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TRANSPORTATION ACCESS ANALYSIS

PALM PROMENADE REDEVELOPMENT

San Diego, California

August 16, 2018

LLG Ref. 3-17-2791

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TABLE OF CONTENTS

APPENDICES

APPENDIX

List of Figures

LIST OF TABLES

Transportation Access Analysis

Palm Promenade Redevelopment

San Diego, California
August 16, 2018

1.0 Introduction

Linscott, Law and Greenspan, Engineers (LLG) has prepared the following Transportation Access Analysis to determine the potential transportation impacts associated with the Palm Promenade Redevelopment Project. The Project proposes to repurpose a portion of the existing movie theatre with additional retail land uses, specifically a “big-box” store and two drive-thru restaurant pads. A more detailed project description is contained in the following section. The project requires an amendment to Planned Commercial Development 92-0736 and CUP 96-7758, a new Tentative Map and Site Development Permit.

The traffic analysis presented in this report encompasses the following key areas:

- Project Description
- Previous Site Approvals
- Existing Conditions Description
- Traffic Analysis Approach & Methodology
- Significance Criteria
- Analysis of Existing Conditions
- Project Trip Generation, Distribution and Assignment
- Cumulative Projects Discussion
- Near-Term (Opening Year 2020) Analysis
- Significant Impacts and Mitigation Measures

2.0 PROJECT DESCRIPTION

The existing Palm Promenade shopping center is located at 770 Dennery Road on the southwest corner of the Palm Avenue / Dennery Road intersection in the City of San Diego. The shopping center currently provides a 107,248 SF movie theatre with 4,836-seats and 416,604 SF of retail land uses. The project proposes to repurpose a portion of the existing movie theatre with additional retail land uses, specifically a "big box" store and two drive-thru restaurant pads. Post construction, the movie theatre square footage will have been reduced to 74,988 SF with 3,192 seats and the total retail land uses will be increased to 489,340 SF. No change to the shopping center access is proposed.

Figure 2–1 shows a Project vicinity map. ***Figure 2–2*** shows the Project area map. ***Figure 2–3*** depicts the Project site plan.

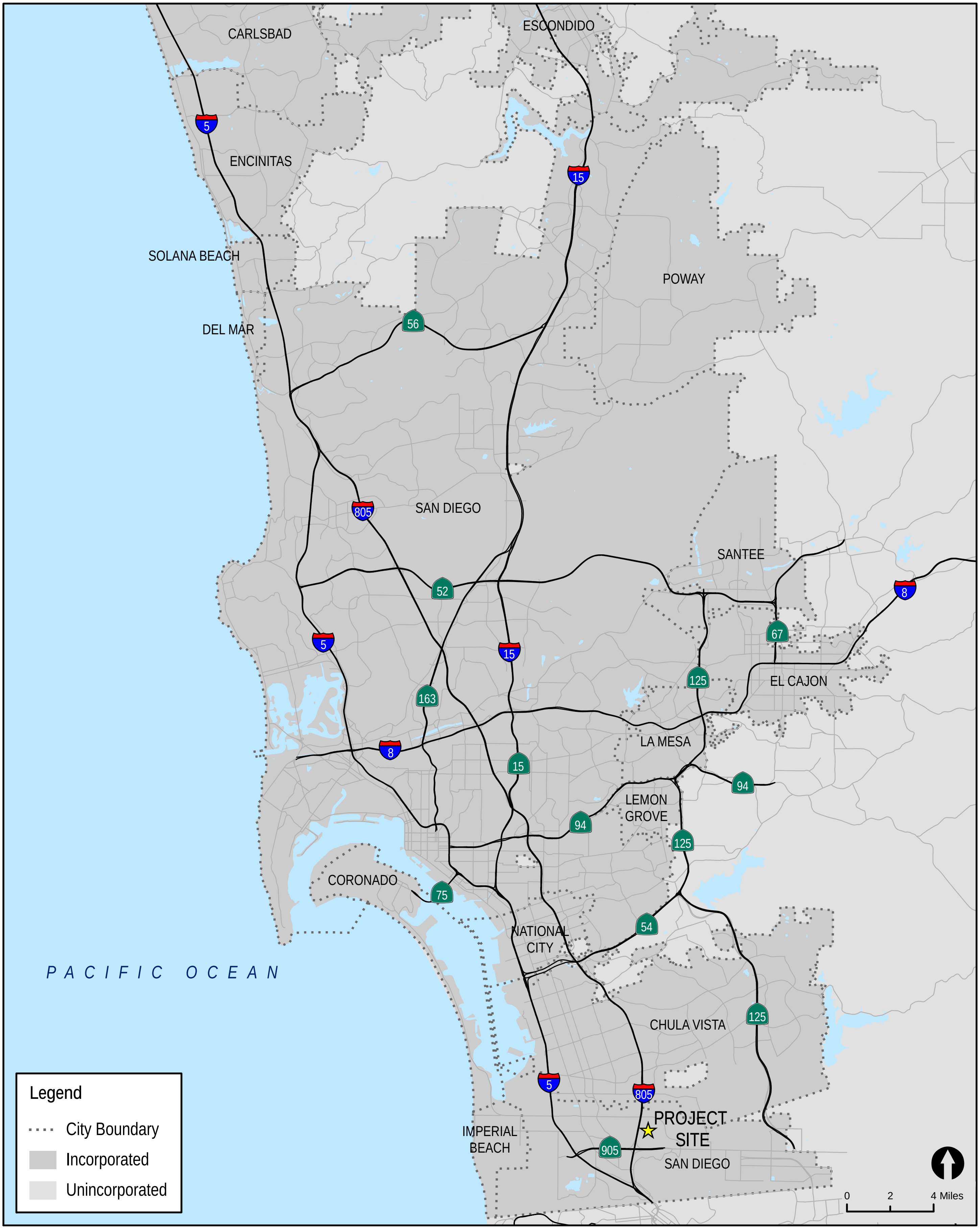

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Figure 2-1

Vicinity Map

PALM PROMENADE

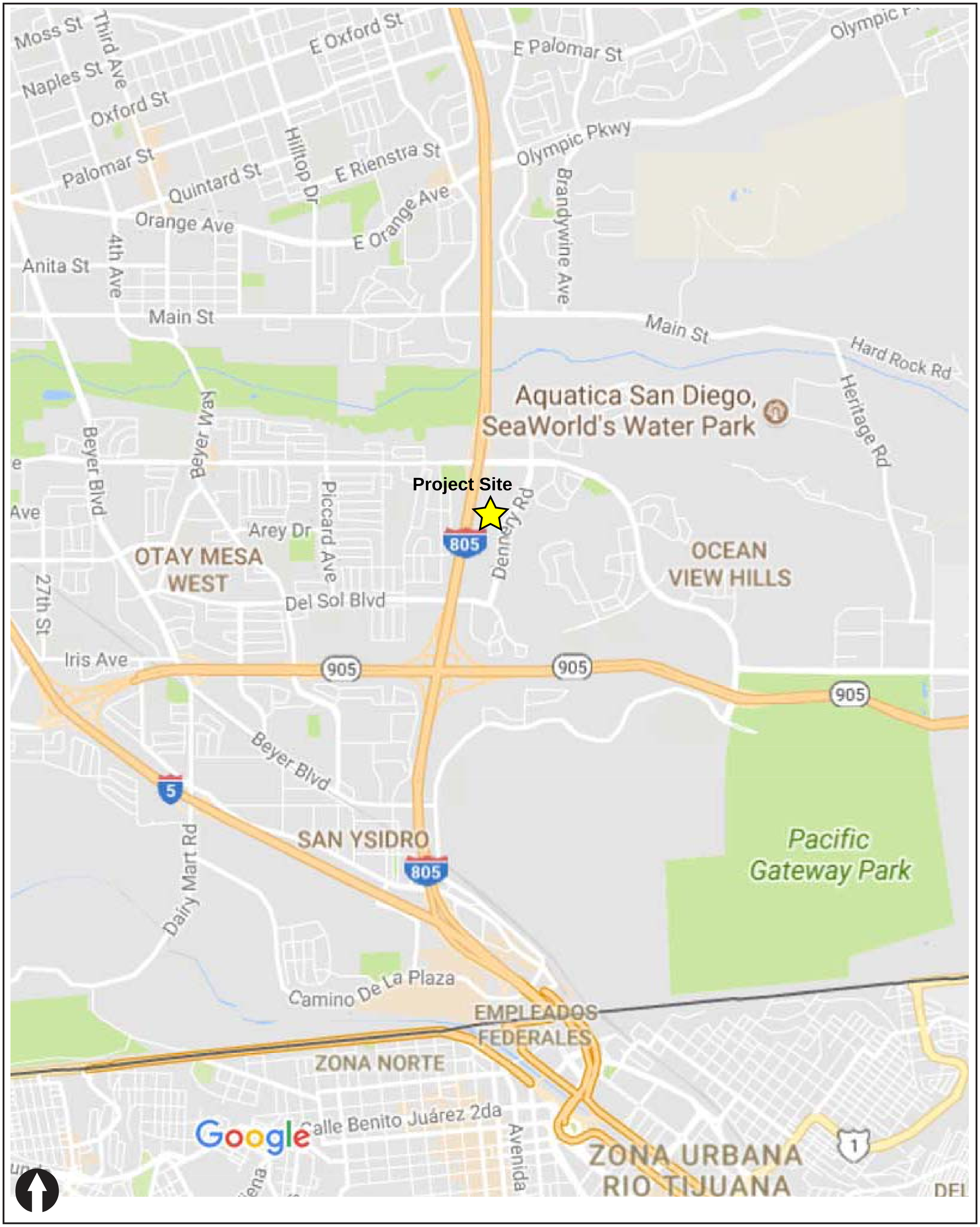

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Figure 2-2

Project Area Map

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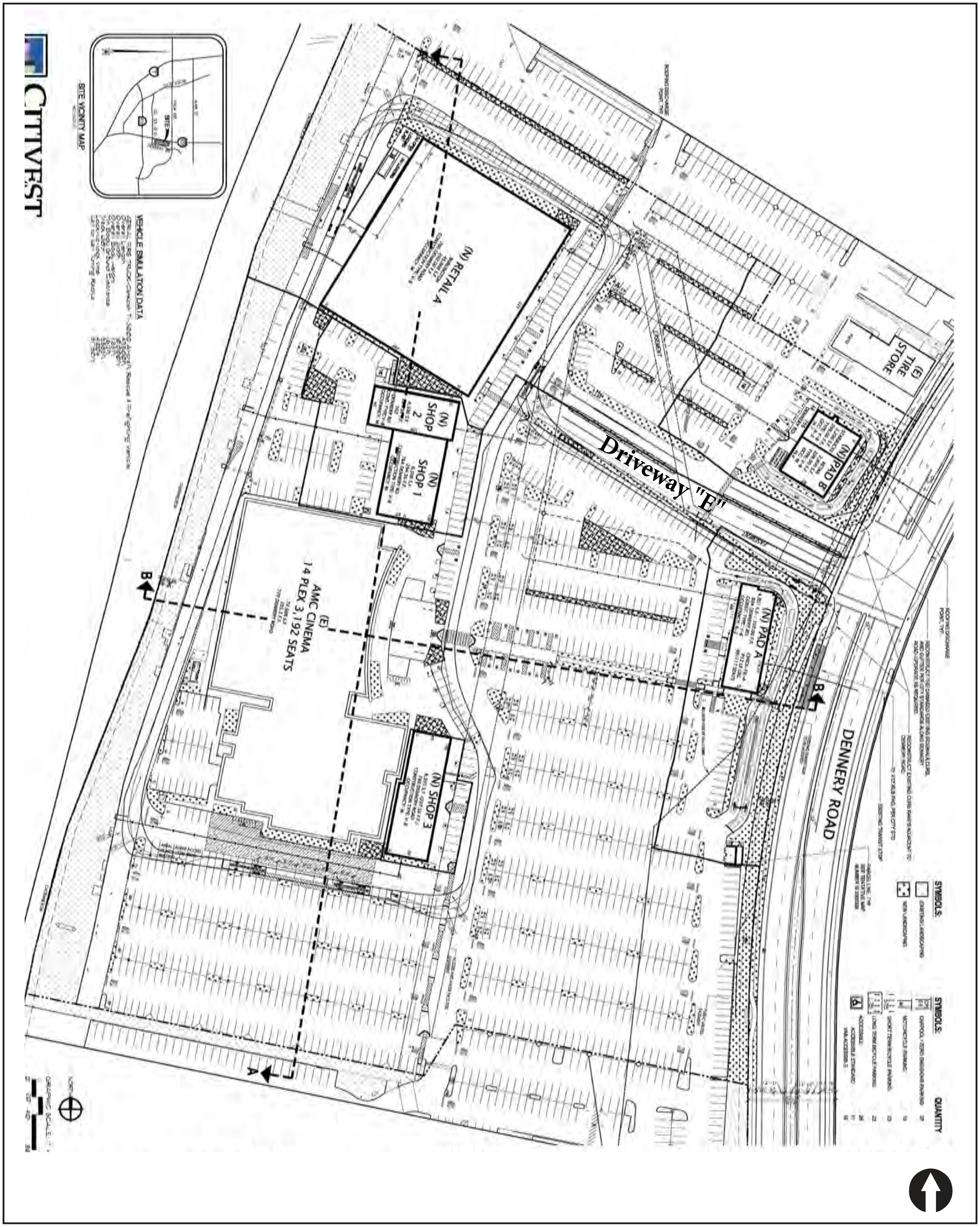

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Figure 2-3

Proposed Site Plan

PALM PROMENADE

3.0 PREVIOUS SITE APPROVALS

Environmental Impact Report (EIR) No. 92-0647, prepared for the original Palm Promenade development and certified by City Council, analyzed the development of a 617,000 SF commercial center. The EIR stated that the development would generate 43,190 average daily trips (ADT), with 1,295 driveway trips during the AM peak hour and 4,319 driveway trips during the PM peak hour. ***Figure 3–1*** shows the site plan for the original Palm Promenade development.

A proposed amendment to the EIR was later approved, allowing for a 24-screen movie theatre complex to replace 167,800 SF of the previously approved retail space. The amended project description was calculated to generate 38,262 ADT with 947 driveway trips during the AM peak hour and 3,654 driveway trips during the PM peak hour. Based on the trip generation calculation for the amended project, it was determined that a traffic study would not be necessary and that no new or more severe traffic impacts would result from the amendment as fewer project trips were expected as compared to the project analyzed in the approved EIR.

The currently proposed project is calculated to generate 40,253 ADT with 1,046 driveway trips during the AM peak hour and 3,905 driveway trips during the PM peak hour. The currently proposed project is calculated to generate 2,937 fewer ADT, 249 fewer AM peak hour trips and 414 fewer PM peak hour trips as compared to the project analyzed in the approved EIR, although it would generate 1,991 more ADT, 99 more AM peak hour trips and 251 more PM peak hour trips than the amended (and constructed existing) project. Based on this, only an access analysis is required.

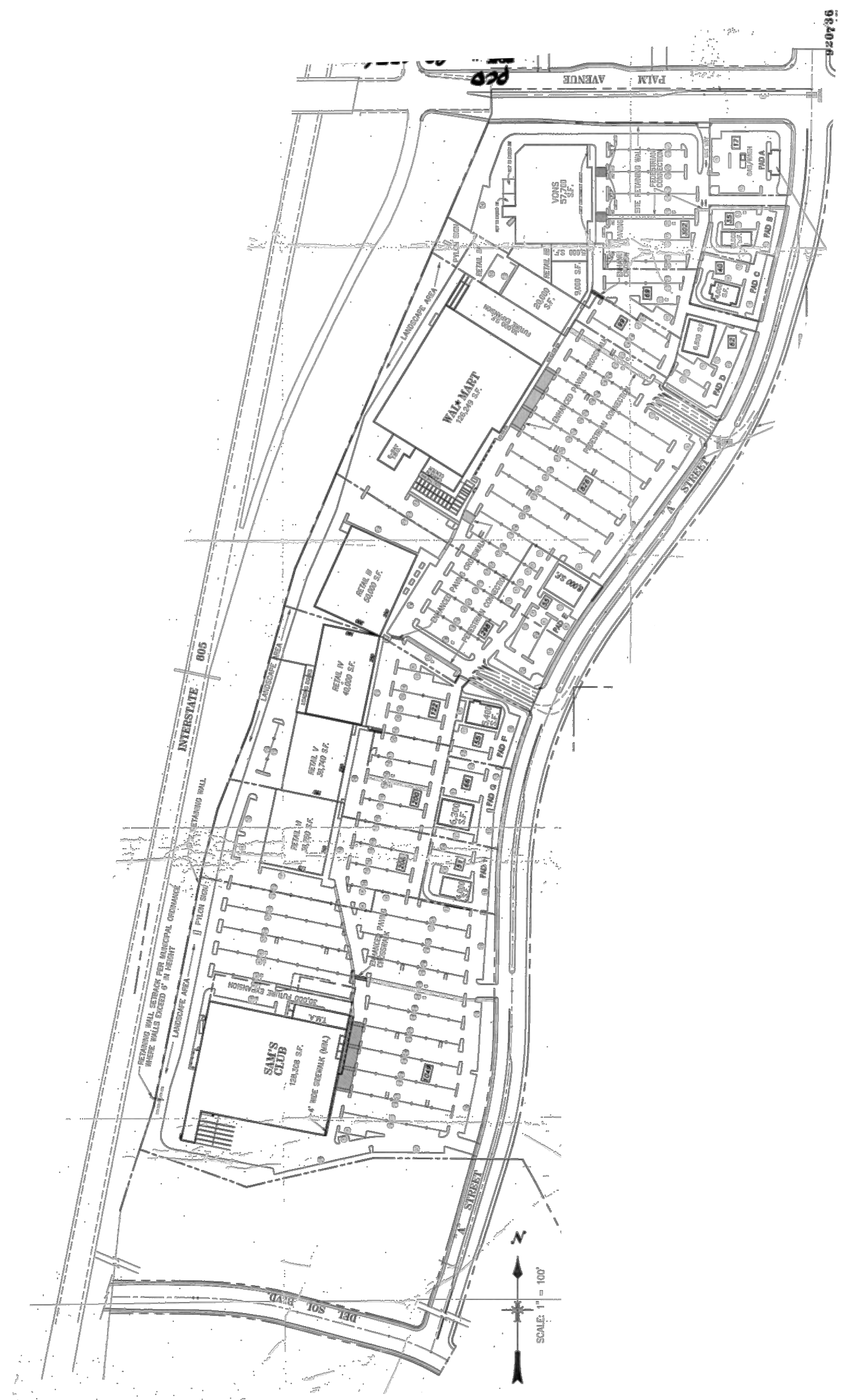

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Figure 3-1

Site Plan for the Originally Approved Project

4.0 EXISTING CONDITIONS

For this access analysis, the following intersections and segments within the immediate vicinity of the project site were analyzed:

Intersections

1. Palm Avenue / Palm Promenade Driveway 'A' (Unsignalized – Right in only)
2. Palm Avenue / Dennery Road (Signalized)
3. Dennery Road / Palm Promenade Driveway 'B' (Unsignalized – Right in / out only)
4. Dennery Road / Palm Promenade Driveway 'C' (Unsignalized – Right in / out only)
5. Dennery Road / Palm Promenade Driveway 'D' (Signalized)
6. Dennery Road / Palm Promenade Driveway 'E' (Signalized)
7. Dennery Road / Palm Promenade Driveway 'F' (Signalized)
8. Dennery Road / Palm Promenade Driveway 'G' (Unsignalized – Full Access in / Right out only)
9. Dennery Road / Del Sol Boulevard (Signalized)

Intersection 6, Driveway 'E', is the closest driveway to the portion of the site that is proposed to be redeveloped.

Street Segments

1. Palm Avenue: Palm Promenade Driveway 'A' to Dennery Road
2. Dennery Road: Palm Promenade Driveway 'D' to Palm Promenade Driveway 'E'
3. Dennery Road: Palm Promenade Driveway 'E' to Palm Promenade Driveway 'F'

4.1 Existing Roadway Conditions

The following is a description of the roadways in the Project area. ***Figure 4–1*** illustrates the existing street network.

Palm Avenue is classified as a 7-lane Primary Arterial on the *Otay Mesa Community Plan Mobility Element*. Within the study area, Palm Avenue is currently built as a 6- to 7-lane divided roadway east of I-805. The posted speed limit on Palm Avenue is 35 mph. Sidewalks, bike lanes and bus stops are provided on both sides of the roadway. On-street parking is not permitted. The two bus lines that run along the roadway are 933 (runs east) and 944 (runs west). Line 933 Runs every 15 minutes along the stops on Palm Avenue on weekdays and every hour on weekends. Line 934 runs every 15 minutes on weekdays, every 30 minutes on Saturdays and every hour on Sundays.

Dennery Road is classified as a 4-lane Major Arterial on the *Otay Mesa Community Plan Mobility Element*. Dennery Road is currently built as a 4-lane divided roadway with a posted speed limit of 40 mph. Sidewalks, bike lanes and bus stops are provided on both sides of the roadway. On-street parking is not permitted. The two bus lines that run along the roadway are 933 (runs north) and 944 (runs south). Line 933 Runs every 15 minutes along the stops on Dennery Road on weekdays and every hour on weekends. Line 934 runs every 15 minutes on weekdays, every 30 minutes on Saturdays and every hour on Sundays.

Del Sol Boulevard is classified as a 4-lane Collector on the *Otay Mesa Community Plan Mobility Element*. Del Sol Boulevard is currently built as a 4-lane undivided roadway with a posted speed limit of 40 mph. Sidewalks and bike lanes are provided on both sides of the roadway and bus stops are provided west of I-805. On-street parking is not permitted. The two bus lines that run along the roadway are 933 (runs east) and 944 (runs west). Line 933 Runs every 15 minutes along the stops on Del Sol Boulevard on weekdays and every hour on weekends. Line 934 runs every 15 minutes on weekdays, every 30 minutes on Saturdays and every hour on Sundays.

4.2 Existing Traffic Volumes

4.2.1 *Peak Hour Intersection Turning Movement Volumes*

Existing weekday AM (7:00-9:00 AM) and PM (4:00-6:00 PM) peak hour traffic volumes and daily traffic counts were collected at the study area intersections and street segments to capture peak commuter activity. The majority of the counts were conducted in April 2018 while area schools were in session. The intersection of Dennery Road / Del Sol Boulevard was counted in September 2017, also while area schools were in session.

Figure 4–2 shows the existing AM and PM peak hour turning movement counts and ADTs. ***Appendix A*** contains copies of the intersection manual count sheets and road tube count summaries.

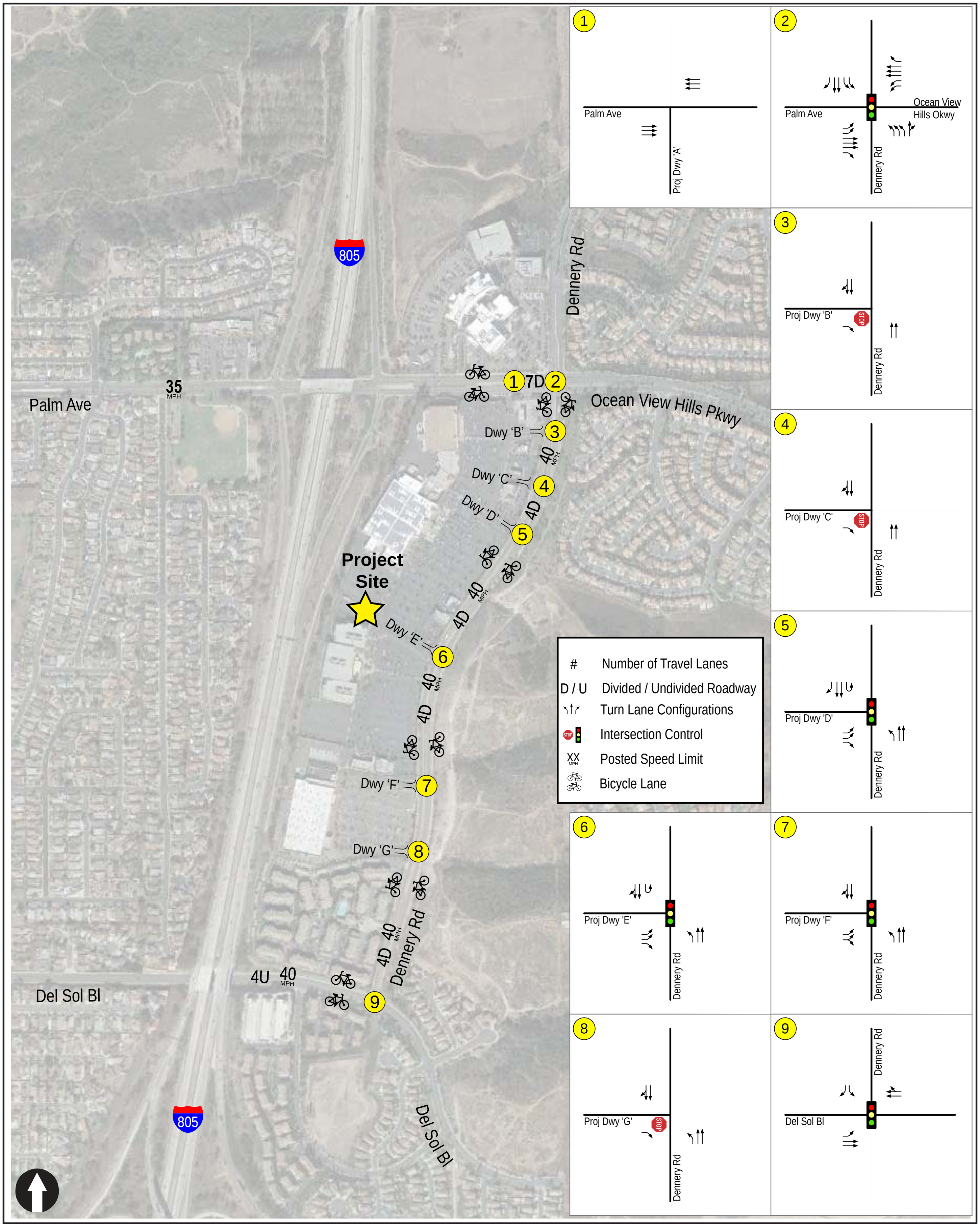

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Figure 4-1

Existing Conditions Diagram

PALM PROMENADE

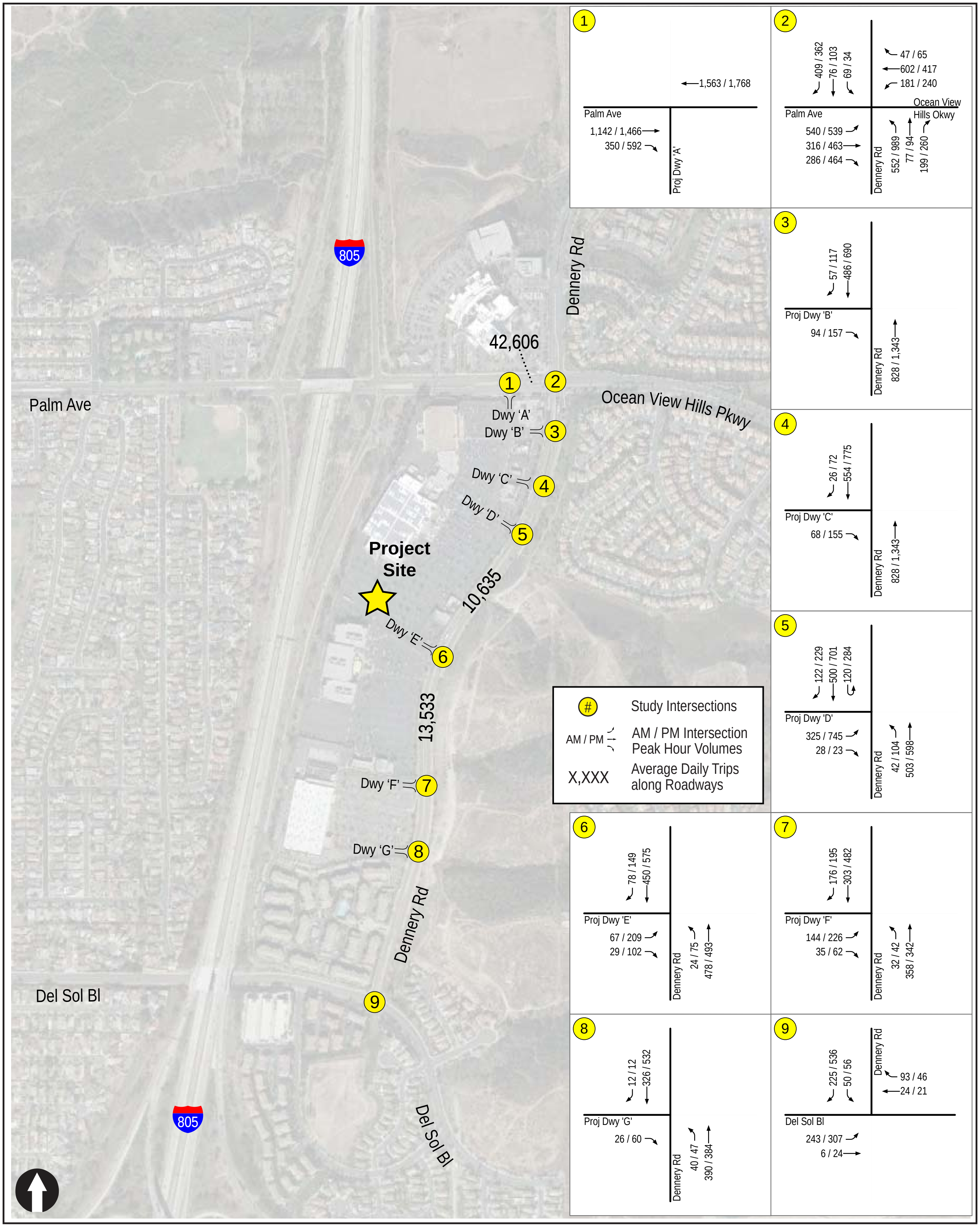

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Figure 4-2

Existing Traffic Volumes

PALM PROMENADE

5.0 Analysis Approach and Methodology

Level of service (LOS) is the term used to denote the different operating conditions which occur on a given roadway segment under various traffic volume loads. It is a qualitative measure used to describe a quantitative analysis considering factors such as roadway geometries, signal phasing, speed, travel delay, freedom to maneuver, and safety. Level of service provides an index to the operational qualities of a roadway segment or an intersection. Level of service designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. Level of service designation is reported differently for intersections and for roadway segments.

5.1 Intersections

Signalized intersections were analyzed under AM and PM peak hour conditions. Average vehicle delay was determined utilizing the methodology found in Chapter 19 of the *Highway Capacity Manual 6th Edition (HCM 6),* with the assistance of the *Synchro 10* computer software. Signal timing plans were obtained from the City of San Diego. The peak hour factor for each intersection was obtained from the existing traffic count data. Both were input and utilized in the Synchro analysis. The delay values (represented in seconds) were qualified with a corresponding intersection Level of Service (LOS). A more detailed explanation of the methodology is attached in ***Appendix B***.

Unsignalized intersections were analyzed under AM and PM peak hour conditions. Average vehicle delay and Levels of Service (LOS) was determined based upon the procedures found in Chapter 20 and Chapter 21 of the *HCM 6* with the assistance of the *Synchro 10* computer software. The peak hour factor for each intersection was obtained from the existing traffic count data and were input and utilized in the Synchro analysis. A more detailed explanation of the methodology is attached in *Appendix B.*

5.2 Street Segments

Street segment analysis is based upon the comparison of daily traffic volumes (ADTs) to the City of San Diego's *Roadway Classification, Level of Service, and ADT Table*. This table provides segment capacities for different street classifications, based on traffic volumes and roadway characteristics. The City of San Diego's *Roadway Classification, Level of Service, and ADT Table* is attached in ***Appendix C***.

6.0 SIGNIFICANCE CRITERIA

For the purposes of this access assessment, City of San Diego's *Significance Determination Thresholds* were used as a guide. According to the City of San Diego's *Significance Determination Thresholds* report dated July 2016, a project is considered to have a significant impact if the new project traffic has decreased the operations of surrounding roadways by a City-defined threshold. The City-defined threshold by roadway type or intersection is shown in ***Table 6–1***.

The impact is designated either a "direct" or "cumulative" impact. According to the City's *Significance Determination Thresholds* report,

> "*Direct* traffic impacts are those projected to occur at the time a proposed development becomes operational, including other developments not presently operational but which are anticipated to be operational at that time (near term)."
>
> "*Cumulative* traffic impacts are those projected to occur at some point after a proposed development becomes operational, such as during subsequent phases of a project and when additional proposed developments in the area become operational (short-term cumulative) or when affected community plan area reaches full planned buildout (long-term cumulative)."

For intersections and roadway segments affected by a project, level of service (LOS) D or better is considered acceptable under both direct and cumulative conditions."

If the project exceeds the thresholds in *Table 6–1*, then the project may be considered to have a significant "direct" or "cumulative" project impact. A significant impact can also occur if a project causes the Level of Service to degrade from D to E, even if the allowable increases in *Table 6–1* are not exceeded. A feasible mitigation measure will need to be identified to return the impact within the City thresholds, or the impact will be considered significant and unmitigated.

TABLE 6–1
CITY OF SAN DIEGO
TRAFFIC IMPACT SIGNIFICANCE THRESHOLDS

Level of Service with Project[b]	Allowable Increase Due to Project Impacts[a]		
	Freeways (V/C)	Roadway Segments (V/C)	Intersection Delay (sec.)
E	0.010	0.02	2.0
F	0.005	0.01	1.0

Footnotes:

a. If a Proposed Project's traffic causes the values shown in the table to be exceeded, the impacts are determined to be significant. The Proposed Project shall then identify feasible improvements (within the Traffic Impact Study) that will restore/and maintain the traffic facility at an acceptable LOS. If the LOS with the Proposed Project becomes unacceptable (see note b), or if the project adds a significant amount of peak-hour trips the Proposed Project shall be responsible for mitigating the project's direct significant and/or cumulatively considerable traffic impacts.

b. All LOS measurements are based upon Highway Capacity Manual procedures for peak-hour conditions. However, V/C ratios for roadway segments are estimated on an ADT/24-hour traffic volume basis (using Table 2 of the City's Traffic Impact Study Manual). The acceptable LOS for freeways, roadways, and intersections is generally "D" ("C" for undeveloped locations).

General Notes:

1. Delay = Average control delay per vehicle measured in seconds for intersections, or minutes for ramp meters.
2. LOS = Level of Service
3. V/C = Volume to Capacity Ratio (capacity at LOS E should be used)
4. Speed = Arterial speed measured in miles per hour for Congestion Management Program (CMP) analyses

7.0 EXISTING ANALYSIS

This section discusses the existing operations of the study area intersections and street segments using the methodologies described in *Section 6.0*. No planned infrastructure improvements have been assumed in the analysis of existing conditions.

7.1 Intersection Analysis

Table 7–1 summarizes the existing intersection Levels of Service. As seen in *Table 7–1*, the study intersections are calculated to currently operate acceptably at LOS C or better during the AM and PM peak hours with the exception of the following:

- Palm Avenue / Dennery Road (LOS E during the PM peak hour)

Appendix D contains the intersection analysis sheets for the Existing scenario.

7.2 Street Segment Analysis

Table 7–2 summarizes the existing street segment operations. As shown in *Table 7–2*, the study street segments are calculated to currently operate acceptably at LOS C or better.

TABLE 7–1
EXISTING INTERSECTION OPERATIONS

Intersection	Control Type	Peak Hour	Existing	
			Delay[a]	LOS[b]
1. Palm Avenue / Driveway 'A'	Unsig.[d]	AM	–	–
		PM	–	–
2. Palm Avenue / Dennery Road	Signal	AM	47.3	D
		PM	64.5	E
3. Dennery Road / Driveway 'B '	MSSC[c]	AM	10.7	B
		PM	13.3	B
4. Dennery Road / Driveway 'C'	MSSC[c]	AM	10.7	B
		PM	13.7	B
5. Dennery Road / Driveway 'D'	Signal	AM	12.3	B
		PM	20.0	B
6. Dennery Road / Driveway 'E'	Signal	AM	5.6	A
		PM	12.2	B
7. Dennery Road / Driveway 'F'	Signal	AM	10.5	B
		PM	14.1	B
8. Dennery Road / Driveway 'G'	MSSC[c]	AM	9.4	A
		PM	10.4	B
9. Del Sol Blvd. / Dennery Road	Signal	AM	24.5	C
		PM	22.8	C

Footnotes:

a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. Minor Street Stop Controlled intersection. Worst approach delay reported.
d. No traffic control or conflicting movements. Provides inbound only access to the shopping center.

SIGNALIZED DELAY/LOS THRESHOLDS		UNSIGNALIZED DELAY/LOS THRESHOLDS	
Delay	LOS	Delay	LOS
0.0 ≤ 10.0	A	0.0 ≤ 10.0	A
10.1 to 20.0	B	10.1 to 15.0	B
20.1 to 35.0	C	15.1 to 25.0	C
35.1 to 55.0	D	25.1 to 35.0	D
55.1 to 80.0	E	35.1 to 50.0	E
≥ 80.1	F	≥ 50.1	F

TABLE 7–2
EXISTING STREET SEGMENT OPERATIONS

Street Segment	Classification	Capacity (LOS E)[a]	ADT[b]	LOS[c]	V/C[d]
Palm Avenue					
Palm Promenade Driveway "A" to Dennery Road	7-Lane Prime Arterial	65,000	42,606	C	0.655
Dennery Road					
Palm Promenade Driveway "D" to Palm Promenade Driveway "E"	4-Lane Major Arterial	40,000	10,635	A	0.266
Palm Promenade Driveway "E" to Palm Promenade Driveway "F"	4-Lane Major Arterial	40,000	13,533	A	0.338

Footnotes:

a. Capacities based on City of San Diego Roadway Classification Table (*See Appendix C)*.
b. Average Daily Traffic.
c. Level of Service.
d. Volume to Capacity ratio.
e. 7-Lane Prime Arterial capacity derived based on the City's established 6-Lane Prime capacity of 60,000.

8.0 TRIP GENERATION/DISTRIBUTION/ASSIGNMENT

8.1 Trip Generation

The Palm Promenade shopping center currently provides a 107,248 SF movie theatre with 4,836 seats and 416,604 SF of retail land uses. The project proposes to repurpose a portion of the existing movie theatre with additional retail land uses, specifically a "big box" store and two drive-thru restaurant pads. Post construction, the movie theatre square footage will have been reduced to 74,988 SF with 3,192 seats and the total retail land uses will be increased to 489,340 SF. The Project trip generation was calculated for the AM/PM peak hours and for the daily (ADT) periods using City of San Diego published "driveway" trip rates.

Table 8–1 shows the total trip generation summary for the proposed Project. As shown in *Table 8-1*, the Project is calculated to generate 2,511 ADT with 145 AM peak hour trips (85 inbound/ 60 outbound) and 303 PM peak hour trips (111 inbound / 192 outbound).

8.2 Trip Distribution/Assignment

Project traffic was distributed to the street system based on existing traffic patterns and driveway counts conducted at the Palm Promenade driveways.

Figure 8–1 shows the Project's traffic distribution. ***Figure 8–2*** shows the Project traffic assignment.

TABLE 8-1
PROJECT TRIP GENERATION

Land Use	Quantity		Rate [a]	ADT[b]	AM Peak Hour					PM Peak Hour				
					% of ADT	In: Out Split	Volume			% of ADT	In: Out Split	Volume		
							In	Out	Total			In	Out	Total
Existing Land Uses														
Movie Theatre	107.248	KSF	80 / KSF	8,580	0.3%	8:2	21	5	26	8%	7:3	480	206	686
Community Shopping Center	416.604	KSF	70 / KSF	29,162	3%	6:4	525	350	875	10%	5:5	1,458	1,458	2,916
Subtotal	-		-	*37,742*	-	-	*546*	*355*	*901*	-	-	*1,938*	*1,664*	*3,602*
Proposed Land Uses														
Movie Theatre	74.988	KSF	80 / KSF	5,999	0.3%	8:2	14	4	18	8%	7:3	336	144	480
Community Shopping Center	489.340	KSF	70 / KSF	34,254	3%	6:4	617	411	1,028	10%	5:5	1,713	1,712	3,425
Subtotal	-		-	*40,253*	-	-	*631*	*415*	*1,046*	-	-	*2,049*	*1,856*	*3,905*
Total Net New Trips	**-**		**-**	**2,511**	**-**	**-**	**85**	**60**	**145**	**-**	**-**	**111**	**192**	**303**

Footnotes:

a. City of San Diego *Trip Generation Manual*, Revised May 2003; Driveway Trip Rates

b. Average Daily Trips

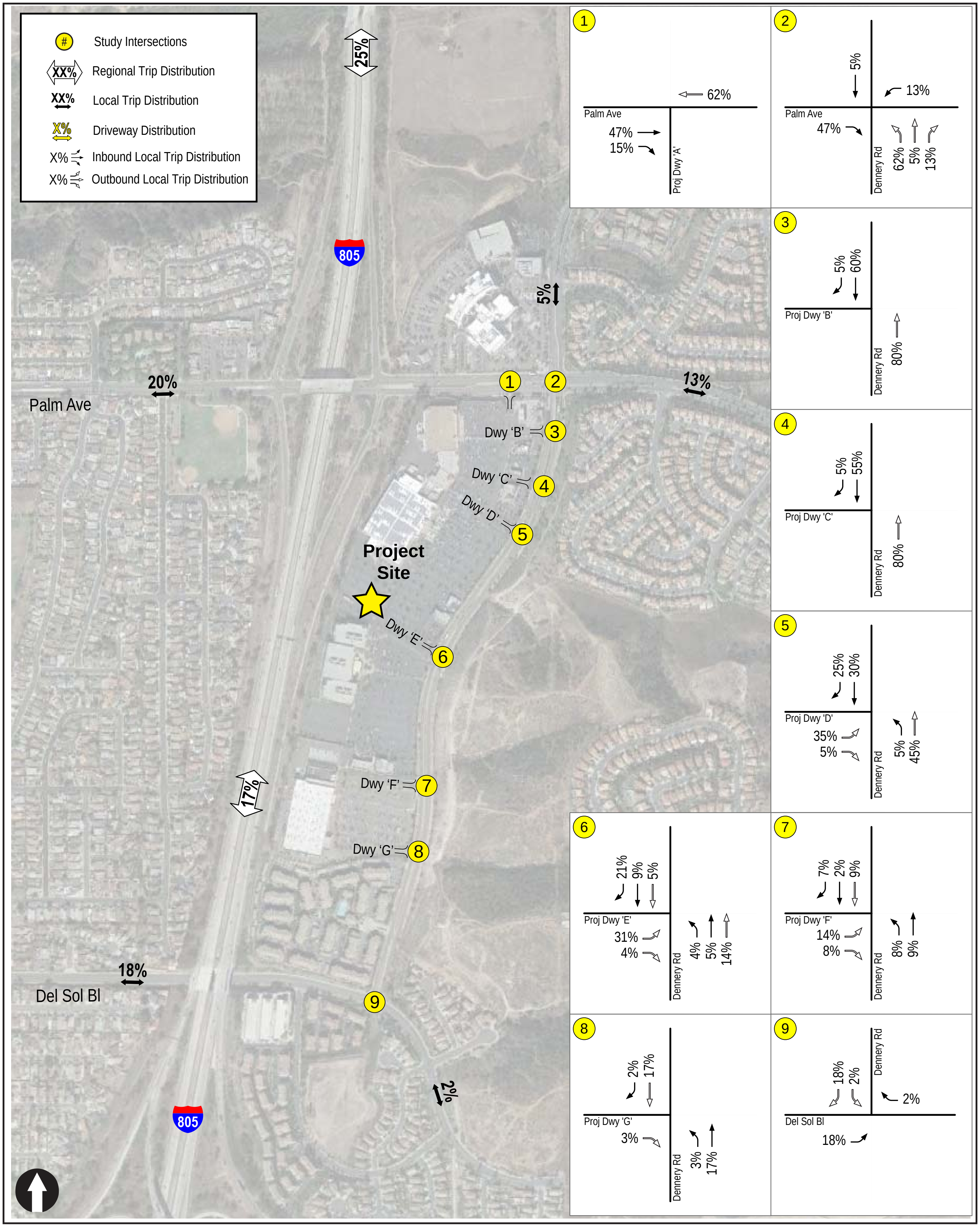

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Figure 8-1

Project Traffic Distribution

PALM PROMENADE

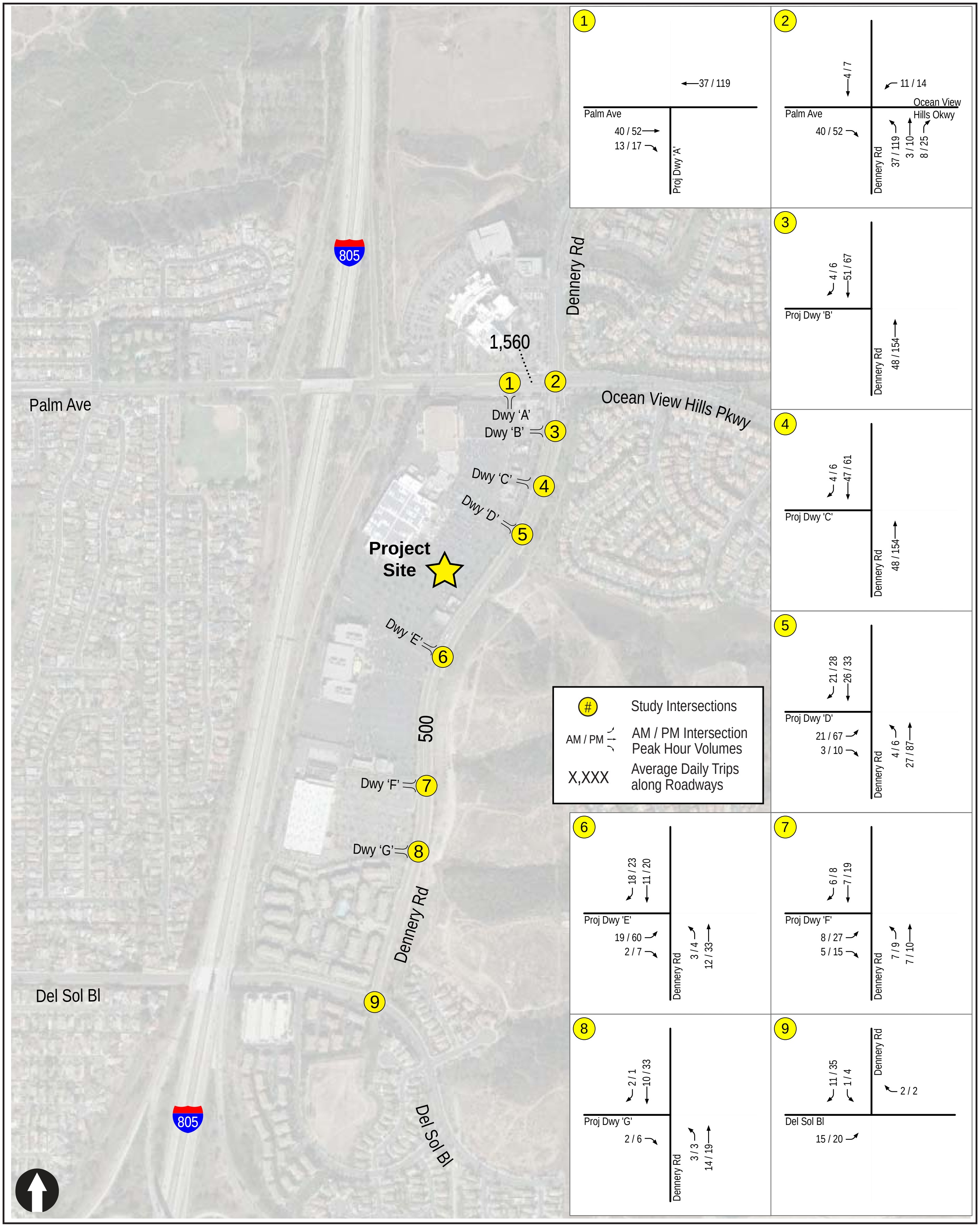

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Figure 8-2

Project Traffic Volumes

PALM PROMENADE

9.0 NEAR-TERM (OPENING YEAR 2020) CONDITIONS

Cumulative projects represent reasonably foreseeable planned development that contributes to background traffic conditions for the Near-Term (Opening Year 2020) scenario. No forthcoming roadway improvements were assumed under Near-Term (Opening Year 2020) conditions.

9.1 Cumulative Project Research

LLG researched ongoing cumulative project development in the study area and identified 20 cumulative projects for consideration in the Near-Term (Opening Year 2020). Much of the traffic from many of these projects is not expected to use Dennery Road. In addition, it is important to note that some of these projects may not be constructed prior to the Project's opening day in 2020. In any case, they were included as a part of the background traffic growth to be conservative.

Table 9–1 contains a list of cumulative projects that were considered in the Near-Term (Opening Year 2020) analysis. ***Figure 9–1*** shows the cumulative projects traffic volumes, and ***Figure 9-2*** shows the location of the cumulative projects.

TABLE 9-1
CUMULATIVE PROJECTS (OPENING DAY 2020)

Project Name	Jurisdiction	Type	ADT	Status
1. Britannia 40	City of San Diego	Auto Auction	1,284 ADT	Approved
2. Brown Field Tech Park (Units I & II)	City of San Diego	Commercial	10,576 ADT	Approved
3. Playa Del Sol	City of San Diego	Residential	5,472 ADT	Under Construction
4. Otay Mesa Batch Plant	City of San Diego	Truck Terminal	1,352 ADT	Pending
5. Siempre Viva Industrial Park	City of San Diego	Industrial	1,250 ADT	Pending
6. South Bay Otay Mesa	City of San Diego	Warehouse	1,678 ADT	Approved
7. Southview	City of San Diego	Residential	3,318 ADT	Under Construction
8. Sunroad 20	City of San Diego	Commercial	2,000 ADT	Pending
9. La Media Retail	City of San Diego	Commercial	9,079 ADT	Pending
10. Sunroad 80	City of San Diego	Commercial	1,500 ADT	In Review
11. USMS Sized Vehicle Lot	City of San Diego	Industrial	125 ADT	Pending
12. Otay Business Park (Phases I & II)	County of San Diego	Business Park	17,184 ADT	Approved
13. Otay Crossings Business Park (Units 1 & 2)	County of San Diego	Mixed-Use Industrial	12,084 ADT	Approved
14. Airway Business Center FedEx	County of San Diego	Industrial	4,000 ADT	Pending
15. National Enterprises Storage & Recycling	County of San Diego	Mixed-Use	2,400 ADT	Pending
16. Travel Plaza	County of San Diego	Mixed-Use	440 ADT	Pending
17. California Crossings	County of San Diego	Retail	15,590 ADT	Approved
18. Candlelight	City of San Diego	Residential	4,350 ADT	Approved
19. Metropolitan Airpark (Phase I)	City of San Diego	Mixed-Use	4,574 ADT	Approved
20. Palm Promenade Fast Food (Home Depot Pad)	City of San Diego	Restaurant	175 ADT	Approved

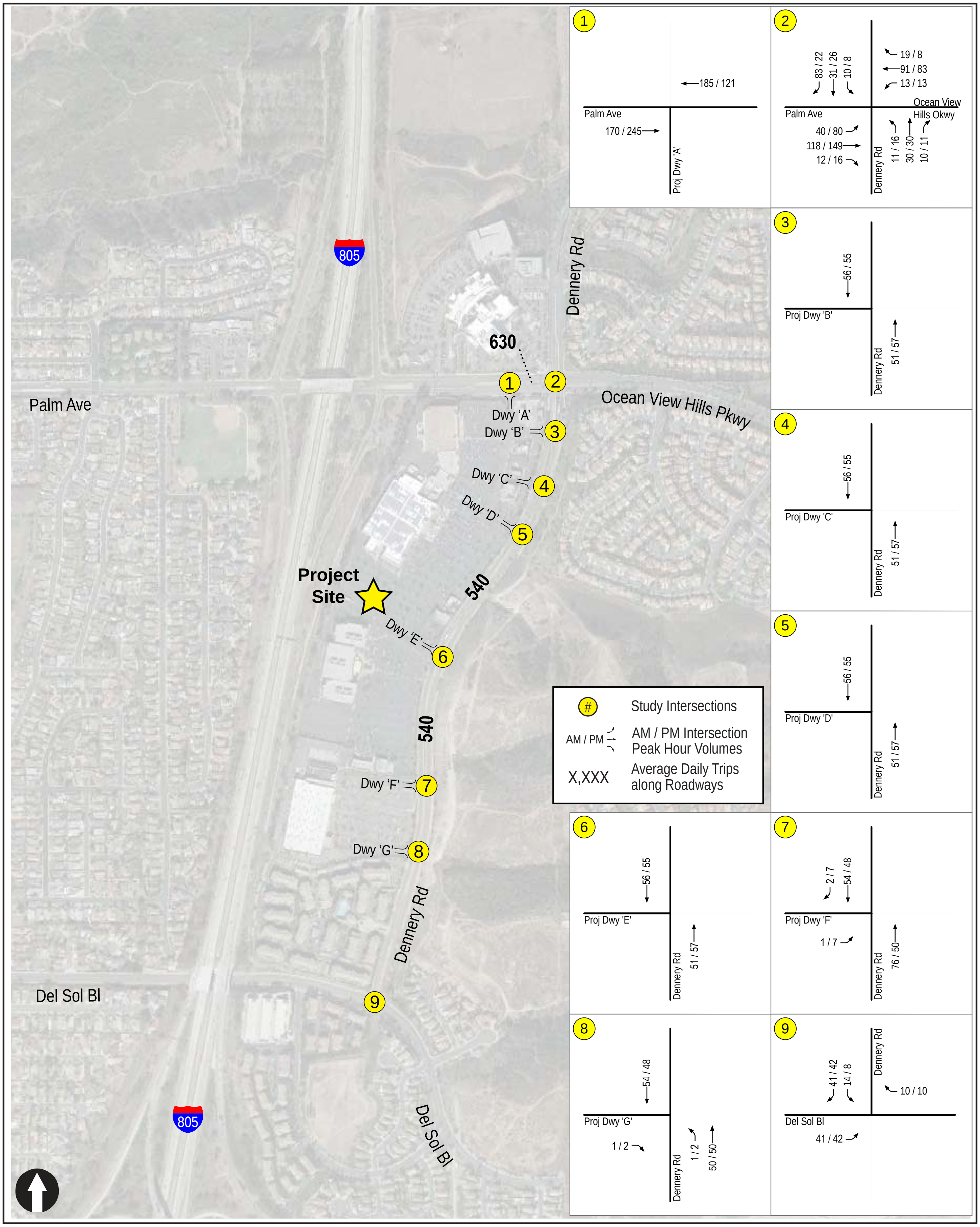

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Figure 9-1

Cumulative Projects Traffic Volumes

PALM PROMENADE

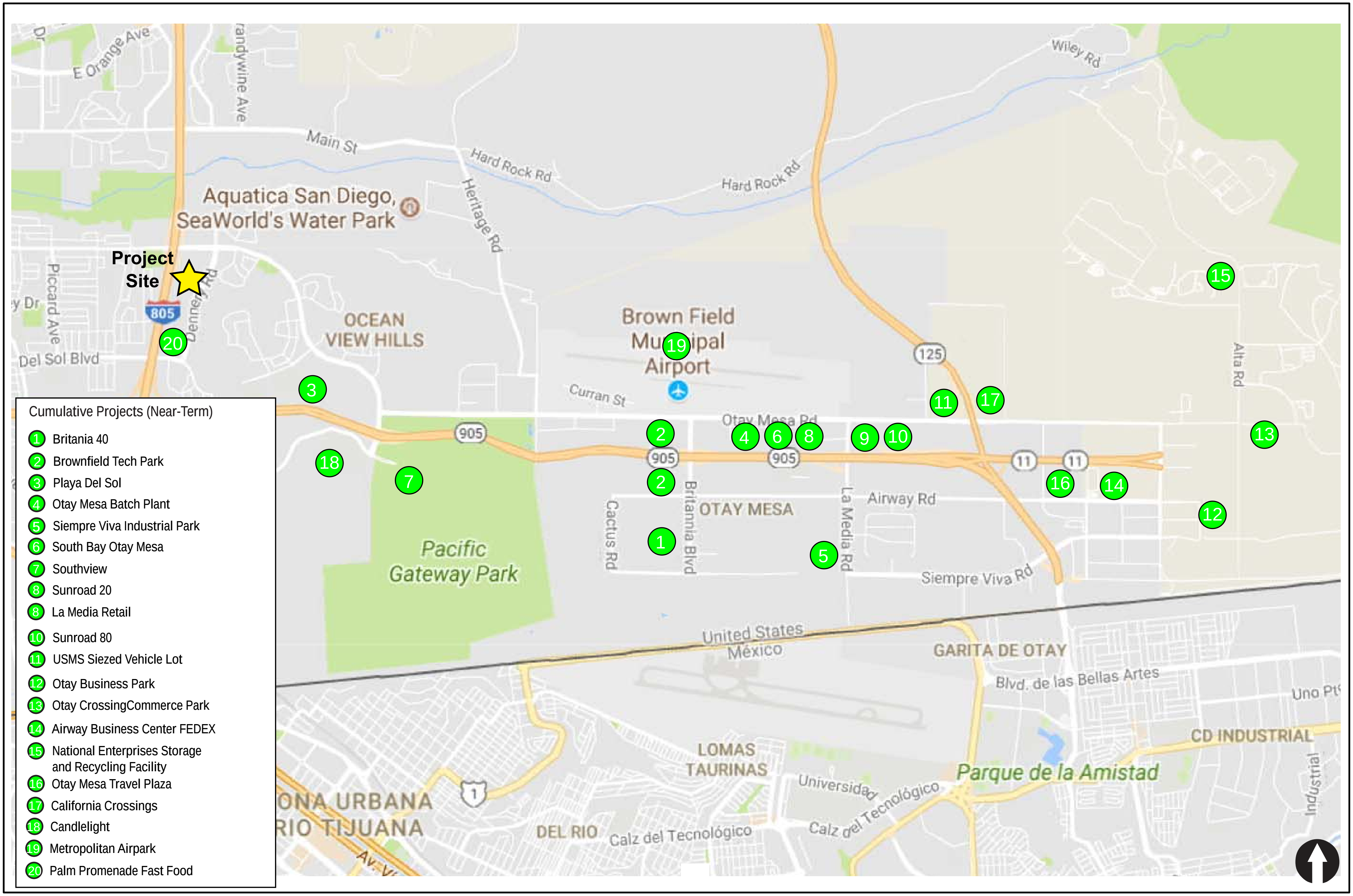

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Figure 9-2

Cumulative Projects Location Map

PALM PROMENADE

10.0 NEAR-TERM (OPENING YEAR 2020) ANALYSIS

The following section presents the analysis of study area intersections and street segments under Near-Term (Opening Year 2020) conditions without and with the proposed Project.

10.1 Near-Term (Opening Year 2020) Traffic Volumes

Near-Term (Opening Year 2020) traffic volumes were calculated for the study area by adding the cumulative project volumes onto the existing traffic volumes. Near-Term (Opening Year 2020) + Project traffic volumes were calculated by then adding the Project traffic volumes. The traffic volumes represent LLG's best efforts of forecasting Near-Term (Opening Year 2020) and Near-Term (Opening Year 2020) + Project conditions with the most recent information available at the time this report was prepared.

Figure 10–1 shows the Near-Term (Opening Year 2020) traffic volumes. ***Figure 10–2*** shows the Near-Term (Opening Year 2020) + Project traffic volumes.

10.2 Near-Term (Opening Year 2020) Operations

10.2.1 *Intersection Analysis*

Table 10–1 summarizes the peak hour intersection operations for the Near-Term (Opening Year 2020) scenario. As seen in *Table 10–1*, the study area intersections are calculated to operate acceptably at LOS C or better with the exception of the following:

- Palm Avenue / Dennery Road (LOS E during the AM and PM peak hours)

Appendix E contains the intersection analysis sheets for the Near-Term (Opening Year 2020) scenario.

10.2.2 *Street Segment Analysis*

Table 10–2 summarizes the Near-Term (Opening Year 2020) street segment operations. As shown in *Table 10–2*, the study street segments are calculated to operate acceptably at LOS C or better.

10.3 Near-Term (Opening Year 2020) + Project Operations

10.3.1 *Intersection Analysis*

Table 10–1 summarizes the peak hour intersection operations for the Near-Term (Opening Year 2020) + Project scenario. As seen in *Table 10–1*, the study area intersections are calculated to continue to operate acceptably at LOS C or better with exception the following:

- Palm Avenue / Dennery Road (LOS E during the AM and PM peak hours)

Based on the City of San Diego's significance criteria, a significant impact is calculated at the intersection of Palm Avenue / Dennery Road.

Appendix F contains the intersection analysis sheets for the Near-Term (Opening Year 2020) + Project scenario.

10.3.2 *Street Segment Analysis*

Table 10–2 summarizes the Near-Term (Opening Year 2020) + Project street segment operations. As shown in *Table 10–2*, the study street segments are calculated to continue to operate acceptably at LOS C or better and no significant impacts are calculated.

Table 10–1
Near-Term (Opening Year 2020) Intersection Operations

Intersection	Control Type	Peak Hour	Near-Term (Opening Year 2020)		Near-Term (Opening Year 2020) +Project		Δ[c]	Significant Impact?
			Delay[a]	LOS[b]	Delay	LOS		
1. Palm Avenue / Driveway 'A'	Unsig.[e]	AM	–	–	–	–	–	None
		PM	–	–	–	–	–	None
2. Palm Avenue / Dennery Road	Signal	AM	60.9	E	62.5	E	1.6	None
		PM	66.2	E	78.5	E	12.3	Yes
3. Dennery Road / Driveway 'B '	MSSC[d]	AM	11.0	B	11.3	B	0.3	None
		PM	13.9	B	14.7	B	0.8	None
4. Dennery Road / Driveway 'C'	MSSC[d]	AM	11.0	B	11.2	B	0.2	None
		PM	14.3	B	15.1	C	0.8	None
5. Dennery Road / Driveway 'D'	Signal	AM	11.8	A	12.1	B	0.3	None
		PM	19.6	B	21.0	C	1.34	None
6. Dennery Road / Driveway 'E'	Signal	AM	5.4	A	6.1	A	0.7	None
		PM	11.7	B	12.9	B	1.2	None
7. Dennery Road / Driveway 'F'	Signal	AM	9.9	A	10.7	B	0.8	None
		PM	13.0	B	15.3	B	2.3	None
8. Dennery Road / Driveway 'G'	MSSC[d]	AM	9.6	A	9.7	A	0.1	None
		PM	10.7	B	10.9	B	0.2	None
9. Del Sol Blvd. / Dennery Road	Signal	AM	25.2	C	25.5	C	0.3	None
		PM	24.0	C	24.5	C	0.5	None

Footnotes:

a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. "Δ" denotes the Project-induced increase in delay.
d. Minor Street Stop Control intersection. Worst approach delay reported.
e. No traffic control or conflicting movements. Provides inbound only access to the shopping center.

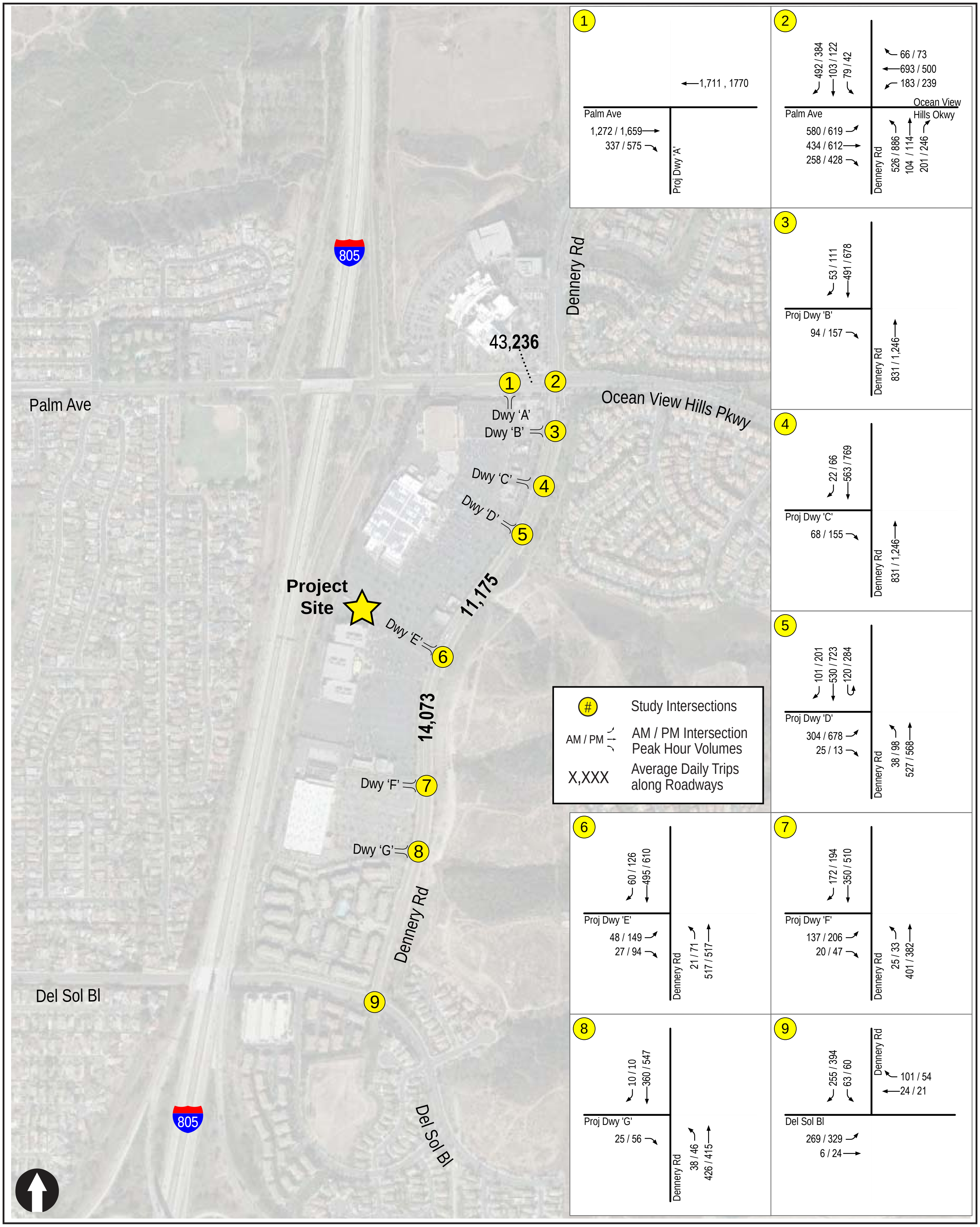
SIGNALIZED DELAY/LOS THRESHOLDS		UNSIGNALIZED DELAY/LOS THRESHOLDS	
Delay	LOS	Delay	LOS
0.0 ≤ 10.0	A	0.0 ≤ 10.0	A
10.1 to 20.0	B	10.1 to 15.0	B
20.1 to 35.0	C	15.1 to 25.0	C
35.1 to 55.0	D	25.1 to 35.0	D
55.1 to 80.0	E	35.1 to 50.0	E
≥ 80.1	F	≥ 50.1	F

TABLE 10–2
NEAR-TERM (OPENING YEAR 2020) STREET SEGMENT OPERATIONS

Street Segment	Capacity (LOS E)[a]	Near-Term (Opening Year 2020)			Near-Term (Opening Year 2020) + Project			Δ[e]	Significant Impact?
		ADT[b]	LOS[c]	V/C[d]	ADT	LOS	V/C		
Palm Avenue									
Palm Promenade Driveway "A" to Dennery Road	65,000	43,236	C	0.665	44,796	C	0.689	0.024	None
Dennery Road									
Palm Promenade Driveway "D" to Palm Promenade Driveway "E"	40,000	11,175	A	0.279	11,675	A	0.292	0.013	None
Palm Promenade Driveway "E" to Palm Promenade Driveway "F"	40,000	14,073	A	0.352	14,573	A	0.364	0.012	None

Footnotes:

a. Capacities based on City of San Diego Roadway Classification Table (*See Appendix C*).
b. Average Daily Traffic.
c. Level of Service.
d. Volume to Capacity ratio.
e. "Δ" denotes the Project-induced increase in Volume to Capacity ratio.



LINSCOTT LAW & GREENSPAN engineers

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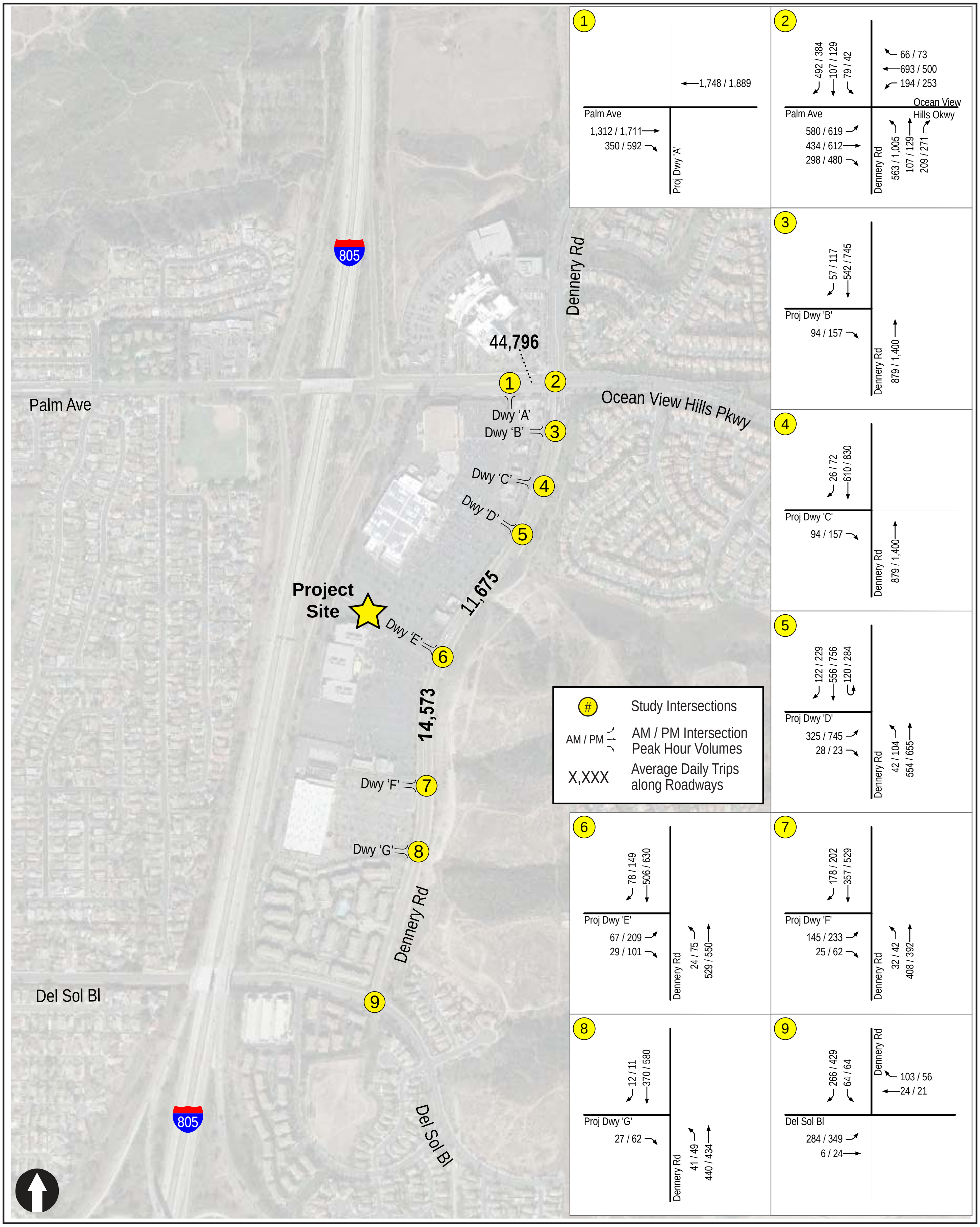
Figure 10-1

Near-Term (2020) Traffic Volumes

PALM PROMENADE



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Date: 08/17/18

Figure 10-2

Near-Term (2020) + Project Traffic Volumes

PALM PROMENADE

11.0 SIGNIFICANCE OF IMPACTS AND MITIGATION MEASURES

Based on the City of San Diego's significance criteria, a significant impact is calculated at the intersection of Palm Avenue / Dennery Road. As shown in ***Table 11-1***, the provision of right-turn overlap signal phasing at the eastbound approach would mitigate the Project's significant impact to below a level of significance.

TABLE 11–1
NEAR TERM INTERSECTION POST–MITIGATION ANALYSIS

Intersection	Control Type	Peak Hour	Near-Term (Opening Year 2020)		Near-Term (Opening Year 2020) + Project		Near-Term (Opening Year 2020) + Project with Mitigation		
			Delay[a]	LOS[b]	Delay	LOS	Delay	LOS	Δ[c]
2. Palm Avenue / Dennery Road	Signal	PM	66.2	E	78.5	E	58.0	E	(8.2)

Footnotes:

a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. Δ denotes the change in delay as compared to Near- Term conditions with the addition of Project trips and proposed mitigation measures.

GEOTECHNICAL INVESTIGATION

THE SHOPS AT AMC PROMENADE
770 DENNERY ROAD
SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

CITIVEST INCORPORATED
NEWPORT BEACH, CALIFORNIA

AUGUST 18, 2017
PROJECT NO. G2171-42-01

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. G2171-42-01
August 18, 2017

Citivest Incorporated
4340 Von Karmen Avenue, Suite 110
Newport Beach, California 92660

Attention: Mr. Michael Mossman

Subject: GEOTECHNICAL INVESTIGATION
THE SHOPS AT AMC PROMENADE
770 DENNERY ROAD
SAN DIEGO, CALIFORNIA

Dear Mr. Mossman

In accordance with your request and authorization of our proposal (LG-17225, dated June 5, 2017), we herein submit the results of our geotechnical investigation for the subject project. We performed our investigation to evaluate the underlying soil and geologic conditions and potential geologic hazards and to assist in the design of the proposed building and associated improvements.

The accompanying report presents the results of our study and conclusions and recommendations pertaining to the geotechnical aspects of the proposed project. The site is suitable for the proposed buildings and improvements provided the recommendations of this report are incorporated into the design and construction of the planned project.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Noel G. Borja
Senior Staff Engineer

Shawn Foy Weedon
GE 2714

Ali Sadr
CEG 1778

REGISTERED PROFESSIONAL ENGINEER SHAWN WEEDON No. 2714 GEOTECHNICAL ★ STATE OF CALIFORNIA ★

PROFESSIONAL GEOLOGIST ALI SADR No. 1778 CERTIFIED ENGINEERING GEOLOGIST ★ STATE OF CALIFORNIA ★

NGB:RCM:AS:dmc

(4) Addressee
(1) Nasland Engineering
Attention: Mr. Sam Waisbord

6960 Flanders Drive ■ San Diego, California 92121-2974 ■ Telephone 858.558.6900 ■ Fax 858.558.6159

TABLE OF CONTENTS

TABLE OF CONTENTS (Concluded)

GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for the proposed new buildings and improvements for The Shops at AMC Promenade located at 770 Dennery Road in San Diego, California (see Vicinity Map, Figure 1). The purpose of this geotechnical investigation is to evaluate the surface and subsurface soil conditions; general site geology; and to identify geotechnical constraints that may impact the planned improvements to the property. This report also provides grading and foundation recommendations, retaining wall design criteria, and storm water management recommendations.

To aid in preparing this geotechnical investigation, we reviewed the following reports and plans:

1. *Final Report of Observation and Testing, AMC 24-Plex, Dennery Road and Palm Avenue, San Diego, California*, prepared by MTGI Incorporated, dated October 28, 1999 (Project No. 1201-03).

2. *Geotechnical Engineering Report, Proposed AMC Theater and Adjacent Restaurants, Palm Avenue and Dennery Road, San Diego, California*, prepared by Terracon Incorporated, dated September 16, 1997 (Project No. 02975220).

3. *Report of Geotechnical Investigation, Proposed AMC Theater and Adjacent Restaurants, Palm Avenue and Dennery Road, San Diego, California*, prepared by Opterra Incorporated, dated September 15, 1997 (Project No. D45201-1).

4. *Report of Limited Geologic and Seismicity Study, Proposed AMC Theater and Adjacent Restaurants, Palm Avenue and Dennery Road, San Diego, California*, prepared by Stephen E. Jacobs, CEG, dated August 27, 1997.

5. *Plans for the Improvement and Grading For: AMC 24 Theaters at Palm Promenade in Lots 3, 4, 5, 6, 14, 16 and 17 of Palm Promenade Map No. 13071, San Diego, California*, prepared by Rick Engineering Company, dated October 14, 1998 (Drawing No. 29290-D).

The field investigation consisted of drilling six small-diameter borings to evaluate the underlying geologic conditions within the area of planned improvements and performing four infiltration tests for storm water management recommendations.

The locations of the small-diameter borings and infiltration tests are shown the *Geologic Map*, Figure 2, and on the *Geologic Cross-Sections*, Figure 3. The base map used for Figure 2 is an AutoCAD file of the grading plan provided by Nasland Engineering. Logs of the exploratory borings and a detailed discussion of the field investigation are presented in Appendix A.

We performed laboratory tests on selected soil samples obtained during the field investigation to evaluate pertinent physical properties for engineering analyses and to assist in providing recommendations for site grading and foundation design criteria. Details of the laboratory testing and a summary of test results are presented in Appendix B.

The conclusions and recommendations presented herein are based on analyses of the data obtained from the field investigation, laboratory tests, and our experience with similar soil and geologic conditions.

2. PREVIOUS SITE DEVELOPMENT

Original development for the AMC 24-plex theater was performed during development for the Palm Promenade commercial center Lots 3 through 6, 14, 16, and 17. Grading was performed under the testing and observation of G. A. Nicholl and Associates, Inc. and was reported in the as-graded report titled *Rough Grading Report, Palm Promenade, Palm Avenue and I-805, San Diego, California, Project 4909-51 for Gatlin Development Company,* dated April 7, 1995. We did not have a copy of this original as-graded report for our review at the time this report was prepared. Based on our review of References 2 and 3, original grading placed and compacted 5 to 26.5 feet of fill soils across the site. However, subsequent to the original grading, a geotechnical investigation and limited geologic/seismic study was performed, References 3 and 4, respectively, prior to the fine grading of the AMC 24-plex theater and proposed restaurants.

In 1999, grading for the AMC theater was completed. Fine grading for the theater was documented in the as-graded report prepared by MTGL, Inc. (Reference 1). Based on the as-graded report, a 1-foot undercut below bottom of the footings were performed in the area of the theater. Grading extended at least 5 feet laterally outside the building footprints. In areas of improvements or where fill soils were required to achieve finish grade, a 1-foot removal and recompaction was performed.

3. SITE AND PROJECT DESCRIPTION

The proposed project is located at 770 Dennery Road in the Otay Mesa area in San Diego, California, within the Palm Promenade commercial development. It consists of the AMC 24-plex movie theater surrounded by asphalt-paved parking lot. The site is bordered to the north by a Walmart store, parking lot and a tire store. On the south the site is bounded by a parking lot and retail stores. The north bound I-805 and Dennery Road bound the site to the west and east, respectively. A 25-foot slope borders the west perimeter of the site. Existing grade slopes from southeast to northwest with elevations varying from approximately 308 feet Mean Sea Level (MSL) at the southeast end to approximately 265 feet MSL at the west end.

We understand the proposed improvement will consist of demolishing the north portion of the AMC 24-plex theater to reduce the cinema to 14-plexes, constructing three new retail shops, a 45,000-square-foot retail building, and two building pads. A loading dock is also planned for the retail building and drive thru's will be included in the construction of the two building pads on the east side of the site. In addition, new parking stalls and associated utilities will also be constructed.

The above locations, site descriptions, and proposed development are based on our site reconnaissance, review of published geologic literature, field investigations, and discussions with the project civil engineer. If development plans differ from those described herein, Geocon Incorporated should be contacted for review of the plans and possible revisions to this report.

4. SOIL AND GEOLOGIC CONDITIONS

The property is underlain by previously placed fill overlying the San Diego Formation. A description of the surficial soils and the formational unit are discussed below. The approximate occurrence and thickness of the units are shown on the Geologic Map (Figure 2) and Geologic Cross-Sections (Figure 3). We prepared the geologic cross-sections using information from our recent site investigation, previous grading, and interpolation between exploratory borings; therefore, actual geologic conditions between the borings may vary from those illustrated.

4.1 Previously Placed Fill (Qpf)

Compacted fill placed during previous grading operations are present throughout the site. We observed previously placed fill soils in all of the borings to the maximum depths explored of 19.5 feet. The fill predominantly consists of silty to clayey sand and silty to sandy clay with varying cobble content. Laboratory tests indicate the fills possess a *low* to *medium* expansion potential with very low to moderate potential for collapse when wetted.

4.2 San Diego` Formation (Tsd)

Based on the geotechnical investigation performed by Opterra dated September 15, 1997, the San Diego Formation was observed underlying the previously placed fill soils at depths of 5 to 26.5 feet below the elevations prior to fine grading. Opterra's report described the San Diego Formation to consist of fine to medium grained sandstone with occasional layers of silty claystone and cobble conglomerate. Excavations during the construction of proposed improvements are anticipated to be shallow. We do not expect to encounter this formational unit during construction.

5. GROUNDWATER

We did not encounter groundwater during our investigation. Groundwater is expected to be greater than 70 feet below the existing ground surface; however, it is not uncommon for saturated or seepage conditions to develop where none previously existed. Groundwater elevation is dependent on seasonal precipitation, irrigation, land use, etc. Proper surface drainage will be important to future performance of the project.

6. GEOLOGIC HAZARDS

6.1 Geologic Hazard Category

The City of San Diego Seismic Safety Study (2008), Sheet 6 defines the site as Hazard Category 52: *Other level areas, gently sloping to steep terrain, unfavorable geologic structure, low to moderate risk*. It is our opinion the site has favorable geologic structure with respect to geologic hazards.

6.2 Faulting and Ground Rupture

A review of USGS and CGS (2006) and Kennedy and Tan (2008) shows the La Nacion fault zone traversing along the eastern edge of the property line trending approximately N10°E. The La Nacion Fault is classified by the California Geologic Survey as "potentially active" fault, meaning that no activity has been detected along this fault in the past 11,000 years (Holocene). During the mass grading operations, G. A. Nicoll and Associates has mapped the La Nacion Fault and Rick Engineering has surveyed the location. They allocated a 25 feet setback from the fault for any habitable structures The fault zone and the allocated 25 feet setback is shown on the Geologic Map (Figure 2). The proposed buildings are located beyond these limits. No other faults are noted in the site vicinity or trending toward the site vicinity. The site is not located within a State of California Earthquake Fault Zone. The nearest active fault is the Newport-Inglewood/Rose Canyon Fault Zone, which is located 7 miles west of the site.

6.3 Seismicity

We performed a deterministic seismic hazard analysis using Risk Engineering (2015). Six known active faults are located within a search radius of 50 miles from the property. We used the 2008 USGS fault database that provides several models and combinations of fault data to evaluate the fault information. The nearest known active faults are the Newport-Inglewood/Rose Canyon Fault system, located less than 7 miles west of the site and is the dominant source of potential ground motion. Earthquakes that might occur on the Newport-Inglewood/Rose Canyon Fault Zone or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated deterministic maximum earthquake magnitude and peak ground acceleration for the Newport-Inglewood Fault are 7.5 and 0.35g, respectively. Table 6.3.1 lists the estimated maximum earthquake magnitude and peak ground acceleration for these and other faults in relationship to the site location. We used acceleration attenuation relationships developed by Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008)

NGA USGS, and Chiou-Youngs (2007) NGA USGS 2008 acceleration-attenuation relationships in our analysis.

TABLE 6.3.1
DETERMINISTIC SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2007 (g)
Newport-Inglewood	7	7.5	0.31	0.27	0.35
Rose Canyon	7	6.9	0.27	0.25	0.29
Coronado Bank	14	7.4	0.22	0.17	0.20
Palos Verdes Connected	14	7.7	0.24	0.18	0.23
Elsinore	44	7.85	0.13	0.09	0.11
Earthquake Valley	48	6.8	0.08	0.05	0.04

It is our opinion the site could be subjected to moderate to severe ground shaking in the event of an earthquake along any of the faults listed on Table 6.3.1 or other faults in the southern California/ northern Baja California region. We do not consider the site to possess a greater risk than that of the surrounding developments.

We performed a probabilistic seismic hazard analysis for the site using Risk Engineering (2015). The computer program operates under the assumption that the occurrence rate of earthquakes on each mapped Quaternary fault is proportional to the faults slip rate. The program accounts for earthquake magnitude as a function of fault rupture length, and site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS 2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2007) NGA USGS 2008 in the analysis. Table 6.3.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence.

TABLE 6.3.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2007 (g)
2% in a 50 Year Period	0.45	0.38	0.44
5% in a 50 Year Period	0.32	0.28	0.31
10% in a 50 Year Period	0.24	0.21	0.23

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the 2016 California Building Code (CBC) guidelines or guidelines currently adopted by the City of San Diego.

6.4 Landslides

No landslides were encountered at the site or in an area that could impact the property. We do not consider the potential for landsliding to be a hazard to this project.

6.5 Liquefaction and Seismically Induced Settlement

Due to the absence of a near surface groundwater elevation and the dense to very dense nature of the on-site soils, the risk associated with ground failure or settlement hazard due to liquefaction is low.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

7.1.1 From a geotechnical engineering standpoint, it is our opinion that the site is suitable for development of the proposed project provided the recommendations presented herein are implemented in design and construction of the project.

7.1.2 The site is underlain by previous place fill overlying the San Diego Formation. The previously placed fill is considered suitable for support of additional fill or proposed improvements; however, upper portions of the fill will require remedial grading consisting of an undercut and recompaction. Based on the proposed project, we do not expect to encounter the San Diego Formation during remedial grading with the exception of deep utility excavations.

7.1.3 The La Nacion Fault zone traverses along the eastern property line of the site trending approximately N10ºE.. This fault is classified as a "potentially active" fault. No other faults are noted in the site vicinity or trending toward the site vicinity.

7.1.4 During the previous phases of development, a 25 foot setback is allocated along the La Nacion Fault. No habitable building is allowed within this zone.

7.1.5 The site is located approximately 7 miles from the nearest active fault, the Newport-Inglewood/Rose Canyon Fault Zone. It is our opinion that beside the La Nacion Fault, no active or potentially active faults cross the site.

7.1.6 The risk associated with geologic hazards due to ground rupture, liquefaction, and landslides are low.

7.1.7 We did not encounter groundwater at the time of our investigation. No subdrains will be required on the project, with the exception of subdrains for retaining walls.

7.1.8 The proposed structures can be supported on conventional shallow foundations system bearing on properly compacted fill soil.

7.1.9 Subsurface conditions observed in the exploratory borings may be extrapolated to reflect general soil/geologic conditions at the site; however, some variations in subsurface conditions between borings should be expected.

7.1.10 Based on our geotechnical investigation and a review of the proposed improvement, we opine that the new development would not have an adverse impact on the adjacent properties.

7.2 Excavation and Soil Characteristics

7.2.1 Excavation of the onsite soils should be possible with moderate to heavy effort using conventional, heavy-duty equipment during grading and trenching operations.

7.2.2 The soil encountered in our field investigation is considered to be "expansive" (Expansion Index [EI] greater than 20) as defined by 2016 California Building Code (CBC) Section 1803.5.3. Table 7.2 presents soil classifications based on the expansion index.

TABLE 7.2
EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Expansion Classification	2016 CBC Expansion Classification
0 – 20	Very Low	Non-Expansive
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

7.2.3 We performed laboratory tests on samples of the site materials to evaluate the percentage of water-soluble sulfate content. Appendix B presents the results from the laboratory water-soluble sulfate content tests. The test results indicate that on-site materials at the locations tested possess "Not Applicable" and "S0" sulfate exposure to concrete structures, as defined by 2016 CBC Section 1904 and ACI 318-14 Chapter 19. The presence of water-soluble sulfates is not a visually discernible characteristic. Therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e. addition of fertilizers and other soil nutrients) may affect the concentration.

7.2.4 Geocon Incorporated does not practice in the field of corrosion engineering. Therefore, if improvements that could be susceptible to corrosion are planned, further evaluation by a corrosion engineer may be needed.

7.3 Grading

7.3.1 All grading should be performed in accordance with the *Recommended Grading Specifications* contained in Appendix D. Where the recommendations of Appendix D conflict with this section of the report, the recommendations of this section take precedence.

7.3.2 Prior to commencing grading, a preconstruction conference should be held at the site with the owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

7.3.3 Grading should be performed in conjunction with the observation and compaction testing services of Geocon Incorporated. Fill soil should be observed on a full-time basis during placement and tested to check in-place dry density and moisture content.

7.3.4 Site preparation should begin with removal of all deleterious material and vegetation. The depth of removal should be such that material exposed in cut areas or soil to be used for fill is relatively free of organic matter. Deleterious material generated during stripping and/or site demolition should be exported from the site.

7.3.5 Abandoned utilities should be removed and the subsequent depressions and/or trenches backfilled with properly compacted fill as part of the remedial grading.

7.3.6 In areas to receive new foundations and structural improvements, the previously placed fill should be removed and replaced as compacted fill to a depth of 3 feet below finish pad grade or 1 foot below bottom of the deepest footing element (whichever results in a deeper excavation). The remedial grading should extend a horizontal distance to at least 5 feet outside of the building footprint. If unsuitable soils are encountered deeper than those recommended herein, the actual extent of the removals will be evaluated in the field during grading by the geotechnical engineer and/or engineering geologist.

7.3.7 In the areas of planned new pavement or surface improvements, we recommend the upper 1 foot of pavement subgrade be removed and replaced with compacted fill. Prior to placing fill, the bottom of excavation should be scarified, moisture conditioned as necessary, and recompacted.

7.3.8 Prior to placing fill, the upper 12 inches at the base of removals should be scarified, moisture conditioned as necessary and recompacted. Soils derived from onsite excavations are suitable for reuse as fill if free from vegetation, debris and other deleterious material. Fill lifts should be no thicker than will allow for adequate bonding and compaction. Fill, backfill, and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of maximum dry density at or slightly above optimum moisture content, as determined in accordance with ASTM D 1557. Grading should be performed so that the upper 3 feet of soil below finish pad subgrade consist of soil with a *low* to *medium* expansive potential (EI of 90 or less).

7.3.9. Oversize rock greater than 12 inches should be placed at least 5 feet below finish pad grade or 3 feet below the deepest utility, whichever is greater. Rock greater than 6 inches should not be placed in the upper 3 feet below building pad grade. Oversize rock that cannot be placed as recommended should be exported off site.

7.3.10 Imported fill should consist of granular soil with a *low* to *medium* expansion potential (EI of 90 or less) that is free of deleterious material or stones larger than 3 inches and should be compacted as recommended above. Geocon Incorporated should be notified of the import soil source and should perform laboratory testing prior to its arrival at the site to evaluate its suitability as fill material.

