D & D ENGINEERING, INC.

THE PARK @ LIVE OAK
LOW IMPACT DEVELOPMENT (LID)

May 23, 2018

D & D Engineering, Inc.
8901 S. La Cienega Blvd.
Inglewood, CA 90301
424-351-6800

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I. Introduction

The purpose of this report is to outline and describe the proposed Low Impact Development (LID) strategies and Best Management Practices (BMPs) necessary to adequately reduce the hydrological and environmental impact of developing the proposed project, The Park @ Live Oak, to comply with the requirements of LID Ordinance and LID Standard Manual. Additionally, this report will determine the storm water quality design volume (SWQDv) calculated from the 85^{th} percentile, 24-hour rain event that is required to be treated. Finally, this report will also discuss the methodology used to arrive at these conclusions, the infrastructure necessary to support it and the operations and maintenance procedures required to maintain the system effective over time.

II. Project Description

The Park @ Live Oak project consist of a 78.32-acre site in the western portion of the City of Irwindale. The project site is surrounded by the I-605 interstate to the east, Arrow Highway to the north, and Live Oak Avenue to the south. Refer to the project site map, *Figure 1 — Vicinity Map,* for project site location.

The Park @ Live Oak Project is a mixed-use project that includes industrial/business park and commercial land use. The project consists of 1,451,400 square feet of industrial/business buildings space, 98,600 square feet of commercial buildings space and substantial amounts of surface parking. Refer to the project site plan, *Figure 2 — Site Plan,* for a conceptual project site plan.

a. Existing Conditions

The existing site is a former sand and gravel quarry and contains several large excavations, or borrow pits, as well as corresponding graded mounds. Generally, site topography slopes from the north-east portion of the site by Arrow Highway and the I-605 to the south-west corner adjacent to the intersection of Arrow Highway and Live Oak Avenue. Due to the nature of the site's previous use as a quarry and its current ongoing fill operations, the site has no groundcover and is composed almost entirely of native or compacted soil. Refer to the project aerial survey, *Figure 3 — Aerial Survey,* for existing conditions.

Preliminary geotechnical investigations, as well as field observations during rain events, indicate that the native soils possess remarkable percolation rates allowing for the infiltration of the majority of storm water and little to no generation of runoff from the site. The storm water runoff that is generated by the site is discharge into public streets where it flows to the existing storm drain system.

b. Proposed Conditions

The proposed project seeks to develop the site into a mixed-use industrial/commercial development. The project includes the construction of four large industrial buildings across most of the site surrounding two smaller commercial developments at the northeastern and southwestern corners of the site. Due to this, a significant portion of the site will require paving and the addition of hardscape. It is estimated that approximately 85% of the project site will be covered by impervious surfaces. Additionally, the current excavations within the site will be backfilled and compacted, reducing the natural percolation of backfilled areas to a negligible amount.

This increase in impervious surfaces, coupled with the compaction of native soils is expected to significantly increase the amount of generated stormwater runoff. However, due to the nature of undisturbed native soils, infiltration systems remain feasible.

III. Low Impact Development (LID) Stormwater Quality Control Measures

The Low Impact Development (LID) plan is intended to mitigate the hydrological and environmental stresses imposed on the site due to its proposed development. As the site's development typically increases impervious level, so does the stormwater runoff volume and the amount of environmental pollutant it produces. The goal of the LID plan is to mitigate these factors by both reducing the volume of stormwater and potential pollutants in stormwater runoff to the most reasonable extent possible. This strategy may be accomplished by implementing a variety of Best Management Practices (BMPs) stormwater quality control measures designed to handle the frequent, smaller storm event, or the initial volume of stormwater run-off from a larger storm event (referred as first flush). This study will focus on and follow the procedures for selecting and implementing stormwater quality measures, as recommended in the Los Angeles County Department of Public Works (LACDPW) Low Impact Development Standards Manual.

a. Los Angeles County Design Guidelines

The focus of the design criteria for stormwater control measures is the construction and implementation of stormwater quality control measures that meet stormwater runoff requirements in terms of on-site retention and pollutant removal. The project must design and implement stormwater quality control measures that can handle the SWQDv. Any surplus storm run-off must be diverted around the stormwater quality control measures to prevent overloading. The Los Angeles County Department of Public Works Low Impact Development Standards Manual categorized stormwater control quality measures into the following types listed in level of priority:

1. Retention based BMPs (bioretention, infiltration basin, drywells, capture and reuse cisterns, green roof)
2. Biofiltration BMPs (biofiltration)
3. Vegetation-based BMPs (stormwater planters, vegetated swales, tree-well filter, etc.)
4. Treatment-based BMPs (Extended detention basin, constructed wetlands, wet pond, sand filters, proprietary devices)

Systems in a lower priority level may only be used if higher priority measures are deemed to be technically infeasible as set forth in the county's standards manual. Due to the properties of the native soils and the tendency to percolate well, this study will focus on retention-based BMPs.

b. Proposed Low Impact Development (LID) System

The proposed Low Impact Development (LID) system will take advantage of the native soils percolation rates to infiltrate the SWQDv from the 85th percentile, 24-hour storm. This will be accomplished through the detention basins currently proposed as part of the site hydrology study and flood control measures. These basins will be designed to accommodate the required portion of the 50-yr design storm that needs to be detained on site. Since these basins will more than likely be constructed within the limits of fill areas, it is assumed that they will not be able to infiltrate captured stormwater and will instead detain and release stormwater peak run-off. The proposed LID system for this site will take advantage of these detention systems by either placing drywells throughout the basin footprints outside the fill area limits or allowing detained stormwater to be infiltrated into the native soils below compacted fill.

The proposed drywells are designed with self-contained pre-treatment systems meant to prolong their lifetime and ensure their long-term functionality. The drywells are to be designed and constructed by Torrent Resources or an equivalent manufacturer. Refer to site specific Torrent Resources drywell details and specifications, *Figures 4 – Site Specific Drywell Details*, for drywell configurations at their given locations. Sizing and capacity analysis of the proposed drywell systems will be calculated by following the design guidelines defined within the Los Angeles County Department of Public Works Low Impact Development Standards Manual[1] for dry wells.

[1] (County of Los Angeles Department of Public Works, 2014)

IV. Hydromodification Analysis

As outlined in Section 8.2 of the Los Angeles County Department of Public Works Low Impact Development Standards Manual, projects may be exempt from implementation of hydromodification control measures where assessments of downstream channel conditions and proposed discharge hydrology indicate that adverse hydromodification effects to beneficial uses of natural drainage systems are unlikely. Since the proposed project site will discharge through a storm drain system into Sawpit Wash concrete channel, the project is exempt from Hydromodification Control Measures.

V. Site Design BMPs

a. Site Design

Current water quality requirements are based on treating a specific volume of stormwater run-off from the project site (SWQDv). The design storm from which the SWQDv is calculated is defined as the greater of:

- The 0.75-inch, 24-hour rain event, or
- The 85^{th} percentile, 24-hour rain event as determine by the Los Angeles County 85^{th} percentile precipitation isohyetal map

The volume of stormwater run-off that must be retained at a project site is calculated using MODRAT. LACDPW developed a hydrologic calculator (HydroCalc) that completes the full MODRAT calculation process and produce the SWQDv volumes and flow rates for single subareas. This report will utilize the results from HydroCalc as a means of determining the stormwater quality design volumes (SWQDv). The proposed site was divided into seven (7) drainage sub-areas, based on the proposed site grading and proposed drainage patterns. Refer to the post-development hydrology map, *Figure 5 – Post-Development Hydrology Map*, for the definition of the drainage sub areas. The following table, *Table 2 – Post-Development Conditions*, summarizes the results of the study and required treating volumes SWQDv for each subarea.

TABLE 1 - POST-DEVELOPMENT CONDITIONS

Drainage Subarea	*Area*	*Q_{pm} [cfs]*	*SWQDv [CF]*
DA-1	4.8	1.2382	15,616
DA-2	18.3	3.2266	60,603
DA-3	17.6	3.5950	58,318
DA-4	21.2	5.1116	70,464
DA-5	8.6	1.9077	28,728
DA-6	5.6	1.6431	18,567
DA-7	1.9	0.7197	6,553
Totals	***78.3***	***17.44***	***258,849***

Refer to *Appendix A – Site Design Calculations for each subarea HydroCalc worksheets*.

b. BMP Selection

Drainage areas one through six, listed in the summary above, discharge via a series of on-site catch basins and storm drain lines to three detention basins located within the site. Run-off from drainage area seven will be directed to a local sump where storm water will be directed to a drywell for treatment and retention. Refer to the conceptual low impact development (LID) plan, *Figure 6 – Conceptual Low impact Development (LID) Exhibit*, for stormwater routing. The following table, Table 3 – *BMP Sufficiency Summary*, summarizes the tributary areas directed to each drywell system, the capacity of each drywell system, and how that relates to the demand.

TABLE 2 - BMP SUFFICIENCY SUMMARY

Drywell System	*Contributing Drainage Areas*	*Demand*		*Capacity*	*Capacity greater than Demand?*
		Peak Flow Rate [cfs]	SWQDv [CF]	96-Hour Infiltration Volume	
1	DA-1, DA-2	4.46	76,219	114,002	Yes
2	DA-3, DA-4, DA-5	10.61	157,511	171,003	Yes
3	DA-6	1.64	18,567	57,001	Yes
4	DA-7	0.72	6,553	57,001	Yes

Refer to the calculation sheets in *Appendix B – Drywell Sizing Calculations*, for detailed calculations demonstrating the capacity of each proposed dry well system.

VI. Structural Source Control BMPs

Source Control Measures are designed to prevent pollutants from contacting stormwater run-off or prevent discharge of contaminated stormwater run-off to stormdrain system and/or receiving water. The project will implement the following source control measures:

- Storm drain message and signage
- Outdoor trash storage/waste area
- Outdoor loading/unloading dock area
- Landscape irrigation practices

Refer to *Appendix C – Structural Source Control Measures* for source control details and design specifications.

VII. Summary and Conclusion

To summarize, the proposed low impact development (LID) system stormwater quality control measures and structural source measures are adequately designed and sized to accomplish the following:

- Capture and mitigate the SQWDv volume from the 85th percentile, 24-hour storm;
- On-site retention of captured volume by infiltrating through a series of drywells located
- Prevent pollutants from contacting stormwater run-off and/or prevent discharge of contaminated stormwater run-off to stormdrain system

Based on the calculations and conclusions presented in this report, the proposed LID stormwater quality control measures will retain on-site through infiltration and will mitigate the required SWQDv volumes as defined by the Los Angeles County Department of Public Works Low Impact Development Standards Manual.

