

# Inspecting Construction of Bioretention Facilities

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# Inspecting Construction of Bioretention Facilities




# Construction Checklist

- Include the Checklist in the plans
  - Suggest getting the checklist on a plan sheet in the plans to give the contractor heads up about what is inspected and when.
  - Make clear at the pre-construction meeting the steps for inspection.
  - Have a separate meeting with the contractor and sub-contractors prior to starting the excavation for the bioretention facilities.

# Construction Checklist

- Use checksheet
- Similar to bldg Workcard
- Binder or Plans



## STORMWATER TREATMENT FACILITIES INSPECTION CHECKLIST

PROJECT INFORMATION

Location: \_\_\_\_\_

Inspector: \_\_\_\_\_ Phone: \_\_\_\_\_

Engineer: \_\_\_\_\_ Phone: \_\_\_\_\_

SDP PERMIT No: \_\_\_\_\_

IMPs ON-SITE: \_\_\_\_\_ Total # of IMPs \_\_\_\_\_

Bio-retention Basins     Vegetated Swales  
 Dry Wells     Other \_\_\_\_\_  
 Other \_\_\_\_\_

**I. ENGINEERING INSPECTION REQUEST LINE**

Call and leave message for assigned inspector prior to midnight on the day before the requested inspection date. Provide City SDP number, address of project, and type of inspection requested. Failure to provide this information may result in the inspection not being made. To obtain an approximate time for the inspection, call the assigned inspector between 7:00 and 7:30 am on the morning of your requested inspection.

**II. IMP GROUP 1 includes IMPs# \_\_\_\_\_**

Layout (*)	Excavation (*)	Overflow Inlet/Surface Connection to SD	Underground connection to SD/outlet orifice (HMP)	Drain rock/sub-drain
Soil media mix (*)	Soil media installation	Irrigation	Planting	Final (*)
Comments:				

**III. IMP GROUP 2 includes IMPs# \_\_\_\_\_**

Layout (*)	Excavation (*)	Overflow Inlet/Surface Connection to SD	Underground connection to SD/outlet orifice (HMP)	Drain rock/sub-drain
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# Construction vs Inspection Sequence

## INSPECTION SEQUENCE REQUIREMENTS

LAYOUT inspection is required prior to beginning the excavation. This stage includes surveying and staking prior to excavation. If necessary, surveying certificate is required.

EXCAVATION inspection is required prior to backfilling any materials or pipe installation. If necessary, certificate is required to verify excavation is done with adequate depth and width for each Integrated Management Practice (IMP).

OVERFLOW INLET or SURFACE CONNECTION TO STORM DRAIN inspection is required prior to backfill of any materials.

CONNECTION TO STORM DRAIN or OUTLET ORIFICE inspection is required prior to backfilling IMP with any materials.

DRAIN ROCK/SUB-DRAIN inspection is required prior to soil media mix (test) and installation.

SOIL MEDIA MIX inspection (test) is required prior to soil media installation.

SOIL MEDIA INSTALLATION inspection is required prior to irrigation installation.

IRRIGATION inspection is required prior to plant materials installation.

PLANTING inspection is required prior to FINAL INSPECTION.

# Layout

- Layout (Certification may be required)
- Square footage of the facility meets or exceeds minimum shown in Stormwater Control Plan.
- Site grading and grade breaks are consistent with the boundaries of the tributary Drainage Management Area(s) shown in the Stormwater Control Plan.
- Preliminary inlet elevation of the facility is low enough to receive drainage from the entire tributary Drainage Management Area(s).
- Locations and elevations of overland flow or piping, including roof leaders, from impervious areas to the facility have been laid out and any conflicts resolved.
- Rim elevation of the facility is laid out to be level all the way around, or elevations are consistent with a detailed cross-section showing location and height of interior dams.
- Locations for vaults, utility boxes, and light standards have been planned so that they will not conflict with the facility.
- Facility protected as needed from construction-phase runoff and sediment.