7.4 Seismic Design Criteria

7.4.1 We used USGS (2017) to determine seismic design criteria. Table 7.4.1 summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The building structure and improvements should be designed using a Site Class C. We evaluated the Site Class in accordance with Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10 based on our experience with the site subsurface soils and exploratory boring information. The values presented in Table 7.4.1 are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 7.4.1
2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Table 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.900g	Figure 1613..3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.341g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.140	Table 1613.3.3(1)
Site Coefficient, F_V	1.718	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.026g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	0.586g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.684g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.390g	Section 1613.3.4 (Eqn 16-40)

7.4.2 Table 7.4.2 presents additional seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

TABLE 7.4.2
2016 CBC SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.367g	Figure 22-7
Site Coefficient, F_{PGA}	1.133	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.367g	Section 11.8.3 (Eqn 11.8-1)

7.4.3 Conformance to the criteria in Tables 7.4.1 and 7.4.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and not to avoid all damage, since such design may be economically prohibitive.

7.5 Foundation and Concrete Slabs-On-Grade Recommendations

7.5.1 The following foundation recommendations assume the proposed structures will bear entirely on properly compacted fill and that the prevailing soil within 3 feet of pad grade will have an Expansion Index (EI) 90 or less.

7.5.2 Foundations for the new structure should consist of continuous strip footings and/or isolated spread footings. Continuous footings should be at least 12 inches wide and extend at least 24 inches below lowest adjacent pad grade. Isolated spread footings should have a minimum width of 24 inches and should extend at least 24 inches below lowest adjacent pad grade. Steel reinforcement for continuous footings should consist of at least four, No. 5 steel, reinforcing bars placed horizontally in the footings, two near the top and two near the bottom. The project structural engineer should design the concrete reinforcement for the spread footings. A typical footing dimension detail depicting lowest adjacent grade is provided on Figure 4.

7.5.3 Foundations may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf) (dead plus live load) for footings founded in properly compacted fill. The bearing pressure may be increased by 300 psf and 500 psf for each additional foot of foundation width and depth, respectively, up to a maximum allowable bearing pressure of 4,000 psf. The allowable bearing pressure may also be increased by up to one-third for transient loads such as those due to wind or seismic forces. We expect settlement due to footing loads conforming to the above recommended allowable soil bearing pressures are expected to be less than 1-inch total and ¾-inch differential over a span of 40 feet.

7.5.4 The minimum foundation dimensions and concrete reinforcement recommendations presented above are based on soil characteristics only and are not intended to replace reinforcement required for structural considerations.

7.5.5 The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, Geocon Incorporated should be consulted where such a condition is anticipated. As a minimum, wall footings should be deepened such that the bottom outside edge of the footing is at least seven feet from the face of slope.

7.5.6 Interior concrete slabs-on-grade should be at least 5 inches thick and reinforced with No. 4-bars placed 18 inches on center in both directions placed at the slab midpoint. The concrete slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slabs for supporting planned loading. Thicker concrete slabs may be required for heavier loads.

7.5.7 The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building, are not recommended. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams.

7.5.8 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06). The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity controlled environment.

7.5.9 The project foundation engineer, architect, and/or developer should determine the thickness of bedding sand below the slab. Sand bedding thicknesses of 3 to 4 inches are typical in the Southern California area. Geocon should be contacted to provide recommendations if the bedding sand is thicker than 6 inches.

7.5.10 The foundation design engineer should provide appropriate concrete mix design criteria and curing measures to assure proper curing of the slab by reducing the potential for rapid moisture loss and subsequent cracking and/or slab curl. We suggest that the foundation design engineer present the concrete mix design and proper curing methods on the foundation plans. It is critical that the foundation contractor understands and follows the recommendations presented on the foundation plans.

7.5.11 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in any such concrete placement.

7.5.12 Exterior slabs not subject to vehicle loads should be at least 4 inches thick and reinforced with 6x6-W2.9/W2.9 (6x6-6/6) welded wire mesh where the slabs are underlain by low expansive soils. The mesh should be placed within the upper one-third of the slab. Proper mesh positioning is critical to future performance of the slabs. The contractor should take extra measures to provide proper mesh placement. For medium expansive soils, the reinforcing should consist of No. 3 reinforcing bars placed 18- inch on center, placed on both directions and placed at slab midpoint.

7.5.13 Prior to construction of slabs, the subgrade should be moisture conditioned to at least optimum moisture content and compacted to a dry density of at least 90 percent of the laboratory maximum dry density.

7.5.14 The recommendations of this report are intended to reduce the potential for cracking of slabs and foundations due to expansive soil (if present), differential settlement of fill soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.5.15 Concrete slabs should be provided with adequate crack-control joints, construction joints and/or expansion joints to reduce unsightly shrinkage cracking. The design of joints should consider criteria of the American Concrete Institute (ACI) when establishing crack-control spacing. Additional steel reinforcing, concrete admixtures and/or closer crack control joint spacing should be considered where concrete-exposed finished floors are planned.

7.5.16 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

7.6 Retaining Walls

7.6.1 Retaining walls that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall) at the top of the wall and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 35 pcf. Where the backfill will be inclined at 2:1 (horizontal:vertical), an active soil pressure of 50 pcf is recommended. These active pressures assume low expansive soil (Expansion Index less than 50) will be used as retaining wall backfill.

7.6.2 Where walls are restrained from movement at the top, an additional uniform pressure of 8H psf should be added to the active soil pressure where the wall possesses a height of 8 feet or less and 13H where the wall is greater than 8 feet.

7.6.3 Soil contemplated for use as retaining wall backfill, including import materials, should identified prior to backfill. At that time Geocon Incorporated should obtain samples for laboratory testing to evaluate its suitability. Modified lateral earth pressures may be necessary if the backfill soil does not meet the required expansion index or shear strength. City or regional standard wall designs, if used, are based on a specific active lateral earth pressure and/or soil friction angle. In this regard, on-site soil to be used as backfill may or may not meet the values for standard wall designs. Geocon Incorporated should be consulted to assess the suitability of the on-site soil for use as wall backfill if standard wall designs will be used.

7.6.4 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The wall designer should provide appropriate lateral deflection quantities for planned retaining walls structures, if applicable. These lateral values should be considered when planning types of improvements above retaining wall structures.

7.6.5 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The above recommendations assume a properly compacted granular (EI of less than 50) free-draining backfill material with no hydrostatic forces or imposed surcharge load. Figure 5 presents a typical retaining wall drainage detail. If conditions different than those described are expected, Geocon Incorporated should be contacted for additional recommendations.

7.6.6 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the 2016 CBC. If the project possesses a seismic design category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section 18.3.5.12 of the 2016 CBC. The seismic load is dependent on the retained height where H is the height of the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the wall. A seismic load of 24H should be used for design. We used the peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.416g calculated from ASCE 7-10 Section 11.8.3 and applied a pseudo-static coefficient of 0.33.

7.6.7 Foundation excavations should be observed by the geotechnical engineer (a representative of Geocon Incorporated) prior to the placement of reinforcing steel and concrete to observe that the exposed soil conditions are consistent with those anticipated and that they have been extended to the appropriate bearing strata. If unanticipated soil conditions are encountered, foundation modifications may be required.

7.7 Lateral Loading

7.7.1 To resist lateral loads, a passive pressure exerted by an equivalent fluid weight of 300 pounds per cubic foot (pcf) should be used for design of footings or shear keys poured neat against compacted fill. The allowable passive pressure assumes a horizontal surface extending at least 5 feet or three times the height of the surface generating the passive pressure, whichever is greater. The upper 12 inches of material not protected by floor slabs or pavement should not be included in the design for lateral resistance. Where walls are planned adjacent to and/or on descending slopes, a passive pressure of 150 pcf should be used in design.

7.7.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between soil and concrete of 0.35 should be used for design for footings founded in compacted fill or formational materials. The recommended passive pressure may be used concurrently with frictional resistance and may be increased by one-third for transient wind or seismic loading.

7.8 Storm Water Management

7.8.1 If storm water management devices are not properly designed and constructed, there is a risk for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water being detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff into the subsurface occurs, downstream improvements may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

7.8.2 We performed an infiltration study on the property. A summary of our study and storm water management recommendations are provided in Appendix C. Based on the results of our study, infiltration is considered infeasible due to low infiltration rates and the presence of compacted fill,

7.9 Site Drainage and Moisture Protection

7.9.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2016 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed or existing structures.

7.9.2 In the case of basement walls or building walls retaining landscaping areas, a waterproofing system should be used on the wall and joints, and a Miradrain drainage panel (or similar) should be placed over the waterproofing. The project architect or civil engineer should provide detailed specifications on the plans for all waterproofing and drainage.

7.9.3 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

7.9.4 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. Area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes can be used. In addition, where landscaping is planned adjacent to the pavement, construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material should be considered.

7.10 Grading and Foundation Plan Review

7.10.1 Geocon Incorporated should review the grading and foundation plans for the project prior to final design submittal to determine if additional analysis and/or recommendations are required.

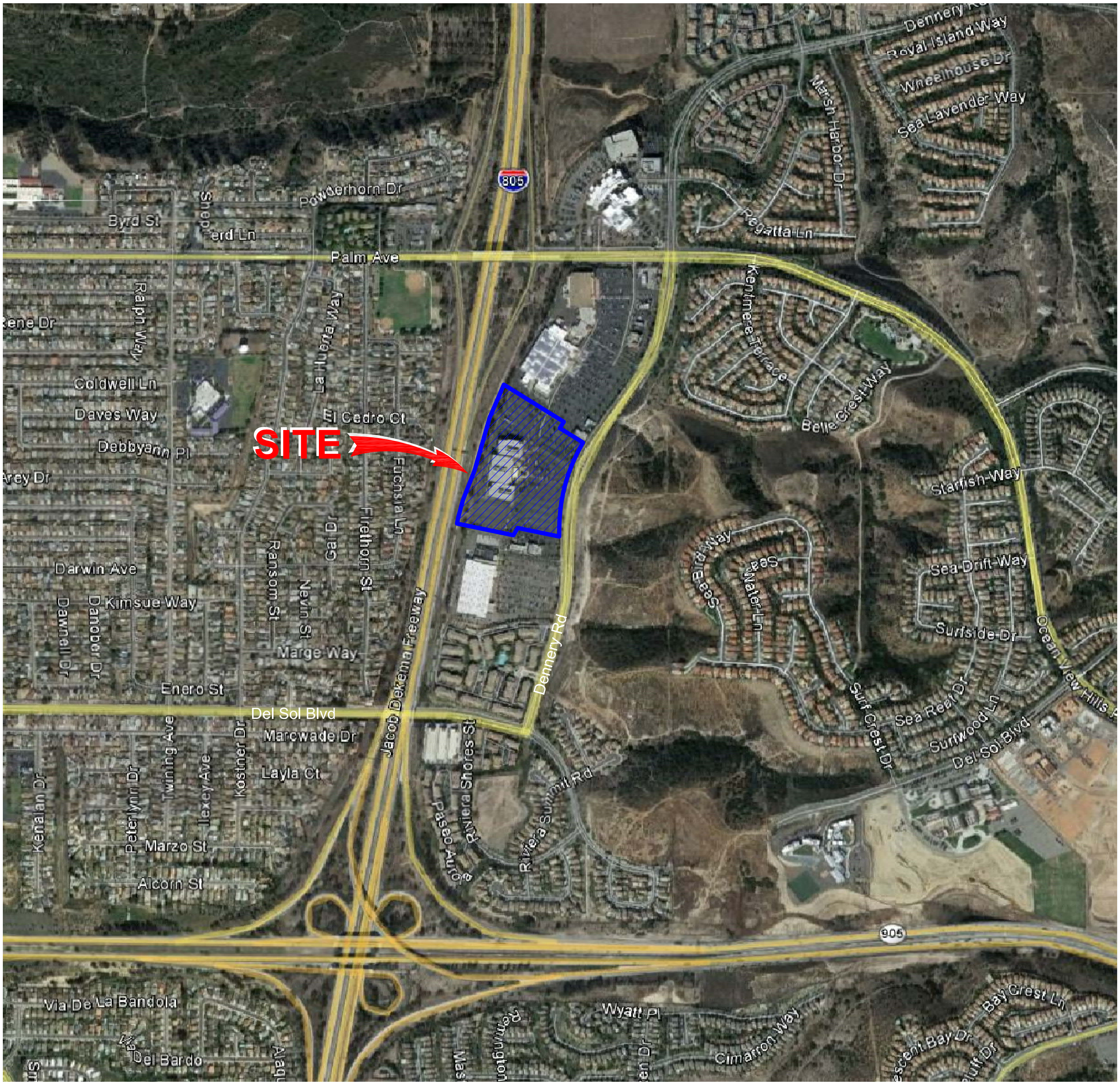
LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

3. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



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N

NO SCALE

VICINITY MAP

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THE SHOPS AT AMC PROMENADE
SAN DIEGO, CALIFORNIA

RM / AML		DSK/GTYPD	DATE 08 - 18 - 2017	PROJECT NO. G2171 - 42 - 01	FIG. 1

Plotted:08/18/2017 11:42AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G2171-42-01 (The Shops at AMC Promenade)\DETAILS\G2171-42-01 Vic Map.dwg

GEOLOGIC MAP

THE SHOPS AT AMC PROMENADE
SAN DIEGO, CALIFORNIA

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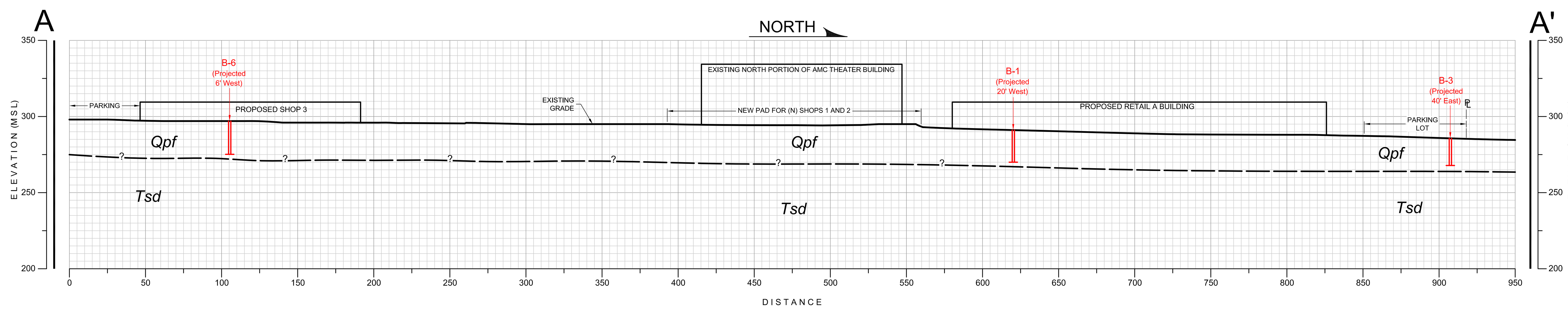
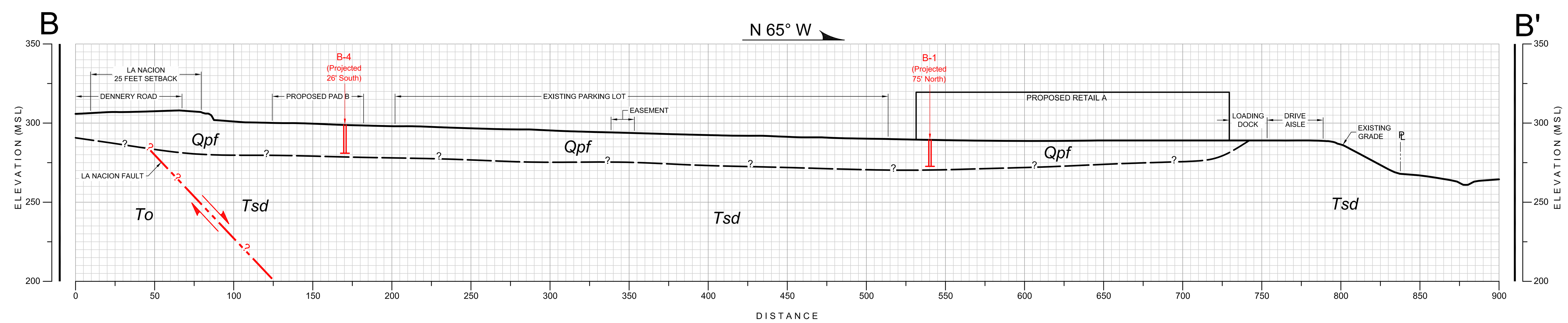
SCALE	1" = 50'
DATE	08 - 18 - 2017
PROJECT NO.	G2171 - 42 - 01
SHEET	1 OF 1
FIGURE	2

Plotted:08/18/2017 3:31PM | By:JONATHAN WILKINS | File Location:Y:\PROJECTS\G2171-42-01 (The Shops at AMC Promenade)\SHEETS\G2171-42-01 Geo Map.dwg



GEOLOGIC CROSS-SECTION A-A'

SCALE: 1" = 50' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION B-B'

SCALE: 1" = 50' (Vert. = Horiz.)

GEOCON LEGEND

Qpf........PREVIOUSLY PLACED FILL

Tsd........SAN DIEGO FORMATION

To........OTAY FORMATION

........APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)

B-6 ....APPROX. LOCATION OF EXPLORATORY BORING

........APPROX. LOCATION OF FAULT (Queried Where Uncertain)

GEOLOGIC CROSS SECTION

THE SHOPS AT AMC PROMENADE
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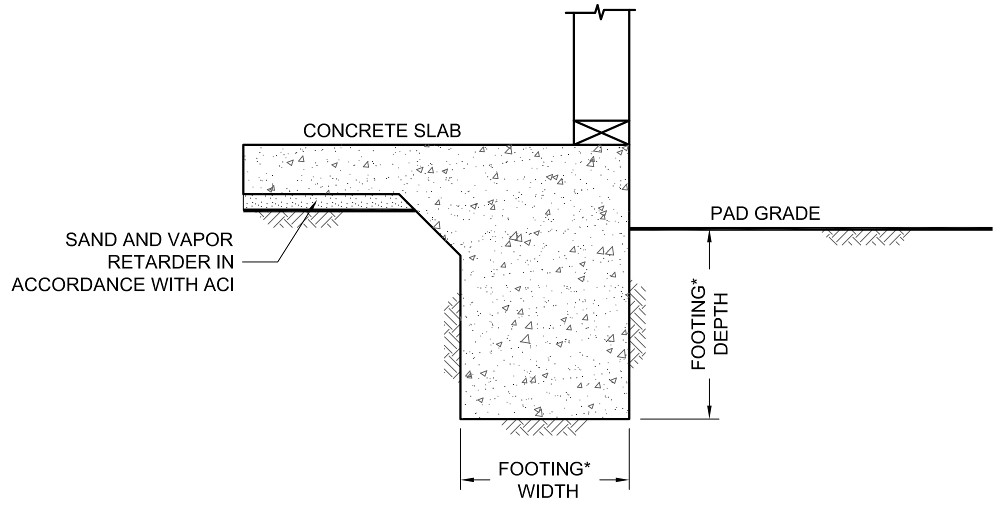
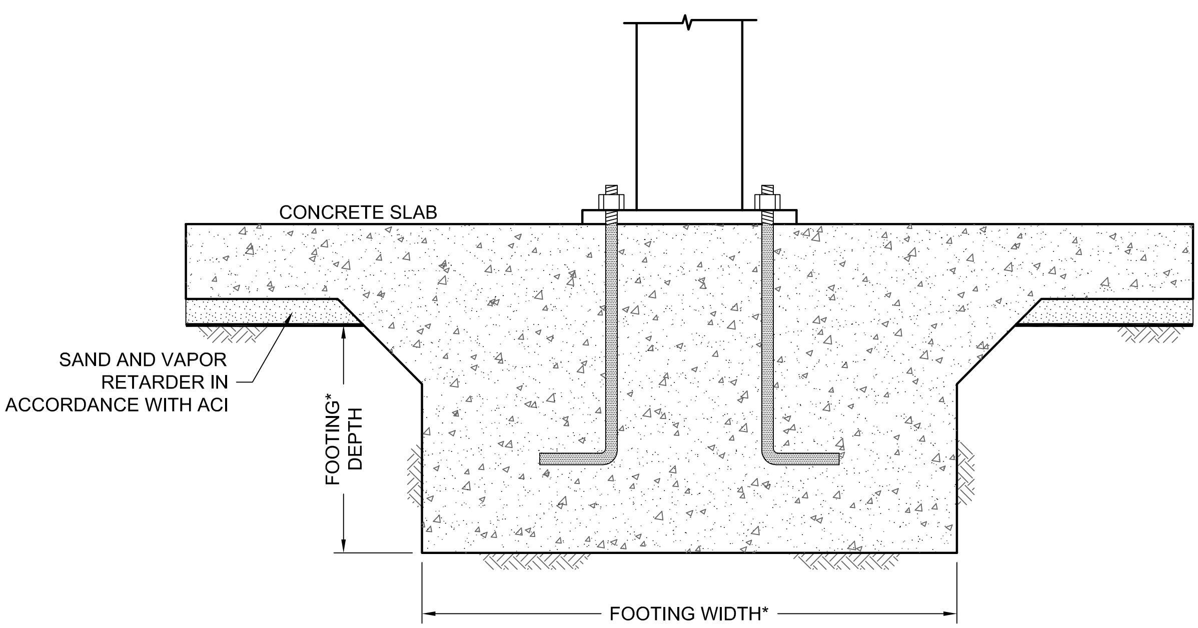
SCALE 1" = 50'	DATE 08 - 18 - 2017		
PROJECT NO. G2171 - 42 - 01		FIGURE 3	
SHEET 1 OF 1			





*....SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

WALL / COLUMN FOOTING DIMENSION DETAIL

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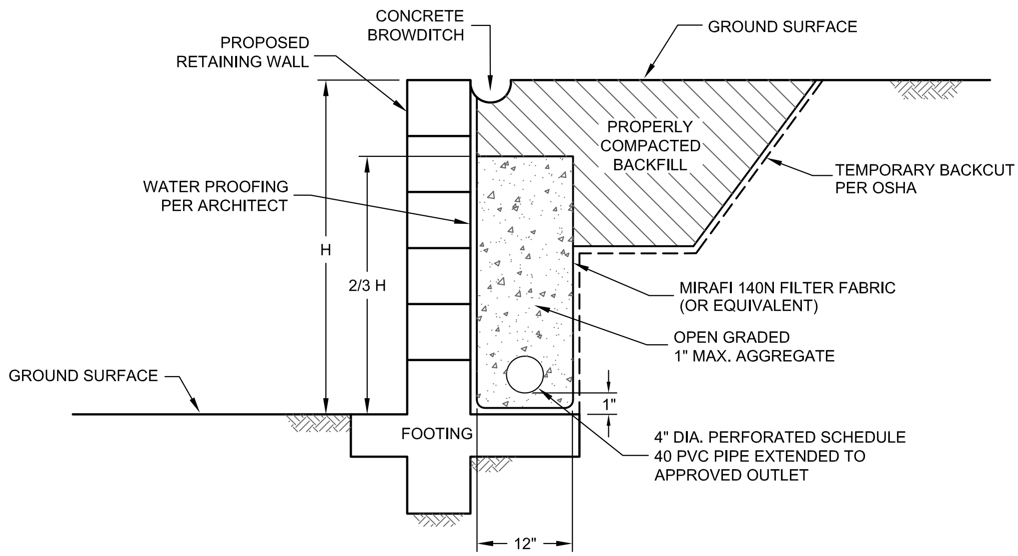
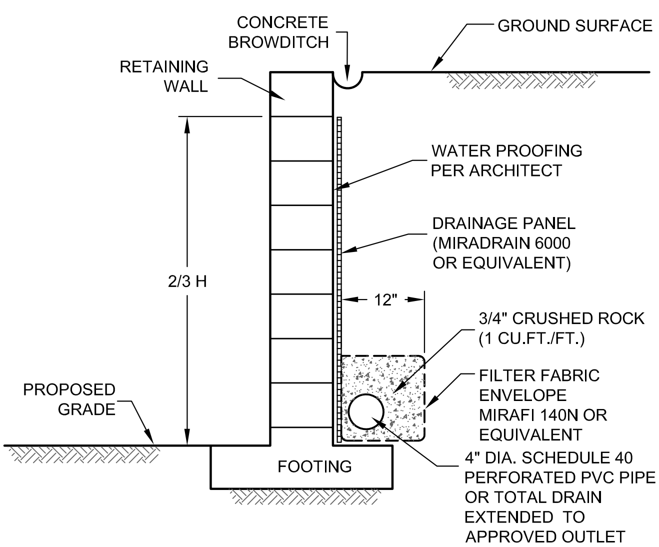
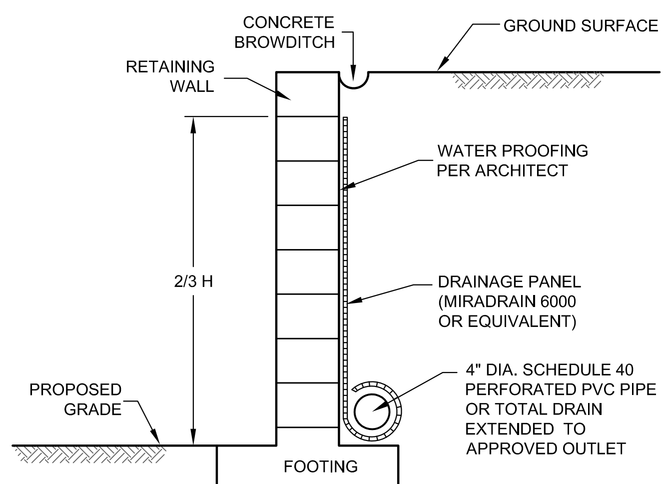
THE SHOPS AT AMC PROMENADE
SAN DIEGO, CALIFORNIA

RM / AML		DSK/GTYPD	DATE 08 - 18 - 2017	PROJECT NO. G2171 - 42 - 01	FIG. 4







NOTE :

DRAIN SHOULD BE UNIFORMLY SLOPED TO GRAVITY OUTLET
OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

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THE SHOPS AT AMC PROMENADE
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RM / AML		DSK/GTYPD	DATE 08 - 18 - 2017	PROJECT NO. G2171 - 42 - 01	FIG. 5

Plotted:08/18/2017 11:41AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G2171-42-01 (The Shops at AMC Promenade)\DETAILS\Typical Retaining Wall Drainage Detail (RWDD7A).dwg

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

We performed the field investigation on July 21, 2017. The investigation consisted of drilling six, small-diameter borings and four, 8-inch diameter infiltration test holes. The approximate locations of the exploratory borings and infiltration tests are shown on Figure 2.

The borings were drilled to depths ranging from approximately 14.5 to 19.5 feet below existing grade using a CME 75 drill rig equipped with 8-inch diameter hollow-stem augers. The infiltration tests were drilled to depths of approximately 4 to 4.5 feet. We obtained relatively undisturbed samples from the borings by driving a 3-inch-diameter sampler 12 inches into the undisturbed soil mass with blows from a 140 pound hammer weighing falling 30 inches. The sampler was lined with 1-inch by 2.5-inch-diameter brass rings to facilitate sampling. Bulk and baggie samples were also collected.

The soil conditions encountered in the borings were visually examined, classified, and logged in general accordance with American Society for Testing and Materials (ASTM) practice for Description and Identification of Soils (Visual-Manual Procedure D 2488). Logs of the exploratory borings are presented on Figures A-1 through A-6. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained.

PROJECT NO. G2171-42-01

BORING B 1

ELEV. (MSL.) 291' DATE COMPLETED 07-21-2017

EQUIPMENT CME 75 BY: B. KUNA

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					3.5" **ASPHALT** Over 3.5" **BASE**			
	B1-1			SC/CL	**PREVIOUSLY PLACED FILL** Medium dense, moist, mottled light gray and grayish brown, Clayey, fine SAND to Sandy CLAY			
2	B1-2					21	106.0	18.3
4								
	B1-3					27		
6				SC	Medium dense, moist, mottled light gray and grayish brown, Clayey, fine to medium SAND			
				SM	Medium dense, moist, grayish brown, Silty, fine to medium SAND; few clay			
8								
				SC	Medium dense, moist, grayish brown, Clayey, fine to medium SAND			
10	B1-4					25	101.0	19.7
12				CL	Stiff to very stiff, moist, grayish brown to reddish brown, Silty CLAY			
14								
	B1-5				-Encountered cobble and gravel	50/6"		

REFUSAL AT 15.5 FEET
Groundwater not encountered
Backfilled on 07-21-2017

Figure A-1,
Log of Boring B 1, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2171-42-01

BORING B 2

ELEV. (MSL.) **288'** DATE COMPLETED **07-21-2017**

EQUIPMENT **CME 75** BY: **B. KUNA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					3" **ASPHALT** Over 6" **BASE**			
				SC&CL	**PREVIOUSLY PLACED FILL** Medium dense, moist, grayish brown, Clayey, fine SAND and Sandy CLAY; trace gravel			
2	B2-1					27	106.5	17.9
				SM	Dense, moist, light grayish brown and gray, Silty, fine- to medium-grained SAND; few clay			
4								
6	B2-2					50		
8								
10	B2-3				-Becomes mottled grayish brown and light gray to white	50/3"		
12								
14	B2-4				-No recovery	50/2"		
					REFUSAL AT 14.5 FEET Groundwater not encountered Backfilled on 07-21-2017			

Figure A-2,
Log of Boring B 2, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2171-42-01

BORING B 3

ELEV. (MSL.) 286.5' DATE COMPLETED 07-21-2017

EQUIPMENT CME 75 BY: B. KUNA

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					5.5" **ASPHALT** Over 3.5" **BASE**			
	B3-1			CL/CH	**PREVIOUSLY PLACED FILL** Stiff, moist, olive brown, Silty CLAY; little gravel			
2								
	B3-2					18	98.9	20.8
4								
	B3-3				-Becomes mottled olive brown and reddish brown	16	99.1	22.5
6								
				CL	Stiff, moist, brown, Sandy CLAY; some gravel			
8								
10	B3-4					40	100.1	20.3
					-Becomes hard, moist, brown and olive brown; little gravel			
12								
14								
	B3-5					50/3"		
16								
18					REFUSAL AT 18 FEET Groundwater not encountered Backfilled on 07-21-2017			

Figure A-3,
Log of Boring B 3, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

PROJECT NO. G2171-42-01

BORING B 4

ELEV. (MSL.) 298' DATE COMPLETED 07-21-2017

EQUIPMENT CME 75 BY: B. KUNA

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			4" **ASPHALT** Over 3" **BASE**			
	B4-1	SC	**PREVIOUSLY PLACED FILL** Medium dense, moist, mottled grayish brown and light gray, Clayey, fine to medium SAND; trace gravel			
2	B4-2					
		SM/SC	Medium dense, moist, grayish brown, Silty to Clayey, fine to medium SAND	29	108.7	17.4
4						
	B4-3	CH	Stiff, moist, mottle grayish brown to reddish brown, Silty CLAY	19	105.3	21.9
6						
8						
10	B4-4	CL	Vey stiff to hard, moist, light reddish brown, Silty to Sandy CLAY	43		
12						
14						
	B4-5			62		
16			-Cobble			
			-Becomes brown and reddish brown; little gravel			
18						
	B4-6			43		

BORING TERMINATED AT 19.5 FEET
Groundwater not encountered
Backfilled on 07-21-2017

Figure A-4,
Log of Boring B 4, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING B 5

ELEV. (MSL.) **301.5'** DATE COMPLETED **07-21-2017**

EQUIPMENT **CME 75** BY: **B. KUNA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					3.5" **ASPHALT** Over 3.5" **BASE**			
	B5-1			CL	**PREVIOUSLY PLACED FILL** Stiff, moist, olive brown, Sandy CLAY; trace gravel			
2	B5-2					32		
4				SM	Medium dense, moist, light brown, Silty, fine to medium SAND; trace gravel; few clay			
6	B5-3					20	109.1	17.5
8								
10	B5-4			CL	Vert stiff, moist, mottled brown, olive brown, and reddish brown, Sandy CLAY; some gravel	36		
12								
14								
16	B5-5					38		
18	B5-6					48		
				CL/CH	Very stiff, moist, mottled dark brown and gray, Silty CLAY; trace gravel			
					BORING TERMINATED AT 19.5 FEET Groundwater not encountered Backfilled on 07-21-2017			

Figure A-5,
Log of Boring B 5, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. G2171-42-01

BORING B 6

ELEV. (MSL.) **286.5'** DATE COMPLETED **07-21-2017**

EQUIPMENT **CME 75** BY: **B. KUNA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					4" **ASPHALT** Over 8" **BASE**			
	B6-1			CL	**PREVIOUSLY PLACED FILL** Firm, moist, olive brown, Silty to Sandy CLAY			
2								
	B6-2					10	96.3	22.8
				SC/CL	Medium dense, moist, mottled grayish brown and light gray, Clayey, fine to medium SAND to Sandy CLAY			
4								
	B6-3					20		
6								
8								
10	B6-4					50		
				CH/CL	Very stiff to hard, moist, olive brown to brown, Silty CLAY; few gravel			
12								
14								
	B6-5				-Cobble encountered; no recovery	48		
16								
				CL	Stiff, moist, brown, Sandy CLAY; trace gravel			
18								
	B6-6					46		

BORING TERMINATED AT 19.5 FEET
Groundwater not encountered
Backfilled on 07-21-2017

Figure A-6,
Log of Boring B 6, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

APPENDIX B

APPENDIX B

LABORATORY TESTING

We performed laboratory tests in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. We tested selected samples for their in-place dry density and moisture content, maximum dry density and optimum moisture content, expansion, water-soluble sulfate characteristics, and gradation. The results of our laboratory tests are presented on the following tables and graph. The in-place dry density and moisture content test results are presented on the exploratory boring logs in Appendix A.

TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557

Proctor Curve No.	Source and Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B3-1	Light brown, Clayey, fine to coarse SAND	128.9	9.7

TABLE B-II
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS
ASTM D 3080

Sample No.	Dry Density (pcf)	Moisture Content (%)		Unit Cohesion (psf)	Angle of Shear Resistance (degrees)
		Initial	Final		
B3-2	98.9	20.8	23.4	500	23

TABLE B-III
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index	Expansion Classification
	Before Test	After Test			
B3-1	10.4	23.5	108.6	63	Medium
B5-1	11.0	20.7	107.7	39	Low
B6-1	11.9	23.5	104.0	44	Low

TABLE B-IV
SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS
CALIFORNIA TEST NO. 417

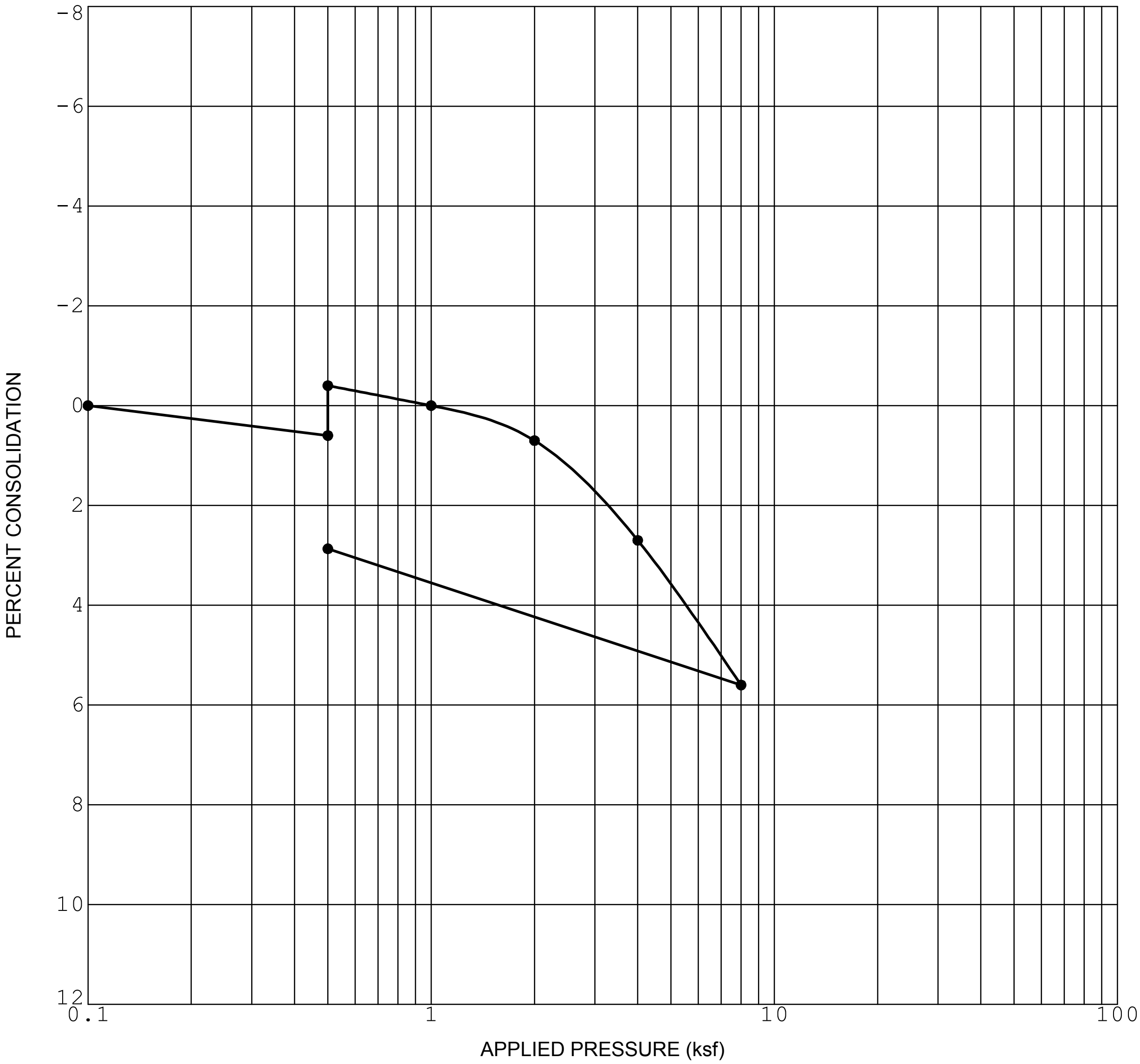
Sample No.	Water-Soluble Sulfate (%)	Classification
B3-1	0.008	Not Applicable (S0)
B5-1	0.029	Not Applicable (S0)
B6-1	0.058	Not Applicable (S0)

TABLE B-V
SUMMARY OF LABORATORY CHLORIDE ION TEST RESULTS
AASHTO T 291

Sample No.	Chloride Ion Content (ppm)	Chloride Ion Content (%)
B3-1	103	0.010
B5-1	513	0.051
B6-1	308	0.031

PROJECT NO. G2171-42-01

SAMPLE NO. B3-3



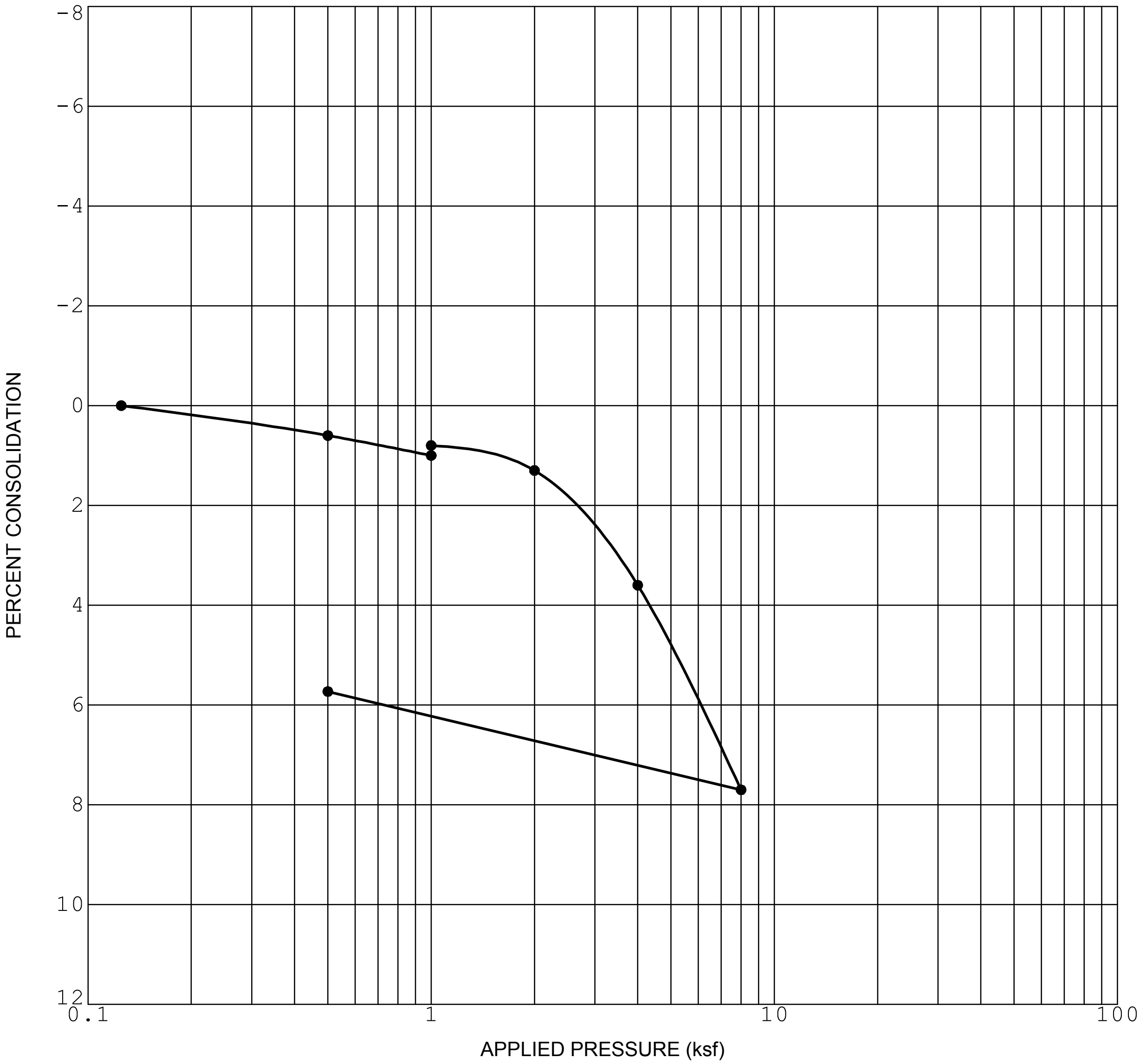
Initial Dry Density (pcf)	99.1	**Initial Saturation (%)**	88.8
Initial Water Content (%)	22.5	**Sample Saturated at (ksf)**	.5

CONSOLIDATION CURVE

THE SHOPS AT AMC PROMENADE

SAN DIEGO, CALIFORNIA

SAMPLE NO. B3-4



Initial Dry Density (pcf)	100.1	**Initial Saturation (%)**	84.2
Initial Water Content (%)	20.8	**Sample Saturated at (ksf)**	1

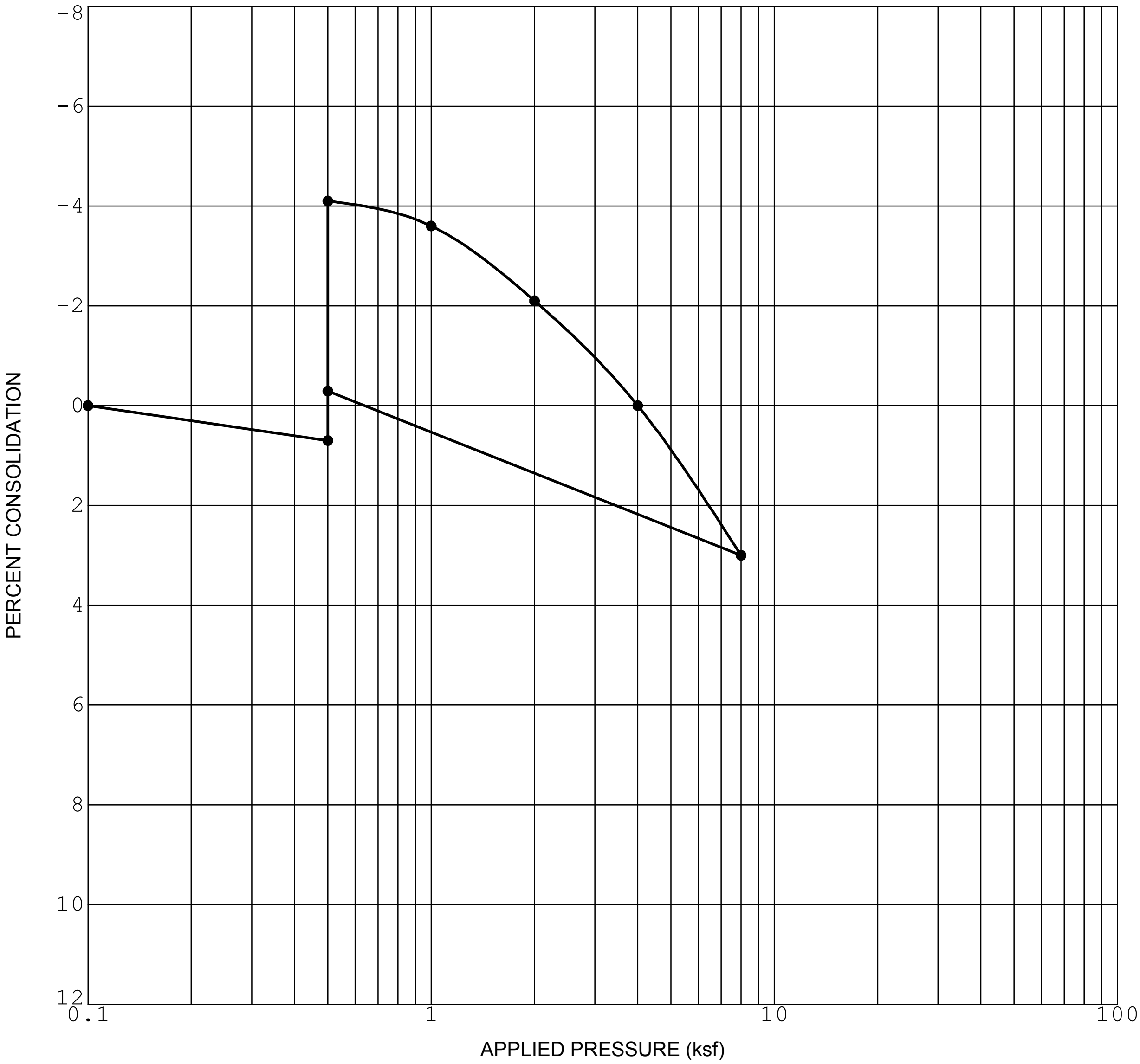
CONSOLIDATION CURVE

THE SHOPS AT AMC PROMENADE

SAN DIEGO, CALIFORNIA

PROJECT NO. G2171-42-01

SAMPLE NO. B4-3



Initial Dry Density (pcf)	105.3		**Initial Saturation (%)**	100
Initial Water Content (%)	21.9		**Sample Saturated at (ksf)**	.5

CONSOLIDATION CURVE

THE SHOPS AT AMC PROMENADE

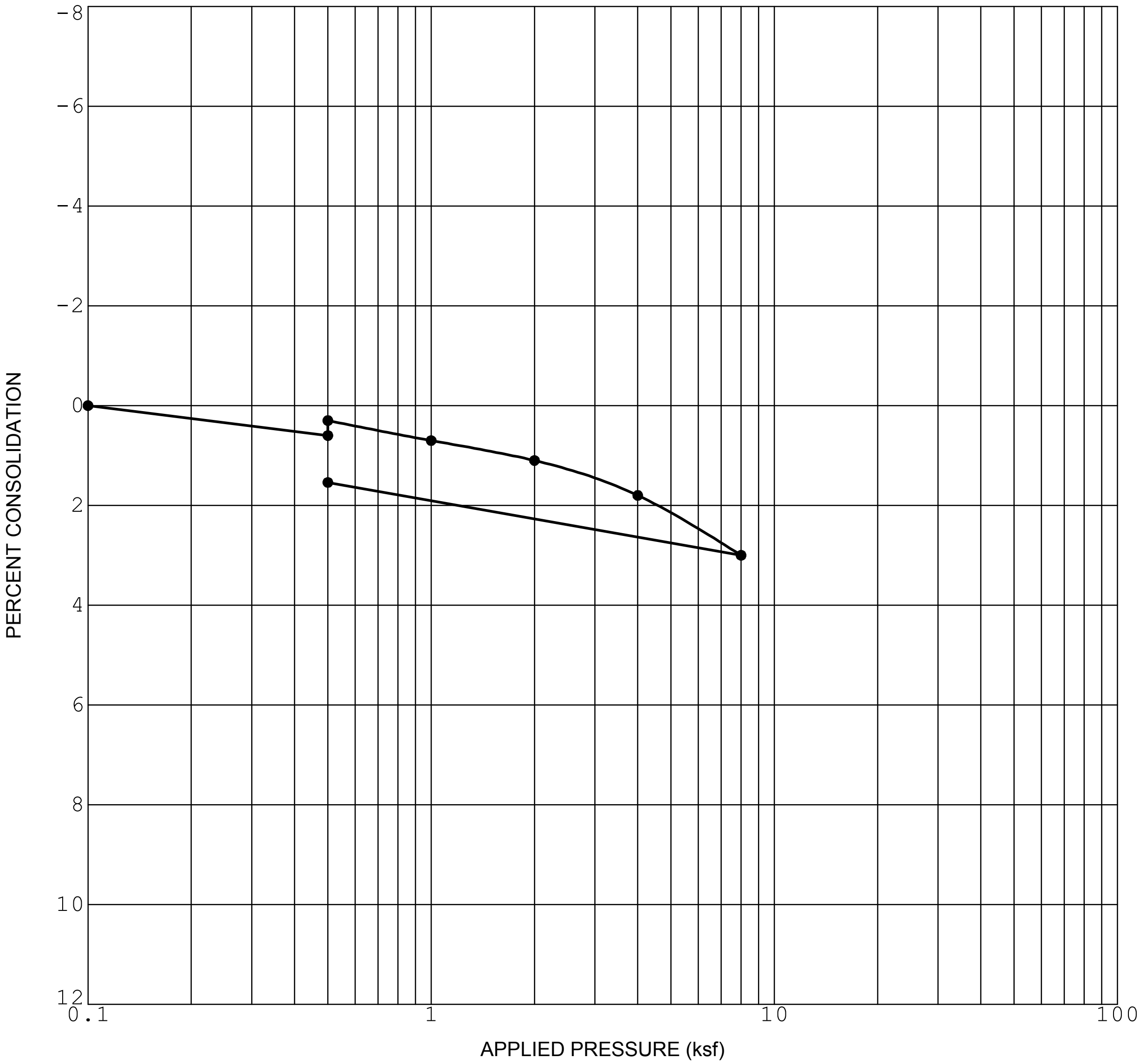
SAN DIEGO, CALIFORNIA

G2171-42-01.GPJ

Figure B-3

GEOCON

SAMPLE NO. B5-3



Initial Dry Density (pcf)	109.1	**Initial Saturation (%)**	89.1
Initial Water Content (%)	17.5	**Sample Saturated at (ksf)**	.5

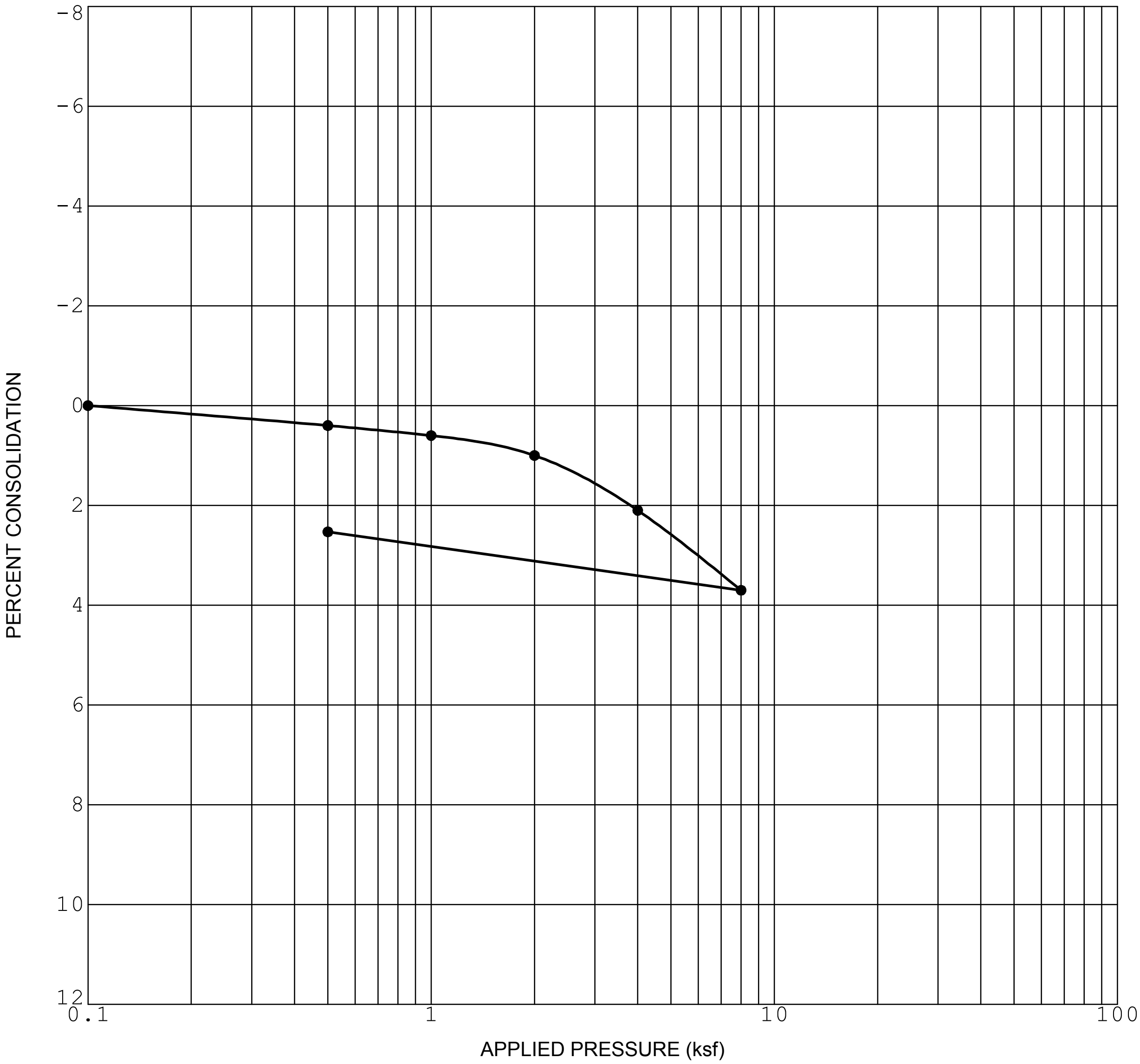
CONSOLIDATION CURVE

THE SHOPS AT AMC PROMENADE

SAN DIEGO, CALIFORNIA

PROJECT NO. G2171-42-01

SAMPLE NO. B6-2



Initial Dry Density (pcf)	96.3	**Initial Saturation (%)**	83.8
Initial Water Content (%)	22.8	**Sample Saturated at (ksf)**	.5

CONSOLIDATION CURVE

THE SHOPS AT AMC PROMENADE

SAN DIEGO, CALIFORNIA

G2171-42-01.GPJ

Figure B-5

GEOCON

APPENDIX C

APPENDIX C

STORM WATER MANAGEMENT

If storm water management devices are not properly designed and constructed, there is a risk for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water being detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff into the subsurface occurs, downstream improvements may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

Hydrologic Soil Group

The United States Department of Agriculture (USDA), Natural Resources Conservation Services, provides general information regarding soil conditions for areas within the United States. The USDA website also provides the Hydrologic Soil Group. Table C-1 presents the descriptions of the hydrologic soil groups.

TABLE C-1
HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The site is underlain by previously placed fill and the San Diego Formation. The property falls within Hydraulic Soil Group D, which has a very slow infiltration rating. Table C-2 presents the information from the USDA website for the property.

TABLE C-2
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group
Huerhuero loam, 5 to 9 percent slopes, eroded	HrC2	49	D
Olivenhain cobbly loam, 9 to 30 percent slopes	OhE	51	D

In-Situ Testing

We performed 4 field-saturated, hydraulic conductivity tests at the site using a Soil Moisture Corp Aardvark Permeameter at the locations presented on the Geologic Map, Figure 2. All of the borings were drilled with a truck-mounted drill rig equipped with 8-inch diameter augers. Table C-3 presents the results of the saturated hydraulic conductivity testing.

We used the guidelines presented in the Riverside County Low Impact Development BMP Design Handbook which references the United States Bureau of Reclamation Well Permeameter Test Method (USBR 7300-89). Based on this widely accepted guideline, the saturated hydraulic conductivity (Ksat) is equal to the infiltration rate. Therefore, the Ksat value determined from the Aardvark Permeameter test is the unfactored infiltration rate. The Ksat (infiltration rate) equation provided in the Riverside County Handbook was used to compute the unfactored infiltration rate.

TABLE C-3
UNFACTORED, FIELD-SATURATED, INFILTRATION TEST RESULTS
USING THE SOILMOISTURE CORP AARDVARK PERMEAMETER

Test No.	Depth (inches)	Geologic Unit	Field Infiltration Rate, I (inches/hour)
A-1	52	Qpf	0.010
A-2	53.5	Qpf	0.007
A-3	46	Qpf	0.006
A-4	51	Qpf	0.006

Soil permeability values from in-situ tests can vary significantly from one location to another due to the non-homogeneous characteristics inherent to most soil. However, if a sufficient amount of field and laboratory test data is obtained, a general trend of soil permeability can usually be evaluated. For this project and for storm water purposes, the test results presented herein should be considered approximate values.

STORM WATER MANAGEMENT CONCLUSIONS

Soil Types

Previously Placed Fill – Previously placed fill underlies the property. The fills are predominately comprised of silty to clayey sand and sandy to silty clay. In our experience, compacted fill does not possess infiltration rates appropriate with infiltration. Therefore, full and partial infiltration should be considered infeasible.

Existing Improvements

The proposed area of infiltration is planned within the areas of the planned surface improvements and structures. Due to variable soil conditions, thickness of fill soils, and the low infiltration rates, there is a potential for lateral water movement, which could impact nearby structures.

Infiltration Rates

The results of the testing show infiltration rates ranging from approximately 0.006 to 0.01 inches per hour. The rates are not high enough to support full or partial infiltration.

Groundwater

We did not observe groundwater or seepage during this investigation, nor does groundwater exist near the surface that may impact the proposed project. We do not expect groundwater or seepage to impact infiltration.

Existing Utilities

Existing utilities exist within of the property. Infiltrating near utilities is not recommended. Mitigation measures to prevent water from infiltrating into the utilities consist of setbacks, installing cutoff walls around the utilities and installing subdrains and/or installing liners.

Soil or Groundwater Contamination

We are unaware of contaminated soil or groundwater on the property. Therefore, infiltration associated with this risk is considered feasible.

Storm Water Management Devices

Liners and subdrains are recommended in the design and construction of the planned storm water devices. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride**,** PVC). The subdrains should be perforated within the liner area, installed at the base and above the liner, be at least 3 inches in diameter and consist of

Schedule 40 PVC pipe. The subdrains outside of the liner should consist of solid pipe. The penetration of the liners at the subdrains should be properly waterproofed. The subdrains should be connected to a proper outlet. The devices should also be installed in accordance with the manufacturer's recommendations.

Storm Water Standard Worksheets

The SWS requests the geotechnical engineer complete the *Categorization of Infiltration Feasibility Condition* (Worksheet C.4-1 or I-8) worksheet information to help evaluate the potential for infiltration on the property. The attached Worksheet C.4-1 presents the completed information for the submittal process.

The regional storm water standards also have a worksheet (Worksheet D.5-1 or Form I-9) that helps the project civil engineer estimate the factor of safety based on several factors. Table C-4 describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

TABLE C-4
SUITABILITY ASSESSMENT RELATED CONSIDERATIONS FOR INFILTRATION FACILITY SAFETY FACTORS

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Assessment Methods	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates. Use of well permeameter or borehole methods without accompanying continuous boring log. Relatively sparse testing with direct infiltration methods	Use of well permeameter or borehole methods with accompanying continuous boring log. Direct measurement of infiltration area with localized infiltration measurement methods (e.g., infiltrometer). Moderate spatial resolution	Direct measurement with localized (i.e. small-scale) infiltration testing methods at relatively high resolution or use of extensive test pit infiltration measurement methods.
Predominant Soil Texture	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site Soil Variability	Highly variable soils indicated from site assessment or unknown variability	Soil boring/test pits indicate moderately homogenous soils	Soil boring/test pits indicate relatively homogenous soils
Depth to Groundwater/ Impervious Layer	<5 feet below facility bottom	5-15 feet below facility bottom	>15 feet below facility bottom

Table C-5 presents the estimated factor values for the evaluation of the factor of safety. The factor of safety is determined using the information contained in Table C-4 and the results of our geotechnical investigation. Table C-5 only presents the suitability assessment safety factor (Part A) of the worksheet. The project civil engineer should evaluate the safety factor for design (Part B of Worksheet D.5-1) and use the combined safety factor for the design infiltration rate.

TABLE C-5
FACTOR OF SAFETY WORKSHEET D.5-1 DESIGN VALUES – PART A[1]

Suitability Assessment Factor Category	Assigned Weight (w)	Factor Value (v)	Product (p = w x v)
Assessment Methods	0.25	2	0.50
Predominant Soil Texture	0.25	3	0.70
Site Soil Variability	0.25	2	0.50
Depth to Groundwater/Impervious Layer	0.25	2	0.50
Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.25

[1] The project civil engineer should complete Worksheet D.5-1 or Form I-9 to determine the overall factor of safety.

CONCLUSIONS

Our results indicate the site has soils that inhibit infiltration. Because of these site conditions, and the overall thickness of the previously placed fill soils exceeding 7 feet, it is our opinion that there is a high probability for lateral water migration. It is our opinion that full and partial infiltration is infeasible on this site. Liners and subdrains should be installed within BMP areas.

Categorization of Infiltration Feasibility Condition	Worksheet I-8

Part 1 - Full Infiltration Feasibility Screening Criteria

Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

We encountered field infiltration rates that were less than 0.5 inches per hour using a factor of safety of 2 for feasibility determination:

A-1: 0.010 in/hr (0.005 with a FOS of 2.0 for feasibility determination)
A-2: 0.007 in/hr (0.0035 with a FOS of 2.0 for feasibility determination)
A-3: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)
A-4: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)

Based on the geotechnical study, test results, and utilizing a factor of safety of 2.0 for feasibility determination, full infiltration is not feasible as the infiltration rates are lower than 0.5 in/hr.

Criteria	Screening Question	Yes	No
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

Previously placed fill underlies the property and will remain in place. Based on the exploratory borings and laboratory testing, the previously placed extends to depths greater than 5 feet and possess a low to moderate potential for hydroconsolidation. We do not recommend infiltrating into the existing fill due to the potential for adverse soil settlement and an increased potential for hydro-collapse.

Worksheet I-8 Page 2 of 4			
Criteria	Screening Question	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not present near the surface of the site and we are unaware of contaminated soil on the property. Therefore, infiltration associated with this risk is considered feasible.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: We do not expect infiltration will cause water balance issues such as seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters.			
Part 1 Result*	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		NO

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

We encountered field infiltration rates that were less than 0.5 inches per hour using a factor of safety of 2 for feasibility determination:

A-1: 0.010 in/hr (0.005 with a FOS of 2.0 for feasibility determination)
A-2: 0.007 in/hr (0.0035 with a FOS of 2.0 for feasibility determination)
A-3: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)
A-4: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)

Based on the geotechnical study, test results, and utilizing a factor of safety of 2.0 for feasibility determination, full infiltration is not feasible as the infiltration rates are lower than 0.5 in/hr.

Criteria	Screening Question	Yes	No
6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

Previously placed fill underlies the property and will remain in place. Based on the exploratory borings and laboratory testing, the previously placed extends to depths greater than 5 feet and possess a low to moderate potential for hydroconsolidation. We do not recommend infiltrating into the existing fill due to the potential for adverse soil settlement and an increased potential for hydro-collapse.

Worksheet I-8 Page 4 of 4			
Criteria	Screening Question	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not present near the surface of the site and we are unaware of contaminated soil on the property. Therefore, infiltration associated with this risk is considered feasible.			
8	**Can infiltration be allowed without violating downstream water rights**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: We did not provide a study regarding water rights. The project Civil Engineer should confirm.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**		No Infiltration

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

GEOCON

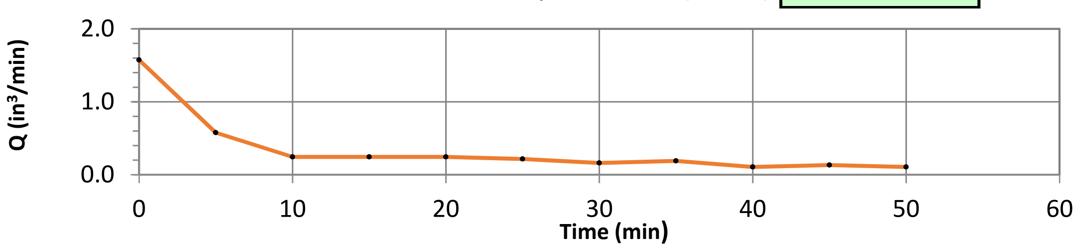
Aardvark Permeameter Data Analysis

Project Name:	AMC Palm Promenade		Date:	7/21/2017
Project Number:	G2171-42-01		By:	JML
Test Number:	A-1			

Borehole Diameter, d (in.):	8.00		Ref. EL (feet, MSL):	0.0
Borehole Depth, **H** (in):	52.00		Bottom EL (feet, MSL):	-4.3
Distance Between Reservoir & Top of Borehole (in.):	30.50			
Estimated Depth to Water Table, **S** (feet):	100.00			
Height APM Raised from Bottom (in.):	1.00			
Pressure Reducer Used:	No			

Distance Between Resevoir and APM Float, **D** (in.):	74.25
Head Height Calculated, **h** (in.):	4.75
Head Height Measured, **h** (in.):	4.70
Distance Between Constant Head and Water Table, **L** (in.):	1152.70

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	2.865	79.34	15.868
3	5.00	0.285	7.89	1.578
4	5.00	0.105	2.91	0.582
5	5.00	0.045	1.25	0.249
6	5.00	0.045	1.25	0.249
7	5.00	0.045	1.25	0.249
8	5.00	0.040	1.11	0.222
9	5.00	0.030	0.83	0.166
10	5.00	0.035	0.97	0.194
11	5.00	0.020	0.55	0.111
12	5.00	0.025	0.69	0.138
13	5.00	0.020	0.55	0.111
			Steady Flow Rate, Q (in^3/min):	0.120



Soil Matric Flux Potential, Φ_m

Φ_m= 0.00171 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 1.75E-04 in/min | 0.010 in/hr

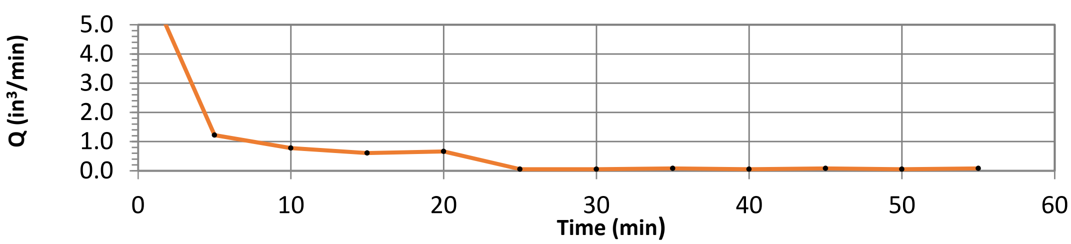
GEOCON

Aardvark Permeameter Data Analysis

Project Name:	AMC Palm Promenade	Date:	7/21/2017
Project Number:	G2171-42-01	By:	JML
Test Number:	A-2	Ref. EL (feet, MSL):	0.0
		Bottom EL (feet, MSL):	-4.5

Borehole Diameter, d (in.):	8.00
Borehole Depth, **H** (in):	53.50
Distance Between Reservoir & Top of Borehole (in.):	30.50
Estimated Depth to Water Table, **S** (feet):	100.00
Height APM Raised from Bottom (in.):	1.00
Pressure Reducer Used:	No
Distance Between Resevoir and APM Float, **D** (in.):	75.75
Head Height Calculated, **h** (in.):	4.75
Head Height Measured, **h** (in.):	4.60
Distance Between Constant Head and Water Table, **L** (in.):	1151.10

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	1.290	35.72	7.145
3	5.00	0.220	6.09	1.218
4	5.00	0.140	3.88	0.775
5	5.00	0.110	3.05	0.609
6	5.00	0.120	3.32	0.665
7	5.00	0.010	0.28	0.055
8	5.00	0.010	0.28	0.055
9	5.00	0.015	0.42	0.083
10	5.00	0.010	0.28	0.055
11	5.00	0.015	0.42	0.083
12	5.00	0.010	0.28	0.055
13	5.00	0.015	0.42	0.083
			Steady Flow Rate, Q (in^3/min):	0.074



Soil Matric Flux Potential, Φ_m

Φ_m= 0.0011 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 1.09E-04 in/min 0.007 in/hr

GEOCON

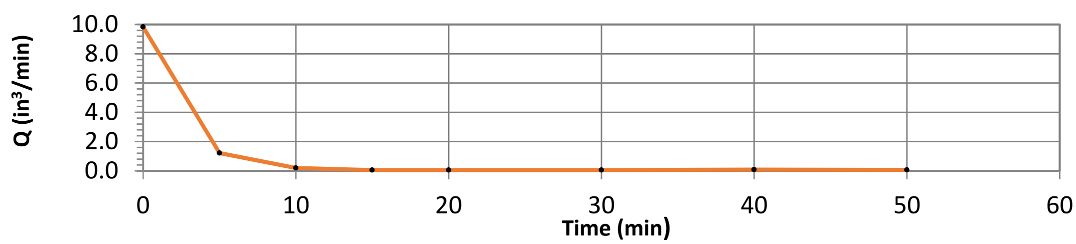
Aardvark Permeameter Data Analysis

Project Name: AMC Palm Promenade
Project Number: G2171-42-01
Test Number: A-3
Date: 7/21/2017
By: JML
Ref. EL (feet, MSL): 0.0
Bottom EL (feet, MSL): -3.8

Borehole Diameter, d (in.):	8.00
Borehole Depth, **H** (in):	46.00
Distance Between Reservoir & Top of Borehole (in.):	30.50
Estimated Depth to Water Table, **S** (feet):	100.00
Height APM Raised from Bottom (in.):	1.00
Pressure Reducer Used:	No
Distance Between Resevoir and APM Float, **D** (in.):	68.25
Head Height Calculated, **h** (in.):	4.73
Head Height Measured, **h** (in.):	4.50
Distance Between Constant Head and Water Table, **L** (in.):	1158.50

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	1.775	49.15	9.831
3	5.00	0.220	6.09	1.218
4	5.00	0.035	0.97	0.194
5	5.00	0.010	0.28	0.055
6	10.00	0.020	0.55	0.055
7	10.00	0.020	0.55	0.055
8	10.00	0.030	0.83	0.083
9	10.00	0.025	0.69	0.069

Steady Flow Rate, Q (in^3/min): 0.066



Soil Matric Flux Potential, Φ_m

Φ_m= 0.0010 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 9.84E-05 in/min | 0.006 in/hr

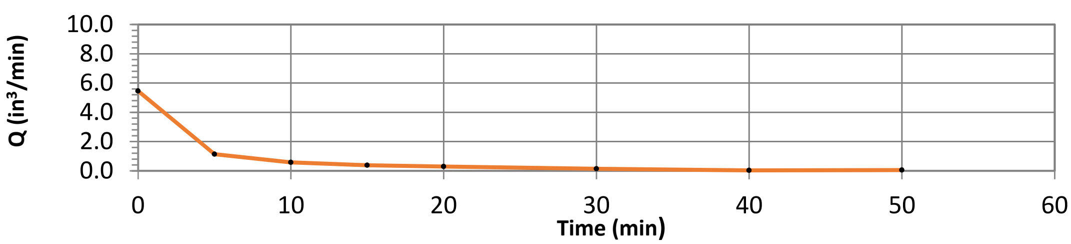
GEOCON

Aardvark Permeameter Data Analysis

Project Name:	AMC Palm Promenade	Date:	7/21/2017	
Project Number:	G2171-42-01	By:	JML	
Test Number:	A-4		Ref. EL (feet, MSL):	0.0
			Bottom EL (feet, MSL):	-4.3

Borehole Diameter, d (in.):	8.00
Borehole Depth, **H** (in):	51.00
Distance Between Reservoir & Top of Borehole (in.):	30.50
Estimated Depth to Water Table, **S** (feet):	100.00
Height APM Raised from Bottom (in.):	1.00
Pressure Reducer Used:	No
Distance Between Resevoir and APM Float, **D** (in.):	73.25
Head Height Calculated, **h** (in.):	4.74
Head Height Measured, **h** (in.):	4.70
Distance Between Constant Head and Water Table, **L** (in.):	1153.70

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	0.985	27.28	5.455
3	5.00	0.205	5.68	1.135
4	5.00	0.105	2.91	0.582
5	5.00	0.070	1.94	0.388
6	10.00	0.105	2.91	0.291
7	10.00	0.050	1.38	0.138
8	10.00	0.010	0.28	0.028
9	10.00	0.020	0.55	0.055
			Steady Flow Rate, Q (in^3/min):	0.074



Soil Matric Flux Potential, Φ_m

Φ_m= 0.0011 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 1.08E-04 in/min 0.006 in/hr

APPENDIX D

APPENDIX D

RECOMMENDED GRADING SPECIFICATIONS

FOR

THE SHOPS AT AMC PROMENADE
770 DENNERY ROAD
SAN DIEGO, CALIFORNIA

PROJECT NO. G2171-42-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition.

4. CLEARING AND PREPARING AREAS TO BE FILLED

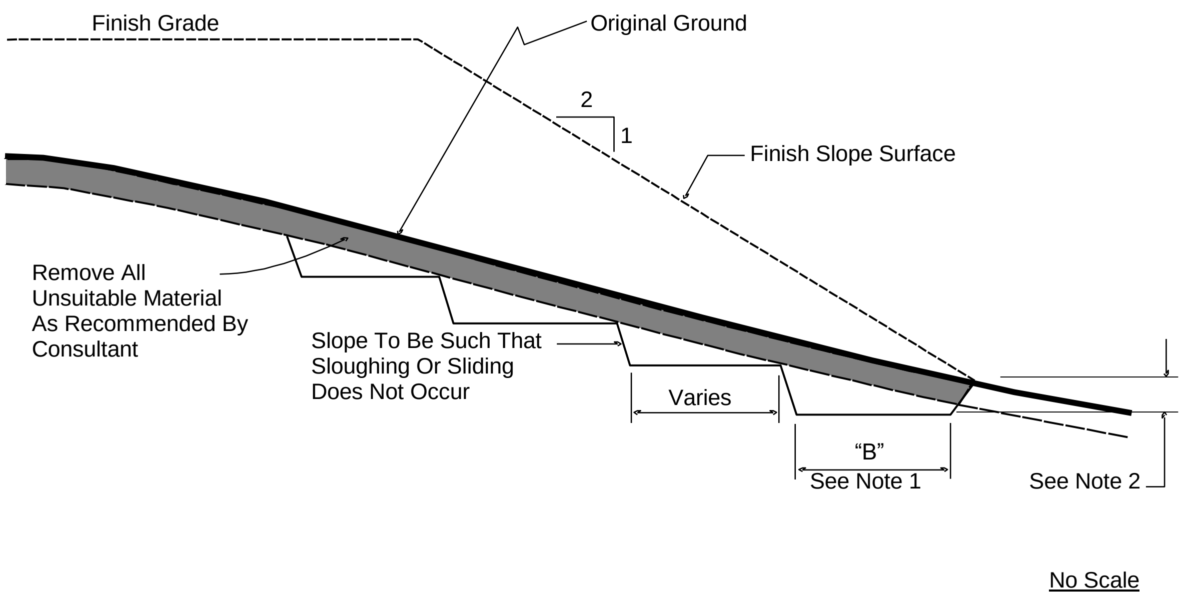
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

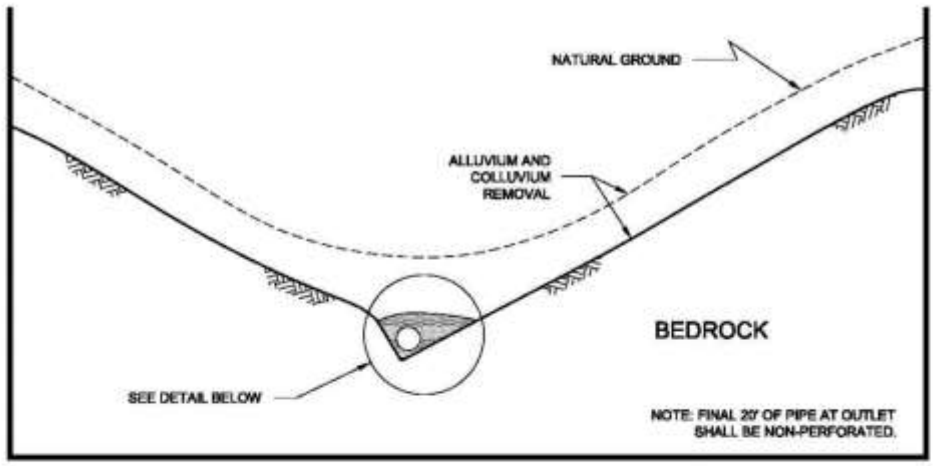
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

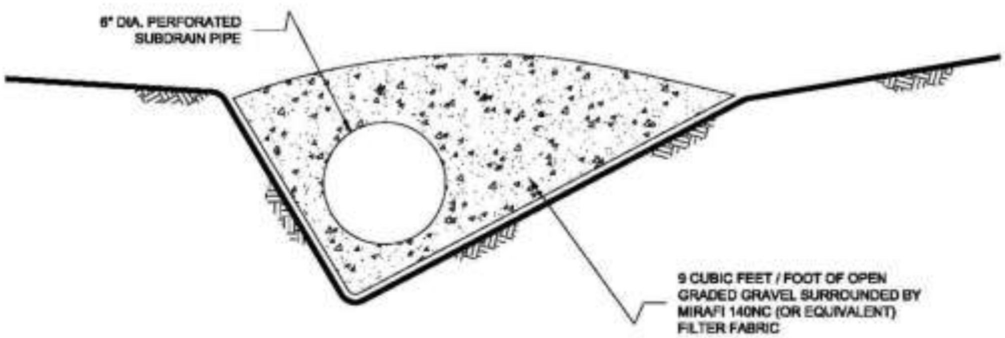
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

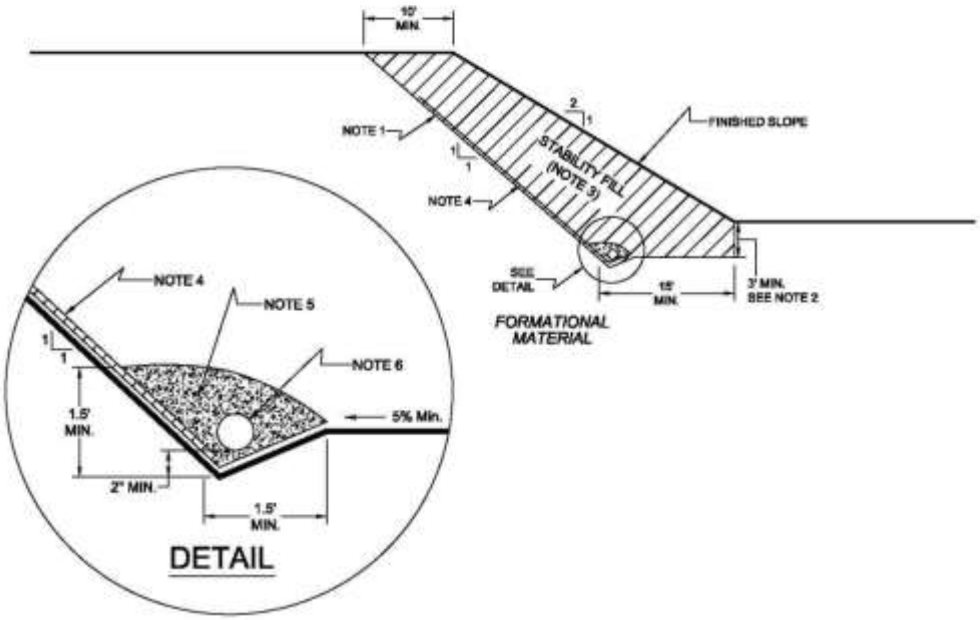
1......8-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

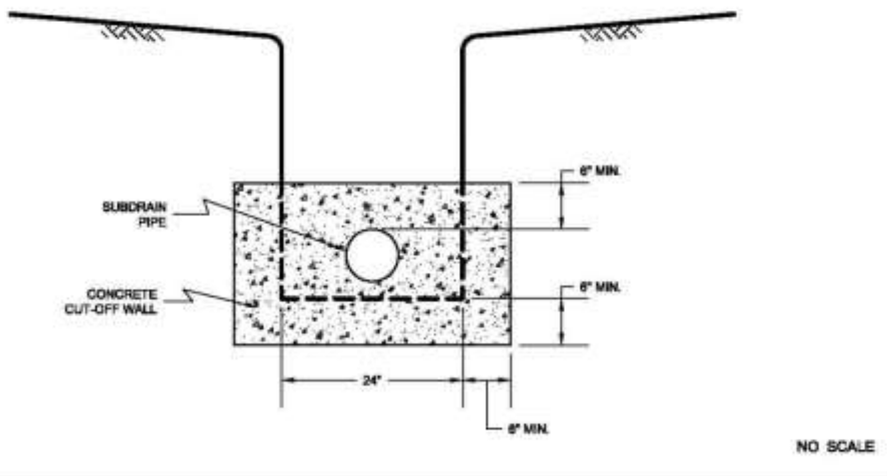
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

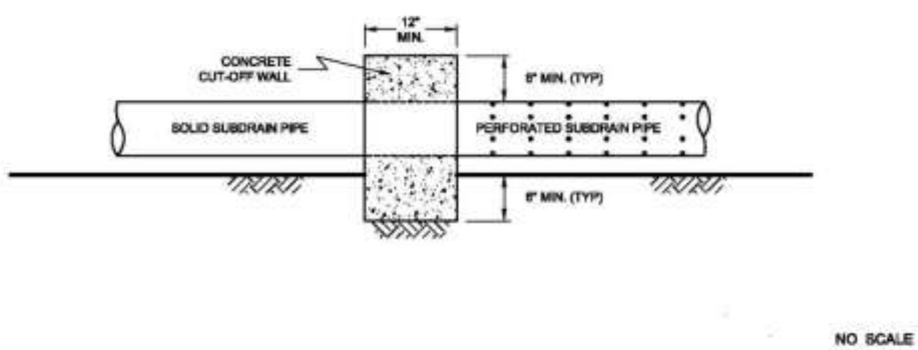
7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



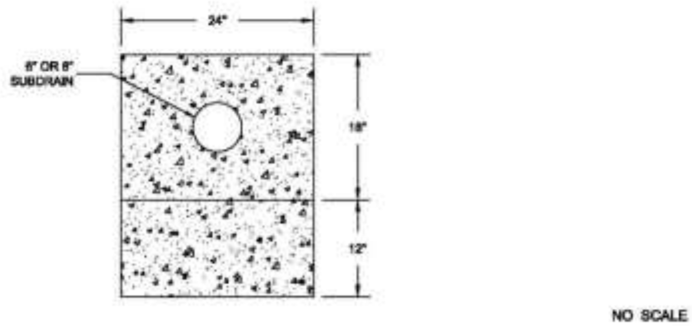
SIDE VIEW



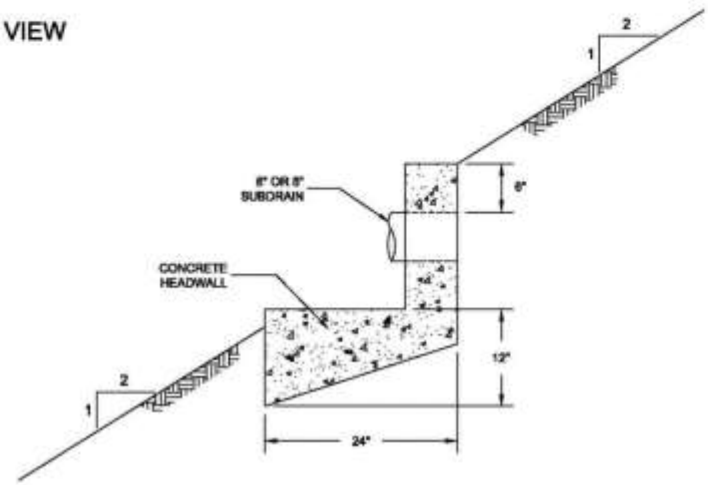
7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

TYPICAL HEADWALL DETAIL

FRONT VIEW



SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE
OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

LIST OF REFERENCES

City of San Diego (2008), *Seismic Safety Study*, *Geologic Hazards and Faults*, *Map Sheet 22*;

Kennedy, M. P., and Tan, S. S., (2008), *Geologic Map of the San Diego 30' x 60' Quadrangle, California*, USGS Regional Geologic Map Series, 1:100,000 Scale, Map No. 3;

Risk Engineering (2011), *EZ-FRISK (version 7.62)*, software package used to perform site-specific earthquake hazard analyses, accessed May 2, 2017;

USGS (2016), *Quaternary Fault and Fold Database of the United States*: U.S. Geological Survey website, http://earthquakes,usgs.gov/hazards/qfaults, accessed May 2, 2017;

USGS (2017), U.S. Seismic Design Maps; USGS Earthquake Hazards Program website, https://earthquake.usgs.gov/designmaps/us/application.php, accessed May 2, 2017

ADDENDUM TO GEOTECHNICAL INVESTIGATION – RESPONSE TO CITY REVIEW COMMENTS

THE SHOPS AT AMC PALM PROMENADE 770 DENNERY ROAD SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

HCP-CCI PALM PROMENADE, LLC
NEWPORT BEACH, CALIFORNIA

DECEMBER 29, 2017
REVISED JANUARY 23, 2018
PROJECT NO. G2171-42-01

Project No. G2171-42-01
December 29, 2017
Revised January 23,2018

HCP-CCI Palm Promenade, LLC
4340 Von Karmen Avenue, Suite 110
Newport Beach, California 92660

Attention: Mr. Michael Mossman

Subject: ADDENDUM TO GEOTECHNICAL INVESTIGATION –
RESPONSE TO CITY REVIEW COMMENTS
THE SHOPS AT AMC PALM PROMENADE
770 DENNERY ROAD
SAN DIEGO, CALIFORNIA

References:

1. *Cycle Issues, 2 Submitted (Multi Discipline) Review*, prepared by City of San Diego, dated November 7, 2017 (Project No. 569517).

2. *Geotechnical Investigation, The Shops at AMC Palm Promenade, 770 Dennery Road, San Diego, California*, prepared by Geocon Incorporated, dated August 18, 2017 (Project No. G2171-42-01).

Dear Mr. Mossman:

In accordance with the request of Nasland Engineering, we have prepared this addendum letter to address geotechnical review comments provided by the City of San Diego LDR-Geology for the subject project (see Reference 1). This report has been revised to include the latest base map on our geologic map (Figure 1). The geotechnical review comments followed by our responses are provided below.

Comment 5: *Submit an addendum geotechnical report that provides the information requested herein.*

Response: This correspondence constitutes the requested addendum.

Comment 6: *Add the location of the fault trace as mapped by G. A. Nicoll (1995) and surveyed by Rick Engineering on the Geologic and Tentative Maps.*

Comment 7: *Clarify the strike and dip of the fault.*

Response to Comments 6 and 7: The approximate location and strike and dip of the LA Nacion Fault derived from G. A. Nicoll and Rick Engineering survey data as well as USGS "Geologic Map of the San Diego 30'X60' Quadrangle, prepared by Kennedy and Tan, 2005, are shown on the attached Geologic Map (map pocket).

Should you have any questions or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Ali Sadr
CEG 1778

Rodney C. Mikesell
GE 2533

AS:RCM:dmc

(e-mail) Addressee
(2) Nasland Engineering
Attention: Mr. Sam Waisbord

GEOLOGIC MAP

THE SHOPS AT AMC PROMENADE
SAN DIEGO, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE	1" = 50'	DATE 08-18-2017 REVISED DATE 01-23-2018	
PROJECT NO.	G2171 - 42 - 01		FIGURE 1
SHEET	1 OF 1		

Waste Management Plan for the Shops at AMC Promenade San Diego, California

Prepared for
Mr. Michael Mossman
Citivest, Inc.
4340 Von Karman Avenue, Suite 110
Newport Beach, CA 92660

Prepared by
RECON Environmental, Inc.
1927 Fifth Avenue
San Diego, CA 92101
P 619.308.9333

RECON Number 8965
January 26, 2018

Andrew Capobianco, Assistant Environmental Analyst

Valerie Mattos, Environmental Analyst

TABLE OF CONTENTS

FIGURES

TABLE OF CONTENTS (cont.)

TABLES

ATTACHMENTS

Acronyms

AB	Assembly Bill
C&D	Construction and Demolition
City	City of San Diego
ESD	Environmental Services Department
I-805	Interstate 805
project	Shops at AMC Promenade
SWMC	Solid Waste Management Coordinator
U.S. EPA	U.S. Environmental Protection Agency
WMP	Waste Management Plan

1.0 Introduction

The purpose of this Waste Management Plan (WMP) for the Shops at AMC Promenade project (project) is to identify the solid waste impacts generated by construction and operation of the project as well as measures to reduce those impacts.

The WMP addresses all four phases of site development, including the Demolition Phase, Grading Phase, Construction Phase, and the Occupancy (post-construction) Phase. The WMP addresses the amount of waste that would be generated by project activities during each phase; waste reduction goals, and the recommended techniques to achieve the waste reduction goals. More specifically, for each phase, the WMP includes the following:

- Tons of waste anticipated to be generated;
- Material/type and amount of waste anticipated to be diverted;
- Project features that would reduce the amount of waste generated;
- Project features that would divert or limit the generation of waste;
- Source separation techniques for waste generated;
- How materials shall be reused on-site; and
- Name and location of recycling, reuse, or landfill facilities where waste shall be taken.

2.0 Existing Conditions

The project is located on a 17.5-acre site in an existing community retail center at 770 Dennery Road within the Otay Mesa community planning area of the City of San Diego. The project site is surrounded by Dennery Road to the east, Interstate 805 (I-805) to the west, and existing commercial/retail development to the north and south. The project site is currently configured with an existing 107,250-square-foot theatre building used for entertainment purposes. Figures 1 and 2 depict the regional location and the project location on a U.S. Geological Survey map, respectively. Figure 3 depicts the project location on a City 800' map.