VIII. References

County of Los Angeles Department of Public Works. (2014). *Low Impact Development Standards Manual.* Los Angeles.

FIGURES

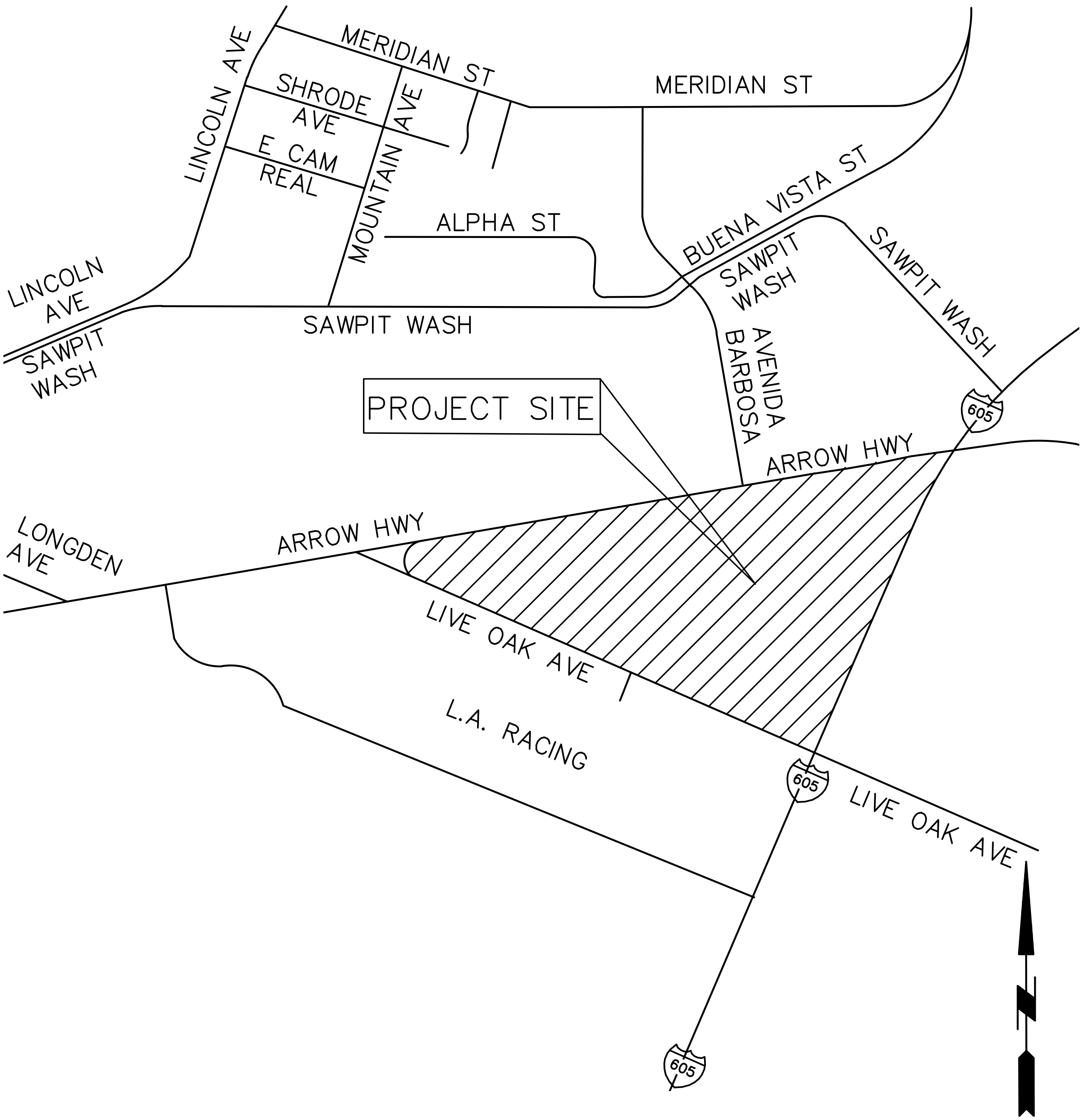

FIGURE 1

D & D ENGINEERING, INC.	THE PARK @ LIVE OAK	SCALE: NTS
8901 S. LA CIENEGA BLVD, SUITE 106 INGLEWOOD, CA 90301 Phone: 424-393-4122	VICINITY MAP	DATE: 03/23/18 SHT NO.: 1 OF 1

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FIGURE 2

CALL 811
AT LEAST TWO DAYS BEFORE YOU DIG
Know what's **below.**
Call before you dig.
UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA

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8901 S. LA CIENEGA BLVD, SUITE 106
INGLEWOOD, CA 90301
Phone: 424-393-4122

IRWINDALE ARROW BUSINESS CENTER

BOUNDARY AND AERIAL EXHIBIT

SCALE: 1" = 120'
DATE: 02/20/2018
SHT NO.: 01 OF 01

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150 0 150 300
scale 1"= 150' feet

FIGURE 3

D & D ENGINEERING, INC.
8901 S. LA CIENEGA BLVD, SUITE 106
INGLEWOOD, CA 90301
Phone: 424-393-4122

THE PARK @ LIVE OAK

AERIAL SURVEY

SCALE: 1" = 150'
DATE: 05/23/18
SHT NO.: 1 OF 1

Drawing Name: M:\17015\Admin\17015\Reports\LID\Figures\FIGURE 3 - AERIAL SURVEY.dwg
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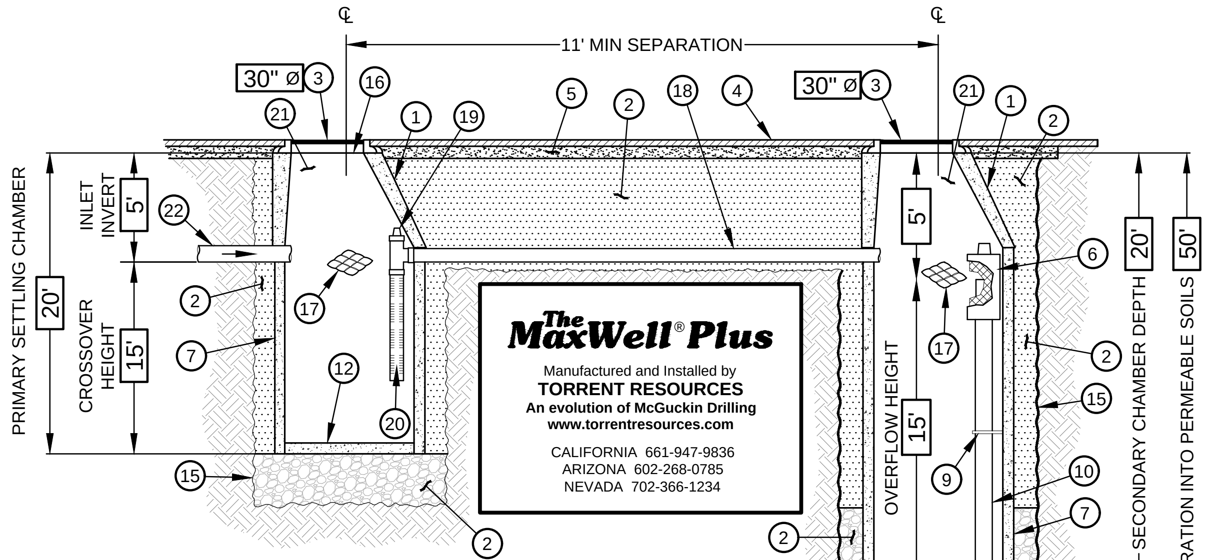
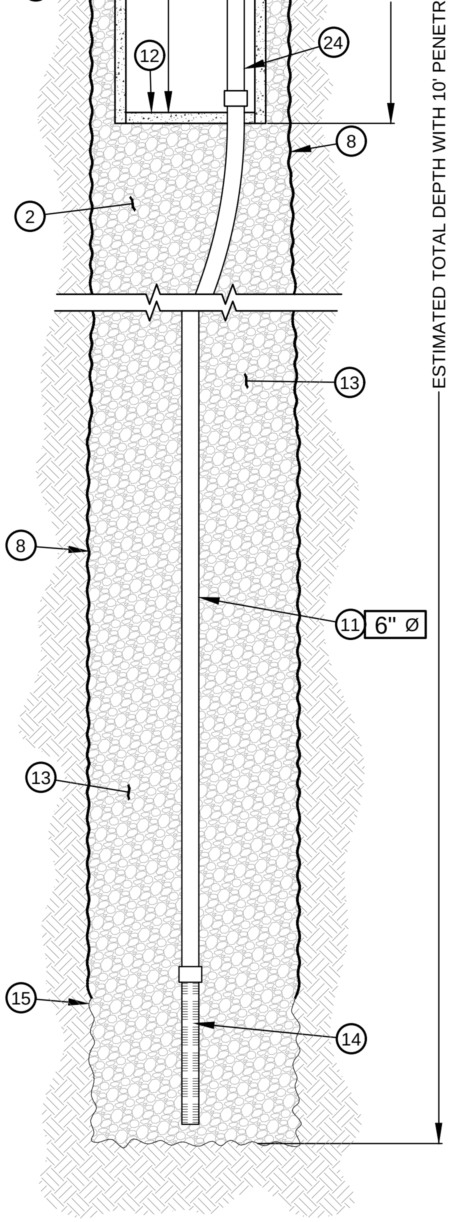
Park@Live Oak - 15MAY18

