California Regional Water Quality Control Board, San Diego Region

March 18, 2015

NOTICE OF VIOLATION
No. R9-2015-0049

Kevin Brickley
Toll Brothers
725 W. Town & Country Road, Suite 200
Orange, CA 92868

Toll Brothers	**Violations of**
Robertson Ranch Construction Project PIN No. SM-829466:lwalsh	**Order No. 2009-0009-DWQ, Construction General Permit**

Toll Brothers is hereby notified that the California Regional Water Quality Control Board, San Diego Region (San Diego Water Board) reserves the right to take any enforcement action authorized by law for the violations described herein.

Toll Brothers is in violation of State Water Resources Control Board (State Water Board) Order No. 2009-0009-DWQ, NPDES No. CAS000002, *National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities* (Construction General Permit).

A. Summary of Violations

<u>Construction General Permit Violations</u>

1. **Failure to Comply with Effluent Limitations for Construction Activities:**

   a. **Pursuant to Provision V.A.2 of State Water Board Order No. 2009-0009-DWQ:** Dischargers shall minimize or prevent pollutants in storm water discharges and authorized non-storm water discharges through the use of controls, structures, and management practices that achieve Best Available Technology Economically Achievable (BAT) for toxic and non-conventional pollutants and Best Conventional Pollutant Control Technology (BCT) for conventional pollutants.

b. **Pursuant to Provision X and Section A.1.b of Attachment D of State Water Board Order No. 2009-0009-DWQ:** Dischargers shall minimize or prevent pollutants in storm water and authorized non-storm water discharges through the use of controls, structures, and management practices that achieve BAT for toxic and non-conventional pollutants and BCT for conventional pollutants.

c. **Observation:** During the February 26, 2015 inspection, the San Diego Water Board inspector observed a lack of effective erosion controls and runoff controls required by the CGP on the site within 48 hours prior to a qualifying rain event based on the amount of active acreage under mass grading during the rainy season. Soil stabilization (e.g. soil tackifiers, hydroseed, etc.) technologies were not deployed in conjunction with runoff controls (i.e. earth dikes and drainage swales) at the site. Without soil stabilization BMPs in place in addition to runoff controls the site did not meet BCT. See attached February 26, 2015 Facility Inspection Report Photos 1, 2, and 5 through18.

2. **Failure to Implement Good Site Management "Housekeeping"**

   a. **Pursuant to Provision X and Section B.1.b of Attachment D of State Water Board Order No. 2009-0009-DWQ:** Risk Level 2 dischargers shall cover and berm loose stockpiled construction materials that are not actively being used (i.e. soil, spoils, aggregate, fly-ash, stucco, hydrated lime, etc.).

   b. **Pursuant to Provision X and Section B.1.c of Attachment D of State Water Board Order No. 2009-0009-DWQ:** Risk Level 2 dischargers shall store chemicals in watertight containers (with appropriate secondary containment to prevent any pillage or leakage) or in a storage shed (completely enclosed).

   c. **Pursuant to Provision X and Section B.2.f of Attachment D of State Water Board Order No. 2009-0009-DWQ:** Risk Level 2 dischargers shall implement good housekeeping measures for waste management to contain and securely protect stockpiled waste material from wind and rain at all times unless actively being used.

   d. **Pursuant to Provision X and Section B.3.c of Attachment D of State Water Board Order No. 2009-0009-DWQ:** Risk Level 2 dischargers shall implement good housekeeping measures for vehicle storage and maintenance to clean leaks immediately and disposing of leaked materials properly.

e. **Observation:** During the February 26, 2015 inspection, the San Diego Water Board inspector observed loose stockpiled construction materials there were not actively being used without berms or covers (see Photos 1 and 2), chemicals stored onsite without secondary containment and outside storage sheds (see Photo 3), unprotected stockpiled waste materials exposed to wind and rain (see Photo 3 through 6), and measures to clean leaks immediately and dispose of leaked materials (see Photo 4). See attached February 26, 2015 Facility Inspection Report Identified Photos.

3. **Failure to Implement Adequate Erosion Controls Active and Inactive Areas:**

   a. **Pursuant to Provision X and Section D.2 of Attachment D of State Water Board Order No. 2009-0009-DWQ:** Risk Level 2 dischargers shall provide effective soil cover for inactive areas and all finished slopes, open space, utility backfill, and completed lots.

   b. **Pursuant to Provision X and Section E.3 of Attachment D of State Water Board Order No. 2009-0009-DWQ:** Risk Level 2 dischargers shall implement appropriate erosion control BMPs (runoff control and soil stabilization) in conjunction with sediment control BMPs for areas under active construction. Active areas of construction are areas undergoing land surface disturbance. This includes construction activity during the preliminary stage, mass grading stage, streets and utilities stage and the vertical construction stage.

   c. **Observation:** During the February 26, 2015 inspection, the San Diego Water Board inspector observed several inactive areas of the site, or could be scheduled to be inactive, without effective soil cover or other BMPs that could prevent erosion. Steep slopes on the perimeter of the site lacked any effective soil cover for soil stabilization or runoff controls for erosion control. See attached February 26, 2015 Facility Inspection Report Photos 7 through 11, 13 and 15.

   The San Diego Water Board inspector observed a lack of erosion control BMPs in conjunction with sediment control BMPs throughout the site. Erosion control BMPs include both runoff controls and soil stabilization controls. Order 2009-0009-DWQ defines erosion control BMPs as vegetation, such as grasses and wildflowers, and other materials, such as straw, fiber, stabilizing emulsion, protective blankets, etc. placed to stabilized areas of disturbed soils, to reduce loss of soil due to the action of water or wind, and prevent water pollution." CASQA Construction BMP Guidance Manual defines erosion control as "any source control practice that protects the soil surface and prevents soil particles from being detached by rainfall, flowing water, or wind. Erosion control consists of preparing the soil surface ***and*** (emphasis added) implementing one or more of the BMPs listed in Table 3-1 (e.g. EC-9 Earth Dikes and Drainage Swales)" Erosion controls/Soil stabilization controls were not deployed throughout the site to stabilize the soil surface and prevent soil particles from being detached by rainfall, flowing water, or wind. See February 26, 2015 Facility Inspection Report Photos 1 through 18.

4. **Failure to Implement Adequate Sediment Controls:**

    a. **Pursuant to Provision X and Section E.2 of Attachment D of State Water Board Order No. 2009-0009-DWQ:** On sites where sediment basins are to be used, Risk Level 2 dischargers shall, at minimum, design sediment basins according to the method provided in CASQA's Construction BMP Guidance Handbook.

    b. **Pursuant to Provision X and Section E.4 of Attachment D of State Water Board Order No. 2009-0009-DWQ:** Risk Level 2 dischargers shall apply linear sediment controls along the toe of the slope, face of the slope, and at the grade breaks of exposed slopes to comply with sheet flow lengths in accordance with Table 1in Attachment D.

    c. **Observation:** During the February 26, 2015 inspection, the San Diego Water Board inspector observed sedimentation basins that were not designed in accordance with CASQA Construction BMP Guidance Handbook. The sedimentation basin created to retain runoff from the south east portion of the site was constructed prior to the QSD providing design calculations. See attached February 26, 2015 Facility Inspection Report Photos 17 and 18.

        Linear sediment controls were not present on all slopes along the toe of the slope, face of the slope, and at the grade breaks of exposed slopes to comply with the sheet flow lengths stipulated in Table 1 of Attachment D in Order No. 2009-00009-DWQ. See attached February 26, 2015 Facility Inspection Report Photos 6 through 13, and 15.

5. **Failure to Implement Adequate Run-on and Runoff Controls:**

    a. **Pursuant to Provision X and Section F.1 of Attachment D of State Water Board Order No. 2009-0009-DWQ:** Risk Level 2 shall effectively manage all run-on, all runoff within the site and all runoff that discharges from the site. Run-on from off site shall be directed away from all disturbed areas or shall collectively be in compliance with the effluent limitations in the CGP.

    b. **Observation:** During the January 26, 2015 inspection, the San Diego Water Board inspector observed areas of the site unprotected from run-on. The northwestern portion of the site was not protected from run-on coming from El Camino Real. See attached February 26, 2015 Facility Inspection Report Photo 15.

B. Summary of Potential Enforcement Options

These violations may subject you to additional enforcement by the San Diego Water Board or State Water Resources Control Board, including a potential civil liability assessment of $10,000 per day of violation (Water Code section 13385) and/or any of the following enforcement actions:

Other Potential Enforcement Options	Applicable Water Code Section
Technical or Investigative Order	Sections 13267 or 13383
Cleanup and Abatement Order	Section 13304
Cease and Desist Order	Sections 13301-13303
Time Schedule Order	Sections 13300, 13308

In addition, the San Diego Water Board may consider revising or rescinding applicable waste discharge requirements, if any, referring the matter to other resource agencies, referring the matter to the State Attorney General for injunctive relief, and referral to the municipal or District Attorney for criminal prosecution.

In the subject line of any response, please include the information located in the heading of this letter: "in reply refer to." Questions pertaining to this Notice of Violation should be directed to Laurie Walsh at (619) 521-3373 or Laurie.Walsh@waterboards.ca.gov.

