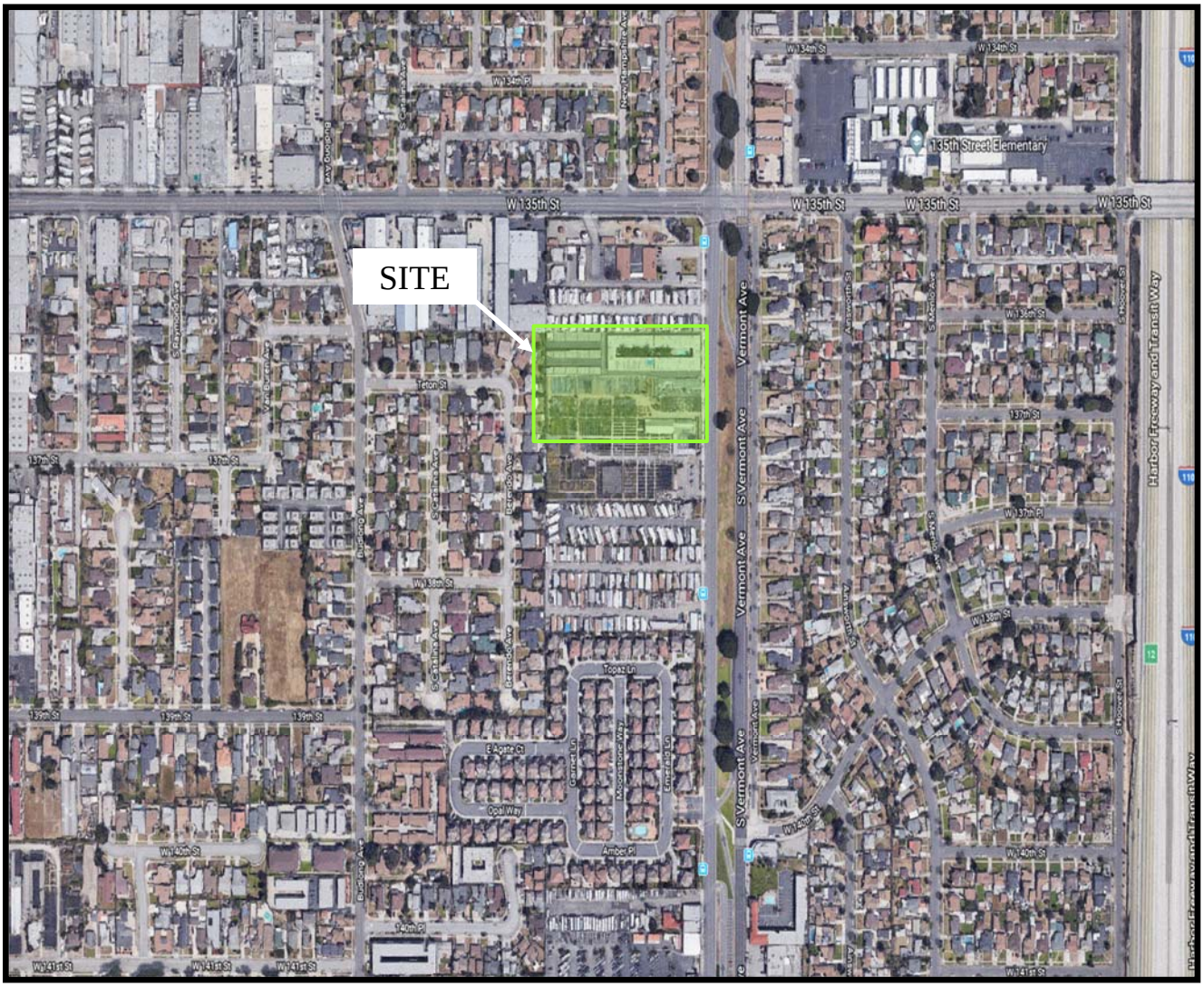
SITE DESCRIPTION AND PROPOSED DEVELOPMENT

Site Location and Description

The site is located at 13633 Vermont Ave, within the city of Gardena, California. The property is bordered by Vermont Avenue to the east, multi-family buildings to the north, single family homes to the west and a mobile home community to the south. The location of the site and its relationship to the surrounding areas is shown on Figure 1, Site Location Map.

The site consists of a rectangular-shaped property containing approximately 4 acres of land. The site is relatively flat with elevations ranging from EL 66 to EL 73 above mean sea level (based on Google Earth) descending to the southwest. The site is currently occupied by a plant nursery. A single-story building that is part of the nursery is situated at the east portion of the site. A single-story motel building is located on the northeast corner of the site. Other site improvements also include asphalt-paved driveways, minor underground utilities, and asphalt-paved parking lots located at the northeast and southeast corners of the site.

Surface drainage within the site is generally directed as a sheet flow toward the southwest corner of the site. Most of the vegetation in the site are sold for commercial purposes and kept in the nursery pots.



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SITE LOCATION MAP

Melia Homes
Proposed Residential Development
13633 Vermont Avenue
Gardena, California

NOT TO SCALE

FIGURE 1

Proposed Development

Based on the architectural site plans by SUMMA Architecture dated on November 4, 2019, the proposed development for the site will consist of 3-story residential townhomes. Associated underground utilities are also planned. The proposed drywell is located at the southwest portion of the site, based on the drywell location plan provided by C&V Consulting dated on March 2, 2020.

No grading or structural plans were available in preparing of this report. However, we anticipate that minor rough grading of the site will be required to achieve future surface configuration. We understand the general elevation will still descend to the southwest. We expect the proposed residential dwellings will be wood-framed structures with concrete slabs on grade yielding relatively light foundation loads.

SUMMARY OF FIELD AND LABORATORY WORK

Subsurface Investigation

Subsurface exploration for this investigation was conducted on October 2, 2019, and consisted of the drilling of five (5) soil borings to depths ranging from approximately 21.5 to 51.5 feet below the existing ground surface (bgs). The borings were drilled using a truck-mounted, continuous flight, hollow-stem-auger drill rig. Representatives of Albus-Keefe & Associates, Inc. logged the exploratory borings. Visual and tactile identifications were made of the materials encountered, and their descriptions are presented in the Exploration Logs in Appendix A. The approximate locations of the exploratory excavations completed by this firm are shown on the enclosed Geotechnical Map, Plate 1.

Bulk, relatively undisturbed and Standard Penetration Test (SPT) samples were obtained at selected depths within the exploratory borings for subsequent laboratory testing. Relatively undisturbed samples were obtained using a 3-inch O.D., 2.5-inch I.D., California split-spoon soil sampler lined with brass rings. SPT samples were obtained from the boring using a standard, unlined SPT soil sampler. During each sampling interval, the sampler was driven 18 inches with successive drops of a 140-pound automatic hammer falling 30 inches. The number of blows required to advance the sampler was recorded for each six inches of advancement. The total blow count for the lower 12 inches of advancement per soil sample is recorded on the exploration log. Samples were placed in sealed containers or plastic bags and transported to our laboratory for analyses. The borings were backfilled with auger cuttings upon completion of sampling.

In addition, one percolation test well, P-1, was installed for subsequent percolation testing. P-1 was excavated to an approximate depth of 30 feet and was installed within exploratory boring B-1. The percolation test well was later backfilled with auger cuttings upon completion of testing.

Percolation Testing

Percolation testing was performed on October 2, 2019, in general conformance with the constant-head test procedures outlined in the referenced Well Permeameter Method (USBR 7300-89). A water hose attached to a water source on site was connected to an inline flow meter to measure the water flow. The flow meter is capable of measuring flow rates up to 13 gallons per minute and as low as 0.06 gallons per minute. A valve was connected in line with the flow meter to control the flow rate. A

filling hose was used to connect the flow meter and the test wells. Water was introduced by the filling hose near the bottom of the test well. A water level meter with 1/100-foot divisions was used to measure the depths to the water surface from the top of well casing. Flow to the well was terminated upon either completion of testing of all the pre-determined water levels or the flow rate exceeded the maximum capacity of the flow meter. Measurements obtained during the percolation testing are provided on Plate C-1 (Appendix C).

Laboratory Testing

Selected samples of representative earth materials from our borings were tested in the laboratory. Tests consisted of USCS classification, in-situ moisture content and dry density, and sieve analysis. Descriptions of laboratory testing and the test results are presented in Appendix B and on the Exploration Logs in Appendix A.

ANALYSIS OF DATA

Subsurface Conditions

Descriptions of the earth materials encountered during our investigation are summarized below and are presented in detail on the Exploration Logs presented in Appendix A.

Soil materials encountered at the subject site consisted of approximately 3.5 feet of artificial fill over older alluvial soils. The artificial fill is predominately comprised of dark brown and reddish-brown sandy clay/clayey sand and silt. These fill materials typically were observed to be slightly moist and very stiff.

The older alluvial soils encountered are comprised of light brown to brown and reddish-brown silt with variable amounts of sand and clay. A layer of sandy clay/clayey sand was observed overlying the silt. Deeper portions of the older alluvium consist of gray-brown to light brown sand overlying interlayers of silty sand and sandy silt/silt.

Groundwater

Groundwater was not encountered during this firm's subsurface exploration to the depth of 51.5 feet. Based on a review of the referenced CDMG Special Report, the site is mapped with a historical groundwater depth of 30 feet.