The MaxWell® Plus Drainage System Detail And Specifications





NOTES

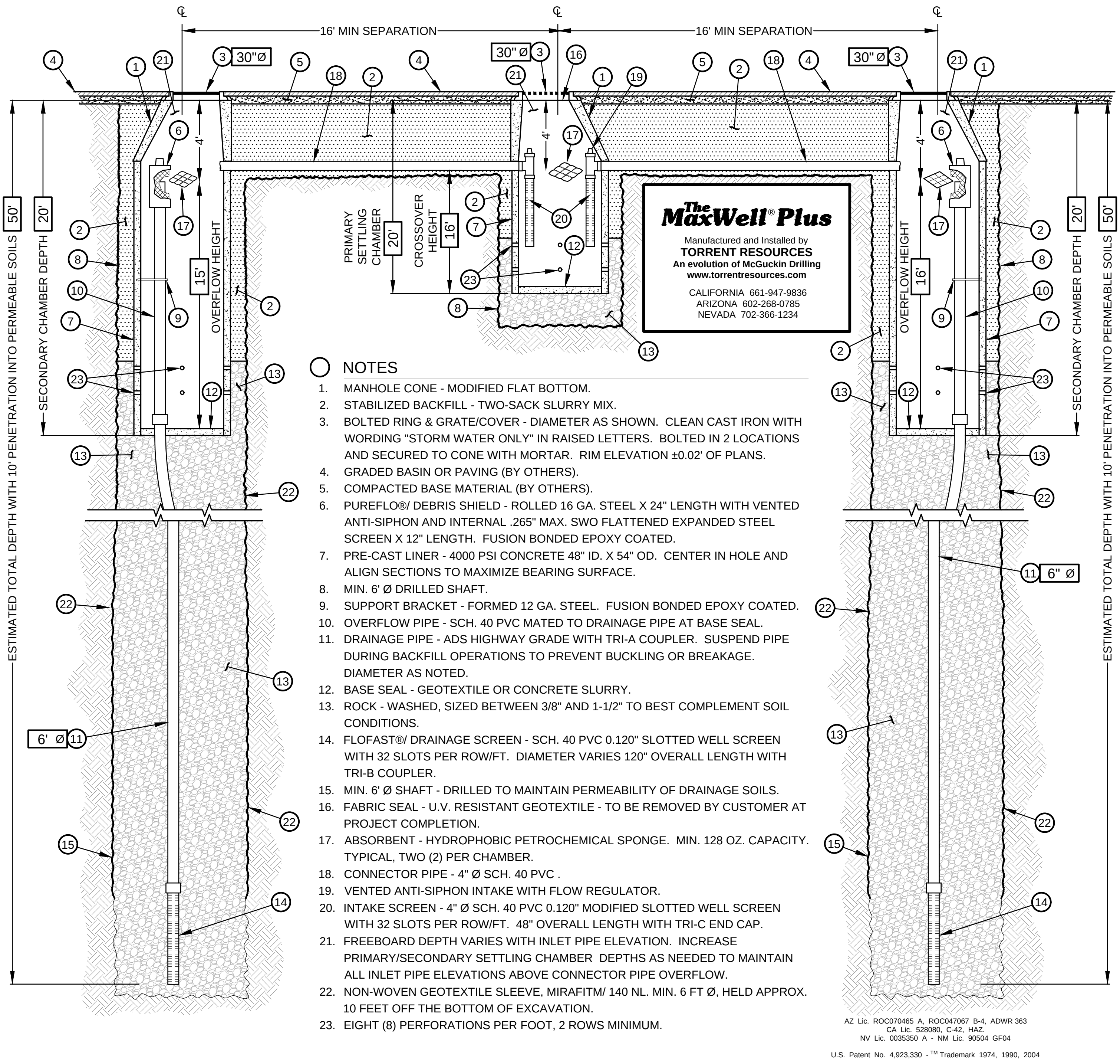
1. MANHOLE CONE - MODIFIED FLAT BOTTOM.
2. STABILIZED BACKFILL - TWO-SACK SLURRY MIX.
3. **FRAME AND COVER -** WATER TIGHT/VAPOR TIGHT, BOLTED IN 3 LOCATIONS. DIAMETER AS SHOWN. CLEAN CAST IRON WITH WORDING "STORM WATER ONLY" IN RAISED LETTERS.
4. GRADED BASIN OR PAVING (BY OTHERS).
5. COMPACTED BASE MATERIAL (BY OTHERS).
6. PUREFLO®/ DEBRIS SHIELD - ROLLED 16 GA. STEEL X 24" LENGTH WITH VENTED ANTI-SIPHON AND INTERNAL .265" MAX. SWO FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH. FUSION BONDED EPOXY COATED.
7. PRE-CAST LINER - 4000 PSI CONCRETE 48" ID. X 54" OD. CENTER IN HOLE AND ALIGN SECTIONS TO MAXIMIZE BEARING SURFACE.
8. **GEOTEXTILE SLEEVE -** MIRAFI 140 NL. MIN. 6 FT Ø, HELD APPROX. 10 FEET OFF THE BOTTOM OF EXCAVATION.
9. SUPPORT BRACKET - FORMED 12 GA. STEEL. FUSION BONDED EPOXY COATED.
10. OVERFLOW PIPE - SCH. 40 PVC MATED TO DRAINAGE PIPE AT BASE SEAL.
11. DRAINAGE PIPE - ADS HIGHWAY GRADE WITH TRI-A COUPLER. SUSPEND PIPE DURING BACKFILL OPERATIONS TO PREVENT BUCKLING OR BREAKAGE. DIAMETER AS NOTED.
12. BASE SEAL - GEOTEXTILE OR CONCRETE SLURRY.
13. ROCK - WASHED, SIZED BETWEEN 3/8" AND 1-1/2" TO BEST COMPLEMENT SOIL CONDITIONS.
14. FLOFAST®/ DRAINAGE SCREEN - SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. DIAMETER VARIES 120" OVERALL LENGTH WITH TRI-B COUPLER.
15. MIN. 6' Ø SHAFT - DRILLED TO MAINTAIN PERMEABILITY OF DRAINAGE SOILS.
16. FABRIC SEAL - U.V. RESISTANT GEOTEXTILE - TO BE REMOVED BY CUSTOMER AT PROJECT COMPLETION.
17. ABSORBENT - HYDROPHOBIC PETROCHEMICAL SPONGE. MIN. 128 OZ. CAPACITY. TYPICAL, TWO (2) PER CHAMBER.
18. CONNECTOR PIPE - 4" Ø SCH. 40 PVC .
19. VENTED ANTI-SIPHON INTAKE WITH FLOW REGULATOR.
20. INTAKE SCREEN - 4" Ø SCH. 40 PVC 0.120" MODIFIED SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. 48" OVERALL LENGTH WITH TRI-C END CAP.
21. FREEBOARD DEPTH VARIES WITH INLET PIPE ELEVATION. INCREASE PRIMARY/SECONDARY SETTLING CHAMBER DEPTHS AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE CONNECTOR PIPE OVERFLOW.
22. **INLET PIPE -** SEE PLAN FOR SIZE AND SLOPE.

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

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

Park@Live Oak A2 - 15May18

The MaxWell® Plus Drainage System Detail And Specifications



NOTES

1. MANHOLE CONE - MODIFIED FLAT BOTTOM.
2. STABILIZED BACKFILL - TWO-SACK SLURRY MIX.
3. BOLTED RING & GRATE/COVER - DIAMETER AS SHOWN. CLEAN CAST IRON WITH WORDING "STORM WATER ONLY" IN RAISED LETTERS. BOLTED IN 2 LOCATIONS AND SECURED TO CONE WITH MORTAR. RIM ELEVATION ±0.02' OF PLANS.
4. GRADED BASIN OR PAVING (BY OTHERS).
5. COMPACTED BASE MATERIAL (BY OTHERS).
6. PUREFLO®/ DEBRIS SHIELD - ROLLED 16 GA. STEEL X 24" LENGTH WITH VENTED ANTI-SIPHON AND INTERNAL .265" MAX. SWO FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH. FUSION BONDED EPOXY COATED.
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12. BASE SEAL - GEOTEXTILE OR CONCRETE SLURRY.
13. ROCK - WASHED, SIZED BETWEEN 3/8" AND 1-1/2" TO BEST COMPLEMENT SOIL CONDITIONS.
14. FLOFAST®/ DRAINAGE SCREEN - SCH. 40 PVC 0.120" SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. DIAMETER VARIES 120" OVERALL LENGTH WITH TRI-B COUPLER.
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16. FABRIC SEAL - U.V. RESISTANT GEOTEXTILE - TO BE REMOVED BY CUSTOMER AT PROJECT COMPLETION.
17. ABSORBENT - HYDROPHOBIC PETROCHEMICAL SPONGE. MIN. 128 OZ. CAPACITY. TYPICAL, TWO (2) PER CHAMBER.
18. CONNECTOR PIPE - 4" Ø SCH. 40 PVC .
19. VENTED ANTI-SIPHON INTAKE WITH FLOW REGULATOR.
20. INTAKE SCREEN - 4" Ø SCH. 40 PVC 0.120" MODIFIED SLOTTED WELL SCREEN WITH 32 SLOTS PER ROW/FT. 48" OVERALL LENGTH WITH TRI-C END CAP.
21. FREEBOARD DEPTH VARIES WITH INLET PIPE ELEVATION. INCREASE PRIMARY/SECONDARY SETTLING CHAMBER DEPTHS AS NEEDED TO MAINTAIN ALL INLET PIPE ELEVATIONS ABOVE CONNECTOR PIPE OVERFLOW.
22. NON-WOVEN GEOTEXTILE SLEEVE, MIRAFITM/ 140 NL. MIN. 6 FT Ø, HELD APPROX. 10 FEET OFF THE BOTTOM OF EXCAVATION.
23. EIGHT (8) PERFORATIONS PER FOOT, 2 ROWS MINIMUM.

