APPENDIX C

STANDARD URBAN STORM WATER MITIGATION UPDATE

BY: KIMLEY-HORN AND ASSOCIATES, INC.

Standard Urban Storm Water Mitigation Update

Douglas Park Rezone Application
Long Beach, CA

July 24, 2009

Prepared for:
The Boeing Company
4501 E. Conant Street
Long Beach, CA 90808

Prepared by:
Kimley-Horn and Associates, Inc.
765 The City Drive, Suite 400
Orange, California 92868

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1. Certification

This document has been prepared to demonstrate that the CDS units which were originally designed for the project and approved by the County of Los Angeles Department of Public Works on 8/10/06 are still of adequate size and capacity to provide treatment under the current conditions which includes the rezoning of all properties north of Cover Street and revised stormwater requirements for all properties north of Cover Street. A copy of the approval and the narrative section are attached in Appendix A.

On July 17, 2009, a revised Hydraulic report titled Miscellaneous Transfer Drain MTD 1775 extension was submitted which demonstrated that the revisions for the rezone of the properties north of Cover Street are within the previously approved parameters of the 8/10/06 report. A copy of the narrative section is attached in Appendix B.

Since the approval of the original hydrology report, The City of Long Beach has required the rezone portion of the project to comply with the installation of storm filters designed to treat potential pollutants from the volume of runoff produced from 90% average annual rainfall to 80% TSS removal. The LEED New Construction Manual was used to further derive calculations for this event. The average annual rainfall in Long Beach CA is 12.94 inches. Based on the LEED manual, this rain fall event is considered an arid climate and the correlating 90% equivalent is 0.5 inches. The equation used in Table 1 from the SUSMP guidelines was modified to reflect the required 0.5 inches in lieu of the traditional 0.75 inch historically used. The revised intensity duration data table is attached in Appendix C.

Referring to the data in Appendix C, note that the rainfall intensity for the new criteria of R=0.5 is less than the original conditions of R=0.75 for all times of concentration 5 through 30 minutes. Based on this fact, when rerunning the calculations for each sub basin in the rezone area, all of the treatment criteria will be less than the original criteria used at the time the CDS Units were originally sized and installed. The calculations and the CDS submittal data are included in Appendices D and E.

Three Continuous Deflection Separation (CDS) hydrodynamic separators have been installed within the project area. The units are installed outside of the area to be rezoned; however, runoff from the rezone area will be treated by these units. The units are located at:

- The southwest corner of Conant Street and Schaufele, per plans prepared by Hunsaker and Associates, Inc., dated September 2006 (MTD 1775 Line 4).
- The southwest corner of Conant Street and Lakewood Boulevard, per plans prepared by Hunsaker and Associates, Inc., dated September 2006 (MTD 1775 Line C).
- The southwest corner of Conant Street and Heineman Street, per plans prepared by Barghausen Consulting Engineers, Inc., dated September 2007 (MTD 1803).

Additionally, the following BMPS will be utilized:

- The facilities constructed as part of the project-wide infrastructure development are maintained through Covenants, Conditions and Restrictions (CC&Rs) which provide for permanent maintenance of the facilities.

- Visible storm drain stenciling directly adjacent to storm drain inlets. The Design Guidelines also require individual developers to provide stenciling as part of the project approval process.

- The proposed on-site developments, through the Design Guidelines, will require individual developers to comply with the City of Long Beach requirements for Trash Storage Areas and Outdoor Material Storage Areas, where applicable.

According to Table 1, the anticipated pollutants of concern after the buildings and parking lot are constructed are trash, debris, and petroleum products (oil and grease). The potential pollutants of concern include sediments, nutrients, organic compounds, oxygen demanding substances, bacteria and viruses, and pesticides.

Table 1: Anticipated Pollutants of Concern

Pollutant	Automobile/ Atmospheric Deposit	Urban Housekeeping/ Landscaping Practices	Industrial Activities	Construction Activities	Non-Storm Water Connections	Accidental Spills
Sediments	X	X	X	X		
Nutrients	X	X	X	X	X	X
Bacteria and Viruses		X		X	X	X
Oxygen Demanding Substances		X	X	X	X	X
Oil and Grease	X	X	X	X	X	X
Anti-Freeze	X	X		X	X	X
Hydraulic Fluids	X	X	X	X	X	X
Cleaners and Solvents	X	X		X	X	X
Heavy Metals	X	X	X	X	X	X
Chromium	X	X	X			
Copper	X	X	X			
Lead	X	X	X			
Zinc	X	X	X			
Iron	X		X			
Cadmium	X		X			
Nickel	X		X			
Manganese	X		X			
Paint		X		X	X	X
Wood Preservatives		X		X	X	X
Fuels	X		X	X	X	X
PCBs	X				X	X
Pesticides	X	X	X	X	X	X
Herbicides	X		X	X	X	X

Floatables[1]		X	X	X		X

The existing Continuous Deflection Separation (CDS) Inline Units (or equivalent) will capture 80% of Total Suspended Solids (TSS) and remove 100% of floatable and neutrally buoyant material. The unit traps virtually 100% of gross particulate material half the aperture size of the screen and more than 90% of the particulates 1/3 the aperture size.

2. Conclusion

As stated above, the proposed project will include source, site and treatment control BMP's including the utilization of the existing CDS Inline Units for minimizing downstream erosion, contact with pollutants, and to treat and filter runoff prior to discharge off-site. Use of these control measures comply with the Municipal Storm Water National Pollutant Discharge Elimination System (NPDES) Permit and the City of Long Beach's Storm Water Standards.

Appendix A

Narrative from approved hydrology report dated 8/2/06

HYDROLOGY REPORT

For
M.T.D. 1775
DOUGLAS PARK

Tentative Tract 61252

City of Long Beach

County of Los Angeles

Prepared For:

Boeing Realty Corporation

4900 Connant St., Bldg. 1
Long Beach, CA 90808-1746
Tel: (562) 733-2206
Fax: (562) 733-2082

BOEING

Prepared By:

H&A

HUNSAKER & ASSOCIATES IRVINE, INC.

Three Hughes
Irvine, CA 92618
(949) 583-1010

W.O.#: 2143-5 HydReport

COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS
CITY ENGINEER/SUPERINTENDENT OF STREET
LAND DEVELOPMENT DIVISION
SUBDIVISION PLAN CHECKING SECTION
DRAINAGE UNIT

TO: H&A

DATE 08/10/06

Attention Massoud Vatankhahi

REVIEW OF HYDROLOGY STUDY/SUSMP

MTD NO. 1775
TR NO. 061252
CITY OF LONG BEACH
SUBMITTAL DATE 08/07/06

We have reviewed your Hydrology Study/SUSMP.

[X] The Hydrology Study/SUSMP is recommended for City approval for Area and Q only subject to the comments noted herein and on the returned map.

COMMENTS:

- Submit Hydrology Study/SUSMP to the City of Long Beach for final signature and approval. Return one set (signed) to LACDPW Land Development Division.

REVIEWED BY [signature]
Ernesto J Rivera
(626) 458-4921

HYDROLOGY STUDY
MTD 1775 CITY OF LONG BEACH
RECOMMENDED FOR CITY APPROVAL
RECOMMENDED BY: E. Rive RCE NO. 67550 DATE: 8/10/06
CHECKED BY: ______ DATE: 8/16/06
LAND DEVELOPMENT DIVISION
LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS

HYDROLOGY ANALYSIS

For

DOUGLAS PARK

TENTATIVE TRACT 61252

City of Long Beach

County of Los Angeles

PREPARED BY:
GARY GUAN, P.E.

RECEIVED
AUG - 7 2006
PROCESSING CENTER
LAND DEVELOPMENT DIVISION

REGISTERED PROFESSIONAL ENGINEER
MASSOUD VATANKHAHI
NO. 37348
Exp. 6/30/06
CIVIL
STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:

M. Vatankhahi 8/02/06

Massoud Vatankhahi, R.C.E. 37348, Exp. 6/30/06, Date

HYDROLOGY STUDY / SUSMP
APPROVED FOR AREA AND Q ONLY
APPROVED BY: ______ RCE NO. ______ DATE: ______

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- HYDRAULIC CALCULATIONS ASSUMING NO CDS UNIT
- HYDRAULIC CALCULATIONS STARTING FROM UPSTREAM OF CDS UNIT
- REDUCED SCALE STORM DRAIN PLANS

REFERENCES -------------- --- **SECTION 5**

- APPROVED HYDROLOGY FOR MTD 1753 BY KIMLEY-HORN & ASSOCIATES
- HYDRAULIC CALCULATIONS FROM KIMLEY-HORN
- PORTION OF MTD 1753 TRACT NO. 61252 LINE "1" BY KIMLEY-HORN & ASSOCIATES

SECTION I

DISCUSSION

The site is a portion of the approved Drainage Concept Plan for Vesting Tentative Tract 61252 (see attached Vicinity Map) located in the City of Long Beach, County of Los Angeles, prepared by Kimley-Horn & Associates, Inc. dated October 7, 2004.

The purpose of this study is to quantify storm runoff that will be produced form the site. This study is for the ultimate condition and based on the current mass grading plan and previously submitted hydrology study prepared by Hunsaker & Associates Irvine, Inc.

The hydrology calculations contained herein are based on the Modified Rational Method hydrology. The hydrology program used in this study is LAR04 developed by Civildesign Corp. For purposes of this study, a 50-year capital flood was analyzed.

The project site is divided into four drainage areas.

Drainage area "A" contains an approximate area of 47.8 acres and produces a 50-year runoff of 69.2 cfs. Per the approved hydrology study for MTD 1753 prepared by Kimley-Horn, the allowable flow rate is 71 cfs.

Drainage area "B" contains an approximate area of 95.4 acres and produces a 50-year runoff of 139.2 cfs. Per the approved hydrology study for MTD 1753 prepared by Kimley-Horn, the allowable flow rate is 155 cfs. The combined flow rates for Areas "A" and "B" are 208.4 cfs (139.2+69.2) which is 17.6 cfs less than the combined allowable flow rate (71+155).

Drainage area "C" contains an approximate area of 26.5 acres and produces a 50-year runoff of 44.8 cfs. Per the approved hydrology study for MTD 1753 prepared by Kimley-Horn, the allowable flow rate is 40 cfs.

Drainage area "D" contains an approximate area of 2.4 acres and produces a 50-year runoff of 5 cfs.

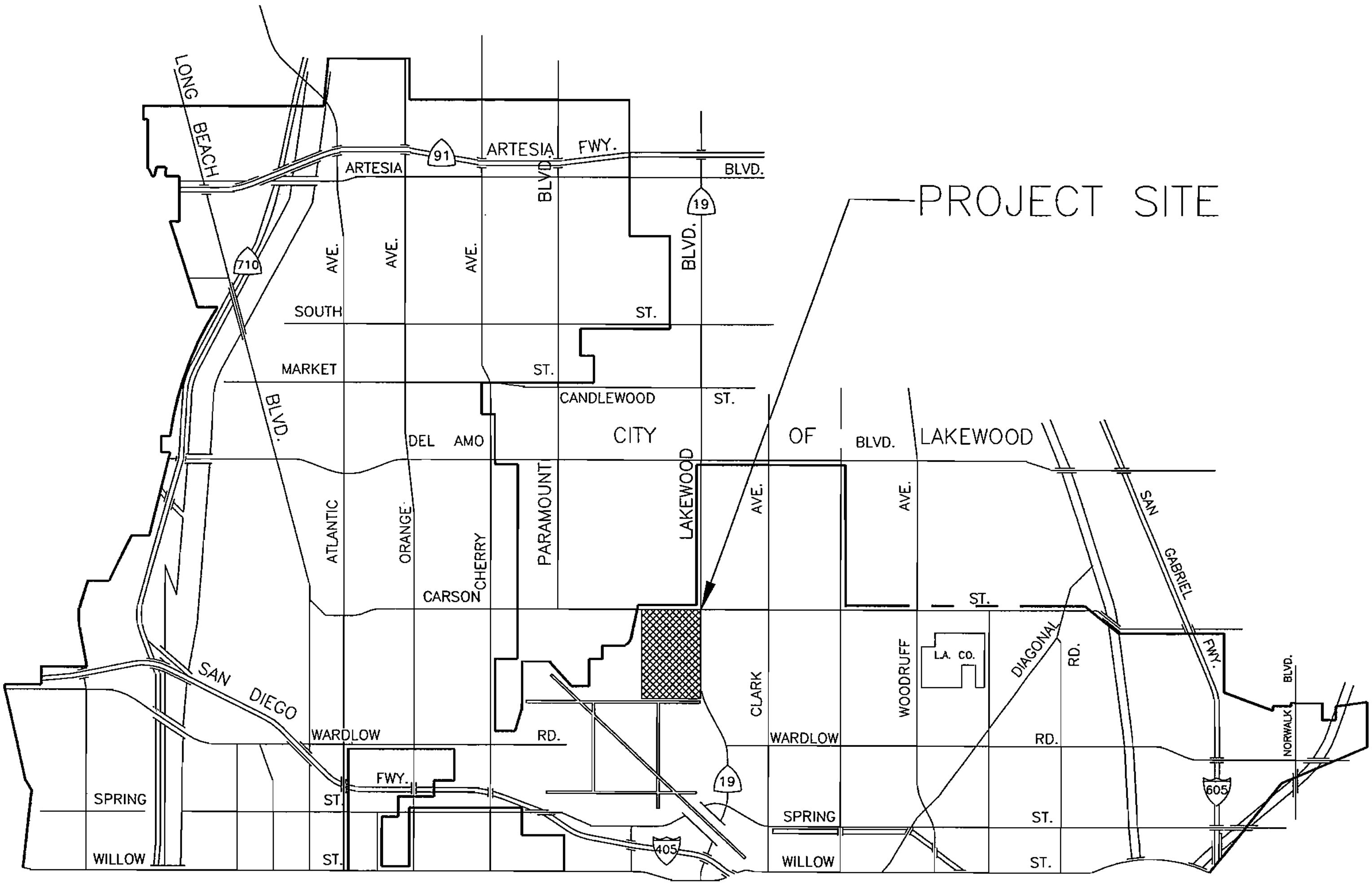
The approximate location of SUSMP device or equivalent is shown on the Hydrology map for all four subareas "A", "B", "C" and "D". The SUSMP calculations can be found in Section 3.

Ponding Analysis

Line "4" was designed to join the existing 96" RCP lateral of MTD 1753 Line "1". Hunsaker & Associates has obtained the digital hydraulic file for MTD 1753 Line "1" from Kimley-Horn. In reviewing the hydraulic calculations by Kimley-Horn, the discrepancies have been found. The invert elevations used in the hydraulic models do not match the updated storm drain plan (see reference plans); the flow rate is 139.2 cfs per Hunsaker & Associates hydrology study instead of 155 cfs used in Kimley-Horn hydraulic studies. The hydraulic model has been changed accordingly. The water surface control is 37.00' for Line "4".

Per county's requirements, the hydraulic analysis for Line "4" was performed assuming there were no CDS Units systems. The hydraulic information was provided to CDS for them to perform the hydraulic calculation for CDS Units systems. Then the hydraulic calculations were performed starting from upstream of the CDS Units using the water surface elevation provided by CDS Units. Because of the relative mild pipe slopes of the studied storm drain systems (s=0.001 for line "4"), the loss through the CDS Units is approximately 0.29' for Line "4".

The hydraulic analysis results indicate that there is **NO** ponding issue for 50-year capital flood. For Line "4" at C.B. #40 and #41 location, the 50-year water surface elevation is approximately 38.05 which is below the Top-of-Curb elevation (38.68 minimum Tc elevation). For Line "4A" at C.B. #23 and #24 location, the 50-year water surface elevation is approximately 37.8' which is 0.4' below the Top-of-Curb elevation (38.20 min. Tc elevation). The detailed hydraulic calculations can be found in Section 4.