Project Location

FIGURE 1
Regional Location

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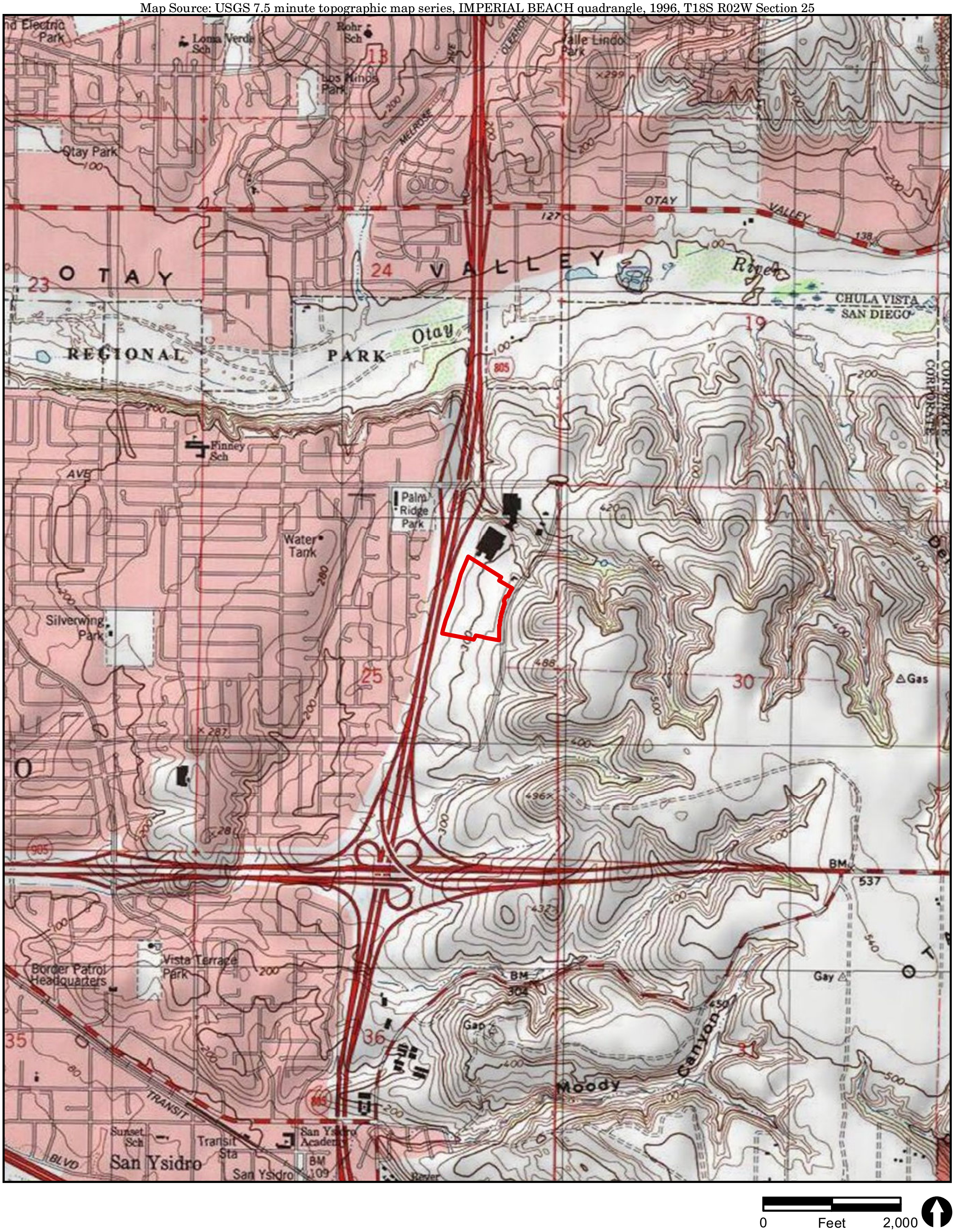
Map Source: USGS 7.5 minute topographic map series, IMPERIAL BEACH quadrangle, 1996, T18S R02W Section 25



Project Boundary

FIGURE 2
Project Location on USGS Map

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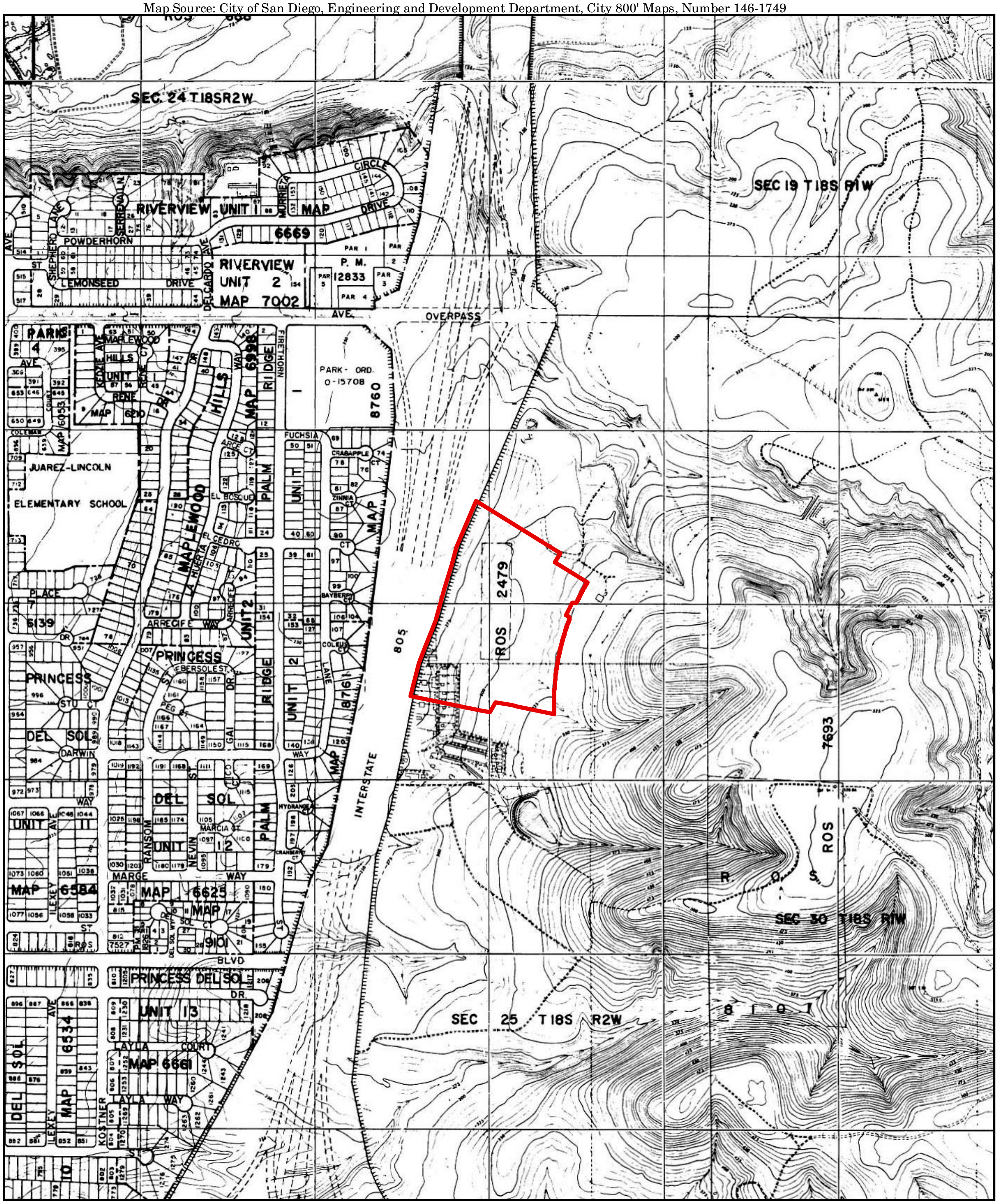
Map Source: City of San Diego, Engineering and Development Department, City 800' Maps, Number 146-1749



0 Feet 800

Project Boundary

FIGURE 3
Project Location on City 800' Map

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3.0 Proposed Conditions

The project would involve the demolition of 32,262 square feet of an existing 107,250-square-foot theatre building. The main theatre building and the south wing would remain (74,988 square feet). The project would construct new non-residential commercial retail space. The 'Retail A' space would be located north of the remaining AMC Cinema and consist of a new stand-alone 45,000-square-foot big box retail space. 'Shop 1' and 'Shop 2' would be located between the remaining AMC Cinema and the new "Retail A" building. These two shops would be attached and consist of 6,500 and 4,500 square feet, respectively. 'Shop 3' would be located east of the remaining AMC Cinema and would consist of one free-standing 6,935-square-foot shop. The project will also include two new pads ('Pad A' and 'Pad B') on either side of the entry aisle along Dennery Road. 'Pad A' would consist of a 4,801-square-foot Chick-fil-A drive-through restaurant. 'Pad B' would consist of a 5,000-square-foot drive-through restaurant. Grading would consist of a net export of approximately 10,000 cubic yards of soil. The proposed site plan is shown on Figure 4, while the demolition plan is shown in Figure 5. The project would be consistent with the existing zoning and the Otay Mesa Community Plan as it is located within the CC-1-3 (Community Commercial) zone.

4.0 Regulatory Framework

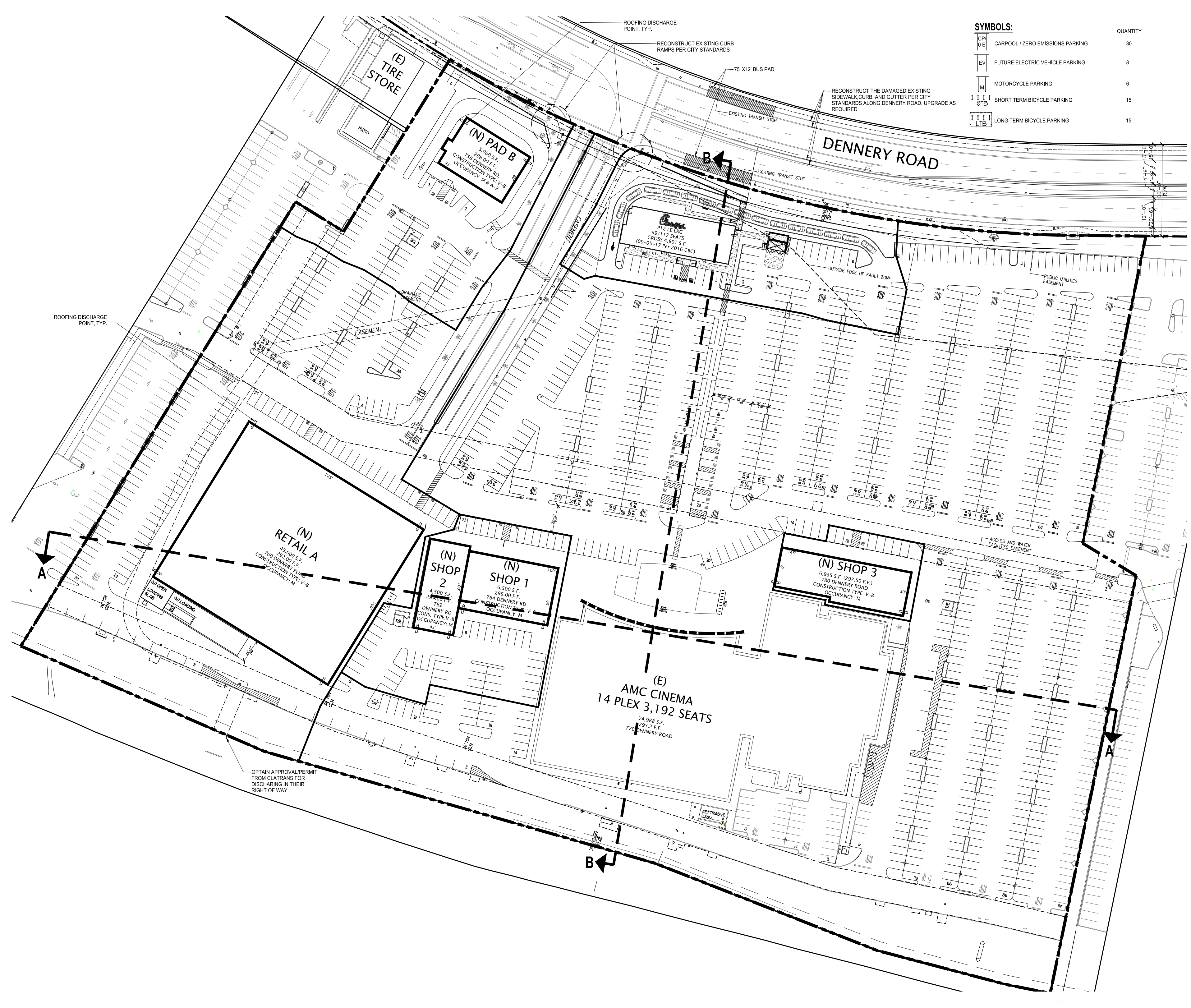
4.1 State Regulations

The California State Legislature has enacted several bills intended to promote waste diversion. In 1989, Assembly Bill (AB) 939, the Integrated Waste Management Act—as modified in 2010 by Senate Bill 1016—mandated that all local governments reduce disposal waste in landfills from generators within their borders by 50 percent by the year 2000 (State of California 1989, 2010).

AB 341, approved October 2011, sets a statewide policy goal of 75 percent waste diversion by the year 2020 (State of California 2011). This bill also created a mandatory commercial recycling requirement that would hold local jurisdictions responsible for implementing and to be in compliance with the 75 percent diversion rate through outreach and monitoring programs.

AB 1826, approved September 2014, requires businesses in California to arrange for recycling services for organic waste including food waste, green waste, landscape and pruning waste, nonhazardous wood waste, and food-soiled paper waste that is mixed in with food waste. The law is effective on and after January 1, 2016 for businesses that generate greater than 8 cubic yards of organic waste per week; effective January 1, 2017 for businesses that generate greater than 4 cubic yards of organic waste per week; effective January 1, 2019 for businesses that generate greater than 4 cubic yards of commercial solid waste per week; and, if a 50 percent statewide reduction in organic waste from 2014 has not yet been achieved, the law will be effective January 1, 2020 for businesses that generate greater than 2 cubic yards of commercial solid waste per week (State of California 2014). Strategies for compliance are discussed in Section 6.2, Waste Reduction Measures.

Map Source: RED Architectural Group



PROJECT SUMMARY:

	SQ. FT.	SEATS
SITE AREA: ± 17.53 AC.	± 763,404 SQ. FT.	
EXISTING THEATER:	107,250 SQ.FT.	4,836
THEATER DEMO:	32,262 SQ. FT.	1,644
EXISTING THEATER TO REMAIN:	74,988 SQ. FT.	3,192
NEW CONSTRUCTION		
FAST FOOD	9,801 SQ. FT.	
RETAIL	62,935 SQ. FT.	
TOTAL BUILDING AREA:	147,724 SQ. FT.	
LAND/BUILDING:	5.2/1	
COVERAGE:	19.4%	
PARKING REQUIRED:		
EXISTING THEATER: 4,836 SEATS @3.3	1,466 STALLS	
PROVIDED PARKING:	1,580 STALLS	
FUTURE MAXIMUM PARKING:	1,271 STALLS	
PROVIDED PARKING AFTER EXPANSION	1,323 STALLS	

SUMMARY OF SHARED PARKING ANALYSIS:

PARKING REQUIRED (PER SHARED PARKING REQUIREMENTS S 142.0545

HOURLY ACCUMULATION BY % OF PEAK HOUR	PEAK HR.	PARKING REQUIRED
WEEKDAY	7PM	1,271
WEEKEND	8PM	1,263
TOTAL PARKING PROVIDED		1,323 STALLS
SURPLUS PARKING PROVIDED		53 STALLS
PARKING RATIO:	9.89/ 1,000 S.F.	

*NOTE:
1. APPLICATION IS BEING SUBMITTED FOR SHARED PARKING APPROVAL PURSUANT TO S142.0545 SHARED PARKING REQUIREMENTS. SEE SHARED PARKING ANALYSIS INCLUDED WITH THE SUBMITTAL APPLICATION BASED ON THE SHARED PARKING FORMULA (142.0545b) AND ITS ASSOCIATED TABLES. (TABLES 142-05I AND 142-05J)
2. THIS PROJECT WILL NOT DISCHARGE ANY INCREASE IN STORM WATER RUN OFF ONTO THE EXISTING HILLSIDE AREAS

PROPERTY ADDRESS:
770 DENNERY RD.
SAN DIEGO, CA 92154

PROPERTY OWNER:
HCP-CCI PALM PROMENADE, LLC
4340 VON KARMAN AVE, SUITE 110
NEWPORT BEACH, CA 92660
P. 949.705.0405

ASSESSOR'S PARCEL NUMBERS:

EXISTING PARCEL #	EXISTING APN	EXISTING PARCEL #	EXISTING APN
LOT 3	0631-041-02	LOT 14	0631-041-05
LOT 4	0631-041-03	LOT 16	0631-041-06
LOT 5	0631-041-04	LOT 17	0631-041-07
LOT 6	0631-042-02		

LEGAL DESCRIPTION:
LOTS 3, 4, 5, 6, 14, 16 AND 17 OF PALM PROMENADE, IN THE CITY OF SAN DIEGO, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, ACCORDING TO MAP THEREOF NO. 13071, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY, NOVEMBER 23, 1993.

ZONING INFORMATION:
THE PROPERTY IS ZONED "CC-1-3", COMMERCIAL COMMUNITY ZONE, AND IS LOCATED IN THE AIRPORT INFLUENCE AREA FOR BROWN FIELD.

ITEM #10:
COMPLETE SCOPE OF WORK - DEMOLITION AND NEW RETAIL DEVELOPMENT:

- DEMOLISH 32,262 SQUARE FOOT NORTH WING (10 SCREENS) OF THE EXISTING 107,250 SQUARE FOOT AMC THEATER BUILDING (24 SCREENS).
- REDUCED 74,988 SQUARE FOOT THEATER BUILDING (14 SCREENS) WILL REMAIN FREESTANDING.
- BUILD TWO NEW FREESTANDING RETAIL STRUCTURES TO THE NORTH OF THE REMAINING THEATER BUILDING.
  - INCLUDING ONE NEW 45,000 SQUARE FOOT BIG BOX (RETAIL A), AND
  - TWO ATTACHED SMALLER RETAIL BUILDINGS OF 6,500 (SHOP 1) AND 4,500 (SHOP 2) SQUARE FEET RESPECTIVELY.
- BUILD ONE NEW FREESTANDING RETAIL BUILDING OF 6,935 SQUARE FEET (SHOP 3) JUST IN FRONT (EAST) OF THE SOUTH WING OF THE THEATER.
- BUILD TWO OUTPARCEL PADS ON EITHER SIDE OF THE ENTRY DRIVE AISLE ALONG DENNERY ROAD.
  - PAD A - 4,801 SQUARE FOOT RETAIL DRIVE THROUGH BUILDING
  - PAD B - 5,000 SQUARE FOOT RETAIL DRIVE THROUGH BUILDING
- NO PROPOSED DEVELOPMENT REGULATION DEVIATIONS.
- AMEND PCD 92-0736 AND/OR CUP 96-7758 AS REQUIRED BY GOVERNING CSD LAND USE REGULATIONS.
- OBTAIN TENTATIVE MAP APPROVAL TO ALTER EXISTING PARCEL COUNT (FROM THE EXISTING 7 PARCELS TO 6) AND PARCEL LINES.

ITEM #12:
YEAR CONSTRUCTED: 2000 PER TITLE COMPANY PROPERTY PROFILE - (CUP APPROVED 1/22/98 | COO ISSUED 4/6/01)
GEOLOGIC HAZARD CATEGORY: 52 LEVEL AREAS, GENTLY SLOPING TO STEEP TERRAIN, FAVORABLE GEOLOGIC STRUCTURE, LOW RISK.
LANDSCAPE AREA: 38,000 SF.

ITEM #14:
NOT APPLICABLE

ENVIRONMENTAL REVIEW OF THE ORIGINAL PROJECT (PCD 92-0736) INCLUDED PREPARATION OF A COMPLETE ENVIRONMENTAL IMPACT REPORT AND MITIGATION MONITORING AND REPORTING PROGRAM. ALL MITIGATION MEASURES REQUIRED BY THE ORIGINAL EIR WERE COMPLETED, PRIOR TO AUGUST 1997 (THE PERIOD WHEN AN APPLICATION FOR DEVELOPMENT OF THE ORIGINAL AMC THEATER BUILDING WAS SUBMITTED TO THE CITY FOR APPROVAL).

AS OF THE APPROVAL DATE OF THE AMC THEATRE DEVELOPMENT IN JANUARY OF 1998 (CUP 96-7758), ALL MITIGATION MEASURES REQUIRED BY THE ORIGINAL EIR WERE COMPLETED. THE CUP (96-7758), AMENDING THE ORIGINAL PCD (92-0736), ISSUED AT THAT TIME INDICATES THAT, "DUE TO PREVIOUS GRADING ACTIVITIES, NO ENVIRONMENTALLY SENSITIVE RESOURCES, HABITATS OR LANDFORM FEATURES EXIST ON THE PROJECT SITE." - PLANNING COMMISSION RESOLUTION NO. 2589-2-PC ON PAGE 8 OF 11

THE PROPOSED PROJECT WILL BE CONSTRUCTED AND OPERATED WITHIN THE EXISTING PARCEL BOUNDARIES OF THE PROPERTY CONSISTENT WITH THE HISTORIC DEVELOPMENT AND USE OF THE LAND AS APPROVED BY THE CITY OF SAN DIEGO UNDER THE GOVERNING PCD (92-0736) AND SUBSEQUENT CUP (96-7758). AS SUCH THE INTENT OF THE DEVELOPER'S PLANNING IS TO CONSTRUCT AND OPERATE THE PROJECT WITHIN THE BOUNDARIES OF PREVIOUSLY ENTITLED AND DEVELOPED LAND PURSUANT TO THE CURRENT MUNICIPAL CODE, THEREBY ELIMINATING THE POSSIBILITY OF IMPACTING SENSITIVE BIOLOGIC RESOURCES THAT MIGHT EXIST OUTSIDE OF THESE BOUNDARIES.

FIGURE 4
Site Plan

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Map Source: RED Architectural Group

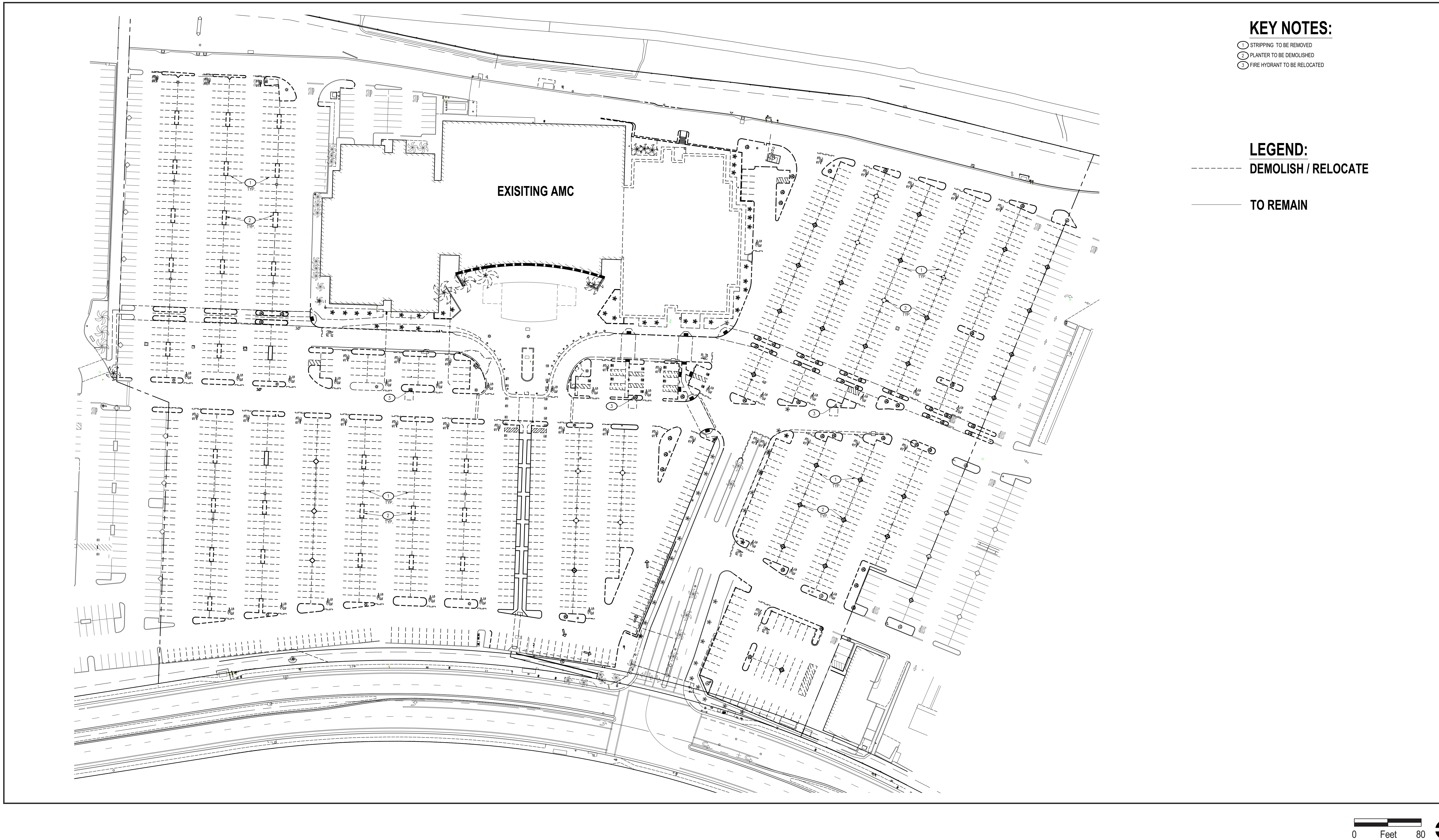

FIGURE 5
Site Demolition Plan

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4.2 City of San Diego Requirements

All landfills within the San Diego region are approaching capacity and are due to close within the next 3 to 20 years. In compliance with the state policies, the City of San Diego (City) Environmental Services Department (ESD) developed the Source Reduction and Recycling Element, which describes local waste management policies and programs. The City's Recycling Ordinance, adopted November 2007, requires on-site recyclable collection for residential and commercial uses (City of San Diego 2007a). The ordinance requires recycling of plastic and glass bottles and jars, paper, newspaper, metal containers, and cardboard. The focus of the ordinance is on education, with responsibility shared between the ESD, haulers, and building owners and managers. On-site technical assistance, educational materials, templates, and service provider lists are provided by the ESD. Property owners and managers provide on-site recycling services and educational materials annually and to new tenants. Strategies for compliance are discussed in Section 6.2, Waste Reduction Measures.

The City's Refuse and Recyclable Materials Storage Regulations, adopted December 2007, indicate the minimum exterior refuse and recyclable material storage areas required at residential and commercial properties (City of San Diego 2007b). These are intended to provide permanent, adequate, and convenient space for the storage and collection of refuse and recyclable materials; encourage recycling of solid waste to reduce the amount of waste material entering landfills; and meet the recycling goals established by the City Council and mandated by the State of California. These regulations are discussed further in Section 6.3, Exterior Storage.

In July 2008, the Construction and Demolition (C&D) Debris Deposit Ordinance was adopted by the City (City of San Diego 2008). The ordinance, which was updated in July 2016, requires that the majority of construction, demolition, and remodeling projects requiring building, combination, or demolition permits pay a refundable C&D Debris Recycling Deposit and divert at least 65 percent of their waste by recycling, reusing, or donating reusable materials. The ordinance is designed to keep C&D materials out of local landfills. Requirements are discussed further in Section 5.4.2, Contractor Education and Responsibilities.

In December 2013, City Council adopted the Zero Waste Objective, implementing the 75 percent diversion of waste target goal from landfills by the year 2020 and zero waste by 2040. An additional City target of 90 percent diversion by 2035 is proposed in the City's Climate Action Plan.

5.0 Demolition, Grading, and Construction Waste Generation and Diversion

According to the Waste Composition Study prepared by the City's ESD (City of San Diego 2000), C&D waste constituted the largest component of disposed waste in San Diego. Of the 1,680,211 tons of waste disposed in 1999, C&D waste comprised of 35 percent (586,157 tons).

5.1 Demolition

The project involves demolition of the north wing of the existing AMC theatre and the demolition, resurfacing, and reorganization of the layout of the existing surface parking lot. Anticipated material waste that would be generated through demolition activities are mostly asphalt and concrete from the foundation, building structure, and surface parking lot. Other anticipated types of waste would include brick/masonry/tile, curb/gutter, drywall, landscape debris, glass, treated wood, and trash. Prior to demolition, salvageable items intended for reuse would be made available. Examples of salvageable items would be light fixtures, seats, window frames, doors, air conditioning units, equipment, signage, and architectural materials. Approximately 70,000 square feet of existing surface parking and approximately 32,262 square feet of the existing theatre building would be demolished as part of the project.

Existing Asphalt

The amount of asphalt (black, tar-like material mixed with aggregate) resulting from the demolition of the existing parking lot would total approximately 907 tons as shown in the following calculation. Note that asphalt depth varies by project and soil type, but is typically 0.5 foot thick. The conversion factor is based on the ESD C&D Debris Conversion Rate Table (Attachment 1).

$$\text{70,000 square feet} \times \text{0.5 foot} = \text{35,000 cubic feet}$$

$$\frac{35{,}000\ cubic\ feet}{27\ cubic\ feet} = \text{1,296 cubic yards} \times 0.70\ \frac{tons}{unit} = \text{907 tons}$$

Existing Building:

Estimated demolition waste from the existing theatre building is based on a 2009 study by the U.S. Environmental Protection Agency (U.S. EPA) where a sample of nonresidential demolition projects generated an average of 158 pounds of waste per square foot (U.S. EPA 2009). Based on this generation rate, the existing building demolition would produce 2,549 tons as shown in the calculation below.

$$\text{32,262 square feet} \times \frac{158\ pounds}{square\ foot} \times \frac{1\ ton}{2{,}000\ pounds} = \text{2,549 tons}$$

Estimates of building material type and amounts are based on the specific characteristics of the theatre building to be demolished. The nearest handling facilities are based on the ESD 2017 Certified C&D Recycling Facilities Directory (Attachment 2). Estimates have a degree of uncertainty and would be revised as the project progresses and demolition debris is more specifically identified and weighed.

Estimates of material type and amounts are included in Table 1.

Table 1
Projected Materials Generated by Demolition Activities

Material	Tons Generated[1]	Percent Diverted	Nearest Handling Facility[2]	Tons Diverted	Tons Disposed
Paved Areas					
Asphalt	907	100	Vulcan Otay Asphalt Recycling Center	907	0
Subtotal	*907*			*907*	*0*
Existing Building					
Building materials (doors, windows, cabinets, etc.)	128	100	Reconstruction Warehouse	128	0
Carpet, padding/foam	204	100	DFS Flooring	204	0
Clean wood	637	100	Otay Landfill	637	0
Concrete (broken)	306	100	Vulcan Otay Asphalt Recycling Center	306	0
Drywall (used)	713	100	EDCO Recovery & Transfer	713	0
Roofing materials (mixed C&D debris)	128	75	Otay C&D/Inert Debris Processing Facility	96	32
Scrap metal	255	100	Cactus Recycling	255	0
Treated wood/trash/ garbage	178	0	Otay Landfill	0	178
Subtotal	*2,549*			*2,339*	*210*
Total	**3,456**			**3,246 (94%)**	**210 (6%)**

NOTE: Totals may vary due to independent rounding. Portions of material types are based on specific characteristics of buildings to be demolished.
SOURCES:
[1]ESD C&D Debris Conversion Rate Table (see Attachment 1).
[2]City of San Diego ESD 2017 Certified C&D Recycling Facility Directory (see Attachment 2).

5.2 Grading

Implementation of the project would require an export of approximately 10,000 cubic yards. Based on the ESD C&D Debris Conversion Rate Table, graded soil weighs approximately 1.3 tons per cubic yard (see Attachment 1). Therefore, project grading would result in a net export of 13,000 tons, as shown in the calculation below.

Export Soil:

Based on the ESD C&D Debris Conversion Rate Table (see Attachment 1), estimated soil to be exported from the project site totals 13,000 tons, as shown in the calculation below:

$$10{,}000 \text{ cubic yards} \times 1.3\frac{tons}{unit} = 13{,}000 \text{ tons}$$

Therefore, project grading would result in a net export of 13,000 tons, as shown in Table 2. All exported soil would be recycled using the City of San Diego Clean Fill Dirt Program or an approved Clean Fill Dirt handler listed on the City's Certified C&D Recycling Facilities Directory (see Attachment 2).

Table 2
Grading Soil Waste Generation, Diversion, and Disposal

Net Export (cubic yards)	Generation Rate[1] (tons per cubic yard)	Tons Exported	Percent Diverted	Tons Diverted	Tons Disposed
10,000	1.3	13,000	100%	13,000	0

SOURCE: [1]City of San Diego C&D Debris Conversion Rate Table (see Attachment 1).

5.3 Construction

The proposed construction would total approximately 72,736 square feet of new building areas (Shops 1, 2, and 3, Retail A, and Pads A and B). It is anticipated that the existing hardscape will remain and would be reconfigured to accommodate the proposed project. Construction of sidewalks and any new surface parking areas are not anticipated to generate waste during the construction phase. According to a 1998 study by the U.S. EPA, a sample of non-residential construction projects including office and restaurant space generated an average of 3.9 pounds of construction waste per square foot (U.S. EPA 1998). Based on this generation rate, the total proposed building construction area is estimated to generate 141.83 tons of waste during construction (see calculation below).

$$72{,}736 \text{ square feet} \times \frac{3.9\ pounds}{square\ foot} \times \frac{1\ ton}{2{,}000\ pounds} = 142 \text{ tons}$$

Estimates of material types and portions are based on similar non-residential developments. The types of construction waste and materials anticipated to be generated are listed in Table 3.

Table 3 Construction Waste Diversion and Disposal by Material Type					
Material Type	Estimated Waste (tons)	Percent Diverted[1]	Nearest Handling Facility[1]	Estimated Diversion (tons)	Estimated Disposal (tons)
Asphalt and Concrete	20	100	Vulcan Otay Asphalt Recycling Center	20	0
Metals	32	100	Cactus Recycling	32	0
Brick/Masonry/Tile	10	100	Vulcan Carol Canyon Landfill and Recycle Site	10	0
Clean Wood/Wood Pallets	5	100	Otay Landfill	5	0
Carpet, Padding/Foam	11	100	DFS Flooring	11	0
Drywall	32	100	EDCO Recovery & Transfer	32	0
Corrugated Cardboard	9	100	Cactus Recycling	9	0
Trash/Garbage	24	0	Otay Landfill	0	24
Total	**142**			**118 (83%)**	**24 (17%)**
NOTE: Totals may vary due to independent rounding. SOURCE: [1]City of San Diego ESD 2017 Certified C&D Recycling Facility Directory (see Attachment 2).					

5.4 Waste Diversion

Waste diversion would be conducted through source separation rather than mixed debris diversion. With mixed debris diversion, all material waste is disposed of in a single container for transport to a mixed C&D recycling facility (Otay C&D/Inert Debris Processing Facility) where 75 percent is diverted for recycling. With source-separated diversion, materials are separated on-site before transport to appropriate facilities that accept specific material types, and a greater diversion rate is achieved. Recyclable waste materials would be separated on-site into material-specific containers and diverted to an approved recycler selected from ESD's directory of facilities that recycle specific waste materials from construction and demolition (see Attachment 2). These facilities achieve a 100 percent diversion rate for most materials with the exception of a 75 diversion rate for roof material (mixed C&D debris). Given the waste reduction target of 75 percent, the majority of waste must be handled at facilities other than landfills.

With implementation of the diversion-estimated calculations outlined in Tables 1 and 3, it is estimated that 94 percent and 83 percent of the waste generated during the respective demolition and construction phases of the proposed project would be diverted to appropriate facilities for reuse. Only 210 tons (roofing materials, treated wood/trash/garbage) and 24 tons (trash/garbage), equivalent to 6 and 17 percent of the respective total demolition and construction waste, would be disposed of in the landfill.

5.4.1 Total Diversion

Table 4 summarizes the amount of waste estimated to be generated and diverted by each phase of the project. Of the 16,598 tons estimated to be generated, 16,364 tons would be diverted during the demolition and construction phases, primarily through source separation. This would result in 98.6 percent of waste material diverted from the landfill for reuse.

Table 4
Total Waste Generated, Diverted, and Disposed of by Phase

Phase	Tons Generated	Tons Diverted	Tons Disposed
Demolition	3,456	3,246 (94%)	210 (6%)
Grading	13,000	13,000 (100%)	0 (0%)
Construction	142	118 (83%)	24 (17%)
Total	**16,598**	**16,364 (98.6%)**	**234 (1.4%)**
NOTE: Totals may vary due to independent rounding.			

5.4.2 Contractor Education and Responsibilities

A Solid Waste Management Coordinator (SWMC) for the project would be designated to ensure that all contractors and subcontractors are educated and that procedures for waste reduction and recycling efforts are implemented. Specific responsibilities of the SWMC would include the following:

- Review of the WMP at the preconstruction meeting, including the SWMC responsibilities.
- Distribute the WMP to all contractors when they first begin work on-site and when training workers, subcontractors, and suppliers on proper waste management procedures applicable to the project.
- Work with the contractors to estimate the quantities of each type of material that would be salvaged, recycled, or disposed of as waste, then assist in documentation.
- Use detailed material estimates to reduce risk of unplanned and potentially wasteful material cuts.
- Review and enforce procedures for source-separated receptacles. Containers of various sizes shall:
  - Be placed in readily accessible areas that will minimize misuse or contamination.
  - Be clearly labeled with a list of acceptable and unacceptable materials, the same as the materials recycled at the receiving material recovery facility or recycling processor.
  - Contain no more than 10 percent non-recyclable materials, by volume.
  - Be inspected daily to remove contaminants and evaluate discarded material for reuse on-site.

- Review and enforce procedures for transportation of materials to appropriate recipients selected from ESD's directory of facilities that recycle C&D materials (see Tables 1 and 4; Attachment 2).
- Ensure removal of C&D waste materials from the project site at least once every week to ensure no over-topping of containers. The accumulation and burning of on-site construction, demolition, and land-clearing waste materials will be prohibited.
- Document the return or reuse of excess materials and packaging to enhance the diversion rate.
- Coordinate implementation of a "buy recycled" program for green construction products, including incorporating mulch and compost into the landscaping.
- Coordinate implementation of solid waste mitigation with other requirements such as storm water requirements, which may include specifications such as the placement of bins to minimize the possibility of runoff contamination.

The SWMC would ensure that the project meets the following state law and City Municipal Code requirements. Adjustments would be made as needed to maintain conformance:

- The City's C&D Debris Diversion Deposit Program, which requires a refundable deposit based on the tonnage of the expected recyclable waste materials as part of the building permit requirements (City of San Diego 2008).
- The City's Recycling Ordinance, which requires that collection of recyclable materials is provided (City of San Diego 2007a).
- The City's Storage Ordinance, which requires that areas for recyclable material collection must be provided (City of San Diego 2007b).
- The name and contact information of the waste contractor provided to ESD at least 10 days prior to the start of any work and updated within 5 days of any changes.

6.0 Occupancy–Operational Waste

6.1 Waste Generation

The estimated annual waste to be generated during occupancy of the project was calculated using the City ESD Waste Generation Factors for general retail and restaurant facilities (Attachment 3). The estimated solid waste generation rate for general retail is 0.0028 ton/year. The estimated solid waste generation rate for restaurants is 0.0122 ton/year. The estimated annual operational amount in tons is based on 62,935 square feet of general retail space and 9,801 square feet of restaurant space, and is calculated below:.

General Retail:

$$62{,}935 \text{ square feet} \times \frac{0.0028 \; tons}{square \; feet/year} = 176 \text{ tons/year}$$

Restaurant:

$$9{,}801 \text{ square feet} \times \frac{0.0122 \; tons}{square \; feet/year} = 120 \text{ tons/year}$$

Table 5 shows the amount of waste that would be generated during the occupancy phase. The total generation of waste for the total proposed building space of 72,736 square feet equates to approximately 296 tons per year. As discussed in Section 6.2 below, the applicant (or applicant's successor in interest) would implement a long-term waste management plan to manage waste disposal in order to meet state and City waste reduction goals.

Table 5
Occupancy Phase Annual Waste Generation

Land Use	Amount (square feet)	Annual Generation Rate[1] (tons/square feet/year)	Waste Generated[2] (tons/year)
General Retail	62,935	0.0028	176
Restaurant	9,801	0.0122	120
		Total	**296**

SOURCES:
[1]City of San Diego Environmental Services Department, Waste Generation Factors – Occupancy Phase (see Attachment 3)
[2]Totals may vary due to independent rounding.

6.2 Waste Reduction Measures

According to the City Waste Management Guidelines (City of San Diego 2013), compliance with the City's Recycling Ordinances is expected to provide a minimum recycling service volume of 40 percent for large complexes. Therefore, waste anticipated to be diverted during the occupancy phase would be approximately 118 tons per year. The remaining 178 tons per year would exceed the 60 ton-per-year threshold of significance for a cumulative impact on solid waste services in the City (City of San Diego 2016).

The applicant (or applicant's successor in interest) shall be responsible for implementing a long-term WMP, as outlined below, that would ensure that the development meets or exceeds the requirements set forth in AB 939 and AB 341. This program shall include providing sufficient interior and exterior storage space for refuse and recyclable materials and a means of handling landscaping and green waste materials. Specific waste reduction program measures are summarized below and are listed in Section 7.2.

- The applicant (or applicant's successor in interest) shall provide recycling services, which include all of the following provisions:

1. Collection of recyclable materials required by and in accordance with applicable City Ordinances.
2. Provide dedicated recycling collection and storage areas required by and in accordance with applicable City Ordinances.
3. Provide signage required by and in accordance with applicable City Ordinances.

6.3 Exterior Storage

This WMP follows the City's Municipal Code on-site refuse and recyclable material storage space requirements (City of San Diego 2007b). Table 6 shows the exterior storage area requirements for non-residential developments. The project would include a total of 72,736 square feet of new non-residential uses (the AMC Cinema and associate trash enclosures would remain), which would require a minimum of 144 square feet of refuse storage area and a minimum of 144 square feet of recyclable material storage area. The total exterior refuse and recyclable material storage requirement for the project would be 288 square feet. Site plans would be modified to show the location and required square footage of refuse and recyclable storage areas to comply with this requirement.

Table 6
Minimum Exterior Refuse and Recyclable Material Storage Areas for Non-Residential Development

Gross Floor Area per Development (square feet)	Minimum Refuse Storage Area per Development (square feet)	Minimum Recyclable Material Storage Area per Development (square feet)	Total Minimum Storage Area per Development (square feet)
0–5,000	12	12	24
5,001–10,000	24	24	48
10,001–25,000	48	48	96
25,001–50,000	96	96	192
50,001–75,000	**144**	**144**	**288**
75,001–100,000	192	192	384
100,000+	192 plus 48 square feet for every 25,000 square feet of building area above 100,001	192 plus 48 square feet for every 25,000 square feet of building area above 100,001	384 plus 96 square feet for every 25,000 square feet of building area above 100,001
Project Total	**144**	**144**	**288**

SOURCE: City of San Diego Municipal Code, Article 2, Division 8: Refuse and Recyclable Material Storage Regulations, Section 142.0830, Table 142-08C; effective, January 2000.

6.4 Organic Waste Recycling

The project would incorporate landscaping and landscape maintenance. Drought-tolerant plants would be used to reduce the amount of green waste produced. Collection of organic waste and its disposal at recycling centers that accept organic waste would further reduce the waste generated by the project during occupancy. An ongoing WMP would include a means for handling landscaping and other organic waste materials.

7.0 Conclusion

7.1 Demolition, Grading, and Construction Waste

A total of approximately 16,598 tons of material would be generated and 16,364 tons of material would be diverted through recycling at source-separated facilities that achieve a 100 percent diversion rate. When necessary, mixed debris and trash would be recycled at a lower diversion rate, leaving 234 tons to be disposed of. This amounts to an approximate 98.6 percent reduction in solid waste that would be diverted from the landfill.

7.2 Occupancy–Operational Waste

The project would include 72,736 square feet of new non-residential uses, generating approximately 296 tons of waste per year, and would be required to provide a minimum of 144 square feet of exterior refuse area and 144 square feet of recyclable material storage area (total of 288 square feet; see Table 6).

The applicant (or applicant's successor in interest) would implement ongoing Waste Reduction Measures as prescribed in this WMP to ensure that the waste is minimized and the operation of the project complies with City ordinances. According to the City of San Diego Waste Management Guidelines (City of San Diego 2013), compliance with existing ordinances is expected to achieve a 40 percent diversion rate. Therefore, approximately 178 tons of non-recyclable waste per year would be generated from the project, exceeding the 60 ton-per-year threshold of significance for having a cumulative impact on solid waste. However, preparation of this WMP and implementation of the Waste Reduction Measures, outlined in Section 6.2 above, would ensure the cumulative solid waste impact is reduced to below a level of significance. In addition, the applicant (or applicant's successor) would implement the following additional WMP measures to further reduce operational waste:

- Collection of recyclable materials required by and in accordance with applicable City Ordinances.
- Provide dedicated recycling collection and storage areas required by and in accordance with applicable City Ordinances.
- Provide signage required by and in accordance with applicable City Ordinances.
- Ensure that a representative of ESD inspects and approves a storage area that has been provided consistent with the City's Storage Ordinance.
- Ensure that a hauler has been retained to provide recyclable materials collection as well as yard waste and/or food waste.

- Ensure the use of drought-tolerant plants, as indicated in the project's landscape plans, which would result in a reduction in the amount of yard waste once the project is constructed and occupied.

- Provide litter bins with recycling as an integral feature in all common areas to increase the opportunity to separate out recyclables from the trash.

7.3 Overall Compliance

With implementation of the strategies outlined in this WMP and compliance with all applicable City ordinances, solid waste impacts would be reduced to below a level of significance regarding collection, diversion, and disposal of waste generated from C&D, grading, and occupancy. The implementation of a SWMC for the project during demolition, grading, and construction phases would achieve a 98.6 percent of waste diverted from landfill disposal.

During occupancy, the applicant or applicant's successor in interest would be required to implement the ongoing WMP measures detailed herein to ensure maximum diversion from landfills. Implementation of the WMP would include provisions to provide adequate exterior storage space for refuse, recyclable, and landscape/green waste materials.

This WMP outlines strategies to achieve 98.6 percent of waste being diverted from disposal during C&D of the project. This would reduce the anticipated impact of waste disposal to below the direct impact threshold of significance. Without implementation of WMP measures, the occupancy phase would only achieve 40 percent diversion. However, with implementation of ongoing WMP measures detailed in Section 7.2, and achievement of a 98.6 percent diversion rate during the C&D phase, the project would achieve overall compliance.

8.0 References Cited

California, State of

1989 Assembly Bill 939. Integrated Waste Management Act.

2006 Waste Disposal and Diversion Findings for Selected Industry Groups. California Environmental Protection Agency, Integrated Waste Management Board. June.

2010 Senate Bill 1016. Solid Waste Per Capita Disposal Measurement Act.

2011 Assembly Bill 341. Jobs and Recycling.

2014 Assembly Bill 1826. Solid Waste: Organic Waste.

San Diego, City of
2000 Waste Composition Study 1999-2000. Final Report. San Diego Environmental Services Department. November 2000.

2007a Recycling Ordinance. San Diego Municipal Code Chapter 6, Article 6, Division 7. November 20, 2007.

2007b Refuse and Recyclable Materials Storage Regulations. Municipal Code Chapter 14, Article 2, Division 8. December 9, 2007.

2008 Construction and Demolition Debris Diversion Deposit Program. San Diego Municipal Code Chapter 6, Article 6, Division 6.

2013 California Environmental Quality Act – Guidelines for a Waste Management Plan. June 2013. https://www.sandiego.gov/sites/default/files/legacy/environmental-services/pdf/recycling/wmpguidelines.pdf Accessed on December 22, 2016.

2016 Significance Determination Thresholds. California Environmental Quality Act. July.

United States Environmental Protection Agency (U.S. EPA)
1998 Characterization of Building-Related Construction and Demolition Debris in the United States. Municipal and Industrial Solid Waste Division. Office of Solid Waste. Report No. EPA530-R-98-010. June.

2009 Estimating 2003 Building-Related Construction and Demolition Materials Amounts. March.

ATTACHMENTS

ATTACHMENT 1

City of San Diego Environmental Services Department
Construction & Demolition Debris Conversion Rate Table

CITY OF SAN DIEGO
CONSTRUCTION & DEMOLITION (C&D) DEBRIS
CONVERSION RATE TABLE

This worksheet lists materials typically generated from a construction or demolition project and provides formulas for converting common units (i.e., cubic yards, square feet, and board feet) to tons. It should be used for preparing your Waste Management Form, which requires that quantities be provided in tons.

Step 1
Enter the estimated quantity for each applicable material in Column I, based on units of cubic yards (cy), square feet (sq ft), or board feet (bd ft).
Step 2
Multiply by Tons/Unit figure listed in Column II. Enter the result for each material in Column III. If using Excel version, column III will automatically calculate tons.
Step 3
Enter quantities for each separated material from Column III on this worksheet into the corresponding section of your Waste Management Form.

For your final calculations, use the actual quantities, based on weight tags, gate receipts, or other documents.

		Column I			Column II		Column III
Category	**Material**	**Volume**	**Unit**		**Tons/Unit**		**Tons**
Asphalt/Concrete	Asphalt (broken)	______	cy	x	0.70	=	______
	Concrete (broken)	______	cy	x	1.20	=	______
	Concrete (solid slab)	______	cy	x	1.30	=	______
Brick/Masonry/Tile	Brick (broken)	______	cy	x	0.70	=	______
	Brick (whole, palletized)	______	cy	x	1.51	=	______
	Masonry Brick (broken)	______	cy	x	0.60	=	______
	Tile	______	sq ft	x	0.00175	=	______
Building Materials (doors, windows, cabinets, etc.)		______	cy	x	0.15	=	______
Cardboard (flat)		______	cy	x	0.05	=	______
Carpet	By square foot	______	sq ft	x	0.0005	=	______
	By cubic yard	______	cy	x	0.30	=	______
Carpet Padding/Foam		______	sq ft	x	0.000125	=	______
Ceiling Tiles	Whole (palletized)	______	sq ft	x	0.0003	=	______
	Loose	______	cy	x	0.09	=	______
Drywall (new or used)	1/2" (by square foot)	______	sq ft	x	0.0008	=	______
	5/8" (by square foot)	______	sq ft	x	0.00105	=	______
	Demo/used (by cubic yd)	______	cy	x	0.25	=	______
Earth	Loose/Dry	______	cy	x	1.20	=	______
	Excavated/Wet	______	cy	x	1.30	=	______
	Sand (loose)	______	cy	x	1.20	=	______
Landscape Debris (brush, trees, etc)		______	cy	x	0.15	=	______
Mixed Debris	Construction	______	cy	x	0.18	=	______
	Demolition	______	cy	x	1.19	=	______
Scrap metal		______	cy	x	0.51	=	______
Shingles, asphalt		______	cy	x	0.22	=	______
Stone (crushed)		______	cy	x	2.35	=	______
Unpainted Wood & Pallets	By board foot	______	bd ft	x	0.001375	=	______
	By cubic yard	______	cy	x	0.15	=	______
Garbage/Trash		______	cy	x	0.18	=	______
Other (estimated weight)		______	cy	x	estimate	=	______
______		______	cy	x	estimate	=	______
______		______	cy	x	estimate	=	______
______		______	cy	x	estimate	=	______

Total All ____________________

ATTACHMENT 2

City of San Diego 2017 Construction & Demolition
Recycling Facility Directory

Environmental Services

2017 Certified Construction & Demolition Recycling Facility Directory

These facilities are certified by the City of San Diego to accept materials listed in each category. Hazardous materials are not accepted. The diversion rate for these materials shall be considered 100%, except mixed C&D debris which updates quarterly. The City is not responsible for changes in facility information. Please call ahead to confirm details such as accepted materials, days and hours of operation, limitations on vehicle types, and cost. For more information visit: www.recyclingworks.com.

Please note: In order to receive recycling credit, Mixed C&D Facility and transfer station receipts must: *-be coded as construction & demolition (C&D) debris* *-have project address or permit number on receipt* **Make sure to notify weighmaster that your load is subject to the City of San Diego C&D Ordinance.* *Note about landfills: Miramar Landfill and other landfills do not recycle mixed C&D debris.*	Mixed C&D Debris	Asphalt/Concrete	Brick/Block/Rock	Building Materials for Reuse	Cardboard	Carpet	Carpet Padding	Ceiling Tile	Ceramic Tile/Porcelain	Clean Fill Dirt	Clean Wood/Green Waste	Drywall	Industrial Plastics	Lamps/Light Fixtures	Metal	Mixed Inerts	Styrofoam Blocks
EDCO Recovery & Transfer 3660 Dalbergia St, San Diego, CA 92113 619-234-7774 | www.edcodisposal.com/public-disposal	71%											•					
EDCO Station Transfer Station & Buy Back Center 8184 Commercial St, La Mesa, CA 91942 619-466-3355 | www.edcodisposal.com/public-disposal	71%				•							•			•		
EDCO CDI Recycling & Buy Back Center 224 S. Las Posas Rd, San Marcos, CA 92078 760-744-2700 | www.edcodisposal.com/public-disposal	90%				•										•		
Escondido Resource Recovery 1044 W. Washington Ave, Escondido 760-745-3203 | www.edcodisposal.com/public-disposal	71%																
Fallbrook Transfer Station & Buy Back Center 550 W. Aviation Rd, Fallbrook, CA 92028 760-728-6114 | www.edcodisposal.com/public-disposal	71%				•										•		
Otay C&D/Inert Debris Processing Facility 1700 Maxwell Rd, Chula Vista, CA 91913 619-421-3773 | www.sd.disposal.com	75%																
Ramona Transfer Station & Buy Back Center 324 Maple St, Ramona, CA 92065 760-789-0516 | www.edcodisposal.com/public-disposal	71%				•										•		
SANCO Resource Recovery & Buy Back Center 6750 Federal Blvd, Lemon Grove, CA 91945 619-287-5696 | www.edcodisposal.com/public-disposal	71%				•										•		
All American Recycling 10805 Kenney St, Santee, CA 92071 619-508-1155 (Must call for appointment)						•											
Allan Company 6733 Consolidated Wy, San Diego, CA 92121 858-578-9300 | www.allancompany.com/facilities.htm					•										•		
Allan Company Miramar Recycling 5165 Convoy St, San Diego, CA 92111 858-268-8971 | www.allancompany.com/facilities.htm					•										•		
AMS 4674 Cardin St, San Diego, CA 92111 858-541-1977 | www.a-m-s.com								•									

	Mixed C&D Debris	Asphalt/Concrete	Brick/Block/Rock	Building Materials for Reuse	Cardboard	Carpet	Carpet Padding	Ceiling Tile	Ceramic Tile/Porcelain	Clean Fill Dirt	Clean Wood/Green Waste	Drywall	Industrial Plastics	Lamps/Light Fixtures	Metal	Mixed Inerts	Styrofoam Blocks
Armstrong World Industries, Inc. 300 S. Myrida St, Pensacola, FL 32505 877-276-7876 (Press 1, Then 8) www.armstrong.com/commceilingsna								•									
Cactus Recycling 8710 Avenida De La Fuente, San Diego, CA 92154 619-661-1283 | www.cactusrecycling.com					•								•		•		•
DFS Flooring 10178 Willow Creek Road, San Diego, CA 92131 858-630-5200 | www.dfsflooring.com						•	•										
Duco Metals 220 Bingham Drive Suite 100, San Marcos, CA 92069 760-747-6330 | www.ducometals.com															•		
Enniss Incorporated 12421 Vigilante Rd, Lakeside, CA 92040 619-443-9024 | www.ennissinc.com		•	•						•	•							
Escondido Sand and Gravel 500 N. Tulip St, Escondido, CA 92025 760-432-4690 | www.weirasphalt.com/esg		•															
Habitat for Humanity ReStore 10222 San Diego Mission Rd, San Diego, CA 92108 619-516-5267 | www.sdhfh.org/restore.php				•													
Hanson Aggregates West – Lakeside Plant 12560 Highway 67, Lakeside, CA 92040 858-547-2141		•															
Hanson Aggregates West – Miramar 9229 Harris Plant Rd, San Diego, CA 92126 858-974-3849		•								•							
HVAC Exchange 2675 Faivre St, Chula Vista, CA 91911 619-423-1855 | www.thehvacexchange.com															•		
IMS Recycling Services 2740 Boston Ave, San Diego, CA 92113 619-423-1564 | www.imsrecyclingservices.com					•								•				
IMS Recycling Services 2697 Main St, San Diego, CA 92113 619-231-2521 | www.imsrecyclingservices.com													•		•		
Inland Pacific Resource Recovery 12650 Slaughterhouse Canyon Rd, Lakeside, CA 92040 619-390-1418											•						
Lamp Disposal Solutions 1405 30th Street, San Diego, CA 92154 858-569-1807 | www.lampdisposalsolutions.com														•			
Los Angeles Fiber Company 4920 S. Boyle Ave, Vernon, CA 90058 323-589-5637 | www.lafiber.com						•	•										

	Mixed C&D Debris	Asphalt/Concrete	Brick/Block/Rock	Building Materials for Reuse	Cardboard	Carpet	Carpet Padding	Ceiling Tile	Ceramic Tile/Porcelain	Clean Fill Dirt	Clean Wood/Green Waste	Drywall	Industrial Plastics	Lamps/Light Fixtures	Metal	Mixed Inerts	Styrofoam Blocks
Miramar Greenery, City of San Diego 5180 Convoy St, San Diego, CA 92111 858-694-7000 | www.sandiego.gov/environmental-services/miramar/greenery.shtml											•						
Moody's 3210 Oceanside Blvd., Oceanside, CA 92056 760-433-3316		•								•						•	
Otay Valley Rock, LLC 2041 Heritage Rd, Chula Vista, CA 91913 619-591-4717 | www.otayrock.com		•															
Reclaimed Aggregates Chula Vista 855 Energy Wy, Chula Vista, CA 91913 619-656-1836		•														•	
Reconstruction Warehouse 3650 Hancock St., San Diego, CA 92110 619-795-7326 | www.recowarehouse.com				•													
Robertson's Ready Mix 2094 Willow Glen Dr, El Cajon, CA 92019 619-593-1856		•								•						•	
Romero General Construction Corp. 8354 Nelson Wy, Escondido, CA 92026 760-749-9312 | www.romerogc.com/crushing/nelsonway.htm		•															
SA Recycling 3055 Commercial St., San Diego, CA 92113 619-238-6740 | www.sarecycling.com															•		
SA Recycling 1211 S. 32nd St., San Diego, CA 92113 619-234-6691 | www.sarecycling.com															•		
Universal Waste Disposal 8051 Wing Avenue, El Cajon, CA 92020 619-438-1093 | www.universalwastedisposal.com														•			
Vulcan Carol Canyon Landfill and Recycle Site 10051 Black Mountain Rd, San Diego, CA 92126 858-530-9465 | www.vulcanmaterials.com		•	•							•						•	
Vulcan Otay Asphalt Recycle Center 7522 Paseo de la Fuente, San Diego, CA 92154 619-571-1945 | www.vulcanmaterials.com		•															

ATTACHMENT 3

City of San Diego Waste Generation
Factors – Occupancy Phase

Waste Generation Factors – Occupancy Phase

The following factors are used by the City of San Diego Environmental Services Department to estimate the expected waste generation in a new residential or commercial development.

Residential Uses

Residential Unit = 1.6 tons/year/unit
Multi-family Unit = 1.2 tons/year/unit

Example: To calculate the amount of waste that will be generated from a project with 100 new homes, multiply the number of homes by the generation factor.

100 single family homes x 1.6 = 160 tons/year
100 multi-family units x 1.2 = 120 tons/year

Commercial/Industrial Uses	
General Retail	0.0028
Restaurants & Bars	0.0122
Hotels/Motels	0.0045
Food Stores	0.0073
Auto/Service/Repair	0.0051
Medical Offices	0.0033
Hospitals	0.0055
Office	0.0017
Transp/Utilities	0.0085
Manufacturing	0.0059
Education	0.0013
Unclassified Services	0.0042

Example: To calculate the amount of waste that could be generated from a new building with 10,000 square feet for offices and 10,000 square feet for manufacturing, multiply the square footage for each use by the generation factor.

10,000 square feet x 0.0017 = 17 tons/year
10,000 square feet x 0.0059 = 59 tons per year

Total estimated waste generation for building = 76 tons/year

Preliminary Hydrology Study

The Shops at AMC Promenade

770 Dennery Road
San Diego, CA 92154

Prepared for:

HCP-CCI Palm Promenade, LLC

4340 Von Karman Avenue, Suite 110
Newport Beach, CA 92660

Prepared by:

Nasland Engineering
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May 10, 2018

Table of Contents

1.0 VICINITY MAP:

Map data ©2016 Google

2.0 PROJECT DESCRIPTION:

The project proposes to redevelop an existing 17.53 acre commercial site. The project will demolish approximately 26,249 square feet of the existing 89,946 square foot AMC Theater. The northern wing of the building will be demolished leaving approximately 63,697 square feet of remaining floor area. The project also proposes to construct six new commercial buildings within the existing parking lot. Construction will include building demolition, building construction, drainage improvements, curbs, sidewalks, asphalt concrete and landscaped areas. The total disturbed area to be redeveloped, including impervious and pervious areas, is 7.96 acres. Since the existing site is 17.53 acres and approximately 8.0 acres are anticipated to be disturbed, this project meets the "50% Rule" requirements for redevelopment Priority Development Projects (PDPs). Structural BMP requirements will only apply to the creation or replacement of impervious surfaces and not to the entire development. For additional information refer to "The City of San Diego 2016 Storm Water Standards Manual Part 1: BMP Design Manual." The proposed project is a previously developed site and is not subject to requirements set forth in the Clean Water Act (CWA) sections 401 and 404 since it will not discharge to navigable waters, and therefore approval from the California Regional Water Quality Control Board is not required.

3.0 DRAINAGE

3.1 EXISTING DRAINAGE

The drainage area is approximately 19.58 acre that consists of 16.72 acres of impervious surfaces and 2.86 acres of pervious surfaces. The site currently has an existing AMC Theater with associated parking and landscaped areas. The onsite runoff generally drains from east to west and consist of 12 sub-basins. The runoff is collected through the use of area drains, curb inlets and brow ditches that discharge to private storm drain systems onsite. The project has 4 discharge locations which connect to the existing underground Caltrans storm drain system along the westerns edge of the property. The offsite runoff along Dennery Road sheet flows towards the east, away from the site, and is collected by existing median and curb inlets. The inlets discharge to a public 30" RCP that runs northwest through the site. The offsite runoff and the majority of the onsite runoff flow into a public 42" RCP prior to exiting the site. These flows enter the existing Caltrans 42" CSP and discharge into a public 60" CSP located within Interstate 805. The 60" CSP flows north where the pipe shifts to the eastern side of the 805 and widens to a public 78" CSP. The 78" CSP discharges into the Otay River approximately 0.75 miles away from the commercial site.

See **Appendix A – Existing Hydrology Exhibit**, for further information.

3.2 PROPOSED DRAINAGE

With the demolition of the existing AMC Theater and the addition of six new commercial buildings the site will consists of approximately 16.57 acres of impervious surfaces and 3.01 acres of pervious surfaces. Therefore there is a small decrease in impervious surfaces, approximately 0.15 acres, from the existing condition. However, with the addition of a 45,000 square foot building the overall peak discharge increased slightly, but is to be considered negligible when compared to the overall size of the commercial site. The site will continue to drain from east to west and consist of 23 sub-basins. This project proposes changes to the current drainage system by installing biofiltration Best Management Practices (BMPs) to intercept sheet flows and treat pollutants prior to discharging into the existing public 42" RCP storm drain system onsite. Some existing private storm drain lines will be removed and replaced in order to construct the BMPs and any proposed storm drain lines will connect to the existing private storm drain system onsite. The existing public storm drains onsite and offsite will remain and be protected in place and no portion of the project will discharge to the Caltrans hillside along the western edge of the property.

See **Appendix B – Proposed Hydrology Exhibit**, for further information.

4.0 RATIONAL METHOD

The storm water runoff for both the existing and proposed site conditions was calculated for the 100-year storm event using methodology outlined by the San Diego County Hydrology Manual. Peak discharge was calculated using the Rational Method which is given by the following equation:

$$Q = CIA$$

Where:
Q = flow rate in cubic feet per second (cfs)
C = area weighted runoff coefficient
I = rainfall intensity in inches per hour (in/hr)
A = drainage basin area in acres (acres)

Assumptions and standards used to calculate the peak discharge are as follows:

- The runoff coefficients were calculated using an area-weighted average coefficient of runoff. The average coefficient of runoff, 'C' was calculated by assuming a 'C' value of 0.9 for all impervious areas and a 'C_p' value of 0.35 for all pervious areas. The runoff coefficients were calculated for an area based on soil type and impervious percentage using the following formula from the SDCHM:
  - $C = 0.90 \text{ x } (\% \text{ Impervious}) + C_p \text{ x } (1.0\text{-}\% \text{ Impervious})$

- For the existing and proposed site conditions, the Time of Concentration was determined by the Overland Time of Flow:
  - $T = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$

- From the SDCHM Rainfall Isopluvial maps for 100 Year Rainfall Events:
  - 6-Hour Precipitation, $P_6 = 2.25$ in
  - 24-Hour Precipitation, $P_{24} = 3.75$ in
  - Adjusted $P_6 = 2.25$ in

- The rainfall intensity duration was calculated using the following formula:
  - $I = 7.44P_6D^{-0.645}$

See **Appendix F – References,** for further information.

5.0 ANALYSIS

The 100-year peak discharge rates were calculated for both the existing and proposed basins using the Rational Method discussed in *Section 5*. These calculations were then used to compare the impacts on existing conditions caused by the AMC Theater redevelopment project.

5.1 EXISTING RATIONAL METHOD CALCULATIONS

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	1.56	88%	0.83	820	11.75	1.4%	12.2	3.3	4.33
3	2.06	100%	0.90	115	2.25	2.0%	5.0	5.9	10.99
4	0.71	79%	0.78	85	0.5	0.6%	6.3	5.1	2.85
5	0.80	95%	0.87	250	7.0	2.8%	5.0	5.9	4.14
6	2.10	96%	0.88	500	10.0	2.0%	7.1	4.7	8.67
7	2.33	88%	0.84	445	20.0	4.5%	6.1	5.2	10.19
8	2.92	88%	0.83	485	22.0	4.5%	6.4	5.0	12.27
9	1.82	88%	0.83	435	20.0	4.7%	6.0	5.3	8.00
10	0.66	94%	0.87	490	21.0	4.3%	5.7	5.4	3.11
11	1.97	91%	0.85	500	25.0	4.9%	5.9	5.3	8.89
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
								Onsite Discharge:	80.61
								Offsite Discharge:	42.00
								Total Discharge:	122.61

5.2 PROPOSED RATIONAL METHOD CALCULATIONS

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	0.96	91%	0.87	705	9.0	1.3%	10.1	3.8	3.16
3	1.46	100%	0.90	115	2.25	2.0%	5.0	5.9	7.79
4	0.35	86%	0.82	85	1.3	1.5%	5.0	5.9	1.70
5	1.03	100%	0.90	150	3.00	2.0%	5.0	5.9	5.50
6	0.61	95%	0.87	205	3.5	1.7%	5.0	5.9	3.16
7	2.33	89%	0.84	445	20.0	4.5%	6.0	5.3	10.37
8	2.07	92%	0.86	540	21.5	4.0%	6.4	5.1	8.97
9	2.11	80%	0.79	600	22.0	3.7%	8.8	4.1	6.84
10	0.53	94%	0.87	415	18.25	4.4%	5.2	5.8	2.67
11	0.68	97%	0.88	420	14.0	3.3%	5.3	5.7	3.42
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
13	0.16	100%	0.90	75	1.5	2.0%	5.0	5.9	0.85
14	0.10	40%	0.57	25	3.0	10.0%	5.0	5.9	0.34
15	0.63	89%	0.84	250	4.00	1.6%	6.4	5.1	2.68
16	0.25	100%	0.90	75	1.5	2.0%	5.0	5.9	1.33
17	0.85	88%	0.84	140	5.5	3.9%	5.0	5.9	4.21
18	0.81	85%	0.82	245	5.0	2.0%	6.3	5.1	3.40
19	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
20	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
21	0.23	48%	0.61	215	2.0	0.7%	14.5	3.0	0.42
22	1.48	90%	0.84	300	8.5	2.8%	5.6	5.5	6.86
23	0.07	29%	0.51	75	2.0	2.0%	7.3	4.6	0.16
								Onsite Discharge:	82.18
								Offsite Discharge:	42.00
								Total Discharge:	124.18

5.3 BEST MANAGEMENT PRACTICES SUMMARY

DMA	DMA Area (SF)	BMP Name	Required BMP Area (SF)	Provided BMP Area (SF)	BMP Type	DMA	DMA Area (SF)	BMP Name	Required BMP Area (SF)	Provided BMP Area (SF)	BMP Type
5	45,000	5	1,215	1,911	BF-1	17	36,815	17	917	1,097	BF-1
- -	- -	5A	- -	361	BF-1	18	35,214	18	856	1,065	BF-1
- -	- -	5B	- -	949	BF-1	19	4,801	19	130	208	BF-1
- -	- -	5C	- -	296	BF-1	- -	- -	19A	- -	103	BF-1
- -	- -	5D	- -	305	BF-1	- -	- -	19B	- -	105	BF-1
9	91,705	9	2,146	2,667	BF-1	20	5,000	20	135	190	BF-1
- -	- -	9A	- -	871	BF-1	- -	- -	20A	- -	92	BF-1
- -	- -	9B	- -	1,574	BF-1	- -	- -	20B	- -	98	BF-1
- -	- -	9C	- -	222	BF-1	21	9,829	21	174	561	BF-1
13	6,935	13	188	1,168	BF-1	22	64,449	22	1,625	1,896	BF-1
- -	- -	13A	- -	565	BF-1	- -	- -	22A	- -	205	BF-1
- -	- -	13B	- -	603	BF-1	- -	- -	22B	- -	330	BF-1
15	27,238	15	687	724	BF-1	- -	- -	22C	- -	205	BF-1
- -	- -	15A	- -	374	BF-1	- -	- -	22D	- -	535	BF-1
- -	- -	15B	- -	350	BF-1	- -	- -	22E	- -	621	BF-1
16	11,000	16	297	959	BF-1	23	2,848	23	45	150	BF-1
- -	- -	16A	- -	509	BF-1						
- -	- -	16B	- -	450	BF-1						

See **Appendix C – Existing Rational Method Calculations, Appendix D – Proposed Rational Method Calculations** and **Appendix E – Best Management Practices Calculations** for further information.

6.0 CONCLUSION

The purpose of this preliminary hydrology study was to analyze the existing drainage patterns and compare them to the newly proposed ones. The intent was to effectively carry the runoff associated with the 100-year storm event to outlet points and prevent any severe ponding and flooding from occurring. Based on the 100 year storm analysis, this redevelopment project will slightly increase the storm water discharge to the underground Caltrans storm drain system after project construction. The existing public storm drains onsite and offsite will remain and be protected in place and no portion of the project will discharge to the Caltrans hillside along the western edge of the property. Despite an increase in flow rates, by directing storm water runoff away from building and parking lot surfaces into curb inlets, catch basins, area drains, brow ditches and landscaped areas the proposed flow rates will not negatively impact the surrounding areas. Re-grading and site features like new curbs and curb inlets will be implemented in order to assure that comingling, between runoffs from DMAs that are exempt and DMAs to be treated, will be avoided. DMAs needing treatment will be mitigated by installing biofiltration BMPs onsite. The small increase to the overall site discharge is not anticipated to negatively impact the existing public 42” RCP that currently carries storm water offsite.

7.0 DECLARATION OF RESPONSIBLE CHARGE:

I hereby declare that I am the Engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current standards.

I understand that the check of project drawings and specification by the City of Encinitas is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

8.0 ENGINEER OF WORK:

This report was prepared under the supervision of Samuel Waisbord, PE, Project Manager for Nasland Engineering.

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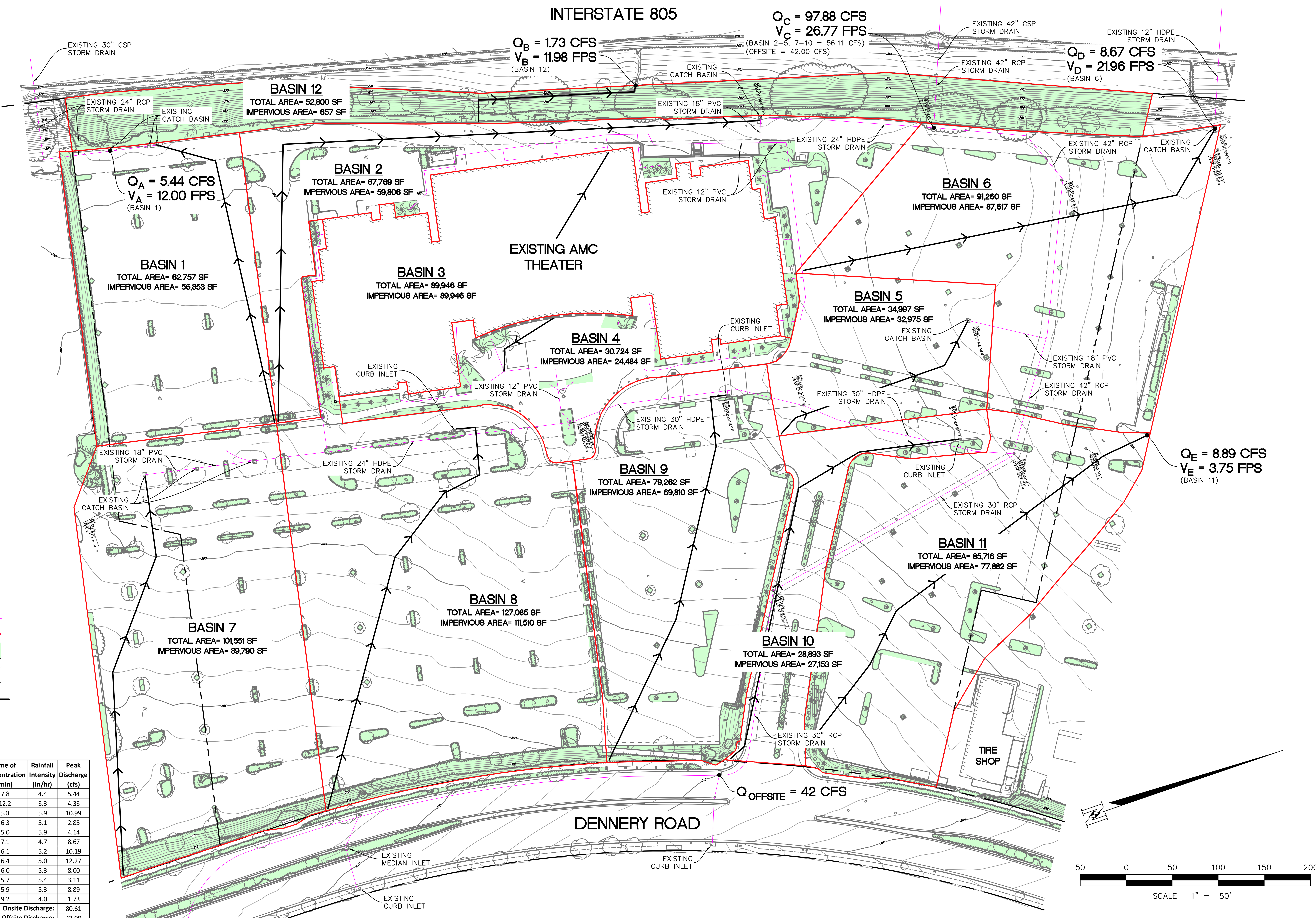
Samuel Waisbord ● RCE 78071 ● Expires 09-30-19

APPENDICES

APPENDIX A

EXISTING HYDROLOGY EXHIBIT



LEGEND

ITEM	SYMBOL
EXISTING STORM DRAIN LINE	
DMA BOUNDARY	
PERVIOUS AREA	
IMPERVIOUS AREA	
FLOW PATH OF TRAVEL FOR THE TIME OF CONCENTRATION	

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	1.56	88%	0.83	820	11.75	1.4%	12.2	3.3	4.33
3	2.06	100%	0.90	115	2.25	2.0%	5.0	5.9	10.99
4	0.71	79%	0.78	85	0.5	0.6%	6.3	5.1	2.85
5	0.80	95%	0.87	250	7.0	2.8%	5.0	5.9	4.14
6	2.10	96%	0.88	500	10.0	2.0%	7.1	4.7	8.67
7	2.33	88%	0.84	445	20.0	4.5%	6.1	5.2	10.19
8	2.92	88%	0.83	485	22.0	4.5%	6.4	5.0	12.27
9	1.82	88%	0.83	435	20.0	4.7%	6.0	5.3	8.00
10	0.66	94%	0.87	490	21.0	4.3%	5.7	5.4	3.11
11	1.97	91%	0.85	500	25.0	4.9%	5.9	5.3	8.89
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
								Onsite Discharge:	80.61
								Offsite Discharge:	42.00
								Total Discharge:	122.61

EXISTING HYDROLOGY

SCALE: 1" = 50'

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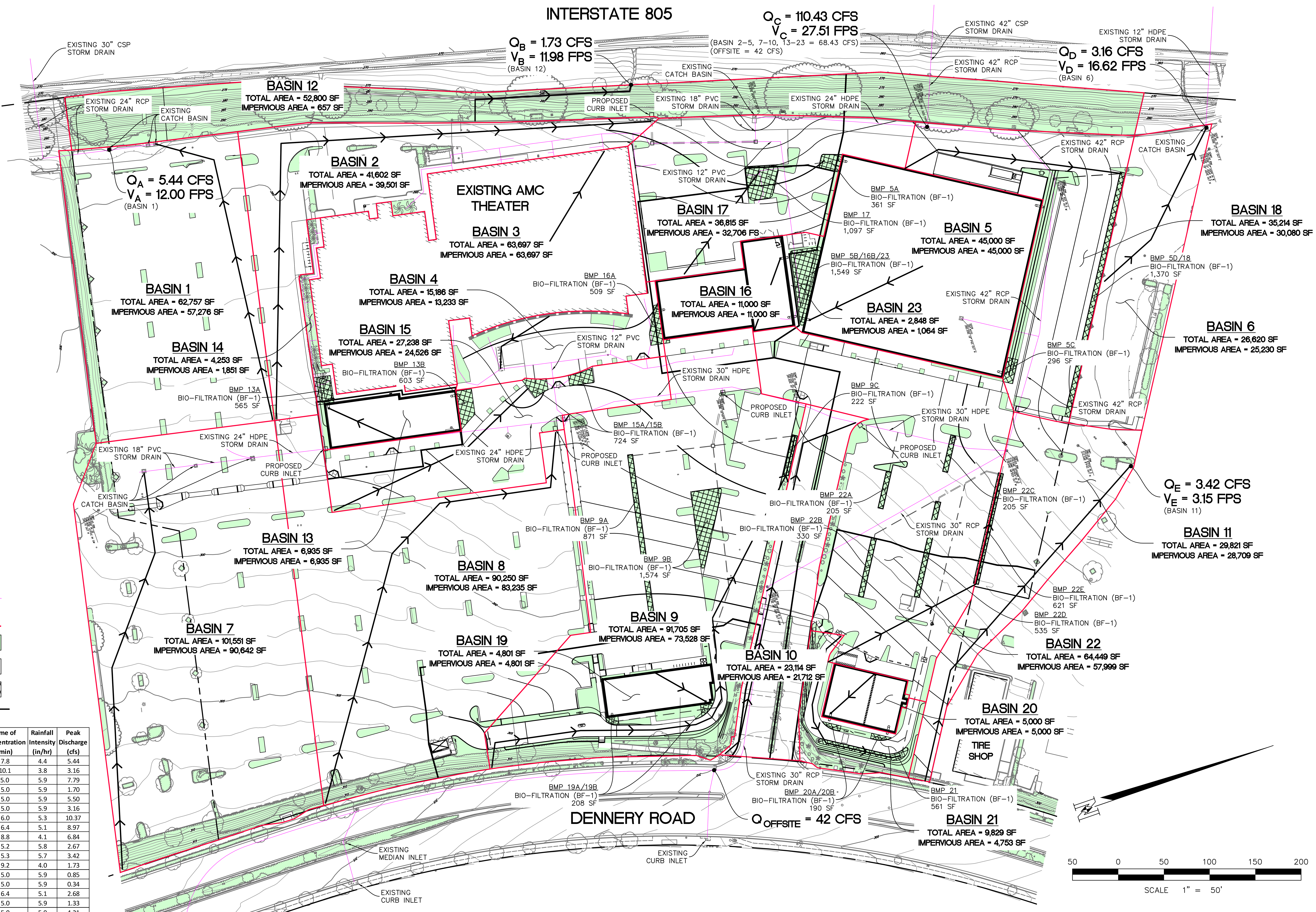
APPENDIX B

PROPOSED HYDROLOGY EXHIBIT



LEGEND

ITEM	SYMBOL
EXISTING STORM DRAIN LINE	
PROPOSED STORM DRAIN LINE	
DMA BOUNDARY	
PERVIOUS AREA	
IMPERVIOUS AREA	
BIOFILTRATION BMP	
FLOW PATH OF TRAVEL FOR THE TIME OF CONCENTRATION	

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	0.96	91%	0.87	705	9.0	1.3%	10.1	3.8	3.16
3	1.46	100%	0.90	115	2.25	2.0%	5.0	5.9	7.79
4	0.35	86%	0.82	85	1.3	1.5%	5.0	5.9	1.70
5	1.03	100%	0.90	150	3.00	2.0%	5.0	5.9	5.50
6	0.61	95%	0.87	205	3.5	1.7%	5.0	5.9	3.16
7	2.33	89%	0.84	445	20.0	4.5%	6.0	5.3	10.37
8	2.07	92%	0.86	540	21.5	4.0%	6.4	5.1	8.97
9	2.11	80%	0.79	600	22.0	3.7%	8.8	4.1	6.84
10	0.53	94%	0.87	415	18.25	4.4%	5.2	5.8	2.67
11	0.68	97%	0.88	420	14.0	3.3%	5.3	5.7	3.42
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
13	0.16	100%	0.90	75	1.5	2.0%	5.0	5.9	0.85
14	0.10	40%	0.57	25	3.0	10.0%	5.0	5.9	0.34
15	0.63	89%	0.84	250	4.00	1.6%	6.4	5.1	2.68
16	0.25	100%	0.90	75	1.5	2.0%	5.0	5.9	1.33
17	0.85	88%	0.84	140	5.5	3.9%	5.0	5.9	4.21
18	0.81	85%	0.82	245	5.0	2.0%	6.3	5.1	3.40
19	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
20	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
21	0.23	48%	0.61	215	2.0	0.7%	14.5	3.0	0.42
22	1.48	90%	0.84	300	8.5	2.8%	5.6	5.5	6.86
23	0.07	29%	0.51	75	2.0	2.0%	7.3	4.6	0.16
								Onsite Discharge:	82.18
								Offsite Discharge:	42.00
								Total Discharge:	124.18

PROPOSED HYDROLOGY

SCALE: 1" = 50'

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APPENDIX C

EXISTING RATIONAL METHOD CALCULATIONS

Rational Method

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	1.56	88%	0.83	820	11.75	1.4%	12.2	3.3	4.33
3	2.06	100%	0.90	115	2.25	2.0%	5.0	5.9	10.99
4	0.71	79%	0.78	85	0.5	0.6%	6.3	5.1	2.85
5	0.80	95%	0.87	250	7.0	2.8%	5.0	5.9	4.14
6	2.10	96%	0.88	500	10.0	2.0%	7.1	4.7	8.67
7	2.33	88%	0.84	445	20.0	4.5%	6.1	5.2	10.19
8	2.92	88%	0.83	485	22.0	4.5%	6.4	5.0	12.27
9	1.82	88%	0.83	435	20.0	4.7%	6.0	5.3	8.00
10	0.66	94%	0.87	490	21.0	4.3%	5.7	5.4	3.11
11	1.97	91%	0.85	500	25.0	4.9%	5.9	5.3	8.89
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
							Total Discharge:		80.61

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
1	1.44	1.31	0.91	0.85

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
1	CB	355	4.5	1.3	0.85	7.8

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
1	2.25	7.8	4.4

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
1	0.85	4.4	1.44	5.44

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
2	1.56	1.37	0.88	0.83

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
2	CB	820	11.75	1.4	0.83	12.2

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
2	2.25	12.2	3.3

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
2	0.83	3.3	1.56	4.33

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
3	2.06	2.06	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
3	RD	115	2.25	2.0	0.90	3.1
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
3	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
3	0.90	5.9	2.06	10.99

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
4	0.71	0.56	0.79	0.78

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
4	AD	85	0.5	0.6	0.78	6.3

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
4	2.25	6.3	5.1

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
4	0.78	5.1	0.71	2.85

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
5	0.8	0.76	0.95	0.87

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
5	CB	250	7	2.8	0.87	4.6
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
5	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
5	0.87	5.9	0.8	4.14

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
6	2.1	2.01	0.96	0.88

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
6	CB	500	10	2.0	0.88	7.1

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
6	2.25	7.1	4.7

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
6	0.88	4.7	2.1	8.67

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
7	2.33	2.06	0.88	0.84

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
7	CB	445	20	4.5	0.84	6.1

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
7	2.25	6.1	5.2

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
7	0.84	5.2	2.33	10.19

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
8	2.92	2.56	0.88	0.83

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% (45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
8	CI	485	22	4.5	0.83	6.4

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
8	2.25	6.4	5.0

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
8	0.83	5.0	2.92	12.27

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
9	1.82	1.60	0.88	0.83

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
9	CI	435	20	4.7	0.83	6.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
9	2.25	6.0	5.3

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
9	0.83	5.3	1.82	8.00

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
10	0.66	0.62	0.94	0.87

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
10	CI	490	21	4.3	0.87	5.7

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
10	2.25	5.7	5.4

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
10	0.87	5.4	0.66	3.11

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
11	1.97	1.79	0.91	0.85

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
11	SF	500	25	4.9	0.85	5.9

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
11	2.25	5.9	5.3

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
11	0.85	5.3	1.97	8.89

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
12	1.21	0.02	0.02	0.36

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
12	BD	200	17	8.5	0.36	9.2

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
12	2.25	9.2	4.0

Step 5: Determine Peak Discharge

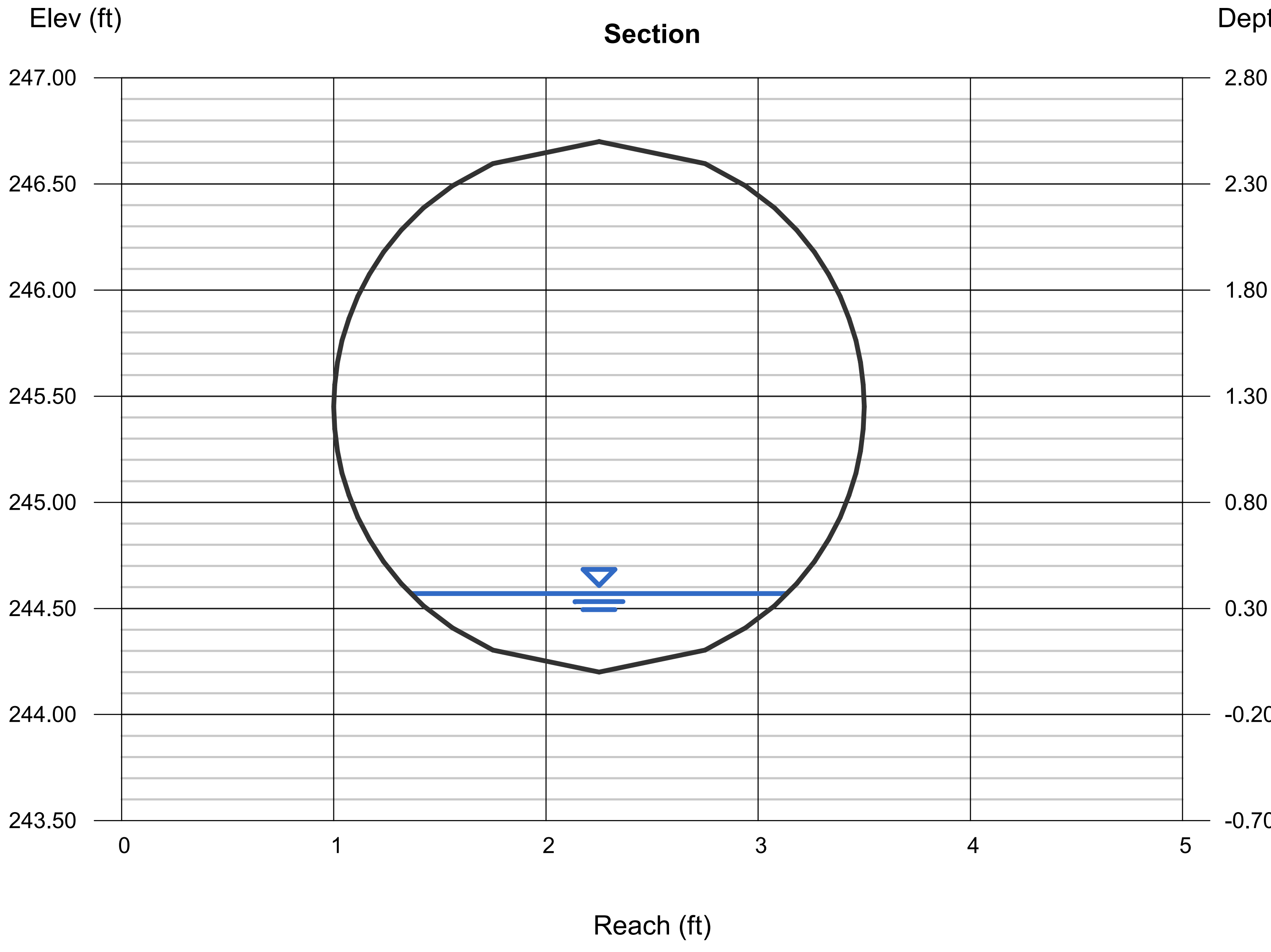
DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
12	0.36	4.0	1.21	1.73

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Apr 11 2018

Qa (Basin 1)

Circular		**Highlighted**	
Diameter (ft)	= 2.50	Depth (ft)	= 0.37
		Q (cfs)	= 5.440
		Area (sqft)	= 0.45
Invert Elev (ft)	= 244.20	Velocity (ft/s)	= 12.00
Slope (%)	= 25.00	Wetted Perim (ft)	= 1.97
N-Value	= 0.023	Crit Depth, Yc (ft)	= 0.77
		Top Width (ft)	= 1.78
Calculations		EGL (ft)	= 2.61
Compute by:	Known Q		
Known Q (cfs)	= 5.44		



Channel Report

Qb (Basin 12)

