Preliminary Water Quality Management Plan (PWQMP)

For compliance with Santa Ana Regional Water Quality Control Board

Order Number R8-2010-0036 (NPDES Permit No. CAS618036)

for

Project Name:	**Duke - State Street**
Ontario Project #:	**PMTT22-008 PDEV22-010**
Project Description:	**Industrial Building Development**
Applicant Name:	**Duke Realty**
Applicant Address:	**200 Spectrum Center Drive, Suite 1600 Irvine, CA 92618**
Project Address:	**NW corner of State Street and Bon View Avenue**
Size of Development:	**16 ACRES**

Submittal Date: February 7, 2022
Revised: April 28, 2022
Revised: June 14, 2022

Preliminary Water Quality Management Plan (PWQMP)

1. Introduction

The Preliminary Water Quality Management Plan (PWQMP) is a planning tool to improve integration of required water quality elements, stormwater management, water conservation, rainwater harvesting and re-use, and flood management in land use planning and the City's development process. The Preliminary WQMP will assist project applicants and planners in properly designing and laying out project sites so that water quality may be incorporated in the most effective manner and at the lowest cost for the developer.

The San Bernardino County Municipal Separate Storm Sewer System Permit (MS4 Permit) requires project-specific Water Quality Management plans (WQMP) to be prepared for all priority new development and significant redevelopment projects listed in Section 2 of this document. The MS4 Permit stipulates that the City of Ontario require priority project applicants to submit a Preliminary project-specific WQMP, as early as possible, during the environmental review or planning phase of a development project and that the Preliminary WQMP be approved prior to the issuance of land use entitlement.

2. Priority Projects (requiring a Preliminary WQMP)

Land Use entitlement shall not be issued for any of the listed projects, below, until a Preliminary WQMP has been approved by the City's Engineering Department. For construction projects not going through entitlement, a Preliminary and Final project-specific WQMP shall be approved, prior to the issuance of construction permits:

Check the appropriate project category below, for this project:

Check below	**Project Categories**
	1. All significant re-development projects. Significant re-development is defined as the addition or replacement of 5,000 or more square feet of impervious surface on an already developed site subject to discretionary approval of the Permittee. Redevelopment does not include routine maintenance activities that are conducted to maintain original line and grade, hydraulic capacity, original purpose of the facility, or emergency redevelopment activity required to protect public health and safety. Where redevelopment results in an increase of less than fifty percent of the impervious surfaces of a previously existing developed site, and the existing development was not subject to WQMP requirements, the numeric sizing criteria discussed below applies only to the addition or replacement, and not to the entire developed site. Where redevelopment results in an increase of fifty percent or more of the impervious surfaces of a previously existing developed site, the numeric sizing criteria applies to the entire development (new and existing).

Check below	**Project Categories**
X	2. New development projects that create 10,000 square feet or more of impervious surface (collectively over the entire project site) including commercial, industrial, residential housing subdivisions (i.e., detached single family home subdivisions, multi-family attached subdivisions or townhomes, condominiums, apartments, etc.), mixed-use, and public projects. This category includes development projects on public and private land, which fall under the planning and building authority of the permitting agency.
	3. Automotive repair shops (with SIC codes 5013, 5014, 5541, 7532- 7534, 7536-7539).
	4. Restaurants and Food Service Establishments where the land area of development is 5,000 square feet or more.
	5. Developments of 2,500 square feet of impervious surface or more adjacent to (within 200 feet) or discharging directly into environmentally sensitive areas (ESA's) such as areas designated in the Ocean Plan as areas of special biological significance or waterbodies listed on the CWA Section 303(d) list of impaired waters.
X	6. Parking lots of 5,000 square feet or more exposed to storm water. Parking lot is defined as land area or facility for the temporary storage of motor vehicles.
	7. Retail Gasoline Outlets (RGOs) that are either 5,000 sq ft or more, or have a projected average daily traffic of 100 or more vehicles per day.
	8. *This project is not covered under any of the categories listed above.

* If the development is not covered under any of the project categories listed in Section 2, the project is not required to design and install Site Design/LID BMPs or Treatment Control BMPs to treat the design storm event (Design Capture Volume) described in Section 4.

3. Preliminary WQMP Objectives

Through a combination of Site Design/LID BMPs (where feasible), Source Control, and/or Treatment Control BMPs, project-specific WQMPs shall address all identified pollutants and hydrologic conditions of concern from new development and significant re-development projects for the categories of projects (priority projects) listed in Section 2. Under each type of BMP, listed below, please indicate which BMPs are planned to be implemented and included in the Final WQMP for the project:

A. Site Design/LID (Low Impact Design) for Reducing Stormwater Runoff:

The MS4 Permit requires each priority development project to infiltrate, harvest and use, evapotranspire, or bio-treat the runoff from a 2-yr, 24-hour storm event (Design Capture Volume). If site conditions do not permit infiltration, harvest and use, evapotranspiration, and/or bio-treatment of the entire Design Capture Volume, at the project site, Site Design/LID techniques are required to be implemented to the Maximum Extent Practicable, at the project site, and the remainder of the DCV shall be infiltrated, harvested, bio-treated or treated by alternative measures.

Project applicants shall submit a Preliminary WQMP that documents the LID/Site Design BMPs, proposed for the project. Please indicate, in the table below, which Site Design/LID BMPs will be utilized on this project to accomplish this requirement:

Site Design/LID Practice	Planned	Not Planned
Provide at least the minimum effective area required for LID BMPs, to comply with the WQMP (see Table 3-1 below).		X
Grade parking lot areas/drive aisles/roof drains to sheet flow runoff into landscaped swales, via curb cuts or zero-face curbs or otherwise disconnect direct drainage from MS4.		X
Design landscaped areas as swales and grade to accept runoff from building roofs, parking lots and project roadways.		X
Install surface retention basins or infiltration trenches to receive impervious area runoff.	X	
Install pervious pavement in parking stalls, alleys, driveways, gutters, walkways, trails or patios.		X
Install underground stormwater retention chambers where downstream landscaped areas are limited.	X	
Install approved Stormwater Drywells in detention areas.		X
Construct streets, sidewalks, and parking lot stalls to the minimum widths necessary.	X	
Install on-site Biotreatment basins/trenches with underdrains, where soil type is poorly draining.		X
Install "Engineered Soil" to increase uptake/soil storage capacity and/or evapotranspiration.		X
Install Rainwater Harvesting/Use Equipment.		X
Utilize approved off-site retention/infiltration, biotreatment or proprietary treatment, where it is infeasible to install, on-site.		X

Table 3-1 Minimum Effective Area[1] Required for LID BMPs (surface + subsurface facilities) for Project WQMP to Demonstrate Infeasibility[2] (% of site)