VICINITY MAP

NOT TO SCALE

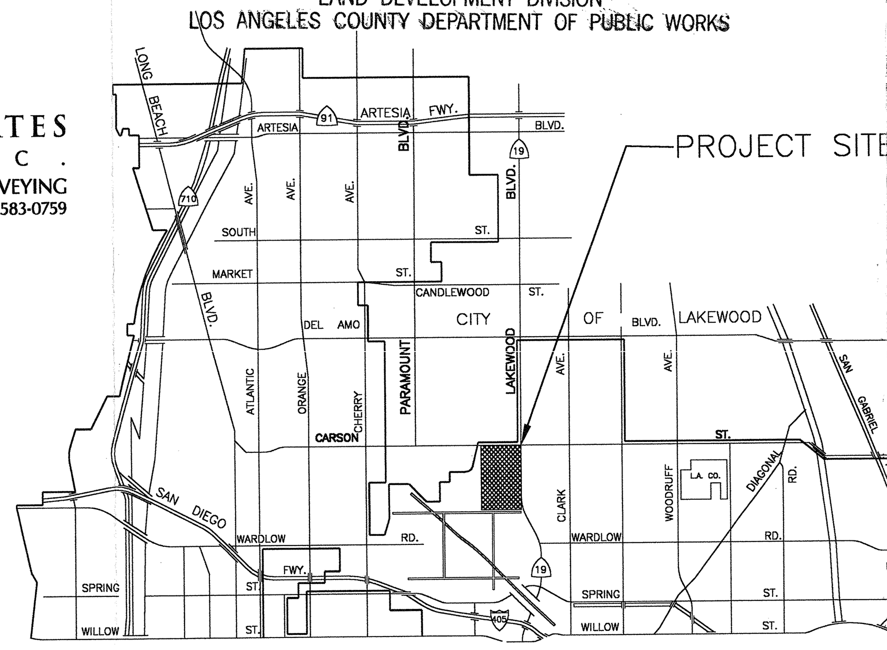
"HYDROLOGY STUDY" FOR MTD 1775
DOUGLAS PARK
T. T. 61252

HYDROLOGY STUDY
MTD 1775 CITY OF LONG BEACH
RECOMMENDED FOR CITY APPROVAL
RECOMMENDED BY: E. R. RCE NO. 67550 DATE: 8/10/06
CHECKED BY: ______ DATE: 8/10/06
LAND DEVELOPMENT DIVISION
LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS

PREPARED BY:
HUNSAKER & ASSOCIATES
IRVINE, INC.
PLANNING ▪ ENGINEERING ▪ SURVEYING
Three Hughes ▪ Irvine, CA 92618 ▪ PH: (949) 583-1010 ▪ FX: (949) 583-0759

PREPARED FOR:
Boeing Realty Corporation
4900 Connant Street, Bldg. 1
Long Beach, CA 90808-1746
Tel: (562) 733-2206
Fax: (562) 733-2082

MAP DATE IDENTIFIER	
DATE OF LATEST CHANGE TO THIS MAP	
08/01/06	BY: G.G.
DATE OF THIS PLOT	
08/02/06	



VICINITY MAP
NOT TO SCALE
THOMAS GUIDE PG. 765, GRID J7

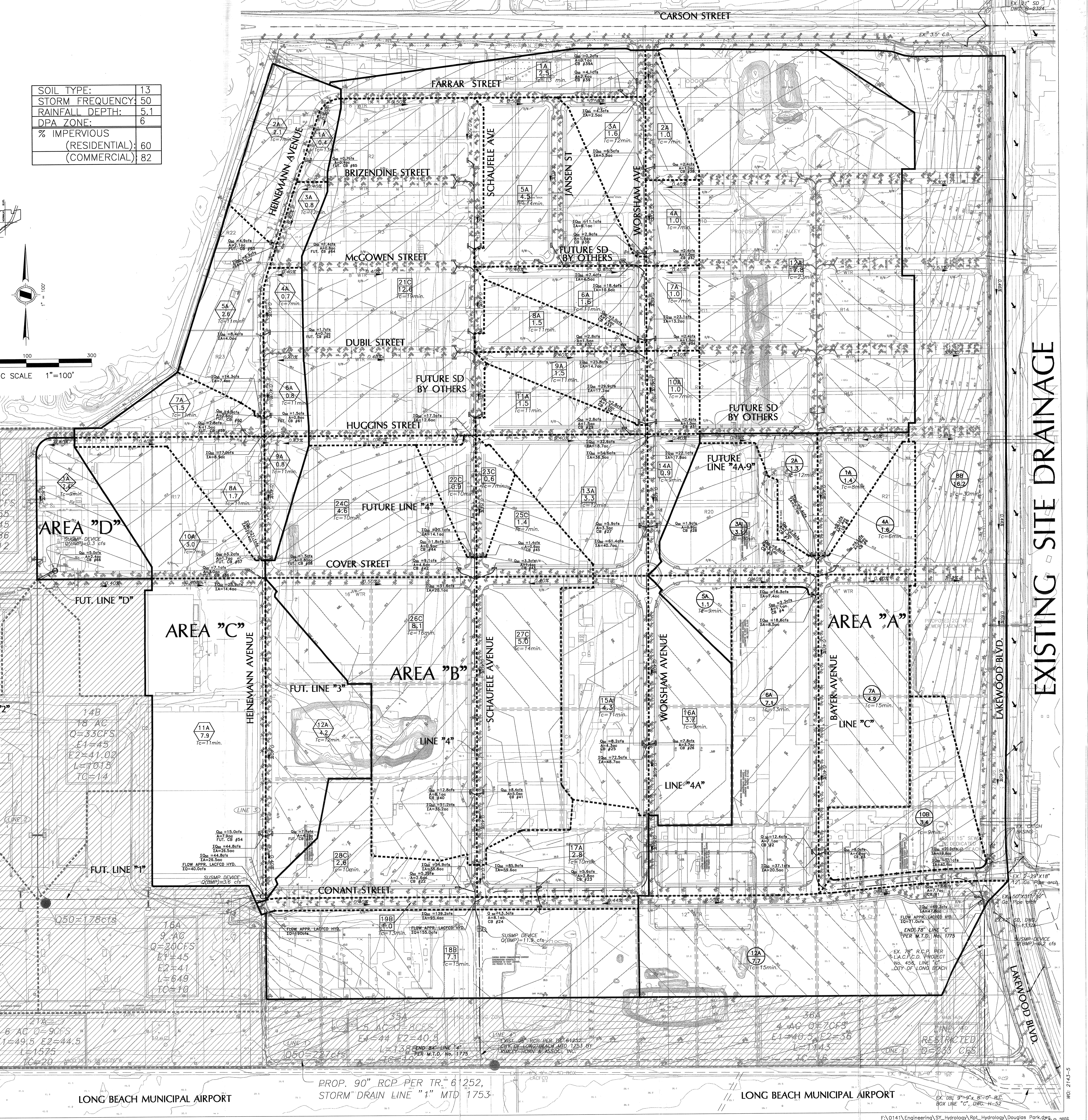
HYDROLOGY STUDY
APPROVED FOR AREA AND Q ONLY
APPROVED BY: ______ RCE NO. ______ DATE: ______

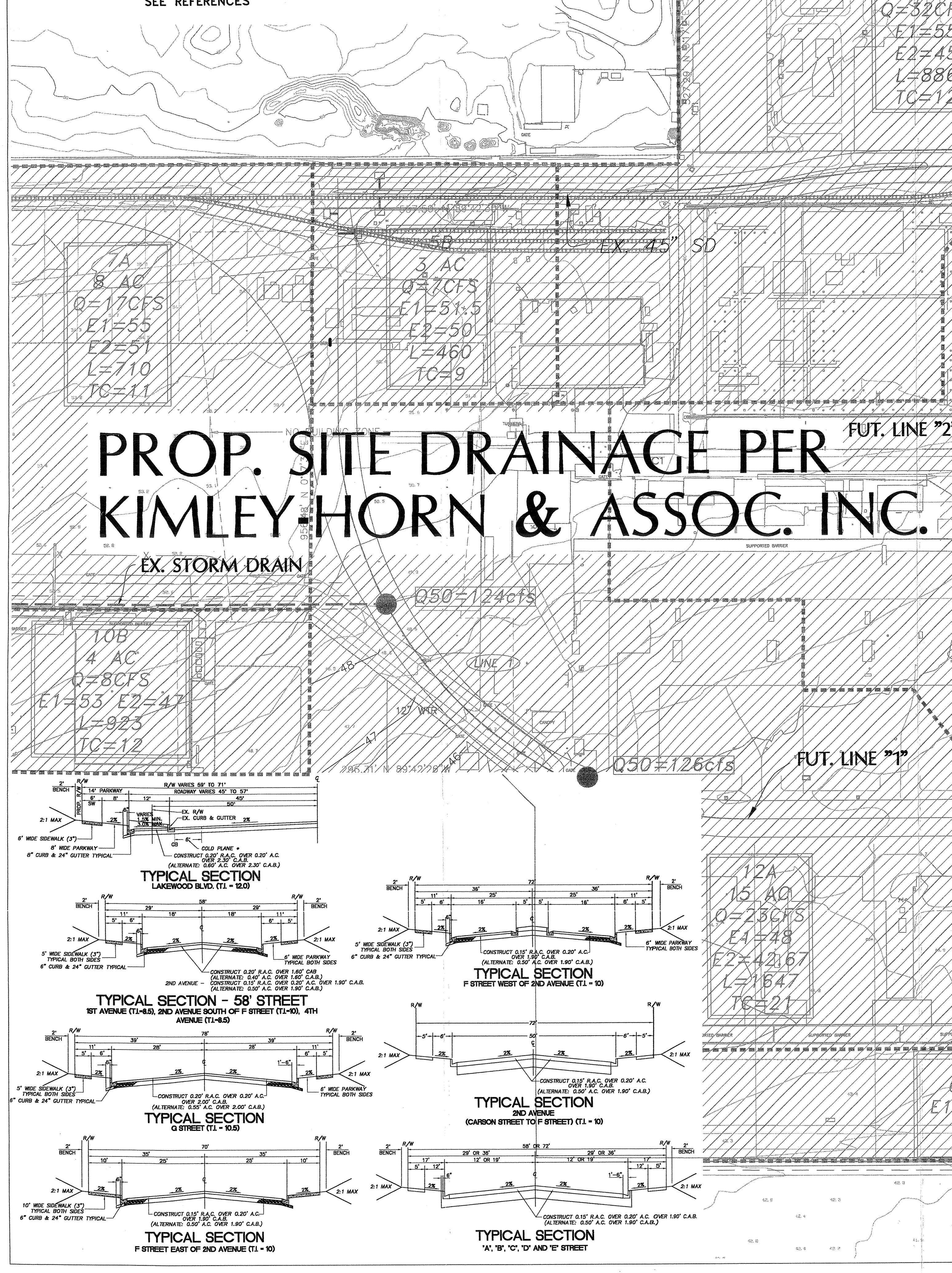
SOIL TYPE:	13
STORM FREQUENCY:	50
RAINFALL DEPTH:	5.1
DPA ZONE:	6
% IMPERVIOUS	
(RESIDENTIAL):	60
(COMMERCIAL):	82

GRAPHIC SCALE 1"=100'

LEGEND

- MAJOR DRAINAGE BOUNDARY
- MINOR DRAINAGE BOUNDARY
- AREA DESIGNATION FOR LINE "C" (AREA "A") AREA ACREAGE (IN ACRES)
- AREA DESIGNATION FOR LINE "4" (AREA "B") AREA ACREAGE (IN ACRES)
- AREA DESIGNATION FOR LINE "3" (AREA "C") AREA ACREAGE (IN ACRES)
- AREA DESIGNATION FOR LINE "D" (AREA "D") AREA ACREAGE (IN ACRES)
- PEAK FLOW RATE TIME OF CONCENTRATION
- PEAK CONFLUENCE FLOW RATE TIME OF CONCENTRATION
- PROPOSED STORM DRAIN
- EXISTING STORM DRAIN
- PROP. MINOR DRAINAGE BOUNDARY PER KIMLEY-HORN & ASSOC. INC. SEE REFERENCES
- PROP. SITE DRAINAGE SYSTEM DOUGLAS PARK TR. NO. 6 MTD 1753 PER KIMLEY-HORN & ASSOC. INC. SEE REFERENCES





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AUG 02 2006

SECTION 3

SUSMP CALCULATIONS

A.1 METHOD FOR CALCULATING STANDARD URBAN STORMWATER MITIGATION PLAN FLOW RATES AND VOLUMES BASED ON 0.75-INCHES OF RAINFALL: WORKSHEET

PROJECT NAME

____

NOMENCLATURE

A_I	=	Impervious Area (acres)
A_P	=	Pervious Area (acres)
A_U	=	Contributing Undeveloped Upstream Area (acres)
A_{Total}	=	Total Area of Development and Contributing Undeveloped Upstream Area (acres)
C_D	=	Developed Runoff Coefficient
C_U	=	Undeveloped Runoff Coefficient
I_X	=	Rainfall Intensity (inches / hour)
Q_{PM}	=	Peak Mitigation Flow Rate (cfs)
T_C	=	Time of Concentration (minutes, must be between 5-30 min.)
V_M	=	Mitigation Volume (ft^3)

EQUATIONS

$$A_{Total} = A_I + A_P + A_U$$

$$A_I = (A_{Total} * \text{ \% of Development which is Impervious})$$

$$A_P = (A_{Total} * \text{ \% of Development which is Pervious})$$

$$A_U = (A_{Total} * \text{ \% of Contributing Undeveloped Upstream Area***})$$

$$C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U] \qquad \text{If } C_D < C_U \text{, use } C_D = C_U$$

$$Q_{PM} = C_D * I_X * A_{Total} * (1 \text{ hour} / 3{,}600 \text{ seconds}) * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$$

$$= C_D * I_X * A_{Total} * (1.008333 \text{ ft}^3\text{-hour} / \text{acre-inches-seconds})$$

$$T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$$

$$V_M = (0.75 \text{ inches}) * [(A_I)(0.9) + (A_P + A_U)(C_U)] * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$$

$$= (2{,}722.5 \text{ ft}^3 / \text{acre}) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$$

***** Contributing Undeveloped Upstream Area is an area where stormwater runoff from an undeveloped upstream area will flow directly or indirectly to the Post-Construction Best Management Practices (BMPs) proposed for the development. This additional flow must be included in the flow rate and volume calculations to appropriately size the BMPs.**

PROVIDE PROPOSED PROJECT CHARACTERISTICS

A_{Total} ______________ Acres

Type of Development ______________

Predominate Soil Type # ______________

% of Project Impervious ______________

% of Project Pervious ______________

% of Project Contributing Undeveloped Area ______________

A_I ______________ Acres

A_P ______________ Acres

A_U ______________ Acres

DETERMINING THE PEAK MITIGATED FLOW RATE (Q_{PM}):

In order to determine the peak mitigated flow rate (Q_{PM}) from the new development, use the Los Angeles County Department of Public Works *Hydrology Manual*. Use the Modified Rational Method for calculating the peak mitigation Q_{PM} for compliance with the Standard Urban Stormwater Mitigation Plan (SUSMP). Use attached **Table 1** for all maximum intensity (I_X) values used.

By trial and error, determine the time of concentration (T_C), as shown below:

CALCULATION STEPS:

1. Assume an initial T_C value between 5 and 30 minutes.

T_C __________ minutes

2. Using Table 1, look up the assumed T_C value and select the corresponding I_X intensity in inches/hour.

I_X __________ inches/hour

3. Determine the value for the Undeveloped Runoff Coefficient, C_U, using the runoff coefficient curve corresponding to the predominant soil type.

C_U __________

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9 * Imp.) + [(1.0 - Imp.) * C_U]$

C_D __________

5. Calculate the value for $C_D * I_X$

$C_D * I_X$ __________

6. Calculate the time of concentration, $T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * Length^{0.483} * Slope^{-0.135}$

Calculated T_C __________ minutes

7. Calculate the difference between the initially assumed T_C and the calculated T_C, if the difference is greater than 0.5 minutes. Use the calculated T_C as the assumed initial T_C in the second iteration. If the T_C value is within 0.5 minutes, round the acceptable T_C value to the nearest minute.