Triangular

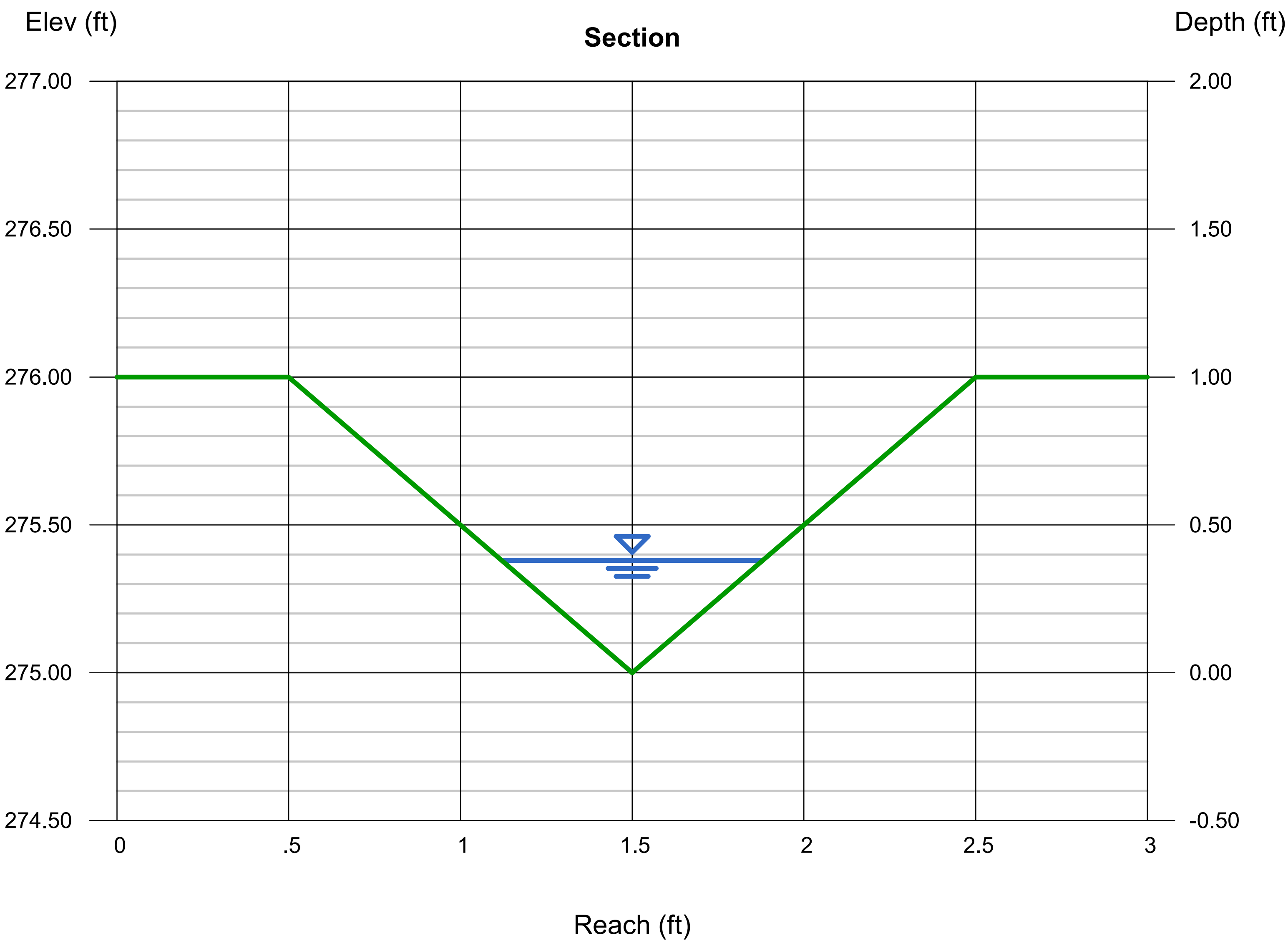
Side Slopes (z:1)	= 1.00, 1.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 275.00
Slope (%)	= 20.00
N-Value	= 0.014

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.73

Highlighted

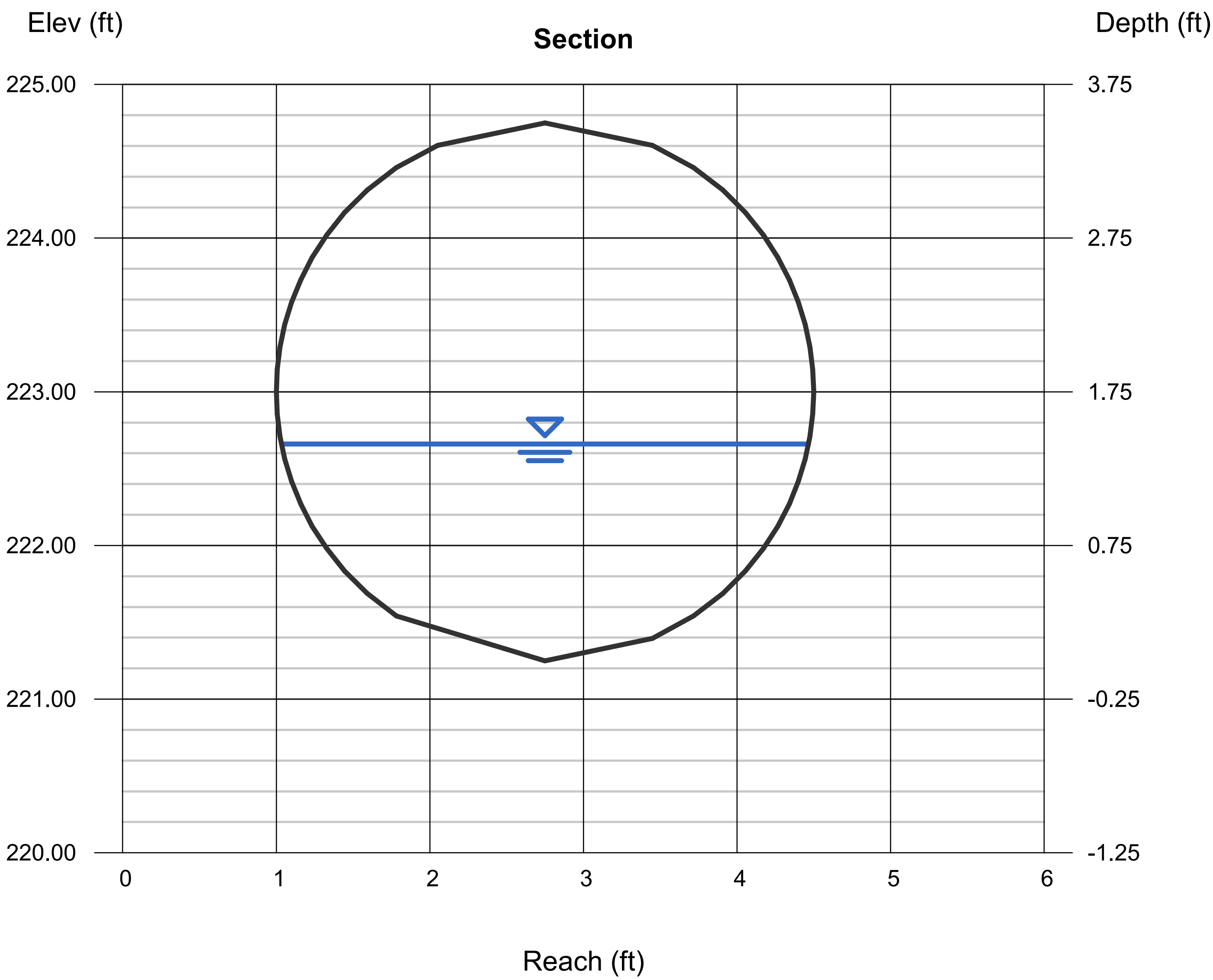
Depth (ft)	= 0.38
Q (cfs)	= 1.730
Area (sqft)	= 0.14
Velocity (ft/s)	= 11.98
Wetted Perim (ft)	= 1.07
Crit Depth, Yc (ft)	= 0.72
Top Width (ft)	= 0.76
EGL (ft)	= 2.61



Channel Report

Qc (Basin 2-5, 7-10, Offsite)

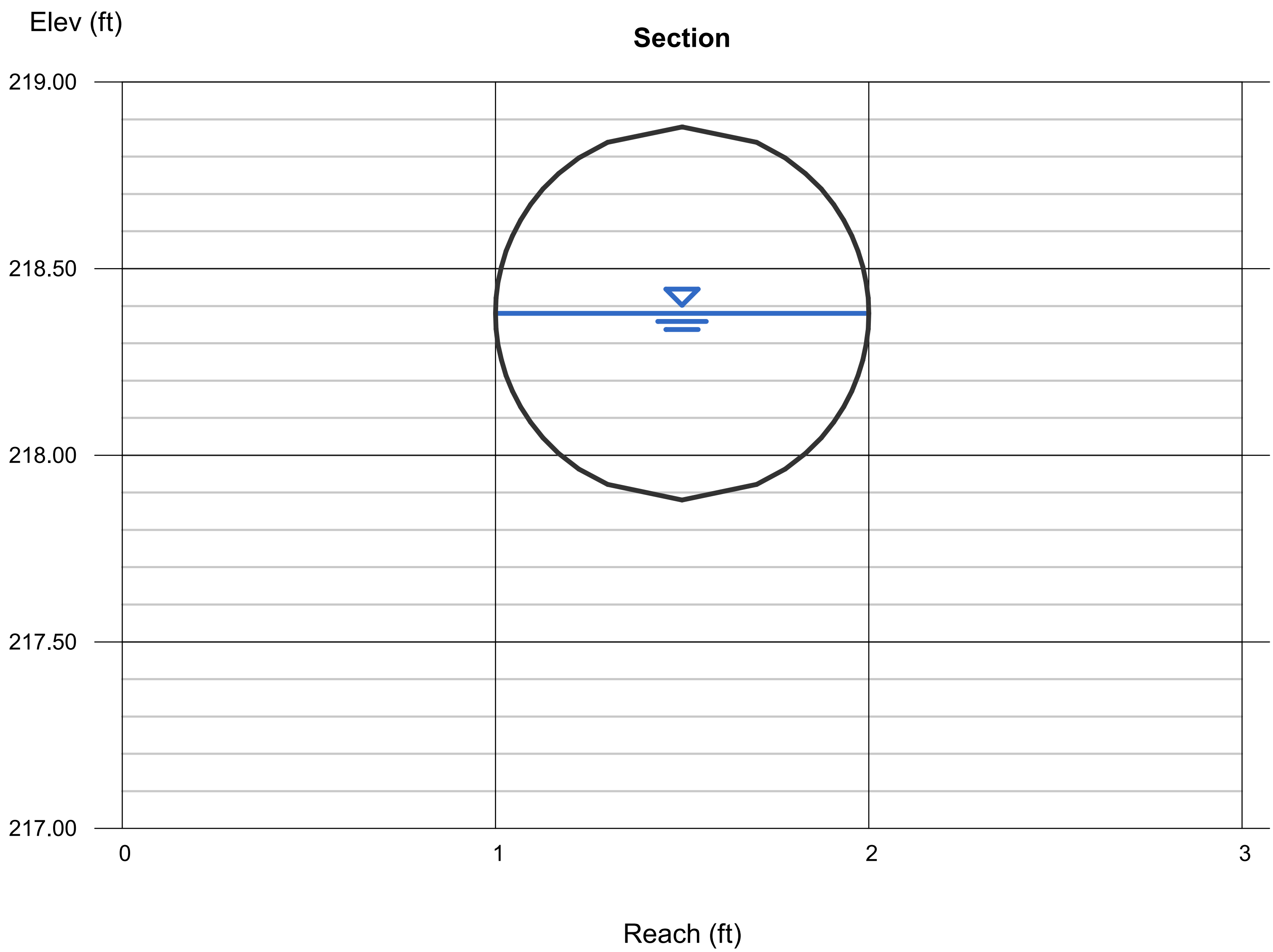
Circular		**Highlighted**	
Diameter (ft)	= 3.50	Depth (ft)	= 1.41
		Q (cfs)	= 97.88
		Area (sqft)	= 3.66
Invert Elev (ft)	= 221.25	Velocity (ft/s)	= 26.77
Slope (%)	= 25.00	Wetted Perim (ft)	= 4.83
N-Value	= 0.023	Crit Depth, Yc (ft)	= 3.05
		Top Width (ft)	= 3.44
Calculations		EGL (ft)	= 12.55
Compute by:	Known Q		
Known Q (cfs)	= 97.88		



Channel Report

Qd (Basin 6)

Circular		**Highlighted**	
Diameter (ft)	= 1.00	Depth (ft)	= 0.50
		Q (cfs)	= 8.670
		Area (sqft)	= 0.39
Invert Elev (ft)	= 217.88	Velocity (ft/s)	= 21.96
Slope (%)	= 25.00	Wetted Perim (ft)	= 1.57
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.99
		Top Width (ft)	= 1.00
Calculations		EGL (ft)	= 8.00
Compute by:	Known Q		
Known Q (cfs)	= 8.67		



Qe (Basin 11)

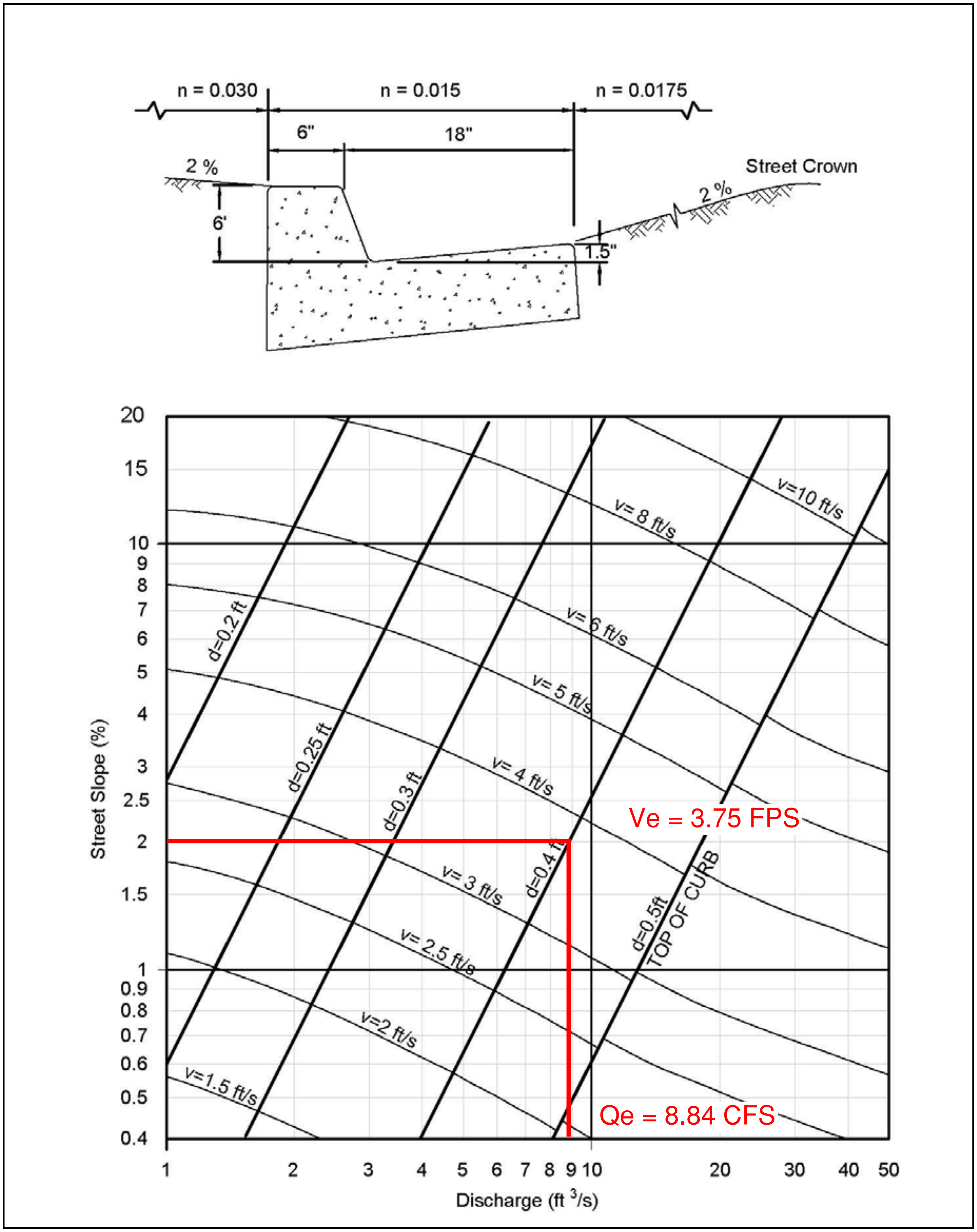


Figure 3-2: Gutter and Roadway Discharge-Velocity Chart (6" Curb)

APPENDIX D

PROPOSED RATIONAL METHOD CALCULATIONS

Rational Method

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	0.96	91%	0.87	705	9.0	1.3%	10.1	3.8	3.16
3	1.46	100%	0.90	115	2.25	2.0%	5.0	5.9	7.79
4	0.35	86%	0.82	85	1.3	1.5%	5.0	5.9	1.70
5	1.03	100%	0.90	150	3.00	2.0%	5.0	5.9	5.50
6	0.61	95%	0.87	205	3.5	1.7%	5.0	5.9	3.16
7	2.33	89%	0.84	445	20.0	4.5%	6.0	5.3	10.37
8	2.07	92%	0.86	540	21.5	4.0%	6.4	5.1	8.97
9	2.11	80%	0.79	600	22.0	3.7%	8.8	4.1	6.84
10	0.53	94%	0.87	415	18.25	4.4%	5.2	5.8	2.67
11	0.68	97%	0.88	420	14.0	3.3%	5.3	5.7	3.42
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
13	0.16	100%	0.90	75	1.5	2.0%	5.0	5.9	0.85
14	0.10	40%	0.57	25	3.0	10.0%	5.0	5.9	0.34
15	0.63	89%	0.84	250	4.00	1.6%	6.4	5.1	2.68
16	0.25	100%	0.90	75	1.5	2.0%	5.0	5.9	1.33
17	0.85	88%	0.84	140	5.5	3.9%	5.0	5.9	4.21
18	0.81	85%	0.82	245	5.0	2.0%	6.3	5.1	3.40
19	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
20	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
21	0.23	48%	0.61	215	2.0	0.7%	14.5	3.0	0.42
22	1.48	90%	0.84	300	8.5	2.8%	5.6	5.5	6.86
23	0.07	29%	0.51	75	2.0	2.0%	7.3	4.6	0.16
								Total Discharge:	82.18

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
1	1.44	1.31	0.91	0.85

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
1	CB	355	4.5	1.3	0.85	7.8

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
1	2.25	7.8	4.4

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
1	0.85	4.4	1.44	5.44

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
2	0.96	0.91	0.95	0.87

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
2	CI	705	9	1.3	0.87	10.1

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
2	2.25	10.1	3.8

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
2	0.87	3.8	0.96	3.16

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
3	1.46	1.46	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
3	RD	115	2.25	2.0	0.90	3.1
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
3	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
3	0.90	5.9	1.46	7.79

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
4	0.35	0.30	0.86	0.82

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
4	AD	85	1.3	1.5	0.82	4.1
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
4	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
4	0.82	5.9	0.35	1.70

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
5	1.03	1.03	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
5	BMP	150	3.00	2.0	0.90	3.5
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
5	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
5	0.90	5.9	1.03	5.50

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
6	0.61	0.58	0.95	0.87

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
6	CB	205	3.5	1.7	0.87	4.9
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
6	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
6	0.87	5.9	0.61	3.16

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
7	2.33	2.08	0.89	0.84

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
7	CB	445	20	4.5	0.84	6.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
7	2.25	6.0	5.3

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
7	0.84	5.3	2.33	10.37

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
8	2.07	1.91	0.92	0.86

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
8	CI	540	21.5	4.0	0.86	6.4

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
8	2.25	6.4	5.1

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
8	0.86	5.1	2.07	8.97

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
9	2.11	1.69	0.80	0.79

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
9	BMP	600	22	3.7	0.79	8.8

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
9	2.25	8.8	4.1

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
9	0.79	4.1	2.11	6.84

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
10	0.53	0.50	0.94	0.87

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
10	CI	415	18.25	4.4	0.87	5.2

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
10	2.25	5.2	5.8

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
10	0.87	5.8	0.53	2.67

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
11	0.68	0.66	0.97	0.88

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
11	C&G	420	14.0	3.3	0.88	5.3

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
11	2.25	5.3	5.7

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
11	0.88	5.7	0.68	3.42

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
12	1.21	0.02	0.02	0.36

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
12	BD	200	17	8.5	0.36	9.2

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
12	2.25	9.2	4.0

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
12	0.36	4.0	1.21	1.73

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
13	0.16	0.16	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
13	BMP	75	1.5	2.0	0.90	2.5
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
13	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
13	0.90	5.9	0.16	0.85

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
14	0.10	0.04	0.40	0.57

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
14	AD	25	3	10.0	0.57	2.2
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
14	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
14	0.57	5.9	0.1	0.34

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
15	0.63	0.56	0.89	0.84

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
15	BMP	250	4.00	1.6	0.84	6.4

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
15	2.25	6.4	5.1

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
15	0.84	5.1	0.63	2.68

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
16	0.25	0.25	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
16	BMP	75	1.5	2.0	0.90	2.5
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
16	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
16	0.90	5.9	0.25	1.33

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
17	0.85	0.75	0.88	0.84

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
17	BMP	140	5.50	3.9	0.84	3.6
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
17	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
17	0.84	5.9	0.85	4.21

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
18	0.81	0.69	0.85	0.82

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% ($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
18	BMP	245	5	2.0	0.82	6.3

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
18	2.25	6.3	5.1

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
18	0.82	5.1	0.81	3.40

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
19	0.11	0.11	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
19	BMP	75	1.5	2.0	0.90	2.5
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
19	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
19	0.90	5.9	0.11	0.59

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
20	0.11	0.11	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
20	BMP	75	1.5	2.0	0.90	2.5
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
20	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
20	0.90	5.9	0.11	0.59

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
21	0.23	0.11	0.48	0.61

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
21	BMP	215	2	0.7	0.61	14.5

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
21	2.25	14.5	3.0

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
21	0.61	3.0	0.23	0.42

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
22	1.48	1.33	0.90	0.84

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	$(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
22	BMP	300	8.50	2.8	0.84	5.6

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
22	2.25	5.6	5.5

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
22	0.84	5.5	1.48	6.86

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
23	0.07	0.02	0.29	0.51

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
23	BMP	75	2	2.0	0.51	7.3

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
23	2.25	7.3	4.6

Step 5: Determine Peak Discharge

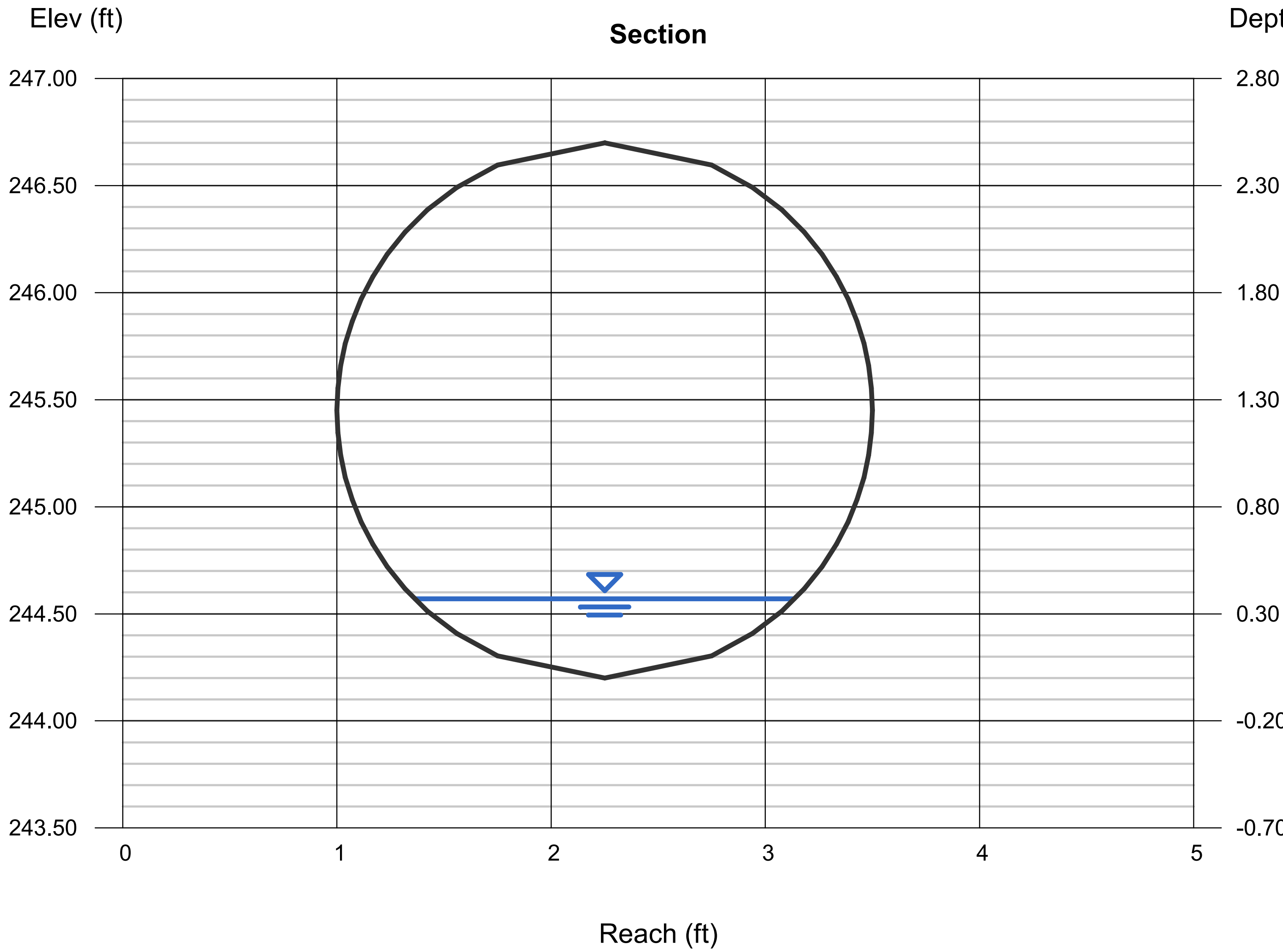
DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
23	0.51	4.6	0.07	0.16

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Apr 11 2018

Qa (Basin 1)

Circular		**Highlighted**	
Diameter (ft)	= 2.50	Depth (ft)	= 0.37
		Q (cfs)	= 5.440
		Area (sqft)	= 0.45
Invert Elev (ft)	= 244.20	Velocity (ft/s)	= 12.00
Slope (%)	= 25.00	Wetted Perim (ft)	= 1.97
N-Value	= 0.023	Crit Depth, Yc (ft)	= 0.77
		Top Width (ft)	= 1.78
Calculations		EGL (ft)	= 2.61
Compute by:	Known Q		
Known Q (cfs)	= 5.44		

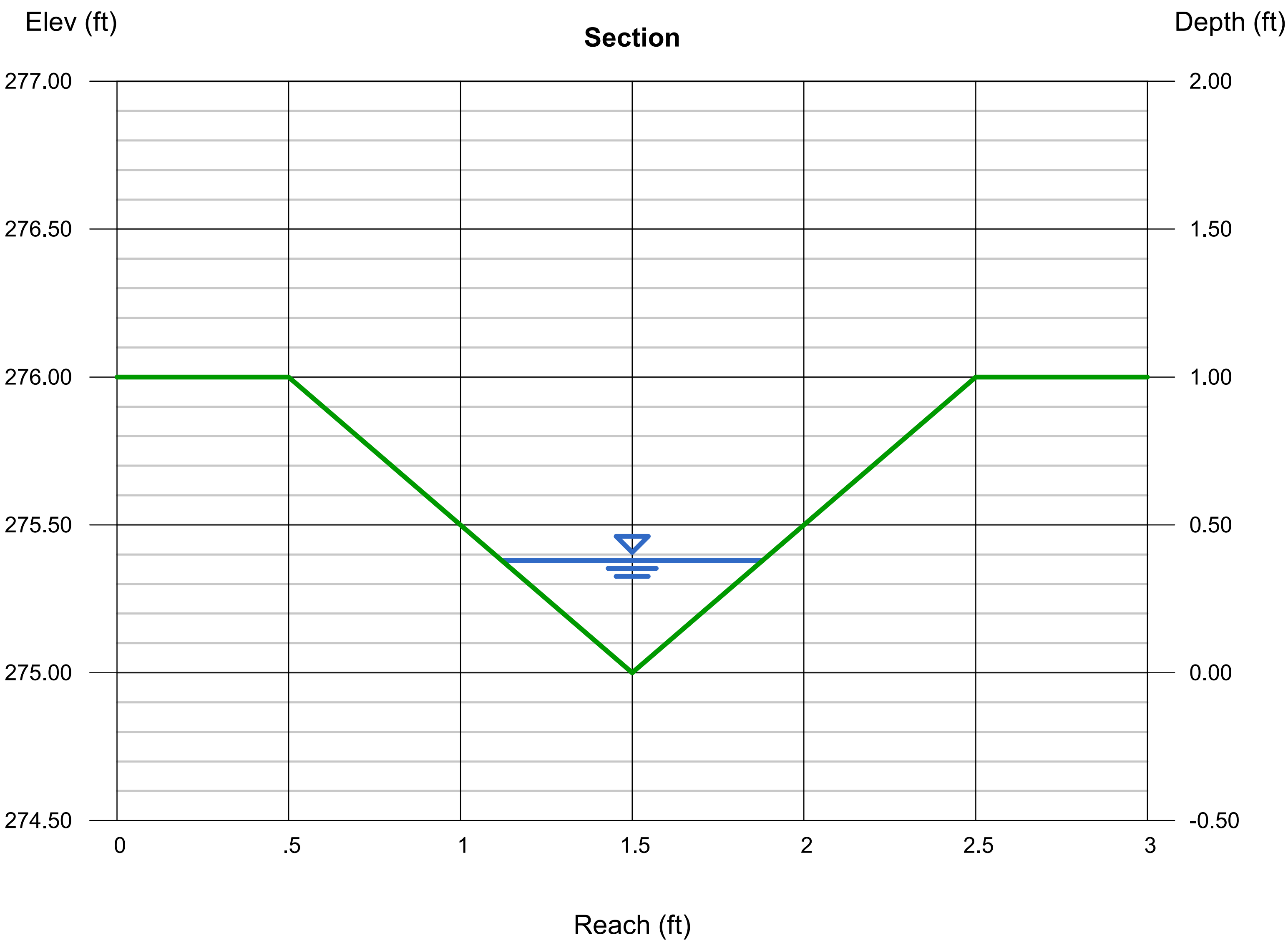


Channel Report

Qb (Basin 12)

Triangular	
Side Slopes (z:1)	= 1.00, 1.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 275.00
Slope (%)	= 20.00
N-Value	= 0.014
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 1.73

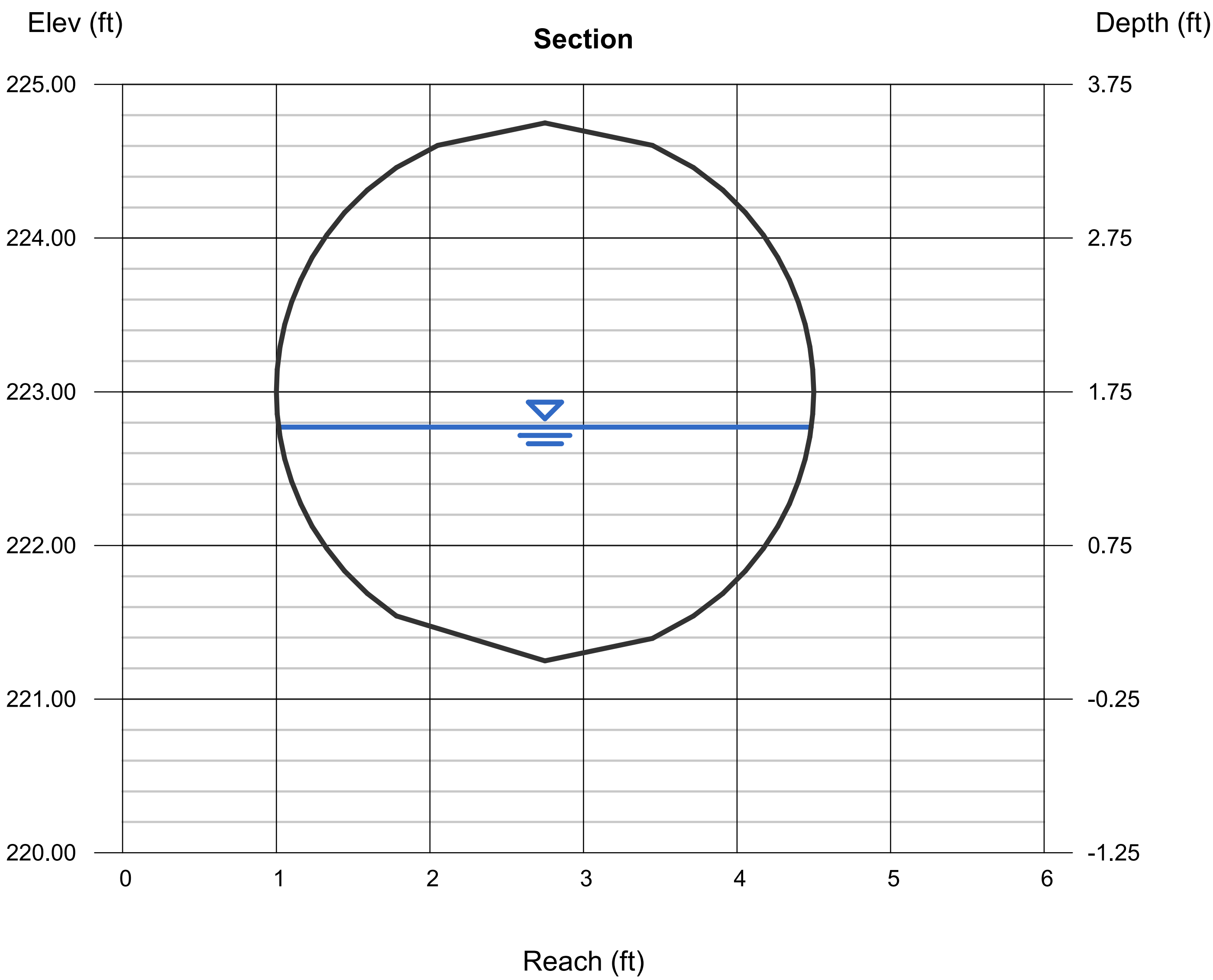
Highlighted	
Depth (ft)	= 0.38
Q (cfs)	= 1.730
Area (sqft)	= 0.14
Velocity (ft/s)	= 11.98
Wetted Perim (ft)	= 1.07
Crit Depth, Yc (ft)	= 0.72
Top Width (ft)	= 0.76
EGL (ft)	= 2.61



Channel Report

Qc (Basin 2-5, 7-10, 13-23, Offsite)

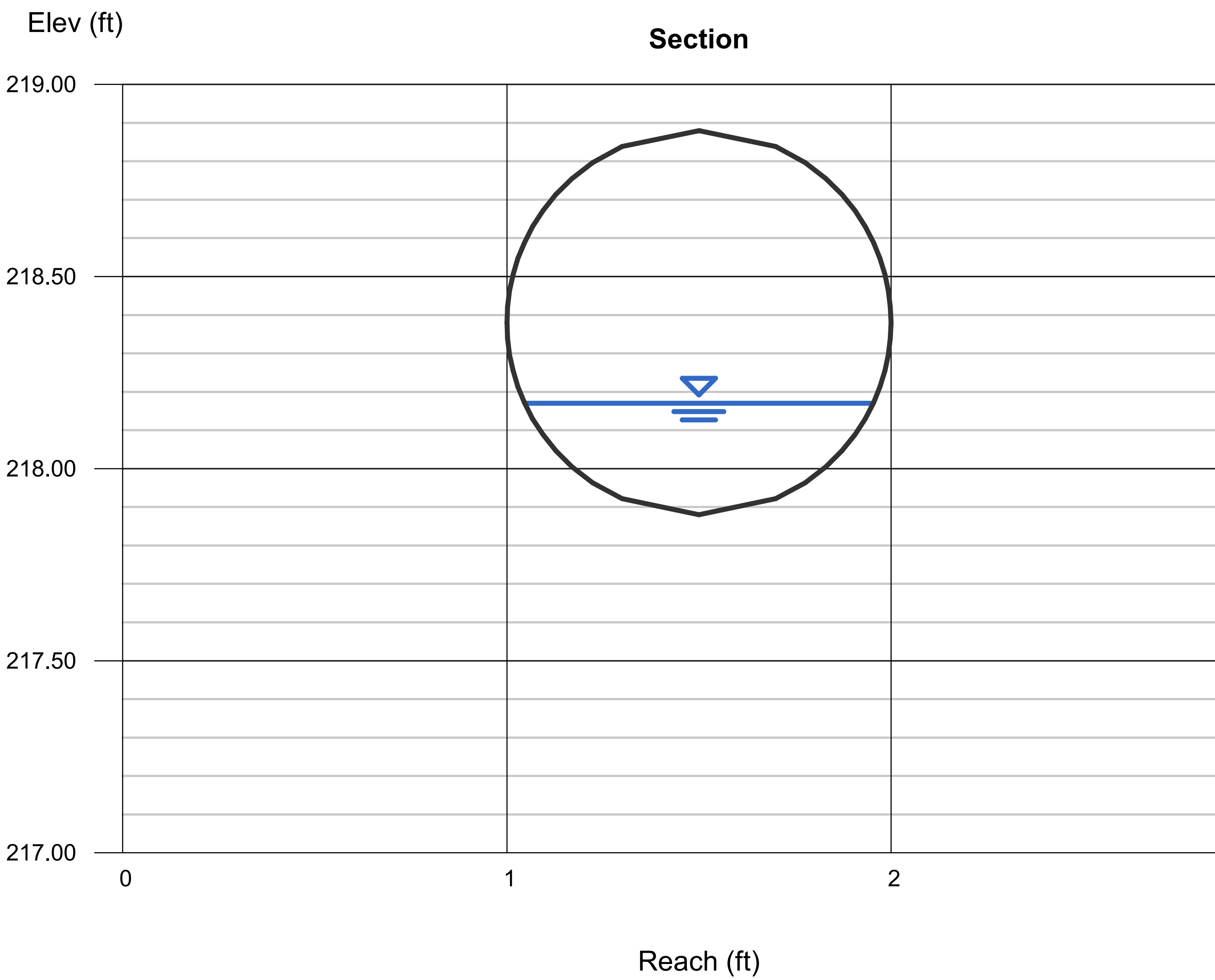
Circular		**Highlighted**	
Diameter (ft)	= 3.50	Depth (ft)	= 1.52
		Q (cfs)	= 110.43
		Area (sqft)	= 4.01
Invert Elev (ft)	= 221.25	Velocity (ft/s)	= 27.51
Slope (%)	= 25.00	Wetted Perim (ft)	= 5.04
N-Value	= 0.023	Crit Depth, Yc (ft)	= 3.18
		Top Width (ft)	= 3.47
Calculations		EGL (ft)	= 13.29
Compute by:	Known Q		
Known Q (cfs)	= 110.43		



Channel Report

Qd (Basin 6)

Circular		**Highlighted**	
Diameter (ft)	= 1.00	Depth (ft)	= 0.29
		Q (cfs)	= 3.160
		Area (sqft)	= 0.19
Invert Elev (ft)	= 217.88	Velocity (ft/s)	= 16.62
Slope (%)	= 25.00	Wetted Perim (ft)	= 1.14
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.77
		Top Width (ft)	= 0.91
Calculations		EGL (ft)	= 4.58
Compute by:	Known Q		
Known Q (cfs)	= 3.16		



Qe (Basin 11)

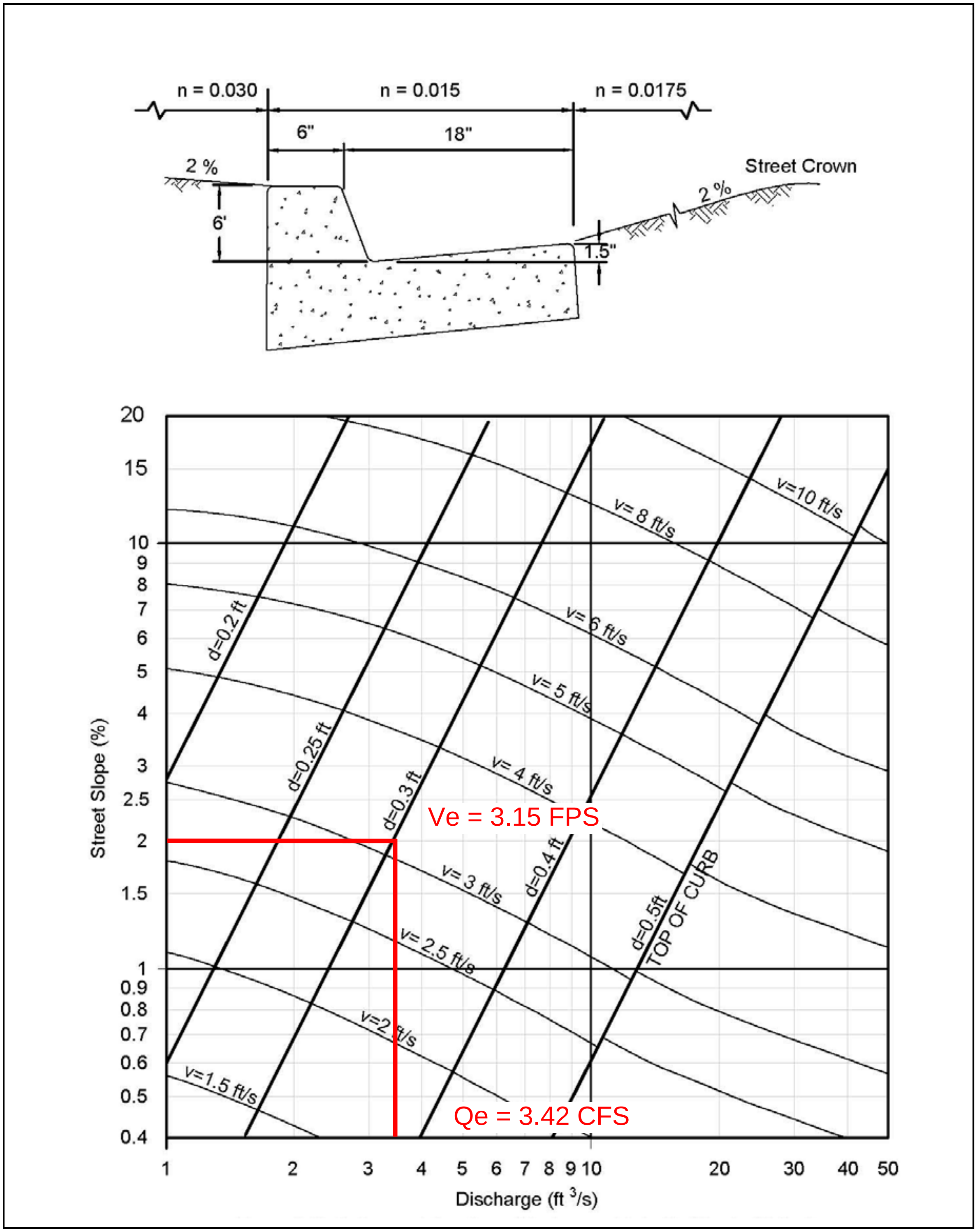


Figure 3-2: Gutter and Roadway Discharge-Velocity Chart (6” Curb)

APPENDIX E

BEST MANAGEMENT PRACTICES CALCULATIONS

BMP Summary

DMA	DMA Area (SF)	BMP Name	Required BMP Area (SF)	Provided BMP Area (SF)	BMP Type
5	45,000	5	1,215	1,911	BF-1
- -	- -	5A	- -	361	BF-1
- -	- -	5B	- -	949	BF-1
- -	- -	5C	- -	296	BF-1
- -	- -	5D	- -	305	BF-1
9	91,705	9	2,146	2,667	BF-1
- -	- -	9A	- -	871	BF-1
- -	- -	9B	- -	1,574	BF-1
- -	- -	9C	- -	222	BF-1
13	6,935	13	188	1,168	BF-1
- -	- -	13A	- -	565	BF-1
- -	- -	13B	- -	603	BF-1
15	27,238	15	687	724	BF-1
- -	- -	15A	- -	374	BF-1
- -	- -	15B	- -	350	BF-1
16	11,000	16	297	959	BF-1
- -	- -	16A	- -	509	BF-1
- -	- -	16B	- -	450	BF-1
17	36,815	17	917	1,097	BF-1
18	35,214	18	856	1,065	BF-1
19	4,801	19	130	208	BF-1
- -	- -	19A	- -	103	BF-1
- -	- -	19B	- -	105	BF-1
20	5,000	20	135	190	BF-1
- -	- -	20A	- -	92	BF-1
- -	- -	20B	- -	98	BF-1
21	9,829	21	174	561	BF-1
22	64,449	22	1,625	1,896	BF-1
- -	- -	22A	- -	205	BF-1
- -	- -	22B	- -	330	BF-1
- -	- -	22C	- -	205	BF-1
- -	- -	22D	- -	535	BF-1
- -	- -	22E	- -	621	BF-1
23	2,848	23	45	150	BF-1

Worksheet B.2-1 DCV (DMA 5)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	1.03	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	1683	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 9)

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	2.11	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.78	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	3634	cubic-feet

C[(73528*0.90)+(18177*0.30)]/91705 = 0.78

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 13)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.16	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	262	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 15)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.63	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.84	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	961	cubic-feet

C[(24526*0.90)+(2712*0.30)]/27238 = 0.84

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 16)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.25	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	409	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 17)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.85	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.83	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	1281	cubic-feet

C[(32706*0.90)+(4109*0.30)]/36815 = 0.83

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 18)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.81	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.81	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	1191	cubic-feet

C[(30080*0.90)+(5134*0.30)]/35214 = 0.81

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 19)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.11	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	180	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 20)

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.11	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	180	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 21)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.23	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.59	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	247	cubic-feet

C[(4753*0.90)+(5076*0.30)]/9829 = 0.59

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 22)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	1.48	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.84	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	2257	cubic-feet

C[(57999*0.90)+(6450*0.30)]/64449 = 0.84

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 23)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.07	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.52	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	67	cubic-feet

C[(1064*0.90)+(1784*0.30)]/2848 = 0.52

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 5)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	1683	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	1200	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	180	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	1503	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	2255	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	601	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	1128	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	903	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	45000	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	1215	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	1215	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 9)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	3634	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	2150	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	323	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	3311	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

City of San Diego
TRANSPORTATION & STORM WATER

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	4967	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	1324	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	2484	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	1988	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	91705	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.78	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	2146	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	2146	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 13)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	262	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	200	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	30	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	232	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	348	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	93	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	174	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	140	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	6935	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	188	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	188	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 15)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	961	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	700	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	105	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	856	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	1284	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	343	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	642	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	514	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	27238	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.84	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	687	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	687	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 16)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	409	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	300	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	45	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	364	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	546	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	146	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	273	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	219	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	11000	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	297	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	297	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 17)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	1281	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	950	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	143	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	1138	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	1707	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	456	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	854	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	684	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	36815	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.83	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	917	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	917	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 18)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	1191	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	875	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	132	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	1059	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	1589	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	424	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	795	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	636	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	35214	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.81	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	856	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	856	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 19)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	180	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	150	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	23	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	157	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	236	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	63	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	118	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	95	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	4801	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	130	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	130	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 20)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	180	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	150	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	23	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	157	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs			Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV				
20	Required biofiltered volume [1.5 x Line 10]	236	cubic-feet	
21	Required Footprint [Line 20/ Line 19] x 12	63	sq-ft	
Option 2 - Store 0.75 of remaining DCV in pores and ponding				
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	118	cubic-feet	
23	Required Footprint [Line 22/ Line 18] x 12	95	sq-ft	
Footprint of the BMP				
24	Area draining to the BMP	5000	sq-ft	
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90		
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03		
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	135	sq-ft	
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	135	sq-ft	
Check for Volume Reduction [Not applicable for No Infiltration Condition]				
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless	
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless	
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No	

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 21)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	247	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	200	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	30	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	217	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	326	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	87	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	163	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	131	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	9829	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.59	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	174	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	174	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 22)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	2257	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	1650	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	248	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	2009	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	3014	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	804	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	1507	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	1206	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	64449	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.84	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	1625	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	1625	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 23)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	67	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	75	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	12	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	55	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	83	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	23	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	42	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	34	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	2848	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.52	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	45	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	45	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

E.13. BF-1 Biofiltration

Location: 43rd Street and Logan Avenue, San Diego, California

MS4 Permit Category
Biofiltration
Manual Category
Biofiltration
Applicable Performance Standard
Pollutant Control Flow Control
Primary Benefits

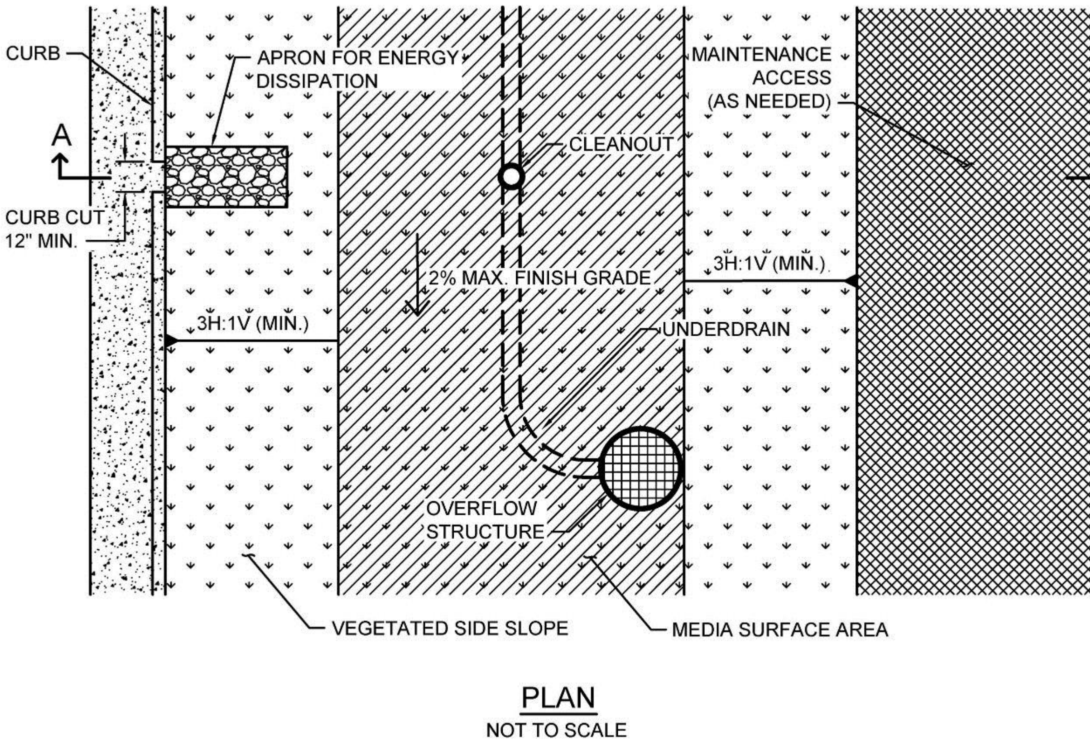
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation (Optional)

Description

Biofiltration (Bioretention with underdrain) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Bioretention with underdrain facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. Because these types of facilities have limited or no infiltration, they are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and plant uptake.

Typical bioretention with underdrain components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer (aka choking layer) consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure



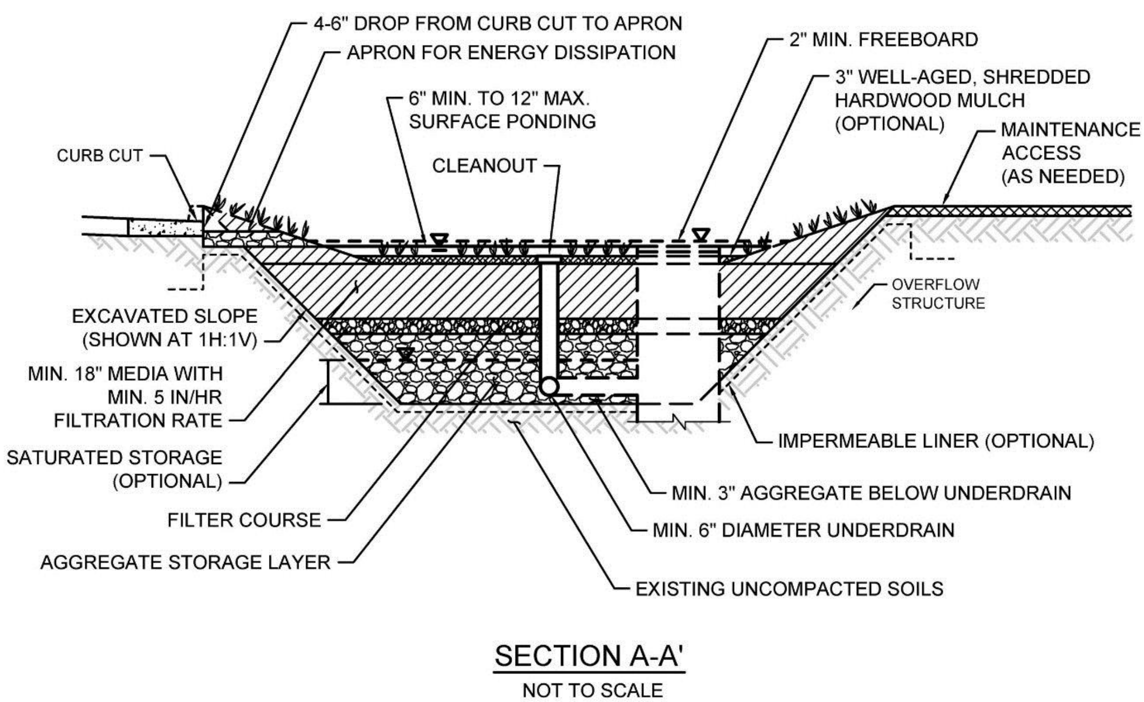


Figure E.13-E.13-1: Typical plan and Section view of a Biofiltration BMP

Design Adaptations for Project Goals

Biofiltration Treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration, and an underdrain is provided at the bottom to carry away filtered runoff. This configuration is considered to provide biofiltration treatment via flow through the media layer. Storage provided above the underdrain within surface ponding, media, and aggregate storage is considered included in the biofiltration treatment volume. Saturated storage within the aggregate storage layer can be added to this design by raising the underdrain above the bottom of the aggregate storage layer or via an internal weir structure designed to maintain a specific water level elevation.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer above the underdrain. This will allow for significant detention storage, which can be controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Bioretention with underdrain must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the City Engineer if it is determined to be appropriate:

	Siting and Design	Intent/Rationale
□	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
□	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
□	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the City Engineer if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the City Engineer for proper performance of the regional BMP.
□	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
Surface Ponding		

	Siting and Design	Intent/Rationale
☐	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hour for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the City Engineer if certified by a landscape architect or agronomist.
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the City Engineer if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
☐	A minimum of 2 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20.	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch (Mandatory)		
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer		

	Siting and Design	Intent/Rationale
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. Additional Criteria for media hydraulic conductivity described in the bioretention soil media model specification (Appendix F.4)	A filtration rate of at least 5 inches per hour allows soil to drain between events. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.
☐	Media is a minimum 18 inches deep, meeting the following media specifications: Model biorention soil media specification provided in Appendix F.4 <u>or</u> County of San Diego Low Impact Development Handbook: Appendix G - Bioretention Soil Specification (June 2014, unless superseded by more recent edition). Alternatively, for proprietary designs and custom media mixes not meeting the media specifications, the media meets the pollutant treatment performance criteria in Section F.1.	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary designs, compliance with Appendix F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
☐	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.
Filter Course Layer		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade and can result in poor water quality performance for turbidity and suspended solids. Filter fabric is more likely to clog.

	Siting and Design	Intent/Rationale
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.
☐	To reduce clogging potential, a two-layer filter course (aka choking stone system) is used consisting of one 3" layer of clean and washed ASTM 33 Fine Aggregate Sand overlying a 3" layer of ASTM No 8 Stone (Appendix F.5).	This specification has been developed to maintain permeability while limiting the migration of media material into the stone reservoir and underdrain system.
Aggregate Storage Layer		
☐	ASTM #57 open graded stone is used for the storage layer and a two layer filter course (detailed above) is used above this layer	This layer provides additional storage capacity. ASTM #8 stone provides an acceptable choking/bridging interface with the particles in ASTM #57 stone.
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
Inflow, Underdrain, and Outflow Structures		
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 8 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains should be affixed with an upturned elbow to an elevation at least 9 to 12 inches above the invert of the underdrain.	An upturned elbow reduces velocity in the underdrain pipe and can help reduce mobilization of sediments from the underdrain and media bed.

	Siting and Design	Intent/Rationale
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An underdrain cleanout with a minimum 8-inch diameter and lockable cap is placed every 50 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design bioretention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet presented in Appendix B.5 to size biofiltration BMPs.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If bioretention with underdrain cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After bioretention with underdrain has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

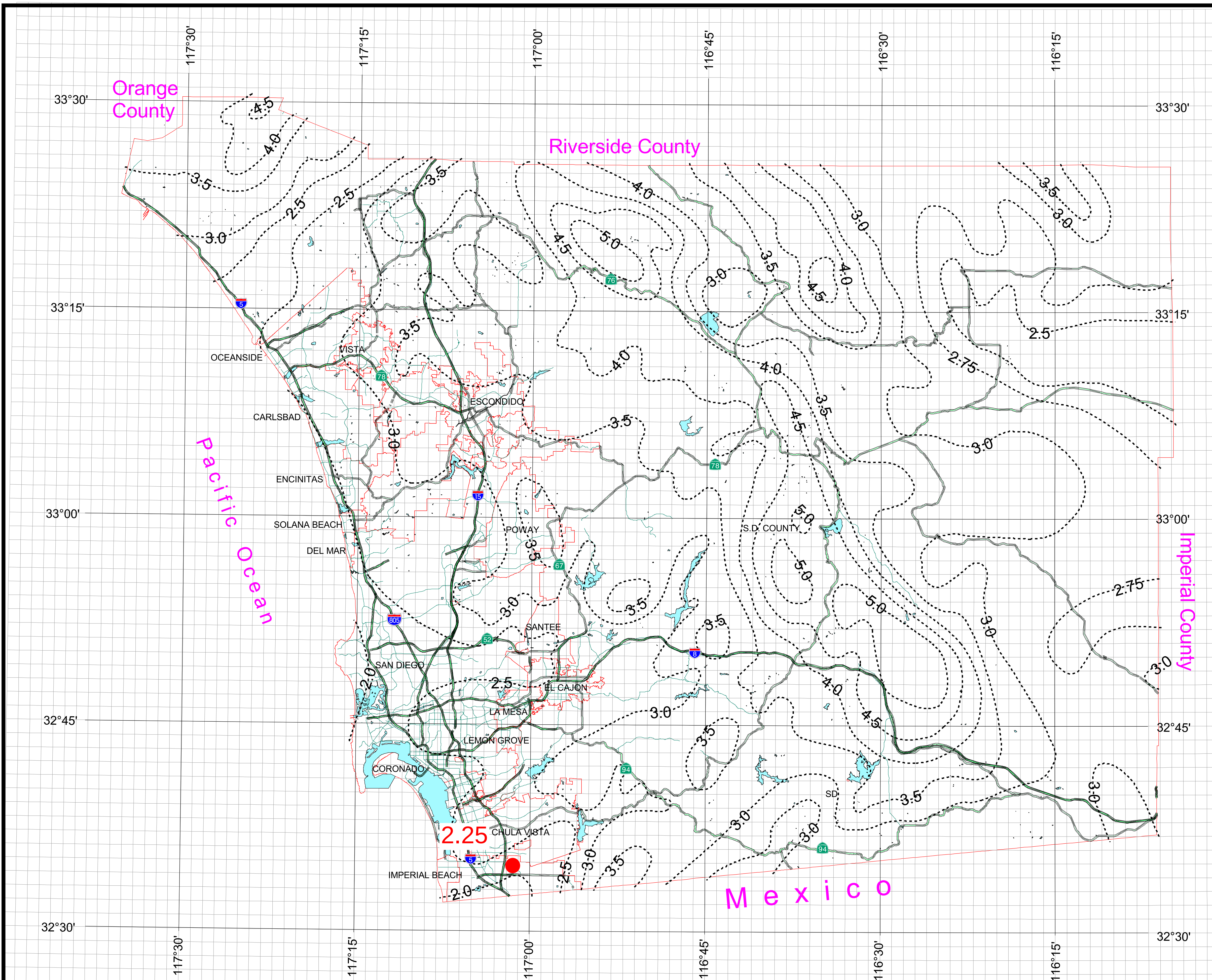
E.21. PL Plant List

Plant Name		Irrigation Requirements		Preferred Location in Basin		Applicable Bioretention Sections (Un-Lined Facilities)				Applicability to Flow-Through Planter? (Lined Facility)	
Latin Name	Common Name	Temporary Irrigation during Plant Establishment Period	Permanent Irrigation (Drip / Spray)(1)	Basin Bottom	Basin Side Slopes	Section A Treatment-Only Bioretention in Hydrologic Soil Group A or B Soils	Section B Treatment-Only Bioretention in Hydrologic Soil Group C or D soils	Section C Treatment Plus Flow Control Bioretention in Hydrologic Soil Group A or B Soils	Section D Treatment Plus Flow Control Bioretention in Hydrologic Soil Group C or D Soils	**NO** Applicable to Un-lined Facilities Only (Bioretention Only)	**YES** Can Use in Lined or Un-Lined Facility (Flow-Through Planter OR Bioretention)
TREES(2)											
Alnus rhombifolia	White Alder	X		X	X	X	X	X	X	X	
Platanus racemosa	California Sycamore	X		X	X	X	X	X	X	X	
Salix lasiolepsis	Arroyo Willow	X			X	X	X	X	X	X	
Salix lucida	Lance-Leaf Willow	X			X	X	X	X	X	X	
Sambucus mexicana	Blue Elderberry	X			X	X	X	X	X	X	
SHRUBS / GROUNDCOVER											
Achillea millefolium	Yarrow	X			X	X	X				X
Agrostis palens	Thingrass	X			X	X	X	X	X		X
Anemopsis californica	Yerba Manza	X			X	X	X	X	X		X
Baccharis douglasii	Marsh Baccahris	X	X	X		X	X	X	X		X
Carex praegracillis	California Field Sedge	X	X	X		X	X	X	X		X
Carex spissa	San Diego Sedge	X	X	X		X	X	X	X		X
Carex subfusca	Rusty Sedge	X	X	X	X	X	X	X	X		X
Distichlis spicata	Salt Grass	X	X	X		X	X	X	X		X
Eleocharis macrostachya	Pale Spike Rush	X	X	X		X	X	X	X		X
Festuca rubra	Red Fescue	X	X	X	X	X	X				X
Festuca californica	California Fescue	X	X		X	X	X				X
Iva hayesiana	Hayes Iva	X			X	X	X				X
Juncus Mexicana	Mexican Rush	X	X	X	X	X	X	X	X		X
Jucus patens	California Gray Rush	X	X	X	X	X	X	X	X		X
Leymus condensatus ‘Canyon Prince’	Canyon Prince Wild Rye	X	X	X	X	X	X	X	X		X
Mahonia nevinii	Nevin’s Barberry	X			X	X	X	X	X		X
Muhlenburgia rigens	Deergrass	X	X	X	X	X	X	X	X		X
Mimulus cardinalis	Scarlet Monkeyflower	X		X	X	X	X				X
Ribes speciosum	Fushia Flowering Goose.	X			X	X	X				X
Rosa californica	California Wild Rose	X	X		X	X	X				X
Scirpus cenuus	Low Bullrush	X	X	X		X	X	X	X		X
Sisyrinchium bellum	Blue-eyed Grass	X			X	X	X				X

1. All plants will benefit from some supplemental irrigation during hot dry summer months, particularly those on basin side slopes and further inland.
2. All trees should be planted a min. of 10’ away from any drain pipes or structures.

APPENDIX F

REFERENCES



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

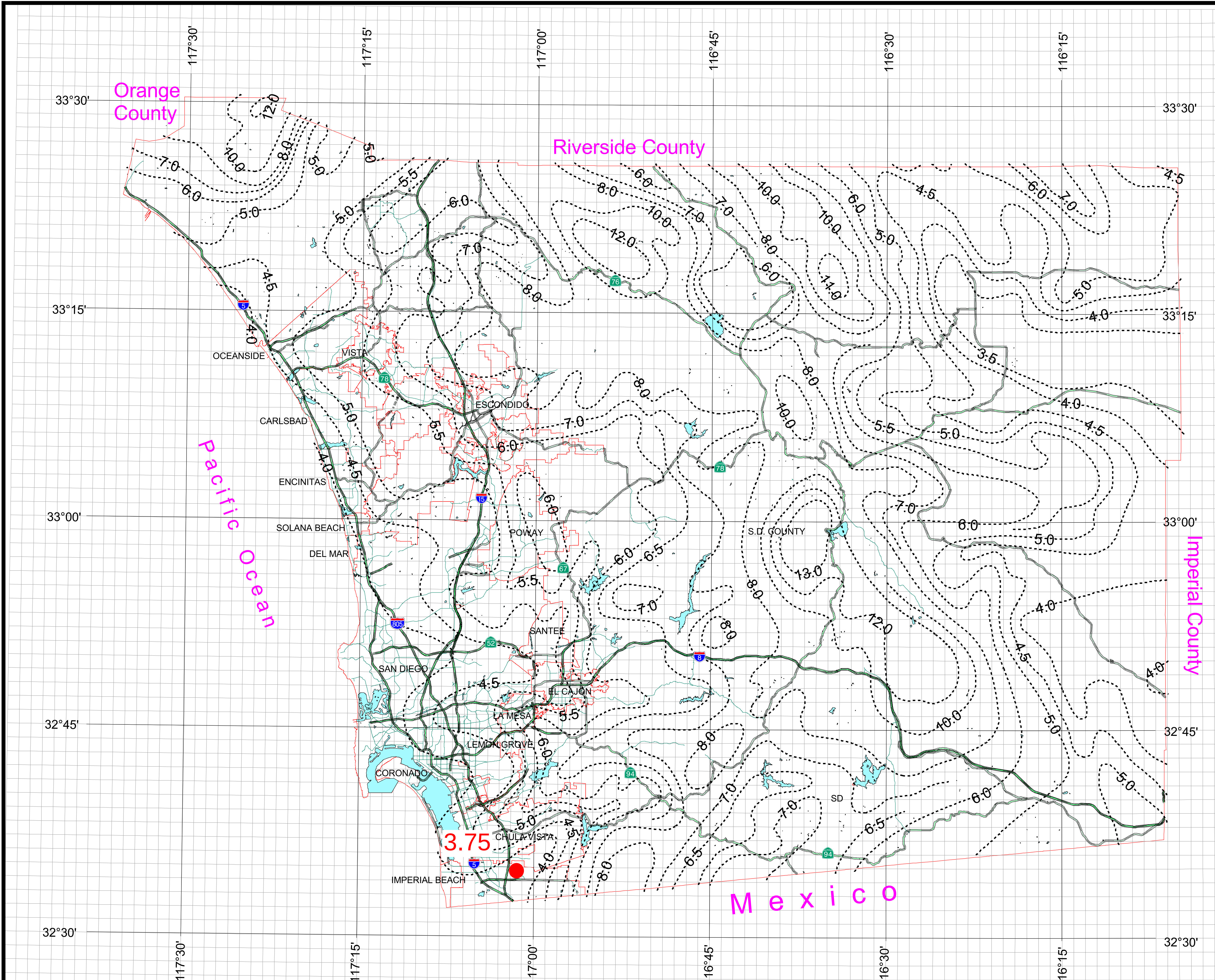
Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N S E W

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works Geographic Information Services

SanGIS
We Have San Diego Covered!

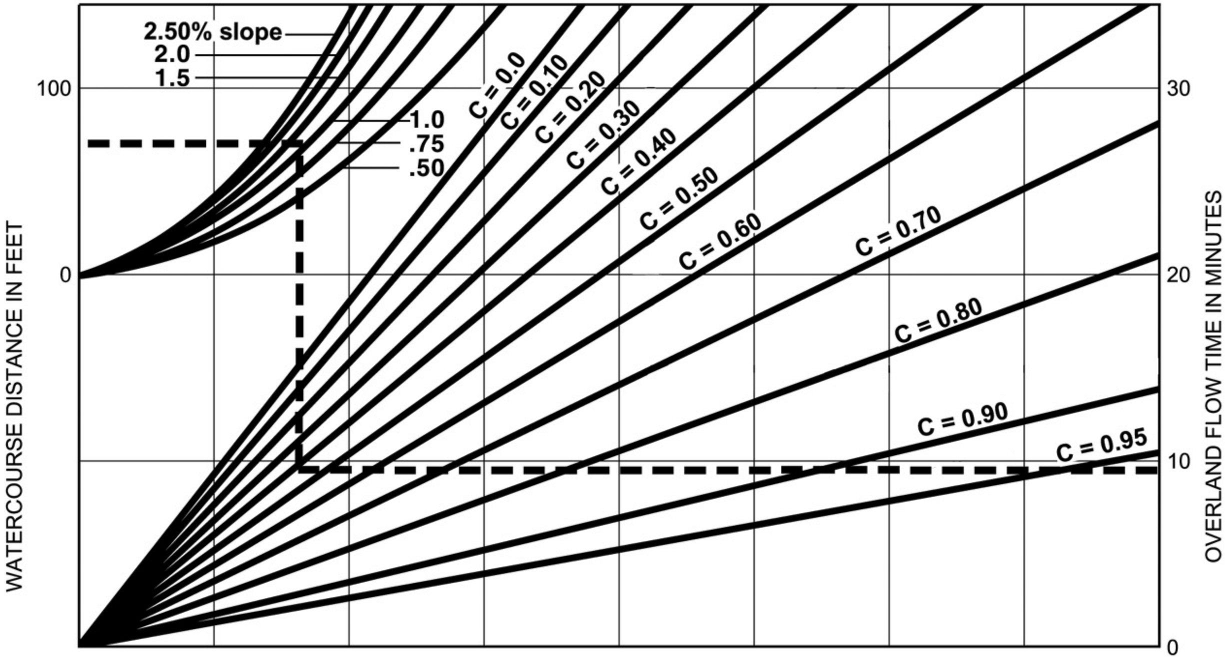
N S E W

3 0 3 Miles

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



EXAMPLE:

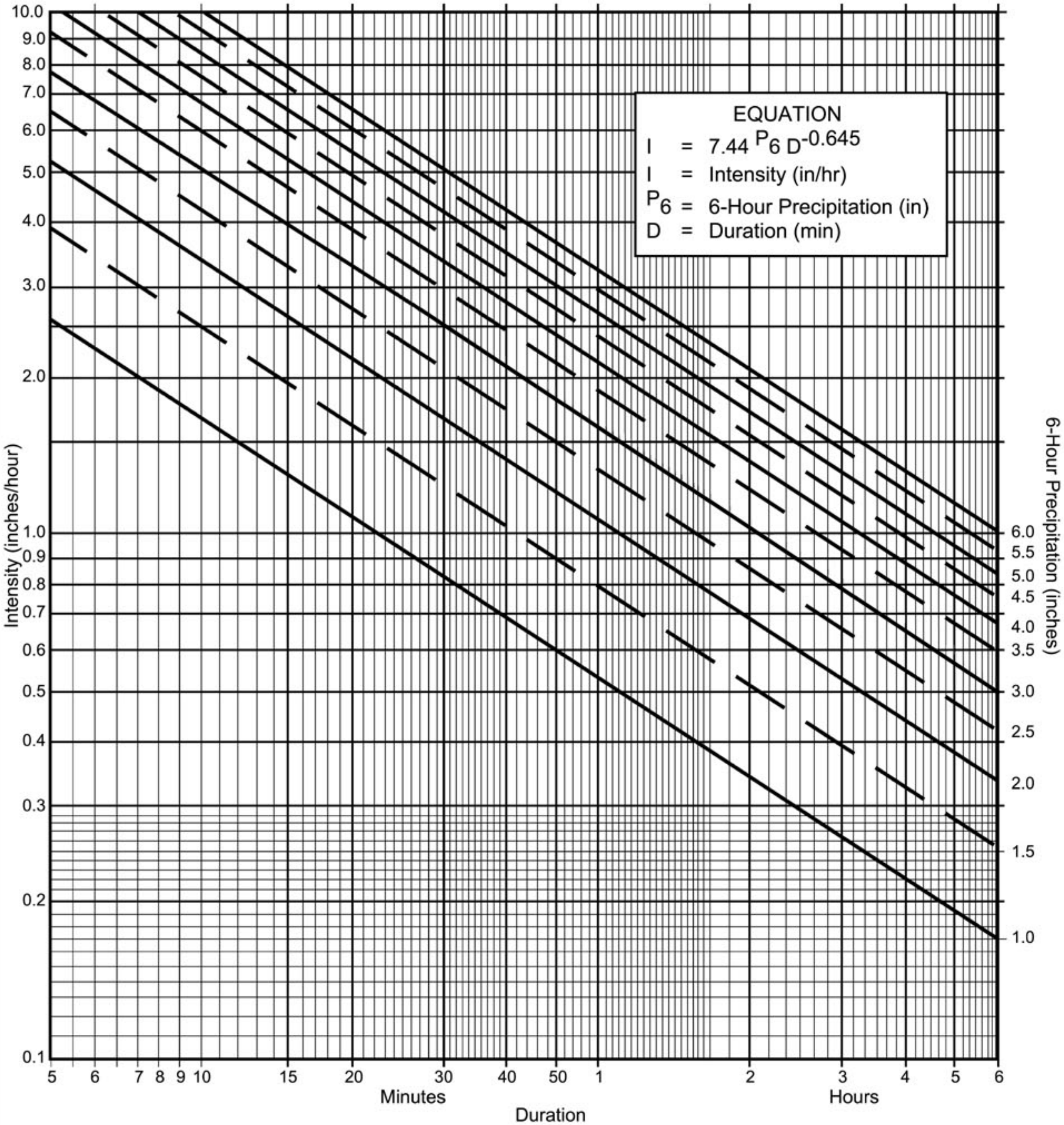
Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1\text{-}C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

Rational Formula - Overland Time of Flow Nomograph

FIGURE **3-3**



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency ______ year

(b) P_6 = ______ in., P_{24} = ______, $\frac{P_6}{P_{24}}$ = ______ %$^{(2)}$

(c) Adjusted $P_6^{(2)}$ = ______ in.

(d) t_x = ______ min.

(e) I = ______ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

The City of San Diego	**PRIORITY DEVELOPMENT PROJECT (PDP) STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) FOR**

The Shops at AMC Promenade
I.O. No.: 24007439
PTS #569517
D-Sheet No.:
ENGINEER OF WORK:

Samuel Waisbord, PE RCE 78071

PREPARED FOR:

HCP-CCI Palm Promenade, LLC

4340 Von Karman Avenue, Suite 110
Newport Beach, CA 92660
(949) 705-0405

PREPARED BY:

Nasland Engineering
4740 Ruffner Street
San Diego, CA 92111
(858) 292-7770

DATE: May 10, 2018

Approved by: City of San Diego Date

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TABLE OF CONTENTS

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ACRONYMS

APN	Assessor's Parcel Number
ASBS	Area of Special Biological Significance
BMP	Best Management Practice
CEQA	California Environmental Quality Act
CGP	Construction General Permit
DCV	Design Capture Volume
DMA	Drainage Management Areas
ESA	Environmentally Sensitive Area
GLU	Geomorphic Landscape Unit
GW	Ground Water
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
HU	Harvest and Use
INF	Infiltration
LID	Low Impact Development
LUP	Linear Underground/Overhead Projects
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
POC	Pollutant of Concern
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWPPP	Stormwater Pollutant Protection Plan
SWQMP	Storm Water Quality Management Plan
TMDL	Total Maximum Daily Load
WMAA	Watershed Management Area Analysis
WPCP	Water Pollution Control Program
WQIP	Water Quality Improvement Plan

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CERTIFICATION PAGE

Project Name:
Permit Application Number:

I hereby declare that I am the Engineer in Responsible Charge of design of storm water BMPs for this project, and that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the requirements of the Storm Water Standards, which is based on the requirements of SDRWQCB Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 (MS4 Permit).

I have read and understand that the City Engineer has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the Storm Water Standards. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable source control and site design BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the City Engineer is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

RCE Exp:

Engineer of Work's Signature, PE Number & Expiration Date

Samuel Waisbord

Print Name

Nasland Engineering

Company

Date

Engineer's Stamp

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SUBMITTAL RECORD

Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project. In last column indicate changes that have been made or indicate if response to plan check comments is included. When applicable, insert response to plan check comments.

Submittal Number	Date	Project Status	Changes
1	08/21/2017	☒ Preliminary Design/Planning/CEQA ☐ Final Design	Initial Submittal
2	01/31/2018	☒ Preliminary Design/Planning/CEQA ☐ Final Design	First Re-Submittal
3	04/20/2018	☒ Preliminary Design/Planning/CEQA ☐ Final Design	Second Re-Submittal
4		☐ Preliminary Design/Planning/CEQA ☐ Final Design	

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PROJECT VICINITY MAP

Project Name: The Shops at AMC Promenade
Permit Application Number:

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STORM WATER REQUIREMENTS APPLICABILITY CHECKLIST

Complete and attach DS-560 Form included in Appendix A.1

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<table>
<tr><th colspan="2">Applicability of Permanent, Post-Construction Storm Water BMP Requirements</th><th>Form I-1</th></tr>
<tr><td colspan="3">Project Identification</td></tr>
<tr><td colspan="3">Project Name: The Shops at AMC Promenade</td></tr>
<tr><td colspan="2">Permit Application Number:</td><td>Date: 01/31/2018</td></tr>
<tr><td colspan="3">Determination of Requirements</td></tr>
<tr><td colspan="3">The purpose of this form is to identify permanent, post-construction requirements that apply to the project. This form serves as a short <u>summary</u> of applicable requirements, in some cases referencing separate forms that will serve as the backup for the determination of requirements.

Answer each step below, starting with Step 1 and progressing through each step until reaching "Stop". Refer to Part 1 of Storm Water Standards sections and/or separate forms referenced in each step below.</td></tr>
<tr><td>Step</td><td>Answer</td><td>Progression</td></tr>
<tr><td rowspan="2">Step 1: Is the project a "development project"? See Section 1.3 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.</td><td>☒ Yes</td><td>Go to Step 2.</td></tr>
<tr><td>☐ No</td><td>Stop.
Permanent BMP requirements do not apply. No SWQMP will be required. Provide discussion below.</td></tr>
<tr><td colspan="3">Discussion / justification if the project is <u>not</u> a "development project" (e.g., the project includes <u>only</u> interior remodels within an existing building):</td></tr>
<tr><td rowspan="3">Step 2: Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions?
To answer this item, see Section 1.4 of the BMP Design Manual (Part 1 of Storm Water Standards) <u>in its entirety</u> for guidance, AND complete Storm Water Requirements Applicability Checklist.</td><td>☐ Standard Project</td><td>Stop.
Standard Project requirements apply.</td></tr>
<tr><td>☒ PDP</td><td>PDP requirements apply, including PDP SWQMP.
Go to Step 3.</td></tr>
<tr><td>☐ PDP Exempt</td><td>Stop.
Standard Project requirements apply. Provide discussion and list any additional requirements below.</td></tr>
<tr><td colspan="3">Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable:</td></tr>
</table>

Form I-1 Page 2		
Step	**Answer**	**Progression**
Step 3. Is the project subject to earlier PDP requirements due to a prior lawful approval? See Section 1.10 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	Consult the City Engineer to determine requirements. Provide discussion and identify requirements below. Go to Step 4.
	☒ No	BMP Design Manual PDP requirements apply. Go to Step 4.
Discussion / justification of prior lawful approval, and identify requirements (<u>not required if prior lawful approval does not apply</u>):		
Step 4. Do hydromodification control requirements apply? See Section 1.6 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	PDP structural BMPs required for pollutant control (Chapter 5) and hydromodification control (Chapter 6). Go to Step 5.
	☒ No	Stop. PDP structural BMPs required for pollutant control (Chapter 5) only. Provide brief discussion of exemption to hydromodification control below.
Discussion / justification if hydromodification control requirements do <u>not</u> apply: As Allowed by the MS4 permit, the WMAA has designated "The Otay River" as a reach that is exempt from hydromodification. This project meets the two requirements of this exemption which are: that the storm drain has adequate energy dissipation devices, and that the pipe invert elevation is equal to the 10 years flood event height. See Attachment 2 for existing details of the energy dissipation device and Flood profiles with invert pipe elevation required to meet this exemption. For Additional information on these exemption requirements refer to page 1-15 of the "City of San Diego Transportation and Stormwater, 2016 Stormwater Standards Part: 1 BMP Design Manual".		
Step 5. Does protection of critical coarse sediment yield areas apply? See Section 6.2 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	Management measures required for protection of critical coarse sediment yield areas (Chapter 6.2). Stop.
	☒ No	Management measures not required for protection of critical coarse sediment yield areas. Provide brief discussion below. Stop.
Discussion / justification if protection of critical coarse sediment yield areas does <u>not</u> apply: Although Critical Course Sediment does exist near the Site, this project does not disrupt areas of potential critical course sediment nor disturb the travel of critical course sediment. This project will protect critical course sediment in place.		

Site Information Checklist For PDPs	Form I-3B
Project Summary Information	
Project Name	The Shops at AMC Promenade
Project Address	770 Denery Road
Assessor's Parcel Number(s) (APN(s))	0631-041-02, 0631-041-03, 0631-041-04, 0631-041-05, 0631-041-06, 0631-041-07, 0631-042-02
Permit Application Number	
Project Watershed	Select One: ☐ San Dieguito River ☐ Penasquitos ☐ Mission Bay ☐ San Diego River ☒ San Diego Bay ☐ Tijuana River
Hydrologic subarea name with Numeric Identifier up to two decimal places (9XX.XX)	910.20
Project Area (total area of Assessor's Parcel(s) associated with the project or total area of the right-of-way)	17.53 Acres (763,455 Square Feet)
Area to be disturbed by the project (Project Footprint)	7.96 Acres (346,990 Square Feet)
Project Proposed Impervious Area (subset of Project Footprint)	6.97 Acres (303,944 Square Feet)
Project Proposed Pervious Area (subset of Project Footprint)	0.99 Acres (43,046 Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Project Area.	
The proposed increase or decrease in impervious area in the proposed condition as compared to the pre-project condition.	1.00 % decrease in impervious area

Form I-3B Page 2 of 11
Description of Existing Site Condition and Drainage Patterns
Current Status of the Site (select all that apply): ☒ Existing development ☐ Previously graded but not built out ☐ Agricultural or other non-impervious use ☐ Vacant, undeveloped/natural Description / Additional Information: The site was previously developed and has a large AMC theater and parking lot.
Existing Land Cover Includes (select all that apply): ☐ Vegetative Cover ☐ Non-Vegetated Pervious Areas ☒ Impervious Areas Description / Additional Information: The existing site has impervious roof tops, sidewalks, parking lots and dive aisles.
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐ NRCS Type A ☐ NRCS Type B ☐ NRCS Type C ☒ NRCS Type D
Approximate Depth to Groundwater (GW): ☐ GW Depth < 5 feet ☐ 5 feet < GW Depth < 10 feet ☐ 10 feet < GW Depth < 20 feet ☒ GW Depth > 20 feet
Existing Natural Hydrologic Features (select all that apply): ☐ Watercourses ☐ Seeps ☐ Springs ☐ Wetlands ☒ None Description / Additional Information: There are no existing natural hydrologic features within the project area.

Form I-3B Page 3 of 11
Description of Existing Site Topography and Drainage:
How is storm water runoff conveyed from the site? At a minimum, this description should answer: 1. Whether existing drainage conveyance is natural or urban; 2. If runoff from offsite is conveyed through the site? If yes, quantification of all offsite drainage areas, design flows, and locations where offsite flows enter the project site and summarize how such flows are conveyed through the site; 3. Provide details regarding existing project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, and natural and constructed channels; 4. Identify all discharge locations from the existing project along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.
Description / Additional Information:
The existing site drainage is urban and follows the existing contours towards the north corner of the site. Running through the site in an existing public 30” RCP storm drain. This storm drain is in a 10’ drainage easement per Drawing No. 27756-D. This pipe connects the offsite storm drain system on Dennery Road towards the west through the site to a 42” RCP storm drain. This main offsite storm drain pipe flows north from the site and eventually discharges through an existing velocity dissipation devices to the Otay River downstream of Interstate 805. Curbs, gutters, curb inlets, medians and other barriers that separate the site from neighboring parcels also prevents off site sheet flow from entering. Off site sheet flow is instead directed to the storm drain system offsite before entering the project site. The majority of the onsite runoff is collected by the City of San Diego public 42” RCP storm drain running through the site.

Form I-3B Page 4 of 11
Description of Proposed Site Development and Drainage Patterns
Project Description / Proposed Land Use and/or Activities: The proposed redevelopment project is to demo portions of the existing AMC Classic Palm Promenade 24 theater and then use the created space and portions of the parking lot to add several proposed buildings. The 6 proposed buildings are: two drive-thrus (a 4,801 sf and a 5,000 sf building) to be on either side of the site main entrance, a 45,000 sf retail building in the north corner of the site, two shops (a 6,500 sf and a 4,500 sf shop) to be constructed where the north wing of the AMC building currently stands, The last proposed shop is a 6,935 sf building proposed to be built on the east side of AMC's south wing. Biofiltration areas and tree wells are proposed in the parking lot.
List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features): Buildings, parking lots, drive isles. The proposed changes are to redevelop the AMC and construct new buildings on site.
List/describe proposed pervious features of the project (e.g., landscape areas): The proposed improvements include the addition of biofiltration areas and tree wells will increase the sites pervious footprint.
Does the project include grading and changes to site topography? ☒ Yes ☐ No Description / Additional Information: In order to achieve the finished floor elevations required for the project, grading and changes to the topography around the proposed building pads is expected. The existing urban drainage pattern will not be affected by this project. The stormwater runoff and sheet flows will continue to drain towards the north corner of the site.

Form I-3B Page 5 of 11
Does the project include changes to site drainage(e.g., installation of new storm water conveyance systems)? ☒ Yes ☐ No If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural and constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations. Description / Additional Information: Refer to Project's Drainage Report Attachment 5 for additional information.

Form I-3B Page 6 of 11

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

- ☒ On-site storm drain inlets
- ☐ Interior floor drains and elevator shaft sump pumps
- ☐ Interior parking garages
- ☐ Need for future indoor & structural pest control
- ☒ Landscape/Outdoor Pesticide Use
- ☐ Pools, spas, ponds, decorative fountains, and other water features
- ☒ Food service
- ☒ Refuse areas
- ☐ Industrial processes
- ☐ Outdoor storage of equipment or materials
- ☐ Vehicle and Equipment Cleaning
- ☐ Vehicle/Equipment Repair and Maintenance
- ☐ Fuel Dispensing Areas
- ☒ Loading Docks
- ☐ Fire Sprinkler Test Water
- ☐ Miscellaneous Drain or Wash Water
- ☒ Plazas, sidewalks, and parking lots
- ☒ Large Trash Generating Facilities
- ☐ Animal Facilities
- ☐ Plant Nurseries and Garden Centers
- ☐ Automotive-related Uses

Description / Additional

Information:

Form I-3B Page 7 of 11
Identification and Narrative of Receiving Water
Narrative describing flow path from discharge location(s), through urban storm conveyance system, to receiving creeks, rivers, and lagoons and ultimate discharge location to Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable) Storm water leaves the site through onsite inlets that connect to a 12”, 24” and 42” public storm drain system along the western edge of the property. Storm water collected along Dennery Road flows through a 30” pipe and connects to the 42” storm drain system onsite. These storm drain conveyance systems discharge to a 60” pipe that then carries the runoff north, approximately 0.75 miles, until it reaches an existing velocity dissipation devices and discharges into the Otay River under the Interstate 805 highway. The Poggi Canton Creek Crosses the Otay River just west of the 805. The Otay River flows west and ultimately discharges into the southern end of the San Diego Bay.
Provide a summary of all beneficial uses of receiving waters downstream of the project dischargelocations. The receiving waters downstream of the project are the Poggi Canyon Creek and the San Diego Bay. They receive the following beneficial uses: AGR, IND, RARE, REC1, REC2, WARM, and WILD.
Identify all ASBS (areas of special biological significance) receiving waters downstream of the project discharge locations. There are no ASBS receiving waters downstream of the project.
Provide distance from project outfall location to impaired or sensitive receivingwaters. Project outfall location is approximately 0.75 miles north to the Otay River then approximately 4.7 miles west to the San Diego Bay.
Summarize information regarding the proximity of the permanent, post-construction storm water BMPs to the City’s Multi-Habitat Planning Area and environmentally sensitivelands. This project and its proposed BMPs will not affect the City’s Multi-Habitat Planning Areas and environmentally sensitive lands. The closest such area are Coastal Sage Scrub communities along the Otay River which are 0.95 miles away from the project site

Form I-3B Page 8 of 11		
Identification of Receiving Water Pollutants of Concern		
List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:		
303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs/ WQIP Highest Priority Pollutant
Poggi Canyon Creek	Toxicity	TMDL Required
Otay River	PCBs (Polychlorinated Biphenyls)	TMDL Required

Identification of Project Site Pollutants*			
*Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated) Identify pollutants anticipated from the project site based on all proposed use(s) of the site (see BMP Design Manual (Part 1 of Storm Water Standards) Appendix B.6):			
Pollutant	Not Applicable to the Project Site	Anticipated from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment	N/A		
Nutrients	N/A		
Heavy Metals	N/A		
Organic Compounds	N/A		
Trash & Debris	N/A		
Oxygen Demanding Substances	N/A		
Oil & Grease	N/A		
Bacteria & Viruses	N/A		
Pesticides	N/A		

Form I-3B Page 9 of 11
Hydromodification Management Requirements
Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual)? ☐ Yes, hydromodification management flow control structural BMPs required. ☐ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☐ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean. ☒ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides. Description / Additional Information (to be provided if a 'No' answer has been selected above): As Allowed by the MS4 permit the WMAA has Designated “the Otay River downstream of the 805” as an exempt from hydromodification reach. See Appendix 2 for existing details of the energy dissipation device and Flood profiles with invert pipe elevation required to meet this exemption. Refer to page 1-15 of the “City of San Diego Transportation and Stormwater 2016 Stormwater Standards Part:1 BMP Design Manual”.
Critical Coarse Sediment Yield Areas* *This Section only required if hydromodification management requirements apply
Based on Section 6.2 and Appendix H does CCSYA exist on the project footprint or in the upstream area draining through the project footprint? ☐ Yes ☐ No Discussion / Additional Information: N/A, this project is hydromodification exempt.

Form I-3B Page 10 of 11
Flow Control for Post-Project Runoff* *This Section only required if hydromodification management requirements apply
List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit. N/A, this project is hydromodification exempt.
Has a geomorphic assessment been performed for the receiving channel(s)? ☐ No, the low flow threshold is 0.1Q2 (default low flow threshold) ☐ Yes, the result is the low flow threshold is 0.1Q2 ☐ Yes, the result is the low flow threshold is 0.3Q2 ☐ Yes, the result is the low flow threshold is 0.5Q2 If a geomorphic assessment has been performed, provide title, date, and preparer: N/A, this project is hydromodification exempt.
Discussion / Additional Information: (optional) N/A, this project is hydromodification exempt.

Form I-3B Page 11 of 11

Other Site Requirements and Constraints

When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements.

A geotechnical report prepared by Geocon Incorporated found that all borings on site showed equal to or greater that 7′ of fill, see Attachment 6 for additional information. Due to this and that the site is known to contain NRCS hydrologic soil group type D, infiltration of storm water is a design constraint. In lieu of retention and infiltration BMPS the Shops at AMC Palm Promenade project will use lined biofiltration BMPS.