Project Type	New Development	Re-Development
SF/MF Residential < 7 du/ac	10%	5%
SF/MF Residential < 7 - 18 du/ac	7%	3.5%
SF/MF Residential > 18 du/ac	5%	2.5%
Mixed Use, Commercial/Industrial w/FAR< 1.0	10%	5%

Mixed Use, Commercial/Industrial w/FAR 1.0-2.0	7%	3.5%
Mixed Use, Commercial/Industrial w/FAR> 2.0	5%	2.5%
Podium (parking under > 75% of project)	3%	1.5%
Zoning allowing development to property lines	2%	1%
Transit Oriented Development[3]	5%	2.5%
Parking	5%	2.5%

[1] "Effective area" is defined as land area which 1) is suitable for a retention/infiltration BMP (based on infeasibility criteria) and 2) is located down-gradient from building roof or paved areas, so that it may receive gravity flow runoff.
[2] Criteria only required if the project WQMP seeks to demonstrate that the full DCV cannot be feasibly managed on-site.
[3] Transit oriented development is defined as a project with development center within one half mile of a mass transit center.
Key: du/ac = dwelling units/acre, FAR = Floor Area Ratio = ratio of gross floor area of building to gross lot area, MF = Multi Family, SF = Single Family

B. Source Control BMPs – The following BMPs are designed to control stormwater pollutants and runoff water at the location where it is generated. Please indicate which of the listed BMPs are planned to be implemented for the project:

Source Control BMPs	Planned	Not Planned
Minimize non-stormwater site runoff through efficient irrigation system design and controllers.	X	
Minimize trash and debris in storm runoff through a regular parking lot, storage yard and roadway sweeping program.	X	
Provide proper covers/roofs and secondary containment for outside material storage & work areas.		X
Provide solid roofs over all trash enclosures.	X	
Site Owner(s)/Property Manager/HOA or POA will be familiar with the project WQMP and stormwater BMPs.	X	
Owner or HOA or POA to provide Education/Training of site occupants and employees on stormwater BMPs.	X	
Install stormwater placards/stenciled messages with a "No Dumping" message on all on-site/off-site storm drain inlets.	X	
Provide contained equipment/vehicle wash rack areas that discharge to sanitary sewer.		X

C. Treatment Control BMPs – The following BMPs are designed to control stormwater pollutants where it is not feasible to install on-site Site Design/LID BMPs, with the requisite capacity to treat the Design Capture Volume for identified Pollutants of Concern or where pretreatment of stormwater runoff is required, ahead of infiltration BMPs. Please indicate which of the listed BMPs are planned to be implemented for the project:

Treatment Control BMP	Planned	Not Planned
Gravity Separator devices for pretreatment of sediment, trash/litter or Oil & Grease	X	
Proprietary Biofiltration vaults/devices		X
Media Cartridge Filtration Vaults		X
Proprietary Filter Inserts for on-site storm drain inlets or retention basin/trench overflow drains		X
Regional Treatment facilities are installed or are planned for installation, off-site, and provide a superior level of treatment or clear advantage to on-site treatment BMPs		X

4. Volume-based calculation (approximate) for sizing on-site or off-site Stormwater Retention/Infiltration, Harvest & Re-Use or Biotreatment facilities

1) Calculate the "Watershed Imperviousness Ratio", i, which is equal to the percent of impervious area in the BMP Drainage Area divided by 100.

2) Calculate the composite runoff coefficient C_{BMP} for the Drainage Area above using the following equation:

$$\mathbf{C_{BMP} = 0.858i^3 - 0.78i^2 + 0.774i + 0.04}$$

where: **C_{BMP}** = composite runoff coefficient; and,

i = watershed imperviousness ratio.

3) Determine the area-averaged "6-hour Mean Storm Rainfall", P_6, for the Drainage Area. This is calculated by multiplying the area averaged 2-year 1-hour value (0.55"-0.6") by the appropriate regression coefficient from Table 1 (1.4807). The 2-yr, 1-hr value for southern Ontario is approximately to 0.5" (P_6 = 0.5*1.4807 = 0.74 and northern Ontario is approximately 0.6" in/hr (P_6 = 0.6*1.4807 = 0.89).

4) Determine the appropriate drawdown time. Use the regression constant a = 1.582 for 24 hours and a = 1.963 for 48 hours. *Note: Regression constants are provided for both 24 hour and 48 hour drawdown times; however, 48 hour drawdown times should be used in most areas of California. Drawdown times in excess of 48 hours should be used with caution as vector breeding can be a problem after water has stood in excess of 72 hours. (Use of the 24 hour drawdown time should be limited to drainage areas with coarse soils (Class 'A' soils, that readily drain.)*

5) Calculate the "Maximized Detention Volume", P_0, using the following equation:

$$\mathbf{P_0 = a \cdot C_{BMP} \cdot P_6}$$

where: **P_0** = Maximized Detention Volume, in inches

a = 1.582 for 24 hour and a = 1.963 for 48 hour drawdown,

C_{BMP} = composite runoff coefficient; and,

P_6 = 6-hour Mean Storm Rainfall, in inches

6) Calculate the "Target Capture Volume", V_0, using the following equation:

$$\mathbf{V_0 = (P_0 \cdot A) / 12}$$

where: **V_0** = Target Capture Volume, in acre-feet

P_0 = Maximized Detention Volume, in inches; and,

A = BMP Drainage Area, in acres

Project Volume-based calculation (approximate) for planned on-site or off-site Stormwater Retention/Infiltration, Harvest & Re-Use or Biotreatment facilities:

Variable	Factor/Formula	Area A Result	Area X Result	Area X Result	Area X Result
Ratio of impervious surface/total site surface	(i)	0.90			
C_{BMP}= runoff coefficient	$0.858i^3 – 0.78i^2 + 0.774i + 0.04$ =	0.73028			
P_6	**P_6 = 2-yr,1- hr depth*1.4807 =	0.9032			
Detention Volume-acre inches	P_0 = a * C_{BMP} * P_6 =	1.295			
Drawdown rate of basin/trench (a)	1.582 for 24-hr drawdown or 1.963 for 48-hr drawdown =	1.963			
Project Total Area (ac)	(A)	16.4			
Design Capture Volume, cu. ft. (DCV)	V_0 = [(P_0 * A)/12]*43560 =	77,083			
Water Volume infiltrated in first 3 hrs of storm	Vol= in/hr/12 x ft^2 of infiltration area x 3 hrs	5,747			
Retention/treatment Volume provided, cu. ft.	Retention capacity of basins, trenches, underground system or biotreatment proposed	77,220			

**For P_6 value, use site coordinates and NOAA website to determine project's average 2-yr, 1-hr rainfall depth, at: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html .