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

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

SUBAREA	ACREAGE	LENGTH	SLOPE	Q_{PM}	$SWQD_V$
A1	4.85	687'	0.003	1.24 cfs	15,616 CF
A2	18.31	1975'	0.009	3.23 cfs	60,603 CF
A3	17.62	1285'	0.012	3.60 cfs	58,318 CF
A4	21.29	703'	0.010	5.11 cfs	70,464 CF
A5	8.68	864'	0.006	1.91 cfs	28,728 CF
A6	5.61	450'	0.019	1.64 cfs	18,567 CF
A7	1.98	193'	0.016	0.72 cfs	6,553 CF

LEGEND

SUB-AREA BOUNDARY

AREA ACRES / SLOPE LENGTH

150 0 150 300
scale 1"= 150' feet

FIGURE 5

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THE PARK @ LIVE OAK

POST-DEVELOPMENT HYDROLOGY MAP

SCALE: 1" = 150'
DATE: 05/23/18
SHT NO.: 1 OF 1

Drawing Name: M:\17015\Admin\17015\Reports\LID\Figures\FIGURE 5 - POST-HYDROLOGY DEVELOPMENT MAP.dwg
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FIGURE 6

811 Know what's below. Call before you dig.

CALL 811
AT LEAST TWO DAYS BEFORE YOU DIG
UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA

D & D ENGINEERING, INC.
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INGLEWOOD, CA 90301
Phone: 424-393-4122

THE PARK @ LIVE OAK

CONCEPTUAL LOW IMPACT DEVELOPMENT (LID) PLAN

SCALE: 1" = 100'
DATE: 05/23/18
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Drawing Name: \\fileserver\Data\17015\Admin\17015\Reports\LID\Figures\FIGURE 6 – CONCEPTUAL LID EXHIBIT.dwg
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Appendix A

Post-Development Hydrological Conditions

Peak Flow Hydrologic Analysis

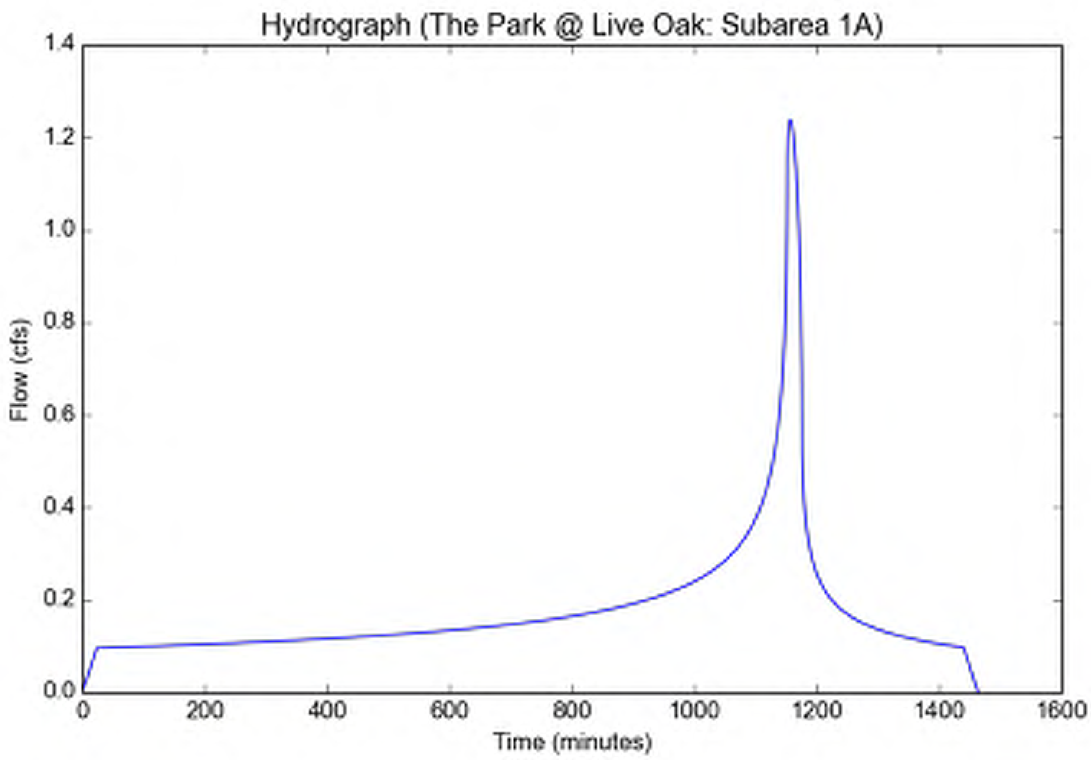
File location: M:/17015/Eng/17015/17015/Hm/LID/The Park @ Live Oak - Subarea 1A.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	The Park @ Live Oak
Subarea ID	Subarea 1A
Area (ac)	4.85
Flow Path Length (ft)	687.0
Flow Path Slope (vft/hft)	0.0291
85th Percentile Rainfall Depth (in)	1.04
Percent Impervious	0.95
Soil Type	15
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.04
Peak Intensity (in/hr)	0.2969
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.86
Time of Concentration (min)	24.0
Clear Peak Flow Rate (cfs)	1.2382
Burned Peak Flow Rate (cfs)	1.2382
24-Hr Clear Runoff Volume (ac-ft)	0.3585
24-Hr Clear Runoff Volume (cu-ft)	15616.3383



Peak Flow Hydrologic Analysis

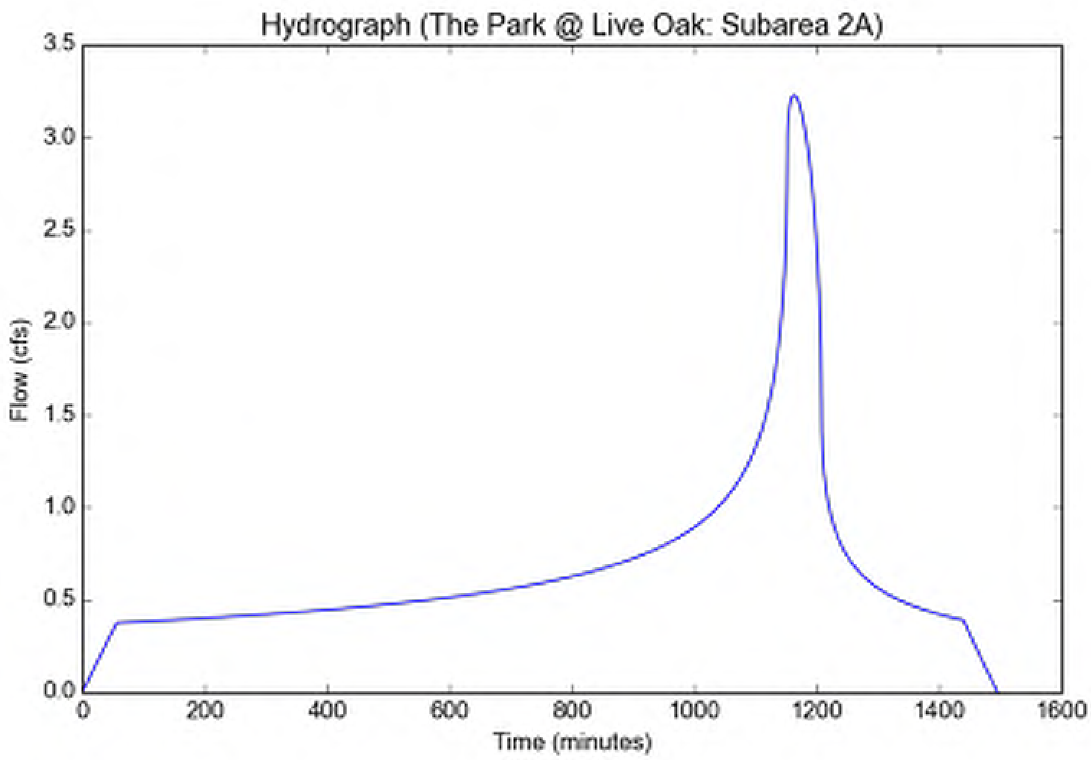
File location: M:/17015/Eng/17015/17015/Hm/LID/The Park @ Live Oak - Subarea 2A.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	The Park @ Live Oak
Subarea ID	Subarea 2A
Area (ac)	18.31
Flow Path Length (ft)	1975.0
Flow Path Slope (vft/hft)	0.0091
85th Percentile Rainfall Depth (in)	1.04
Percent Impervious	0.98
Soil Type	8
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.04
Peak Intensity (in/hr)	0.1993
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.884
Time of Concentration (min)	56.0
Clear Peak Flow Rate (cfs)	3.2266
Burned Peak Flow Rate (cfs)	3.2266
24-Hr Clear Runoff Volume (ac-ft)	1.3913
24-Hr Clear Runoff Volume (cu-ft)	60603.0



Peak Flow Hydrologic Analysis

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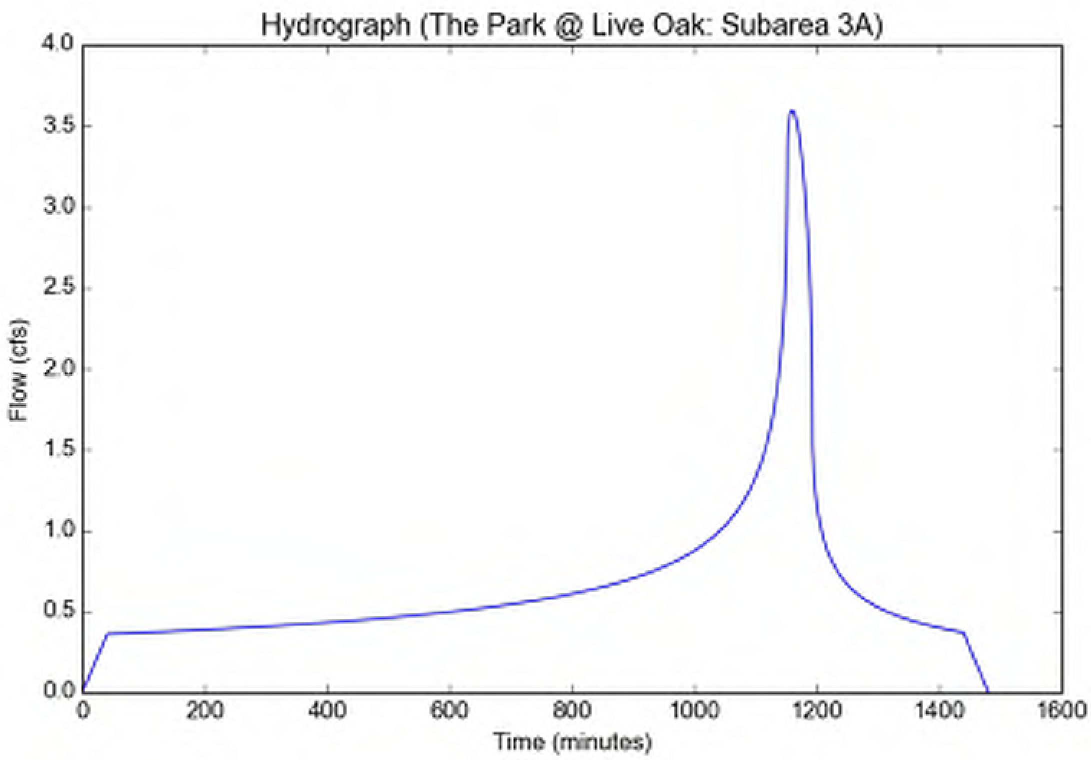
Version: HydroCalc 1.0.2