Eric S. Becker

Eric S. Becker, P.E.
Senior Water Resource Control Engineer
Storm Water Management

ESB:lw

Attachments: Facility Inspection Report dated February 26, 2015

Tech Staff Info & Use	
Order No.	2009-00009-DWQ
NPDES No.	CAS000002
Place ID	SM-829466
WDID	9 37C369879
Inspection ID	2025074
Violation ID	856699, 856700, 856701, 856702, 856703
Enforcement ID	418529

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD - SAN DIEGO REGION
WATERSHED PROTECTION PROGRAM

FACILITY INSPECTION REPORT

FACILITY: Robertson Ranch **INSPECTION DATE/TIME:** 02/26/2015; 12:30

WDID/FILE NO.: 9 37C369879

REPRESENTATIVE(S) PRESENT DURING INSPECTION:

NAME: Laurie Walsh, PE WRC Engineer AFFILIATION: San Diego Water Board

NAME: Kevin Brickley Land Development Manager AFFILIATION: Toll Brothers Land Development

NAME: Greg Deacon, Asst. Vice President AFFILIATION: Toll Brothers

NAME: Joe McMahon, Public Works Inspector AFFILIATION: City of Carlsbad

NAME: Shawnetta Grandberry, Senior Construction Inspector AFFILIATION: City of Carlsbad

NAME: Grant Clavier, Public Works Inspector AFFILIATION: City of Carlsbad

Kevin Brickley
NAME OF OWNER, AGENCY OR PARTY RESPONSIBLE FOR DISCHARGE

Toll Brothers Land Development /formerly Rancho Costera LLC
FACILITY OR DEVELOPER NAME (if different from owner)

725 W. Town and Country Road, Suite 200
OWNER MAILING ADDRESS

4980 El Camino Real
Carlsbad, CA 90010
FACILITY ADDRESS

Kevin Brickley (760) 877-9885
OWNER CONTACT NAME AND PHONE #

Kevin Brickley (760) 877-9885
FACILITY OR DEVELOPER CONTACT NAME AND PHONE #

APPLICABLE WATER QUALITY LICENSING REQUIREMENTS:

☐ MS4 URBAN RUNOFF REQUIREMENTS
☒ CONSTRUCTION GENERAL PERMIT
☐ CALTRANS GENERAL PERMIT
☐ INDUSTRIAL GENERAL PERMIT
☐ GENERAL OR INDIVIDUAL WASTE DISCHARGE REQUIREMENTS OR NPDES
☐ GENERAL OR INDIVIDUAL WAIVER OF WASTE DISCHARGE REQUIREMENTS
☐ SECTION 401 WATER QUALITY CERTIFICATION
☐ CWC SECTION 13264

INSPECTION TYPE (Check One):

☐ "A" TYPE COMPLIANCE--COMPREHENSIVE INSPECTION IN WHICH SAMPLES ARE TAKEN. (EPA TYPE S)

☒ "B" TYPE COMPLIANCE--A ROUTINE NONSAMPLING INSPECTION. (EPA TYPE C)

☐ NONCOMPLIANCE FOLLOW-UP--INSPECTION MADE TO VERIFY CORRECTION OF A PREVIOUSLY IDENTIFIED VIOLATION.

☐ ENFORCEMENT FOLLOW-UP--INSPECTION MADE TO VERIFY THAT CONDITIONS OF AN ENFORCEMENT ACTION ARE BEING MET.

☐ COMPLAINT--INSPECTION MADE IN RESPONSE TO A COMPLAINT.

☐ PRE-REQUIREMENT--INSPECTION MADE TO GATHER INFO. RELATIVE TO PREPARING, MODIFYING, OR RESCINDING REQUIREMENTS.

☐ NO EXPOSURE CERTIFICATION (NEC) - VERIFICATION THAT THERE IS NO EXPOSURE OF INDUSTRIAL ACTIVITIES TO STORM WATER.

☐ NOTICE OF TERMINATION REQUEST FOR INDUSTRIAL FACILITIES OR CONSTRUCTION SITES - VERIFICATION THAT THE FACILITY OR CONSTRUCTION SITE IS NOT SUBJECT TO PERMIT REQUIREMENTS.

☐ COMPLIANCE ASSISTANCE INSPECTION-OUTREACH INSPECTION DUE TO DISCHARGER'S REQUEST FOR COMPLIANCE ASSISTANCE.

INSPECTION FINDINGS:

__Y__ WERE VIOLATIONS NOTED DURING THIS INSPECTION? (YES/NO/PENDING SAMPLE RESULTS) –

I. COMPLIANCE HISTORY / PURPOSE OF INSPECTION

On February 26, 2015 Laurie Walsh of the San Diego Water Board performed a routine inspection of the Robertson Ranch LLC Construction Site (site). The 211 acre site is a Risk Level 2 construction project that has been entirely disturbed during the mass grading phase. Construction began at Robertson Ranch in June 2014. This site is located in the Carlsbad Watershed (904.00 HU) adjacent to El Camino Real between Canon Road and Tamarack. The site drains to Aqua Hedionda Creek, a water of the U.S. and tributary to the Aqua Hedionda Lagoon. The inspection occurred at within 48 hours of a qualifying rain event. During the inspection it was documented that much of the site was without soil stabilization controls and linear sediment controls on both active and inactive portions of the site during mass grading. Sedimentation basins were not constructed in accordance with CASQA Construction BMP Guidance Handbook.

Ms. Walsh conducted a non-sampling site inspection, per Order 2009-0009-DWQ Construction General Permit (CGP) and ultimately issued the site Notice of Violation No. R9-2015-0049 for multiple violations of the Construction General Permit Order No. 2009-0009-DWQ.

The QSP for the site is Greg Deacon with Toll Brothers, LLC. The QSD is Wayne Chang with ChangConsultants. Mr. Deacon was present during this site inspection; Mr. Chang was not present during the site inspection. Mr. Brickley with Toll Brothers Land Development (LRP in SMARTS), Joe McMahon, Grant Clavier, and Shawnetta Grandberry, City of Carlsbad Inspectors was present during this inspection. During this inspection focus was again on the lack of erosion controls and sediment controls in place throughout the site on both active and inactive portions of the project less than 48 hours prior to a forecasted 100% chance of rain. The inspection did include review of the SWPPP prior to and after the field visit.

II. FINDINGS

1. A lack of controls, structures, and management practices to achieve Best Conventional Pollutant Control Technology for conventional pollutants (i.e. TSS, pH, oil and grease) was observed during this inspection.

2. A lack of good housekeeping related to stockpile management, waste management, prevention of discharges from vehicle maintenance, and timely response and disposal of materials leaked to the ground was observed during this inspection.

3. Inactive portions of the site lacked soil cover to prevent erosion.

4. At the time of this inspection, the constructed sedimentation basins were not designed in accordance with the method provided in the CASQA Construction BMP Guidance Handbook. Only after the San Diego Water Board inspector brought this requirement to the attention of Mr. Brinkley and City of Carlsbad

Inspectors did the QSD provide an engineering analysis to provide guidance for sizing the sedimentation basins (see Attachment 1 - Rancho Costera – Temporary Sedimentation Basins February 27, 2015 Letter by ChangConsultants)

5. Areas of the site under active construction lacked appropriate erosion control BMPs (runoff control and soil stabilization) in conjunction with sediment control BMPs.

6. Slopes throughout the site lacked effective sedimentation controls.

7. The large slopes at the perimeter of the site lacked linear sediment controls along the toe of the slope, face of the slope, and at the grade breaks of exposed slope to comply with sheet flow lengths in accordance with Table 1 in Attachment D or Order No. 2009-0009-DWQ.

8. The SMARTS database on the project indicates grading will be completed by January 19, 2015. Since that date has passed and there is evidence that grading is not complete as of the date of this inspection, an update to SMARTS is required.

III. COMMENTS AND RECOMMENDATIONS

<u>Comments</u>

1. There is evidence that the site has not implemented BMPs to meet Best Conventional Treatment Technology Based Effluent Limitations under Section V.A.2 of the CGP, as required for all construction sites.

2. There is evidence that the site did not implement good housekeeping BMPs. Loose stockpiles were not covered and bermed (see Photos 1and 2). Chemicals were not stored in watertight containers and lacked any secondary containment (see Photo 3). Waste was not securely protected from wind and rain at all times unless being actively used (see Photos 3 through 6). Leaked materials were not cleaned immediately and disposed of properly (see Photo 4).

3. There is evidence that erosion controls were not adequately implemented throughout the site. The site lacked soil cover technologies to prevent erosion on both inactive and active portions of the site. (see Photos 6 through 13).

4. At the time of this inspection, the constructed sedimentation basins were not designed in accordance with the method provided in the CASQA Construction BMP Guidance Handbook. (see Photos 15 and 16)

5. There is evidence that areas of the site under active construction lacked adequate erosion control BMPs (runoff control and soil stabilization) in conjunction with sediment control BMPs. (see Photos 7 through 16)

6. Slopes throughout the site lacked linear sediment controls along the toe of the slope, face of the slop, and at the grade breaks of exposed slope to comply with sheet flow lengths in accordance with Table 1 in Attachment D or Order No. 2009-0009-DWQ. (see Photos 7 through 18)

7. There is evidence that sediment controls were not adequately implemented throughout the site. (Photos 7 through 13 and see Photo 14 (e.g. improper installation of fiber rolls, and 15 through 18)

8. There is evidence that run-on, all run-off within the site and all runoff that discharges from the site was not properly managed. At the time of this inspection (i.e. less than 48 hours prior to a qualifying rain event) run-on from El Camino Real and Tamarack was not directed away from all disturbed areas. (see Photo 16). The southernmost portion of the site was not reviewed during this inspection, therefore it is uncertain if that portion of the site was adequately protected from run-on.

9. SMARTS requires updating to reflect an accurate date upon which grading will be complete.

Recommendations

1. Issue a Notice of Violation to Rancho Costera LLC for failure to implement Risk Level 2 requirements of CGP.

2. Refer the site to the Compliance Assurance Unit to determine whether or not issuing formal enforcement action may be appropriate.

IV. SIGNATURE SECTION

Laurie Walsh, PE	Laurie Walsh	2/26/2015
STAFF INSPECTOR	SIGNATURE	INSPECTION DATE
Eric Becker, PE	Eric Becker	3/18/15
REVIEWED BY SUPERVISOR	SIGNATURE	DATE

SMARTS:

Tech Staff Info & Use	
Order No.	2009-00009-DWQ
NPDES No.	CAS000002
Place ID	SM-829466
WDID	9 37C369879
Inspection ID	2025074
Violation ID	856699, 856700, 856701, 856702, 856703
Enforcement ID	418529

Attachment 1 - Rancho Costera – Temporary Sedimentation Basins February 27, 2015 Letter by ChangConsultants

Photo 1: Loose soil stockpiles were not covered or bermed. Evidence supports stockpiles were not being used because there is no disturbance of pile.

Photo 2: Loose piles of gravel were not covered or bermed. Evidence supports stockpiles were not being used because there is no disturbance of pile.

Photo 3: Chemicals were not stored in watertight container or storage shed. Waste without secondary containment and not protected from wind and rain.

Photo 4: Leaks to the ground must be cleaned up immediately and disposed of leaked materials appropriately.

Photo 5: Stockpiled tires not contained and securely protected from rain. Waste bin not covered and no evidence of cover nearby indicating that the container is covered at the end of each workday.

Photo 6: Waste bin not covered to provide protection from wind and rain. No evidence of cover nearby indicating that the container is covered at the end of each workday.

Photo 7: Signs of erosion on inactive areas of the site. Portion of the site without erosion or sediment control BMPs even though it has been inactive for more than 14 days (CGP requirement) which also exceeded the City's 10 day definition of inactive.