5. Hydrologic Conditions of Concern (HCOC) and use of the on-line San Bernardino County HCOC Map for determining necessary mitigation steps necessary if there are HCOCs downstream of a project:

Project applicants may access the on-line HCOC Map at: http://sbcounty.permitrack.com/WAP/ . The map will indicate any hydrology concerns with downstream waterways that are hydraulically connected to the project and will indicate if there are any approved regional projects downstream that could be utilized for off-site mitigation of HCOCs. Please indicate here if the project will or will not be able to retain/infilter, harvest and use or biotreat and detain the DCV, on-site, as calculated in Section 4 and if there are HCOCs identified downstream of the project:

Retain or Harvest/Use the DCV on site?	Yes	**X**	No	
Biotreat the DCV but not infilter the runoff?	Yes		No	**X**
HCOCs identified downstream of site?	Yes		No	**X**

If the entire DCV will not be retained on site, the DCV is biotreated but not infiltered or additional detention capacity is needed to address identified HCOCs, downstream of the site, please list here, what additional mitigation measures will be utilized (on-site or off-site) to address HCOCs (see Section 4.2.1-4.2.3 of the SB County WQMP Technical Guidance):

6. Site Plan and Conceptual Grading/Drainage Plan requirements for submission with the Preliminary WQMP:

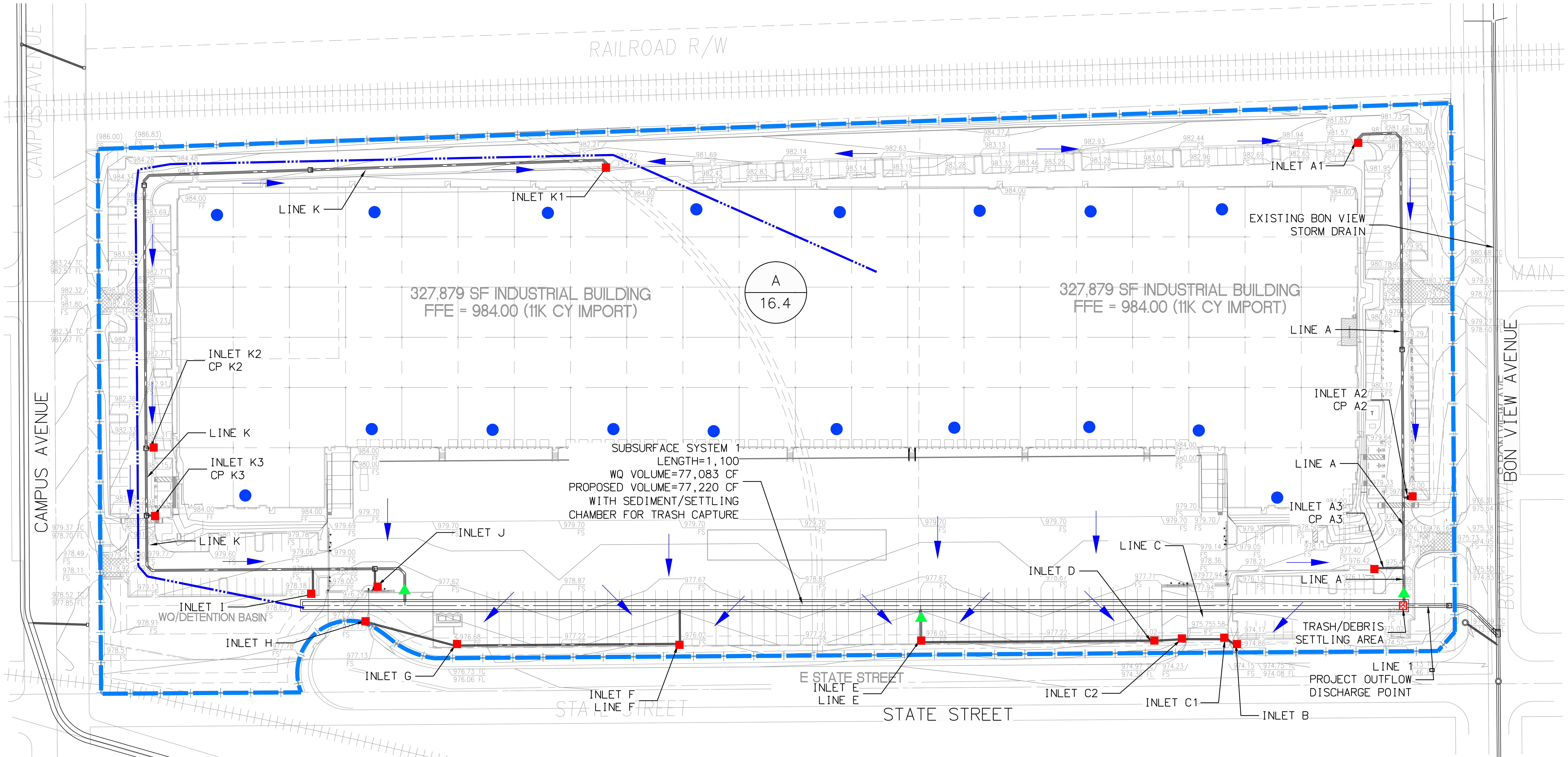
Provide a Site Plan and Conceptual Grading/Drainage Plan along with this Preliminary WQMP, which conceptually shows the proposed locations of buildings, homes, parking lots, parks, new paved roadways, landscaped areas, drainage patterns and drainage sub-areas, methods of conveyance, proposed retention/infiltration, harvest & use or biotreatment facilities that are planned for installation. Where it is determined to be infeasible to capture and detain design storm runoff volumes, on-site, please include other design features, as described in Section 3, above. Include numbered or lettered notes on the Site Plan with a legend detailing other BMPs, as described in Section 3.

WQMP SITE PLAN

DUKE - STATE STREET

IN THE CITY OF ONTARIO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA

WQMP SITE PLAN



LEGEND:

- XXX / X.X — SUB AREA / ACRES
- SURFACE FLOW DIRECTION
- FLOW PATH
- WATERSHED BOUNDARY
- COLLECTION POINT
- ROOF DRAIN
- CDS UNIT (GRAVITY SEPARATOR DEVICE)

DRAINAGE AREA SUMMARY TABLE	
DRAINAGE AREA	A
AREA (ACRES)	16.4
IMPERVIOUS RATIO	0.9
WATER QUALITY VOLUME REQUIRED	77,083
DESIGN SUBSURFACE STORAGE VOLUME	77,220

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

EXHIBIT "A"