Input Parameters

Project Name	The Park @ Live Oak
Subarea ID	Subarea 3A
Area (ac)	17.62
Flow Path Length (ft)	1285.0
Flow Path Slope (vft/hft)	0.0121
85th Percentile Rainfall Depth (in)	1.04
Percent Impervious	0.98
Soil Type	15
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.04
Peak Intensity (in/hr)	0.2308
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.884
Time of Concentration (min)	41.0
Clear Peak Flow Rate (cfs)	3.595
Burned Peak Flow Rate (cfs)	3.595
24-Hr Clear Runoff Volume (ac-ft)	1.3388
24-Hr Clear Runoff Volume (cu-ft)	58318.1032



Peak Flow Hydrologic Analysis

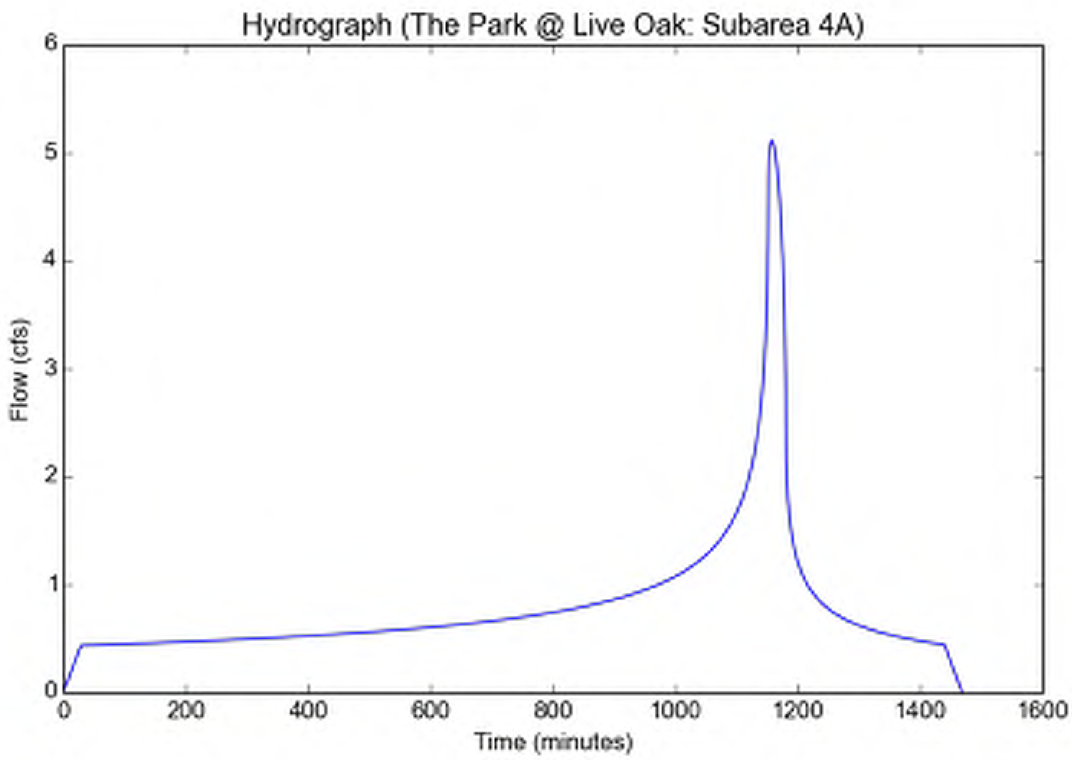
File location: M:/17015/Eng/17015/17015/Hm/LID/The Park @ Live Oak - Subarea 4A.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	The Park @ Live Oak
Subarea ID	Subarea 4A
Area (ac)	21.29
Flow Path Length (ft)	703.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	1.04
Percent Impervious	0.98
Soil Type	15
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.04
Peak Intensity (in/hr)	0.2716
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.884
Time of Concentration (min)	29.0
Clear Peak Flow Rate (cfs)	5.1116
Burned Peak Flow Rate (cfs)	5.1116
24-Hr Clear Runoff Volume (ac-ft)	1.6176
24-Hr Clear Runoff Volume (cu-ft)	70464.1833



Peak Flow Hydrologic Analysis

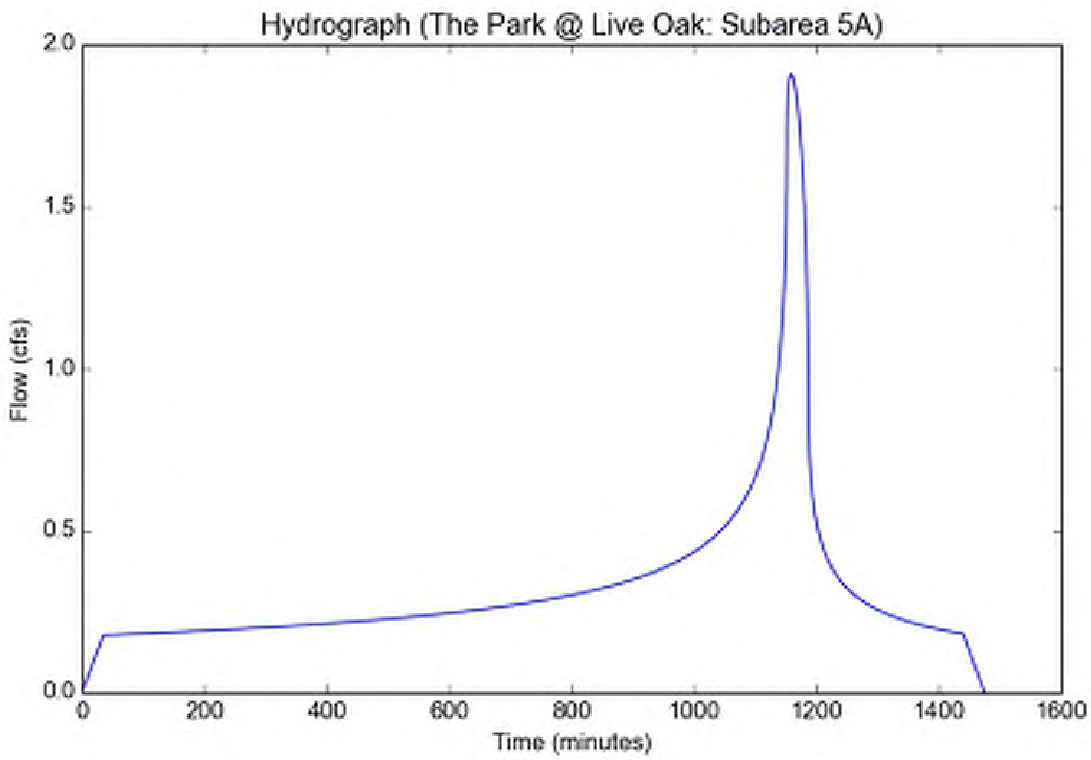
File location: M:/17015/Eng/17015/17015/Hm/LID/The Park @ Live Oak - Subarea 5A.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	The Park @ Live Oak
Subarea ID	Subarea 5A
Area (ac)	8.68
Flow Path Length (ft)	864.0
Flow Path Slope (vft/hft)	0.0064
85th Percentile Rainfall Depth (in)	1.04
Percent Impervious	0.98
Soil Type	15
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.04
Peak Intensity (in/hr)	0.2486
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.884
Time of Concentration (min)	35.0
Clear Peak Flow Rate (cfs)	1.9077
Burned Peak Flow Rate (cfs)	1.9077
24-Hr Clear Runoff Volume (ac-ft)	0.6595
24-Hr Clear Runoff Volume (cu-ft)	28728.6117



Peak Flow Hydrologic Analysis

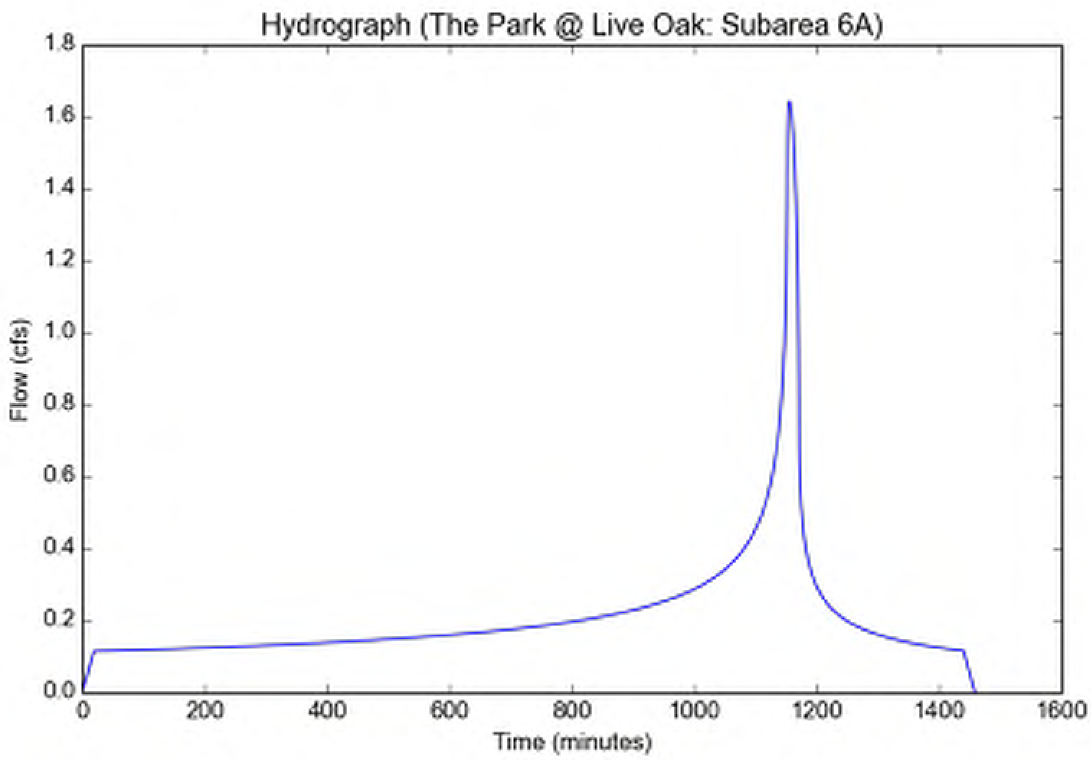
File location: M:/17015/Eng/17015/17015/Hm/LID/The Park @ Live Oak - Subarea 6A.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	The Park @ Live Oak
Subarea ID	Subarea 6A
Area (ac)	5.61
Flow Path Length (ft)	450.0
Flow Path Slope (vft/hft)	0.0189
85th Percentile Rainfall Depth (in)	1.04
Percent Impervious	0.98
Soil Type	15
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.04
Peak Intensity (in/hr)	0.3313
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.884
Time of Concentration (min)	19.0
Clear Peak Flow Rate (cfs)	1.6431
Burned Peak Flow Rate (cfs)	1.6431
24-Hr Clear Runoff Volume (ac-ft)	0.4263
24-Hr Clear Runoff Volume (cu-ft)	18567.4795