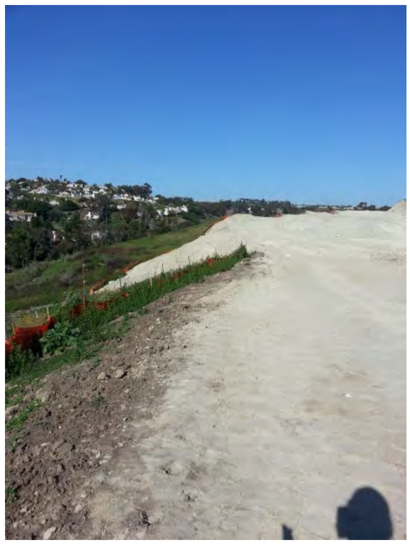

Photo 8: Large steep slopes along much of the perimeter of the site (this view is of the northern perimeter of the site parallel to Tamarack) without linear sediment controls or erosion controls. Portion of the site without erosion or sediment control BMPs even though it has been inactive for more than 14 days (CGP requirement) which also exceeded the City's 10 day definition of inactive. Silt fence is present at the toe of the slope that surrounds the perimeter of the site.

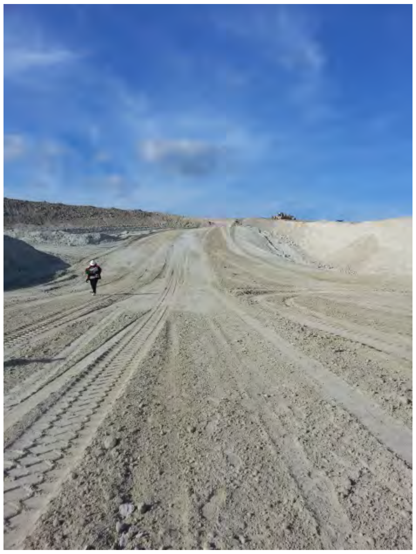

Photo 9: No erosion controls present on large slopes. No linear sediment controls on large slopes. No erosion in conjunction with sediment controls present on other areas of site.

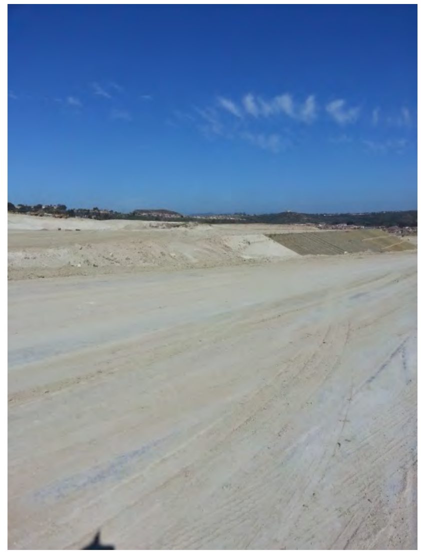

Photo 10 Partial erosion control present (i.e. straw blankets) on one large slope. Partial linear sediment controls on a part of the large slope in this photo. No erosion in conjunction with sediment controls present on other areas of site in this photo.

Photo 11 No erosion controls present on large slopes. No linear sediment controls on large slopes. No erosion in conjunction with sediment controls present on other areas of site.

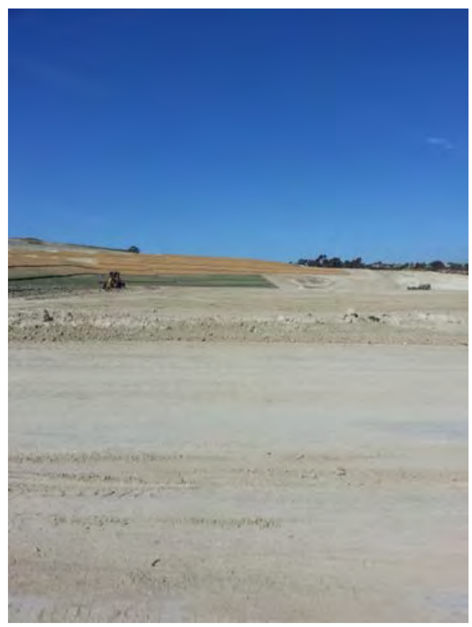

Photo 12 Erosion and sediment controls present only on those slopes that have reached final grade. No erosion in conjunction with sediment controls present on other areas of site.

Photo 13 No erosion controls present on large slopes. No linear sediment controls on large slopes. No erosion in conjunction with sediment controls present on other areas of site.

Photo 14 Erosion controls present only on slopes that have reached final grade. Linear sediment controls installed end to end and not overlapped per CASQA Construction BMP Handbooks. None of the fiber rolls on the site at the time of this inspection were installed with overlapping ends It was unclear if the rolls were trenched in 4 inches.

Photo 15 No erosion controls present on large steep slopes (red arrow). No linear sediment controls on large slopes steep slopes (outlined in orange). No erosion in conjunction with sediment controls present on either areas.

Photo 16 No protection from run-on. Looking south onto the site this area is subject to run-on from El Camino Real and Tamarak (yellow arrows indicate plath of flow) At the time of this inspection (less than 48 hours prior to a rain event) this area was unprotected from run-in. The large soil stockpile was unprotected from wind and rain. The stockpile was not protected using soil stabilizers or bermed.

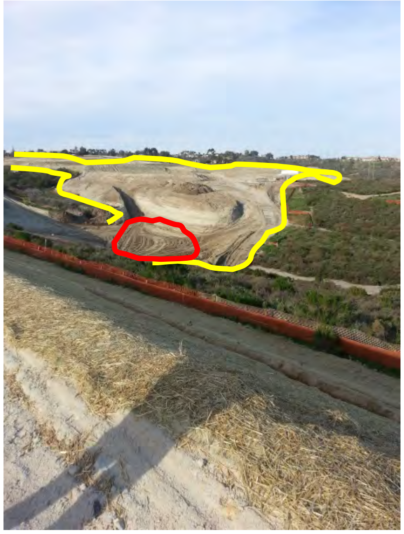

Photo 17 Large sediment basin (outined in red) is the only BMP being relied upon to capture sediment and runoff from the approximately 45 acre portion of the site identified by the yellow line. At the time of this inpsection this basin had not been designed in accordance with CASQA guidelines. No erosioin controls present.

Photo 18 Large sediment basin (outined in red) is the only BMP being relied upon to capture sediment and runoff from the surroudning area site shown in the photo. At the time of this inpsection this basin had not been designed in accordance with CASQA guidelines. At the time of this inspection a berm to close off this basin (blue line) had not been constructed. No soil stabilization erosoin controls are present. No linear sediment controls are in place on slopes. No erosion in conjunction with sediment controls present.

ChangConsultants
Civil Engineering◦Hydrology◦Hydraulics◦Sedimentation

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February 27, 2015

Kevin Brickley
Toll Brothers
725 W. Town & Country Road, Suite 200
Orange, CA 92868

Subject: Rancho Costera – Temporary Sedimentation Basins

Dear Kevin:

As requested, I have performed engineering analyses to provide guidance for sizing the temporary sediment basins implemented during your Rancho Costera grading operations. Sediment basins will be constructed at various locations throughout the site during grading, and are an appropriate construction best management practice because the primary pollutant generated by grading is sediment. Since the grading is dynamic, these guidelines should be used to ensure that the storage volume is adequate as grading progresses. A temporary sediment basin is only needed until its tributary area receives final stabilization.

The California Stormwater Quality Association's (CASQA) *California Stormwater BMP Handbook – Construction* provides sizing criteria for sediment basins (see attached data sheet SE-2). The data sheet outlines three design options. The first option was chosen because the input values can be specifically determined for the site. The associated equation is:

$A_S = 1.2Q / V_s$ where As is the required sediment basin surface area, square feet
Q is the discharge rate, cubic feet per second
V_s is the settling velocity, feet per second

Q is determined from the rational method equation:

$Q = CIA$ where C is the runoff coefficient, dimensionless
I is the 10-year, 6-hour intensity rainfall; inches per hour
A is the area tributary to the sediment basin, acres

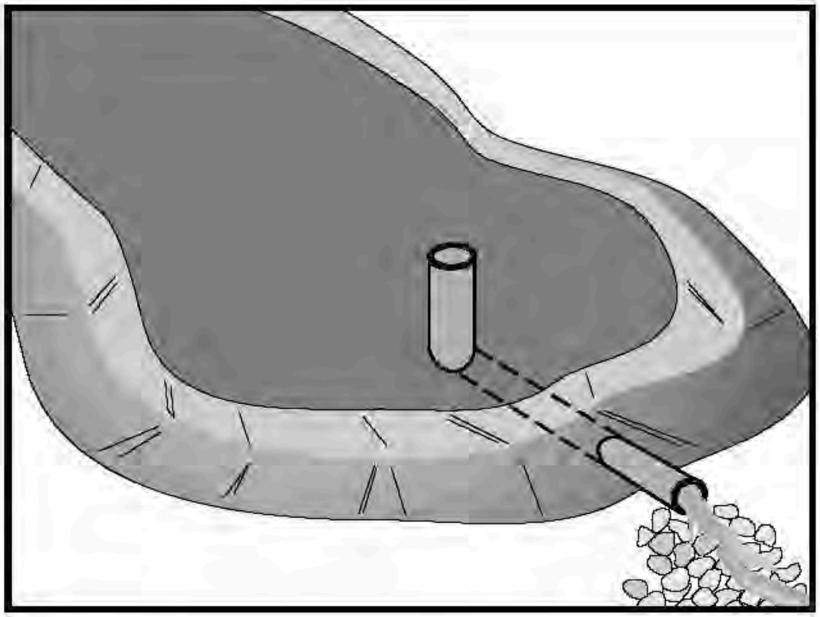
The input values for Q are as follows (the supporting data is attached). The runoff coefficient, C, is determined from Table 3-1 from the County of San Diego's *Hydrology Manual*, which is based on the hydrologic soil group and land use. The hydrologic soil group at the site was conservatively selected as D and the land use during grading is equivalent to 0 percent impervious. Table 3-1 shows that these values result in a C of 0.35. The rainfall intensity, I, is determined from Figure 3-1 from the *Hydrology Manual*. The 10-year rainfall amounts are entered into Figure 3-1 to determine the 10-year, 6-hour intensity-duration curve. Since the sediment basins will be installed throughout the site, the flow path to each basin will be relatively short, so the time of concentration was assumed to be 5 minutes. Based on this Figure 3-1 shows that I is approximately 4.9 inches per hour. Therefore, Q = (0.35)(4.9)A = 1.72A.