We obtained and reviewed historic groundwater data made available by the County of Los Angeles Department of Public Works through their online services. Two wells, 3S14W13J03 and 3S14W13J04, were located approximately 1,000 feet north of the site. Based on the two wells spanning a time period from 1940 to 2003, the groundwater has essentially remained below a depth of 96 feet since 1943. A plot of the data from the two wells is provided on Figure 2.

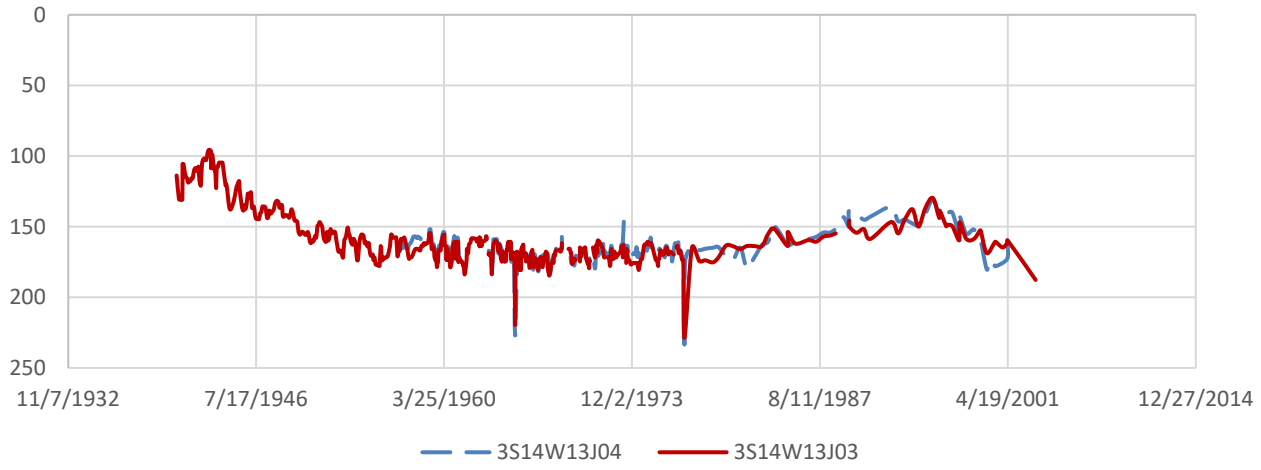


FIGURE 2- Historical Water Well Data

Percolation Data

Analyses were performed to evaluate permeability using the flow rate obtained at the end of the constant-head stage of field percolation testing. These analyses were performed in accordance with the procedures provided in the referenced USBR 7300-89. The procedure essentially uses a closed-form solution to the percolation out of a small-diameter well.

Using the USBR method, we calculated a composite permeability value for the head condition maintained in the well. The result is summarized in Table 1 below and the supporting analyses are included in Appendix C, Plate C-2.

TABLE 1
Summary of Back-Calculated Permeability Coefficient from Constant Head Test

Location	Total Depth of Well (ft)	Depth to Water in Well (ft)	Height of Water in Well (ft)	Static Flow Rate (gal/min)	Estimated Permeability, k_s (in/hr)
P-1	30	25	5.0	1.36	4.4

Design of Dry Well

The ***infiltration rate*** in a BMP is dependent upon several factors including the soil permeabilities of the various soil layers throughout the soil mass, hydraulic gradient of water pressure head in the soil mass, and depth to groundwater. The infiltration rate is related to the permeability by Darcy's equation:

$V = ki$

Where:

V= water velocity (infiltration rate)
k= permeability
i=hydraulic gradient

We have performed the Well Permeameter tests in accordance with the USBR 7300-89 test method. This test provides a means to estimate the ***Permeability Rate*** of the soils being tested, not the infiltration rate. Therefore, the effective infiltration rate must be determined using the relationship between permeability and infiltration rate as expressed by Darcy's equation. Generally, solution of Darcy's equation would require solving a differential equation. Where the BMP is a shallow basin with homogenous soil conditions and no groundwater within the influence of infiltration, the hydraulic gradient is approximately 1 and therefore, the infiltration rate would simply be equal to the permeability rate. However, where these conditions are not met such as the presence of variable permeability characteristics with depth, shallow groundwater, or the BMP has significant water head conditions such as a dry well, the hydraulic gradient could be more or less than 1 and a more complex approach is required to determine the effective infiltration rate. The site lithology is not homogeneous and the suitable BMP is a dry well. Given these factors, a more complex approach is needed.

Infiltration in a dry well was modeled using the software Seep/W, version 2007, by Geo-Slope International. The program allows for modeling of both partially-saturated and saturated porous medium using a finite element approach to solve Darcy's Law. The program can evaluate both steady-state and transient flow in planer and axisymmetric cases. Regions within the model can be set to represent a finite area or to extend in a direction infinitely. Boundaries of the model can be identified with various conditions including fix total head, fix pressure head, fix flow rate, and head as a function of flow. Soil conductivity properties can be modeled with either Fredlund et al. (1994), Green and Corey (1971), Van Genuchten (1980), or Saxton et al. (1986). The parameters suggested by Saxton et al. (1986) were selected for use in our model and were based on test results of particle-size analyses and estimated in-place densities.

A Seep/W model was setup for a well configuration with the bottom of the dry well at a depth of 47 below ground surface. The top 20 feet of the dry well assumed a shaft that is 6 feet in diameter and contains a settling chamber that is 18 feet in depth, has an inside diameter of 4 feet, and outside diameter of 4.5 feet. Below 20 feet, the shaft is assumed to be 4 feet in diameter. The annular space around the chamber from the surface to a depth of 15 feet is assumed to consist of grout. Below 15 feet, the annular space around the chamber and below the chamber is assumed to consist of gravel. A more detailed configuration of the dry well design can be found on Plate 2.

The model consisted of six (6) zones using four (4) material types for the general soil profile. The first and fourth layer (Material # 1) represents the upper 8 feet and 31 to 38 feet where infiltration will not be allowed due to the variability of the artificial fill materials in the upper 8 feet and fine-grained nature of the material at 31 to 38 feet. The saturated conductivity of this layer is represented by a set of input parameters to be nearly impermeable. The second (Material # 2) represents a sandy silt layer that was typically encountered between approximate depths of 8 to 24 feet. A saturated conductivity of 0.1 in/hr was utilized for this layer based on correlation with grain-size testing. The third and fifth layers (Material # 3) represents the sand layers encountered near a depth of 24 to 31 feet and 38 to 48 feet. A saturated conductivity of 4.0 in/hr was utilized for this layer based on the percolation test and correlation with laboratory testing. The final layer (Material # 4) represents the material greater than

48 feet. A saturated conductivity of 1.0 in/hr was utilized for this layer and was based on typical values for this material type. A summary of the well model parameters is provided in Table 2.

TABLE 2
Summary of Characteristic Curve Parameters

Zone No.	Material No.	USCS Classification	Depth (ft)	Ks (in/hr)	Van Genuchten Parameters				
					a (1/cm)	n	m	Sat. Water Content	Residual Water Content
1	1	Impermeable	0 – 8	0.001	0.000	1.22	0.18	0.41	0.01
2	2	ML	8 – 24	0.10	0.002	1.12	0.11	0.38	0.025
3	3	SP	24 – 31	4.0	0.037	1.36	0.27	0.30	0.025
4	1	Impermeable	31 – 38	0.001	0.000	1.22	0.18	0.41	0.01
5	3	SP	38 – 48	4.0	0.037	1.36	0.27	0.30	0.025
6	4	SM	>48	1.0	0.007	1.24	0.19	0.29	0.025

A steady state analysis was performed to estimate the maximum inflow that the well can accommodate. Using a well as described above and inflow invert of 7 feet below grade, we obtain a static total flow of 0.13 ft³/sec. A plot depicting the resulting pressure head contours and flow vectors for the model is provided on Plate C-3.

To evaluate the time required to empty the well chamber once no more water is introduced, the model was reanalyzed with a variable head condition that was dependent upon the volume of water leaving the well. As water infiltrates into the surrounding soil, both the volume of water remaining in the well and the total head in the well drop. A graph of the well head versus exit volume for the well is provided in Figure 3. The function assumes a void ratio of 0.4 within the zones occupied by gravel. If some other well configuration is used, the analyses will require updating.

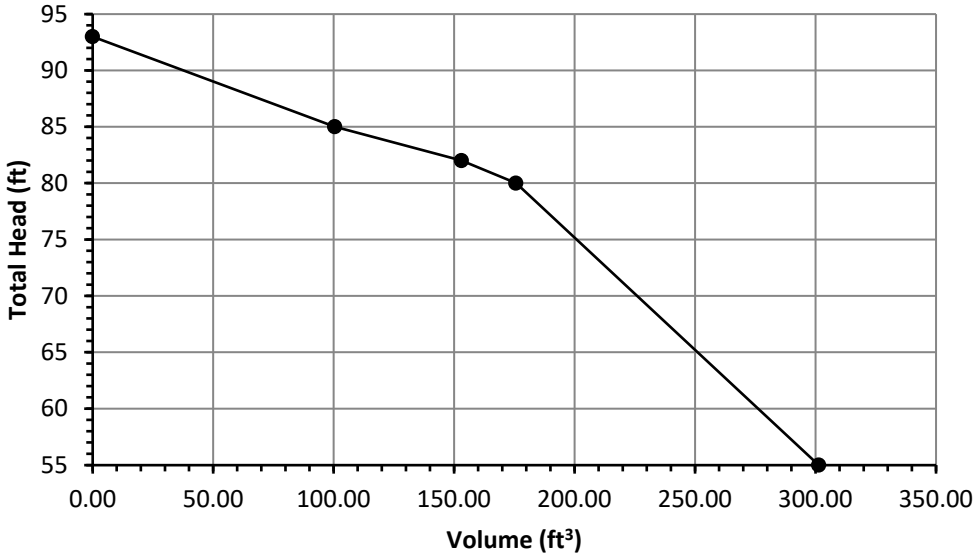


Figure 2 - Well Head Function

The analysis was performed as a transient case over a maximum time of approximately 2.5 hours. The conditions in the model were evaluated in various increments of time over the total duration. From our analyses, the water in the well chamber is completely evacuated in approximately 0.53 hour. Plots depicting the resulting pressure head contours and flow vectors at selected times are provided in Appendix C on Plate C-4 through C-6. A plot of time versus water height in the well is shown on Figure 4.