TABLE FOR ITERATIONS:

Iteration No.	Initial T_C (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr)	Calculated T_C (min)	Difference (min)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable T_C value ____________ minutes

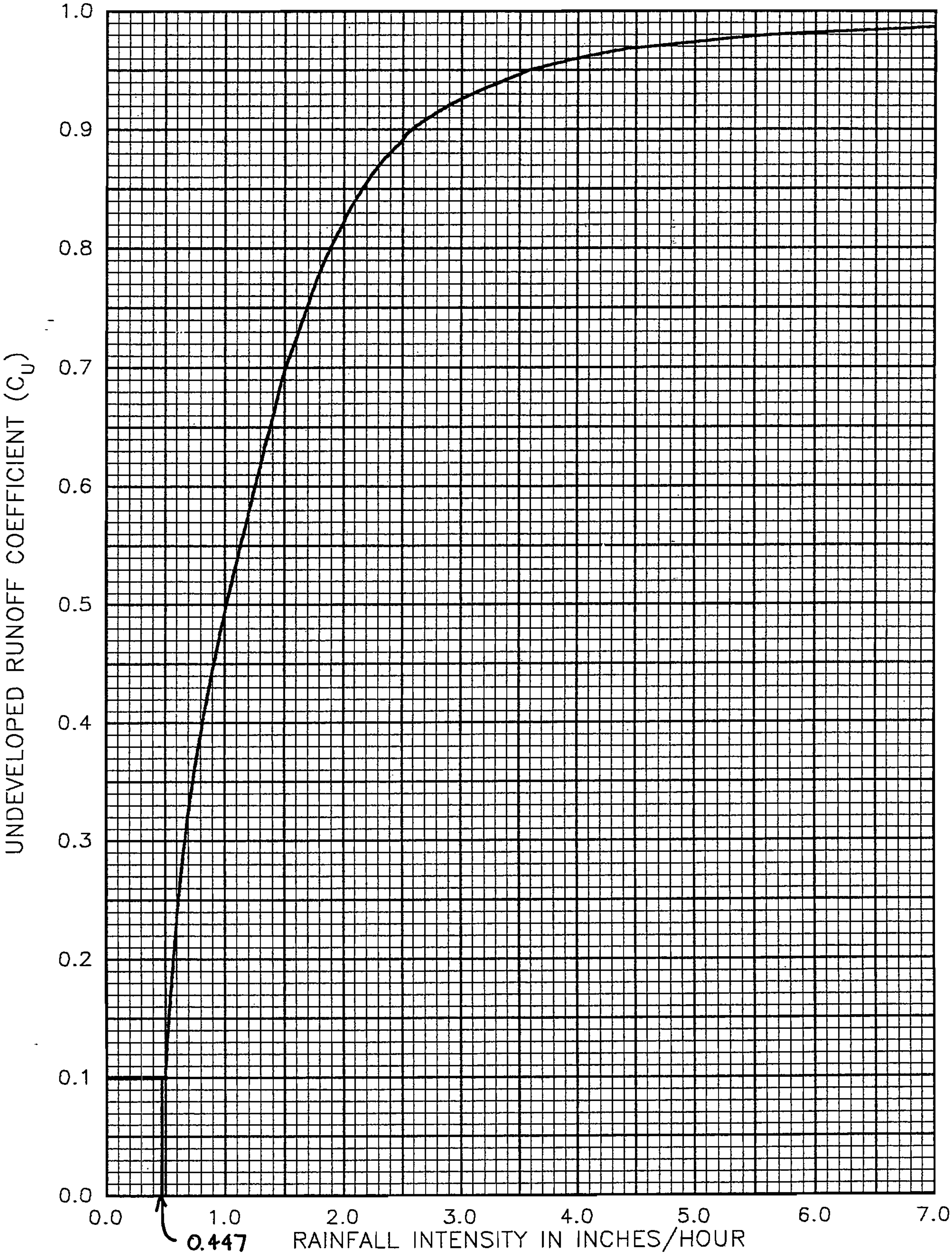
8. Calculate the Peak Mitigation Flow Rate,
$Q_{PM} = C_D * I_X * A_{Total} * (1.008333\ ft^3\text{-hour / acre-inches-seconds})$

Q_{PM} __________ cfs

TABLE 1

INTENSITY - DURATION DATA FOR 0.75-INCHES OF RAINFALL
FOR ALL RAINFALL ZONES

Duration, T_C (min)	Rainfall Intensity, I_X (in/hr)
5	0.447
6	0.411
7	0.382
8	0.359
9	0.339
10	0.323
11	0.309
12	0.297
13	0.286
14	0.276
15	0.267
16	0.259
17	0.252
18	0.245
19	0.239
20	0.233
21	0.228
22	0.223
23	0.218
24	0.214
25	0.210
26	0.206
27	0.203
28	0.199
29	0.196
30	0.193



Equation:

$C_D = (0.9 * IMP) + (1.0 - IMP)\ C_U$

Where:
C_D = Developed runoff coefficient.
IMP = Proportion impervious.
C_U = Undeveloped runoff coefficient.

Los Angeles County
Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 013

NS013.SP

SUSMP VOLUME AND FLOW CALCULATIONS
(DRAINAGE AREA "A")

TABLE

SUSMP RUNOFF/VOLUME SUMMARY TABLE

AREA "A"

AREA NO.	DRAINAGE AREA (acres)	Q50 (cfs)	SUSMP	
			Q(CFS)	V (ft3)
1A	1.4	3	0.2	2,211
2A	1.3	2	0.1	2,053
3A	3.1	7	0.3	4,895
4A	1.6	4	0.2	2,526
5A	1.1	3	0.2	2,264
6A	7.1	14	1.0	14,613
7A	4.9	9	0.7	10,085
8B	16.2	19	1.8	25,581
9B	3.4	8	0.5	6,998
11A	7.7	14	1.1	15,848
TOTAL	**47.8**		**6.2**	**87,074**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 1A

Drainage Area	1.40
Impervious Area	0.84
Pervious Area	0.56
Length	419.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.84
A_P	0.56
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	31.9	16.89
2	20	0.233	0.1	0.580	0.135	34.2	14.23
3	30	0.193	0.1	0.580	0.112	37.7	7.74
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.2 cfs**

VM = **2,211 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 2A

Drainage Area	1.30
Impervious Area	0.78
Pervious Area	0.52
Length	708.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.78
A_P	0.52
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	41.1	26.09
2	30	0.193	0.1	0.580	0.112	48.6	18.63
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.1 cfs**

VM = **2,053 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 3A

Drainage Area	3.10
Impervious Area	1.86
Pervious Area	1.24
Length	436.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	1.86
A_P	1.24
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	32.5	17.51
2	30	0.193	0.1	0.580	0.112	38.5	8.47
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value 30 minutes

Q_{PM} = 0.3 cfs

VM = 4,895 ft^3

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 4A

Drainage Area	1.60
Impervious Area	0.96
Pervious Area	0.64
Length	247.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.96
A_P	0.64
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	24.7	9.71
2	20	0.233	0.1	0.580	0.135	26.5	6.52
3	25	0.21	0.1	0.580	0.122	28.0	2.99
4	30	0.193	0.1	0.580	0.112	29.2	-0.76
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.22 cfs**

VM = **2,526 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 5A

Drainage Area	1.10
Impervious Area	0.90
Pervious Area	0.20
Length	476.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	0.90
A_P	0.20
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	29.6	14.56
2	30	0.193	0.1	0.756	0.146	35.0	5.42
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.2 cfs**

VM = **2,264 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 6A

Drainage Area	7.10
Impervious Area	5.82
Pervious Area	1.28
Length	925.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	5.82
A_P	1.28
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	40.7	25.7
2	30	0.193	0.1	0.756	0.146	48.2	18.2
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **1.0 cfs**

VM = **14,613 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 7A

Drainage Area	4.90
Impervious Area	4.02
Pervious Area	0.88
Length	1108.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	4.02
A_P	0.88
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	44.5	29.46
2	30	0.193	0.1	0.756	0.146	52.6	22.61
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.7 cfs**

VM = **10,085 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 8B

Drainage Area	16.20
Impervious Area	9.72
Pervious Area	6.48
Length	2985.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	9.72
A_P	6.48
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	82.3	67.33
2	30	0.193	0.1	0.580	0.112	97.4	67.43
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **1.8 cfs**

VM = **25,581 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 9B

Drainage Area	3.40
Impervious Area	2.79
Pervious Area	0.61
Length	500.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	2.79
A_P	0.61
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	30.3	15.27
2	26	0.206	0.1	0.756	0.156	34.6	8.63
3	30	0.193	0.1	0.756	0.146	35.8	5.82
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.5 cfs**

VM = **6,998 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 11A

Drainage Area	7.70
Impervious Area	6.31
Pervious Area	1.39
Length	1053.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	6.31
A_P	1.39
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	43.4	28.38
2	30	0.193	0.1	0.756	0.146	51.3	21.33
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **1.1 cfs**

VM = **15,848 ft^3**

SUSMP VOLUME AND FLOW CALCULATIONS
(DRAINAGE AREA "B")

TABLE

SUSMP RUNOFF/VOLUME SUMMARY TABLE

AREA "B"

AREA NO.	DRAINAGE AREA (acres)	Q50 (cfs)	SUSMP	
			Q(CFS)	V (ft3)
1A	2.5	5	0.3	3,948
2A	1	3	0.1	1,579
3A	1.6	3	0.2	2,526
4A	1	3	0.1	1,579
5A	4.5	8	0.5	7,106
6A	1.6	3	0.2	2,526
7A	1	3	0.1	1,579
8A	1.5	3	0.2	2,369
9A	1.5	3	0.2	2,369
10A	1	3	0.1	1,579
11A	1.5	3	0.2	2,369
12A	17.8	24	2.0	28,107
13A	3.3	6	0.4	5,211
14A	0.9	2	0.1	1,421
15A	4.3	9	0.6	8,850
16A	3.7	8	0.5	7,615
17A	2.8	6	0.4	5,763
18B	7.1	13	1.0	14,613
19B	1	2	0.1	2,058
21C	12.6	19	1.4	19,896
22C	0.9	2	0.1	1,421
23C	0.6	2	0.1	947
24C	4.6	10	0.5	7,264
25C	1.4	4	0.2	2,211
26C	8.1	14	1.2	16,672
27C	5	9	0.7	10,291
28C	2.6	6	0.4	5,351
TOTAL	**95.4**		**11.9**	**27,160**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 1A

Drainage Area	2.50
Impervious Area	1.50
Pervious Area	1.00
Length	861.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	1.50
A_P	1.00
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	45.2	30.16
2	20	0.233	0.1	0.580	0.135	48.5	28.47
3	30	0.193	0.1	0.580	0.112	53.4	23.44
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.3 cfs**

VM = **3,948 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 2A

Drainage Area	1.00
Impervious Area	0.60
Pervious Area	0.40
Length	338.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.60
A_P	0.40
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	**Initial Tc** (min)	**Ix** (in/hr)	**Cu**	**Cd**	**Cd*Ix** (in/hr)	**Calclated Tc** (min)	**Difference** (min)
1	15	0.267	0.1	0.580	0.155	28.7	13.75
2	30	0.193	0.1	0.580	0.112	34.0	4.02
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.1 cfs**

VM = **1,579 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 3A

Drainage Area	1.60
Impervious Area	0.96
Pervious Area	0.64
Length	436.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.96
A_P	0.64
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	32.5	17.51
2	30	0.193	0.1	0.580	0.112	38.5	8.47
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.2 cfs**

VM = **2,526 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 4A

Drainage Area	1.00
Impervious Area	0.60
Pervious Area	0.40
Length	321.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.60
A_P	0.40
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	28.0	13.04
2	20	0.233	0.1	0.580	0.135	30.1	10.09
3	25	0.21	0.1	0.580	0.122	31.8	6.76
4	30	0.193	0.1	0.580	0.112	33.2	3.18
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.14 cfs**

VM = **1,579 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 5A

Drainage Area	4.50
Impervious Area	2.70
Pervious Area	1.80
Length	970.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	2.70
A_P	1.80
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	47.8	32.84
2	48	0.193	0.1	0.580	0.112	56.6	8.78
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.5 cfs**

VM = **7,106 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 6A

Drainage Area	1.60
Impervious Area	0.96
Pervious Area	0.64
Length	670.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.96
A_P	0.64
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	40.0	25.0
2	30	0.193	0.1	0.580	0.112	47.3	17.3
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.2 cfs**

VM = **2,526 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 7A

Drainage Area	1.00
Impervious Area	0.60
Pervious Area	0.40
Length	322.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.60
A_P	0.40
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	28.1	13.08
2	30	0.193	0.1	0.580	0.112	33.2	3.23
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.1 cfs**

VM = **1,579 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 8A

Drainage Area	1.50
Impervious Area	0.90
Pervious Area	0.60
Length	659.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.90
A_P	0.60
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	39.7	24.69
2	30	0.193	0.1	0.580	0.112	47.0	16.97
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.2 cfs**

VM = **2,369 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 9A

Drainage Area	1.50
Impervious Area	0.90
Pervious Area	0.60
Length	663.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.90
A_P	0.60
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	39.8	24.80
2	26	0.206	0.1	0.580	0.119	45.5	19.54
3	30	0.193	0.1	0.580	0.112	47.1	17.11
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.2 cfs**
VM = **2,369 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 10A

Drainage Area	1.00
Impervious Area	0.60
Pervious Area	0.40
Length	314.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.60
A_P	0.40
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	27.7	12.74
2	30	0.193	0.1	0.580	0.112	32.8	2.83
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.1 cfs**

VM = **1,579 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 11A

Drainage Area	1.50
Impervious Area	0.90
Pervious Area	0.60
Length	655.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.90
A_P	0.60
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	**Initial Tc** (min)	**Ix** (in/hr)	**Cu**	**Cd**	**Cd*Ix** (in/hr)	**Calclated Tc** (min)	**Difference** (min)
1	15	0.267	0.1	0.580	0.155	39.6	24.57
2	30	0.193	0.1	0.580	0.112	46.8	16.83
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.2 cfs**

VM = **2,369 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 12A

Drainage Area	17.80
Impervious Area	10.68
Pervious Area	7.12
Length	1940.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	10.68
A_P	7.12
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	**Initial Tc** (min)	**Ix** (in/hr)	**Cu**	**Cd**	**Cd*Ix** (in/hr)	**Calclated Tc** (min)	**Difference** (min)
1	15	0.267	0.1	0.580	0.155	66.9	51.86
2	30	0.193	0.1	0.580	0.112	79.1	49.12
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **2.0 cfs**

VM = **28,107 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 13A

Drainage Area	3.30
Impervious Area	1.98
Pervious Area	1.32
Length	787.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	1.98
A_P	1.32
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	43.2	28.24
2	30	0.193	0.1	0.580	0.112	51.2	21.17
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.4 cfs**

VM = **5,211 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 14A

Drainage Area	0.90
Impervious Area	0.54
Pervious Area	0.36
Length	451.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.54
A_P	0.36
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	33.0	18.05
2	30	0.193	0.1	0.580	0.112	39.1	9.11
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.1 cfs**

VM = **1,421** ft^3

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 15A

Drainage Area	4.30
Impervious Area	3.53
Pervious Area	0.77
Length	627.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	3.53
A_P	0.77
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	33.8	18.77
2	30	0.193	0.1	0.756	0.146	40.0	9.96
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.6 cfs**

VM = **8,850 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 16A

Drainage Area	3.70
Impervious Area	3.03
Pervious Area	0.67
Length	485.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	3.03
A_P	0.67
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	29.8	14.83
2	30	0.193	0.1	0.756	0.146	35.3	5.30
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.5 cfs**

VM = **7,615 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 17A

Drainage Area	2.80
Impervious Area	2.30
Pervious Area	0.50
Length	485.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	2.30
A_P	0.50
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	29.8	14.83
2	30	0.193	0.1	0.756	0.146	35.3	5.30
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.4 cfs**

VM = **5,763 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 18B

Drainage Area	7.10
Impervious Area	5.82
Pervious Area	1.28
Length	1118.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	5.82
A_P	1.28
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	44.6	29.65
2	30	0.193	0.1	0.756	0.146	52.8	22.84
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **1.0 cfs**

VM = **14,613 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 19B

Drainage Area	1.00
Impervious Area	0.82
Pervious Area	0.18
Length	862.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	0.82
A_P	0.18
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	39.4	24.38
2	30	0.193	0.1	0.756	0.146	46.6	16.60
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = 0.1 cfs

VM = 2,058 ft^3

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 21C

Drainage Area	12.60
Impervious Area	7.56
Pervious Area	5.04
Length	1460.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	7.56
A_P	5.04
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	58.3	43.28
2	30	0.193	0.1	0.580	0.112	69.0	38.97
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **1.4 cfs**

VM = **19,896 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 22C

Drainage Area	0.90
Impervious Area	0.54
Pervious Area	0.36
Length	560.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.54
A_P	0.36
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	36.7	21.69
2	30	0.193	0.1	0.580	0.112	43.4	13.42
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value 30 minutes