The Q value is entered into the first equation along with the appropriate settling velocity. According to the Web Soil Survey, the soil within the grading footprint is predominantly loamy fine sand. The fall velocity for fine sand is 0.023 feet per second. Therefore, A_S = 1.2 (1.72A) / 0.023 = 89.5A. This can be rewritten as A_S / A = 89.5, which indicates that the surface area of a sediment basin must cover 89.5 square feet (approximately 9.5 feet by 9.5 feet) for every acre that drains to the basin. This should be used as guidance in establishing the sediment basin sizing during the grading operations. The attached data sheet SE-2 should be referred to for additional sediment basin guidelines.

Sincerely,

Wayne W. Chang, M.S., P.E.

Sediment Basin SE-2



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

SE-3 Sediment Trap (for smaller areas)

Description and Purpose

A sediment basin is a temporary basin formed by excavation or by constructing an embankment so that sediment-laden runoff is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is discharged.

Sediment basin design guidance presented in this fact sheet is intended to provide options, methods, and techniques to optimize temporary sediment basin performance and basin sediment removal. Basin design guidance provided in this fact sheet is not intended to guarantee basin effluent compliance with numeric discharge limits (numeric action levels or numeric effluent limits for turbidity). Compliance with discharge limits requires a thoughtful approach to comprehensive BMP planning, implementation, and maintenance. Therefore, optimally designed and maintained sediment basins should be used in conjunction with a comprehensive system of BMPs that includes:

- Diverting runoff from undisturbed areas away from the basin
- Erosion control practices to minimize disturbed areas on-site
  and to provide temporary stabilization and interim sediment controls (e.g., stockpile perimeter control, check dams, perimeter controls around individual lots) to reduce the basin's influent sediment concentration.

At some sites, sediment basin design enhancements may be required to adequately remove sediment. Traditional (aka "physical") enhancements such as alternative outlet configurations or flow deflection baffles increase detention time and other techniques such as outlet skimmers preferentially drain flows with lower sediment concentrations. These "physical" enhancement techniques are described in this fact sheet. To further enhance sediment removal particularly at sites with fine soils or turbidity sensitive receiving waters, some projects may need to consider implementing Active Treatment Systems (ATS) whereby coagulants and flocculants are used to enhance settling and removal of suspended sediments. Guidance on implementing ATS is provided in SE-11.

Suitable Applications

Sediment basins may be suitable for use on larger projects with sufficient space for constructing the basin. Sediment basins should be considered for use:

- Where sediment-laden water may enter the drainage system or watercourses
- On construction projects with disturbed areas during the rainy season
- At the outlet of disturbed watersheds between 5 acres and 75 acres and evaluated on a site by site basis
- Where post construction detention basins are required
- In association with dikes, temporary channels, and pipes used to convey runoff from disturbed areas

Limitations

Sediment basins must be installed only within the property limits and where failure of the structure will not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities. In addition, sediment basins are attractive to children and can be very dangerous. Local ordinances regarding health and safety must be adhered to. If fencing of the basin is required, the type of fence and its location should be shown in the SWPPP and in the construction specifications.

- As a general guideline, sediment basins are suitable for drainage areas of 5 acres or more, but not appropriate for drainage areas greater than 75 acres. However, the tributary area should be evaluated on a site by site basis.
- Sediment basins may become an "attractive nuisance" and care must be taken to adhere to all safety practices. If safety is a concern, basin may require protective fencing.
- Sediment basins designed according to this fact sheet are only effective in removing sediment down to about the silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) may not be adequately treated unless chemical (or other appropriate method) treatment is used in addition to the sediment basin.
- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft or more must obtain approval from California Department of Water Resources Division of Safety of Dams (http://www.water.ca.gov/damsafety/).

- Water that stands in sediment basins longer than 96 hours may become a source of mosquitoes (and midges), particularly along perimeter edges, in shallow zones, in scour or below-grade pools, around inlet pipes, along low-flow channels, and among protected habitats created by emergent or floating vegetation (e.g. cattails, water hyacinth), algal mats, riprap, etc.
- Basins require large surface areas to permit settling of sediment. Size may be limited by the available area.

Implementation

General

A sediment basin is a controlled stormwater release structure formed by excavation or by construction of an embankment of compacted soil across a drainage way, or other suitable location. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure expected to be used during active construction in most cases and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed.

Sediment basins are suitable for nearly all types of construction projects. Whenever possible, construct the sediment basins before clearing and grading work begins. Basins should be located at the stormwater outlet from the site but not in any natural or undisturbed stream. A typical application would include temporary dikes, pipes, and/or channels to convey runoff to the basin inlet.

Many development projects in California are required by local ordinances to provide a stormwater detention basin for post-construction flood control, desilting, or stormwater pollution control. A temporary sediment basin may be constructed by rough grading the post-construction control basins early in the project.

Sediment basins if properly designed and maintained can trap a significant amount of the sediment that flows into them. However, traditional basins do not remove all inflowing sediment. Therefore, they should be used in conjunction with erosion control practices such as temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

Planning

To improve the effectiveness of the basin, it should be located to intercept runoff from the largest possible amount of disturbed area. Locations best suited for a sediment basin are generally in lower elevation areas of the site (or basin tributary area) where site drainage would not require significant diversion or other means to direct water to the basin but outside jurisdictional waterways. However, as necessary, drainage into the basin can be improved by the use of earth dikes and drainage swales (see BMP EC-9). . The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

Construct before clearing and grading work begins when feasible.

- Do not locate the basin in a jurisdictional stream.

- Basin sites should be located where failure of the structure will not cause loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities.

- Basins with a height of 25 ft or more or an impounding capacity of 50 ac-ft must obtain approval from the Division of Dam Safety. Local dam safety requirements may be more stringent.

- Limit the contributing area to the sediment basin to only the runoff from the disturbed soil areas. Use temporary concentrated flow conveyance controls to divert runoff from undisturbed areas away from the sediment basin.

- The basin should be located: (1) by excavating a suitable area or where a low embankment can be constructed across a swale, (2) where post-construction (permanent) detention basins will be constructed, and (3) where the basins can be maintained on a year-round basis to provide access for maintenance, including sediment removal and sediment stockpiling in a protected area, and to maintain the basin to provide the required capacity.

Design

When designing a sediment basin, designers should evaluate the site constraints that could affect the efficiency of the BMP. Some of these constraints include: the relationship between basin capacity, anticipated sediment load, and freeboard, available footprint for the basin, maintenance frequency and access, and hydraulic capacity and efficiency of the temporary outlet infrastructure. Sediment basins should be designed to maximize sediment removal and to consider sediment load retained by the basin as it affects basin performance.

Three Basin Design Options (Part A) are presented below along with a Typical Sediment/Detention Basin Design Methodology (Part B). Regardless of the design option that is selected, designers also need to evaluate the sediment basin capacity with respect to sediment accumulation (See "*Step 3. Evaluate the Capacity of the Sediment Basin*"), and should incorporate approaches identified in "*Step 4. Other Design Considerations*" to enhance basin performance.

A) Basin Design Options:

Option 1:

Design sediment basin(s) using the standard equation:

$$A_s = \frac{1.2Q}{V_s} \qquad \text{(Eq. 1)}$$

Where:

A_s = Minimum surface area for trapping soil particles of a certain size

V_s = Settling velocity of the design particle size chosen (V_s = 0.00028 ft/s for a design particle size of 0.01 mm at 68°F)

1.2 = Factor of safety recommended by USEPA to account for the reduction in basin efficiency caused due to turbulence and other non ideal conditions.

$Q = CIA$ (Eq.2)

Where

Q = Discharge rate measured in cubic feet per second

C = Runoff coefficient (unitless)

I = Peak rainfall intensity for the 10-year, 6-hour rain event (in/hr)

A = Area draining into the sediment basin in acres

The design particle size should be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01 mm [or 0.0004 in.]) particle, and the Vs used should be 100 percent of the calculated settling velocity.

This sizing basin method is dependent on the outlet structure design or the total basin length with an appropriate outlet. If the designer chooses to utilize the outlet structure to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a minimum of twice the basin width; the depth should not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity). If the designer chooses to utilize the basin length (with appropriate basin outlet) to control the flow duration in the basin, the basin length (distance between the inlet and the outlet) should be a specifically designed to capture 100% of the design particle size; the depth should not be less than 3 ft nor greater than 5 ft for safety reasons and for maximum efficiency (2 ft of sediment storage, 2 ft of capacity).

The basin should be located on the site where it can be maintained on a year-round basis and should be maintained on a schedule to retain the 2 ft of capacity.

Option 2:

Design pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 1.

Option 3:

The use of an equivalent surface area design or equation provided that the design efficiency is as protective or more protective of water quality than Option 1.

B) Typical Sediment/Detention Basin Design Methodology:

Design of a sediment basin requires the designer to have an understanding of the site constraints, knowledge of the local soil (e.g., particle size distribution of potentially contributing soils), drainage area of the basin, and local hydrology. Designers should not assume that a sediment basin for location A is applicable to location B. Therefore, designers can use this factsheet as guidance but will need to apply professional judgment and knowledge of the site to design an effective and efficient sediment basin. The following provides a general overview of typical design methodologies:

Step 1. Hydrologic Design

- Evaluate the site constraints and assess the drainage area for the sediment basin. Designers should consider on- and off-site flows as well as changes in the drainage area associated with site construction/disturbance. To minimize additional construction during the course of the project, the designer should consider identifying the maximum drainage area when calculating the basin dimensions.

- If a local hydrology manual is not available it is recommended to follow standard rational method procedures to estimate discharge. The references section of this factsheet provides a reference to standard hydrology textbooks that can provide standard methodologies. If local rainfall depths are not available, values can be obtained from standard precipitation frequency maps from NOAA (downloaded from http://www.wrcc.dri.edu/pcpnfreq.html).

Step 2. Hydraulic Design

- Calculate the surface area required for the sediment basin using Equation 1. In which discharge is estimated for a 10-yr 6-hr event using rational method procedure listed in local hydrology manual and Vs is estimated using Stokes Law presented in Equation 3.

$V_s = 2.81d^2$ (Eq.3)

Where

V_s = Settling velocity in feet per second at 68˚F

d = diameter of sediment particle in millimeters (smallest soil grain size determined by wet sieve analysis or fine silt (0.01 mm [or 0.0004 in.])