# Excavation

- Excavation (Certification may be required)
- Excavation conducted with materials and techniques to minimize compaction of soils within the facility area.
- Excavation is to proper area and depth.
- Slopes or side walls protect from sloughing of native soils into the facility.
- Moisture barrier, if needed, added to protect adjacent pavement or structures.
- Native soils at bottom of excavation are ripped or loosened to promote infiltration.

# Overflow Inlet/Surface Connection to Storm System

- Overflow inlet is at specified elevation (typically no lower than two inches below facility rim).
- No knockouts or side inlets are in overflow riser.
- Inlet location selected to minimize surface flow velocity (near and offset from inlet recommended).
- Grating selected to exclude mulch and litter (beehive or atrium-style grates with ¼" openings recommended).
- Inlet is connected to storm drain via appropriately sized piping.
- Facility emergency overflow path designed to avoid flood damage.



# Underdrain

- Underground Connection to Storm Drain/Outlet Orifice
- Perforated pipe underdrain (PVC SDR 35 or approved equivalent) is installed with holes facing down.
- No filter fabric is installed around the underdrain.
- Perforated pipe is connected to storm drain (treatment-only) or orifice (treatment-plus-flow-control) per plans.
- Underdrain pipe is at elevation shown in plans. In facilities allowing infiltration, preferred elevation is above native soil (but low enough to be covered at least 2 inches by Class 2 perm); in sealed planter boxes or bioretention facilities with liners, preferred elevation is as near bottom as possible.
- Cleanouts are in accessible location(s) and connected via sweeps.
- Structures (arches or large diameter pipes) for additional subsurface storage are installed as shown in plans and specifications and have the specified volume.

# Drain Rock (12" Layer)

- Rock is installed as specified. Class 2 permeable, Caltrans specification 68-1.025 recommended, **OR** 4"-6" pea gravel is installed at the top of the crushed rock layer.
- Rock is smoothed to a consistent top elevation. Depth and top elevation are as shown in plans, accounting for depth of soil mix and mulch to follow and required top reservoir depth.
- **No** filter fabric is placed between the subdrain and soil mix layers.

# Soil Media Mix

- Soil media mix is as specified. Quality of mix is confirmed by delivery ticket or on-site testing as appropriate to the size and complexity of the job.
- Mix is installed in lifts not exceeding 12".
- Mix is not compacted during installation but may be wetted thoroughly to encourage consolidation.
- Mix is smoothed to a consistent top elevation. Depth of mix (**18" minimum**) and top elevation are as shown in plans, accounting for depth of mulch to follow and required top reservoir depth.

# Irrigation

- Irrigation system is installed so it can be controlled separately from other landscaped areas. Smart irrigation controllers and drip emitters are recommended.
- Spray heads, if any, are positioned to avoid direct spray into outlet structures.

# Planting

- Plants are installed consistent with the approved planting plan.
- Any trees and large shrubs are staked securely.
- No fertilizer is added. Compost tea may be used.
- No native soil or clayey material are imported into the facility with plantings.
- 1" to 2" mulch may be applied following planting. Mulch selected to avoid floating.
- Maintain final design elevation of soil mix following planting.
- Curb openings are free of obstructions.

# Final Engineering Inspection

- Drainage Management Area(s) are free of construction sediment; landscaped areas are stabilized.
- Inlets are installed to provide smooth entry of runoff from adjoining pavement, have sufficient reveal (drop) from the adjoining pavement to the top of the mulch or soil mix, and are not blocked.
- Inflows from roof leaders and pipes are connected and operable.

# Final Engineering Inspection (Cont'd)

- Temporary flow diversions are removed.
- Rock or other energy dissipation at piped or surface inlets is adequate.
- Overflow outlets are configured to allow the facility to flood and fill to near rim before overflow.
- Plantings are healthy and becoming established.
- Irrigation is operable.
- Facility drains rapidly; no surface ponding is evident.
- Any accumulated construction debris, trash, or sediment is removed from facility.