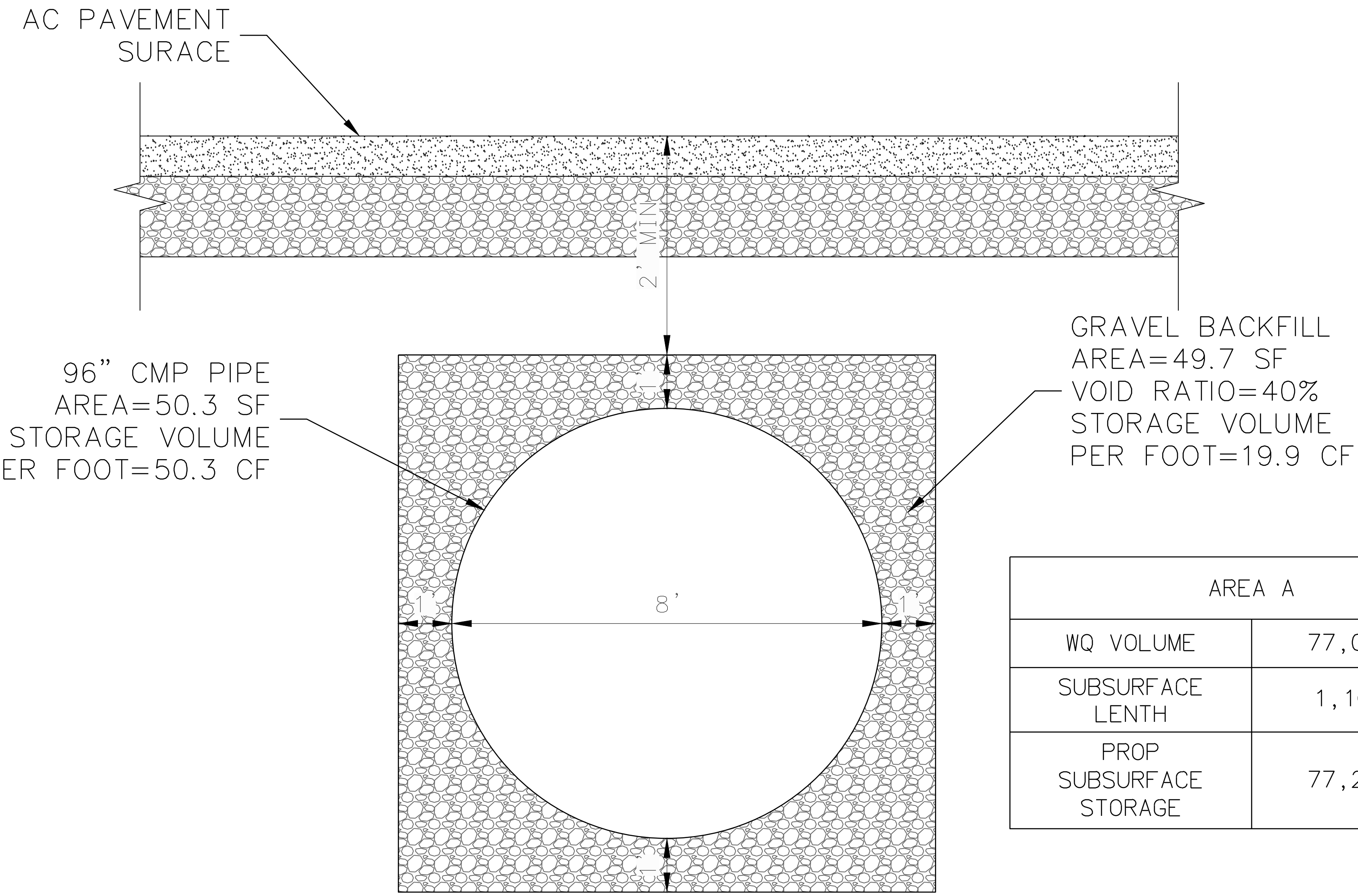
DUKE - STATE STREET

WQMP SITE PLAN

SUBSURFACE SYSTEM DETAIL SHEET

TYPICAL 96" SUBSURFACE STORAGE CROSS SECTION AND STORAGE VOLUME PER FOOT

96" CMP SUBSURFACE STORAGE VOLUME CALCULATION
SUBSURFACE STORAGE PER FOOT=70.2 CF



AREA A	
WQ VOLUME	77,083 CF
SUBSURFACE LENTH	1,100 FT
PROP SUBSURFACE STORAGE	77,220 CF

BMP CALCULATIONS

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume
DUKE - STATE STREET - DMA A

1 Project area DA 1 (ft^2): 714,384	**2** Impervious area after applying preventative site design practices (Imp%): 0.9	3 Runoff Coefficient (Rc): 0.7303 *$R_c = 0.858(Imp\%)^3 - 0.78(Imp\%)^2 + 0.774(Imp\%) + 0.04$*

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.61 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*

5 Compute P_6, Mean 6-hr Preciptiation (inches) 0.9032

*P_6 = Item 4 * C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*

6 Drawdown Rate

Use 48 hours as the default condition. Selection and use of the 24 hour drawdonw time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.

24-hrs ☐

48-hrs ☑

7 Compute design capture volume, DCV (ft^3) 77,083

*DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C2], where C2 is a function of drawdown rate (24-hr = 1.582; 48-hr =1.963)*

Compute separate DCV for each outlet from the project site per schematic drawdown in Form 3-1 Item 2

CALCULATED DRAWDOWN TIME	
INFILTRATION RATE	
8.35	INFILTRATION RATE (IN/HR)
4	SAFETY FACTOR
2.09	INFILTRATION RATE (IN/HR)
SUBSURFACE SYSTEM DETAILS	
1100	LENGTH (FT)
77220	STORAGE VOLUME (CF)
11000	INFILTRATION AREA (SF)
DRAWDOWN CALCULATION	
40.3	DRAWDOWN TIME (HR)

HCOC EXEMPTION


STORMWATER FACILITY MAPPING TOOL
TOC
Choose search item from list
Enter Value
Locate
Clear
Clear All
Metadata
Base Maps
Base Data
Stormwater Data
Drainage Facilities
EHM
Santa Ana River
Non-EHM (low)
Non-EHM (medium)
Non-EHM (high)
Non-EHM (default-high)
2006 - 303d/TMDL
Water Storage Facility
Interim
Ultimate
Other
Drainage Area Boundaries
HCOC Exempt Areas
City Storm Drains
Ground Water Basins
Ground Water Contours
Septic
Plumes
Soils
As-Built Plans
Hydromod Field Observations
Habitat/Species
APPROXIMATE
PROJECT SITE
LOCATION
0.2 Miles
RBF
GIS

INFILTRATION REPORT

August 26, 2021

Duke Realty
200 Spectrum Center Drive, Suite 1600
Irvine, California 92618

Attention: D.J. Arellano, P.E.
Director, Development Services

Project No.: **21G200-2**

Subject: **Results of Infiltration Testing**
Proposed Warehouse
NWC East State Street and South Bon View Avenue
Ontario, California

Reference: Geotechnical Investigation, Proposed Warehouse, NWC East State Street and South Bon View Avenue, Ontario, California, prepared by Southern California Geotechnical, Inc. (SCG) for Duke Realty, SCG Project No. 21G200-1, dated August 24, 2021.