- In general the basin outlet design requires an iterative trial and error approach that considered the maximum water surface elevation, the elevation versus volume (stage-storage) relationship, the elevation verses discharge (stage-discharge) relationship, and the estimated inflow hydrograph. To adequately design the basins to settle sediment, the outlet configuration and associated outflow rates can be estimated by numerous methodologies. The following provides some guidance for design the basin outlet:
  - An outlet should have more than one orifice.
  - An outlet design typically utilizes multiple horizontal rows of orifices (approximately 3 or more) with at least 2 orifices per row (see Figures 1 and 2 at the end of this fact sheet).
  - Orifices can vary in shape.
  - Select the appropriate orifice diameter and number of perforations per row with the objective of minimizing the number of rows while maximizing the detention time.

- The diameter of each orifice is typically a maximum of 3-4 inches and a minimum of 0.25-0.5 inches.
- If a rectangular orifice is used, it is recommended to have minimum height of 0.5 inches and a maximum height of 6 inches.
- Rows are typically spaced at three times the diameter center to center vertically with a minimum distance of approximately 4 inches on center and a maximum distance of 1 foot on center.
- To estimate the outflow rate, each row is calculated separately based on the flow through a single orifice then multiplied by the number of orifices in the row. This step is repeated for each of the rows. Once all of the orifices are estimated, the total outflow rate versus elevation (stage-discharge curve) is developed to evaluate the detention time within the basin.
- Flow through a single orifice can be estimated using an Equation 4:

$$Q = BC'A(2gH)^{0.5} \qquad \text{(Eq.4)}$$

Where
Q = Discharge in ft^3/s
C′ = Orifice coefficient (unitless)
A = Area of the orifice (ft^2)
g = acceleration due to gravity (ft^3/s)
H = Head above the orifice (ft)
B = Anticipated Blockage or clogging factor (unitless), It is dependent on anticipated sediment and debris load, trash rack configuration etc, so the value is dependent on design engineers professional judgment and/or local requirements (B is never greater than 1 and a value of 0.5 is generally used)

  - Care must be taken in the selection of orifice coefficient ("C′"); 0.60 is most often recommended and used. However, based on actual tests, Young and Graziano (1989), "Outlet Hydraulics of Extended Detention Facilities for Northern Virginia Planning District Commission", recommends the following:
    - C′ = 0.66 for thin materials; where the thickness is equal to or less than the orifice diameter, or
    - C′ = 0.80 when the material is thicker than the orifice diameter
- If different sizes of orifices are used along the riser then they have to be sized such that not more than 50 percent of the design storm event drains in one-third of the drawdown time (to provide adequate settling time for events smaller than the design storm event) and the entire volume drains within 96 hours or as regulated by the local vector control agency. If a basin fails to drain within 96 hours, the basin must be pumped dry.

- Because basins are not maintained for infiltration, water loss by infiltration should be disregarded when designing the hydraulic capacity of the outlet structure.

- Floating Outlet Skimmer: The floating skimmer (see Figure 3 at the end of this fact sheet is an alternative outlet configuration (patented) that drains water from upper portion of the water column. This configuration has been used for temporary and permanent basins and can improve basin performance by eliminating bottom orifices which have the potential of discharging solids. Some design considerations for this alternative outlet device includes the addition of a sand filter or perforated under drain at the low point in the basin and near the floating skimmer. These secondary drains allow the basin to fully drain. More detailed guidelines for sizing the skimmer can be downloaded from http://www.fairclothskimmer.com/.

- Hold and Release Valve: An ideal sediment/detention basin would hold all flows to the design storm level for sufficient time to settle solids, and then slowly release the storm water. Implementing a reliable valve system for releasing detention basins is critical to eliminate the potential for flooding in such a system. Some variations of hold and release valves include manual valves, bladder devices or electrically operated valves. When a precipitation event is forecast, the valve would be close for the duration of the storm and appropriate settling time. When the settling duration is met (approximately 24 or 48 hours), the valve would be opened and allow the stormwater to be discharged at a rate that does not resuspend settled solids and in a non-erosive manner. If this type of system is used the valve should be designed to empty the entire basin within 96 hours or as stipulated by local vector control regulations.

Step 3. Evaluate the Capacity of the Sediment Basin

- Typically, sediment basins do not perform as designed when they are not properly maintained or the sediment yield to the basin is larger than expected. As part of a good sediment basin design, designers should consider maintenance cycles, estimated soil loss and/or sediment yield, and basin sediment storage volume. The two equations below can be used to quantify the amount of soil entering the basin.

- The Revised Universal Soil Loss Equation (RUSLE, Eq.5) can be used to estimate annual soil loss and the Modified Universal Soil Equation (MUSLE, Eq.6) can be used to estimate sediment yield from a single storm event.

$$A = R \times K \times LS \times C \times P \qquad \text{(Eq.5)}$$

$$Y = 95\left(Q \times q_p\right)^{0.56} \times K \times LS \times C \times P \qquad \text{(Eq.6)}$$

Where:

A = annual soil loss, tons/acre-year

R = rainfall erosion index, in 100 ft.tons/acre.in/hr

K = soil erodibility factor, tons/acre per unit of R

LS = slope length and steepness factor (unitless)

C = vegetative cover factor (unitless)

P = erosion control practice factor (unitless)

Y = single storm sediment yield in tons

Q = runoff volume in acre-feet

q_p = peak flow in cfs

- Detailed descriptions and methodologies for estimating the soil loss can be obtained from standard hydrology text books (See References section).

- Determination of the appropriate equation should consider construction duration and local environmental factors (soils, hydrology, etc.). For example, if a basin is planned for a project duration of 1 year and the designer specifies one maintenance cycle, RUSLE could be used to estimate the soil loss and thereby the designer could indicate that the sediment storage volume would be half of the soil loss value estimated. As an example for use of MUSLE, a project may have a short construction duration thereby requiring fewer maintenance cycles and a reduced sediment storage volume. MUSLE would be used to estimate the anticipated soil loss based on a specific storm event to evaluate the sediment storage volume and appropriate maintenance frequency.

- The soil loss estimates are an essential step in the design and it is essential that the designer provide construction contractors with enough information to understand maintenance frequency and/or depths within the basin that would trigger maintenance. Providing maintenance methods, frequency and specification should be included in design bid documents such as the SWPPP Site Map.

- Once the designer has quantified the amount of soil entering the basin, the depth required for sediment storage can be determined by dividing the estimated sediment loss by the surface area of the basin.

Step 4. Other Design Considerations

- Consider designing the volume of the settling zone for the total storm volume associated with the 2-year event or other appropriate design storms specified by the local agency. This volume can be used as a guide for sizing the basin without iterative routing calculations. The depth of the settling zone can be estimated by dividing the estimated 2-yr storm volume by the surface area of the basin.

- The basin volume consists of two zones:

  - A sediment storage zone at least 1 ft deep.

  - A settling zone at least 2 ft deep.

  - The basin depth must be no less than 3 ft (not including freeboard).

- Proper hydraulic design of the outlet is critical to achieving the desired performance of the basin. The outlet should be designed to drain the basin within 24 to 96 hours (also referred to as “drawdown time”). The 24-hour limit is specified to provide adequate settling time; the 96-hour limit is specified to mitigate vector control concerns.

- Confirmation of the basin performance can be evaluated by routing the design storm (10-yr 6-hr, or as directed by local regulations) through the basin based on the basin volume (stage-storage curve) and the outlet design (stage-discharge curve based on the orifice configuration or equivalent outlet design).

- Sediment basins, regardless of size and storage volume, should include features to accommodate overflow or bypass flows that exceed the design storm event.

  - Include an emergency spillway to accommodate flows not carried by the principal spillway. The spillway should consist of an open channel (earthen or vegetated) over undisturbed material (not fill) or constructed of a non-erodible riprap (or equivalent protection) on fill slopes.

  - The spillway control section, which is a level portion of the spillway channel at the highest elevation in the channel, should be a minimum of 20 ft in length.

- Rock, vegetation or appropriate erosion control should be used to protect the basin inlet, outlet, and slopes against erosion.

- The total depth of the sediment basin should include the depth required for sediment storage, depth required for settling zone and freeboard of at least 1 foot or as regulated by local flood control agency for a flood event specified by the local agency.

- The basin alignment should be designed such that the length of the basin is more than twice the width of the basin; the length should be determined by measuring the distance between the inlet and the outlet. If the site topography does not allow for this configuration baffles should be installed so that the ratio is satisfied. If a basin has more than one inflow point, any inflow point that conveys more than 30 percent of the total peak inflow rate has to meet the required length to width ratio.

- An alternative basin sizing method proposed by Fifield (2004) can be consulted to estimate an alternative length to width ratio and basin configuration. These methods can be considered as part of Option 3 which allows for alternative designs that are protective or more protective of water quality.

- Baffles (see Figure 4 at the end of this fact sheet) can be considered at project sites where the existing topography or site constraints limit the length to width ratio. Baffles should be constructed of earthen berms or other structural material within the basin to divert flow in the basin, thus increasing the effective flow length from the basin inlet to the outlet riser. Baffles also reduce the change of short circuiting and allows for settling throughout the basin.

- Baffles are typically constructed from the invert of the basin to the crest of the emergency spillway (i.e., design event flows are meant to flow around the baffles and flows greater than the design event would flow over the baffles to the emergency spillway).

- Use of other materials for construction of basin baffles (such as silt fence) may not be appropriate based on the material specifications and will require frequent maintenance (maintain after every storm event). Maintenance may not be feasible when required due to flooded conditions resulting from frequent (i.e., back to back) storm events. Use of alternative baffle materials should not deviate from the intended purpose of the material, as described by the manufacturer.
- Sediment basins are best used in conjunction with erosion controls.
- Basins with an impounding levee greater than 4.5 ft tall, measured from the lowest point to the impounding area to the highest point of the levee, and basins capable of impounding more than 35,000 ft^3, should be designed by a Registered Civil Engineer. The design should include maintenance requirements, including sediment and vegetation removal, to ensure continuous function of the basin outlet and bypass structures.
- A forebay, constructed upstream of the basin may be provided to remove debris and larger particles.
- The outflow from the sediment basin should be provided with velocity dissipation devices (see BMP EC-10) to prevent erosion and scouring of the embankment and channel.
- The principal outlet should consist of a corrugated metal, high density polyethylene (HDPE), or reinforced concrete riser pipe with dewatering holes and an anti-vortex device and trash rack attached to the top of the riser, to prevent floating debris from flowing out of the basin or obstructing the system. This principal structure should be designed to accommodate the inflow design storm.
- A rock pile or rock-filled gabions can serve as alternatives to the debris screen, although the designer should be aware of the potential for extra maintenance involved should the pore spaces in the rock pile clog.
- The outlet structure should be placed on a firm, smooth foundation with the base securely anchored with concrete or other means to prevent floatation.
- Attach riser pipe (watertight connection) to a horizontal pipe (barrel). Provide anti-seep collars on the barrel.
- Cleanout level should be clearly marked on the riser pipe.