# Construction Material Submittal

**CONTRACTOR:**

COOK ENGINEERING, INC.  
3203 Fitzgerald Road  
Rancho Cordova, CA 95742

**MATERIALS/  
SUPPLIER**

Class II AB- *ok*  
County Quarry

3/4" Crushed Rock- *ok*  
Hanson Clayton Quarry

Class II Perm- *ok*  
Vulcan Pleasanton

Bio-swale Mix *- rejected*  
Soil & Plant Laboratories

*Denial*



# Class II Perm



Pleasanton Plant  
SMARA 91-01-0010

CITY OF WALNUT CREEK

PUBLIC SERVICES - ENGINEERING

DATE: 8/12/14 BY: [Signature]  
 NO EXCEPTIONS TAKEN  MAKE CORRECTION NO  
 REVISE AND RESUBMIT  REJECTED

December, 2013

To:

Subject: Class II Perm Submittal

Project:

Please find below the laboratory test results. We certify that the fine aggregate produced at our Pleasanton operation meets the requirements of Caltrans Section 68. Our most recent test data presented for your review:

Corrections or comments made on the shop drawings during the review do not relieve the contractor of his responsibility to comply with the requirements of drawings and specifications. This review is only to check general conformance with the design concept of the project and general compliance with the contract documents. Contractor remains responsible for: confirming, correlating all dimensions and quantities, selecting fabrics, processes and techniques of construction, coordinating Pleasanton operation meets the requirements satisfactory.

## 66000 - CLASS II PERM

SIEVE SIZE	PERCENT PASSING	GRADATION	
		Caltrans Section 68	
1" (25.0 mm)	100	100	
3/4" (19.0 mm)	95	90-100	
1/2" (12.5 mm)	79		
3/8" (9.5 mm)	71	40-100	
No. 4 (4.75 mm)	36	25-40	
No. 8 (2.36 mm)	25	18-33	
No. 16 (1.18 mm)	16		
No. 30 (600 µm)	10	5-15	
No. 50 (300 µm)	5	0-7	
No. 100 (150 µm)	2		
No. 200 (75 µm)	1.5	0-3	

## PHYSICAL PROPERTIES

ASTM STANDARD	FINE AGGREGATE ASTM C 33
Sand Equivalent	78
Fine Durability Index	69

Respectfully,  
Vulcan Materials Company

# Soil Submittal

EXTRACTABLE NUTRIENTS								
Test	Result	Sufficiency Factor	SOIL TEST RATINGS					NO3-N
			Very Low	Low	Medium	Optimum	Very High	
Available-N	24 ppm	0.6	[Bar chart showing rating in Low-Medium range]					5 ppm
Phosphorus (P) - Olsen	44 ppm	1.9	[Bar chart showing rating in Low-Medium range]					NH4-N 19 ppm
Potassium (K)	493 ppm	3.4	[Bar chart showing rating in Very High range]					
Potassium - sat. ext.	3.3 meq/L							Total Exchangeable Cations(TEC) 107 meq/kg
Calcium (Ca)	1166 ppm	0.7	[Bar chart showing rating in Low-Medium range]					
Calcium - sat. ext.	8.2 meq/L							
Magnesium (Mg)	405 ppm	2.1	[Bar chart showing rating in Medium-Optimum range]					
Magnesium - sat. ext.	9.4 meq/L							
Copper (Cu)	2.1 ppm	1.5	[Bar chart showing rating in Medium-Optimum range]					
Zinc (Zn)	12 ppm	2.3	[Bar chart showing rating in Medium-Optimum range]					
Manganese (Mn)	38 ppm	3.1	[Bar chart showing rating in Very High range]					
Iron (Fe)	432 ppm	8.2	[Bar chart showing rating in Very High range]					
Boron (B) - sat. ext.	1.02 ppm	3.4	[Bar chart showing rating in Very High range]					
Sulfate - sat. ext.	8.4 meq/L	2.8	[Bar chart showing rating in Medium-Optimum range]					
Exch Aluminum								

Cu, Zn, Mn and Fe were analyzed by DTPA extract.