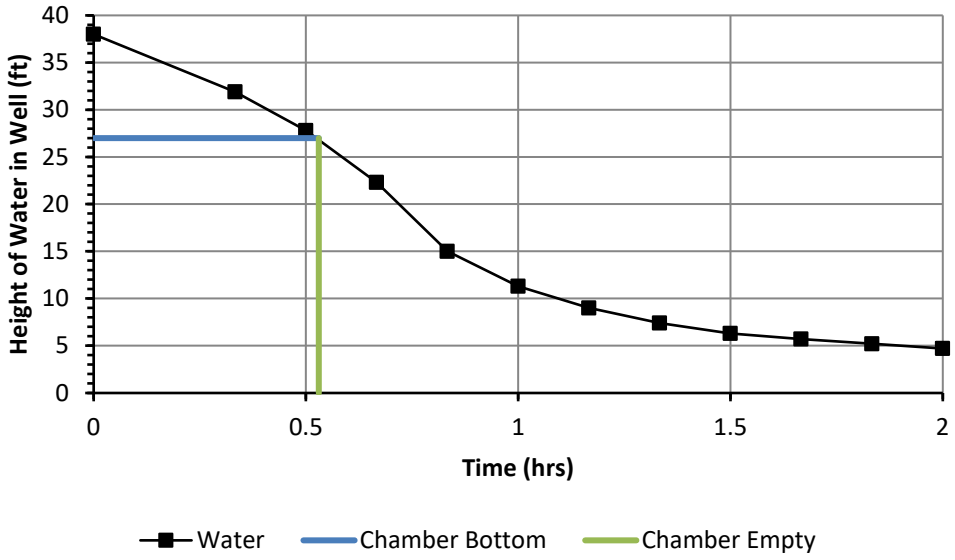


Figure 4 - Height of Water in Dry Well

CONCLUSIONS AND RECOMMENDATIONS

Results of our work indicate a storm water disposal system consisting of a dry well is feasible within the site. The use of dry wells is not anticipated to result in worsening any adverse conditions or hazards that may be present for the proposed site development or adjacent properties including subsidence, landsliding, or liquefaction. Groundwater is anticipated to remain below a depth of 100 feet during the lifetime of the dry well. As such, a dry well having a total depth of 47 feet will provide a minimum clearance of 10 feet above the shallow seasonal groundwater level.

Based on the results of percolation testing and analyses, the percolation rate for the well configuration as depicted on Plate 2 may utilize an unfactored (measured) peak flow rate of 0.13 ft^3/sec. An appropriate factor of safety should be applied to the flow rate as required by the appropriate governmental authority. Based on this peak flow, the maximum average infiltration rate around the wetted perimeter of the well is the flow divided by the area which equals 13.1 in./hr.

The design infiltration rate requires the application of a Reduction Factor in accordance with the County of Los Angeles GS200.2 guidelines. Based on the county requirements, the reduction factor (safety factor) is determined by multiplying the partial reduction factors as indicated in Table 1 below.

The RFt value is prescribed by the test method used. The RFv value is based on the fact that soil conditions are uniform within the infiltration zone, that a test was performed in close proximity to the proposed dry well location, and correlations with laboratory testing of site materials confirm the selected permeability rate obtained by the field test. The RFs value is based on the dry well providing a chamber that traps sediments and removes oils via an absorptive pillow or some other system providing for the removal of most sediment and oils before entering the dry well.

TABLE 1
Reduction Factor

Factor	Value
RFt	2.0
RFv	1.0
RFs	1.0
Total Reduction Factor (RF)	**2.0**
Note: Total Reduction Factor, RF= RFt x RFv x RFs	

Based on the above reduction factor, design of the system should be based on a peak "design" flow of 0.13 cfs/2 = **0.065 cfs.** Once water flow to the well has ceased, we estimate the time to empty the chamber will be approximately 0.53 hour. Assuming an allowable total drawdown time of 96 hours, the maximum total design capture volume (DCV) one dry well can dispose would be approximately (96-0.53) hrs x 0.065 cfs x 3600 s/hr = 22,340 cubic feet.

This infiltration rate only applies to the well configuration described above including the water invert depth of 7 feet. If some other configuration of the dry well or water invert depth is used, the above flow rate and average infiltration rate will not apply and should be updated accordingly.

The actual flow capacity of the dry well could be less or more than the estimated value. As such, provisions should be made to accommodate excess flow quantities in the event the dry well does not infiltrate the anticipated amount. The design also assumes that sediments will be removed from the inflowing water through an upper chamber or other device. Sediments that are allowed to enter the dry well will tend to degrade the flow capacity by plugging up the infiltration surfaces.

In general, the dry well may consist of a concrete inner chamber surrounded by ½-inch open graded gravel. The concrete chamber should have perforations to allow the well to drain. The holes should be sized to prevent piping of the gravel into the chamber. A general diagram of the dry well is provided on Plate 2.

In general, the dry well shaft is anticipated to be adequately stable under temporary construction conditions for uncased drilling. However, granular portions of the older fan deposits are friable and will be prone to sloughing and caving especially if left open for a prolonged period of time. In the event of caving, casing will be required to install the well. Workers should not enter the shaft unless the excavation is laid back or shored in accordance with OSHA requirements. The placement and compaction of backfill materials, including the gravel, should be observed by the project geotechnical consultant.

LIMITATIONS

This report is based on the geotechnical data as described herein. The materials encountered in our boring excavations and utilized in our laboratory testing for this investigation are believed representative of the study area, and the conclusions and recommendations contained in this report are presented on that basis. However, soil and bedrock materials can vary in characteristics between points of exploration, both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein. As such, observations by a geotechnical consultant during the construction phase of the storm water infiltration systems are essential to confirming the basis of this report.

This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty.

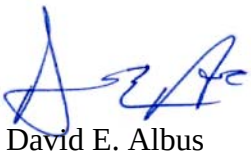
This report should be reviewed and updated after a period of one year or if the site ownership or project concept changes from that described herein. This report has been prepared for the exclusive use of the **Melia Homes** to assist the project consultants in the design of the proposed development. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

This report is subject to review by the controlling governmental agency.

We appreciate this opportunity to be of service to you. If you should have any questions regarding the contents of this report, please do not hesitate to call.

Sincerely,

ALBUS-KEEFE & ASSOCIATES, INC.



David E. Albus
Principal Engineer
G.E. 2455

Enclosures: Plate 1- Geotechnical Map
Plate 2- Dry Well Design
Appendix A - Exploratory Logs
Appendix B - Laboratory Testing
Appendix C - Percolation Testing and Analyses

REFERENCES

Publications and Reports

California Department of Conservation, Division of Mines and Geology, Seismic Hazard Report 027, "Seismic Hazard Zone Report for the Inglewood 7.5-Minute Quadrangle, Los Angeles County, California", 1998.

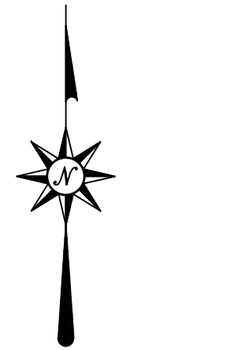
Procedure for Performing Field Permeability Testing by the Well Permeameter Method, by United States Department of The Interior, Bureau of Reclamation (USBR 7300-89).