Installation

- Securely anchor and install an anti-seep collar on the outlet pipe/riser and provide an emergency spillway for passing major floods (see local flood control agency).
- Areas under embankments must be cleared and stripped of vegetation.
- Chain link fencing should be provided around each sediment basin to prevent unauthorized entry to the basin or if safety is a concern.

Costs

The cost of a sediment basin is highly variable and is dependent of the site configuration. To decrease basin construction costs, designers should consider using existing site features such as berms or depressed area to site the sediment basin. Designers should also consider potential savings associated with designing the basin to minimize the number of maintenance cycles and siting the basin in a location where a permanent BMP (e.g., extended detention basin) is required for the project site.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level and as required by local requirements. It is recommended that at a minimum, basins be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Examine basin banks for seepage and structural soundness.
- Check inlet and outlet structures and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Check inlet and outlet area for erosion and stabilize if required.
- Check fencing for damage and repair as needed.
- Sediment that accumulates in the basin must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when sediment accumulation reaches one-half the designated sediment storage volume. Sediment removed during maintenance should be managed properly. The sediment should be appropriately evaluated and used or disposed of accordingly. Options include: incorporating sediment into earthwork on the site (only if there is no risk that sediment is contaminated); or off-site export/disposal at an appropriate location (e.g., sediment characterization and disposal to an appropriate landfill).
- Remove standing water from basin within 96 hours after accumulation.
- If the basin does not drain adequately (e.g., due to storms that are more frequent or larger than the design storm or other unforeseen site conditions), dewatering should be conducted in accordance with appropriate dewatering BMPs (see NS-2) and in accordance with local permits as applicable.
- To minimize vector production:
  - Remove accumulation of live and dead floating vegetation in basins during every inspection.
  - Remove excessive emergent and perimeter vegetation as needed or as advised by local or state vector control agencies.

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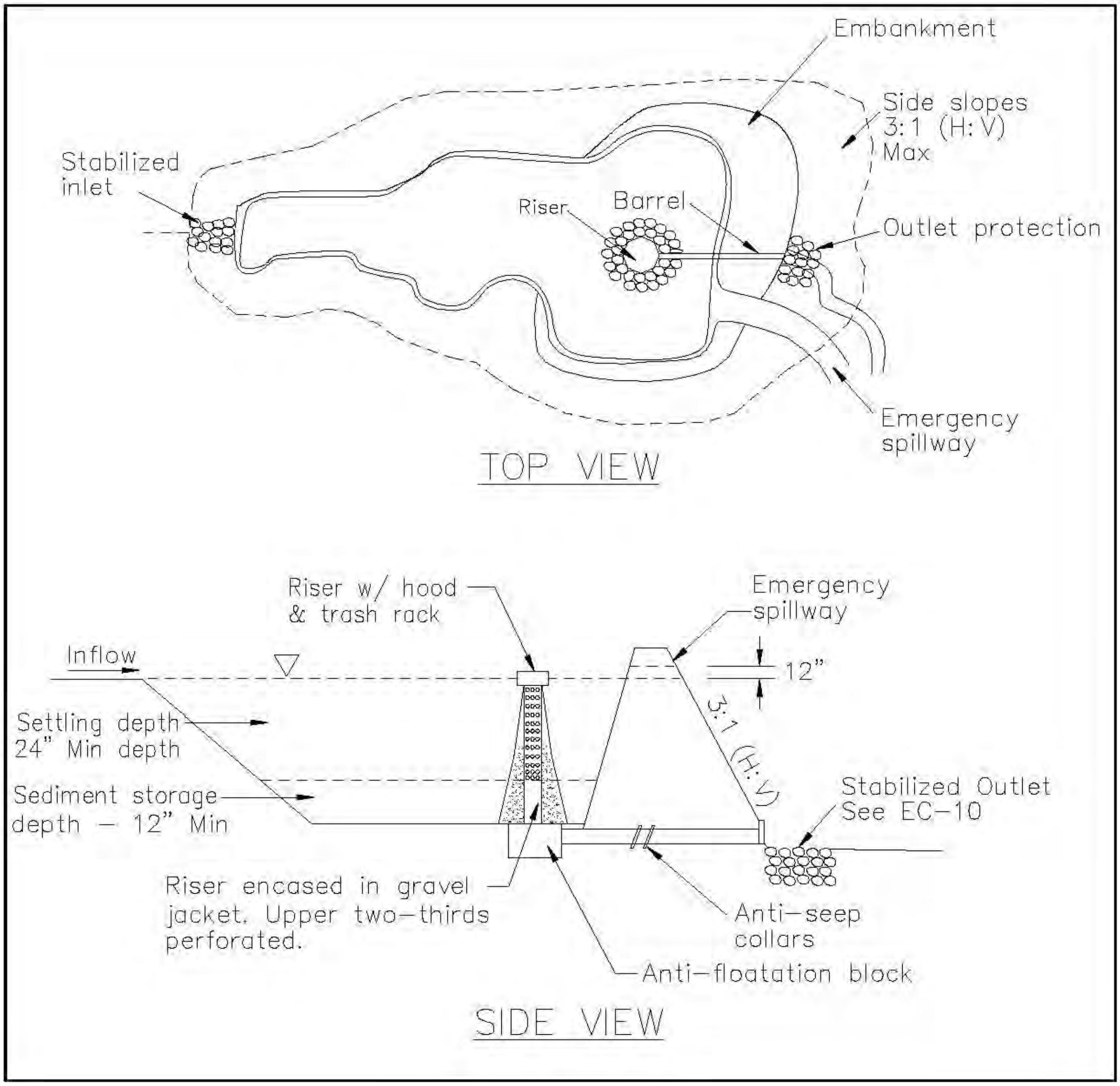