PARTICLE SIZE ANALYSIS										
Weight Percent of Sample Passing 2mm Screen										
Half Sat	Organic Matter	Gravel		Sand			Silt	Clay	USDA Soil Classification	
		Coarse 5-12	Fine 2-5	Very Coarse 1-2	Coarse 0.5-1	Med. to Very Fine 0.05-0.5	.002-.05	0-.002		
19 %	5.9 %	1.4 %	16.3 %	17.5 %	39.5 %	33.1 %	4.6 %	5.1 %	Sand	
Gravelly										

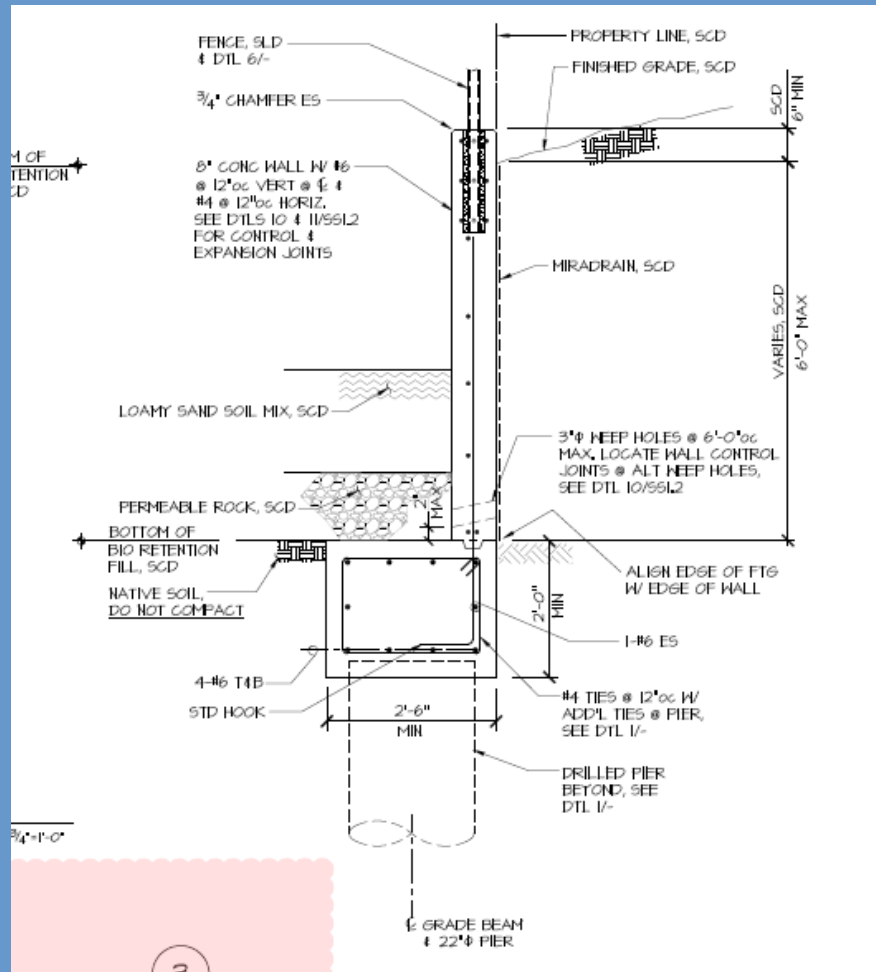
Graphical interpretation is a general guide. Optimum levels will vary by crop and objectives.