Optional Additional Information or Continuation of Previous Sections As Needed

This space provided for additional information or continuation of information from previous sections as needed.

The total disturbed area to be redeveloped with impervious and pervious is 7.96 acres.
The total project area is 17.53 acres.
Per the "50% Rule Test" for redevelopment PDPs, **7.96 / 17.53 = 45.41%**
The "50% Rule" for redevelopment projects allows for redevelopments that create or replace an amount of impervious surface of less than fifty percent of the surface area of the previously existing development than the structural BMP requirements of Provision E.3.c. [of the MS4 Permit] apply only to the creation or replacement of impervious surface and not the entire development.
For additional information see page 1-17 of "The City of San Diego Transportation and Stormwater 2016 Storm Water Standards Part 1: BMP Design Manual."

Existing site (ac)		Proposed site (ac)	
Impervious	15.01	Impervious	14.86
Pervious	2.52	Pervious	2.67

Total Site: 17.53 Acres

Replaced/Created Area	
Impervious	6.97
Pervious	0.99

Total Area Disturbed: 7.96 Acres

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Source Control BMP Checklist for All Development Projects	Form I-4

Source Control BMPs

All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual (Part 1 of the Storm Water Standards) for information to implement source control BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.

Source Control Requirement	Applied?		
SC-1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-1 not implemented:			
SC-2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented:			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-3 not implemented: No proposed commercial building will have outdoor storage of materials.			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-4 not implemented: No proposed commercial building will have outdoor work areas.			
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-5 not implemented:			

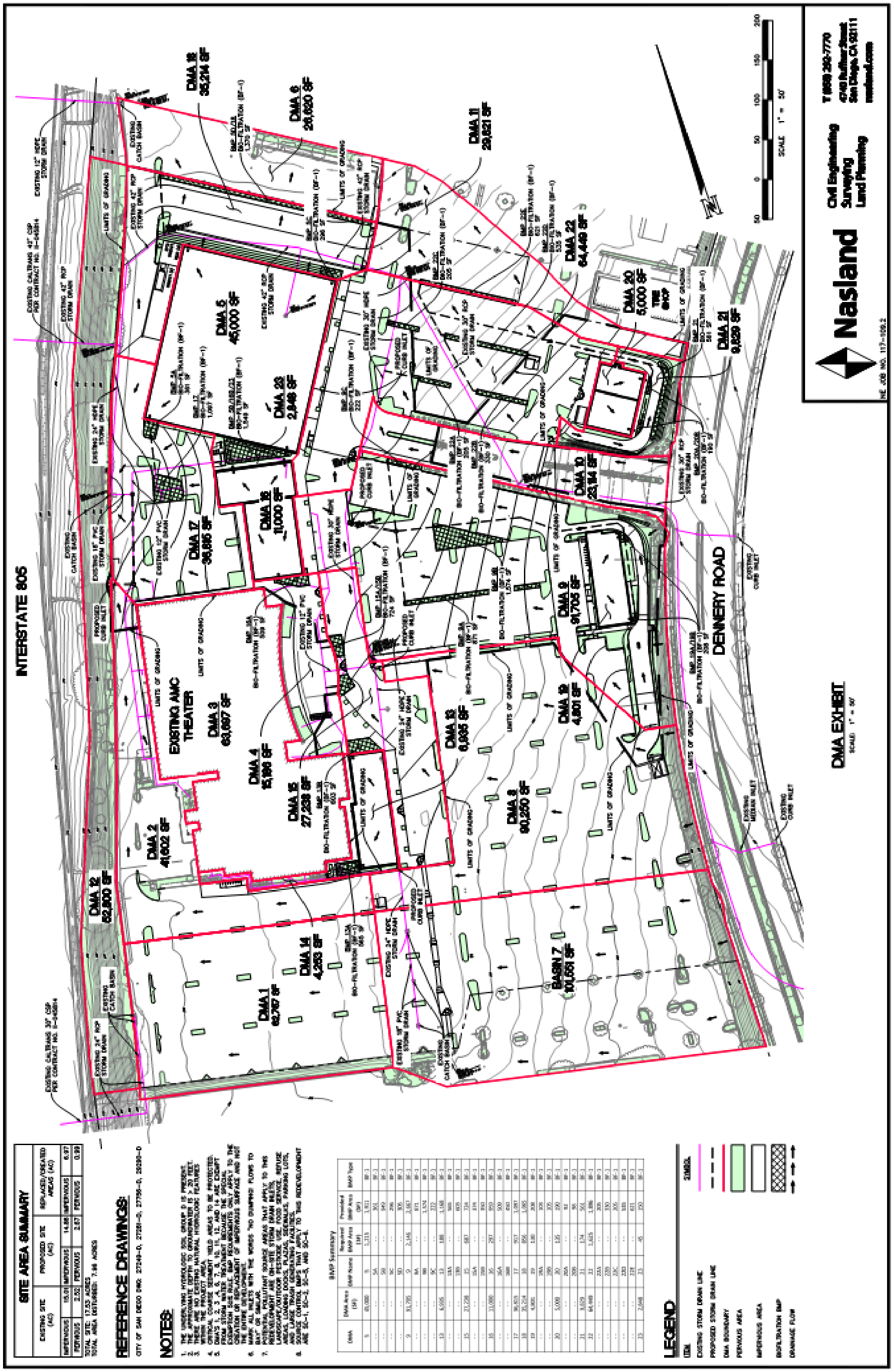
Form I-4 Page 2 of 2			
Source Control Requirement	**Applied?**		
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
On-site storm drain inlets	☒ Yes	☐ No	☐ N/A
Interior floor drains and elevator shaft sump pumps	☐ Yes	☐ No	☒ N/A
Interior parking garages	☐ Yes	☐ No	☒ N/A
Need for future indoor & structural pest control	☐ Yes	☐ No	☒ N/A
Landscape/Outdoor Pesticide Use	☒ Yes	☐ No	☐ N/A
Pools, spas, ponds, decorative fountains, and other water features	☐ Yes	☐ No	☒ N/A
Food service	☒ Yes	☐ No	☐ N/A
Refuse areas	☒ Yes	☐ No	☐ N/A
Industrial processes	☐ Yes	☐ No	☒ N/A
Outdoor storage of equipment or materials	☐ Yes	☐ No	☒ N/A
Vehicle/Equipment Repair and Maintenance	☐ Yes	☐ No	☒ N/A
Fuel Dispensing Areas	☐ Yes	☐ No	☒ N/A
Loading Docks	☒ Yes	☐ No	☐ N/A
Fire Sprinkler Test Water	☐ Yes	☐ No	☒ N/A
Miscellaneous Drain or Wash Water	☐ Yes	☐ No	☒ N/A
Plazas, sidewalks, and parking lots	☒ Yes	☐ No	☐ N/A
SC-6A: Large Trash Generating Facilities	☒ Yes	☐ No	☐ N/A
SC-6B: Animal Facilities	☐ Yes	☐ No	☒ N/A
SC-6C: Plant Nurseries and Garden Centers	☐ Yes	☐ No	☒ N/A
SC-6D: Automotive-related Uses	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for all "No" answers shown above.			

Site Design BMP Checklist for All Development Projects			Form I-5
Site Design BMPs			
All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual (Part 1 of Storm Water Standards) for information to implement site design BMPs shown in this checklist. Answer each category below pursuant to the following. • "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required. • "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided. • "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided. A site map with implemented site design BMPs must be included at the end of this checklist.			
Site Design Requirement	Applied?		
SD-1 Maintain Natural Drainage Pathways and Hydrologic Features	☐ Yes	☒ No	☐ N/A
Discussion / justification if SD-1 not implemented: There are no existing natural drainage pathways or hydrologic features on site. This project is a redevelopment project and all existing drainage is urban. The existing drainage patterns will not be affected by the proposed buildings or grading.			
1-1 Are existing natural drainage pathways and hydrologic features mapped on the site map?	☐ Yes	☐ No	
1-2 Are trees implemented? If yes, are they shown on the site map?	☐ Yes	☐ No	
1-3 Implemented trees meet the design criteria in SD-1 Fact Sheet (e.g. soil volume, maximum credit, etc.)?	☐ Yes	☐ No	
1-4 Is tree credit volume calculated using Appendix B.2.2.1 and SD-1 Fact Sheet in Appendix E?	☐ Yes	☐ No	
SD-2 Have natural areas, soils and vegetation been conserved?	☐ Yes	☐ No	☒ N/A
Discussion / justification if SD-2 not implemented: There are no existing natural areas, the site was previously developed.			
Form I-5 Page 2 of 4			

Site Design Requirement	Applied?		
SD-3 Minimize Impervious Area	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-3 not implemented:			
SD-4 Minimize Soil Compaction	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-4 not implemented:			
SD-5 Impervious Area Dispersion	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-5 not implemented: Permanent BMPS are planed throughout the site. This project is compliant with the 50% rule; therefore, BMPs placement is designed to keep run off from comingling as well as only created or replaced impervious areas. (See DMA exhibit, attachment 1a) The proposed BMPs will break up parking lot sheet flow and collect from roof drains.			
5-1 Is the pervious area receiving runon from impervious area identified on the site map?	☒ Yes	☐ No	
5-2 Does the pervious area satisfy the design criteria in SD-5 Fact Sheet in Appendix E (e.g. maximum slope, minimum length, etc.)	☒ Yes	☐ No	
5-3 Is impervious area dispersion credit volume calculated using Appendix B.2.1.1 and SD-5 Fact Sheet in Appendix E?	☒ Yes	☐ No	

Form I-5 Page 3 of 4			
Site Design Requirement	Applied?		
SD-6 Runoff Collection	☐ Yes	☒ No	☐ N/A
Discussion / justification if SD-6 not implemented: As seen in the geotechnical report, Attachment 6, the borings on site found that there was 7′ or greater of fill under the site. This in conjunction with the Hydrologic soil group type D underlying the site has excluded infiltration as an option. The proposed design will use lined biofiltration areas to treat stormwater before it discharges to the MS4.			
6a-1 Are green roofs implemented in accordance with design criteria in SD-6A Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☐ No	
6a-2 Is green roof credit volume calculated using Appendix B.2.1.2 and SD-6A Fact Sheet in Appendix E?	☐ Yes	☐ No	
6b-1 Are permeable pavements implemented in accordance with design criteria in SD-6B Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☐ No	
6b-2 Is permeable pavement credit volume calculated using Appendix B.2.1.3 and SD-6B Fact Sheet in Appendix E?	☐ Yes	☐ No	
SD-7 Landscaping with Native or Drought Tolerant Species	☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-7 not implemented:			
SD-8 Harvesting and Using Precipitation	☐ Yes	☒ No	☐ N/A
Discussion / justification if SD-8 not implemented: The proposed design will instead preserve the existing drainage patterns on site.			
8-1 Are rain barrels implemented in accordance with design criteria in SD-8 Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☐ No	
8-2 Is rain barrel credit volume calculated using Appendix B.2.2.2 and SD-8 Fact Sheet in Appendix E?	☐ Yes	☐ No	

Form I-5 Page 4 of 4
Insert Site Map with all site design BMPs identified: NOTE: fullsize map in Attachment 1a.



Summary of PDP Structural BMPs	Form I-6
PDP Structural BMPs	
All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the BMP Design Manual, Part 1 of Storm Water Standards). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the BMP Design Manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s). PDP structural BMPs must be verified by the City at the completion of construction. This includes requiring the project owner or project owner's representative to certify construction of the structural BMPs (complete Form DS-563). PDP structural BMPs must be maintained into perpetuity (see Chapter 7 of the BMP Design Manual). Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).	

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

The Shops at AMC Project is a Redevelopment PDP that will demo a portion of the existing AMC Classic 24 theater building located at 770 Dennery Road, San Diego, California 92154. The project will also construct six new commercial buildings on the current AMC lot and create new parcels for the proposed buildings. The total lot size and project area is 17.53 acres with 7.96 acres of disturbed area.

Per the “50% Rule Test” for redevelopment PDPs, 7.96 / 17.53 = 45.41%
The “50% Rule” for redevelopment projects allows for redevelopments that create or replace an amount of impervious surface of less than fifty percent of the surface area of the previously existing development than the structural BMP requirements of Provision E.3.c. [of the MS4 Permit] apply only to the creation or replacement of impervious surface and no the entire development. For additional information see page 1-17 of “The City of San Diego Transportation and Stormwater 2016 Storm Water Standards Part 1: BMP Design Manual.” Because this project meets the requirements of the 50% rule DMA and structural BMP designs only apply to the redevelopments of the project.

The existing urban drainage follows the topography towards the north corner of the site; although, there is grading associated with the building pad elevations the general drainage patterns and pathways on site are not compromised by this project. Curbs, gutters, curb inlets, medians and other barriers that separate the site from neighboring parcels also prevents off site sheet flow from entering. Offsite sheet flow is instead directed to the storm drain before entering the project site. Running under and through the site in an existing public 30” RCP storm drain. This storm drain is in a 10’ drainage easement per Drawing No. 27756-D. This pipe connects the offsite storm drain system on Dennery Road the 42” RCP storm drain pipe onsite. This flows from this 42” RCP storm drain pipe travel north from the site and eventually discharges through existing velocity dissipation devices to the Otay River downstream of Interstate 805.

(Continue on page 2 as necessary.)

Form I-6 Page 2 of 27
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from page 1) The majority of the onsite stormwater runoff leaves the project area by means of the City of San Diego public 42" RCP storm drain running through the site. The storm drain conveyance system then carries the runoff north, approximately 0.75 miles until it reaches the existing energy dissipation devices and discharges into the Otay River downstream of the Interstate 805 highway. The Poggi Canyon Creek Crosses the Otay River just west of the 805. The Otay River flows west and ultimately discharges into the southern end of the San Diego Bay 4.7 miles downstream. As Allowed by the MS4 permit the WMAA has designated "the Otay River downstream of the 805" as a reach that is exempt from hydromodification. This project meets the two requirements of this exemption which are: that the storm drain has adequate energy dissipation devices, and that the pipe invert elevation is equal to the 10 years flood event height. See Attachment 2a for existing details of the energy dissipation device and Flood profiles with invert pipe elevation required to meet this exemption. For Additional information on these exemption requirements refer to page 1-15 of the "City of San Diego Transportation and Stormwater, 2016 Stormwater Standards Part: 1 BMP Design Manual". The special consideration 50% rule for redevelopment projects and hydromodification exception were driving factors in the Structural BMP design for this project. An additional design constraint when assessing the best design options for structural BMPs was the poor soil infiltration rate. The geotechnical report preformed by Geocon Incorporated, see attachment 6, found that in all the borings on site there was 7' or greater of fill. This in conjunction with the site known to have NRCS type D soil lead to a no infiltration scenario for BMP design. For this reason lined biofiltration BMPs draining to perforated pipes have been selected to treat the stormwater run off. The DMA's will be sized to handle the 100-year storm event per section 1-102.2 in the Drainage Design Manual. As seen in the DMA exhibit, attachment 1a, DMA's 1, 2, 3, 4, 6, 7, 8, 10, 11, 12, and 14 are all exempt from stormwater treatment. The remaining DMA's 5, 9, 13, 15, 16, 17, 18, 19, 20, 21, 22, and 23 are designed to treat the redevelopment areas of the project and do so as close to the point sources as is feasibly possible. The DMA's intended to treat the storm water shall all be BF-1, a biofiltration BMP. The proposed structural BMPs vary in size and are located around the site near the proposed buildings and throughout the parking lot. As seen on the DMA exhibit each DMA area has a corresponding number BMP that it drains too. (Example: DMA 17 drains towards BMP 17, DMA 13 Drains towards BMP 13A, 13B) This is true for all DMA except for 5/16/23 and 5/18 which share some BMPs. The maintenance of all structural BMPs on site will be private and shall be dictated by the draft O&M Agreement, refer to Attachment 3 of this report for more information.

Form I-6 Page 3 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 5A	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 4 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 5B/16B/23	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 5 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 5C	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 6 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 5D/18	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 7 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 9A	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 8 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 9B	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 9 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 9C	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 10 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 13A	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 11 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 13B	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 12 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 15A	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 13 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 15B	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 14 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 16A	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 15 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 17	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 16 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 19A	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 17 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 19B	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 18 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 20A	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 19 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 20B	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 20 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 21	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 21 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 22A	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 22 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 22B	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 23 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 22C	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 24 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 22D	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 25 of 27 (Copy as many as needed)

Structural BMP Summary Information

Structural BMP ID No. BF-1

Construction Plan Sheet No. BMP 22E

Type of structural BMP:

- ☐ Retention by harvest and use (HU-1)
- ☐ Retention by infiltration basin (INF-1)
- ☐ Retention by bioretention (INF-2)
- ☐ Retention by permeable pavement (INF-3)
- ☐ Partial Retention by biofiltration with partial retention (PR-1)
- ☒ Biofiltration (BF-1)
- ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below)
- ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below)
- ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below)
- ☐ Detention pond or vault for hydromodification management
- ☐ Other (describe in discussion section below

Purpose:

- ☒ Pollutant control only
- ☐ Hydromodification control only
- ☐ Combined pollutant control and hydromodification control
- ☐ Pre-treatment / forebay for another structural BMP
- ☐ Other (describe in discussion section below)

Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 26 of 27 (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. BF-1	
Construction Plan Sheet No. BMP 23	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☐ Partial Retention by biofiltration with partial retention (PR-1) ☒ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion section below) ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below	
Purpose: ☒ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment / forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	
Who will be the final owner of this BMP?	Private ownership
Who will maintain this BMP into perpetuity?	Private ownership
What is the funding mechanism for maintenance?	The Private owner.

Form I-6 Page 27 of 27 (Copy as many as needed)
Structural BMP ID No. BF-1
Construction Plan Sheet No.
Discussion (as needed):

For reference the DMAs and the biofiltration BMPs that they drain to are all listed below.

BMP Summary

DMA	DMA Area (SF)	BMP Name	Required BMP Area (SF)	Provided BMP Area (SF)	BMP Type
5	45,000	5	1,215	1,911	BF-1
- -	- -	5A	- -	361	BF-1
- -	- -	5B	- -	949	BF-1
- -	- -	5C	- -	296	BF-1
- -	- -	5D	- -	305	BF-1
9	91,705	9	2,146	2,667	BF-1
- -	- -	9A	- -	871	BF-1
- -	- -	9B	- -	1,574	BF-1
- -	- -	9C	- -	222	BF-1
13	6,935	13	188	1,168	BF-1
- -	- -	13A	- -	565	BF-1
- -	- -	13B	- -	603	BF-1
15	27,238	15	687	724	BF-1
- -	- -	15A	- -	374	BF-1
- -	- -	15B	- -	350	BF-1
16	11,000	16	297	959	BF-1
- -	- -	16A	- -	509	BF-1
- -	- -	16B	- -	450	BF-1
17	36,815	17	917	1,097	BF-1
18	35,214	18	856	1,065	BF-1
19	4,801	19	130	208	BF-1
- -	- -	19A	- -	103	BF-1
- -	- -	19B	- -	105	BF-1
20	5,000	20	135	190	BF-1
- -	- -	20A	- -	92	BF-1
- -	- -	20B	- -	98	BF-1
21	9,829	21	174	561	BF-1
22	64,449	22	1,625	1,896	BF-1
- -	- -	22A	- -	205	BF-1
- -	- -	22B	- -	330	BF-1
- -	- -	22C	- -	205	BF-1
- -	- -	22D	- -	535	BF-1
- -	- -	22E	- -	621	BF-1
23	2,848	23	45	150	BF-1

THE CITY OF SAN DIEGO	City of San Diego **Development Services** 1222 First Ave., MD-302 San Diego, CA 92101 (619) 446-5000	**Permanent BMP Construction** **Self Certification Form**	FORM DS-563 February 2016

Date Prepared: 04/20/2018	Project No.:
Project Applicant: F L I N K INC.	Phone: (913) 213-2000
Project Address:770 Dennery Road, San Diego, CA 92154	
Project Engineer: Samuel Waisbord P.E.	Phone: (858) 292-7770

The purpose of this form is to verify that the site improvements for the project, identified above, have been constructed in conformance with the approved Storm Water Quality Management Plan (SWQMP) documents and drawings.

This form must be completed by the engineer and submitted prior to final inspection of the construction permit. Completion and submittal of this form is required for all new development and redevelopment projects in order to comply with the City's Storm Water ordinances and NDPES Permit Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100. Final inspection for occupancy and/or release of grading or public improvement bonds may be delayed if this form is not submitted and approved by the City of San Diego.

CERTIFICATION:
As the professional in responsible charge for the design of the above project, I certify that I have inspected all constructed Low Impact Development (LID) site design, source control and structural BMP's required per the approved SWQMP and Construction Permit No.________________________; and that said BMP's have been constructed in compliance with the approved plans and all applicable specifications, permits, ordinances and Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 of the San Diego Regional Water Quality Control Board.

I understand that this BMP certification statement does not constitute an operation and maintenance verification.

Signature: ________________________________

Date of Signature: ___________________________

Printed Name: ___________________________

Title: ___________________________

Phone No. ___________________________

Engineer's Stamp

DS-563 (01-16)

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ATTACHMENT 1
BACKUP FOR PDP POLLUTANT CONTROL BMPS

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Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist.	☒ Included.
Attachment 1b	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	☒ Included.
Attachment 1c	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	☒ Included.
Attachment 1d	Form I-8, Categorization of Infiltration Feasibility Condition (Required unless the project will use harvest and use BMPs) Refer to Appendices C and D of the BMP Design Manual to complete Form I-8.	☒ Included.
Attachment 1e	Pollutant Control BMP Design Worksheets / Calculations (Required) Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines and site design credit calculations	☒ Included

Use this checklist to ensure the required information has been included on the DMA Exhibit:

The DMA Exhibit must identify:

☒ Underlying hydrologic soil group
☒ Approximate depth to groundwater
☒ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☒ Critical coarse sediment yield areas to be protected
☒ Existing topography and impervious areas
☒ Existing and proposed site drainage network and connections to drainage offsite
☒ Proposed grading
☒ Proposed impervious features
☒ Proposed design features and surface treatments used to minimize imperviousness
☒ Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
☒ Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B)
☒ Structural BMPs (identify location, type of BMP, and size/detail)

SITE AREA SUMMARY					
EXISTING SITE (AC)		PROPOSED SITE (AC)		REPLACED/CREATED AREAS (AC)	
IMPERVIOUS	15.01	IMPERVIOUS	14.86	IMPERVIOUS	6.97
PERVIOUS	2.52	PERVIOUS	2.67	PERVIOUS	0.99

TOTAL SITE: 17.53 ACRES
TOTAL AREA DISTURBED: 7.96 ACRES

REFERENCE DRAWINGS:

CITY OF SAN DIEGO DWG: 27249–D, 27281–D, 27756–D, 29290–D

NOTES:

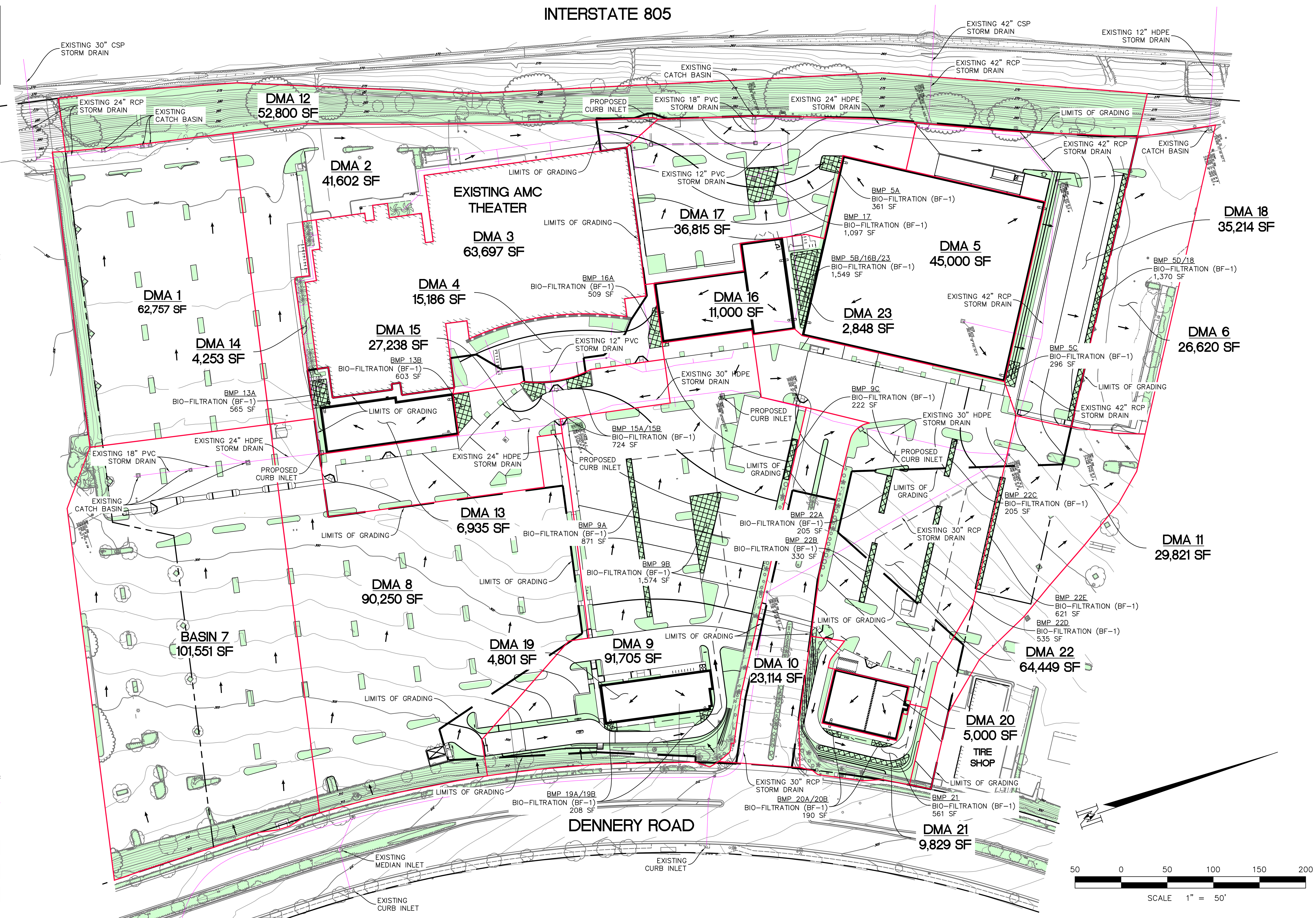
1. THE UNDERLYING HYDROLOGIC SOIL GROUP D IS PRESENT.
2. THE APPROXIMATE DEPTH TO GROUNDWATER IS > 20 FEET.
3. THERE ARE NO EXISTING NATURAL HYDROLOGIC FEATURES WITHIN THE PROJECT AREA.
4. CRITICAL COARSE SEDIMENT YIELD AREAS TO BE PROTECTED.
5. DMA'S 1, 2, 3, 4, 6, 7, 8, 10, 11, 12, AND 14 ARE EXEMPT FROM STORM WATER TREATMENT BECAUSE THE SPECIAL EXEMPTION 50% RULE. BMP REQUIREMENTS ONLY APPLY TO THE CREATION OR REPLACEMENT OF IMPERVIOUS SURFACE AND NOT THE ENTIRE DEVELOPMENT.
6. MARK ALL INLETS WITH THE WORDS "NO DUMPING! FLOWS TO BAY" OR SIMILAR.
7. POTENTIAL POLLUTANT SOURCE AREAS THAT APPLY TO THIS REDEVELOPMENT ARE ON–SITE STORM DRAIN INLETS, LANDSCAPE/OUTDOOR PESTICIDE USE, FOOD SERVICE, REFUSE AREAS, LOADING DOCKS, PLAZAS, SIDEWALKS, PARKING LOTS, AND LARGE TRASH GENERATING FACILITIES.
8. SOURCE CONTROL BMPS THAT APPLY TO THIS REDEVELOPMENT ARE SC–1, SC–2, SC–5, AND SC–6.

BMP Summary

DMA	DMA Area (SF)	BMP Name	Required BMP Area (SF)	Provided BMP Area (SF)	BMP Type
5	45,000	5	1,215	1,911	BF-1
- -	- -	5A	- -	361	BF-1
- -	- -	5B	- -	949	BF-1
- -	- -	5C	- -	296	BF-1
- -	- -	5D	- -	305	BF-1
9	91,705	9	2,146	2,667	BF-1
- -	- -	9A	- -	871	BF-1
- -	- -	9B	- -	1,574	BF-1
- -	- -	9C	- -	222	BF-1
13	6,935	13	188	1,168	BF-1
- -	- -	13A	- -	565	BF-1
- -	- -	13B	- -	603	BF-1
15	27,238	15	687	724	BF-1
- -	- -	15A	- -	374	BF-1
- -	- -	15B	- -	350	BF-1
16	11,000	16	297	959	BF-1
- -	- -	16A	- -	509	BF-1
- -	- -	16B	- -	450	BF-1
17	36,815	17	917	1,097	BF-1
18	35,214	18	856	1,065	BF-1
19	4,801	19	130	208	BF-1
- -	- -	19A	- -	103	BF-1
- -	- -	19B	- -	105	BF-1
20	5,000	20	135	190	BF-1
- -	- -	20A	- -	92	BF-1
- -	- -	20B	- -	98	BF-1
21	9,829	21	174	561	BF-1
22	64,449	22	1,625	1,896	BF-1
- -	- -	22A	- -	205	BF-1
- -	- -	22B	- -	330	BF-1
- -	- -	22C	- -	205	BF-1
- -	- -	22D	- -	535	BF-1
- -	- -	22E	- -	621	BF-1
23	2,848	23	45	150	BF-1

LEGEND

ITEM	SYMBOL
EXISTING STORM DRAIN LINE	
PROPOSED STORM DRAIN LINE	
DMA BOUNDARY	
PERVIOUS AREA	
IMPERVIOUS AREA	
BIOFILTRATION BMP	
DRAINAGE FLOW	



DMA EXHIBIT
SCALE: 1" = 50'

Nasland
Civil Engineering
Surveying
Land Planning
T (858) 292-7770
4740 Ruffner Street
San Diego, CA 92111
nasland.com

NE JOB NO. 117–109.2

City of San Diego
Development Services
1222 First Ave., MS-302
San Diego, CA 92101
(619) 446-5000

Storm Water Requirements Applicability Checklist

FORM DS-560
OCTOBER 2016

Project Address: 770 Dennery Road, San Diego, CA 92154 | Project Number *(for City Use Only)*:

SECTION 1. Construction Storm Water BMP Requirements:

All construction sites are required to implement construction BMPs in accordance with the performance standards in the Storm Water Standards Manual. Some sites are additionally required to obtain coverage under the State Construction General Permit (CGP)[1], which is administered by the State Water Resources Control Board.

For all projects complete PART A: If project is required to submit a SWPPP or WPCP, continue to PART B.

PART A: Determine Construction Phase Storm Water Requirements.

1. Is the project subject to California's statewide General NPDES permit for Storm Water Discharges Associated with Construction Activities, also known as the State Construction General Permit (CGP)? (Typically projects with land disturbance greater than or equal to 1 acre.)

☒ Yes; SWPPP required, skip questions 2-4 ☐ No; next question

2. Does the project propose construction or demolition activity, including but not limited to, clearing, grading, grubbing, excavation, or any other activity resulting in ground disturbance and contact with storm water runoff?

☐ Yes; WPCP required, skip 3-4 ☐ No; next question

3. Does the project propose routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility? (Projects such as pipeline/utility replacement)

☐ Yes; WPCP required, skip 4 ☐ No; next question

4. Does the project only include the following Permit types listed below?

- Electrical Permit, Fire Alarm Permit, Fire Sprinkler Permit, Plumbing Permit, Sign Permit, Mechanical Permit, Spa Permit.
- Individual Right of Way Permits that exclusively include only ONE of the following activities: water service, sewer lateral, or utility service.
- Right of Way Permits with a project footprint less than 150 linear feet that exclusively include only ONE of the following activities: curb ramp, sidewalk and driveway apron replacement, pot holing, curb and gutter replacement, and retaining wall encroachments.

☐ Yes; no document required

Check one of the boxes below, and continue to PART B:

☒ If you checked "Yes" for question 1, **a SWPPP is REQUIRED. Continue to PART B**

☐ If you checked "No" for question 1, and checked "Yes" for question 2 or 3, **a WPCP is REQUIRED.** If the project proposes less than 5,000 square feet of ground disturbance AND has less than a 5-foot elevation change over the entire project area, a Minor WPCP may be required instead. **Continue to PART B.**

☐ If you checked "No" for all questions 1-3, and checked "Yes" for question 4 PART B **does not apply and no document is required. Continue to Section 2.**

1. More information on the City's construction BMP requirements as well as CGP requirements can be found at: www.sandiego.gov/stormwater/regulations/index.shtml

PART B: Determine Construction Site Priority

This prioritization must be completed within this form, noted on the plans, and included in the SWPPP or WPCP. The city reserves the right to adjust the priority of projects both before and after construction. Construction projects are assigned an inspection frequency based on if the project has a "high threat to water quality." The City has aligned the local definition of "high threat to water quality" to the risk determination approach of the State Construction General Permit (CGP). The CGP determines risk level based on project specific sediment risk and receiving water risk. Additional inspection is required for projects within the Areas of Special Biological Significance (ASBS) watershed. **NOTE:** The construction priority does **NOT** change construction BMP requirements that apply to projects; rather, it determines the frequency of inspections that will be conducted by city staff.

Complete PART B and continued to Section 2

1. ☐ **ASBS**

a. Projects located in the ASBS watershed.

2. ☒ **High Priority**

a. Projects 1 acre or more determined to be Risk Level 2 or Risk Level 3 per the Construction General Permit and not located in the ASBS watershed.

b. Projects 1 acre or more determined to be LUP Type 2 or LUP Type 3 per the Construction General Permit and not located in the ASBS watershed.

3. ☐ **Medium Priority**

a. Projects 1 acre or more but not subject to an ASBS or high priority designation.

b. Projects determined to be Risk Level 1 or LUP Type 1 per the Construction General Permit and not located in the ASBS watershed.

4. ☐ **Low Priority**

a. Projects requiring a Water Pollution Control Plan but not subject to ASBS, high, or medium priority designation.

SECTION 2. Permanent Storm Water BMP Requirements.

Additional information for determining the requirements is found in the Storm Water Standards Manual.

PART C: Determine if Not Subject to Permanent Storm Water Requirements.

Projects that are considered maintenance, or otherwise not categorized as "new development projects" or "redevelopment projects" according to the Storm Water Standards Manual are not subject to Permanent Storm Water BMPs.

If "yes" is checked for any number in Part C, proceed to Part F and check "Not Subject to Permanent Storm Water BMP Requirements".

If "no" is checked for all of the numbers in Part C continue to Part D.

1.	Does the project only include interior remodels and/or is the project entirely within an existing enclosed structure and does not have the potential to contact storm water?	☐ Yes ☒ No
2.	Does the project only include the construction of overhead or underground utilities without creating new impervious surfaces?	☐ Yes ☒ No
3.	Does the project fall under routine maintenance? Examples include, but are not limited to: roof or exterior structure surface replacement, resurfacing or reconfiguring surface parking lots or existing roadways without expanding the impervious footprint, and routine replacement of damaged pavement (grinding, overlay, and pothole repair).	☐ Yes ☒ No

PART D: PDP Exempt Requirements.

PDP Exempt projects are required to implement site design and source control BMPs.

If "yes" was checked for any questions in Part D, continue to Part F and check the box labeled "PDP Exempt."

If "no" was checked for all questions in Part D, continue to Part E.

1. **Does the project ONLY include new or retrofit sidewalks, bicycle lanes, or trails that:**
   - **Are designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas? Or;**
   - **Are designed and constructed to be hydraulically disconnected from paved streets and roads? Or;**
   - **Are designed and constructed with permeable pavements or surfaces in accordance with the Green Streets guidance in the City's Storm Water Standards manual?**

   ☐ Yes; PDP exempt requirements apply ☒ No; next question

2. Does the project ONLY include retrofitting or redeveloping existing paved alleys, streets or roads designed and constructed in accordance with the Green Streets guidance in the City's Storm Water Standards Manual?

   ☐ Yes; PDP exempt requirements apply ☒ No; project not exempt.

PART E: Determine if Project is a Priority Development Project (PDP).
Projects that match one of the definitions below are subject to additional requirements including preparation of a Storm Water Quality Management Plan (SWQMP).

If "yes" is checked for any number in PART E, continue to PART F and check the box labeled "Priority Development Project".

If "no" is checked for every number in PART E, continue to PART F and check the box labeled "Standard Development Project".

1.	**New Development that creates 10,000 square feet or more of impervious surfaces collectively over the project site.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☐ Yes ☒ No
2.	**Redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surfaces on an existing site of 10,000 square feet or more of impervious surfaces**. This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☒ Yes ☐ No
3.	**New development or redevelopment of a restaurant.** Facilities that sell prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC 5812), and where the land development creates and/or replace 5,000 square feet or more of impervious surface.	☒ Yes ☐ No
4.	**New development or redevelopment on a hillside.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site) and where the development will grade on any natural slope that is twenty-five percent or greater.	☐ Yes ☒ No
5.	**New development or redevelopment of a parking lot that creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).**	☒ Yes ☐ No
6.	**New development or redevelopment of streets, roads, highways, freeways, and driveways.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).	☐ Yes ☒ No

7. **New development or redevelopment discharging directly to an Environmentally Sensitive Area.** The project creates and/or replaces 2,500 square feet of impervious surface (collectively over project site), and discharges directly to an Environmentally Sensitive Area (ESA). "Discharging directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands). ☐ Yes ☒ No

8. **New development or redevelopment projects of a retail gasoline outlet (RGO) that create and/or replaces 5,000 square feet of impervious surface.** The development project meets the following criteria: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic (ADT) of 100 or more vehicles per day. ☐ Yes ☒ No

9. **New development or redevelopment projects of an automotive repair shops that creates and/or replaces 5,000 square feet or more of impervious surfaces.** Development projects categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539. ☐ Yes ☒ No

10. **Other Pollutant Generating Project.** The project is not covered in the categories above, results in the disturbance of one or more acres of land and is expected to generate pollutants post construction, such as fertilizers and pesticides. This does not include projects creating less than 5,000 sf of impervious surface and where added landscaping does not require regular use of pesticides and fertilizers, such as slope stabilization using native plants. Calculation of the square footage of impervious surface need not include linear pathways that are for infrequent vehicle use, such as emergency maintenance access or bicycle pedestrian use, if they are built with pervious surfaces of if they sheet flow to surrounding pervious surfaces. ☐ Yes ☒ No

PART F: Select the appropriate category based on the outcomes of PART C through PART E.

1. The project is **NOT SUBJECT TO PERMANENT STORM WATER REQUIREMENTS**. ☐
2. The project is a **STANDARD DEVELOPMENT PROJECT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance. ☐
3. The project is **PDP EXEMPT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance. ☐
4. The project is a **PRIORITY DEVELOPMENT PROJECT**. Site design, source control, and structural pollutant control BMP requirements apply. See the Storm Water Standards Manual for guidance on determining if project requires a hydromodification plan management ☒

Name of Owner or Agent *(Please Print)*	Title

Signature	Date

DMA ID	DMA Area, A (ft^2)	Hydrologic Soil Group (A, B, C, or D)	Post-Project Surface Type From Table B.1-1	Post-Project Surface Runoff Factor From Table B.1-1	DMA Excluded from Pollutant Control Design Capture Volume (DCV) Calculations in Accordance with BMP Design Manual Chapter 5.2? (Yes/No)	Un-Adjusted DCV (Ft^3)	DCV Reduction Through Site Design BMPs Applied? (Yes/No)	Site Design Adjusted DCV (ft^3)	Retention BMPs Implemented	DCV Remaining after Retention BMPs Implemented (ft^3)	Biofiltration BMPs Implemented? (Yes/No)	DCV Remaining After Biofiltration BMPs Implemented (ft^3)	Offsite Alternative Compliance and Onsite Flow-Thru Treatment Control BMPs Required? (Yes/No)
1	62,757	D	Asphalt	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
2	41,602	D	Asphalt	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
3	63,697	D	Roof	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
4	15,186	D	Concrete	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
5	45,000	D	Roof	0.90	No	1683	No	1683	No	1683	Yes	1683	No
6	26,620	D	Asphalt	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
7	101,551	D	Asphalt	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
8	90,250	D	Asphalt	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
9	91,705	D	Asphalt	0.78	No	3624	No	3624	No	3624	Yes	3624	No
10	23,114	D	Asphalt	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
11	29,821	D	Asphalt	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
12	52,800	D	Landscape	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
13	6,935	D	Roof	0.90	No	262	No	262	No	262	Yes	262	No
14	4,253	D	Landscape	N/A	Yes	N/A	No	N/A	N/A	N/A	No	N/A	No
15	27,238	D	Concrete	0.84	No	961	No	961	No	961	Yes	961	No
16	11,000	D	Roof	0.90	No	409	No	409	No	409	Yes	409	No
17	36,815	D	Asphalt	0.83	No	1281	No	1281	No	1281	Yes	1281	No
18	35,214	D	Asphalt	0.81	No	1191	No	1191	No	1191	Yes	1191	No
19	4,801	D	Roof	0.90	No	180	No	180	No	180	Yes	180	No
20	5,000	D	Roof	0.90	No	180	No	180	No	180	Yes	180	No
21	9829	D	Asphalt	0.59	No	247	No	247	No	247	Yes	247	No
22	64449	D	Asphalt	0.84	No	2257	No	2257	No	2257	Yes	2257	No
23	2848	D	Landscape	0.52	No	67	No	67	No	67	Yes	67	No

Worksheet B.3-1. Harvest and Use Feasibility Screening

<table>
<tr><th colspan="2">Harvest and Use Feasibility Screening</th><th>Worksheet B.3-1</th></tr>
<tr><td colspan="3">1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?
☑ Toilet and urinal flushing
☑ Landscape irrigation
☐ Other:_______________</td></tr>
<tr><td colspan="3">2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.
<u>Toilet/urinal flush Demand:</u> For 133,740 total retail sf and approximately 225 employees. 225*7=1575 Gal/day. For a 36 Hour demand 1575*1.5= 2363 cubic ft
<u>Irrigation Demand:</u> For 1.48 Acres of landscaped area. The Modified ETWU =2.78*((0.3*15273)/0.9)*0.015 = 210 cubic ft
Total 36 hour Demand: 2363+210 = 2563</td></tr>
<tr><td colspan="3">3. Calculate the DCV using worksheet B-2.1.
<u>Total DCV:</u> 12,352 cubic ft</td></tr>
<tr><td>3a. Is the 36-hour demand greater than or equal to the DCV?
Yes / No ⇨
⇩</td><td>3b. Is the 36-hour demand greater than 0.25DCV but less than the full DCV?
Yes / No ⇨
⇩</td><td>3c. Is the 36-hour demand less than 0.25DCV?
Yes
⇩</td></tr>
<tr><td>Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.</td><td>Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.</td><td>Harvest and use is considered to be <u>infeasible.</u></td></tr>
</table>

2,563 cubic feet (from question 2 of this form) is not greater or equal to 11,761 cubic ft (from section 3 of this form)

11,761*0.25=2941
The 36 hour demand is 2563 less than the 0.25DCV.

The 36 hour demand is 2563 less than the 0.25DCV.
2563<2941

Categorization of Infiltration Feasibility Condition	Worksheet I-8

Part 1 - Full Infiltration Feasibility Screening Criteria

Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

We encountered field infiltration rates that were less than 0.5 inches per hour using a factor of safety of 2 for feasibility determination:

A-1: 0.010 in/hr (0.005 with a FOS of 2.0 for feasibility determination)
A-2: 0.007 in/hr (0.0035 with a FOS of 2.0 for feasibility determination)
A-3: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)
A-4: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)

Based on the geotechnical study, test results, and utilizing a factor of safety of 2.0 for feasibility determination, full infiltration is not feasible as the infiltration rates are lower than 0.5 in/hr.

Criteria	Screening Question	Yes	No
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

Previously placed fill underlies the property and will remain in place. Based on the exploratory borings and laboratory testing, the previously placed extends to depths greater than 5 feet and possess a low to moderate potential for hydroconsolidation. We do not recommend infiltrating into the existing fill due to the potential for adverse soil settlement and an increased potential for hydro-collapse.

<table>
<tr><th colspan="4">Worksheet I-8 Page 2 of 4</th></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>3</td><td>Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

Groundwater is not present near the surface of the site and we are unaware of contaminated soil on the property. Therefore, infiltration associated with this risk is considered feasible.</td></tr>
<tr><td>4</td><td>Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

We do not expect infiltration will cause water balance issues such as seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters.</td></tr>
<tr><td>Part 1 Result*</td><td colspan="2">If all answers to rows 1 - 4 are “Yes” a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration

If any answer from row 1-4 is “No”, infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a “full infiltration” design. Proceed to Part 2</td><td>NO</td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

<u>Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria</u>

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

We encountered field infiltration rates that were less than 0.5 inches per hour using a factor of safety of 2 for feasibility determination:

A-1: 0.010 in/hr (0.005 with a FOS of 2.0 for feasibility determination)
A-2: 0.007 in/hr (0.0035 with a FOS of 2.0 for feasibility determination)
A-3: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)
A-4: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)

Based on the geotechnical study, test results, and utilizing a factor of safety of 2.0 for feasibility determination, full infiltration is not feasible as the infiltration rates are lower than 0.5 in/hr.

Criteria	Screening Question	Yes	No
6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

Previously placed fill underlies the property and will remain in place. Based on the exploratory borings and laboratory testing, the previously placed extends to depths greater than 5 feet and possess a low to moderate potential for hydroconsolidation. We do not recommend infiltrating into the existing fill due to the potential for adverse soil settlement and an increased potential for hydro-collapse.

<table>
<tr><th colspan="4">Worksheet I-8 Page 4 of 4</th></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>7</td><td>Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

Groundwater is not present near the surface of the site and we are unaware of contaminated soil on the property. Therefore, infiltration associated with this risk is considered feasible.</td></tr>
<tr><td>8</td><td>Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

We did not provide a study regarding water rights. The project Civil Engineer should confirm.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration.

If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.</td><td>No Infiltration</td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

Worksheet B.2-1 DCV (DMA 5)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	1.03	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	1683	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 9)

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	2.11	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.78	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	3634	cubic-feet

C[(73528*0.90)+(18177*0.30)]/91705 = 0.78

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 13)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.16	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	262	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 15)

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.63	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.84	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	961	cubic-feet

C[(24526*0.90)+(2712*0.30)]/27238 = 0.84

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 16)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.25	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	409	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 17)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.85	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.83	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	1281	cubic-feet

C[(32706*0.90)+(4109*0.30)]/36815 = 0.83

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 18)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.81	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.81	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	1191	cubic-feet

C[(30080*0.90)+(5134*0.30)]/35214 = 0.81

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 19)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.11	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	180	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

City of San Diego TRANSPORTATION & STORM WATER

Worksheet B.2-1 DCV (DMA 20)

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.11	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	180	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

City of San Diego TRANSPORTATION & STORM WATER

Worksheet B.2-1 DCV (DMA 21)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.23	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.59	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	247	cubic-feet

C[(4753*0.90)+(5076*0.30)]/9829 = 0.59

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 22)

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	1.48	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.84	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	2257	cubic-feet

C[(57999*0.90)+(6450*0.30)]/64449 = 0.84

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 23)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.07	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.52	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	67	cubic-feet

C[(1064*0.90)+(1784*0.30)]/2848 = 0.52

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 5)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	1683	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	1200	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	180	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	1503	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	2255	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	601	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	1128	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	903	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	45000	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	1215	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	1215	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 9)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	3634	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	2150	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	323	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	3311	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	4967	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	1324	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	2484	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	1988	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	91705	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.78	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	2146	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	2146	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 13)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	262	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	200	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	30	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	232	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	348	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	93	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	174	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	140	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	6935	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	188	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	188	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 15)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	961	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	700	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	105	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	856	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	1284	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	343	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	642	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	514	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	27238	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.84	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	687	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	687	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 16)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	409	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	300	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	45	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	364	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	546	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	146	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	273	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	219	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	11000	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	297	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	297	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 17)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	1281	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	950	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	143	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	1138	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	1707	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	456	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	854	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	684	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	36815	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.83	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	917	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	917	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 18)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	1191	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	875	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	132	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	1059	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	1589	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	424	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	795	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	636	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	35214	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.81	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	856	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	856	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 19)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	180	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	150	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	23	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	157	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	236	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	63	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	118	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	95	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	4801	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	130	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	130	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 20)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	180	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	150	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	23	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	157	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	236	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	63	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	118	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	95	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	5000	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	135	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	135	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 21)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	247	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	200	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	30	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	217	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	326	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	87	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	163	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	131	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	9829	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.59	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	174	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	174	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 22)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	2257	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	1650	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	248	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	2009	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

City of San Diego
TRANSPORTATION & STORM WATER

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs			Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV				
20	Required biofiltered volume [1.5 x Line 10]	3014	cubic-feet	
21	Required Footprint [Line 20/ Line 19] x 12	804	sq-ft	
Option 2 - Store 0.75 of remaining DCV in pores and ponding				
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	1507	cubic-feet	
23	Required Footprint [Line 22/ Line 18] x 12	1206	sq-ft	
Footprint of the BMP				
24	Area draining to the BMP	64449	sq-ft	
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.84		
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03		
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	1625	sq-ft	
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	1625	sq-ft	
Check for Volume Reduction [Not applicable for No Infiltration Condition]				
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless	
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless	
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No	

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 23)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	67	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	75	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	12	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	55	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	83	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	23	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	42	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	34	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	2848	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.52	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	45	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	45	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

E.13. BF-1 Biofiltration

Location: 43rd Street and Logan Avenue, San Diego, California

MS4 Permit Category
Biofiltration
Manual Category
Biofiltration
Applicable Performance Standard
Pollutant Control Flow Control
Primary Benefits
Treatment Volume Reduction (Incidental) Peak Flow Attenuation (Optional)

Description

Biofiltration (Bioretention with underdrain) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Bioretention with underdrain facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. Because these types of facilities have limited or no infiltration, they are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and plant uptake.

Typical bioretention with underdrain components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer (aka choking layer) consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure

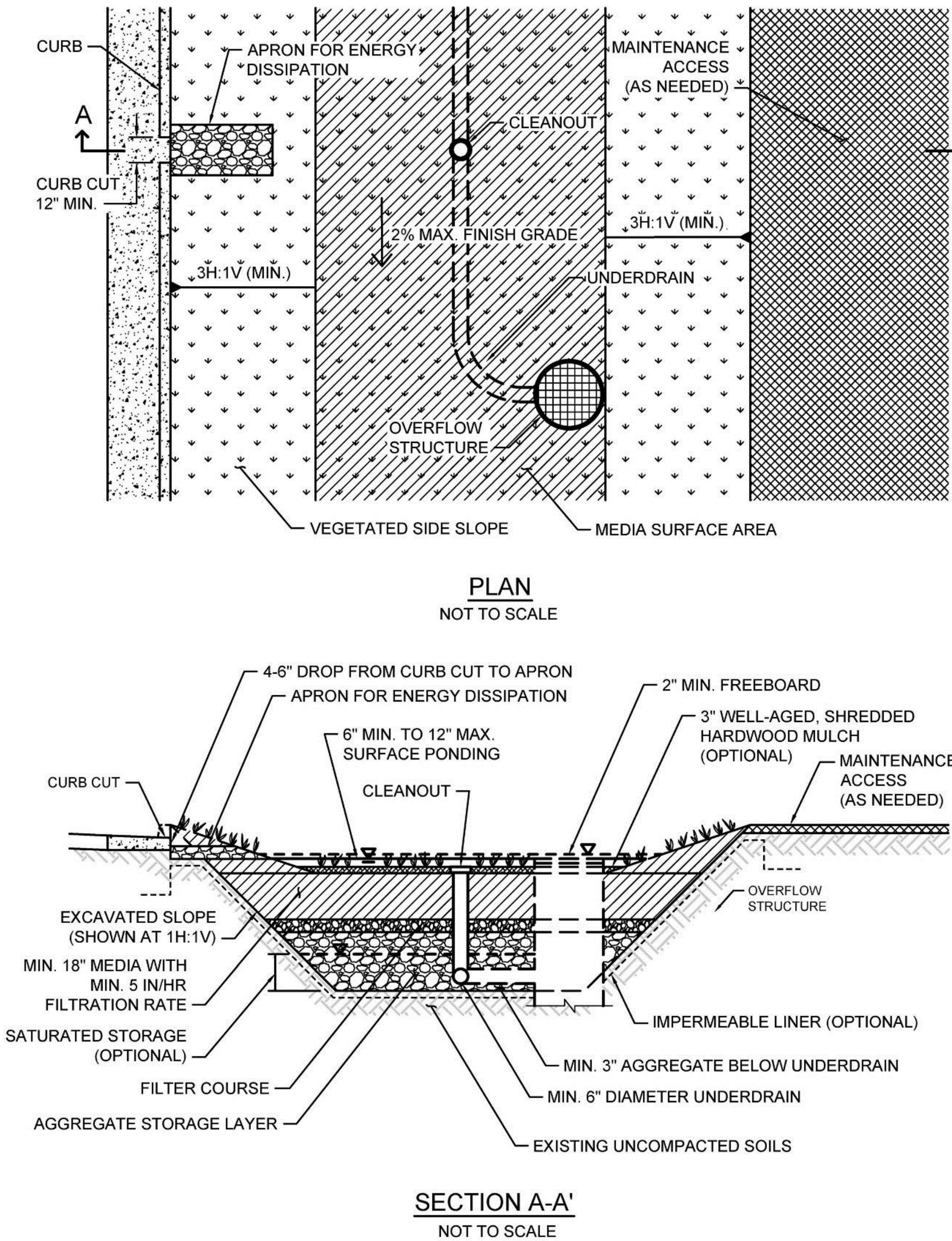


Figure E.13-E.13-1: Typical plan and Section view of a Biofiltration BMP

Design Adaptations for Project Goals

Biofiltration Treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration, and an underdrain is provided at the bottom to carry away filtered runoff. This configuration is considered to provide biofiltration treatment via flow through the media layer. Storage provided above the underdrain within surface ponding, media, and aggregate storage is considered included in the biofiltration treatment volume. Saturated storage within the aggregate storage layer can be added to this design by raising the underdrain above the bottom of the aggregate storage layer or via an internal weir structure designed to maintain a specific water level elevation.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer above the underdrain. This will allow for significant detention storage, which can be controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Bioretention with underdrain must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the City Engineer if it is determined to be appropriate:

	Siting and Design	Intent/Rationale
□	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
□	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
□	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the City Engineer if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the City Engineer for proper performance of the regional BMP.
□	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
Surface Ponding		

	Siting and Design	Intent/Rationale
☐	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hour for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the City Engineer if certified by a landscape architect or agronomist.
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the City Engineer if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
☐	A minimum of 2 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20.	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch (Mandatory)		
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer		

	Siting and Design	Intent/Rationale
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. Additional Criteria for media hydraulic conductivity described in the bioretention soil media model specification (Appendix F.4)	A filtration rate of at least 5 inches per hour allows soil to drain between events. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.
☐	Media is a minimum 18 inches deep, meeting the following media specifications: Model biorention soil media specification provided in Appendix F.4 <u>or</u> County of San Diego Low Impact Development Handbook: Appendix G - Bioretention Soil Specification (June 2014, unless superseded by more recent edition). Alternatively, for proprietary designs and custom media mixes not meeting the media specifications, the media meets the pollutant treatment performance criteria in Section F.1.	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary designs, compliance with Appendix F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
☐	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.
Filter Course Layer		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade and can result in poor water quality performance for turbidity and suspended solids. Filter fabric is more likely to clog.

	Siting and Design	Intent/Rationale
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.
☐	To reduce clogging potential, a two-layer filter course (aka choking stone system) is used consisting of one 3" layer of clean and washed ASTM 33 Fine Aggregate Sand overlying a 3" layer of ASTM No 8 Stone (Appendix F.5).	This specification has been developed to maintain permeability while limiting the migration of media material into the stone reservoir and underdrain system.
Aggregate Storage Layer		
☐	ASTM #57 open graded stone is used for the storage layer and a two layer filter course (detailed above) is used above this layer	This layer provides additional storage capacity. ASTM #8 stone provides an acceptable choking/bridging interface with the particles in ASTM #57 stone.
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
Inflow, Underdrain, and Outflow Structures		
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 8 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains should be affixed with an upturned elbow to an elevation at least 9 to 12 inches above the invert of the underdrain.	An upturned elbow reduces velocity in the underdrain pipe and can help reduce mobilization of sediments from the underdrain and media bed.

	Siting and Design	Intent/Rationale
□	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
□	An underdrain cleanout with a minimum 8-inch diameter and lockable cap is placed every 50 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
□	Overflow is safely conveyed to a downstream storm drain system or discharge point Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design bioretention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet presented in Appendix B.5 to size biofiltration BMPs.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If bioretention with underdrain cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After bioretention with underdrain has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.21. PL Plant List

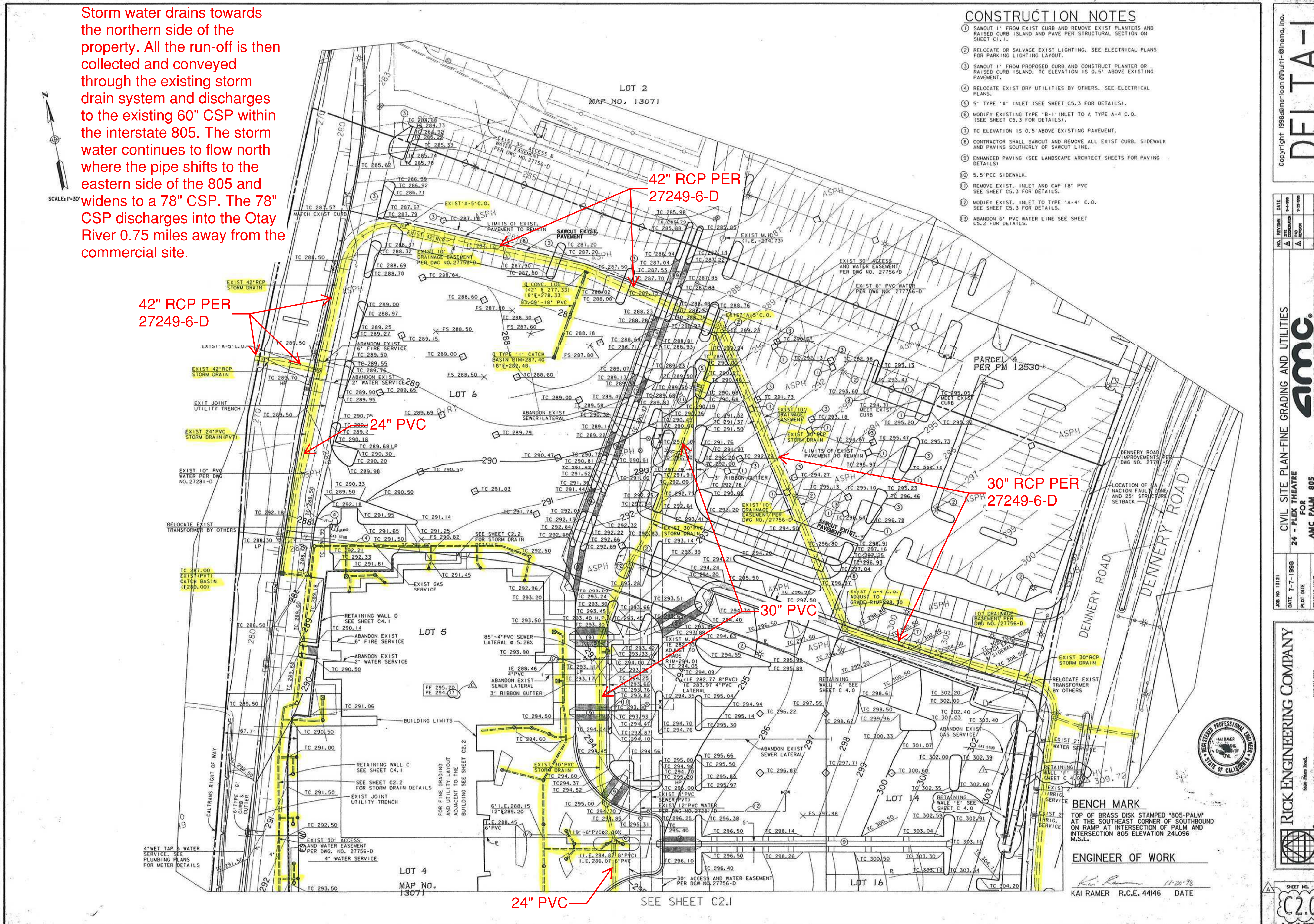
Plant Name		Irrigation Requirements		Preferred Location in Basin		Applicable Bioretention Sections (Un-Lined Facilities)				Applicability to Flow-Through Planter? (Lined Facility)	
Latin Name	Common Name	Temporary Irrigation during Plant Establishment Period	Permanent Irrigation (Drip / Spray)(1)	Basin Bottom	Basin Side Slopes	Section A Treatment-Only Bioretention in Hydrologic Soil Group A or B Soils	Section B Treatment-Only Bioretention in Hydrologic Soil Group C or D soils	Section C Treatment Plus Flow Control Bioretention in Hydrologic Soil Group A or B Soils	Section D Treatment Plus Flow Control Bioretention in Hydrologic Soil Group C or D Soils	**NO** Applicable to Un-lined Facilities Only (Bioretention Only)	**YES** Can Use in Lined or Un-Lined Facility (Flow-Through Planter OR Bioretention)
TREES(2)											
Alnus rhombifolia	White Alder	X		X	X	X	X	X	X	X	
Platanus racemosa	California Sycamore	X		X	X	X	X	X	X	X	
Salix lasiolepsis	Arroyo Willow	X			X	X	X	X	X	X	
Salix lucida	Lance-Leaf Willow	X			X	X	X	X	X	X	
Sambucus mexicana	Blue Elderberry	X			X	X	X	X	X	X	
SHRUBS / GROUNDCOVER											
Achillea millefolium	Yarrow	X			X	X	X				X
Agrostis palens	Thingrass	X			X	X	X	X	X		X
Anemopsis californica	Yerba Manza	X			X	X	X	X	X		X
Baccharis douglasii	Marsh Baccahris	X	X	X		X	X	X	X		X
Carex praegracillis	California Field Sedge	X	X	X		X	X	X	X		X
Carex spissa	San Diego Sedge	X	X	X		X	X	X	X		X
Carex subfusca	Rusty Sedge	X	X	X	X	X	X	X	X		X
Distichlis spicata	Salt Grass	X	X	X		X	X	X	X		X
Eleocharis macrostachya	Pale Spike Rush	X	X	X		X	X	X	X		X
Festuca rubra	Red Fescue	X	X	X	X	X	X				X
Festuca californica	California Fescue	X	X		X	X	X				X
Iva hayesiana	Hayes Iva	X			X	X	X				X
Juncus Mexicana	Mexican Rush	X	X	X	X	X	X	X	X		X
Jucus patens	California Gray Rush	X	X	X	X	X	X	X	X		X
Leymus condensatus 'Canyon Prince'	Canyon Prince Wild Rye	X	X	X	X	X	X	X	X		X
Mahonia nevinii	Nevin's Barberry	X			X	X	X	X	X		X
Muhlenburgia rigens	Deergrass	X	X	X	X	X	X	X	X		X
Mimulus cardinalis	Scarlet Monkeyflower	X		X	X	X	X				X
Ribes speciosum	Fushia Flowering Goose.	X			X	X	X				X
Rosa californica	California Wild Rose	X	X		X	X	X				X
Scirpus cenuus	Low Bullrush	X	X	X		X	X	X	X		X
Sisyrinchium bellum	Blue-eyed Grass	X			X	X	X				X

1. All plants will benefit from some supplemental irrigation during hot dry summer months, particularly those on basin side slopes and further inland.
2. All trees should be planted a min. of 10' away from any drain pipes or structures.

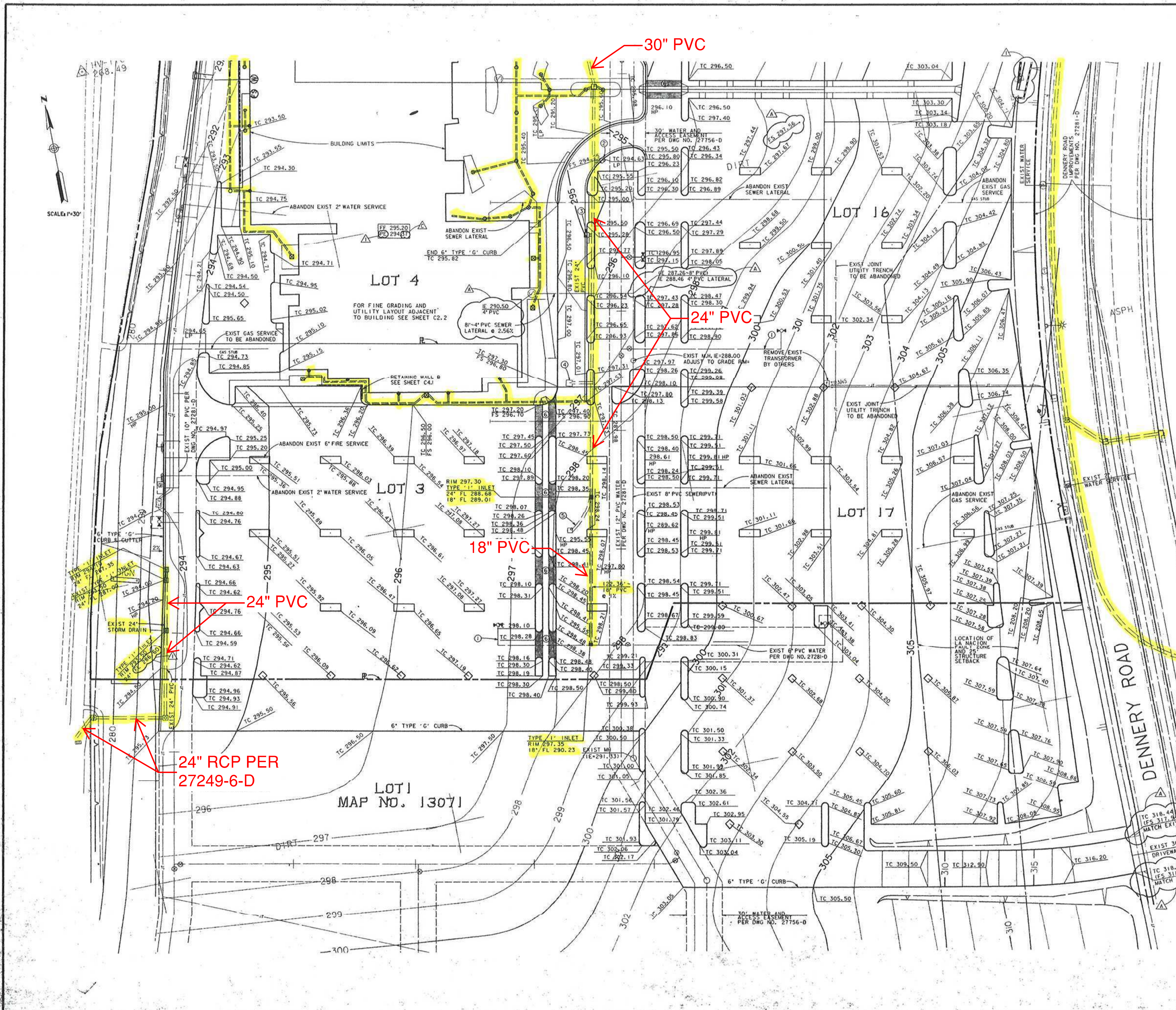
ATTACHMENT 2
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

☒ Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

NOTE: Documentation demonstrating how this project meets the PDP hydromodification exemption is included.



Storm water drains towards the northern side of the property. All the run-off is then collected and conveyed through the existing storm drain system and discharges to the existing 60" CSP within the interstate 805. The storm water continues to flow north where the pipe shifts to the eastern side of the 805 and widens to a 78" CSP. The 78" CSP discharges into the Otay River 0.75 miles away from the commercial site.
42" RCP PER 27249-6-D
42" RCP PER 27249-6-D
24" PVC
30" RCP PER 27249-6-D
30" PVC
24" PVC
CONSTRUCTION NOTES
(1) SAWCUT 1' FROM EXIST CURB AND REMOVE EXIST PLANTERS AND RAISED CURB ISLAND AND PAVE PER STRUCTURAL SECTION ON SHEET C1.1.
(2) RELOCATE OR SALVAGE EXIST LIGHTING. SEE ELECTRICAL PLANS FOR PARKING LIGHTING LAYOUT.
(3) SAWCUT 1' FROM PROPOSED CURB AND CONSTRUCT PLANTER OR RAISED CURB ISLAND. TC ELEVATION IS 0.5' ABOVE EXISTING PAVEMENT.
(4) RELOCATE EXIST DRY UTILITIES BY OTHERS. SEE ELECTRICAL PLANS.
(5) 5' TYPE 'A' INLET (SEE SHEET C5.3 FOR DETAILS).
(6) MODIFY EXISTING TYPE 'B-1' INLET TO A TYPE A-4 C.O. (SEE SHEET C5.3 FOR DETAILS).
(7) TC ELEVATION IS 0.5' ABOVE EXISTING PAVEMENT.
(8) CONTRACTOR SHALL SAWCUT AND REMOVE ALL EXIST CURB, SIDEWALK AND PAVING SOUTHERLY OF SAWCUT LINE.
(9) ENHANCED PAVING (SEE LANDSCAPE ARCHTECT SHEETS FOR PAVING DETAILS)
(10) 5.5' PCC SIDEWALK.
(11) REMOVE EXIST. INLET AND CAP 18" PVC SEE SHEET C5.3 FOR DETAILS.
(12) MODIFY EXIST. INLET TO TYPE 'A-4' C.O. SEE SHEET C5.3 FOR DETAILS.
(13) ABANDON 6" PVC WATER LINE SEE SHEET C5.2 FOR DETAILS.
LOT 2
MAP NO. 13071
LOT 6
LOT 5
LOT 4
MAP NO. 13071
LOT 14
LOT 16
PARCEL 4
PER PM 12530
DENNERY ROAD
SEE SHEET C2.1
BENCH MARK
TOP OF BRASS DISK STAMPED '805-PALM' AT THE SOUTHEAST CORNER OF SOUTHBOUND ON RAMP AT INTERSECTION OF PALM AND INTERSECTION 805 ELEVATION 241.096 M.S.L.
ENGINEER OF WORK
KAI RAMER R.C.E. 44146 DATE
DELTA-1
CIVIL SITE PLAN-FINE GRADING AND UTILITIES
24 - PLEX THEATRE FOR AMC PALM 805
AMC AMERICAN MULTI-CINEMA, INC.
RICK ENGINEERING COMPANY
DATE 7-7-1998
C2.0



CONSTRUCTION NOTES

1. ABANDON 6" PVC WATER MAIN. SEE SHEET C5.2 FOR DETAILS.
2. 5' TYPE 'B' INLET. SEE SHEET C5.4 FOR DETAILS.
3. 9' TYPE 'A-1' INLET. SEE SHEET C5.4 FOR DETAILS.
4. REMOVE EXIST INLET AND CAP EXIST 18" PVC. SEE SHEET C5.4 FOR DETAILS.
5. REMOVE EXIST INLET AND STORM DRAIN PIPE. SEE SHEET C5.4 FOR DETAILS.
6. ENHANCED PAVING. SEE LANDSCAPE ARCHITECTS SHEET FOR DETAILS.

BENCH MARK
TOP OF BRASS DISK STAMPED "805-PALM" AT THE SOUTHEAST CORNER OF SOUTHBOUND ON RAMP AT INTERSECTION OF PALM AND INTERSECTION 805 ELEVATION 314.096 M.S.L.

ENGINEER OF WORK

KAI RAMER R.C.E. 44146 DATE

DELTA-1

NO.	REVISION	DATE
1	SITE COORDINATION	9-4-1998
2	PAD REVISION	9-29-1998
3	PLAN CHECK/OWNER CHANGES	11-6-1998

CIVIL SITE PLAN-FINE GRADING AND UTILITIES

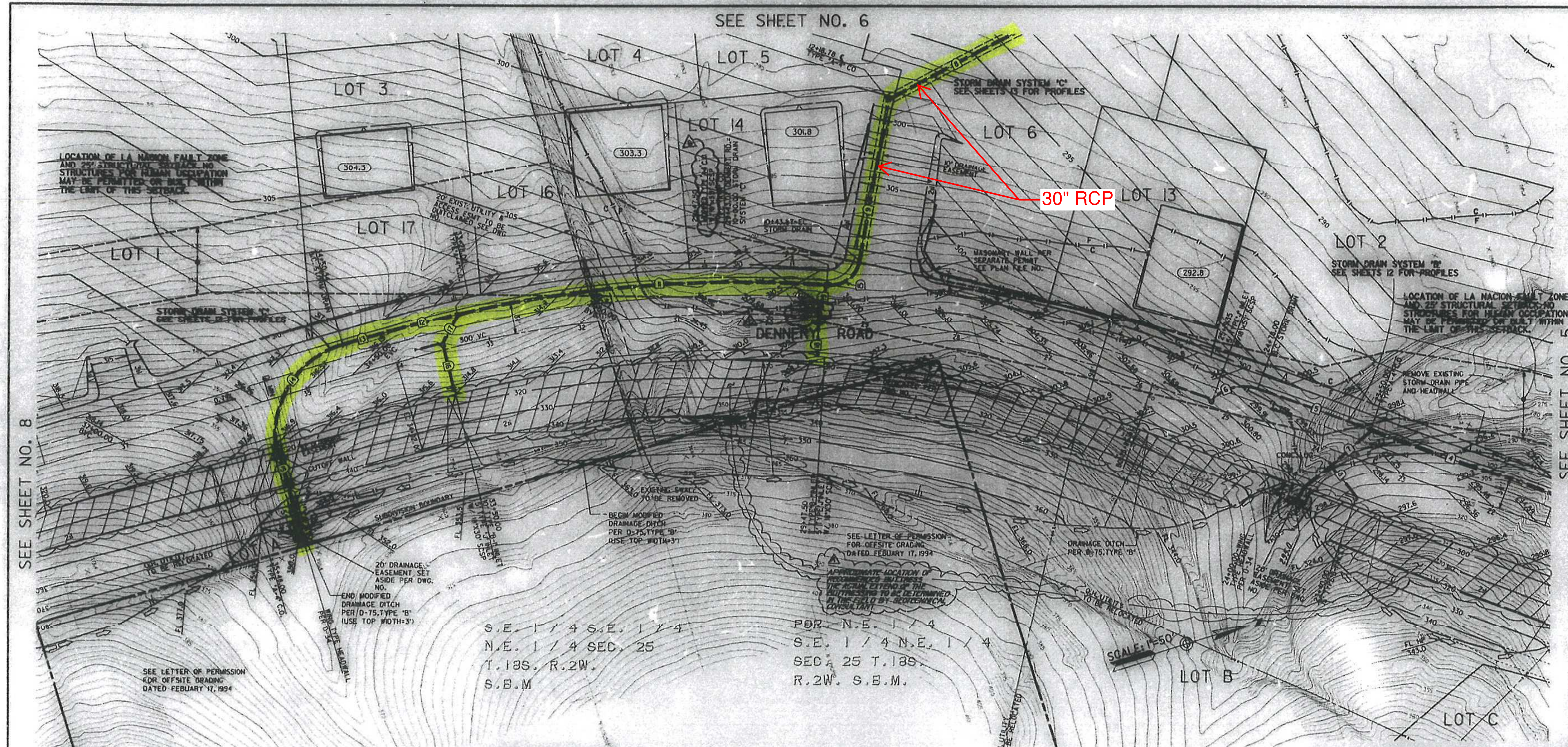
24 - PLEX THEATRE FOR AMC PALM 805
SAN DIEGO CALIFORNIA

AMC AMERICAN MULTI-CINEMA, INC.

JOB NO. 13121
DATE 7-7-1998
PLOT DATE
DRAWING NAME

RICK ENGINEERING COMPANY
5620 Friars Road, San Diego, California 92110-2596
(619) 291-0707

SHEET NO. C2.1
4 OF 15 SHEETS



* 4' LENGTHS 5° BEVEL BOTH ENDS
** 8' LENGTHS 5° BEVEL ONE END

STORM DRAIN DATA (SYSTEM "C")				
NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
8	SEE SHEET NO. 6			30" RCP(1350-D)
9	N 62°54'00"W		172.91'	" "
10	Δ= 83°47'31"	* 30.00'	48.87'	" "
11	Δ= 16°47'37"	1334.00'	391.00'	30" RCP(1350-D)
12	Δ= 03°15'41"	1334.00'	73.94'	24" RCP(1350-D)
13	N 00°34'45"E		48.34'	" "
14	Δ= 77°35'04"	** 100.00'	135.41'	" "
15	N 89°25'15"W		91.00'	30" RCP(1350-D) ***
16	N 87°07'04"W		42.00'	18" RCP(1350-D)
17	N 45°09'29"W		33.71'	" "
18	N 69°23'21"W		46.75'	" "
19	N 59°05'44"W		21.07'	" "

STORM DRAIN DATA (SYSTEM "B")				
NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
4	SEE SHEET NO. 5			30" RCP(1350-D)
5	N 36°33'54"E		126.00'	18" RCP(1350-D)
6	Δ= 66°46'07"W	* 45.00'	52.44'	18" RCP(1350-D)
7	N 23°08'29"W		111.12'	24" RCP(1350-D)
8	N 66°51'33"E		43.33'	18" RCP(1350-D)

* 4' LENGTHS 5° BEVEL ONE END
*** USE WATER TIGHT JOINTS

BENCH MARK

TOP OF BRASS STAMPED "805-PALM" AT THE SOUTHEAST CORNER OF THE SOUTHBOUND ON RAMP AT THE INTERSECTION OF PALM AND INTERSTATE 805.
ELEVATION: 241.096 DATUM: M.S.L.

ENGINEER OF WORK

4/15/94
HOUSHMAND AFTAHI R.C.E. 18878 DATE

RICK ENGINEERING COMPANY

PRIVATE CONTRACT J-12300

GRADING PLANS FOR:

PALM PROMENADE

MAP NO. 13071

CITY OF SAN DIEGO, CALIFORNIA
SHEET 7 OF 37 SHEETS

W.O. NO. TM-92-0736 930248

4/25/94

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	REC			
"A" CHANGE	REC		7/1/94	JUL 29 '94
"B" CHANGE	REC			
AS BUILT	REC			

1788-6317
148-1757
CONTRACTOR: CATLIN DEV. CO.
INSPECTOR: MATT SOUTTERE
DATE STARTED: APRIL 25, 1994

27249- 7-D

AS BUILT

6-29-94 △A ADD BUTTRESS AREA
8-16-94 △B REVISED STORM DRAIN STRUCTURE @ 29+50

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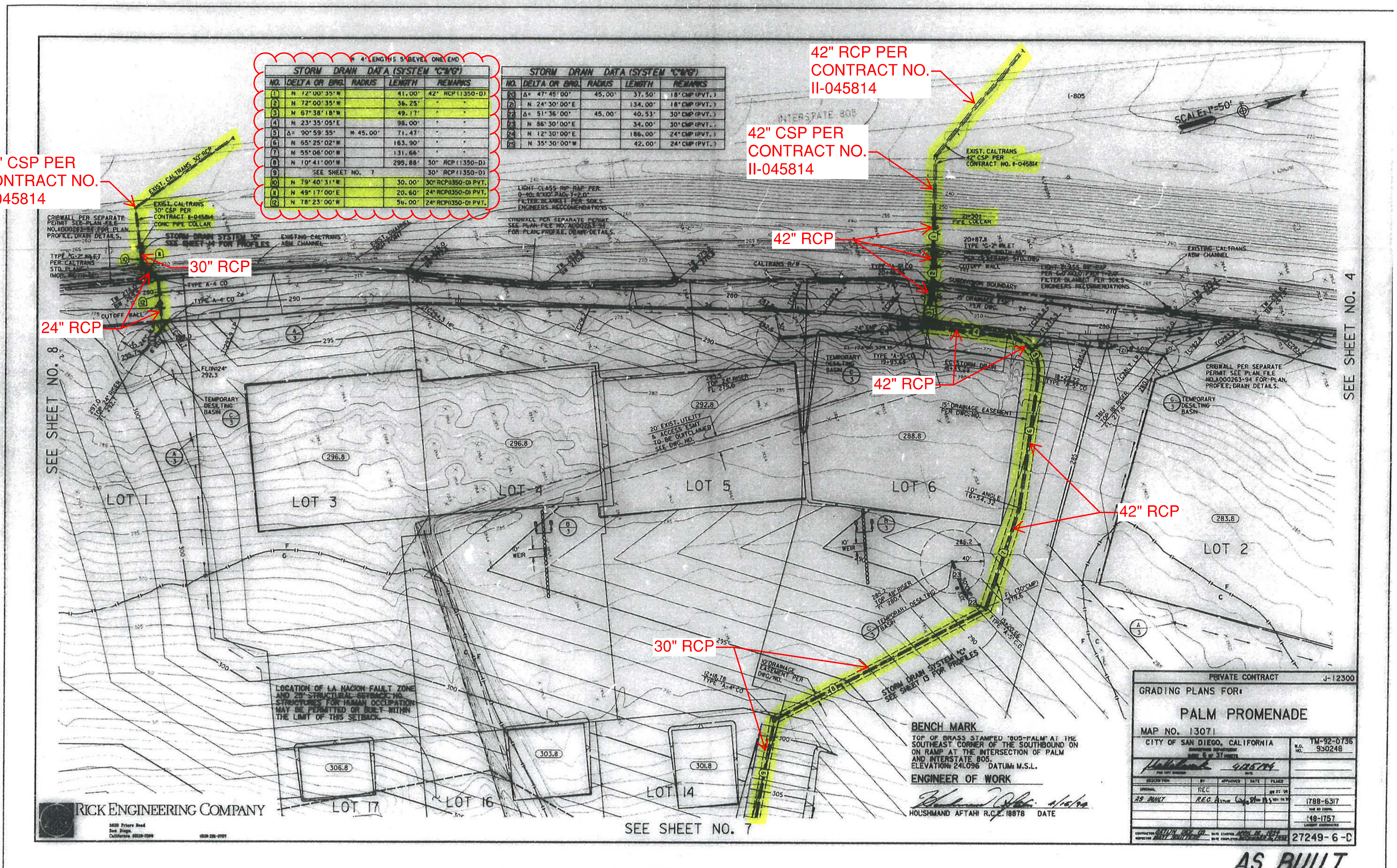
13-APR-1994 13:47



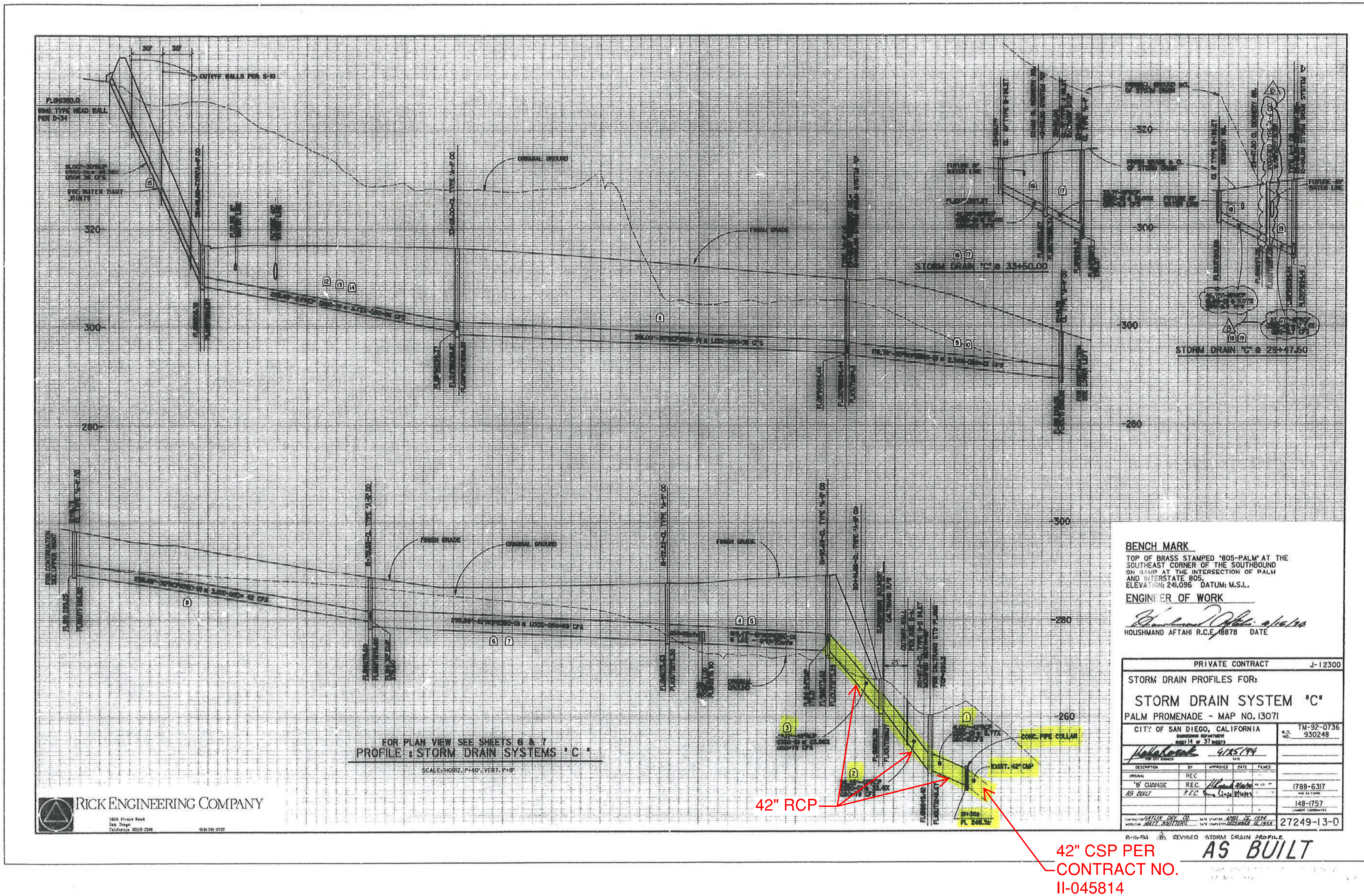
* 4' LENGTHS 5° BEVEL ONE END

STORM DRAIN DATA (SYSTEM "C"&"G")

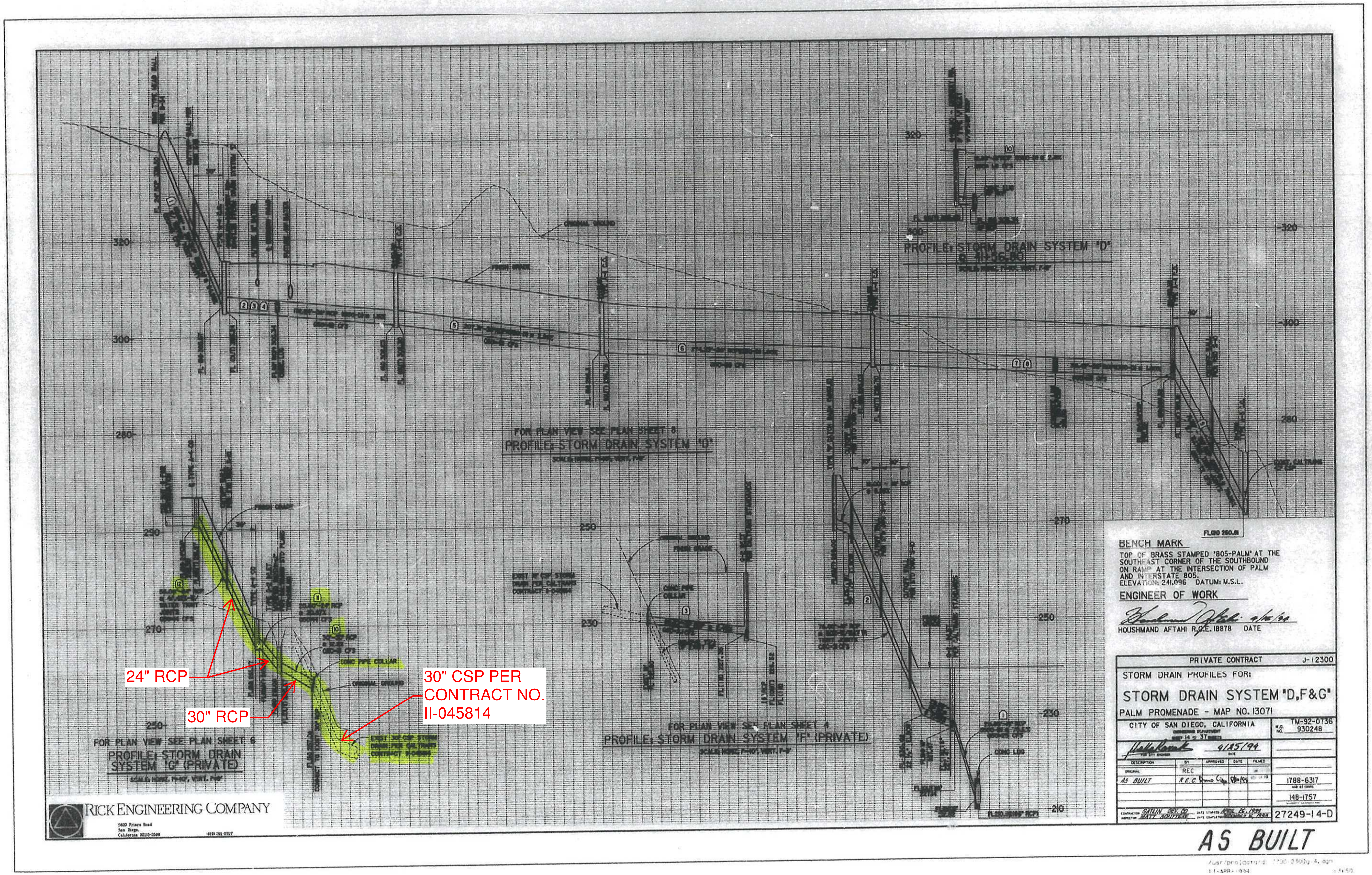
NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	N 72°00'35"W		41.00'	42" RCP (1350-D)
2	N 72°00'35"W		36.25'	" "
3	N 67°38'18"W		49.17'	" "
4	N 23°35'05"E		98.00'	" "
5	Δ= 90°59'55"	* 45.00'	71.47'	" "
6	N 65°25'02"W		163.90'	" "
7	N 55°06'00"W		131.66'	" "
8	N 10°41'00"W		295.88'	30" RCP (1350-D)
9	SEE SHEET NO. 7			30" RCP (1350-D)
10	N 79°40'31"W		30.00'	30" RCP(1350-D) PVT.
11	N 49°17'00"E		20.60'	24" RCP(1350-D) PVT.
12	N 78°23'00"W		56.00'	24" RCP(1350-D) PVT.