Peak Flow Hydrologic Analysis

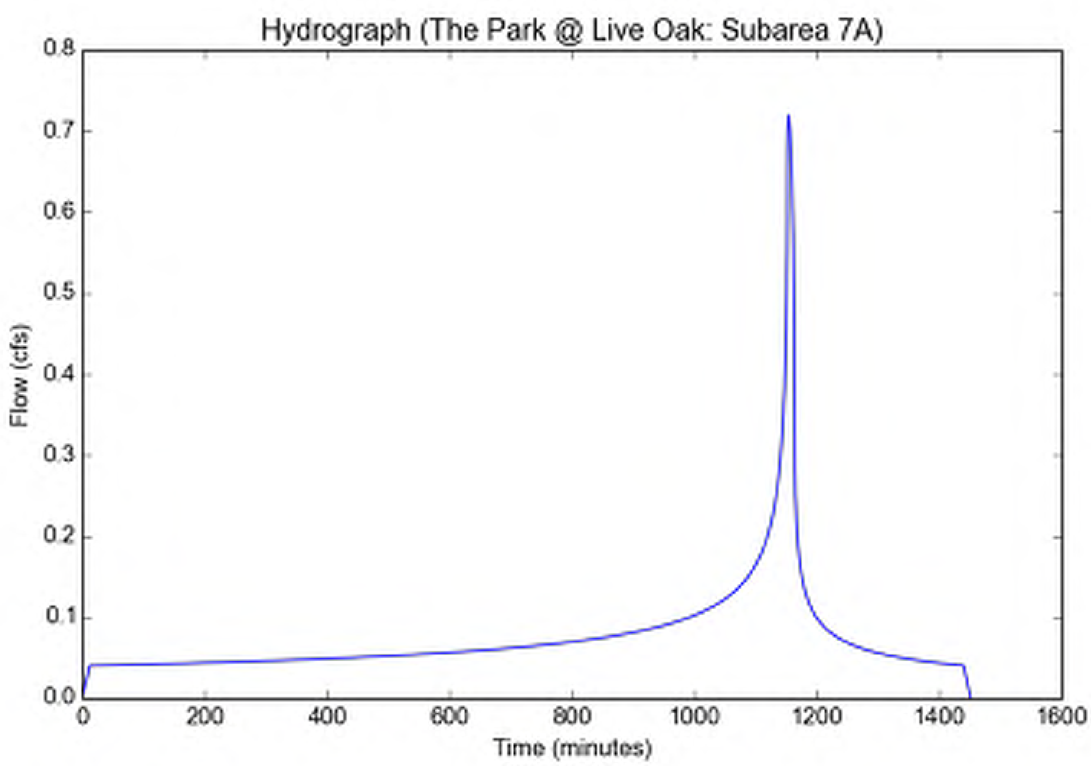
File location: M:/17015/Eng/17015/17015/Hm/LID/The Park @ Live Oak - Subarea 7A.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	The Park @ Live Oak
Subarea ID	Subarea 7A
Area (ac)	1.98
Flow Path Length (ft)	193.0
Flow Path Slope (vft/hft)	0.0155
85th Percentile Rainfall Depth (in)	1.04
Percent Impervious	0.98
Soil Type	15
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.04
Peak Intensity (in/hr)	0.4112
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.884
Time of Concentration (min)	12.0
Clear Peak Flow Rate (cfs)	0.7197
Burned Peak Flow Rate (cfs)	0.7197
24-Hr Clear Runoff Volume (ac-ft)	0.1504
24-Hr Clear Runoff Volume (cu-ft)	6553.21



Appendix B

Drywell Sizing Calculations

DRAFT

May 15, 2018
D & D - Inglewood
Attn: Gilbert Tecero

Re: Maxwell® Plus Drainage System Calculations for **Park @ Live Oak A6 - Irwindale**

Given:

Measured Infiltration Rate	36.00	in/hr
Safety Factor	3	
Mitigated Volume	18,567	ft^3
Required Drawdown Time	96	hours
Min. Depth to Infiltration	20	ft
Max. Drywell Depth	120	ft
Rock Porosity	40	%

Design:

Actual Depth to Infiltration	20	ft
Actual Drywell Bottom Depth	50	ft

Convert Measured Infiltration Rate from in/hr to ft/sec.

$$36.00 \frac{in}{hr} \times \frac{1\ ft}{12\ in} \times \frac{1\ hr}{3600\ sec} = 0.000833 \frac{ft}{sec}$$

Apply Safety Factor to get Design Rate.

$$0.000833 \frac{ft}{sec} \div 3 = 0.000278 \frac{ft}{sec}$$

A 6 foot diameter drywell provides 18.85 SF of infiltration area per foot of depth, plus 28.27 SF at the bottom.

For a 50 foot deep drywell, infiltration occurs between 20 feet and 50 feet below grade. This provides 30 feet of infiltration depth in addition to the bottom area. Total infiltration area is calculated below.

$$30\ ft \times 18.85 \frac{ft^2}{ft} + 28.27\ ft^2 = 594\ ft^2$$

Combine design rate with infiltration area to get flow (disposal) rate for drywell.

$$0.000278 \frac{ft}{sec} \times 594\ ft^2 = 0.16493 \frac{ft^3}{sec}$$

Volume of disposal based on various time frames are included below.

96 hrs: 0.1649 CFS x 96 hours x $\frac{3600\ sec}{1\ hr}$ = 57,001 cubic feet of retained water disposed of.

3 hrs: 0.1649 CFS x 3 hours x $\frac{3600\ sec}{1\ hr}$ = 1,781 cubic feet of retained water disposed of.

1 drywell(s) are required to drawdown mitigated volume in 96 hours.

Chamber diameter = 4 feet. Drywell rock shaft diameter = 6 feet.
Volume provided in each drywell with primary depth of 20 feet and secondary chamber depth of 20 feet.

$$(20\ ft + 20\ ft) \times 12.57\ ft^2 + 30\ ft \times 28.27\ ft^2 \times 40\ \% = 842\ ft^3$$

Based on the total mitigated volume of 18567 CF, after subtracting the volume stored in drywell, the residual volume of 17726 CF could be stored in a separate detention system and connected to the drywell system.

Maryjane MacLeod
Technical Marketing Engineer
Torrent Resources (CA), Inc.
805-610-0119

Torrent Resources (CA) Incorporated
9950 Alder Avenue
Bloomington, CA 92316
Phone 909-829-0740
CA Lic. 886759 A, C-42
An Evolution of McGuckin Drilling

May 15, 2018
D & D - Inglewood
Attn: Gilbert Tecero

Re: Maxwell® Plus Drainage System Calculations for **Park @ Live Oak A2 - Irwindale** DRAFT

Given:

Measured Infiltration Rate	36.00	in/hr
Safety Factor	3	
Mitigated Volume	76,219	ft^3
Required Drawdown Time	96	hours
Min. Depth to Infiltration	20	ft
Max. Drywell Depth	120	ft
Rock Porosity	40	%

Design:

Actual Depth to Infiltration	20	ft
Actual Drywell Bottom Depth	50	ft

Convert Measured Infiltration Rate from in/hr to ft/sec.

$36.00 \frac{in}{hr} \times \frac{1\ ft}{12\ in} \times \frac{1\ hr}{3600\ sec} = 0.000833 \frac{ft}{sec}$

Apply Safety Factor to get Design Rate.

$0.000833 \frac{ft}{sec} \div 3 = 0.000278 \frac{ft}{sec}$

A 6 foot diameter drywell provides 18.85 SF of infiltration area per foot of depth, plus 28.27 SF at the bottom.

For a 50 foot deep drywell, infiltration occurs between 20 feet and 50 feet below grade. This provides 30 feet of infiltration depth in addition to the bottom area. Total infiltration area is calculated below.

$30\ ft \times 18.85 \frac{ft^2}{ft} + 28.27\ ft^2 = 594\ ft^2$

Combine design rate with infiltration area to get flow (disposal) rate for drywell.

$0.000278 \frac{ft}{sec} \times 594\ ft^2 = 0.16493 \frac{ft^3}{sec}$

Volume of disposal based on various time frames are included below.

96 hrs: 0.1649 CFS x 96 hours x $\frac{3600\ sec}{1\ hr}$ = 57,001 cubic feet of retained water disposed of.

3 hrs: 0.1649 CFS x 3 hours x $\frac{3600\ sec}{1\ hr}$ = 1,781 cubic feet of retained water disposed of.

2 drywell(s) are required to drawdown mitigated volume in 96 hours.

Chamber diameter = 4 feet. Drywell rock shaft diameter = 6 feet.
Volume provided in each drywell with primary depth of 20 feet and secondary chamber depth of 20 feet.

$(20\ ft + 20\ ft) \times 12.57\ ft^2 + 30\ ft \times 28.27\ ft^2 \times 40\ \% = 842\ ft^3$

Based on the total mitigated volume of 76219 CF, after subtracting the volume stored in drywell, the residual volume of 74536 CF could be stored in a separate detention system and connected to the drywell system.