Q_{PM} = 0.1 cfs

VM = 1,421 ft^3

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 23C

Drainage Area	0.60
Impervious Area	0.36
Pervious Area	0.24
Length	356.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.36
A_P	0.24
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	29.5	14.48
2	30	0.193	0.1	0.580	0.112	34.9	4.89
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.1 cfs**

VM = **947 ft^3**

SUSMP VOLUME AND FLOW CALCULATIONS
(DRAINAGE AREA "C")

TABLE

SUSMP RUNOFF/VOLUME SUMMARY TABLE

AREA "C"

AREA NO.	DRAINAGE AREA (acres)	Q50 (cfs)	SUSMP	
			Q(CFS)	V (ft3)
1A	0.4	1	0.0	632
2A	2.1	5	0.2	3,316
3A	0.8	2	0.1	1,263
4A	0.7	2	0.1	1,105
5A	2.6	5	0.5	7,106
6A	0.8	2	0.1	1,263
7A	1.5	3	0.2	3,022
8A	1.7	3	0.2	2,423
9A	0.8	2	0.1	1,263
10A	3	8	0.3	4,737
11A	7.9	16	1.2	16,260
12A	4.2	8	0.6	8,644
TOTAL	**26.5**		**3.6**	**26,131**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 1A

Drainage Area	0.40
Impervious Area	0.24
Pervious Area	0.16
Length	861.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.24
A_P	0.16
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	45.2	30.16
2	20	0.233	0.1	0.580	0.135	48.5	28.47
3	30	0.193	0.1	0.580	0.112	53.4	23.44
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.0 cfs**

VM = **632 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 2A

Drainage Area	2.10
Impervious Area	1.26
Pervious Area	0.84
Length	338.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	1.26
A_P	0.84
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	28.7	13.75
2	30	0.193	0.1	0.580	0.112	34.0	4.02
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.2 cfs**

VM = **3,316 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 3A

Drainage Area	0.80
Impervious Area	0.48
Pervious Area	0.32
Length	683.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.48
A_P	0.32
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	40.4	25.38
2	30	0.193	0.1	0.580	0.112	47.8	17.79
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.1 cfs**

VM = **1,263 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 4A

Drainage Area	0.70
Impervious Area	0.42
Pervious Area	0.28
Length	321.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.42
A_P	0.28
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	28.0	13.04
2	20	0.233	0.1	0.580	0.135	30.1	10.09
3	25	0.21	0.1	0.580	0.122	31.8	6.76
4	30	0.193	0.1	0.580	0.112	33.2	3.18
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.09 cfs**

VM = **1,105 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 5A

Drainage Area	4.50
Impervious Area	2.70
Pervious Area	1.80
Length	681.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	2.70
A_P	1.80
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	**Initial Tc** (min)	**Ix** (in/hr)	**Cu**	**Cd**	**Cd*Ix** (in/hr)	**Calclated Tc** (min)	**Difference** (min)
1	15	0.267	0.1	0.580	0.155	40.3	25.32
2	30	0.193	0.1	0.580	0.112	47.7	17.72
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.5 cfs**

VM = **7,106 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 6A

Drainage Area	0.80
Impervious Area	0.48
Pervious Area	0.32
Length	662.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.48
A_P	0.32
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	39.8	24.8
2	30	0.193	0.1	0.580	0.112	47.1	17.1
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.1 cfs**

VM = **1,263 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA **7A**

Drainage Area	1.50
Impervious Area	1.20
Pervious Area	0.30
Length	662.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	80
% of Pervious	20
A_I	1.20
A_P	0.30
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	**Initial Tc** (min)	**Ix** (in/hr)	**Cu**	**Cd**	**Cd*Ix** (in/hr)	**Calclated Tc** (min)	**Difference** (min)
1	15	0.267	0.1	0.740	0.198	35.1	20.05
2	30	0.193	0.1	0.740	0.143	41.5	11.48
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **29 minutes**

Q_{PM} = **0.2 cfs**

VM = **3,022 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 8A

Drainage Area	1.70
Impervious Area	0.90
Pervious Area	0.80
Length	670.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	53
% of Pervious	47
A_I	0.90
A_P	0.80
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.524	0.140	42.2	27.19
2	30	0.193	0.1	0.524	0.101	49.9	19.93
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.2 cfs**

VM = **2,423 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 9A

Drainage Area	0.80
Impervious Area	0.48
Pervious Area	0.32
Length	670.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	0.48
A_P	0.32
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.580	0.155	40.0	25.01
2	26	0.206	0.1	0.580	0.119	45.8	19.77
3	30	0.193	0.1	0.580	0.112	47.3	17.35
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.1 cfs**

VM = **1,263 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 10A

Drainage Area	3.00
Impervious Area	1.80
Pervious Area	1.20
Length	322.00
Slope	0.004
Type of Development	Residential
Soil Type #	13
% of Impervious	60
% of Pervious	40
A_I	1.80
A_P	1.20
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	**Initial Tc** (min)	**Ix** (in/hr)	**Cu**	**Cd**	**Cd*Ix** (in/hr)	**Calclated Tc** (min)	**Difference** (min)
1	15	0.267	0.1	0.580	0.155	28.1	13.08
2	30	0.193	0.1	0.580	0.112	33.2	3.23
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **0.3 cfs**

VM = **4,737 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 11A

Drainage Area	7.90
Impervious Area	6.48
Pervious Area	1.42
Length	659.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	6.48
A_P	1.42
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	34.6	19.59
2	30	0.193	0.1	0.756	0.146	40.9	10.93
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value **30 minutes**

Q_{PM} = **1.2 cfs**

VM = **16,260 ft^3**

VOLUME AND FLOW RATE CALCULATIONS

DRAINAGE AREA 12A

Drainage Area	4.20
Impervious Area	3.44
Pervious Area	0.76
Length	757.00
Slope	0.004
Type of Development	Industrial
Soil Type #	13
% of Impervious	82
% of Pervious	18
A_I	3.44
A_P	0.76
A_U	0.00

TABLE FOR ITRATIONS:

Itration No.	Initial Tc (min)	Ix (in/hr)	Cu	Cd	Cd*Ix (in/hr)	Calclated Tc (min)	Difference (min)
1	15	0.267	0.1	0.756	0.202	37.0	21.98
2	30	0.193	0.1	0.756	0.146	43.8	13.77
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable Tc Value 30 minutes

Q_{PM} = 0.6 cfs

VM = 8,644 ft^3

Appendix B

Narrative from revised hydrology report dated 7/17/09

Kimley-Horn
and Associates, Inc.

HYDRAULIC REPORT

FOR

DOUGLAS PARK

TRACT NO. 70937

LONG BEACH, CALIFORNIA

July 17, 2009

"I hereby certify that this drainage report was prepared by me or under my supervision in accordance with standard practices"

Nikki Kerry, P.E. Date

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EXHIBITS

Exhibit 1 – Location Map

Exhibit 2 – Douglas Park Summary of Storm Drain System at Full Build-Out

Exhibit 3 – 50-Year Hydrology Study Proposed Site Drainage System Douglas Park at Full Build-Out

APPENDICES

Appendix A – Proposed Full Build-Out Condition LAR04 and TC Model Output

Appendix B – Detention Area Hydrographs and Stage-Storage Analysis

Appendix C –Revised HGL Calculations for MTD 1753 and MTD 1775

Appendix D – Catch Basin Summary

Appendix E – Proposed Storm Drain Plan and Profile

Appendix F – Approved MTD 1775 Storm Drain Plan and Profile

Appendix G – Approved MTD 1775 Storm Drain Plan and Profile

HYDRAULIC REPORT

Project Description

The Douglas Park project in the City of Long Beach proposed by Boeing Realty Corporation is a redevelopment of 261 acres of the Boeing Company's C-1 aircraft production facility. The project is located within the cities of both Long Beach and Lakewood. Project implementation would provide for the replacement of approximately 379,500 square feet of existing research and development (R&D), office, warehousing, manufacturing, and other aviation-related uses with new R&D, light industrial, office, areas for hotel and retail uses and potentially the continuation of aviation-related uses.

The northern portion of the site (North of Cover Street), consisting of approximately 100 acres, currently zoned residential (TTM 61252) is proposed to be rezoned with occupied uses including office, R & D, light industrial, and mixed-use which could include retail, office and hotel. This area is referred to as the Rezone Area (TTM 70937). The southern portion of the project, which is comprised of approximately 161 acres, will remain researcd and development, light industrial, office, retail, hotel, and potentially the continuation of a small amount of aviation-related uses.

The project site is located approximately 5 miles northeast of downtown Long Beach and immediately north of the Long Beach Municipal Airport. The majority of the site (approximately 238 acres) is located within the City of Long Beach, while the remaining portion of the site (approximately 23 acres) is within the City of Lakewood. In general, the project site is bound by Carson Street on the north, the Airport on the south and southwest, Lakewood Boulevard on the east, and the Lakewood Country Club and Airport on the west.

For the purpose of this report the Rezone Area Northwest Quadrant (TTM 70937) is being analyzed for two proposed underground storm drain lines. The Rezone Northwest Quadrant phase is bounded by Carson Street to the North, Cherry Avenue to the West, Cover Street to the South, and the Lakewood Boulevard to the East. A location map of the Douglas Park project is attached as **Exhibit 1**.

Existing Site Storm Drain

The Douglas Park site is relatively flat topographically, differing only 24-feet in elevation, across the site from West to East over a distance of 5,800 feet. The resultant grade is approximately 0.4 percent. The site storm drain system generally runs north to south and west to east. The on-site storm drain system point of discharge is located at the southeast corner of the site where it discharges into the public storm drain system owned by the Los Angeles County Flood Control District (LACDPW).

Proposed Storm Drain

The proposed preliminary grading plan for the site will follow existing topography by draining from the northwest to southeast. Site grades generally range from 0.5 percent to 4 percent. Drainage characteristics for the proposed on-site storm drain system have been designed not to differentiate from patterns of the existing condition to the maximum extent practicable. The proposed Northwest Quadrant of TTM 70937 will contribute flow to several existing catch basins designed as part of the MTD 1775, MTD 1803, and MTD 1817.

The overall Douglas Park development is restricted to a downstream allowable peak flow of 233 cfs during a capitol storm event (50 year storm event). As a result, two underground storm drain pipes will be installed within the rezone area to detain the excess peak flow during the capitol storm. This report includes the hydraulic analysis of the proposed underground storm drain in Schaufele Avenue. The second underground system in the Northeast Quadrant of Douglas Park is to be designed and permitted per separate submittal, at a later date, however the storage calculations for the storm drain in the Northeast Quadrant are included in **Appendix B**.

The proposed Schaufele Avenue storm drain will tie into the existing MTD-1775 at SD STA 25+63.17. A small segment of 21-inch reinforced concrete pipe (RCP) will be installed to restrict the flow to 22.9 cfs. Based upon this restriction a storage volume of 13,970 ft^3 is needed to detain the capitol storm event; the inflow and outflow hydrographs are attached in Appendix B. This storage volume will be detained in a 60-inch RCP storm drain; the plan and profile for the proposed line is attached in **Appendix E**.

The proposed Huggins Street & BayerAvenue storm drain will tie into the existing MTD-1775 at SD STA 29+29.17. A small segment of 18-inch reinforced concrete pipe (RCP) will be installed to restrict the flow to 16.3 cfs. Based upon this restriction a storage volume of 15,718 ft^3 is needed to detain the capitol storm event; the inflow and outflow hydrographs are attached in **Appendix B**. This storage volume will be detained in a 60-inch RCP storm drain with a minimum length of 930 ft; the design of this underground storm drain will be during a later phase of the site development.

Hydraulic Analysis

The Hydraulic Calculation for the existing MTD-1753 and MTD-1775 was calculated based upon revised peak flow information for the entire Douglas Park Development. In order to comply with a downstream restriction of 233cfs during the capitol storm event the Douglas Park project is required to detain the excess peak flow. In addition to utilizing two underground storm drain pipes to mitigate the excess peak runoff several orifice plates will be installed in catch basins to restrict the flow.

The WSPG software program was utilized to determine the HGL. The inputs for the WSPG program reflect the mitigated flow entering the storm drain. The revised HGL results are attached in **Appendix C** as well as a summary table to reference the inlet locations as they correspond to the subareas from the hydrology map. A comparison of the peak flow and HGL at the junction of the proposed line into MTD-1775 line 4 is summarized on the following page in Table 1.

Table 1 - Peak Flow and HGL Comparison

Report	Station	Invert	Peak Flow (cfs)	HGL
MTD-1775 prepared by Hunsaker and Associates (9/14/2006)	25+63.17	31.8	20.1	40.1
Rezone Schaufele Storm Drain prepared by Kimley-Horn and Associates, Inc. (3/10/2009)	25+63.17	31.8	22.9	41.5

Due to the reconfiguration of the site the connection of the proposed storm drain in Schaufele Avenue contributes a flow rate greater than the original design of MTD 1775 Line 4. Additionally it was determined that the HGL used as the downstream control of MTD 1775 was approximately 1.5ft lower than the HGL of the approved MTD 1753. An analysis of MTD 1775 and MTD 1753 was performed to determine the impacts of this increased flow. The WSPG printouts are included in **Appendix C**. While the flow in MTD 1775 is increased the overall impact is neglible as the peak flow rate for the Douglas Park development is 204cfs which is less than the allowable rate of 233cfs to the LACFCD culvert.

The storage retention analysis was performed using Hydraflow software. This model routes the hydrographs from the three tributary inlets into the Schaufele storm drain through the storage pipe. The hydrographs utilized for this model were created by the LAR04 software as part of the overall Douglas Park Drainage Master Plan. The storage analysis results are attached in **Appendix B**.

As a part of the storm drain construction three new catch basins will be installed. The catch basin hydraulic calculation results are attached to this report in **Appendix D**. In addition to the new catch basins, the tributary flow for the two existing catch basins will be lowered as a result of the new catch basins upstream. The revised hydraulics for these inlets is also attached in **Appendix D**.