FIGURE 1: TYPICAL TEMPORARY SEDIMENT BASIN
MULTIPLE ORIFICE DESIGN
NOT TO SCALE

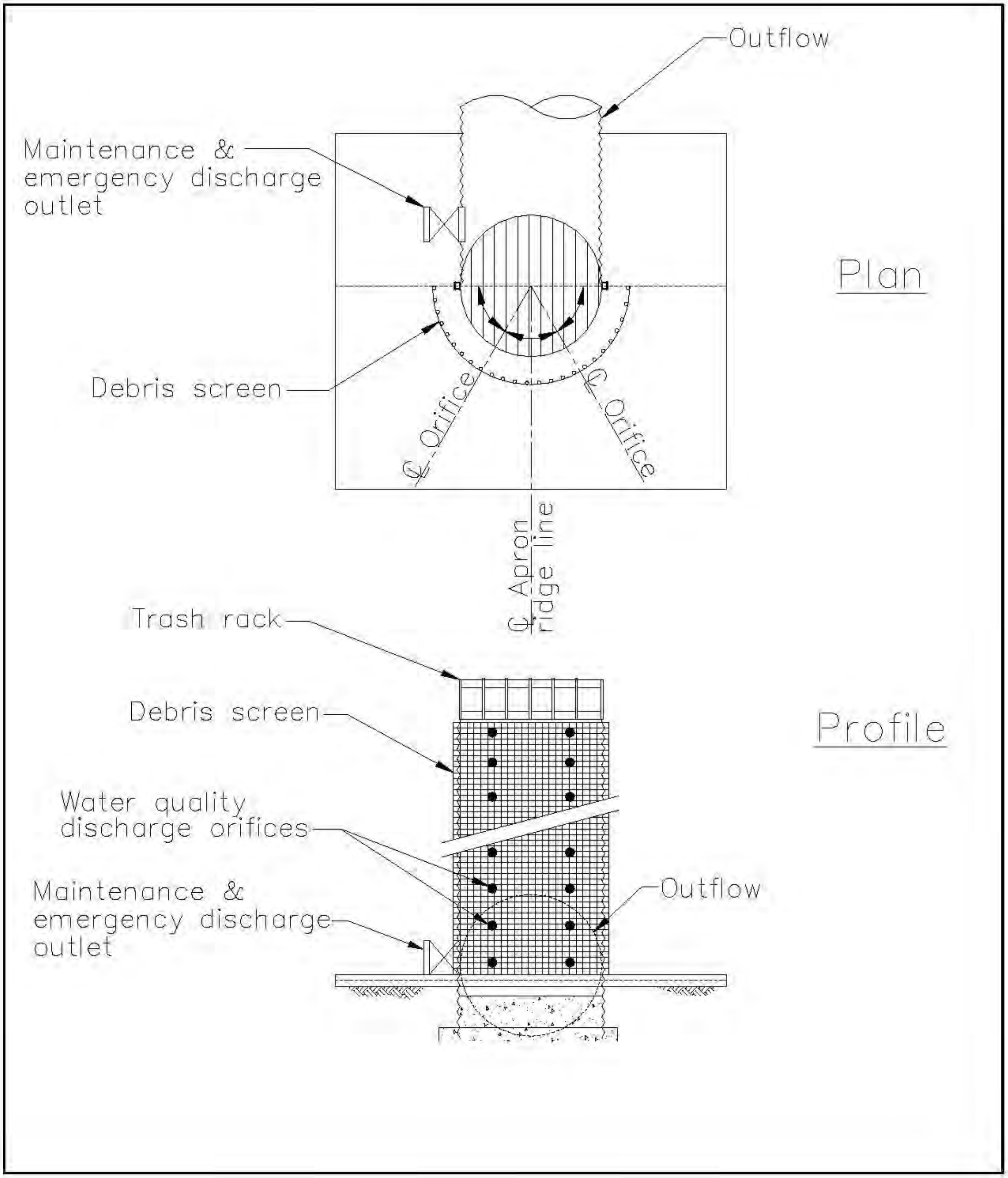


FIGURE 2: MULTIPLE ORIFICE OUTLET RISER
NOT TO SCALE

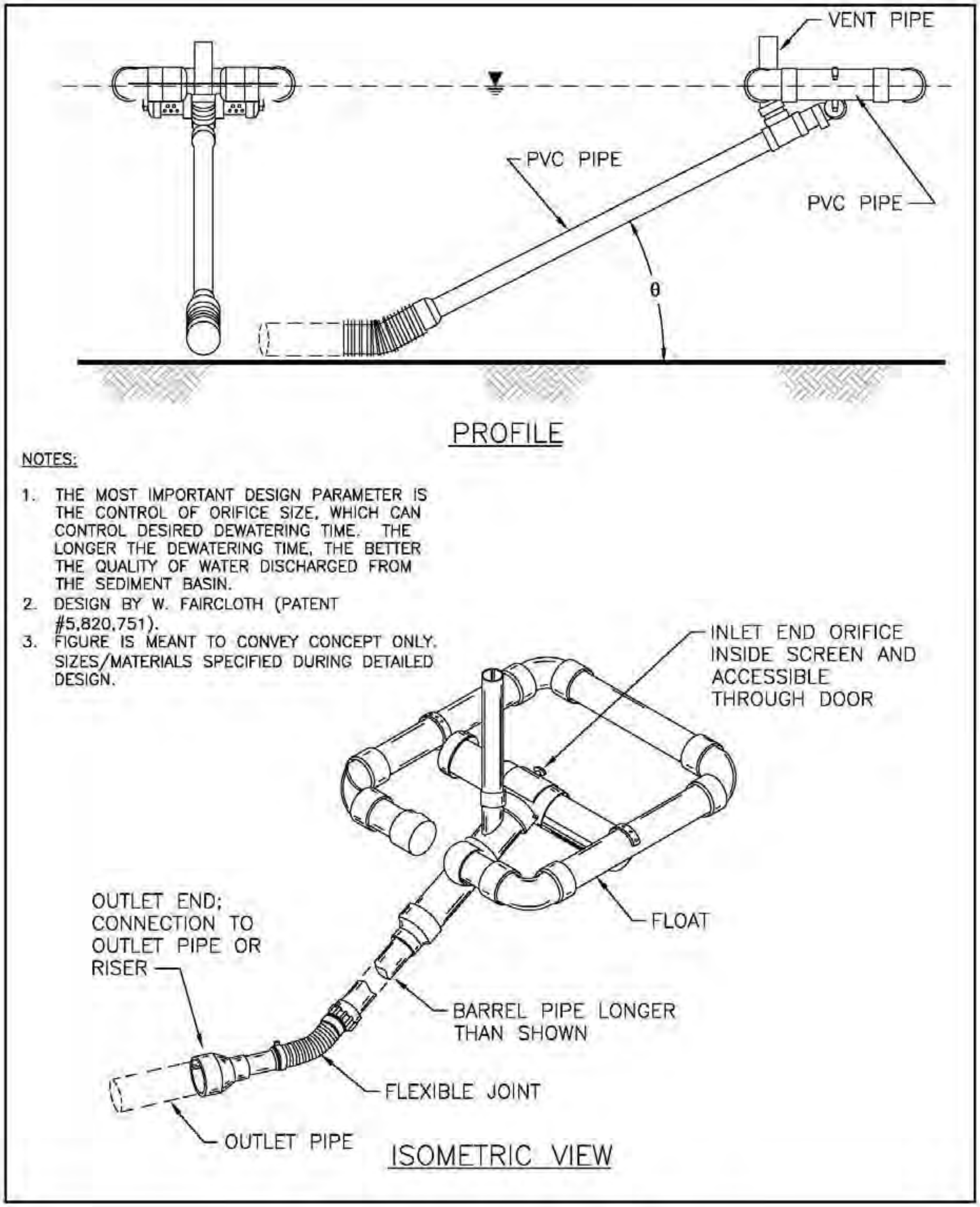


FIGURE 3: TYPICAL SKIMMER
NOT TO SCALE

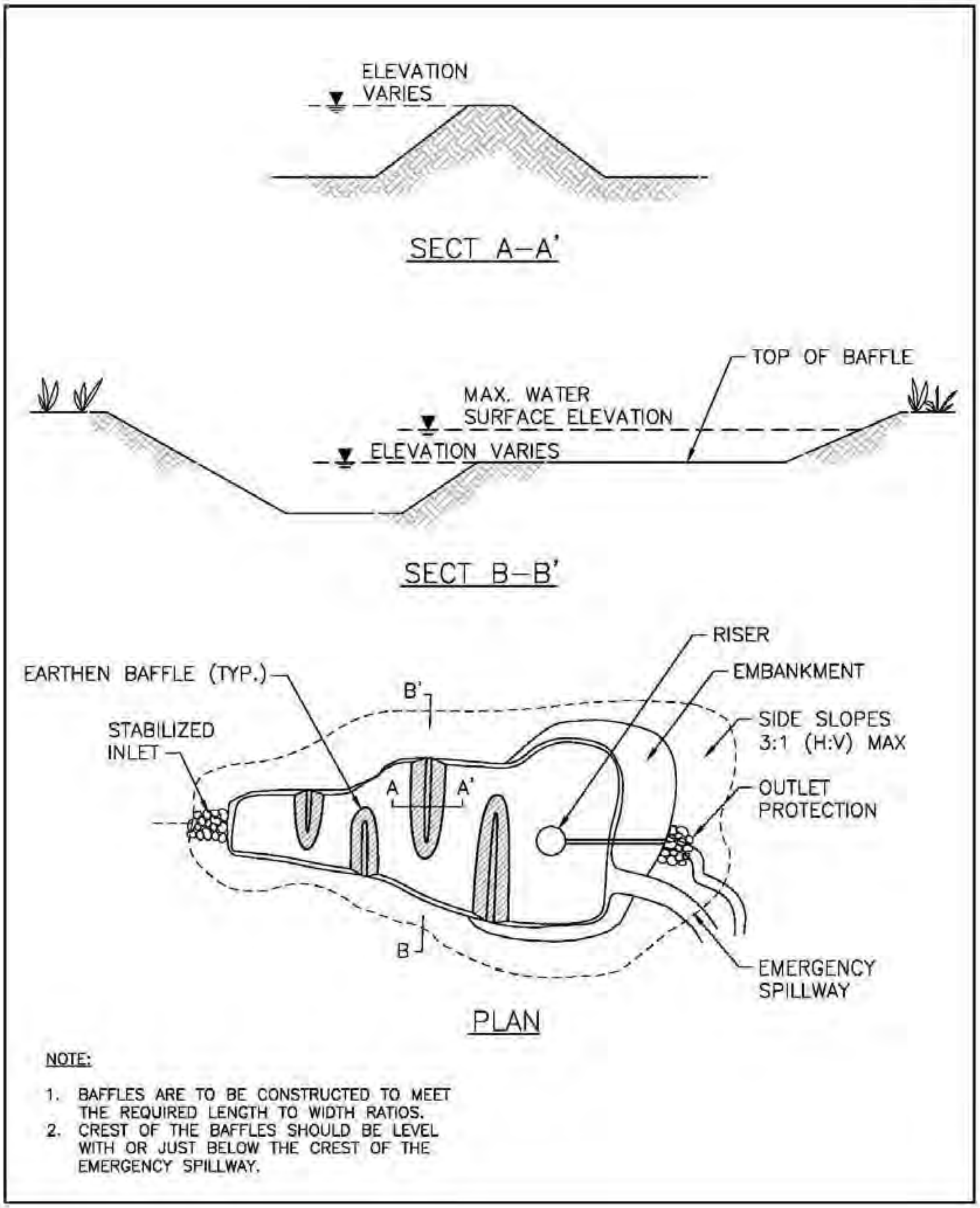


FIGURE 4: TYPICAL TEMPORARY SEDIMENT BASIN
WITH BAFFLES
NOT TO SCALE

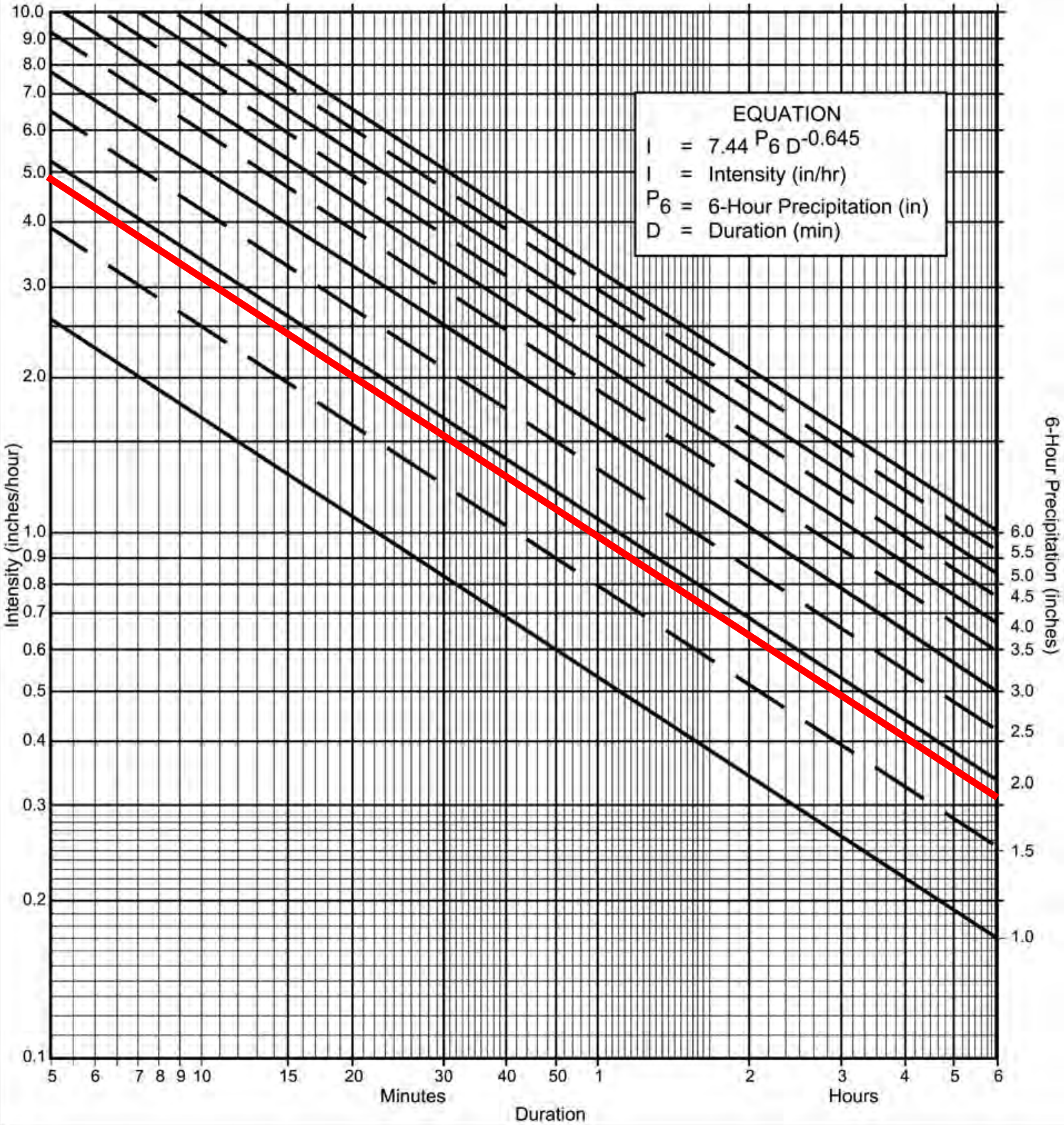
Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency **10** year

(b) P_6 = **1.8** in., P_{24} = **3.2**, $\frac{P_6}{P_{24}}$ = **56** %(2)

(c) Adjusted $P_6^{(2)}$ = **1.8** in.