Dear Mr. Arellano:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 21P334, dated July 22, 2021. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the guidelines published in the Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, prepared for the Riverside County Department of Environmental Health (RCDEH), dated December, 2013. The San Bernardino County standards defer to the guidelines published by the RCDEH.

Site and Project Description

The overall site is located at the northwest corner of East State Street and South Bon View Avenue in Ontario, California. The site is bounded to the north by a railroad easement, to the west by South Campus Avenue, to the south by East State Street, and to the east by South Bon View Avenue. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 of this report.

The overall site consists of several contiguous rectangular-shaped lots which total 15.7± acres in size. The lots are developed for various usage such as small industrial/manufacturing buildings,

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equipment storage, a brewing company, a towing service yard, truck and trailer parking facilities, and a recycling plant.

The western portion of the site consists of fourteen (14) commercial/industrial buildings ranging from 8,000 to 30,000± ft² in size. Several of the buildings share common walls. The majority of these buildings are one- to two-story structures of concrete tilt-up construction, and are presumed to be supported on conventional shallow foundations with concrete slab-on-grade floors. The buildings are generally surrounded by asphaltic concrete (AC) pavements which are in poor to fair condition, with moderate to severe cracking throughout. One single-story structure composed of wood frame and stucco construction, 2,000± ft² in size, is also located in this region.

The central portion of the site is currently a shared storage yard for a construction and a trucking company. These facilities share a two-story structure, approximately 2,600 ft² in size. The existing building is of concrete tilt-up construction, and is presumed to be supported on conventional shallow foundations with a concrete slab-on-grade floor. Construction equipment and truck trailers are scattered throughout the site. The existing AC pavements in this area are in poor condition, with moderate cracking throughout.

The eastern portion of the site is an active recycling plant, 6.5± acres in size. Two (2) metal frame structures, 1,910 and 5,300± in size, are located in the northwestern and southern portions of the recycling plant site. These structures are presumed to be supported on conventional shallow foundations with concrete slab-on-grade floors. Loading dock ramps are located in the northern and southwestern area of the site. Several metal containers are located along the northern and western property line of the recycling plant. Several stockpiles containing paper, plastic, and/or scrap metal are scattered throughout the recycling site. The ground surface cover for this site generally consists of Portland cement concrete (PCC) pavements which are in poor condition, with severe cracking throughout. Exposed steel reinforcement was observed in several areas within the existing PCC pavements.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the overall site topography slopes downward to the south at a gradient of 2± percent.

Proposed Development

A conceptual site plan, identified as Scheme 5 and prepared by HPA, Inc., was provided to our office by the client. Based on this plan, the subject site will be developed with a 327,770± ft² warehouse, located in the northern region of the site. Dock-high doors will be constructed along a portion of the south building wall. The proposed building is expected to be surrounded by AC pavements in the parking and drive areas, PCC pavements in the loading dock area, and concrete flatwork and landscaped planters throughout the site.

We understand that the proposed development will include on-site stormwater infiltration. Based on conversations with the client, we understand that the infiltration system will consist of a below-grade chamber system or infiltration basin located in the southeastern area of the site. The bottom of the infiltration system will be 8± feet below the existing site grades.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, referenced above. As a part of this study, six (6) borings (identified as Boring Nos. B-1 through B-6) were advanced to depths of 15 to 25± feet below the existing site grades. Artificial fill soils were encountered beneath the existing pavements at all of the boring locations, extending to depths of 4½ to 5½± feet below the existing site grades. The fill soils generally consisted of loose to medium dense silty sands with varying fine gravel content. Native alluvium was encountered beneath the artificial fill soils at all of the boring locations, extending to at least the maximum depth explored of 25± feet below existing site grades. The alluvium generally consisted of medium dense sands, silty sands, and sandy silts with varying fine to coarse gravel content, with occasional loose silty sands and sandy silts within the upper 6½ to 12± feet, and dense to very dense sands at depths of 8 to 25± feet.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

As a part of our research, we reviewed available groundwater data in order to determine groundwater levels for the site. Water level data was obtained from the California Department of Water Resources Water Data Library website, https://wdl.water.ca.gov/waterdatalibrary/. The nearest monitoring well on record (identified as State Well Number: 01S07W29A001S) is located ½± mile east of the project site. Water level readings within this monitoring well indicate a high groundwater level of 310± feet below the ground surface in May 1967.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for the infiltration testing consisted of two (2) infiltration test borings, advanced to a depth of 8± feet below the existing site grades. The infiltration borings were advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow-stem augers and were logged during drilling by a member of our staff. The approximate locations of the infiltration test borings (identified as I-1 and I-2) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration borings, the bottom of each test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into each test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Artificial fill soils were encountered beneath the pavements at both infiltration boring locations, extending to a depths of 5½± below the existing site grades. The fill soils generally consist of loose silty sands with varying amount of fine gravel content. The fill soils possess a disturbed mottled appearance resulting in their classification as artificial fill. Native alluvial soils were encountered beneath the fill soils at both infiltration boring locations, extending to at least the maximum depth explored of 8± feet below the existing site grades. The alluvial soils generally consist of medium dense silty sands and gravelly sands. The Boring Logs, which illustrate the conditions encountered at the boring locations, are included with this report.

Infiltration Testing

As previously mentioned, the infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, which apply to San Bernardino County.

Pre-soaking

In accordance with the county infiltration standards for sandy soils, all infiltration test borings were pre-soaked 2 hours prior to the infiltration testing or until all of the water had percolated through the test holes. The pre-soaking process consisted of filling test borings by inverting a full 5-gallon bottle of clear water supported over each hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of each hole. Pre-soaking was completed after all of the water had percolated through the test holes.

Infiltration Testing

Following the pre-soaking process of the infiltration test borings, SCG performed the infiltration testing. Each test hole was filled with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of the test holes. In accordance with the Riverside County guidelines, since "sandy soils" were encountered at the bottom of both of the infiltration test borings (where 6 inches of water infiltrated into the surrounding soils for two consecutive 25-minute readings), readings were taken at 10-minute intervals for a total of 1 hour at each test location. After each reading, water was added to the borings so that the depth of the water was at least 5 times the radius of the hole. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates from the test are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration tests be used as the design infiltration rate. The rates are summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Infiltration Rate (inches/hour)
I-1	8	Silty fine to medium Sand	1.8
I-2	8	Gravelly fine to coarse Sand, trace Silt	14.9

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 and C-2 of this report.

Design Recommendations

Two (2) infiltration tests were performed at the subject site. As noted above, the infiltration rates at these locations vary from 1.8 to 14.9 inches per hour. The major factors affecting the difference in infiltration rate at these borings is the presence of silt in the soils at the test depths. Based on the infiltration test results, we recommend an infiltration rate of 5.0 inches per hour be used in the design of the infiltration system.