DOUGLAS PARK (TTM 61252)
50 YEAR HYDROLOGY STUDY PROPOSED SITE DRAINAGE SYSTEM
AT FULL BUILD-OUT WITH REZONE AREA (TTM 70937)

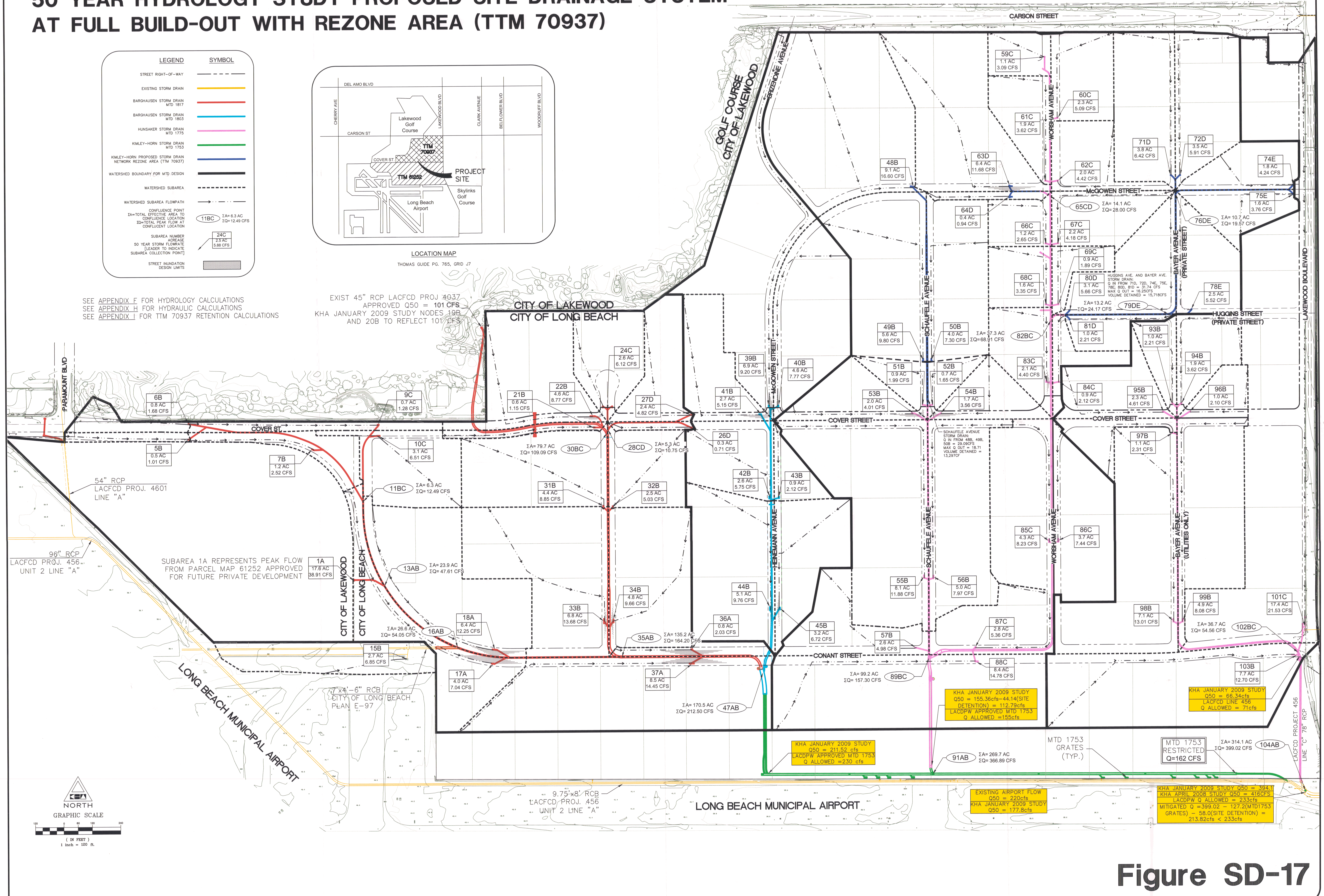
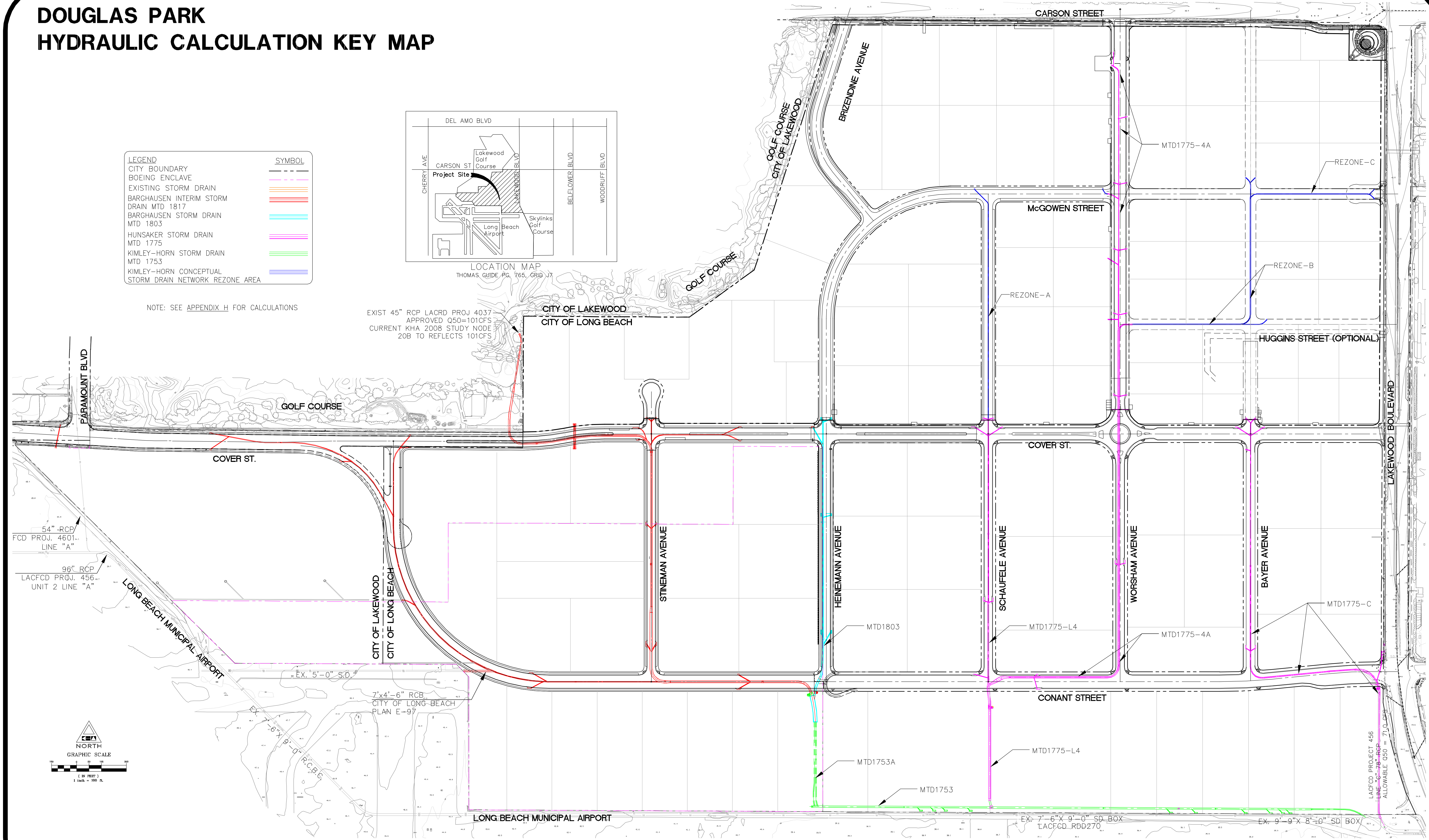


Figure SD-17

Kimley-Horn and Associates, Inc.

DOUGLAS PARK
HYDRAULIC CALCULATION KEY MAP



Kimley-Horn and Associates Inc. © 2008

Figure SD-23

Appendix C

Intensity Duration data table

INTENSITY - DURATION DATA FOR "R" INCHES OF RAINFALL FOR ALL RAINFALL ZONES

Ix=(R/24)*((1440/Tc)^0.47

R= 0.75

R= 0.5

DURATION, Tc (mins)	RAINFALL INTENSITY, Ix, (in/hr) for R=0.75	RAINFALL INTENSITY, Ix, (in/hr) for R=0.5
5	0.447	0.298
6	0.411	0.274
7	0.382	0.255
8	0.359	0.239
9	0.339	0.226
10	0.323	0.215
11	0.309	0.206
12	0.297	0.198
13	0.286	0.190
14	0.276	0.184
15	0.267	0.178
16	0.259	0.173
17	0.252	0.168
18	0.245	0.163
19	0.239	0.159
20	0.233	0.155
21	0.228	0.152
22	0.223	0.149
23	0.218	0.146
24	0.214	0.143
25	0.210	0.140
26	0.206	0.137
27	0.203	0.135
28	0.199	0.133
29	0.196	0.131
30	0.193	0.129

Appendix D

Approved CDS submittal package dated 10/25/06

CDS TECHNOLOGIES

October 25, 2006

SUBMITTAL: **STORM WATER TREATMENT UNITS**
TRACT 061252 – DOUGLAS PARK
LONG BEACH, CA

PRODUCTS: **CDS MODEL PSW50_42 (SD LINE "C")**
CDS MODEL PSWC56_53 (SD LINE "4")

INDEX:

Section 1 - Catalog Cut Sheets
Section 2 - Typical Assembly Drawings
Section 3 - PSW50_42 Drawing
Section 4 - PSW50_42 Material / Product Specifications
Section 5 - PSW50_42 Installation Specifications
Section 6 - PSWC56_53 Drawing
Section 7 - PSWC56_53 Material / Product Specifications
Section 8 - PSWC56_53 Installation Specifications

Submitted by: *Tim Joyce*

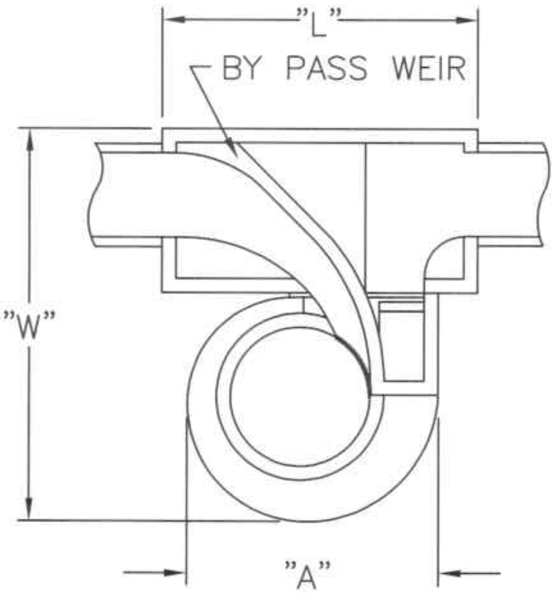
Tim Joyce, P.E.

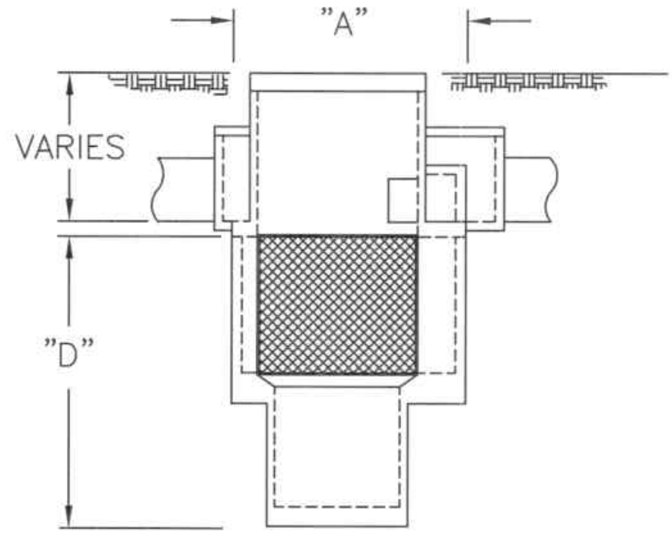
CDS Technologies, Inc.
3950 Long Beach Boulevard, Suite 100
Long Beach, CA 90807
(562) 424-6334

SECTION 1
CATALOG CUT SHEETS

PRECAST MODELS

PROCESSES FLOWS 3 TO 64 CFS





W = (2.5 to 3.0 × Screen Dia.) Varies with site conditions
L = (2.0 to 3.0 × Screen Dia.) Varies with site conditions

PRECAST MODEL NUMBER	**TREATMENT DESIGN FLOW RATE			***DESIGN HEAD LOSS @ DESIGN TREATMENT FLOW RATE		SCREEN DIA./HT.	DEPTH BELOW PIPE INVERT "D"	FOOT PRINT DIAMETER "A"
	cfs	MGD	m^3/sec	ft.	m	ft.	ft.	ft.
~~PSW30_30~~	~~3.0~~	~~1.9~~	~~0.08~~	~~0.78~~	~~0.24~~	~~3.0/2.8~~	~~7.0~~	~~6.0~~
PSW50_42	9.0	5.8	0.25	1.15	0.35	5.0/4.2	9.6	9.5
~~PSW50_50~~	~~11~~	~~7.1~~	~~0.31~~	~~1.37~~	~~0.42~~	~~5.0/5.0~~	~~10.3~~	~~9.5~~
~~PSW70_70~~	~~26~~	~~17~~	~~0.74~~	~~1.95~~	~~0.58~~	~~7.0/7.0~~	~~11.0~~	~~12.5~~
~~PSW100_60~~	~~30~~	~~19~~	~~0.85~~	~~1.60~~	~~0.49~~	~~10.0/6.0~~	~~12.0~~	~~18.0~~
~~PSW100_80~~	~~50~~	~~32~~	~~1.4~~	~~2.34~~	~~0.71~~	~~10.0/8.0~~	~~14.0~~	~~18.0~~
~~PSW100_100~~	~~64~~	~~41~~	~~1.8~~	~~2.61~~	~~0.80~~	~~10.0/10.0~~	~~16.0~~	~~18.0~~

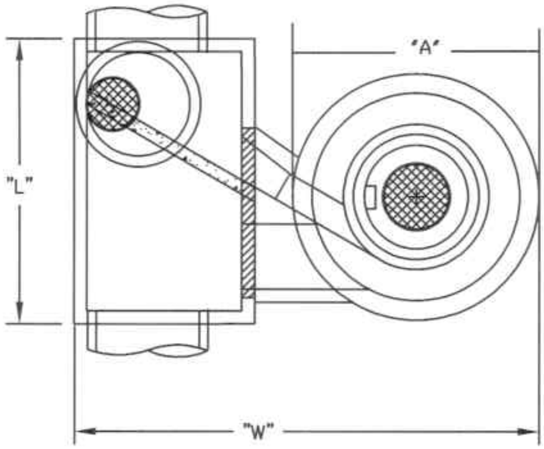
*Standard screen opening is 4700 microns (.185 in.). Screens also available in 2400 microns (.095 in.).

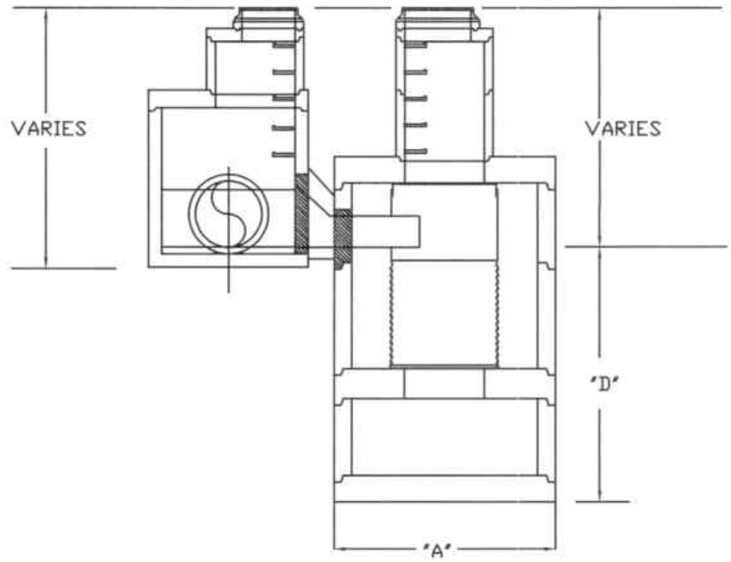
**This is the minimum flow that will receive treatment before bypass is allowed. These offline units are capable of unlimited bypass flows rates. CDS Engineers are readily available to provide hydraulic consultations on all applications.