Maryjane MacLeod
Technical Marketing Engineer
Torrent Resources (CA), Inc.
805-610-0119

Torrent Resources (CA) Incorporated
9950 Alder Avenue
Bloomington, CA 92316
Phone 909-829-0740
CA Lic. 886759 A, C-42
An Evolution of McGuckin Drilling

DRAFT

May 15, 2018
D & D - Inglewood
Attn: Gilbert Tecero

Re: Maxwell® Plus Drainage System Calculations for **Park @ Live Oak A5 - Irwindale**

Given:

Measured Infiltration Rate	36.00	in/hr
Safety Factor	3	
Mitigated Volume	157,511	ft^3
Required Drawdown Time	96	hours
Min. Depth to Infiltration	20	ft
Max. Drywell Depth	120	ft
Rock Porosity	40	%

Design:

Actual Depth to Infiltration	20	ft
Actual Drywell Bottom Depth	50	ft

Convert Measured Infiltration Rate from in/hr to ft/sec.

$36.00 \frac{in}{hr} \times \frac{1\ ft}{12\ in} \times \frac{1\ hr}{3600\ sec} = 0.000833 \frac{ft}{sec}$

Apply Safety Factor to get Design Rate.

$0.000833 \frac{ft}{sec} \div 3 = 0.000278 \frac{ft}{sec}$

A 6 foot diameter drywell provides 18.85 SF of infiltration area per foot of depth, plus 28.27 SF at the bottom.

For a 50 foot deep drywell, infiltration occurs between 20 feet and 50 feet below grade. This provides 30 feet of infiltration depth in addition to the bottom area. Total infiltration area is calculated below.

$30\ ft \times 18.85 \frac{ft^2}{ft} + 28.27\ ft^2 = 594\ ft^2$

Combine design rate with infiltration area to get flow (disposal) rate for drywell.

$0.000278 \frac{ft}{sec} \times 594\ ft^2 = 0.16493 \frac{ft^3}{sec}$

Volume of disposal based on various time frames are included below.

96 hrs: 0.1649 CFS x 96 hours x $\frac{3600\ sec}{1\ hr}$ = 57,001 cubic feet of retained water disposed of.

3 hrs: 0.1649 CFS x 3 hours x $\frac{3600\ sec}{1\ hr}$ = 1,781 cubic feet of retained water disposed of.

3 drywell(s) are required to drawdown mitigated volume in 96 hours.

Chamber diameter = 4 feet. Drywell rock shaft diameter = 6 feet.
Volume provided in each drywell with primary depth of 20 feet and secondary chamber depth of 20 feet.

$(20\ ft + 20\ ft) \times 12.57\ ft^2 + 30\ ft \times 28.27\ ft^2 \times 40\ \% = 842\ ft^3$

Based on the total mitigated volume of 157511 CF, after subtracting the volume stored in drywell, the residual volume of 154986 CF could be stored in a separate detention system and connected to the drywell system.

Maryjane MacLeod
Technical Marketing Engineer
Torrent Resources (CA), Inc.
805-610-0119

Torrent Resources (CA) Incorporated
9950 Alder Avenue
Bloomington, CA 92316
Phone 909-829-0740
CA Lic. 886759 A, C-42
An Evolution of McGuckin Drilling

DRAFT

May 15, 2018
D & D - Inglewood
Attn: Gilbert Tecero

Re: Maxwell® Plus Drainage System Calculations for **Park @ Live Oak A7 - Irwindale**

Given:

Measured Infiltration Rate	36.00 in/hr
Safety Factor	3
Mitigated Volume	6,553 ft^3
Required Drawdown Time	96 hours
Min. Depth to Infiltration	20 ft
Max. Drywell Depth	120 ft
Rock Porosity	40 %

Design:

Actual Depth to Infiltration	20 ft
Actual Drywell Bottom Depth	50 ft

Convert Measured Infiltration Rate from in/hr to ft/sec.

$$36.00 \frac{in}{hr} \times \frac{1\ ft}{12\ in} \times \frac{1\ hr}{3600\ sec} = 0.000833 \frac{ft}{sec}$$

Apply Safety Factor to get Design Rate.

$$0.000833 \frac{ft}{sec} \div 3 = 0.000278 \frac{ft}{sec}$$

A 6 foot diameter drywell provides 18.85 SF of infiltration area per foot of depth, plus 28.27 SF at the bottom.

For a 50 foot deep drywell, infiltration occurs between 20 feet and 50 feet below grade. This provides 30 feet of infiltration depth in addition to the bottom area. Total infiltration area is calculated below.

$$30\ ft \times 18.85 \frac{ft^2}{ft} + 28.27\ ft^2 = 594\ ft^2$$

Combine design rate with infiltration area to get flow (disposal) rate for drywell.

$$0.000278 \frac{ft}{sec} \times 594\ ft^2 = 0.16493 \frac{ft^3}{sec}$$

Volume of disposal based on various time frames are included below.

96 hrs: 0.1649 CFS x 96 hours x $\frac{3600\ sec}{1\ hr}$ = 57,001 cubic feet of retained water disposed of.
3 hrs: 0.1649 CFS x 3 hours x $\frac{3600\ sec}{1\ hr}$ = 1,781 cubic feet of retained water disposed of.

1 drywell(s) are required to drawdown mitigated volume in 96 hours.

Chamber diameter = 4 feet. Drywell rock shaft diameter = 6 feet.
Volume provided in each drywell with primary depth of 20 feet and secondary chamber depth of 20 feet.

$$(20\ ft + 20\ ft) \times 12.57\ ft^2 + 30\ ft \times 28.27\ ft^2 \times 40\ \% = 842\ ft^3$$

Based on the total mitigated volume of 6553 CF, after subtracting the volume stored in drywell, the residual volume of 5712 CF could be stored in a separate detention system and connected to the drywell system.

Maryjane MacLeod
Technical Marketing Engineer
Torrent Resources (CA), Inc.
805-610-0119

Torrent Resources (CA) Incorporated
9950 Alder Avenue
Bloomington, CA 92316
Phone 909-829-0740
CA Lic. 886759 A, C-42
An Evolution of McGuckin Drilling

Appendix C

Structural Source Control Measures

Categories

EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

None

Description and Purpose

Water conservation practices are activities that use water during the construction of a project in a manner that avoids causing erosion and the transport of pollutants offsite. These practices can reduce or eliminate non-stormwater discharges.

Suitable Applications

Water conservation practices are suitable for all construction sites where water is used, including piped water, metered water, trucked water, and water from a reservoir.

Limitations

- None identified.

Implementation

- Keep water equipment in good working condition.
- Stabilize water truck filling area.
- Repair water leaks promptly.
- Washing of vehicles and equipment on the construction site is discouraged.
- Avoid using water to clean construction areas. If water must be used for cleaning or surface preparation, surface should be swept and vacuumed first to remove dirt. This will minimize amount of water required.
- Direct construction water runoff to areas where it can soak

into the ground or be collected and reused.

- Authorized non-stormwater discharges to the storm drain system, channels, or receiving waters are acceptable with the implementation of appropriate BMPs.
- Lock water tank valves to prevent unauthorized use.

Costs

The cost is small to none compared to the benefits of conserving water.

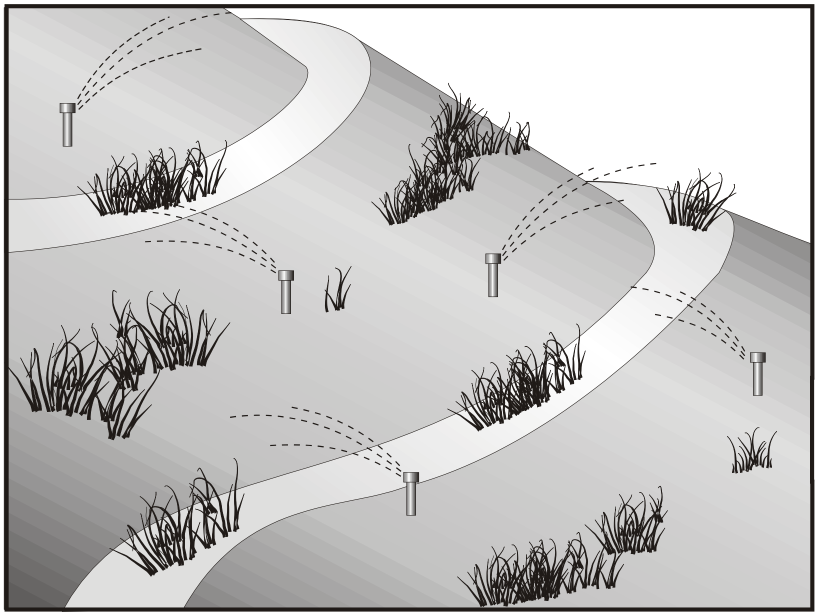
Inspection and Maintenance

- Inspect and verify that activity based BMPs are in place prior to the commencement of authorized non-stormwater discharges.
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges are occuring.
- Repair water equipment as needed to prevent unintended discharges.
    - Water trucks
    - Water reservoirs (water buffalos)
    - Irrigation systems
    - Hydrant connections

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Potable Water/Irrigation NS-7



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	☑
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	
Organics	☑

Potential Alternatives

None

Description and Purpose

Potable Water/Irrigation consists of practices and procedures to manage the discharge of potential pollutants generated during discharges from irrigation water lines, landscape irrigation, lawn or garden watering, planned and unplanned discharges from potable water sources, water line flushing, and hydrant flushing.

Suitable Applications

Implement this BMP whenever potable water or irrigation water discharges occur at or enter a construction site.

Limitations

None identified.

Implementation

- Direct water from offsite sources around or through a construction site, where feasible, in a way that minimizes contact with the construction site.
- Discharges from water line flushing should be reused for landscaping purposes where feasible.
- Shut off the water source to broken lines, sprinklers, or valves as soon as possible to prevent excess water flow.
- Protect downstream stormwater drainage systems and watercourses from water pumped or bailed from trenches excavated to repair water lines.
- Inspect irrigated areas within the construction limits for

excess watering. Adjust watering times and schedules to ensure that the appropriate amount of water is being used and to minimize runoff. Consider factors such as soil structure, grade, time of year, and type of plant material in determining the proper amounts of water for a specific area.

Costs

Cost to manage potable water and irrigation are low and generally considered to be a normal part of related activities.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events..
- Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.
- Repair broken water lines as soon as possible.
- Inspect irrigated areas regularly for signs of erosion and/or discharge.