STORM DRAIN DATA (SYSTEM "C"&"G")

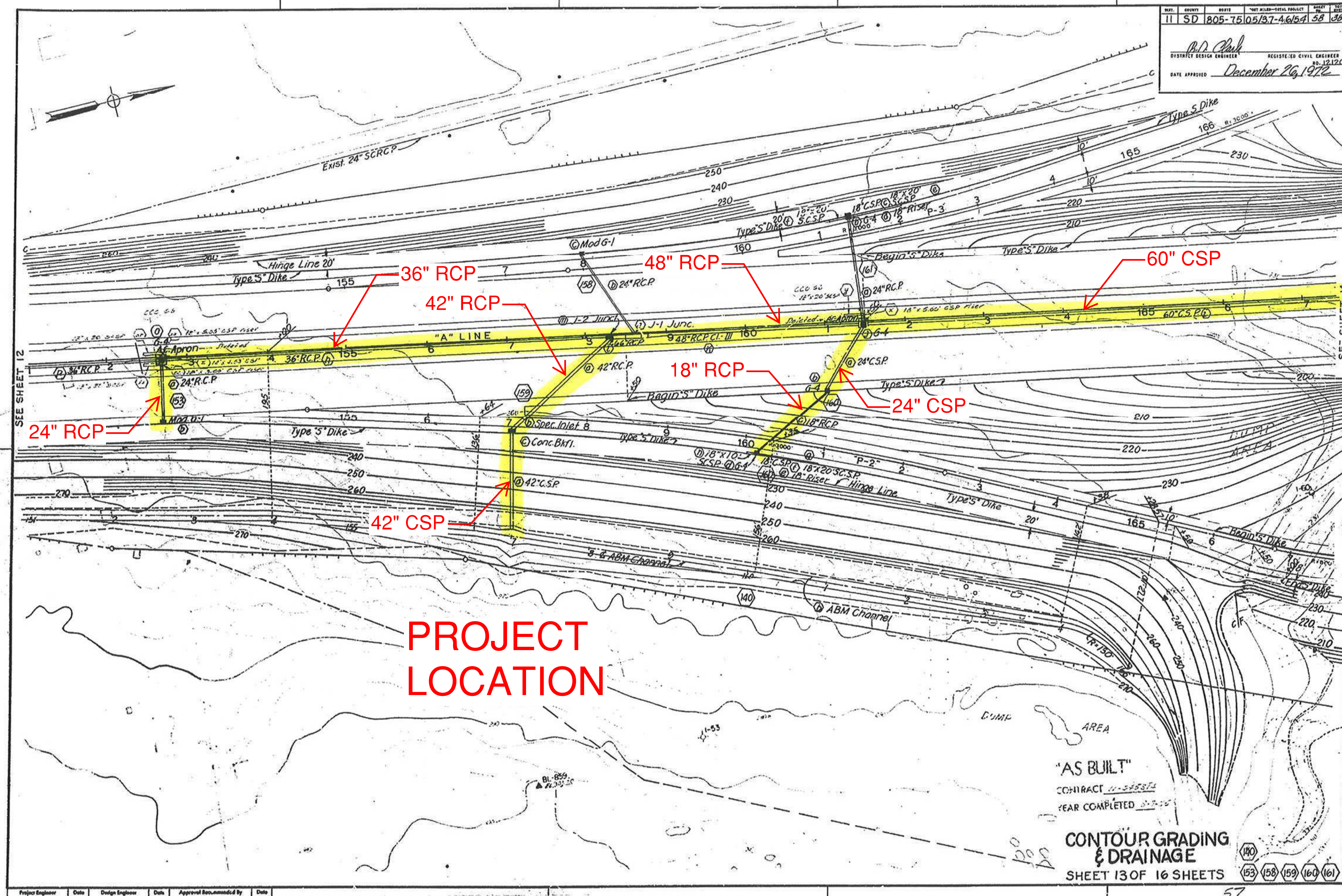
NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
20	Δ= 47°45'00"	45.00'	37.50'	18" CMP (PVT.)
21	N 24°30'00"E		134.00'	18" CMP (PVT.)
22	Δ= 51°36'00"	45.00'	40.53'	30" CMP (PVT.)
23	N 86°30'00"E		34.00'	30" CMP (PVT.)
24	N 12°30'00"E		186.00'	24" CMP (PVT.)
25	N 35°30'00"W		42.00'	24" CMP (PVT.)



FOR PLAN VIEW SEE SHEETS 6 & 7
PROFILE : STORM DRAIN SYSTEMS 'C'
STORM DRAIN "C" @ 33+50.00
STORM DRAIN "C" @ 29+47.50
ORIGINAL GROUND
FINISH GRADE
CONC. PIPE COLLAR
EXIST. 42" CMP
42" RCP
42" CSP PER CONTRACT NO. II-045814
BENCH MARK
TOP OF BRASS STAMPED '805-PALM' AT THE SOUTHEAST CORNER OF THE SOUTHBOUND ON RAMP AT THE INTERSECTION OF PALM AND INTERSTATE 805.
ELEVATION: 241.096 DATUM: M.S.L.
ENGINEER OF WORK
HOUSHMAND AFTAHI R.C.E. 18878 DATE
PRIVATE CONTRACT J-12300
STORM DRAIN PROFILES FOR:
STORM DRAIN SYSTEM "C"
PALM PROMENADE - MAP NO. 13071
CITY OF SAN DIEGO, CALIFORNIA
SHEET 14 OF 37 SHEETS
W.O. NO. TM-92-0736 930248
4/25/94
ORIGINAL REC
'B' CHANGE REC.
AS BUILT R.E.C.
1788-6317
148-1757
CONTRACTOR GATLIN DEV. CO
INSPECTOR MATT SOUTTERS
DATE STARTED APRIL 06, 1994
DATE COMPLETED DECEMBER 06, 1994
27249-13-D
8-16-94 B REVISED STORM DRAIN PROFILE
AS BUILT
RICK ENGINEERING COMPANY



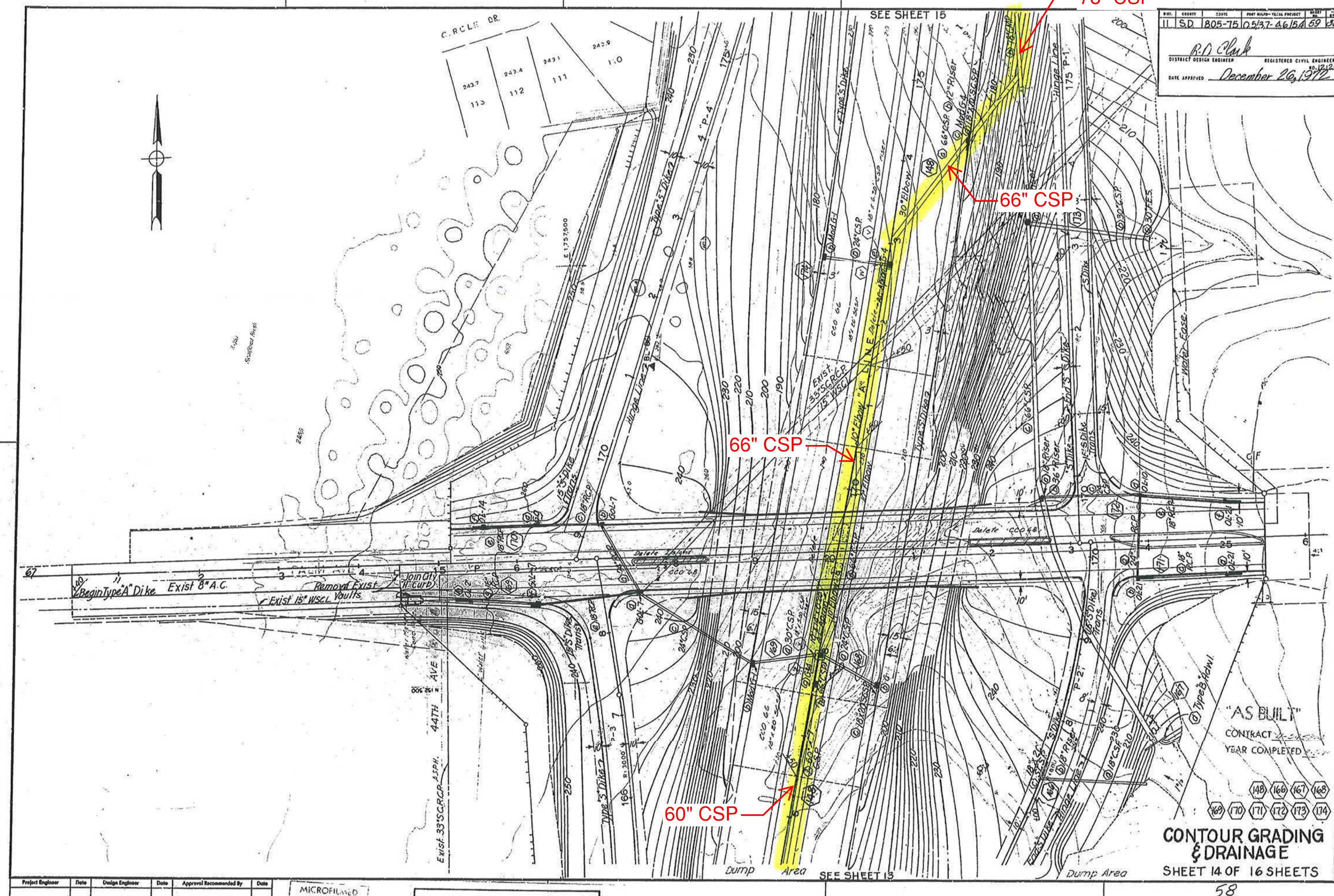
PROFILE: STORM DRAIN SYSTEM "D"
FOR PLAN VIEW SEE PLAN SHEET 6
PROFILE: STORM DRAIN SYSTEM "D"
FOR PLAN VIEW SEE PLAN SHEET 4
PROFILE: STORM DRAIN SYSTEM "F" (PRIVATE)
FOR PLAN VIEW SEE PLAN SHEET 6
PROFILE: STORM DRAIN SYSTEM "G" (PRIVATE)
ORIGINAL GROUND
FINISH GRADE
CONC PIPE COLLAR
24" RCP
30" RCP
30" CSP PER CONTRACT NO. II-045814
BENCH MARK
TOP OF BRASS STAMPED '805-PALM' AT THE SOUTHEAST CORNER OF THE SOUTHBOUND ON RAMP AT THE INTERSECTION OF PALM AND INTERSTATE 805.
ELEVATION: 241.096 DATUM: M.S.L.
ENGINEER OF WORK
HOUSHMAND AFTAHI R.C.E. 18878 DATE
PRIVATE CONTRACT J-12300
STORM DRAIN PROFILES FOR:
STORM DRAIN SYSTEM "D,F&G"
PALM PROMENADE - MAP NO. 13071
CITY OF SAN DIEGO, CALIFORNIA
4/25/94
TM-92-0736
930248
AS BUILT
1788-6317
148-1757
27249-14-D
RICK ENGINEERING COMPANY
AS BUILT



AS BUILT PLANS
Contract No. 11-174504
Date Completed 7-9-76
Document No. 4000 1528

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

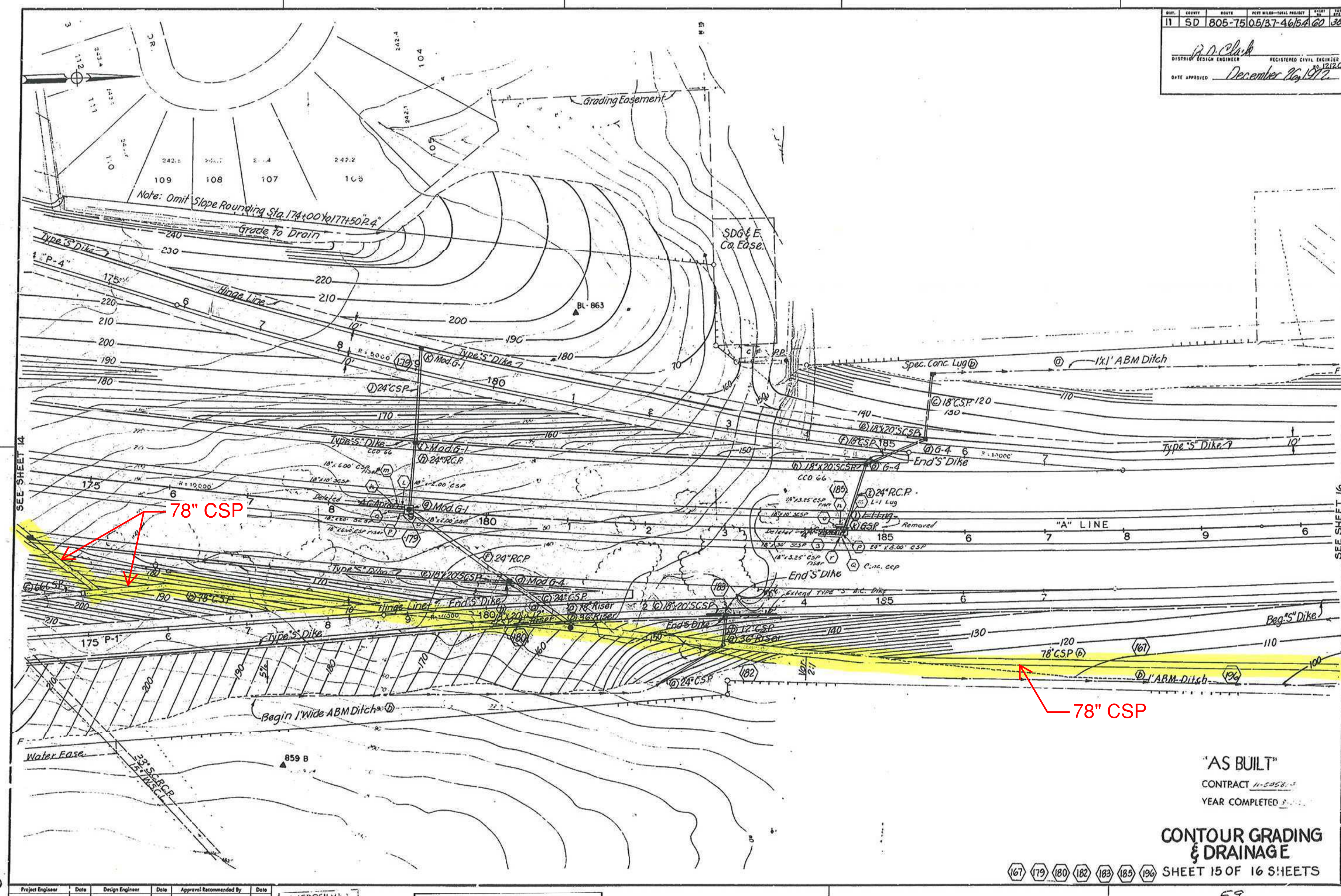
MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION - MICROFILM



AS BUILT PLANS
Contract No. 11-045814
Date Completed 7-9-76
Document No. A000 6281

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION - MICROFILM



MICROFILMED

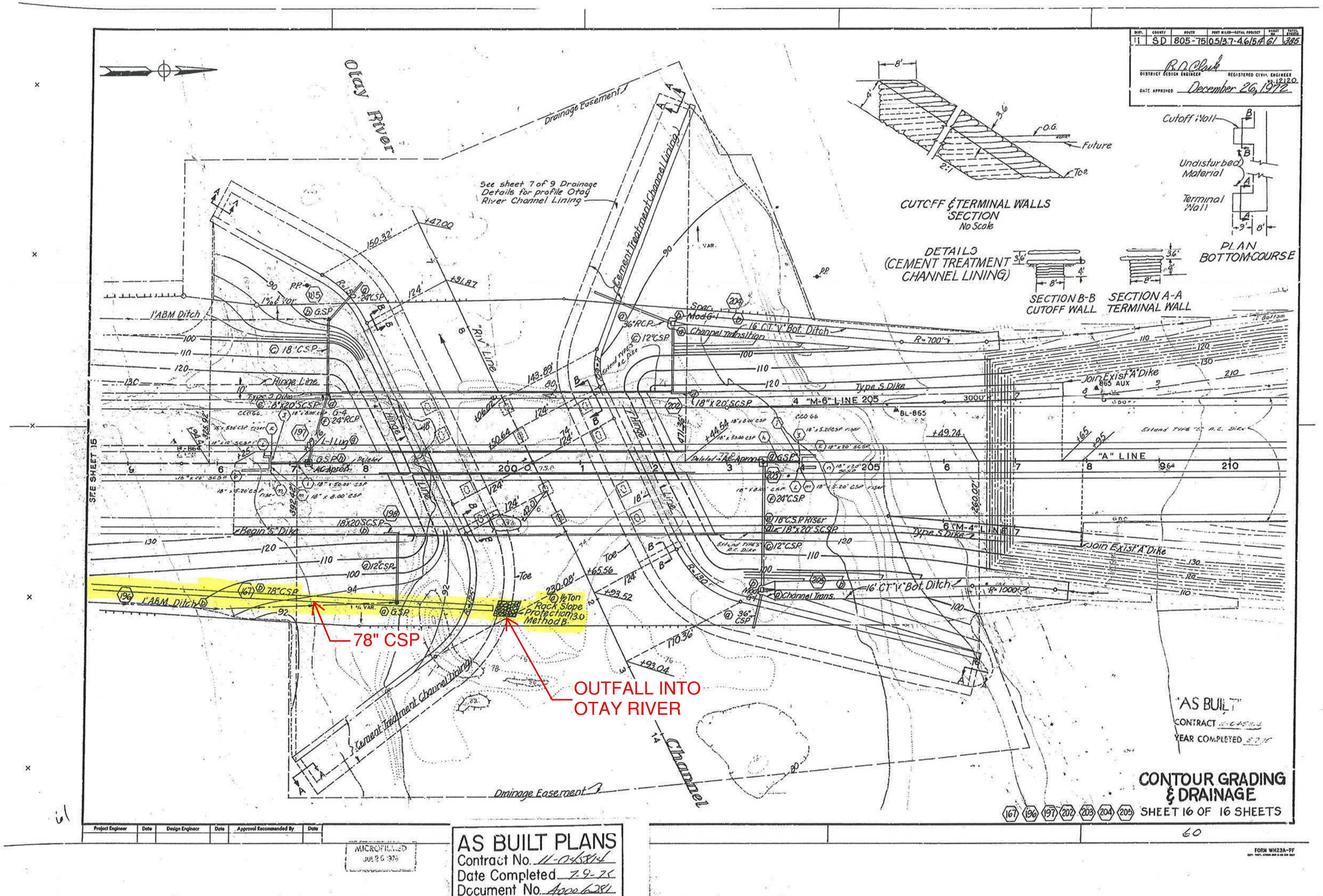
AS BUILT PLANS
Contract No. 11-045814
Date Completed 7-9-75
Document No. A0006281

FORM WH23A-PF

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

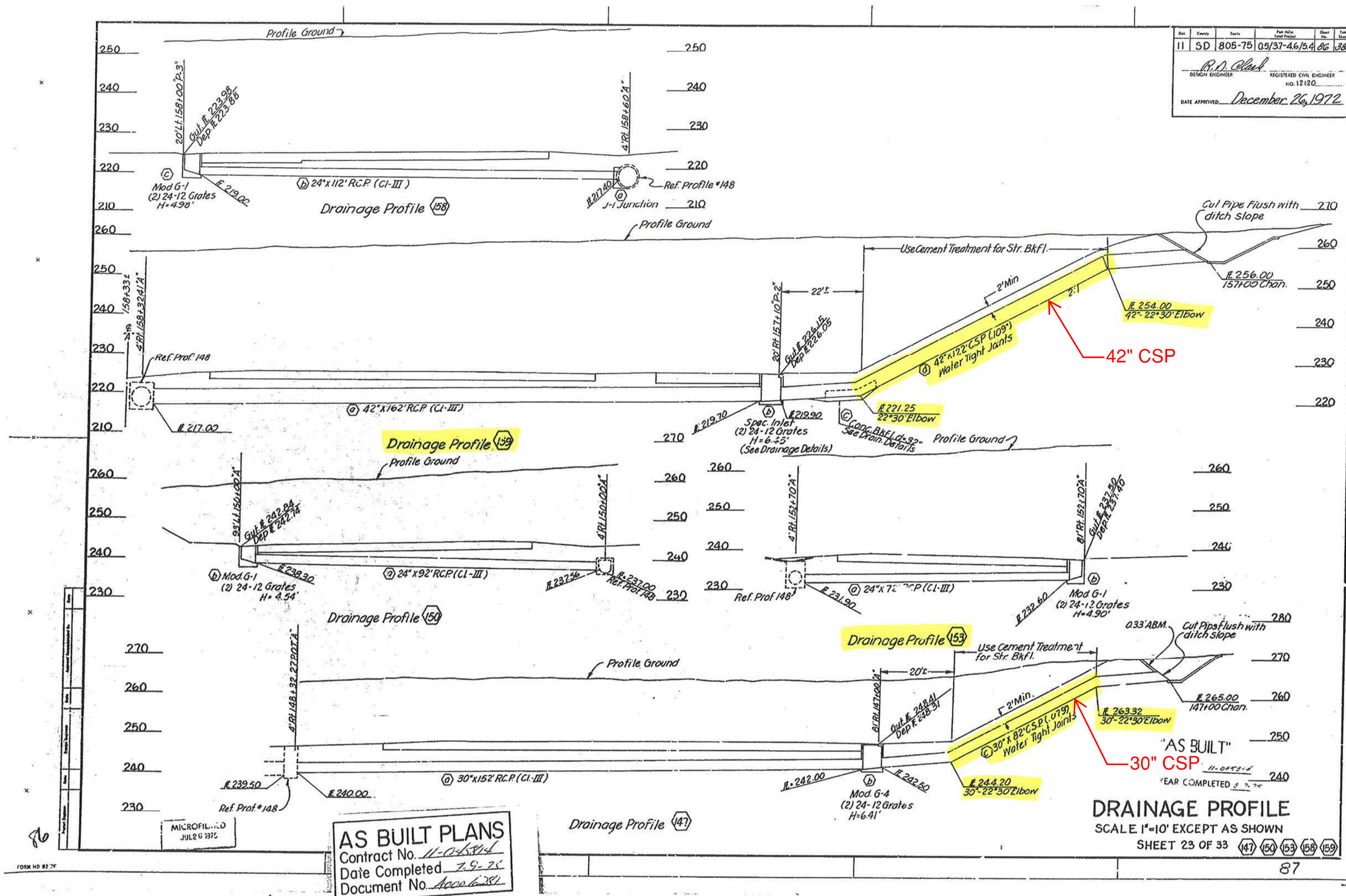
MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION - MICROFILM

SCALE 1" = 50' SCALE 1" = 20' SCALE 1" = 10' or 1" = 100' SCALE 1" = 40'

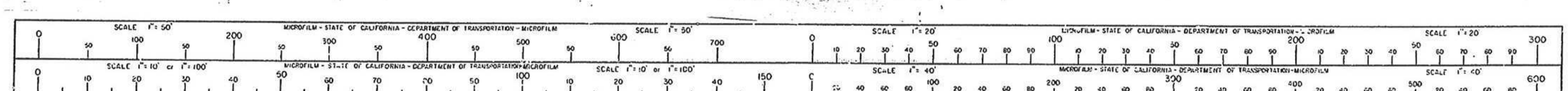


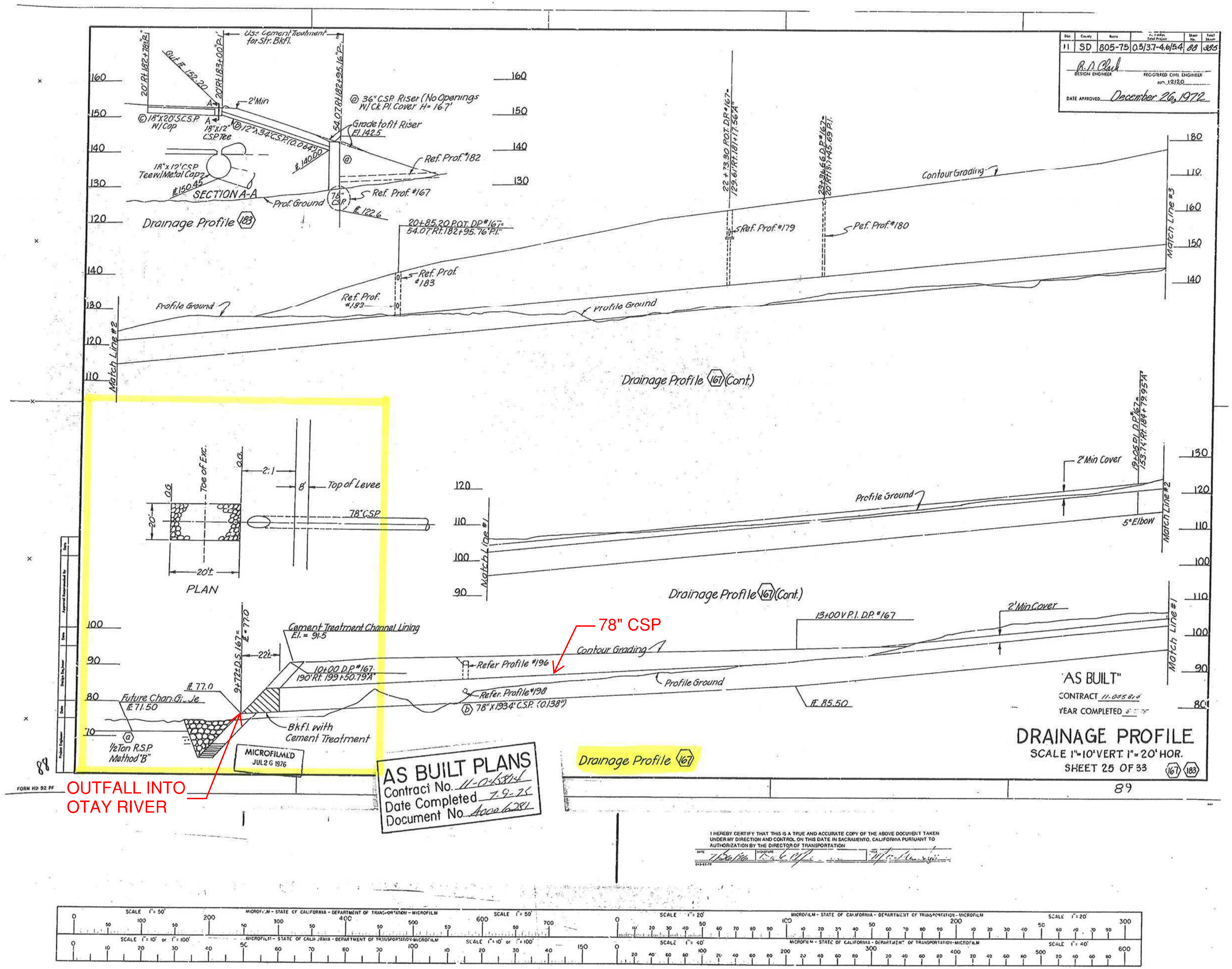
Storm water drains towards the northern side of the property. All the run-off is then collected and conveyed through the existing storm drain system and discharges to the existing 60" CSP within the interstate 805. The storm water continues to flow north where the pipe shifts to the eastern side of the 805 and widens to a 78" CSP. The 78" CSP discharges into the Otay River 0.75 miles away from the commercial site.

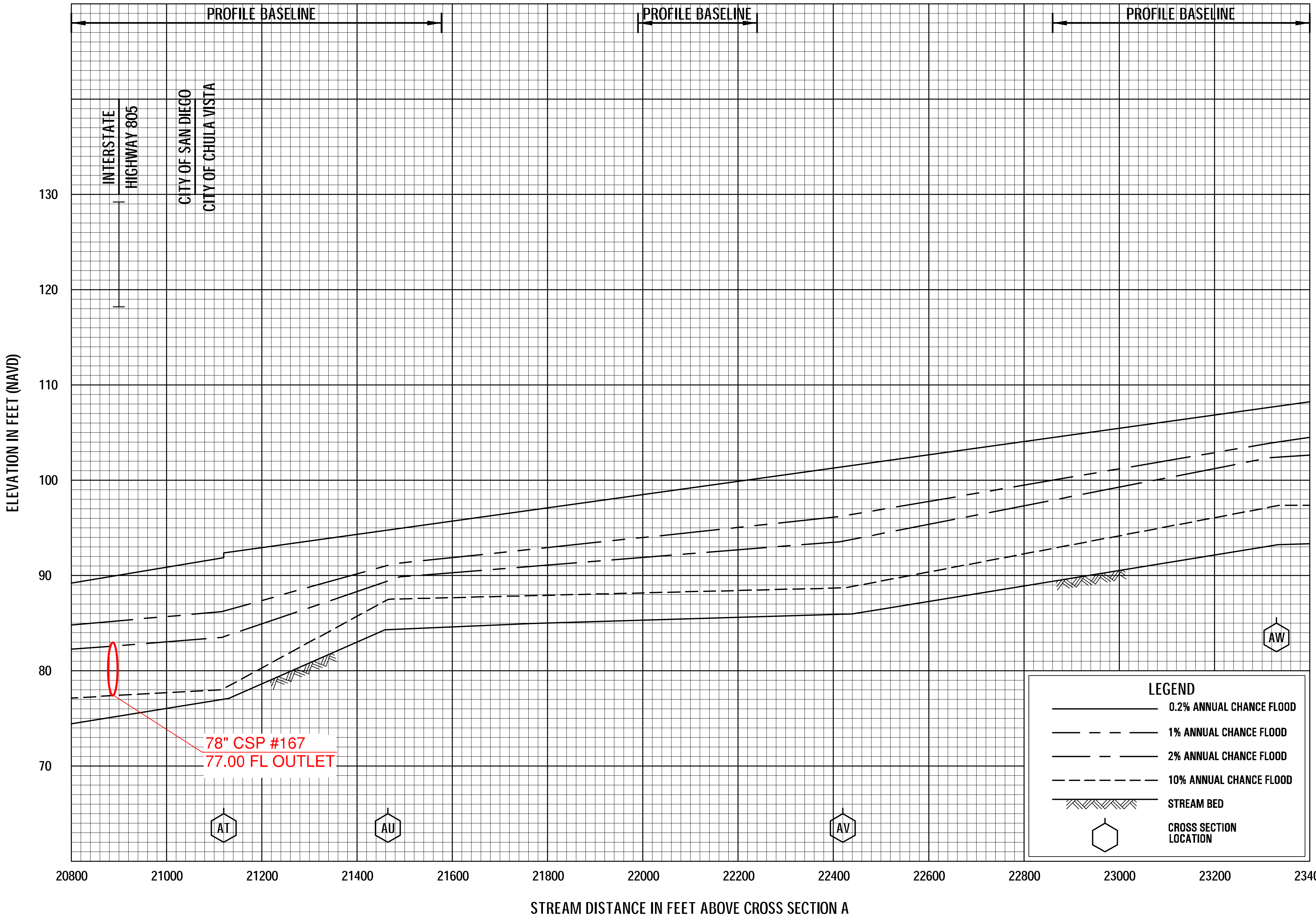
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.



I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.




11 SD 805-75 05/37-4.6/54 88 395
R.D. Clark
DESIGN ENGINEER
REGISTERED CIVIL ENGINEER
No. 12120
DATE APPROVED December 26, 1972
Drainage Profile 183
SECTION A-A
36" CSP Riser (No Openings W/ Ck. Pl. Cover H= 16.7'
Grade to fit Riser
Ref. Prof. #182
Ref. Prof. #167
Prof. Ground
Ref. Prof. #179
Ref. Prof. #180
Contour Grading
Profile Ground
Drainage Profile 167 (Cont.)
Match Line #1
Match Line #2
Match Line #3
2' Min Cover
5° Elbow
PLAN
Toe of Exc.
Top of Levee
78" CSP
Cement Treatment Channel Lining
Future Chan. Grade
1/2 Ton R.S.P. Method "B"
Bkfl. with Cement Treatment
Refer Profile #196
Refer Profile #198
13+00 V.P.I. D.P. #167
El. 85.50
78" CSP
OUTFALL INTO OTAY RIVER
MICROFILMED JUL 26 1976
AS BUILT PLANS
Contract No. 11-045814
Date Completed 7-9-75
"AS BUILT"
Drainage Profile 167
DRAINAGE PROFILE
SCALE 1"=10' VERT. 1"=20' HOR.
SHEET 25 OF 33
89
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION
MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION - MICROFILM



FLOOD PROFILES

OTAY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN DIEGO COUNTY, CA
(AND INCORPORATED AREAS)

266P

ATTACHMENT 3
STRUCTURAL BMP MAINTENANCE INFORMATION

Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 3a	Structural BMP Maintenance Thresholds and Actions (Required)	☒ Included See Structural BMP Maintenance Information Checklist.
Attachment 3b	Maintenance Agreement (Form DS-3247) (when applicable)	☒ Included

The City of SAN DIEGO

RECORDING REQUESTED BY:
THE CITY OF SAN DIEGO AND
WHEN RECORDED MAIL TO:

F L I K INC.

11500 Ash Street

Leawood, KS 66211

(THIS SPACE IS FOR RECORDER'S USE ONLY)

STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

APPROVAL NUMBER:	ASSESSORS PARCEL NUMBER:	PROJECT NUMBER:
____________	____________	____________

This agreement is made by and between the City of San Diego, a municipal corporation [City] and F L I K INC. ____,
the owner or duly authorized representative of the owner [Property Owner] of property located at
770 Dennery Road, San Diego Ca, 92154
(PROPERTY ADDRESS)

and more particularly described as: Existing AMC Classic Palm Promenade and parking lot
(LEGAL DESCRIPTION OF PROPERTY)

in the City of San Diego, County of San Diego, State of California.

Property Owner is required pursuant to the City of San Diego Municipal Code, Chapter 4, Article 3, Division 3, Chapter 14, Article 2, Division 2, and the Land Development Manual, Storm Water Standards to enter into a Storm Water Management and Discharge Control Maintenance Agreement [Maintenance Agreement] for the installation and maintenance of Permanent Storm Water Best Management Practices [Permanent Storm Water BMP's] prior to the issuance of construction permits. The Maintenance Agreement is intended to ensure the establishment and maintenance of Permanent Storm Water BMP's onsite, as described in the attached exhibit(s), the project's Storm Water Quality Management Plan [SWQMP] and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s): ____________.

Property Owner wishes to obtain a building or engineering permit according to the Grading and/or Improvement Plan Drawing No(s) or Building Plan Project No(s): ____________.

Continued on Page 2

NOW, THEREFORE, the parties agree as follows:

1. Property Owner shall have prepared, or if qualified, shall prepare an Operation and Maintenance Procedure [OMP] for Permanent Storm Water BMP's, satisfactory to the City, according to the attached exhibit(s), consistent with the Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s): ___________.

2. Property Owner shall install, maintain and repair or replace all Permanent Storm Water BMP's within their property, according to the OMP guidelines as described in the attached exhibit(s), the project's SWQMP and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s) ____________.

3. Property Owner shall maintain operation and maintenance records for at least five (5) years. These records shall be made available to the City for inspection upon request at any time.

This Maintenance Agreement shall commence upon execution of this document by all parties named hereon, and shall run with the land.

Executed by the City of San Diego and by Property Owner in San Diego, California.

See Attached Exhibit(s): ______________________________

____
(Owner Signature)

____
(Print Name and Title)

____
(Company/Organization Name)

____
(Date)

THE CITY OF SAN DIEGO

APPROVED:

____
(City Control Engineer Signature)

____
(Print Name)

____
(Date)

NOTE: ALL SIGNATURES MUST INCLUDE NOTARY ACKNOWLEDGMENTS PER CIVIL CODE SEC. 1180 ET.SEQ.

Reset Button Page 2

Table 7-2. Maintenance Indicators and Actions for Vegetated BMPs

Typical Maintenance Indicator(s) for Vegetated BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.
Overgrown vegetation	Mow or trim as appropriate, but not less than the design height of the vegetation per original plans when applicable (e.g. a vegetated swale may require a minimum vegetation height).
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.
Standing water in vegetated swales	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, loosening or replacing top soil to allow for better infiltration, or minor re-grading for proper drainage. If the issue is not corrected by restoring the BMP to the original plan and grade, the City Engineer shall be contacted prior to any additional repairs or reconstruction.
Standing water in bioretention, biofiltration with partial retention, or biofiltration areas, or flow-through planter boxes for longer than 96 hours following a storm event*	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains (where applicable), or repairing/replacing clogged or compacted soils.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.
*These BMPs typically include a surface ponding layer as part of their function which may take 96 hours to drain following a storm event.	

Table 7-4. Maintenance Indicators and Actions for Filtration BMPs

Typical Maintenance Indicator(s) for Filtration BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose accumulated materials.
Obstructed inlet or outlet structure	Clear obstructions.
Clogged filter media	Remove and properly dispose filter media, and replace with fresh media.
Damage to components of the filtration system	Repair or replace as applicable.
Note: For proprietary media filters, refer to the manufacturer's maintenance guide.	

7.7.4 Maintenance of Detention BMPs

"Detention BMPs" includes basins, cisterns, vaults, and underground galleries that are primarily designed to store runoff for controlled release to downstream systems. For the purpose of the maintenance discussion, this category does not include an infiltration component (refer to "vegetated infiltration or filtration BMPs" or "non-vegetated infiltration BMPs" above). Applicable Fact Sheets may include HU-1 (cistern) or FT-4 (extended detention basin). There are many possible configurations of above ground and underground detention BMPs, including both proprietary and non-proprietary systems. The project civil engineer is responsible for determining which maintenance indicators and actions shown below are applicable based on the components of the structural BMP.

ATTACHMENT 4
COPY OF PLAN SHEETS SHOWING PERMANENT STORM WATER BMPS

SITE AREA SUMMARY

EXISTING SITE (AC)		PROPOSED SITE (AC)		REPLACED/CREATED AREAS (AC)	
IMPERVIOUS	15.01	IMPERVIOUS	14.86	IMPERVIOUS	6.97
PERVIOUS	2.52	PERVIOUS	2.67	PERVIOUS	0.99

TOTAL SITE: 17.53 ACRES
TOTAL AREA DISTURBED: 7.96 ACRES

REFERENCE DRAWINGS:

CITY OF SAN DIEGO DWG: 27249-D, 27281-D, 27756-D, 29290-D

NOTES:

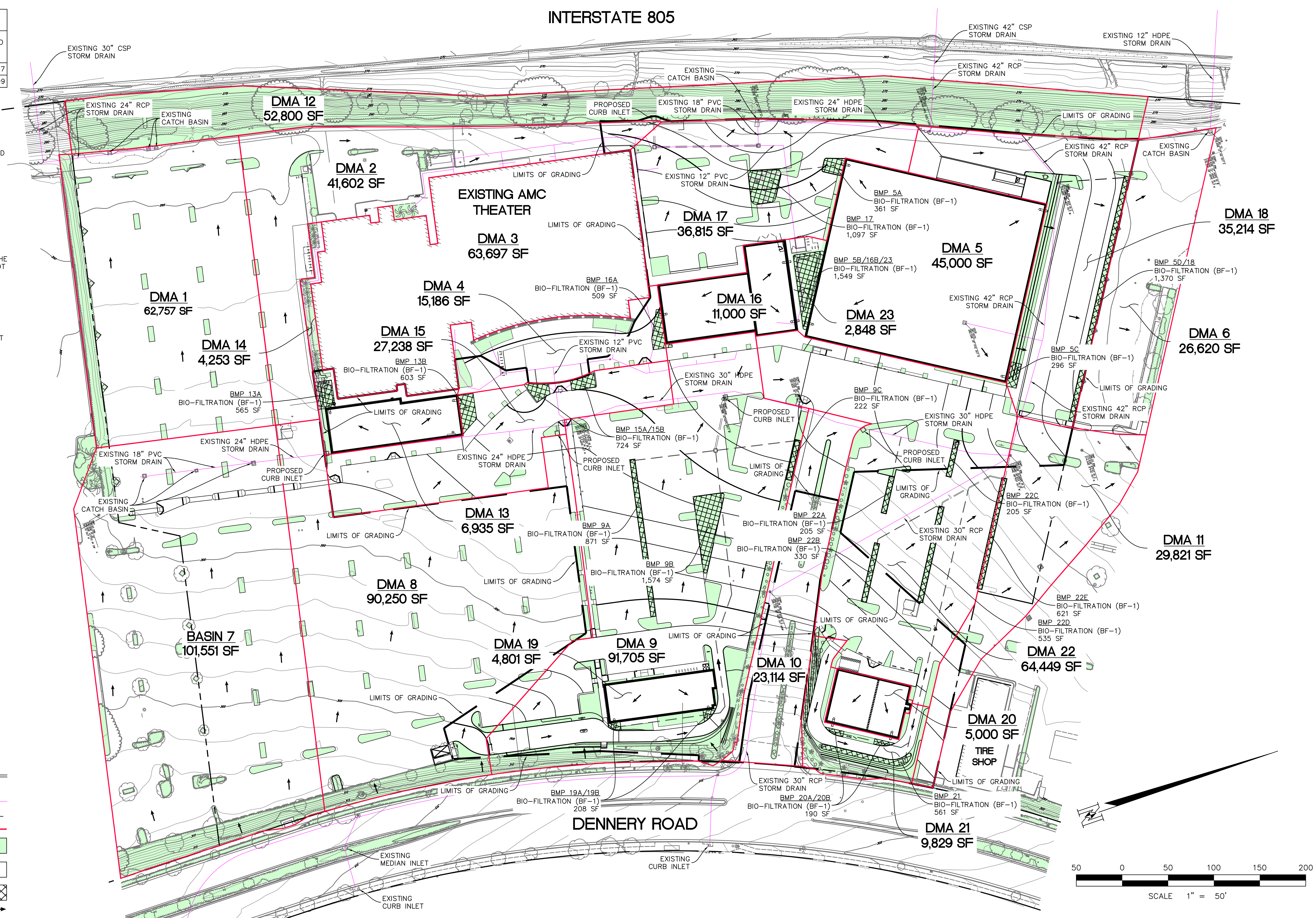
1. THE UNDERLYING HYDROLOGIC SOIL GROUP D IS PRESENT.
2. THE APPROXIMATE DEPTH TO GROUNDWATER IS > 20 FEET.
3. THERE ARE NO EXISTING NATURAL HYDROLOGIC FEATURES WITHIN THE PROJECT AREA.
4. CRITICAL COARSE SEDIMENT YIELD AREAS TO BE PROTECTED.
5. DMA'S 1, 2, 3, 4, 6, 7, 8, 10, 11, 12, AND 14 ARE EXEMPT FROM STORM WATER TREATMENT BECAUSE THE SPECIAL EXEMPTION 50% RULE. BMP REQUIREMENTS ONLY APPLY TO THE CREATION OR REPLACEMENT OF IMPERVIOUS SURFACE AND NOT THE ENTIRE DEVELOPMENT.
6. MARK ALL INLETS WITH THE WORDS "NO DUMPING! FLOWS TO BAY" OR SIMILAR.
7. POTENTIAL POLLUTANT SOURCE AREAS THAT APPLY TO THIS REDEVELOPMENT ARE ON-SITE STORM DRAIN INLETS, LANDSCAPE/OUTDOOR PESTICIDE USE, FOOD SERVICE, REFUSE AREAS, LOADING DOCKS, PLAZAS, SIDEWALKS, PARKING LOTS, AND LARGE TRASH GENERATING FACILITIES.
8. SOURCE CONTROL BMPS THAT APPLY TO THIS REDEVELOPMENT ARE SC-1, SC-2, SC-5, AND SC-6.

BMP Summary

DMA	DMA Area (SF)	BMP Name	Required BMP Area (SF)	Provided BMP Area (SF)	BMP Type
5	45,000	5	1,215	1,911	BF-1
- -	- -	5A	- -	361	BF-1
- -	- -	5B	- -	949	BF-1
- -	- -	5C	- -	296	BF-1
- -	- -	5D	- -	305	BF-1
9	91,705	9	2,146	2,667	BF-1
- -	- -	9A	- -	871	BF-1
- -	- -	9B	- -	1,574	BF-1
- -	- -	9C	- -	222	BF-1
13	6,935	13	188	1,168	BF-1
- -	- -	13A	- -	565	BF-1
- -	- -	13B	- -	603	BF-1
15	27,238	15	687	724	BF-1
- -	- -	15A	- -	374	BF-1
- -	- -	15B	- -	350	BF-1
16	11,000	16	297	959	BF-1
- -	- -	16A	- -	509	BF-1
- -	- -	16B	- -	450	BF-1
17	36,815	17	917	1,097	BF-1
18	35,214	18	856	1,065	BF-1
19	4,801	19	130	208	BF-1
- -	- -	19A	- -	103	BF-1
- -	- -	19B	- -	105	BF-1
20	5,000	20	135	190	BF-1
- -	- -	20A	- -	92	BF-1
- -	- -	20B	- -	98	BF-1
21	9,829	21	174	561	BF-1
22	64,449	22	1,625	1,896	BF-1
- -	- -	22A	- -	205	BF-1
- -	- -	22B	- -	330	BF-1
- -	- -	22C	- -	205	BF-1
- -	- -	22D	- -	535	BF-1
- -	- -	22E	- -	621	BF-1
23	2,848	23	45	150	BF-1

LEGEND

ITEM	SYMBOL
EXISTING STORM DRAIN LINE	
PROPOSED STORM DRAIN LINE	
DMA BOUNDARY	
PERVIOUS AREA	
IMPERVIOUS AREA	
BIOFILTRATION BMP	
DRAINAGE FLOW	



DMA EXHIBIT
SCALE: 1" = 50'

Nasland
Civil Engineering
Surveying
Land Planning

T (858) 292-7770
4740 Ruffner Street
San Diego, CA 92111
nasland.com

NE JOB NO. 117-109.2

ATTACHMENT 5
DRAINAGE REPORT

Preliminary Hydrology Study

The Shops at AMC Promenade

770 Dennery Road
San Diego, CA 92154

Prepared for:

HCP-CCI Palm Promenade, LLC

4340 Von Karman Avenue, Suite 110
Newport Beach, CA 92660

Prepared by:

Nasland Engineering
4740 Ruffner Street
San Diego, CA 92111
(858) 292-7770

May 10, 2018

Table of Contents

1.0 VICINITY MAP:

Map data ©2016 Google

2.0 PROJECT DESCRIPTION:

The project proposes to redevelop an existing 17.53 acre commercial site. The project will demolish approximately 26,249 square feet of the existing 89,946 square foot AMC Theater. The northern wing of the building will be demolished leaving approximately 63,697 square feet of remaining floor area. The project also proposes to construct six new commercial buildings within the existing parking lot. Construction will include building demolition, building construction, drainage improvements, curbs, sidewalks, asphalt concrete and landscaped areas. The total disturbed area to be redeveloped, including impervious and pervious areas, is 7.96 acres. Since the existing site is 17.53 acres and approximately 8.0 acres are anticipated to be disturbed, this project meets the "50% Rule" requirements for redevelopment Priority Development Projects (PDPs). Structural BMP requirements will only apply to the creation or replacement of impervious surfaces and not to the entire development. For additional information refer to "The City of San Diego 2016 Storm Water Standards Manual Part 1: BMP Design Manual." The proposed project is a previously developed site and is not subject to requirements set forth in the Clean Water Act (CWA) sections 401 and 404 since it will not discharge to navigable waters, and therefore approval from the California Regional Water Quality Control Board is not required.

3.0 DRAINAGE

3.1 EXISTING DRAINAGE

The drainage area is approximately 19.58 acre that consists of 16.72 acres of impervious surfaces and 2.86 acres of pervious surfaces. The site currently has an existing AMC Theater with associated parking and landscaped areas. The onsite runoff generally drains from east to west and consist of 12 sub-basins. The runoff is collected through the use of area drains, curb inlets and brow ditches that discharge to private storm drain systems onsite. The project has 4 discharge locations which connect to the existing underground Caltrans storm drain system along the westerns edge of the property. The offsite runoff along Dennery Road sheet flows towards the east, away from the site, and is collected by existing median and curb inlets. The inlets discharge to a public 30" RCP that runs northwest through the site. The offsite runoff and the majority of the onsite runoff flow into a public 42" RCP prior to exiting the site. These flows enter the existing Caltrans 42" CSP and discharge into a public 60" CSP located within Interstate 805. The 60" CSP flows north where the pipe shifts to the eastern side of the 805 and widens to a public 78" CSP. The 78" CSP discharges into the Otay River approximately 0.75 miles away from the commercial site.

See **Appendix A – Existing Hydrology Exhibit**, for further information.

3.2 PROPOSED DRAINAGE

With the demolition of the existing AMC Theater and the addition of six new commercial buildings the site will consists of approximately 16.57 acres of impervious surfaces and 3.01 acres of pervious surfaces. Therefore there is a small decrease in impervious surfaces, approximately 0.15 acres, from the existing condition. However, with the addition of a 45,000 square foot building the overall peak discharge increased slightly, but is to be considered negligible when compared to the overall size of the commercial site. The site will continue to drain from east to west and consist of 23 sub-basins. This project proposes changes to the current drainage system by installing biofiltration Best Management Practices (BMPs) to intercept sheet flows and treat pollutants prior to discharging into the existing public 42" RCP storm drain system onsite. Some existing private storm drain lines will be removed and replaced in order to construct the BMPs and any proposed storm drain lines will connect to the existing private storm drain system onsite. The existing public storm drains onsite and offsite will remain and be protected in place and no portion of the project will discharge to the Caltrans hillside along the western edge of the property.

See **Appendix B – Proposed Hydrology Exhibit**, for further information.

4.0 RATIONAL METHOD

The storm water runoff for both the existing and proposed site conditions was calculated for the 100-year storm event using methodology outlined by the San Diego County Hydrology Manual. Peak discharge was calculated using the Rational Method which is given by the following equation:

$$Q = CIA$$

Where:
- Q = flow rate in cubic feet per second (cfs)
- C = area weighted runoff coefficient
- I = rainfall intensity in inches per hour (in/hr)
- A = drainage basin area in acres (acres)

Assumptions and standards used to calculate the peak discharge are as follows:

- The runoff coefficients were calculated using an area-weighted average coefficient of runoff. The average coefficient of runoff, 'C' was calculated by assuming a 'C' value of 0.9 for all impervious areas and a 'C_p' value of 0.35 for all pervious areas. The runoff coefficients were calculated for an area based on soil type and impervious percentage using the following formula from the SDCHM:
  - $C = 0.90 \text{ x } (\% \text{ Impervious}) + C_p \text{ x } (1.0\text{-}\% \text{ Impervious})$

- For the existing and proposed site conditions, the Time of Concentration was determined by the Overland Time of Flow:
  - $T = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$

- From the SDCHM Rainfall Isopluvial maps for 100 Year Rainfall Events:
  - 6-Hour Precipitation, $P_6 = 2.25$ in
  - 24-Hour Precipitation, $P_{24} = 3.75$ in
  - Adjusted $P_6 = 2.25$ in

- The rainfall intensity duration was calculated using the following formula:
  - $I = 7.44P_6D^{-0.645}$

See **Appendix F – References,** for further information.

5.0 ANALYSIS

The 100-year peak discharge rates were calculated for both the existing and proposed basins using the Rational Method discussed in *Section 5*. These calculations were then used to compare the impacts on existing conditions caused by the AMC Theater redevelopment project.

5.1 EXISTING RATIONAL METHOD CALCULATIONS

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	1.56	88%	0.83	820	11.75	1.4%	12.2	3.3	4.33
3	2.06	100%	0.90	115	2.25	2.0%	5.0	5.9	10.99
4	0.71	79%	0.78	85	0.5	0.6%	6.3	5.1	2.85
5	0.80	95%	0.87	250	7.0	2.8%	5.0	5.9	4.14
6	2.10	96%	0.88	500	10.0	2.0%	7.1	4.7	8.67
7	2.33	88%	0.84	445	20.0	4.5%	6.1	5.2	10.19
8	2.92	88%	0.83	485	22.0	4.5%	6.4	5.0	12.27
9	1.82	88%	0.83	435	20.0	4.7%	6.0	5.3	8.00
10	0.66	94%	0.87	490	21.0	4.3%	5.7	5.4	3.11
11	1.97	91%	0.85	500	25.0	4.9%	5.9	5.3	8.89
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
								Onsite Discharge:	80.61
								Offsite Discharge:	42.00
								Total Discharge:	122.61

5.2 PROPOSED RATIONAL METHOD CALCULATIONS

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	0.96	91%	0.87	705	9.0	1.3%	10.1	3.8	3.16
3	1.46	100%	0.90	115	2.25	2.0%	5.0	5.9	7.79
4	0.35	86%	0.82	85	1.3	1.5%	5.0	5.9	1.70
5	1.03	100%	0.90	150	3.00	2.0%	5.0	5.9	5.50
6	0.61	95%	0.87	205	3.5	1.7%	5.0	5.9	3.16
7	2.33	89%	0.84	445	20.0	4.5%	6.0	5.3	10.37
8	2.07	92%	0.86	540	21.5	4.0%	6.4	5.1	8.97
9	2.11	80%	0.79	600	22.0	3.7%	8.8	4.1	6.84
10	0.53	94%	0.87	415	18.25	4.4%	5.2	5.8	2.67
11	0.68	97%	0.88	420	14.0	3.3%	5.3	5.7	3.42
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
13	0.16	100%	0.90	75	1.5	2.0%	5.0	5.9	0.85
14	0.10	40%	0.57	25	3.0	10.0%	5.0	5.9	0.34
15	0.63	89%	0.84	250	4.00	1.6%	6.4	5.1	2.68
16	0.25	100%	0.90	75	1.5	2.0%	5.0	5.9	1.33
17	0.85	88%	0.84	140	5.5	3.9%	5.0	5.9	4.21
18	0.81	85%	0.82	245	5.0	2.0%	6.3	5.1	3.40
19	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
20	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
21	0.23	48%	0.61	215	2.0	0.7%	14.5	3.0	0.42
22	1.48	90%	0.84	300	8.5	2.8%	5.6	5.5	6.86
23	0.07	29%	0.51	75	2.0	2.0%	7.3	4.6	0.16
								Onsite Discharge:	82.18
								Offsite Discharge:	42.00
								Total Discharge:	124.18

5.3 BEST MANAGEMENT PRACTICES SUMMARY

DMA	DMA Area (SF)	BMP Name	Required BMP Area (SF)	Provided BMP Area (SF)	BMP Type	DMA	DMA Area (SF)	BMP Name	Required BMP Area (SF)	Provided BMP Area (SF)	BMP Type
5	45,000	5	1,215	1,911	BF-1	17	36,815	17	917	1,097	BF-1
- -	- -	5A	- -	361	BF-1	18	35,214	18	856	1,065	BF-1
- -	- -	5B	- -	949	BF-1	19	4,801	19	130	208	BF-1
- -	- -	5C	- -	296	BF-1	- -	- -	19A	- -	103	BF-1
- -	- -	5D	- -	305	BF-1	- -	- -	19B	- -	105	BF-1
9	91,705	9	2,146	2,667	BF-1	20	5,000	20	135	190	BF-1
- -	- -	9A	- -	871	BF-1	- -	- -	20A	- -	92	BF-1
- -	- -	9B	- -	1,574	BF-1	- -	- -	20B	- -	98	BF-1
- -	- -	9C	- -	222	BF-1	21	9,829	21	174	561	BF-1
13	6,935	13	188	1,168	BF-1	22	64,449	22	1,625	1,896	BF-1
- -	- -	13A	- -	565	BF-1	- -	- -	22A	- -	205	BF-1
- -	- -	13B	- -	603	BF-1	- -	- -	22B	- -	330	BF-1
15	27,238	15	687	724	BF-1	- -	- -	22C	- -	205	BF-1
- -	- -	15A	- -	374	BF-1	- -	- -	22D	- -	535	BF-1
- -	- -	15B	- -	350	BF-1	- -	- -	22E	- -	621	BF-1
16	11,000	16	297	959	BF-1	23	2,848	23	45	150	BF-1
- -	- -	16A	- -	509	BF-1						
- -	- -	16B	- -	450	BF-1						

See **Appendix C – Existing Rational Method Calculations, Appendix D – Proposed Rational Method Calculations** and **Appendix E – Best Management Practices Calculations** for further information.

6.0 CONCLUSION

The purpose of this preliminary hydrology study was to analyze the existing drainage patterns and compare them to the newly proposed ones. The intent was to effectively carry the runoff associated with the 100-year storm event to outlet points and prevent any severe ponding and flooding from occurring. Based on the 100 year storm analysis, this redevelopment project will slightly increase the storm water discharge to the underground Caltrans storm drain system after project construction. The existing public storm drains onsite and offsite will remain and be protected in place and no portion of the project will discharge to the Caltrans hillside along the western edge of the property. Despite an increase in flow rates, by directing storm water runoff away from building and parking lot surfaces into curb inlets, catch basins, area drains, brow ditches and landscaped areas the proposed flow rates will not negatively impact the surrounding areas. Re-grading and site features like new curbs and curb inlets will be implemented in order to assure that comingling, between runoffs from DMAs that are exempt and DMAs to be treated, will be avoided. DMAs needing treatment will be mitigated by installing biofiltration BMPs onsite. The small increase to the overall site discharge is not anticipated to negatively impact the existing public 42” RCP that currently carries storm water offsite.

7.0 DECLARATION OF RESPONSIBLE CHARGE:

I hereby declare that I am the Engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current standards.

I understand that the check of project drawings and specification by the City of Encinitas is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

8.0 ENGINEER OF WORK:

This report was prepared under the supervision of Samuel Waisbord, PE, Project Manager for Nasland Engineering.

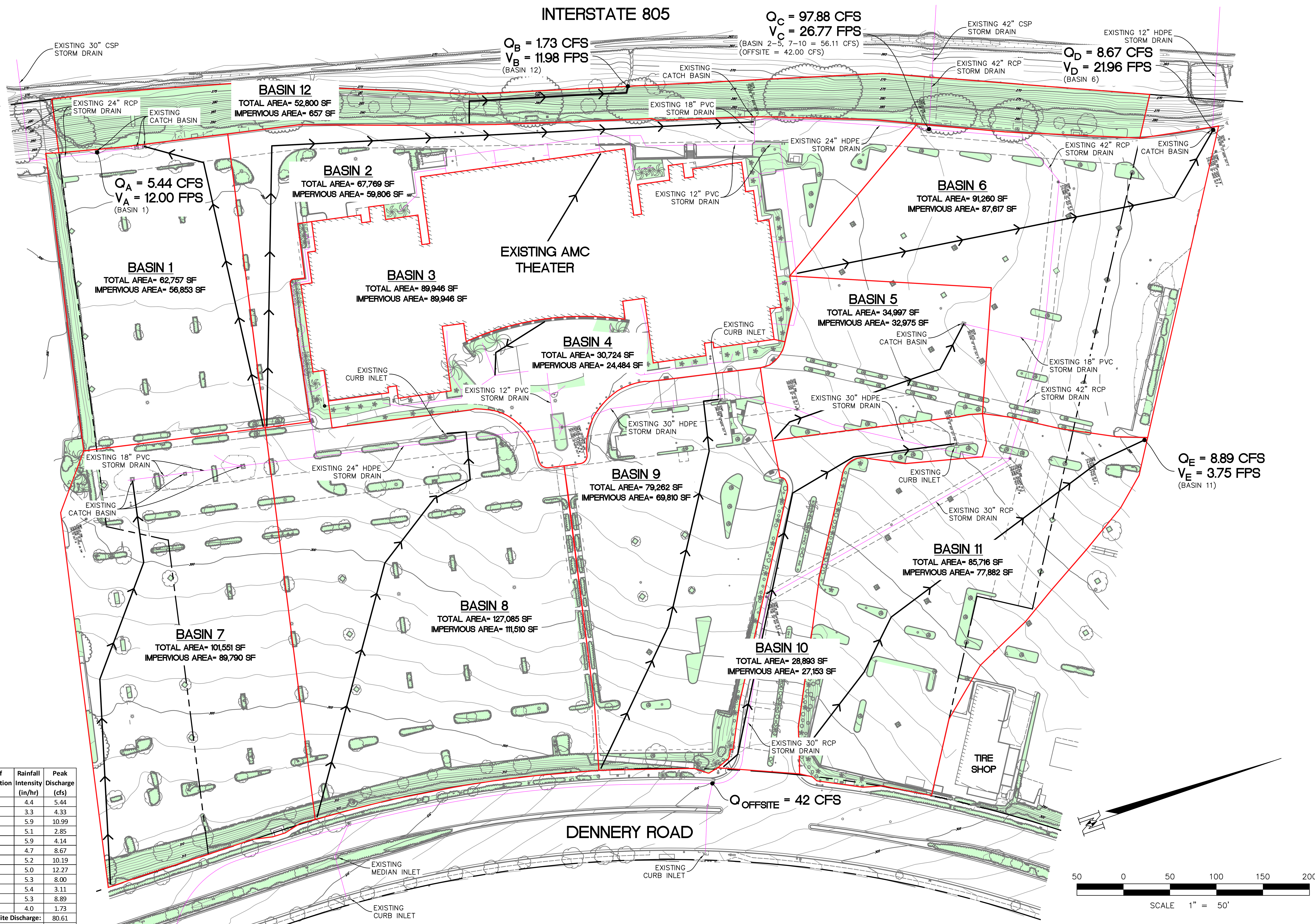
____

Samuel Waisbord ● RCE 78071 ● Expires 09-30-19

APPENDICES

APPENDIX A

EXISTING HYDROLOGY EXHIBIT



LEGEND

ITEM	SYMBOL
EXISTING STORM DRAIN LINE	
DMA BOUNDARY	
PERVIOUS AREA	
IMPERVIOUS AREA	
FLOW PATH OF TRAVEL FOR THE TIME OF CONCENTRATION	

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	1.56	88%	0.83	820	11.75	1.4%	12.2	3.3	4.33
3	2.06	100%	0.90	115	2.25	2.0%	5.0	5.9	10.99
4	0.71	79%	0.78	85	0.5	0.6%	6.3	5.1	2.85
5	0.80	95%	0.87	250	7.0	2.8%	5.0	5.9	4.14
6	2.10	96%	0.88	500	10.0	2.0%	7.1	4.7	8.67
7	2.33	88%	0.84	445	20.0	4.5%	6.1	5.2	10.19
8	2.92	88%	0.83	485	22.0	4.5%	6.4	5.0	12.27
9	1.82	88%	0.83	435	20.0	4.7%	6.0	5.3	8.00
10	0.66	94%	0.87	490	21.0	4.3%	5.7	5.4	3.11
11	1.97	91%	0.85	500	25.0	4.9%	5.9	5.3	8.89
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
							Onsite Discharge:		80.61
							Offsite Discharge:		42.00
							Total Discharge:		122.61

EXISTING HYDROLOGY

SCALE: 1" = 50'

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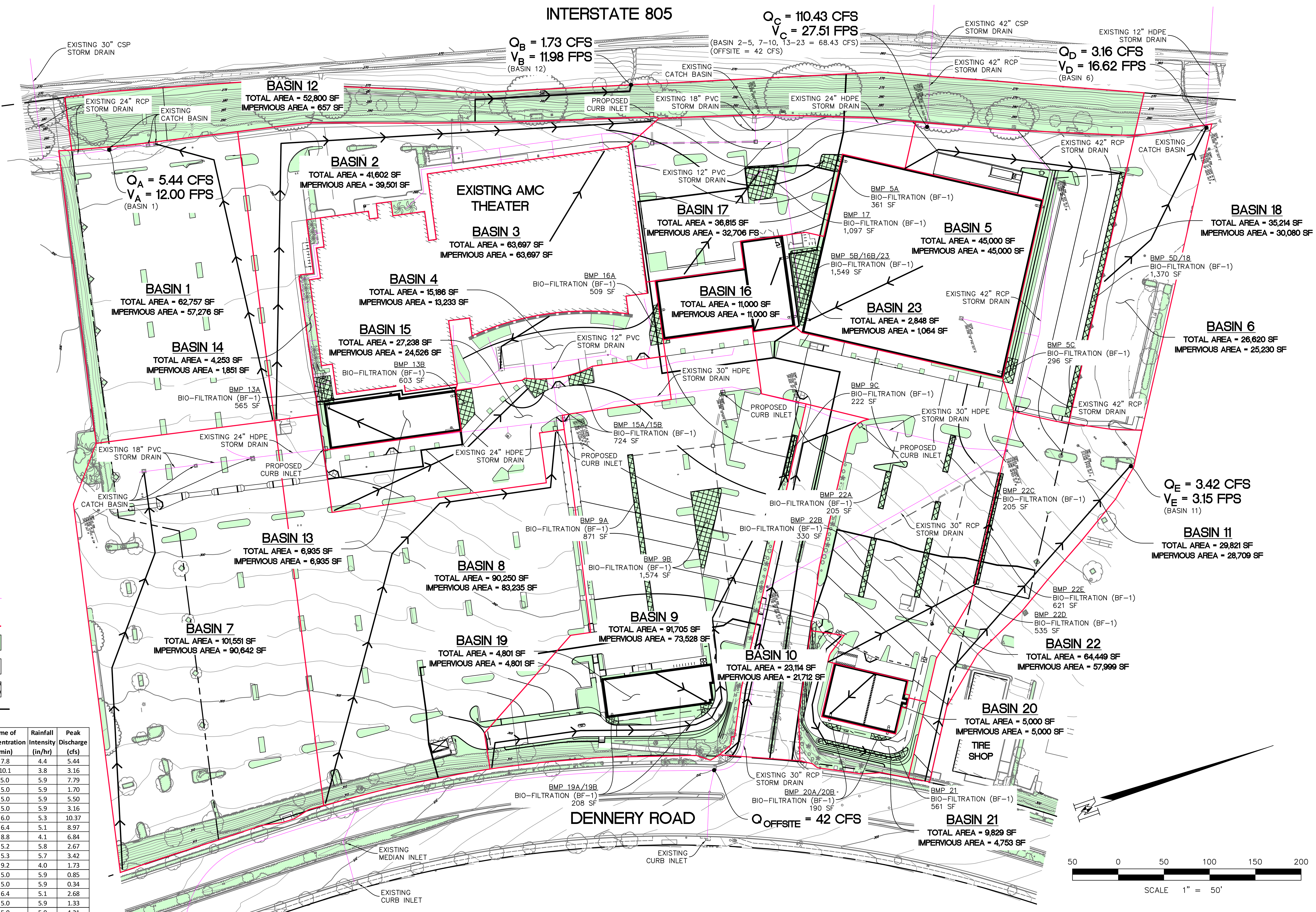
APPENDIX B

PROPOSED HYDROLOGY EXHIBIT



LEGEND

ITEM	SYMBOL
EXISTING STORM DRAIN LINE	
PROPOSED STORM DRAIN LINE	
DMA BOUNDARY	
PERVIOUS AREA	
IMPERVIOUS AREA	
BIOFILTRATION BMP	
FLOW PATH OF TRAVEL FOR THE TIME OF CONCENTRATION	

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	0.96	91%	0.87	705	9.0	1.3%	10.1	3.8	3.16
3	1.46	100%	0.90	115	2.25	2.0%	5.0	5.9	7.79
4	0.35	86%	0.82	85	1.3	1.5%	5.0	5.9	1.70
5	1.03	100%	0.90	150	3.00	2.0%	5.0	5.9	5.50
6	0.61	95%	0.87	205	3.5	1.7%	5.0	5.9	3.16
7	2.33	89%	0.84	445	20.0	4.5%	6.0	5.3	10.37
8	2.07	92%	0.86	540	21.5	4.0%	6.4	5.1	8.97
9	2.11	80%	0.79	600	22.0	3.7%	8.8	4.1	6.84
10	0.53	94%	0.87	415	18.25	4.4%	5.2	5.8	2.67
11	0.68	97%	0.88	420	14.0	3.3%	5.3	5.7	3.42
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
13	0.16	100%	0.90	75	1.5	2.0%	5.0	5.9	0.85
14	0.10	40%	0.57	25	3.0	10.0%	5.0	5.9	0.34
15	0.63	89%	0.84	250	4.00	1.6%	6.4	5.1	2.68
16	0.25	100%	0.90	75	1.5	2.0%	5.0	5.9	1.33
17	0.85	88%	0.84	140	5.5	3.9%	5.0	5.9	4.21
18	0.81	85%	0.82	245	5.0	2.0%	6.3	5.1	3.40
19	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
20	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
21	0.23	48%	0.61	215	2.0	0.7%	14.5	3.0	0.42
22	1.48	90%	0.84	300	8.5	2.8%	5.6	5.5	6.86
23	0.07	29%	0.51	75	2.0	2.0%	7.3	4.6	0.16
								Onsite Discharge:	82.18
								Offsite Discharge:	42.00
								Total Discharge:	124.18

PROPOSED HYDROLOGY

SCALE: 1" = 50'

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NE JOB NO. 117-109.2

APPENDIX C

EXISTING RATIONAL METHOD CALCULATIONS

Rational Method

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	1.56	88%	0.83	820	11.75	1.4%	12.2	3.3	4.33
3	2.06	100%	0.90	115	2.25	2.0%	5.0	5.9	10.99
4	0.71	79%	0.78	85	0.5	0.6%	6.3	5.1	2.85
5	0.80	95%	0.87	250	7.0	2.8%	5.0	5.9	4.14
6	2.10	96%	0.88	500	10.0	2.0%	7.1	4.7	8.67
7	2.33	88%	0.84	445	20.0	4.5%	6.1	5.2	10.19
8	2.92	88%	0.83	485	22.0	4.5%	6.4	5.0	12.27
9	1.82	88%	0.83	435	20.0	4.7%	6.0	5.3	8.00
10	0.66	94%	0.87	490	21.0	4.3%	5.7	5.4	3.11
11	1.97	91%	0.85	500	25.0	4.9%	5.9	5.3	8.89
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
							Total Discharge:		80.61

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
1	1.44	1.31	0.91	0.85

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
1	CB	355	4.5	1.3	0.85	7.8

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
1	2.25	7.8	4.4

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
1	0.85	4.4	1.44	5.44

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
2	1.56	1.37	0.88	0.83

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	$(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
2	CB	820	11.75	1.4	0.83	12.2

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
2	2.25	12.2	3.3

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
2	0.83	3.3	1.56	4.33

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
3	2.06	2.06	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
3	RD	115	2.25	2.0	0.90	3.1
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
3	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
3	0.90	5.9	2.06	10.99

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
4	0.71	0.56	0.79	0.78

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
4	AD	85	0.5	0.6	0.78	6.3

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
4	2.25	6.3	5.1

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
4	0.78	5.1	0.71	2.85

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
5	0.8	0.76	0.95	0.87

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
5	CB	250	7	2.8	0.87	4.6
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
5	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
5	0.87	5.9	0.8	4.14

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
6	2.1	2.01	0.96	0.88

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
6	CB	500	10	2.0	0.88	7.1

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
6	2.25	7.1	4.7

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
6	0.88	4.7	2.1	8.67

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
7	2.33	2.06	0.88	0.84

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
7	CB	445	20	4.5	0.84	6.1

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
7	2.25	6.1	5.2

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
7	0.84	5.2	2.33	10.19

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
8	2.92	2.56	0.88	0.83

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
8	CI	485	22	4.5	0.83	6.4

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
8	2.25	6.4	5.0

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
8	0.83	5.0	2.92	12.27

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
9	1.82	1.60	0.88	0.83

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
9	CI	435	20	4.7	0.83	6.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
9	2.25	6.0	5.3

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
9	0.83	5.3	1.82	8.00

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
10	0.66	0.62	0.94	0.87

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
10	CI	490	21	4.3	0.87	5.7

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
10	2.25	5.7	5.4

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
10	0.87	5.4	0.66	3.11

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
11	1.97	1.79	0.91	0.85

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
11	SF	500	25	4.9	0.85	5.9

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
11	2.25	5.9	5.3

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
11	0.85	5.3	1.97	8.89

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
12	1.21	0.02	0.02	0.36

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
12	BD	200	17	8.5	0.36	9.2

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
12	2.25	9.2	4.0

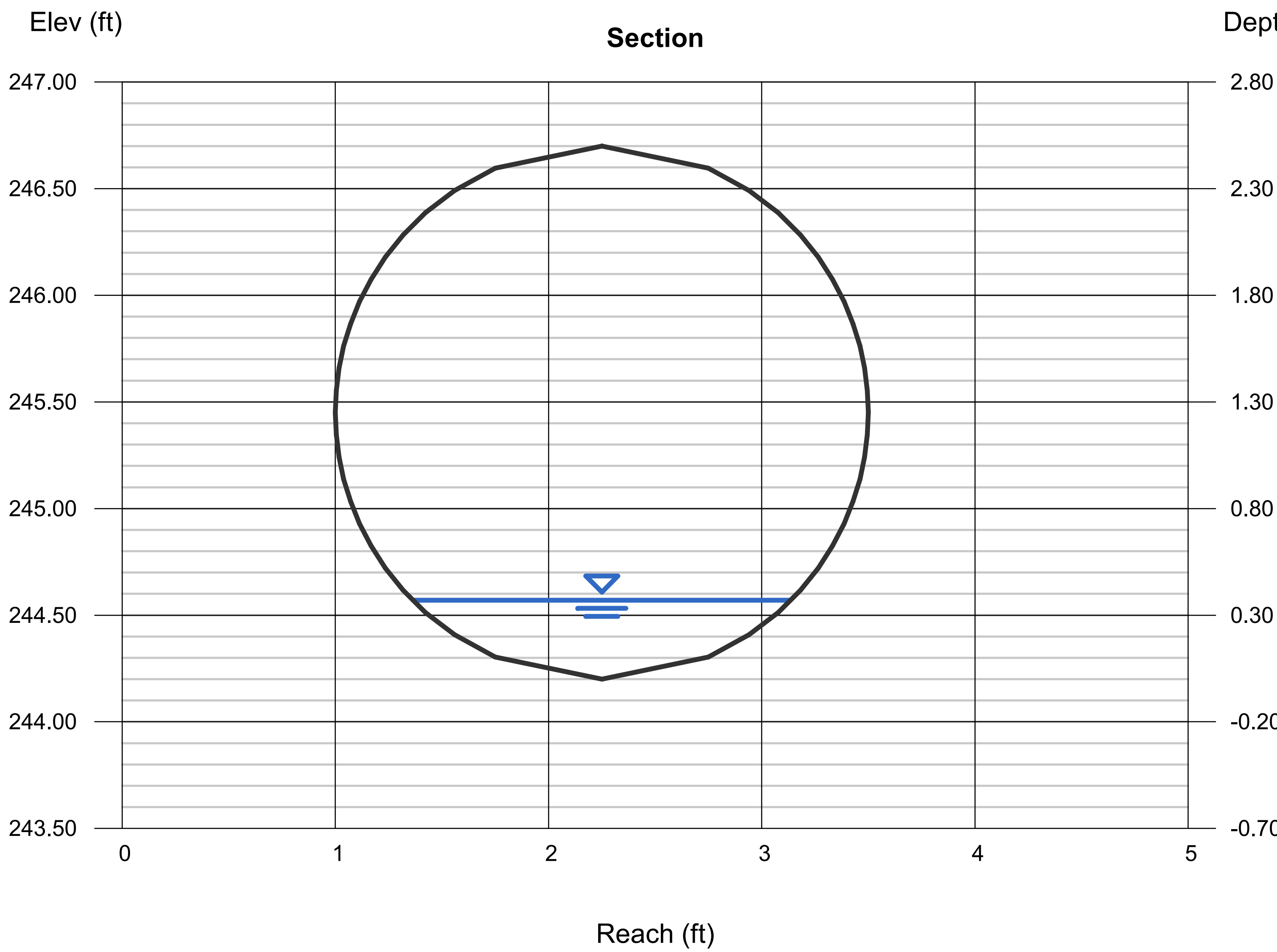
Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
12	0.36	4.0	1.21	1.73

Channel Report

Qa (Basin 1)

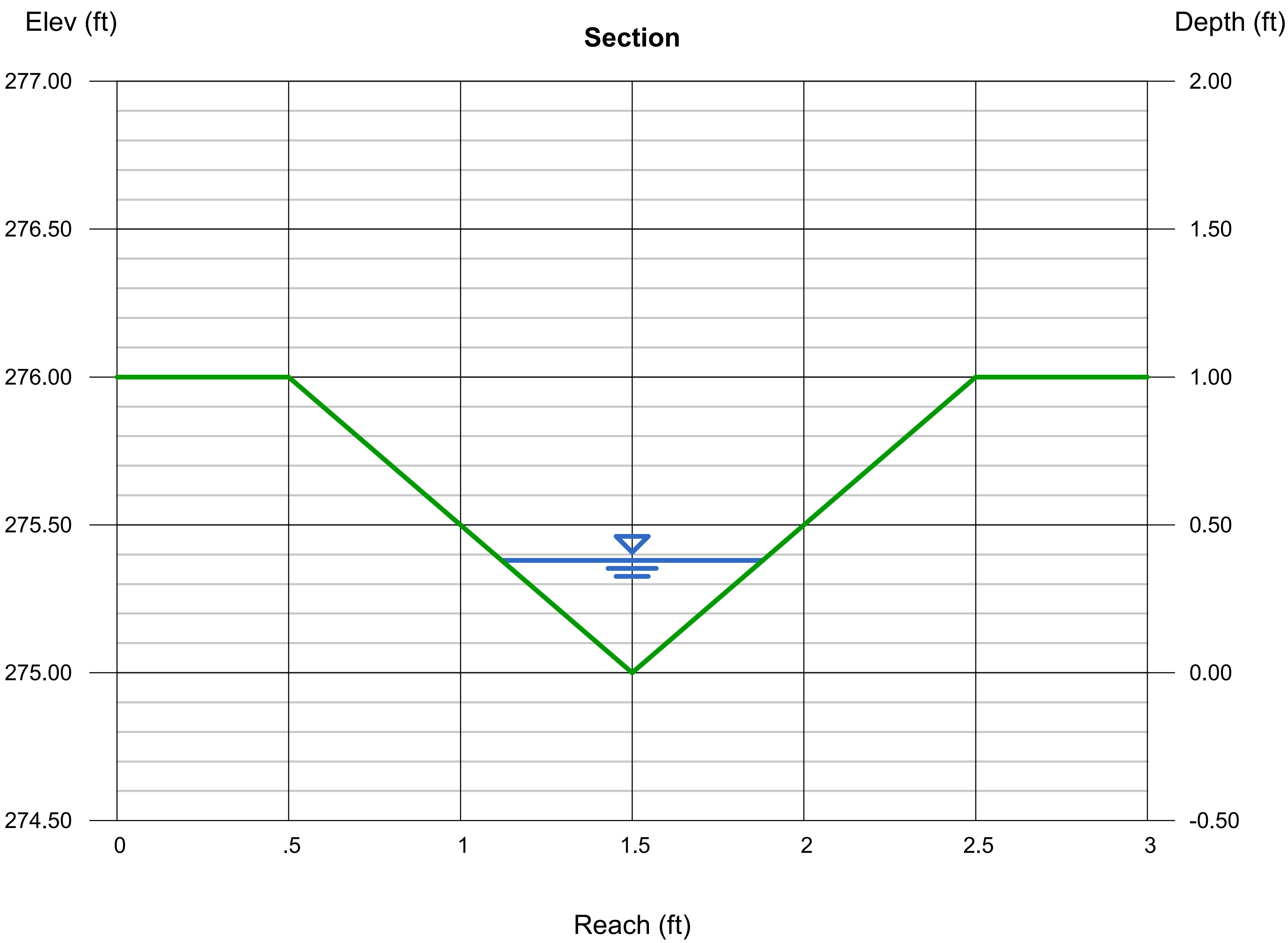
Circular		**Highlighted**	
Diameter (ft)	= 2.50	Depth (ft)	= 0.37
		Q (cfs)	= 5.440
		Area (sqft)	= 0.45
Invert Elev (ft)	= 244.20	Velocity (ft/s)	= 12.00
Slope (%)	= 25.00	Wetted Perim (ft)	= 1.97
N-Value	= 0.023	Crit Depth, Yc (ft)	= 0.77
		Top Width (ft)	= 1.78
Calculations		EGL (ft)	= 2.61
Compute by:	Known Q		
Known Q (cfs)	= 5.44		



Channel Report

Qb (Basin 12)

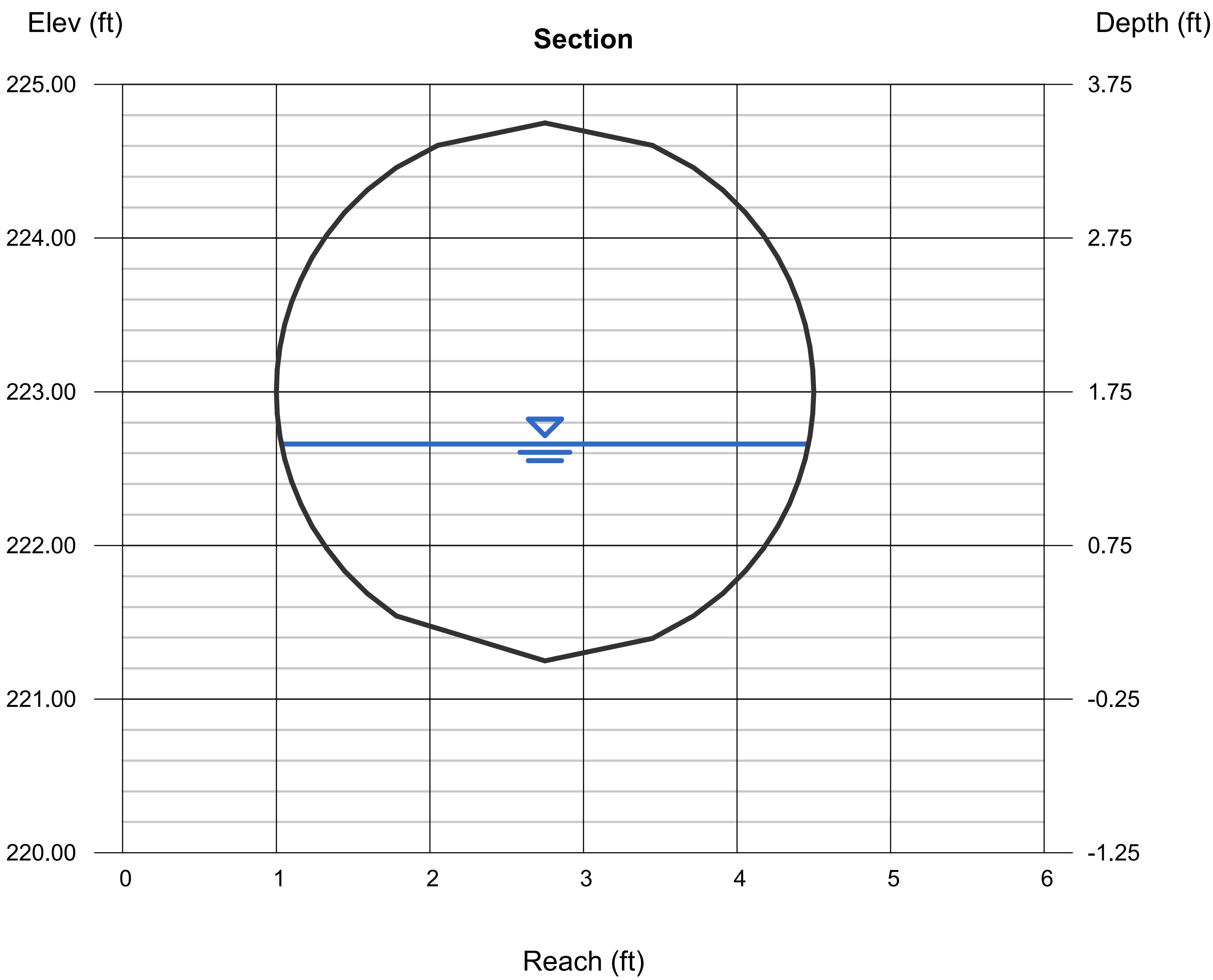
Triangular		**Highlighted**	
Side Slopes (z:1)	= 1.00, 1.00	Depth (ft)	= 0.38
Total Depth (ft)	= 1.00	Q (cfs)	= 1.730
		Area (sqft)	= 0.14
Invert Elev (ft)	= 275.00	Velocity (ft/s)	= 11.98
Slope (%)	= 20.00	Wetted Perim (ft)	= 1.07
N-Value	= 0.014	Crit Depth, Yc (ft)	= 0.72
		Top Width (ft)	= 0.76
Calculations		EGL (ft)	= 2.61
Compute by:	Known Q		
Known Q (cfs)	= 1.73		



Channel Report

Qc (Basin 2-5, 7-10, Offsite)

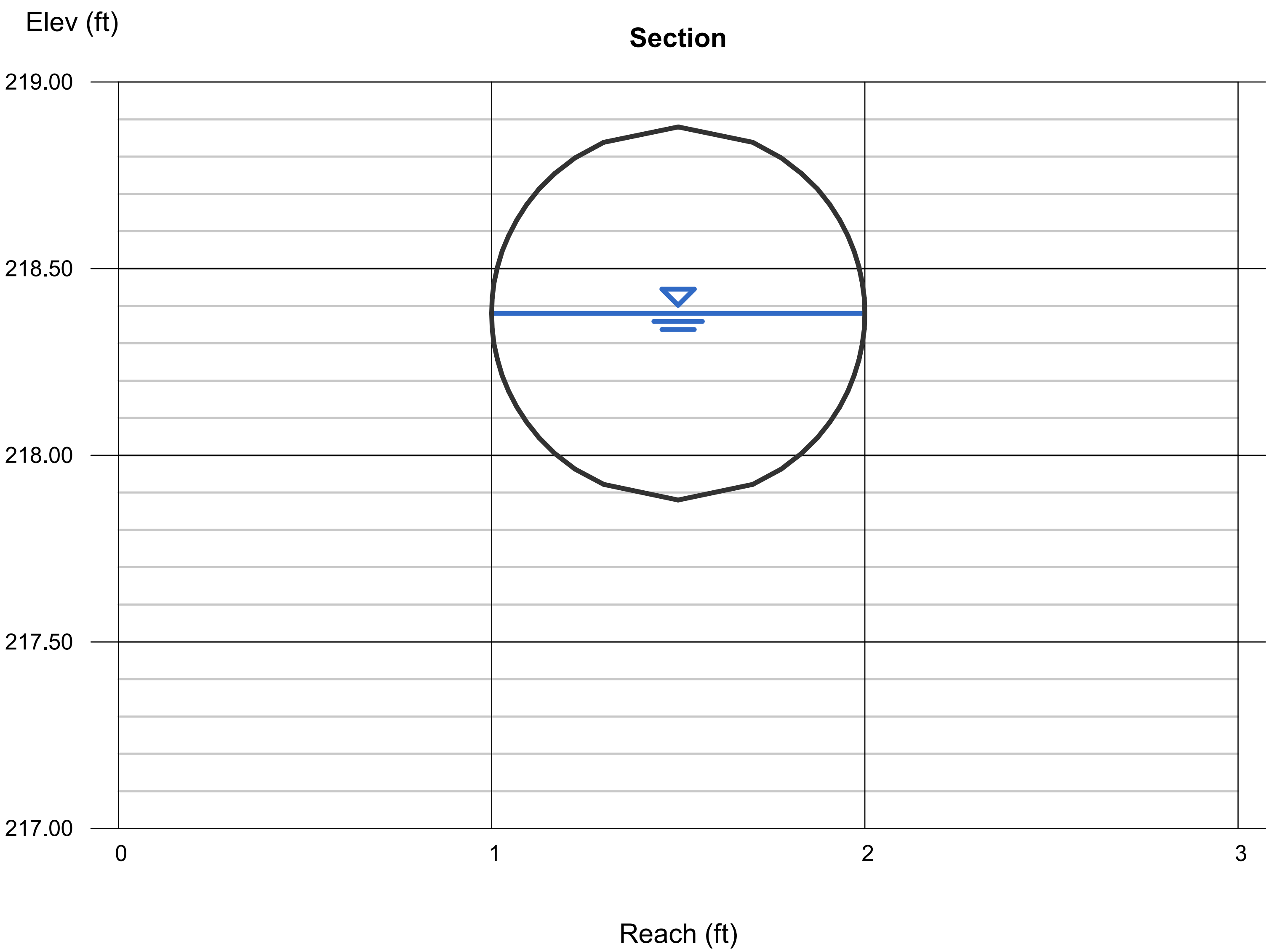
Circular		**Highlighted**	
Diameter (ft)	= 3.50	Depth (ft)	= 1.41
		Q (cfs)	= 97.88
		Area (sqft)	= 3.66
Invert Elev (ft)	= 221.25	Velocity (ft/s)	= 26.77
Slope (%)	= 25.00	Wetted Perim (ft)	= 4.83
N-Value	= 0.023	Crit Depth, Yc (ft)	= 3.05
		Top Width (ft)	= 3.44
Calculations		EGL (ft)	= 12.55
Compute by:	Known Q		
Known Q (cfs)	= 97.88		



Channel Report

Qd (Basin 6)

Circular		**Highlighted**	
Diameter (ft)	= 1.00	Depth (ft)	= 0.50
		Q (cfs)	= 8.670
		Area (sqft)	= 0.39
Invert Elev (ft)	= 217.88	Velocity (ft/s)	= 21.96
Slope (%)	= 25.00	Wetted Perim (ft)	= 1.57
N-Value	= 0.013	Crit Depth, Yc (ft)	= 0.99
		Top Width (ft)	= 1.00
Calculations		EGL (ft)	= 8.00
Compute by:	Known Q		
Known Q (cfs)	= 8.67		



Qe (Basin 11)

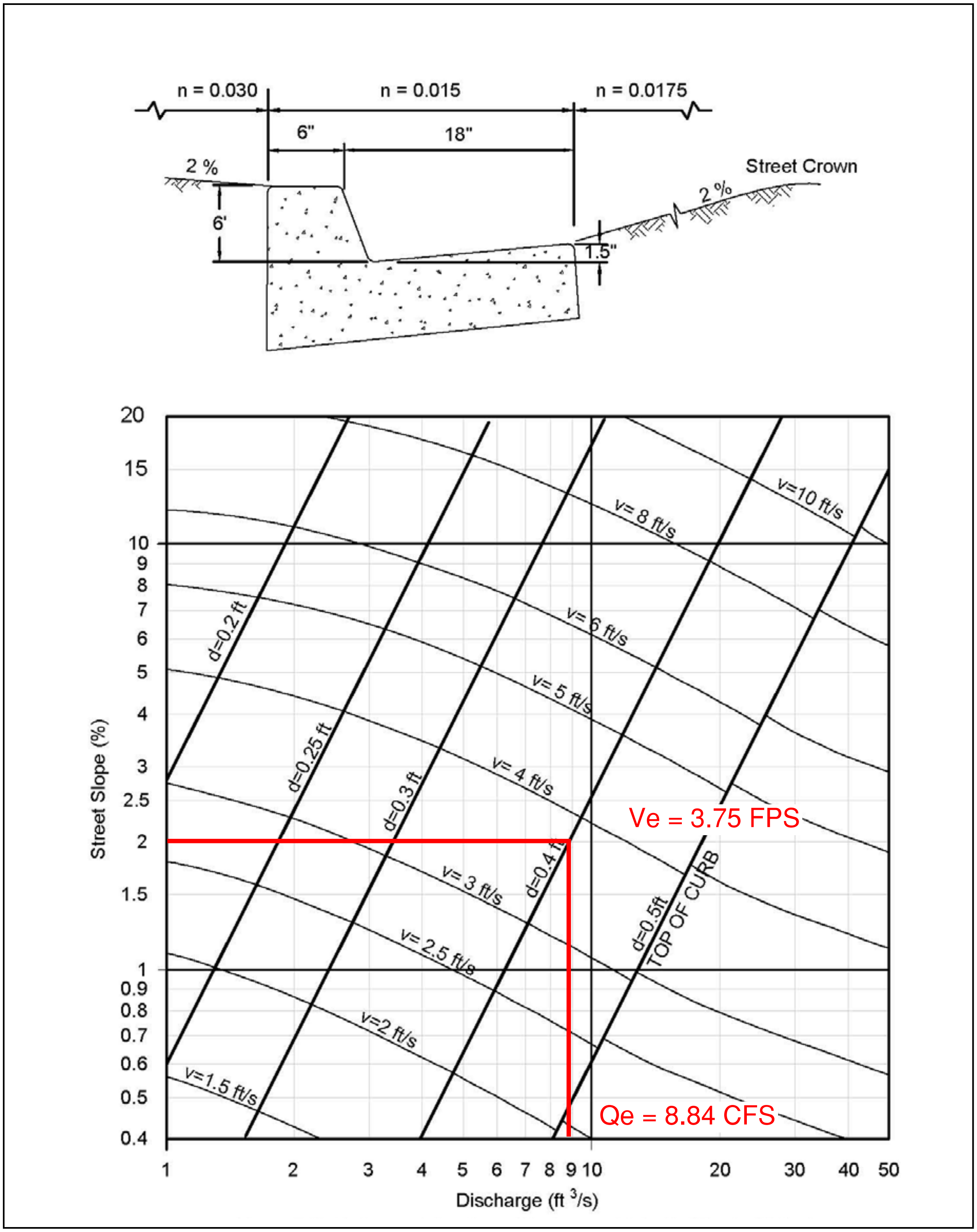


Figure 3-2: Gutter and Roadway Discharge-Velocity Chart (6" Curb)