Saxton, K.E., W.J. Rawls, J.S. Romberger, and R.I. Papendick. 1986. Estimating generalized soil-water characteristics from texture. Soil Sci. Soc. Am. J. 50(4):1031-103

Plans

Drywell Location, VTTM No. 83037, 13615 & 13633 S Vermont Ave., Gardena, CA 90249, prepared by C&V Consulting, dated March 2, 2020

Site Plan, Vermont Ave – Row Townhomes, prepared by Summa Architecture, dated November 19, 2019



EXPLANATION

(Locations Approximate)

- Exploratory Boring
- Exploratory Percolation Test Boring

ALBUS-KEEFE & ASSOCIATES, INC.
GEOTECHNICAL CONSULTANTS

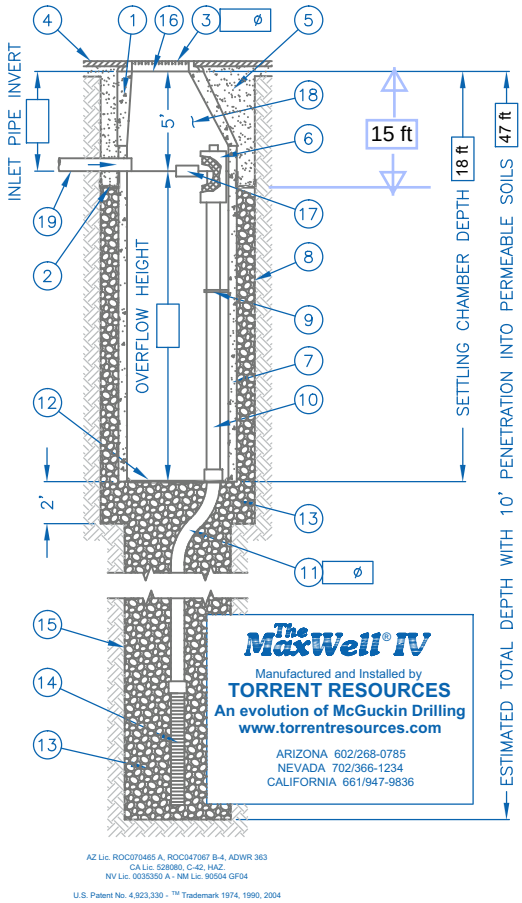
GEOTECHNICAL MAP

Job No.: 2848.00	Date: 03/04/19	Plate: 1

MAXWELL® IV DRAINAGE SYSTEM DETAIL AND SPECIFICATIONS

ITEM NUMBERS

1. **Manhole Cone** - Modified Flat Bottom.
2. **Moisture Membrane** - 6 Mil. Plastic. Applies only when native material is used for backfill. Place membrane securely against eccentric cone and hole sidewall.
3. **Bolted Ring & Grate** - Diameter as shown. Clean cast iron with wording **"Storm Water Only"** in raised letters. **Bolted in 2 locations** and secured to cone with mortar. Rim elevation ±0.02' of plans.
4. **Graded Basin or Paving** (by Others).
5. **Compacted Base Material** - 1-Sack Slurry except in landscaped installtions with no pipe connections.
6. **PureFlo® Debris Shield** - Rolled 16 ga. steel X 24" length with vented anti-siphon and Internal .265" Max. SWO flattened expanded steel screen X 12" length. **Fusion bonded epoxy coated.**
7. **Pre-cast Liner** - 4000 PSI concrete 48" ID. X 54" OD. **Center in hole** and align sections **to maximize bearing surface.**
8. **Min. 6' Ø Drilled Shaft.**
9. **Support Bracket** - Formed 12 Ga. steel. **Fusion bonded epoxy coated.**
10. **Overflow Pipe** - Sch. 40 PVC mated to drainage pipe at base seal.
11. **Drainage Pipe** - ADS highway grade with TRI-A coupler. **Suspend pipe** during backfill operations to prevent buckling or breakage. Diameter as noted.
12. **Base Seal** - Geotextile or concrete slurry.
13. **Rock** - Washed, sized between 3/8" and 1-1/2" to **best complement soil conditions.**
14. **FloFast® Drainage Screen** - Sch. 40 PVC 0.120" slotted well screen with 32 slots per row/ft.Diameter varies 120" overall length with TRI-B coupler.
15. **Min. 4' Ø Shaft** - Drilled to **maintain permeability** of drainage soils.
16. **Fabric Seal** - U.V. resistant geotextile - **to be removed by customer** at project completion.
17. **Absorbent** – Hydrophobic Petrochemical Sponge. Min. to 128 oz. capacity.
18. **Freeboard Depth** Varies with inlet pipe elevation. Increase settling chamber depth as needed to maintain all inlet pipe elevations above overflow pipe inlet.
19. **Optional Inlet Pipe** (Maximum 4", by Others). Extend moisture membrane and compacted base material or 1 sack slurry backfill below pipe invert.



AZ Lic. ROC070465 A, ROC047067 B-4, ADWR 363
CA Lic. 528080, C-42, HAZ.
NV Lic. 0035350 A - NM Lic. 90504 GF04

U.S. Patent No. 4,923,330 - ™ Trademark 1974, 1990, 2004

The referenced drawing and specifications are available on CAD either through our office or web site. This detail is copyrighted (2004) but may be used as is in construction plans without further release. For information on product application, individual project specifications or site evaluation, contact our Design Staff for no-charge assistance in any phase of your planning.

CALCULATING MAXWELL IV REQUIREMENTS

The type of property, soil permeability, rainfall intensity and local drainage ordinances determine the number and design of MaxWell Systems. For general applications draining retained stormwater, use one standard **MaxWell IV** per the instructions below for up to 3 acres of landscaped contributory area, and up to 1 acre of paved surface. For larger paved surfaces, subdivision drainage, nuisance water drainage, connecting pipes larger than 4" Ø from catch basins or underground storage, or other demanding applications, refer to our **MaxWell® Plus** System. For industrial drainage, including gasoline service stations, our **Envibro® System** may be recommended. For additional considerations, please refer to **"Design Suggestions For Retention And Drainage Systems"** or consult our Design Staff.

COMPLETING THE MAXWELL IV DRAWING

To apply the **MaxWell IV** drawing to your specific project, simply fill in the blue boxes per instructions below. For assistance, please consult our Design Staff.

45 feet ESTIMATED TOTAL DEPTH

The Estimated Total Depth is the approximate depth required to achieve 10 continuous feet of penetration into permeable soils. Torrent utilizes specialized **"crowd"** equipped drill rigs to penetrate difficult, cemented soils and to reach permeable materials at depths up to **180 feet.** Our extensive database of drilling logs and soils information is available for use as a reference. Please contact our Design Staff for site-specific information on your project.

18 feet SETTLING CHAMBER DEPTH

On MaxWell IV Systems of over 30 feet overall depth and up to 0.25cfs design rate, the **standard** Settling Chamber Depth is **18 feet .** For systems exposed to greater contributory area than noted above, extreme service conditions, or that require higher design rates, chamber depths up to 25 feet are recommended.

' OVERFLOW HEIGHT

The Overflow Height and Settling Chamber Depth determine the effectiveness of the settling process. The higher the overflow pipe, the deeper the chamber, the greater the settling capacity. For normal drainage applications, an overflow height of **13 feet** is used with the standard settling chamber depth of **18 feet**. Sites with higher design rates than noted above, heavy debris loading or unusual service conditions require greater settling capacities

"Ø DRAINAGE PIPE

This dimension also applies to the **PureFlo®** Debris Shield, the **FloFast®** Drainage Screen, and fittings. The size selected is based upon system design rates, soil conditions, and the need for adequate venting. Choices are 6", 8", or 12" diameter. Refer to "Design Suggestions for Retention and Drainage Systems" for recommendations on which size best matches your application.

"Ø BOLTED RING & GRATE

Standard models are quality cast iron and available to fit 24" Ø or 30" Ø manhole openings. All units are bolted in two locations with wording "Storm Water Only" in raised letters. For other surface treatments, please refer to "Design Suggestions for Retention and Drainage Systems."

"Ø INLET PIPE INVERT

Pipes up to 4" in diameter from catch basins, underground storage, etc. may be connected into the settling chamber. Inverts deeper than 5 feet will require additional settling chamber depth to maintain effective overflow height.

TORRENT RESOURCES INCORPORATED
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TORRENT RESOURCES (CA) INCORPORATED
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An evolution of McGuckin Drilling

The watermark for drainage solutions.®

PLATE 2

TORRENT® RESOURCES

APPENDIX A

EXPLORATORY LOGS

EXPLORATION LOG

Project:		Location:
Address:		Elevation:
Job Number:	Client:	Date:
Drill Method:	Driving Weight:	Logged By:

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
5		**EXPLANATION** Solid lines separate geologic units and/or material types. Dashed lines indicate unknown depth of geologic unit change or material type change. **Solid black rectangle** in Core column represents California Split Spoon sampler (2.5in ID, 3in OD). **Double triangle** in core column represents SPT sampler. **Vertical Lines** in core column represents Shelby sampler. **Solid black rectangle** in Bulk column respresents large bag sample. **Other Laboratory Tests:** Max = Maximum Dry Density/Optimum Moisture Content EI = Expansion Index SO4 = Soluble Sulfate Content DSR = Direct Shear, Remolded DS = Direct Shear, Undisturbed SA = Sieve Analysis (1" through #200 sieve) Hydro = Particle Size Analysis (SA with Hydrometer) 200 = Percent Passing #200 Sieve Consol = Consolidation SE = Sand Equivalent Rval = R-Value ATT = Atterberg Limits							
10									
15									
20									

EXPLORATION LOG

Project:		Location: B-1
Address: 13633 Vermont Ave, Gardena, CA 90247		Elevation: 76
Job Number: 2848.00	Client: Melia Homes	Date: 11/1/2019
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: SD/SB

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		ARTIFICIAL FILL (Af) Sand (SP): Gray, dry							
		Sandy Clay/ Clayey Sand (CL/SC): Reddish brown, moist, very stiff/ medium dense, trace medium grained sand, some pinhole pores		35			14	118	
		OLDER ALLUVIUM (Qoal)		44			15.5	115.8	Consol
5		Silty Sand (SM): Light brown, moist, medium dense, fine grained sand, trace medium grained sand, mica present, iron oxide stainings, magnesium oxide stainings		55			11.7	121.2	
		Sandy Clay (CL): Light brown, slightly moist, very stiff, caliche, magnesium oxide stainings							
		Clayey Sand (SC): Light brown, moist, hard, fine to medium grained sand, increased sand content toward sampler tip, trace coarse grained sand, mica present							
10				44			16.1	115.3	
		Clayey Silt (ML): Light brown, slightly moist, hard, pinhole pores							
15		@ 15 ft, increased silt content, magnesium oxide stainings		34					
		Silt with Sand (ML): Light brown, moist, mica present							
20				14					Hydro
		@ 23.5 ft, becomes very moist to wet							

Albus-Keefe & Associates, Inc.