***The headloss during a bypass event is a function of the velocity head. The typical coefficient of headloss "K_{CDS}" ranges from 1.3 to 2.5 $H_{CDS} = K_{CDS}\left(V^2/2_g\right) \Rightarrow \begin{bmatrix}1.3\\2.5\end{bmatrix} V^2/2_g$

PRECAST CONCENTRIC MODELS

PROCESSES FLOWS 3 TO 25 CFS





A = FOOT PRINT DIAMETER
D = DEPTH BELOW PIPE INVERT
W = VARIES 15' TO 18' (TYPICAL)
L = 8–11' TYPICAL

PRECAST MODEL NUMBER	**TREATMENT DESIGN FLOW RATE			***DESIGN HEAD LOSS * DESIGN TREATMENT FLOW RATE		SCREEN DIA./HT.	DEPTH BELOW PIPE INVERT "D"	FOOT PRINT DIAMETER "A"
	cfs	MGD	m³/sec	ft.	m	ft.	ft.	ft.
~~PSWC30_30~~	~~3.0~~	~~1.9~~	~~0.08~~	~~0.71~~	~~0.22~~	~~3.0/2.8~~	~~8.2~~	~~7.2~~
~~PSWC40_30~~	~~4.5~~	~~2.9~~	~~0.13~~	~~0.85~~	~~0.26~~	~~4.0/3.0~~	~~8.6~~	~~8.3~~
~~PSWC40_40~~	~~6.0~~	~~3.9~~	~~0.17~~	~~1.00~~	~~0.30~~	~~4.0/4.0~~	~~9.6~~	~~8.3~~
~~PSWC56_40~~	~~9.0~~	~~5.8~~	~~0.25~~	~~1.11~~	~~0.34~~	~~5.6/4.0~~	~~9.6~~	~~9.5~~
PSWC56_53	14	9.0	0.40	1.48	0.45	5.6/5.3	10.9	9.5
~~PSWC56_68~~	~~19~~	~~12~~	~~0.54~~	~~1.91~~	~~0.58~~	~~5.6/6.8~~	~~12.6~~	~~9.5~~
~~PSWC56_78~~	~~25~~	~~16~~	~~0.71~~	~~2.19~~	~~0.67~~	~~5.6/7.8~~	~~13.6~~	~~9.5~~

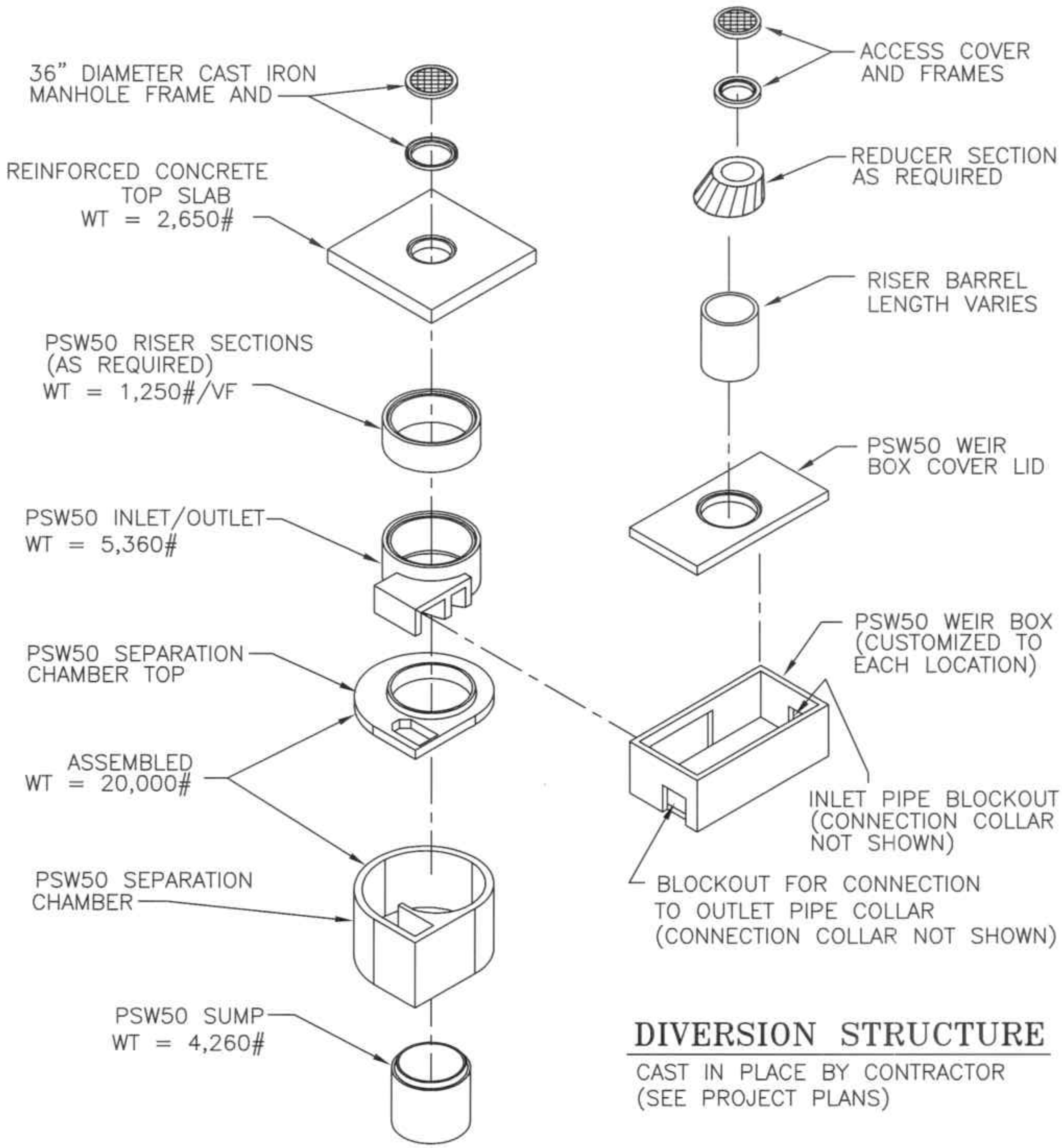
*Standard screen opening is 4700 microns (.185 in.). Screens also available in 2400 microns (.095 in.).

**This is the minimum flow that will receive treatment before bypass is allowed. These offline units are capable of unlimited bypass flow rates. CDS Engineers are readily available to provide hydraulic consultations on all applications.

***The headloss during a bypass event is a function of the velocity head. The typical coefficient of headloss "K_{CDS}" ranges from 1.3 to 2.5

$$H_{CDS} = K_{CDS}\left(V^2/2_g\right) \Rightarrow \begin{bmatrix}1.3\\2.5\end{bmatrix} V^2/2_g$$

SECTION 2
TYPICAL ASSEMBLY DRAWINGS



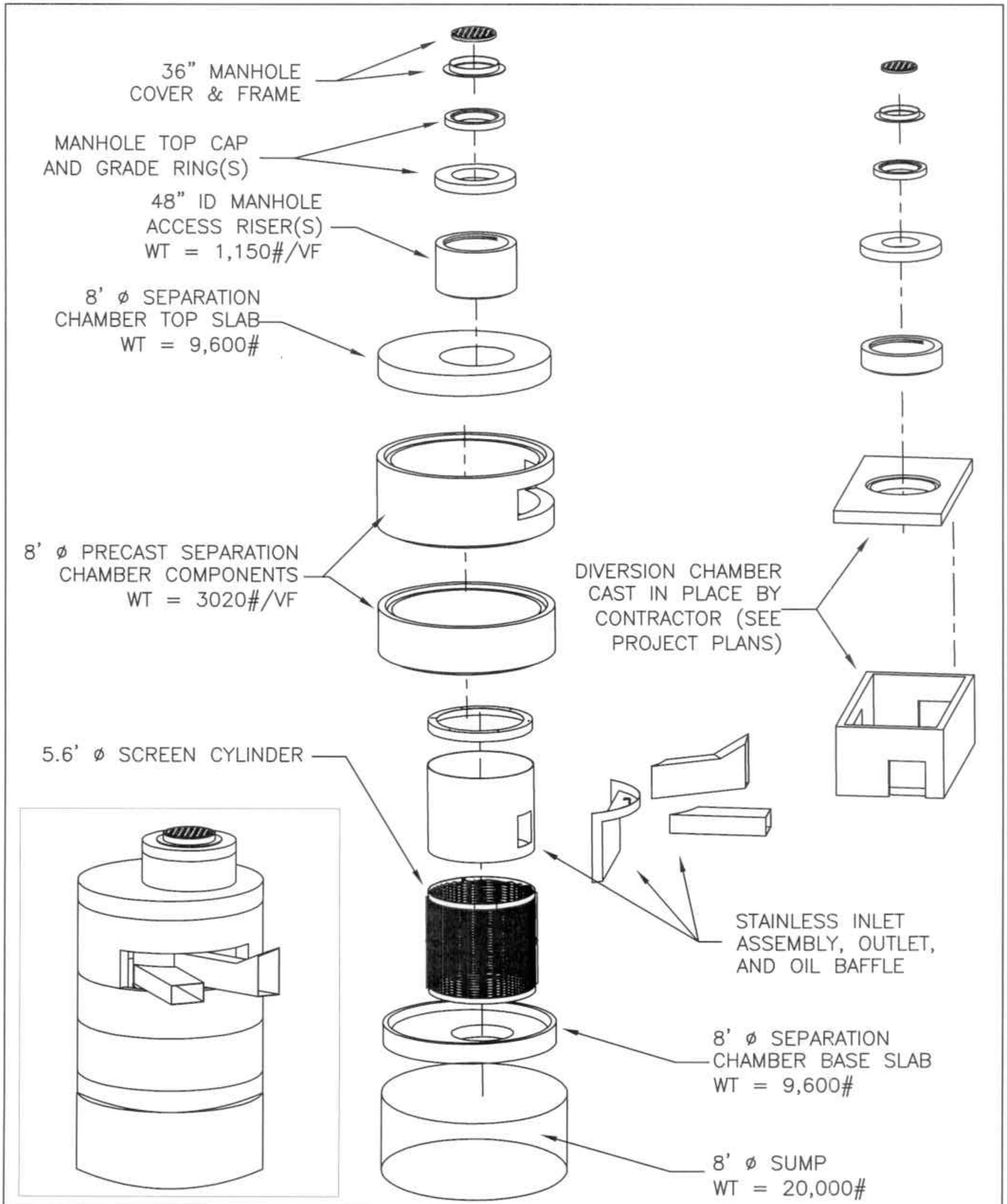
DIVERSION STRUCTURE

CAST IN PLACE BY CONTRACTOR
(SEE PROJECT PLANS)

PSW50_42 ASSEMBLY

SUPPLIED BY CDS

CDS TECHNOLOGIES PATENTED	CDS PSW50_42 ASSEMBLY AND DIVERSION STRUCTURE	DATE 01/25/02	SCALE N.T.S.
		DRAWN Ardy / TOTAL SOLUTION	SHEET 1
		APPROV.	

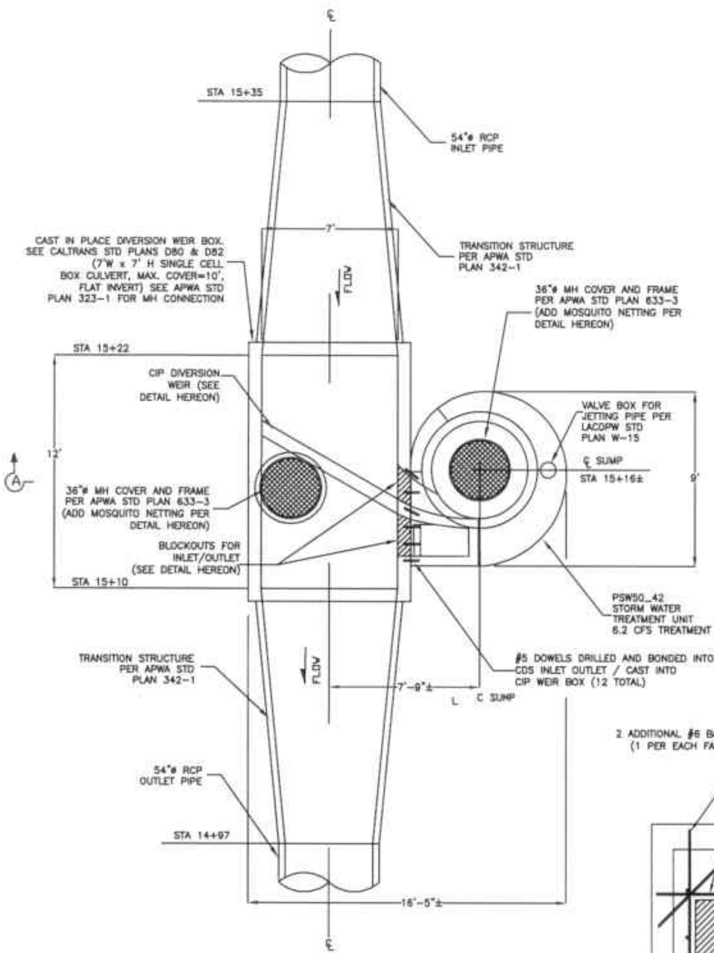


CDS™ TECHNOLOGIES
PATENTED

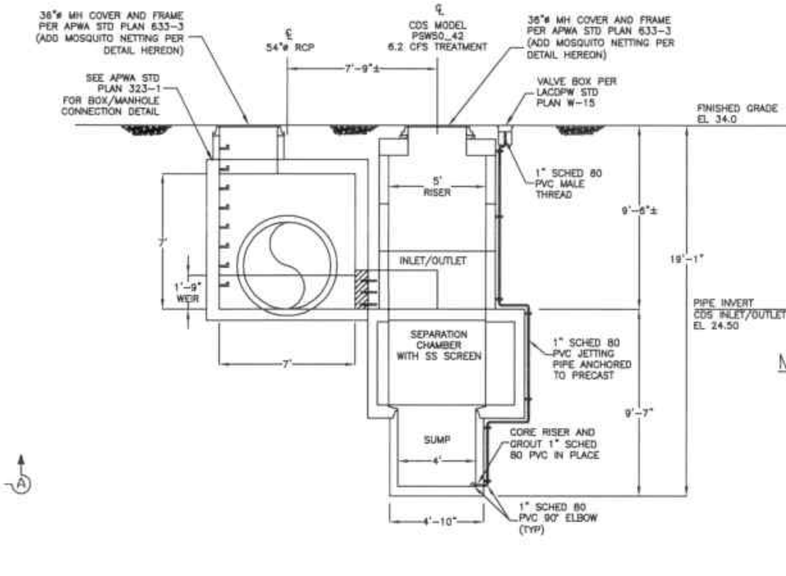
CDS MODEL PSWC56_53
ASSEMBLY DETAIL

DATE	10/13/00	SCALE	N.T.S.
DRAWN	J.S.F.	SHEET	1
APPROV.			

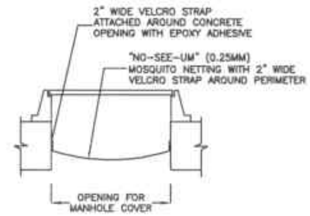
SECTION 3
PSW50_42 DRAWING



LINE "C" PLAN



SECTION A-A

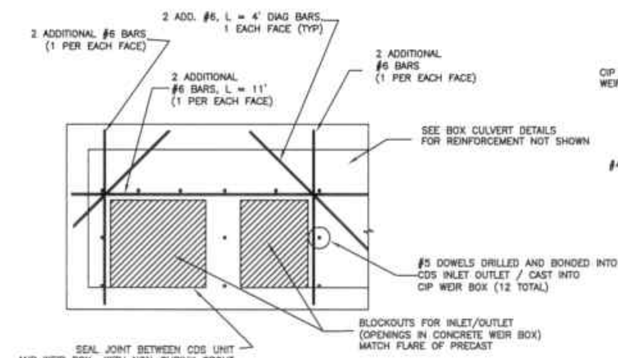


MOSQUITO NETTING DETAIL

(NO SCALE)

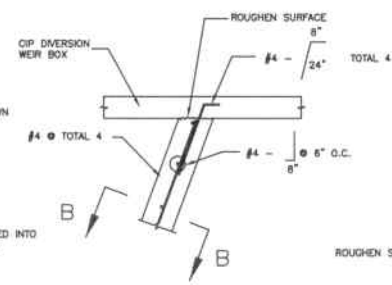
GENERAL NOTES:

1. ALL PRECAST MANHOLE COMPONENTS SHALL CONFORM TO ASTM C-478.
2. VECTOR NETTING SHALL BE ADDED PER DETAIL.
3. OIL SORBENTS SHALL BE ADDED TO THE CDS UNIT AS REQUIRED BY LACDPW.



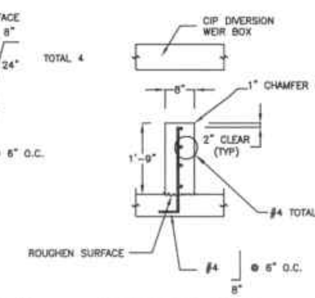
BLOCKOUT DETAIL

(NO SCALE)



DIVERSION WEIR DETAIL

(NO SCALE)



SECTION B-B

(NO SCALE)

REV	DESCRIPTION	DATE	APPR	REFERENCE INFORMATION AND NOTES

DATE	CDS TECHNOLOGIES, INC.		TITLE	SCALE
8/24/06			DOUGLAS PARK STORM DRAIN LINE "C" CDS MODEL PSW50_42 INSTALLATION LONG BEACH, CA	NTS
DRAWN: GPW	CHECKED	APPROVAL		SHEET: 1

SECTION 4
PSW50_42 MATERIAL / PRODUCT SPECIFICATIONS

Product Specifications
PRECAST - PSW "OFFLINE"
Continuous Deflective Separation Unit

(Note: The following specifications are applicable for the ~~PSW30_30~~, PSW50_42~~, PSW50_50 & PSW70_70~~ units.)

The Contractor shall install a precast continuous deflective separator (CDS®) unit in accordance with the notes and details shown on the Drawings and in conformance with these Specifications. The precast CDS® unit shall be a storm water filtration treatment unit as manufactured by CDS Technologies, Inc., 16360 South Monterey Road, Suite 250, Morgan Hill, CA 95037. CDS Technologies® may be reached by telephone (888) 535-7559.