APPENDIX D

PROPOSED RATIONAL METHOD CALCULATIONS

Rational Method

Basin	Area (ac)	Percent Impervious	Runoff Coefficient	Distance (ft)	Elevation Change (ft)	Average Slope	Time of Concentration (min)	Rainfall Intensity (in/hr)	Peak Discharge (cfs)
1	1.44	91%	0.85	355	4.5	1.3%	7.8	4.4	5.44
2	0.96	91%	0.87	705	9.0	1.3%	10.1	3.8	3.16
3	1.46	100%	0.90	115	2.25	2.0%	5.0	5.9	7.79
4	0.35	86%	0.82	85	1.3	1.5%	5.0	5.9	1.70
5	1.03	100%	0.90	150	3.00	2.0%	5.0	5.9	5.50
6	0.61	95%	0.87	205	3.5	1.7%	5.0	5.9	3.16
7	2.33	89%	0.84	445	20.0	4.5%	6.0	5.3	10.37
8	2.07	92%	0.86	540	21.5	4.0%	6.4	5.1	8.97
9	2.11	80%	0.79	600	22.0	3.7%	8.8	4.1	6.84
10	0.53	94%	0.87	415	18.25	4.4%	5.2	5.8	2.67
11	0.68	97%	0.88	420	14.0	3.3%	5.3	5.7	3.42
12	1.21	2%	0.36	200	17.0	8.5%	9.2	4.0	1.73
13	0.16	100%	0.90	75	1.5	2.0%	5.0	5.9	0.85
14	0.10	40%	0.57	25	3.0	10.0%	5.0	5.9	0.34
15	0.63	89%	0.84	250	4.00	1.6%	6.4	5.1	2.68
16	0.25	100%	0.90	75	1.5	2.0%	5.0	5.9	1.33
17	0.85	88%	0.84	140	5.5	3.9%	5.0	5.9	4.21
18	0.81	85%	0.82	245	5.0	2.0%	6.3	5.1	3.40
19	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
20	0.11	100%	0.90	75	1.5	2.0%	5.0	5.9	0.59
21	0.23	48%	0.61	215	2.0	0.7%	14.5	3.0	0.42
22	1.48	90%	0.84	300	8.5	2.8%	5.6	5.5	6.86
23	0.07	29%	0.51	75	2.0	2.0%	7.3	4.6	0.16
								Total Discharge:	82.18

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
1	1.44	1.31	0.91	0.85

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
1	CB	355	4.5	1.3	0.85	7.8

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
1	2.25	7.8	4.4

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
1	0.85	4.4	1.44	5.44

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
2	0.96	0.91	0.95	0.87

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
2	CI	705	9	1.3	0.87	10.1

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
2	2.25	10.1	3.8

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
2	0.87	3.8	0.96	3.16

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
3	1.46	1.46	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
3	RD	115	2.25	2.0	0.90	3.1
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
3	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
3	0.90	5.9	1.46	7.79

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
4	0.35	0.30	0.86	0.82

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% ($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
4	AD	85	1.3	1.5	0.82	4.1
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
4	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
4	0.82	5.9	0.35	1.70

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
5	1.03	1.03	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
5	BMP	150	3.00	2.0	0.90	3.5
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
5	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
5	0.90	5.9	1.03	5.50

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
6	0.61	0.58	0.95	0.87

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
6	CB	205	3.5	1.7	0.87	4.9
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
6	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
6	0.87	5.9	0.61	3.16

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
7	2.33	2.08	0.89	0.84

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
7	CB	445	20	4.5	0.84	6.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
7	2.25	6.0	5.3

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
7	0.84	5.3	2.33	10.37

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
8	2.07	1.91	0.92	0.86

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
8	CI	540	21.5	4.0	0.86	6.4

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
8	2.25	6.4	5.1

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
8	0.86	5.1	2.07	8.97

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
9	2.11	1.69	0.80	0.79

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% ($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
9	BMP	600	22	3.7	0.79	8.8

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
9	2.25	8.8	4.1

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
9	0.79	4.1	2.11	6.84

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
10	0.53	0.50	0.94	0.87

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
10	CI	415	18.25	4.4	0.87	5.2

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
10	2.25	5.2	5.8

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
10	0.87	5.8	0.53	2.67

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
11	0.68	0.66	0.97	0.88

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
11	C&G	420	14.0	3.3	0.88	5.3

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
11	2.25	5.3	5.7

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
11	0.88	5.7	0.68	3.42

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
12	1.21	0.02	0.02	0.36

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
12	BD	200	17	8.5	0.36	9.2

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
12	2.25	9.2	4.0

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
12	0.36	4.0	1.21	1.73

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
13	0.16	0.16	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
13	BMP	75	1.5	2.0	0.90	2.5
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
13	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
13	0.90	5.9	0.16	0.85

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
14	0.10	0.04	0.40	0.57

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
14	AD	25	3	10.0	0.57	2.2
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
14	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
14	0.57	5.9	0.1	0.34

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
15	0.63	0.56	0.89	0.84

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
15	BMP	250	4.00	1.6	0.84	6.4

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
15	2.25	6.4	5.1

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
15	0.84	5.1	0.63	2.68

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
16	0.25	0.25	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
16	BMP	75	1.5	2.0	0.90	2.5
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
16	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
16	0.90	5.9	0.25	1.33

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
17	0.85	0.75	0.88	0.84

Step 2: Determine P_6

100 Year Storm	
P_6	2.25
P_{24}	3.75
%	60%
Adjusted P_6	2.25

60% $(45\% < P_6 < 65\%)$

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
17	BMP	140	5.50	3.9	0.84	3.6
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
17	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
17	0.84	5.9	0.85	4.21

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
18	0.81	0.69	0.85	0.82

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	($45\% < P_6 < 65\%$)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
18	BMP	245	5	2.0	0.82	6.3

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
18	2.25	6.3	5.1

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
18	0.82	5.1	0.81	3.40

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
19	0.11	0.11	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
19	BMP	75	1.5	2.0	0.90	2.5
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
19	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
19	0.90	5.9	0.11	0.59

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
20	0.11	0.11	1.00	0.90

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
20	BMP	75	1.5	2.0	0.90	2.5
					Min:	5.0

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
20	2.25	5.0	5.9

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
20	0.90	5.9	0.11	0.59

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
21	0.23	0.11	0.48	0.61

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
21	BMP	215	2	0.7	0.61	14.5

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
21	2.25	14.5	3.0

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
21	0.61	3.0	0.23	0.42

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
22	1.48	1.33	0.90	0.84

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
22	BMP	300	8.50	2.8	0.84	5.6

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
22	2.25	5.6	5.5

Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
22	0.84	5.5	1.48	6.86

Rational Method

Step 1: Determine Runoff Coefficient

DMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious (%)	Runoff Coefficient (C)
23	0.07	0.02	0.29	0.51

Step 2: Determine P_6

100 Year Storm			
P_6	2.25		
P_{24}	3.75		
%	60%		
Adjusted P_6	2.25	60%	(45% < P_6 < 65%)

Step 3: Determine Time of Concentration

DMA	Outfall	Distance (ft)	Elevation Change (ft)	Average Slope (%)	Runoff Coefficient (C)	Time of Concentration (Tc)
23	BMP	75	2	2.0	0.51	7.3

Step 4: Determine Rainfall Intensity

DMA	P_6	Time of Concentration (Tc)	Rainfall Intensity (in/hr)
23	2.25	7.3	4.6

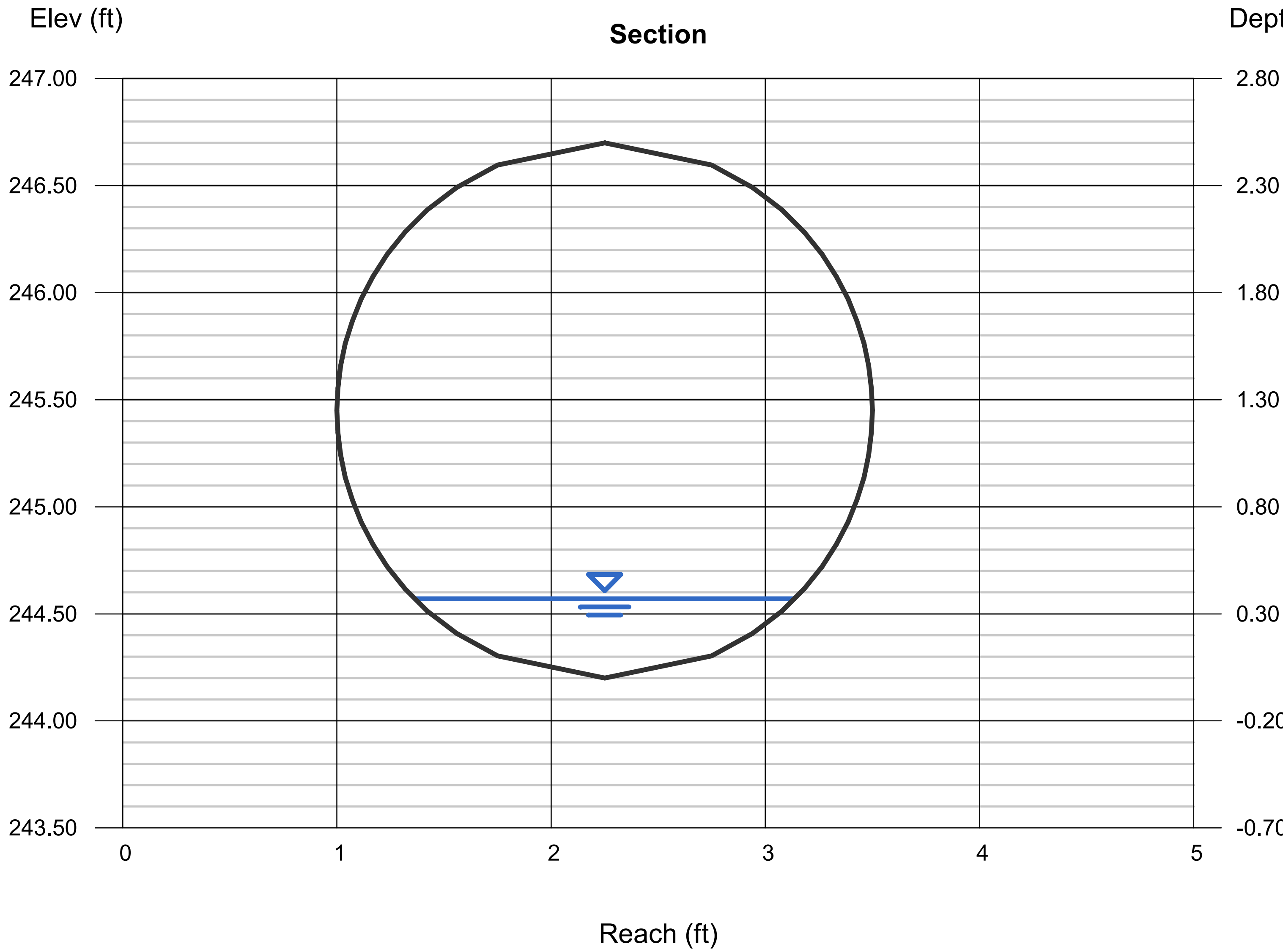
Step 5: Determine Peak Discharge

DMA	Runoff Coefficient (C)	Rainfall Intensity (in/hr)	Total Area (ac)	Peak Discharge (cfs)
23	0.51	4.6	0.07	0.16

Channel Report

Qa (Basin 1)

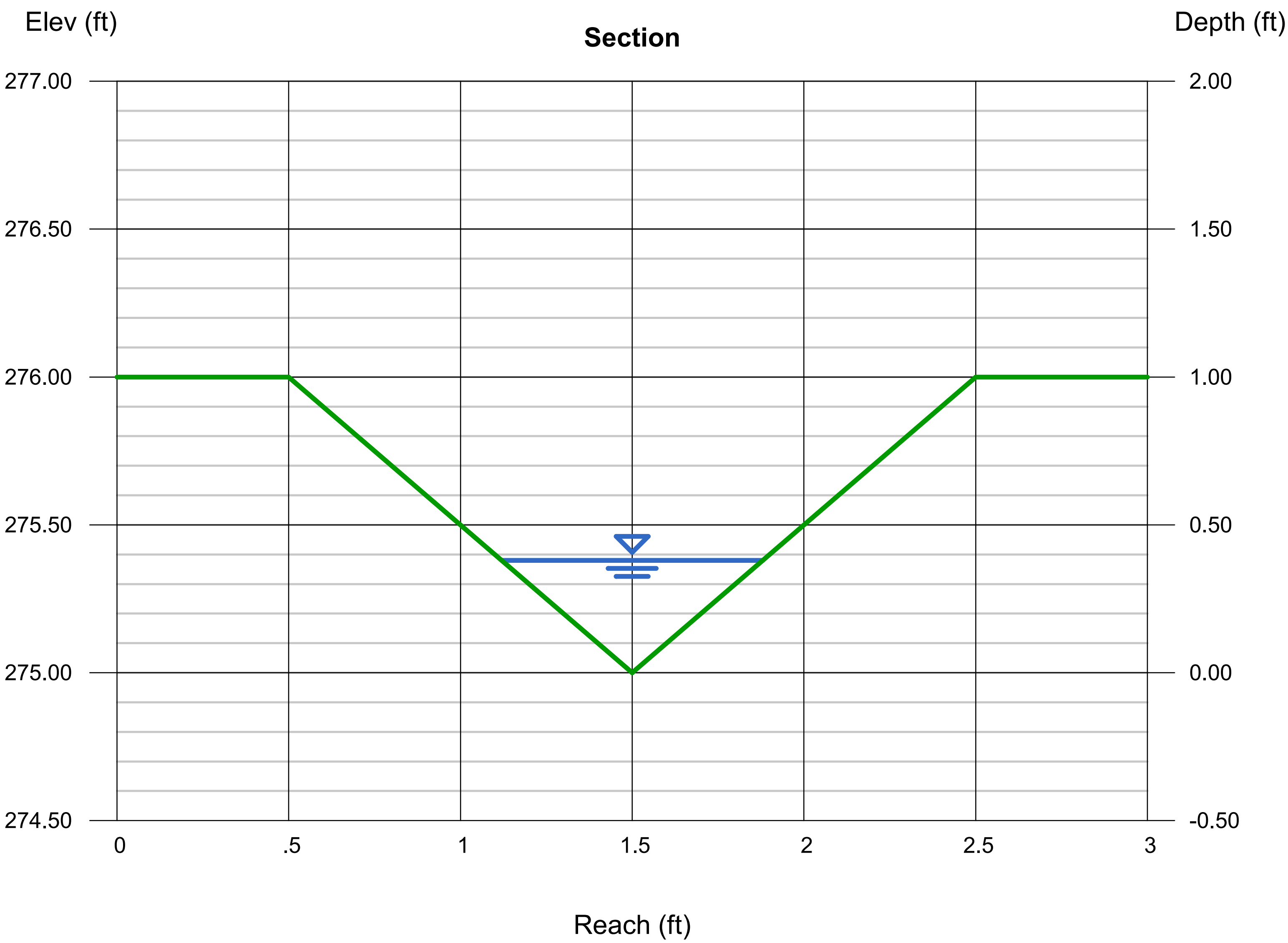
Circular		**Highlighted**	
Diameter (ft)	= 2.50	Depth (ft)	= 0.37
		Q (cfs)	= 5.440
		Area (sqft)	= 0.45
Invert Elev (ft)	= 244.20	Velocity (ft/s)	= 12.00
Slope (%)	= 25.00	Wetted Perim (ft)	= 1.97
N-Value	= 0.023	Crit Depth, Yc (ft)	= 0.77
		Top Width (ft)	= 1.78
Calculations		EGL (ft)	= 2.61
Compute by:	Known Q		
Known Q (cfs)	= 5.44		



Channel Report

Qb (Basin 12)

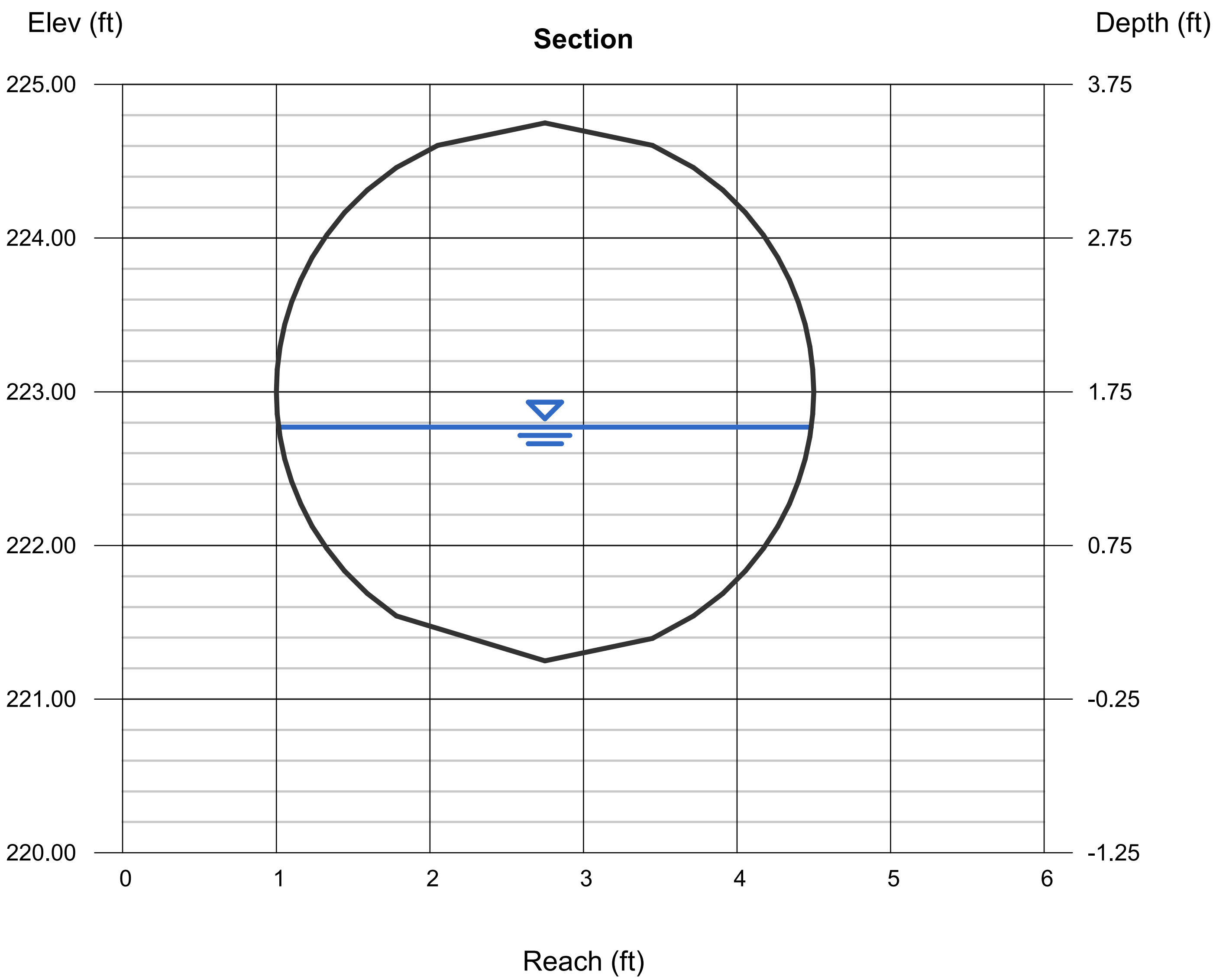
Triangular		**Highlighted**	
Side Slopes (z:1)	= 1.00, 1.00	Depth (ft)	= 0.38
Total Depth (ft)	= 1.00	Q (cfs)	= 1.730
		Area (sqft)	= 0.14
Invert Elev (ft)	= 275.00	Velocity (ft/s)	= 11.98
Slope (%)	= 20.00	Wetted Perim (ft)	= 1.07
N-Value	= 0.014	Crit Depth, Yc (ft)	= 0.72
		Top Width (ft)	= 0.76
Calculations		EGL (ft)	= 2.61
Compute by:	Known Q		
Known Q (cfs)	= 1.73		



Channel Report

Qc (Basin 2-5, 7-10, 13-23, Offsite)

Circular		**Highlighted**	
Diameter (ft)	= 3.50	Depth (ft)	= 1.52
		Q (cfs)	= 110.43
		Area (sqft)	= 4.01
Invert Elev (ft)	= 221.25	Velocity (ft/s)	= 27.51
Slope (%)	= 25.00	Wetted Perim (ft)	= 5.04
N-Value	= 0.023	Crit Depth, Yc (ft)	= 3.18
		Top Width (ft)	= 3.47
Calculations		EGL (ft)	= 13.29
Compute by:	Known Q		
Known Q (cfs)	= 110.43		



Channel Report

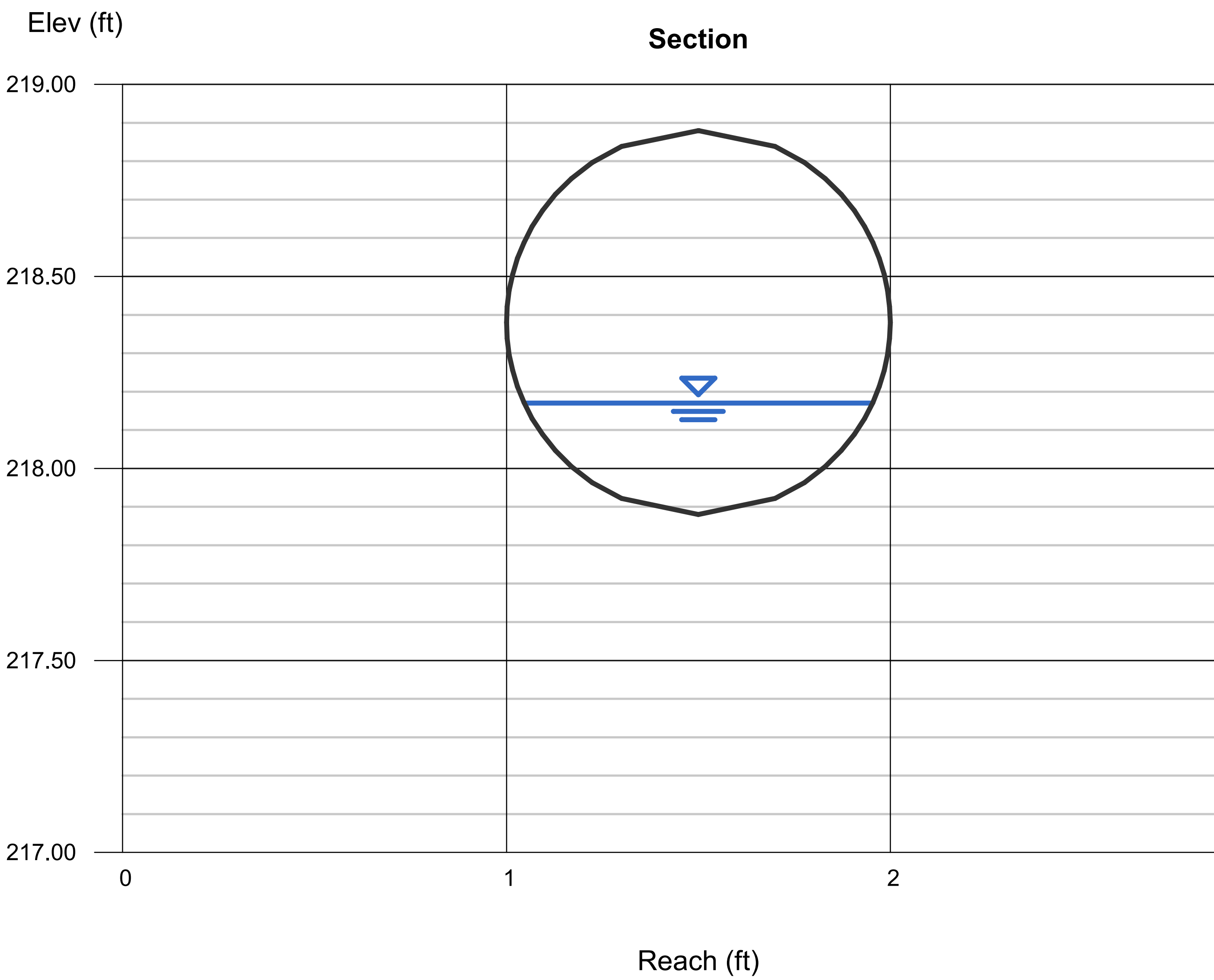
Qd (Basin 6)

Circular
Diameter (ft) = 1.00

Invert Elev (ft) = 217.88
Slope (%) = 25.00
N-Value = 0.013

Calculations
Compute by: Known Q
Known Q (cfs) = 3.16

Highlighted
Depth (ft) = 0.29
Q (cfs) = 3.160
Area (sqft) = 0.19
Velocity (ft/s) = 16.62
Wetted Perim (ft) = 1.14
Crit Depth, Yc (ft) = 0.77
Top Width (ft) = 0.91
EGL (ft) = 4.58



Qe (Basin 11)

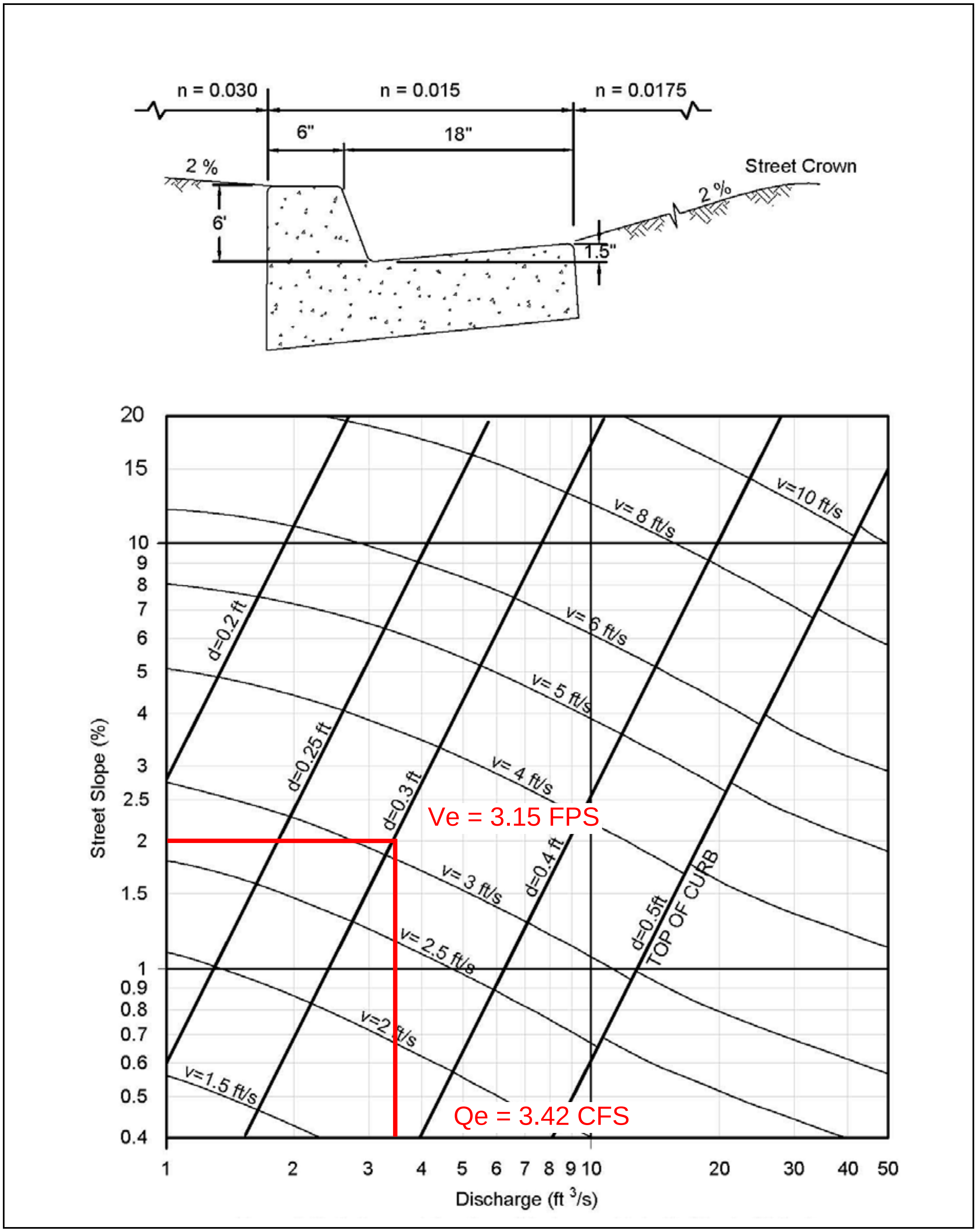


Figure 3-2: Gutter and Roadway Discharge-Velocity Chart (6" Curb)

APPENDIX E

BEST MANAGEMENT PRACTICES CALCULATIONS

BMP Summary

DMA	DMA Area (SF)	BMP Name	Required BMP Area (SF)	Provided BMP Area (SF)	BMP Type
5	45,000	5	1,215	1,911	BF-1
- -	- -	5A	- -	361	BF-1
- -	- -	5B	- -	949	BF-1
- -	- -	5C	- -	296	BF-1
- -	- -	5D	- -	305	BF-1
9	91,705	9	2,146	2,667	BF-1
- -	- -	9A	- -	871	BF-1
- -	- -	9B	- -	1,574	BF-1
- -	- -	9C	- -	222	BF-1
13	6,935	13	188	1,168	BF-1
- -	- -	13A	- -	565	BF-1
- -	- -	13B	- -	603	BF-1
15	27,238	15	687	724	BF-1
- -	- -	15A	- -	374	BF-1
- -	- -	15B	- -	350	BF-1
16	11,000	16	297	959	BF-1
- -	- -	16A	- -	509	BF-1
- -	- -	16B	- -	450	BF-1
17	36,815	17	917	1,097	BF-1
18	35,214	18	856	1,065	BF-1
19	4,801	19	130	208	BF-1
- -	- -	19A	- -	103	BF-1
- -	- -	19B	- -	105	BF-1
20	5,000	20	135	190	BF-1
- -	- -	20A	- -	92	BF-1
- -	- -	20B	- -	98	BF-1
21	9,829	21	174	561	BF-1
22	64,449	22	1,625	1,896	BF-1
- -	- -	22A	- -	205	BF-1
- -	- -	22B	- -	330	BF-1
- -	- -	22C	- -	205	BF-1
- -	- -	22D	- -	535	BF-1
- -	- -	22E	- -	621	BF-1
23	2,848	23	45	150	BF-1

Worksheet B.2-1 DCV (DMA 5)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	1.03	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	1683	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 9)

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	2.11	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.78	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	3634	cubic-feet

C[(73528*0.90)+(18177*0.30)]/91705 = 0.78

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 13)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.16	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	262	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 15)

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.63	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.84	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	961	cubic-feet

C[(24526*0.90)+(2712*0.30)]/27238 = 0.84

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 16)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.25	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	409	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 17)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.85	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.83	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	1281	cubic-feet

C[(32706*0.90)+(4109*0.30)]/36815 = 0.83

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 18)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.81	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.81	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	1191	cubic-feet

C[(30080*0.90)+(5134*0.30)]/35214 = 0.81

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 19)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.11	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	180	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 20)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.11	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.90	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	180	cubic-feet

For Impervious Roofs and Pavement Areas C=0.90

Worksheet B.2-1 DCV (DMA 21)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.23	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.59	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	247	cubic-feet

C[(4753*0.90)+(5076*0.30)]/9829 = 0.59

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 22)

Design Capture Volume		Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	1.48	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.84	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	2257	cubic-feet

C[(57999*0.90)+(6450*0.30)]/64449 = 0.84

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.2-1 DCV (DMA 23)

	Design Capture Volume	Worksheet B.2-1		
1	85th percentile 24-hr storm depth from Figure B.1-1	d=	0.5	inches
2	Area tributary to BMP (s)	A=	0.07	acres
3	Area weighted runoff factor (estimate using Appendix B.1.1 and B.2.1)	C=	0.52	unitless
4	Trees Credit Volume	TCV=	0	cubic-feet
5	Rain barrels Credit Volume	RCV=	0	cubic-feet
6	Calculate DCV = (3630 x C x d x A) – TCV - RCV	DCV=	67	cubic-feet

C[(1064*0.90)+(1784*0.30)]/2848 = 0.52

For Impervious Roofs and Pavement Areas C=0.90
For landscaped Areas C=0.30

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 5)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	1683	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	1200	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	180	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	1503	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	2255	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	601	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	1128	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	903	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	45000	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	1215	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	1215	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:
1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 9)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	3634	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	2150	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	323	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	3311	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	4967	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	1324	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	2484	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	1988	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	91705	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.78	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	2146	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	2146	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 13)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	262	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	200	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	30	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	232	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	348	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	93	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	174	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	140	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	6935	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	188	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	188	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 15)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	961	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	700	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	105	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	856	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	1284	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	343	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	642	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	514	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	27238	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.84	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	687	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	687	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 16)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	409	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	300	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	45	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	364	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	546	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	146	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	273	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	219	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	11000	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	297	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	297	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 17)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	1281	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	950	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	143	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	1138	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	1707	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	456	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	854	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	684	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	36815	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.83	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	917	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	917	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 18)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	1191	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	875	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	132	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	1059	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	1589	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	424	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	795	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	636	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	35214	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.81	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	856	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	856	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 19)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	180	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	150	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	23	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	157	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	236	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	63	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	118	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	95	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	4801	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	130	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	130	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 20)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	180	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	150	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	23	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	157	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	236	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	63	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	118	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	95	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	5000	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.90	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	135	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	135	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 21)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	247	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	200	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	30	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	217	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	326	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	87	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	163	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	131	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	9829	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.59	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	174	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	174	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:
1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 22)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	2257	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	1650	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	248	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	2009	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	3014	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	804	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	1507	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	1206	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	64449	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.84	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	1625	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	1625	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (DMA 23)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 1 of 2)	
1	Remaining DCV after implementing retention BMPs	67	cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible	N/A	in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]	0	inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]	N/A	inches
7	Assumed surface area of the biofiltration BMP	75	sq-ft
8	Media retained pore storage	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7	12	cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]	55	cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]	6	inches
12	Media Thickness [18 inches minimum], also add mulch layer thickness to this line for sizing calculations	18	inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area	12	inches
14	Freely drained pore storage	0.2	in/in
15	Media filtration rate to be used for sizing (5 in/hr. with no outlet control; if the filtration rate is controlled by the outlet use the outlet controlled rate which will be less than 5 in/hr.)	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]	15	inches
19	Total Depth Treated [Line 17 + Line 18]	45	inches

Note: Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs (continued)

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1 (Page 2 of 2)	
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]	83	cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12	23	sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]	42	cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12	34	sq-ft
Footprint of the BMP			
24	Area draining to the BMP	2848	sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)	0.52	
26	BMP Footprint Sizing Factor (Default 0.03 or an alternative minimum footprint sizing factor from Worksheet B.5-2, Line 11)	0.03	
27	Minimum BMP Footprint [Line 24 x Line 25 x Line 26]	45	sq-ft
28	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 27)	45	sq-ft
Check for Volume Reduction [Not applicable for No Infiltration Condition]			
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]	N/A	unitless
30	Minimum required fraction of DCV retained for partial infiltration condition	0.375	unitless
31	Is the retained DCV ≥ 0.375? If the answer is no increase the footprint sizing factor in Line 26 until the answer is yes for this criterion.	☐ Yes	☐ No

Note:

1. Line 7 is used to estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)
2. The DCV fraction of 0.375 is based on a 40% average annual percent capture and a 36-hour drawdown time.
3. The increase in footprint for volume reduction can be optimized using the approach presented in Appendix B.5.2. The optimized footprint cannot be smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2.
4. If the proposed biofiltration BMP footprint is smaller than the alternative minimum footprint sizing factor from Worksheet B.5-2, but satisfies Option 1 or Option 2 sizing, it is considered a compact biofiltration BMP and may be allowed at the discretion of the City Engineer, if it meets the requirements in Appendix F.

E.13. BF-1 Biofiltration

Location: 43rd Street and Logan Avenue, San Diego, California

MS4 Permit Category
Biofiltration
Manual Category
Biofiltration
Applicable Performance Standard
Pollutant Control Flow Control
Primary Benefits

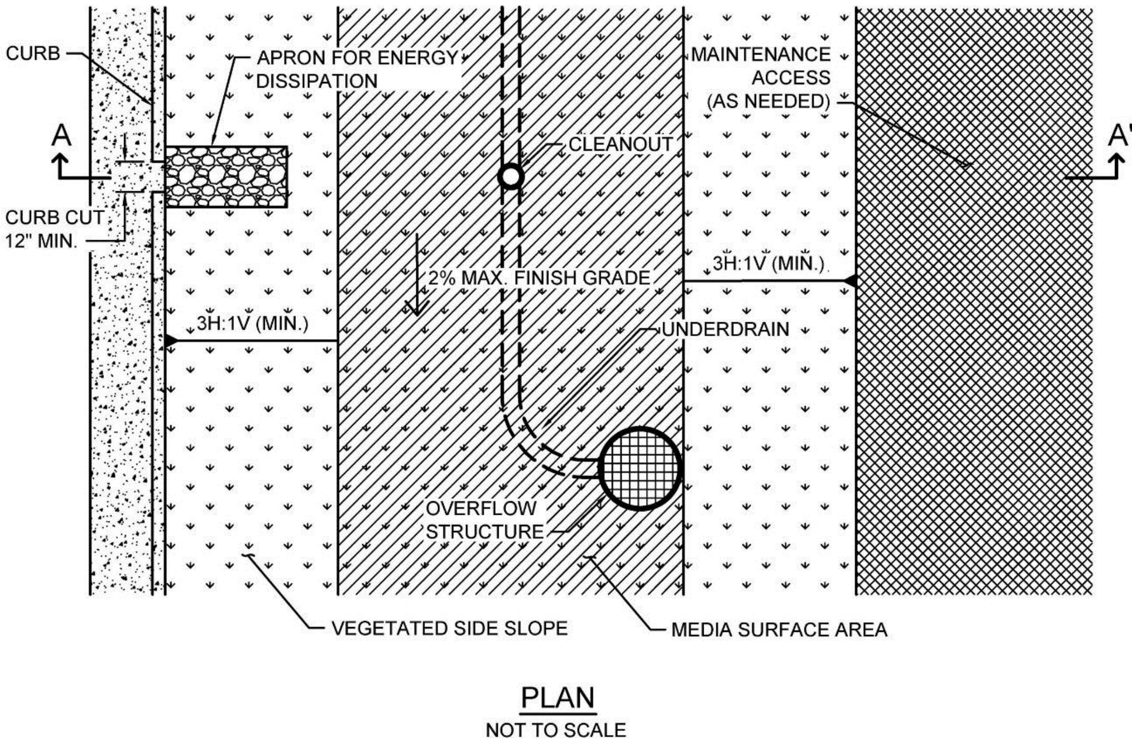
Treatment
Volume Reduction (Incidental)
Peak Flow Attenuation (Optional)

Description

Biofiltration (Bioretention with underdrain) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Bioretention with underdrain facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. Because these types of facilities have limited or no infiltration, they are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and plant uptake.

Typical bioretention with underdrain components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer (aka choking layer) consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility
- Overflow structure



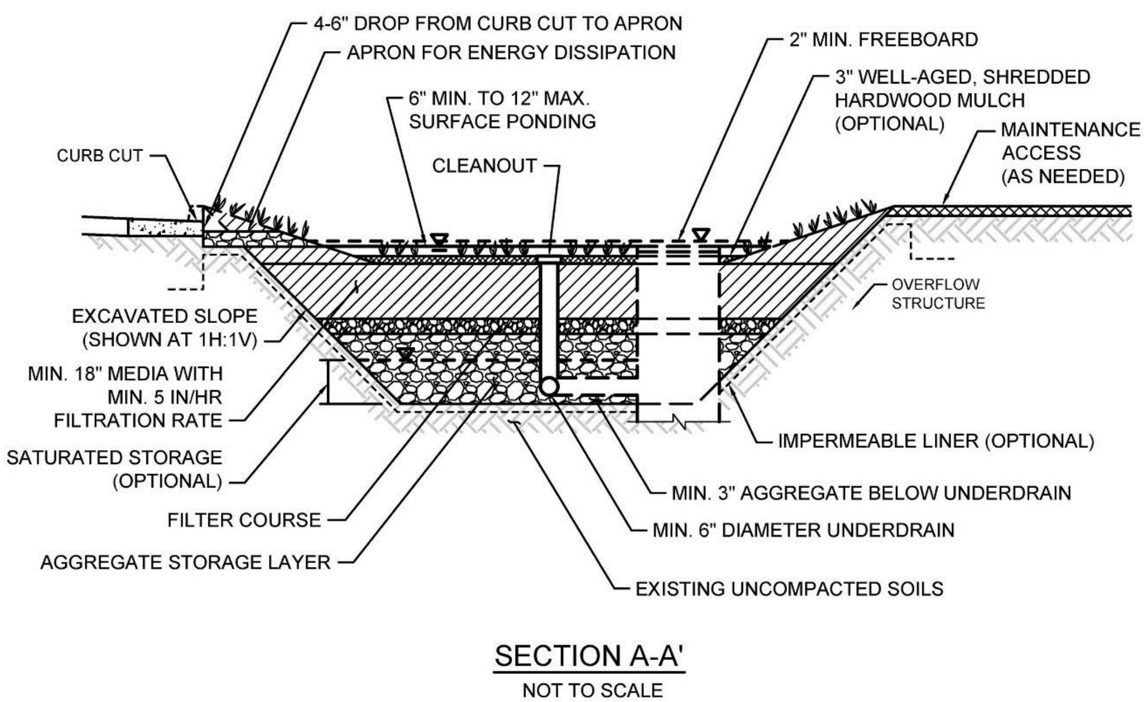


Figure E.13-E.13-1: Typical plan and Section view of a Biofiltration BMP

Design Adaptations for Project Goals

Biofiltration Treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration, and an underdrain is provided at the bottom to carry away filtered runoff. This configuration is considered to provide biofiltration treatment via flow through the media layer. Storage provided above the underdrain within surface ponding, media, and aggregate storage is considered included in the biofiltration treatment volume. Saturated storage within the aggregate storage layer can be added to this design by raising the underdrain above the bottom of the aggregate storage layer or via an internal weir structure designed to maintain a specific water level elevation.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer above the underdrain. This will allow for significant detention storage, which can be controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Bioretention with underdrain must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the City Engineer if it is determined to be appropriate:

	Siting and Design	Intent/Rationale
□	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
□	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
□	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the City Engineer if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the City Engineer for proper performance of the regional BMP.
□	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
Surface Ponding		

	Siting and Design	Intent/Rationale
☐	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hour for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the City Engineer if certified by a landscape architect or agronomist.
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the City Engineer if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
☐	A minimum of 2 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20.	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch (Mandatory)		
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer		

	Siting and Design	Intent/Rationale
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. Additional Criteria for media hydraulic conductivity described in the bioretention soil media model specification (Appendix F.4)	A filtration rate of at least 5 inches per hour allows soil to drain between events. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.
☐	Media is a minimum 18 inches deep, meeting the following media specifications: Model biorention soil media specification provided in Appendix F.4 <u>or</u> County of San Diego Low Impact Development Handbook: Appendix G - Bioretention Soil Specification (June 2014, unless superseded by more recent edition). Alternatively, for proprietary designs and custom media mixes not meeting the media specifications, the media meets the pollutant treatment performance criteria in Section F.1.	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary designs, compliance with Appendix F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
☐	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.
Filter Course Layer		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade and can result in poor water quality performance for turbidity and suspended solids. Filter fabric is more likely to clog.

	Siting and Design	Intent/Rationale
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.
☐	To reduce clogging potential, a two-layer filter course (aka choking stone system) is used consisting of one 3" layer of clean and washed ASTM 33 Fine Aggregate Sand overlying a 3" layer of ASTM No 8 Stone (Appendix F.5).	This specification has been developed to maintain permeability while limiting the migration of media material into the stone reservoir and underdrain system.
Aggregate Storage Layer		
☐	ASTM #57 open graded stone is used for the storage layer and a two layer filter course (detailed above) is used above this layer	This layer provides additional storage capacity. ASTM #8 stone provides an acceptable choking/bridging interface with the particles in ASTM #57 stone.
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
Inflow, Underdrain, and Outflow Structures		
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 8 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains should be affixed with an upturned elbow to an elevation at least 9 to 12 inches above the invert of the underdrain.	An upturned elbow reduces velocity in the underdrain pipe and can help reduce mobilization of sediments from the underdrain and media bed.

	Siting and Design	Intent/Rationale
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An underdrain cleanout with a minimum 8-inch diameter and lockable cap is placed every 50 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design bioretention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Use the sizing worksheet presented in Appendix B.5 to size biofiltration BMPs.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If bioretention with underdrain cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After bioretention with underdrain has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.21. PL Plant List

Plant Name		Irrigation Requirements		Preferred Location in Basin		Applicable Bioretention Sections (Un-Lined Facilities)				Applicability to Flow-Through Planter? (Lined Facility)	
Latin Name	Common Name	Temporary Irrigation during Plant Establishment Period	Permanent Irrigation (Drip / Spray)(1)	Basin Bottom	Basin Side Slopes	Section A Treatment-Only Bioretention in Hydrologic Soil Group A or B Soils	Section B Treatment-Only Bioretention in Hydrologic Soil Group C or D soils	Section C Treatment Plus Flow Control Bioretention in Hydrologic Soil Group A or B Soils	Section D Treatment Plus Flow Control Bioretention in Hydrologic Soil Group C or D Soils	**NO** Applicable to Un-lined Facilities Only (Bioretention Only)	**YES** Can Use in Lined or Un-Lined Facility (Flow-Through Planter OR Bioretention)
TREES(2)											
Alnus rhombifolia	White Alder	X		X	X	X	X	X	X	X	
Platanus racemosa	California Sycamore	X		X	X	X	X	X	X	X	
Salix lasiolepsis	Arroyo Willow	X			X	X	X	X	X	X	
Salix lucida	Lance-Leaf Willow	X			X	X	X	X	X	X	
Sambucus mexicana	Blue Elderberry	X			X	X	X	X	X	X	
SHRUBS / GROUNDCOVER											
Achillea millefolium	Yarrow	X			X	X	X				X
Agrostis palens	Thingrass	X			X	X	X	X	X		X
Anemopsis californica	Yerba Manza	X			X	X	X	X	X		X
Baccharis douglasii	Marsh Baccahris	X	X	X		X	X	X	X		X
Carex praegracillis	California Field Sedge	X	X	X		X	X	X	X		X
Carex spissa	San Diego Sedge	X	X	X		X	X	X	X		X
Carex subfusca	Rusty Sedge	X	X	X	X	X	X	X	X		X
Distichlis spicata	Salt Grass	X	X	X		X	X	X	X		X
Eleocharis macrostachya	Pale Spike Rush	X	X	X		X	X	X	X		X
Festuca rubra	Red Fescue	X	X	X	X	X	X				X
Festuca californica	California Fescue	X	X		X	X	X				X
Iva hayesiana	Hayes Iva	X			X	X	X				X
Juncus Mexicana	Mexican Rush	X	X	X	X	X	X	X	X		X
Jucus patens	California Gray Rush	X	X	X	X	X	X	X	X		X
Leymus condensatus 'Canyon Prince'	Canyon Prince Wild Rye	X	X	X	X	X	X	X	X		X
Mahonia nevinii	Nevin's Barberry	X			X	X	X	X	X		X
Muhlenburgia rigens	Deergrass	X	X	X	X	X	X	X	X		X
Mimulus cardinalis	Scarlet Monkeyflower	X		X	X	X	X				X
Ribes speciosum	Fushia Flowering Goose.	X			X	X	X				X
Rosa californica	California Wild Rose	X	X		X	X	X				X
Scirpus cenuus	Low Bullrush	X	X	X		X	X	X	X		X
Sisyrinchium bellum	Blue-eyed Grass	X			X	X	X				X

1. All plants will benefit from some supplemental irrigation during hot dry summer months, particularly those on basin side slopes and further inland.
2. All trees should be planted a min. of 10' away from any drain pipes or structures.

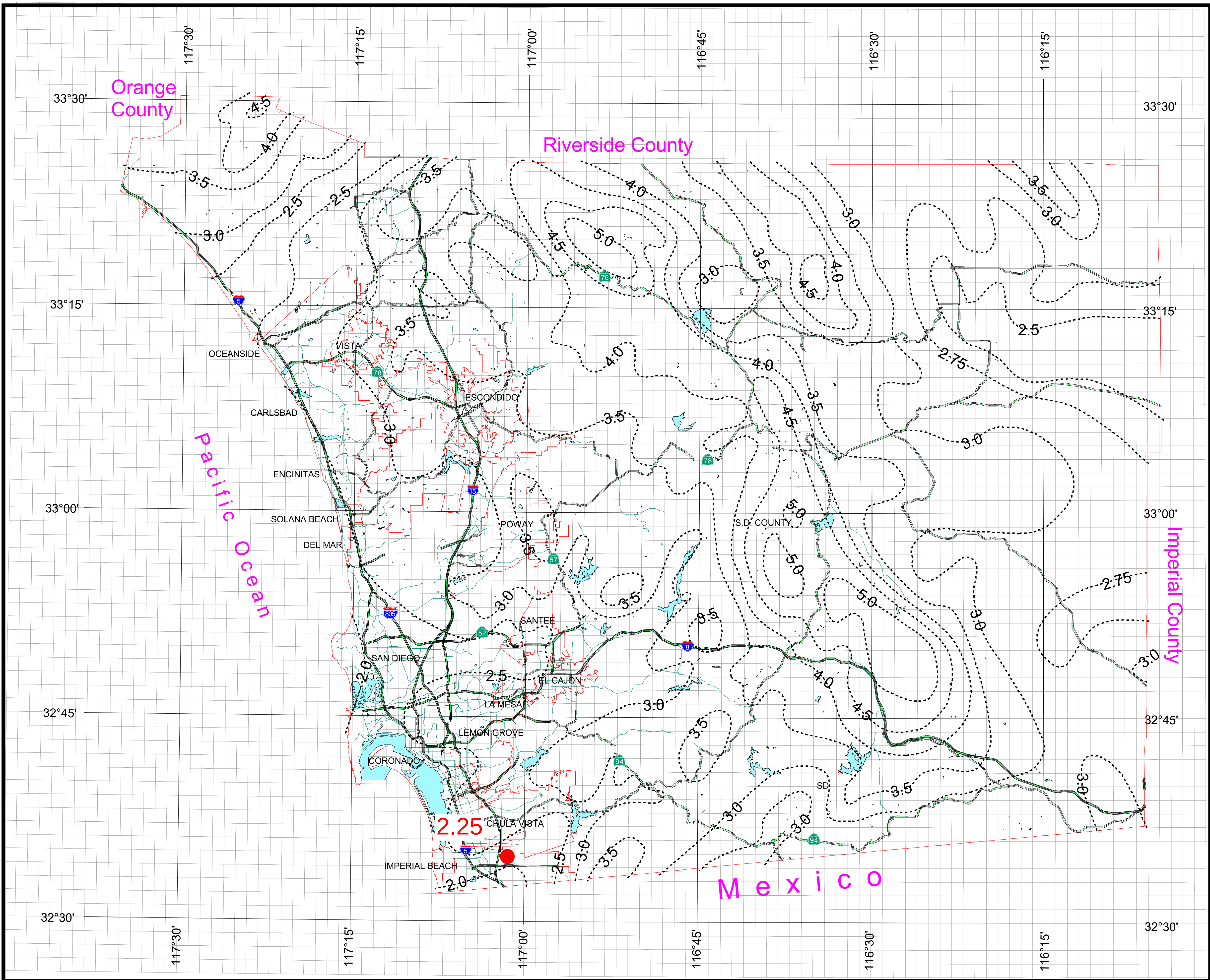
APPENDIX F

REFERENCES

County of San Diego Hydrology Manual

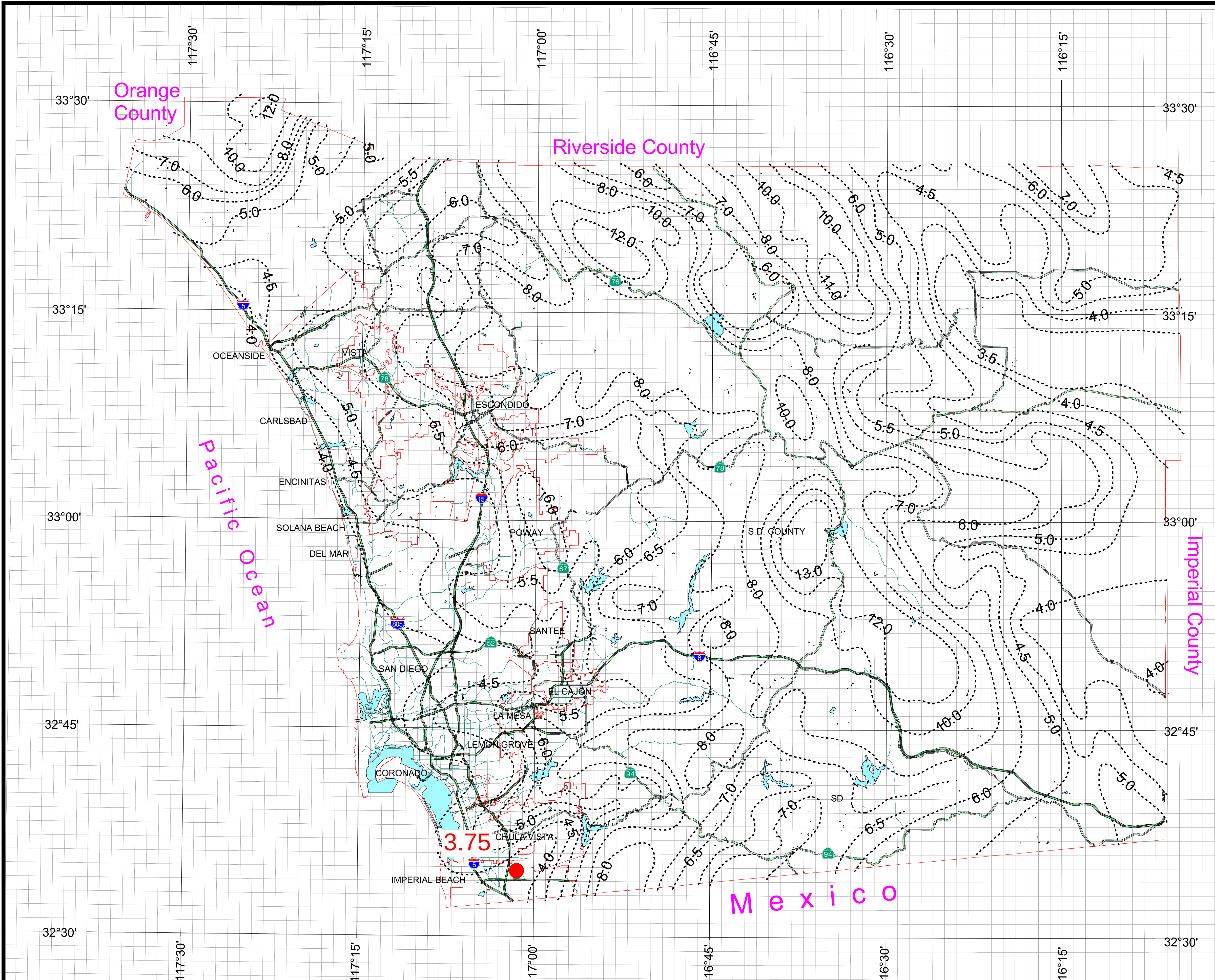
Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours



DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works Geographic Information Services

SanGIS
We Have San Diego Covered!

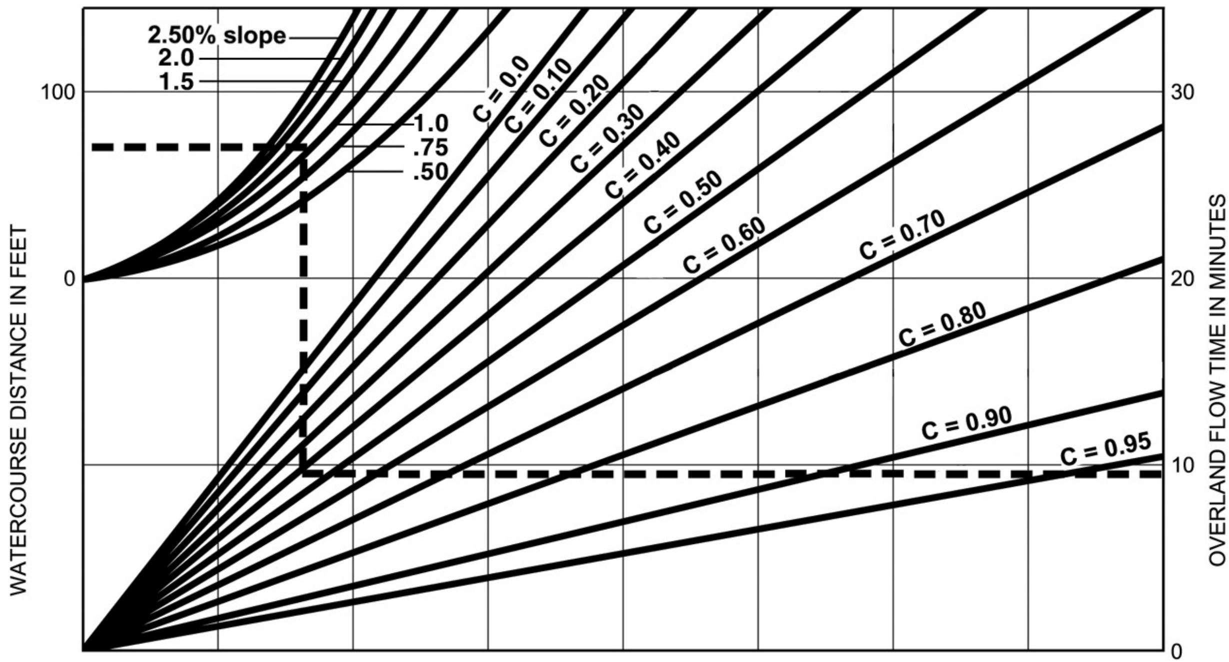
N
W E
S

3 0 3 Miles

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



EXAMPLE:

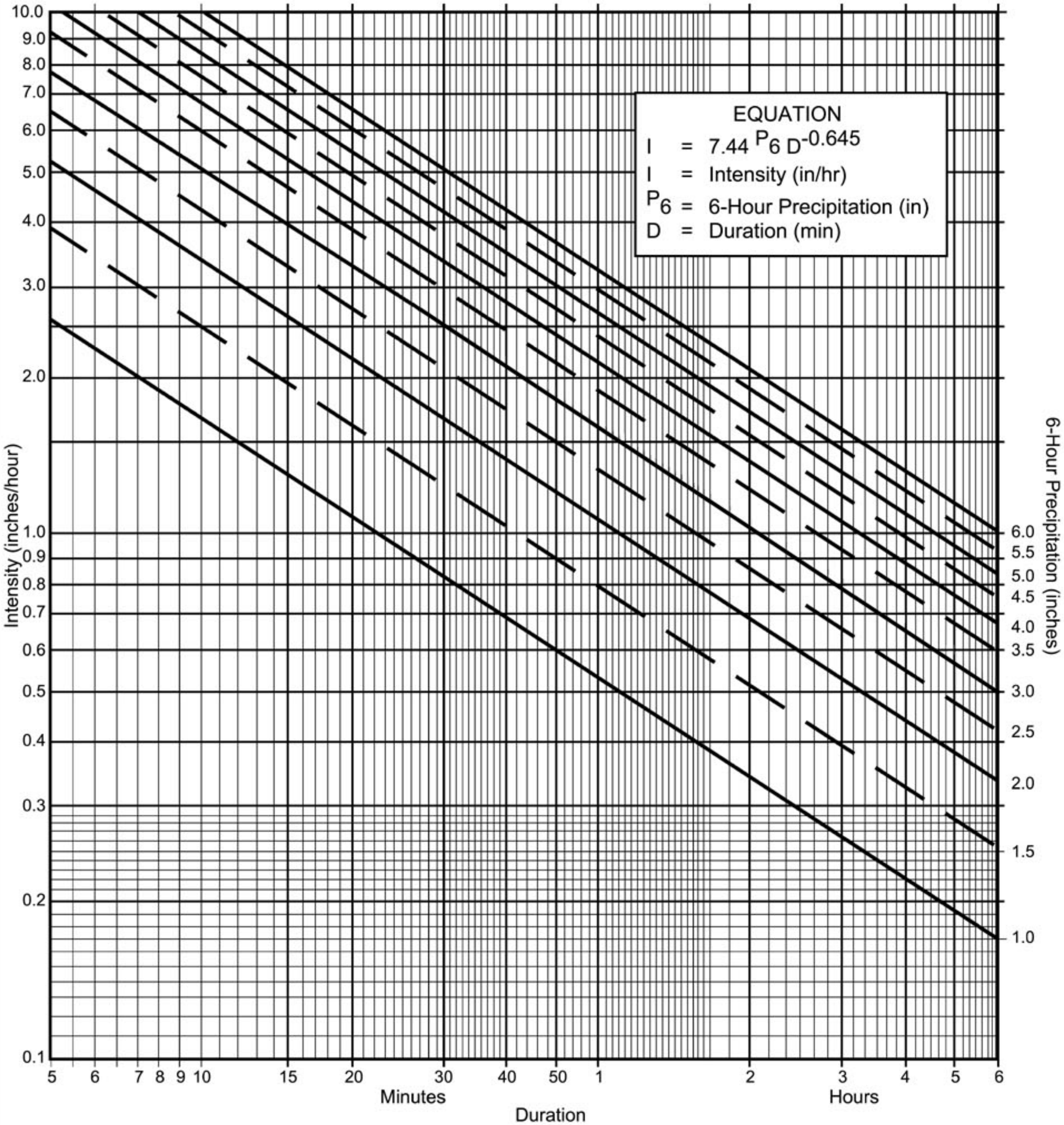
Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE **3-3**

Rational Formula - Overland Time of Flow Nomograph



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency ______ year

(b) P_6 = ______ in., P_{24} = ______, $\frac{P_6}{P_{24}}$ = ______ %(2)

(c) Adjusted P_6(2) = ______ in.

(d) t_x = ______ min.

(e) I = ______ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

ATTACHMENT 6
GEOTECHNICAL AND GROUNDWATER INVESTIGATION REPORT

ADDENDUM TO GEOTECHNICAL INVESTIGATION – RESPONSE TO CITY REVIEW COMMENTS

THE SHOPS AT AMC PALM PROMENADE 770 DENNERY ROAD SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

HCP-CCI PALM PROMENADE, LLC
NEWPORT BEACH, CALIFORNIA

DECEMBER 29, 2017
REVISED JANUARY 23, 2018
PROJECT NO. G2171-42-01

Project No. G2171-42-01
December 29, 2017
Revised January 23,2018

HCP-CCI Palm Promenade, LLC
4340 Von Karmen Avenue, Suite 110
Newport Beach, California 92660

Attention: Mr. Michael Mossman

Subject: ADDENDUM TO GEOTECHNICAL INVESTIGATION –
RESPONSE TO CITY REVIEW COMMENTS
THE SHOPS AT AMC PALM PROMENADE
770 DENNERY ROAD
SAN DIEGO, CALIFORNIA

References:

1. *Cycle Issues, 2 Submitted (Multi Discipline) Review*, prepared by City of San Diego, dated November 7, 2017 (Project No. 569517).

2. *Geotechnical Investigation, The Shops at AMC Palm Promenade, 770 Dennery Road, San Diego, California*, prepared by Geocon Incorporated, dated August 18, 2017 (Project No. G2171-42-01).

Dear Mr. Mossman:

In accordance with the request of Nasland Engineering, we have prepared this addendum letter to address geotechnical review comments provided by the City of San Diego LDR-Geology for the subject project (see Reference 1). This report has been revised to include the latest base map on our geologic map (Figure 1). The geotechnical review comments followed by our responses are provided below.

Comment 5: *Submit an addendum geotechnical report that provides the information requested herein.*

Response: This correspondence constitutes the requested addendum.

Comment 6: *Add the location of the fault trace as mapped by G. A. Nicoll (1995) and surveyed by Rick Engineering on the Geologic and Tentative Maps.*

Comment 7: *Clarify the strike and dip of the fault.*

Response to Comments 6 and 7: The approximate location and strike and dip of the LA Nacion Fault derived from G. A. Nicoll and Rick Engineering survey data as well as USGS "Geologic Map of the San Diego 30'X60' Quadrangle, prepared by Kennedy and Tan, 2005, are shown on the attached Geologic Map (map pocket).

Should you have any questions or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Ali Sadr
CEG 1778

Rodney C. Mikesell
GE 2533

AS:RCM:dmc

(e-mail) Addressee
(2) Nasland Engineering
Attention: Mr. Sam Waisbord

GEOCON LEGEND

Qpf ....PREVIOUSLY PLACED FILL

Tsd ....SAN DIEGO FORMATION (Dotted Where Buried)

B-6 ....APPROX. LOCATION OF EXPLORATORY BORING

A-4 ....APPROX. LOCATION OF INFILTRATION TEST

B B' ....APPROX. LOCATION OF GEOLOGIC CROSS-SECTION

35° ....APPROX. LOCATION OF BURIED LA NACION FAULT, DIPPING 35° Northwest

GEOLOGIC MAP

THE SHOPS AT AMC PROMENADE
SAN DIEGO, CALIFORNIA

GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159

SCALE 1" = 50'	DATE 08-18-2017 REVISED DATE 01-23-2018	
PROJECT NO. G2171 - 42 - 01		FIGURE 1
SHEET 1 OF 1		

Plotted:01/23/2018 3:36PM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G2171-42-01 (The Shops at AMC Promenade)\SHEETS\G2171-42-01 Geo Map (2018-01-23).dwg

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

GEOTECHNICAL INVESTIGATION

THE SHOPS AT AMC PROMENADE
770 DENNERY ROAD
SAN DIEGO, CALIFORNIA

PREPARED FOR

CITIVEST INCORPORATED
NEWPORT BEACH, CALIFORNIA

AUGUST 18, 2017
PROJECT NO. G2171-42-01

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. G2171-42-01
August 18, 2017

Citivest Incorporated
4340 Von Karmen Avenue, Suite 110
Newport Beach, California 92660

Attention: Mr. Michael Mossman

Subject: GEOTECHNICAL INVESTIGATION
THE SHOPS AT AMC PROMENADE
770 DENNERY ROAD
SAN DIEGO, CALIFORNIA

Dear Mr. Mossman

In accordance with your request and authorization of our proposal (LG-17225, dated June 5, 2017), we herein submit the results of our geotechnical investigation for the subject project. We performed our investigation to evaluate the underlying soil and geologic conditions and potential geologic hazards and to assist in the design of the proposed building and associated improvements.

The accompanying report presents the results of our study and conclusions and recommendations pertaining to the geotechnical aspects of the proposed project. The site is suitable for the proposed buildings and improvements provided the recommendations of this report are incorporated into the design and construction of the planned project.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Noel G. Borja
Senior Staff Engineer

Shawn Foy Weedon
GE 2714

Ali Sadr
CEG 1778

REGISTERED PROFESSIONAL ENGINEER
SHAWN WEEDON
No. 2714
GEOTECHNICAL
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
ALI SADR
No. 1778
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

NGB:RCM:AS:dmc

(4) Addressee
(1) Nasland Engineering
Attention: Mr. Sam Waisbord

TABLE OF CONTENTS

TABLE OF CONTENTS (Concluded)

GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation for the proposed new buildings and improvements for The Shops at AMC Promenade located at 770 Dennery Road in San Diego, California (see Vicinity Map, Figure 1). The purpose of this geotechnical investigation is to evaluate the surface and subsurface soil conditions; general site geology; and to identify geotechnical constraints that may impact the planned improvements to the property. This report also provides grading and foundation recommendations, retaining wall design criteria, and storm water management recommendations.

To aid in preparing this geotechnical investigation, we reviewed the following reports and plans:

1. *Final Report of Observation and Testing, AMC 24-Plex, Dennery Road and Palm Avenue, San Diego, California*, prepared by MTGI Incorporated, dated October 28, 1999 (Project No. 1201-03).
2. *Geotechnical Engineering Report, Proposed AMC Theater and Adjacent Restaurants, Palm Avenue and Dennery Road, San Diego, California*, prepared by Terracon Incorporated, dated September 16, 1997 (Project No. 02975220).
3. *Report of Geotechnical Investigation, Proposed AMC Theater and Adjacent Restaurants, Palm Avenue and Dennery Road, San Diego, California*, prepared by Opterra Incorporated, dated September 15, 1997 (Project No. D45201-1).
4. *Report of Limited Geologic and Seismicity Study, Proposed AMC Theater and Adjacent Restaurants, Palm Avenue and Dennery Road, San Diego, California*, prepared by Stephen E. Jacobs, CEG, dated August 27, 1997.
5. *Plans for the Improvement and Grading For: AMC 24 Theaters at Palm Promenade in Lots 3, 4, 5, 6, 14, 16 and 17 of Palm Promenade Map No. 13071, San Diego, California*, prepared by Rick Engineering Company, dated October 14, 1998 (Drawing No. 29290-D).

The field investigation consisted of drilling six small-diameter borings to evaluate the underlying geologic conditions within the area of planned improvements and performing four infiltration tests for storm water management recommendations.

The locations of the small-diameter borings and infiltration tests are shown the *Geologic Map*, Figure 2, and on the *Geologic Cross-Sections*, Figure 3. The base map used for Figure 2 is an AutoCAD file of the grading plan provided by Nasland Engineering. Logs of the exploratory borings and a detailed discussion of the field investigation are presented in Appendix A.

We performed laboratory tests on selected soil samples obtained during the field investigation to evaluate pertinent physical properties for engineering analyses and to assist in providing recommendations for site grading and foundation design criteria. Details of the laboratory testing and a summary of test results are presented in Appendix B.

The conclusions and recommendations presented herein are based on analyses of the data obtained from the field investigation, laboratory tests, and our experience with similar soil and geologic conditions.

2. PREVIOUS SITE DEVELOPMENT

Original development for the AMC 24-plex theater was performed during development for the Palm Promenade commercial center Lots 3 through 6, 14, 16, and 17. Grading was performed under the testing and observation of G. A. Nicholl and Associates, Inc. and was reported in the as-graded report titled *Rough Grading Report, Palm Promenade, Palm Avenue and I-805, San Diego, California, Project 4909-51 for Gatlin Development Company,* dated April 7, 1995. We did not have a copy of this original as-graded report for our review at the time this report was prepared. Based on our review of References 2 and 3, original grading placed and compacted 5 to 26.5 feet of fill soils across the site. However, subsequent to the original grading, a geotechnical investigation and limited geologic/seismic study was performed, References 3 and 4, respectively, prior to the fine grading of the AMC 24-plex theater and proposed restaurants.

In 1999, grading for the AMC theater was completed. Fine grading for the theater was documented in the as-graded report prepared by MTGL, Inc. (Reference 1). Based on the as-graded report, a 1-foot undercut below bottom of the footings were performed in the area of the theater. Grading extended at least 5 feet laterally outside the building footprints. In areas of improvements or where fill soils were required to achieve finish grade, a 1-foot removal and recompaction was performed.

3. SITE AND PROJECT DESCRIPTION

The proposed project is located at 770 Dennery Road in the Otay Mesa area in San Diego, California, within the Palm Promenade commercial development. It consists of the AMC 24-plex movie theater surrounded by asphalt-paved parking lot. The site is bordered to the north by a Walmart store, parking lot and a tire store. On the south the site is bounded by a parking lot and retail stores. The north bound I-805 and Dennery Road bound the site to the west and east, respectively. A 25-foot slope borders the west perimeter of the site. Existing grade slopes from southeast to northwest with elevations varying from approximately 308 feet Mean Sea Level (MSL) at the southeast end to approximately 265 feet MSL at the west end.

We understand the proposed improvement will consist of demolishing the north portion of the AMC 24-plex theater to reduce the cinema to 14-plexes, constructing three new retail shops, a 45,000-square-foot retail building, and two building pads. A loading dock is also planned for the retail building and drive thru's will be included in the construction of the two building pads on the east side of the site. In addition, new parking stalls and associated utilities will also be constructed.

The above locations, site descriptions, and proposed development are based on our site reconnaissance, review of published geologic literature, field investigations, and discussions with the project civil engineer. If development plans differ from those described herein, Geocon Incorporated should be contacted for review of the plans and possible revisions to this report.

4. SOIL AND GEOLOGIC CONDITIONS

The property is underlain by previously placed fill overlying the San Diego Formation. A description of the surficial soils and the formational unit are discussed below. The approximate occurrence and thickness of the units are shown on the Geologic Map (Figure 2) and Geologic Cross-Sections (Figure 3). We prepared the geologic cross-sections using information from our recent site investigation, previous grading, and interpolation between exploratory borings; therefore, actual geologic conditions between the borings may vary from those illustrated.

4.1 Previously Placed Fill (Qpf)

Compacted fill placed during previous grading operations are present throughout the site. We observed previously placed fill soils in all of the borings to the maximum depths explored of 19.5 feet. The fill predominantly consists of silty to clayey sand and silty to sandy clay with varying cobble content. Laboratory tests indicate the fills possess a *low* to *medium* expansion potential with very low to moderate potential for collapse when wetted.

4.2 San Diego` Formation (Tsd)

Based on the geotechnical investigation performed by Opterra dated September 15, 1997, the San Diego Formation was observed underlying the previously placed fill soils at depths of 5 to 26.5 feet below the elevations prior to fine grading. Opterra's report described the San Diego Formation to consist of fine to medium grained sandstone with occasional layers of silty claystone and cobble conglomerate. Excavations during the construction of proposed improvements are anticipated to be shallow. We do not expect to encounter this formational unit during construction.

5. GROUNDWATER

We did not encounter groundwater during our investigation. Groundwater is expected to be greater than 70 feet below the existing ground surface; however, it is not uncommon for saturated or seepage conditions to develop where none previously existed. Groundwater elevation is dependent on seasonal precipitation, irrigation, land use, etc. Proper surface drainage will be important to future performance of the project.

6. GEOLOGIC HAZARDS

6.1 Geologic Hazard Category

The City of San Diego Seismic Safety Study (2008), Sheet 6 defines the site as Hazard Category 52: *Other level areas, gently sloping to steep terrain, unfavorable geologic structure, low to moderate risk*. It is our opinion the site has favorable geologic structure with respect to geologic hazards.

6.2 Faulting and Ground Rupture

A review of USGS and CGS (2006) and Kennedy and Tan (2008) shows the La Nacion fault zone traversing along the eastern edge of the property line trending approximately N10°E. The La Nacion Fault is classified by the California Geologic Survey as "potentially active" fault, meaning that no activity has been detected along this fault in the past 11,000 years (Holocene). During the mass grading operations, G. A. Nicoll and Associates has mapped the La Nacion Fault and Rick Engineering has surveyed the location. They allocated a 25 feet setback from the fault for any habitable structures The fault zone and the allocated 25 feet setback is shown on the Geologic Map (Figure 2). The proposed buildings are located beyond these limits. No other faults are noted in the site vicinity or trending toward the site vicinity. The site is not located within a State of California Earthquake Fault Zone. The nearest active fault is the Newport-Inglewood/Rose Canyon Fault Zone, which is located 7 miles west of the site.

6.3 Seismicity

We performed a deterministic seismic hazard analysis using Risk Engineering (2015). Six known active faults are located within a search radius of 50 miles from the property. We used the 2008 USGS fault database that provides several models and combinations of fault data to evaluate the fault information. The nearest known active faults are the Newport-Inglewood/Rose Canyon Fault system, located less than 7 miles west of the site and is the dominant source of potential ground motion. Earthquakes that might occur on the Newport-Inglewood/Rose Canyon Fault Zone or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated deterministic maximum earthquake magnitude and peak ground acceleration for the Newport-Inglewood Fault are 7.5 and 0.35g, respectively. Table 6.3.1 lists the estimated maximum earthquake magnitude and peak ground acceleration for these and other faults in relationship to the site location. We used acceleration attenuation relationships developed by Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008)

NGA USGS, and Chiou-Youngs (2007) NGA USGS 2008 acceleration-attenuation relationships in our analysis.

TABLE 6.3.1
DETERMINISTIC SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2007 (g)
Newport-Inglewood	7	7.5	0.31	0.27	0.35
Rose Canyon	7	6.9	0.27	0.25	0.29
Coronado Bank	14	7.4	0.22	0.17	0.20
Palos Verdes Connected	14	7.7	0.24	0.18	0.23
Elsinore	44	7.85	0.13	0.09	0.11
Earthquake Valley	48	6.8	0.08	0.05	0.04

It is our opinion the site could be subjected to moderate to severe ground shaking in the event of an earthquake along any of the faults listed on Table 6.3.1 or other faults in the southern California/ northern Baja California region. We do not consider the site to possess a greater risk than that of the surrounding developments.

We performed a probabilistic seismic hazard analysis for the site using Risk Engineering (2015). The computer program operates under the assumption that the occurrence rate of earthquakes on each mapped Quaternary fault is proportional to the faults slip rate. The program accounts for earthquake magnitude as a function of fault rupture length, and site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS 2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2007) NGA USGS 2008 in the analysis. Table 6.3.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence.

TABLE 6.3.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2007 (g)
2% in a 50 Year Period	0.45	0.38	0.44
5% in a 50 Year Period	0.32	0.28	0.31
10% in a 50 Year Period	0.24	0.21	0.23

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the 2016 California Building Code (CBC) guidelines or guidelines currently adopted by the City of San Diego.

6.4 Landslides

No landslides were encountered at the site or in an area that could impact the property. We do not consider the potential for landsliding to be a hazard to this project.

6.5 Liquefaction and Seismically Induced Settlement

Due to the absence of a near surface groundwater elevation and the dense to very dense nature of the on-site soils, the risk associated with ground failure or settlement hazard due to liquefaction is low.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

7.1.1 From a geotechnical engineering standpoint, it is our opinion that the site is suitable for development of the proposed project provided the recommendations presented herein are implemented in design and construction of the project.

7.1.2 The site is underlain by previous place fill overlying the San Diego Formation. The previously placed fill is considered suitable for support of additional fill or proposed improvements; however, upper portions of the fill will require remedial grading consisting of an undercut and recompaction. Based on the proposed project, we do not expect to encounter the San Diego Formation during remedial grading with the exception of deep utility excavations.

7.1.3 The La Nacion Fault zone traverses along the eastern property line of the site trending approximately N10ºE.. This fault is classified as a “potentially active” fault. No other faults are noted in the site vicinity or trending toward the site vicinity.

7.1.4 During the previous phases of development, a 25 foot setback is allocated along the La Nacion Fault. No habitable building is allowed within this zone.

7.1.5 The site is located approximately 7 miles from the nearest active fault, the Newport-Inglewood/Rose Canyon Fault Zone. It is our opinion that beside the La Nacion Fault, no active or potentially active faults cross the site.

7.1.6 The risk associated with geologic hazards due to ground rupture, liquefaction, and landslides are low.

7.1.7 We did not encounter groundwater at the time of our investigation. No subdrains will be required on the project, with the exception of subdrains for retaining walls.

7.1.8 The proposed structures can be supported on conventional shallow foundations system bearing on properly compacted fill soil.

7.1.9 Subsurface conditions observed in the exploratory borings may be extrapolated to reflect general soil/geologic conditions at the site; however, some variations in subsurface conditions between borings should be expected.

7.1.10 Based on our geotechnical investigation and a review of the proposed improvement, we opine that the new development would not have an adverse impact on the adjacent properties.

7.2 Excavation and Soil Characteristics

7.2.1 Excavation of the onsite soils should be possible with moderate to heavy effort using conventional, heavy-duty equipment during grading and trenching operations.

7.2.2 The soil encountered in our field investigation is considered to be “expansive” (Expansion Index [EI] greater than 20) as defined by 2016 California Building Code (CBC) Section 1803.5.3. Table 7.2 presents soil classifications based on the expansion index.

TABLE 7.2
EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Expansion Classification	2016 CBC Expansion Classification
0 – 20	Very Low	Non-Expansive
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

7.2.3 We performed laboratory tests on samples of the site materials to evaluate the percentage of water-soluble sulfate content. Appendix B presents the results from the laboratory water-soluble sulfate content tests. The test results indicate that on-site materials at the locations tested possess “Not Applicable” and “S0” sulfate exposure to concrete structures, as defined by 2016 CBC Section 1904 and ACI 318-14 Chapter 19. The presence of water-soluble sulfates is not a visually discernible characteristic. Therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e. addition of fertilizers and other soil nutrients) may affect the concentration.

7.2.4 Geocon Incorporated does not practice in the field of corrosion engineering. Therefore, if improvements that could be susceptible to corrosion are planned, further evaluation by a corrosion engineer may be needed.

7.3 Grading

7.3.1 All grading should be performed in accordance with the *Recommended Grading Specifications* contained in Appendix D. Where the recommendations of Appendix D conflict with this section of the report, the recommendations of this section take precedence.

7.3.2 Prior to commencing grading, a preconstruction conference should be held at the site with the owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

7.3.3 Grading should be performed in conjunction with the observation and compaction testing services of Geocon Incorporated. Fill soil should be observed on a full-time basis during placement and tested to check in-place dry density and moisture content.

7.3.4 Site preparation should begin with removal of all deleterious material and vegetation. The depth of removal should be such that material exposed in cut areas or soil to be used for fill is relatively free of organic matter. Deleterious material generated during stripping and/or site demolition should be exported from the site.

7.3.5 Abandoned utilities should be removed and the subsequent depressions and/or trenches backfilled with properly compacted fill as part of the remedial grading.

7.3.6 In areas to receive new foundations and structural improvements, the previously placed fill should be removed and replaced as compacted fill to a depth of 3 feet below finish pad grade or 1 foot below bottom of the deepest footing element (whichever results in a deeper excavation). The remedial grading should extend a horizontal distance to at least 5 feet outside of the building footprint. If unsuitable soils are encountered deeper than those recommended herein, the actual extent of the removals will be evaluated in the field during grading by the geotechnical engineer and/or engineering geologist.

7.3.7 In the areas of planned new pavement or surface improvements, we recommend the upper 1 foot of pavement subgrade be removed and replaced with compacted fill. Prior to placing fill, the bottom of excavation should be scarified, moisture conditioned as necessary, and recompacted.

7.3.8 Prior to placing fill, the upper 12 inches at the base of removals should be scarified, moisture conditioned as necessary and recompacted. Soils derived from onsite excavations are suitable for reuse as fill if free from vegetation, debris and other deleterious material. Fill lifts should be no thicker than will allow for adequate bonding and compaction. Fill, backfill, and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of maximum dry density at or slightly above optimum moisture content, as determined in accordance with ASTM D 1557. Grading should be performed so that the upper 3 feet of soil below finish pad subgrade consist of soil with a *low* to *medium* expansive potential (EI of 90 or less).

7.3.9. Oversize rock greater than 12 inches should be placed at least 5 feet below finish pad grade or 3 feet below the deepest utility, whichever is greater. Rock greater than 6 inches should not be placed in the upper 3 feet below building pad grade. Oversize rock that cannot be placed as recommended should be exported off site.

7.3.10 Imported fill should consist of granular soil with a *low* to *medium* expansion potential (EI of 90 or less) that is free of deleterious material or stones larger than 3 inches and should be compacted as recommended above. Geocon Incorporated should be notified of the import soil source and should perform laboratory testing prior to its arrival at the site to evaluate its suitability as fill material.

7.4 Seismic Design Criteria

7.4.1 We used USGS (2017) to determine seismic design criteria. Table 7.4.1 summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The building structure and improvements should be designed using a Site Class C. We evaluated the Site Class in accordance with Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10 based on our experience with the site subsurface soils and exploratory boring information. The values presented in Table 7.4.1 are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 7.4.1
2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Table 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.900g	Figure 1613..3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.341g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.140	Table 1613.3.3(1)
Site Coefficient, F_V	1.718	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.026g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	0.586g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.684g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.390g	Section 1613.3.4 (Eqn 16-40)

7.4.2 Table 7.4.2 presents additional seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

TABLE 7.4.2
2016 CBC SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.367g	Figure 22-7
Site Coefficient, F_{PGA}	1.133	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.367g	Section 11.8.3 (Eqn 11.8-1)

7.4.3 Conformance to the criteria in Tables 7.4.1 and 7.4.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of seismic design is to protect life and not to avoid all damage, since such design may be economically prohibitive.

7.5 Foundation and Concrete Slabs-On-Grade Recommendations

7.5.1 The following foundation recommendations assume the proposed structures will bear entirely on properly compacted fill and that the prevailing soil within 3 feet of pad grade will have an Expansion Index (EI) 90 or less.

7.5.2 Foundations for the new structure should consist of continuous strip footings and/or isolated spread footings. Continuous footings should be at least 12 inches wide and extend at least 24 inches below lowest adjacent pad grade. Isolated spread footings should have a minimum width of 24 inches and should extend at least 24 inches below lowest adjacent pad grade. Steel reinforcement for continuous footings should consist of at least four, No. 5 steel, reinforcing bars placed horizontally in the footings, two near the top and two near the bottom. The project structural engineer should design the concrete reinforcement for the spread footings. A typical footing dimension detail depicting lowest adjacent grade is provided on Figure 4.

7.5.3 Foundations may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf) (dead plus live load) for footings founded in properly compacted fill. The bearing pressure may be increased by 300 psf and 500 psf for each additional foot of foundation width and depth, respectively, up to a maximum allowable bearing pressure of 4,000 psf. The allowable bearing pressure may also be increased by up to one-third for transient loads such as those due to wind or seismic forces. We expect settlement due to footing loads conforming to the above recommended allowable soil bearing pressures are expected to be less than 1-inch total and ¾-inch differential over a span of 40 feet.

7.5.4 The minimum foundation dimensions and concrete reinforcement recommendations presented above are based on soil characteristics only and are not intended to replace reinforcement required for structural considerations.

7.5.5 The proximity of the foundation to the top of a slope steeper than 3:1 could impact the allowable soil bearing pressure. Therefore, Geocon Incorporated should be consulted where such a condition is anticipated. As a minimum, wall footings should be deepened such that the bottom outside edge of the footing is at least seven feet from the face of slope.

7.5.6 Interior concrete slabs-on-grade should be at least 5 inches thick and reinforced with No. 4-bars placed 18 inches on center in both directions placed at the slab midpoint. The concrete slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slabs for supporting planned loading. Thicker concrete slabs may be required for heavier loads.

7.5.7 The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building, are not recommended. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams.

7.5.8 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06). The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity controlled environment.

7.5.9 The project foundation engineer, architect, and/or developer should determine the thickness of bedding sand below the slab. Sand bedding thicknesses of 3 to 4 inches are typical in the Southern California area. Geocon should be contacted to provide recommendations if the bedding sand is thicker than 6 inches.

7.5.10 The foundation design engineer should provide appropriate concrete mix design criteria and curing measures to assure proper curing of the slab by reducing the potential for rapid moisture loss and subsequent cracking and/or slab curl. We suggest that the foundation design engineer present the concrete mix design and proper curing methods on the foundation plans. It is critical that the foundation contractor understands and follows the recommendations presented on the foundation plans.

7.5.11 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in any such concrete placement.

7.5.12 Exterior slabs not subject to vehicle loads should be at least 4 inches thick and reinforced with 6x6-W2.9/W2.9 (6x6-6/6) welded wire mesh where the slabs are underlain by low expansive soils. The mesh should be placed within the upper one-third of the slab. Proper mesh positioning is critical to future performance of the slabs. The contractor should take extra measures to provide proper mesh placement. For medium expansive soils, the reinforcing should consist of No. 3 reinforcing bars placed 18- inch on center, placed on both directions and placed at slab midpoint.

7.5.13 Prior to construction of slabs, the subgrade should be moisture conditioned to at least optimum moisture content and compacted to a dry density of at least 90 percent of the laboratory maximum dry density.

7.5.14 The recommendations of this report are intended to reduce the potential for cracking of slabs and foundations due to expansive soil (if present), differential settlement of fill soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.5.15 Concrete slabs should be provided with adequate crack-control joints, construction joints and/or expansion joints to reduce unsightly shrinkage cracking. The design of joints should consider criteria of the American Concrete Institute (ACI) when establishing crack-control spacing. Additional steel reinforcing, concrete admixtures and/or closer crack control joint spacing should be considered where concrete-exposed finished floors are planned.

7.5.16 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

7.6 Retaining Walls

7.6.1 Retaining walls that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall) at the top of the wall and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 35 pcf. Where the backfill will be inclined at 2:1 (horizontal:vertical), an active soil pressure of 50 pcf is recommended. These active pressures assume low expansive soil (Expansion Index less than 50) will be used as retaining wall backfill.

7.6.2 Where walls are restrained from movement at the top, an additional uniform pressure of 8H psf should be added to the active soil pressure where the wall possesses a height of 8 feet or less and 13H where the wall is greater than 8 feet.

7.6.3 Soil contemplated for use as retaining wall backfill, including import materials, should identified prior to backfill. At that time Geocon Incorporated should obtain samples for laboratory testing to evaluate its suitability. Modified lateral earth pressures may be necessary if the backfill soil does not meet the required expansion index or shear strength. City or regional standard wall designs, if used, are based on a specific active lateral earth pressure and/or soil friction angle. In this regard, on-site soil to be used as backfill may or may not meet the values for standard wall designs. Geocon Incorporated should be consulted to assess the suitability of the on-site soil for use as wall backfill if standard wall designs will be used.

7.6.4 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The wall designer should provide appropriate lateral deflection quantities for planned retaining walls structures, if applicable. These lateral values should be considered when planning types of improvements above retaining wall structures.

7.6.5 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The above recommendations assume a properly compacted granular (EI of less than 50) free-draining backfill material with no hydrostatic forces or imposed surcharge load. Figure 5 presents a typical retaining wall drainage detail. If conditions different than those described are expected, Geocon Incorporated should be contacted for additional recommendations.