(d) t_x = ______ min.

(e) I = ______ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

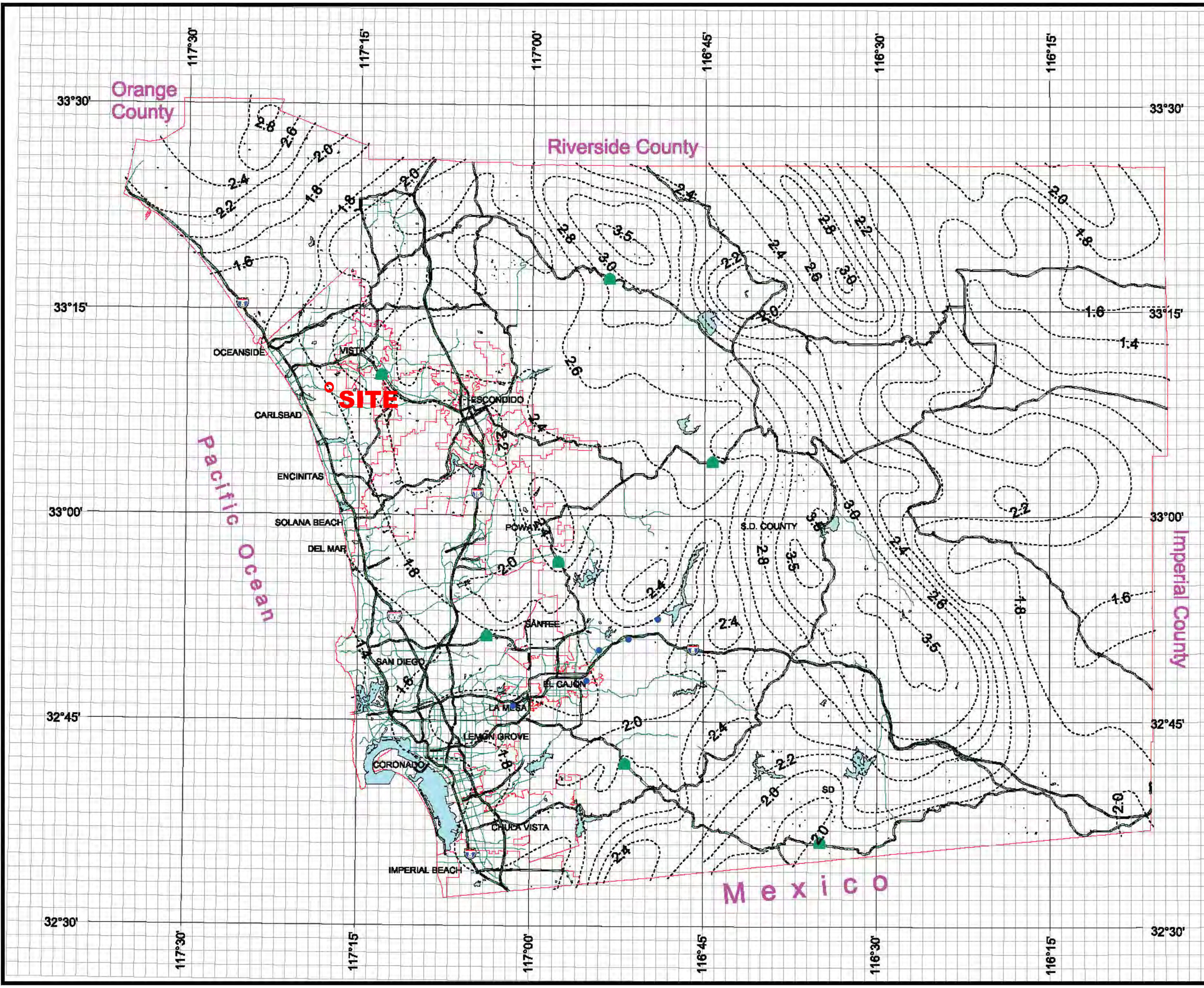
Intensity-Duration Design Chart - Template

FIGURE

3-1

County of San Diego Hydrology Manual

Rainfall Isopluvials



10 Year Rainfall Event - 6 Hours

--------	Isopluvial (inches)

P6 = 1.8"

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

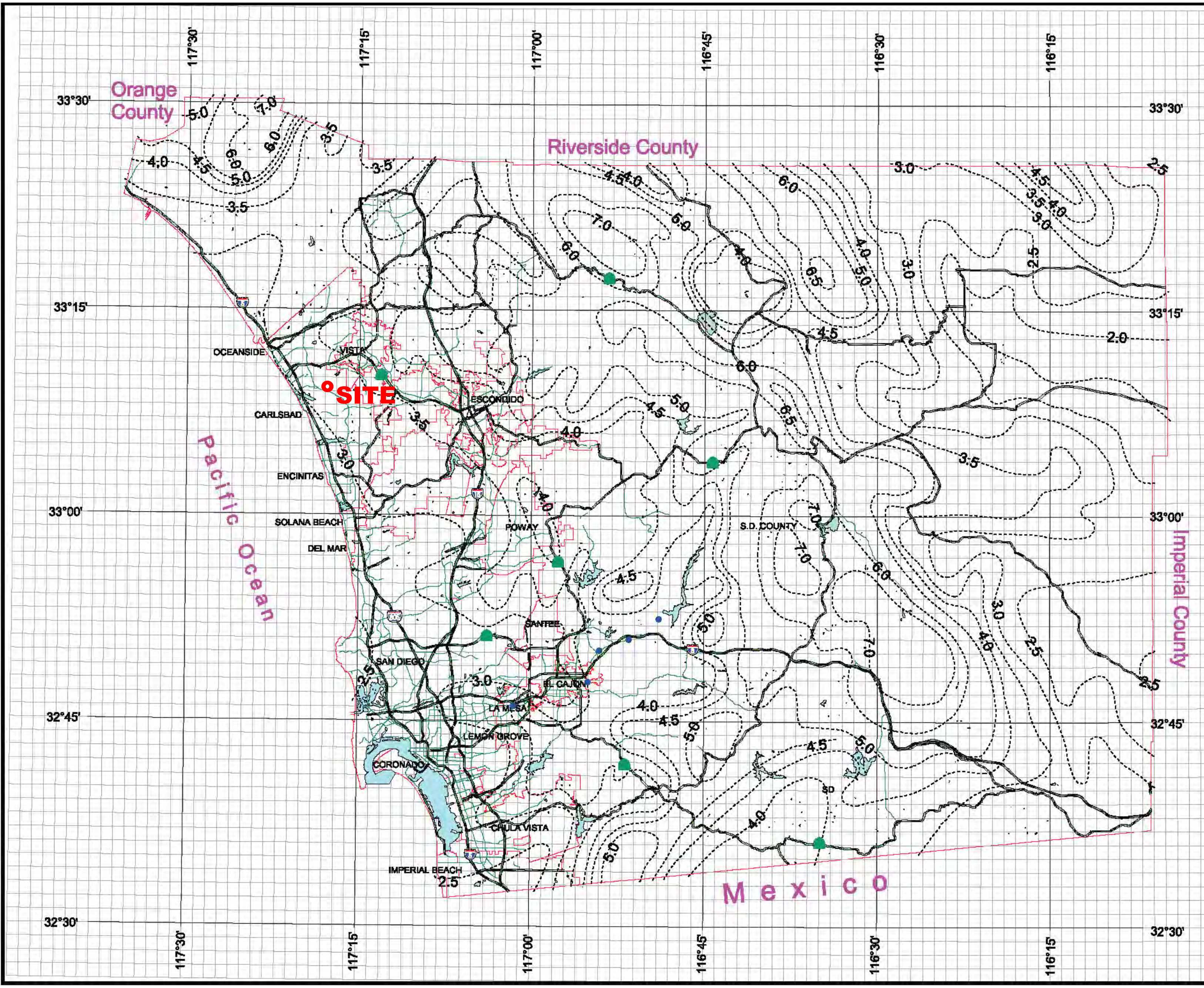
N
W E
S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 24 Hours



Isopluvial (inches)

P24 = 3.2"

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Department of Public Works
Geographic Information Services

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N S E W

3 0 3 Miles

Map Scale: 1:12,000 if printed on A size (8.5" x 11") sheet.

Meters: 0, 150, 300, 600, 900

Feet: 0, 500, 1,000, 2,000, 3,000

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:12,000 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 6, Dec 17, 2007

Date(s) aerial images were photographed: 6/7/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

San Diego County Area, California (CA638)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AtC	Altamont clay, 5 to 9 percent slopes	15.0	2.3%
AtE	Altamont clay, 15 to 30 percent slopes	24.7	3.8%
DaC	Diablo clay, 2 to 9 percent slopes	10.3	1.6%
DaE2	Diablo clay, 15 to 30 percent slopes, eroded	34.6	5.3%
FxE	Friant rocky fine sandy loam, 9 to 30 percent slopes	21.9	3.4%
GaF	Gaviota fine sandy loam, 30 to 50 percent slopes	6.5	1.0%
LeC	Las Flores loamy fine sand, 2 to 9 percent slopes	56.5	8.6%
LeC2	Las Flores loamy fine sand, 5 to 9 percent slopes, erod ed	75.2	11.5%
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, ero ded	76.8	11.8%
LeE2	Las Flores loamy fine sand, 15 to 30 percent slopes, er oded	76.5	11.7%
LeE3	Las Flores loamy fine sand, 9 to 30 percent slopes, sev erely eroded	65.0	10.0%
MlC	Marina loamy coarse sand, 2 to 9 percent slopes	1.1	0.2%
Rm	Riverwash	10.7	1.6%
SbC	Salinas clay loam, 2 to 9 percent slopes	164.1	25.1%
TuB	Tujunga sand, 0 to 5 percent slopes	1.5	0.2%
VaB	Visalia sandy loam, 2 to 5 percent slopes	12.3	1.9%
Totals for Area of Interest		**652.6**	**100.0%**