**Municipal Regional Stormwater Permit  
Order No. R2-2009-0074**

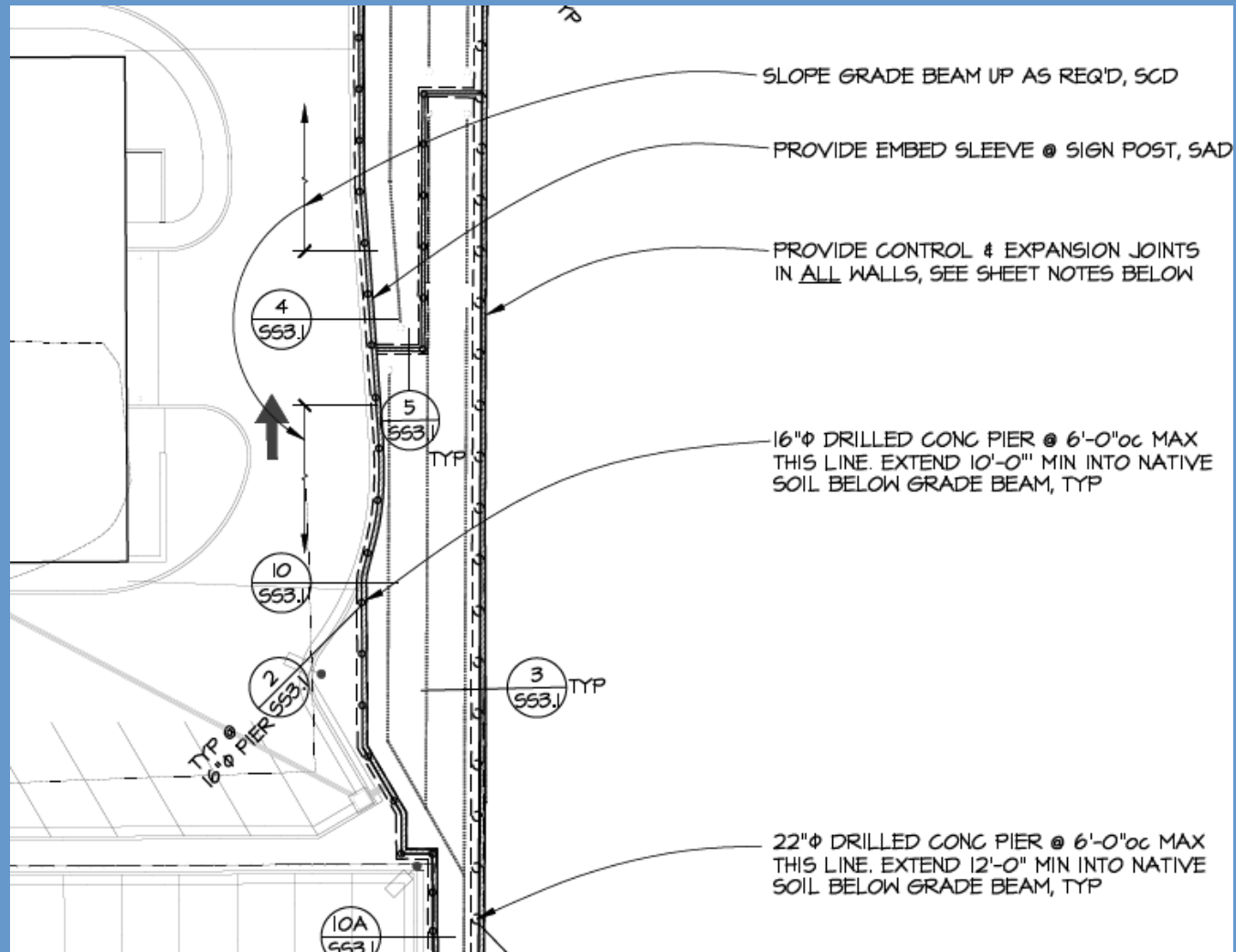
**NPDES No. CAS612008  
Attachment L**

- e. Organic content test results of mixed Bioretention Soil. Organic content test shall be performed in accordance with by Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
- f. Grain size analysis results of compost component performed in accordance with ASTM D 422, Standard Test Method for Particle Size Analysis of Soils.

# Progressive Bioretention Area under Construction



# Progressive Bioretention Area under Construction



# Progressive Bioretention Area under Construction



# Progressive Bioretention Area under Construction



This is the bioretention basin  
side of the wall,  
must be 3' deep  
from top of wall

# SOB Bioretention Area under Construction



# Bioretention during storm





# LDS bioretention during storm



# Bioretention Area

- City Hall Downspout



# Vic Stewarts Bioretention Area



# Vic Stewarts Bioretention Area



# Vic Stewarts Bioretention Area



# Vic Stewarts Bioretention Area



# Vic Stewarts Bioretention Area