Storm Water Filtration Treatment Unit Design
Hydraulic Treatment Capacity and Separation Screen Design:

Minimum Treatment Flow Capacity: The CDS® unit shall have a minimum treatment flow capacity as follows:

Precast Model Number	Flow Capacity	
	Cubic Feet per Second (cfs)	Gallons per Minute (gpm)
~~PSW30_30~~	~~3~~	~~1,344~~
PSW50_42	9	4,032
~~PSW50_50~~	~~11~~	~~4,928~~
~~PSW70_70~~	~~26~~	~~11,648~~

Storm Water Filtration Treatment Unit Structure and Design:
If required, the structure shall be designed to withstand H20 traffic and earth loadings to be experienced during the life of the installation. The materials and structural design of the stormwater filtration treatment unit shall be per ASTM C857 "Recommended Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures" and ASTM C858 "Specification for Underground Precast Utility Structures".

The CDS® unit shall be furnished with sump as shown on the drawings for the storage of sediments, organic solids, and other settable trash and debris. CDS® models shall be furnished with a sump that has a minimum volume of cubic yards for storage of sediments, organic solids, and other settable trash and debris as follows:

CDS TECHNOLOGIES

Precast Model Number	Minimum Storage Volume (cubic yards)
~~PSW30_30~~	~~1.4~~
PSW50_42	1.9
~~PSW50_50~~	~~1.9~~
~~PSW70_70~~	~~3.9~~

Oil and Grease Removal

Unless otherwise specified all PSW units will be equipped with a conventional oil baffle to capture and retain oil and grease and Total Petroleum Hydrocarbons (TPH) pollutants as they are transported through the storm drain system during dry weather (gross spills) and wet weather flows. The conventional oil baffle within a unit assures satisfactory oil and grease removal from typical urban storm water runoff. Additionally, the storm water filtration unit shall have the following gross oil storage capacities:

Precast Model Number	MINIMUM OIL STORAGE CAPACITY WITH BAFFLE (GALLONS)
~~PSW30_30~~	~~115~~
PSW50_42	359
~~PSW50_50~~	~~408~~
~~PSW70_70~~	~~1,030~~

The CDS® PSW water filtration treatment units shall also be capable of receiving and retaining the addition of Oil Sorbents within their separation chambers. The addition of the oil sorbents can ensure the permanent removal of 80% to 90% of the free oil and grease from the storm water runoff. The addition of sorbents enables increased oil and grease capture efficiencies beyond that obtainable by conventional oil baffle systems. Sorbent material shall be added in accordance with the **"USE OF OIL SORBENTS"** specifications provided by CDS Technologies.

Materials Design for CDS® Unit Manufacture

Concrete:

Storm water filtration treatment units shall be manufactured from concrete and have a 28 day compressive strength of not less than 5,000 pounds per square inch (psi), using either Type I or Type 3 portland cement. Aggregates shall conform to ASTM Designation C33, except the requirement for gradation shall not apply.

Reinforcement shall consist of wire conforming to ASTM Designation A82 or ASTM Designation A496 or wire fabric conforming to ASTM A185 or A497 or of deformed bars of Grade 60 steel conforming to ASTM Designation A615.

The sump and access riser for the unit may be manufactured from storm drain pipes conforming to ASTM Designation C76 Class III Reinforced Concrete Pipe.

Hardware:

The separation screen shall be fabricated from stainless steel conforming to AISI Designation A316L. Support structure shall be fabricated from stainless steel conforming to AISI Designation A316. Fasteners used to install the support structure and screen shall be AISI 316 stainless steel.

Ultra high molecular weight (UHMW) or High Density Poly (HDPE) blocks may be fastened to the support structure and embedded into the concrete structure to facilitate screen installation.

The access cover for the unit shall be designed to withstand H20 traffic loading and manufactured from cast iron, materials conforming to ASTM A-48-30.

SECTION 5
PSW50_42 INSTALLATION SPECIFICATIONS

CDS MODEL PSW50_42

INSTALLATION SPECIFICATIONS

General

The precast components of the stormwater filtration treatment unit shall be delivered to the project site via a flatbed transport. The unit shall be delivered to the project site with the screen installed. The Contractor shall provide equipment at the site that has adequate capacity to unload the precast components. **The heaviest component (separation chamber) of the model PSW50_42 weighs 20,000 pounds.** It will be delivered with four "lifting eye" pick points. The Contractor shall provide the lifting harness used for lifting the separation chamber. This lifting harness assembly shall provide cabling for the four pick points, with each leg of cable being at least 16 feet long.

The installation sequence requires the precast sump to be installed and backfilled, followed by the precast separation chamber, precast inlet/outlet riser and precast access riser (optional). After setting the precast components, backfill is placed to the bottom of the diversion weir box. The diversion weir box and weir shall be constructed as cast-in-place structures.

Establish Control

Pothole to locate existing utilities and the drainage pipe in both horizontal and vertical planes. The vertical control for the installation is based on the existing pipe invert at the outlet of the CDS unit. **The top of the precast separation chamber must be set at the invert of the pipe**.

Excavation, Dewatering and Shoring

The Contractor shall excavate, and if necessary, dewater and shore in conformance with the project specifications. The excavation shall be sized to accommodate the precast concrete components.

Subgrade Preparation

Subgrade shall be established as shown on the Drawings. The subgrade material shall have a bearing capacity of 2,000 pounds per square foot (psf). Place not less than 6-inches of crushed ¾" minus baserock that is compacted to 95% relative compaction below the bottom of the sump. A two-sack sand cement slurry may be placed in lieu of the base rock. Upon completion of placing the baserock or slurry, ensure that it is level within 1/2 inch across the pad that the sump will rest on, and at proper grade.

Sump Installation

The sump shall be set on the compacted base, elevation confirmed, plumbed and aligned to ensure that the balance of the unit will be properly aligned and situated as installation of the precast unit proceed. The backfill material around the sump shall be placed and compacted in accordance with the backfill provisions of the standard specifications. BACKFILL EQUALLY ON ALL SIDES IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

Backfill shall be carried to ½ inch above the seating ring of the sump joint and leveled to ensure bearing of the separation chamber on the backfill NOT on the precast sump ring.

Separation Chamber Installation

Prior to setting the separation chamber, the Contractor shall place two layers of ¾ inch X 1½ inch mastic rope on the sump-seating ring. The mastic rope will be delivered with the CDS® unit. The mastic rope layers shall be applied such that the mastic will be ¾ inches X 3 inches, with the butting ends of each layer ring of mastic being offset and overlapped to ensure a watertight seal.

The separation chamber shall be placed on top of the sump and backfill, exercising care to ensure that the mastic rope is not unseated to ensure a watertight seal between the sump and separation chamber.

The separation chamber shall be set with the proper orientation to the storm drain to ensure correct alignment of the inlet/outlet unit to follow.

Inlet/Outlet Installation

Prior to placement of the inlet/outlet section, the Contractor shall place two layers of mastic rope on top of the separation chamber, locating the mastic ropes to ensure the bottom inlet/outlet section seats on top of it. The mastic will be placed such that it is ¾ inches high X 3 inches wide and bonds to the concrete surfaces as it is compressed under the weight of the inlet/outlet section.

The inlet/outlet section shall be placed to its proper orientation.

At this point, the Contractor may elect to backfill in accordance with the specifications to the subgrade of the weir box, or the Contractor may elect to continue stacking access riser sections as the Contractor deems appropriate. BACKFILL EQUALLY ON ALL SIDES IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

If shown on the plans, a cast in place concrete collar shall be constructed on the top of the separation chamber.

Access Riser(s) Installation

Prior to installation of the required riser section(s), place mastic sealant such that it is all joints to ensure a watertight seal.

Grout Precast Joints

All joints between precast components shall be grouted in accordance with the specifications. **Joints shall be watertight**.

The above installation sequence completes the installation of the separation unit. The weir box can be constructed at this point to facilitate the connection of the storm drain to the separation unit.

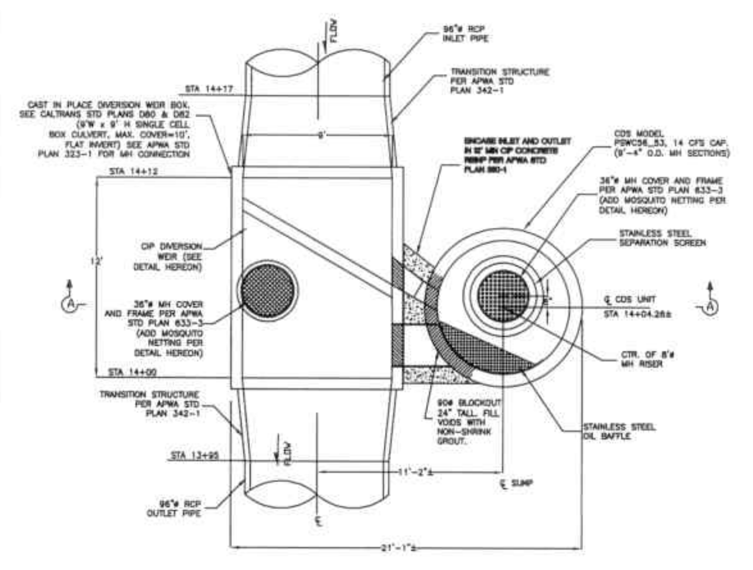
Weir Box Installation

A portion of the storm drainpipe shall be removed as shown on the drawings. The Contractor shall construct the weir box as a cast-in-place structure to the nominal dimensions shown on the drawings. The weir box shall be constructed on subgrade that has been graded to ensure proper vertical and horizontal alignment of the box relative to the storm drain invert and separation inlet/outlet. **The Contractor shall place dowels in the inlet/outlet structure as shown on the plans**. Formwork for the weir box shall ensure that the dowels and box reinforcing steel structurally connect the weir box to the inlet/outlet riser as shown in the drawings. The storm drain piping shall be extended into the formed end walls and encased in concrete.

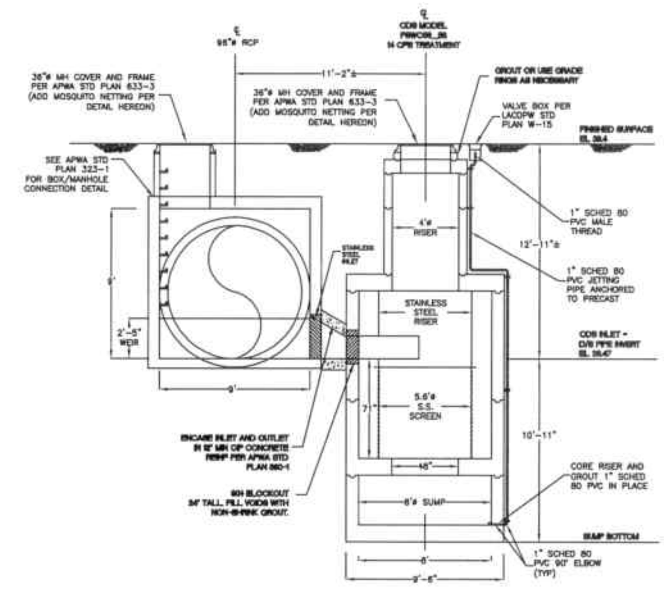
Backfill

On completion of the weir box including the inspection/maintenance access into the weir box and completion of the separation chamber access riser shaft, the excavation shall be backfilled in accordance with the standard specifications. BACKFILL EQUALLY ON ALL SIDES IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

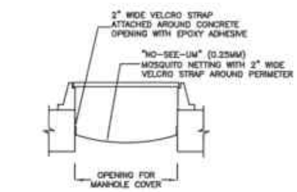
SECTION 6
PSWC56_53 DRAWINGS



LINE "4" PLAN



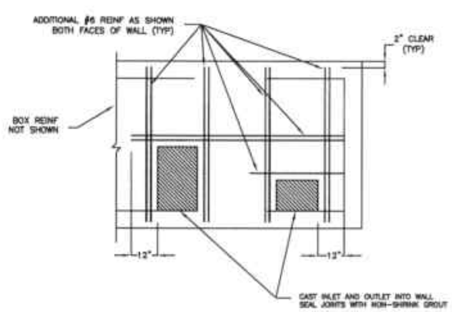
SECTION A–A



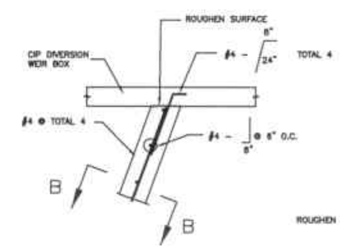
MOSQUITO NETTING DETAIL
(NO SCALE)

GENERAL NOTES:

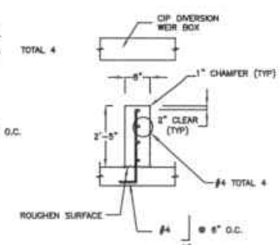
1. ALL PRECAST MANHOLE COMPONENTS SHALL CONFORM TO ASTM C-478.
2. VECTOR NETTING SHALL BE ADDED PER DETAIL.
3. OIL SORBENTS SHALL BE ADDED TO THE CDS UNIT AS REQUIRED BY LACDPW.



BLOCKOUT DETAIL
(NO SCALE)



DIVERSION WEIR DETAIL
(NO SCALE)



SECTION B–B
(NO SCALE)

REV	DESCRIPTION	DATE	APPR	REFERENCE INFORMATION AND NOTES	DATE 8/24/06	CDS TECHNOLOGIES, INC.	TITLE	SCALE 1"=3.5'
					DRAWN GPV	CHECKED / APPROVAL	DOUGLAS PARK STORM DRAIN LINE "4" CDS MODEL PSWC56_53 LONG BEACH, CA	SHEET 1

SECTION 7
PSWC56_53 MATERIAL / PRODUCT SPECIFICATIONS

Product Specifications

PRECAST - PSWC "OFFLINE"

Continuous Deflective Separation Unit

(Note: The following specifications are applicable for the ~~PSWC30_30, PSWC40_30, PSWC40_40, PSWC56_40,~~ PSWC56_53, ~~PSWC56_68 & PSWC56_78~~ units.)

The Contractor shall install a precast continuous deflective separator (CDS®) unit in accordance with the notes and details shown on the Drawings and in conformance with these Specifications. The precast CDS® unit shall be a storm water filtration treatment unit as manufactured by CDS Technologies, Inc., 16360 Monterey Road, Suite 250, Morgan Hill, CA 95037. CDS Technologies® may be reached by telephone (888) 535-7559.

Storm Water Filtration Treatment Unit Design
<u>Hydraulic Treatment Capacity and Separation Screen Design:</u>

Minimum Treatment Flow Capacity: The CDS® unit shall have a minimum treatment flow capacity as follows:

Precast Model Number	Flow Capacity	
	Cubic Feet Per Second (cfs)	Gallons Per Minute (gpm)
~~PSWC40_30~~	~~4.5~~	~~2,020~~
~~PSWC40_40~~	~~6~~	~~2,688~~
~~PSWC56_40~~	~~9~~	~~4,035~~
PSWC56_53	14	6,272
~~PSWC56_68~~	~~19~~	~~8,512~~
~~PSWC56_78~~	~~25~~	~~11,220~~

<u>Storm Water Filtration Treatment Unit Structure and Design:</u>
If required, the structure shall be designed to withstand H20 traffic and earth loadings to be experienced during the life of the installation. The materials and structural design of the stormwater filtration treatment unit shall be per ASTM C857 "Recommended Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures" and ASTM C858 "Specification for Underground Precast Utility Structures".