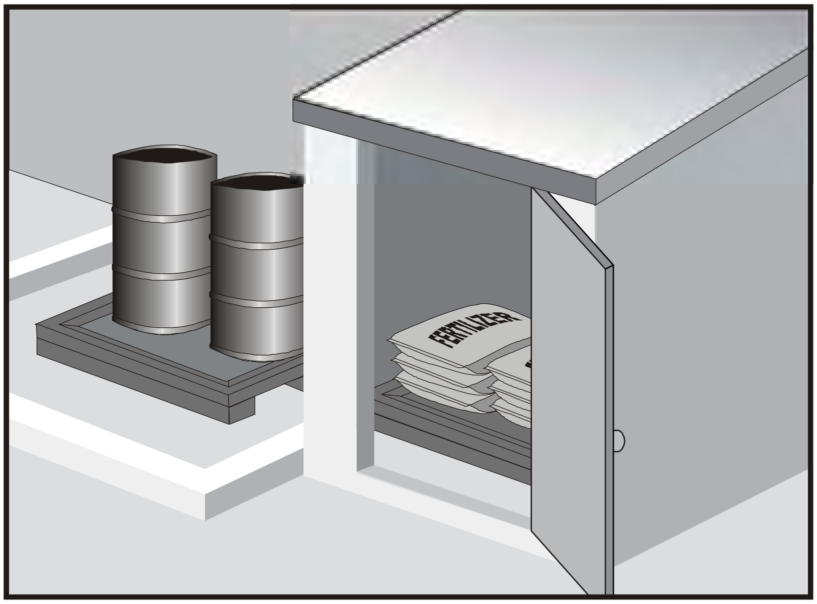
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Material Delivery and Storage WM-1



Description and Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in watertight containers and/or a completely enclosed designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see WM-2, Material Use, or WM-4, Spill Prevention and Control. For information on wastes, see the waste management BMPs in this section.

Suitable Applications

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Soil stabilizers and binders
- Pesticides and herbicides
- Fertilizers
- Detergents
- Plaster
- Petroleum products such as fuel, oil, and grease

Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Asphalt and concrete components
- Hazardous chemicals such as acids, lime, glues, adhesives, paints, solvents, and curing compounds
- Concrete compounds
- Other materials that may be detrimental if released to the environment

Limitations

- Space limitation may preclude indoor storage.
- Storage sheds often must meet building and fire code requirements.

Implementation

The following steps should be taken to minimize risk:

- Chemicals must be stored in water tight containers with appropriate secondary containment or in a storage shed.
- When a material storage area is located on bare soil, the area should be lined and bermed.
- Use containment pallets or other practical and available solutions, such as storing materials within newly constructed buildings or garages, to meet material storage requirements.
- Stack erodible landscape material on pallets and cover when not in use.
- Contain all fertilizers and other landscape materials when not in use.
- Temporary storage areas should be located away from vehicular traffic.
- Material Safety Data Sheets (MSDS) should be available on-site for all materials stored that have the potential to effect water quality.
- Construction site areas should be designated for material delivery and storage.
- Material delivery and storage areas should be located away from waterways, if possible.
  - Avoid transport near drainage paths or waterways.
  - Surround with earth berms or other appropriate containment BMP. See EC-9, Earth Dikes and Drainage Swales.
  - Place in an area that will be paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- An up to date inventory of materials delivered and stored onsite should be kept.

- Hazardous materials storage onsite should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- Keep ample spill cleanup supplies appropriate for the materials being stored. Ensure that cleanup supplies are in a conspicuous, labeled area.
- Employees and subcontractors should be trained on the proper material delivery and storage practices.
- Employees trained in emergency spill cleanup procedures must be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove and dispose of materials and any contaminated soil. See WM-7, Contaminated Soil Management. If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

Material Storage Areas and Practices

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 should be stored in approved containers and drums and should not be overfilled. Containers and drums should be placed in temporary containment facilities for storage.
- A temporary containment facility should provide for a spill containment volume able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.
- A temporary containment facility should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be collected and placed into drums. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids should be sent to an approved disposal site.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.
- Materials should be covered prior to, and during rain events.
- Materials should be stored in their original containers and the original product labels should be maintained in place in a legible condition. Damaged or otherwise illegible labels should be replaced immediately.

- Bagged and boxed materials should be stored on pallets and should not be allowed to accumulate on the ground. To provide protection from wind and rain throughout the rainy season, bagged and boxed materials should be covered during non-working days and prior to and during rain events.

- Stockpiles should be protected in accordance with WM-3, Stockpile Management.

- Materials should be stored indoors within existing structures or completely enclosed storage sheds when available.

- Proper storage instructions should be posted at all times in an open and conspicuous location.

- An ample supply of appropriate spill clean up material should be kept near storage areas.

- Also see WM-6, Hazardous Waste Management, for storing of hazardous wastes.

Material Delivery Practices

- Keep an accurate, up-to-date inventory of material delivered and stored onsite.

- Arrange for employees trained in emergency spill cleanup procedures to be present when dangerous materials or liquid chemicals are unloaded.

Spill Cleanup

- Contain and clean up any spill immediately.

- Properly remove and dispose of any hazardous materials or contaminated soil if significant residual materials remain on the ground after construction is complete. See WM-7, Contaminated Soil Management.

- See WM-4, Spill Prevention and Control, for spills of chemicals and/or hazardous materials.

- If spills or leaks of materials occur that are not contained and could discharge to surface waters, non-visible sampling of site discharge may be required. Refer to the General Permit or to your project specific Construction Site Monitoring Plan to determine if and where sampling is required.

Cost

- The largest cost of implementation may be in the construction of a materials storage area that is covered and provides secondary containment.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Keep storage areas clean and well organized, including a current list of all materials onsite.

- Inspect labels on containers for legibility and accuracy.

- Repair or replace perimeter controls, containment structures, covers, and liners as needed to maintain proper function.

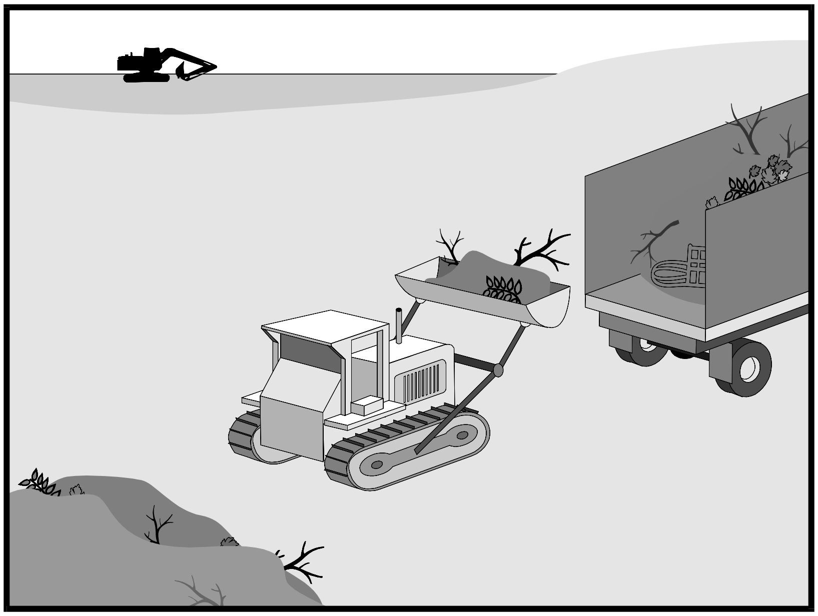
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.



Categories

EC	Erosion Control	
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	☑

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑

Potential Alternatives

None

Description and Purpose

Solid waste management procedures and practices are designed to prevent or reduce the discharge of pollutants to stormwater from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

Suitable Applications

This BMP is suitable for construction sites where the following wastes are generated or stored:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction
- Packaging materials including wood, paper, and plastic
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces, and masonry products
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, plastic wrappers, and cigarettes
- Construction wastes including brick, mortar, timber, steel and metal scraps, pipe and electrical cuttings, non-hazardous equipment parts, styrofoam and other materials used to transport and package construction materials
- Highway planting wastes, including vegetative material,

plant containers, and packaging materials

Limitations

Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season or in desert areas with low rainfall.

Implementation

The following steps will help keep a clean site and reduce stormwater pollution:

- Select designated waste collection areas onsite.
- Inform trash-hauling contractors that you will accept only watertight dumpsters for onsite use. Inspect dumpsters for leaks and repair any dumpster that is not watertight.
- Locate containers in a covered area or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it is windy.
- Cover waste containers at the end of each work day and when it is raining.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Remove this solid waste promptly since erosion and sediment control devices tend to collect litter.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to the trash hauling contractor.
- Arrange for regular waste collection before containers overflow.
- Clean up immediately if a container does spill.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.

Education

- Have the contractor's superintendent or representative oversee and enforce proper solid waste management procedures and practices.
- Instruct employees and subcontractors on identification of solid waste and hazardous waste.
- Educate employees and subcontractors on solid waste storage and disposal procedures.

- Hold regular meetings to discuss and reinforce disposal procedures (incorporate into regular safety meetings).
- Require that employees and subcontractors follow solid waste handling and storage procedures.
- Prohibit littering by employees, subcontractors, and visitors.
- Minimize production of solid waste materials wherever possible.

Collection, Storage, and Disposal

- Littering on the project site should be prohibited.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Trash receptacles should be provided in the contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
- Litter from work areas within the construction limits of the project site should be collected and placed in watertight dumpsters at least weekly, regardless of whether the litter was generated by the contractor, the public, or others. Collected litter and debris should not be placed in or next to drain inlets, stormwater drainage systems, or watercourses.
- Dumpsters of sufficient size and number should be provided to contain the solid waste generated by the project.
- Full dumpsters should be removed from the project site and the contents should be disposed of by the trash hauling contractor.
- Construction debris and waste should be removed from the site biweekly or more frequently as needed.
- Construction material visible to the public should be stored or stacked in an orderly manner.
- Stormwater runon should be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
- Solid waste storage areas should be located at least 50 ft from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding.
- Except during fair weather, construction and highway planting waste not stored in watertight dumpsters should be securely covered from wind and rain by covering the waste with tarps or plastic.
- Segregate potentially hazardous waste from non-hazardous construction site waste.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.

- For disposal of hazardous waste, see WM-6, Hazardous Waste Management. Have hazardous waste hauled to an appropriate disposal and/or recycling facility.

- Salvage or recycle useful vegetation debris, packaging and surplus building materials when practical. For example, trees and shrubs from land clearing can be used as a brush barrier, or converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.

Costs

All of the above are low cost measures.

Inspection and Maintenance

- Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur

- Inspect construction waste area regularly.

- Arrange for regular waste collection.

References

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

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