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration system to identify the soil classification at the base of the system. It should be confirmed that the soils at the base of the proposed infiltration system correspond with those presented in this report to ensure that the performance of the system will be consistent with the rate reported herein.

The design of the storm water infiltration system should be performed by the project civil engineer, in accordance with the City of Ontario and/or County of San Bernardino guidelines. It is recommended that the system be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such materials would decrease the effective infiltration rate. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rate recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rate.** It should be noted that the recommended infiltration rates are based on infiltration testing at two (2) discrete locations and that the overall infiltration rate of the proposed infiltration system could vary considerably.

Infiltration Rate Considerations

The infiltration rates presented herein was determined in accordance with the San Bernardino County guidelines and are considered valid only for the time and place of the actual test. Varying subsurface conditions will exist in other areas of the site, which could alter the recommended infiltration rates presented above. The infiltration rates will decline over time between maintenance cycles as silt or clay particles accumulate on the BMP surface. The infiltration rate is highly dependent upon a number of factors, including density, silt and clay content, grainsize distribution throughout the range of particle sizes, and particle shape. Small changes in these factors can cause large changes in the infiltration rates.

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. Changes in soil moisture content will affect the infiltration rate. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and tested depths. Infiltration rates can be significantly reduced if the soils are exposed to excessive disturbance or compaction during construction. Compaction of the soils at the bottom of the infiltration system can significantly reduce the infiltration ability of the basins. Therefore, the subgrade soils within proposed infiltration system areas should not be over-excavated, undercut or compacted in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each system. It should be confirmed that the soils at the base of the proposed infiltration systems correspond with those presented in this report to ensure that the performance of the systems will be consistent with the rates reported herein.

We recommend that scrapers and other rubber-tired heavy equipment not be operated on the basin bottom, or at levels lower than 2 feet above the bottom of the system, particularly within basins. As such, the bottom 24 inches of the infiltration systems should be excavated with non-rubber-tired equipment, such as excavators.

Basin Maintenance

The proposed project may include infiltration basins. Water flowing into these basins will carry some level of sediment. Wind-blown sediments and erosion of the basin side walls will also contribute to sediment deposition at the bottom of the basin. This layer has the potential to significantly reduce the infiltration rate of the basin subgrade soils. Therefore, a formal basin maintenance program should be established to ensure that these silt and clay deposits are removed from the basin on a regular basis. Appropriate vegetation on the basin sidewalls and bottom may reduce erosion and sediment deposition.

Basin maintenance should also include measures to prevent animal burrows, and to repair any burrows or damage caused by such. Animal burrows in the basin sidewalls can significantly increase the risk of erosion and piping failures.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of the subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the building(s), it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration systems may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer.

The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

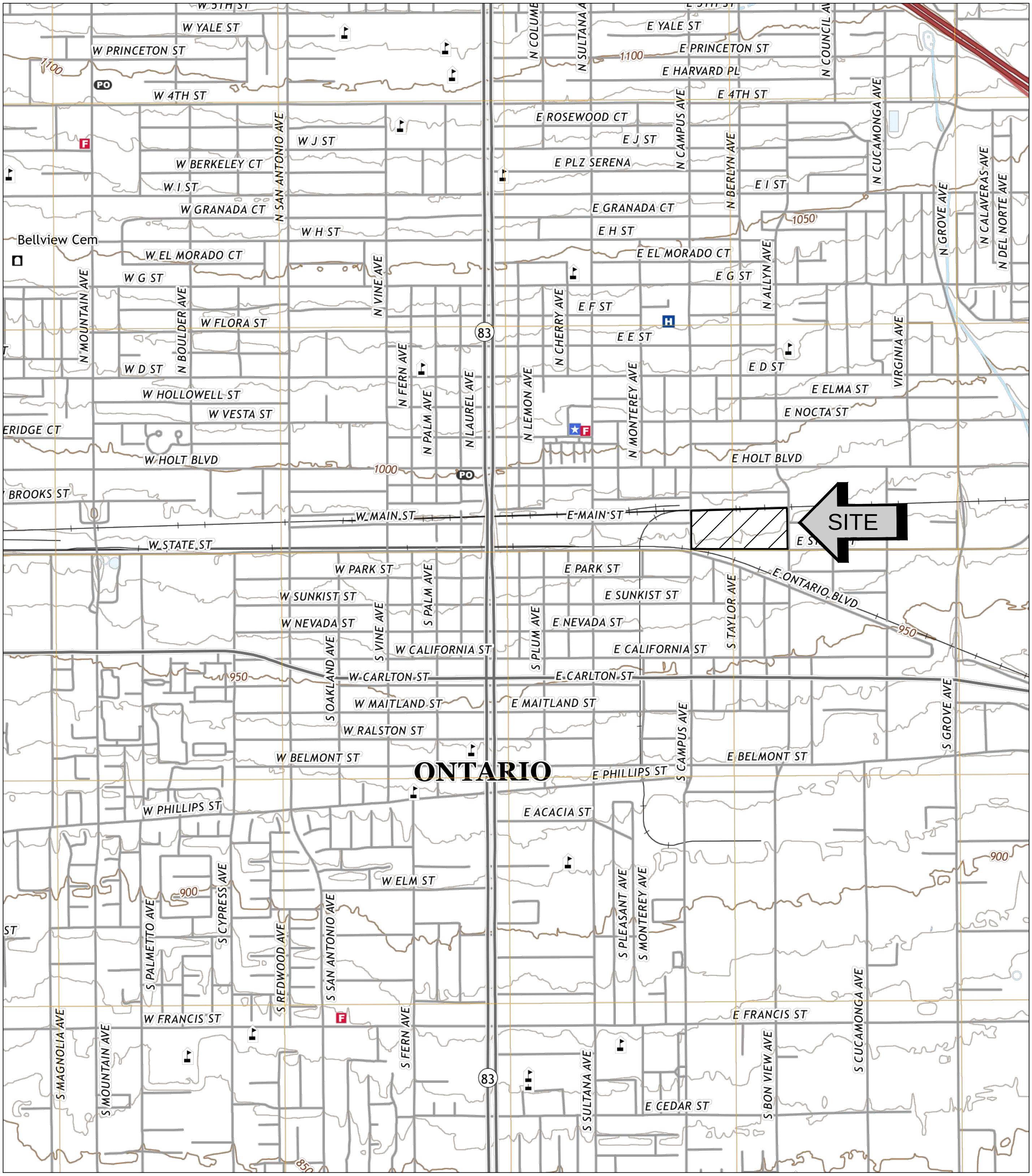
Jose A. Zuniga
Staff Engineer

Gregory K. Mitchell, GE 2364
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
GREGORY K. MITCHELL
No. 2364
Exp. 09/30/22
GEOTECHNICAL
STATE OF CALIFORNIA

Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs (4 pages)
Infiltration Test Results Spreadsheets (2 pages)
Grain Size Distribution Graphs (2 pages)



SOURCE: USGS TOPOGRAPHIC MAP OF THE ONTARIO QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA, 2018.