7.6.6 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the 2016 CBC. If the project possesses a seismic design category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section 18.3.5.12 of the 2016 CBC. The seismic load is dependent on the retained height where H is the height of the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the wall. A seismic load of 24H should be used for design. We used the peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.416g calculated from ASCE 7-10 Section 11.8.3 and applied a pseudo-static coefficient of 0.33.

7.6.7 Foundation excavations should be observed by the geotechnical engineer (a representative of Geocon Incorporated) prior to the placement of reinforcing steel and concrete to observe that the exposed soil conditions are consistent with those anticipated and that they have been extended to the appropriate bearing strata. If unanticipated soil conditions are encountered, foundation modifications may be required.

7.7 Lateral Loading

7.7.1 To resist lateral loads, a passive pressure exerted by an equivalent fluid weight of 300 pounds per cubic foot (pcf) should be used for design of footings or shear keys poured neat against compacted fill. The allowable passive pressure assumes a horizontal surface extending at least 5 feet or three times the height of the surface generating the passive pressure, whichever is greater. The upper 12 inches of material not protected by floor slabs or pavement should not be included in the design for lateral resistance. Where walls are planned adjacent to and/or on descending slopes, a passive pressure of 150 pcf should be used in design.

7.7.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between soil and concrete of 0.35 should be used for design for footings founded in compacted fill or formational materials. The recommended passive pressure may be used concurrently with frictional resistance and may be increased by one-third for transient wind or seismic loading.

7.8 Storm Water Management

7.8.1 If storm water management devices are not properly designed and constructed, there is a risk for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water being detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff into the subsurface occurs, downstream improvements may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

7.8.2 We performed an infiltration study on the property. A summary of our study and storm water management recommendations are provided in Appendix C. Based on the results of our study, infiltration is considered infeasible due to low infiltration rates and the presence of compacted fill,

7.9 Site Drainage and Moisture Protection

7.9.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2016 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed or existing structures.

7.9.2 In the case of basement walls or building walls retaining landscaping areas, a waterproofing system should be used on the wall and joints, and a Miradrain drainage panel (or similar) should be placed over the waterproofing. The project architect or civil engineer should provide detailed specifications on the plans for all waterproofing and drainage.

7.9.3 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

7.9.4 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. Area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes can be used. In addition, where landscaping is planned adjacent to the pavement, construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material should be considered.

7.10 Grading and Foundation Plan Review

7.10.1 Geocon Incorporated should review the grading and foundation plans for the project prior to final design submittal to determine if additional analysis and/or recommendations are required.

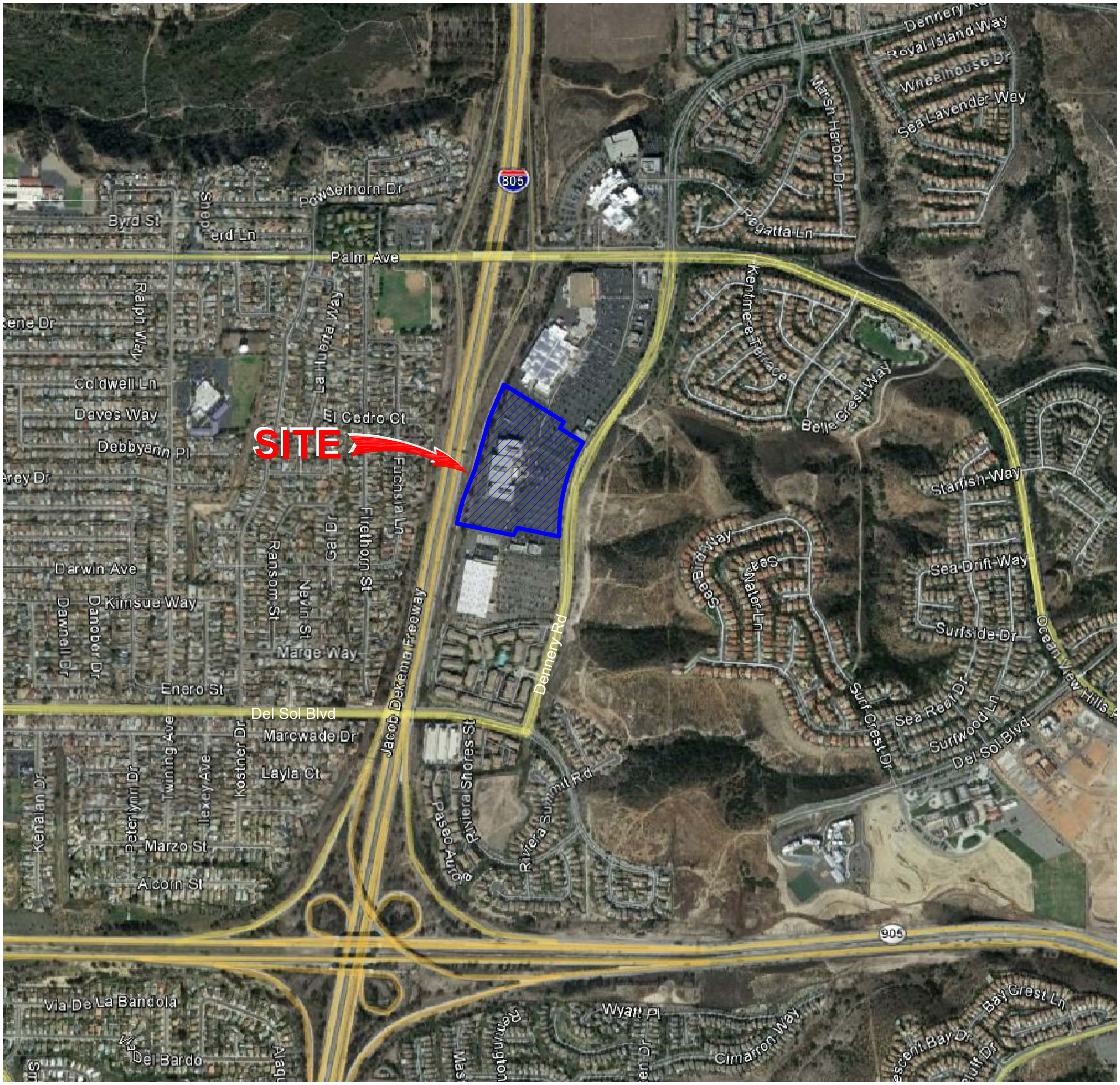
LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

3. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



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NO SCALE

VICINITY MAP

GEOCON INCORPORATED

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THE SHOPS AT AMC PROMENADE
SAN DIEGO, CALIFORNIA

RM / AML		DSK/GTYPD	DATE 08 - 18 - 2017	PROJECT NO. G2171 - 42 - 01	FIG. 1

Plotted:08/18/2017 11:42AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\G2171-42-01 (The Shops at AMC Promenade)\DETAILS\G2171-42-01 Vic Map.dwg

GEOCON LEGEND

Qpf ....PREVIOUSLY PLACED FILL

Tsd ....SAN DIEGO FORMATION (Dotted Where Buried)

B-6 ....APPROX. LOCATION OF EXPLORATORY BORING

A-4 ....APPROX. LOCATION OF INFILTRATION TEST

B B' ....APPROX. LOCATION OF GEOLOGIC CROSS-SECTION

GEOLOGIC MAP

THE SHOPS AT AMC PROMENADE
SAN DIEGO, CALIFORNIA

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SCALE 1" = 50'	DATE 08 - 18 - 2017		
PROJECT NO. G2171 - 42 - 01			FIGURE 2
SHEET 1 OF 1			

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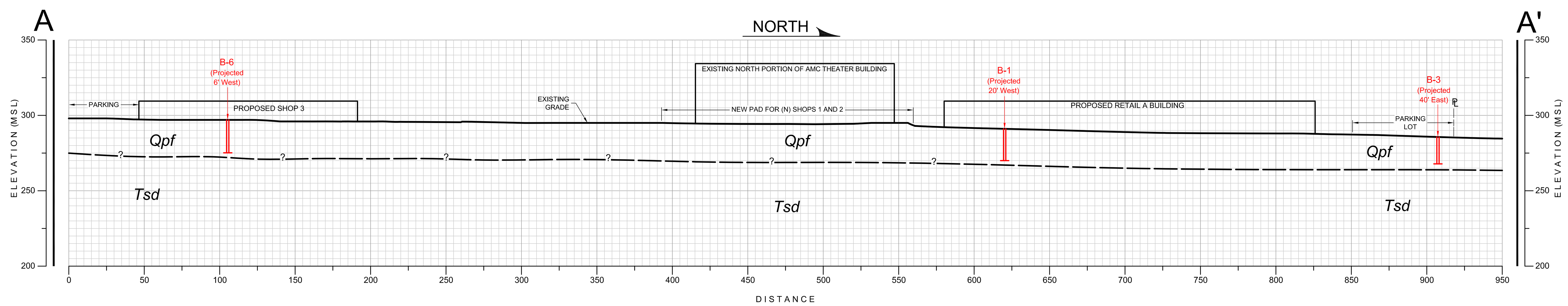
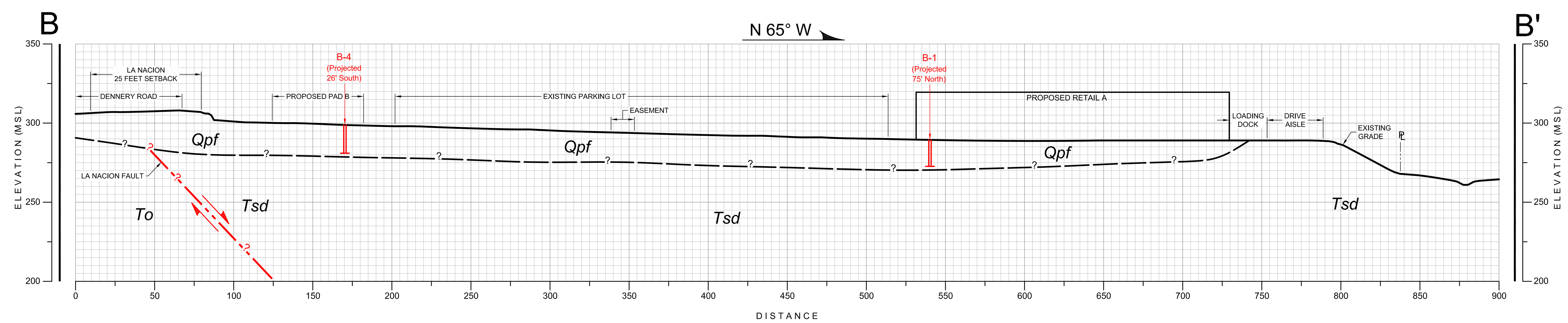


GEOLOGIC CROSS-SECTION A-A'

SCALE: 1" = 50' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION B-B'

SCALE: 1" = 50' (Vert. = Horiz.)

GEOCON LEGEND

Qpf ....PREVIOUSLY PLACED FILL

Tsd ....SAN DIEGO FORMATION

To ....OTAY FORMATION

........APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)

B-6 ....APPROX. LOCATION OF EXPLORATORY BORING

-?- ....APPROX. LOCATION OF FAULT (Queried Where Uncertain)

GEOLOGIC CROSS SECTION

THE SHOPS AT AMC PROMENADE
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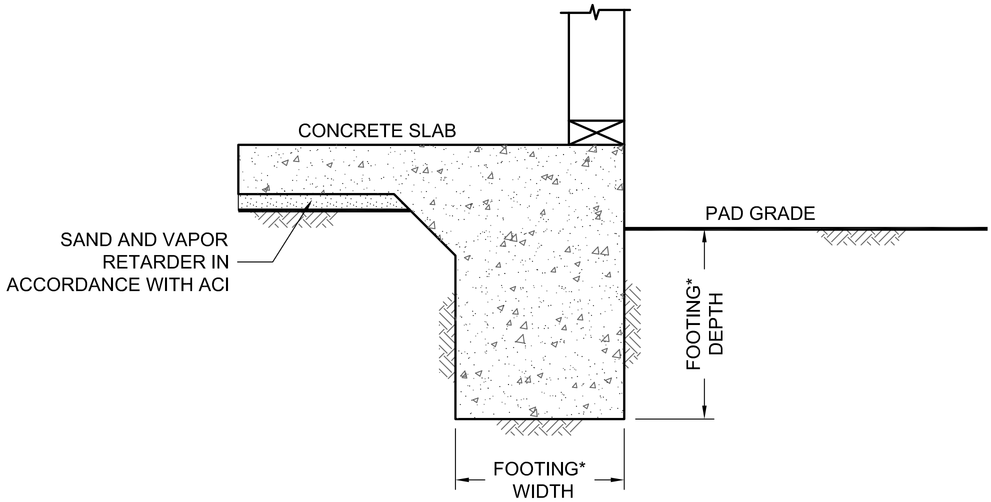
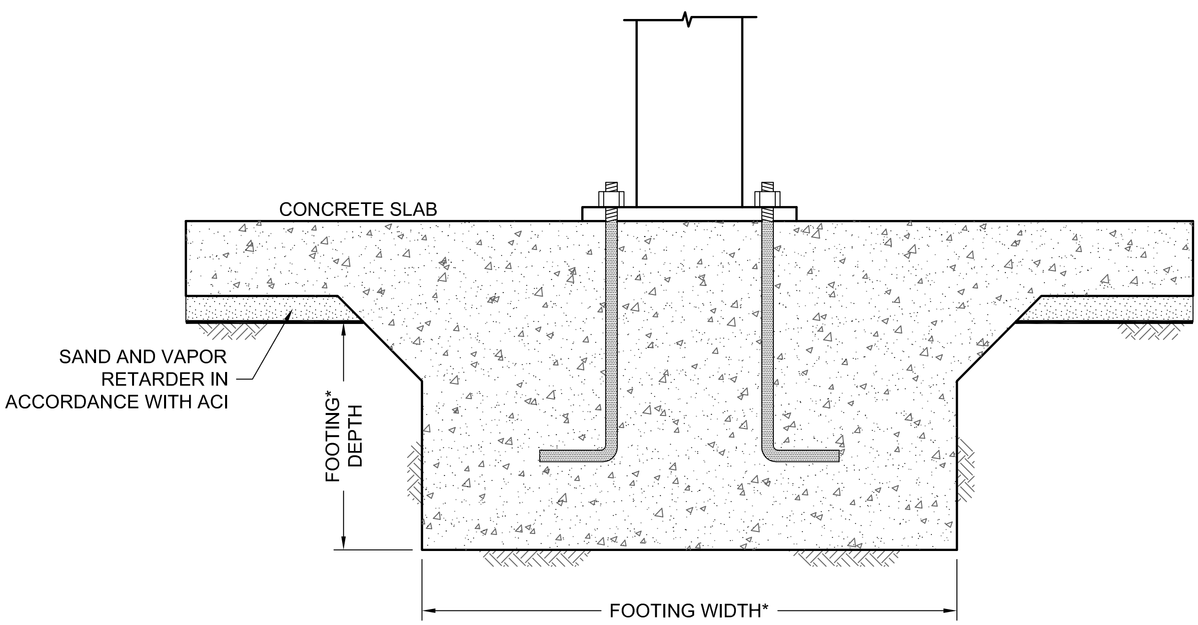
SCALE 1" = 50'	DATE 08 - 18 - 2017	
PROJECT NO. G2171 - 42 - 01		FIGURE 3
SHEET 1 OF 1		

Plotted:08/18/2017 3:54PM | By:JONATHAN WILKINS | File Location:Y:\PROJECTS\G2171-42-01 (The Shops at AMC Promenade)\SHEETS\G2171-42-01 Geo XSection.dwg





*....SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

WALL / COLUMN FOOTING DIMENSION DETAIL

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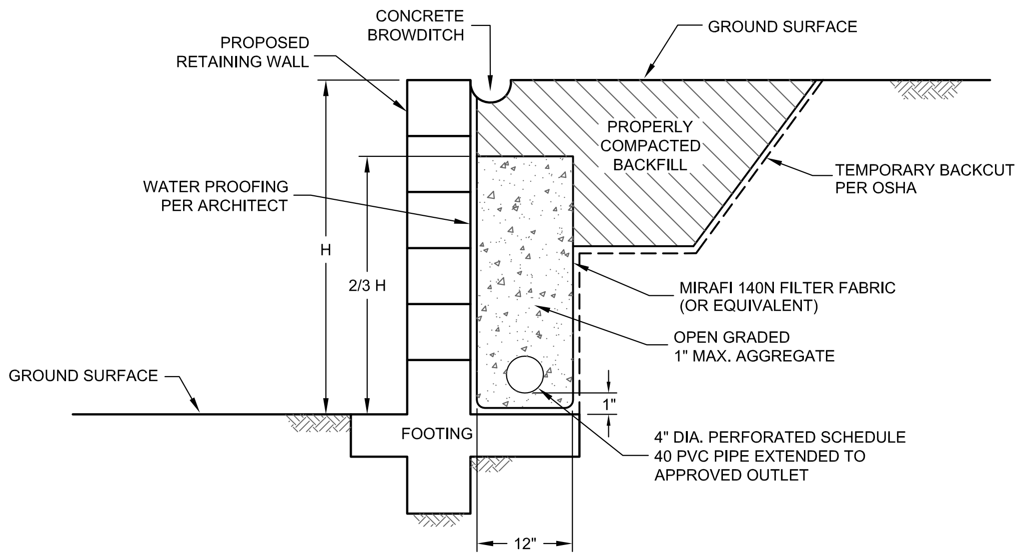
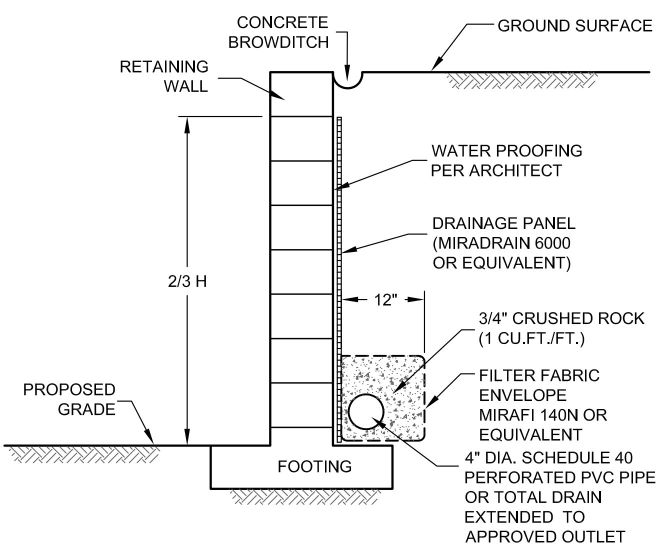
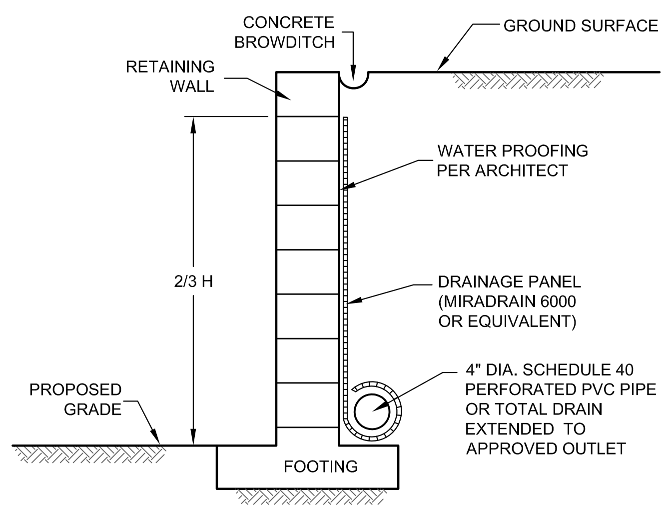
THE SHOPS AT AMC PROMENADE
SAN DIEGO, CALIFORNIA

RM / AML		DSK/GTYPD	DATE 08 - 18 - 2017	PROJECT NO. G2171 - 42 - 01	FIG. 4







NOTE :

DRAIN SHOULD BE UNIFORMLY SLOPED TO GRAVITY OUTLET
OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

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SAN DIEGO, CALIFORNIA

RM / AML		DSK/GTYPD	DATE 08 - 18 - 2017	PROJECT NO. G2171 - 42 - 01	FIG. 5

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

We performed the field investigation on July 21, 2017. The investigation consisted of drilling six, small-diameter borings and four, 8-inch diameter infiltration test holes. The approximate locations of the exploratory borings and infiltration tests are shown on Figure 2.

The borings were drilled to depths ranging from approximately 14.5 to 19.5 feet below existing grade using a CME 75 drill rig equipped with 8-inch diameter hollow-stem augers. The infiltration tests were drilled to depths of approximately 4 to 4.5 feet. We obtained relatively undisturbed samples from the borings by driving a 3-inch-diameter sampler 12 inches into the undisturbed soil mass with blows from a 140 pound hammer weighing falling 30 inches. The sampler was lined with 1-inch by 2.5-inch-diameter brass rings to facilitate sampling. Bulk and baggie samples were also collected.

The soil conditions encountered in the borings were visually examined, classified, and logged in general accordance with American Society for Testing and Materials (ASTM) practice for Description and Identification of Soils (Visual-Manual Procedure D 2488). Logs of the exploratory borings are presented on Figures A-1 through A-6. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained.

BORING B 1

ELEV. (MSL.) 291' DATE COMPLETED 07-21-2017

EQUIPMENT CME 75 BY: B. KUNA

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					3.5" **ASPHALT** Over 3.5" **BASE**			
	B1-1			SC/CL	**PREVIOUSLY PLACED FILL** Medium dense, moist, mottled light gray and grayish brown, Clayey, fine SAND to Sandy CLAY			
2	B1-2					21	106.0	18.3
4								
	B1-3					27		
6				SC	Medium dense, moist, mottled light gray and grayish brown, Clayey, fine to medium SAND			
				SM	Medium dense, moist, grayish brown, Silty, fine to medium SAND; few clay			
8								
				SC	Medium dense, moist, grayish brown, Clayey, fine to medium SAND			
10	B1-4					25	101.0	19.7
12				CL	Stiff to very stiff, moist, grayish brown to reddish brown, Silty CLAY			
14								
	B1-5				-Encountered cobble and gravel	50/6"		

REFUSAL AT 15.5 FEET
Groundwater not encountered
Backfilled on 07-21-2017

Figure A-1,
Log of Boring B 1, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2171-42-01

BORING B 2

ELEV. (MSL.) **288'** DATE COMPLETED **07-21-2017**

EQUIPMENT **CME 75** BY: **B. KUNA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					3" **ASPHALT** Over 6" **BASE**			
				SC&CL	**PREVIOUSLY PLACED FILL** Medium dense, moist, grayish brown, Clayey, fine SAND and Sandy CLAY; trace gravel			
2	B2-1					27	106.5	17.9
				SM	Dense, moist, light grayish brown and gray, Silty, fine- to medium-grained SAND; few clay			
4								
	B2-2					50		
6								
8								
10	B2-3				-Becomes mottled grayish brown and light gray to white	50/3"		
12								
14	B2-4				-No recovery	50/2"		

REFUSAL AT 14.5 FEET
Groundwater not encountered
Backfilled on 07-21-2017

Figure A-2,
Log of Boring B 2, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2171-42-01

BORING B 3

ELEV. (MSL.) 286.5' DATE COMPLETED 07-21-2017

EQUIPMENT CME 75 BY: B. KUNA

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					5.5" **ASPHALT** Over 3.5" **BASE**			
	B3-1			CL/CH	**PREVIOUSLY PLACED FILL** Stiff, moist, olive brown, Silty CLAY; little gravel			
2	B3-2					18	98.9	20.8
4								
	B3-3				-Becomes mottled olive brown and reddish brown	16	99.1	22.5
6								
				CL	Stiff, moist, brown, Sandy CLAY; some gravel			
8								
10	B3-4					40	100.1	20.3
					-Becomes hard, moist, brown and olive brown; little gravel			
12								
14								
	B3-5					50/3"		
16								
18					REFUSAL AT 18 FEET Groundwater not encountered Backfilled on 07-21-2017			

Figure A-3,
Log of Boring B 3, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2171-42-01

BORING B 4

ELEV. (MSL.) 298' DATE COMPLETED 07-21-2017

EQUIPMENT CME 75 BY: B. KUNA

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					4" **ASPHALT** Over 3" **BASE**			
	B4-1			SC	**PREVIOUSLY PLACED FILL** Medium dense, moist, mottled grayish brown and light gray, Clayey, fine to medium SAND; trace gravel			
2	B4-2							
				SM/SC	Medium dense, moist, grayish brown, Silty to Clayey, fine to medium SAND	29	108.7	17.4
4								
	B4-3							
6				CH	Stiff, moist, mottle grayish brown to reddish brown, Silty CLAY	19	105.3	21.9
8								
10	B4-4							
				CL	Vey stiff to hard, moist, light reddish brown, Silty to Sandy CLAY	43		
12								
14								
	B4-5					62		
16					-Cobble			
					-Becomes brown and reddish brown; little gravel			
18								
	B4-6					43		

BORING TERMINATED AT 19.5 FEET
Groundwater not encountered
Backfilled on 07-21-2017

Figure A-4,
Log of Boring B 4, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2171-42-01

BORING B 5

ELEV. (MSL.) **301.5'** DATE COMPLETED **07-21-2017**

EQUIPMENT **CME 75** BY: **B. KUNA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					3.5" **ASPHALT** Over 3.5" **BASE**			
	B5-1			CL	**PREVIOUSLY PLACED FILL** Stiff, moist, olive brown, Sandy CLAY; trace gravel			
2	B5-2					32		
4				SM	Medium dense, moist, light brown, Silty, fine to medium SAND; trace gravel; few clay			
6	B5-3					20	109.1	17.5
8								
10	B5-4			CL	Vert stiff, moist, mottled brown, olive brown, and reddish brown, Sandy CLAY; some gravel	36		
12								
14								
16	B5-5					38		
18	B5-6					48		
				CL/CH	Very stiff, moist, mottled dark brown and gray, Silty CLAY; trace gravel			

BORING TERMINATED AT 19.5 FEET
Groundwater not encountered
Backfilled on 07-21-2017

Figure A-5,
Log of Boring B 5, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL ... STANDARD PENETRATION TEST ... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE ... CHUNK SAMPLE ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. G2171-42-01

BORING B 6

ELEV. (MSL.) **286.5'** DATE COMPLETED **07-21-2017**

EQUIPMENT **CME 75** BY: **B. KUNA**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					4" **ASPHALT** Over 8" **BASE**			
	B6-1			CL	**PREVIOUSLY PLACED FILL** Firm, moist, olive brown, Silty to Sandy CLAY			
2	B6-2					10	96.3	22.8
				SC/CL	Medium dense, moist, mottled grayish brown and light gray, Clayey, fine to medium SAND to Sandy CLAY			
4								
	B6-3					20		
6								
8								
10	B6-4					50		
				CH/CL	Very stiff to hard, moist, olive brown to brown, Silty CLAY; few gravel			
12								
14								
	B6-5				-Cobble encountered; no recovery	48		
16								
				CL	Stiff, moist, brown, Sandy CLAY; trace gravel			
18								
	B6-6					46		
					BORING TERMINATED AT 19.5 FEET Groundwater not encountered Backfilled on 07-21-2017			

Figure A-6,
Log of Boring B 6, Page 1 of 1

G2171-42-01.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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APPENDIX B

APPENDIX B

LABORATORY TESTING

We performed laboratory tests in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. We tested selected samples for their in-place dry density and moisture content, maximum dry density and optimum moisture content, expansion, water-soluble sulfate characteristics, and gradation. The results of our laboratory tests are presented on the following tables and graph. The in-place dry density and moisture content test results are presented on the exploratory boring logs in Appendix A.

TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D 1557

Proctor Curve No.	Source and Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B3-1	Light brown, Clayey, fine to coarse SAND	128.9	9.7

TABLE B-II
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS
ASTM D 3080

Sample No.	Dry Density (pcf)	Moisture Content (%)		Unit Cohesion (psf)	Angle of Shear Resistance (degrees)
		Initial	Final		
B3-2	98.9	20.8	23.4	500	23

TABLE B-III
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index	Expansion Classification
	Before Test	After Test			
B3-1	10.4	23.5	108.6	63	Medium
B5-1	11.0	20.7	107.7	39	Low
B6-1	11.9	23.5	104.0	44	Low

TABLE B-IV
SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS
CALIFORNIA TEST NO. 417

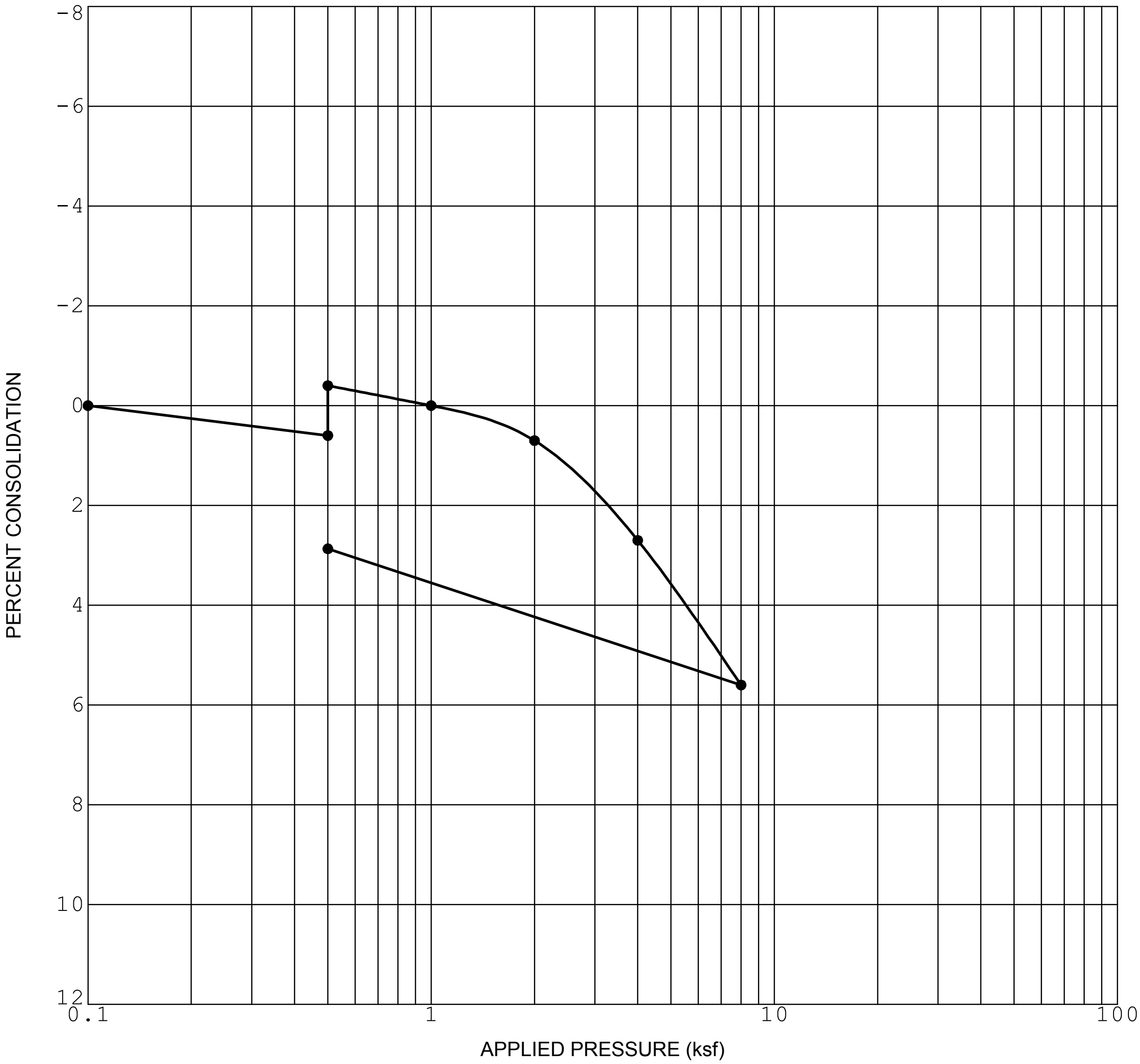
Sample No.	Water-Soluble Sulfate (%)	Classification
B3-1	0.008	Not Applicable (S0)
B5-1	0.029	Not Applicable (S0)
B6-1	0.058	Not Applicable (S0)

TABLE B-V
SUMMARY OF LABORATORY CHLORIDE ION TEST RESULTS
AASHTO T 291

Sample No.	Chloride Ion Content (ppm)	Chloride Ion Content (%)
B3-1	103	0.010
B5-1	513	0.051
B6-1	308	0.031

PROJECT NO. G2171-42-01

SAMPLE NO. B3-3



Initial Dry Density (pcf)	99.1
Initial Water Content (%)	22.5

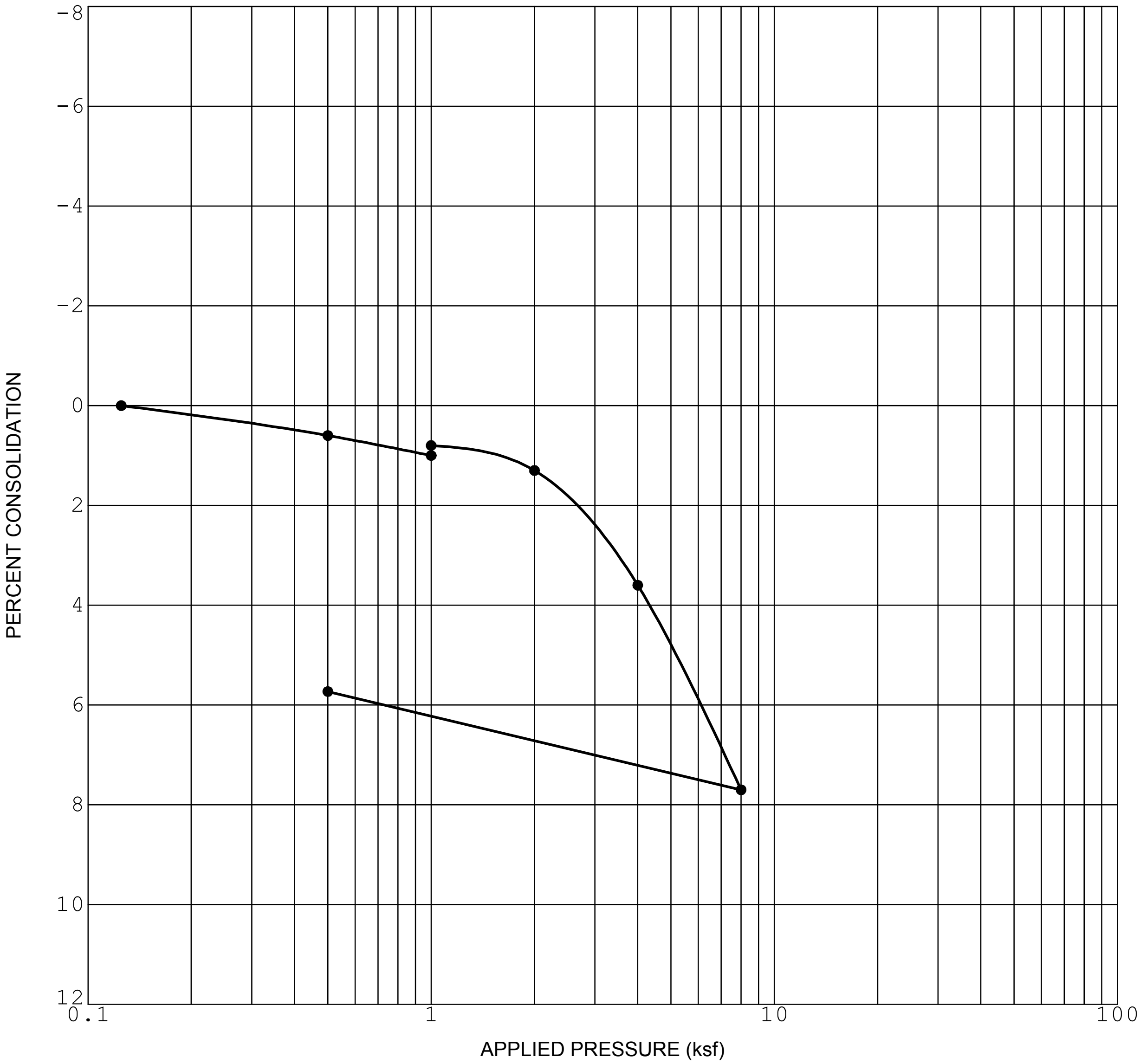
Initial Saturation (%)	88.8
Sample Saturated at (ksf)	.5

CONSOLIDATION CURVE

THE SHOPS AT AMC PROMENADE

SAN DIEGO, CALIFORNIA

SAMPLE NO. B3-4



Initial Dry Density (pcf)	100.1
Initial Water Content (%)	20.8

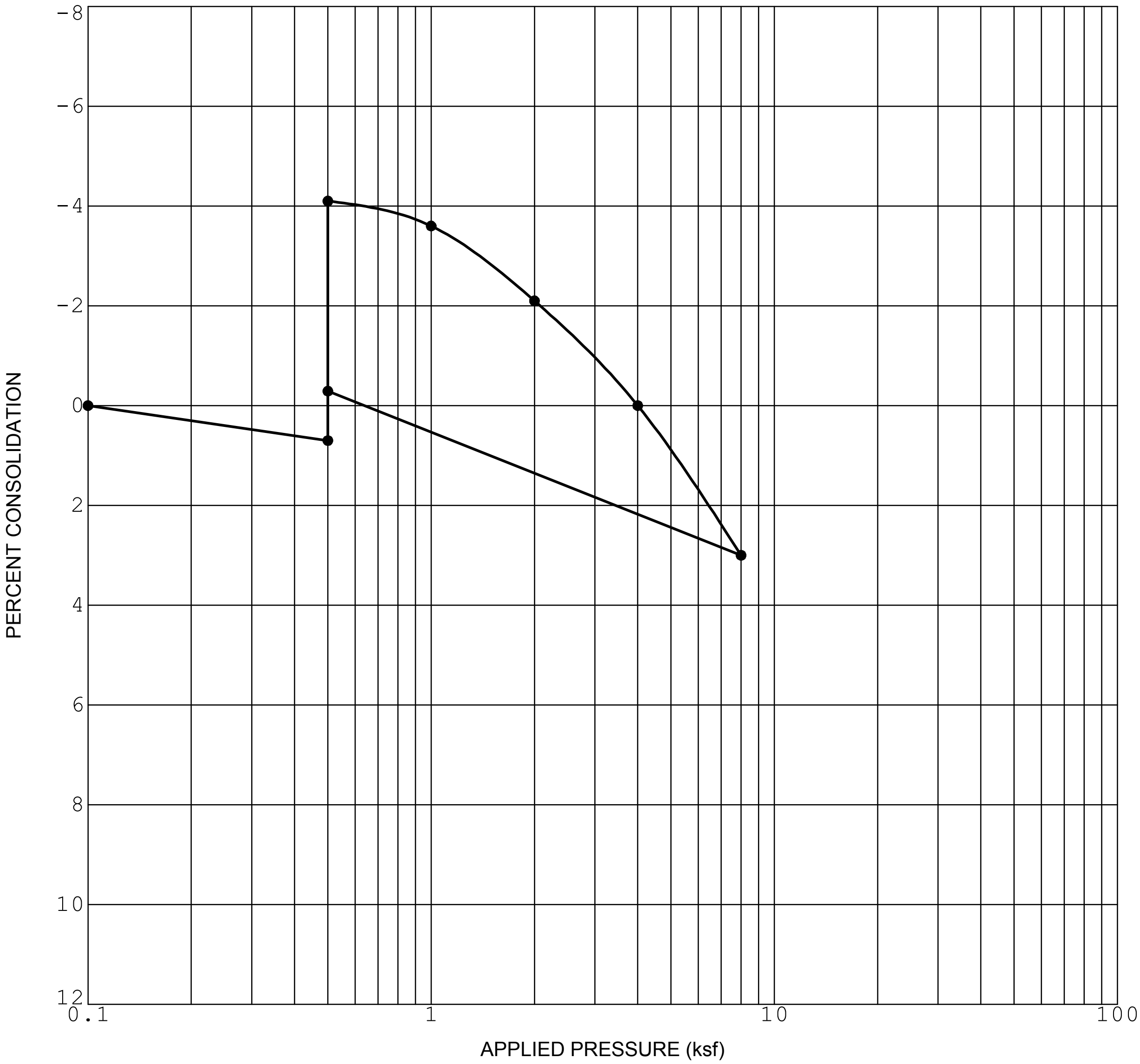
Initial Saturation (%)	84.2
Sample Saturated at (ksf)	1

CONSOLIDATION CURVE

THE SHOPS AT AMC PROMENADE

SAN DIEGO, CALIFORNIA

SAMPLE NO. B4-3



Initial Dry Density (pcf)	105.3	**Initial Saturation (%)**	100
Initial Water Content (%)	21.9	**Sample Saturated at (ksf)**	.5

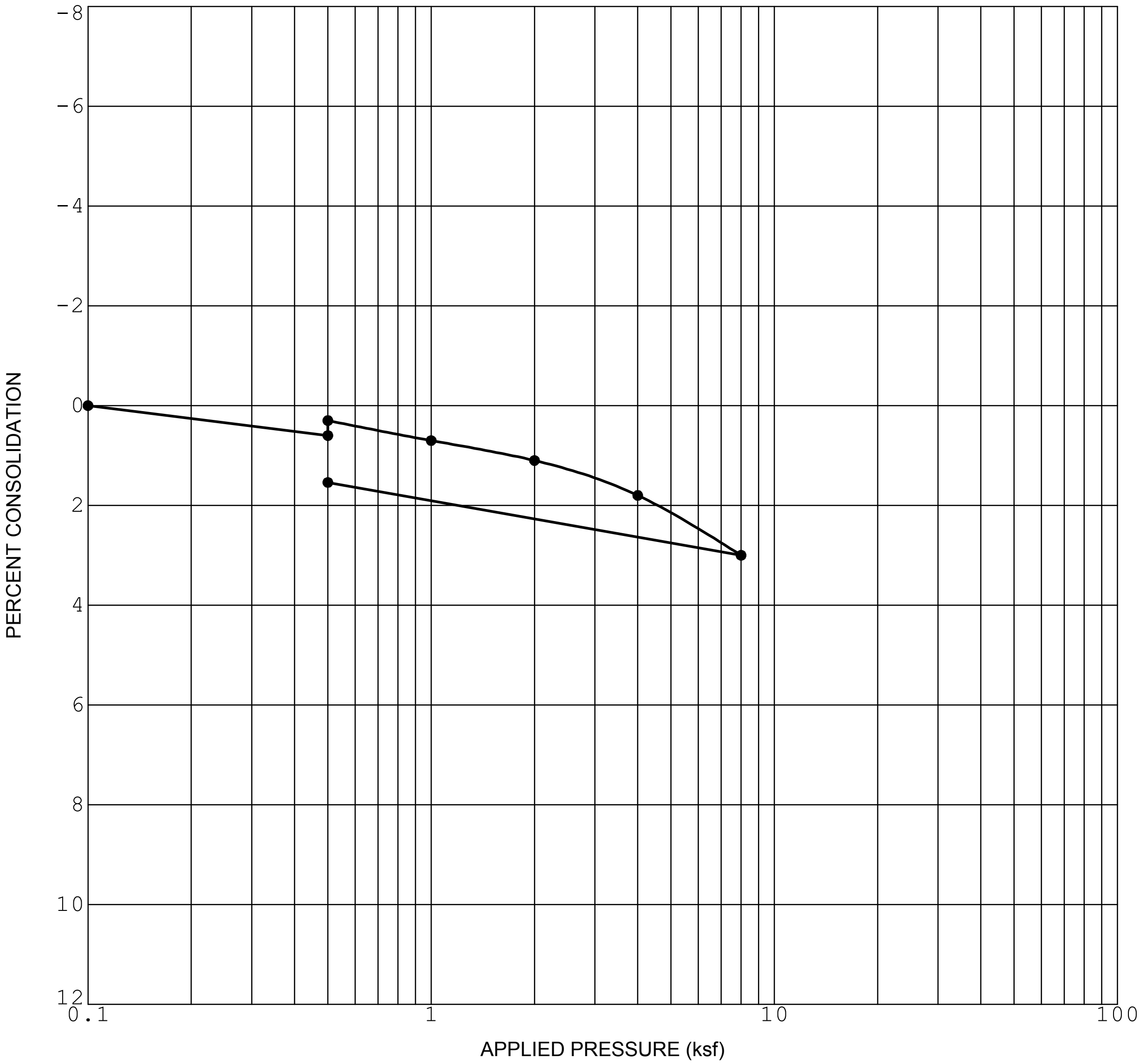
CONSOLIDATION CURVE

THE SHOPS AT AMC PROMENADE

SAN DIEGO, CALIFORNIA

PROJECT NO. G2171-42-01

SAMPLE NO. B5-3



Initial Dry Density (pcf)	109.1		**Initial Saturation (%)**	89.1
Initial Water Content (%)	17.5		**Sample Saturated at (ksf)**	.5

CONSOLIDATION CURVE

THE SHOPS AT AMC PROMENADE

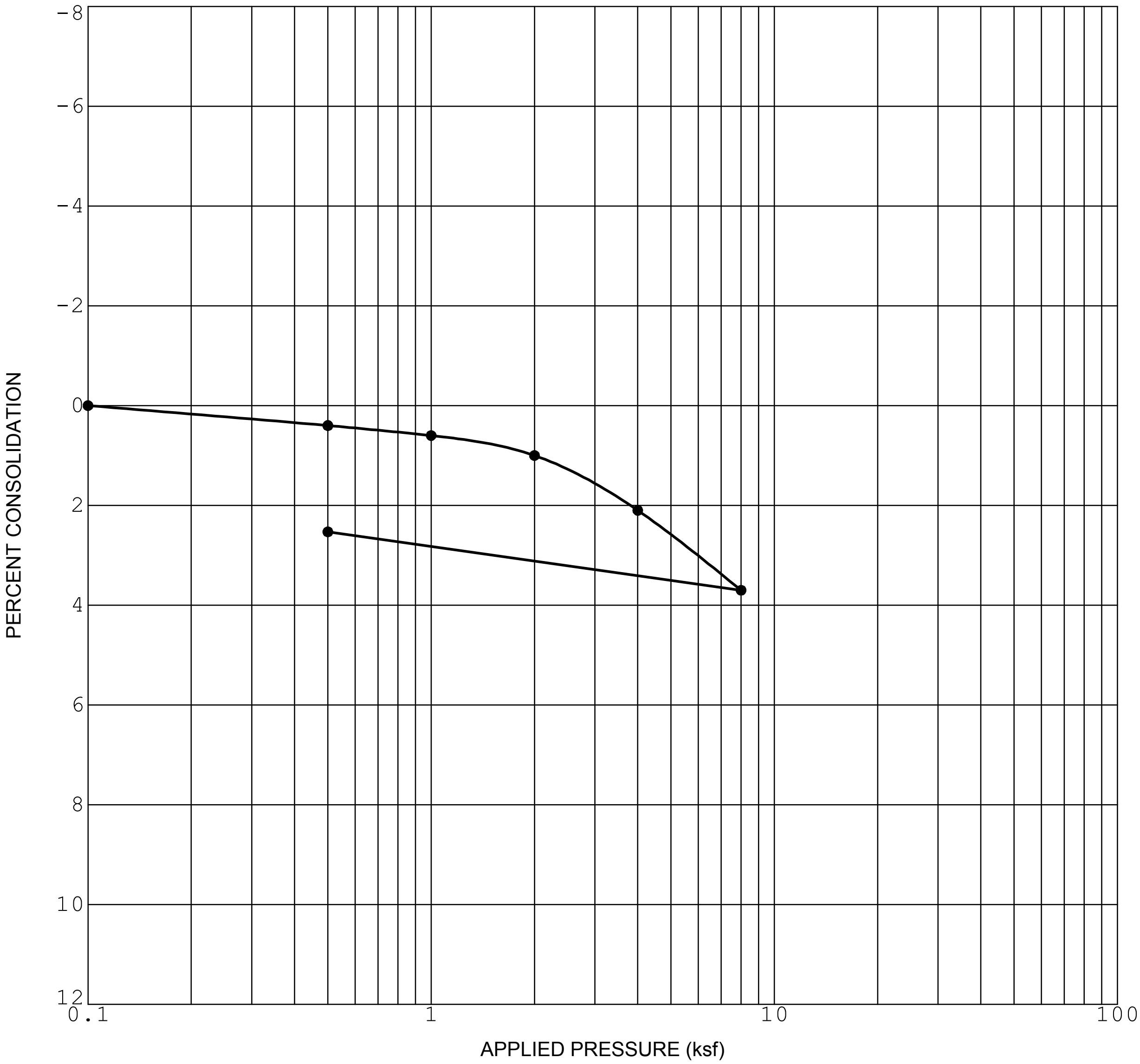
SAN DIEGO, CALIFORNIA

G2171-42-01.GPJ

Figure B-4

GEOCON

SAMPLE NO. B6-2



Initial Dry Density (pcf)	96.3	**Initial Saturation (%)**	83.8
Initial Water Content (%)	22.8	**Sample Saturated at (ksf)**	.5

CONSOLIDATION CURVE

THE SHOPS AT AMC PROMENADE

SAN DIEGO, CALIFORNIA

APPENDIX C

APPENDIX C

STORM WATER MANAGEMENT

If storm water management devices are not properly designed and constructed, there is a risk for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water being detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff into the subsurface occurs, downstream improvements may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

Hydrologic Soil Group

The United States Department of Agriculture (USDA), Natural Resources Conservation Services, provides general information regarding soil conditions for areas within the United States. The USDA website also provides the Hydrologic Soil Group. Table C-1 presents the descriptions of the hydrologic soil groups.

TABLE C-1
HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The site is underlain by previously placed fill and the San Diego Formation. The property falls within Hydraulic Soil Group D, which has a very slow infiltration rating. Table C-2 presents the information from the USDA website for the property.

TABLE C-2
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group
Huerhuero loam, 5 to 9 percent slopes, eroded	HrC2	49	D
Olivenhain cobbly loam, 9 to 30 percent slopes	OhE	51	D

In-Situ Testing

We performed 4 field-saturated, hydraulic conductivity tests at the site using a Soil Moisture Corp Aardvark Permeameter at the locations presented on the Geologic Map, Figure 2. All of the borings were drilled with a truck-mounted drill rig equipped with 8-inch diameter augers. Table C-3 presents the results of the saturated hydraulic conductivity testing.

We used the guidelines presented in the Riverside County Low Impact Development BMP Design Handbook which references the United States Bureau of Reclamation Well Permeameter Test Method (USBR 7300-89). Based on this widely accepted guideline, the saturated hydraulic conductivity (Ksat) is equal to the infiltration rate. Therefore, the Ksat value determined from the Aardvark Permeameter test is the unfactored infiltration rate. The Ksat (infiltration rate) equation provided in the Riverside County Handbook was used to compute the unfactored infiltration rate.

TABLE C-3
UNFACTORED, FIELD-SATURATED, INFILTRATION TEST RESULTS
USING THE SOILMOISTURE CORP AARDVARK PERMEAMETER

Test No.	Depth (inches)	Geologic Unit	Field Infiltration Rate, I (inches/hour)
A-1	52	Qpf	0.010
A-2	53.5	Qpf	0.007
A-3	46	Qpf	0.006
A-4	51	Qpf	0.006

Soil permeability values from in-situ tests can vary significantly from one location to another due to the non-homogeneous characteristics inherent to most soil. However, if a sufficient amount of field and laboratory test data is obtained, a general trend of soil permeability can usually be evaluated. For this project and for storm water purposes, the test results presented herein should be considered approximate values.

STORM WATER MANAGEMENT CONCLUSIONS

Soil Types

Previously Placed Fill – Previously placed fill underlies the property. The fills are predominately comprised of silty to clayey sand and sandy to silty clay. In our experience, compacted fill does not possess infiltration rates appropriate with infiltration. Therefore, full and partial infiltration should be considered infeasible.

Existing Improvements

The proposed area of infiltration is planned within the areas of the planned surface improvements and structures. Due to variable soil conditions, thickness of fill soils, and the low infiltration rates, there is a potential for lateral water movement, which could impact nearby structures.

Infiltration Rates

The results of the testing show infiltration rates ranging from approximately 0.006 to 0.01 inches per hour. The rates are not high enough to support full or partial infiltration.

Groundwater

We did not observe groundwater or seepage during this investigation, nor does groundwater exist near the surface that may impact the proposed project. We do not expect groundwater or seepage to impact infiltration.

Existing Utilities

Existing utilities exist within of the property. Infiltrating near utilities is not recommended. Mitigation measures to prevent water from infiltrating into the utilities consist of setbacks, installing cutoff walls around the utilities and installing subdrains and/or installing liners.

Soil or Groundwater Contamination

We are unaware of contaminated soil or groundwater on the property. Therefore, infiltration associated with this risk is considered feasible.

Storm Water Management Devices

Liners and subdrains are recommended in the design and construction of the planned storm water devices. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride, PVC). The subdrains should be perforated within the liner area, installed at the base and above the liner, be at least 3 inches in diameter and consist of

Schedule 40 PVC pipe. The subdrains outside of the liner should consist of solid pipe. The penetration of the liners at the subdrains should be properly waterproofed. The subdrains should be connected to a proper outlet. The devices should also be installed in accordance with the manufacturer's recommendations.

Storm Water Standard Worksheets

The SWS requests the geotechnical engineer complete the *Categorization of Infiltration Feasibility Condition* (Worksheet C.4-1 or I-8) worksheet information to help evaluate the potential for infiltration on the property. The attached Worksheet C.4-1 presents the completed information for the submittal process.

The regional storm water standards also have a worksheet (Worksheet D.5-1 or Form I-9) that helps the project civil engineer estimate the factor of safety based on several factors. Table C-4 describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

TABLE C-4
SUITABILITY ASSESSMENT RELATED CONSIDERATIONS FOR INFILTRATION FACILITY SAFETY FACTORS

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Assessment Methods	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates. Use of well permeameter or borehole methods without accompanying continuous boring log. Relatively sparse testing with direct infiltration methods	Use of well permeameter or borehole methods with accompanying continuous boring log. Direct measurement of infiltration area with localized infiltration measurement methods (e.g., infiltrometer). Moderate spatial resolution	Direct measurement with localized (i.e. small-scale) infiltration testing methods at relatively high resolution or use of extensive test pit infiltration measurement methods.
Predominant Soil Texture	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site Soil Variability	Highly variable soils indicated from site assessment or unknown variability	Soil boring/test pits indicate moderately homogenous soils	Soil boring/test pits indicate relatively homogenous soils
Depth to Groundwater/ Impervious Layer	<5 feet below facility bottom	5-15 feet below facility bottom	>15 feet below facility bottom

Table C-5 presents the estimated factor values for the evaluation of the factor of safety. The factor of safety is determined using the information contained in Table C-4 and the results of our geotechnical investigation. Table C-5 only presents the suitability assessment safety factor (Part A) of the worksheet. The project civil engineer should evaluate the safety factor for design (Part B of Worksheet D.5-1) and use the combined safety factor for the design infiltration rate.

TABLE C-5
FACTOR OF SAFETY WORKSHEET D.5-1 DESIGN VALUES – PART A[1]

Suitability Assessment Factor Category	Assigned Weight (w)	Factor Value (v)	Product (p = w x v)
Assessment Methods	0.25	2	0.50
Predominant Soil Texture	0.25	3	0.70
Site Soil Variability	0.25	2	0.50
Depth to Groundwater/Impervious Layer	0.25	2	0.50
Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.25

[1] The project civil engineer should complete Worksheet D.5-1 or Form I-9 to determine the overall factor of safety.

CONCLUSIONS

Our results indicate the site has soils that inhibit infiltration. Because of these site conditions, and the overall thickness of the previously placed fill soils exceeding 7 feet, it is our opinion that there is a high probability for lateral water migration. It is our opinion that full and partial infiltration is infeasible on this site. Liners and subdrains should be installed within BMP areas.

Categorization of Infiltration Feasibility Condition			Worksheet I-8
Part 1 - Full Infiltration Feasibility Screening Criteria **Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?**			
Criteria	Screening Question	Yes	No
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

We encountered field infiltration rates that were less than 0.5 inches per hour using a factor of safety of 2 for feasibility determination:

A-1: 0.010 in/hr (0.005 with a FOS of 2.0 for feasibility determination)
A-2: 0.007 in/hr (0.0035 with a FOS of 2.0 for feasibility determination)
A-3: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)
A-4: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)

Based on the geotechnical study, test results, and utilizing a factor of safety of 2.0 for feasibility determination, full infiltration is not feasible as the infiltration rates are lower than 0.5 in/hr.

2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

Previously placed fill underlies the property and will remain in place. Based on the exploratory borings and laboratory testing, the previously placed extends to depths greater than 5 feet and possess a low to moderate potential for hydroconsolidation. We do not recommend infiltrating into the existing fill due to the potential for adverse soil settlement and an increased potential for hydro-collapse.

Worksheet I-8 Page 2 of 4			
Criteria	Screening Question	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Groundwater is not present near the surface of the site and we are unaware of contaminated soil on the property. Therefore, infiltration associated with this risk is considered feasible.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: We do not expect infiltration will cause water balance issues such as seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters.			
Part 1 Result*	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		NO

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

We encountered field infiltration rates that were less than 0.5 inches per hour using a factor of safety of 2 for feasibility determination:

A-1: 0.010 in/hr (0.005 with a FOS of 2.0 for feasibility determination)
A-2: 0.007 in/hr (0.0035 with a FOS of 2.0 for feasibility determination)
A-3: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)
A-4: 0.006 in/hr (0.003 with a FOS of 2.0 for feasibility determination)

Based on the geotechnical study, test results, and utilizing a factor of safety of 2.0 for feasibility determination, full infiltration is not feasible as the infiltration rates are lower than 0.5 in/hr.

Criteria	Screening Question	Yes	No
6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

Previously placed fill underlies the property and will remain in place. Based on the exploratory borings and laboratory testing, the previously placed extends to depths greater than 5 feet and possess a low to moderate potential for hydroconsolidation. We do not recommend infiltrating into the existing fill due to the potential for adverse soil settlement and an increased potential for hydro-collapse.

<table>
<tr><th colspan="4">Worksheet I-8 Page 4 of 4</th></tr>
<tr><td>Criteria</td><td>Screening Question</td><td>Yes</td><td>No</td></tr>
<tr><td>7</td><td>Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

Groundwater is not present near the surface of the site and we are unaware of contaminated soil on the property. Therefore, infiltration associated with this risk is considered feasible.</td></tr>
<tr><td>8</td><td>Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.</td><td>X</td><td></td></tr>
<tr><td colspan="4">Provide basis:

We did not provide a study regarding water rights. The project Civil Engineer should confirm.</td></tr>
<tr><td>Part 2 Result*</td><td colspan="2">If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration.

If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.</td><td>No Infiltration</td></tr>
</table>

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

GEOCON

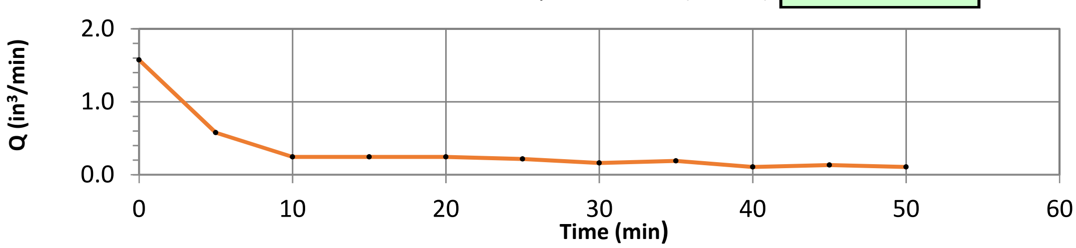
Aardvark Permeameter Data Analysis

Project Name:	AMC Palm Promenade	Date:	7/21/2017
Project Number:	G2171-42-01	By:	JML
Test Number:	A-1		

Borehole Diameter, d (in.):	8.00	Ref. EL (feet, MSL):	0.0
Borehole Depth, **H** (in):	52.00	Bottom EL (feet, MSL):	-4.3
Distance Between Reservoir & Top of Borehole (in.):	30.50		
Estimated Depth to Water Table, **S** (feet):	100.00		
Height APM Raised from Bottom (in.):	1.00		
Pressure Reducer Used:	No		

Distance Between Resevoir and APM Float, **D** (in.):	74.25
Head Height Calculated, **h** (in.):	4.75
Head Height Measured, **h** (in.):	4.70
Distance Between Constant Head and Water Table, **L** (in.):	1152.70

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	2.865	79.34	15.868
3	5.00	0.285	7.89	1.578
4	5.00	0.105	2.91	0.582
5	5.00	0.045	1.25	0.249
6	5.00	0.045	1.25	0.249
7	5.00	0.045	1.25	0.249
8	5.00	0.040	1.11	0.222
9	5.00	0.030	0.83	0.166
10	5.00	0.035	0.97	0.194
11	5.00	0.020	0.55	0.111
12	5.00	0.025	0.69	0.138
13	5.00	0.020	0.55	0.111
			Steady Flow Rate, Q (in^3/min):	0.120



Soil Matric Flux Potential, Φ_m

Φ_m= 0.00171 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 1.75E-04 in/min 0.010 in/hr

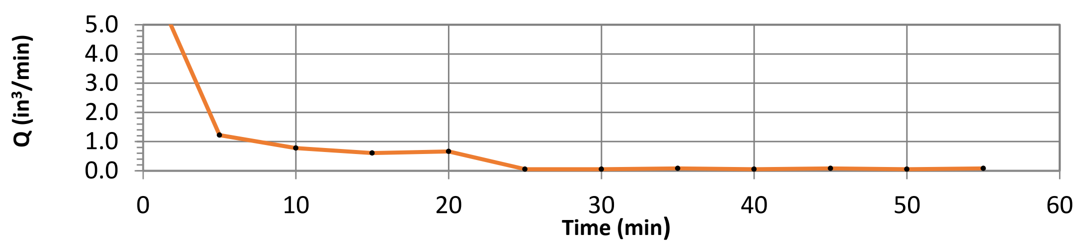
GEOCON

Aardvark Permeameter Data Analysis

Project Name:	AMC Palm Promenade	Date:	7/21/2017
Project Number:	G2171-42-01	By:	JML
Test Number:	A-2	Ref. EL (feet, MSL):	0.0
		Bottom EL (feet, MSL):	-4.5

Borehole Diameter, d (in.):	8.00
Borehole Depth, **H** (in):	53.50
Distance Between Reservoir & Top of Borehole (in.):	30.50
Estimated Depth to Water Table, **S** (feet):	100.00
Height APM Raised from Bottom (in.):	1.00
Pressure Reducer Used:	No
Distance Between Resevoir and APM Float, **D** (in.):	75.75
Head Height Calculated, **h** (in.):	4.75
Head Height Measured, **h** (in.):	4.60
Distance Between Constant Head and Water Table, **L** (in.):	1151.10

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	1.290	35.72	7.145
3	5.00	0.220	6.09	1.218
4	5.00	0.140	3.88	0.775
5	5.00	0.110	3.05	0.609
6	5.00	0.120	3.32	0.665
7	5.00	0.010	0.28	0.055
8	5.00	0.010	0.28	0.055
9	5.00	0.015	0.42	0.083
10	5.00	0.010	0.28	0.055
11	5.00	0.015	0.42	0.083
12	5.00	0.010	0.28	0.055
13	5.00	0.015	0.42	0.083
			Steady Flow Rate, Q (in^3/min):	0.074



Soil Matric Flux Potential, Φ_m

Φ_m= 0.0011 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

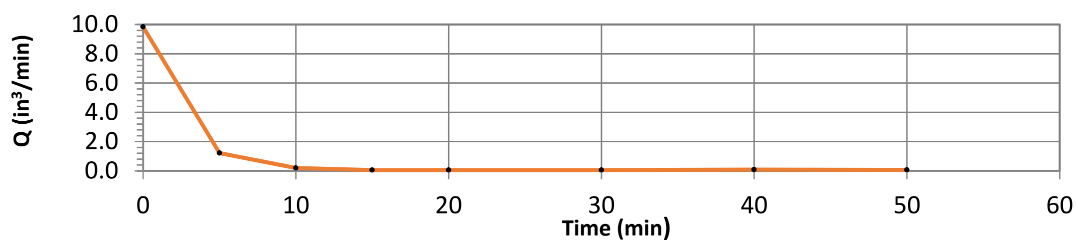
K_{sat} = 1.09E-04 in/min 0.007 in/hr

Aardvark Permeameter Data Analysis

Project Name:	AMC Palm Promenade	Date:	7/21/2017
Project Number:	G2171-42-01	By:	JML
Test Number:	A-3	Ref. EL (feet, MSL):	0.0
		Bottom EL (feet, MSL):	-3.8

Borehole Diameter, d (in.):	8.00
Borehole Depth, **H** (in):	46.00
Distance Between Reservoir & Top of Borehole (in.):	30.50
Estimated Depth to Water Table, **S** (feet):	100.00
Height APM Raised from Bottom (in.):	1.00
Pressure Reducer Used:	No
Distance Between Resevoir and APM Float, **D** (in.):	68.25
Head Height Calculated, **h** (in.):	4.73
Head Height Measured, **h** (in.):	4.50
Distance Between Constant Head and Water Table, **L** (in.):	1158.50

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	1.775	49.15	9.831
3	5.00	0.220	6.09	1.218
4	5.00	0.035	0.97	0.194
5	5.00	0.010	0.28	0.055
6	10.00	0.020	0.55	0.055
7	10.00	0.020	0.55	0.055
8	10.00	0.030	0.83	0.083
9	10.00	0.025	0.69	0.069
			Steady Flow Rate, Q (in^3/min):	0.066



Soil Matric Flux Potential, Φ_m

Φ_m= 0.0010 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 9.84E-05 in/min | 0.006 in/hr

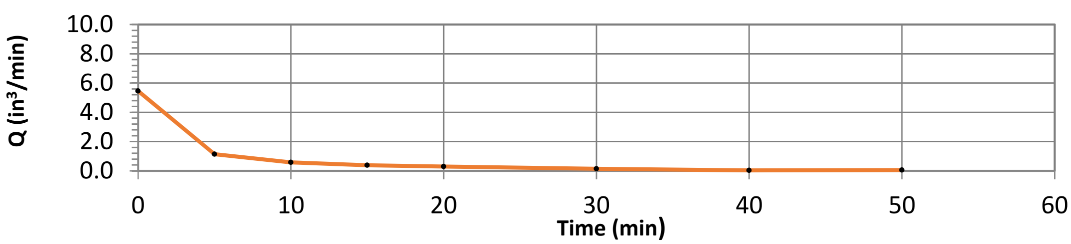
GEOCON

Aardvark Permeameter Data Analysis

Project Name:	AMC Palm Promenade	Date:	7/21/2017
Project Number:	G2171-42-01	By:	JML
Test Number:	A-4	Ref. EL (feet, MSL):	0.0
		Bottom EL (feet, MSL):	-4.3

Borehole Diameter, d (in.):	8.00
Borehole Depth, **H** (in):	51.00
Distance Between Reservoir & Top of Borehole (in.):	30.50
Estimated Depth to Water Table, **S** (feet):	100.00
Height APM Raised from Bottom (in.):	1.00
Pressure Reducer Used:	No
Distance Between Resevoir and APM Float, **D** (in.):	73.25
Head Height Calculated, **h** (in.):	4.74
Head Height Measured, **h** (in.):	4.70
Distance Between Constant Head and Water Table, **L** (in.):	1153.70

Reading	Time Elapsed (min)	Water Weight Consummed (lbs)	Water Volume Consummed (in^3)	Q (in^3/min)
1	0.00	0.000	0.00	0.00
2	5.00	0.985	27.28	5.455
3	5.00	0.205	5.68	1.135
4	5.00	0.105	2.91	0.582
5	5.00	0.070	1.94	0.388
6	10.00	0.105	2.91	0.291
7	10.00	0.050	1.38	0.138
8	10.00	0.010	0.28	0.028
9	10.00	0.020	0.55	0.055
			Steady Flow Rate, Q (in^3/min):	0.074



Soil Matric Flux Potential, Φ_m

Φ_m= 0.0011 in^2/min

Field-Saturated Hydraulic Conductivity (Infiltration Rate)

K_{sat} = 1.08E-04 in/min 0.006 in/hr

APPENDIX D

APPENDIX D

RECOMMENDED GRADING SPECIFICATIONS

FOR

THE SHOPS AT AMC PROMENADE
770 DENNERY ROAD
SAN DIEGO, CALIFORNIA

PROJECT NO. G2171-42-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition.

4. CLEARING AND PREPARING AREAS TO BE FILLED

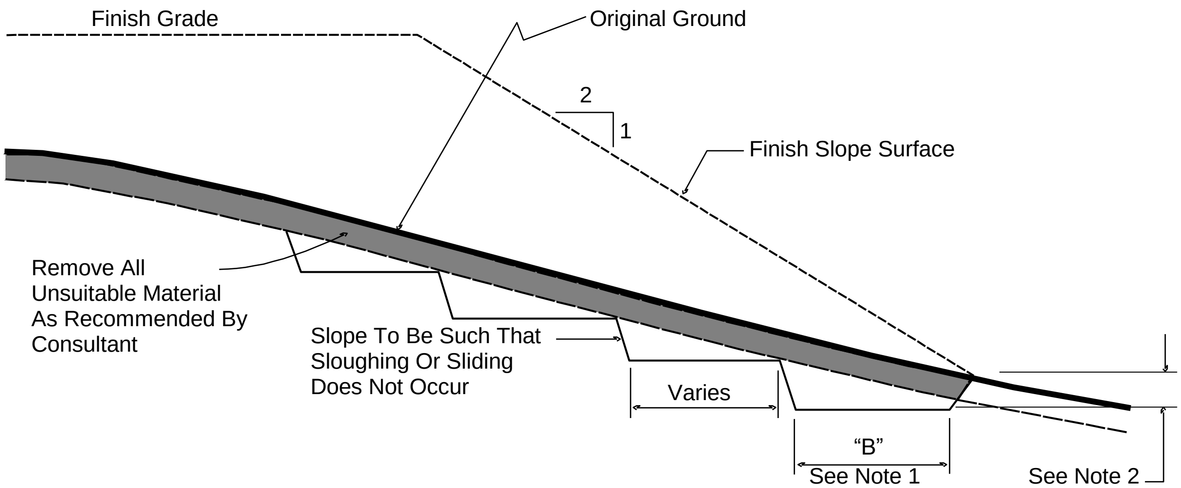
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

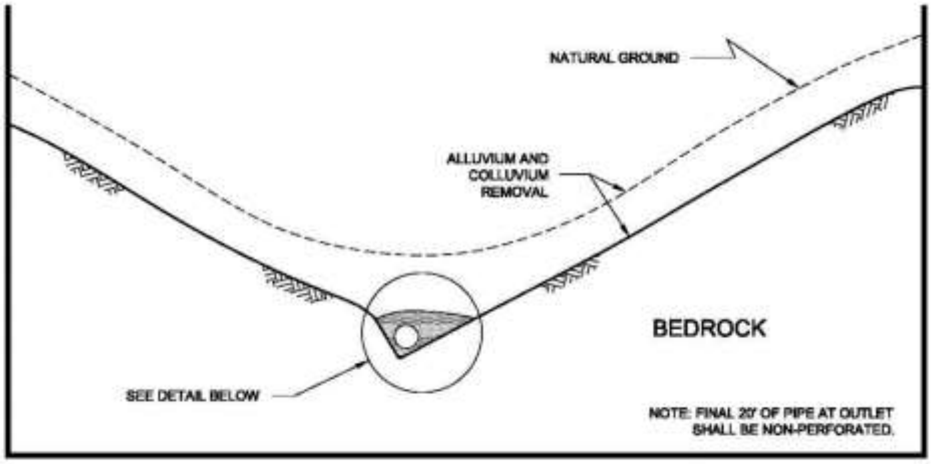
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

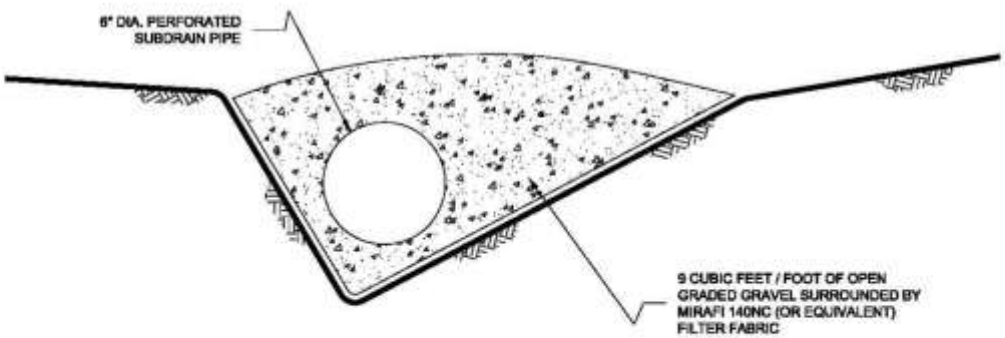
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

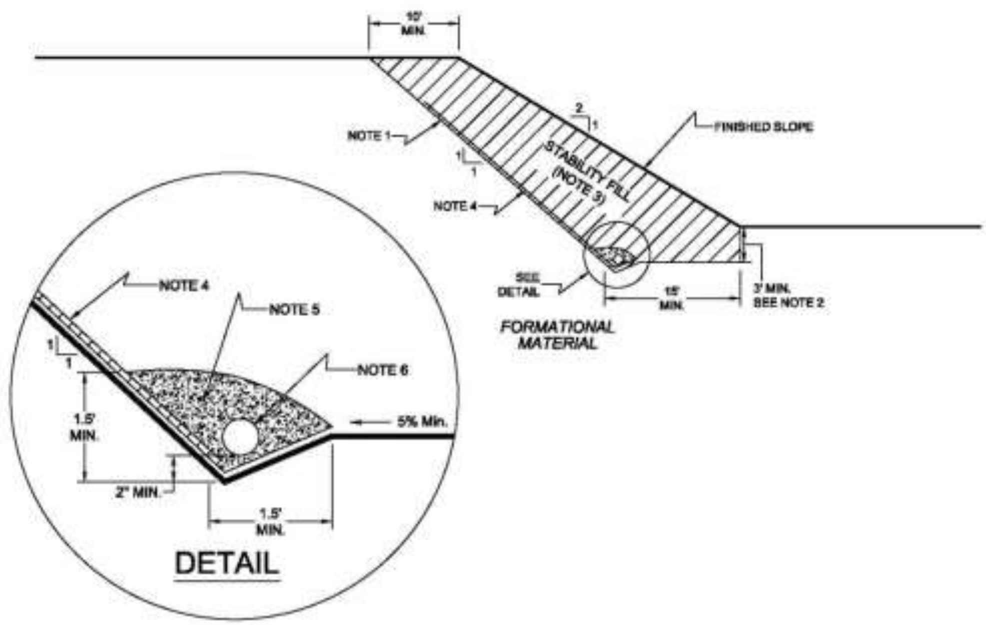
1......8-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

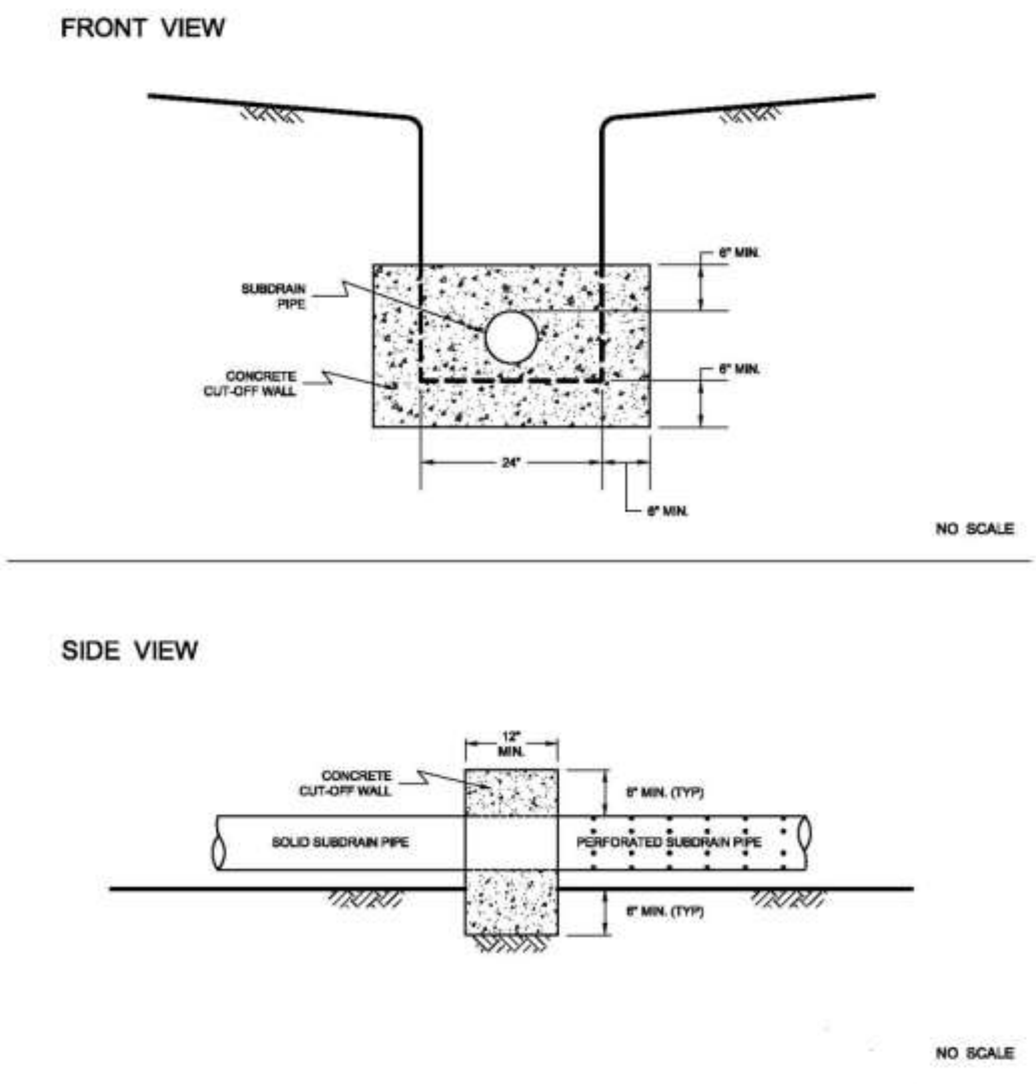
NO SCALE

7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

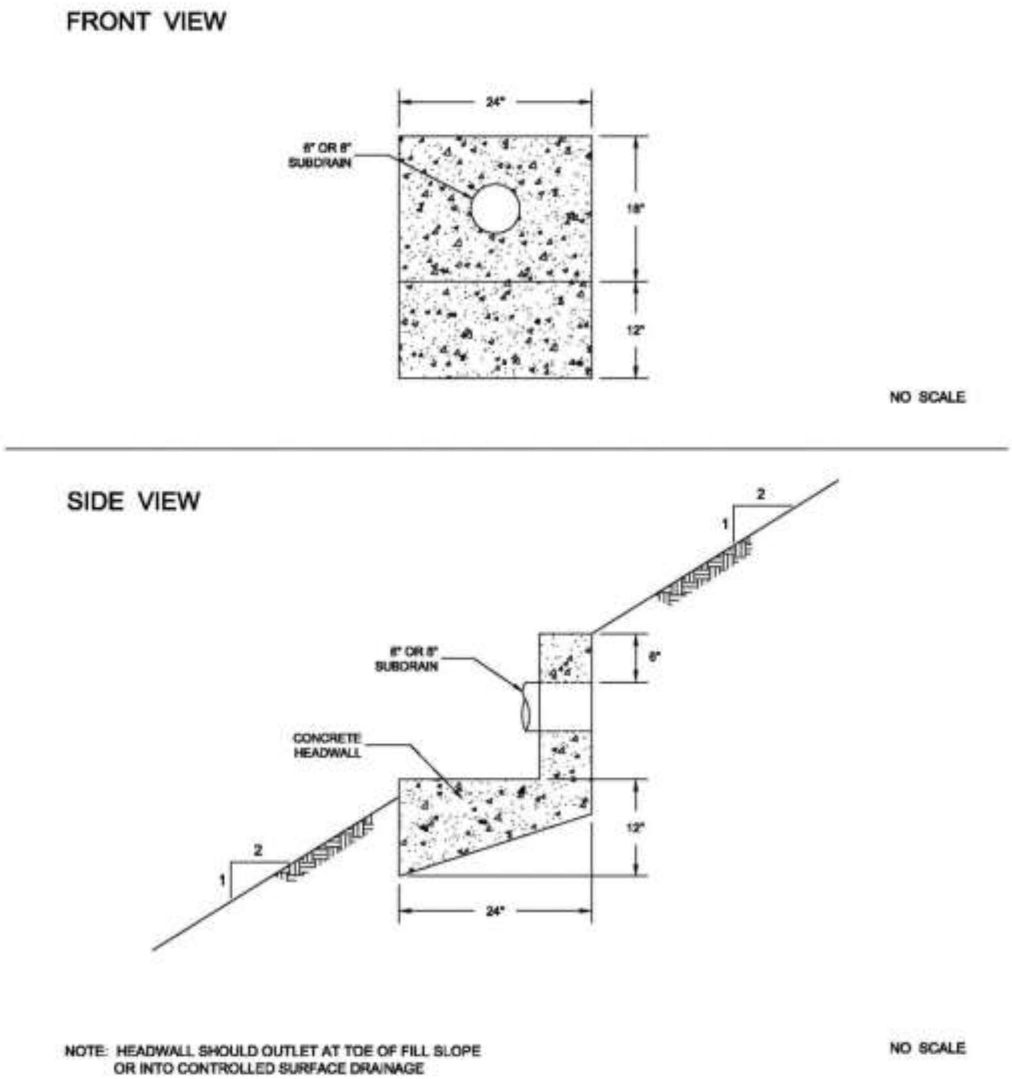
7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

TYPICAL CUT OFF WALL DETAIL



7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

TYPICAL HEADWALL DETAIL



7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an “as-built” map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop.*

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

LIST OF REFERENCES

City of San Diego (2008), *Seismic Safety Study*, *Geologic Hazards and Faults*, *Map Sheet 22*;

Kennedy, M. P., and Tan, S. S., (2008), *Geologic Map of the San Diego 30' x 60' Quadrangle, California*, USGS Regional Geologic Map Series, 1:100,000 Scale, Map No. 3;

Risk Engineering (2011), *EZ-FRISK (version 7.62)*, software package used to perform site-specific earthquake hazard analyses, accessed May 2, 2017;

USGS (2016), *Quaternary Fault and Fold Database of the United States*: U.S. Geological Survey website, http://earthquakes,usgs.gov/hazards/qfaults, accessed May 2, 2017;

USGS (2017), U.S. Seismic Design Maps; USGS Earthquake Hazards Program website, https://earthquake.usgs.gov/designmaps/us/application.php, accessed May 2, 2017

Onsite Proprietary Biofiltration BMP Checklist	Form I-10

A proprietary biofiltration BMP may satisfy the pollutant control requirements for a DMA onsite in some cases. This depends on the characteristics of the DMA and the performance certification/data of the proprietary biofiltration BMP. If the pollutant control requirements for a DMA are met onsite, then the DMA is not required to participate in an offsite alternative compliance program to meet its pollutant control obligations.

An applicant using a proprietary biofiltration BMP to meet the pollutant control requirements onsite must complete Section 1 of this form and include it in the PDP SWQMP. A separate form must be completed for each DMA. In instances where the City Engineer does not agree with the applicant's determination, Section 2 of this form will be completed by the City and returned to the applicant.

Section 1: Biofiltration Criteria Checklist (Appendix F)

Refer to Part 1 of the Storm Water Standards to complete this section. When separate forms/worksheets are referenced below, the applicant must also complete these separate forms/worksheets (as applicable) and include in the PDP SWQMP. The criteria numbers below correspond to the criteria numbers in Appendix F.

<table>
<tr><th>Criteria</th><th>Answer</th><th>Progression</th></tr>
<tr><td rowspan="3"><u>Criteria 1 and 3</u>:

What is the infiltration condition of the DMA?

Refer to Section 5.4.2 and Appendix C of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.

Complete and attach Worksheet C.4-1: Categorization of Infiltration Feasibility Condition to support the feasibility determination.</td><td>☐ Full Infiltration Condition</td><td>Stop. Proprietary biofiltration BMP is not allowed.</td></tr>
<tr><td>☐ Partial Infiltration Condition</td><td>Proprietary biofiltration BMP is only allowed, if 40% (average annual capture) volume reduction is achieved within the BMP or downstream of the BMP.

If the 40% volume reduction is achieved from within the BMP or downstream of the BMP proceed to Criteria 2.

If the 40% of the volume reduction is not achieved, proprietary biofiltration BMP is not allowed. Stop.</td></tr>
<tr><td>☒ No Infiltration Condition</td><td>Proprietary biofiltration BMP is allowed if one of the two criteria listed below are met:

☒ Documentation is provided to the satisfaction of the City Engineer that a larger footprint biofiltration BMP (i.e. minimum sizing factor calculated using worksheet B.5.2) is not feasible onsite; or
☐ Documentation is provided that volume reduction achieved by the larger footprint biofiltration BMP can be achieved through other measures (e.g., downstream site design BMPs, evapotranspiration from proprietary BMP, etc.)

If one of the two criteria listed above is met proceed to Criteria 2.

If neither criteria are met, proprietary biofiltration BMP is not allowed. Stop.</td></tr>
</table>

Onsite Proprietary Biofiltration BMP Checklist	Form I-10

Provide basis for Criteria 1 and 3:

Feasibility Analysis:
Summarize findings and attach Worksheet C.4-1

If Partial Infiltration Condition:
Provide documentation that 40% (average annual capture; or 0.375*DCV when using a 36-hour drawdown BMP) volume reduction is achieved within the BMP or downstream of the BMP. This could be achieved through downstream site design BMPs, downstream infiltration BMP, incidental retention by having an open bottom in the proprietary BMP or other similar measures.

If No Infiltration Condition:
Provide documentation that the alternative minimum sizing factor (attach Worksheet B.5-2) BMP is not feasible onsite or the volume reduction achieved by a non-proprietary BMP sized to the alternative minimum sizing factor can be achieved through downstream site design BMPs, downstream evapotranspiration BMPs, incidental evapotranspiration from the proprietary BMP or other similar measures.

Criteria	Answer	Progression
Criteria 2: Is the proprietary biofiltration BMP sized to meet the performance standard from the MS4 Permit? Refer to Appendix B.5 and Appendix F.2 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Meets Flow based Criteria	Use guidance from Appendix F.2 to size the proprietary BMP to meet the flow based criteria. Include the calculations in the PDP SWQMP. Use parameters for sizing consistent with manufacturer guidelines and conditions of its third party certifications (i.e. a BMP certified at a loading rate of 1 gpm/sq. ft cannot be designed using a loading rate of 1.5 gpm/sq. ft) **Proceed to Criteria 4**.
	☒ Meets Volume based Criteria	Provide documentation that the proprietary biofiltration BMP has a total static (i.e. non-routed) storage volume, including pore-spaces and pre-filter detention volume (Refer to Appendix B.5 for a schematic) of at least 0.75 times the portion of the DCV not reliably retained onsite. **Proceed to Criteria 4**.
	☐ Does not Meet either	**Stop**. Proprietary biofiltration BMP is not allowed.

Onsite Proprietary Biofiltration BMP Checklist		Form I-10
Provide basis for Criteria 2: The DCV calculations and BMP worksheets are in Attachment 1e.		
Criteria	**Answer**	**Progression**
<u>Criteria 4</u>: Does the proprietary biofiltration BMP meet the pollutant treatment performance standard for the projects most significant pollutants of concern? Refer to Appendix B.6 and Appendix F.1 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes, meets the TAPE certification.	Provide documentation that the proprietary BMP has an appropriate TAPE certification for the projects most significant pollutants of concern. **Proceed to Criteria 5.**
	☒ Yes, through other third-party documentation	Acceptance of third-party documentation is at the discretion of the City Engineer. The City engineer will consider, (a) the data submitted; (b) representativeness of the data submitted; and (c) consistency of the BMP performance claims with pollutant control objectives in Table F.1-2 and Table F.1-1 while making this determination. If a proprietary biofiltration BMP is not accepted, a written explanation/ reason will be provided in Section 2. **Proceed to Criteria 5.**
	☐ No	**Stop**. Proprietary biofiltration BMP is not allowed.
Provide basis for Criteria 4: As part of the Special Consideration "50% rule" for Redevelopment projects our site only has to treat the areas of redevelopment for the proposed site.		

Onsite Proprietary Biofiltration BMP Checklist		Form I-10
Criteria	**Answer**	**Progression**
Criteria 5: Is the proprietary biofiltration BMP designed to promote appropriate biological activity to support and maintain treatment process? Refer to Appendix F of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☒ Yes	Provide documentation that the proprietary biofiltration BMP support appropriate biological activity. Refer to Appendix F for guidance. **Proceed to Criteria 6.**
	☐ No	**Stop**. Proprietary biofiltration BMP is not allowed.
Provide basis for Criteria 5: Provide documentation that appropriate biological activity is supported by the proprietary biofiltration BMP to maintain treatment process.		
Criteria	**Answer**	**Progression**
Criteria 6: Is the proprietary biofiltration BMP designed with a hydraulic loading rate to prevent erosion, scour and channeling within the BMP?	☒ Yes	Provide documentation that the proprietary biofiltration BMP is used in a manner consistent with manufacturer guidelines and conditions of its third-party certification. **Proceed to Criteria 7**.
	☐ No	**Stop**. Proprietary biofiltration BMP is not allowed.
Provide basis for Criteria 6: Provide documentation that the BMP meets the numeric criteria and is designed consistent with the manufacturer guidelines and conditions of its third-party certification (i.e., maximum tributary area, maximum inflow velocities, etc., as applicable).		

Onsite Proprietary Biofiltration BMP Checklist		Form I-10
Criteria	**Answer**	**Progression**
<u>**Criteria 7**</u>: Is the proprietary biofiltration BMP maintenance plan consistent with manufacturer guidelines and conditions of its third-party certification (i.e., maintenance activities, frequencies)?	☒ Yes, and the proprietary BMP is privately owned, operated and not in the public right of way.	Submit a maintenance agreement that will also include a statement that the BMP will be maintained in accordance with manufacturer guidelines and conditions of third-party certification. **Stop**. The proprietary biofiltration BMP meets the required criteria.
	☐ Yes, and the BMP is either owned or operated by the City or in the public right of way.	Approval is at the discretion of the City Engineer. The city engineer will consider maintenance requirements, cost of maintenance activities, relevant previous local experience with operation and maintenance of the BMP type, ability to continue to operate the system in event that the vending company is no longer operating as a business or other relevant factors while making the determination. **Stop**. Consult the City Engineer for a determination.
	☐ No	**Stop**. Proprietary biofiltration BMP is not allowed.

Provide basis for Criteria 7:

Include copy of manufacturer guidelines and conditions of third-party certification in the maintenance agreement. Attachment 3A of the PDP SWQMP must include a statement that the proprietary BMP will be maintained in accordance with manufacturer guidelines and conditions of third-party certification.

Onsite Proprietary Biofiltration BMP Checklist	Form I-10
Section 2: Verification (For City Use Only)	
Is the proposed proprietary BMP accepted by the City Engineer for onsite pollutant control compliance for the DMA?	☒ Yes ☐ No, See explanation below
Explanation/reason if the proprietary BMP is not accepted by the City for onsite pollutant control compliance:	