Plate A-2

EXPLORATION LOG

Project:		Location: B-1
Address: 13633 Vermont Ave, Gardena, CA 90247		Elevation: 76
Job Number: 2848.00	Client: Melia Homes	Date: 11/1/2019
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: SD/SB

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
30		Silty Sand : Mottled gray and light brown, moist, dense, fine grained sand, trace silt, mica present, no groundwater observed		31	■				SA
				36	■				
				23	■				
		Clay (CL): Reddish brown, slightly moist, hard, trace fine grained sand, mica present, iron oxide stainings							
35		@ 35 ft, magnesium oxide stainings		26	■				
		Sand (SP): Gray, slightly moist, very dense, fine grained sand, mica present		72	■				
40									
		Sandy Silt (ML): Mottled grayish brown and light brown, moist, very stiff, mica present, increased silt content toward sampler tip and decreased sand content		11	■				
45									

EXPLORATION LOG

Project:		Location: B-1
Address: 13633 Vermont Ave, Gardena, CA 90247		Elevation: 76
Job Number: 2848.00	Client: Melia Homes	Date: 11/1/2019
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: SD/SB

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
50		Silty Sand (SM): Light brown, moist, medium dense, increased silt content toward sampler tip		15					
		End of boring at depth of 51.5 ft. Backfilled with soil cuttings. No groundwater.							

EXPLORATION LOG

Project:		Location: B-2
Address: 13633 Vermont Ave, Gardena, CA 90247		Elevation: 78
Job Number: 2848.00	Client: Melia Homes	Date: 11/1/2019
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: SD/SB

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Asphalt (AC): 1 inch Crushed Aggregate Base (CAB): 5 inch							SO4 DS ATT pH Resist Ch
		ARTIFICIAL FILL (Af) Sandy Clay (CL): Brown, moist, very stiff		34			12.6	121.8	
5		**OLDER ALLUVIUM (Qoal)** Sandy Silt/ Silty Sand (ML/SM): Brown, moist, hard/ very dense, fine grained sand, trace clay, some medium grained sand		91/ 10"			11.9	120.6	
		@ 6 ft, mottled light brown and brown		73/ 11"			13.8	119.2	
		Silt (ML): Light brown, moist, hard, pinhole pores, mica present, magnesium oxide stainings							
10				49			17.3	112.8	
		Sand (SP): Light brown, moist, dense, fine grained sand, trace silt nodules, pinhole pores							
15				24					
		Sandy Silt/ Silty Sand (ML/SM): Light brown, moist, very stiff/ medium dense, fine to medium grained sand, iron oxide stainings		18					
		Silt (ML): Olive, moist, very stiff, iron oxide stainings, trace fine grained sand							
20				16					
		Silty Sand (SM): Brown, moist, dense							

EXPLORATION LOG

Project:		Location: B-2
Address: 13633 Vermont Ave, Gardena, CA 90247		Elevation: 78
Job Number: 2848.00	Client: Melia Homes	Date: 11/1/2019
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: SD/SB

Depth (feet)	Lith-ology	Material Description	Water	Samples			Laboratory Tests		
				Blows Per Foot	Core	Bulk	Moisture Content (%)	Dry Density (pcf)	Other Lab Tests
				27					
		End of the boring at depth of 26.5. No groundwater encountered. Backfilled with soil cuttings and patched with cold patch asphalt cold patch.							

EXPLORATION LOG

Project:		Location: B-3
Address: 13633 Vermont Ave, Gardena, CA 90247		Elevation: 75
Job Number: 2848.00	Client: Melia Homes	Date: 11/1/2019
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: SD/SB

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Asphalt (AC): 2.5 inch							
		Crushed Aggregate Base (CAB): 2 inch							
		ARTIFICIAL FILL (Af) Sandy Clay (CL): Reddish brown to brown, moist, very stiff, fine grained sand, trace pinhole pores		25	■		13.5	119	
		OLDER ALLUVIUM (Qoal)		31	■		12.5	120.8	
5		Sandy Clay/ Clayey Sand (CL/SC): Reddish brown to brown, moist, very stiff/ medium dense, fine grained sand, some medium grained sand, trace pinhole pores		39	■		13.5	118.5	Consol
		Sandy Silt (ML): Brown to reddish brown, moist, very stiff, fine grained sand, trace clay, pinhole pores, glass debris in 6 ft cuttings							
10		@ 10 ft, hard		50	■		13.3	114.5	
		Silty Sand (SM): Brown, moist, medium dense, fine grained sand, some medium grained sand							
15				19	◆				
		@ 16.5 ft, increased silt content		20	◆				
		Sandy Silt (ML): Pale brown, moist, very stiff, fine grained sand, pinhole pores, trace medium grained sand							
20				18	◆				
		End of boring at depth of 21.5 feet. No groundwater encountered. Backfilled with soil cuttings and patched with cold patch asphalt.							

EXPLORATION LOG

Project:		Location: B-4
Address: 13633 Vermont Ave, Gardena, CA 90247		Elevation: 77
Job Number: 2848.00	Client: Melia Homes	Date: 11/1/2019
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: SD/SB

Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		ARTIFICIAL FILL (Af) Sandy Clay (CL): Dark brown, dry to slightly moist, very stiff, fine grained sand, pinhole pores, black stainings		26			13.7	117.9	SO4 ATT pH Resist Ch
5		**OLDER ALLUVIUM (Qoal)** Sandy Clay/ Sandy Silt (CL/ML): Reddish brown, dry to slightly moist, hard, fine grained sand, caliche		67			14.4	119.8	
		@ 6 ft, iron oxide stainings, increased sand toward sampler tip		74			15.5	118.6	
		Silt (ML): Light brown, dry to slightly moist, very stiff, trace fine grained sand, pinhole pores							
10				36			14.1	118.4	
15		@ 15 ft, slightly moist to moist		15					
		Sand (SP): Grayish brown to light brown, slightly moist, dense, trace clay nodules							
20				32					
		End of boring at depth of 21.5 feet. No groundwater encountered. Backfilled with soil cuttings.							

EXPLORATION LOG

Project:		Location: B-5
Address: 13633 Vermont Ave, Gardena, CA 90247		Elevation: 77
Job Number: 2848.00	Client: Melia Homes	Date: 11/1/2019
Drill Method: Hollow-Stem Auger	Driving Weight: 140 lbs / 30 in	Logged By: SD/SB

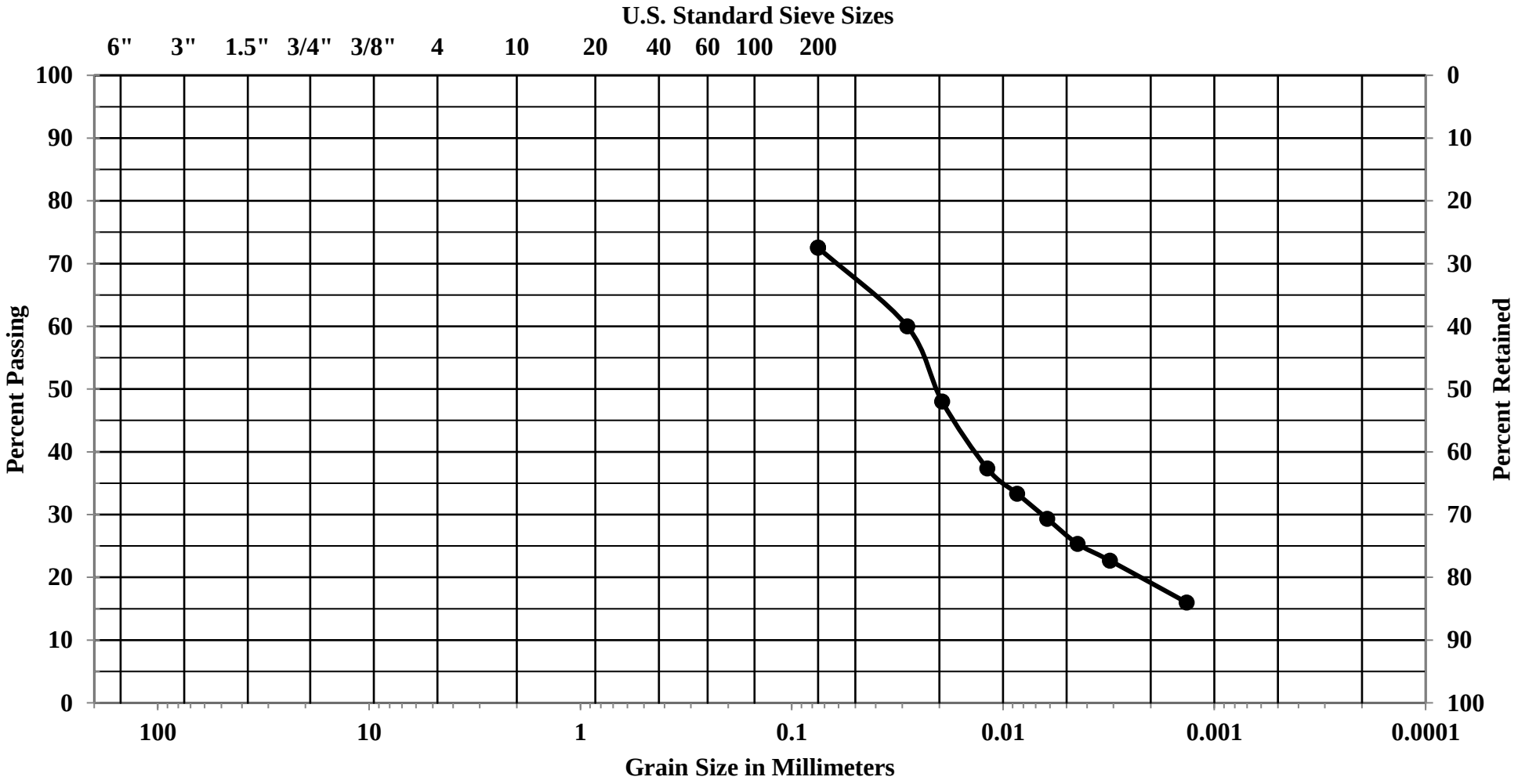
Depth (feet)	Lith-ology	Material Description	Water	Samples: Blows Per Foot	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		ARTIFICIAL FILL (Af) Sandy Silt (ML): Mottled dark brown and light brown, moist, medium stiff, rootlets		11	■		11.8	117.2	
5		**OLDER ALLUVIUM (Qoal)** Sandy Clay (CL): Dark brown, moist, very stiff, pinhole pores, increased fine to medium grained sand toward sampler tip		37	■		13.5	117.4	Consol
		Silt with Clay(ML): Brown, dry to slightly moist, hard, magnesium oxide stainings, caliche, pinhole pores		73	■		14.9	117.5	
10		@ 10 ft, light brown, moist, very stiff, mica present, magnesium oxide stainings		31	■		16.5	115	
15		@ 15 ft, hard		28	⧗				
		Sand (SP): Brown to grayish brown, slightly moist, dense, fine to medium grained sand, trace silt							
20				28	⧗				
		End of boring at depth of 21.5 feet. No groundwater encountered. Backfilled with soil cuttings.							

APPENDIX B

LABORATORY TESTING

GRAIN SIZE DISTRIBUTION

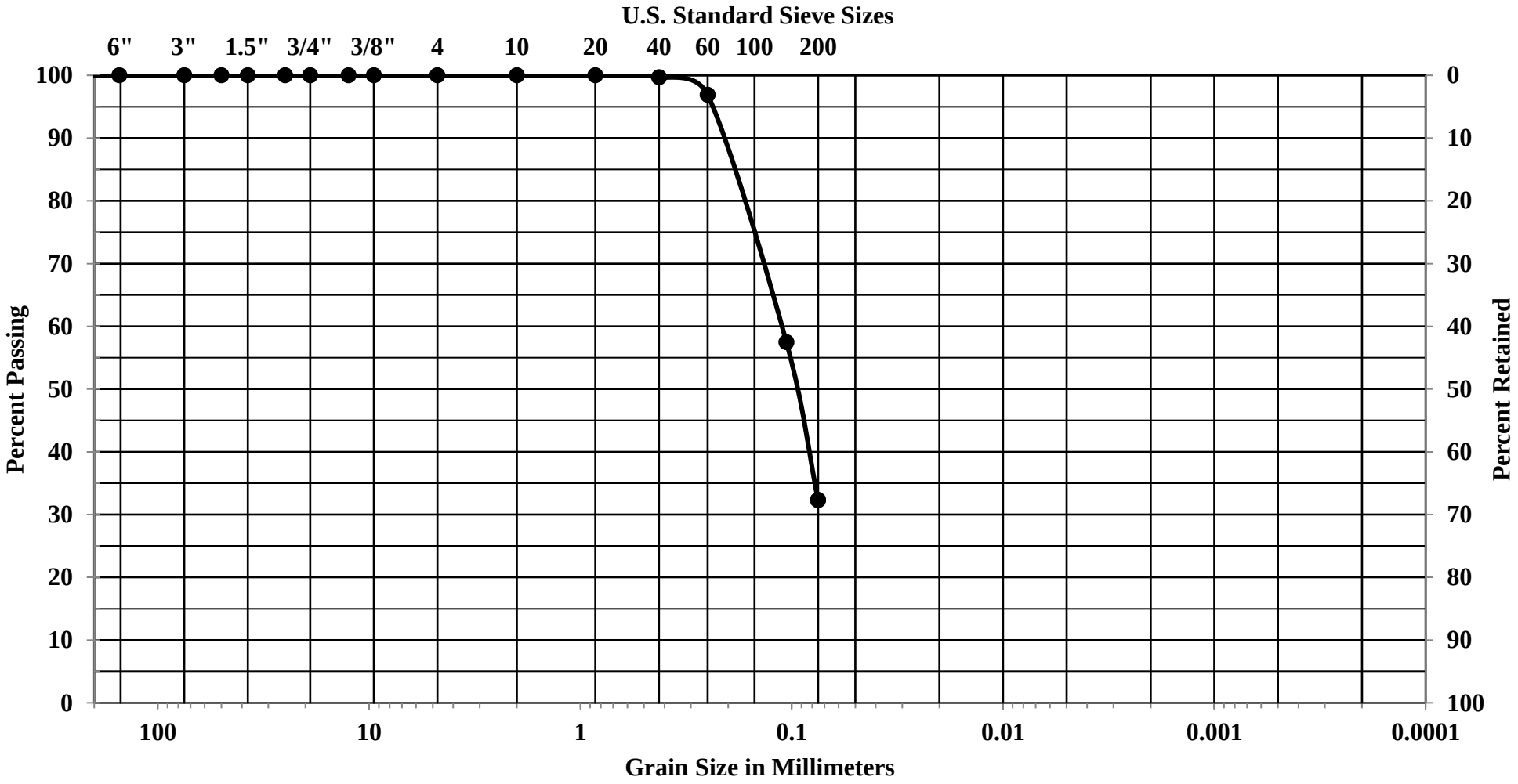
COBBLES	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Job Number	Location	Depth	Description
2848.00	B-1	20	Silt with Sand (ML)

GRAIN SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Job Number	Location	Depth	Description
2848.00	B-1	27	Silty Sand (SM)

APPENDIX C

PERCOLATION TESTING AND ANALYSES

Field Percolation Testing - Constant Head

Client: Melia Homes

Job. No.: 2848.00

Date Tested: 11/1/2019

Test by: SD

Location: P-1

Top of Casing to Bottom of Well (ft): 30

Elev. of Ground Surface (ft): 76

Diam. of Test Hole (in): 8

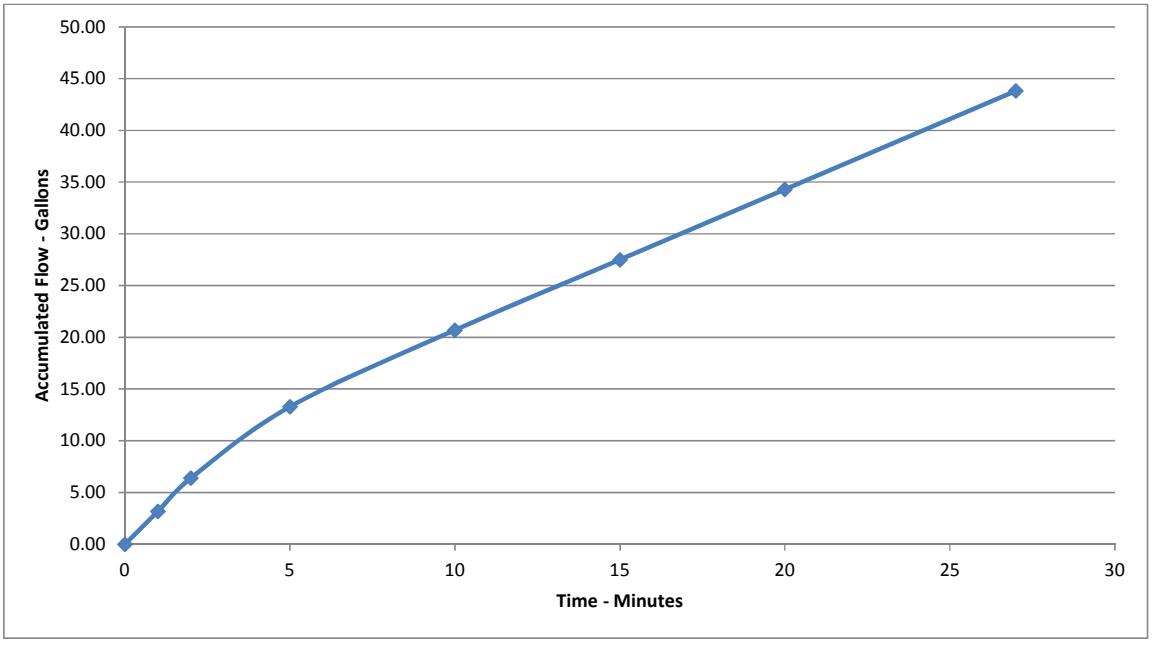
Diam. of Casing (in): 3

Ht. to Top of Casing (ft): 0

Water Tempurature (C°): 21

Constant Head

Elapsed Time (minutes)	Time	Depth to H2O (ft)	Flow Rate (gal./min.)	Total H_2O used (gal)
0	3:50	25	3.40	0.00
1	3:51	25	3.00	3.20
2	3:52	25	1.60	6.40
5	3:55	25	1.36	13.30
10	4:00	25	1.36	20.70
15	4:05	25	1.36	27.50
20	4:10	25	1.36	34.30
27	4:17	25	1.36	43.82



INFILTRATION WELL DESIGN

Constant Head
USBR 7300-89 Method
J.N.: 2848.00
Client: Melia Homes
Well No.: P-1

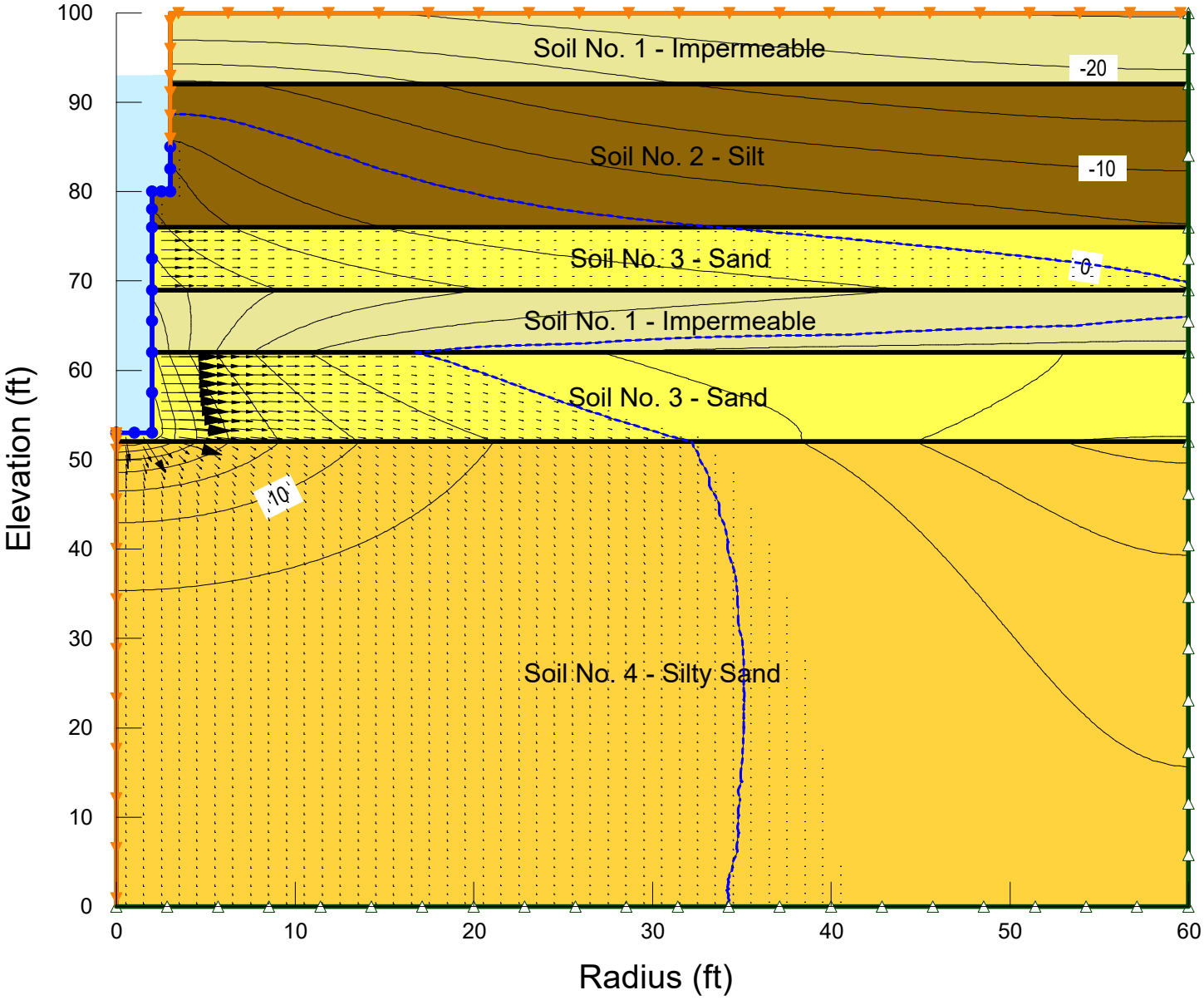
Low Water Table	Condition 1	
High Water Table & Water Below Bottom of Well	Condition 2	
High water Table with Water Above the Well Bottom	Condition 3	
		Units:
Enter Condition (1, 2 or 3):	2	
Ground Surface to Bottom of Well (h_1):	30	feet
Depth to Water (h_2):	25	feet
Height of Water in the Well (h_1-h_2=**h**):	5	feet
Radius of Well (**r**):	4.0	Inches
Minimum Volume Required:	1473.4	Gal.
Discharge Rate of Water Into Well for Steady-State Condition (**q**):	1.36	Gal/min.
Temperature (**T**):	21	Celsius
(Viscosity of Water @ Temp. T) / (Viscosity of water @ 20° C) (**V**):	0.9647	ft^3/min.
Unsaturated Distance Between the Water Surface in the Well and the Water table (T_u):	5	
Factor of Safety:	1	
Coefficient of Permeability @ 20° C (k_{20}):	6.11E-03	ft/min.
Design k_{20}:	4.40	in./hr.

The presence or absence of a water table or impervious soil layer within a distance of less than three times that of the water depth in the well (measured from the water surface) will enable the water table to be classified as **Condition I**, **Condition II**, **Condtion III**.

Low Water Table-When the distance from the water surface in the test well to the ground water table, or to an impervious soil layer which is considered for test puposes to be equivalent to a water table, is greater than three times the depth of water in the well, classify as **Condition I**.

High Water Table-When the distance from the water surface in the test well to the ground water table or to an impervious layer is less than three times the depth of water in the well, a high water table condition exists. Use **Condition II** when the water table or impervious layer is below the well bottom. Use **Condition III** when the water table or impervious layer is above the well bottom.

STEADY STATE
FLOW ANALYSIS OF 45 ft DEEP DRY WELL

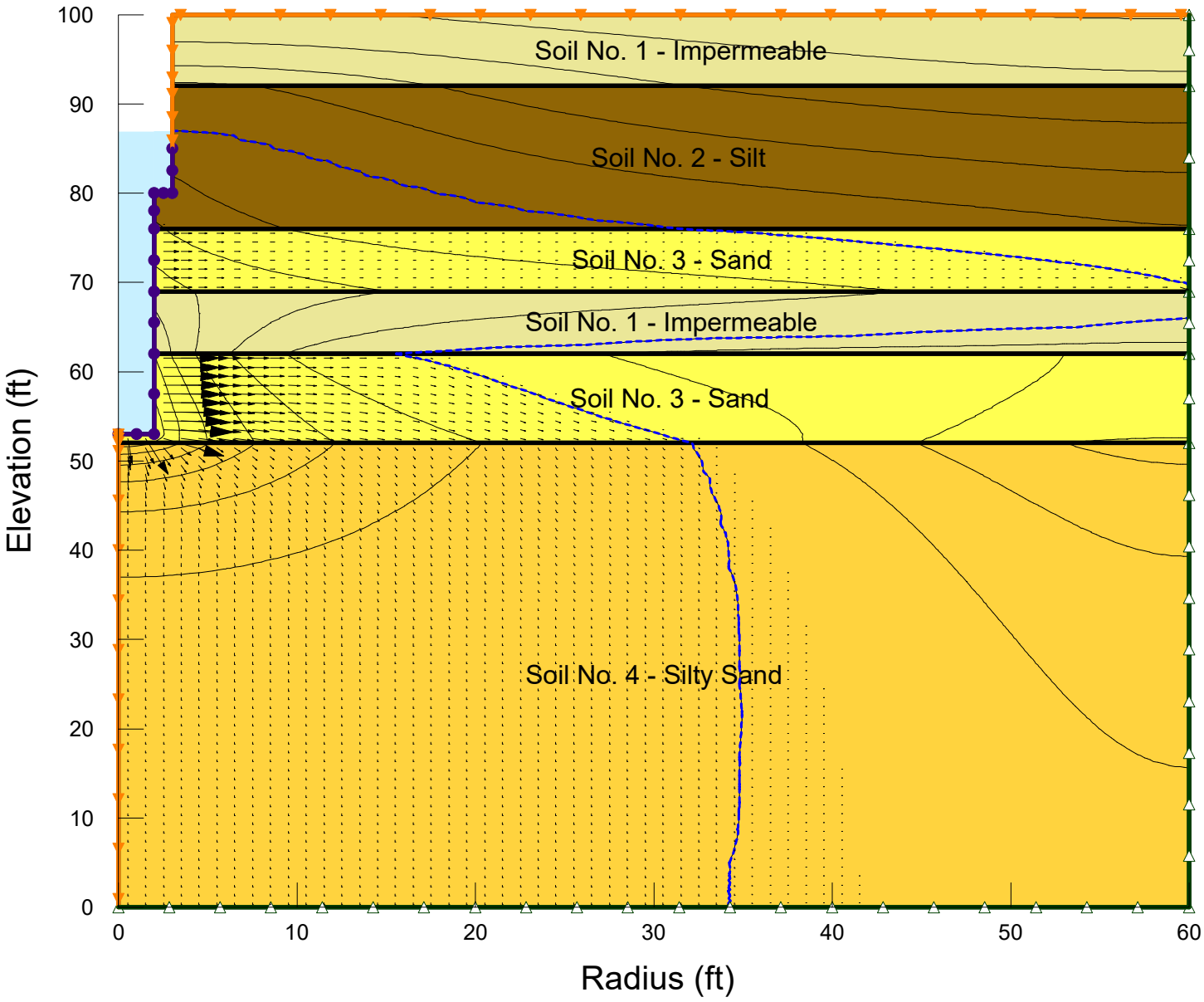


Contours are Pressure Head in Feet.
Arrows indicate direction of flow and relative magnitude of velocity.

LEGEND

- Zero Flux
- Potential Seepage Face
- Fixed Total Head = 93'

TRANSIENT @ 0.3 hour
FLOW ANALYSIS OF 45 ft DEEP DRY WELL

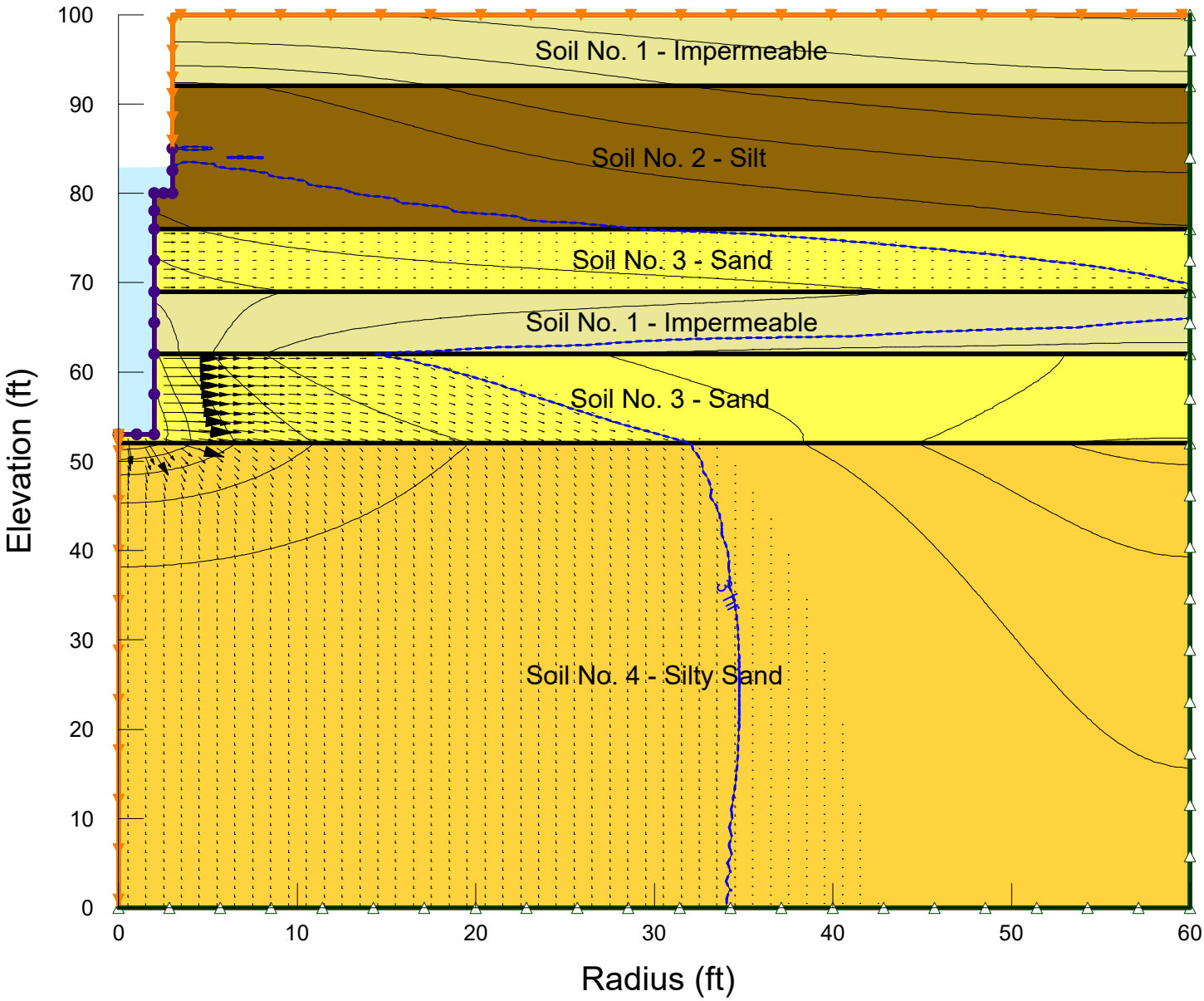


Contours are Pressure Head in Feet.
Arrows indicate direction of flow and relative magnitude of velocity.

LEGEND

- Zero Flux
- Potential Seepage Face
- Well Head Function

TRANSIENT @ 0.5 hour
FLOW ANALYSIS OF 45 ft DEEP DRY WELL

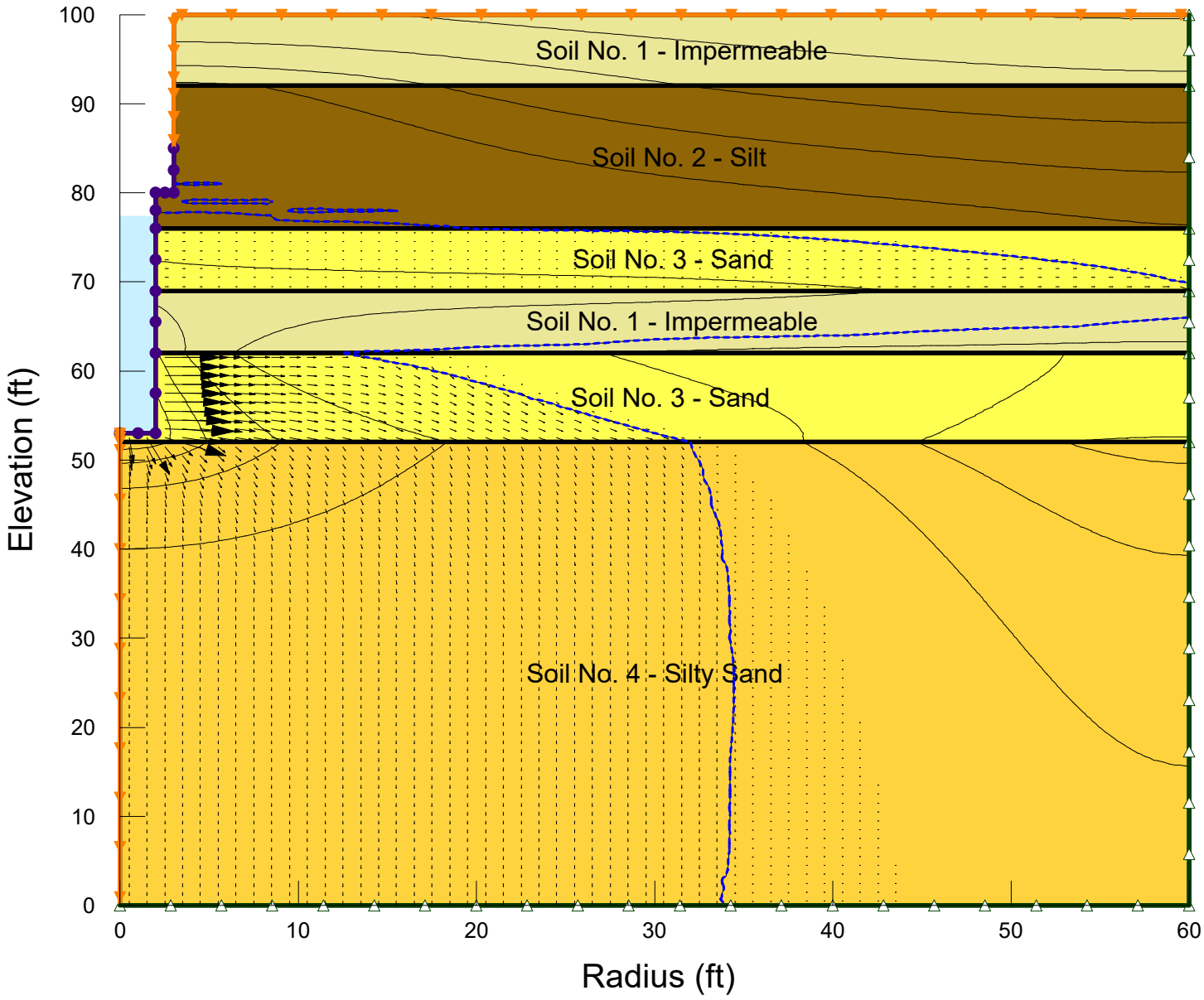


Contours are Pressure Head in Feet.
Arrows indicate direction of flow and relative magnitude of velocity.

LEGEND

- Zero Flux
- Potential Seepage Face
- Well Head Function

TRANSIENT @ 0.7 hour
FLOW ANALYSIS OF 45 ft DEEP DRY WELL



Contours are Pressure Head in Feet.
Arrows indicate direction of flow and relative magnitude of velocity.

LEGEND

- Zero Flux
- Potential Seepage Face
- Well Head Function