SITE LOCATION MAP	
PROPOSED WAREHOUSE	
ONTARIO, CALIFORNIA	
SCALE: 1" = 2000'	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAH CHKD: JLL	
SCG PROJECT 21G200-2	
PLATE 1	

GEOTECHNICAL LEGEND

APPROXIMATE INFILTRATION LOCATION

APPROXIMATE BORING LOCATION (SCG PROJECT NO. 21G200-1)

NOTE: AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH. CONCEPTUAL SITE PLAN PROVIDED BY THE CLIENT.

INFILTRATION TEST LOCATION PLAN

PROPOSED WAREHOUSE

ONTARIO, CALIFORNIA

SCALE: 1" = 120'

DRAWN: JAH
CHKD: RGT

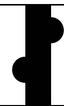
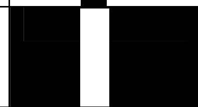
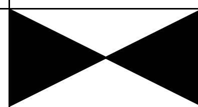
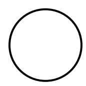
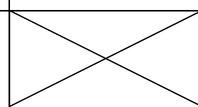
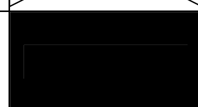
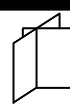
SCG PROJECT
21G200-2

PLATE 2

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3” indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-1

JOB NO.: 21G200-2
PROJECT: Proposed Warehouse
LOCATION: Ontario, California

DRILLING DATE: 7/30/21
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Oscar Sandoval

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					6± inches Portland Cement Concrete							
	X	8			FILL: Dark Brown Silty fine Sand, trace medium to coarse Sand, loose-damp		5					
	X	5			FILL: Brown Silty fine Sand, trace medium Sand, loose-damp		5					
5												
	X	12			ALLUVIUM: Light Gray Brown Silty fine to medium Sand, medium dense-moist		11			43		

Boring Terminated at 8'

TBL 21G200-2.GPJ SOCALGEO.GDT 8/26/21

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-2

JOB NO.: 21G200-2
PROJECT: Proposed Warehouse
LOCATION: Ontario, California

DRILLING DATE: 7/30/21
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Oscar Sandoval

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					1± inches Asphaltic Concrete; 0± inches Aggregate Base							
	X	7			FILL: Gray Brown Silty fine Sand, trace medium Sand, loose-damp		5					
5	X	9			FILL: Dark Brown Silty fine to medium Sand, trace coarse Sand, trace fine Gravel, loose-damp		5					
	X	22			ALLUVIUM: Brown Gravelly fine to coarse Sand, trace Silt, medium dense-dry to damp		3			10		

Boring Terminated at 8'

TBL 21G200-2.GPJ SOCALGEO.GDT 8/26/21

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	Ontario, California
Project Number	21G200-2
Engineer	Caleb Brackett

Test Hole Radius	4	(in)
Test Depth	8.00	(ft)

Infiltration Test Hole	I-1

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	9:00 AM	25.00	5.00	13.44	YES	SANDY SOILS
	Final	9:25 AM		6.12			
2	Initial	9:25 AM	25.00	5.00	12.48	YES	SANDY SOILS
	Final	9:50 AM		6.04			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	9:50 AM	10.00	5.00	0.53	2.74	2.19
	Final	10:00 AM		5.53			
2	Initial	10:00 AM	10.00	5.00	0.52	2.74	2.15
	Final	10:10 AM		5.52			
3	Initial	10:10 AM	10.00	5.00	0.50	2.75	2.06
	Final	10:20 AM		5.50			
4	Initial	10:20 AM	10.00	5.00	0.48	2.76	1.97
	Final	10:30 AM		5.48			
5	Initial	10:30 AM	10.00	5.00	0.45	2.78	1.84
	Final	10:40 AM		5.45			
6	Initial	10:40 AM	10.00	5.00	0.45	2.78	1.84
	Final	10:50 AM		5.45			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where:

Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	Ontario, California
Project Number	21G200-2
Engineer	Caleb Brackett

Test Hole Radius	4	(in)
Test Depth	8.00	(ft)

Infiltration Test Hole	I-2

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	7:52 AM	25.00	5.30	36.00	YES	SANDY SOILS
	Final	8:17 AM		8.30			
2	Initial	8:17 AM	25.00	5.30	36.00	YES	SANDY SOILS
	Final	8:42 AM		8.30			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	8:42 AM	10.00	5.30	2.78	1.31	22.59
	Final	8:52 AM		8.08			
2	Initial	8:52 AM	10.00	5.30	2.55	1.43	19.23
	Final	9:02 AM		7.85			
3	Initial	9:02 AM	10.00	5.30	2.45	1.48	17.91
	Final	9:12 AM		7.75			
4	Initial	9:12 AM	10.00	5.30	2.21	1.60	15.05
	Final	9:22 AM		7.51			
5	Initial	9:22 AM	10.00	5.30	2.20	1.60	14.94
	Final	9:32 AM		7.50			
6	Initial	9:32 AM	10.00	5.30	2.20	1.60	14.94
	Final	9:42 AM		7.50			