The CDS® unit shall be furnished with sump as shown on the drawings for the storage of sediments, organic solids, and other settable trash and debris. CDS® models shall be furnished with a sump that has a minimum volume of cubic yards for storage of sediments, organic solids, and other settleable trash and debris as follows:

CDS TECHNOLOGIES

PSWC "Offline" Product Specifications

Precast Model Number	Minimum Volume (Cubic Yards)
~~PSWC40_30~~	~~1.9~~
~~PSWC40_40~~	~~1.9~~
~~PSWC56_40~~	~~5.6~~
PSWC56_53	5.6
~~PSWC56_68~~	~~5.6~~
~~PSWC56_78~~	~~5.6~~

Oil and Grease Removal

Unless otherwise specified all PSWC units will be equipped with a conventional oil baffle to capture and retain oil and grease and Total Petroleum Hydrocarbons (TPH) pollutants as they are transported through the storm drain system during dry weather (gross spills) and wet weather flows. The conventional oil baffle within a unit assures satisfactory oil and grease removal from typical urban storm water runoff. Additionally, the storm water filtration unit shall have the following gross oil storage capacities:

Precast Model Number	MINIMUM OIL STORAGE CAPACITY WITH BAFFLE (GALLONS)
~~PSWC40_30~~	~~406~~
~~PSWC40_40~~	~~482~~
~~PSWC56_40~~	~~568~~
PSWC56_53	723
~~PSWC56_68~~	~~900~~
~~PSWC56_78~~	~~1,020~~

The CDS® PSWC water filtration treatment units shall also be capable of receiving and retaining the addition of Oil Sorbents within their separation chambers. The addition of the oil sorbents can ensure the permanent removal of 80% to 90% of the free oil and grease from the storm water runoff. The addition of sorbents enables increased oil and grease capture efficiencies beyond that obtainable by conventional oil baffle systems. Sorbent material shall be added in accordance with the **"USE OF OIL SORBENTS"** specifications provided by CDS Technologies.

Materials Design for CDS® Unit Manufacture

Concrete:

Storm water filtration treatment units shall be structurally designed and manufactured from materials per ASTM C478 – 88a "Standard Specification for Precast Reinforced Concrete Manhole Sections". Concrete shall adhere to ASTM specifications C33, C39, andC150.

Reinforcement shall consist of wire conforming to ASTM Designation A82 or ASTM Designation A496 or wire fabric conforming to ASTM A185 or A497 or of deformed bars of Grade 60 steel conforming to ASTM Designation A615.

Hardware:

The separation screen, inlet, outlet, and oil baffle shall be fabricated from stainless steel conforming to AISI Designation A316L. Support structure shall be fabricated from stainless steel conforming to AISI Designation A316. Fasteners used to install the support structure and screen shall be AISI 316 stainless steel.

The access cover for the unit shall be designed to withstand H20 traffic loading and manufactured from cast iron, materials conforming to ASTM A-48-30.

SECTION 8
PSWC56_53 INSTALLATION SPECIFICATIONS

CDS MODEL PSWC56_53 STORM WATER TREATMENT UNIT INSTALLATION SPECIFICATIONS

Small Tools Recommended For A Successful Installation

- Builders Level and Rod
- Combination rotary drill and hammer drill
- 3/8" diameter masonry bit that will drill a hole at least 3" deep
- Hammer
- 9/16" deep socket ratchet drive for tightening nuts on 3/8" concrete anchors
- 3/4" wrench and 3/4" socket for tightening the 1/2" diameter bolts and nuts used to connect the screen to the stainless steel riser
- 3/4" mastic to fill gaps that may exist between the stainless steel flanges and the concrete wall (~ 10')
- Small generator (1500 watt)
- 50' extension cord with splitter to operate both drills simultaneously
- A rotary saw with a wood cutting and masonry cutting blade
- Two boards long enough to hold the oil baffle to the correct height while it is fastened to the manhole wall with the concrete anchors
- **ALL REQUIRED FASTENERS WILL BE DELIVERED WITH THE CDS SEPARATION SCREEN**

General Finishing Requirements

The precast components are delivered with lifting points cast into the various pieces. Where cavities were created for lifting, said cavities shall be mortar packed and finished to conform to the surface that would have otherwise existed had not the lifting point been cast. Where rebar or fabricated cable loops have been used to provide for lifting, those that project above the normal finish surface shall be cut flush with the normal finished surface.

All work throughout the installation shall be done to a professional standard normally expected for the class of work being performed. **The PSWC unit shall be installed using Butyl Mastic and non-shrink grout to seal joints of the precast manhole structure to ensure that unit is water tight, holding water up to the flow line invert of the inlet and outlet pipes.**

Product Installation

The Contractor shall install the storm water pollution control device and construct the diversion weir box, diversion weir and frames and covers in accordance with the general following guidelines.

Contractor may elect to remove the storm drain to the extent necessary to accommodate the new diversion weir box, or may elect to do it later in the construction sequence.

Excavation shall be carried out as required to accommodate the equipment. Contractor shall provide shoring as required to ensure a stable excavation. The depth of excavation to the bottom of the precast structure for the installation of the storm water treatment unit is as follows:

CDS Model No.:	Depth below Pipeline Invert:
PSWC56_53	10'-11"± below pipeline invert

Sump Base Slab Installation

The subgrade material shall be composed to withstand a design loading of 2,000 pounds per square foot (psf). It is recommended that the hole be over-excavated by a minimum of 6" and backfilled with aggregate base and compacted to 90% to make subgrade.

The sump base slab shall be placed on the compacted base, elevation confirmed, plumbed and aligned to ensure that the remaining precast components will be properly situated as assembly proceeds.

Sump Riser Installation

Prior to setting the sump riser section, Contractor shall place a layer of 3/4 inch X 3 inch mastic rope (delivered with the CDS Unit) on top of the tongue of the base slab joint. A two or three-foot barrel-section as indicated on the Drawings shall be placed on top of the base slab exercising care to ensure that the mastic sealant is not unseated. The goal is to ensure a watertight seal between the sump riser and base slab.

Separation Slab Installation

Prior to placement of the separation slab, the Contractor shall place a layer of mastic rope on the tongue joint of the sump riser in the manner described previously. The separation slab shall be set with the proper orientation to the storm drain to ensure correct alignment of the separation screen and inlet. Note: The correct vertical distance between the top of the separation slab and pipe invert must exist in order to ensure proper installation of the separation screen, inlet, and outlet. The Contractor may wish to "dry stack" the sump and separation slab first to determine any discrepancy between the actual height of these two components and the nominal height as indicated on the drawings. **The proper distance from the outlet pipe to the top separation slab for the PSWC56_53 is 71".**

IMPORTANT: THE SEPARATION SUMP SLAB MUST BE ORIENTED TO ENSURE THAT THE CENTERPOINT OF THE OPENING HAS AN OFFSET DISTANCE OF EIGHT (8) INCHES UPSTREAM FROM THE CENTER OF THE SLAB.

Riser Installation

The 96" inch ID manhole shafting shall be stacked up to the section with the 90-degree blockout. **The flat top slab shall not be set until the stainless steel oil baffle, inlet/outlet, riser and screen have been installed.**

Stainless Steel Oil Baffle, Inlet/Outlet, Riser, and Screen Installation

Outside of the manhole, the stainless steel riser shall be attached to the screen using the supplied ½" diameter bolts. This PSWC unit is specified as a **"LEFT-HAND"** orientation, place the screen so that the **RED FLANGE IS UP**. The screen/cylinder assembly shall be lowered into the manhole. The inlet shall be placed through the 90-degree blockout in the manhole riser and bolted to the cylinder. At this point, the Contractor shall connect the stainless steel outlet to the precast manhole section at the

90-degree block-out section using stainless steel expansion anchors. Any remaining voids in the riser blockout around the inlet and outlet shall be filled with brick or concrete and non-shrink grout. Next, the stainless steel oil baffle should be installed. Prior to fastening the baffle to the riser wall, the stainless steel inlet, screen assembly, and riser shall be pre-positioned to determine the correct location of the oil baffle. The oil baffle shall be placed above 45" above the separation slab and fastened to the manhole riser wall using the supplied stainless steel expansion anchors. It is recommended that the contractor use two by fours cut to a length of 45" to hold the oil baffle at the correct height above the separation slab while fastening the oil baffle to the wall. Once the oil baffle is installed, the Contractor shall fasten the bottom of the screen to the separation slab by placing stainless steel expansion anchors through each of the tab ears that protrude from the bottom of the screen.

Diversion Box Construction

The Contractor may elect to backfill and remove shoring around the precast stack at this point before proceeding with additional structure placement. Backfill shall be placed and compacted in conformance with the project specifications. Backfill shall be carried to the outside invert of the diversion structure.

The Contractor shall hold both the stainless steel inlet and outlet to proper grade. The Contractor shall construct the cast-in place diversion structure (modified reinforced concrete box culvert) in accordance with the details shown on the project plans. The stainless steel inlet and outlet of the CDS unit shall be cast into the sidewall of the diversion structure.

A 12" minimum thickness concrete collar shall be cast around the stainless steel inlet and outlet, reinforced per APWA standard plan 380-2.

After completion of the diversion structure, the necessary access riser sections and manhole covers and frames shall be installed over the diversion structure and CDS unit to match final grade. All joints between precast concrete sections shall be filled with non-shrink grout to ensure a watertight seal. The Contractor shall complete backfilling the excavation and pavement replacement in conformance with the plans and specifications.

Appendix E

CDS calculation sheets dated 8/2/06 and 8/14/06

DOUGLAS PARK
LINE "C"
LONG BEACH, CA
AUGUST 2, 2006

PROJECT PARAMETERS			
CDS Model	PSW50_42		
Q treat	6.2	cfs	
Q system	69.2	cfs	Total Flow in Storm Drain
H cds	0.84	ft	Required Head Difference to Process Q treat
D/S Pipe Size	4.5	ft	
D/S Pipe Slope	0.0017	ft/ft	
U/S Pipe Size	4.5	ft	
U/S Pipe Slope	0.0017	ft/ft	

WEIR HEIGHT CALCULATION SUMMARY WEIR HEIGHT = Y d/s (@ Qtreat) + H cds			
Y d/s Case 1	0.65	ft	Critical Depth in CDS Outlet
Y d/s Case 2A	0.80	ft	Critical Depth in d/s Pipe + Hcont (supercritical flows)
Y d/s Case 2B	0.90	ft	Normal Depth in d/s Pipe + Hcont (subcritical flows)
Y d/s Case 3	N/A	ft	Yd/s from Receiving Water Level
Controlling Y d/s	0.90	ft	
Calculated Weir Height	1.74	ft	Controlling Y d/s + H cds
Use Weir Height	1'-9"		

HYDRAULIC IMPACT OF CDS WEIR BOX AT SYSTEM FLOW				
SD Station D/S of CDS		15+10		
1	Pipe Invert El d/s of CDS	24.50		
2	Finished Grade El @ CDS	34.20		
3	EGL El d/s of Weir Box	31.26		
	HGL El d/s of Weir Box	30.97		From Plans
Weir Box Height		7	ft	
Weir Box Width		7	ft	
4	Hcont	0.09	ft	Contraction Loss from Weir Box to d/s Pipe
5	EGL El d/s of Weir	31.36		
	HGL El d/s of Weir	31.32		
6	Hweir	0.12	ft	Loss Created by Flow Over Weir
7	EGL El u/s of Weir	31.47		
	HGL El u/s of Weir	31.44		
8	Hexp	0.13	ft	Expansion Loss from u/s Pipe to Weir Box
9	EGL u/s of Weir Box	31.60		
	HGL El u/s of Weir Box	31.31		
SD Station U/S of CDS		15+22		
Increase in HGL		**0.34**	**ft**	
Freeboard U/S of CDS Unit		2.89	ft	

UPSTREAM CONVEYANCE SYSTEM CHECK AT SYSTEM FLOW			
Length to 1ST U/S Manhole/CB	25.42	ft	
Rim Elevation at 1ST U/S Manhole/CB	33.8		
Friction Loss to 1ST U/S Manhole/CB	0.03	ft	
HGL El at 1ST U/S Manhole/CB	31.34		
Freeboard at 1ST U/S Manhole/CB	2.46	ft	NO FLOODING OCCURS AT 1ST U/S MANHOLE/CB

Loss of Head Due to Contractions

For Higher Velocities with H > 1.0 foot: $Hcont = (1/c - 1)^2 * [v^2/2g]$ $c = 0.582 + 0.0418/(1.1 - r)$
r = ratio of pipe diameters

For Lower Velocities with H < 1.0 foot: $Hcont = 0.7*(v1 - v2)^2 / 2g$

Loss of Head Due to Weir

For Weir (free discharge): $Hweir = [Q / cL]^{2/3}$ $c = 3.08$

For Submerged Weir: $Hweir = Hu/s - Hd/s$
$Hu/s = [Q / Ks * cL]^{2/3}$ $c = 3.08$
$Ks = [1 - (Hd/s / Hu/s)^{1.5}]^{0.385}$

For Weir/Orifice (pressure): $Hweir = [Q / c\,Aor]^2 / 2g$ $c = 0.6$

Loss of Head Due to Expansion/Enlargement:

For All Situations: $Hexp = 1.098 [(v1 - v2)^{1.919}] / 2g$

DOUGLAS PARK
LINE "4"
LONG BEACH, CA
AUGUST 14, 2006

PROJECT PARAMETERS			
CDS Model	PSWC56_53		
Q treat	11.9	cfs	
Q system	139.2	cfs	Total Flow in Storm Drain
H cds	1.22	ft	Required Head Difference to Process Q treat
D/S Pipe Size	8.0	ft	
D/S Pipe Slope	0.0010	ft/ft	
U/S Pipe Size	8.0	ft	
U/S Pipe Slope	0.0010	ft/ft	

WEIR HEIGHT CALCULATION SUMMARY WEIR HEIGHT = Y d/s (@ Qtreat) + H cds			
Y d/s Case 1	0.89	ft	Critical Depth in CDS Outlet
Y d/s Case 2A	N/A	ft	Critical Depth in d/s Pipe + Hcont (supercritical flows)
Y d/s Case 2B	1.16	ft	Normal Depth in d/s Pipe + Hcont (subcritical flows)
Y d/s Case 3	N/A	ft	Yd/s from Receiving Water Level
Controlling Y d/s	1.16	ft	
Calculated Weir Height	2.38	ft	Controlling Y d/s + H cds
Use Weir Height	2'-5"		

HYDRAULIC IMPACT OF CDS WEIR BOX AT SYSTEM FLOW				
SD Station D/S of CDS		14+00		
1	Pipe Invert El d/s of CDS	26.47		
2	Finished Grade El @ CDS	44.80		
3	EGL El d/s of Weir Box	37.21		
	HGL El d/s of Weir Box	37.09		From Plans
Weir Box Height		9	ft	
Weir Box Width		9	ft	
4	Hcont	0.01	ft	Contraction Loss from Weir Box to d/s Pipe
5	EGL El d/s of Weir	37.22		
	HGL El d/s of Weir	37.18		
6	Hweir	0.24	ft	Loss Created by Flow Through Orifice Over Weir
7	EGL El u/s of Weir	37.46		
	HGL El u/s of Weir	37.41		
8	Hexp	0.02	ft	Expansion Loss from u/s Pipe to Weir Box
9	EGL u/s of Weir Box	37.48		
	HGL El u/s of Weir Box	37.36		
SD Station U/S of CDS		14+12		
Increase in HGL		**0.27**	**ft**	
Freeboard U/S of CDS Unit		7.44	ft	

UPSTREAM CONVEYANCE SYSTEM CHECK AT SYSTEM FLOW			
Length to 1ST U/S Manhole/CB	82.00	ft	
Rim Elevation at 1ST U/S Manhole/CB	44.4		
Friction Loss to 1ST U/S Manhole/CB	0.02	ft	
HGL El at 1ST U/S Manhole/CB	37.38		
Freeboard at 1ST U/S Manhole/CB	7.02	ft	NO FLOODING OCCURS AT 1ST U/S MANHOLE/CB

Loss of Head Due to Contractions

For Higher Velocities with H > 1.0 foot: $Hcont = (1/c - 1)^2 * [v^2/2g]$ $c = 0.582 + 0.0418/(1.1 - r)$
r = ratio of pipe diameters

For Lower Velocities with H < 1.0 foot: $Hcont = 0.7*(v1 - v2)^2 / 2g$

Loss of Head Due to Weir

For Weir (free discharge): $Hweir = [Q / cL]^{2/3}$ $c = 3.08$

For Submerged Weir: $Hweir = Hu/s - Hd/s$

$Hu/s = [Q / Ks * cL]^{2/3}$ $c = 3.08$

$Ks = [1 - (Hd/s / Hu/s)^{1.5}]^{0.385}$

For Weir/Orifice (pressure): $Hweir = [Q / c\,Aor]^2 / 2g$ $c = 0.6$

Loss of Head Due to Expansion/Enlargement:

For All Situations: $Hexp = 1.098 [(v1 - v2)^{1.919}] / 2g$