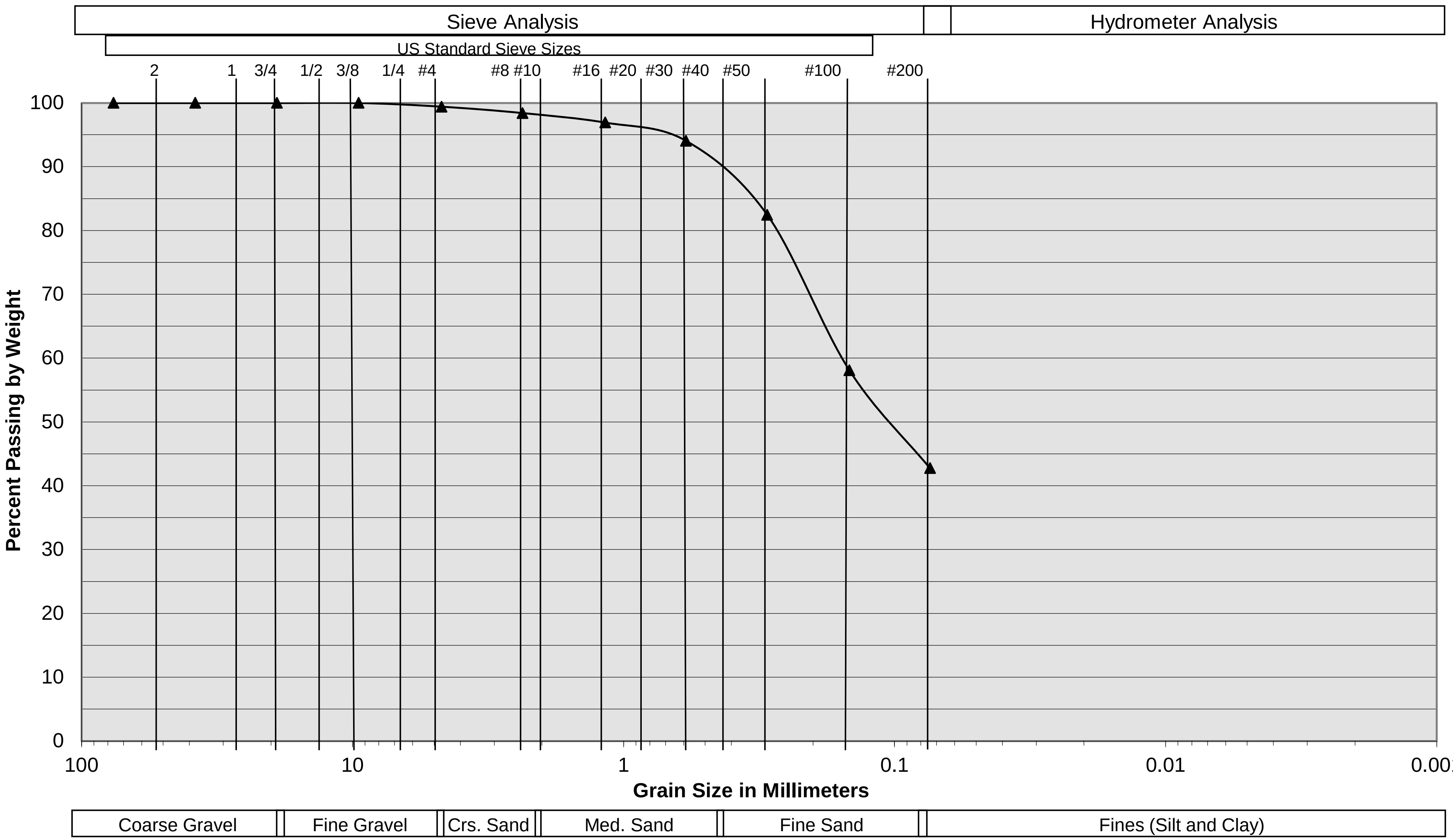
Per County Standards, Infiltration Rate calculated as follows:

$$\boxed{Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}}$$

Where:

Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

Grain Size Distribution

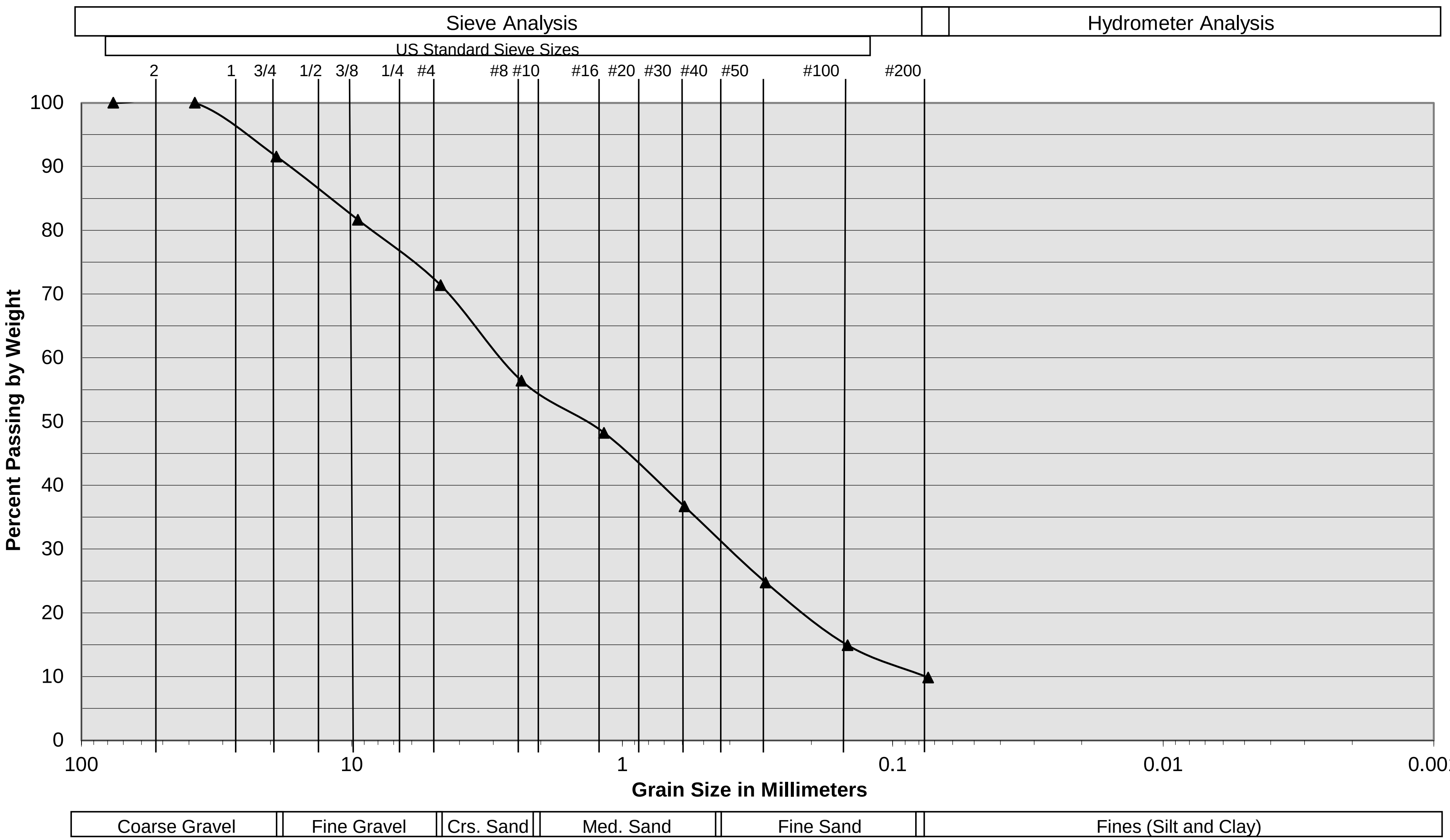


Sample Description	I-1 @ 6½ feet
Soil Classification	Light Gray Brown Silty fine to medium Sand

Proposed Warehouse
Ontario, CA
Project No. 21G200-2
PLATE C- 1

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-2 @ 6½ feet
Soil Classification	Brown Gravelly fine to coarse Sand, trace Silt

Proposed Warehouse
Ontario, CA
Project No. 21G200-2
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation