

Stormwater Best Management Practices (BMPs)



NPDES Phase I Permit

The permit requires staff training:

- **S5.C.5.a.vii:** Each permittee shall ensure that all staff whose primary job duties are implementing the program to Control Stormwater Runoff from New Development, Redevelopment, and Construction Sites, including permitting, plan review, construction site inspections, and enforcement, are trained to conduct these activities. As determined necessary by the Permittee, follow-up training shall be provided to address changes in procedures, techniques or staffing. Permittees shall document and maintain records of the training provided and the staff trained.
- **S5.C.7.b.v:** Permittees shall train staff who are responsible for implementing the source control program to conduct these activities. The ongoing training program shall cover the legal authority for source control, source control BMPs and their proper application, inspection protocols, lessons learned, typical cases, and enforcement procedures. Follow-up training shall be provided as needed to address changes in procedures, techniques, requirements, or staff. Permittees shall document and maintain records of the training provided and the staff trained.

Stormwater Management Manual

- Training is based off BMPs contained in the current 2016 SWMM.

Types of Best Management Practices

- On-site Stormwater Management BMPs (Volume 3 & 6)
- Stormwater Water Quality BMPs (Volume 5 & 6)
- Flow Control BMPs (Volume 3)
- Source Control BMPs (Volume 4)
- Construction BMPs (Volume 2) – Covered in CESCL – not covered in this presentation.

Best Management Practices

- The type of BMP required for a project is based on project impacts and location.
- Plan review or design staff will determine type of BMP required for a project.
- Plans will show the BMP.
- SSP or design report will outline why the BMP was chosen and include appropriate sizing and design calculations.

Purpose for BMP Installation

- New Construction
- Redevelopment (a combination of new construction and replacement)
- Retrofit

New Construction



Predeveloped



Developed

Redevelopment

Geiger Elementary School



Existing (2009)



Redeveloped (2015)

Retrofit



Existing



Developed

In Retrofit situation the land cover does not change.

Thresholds

- New and redevelopment thresholds for determining when a stormwater BMP is required are contained in the SWMM as mandated by the NPDES Phase 1 Permit.
- Retrofit projects are not required by Permit to provide stormwater BMPs.

Thresholds – Typically...

- **Minimum Requirement #1-#5** (construction, source control, onsite permanent BMPs)
 - Project that:
 - Results in 2,000 SF or greater of new plus replaced hard surface;
 - Has land disturbing activity of 7,000 SF or more
- **Minimum Requirements #1-#10** (construction, source control, onsite, treatment, and flow control-permanent BMPs)
 - Project that:
 - Adds 5,000 SF of new hard surface
 - Convert $\frac{3}{4}$ acres or more of vegetation to lawn/landscaped
 - Convert 2.5 acres or more of native vegetation to pasture.
 - Add or replace 5,000 square feet of hard surfaces and value exceeds more than 50% of assessed value
 - Adds or replaces 5,000 square feet of hard surfaces and new adds 50% to existing (roads)

SWMM Min Req

- Minimum Requirement #1 Stormwater Site Plan (Report)
- Minimum Requirement #2 TESC
- Minimum Requirement #3 Source Control
- Minimum Requirement #4 Natural Drainage Systems
- Minimum Requirement #5 On-Site Management
- Minimum Requirement #6 Water Quality
- Minimum Requirement #7 Flow Control
- Minimum Requirement #8 Wetlands Protection
- Minimum Requirement #9 Operation and Maintenance
- Minimum Requirement #10 Offsite Analysis and Mitigation

What is the BMP?

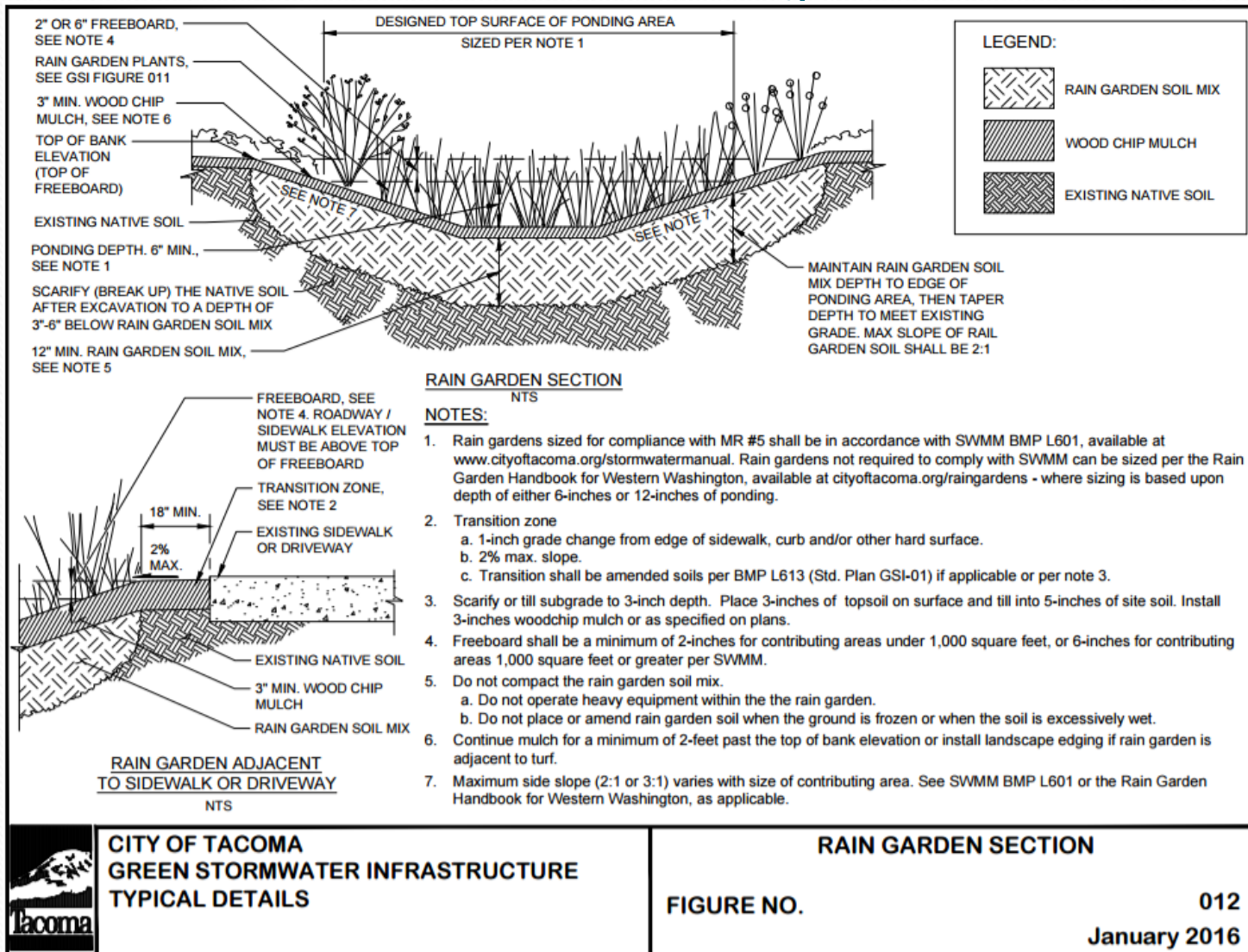
- Approved Plans are Required!!!!
- You cannot complete a plan review or a proper inspection without knowing what BMP is proposed/approved for the site.
 - There may be multiple BMPs on a site.
 - There may be some BMPs that go to storm and some that go to sanitary.

If you don't know...ask!!

Onsite Stormwater BMPs

- Roof Downspout Full Infiltration BMPs
 - Infiltration Trenches
 - Drywells
 - Rain Gardens
- Roof Downspout Dispersion BMPs
 - Dispersion Trench
 - Splash Blocks
- Roof Downspout Partial Infiltration BMP
 - Perforated Stub-Out Connection
- Dispersion BMPs
 - Concentrated Flow Dispersion
 - Sheet Flow Dispersion
 - Full Dispersion
- BMP L613 - Post Construction Soil Quality and Depth

How the Facility Works



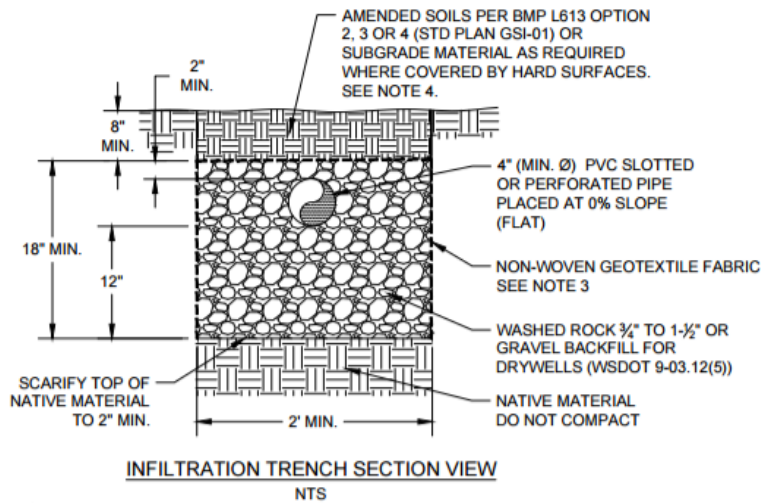
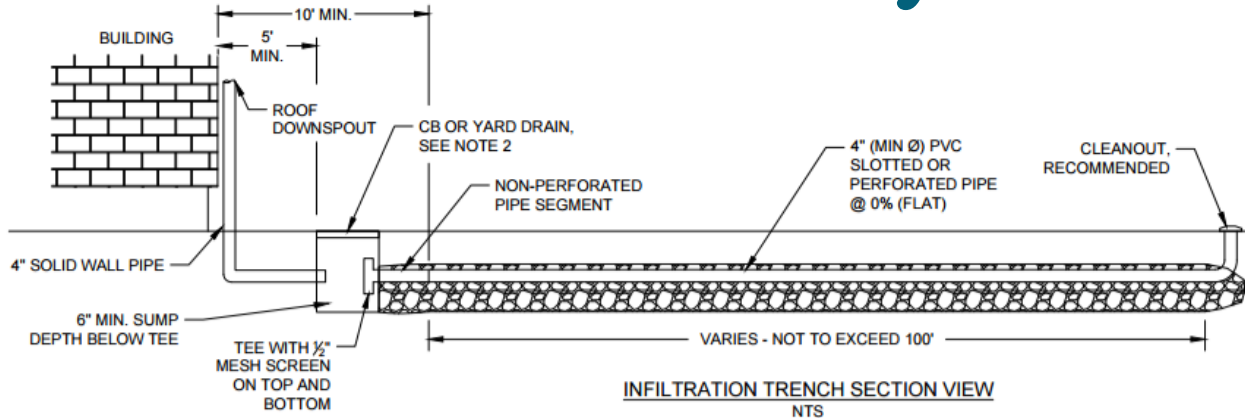
Rain Garden

- Water enters facility
- Ponds
- Infiltrates through rain garden soil mix
- Infiltrates into underlying soil
- Excess flows overflow



Rain Garden for Residence

How the Facility Works



NOTES:

1. Cleanouts recommended at pipe bends and end of trench.
2. Solid lid yard drain or catch basin shall be designed to be traffic bearing in areas subject to traffic.
3. Place non-woven geotextile fabric along walls and top of washed rock. Non-woven geotextile to conform to WSDOT Spec. 9-33.2(1), Tables 1 and 2.
4. All disturbed areas not covered with hard surfaces shall be stabilized by planting or mulching.

Infiltration Trench

- Water enters facility
- Infiltrates through the rock trench and into underlying soil



**CITY OF TACOMA
GREEN STORMWATER INFRASTRUCTURE
TYPICAL DETAILS**

DOWNSPOUT INFILTRATION TRENCH

FIGURE NO.

001

January 2016

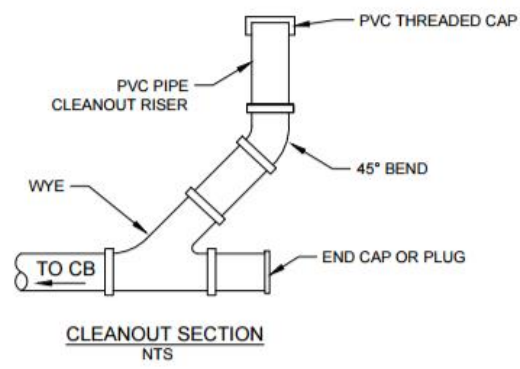
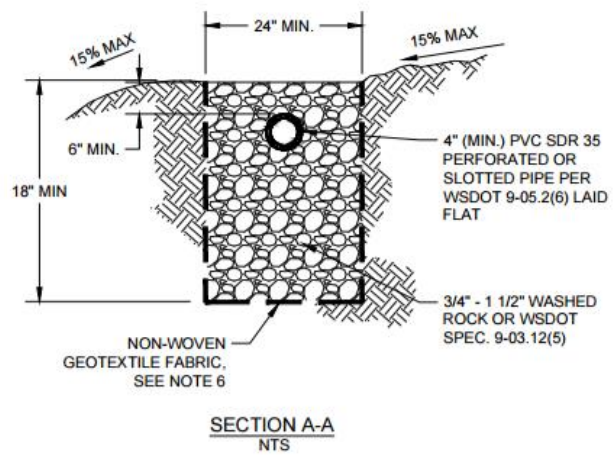
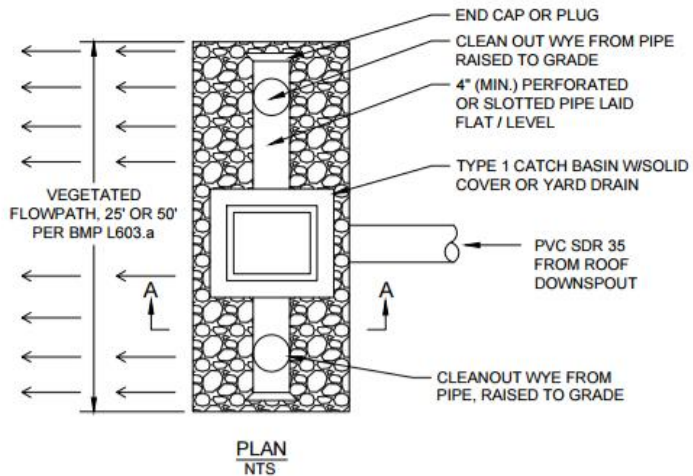


Infiltration Trench – the solid pipe distributes the flows, the perpendicular trenches will have perforated pipe to allow the stormwater into the gravel and then it will infiltrate.



Infiltration Trench and presettling vault (CB)

How the Facility Works



NOTES:

1. Trench may be placed no closer than 10 feet to another (100 feet along flowpath)
2. Trench must be level. Align to follow contours on site.
3. Trench may serve roof areas up to 700 square feet. For larger roof areas, refer to GSI Figure No. 004 - Dispersion Trench with Notched Grade Board.
4. Refer to SWMM BMP L603.a.
5. Trench length not to exceed 10 feet.
6. Place non-woven geotextile fabric along walls and bottom of washed rock. Non-woven geotextile to conform to WSDOT Spec. 9-33.2(1), Tables 1 and 2.

Dispersion

- Water enters facility at the catch basin
- Water is distributed through perforated pipe
- Water fills up gravel trench that spills over into vegetated area.



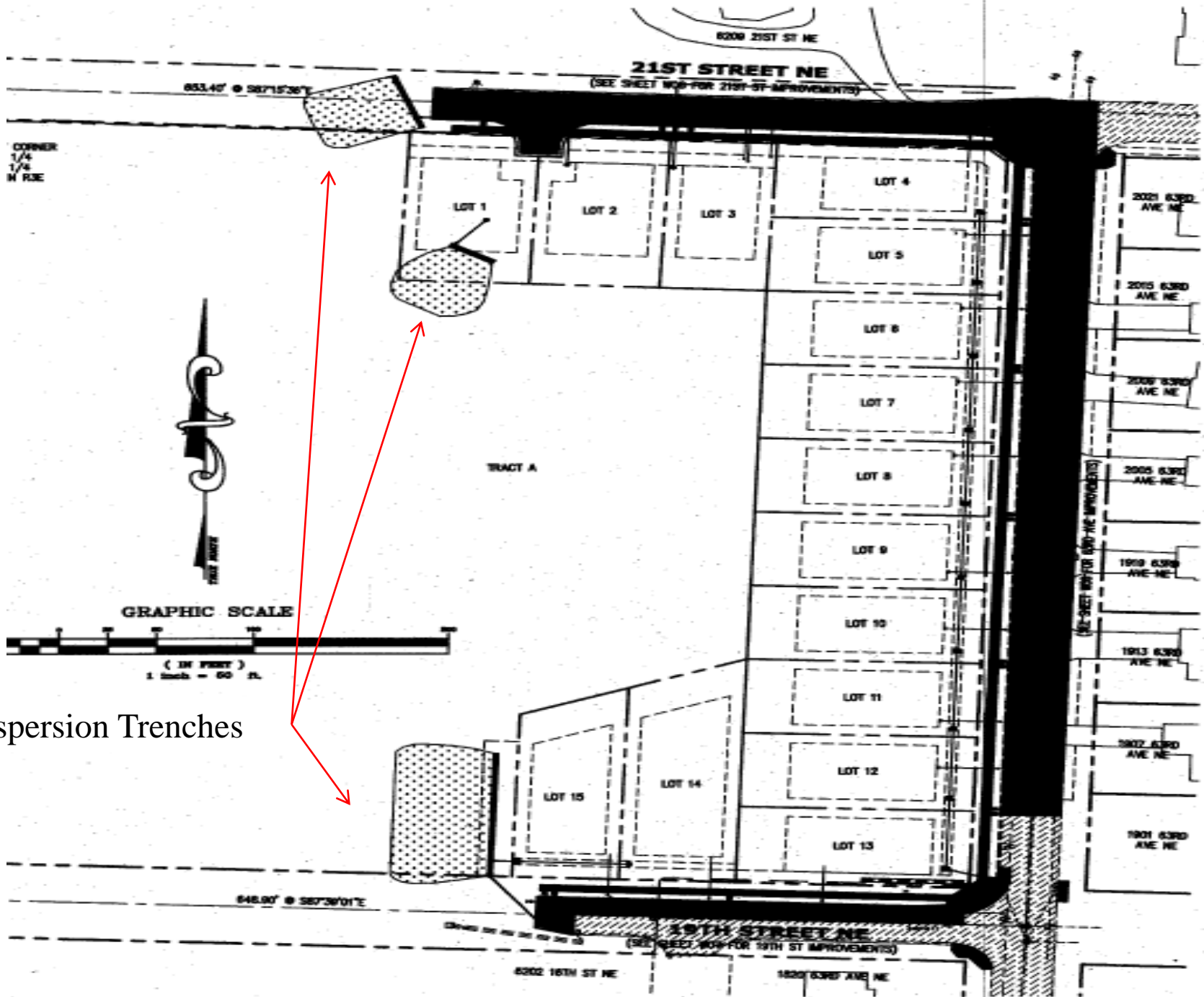
CITY OF TACOMA
 GREEN STORMWATER INFRASTRUCTURE
 TYPICAL DETAILS

DISPERSION TRENCH

FIGURE NO.

003

January 2016



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WOODNORTH
1200 EAST
TACOMA, WA
(253) 383-

GEOTI
GEO TECHNICAL
FOR WOODNORTH
PROVIDED BY
EARTH CODE
1800 - 138
BELLEVUE, WA
(425) 843-
TOLL FREE

SURV
CENTRE FOR
33701 9TH
FEDERAL, WA
(253) 891-

PARCI
6321254013
6201 19th St
TACOMA, WA

UTILIT
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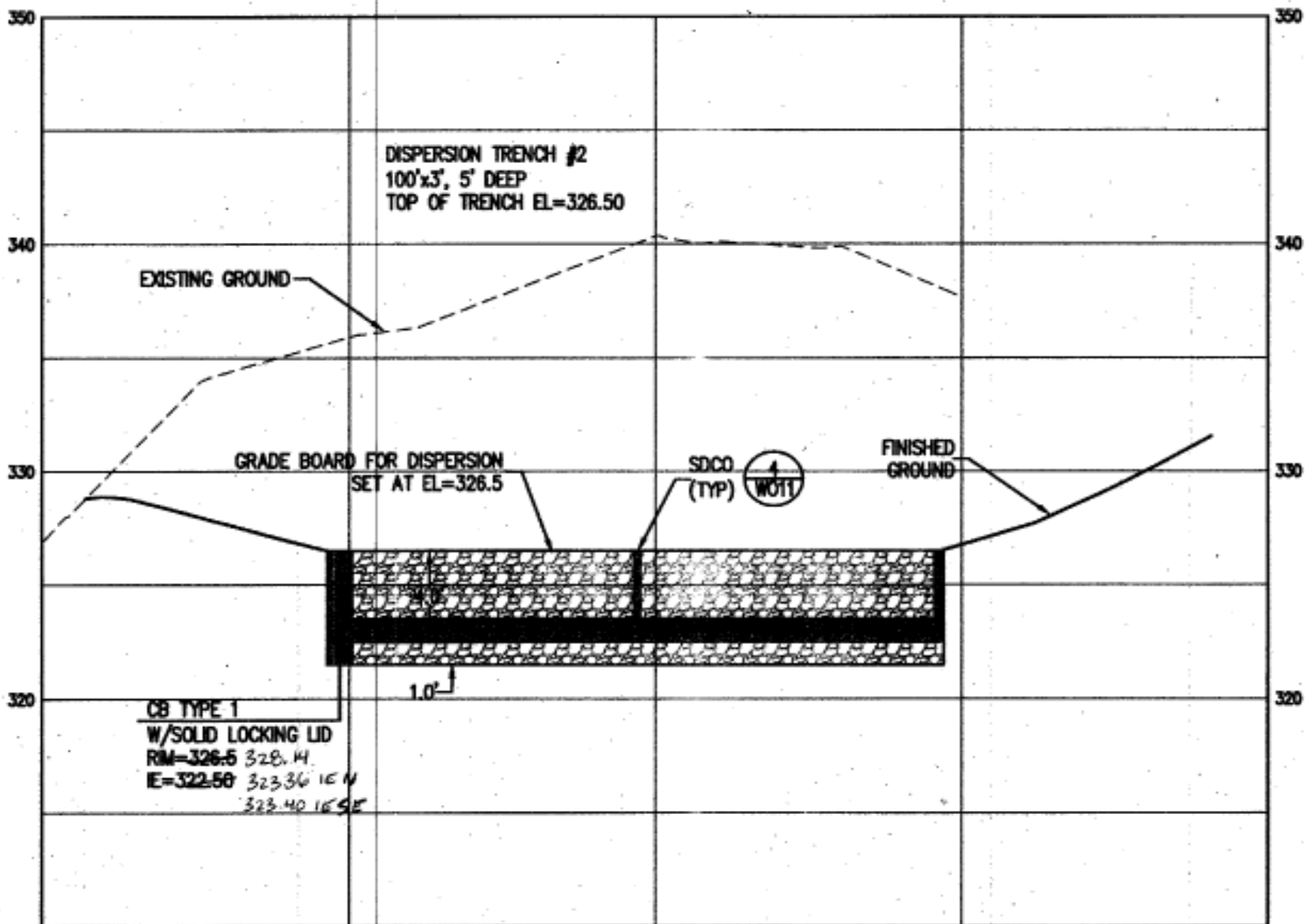
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SITE DATUM
SITE DATUM

BENCH
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ELEVATION -
EASTERLY 1/4
NE 29TH ST

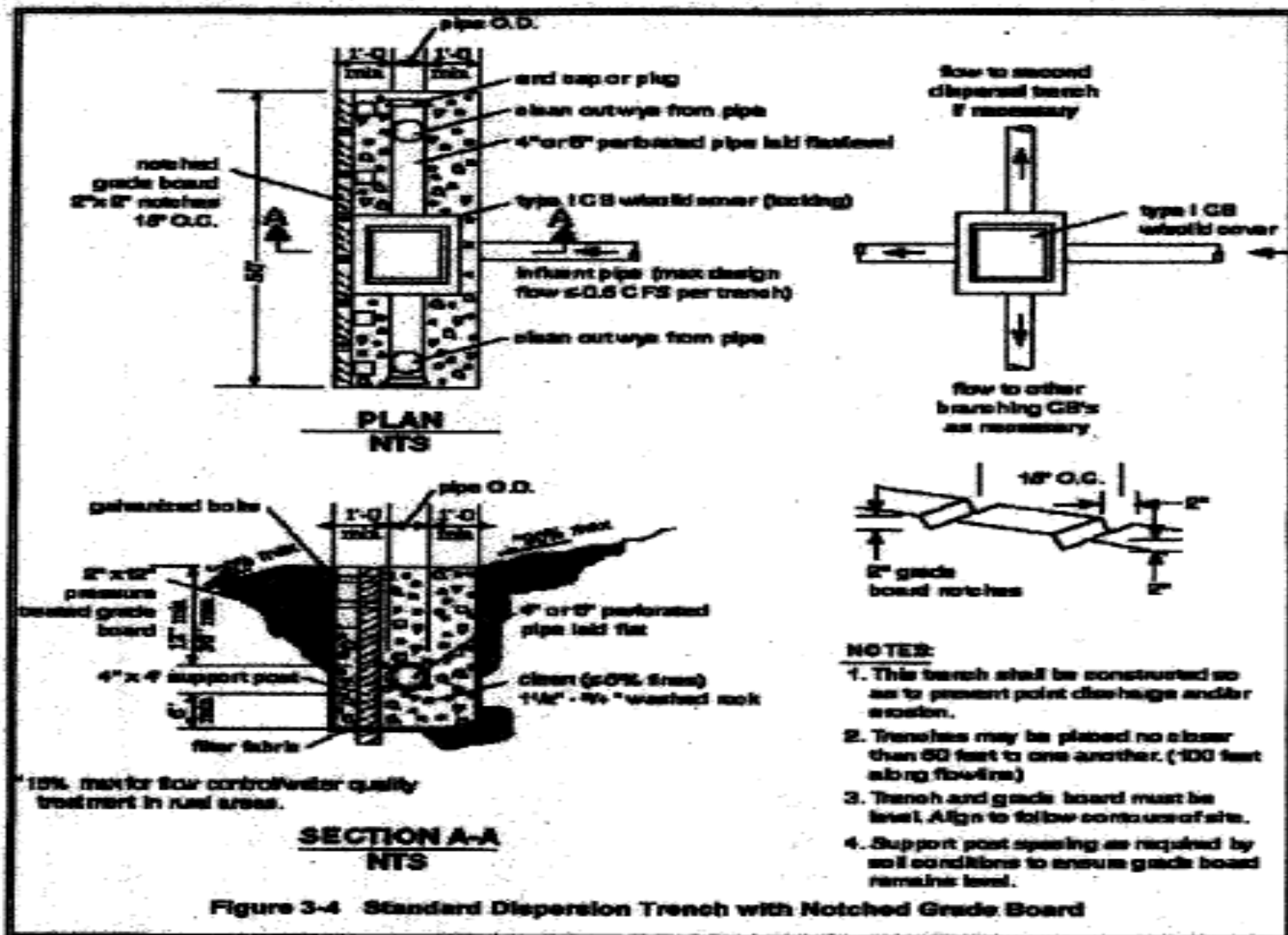
BASE #2 ST
ELEVATION -
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N MONUMENT
AND SOUTH

SURV
A CAD FILE
TO ADD IN
IF ANY DE
CAD FILE
PROJECT E

Dispersion Trenches



2 **DISPERSION TRENCH 2 SECTION (CITY, 19TH ST. NE)**
 HORIZ 1"=20'
 VERT 1"=4'





Dispersion Trench



Dispersion Trench



This patio is not a vegetated flowpath!!!

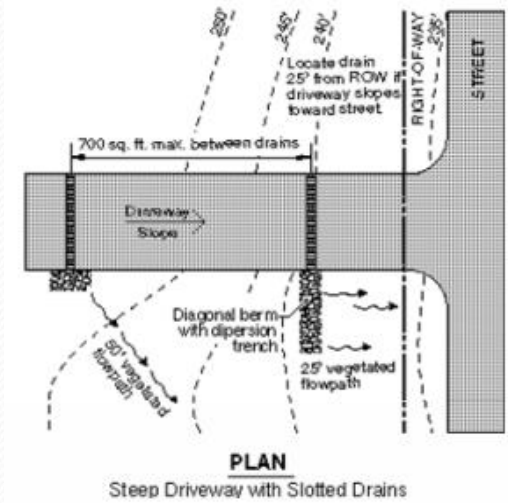
Dispersion BMPs



Splash Blocks



Sheet Flow Dispersion



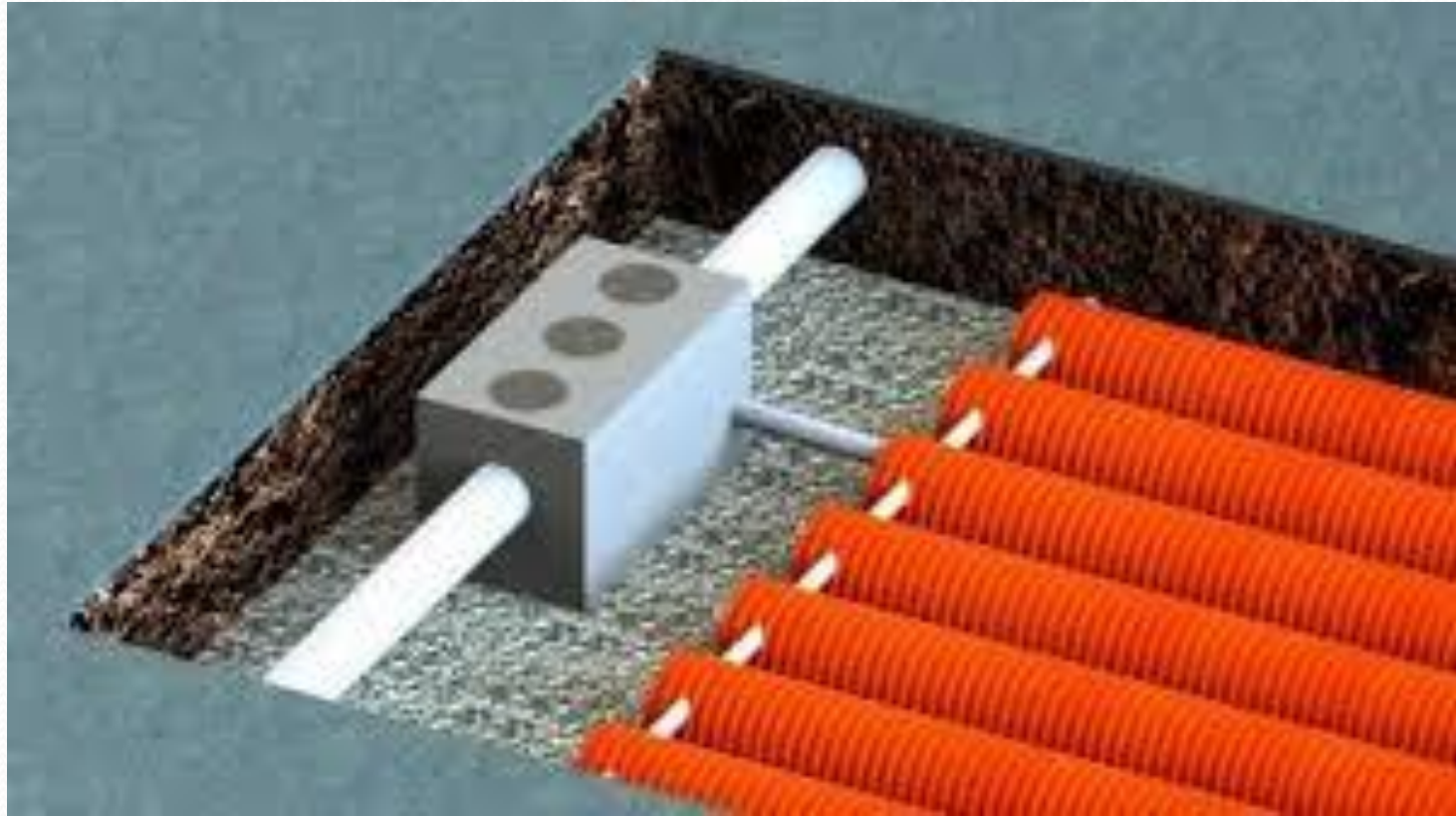
Concentrated Flow Dispersion

Stormwater Water Quality BMPs

- Pretreatment
- Basic Treatment
- Enhanced Treatment
- Phosphorus Treatment
- Oil Control

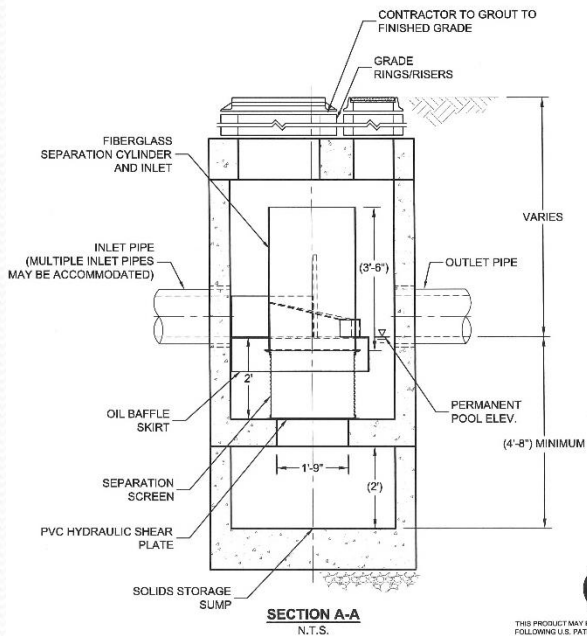
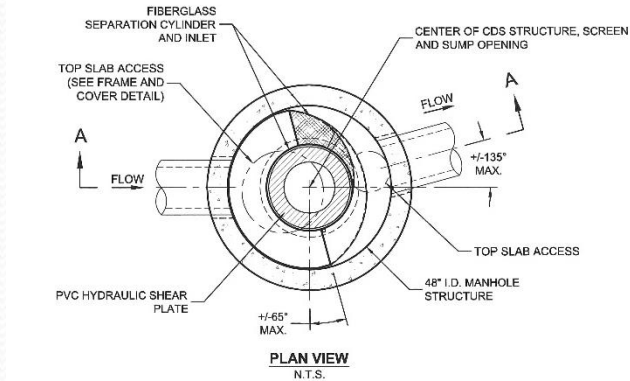
Water Quality - Pretreatment

- Pretreatment – Targets Larger Total Suspended Solids – Sands
 - Presettling Basin
 - Emerging Technologies
 - Sedimentation Devices (Swirl Separators)



Presetting Vault – the grey rectangular vault

CDS (Hydrodynamic Separator)



GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH STORMWATER SOLUTIONS REPRESENTATIVE. www.contechstormwater.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE AND CASTINGS SHALL MEET AASHTO HS20 LOAD RATING.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES

1. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
2. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
3. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
4. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
5. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

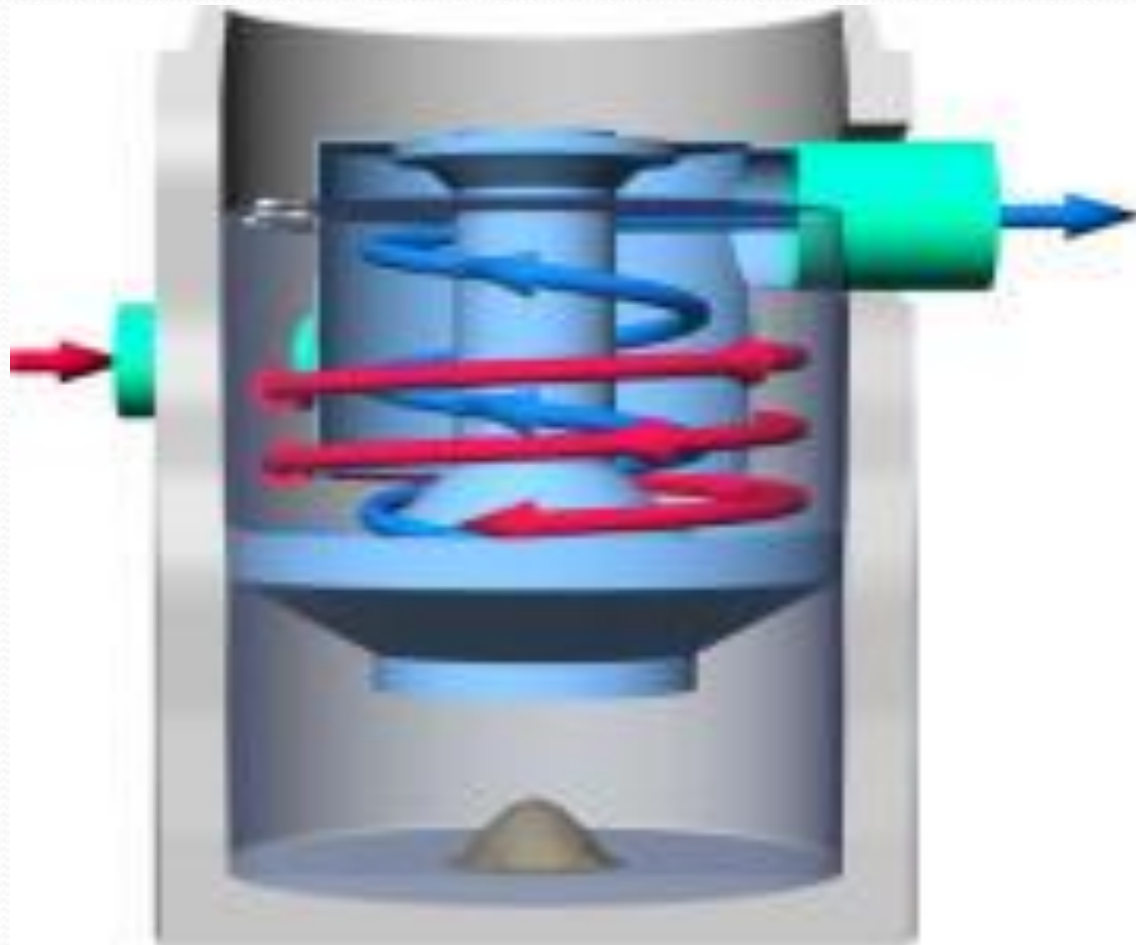


THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 6,798,998; 6,841,720; 6,911,696; 6,966,788; RELATED FOREIGN PATENTS, OR OTHER PATENTS PENDING.



CDS2015-4
PRECAST CONCRETE WATER QUALITY SYSTEM
STANDARD DETAIL

contechstormwater.com

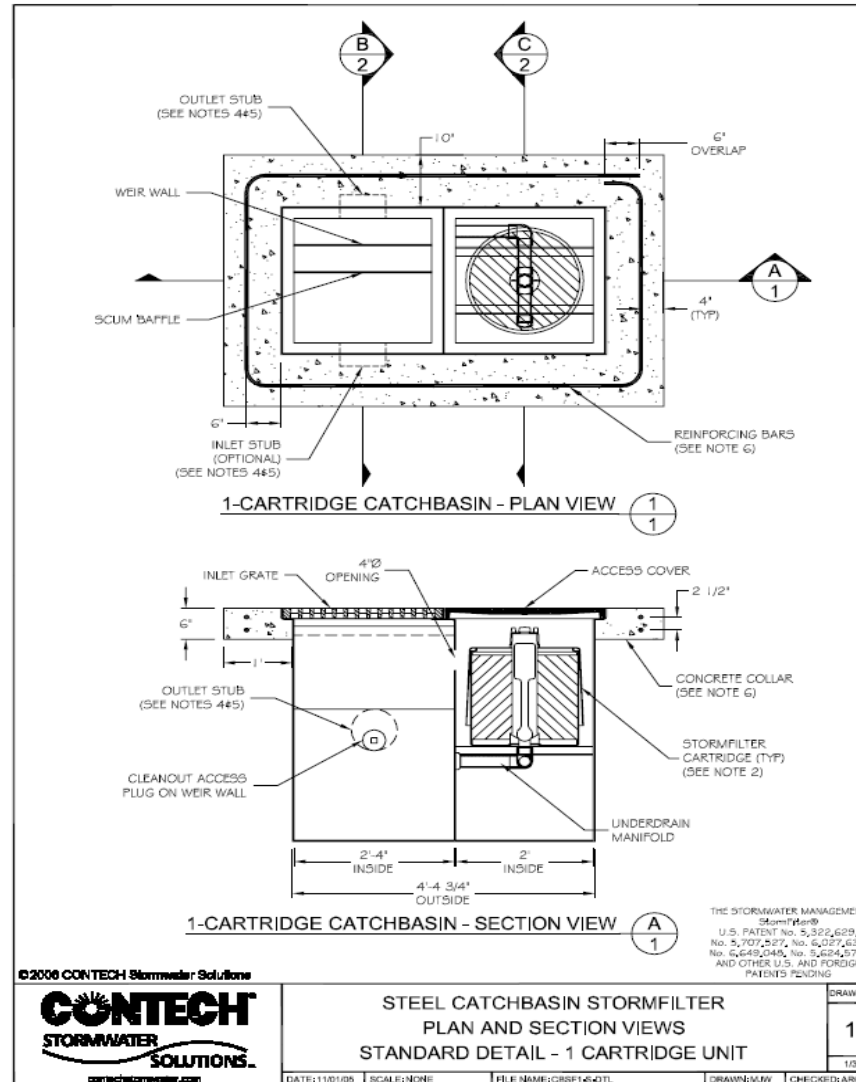


Swirl Separator (Downstream Defender®)

Water Quality – Basic Treatment

- Basic Treatment – Targets Total Suspended Solids
 - Emerging Technologies (Proprietary Devices)
 - Media Filtration (StormFilter, Bayfilter, etc.)
 - Filterra
 - Biofiltration Swale
 - Infiltration (Permeable Pavement)
 - Vegetated Filter Strips
 - Compost Amended Vegetated Filter Strips
 - Basic Wetpond
 - Wetvault
 - Sand Filters
 - Combined Detention and Wetpool
 - Stormwater Treatment Wetland
 - Bioretention
 - Media Filter Drain

StormFilters





Catch Basin StormFilter



Catch Basin StormFilter



Stormfilter Vault

Filterra





Wetpond



Wetpond



Wetpond

Marine View Drive Bioswales





Biofiltration Swale

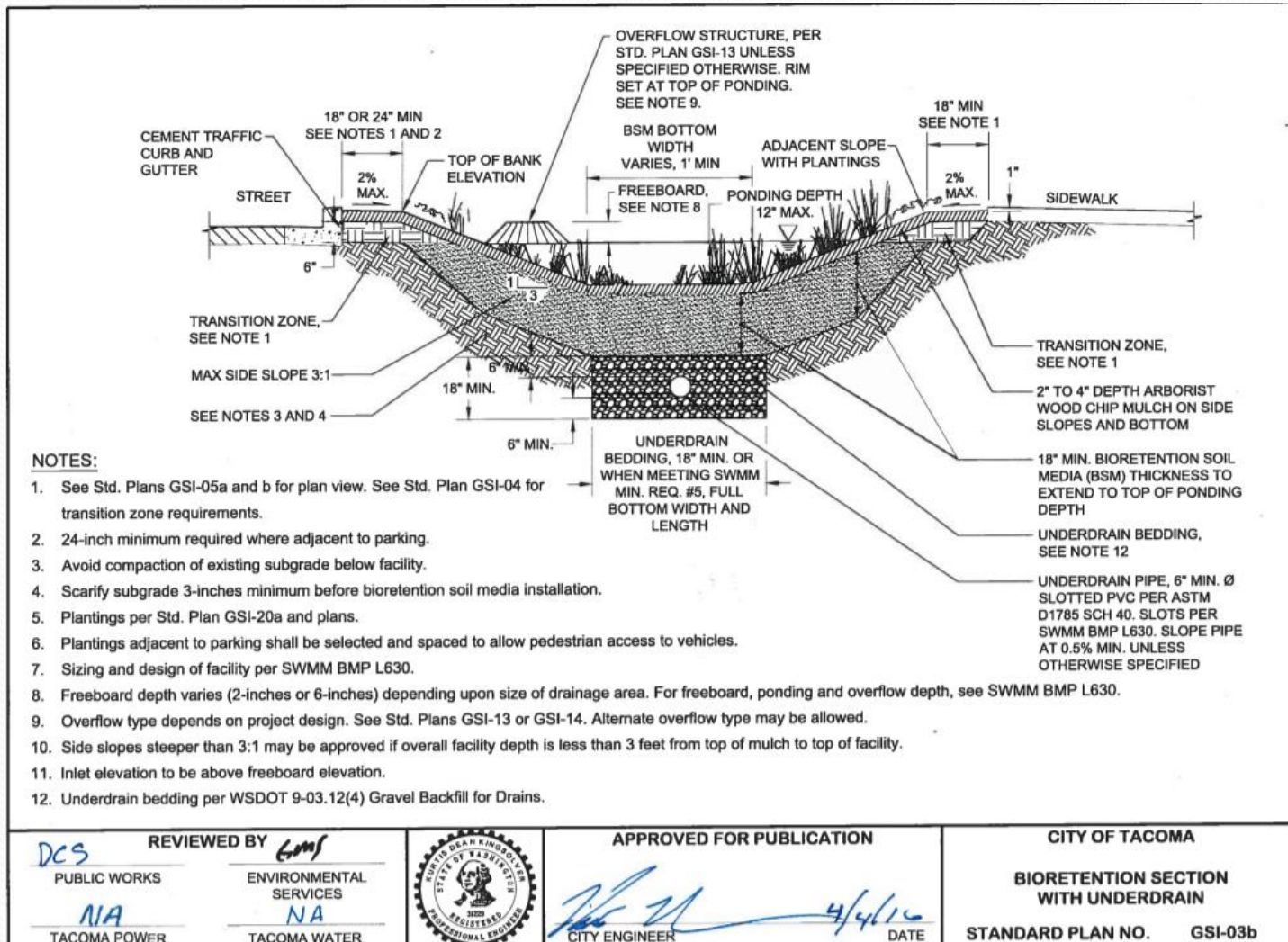


Biofiltration Swale During Construction

Water Quality – Enhanced Treatment

- Enhanced Treatment – Targets Metals Removal (Copper and Zinc)
 - Emerging Technologies
 - Filterra
 - Media Filters
 - Bioretention
 - Infiltration with Pretreatment
 - Large Sand Filter
 - Stormwater Treatment Wetland
 - Compost Amended Vegetated Filter Strip
 - Media Filter Drain
 - Biofiltration Swale + Sand Filter/Media Filter
 - Filter Strip + Linear Sand Filter
 - Wetpond + Sand Filter/Media Filter
 - Wetvault + Sand Filter/Media Filter
 - Combined Detention/Wetpool + Sand Filter/Media Filter
 - Sand Filter (with Presettling) + Media Filter

Bioretention



DCS

PUBLIC WORKS

NA

TACOMA POWER

REVIEWED BY

ENVIRONMENTAL SERVICES

NA

TACOMA WATER



APPROVED FOR PUBLICATION

CITY ENGINEER

4/4/16

DATE

CITY OF TACOMA

BIORETENTION SECTION WITH UNDERDRAIN

STANDARD PLAN NO. GSI-03b



Bioretention



Bioretention



Bioretention used for
Industrial Type Facility



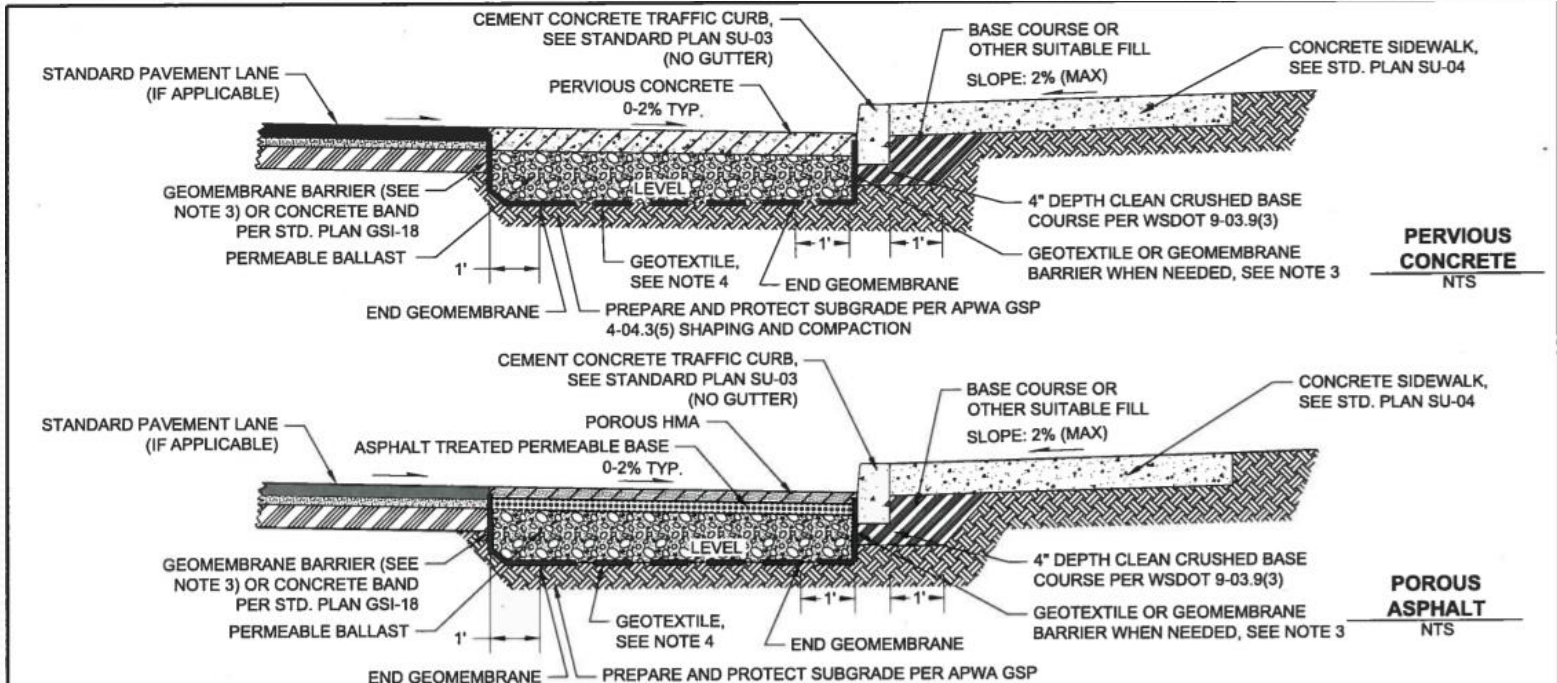
Scarsella Plat Stormwater Wetland





Stormwater Wetland

The permeable pavement section does not provide treatment, treatment is provided by the underlying soil or treatment layer.



NOTES:

1. Permeable ballast shall meet APWA GSP 4-04.2 Gravel Base and 9-03.9(2) Permeable Ballast Opt1 and shall be installed per APWA GSP 4-04.3(5) Shaping and Compaction.
2. Minimum surface longitudinal slope shall be 0.5%.
3. Geomembrane barrier shall provide an impermeable barrier between standard and permeable section. Geomembrane may also be required at the shoulder side of the road. It shall be installed 1" below finished grade of surfacing, as shown. Alternatively, the liner shall fold over the permeable ballast a minimum of 6". Geomembrane barrier seams shall overlap at least 18"
4. Geotextile to be provided when recommended by geotechnical professional and shall be required when fines in native subgrade exceed 7% on the #200 sieve.
5. Geotextile for separation per WSDOT 9.33.2(1), woven, Table 3 and installed per WSDOT 2-12.3(1).
6. See Std. Plan PD-01 for minimum pavement section.
7. Permeable pavement surfacing shall meet APWA GSP 5-04.3 Construction Requirements Porous Asphalt (PHMA/PWMA) Acceptance Infiltration Test for porous asphalt or 5-06.3(6)A Infiltration Rate of the Placed Pavement for pervious concrete.
8. Permeable ballast may be extended under curb and sidewalk when approved, see Std. Plan SU-31b.

<p>DCS PUBLIC WORKS</p> <p>NA TACOMA POWER</p>	<p>REVIEWED BY <i>GMS</i></p> <p>ENVIRONMENTAL SERVICES</p> <p>NA TACOMA WATER</p>		<p>APPROVED FOR PUBLICATION</p> <p><i>[Signature]</i> CITY ENGINEER</p> <p><i>4/24/12</i> DATE</p>	<p>CITY OF TACOMA PERMEABLE ROADWAY WITH IMPERVIOUS SIDEWALK</p> <p>STANDARD PLAN NO. SU-31a</p>
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Water Quality – Oil Control

- Oil – Targets Oil
 - API Oil/Water Separator
 - Coalescing Plate Separator
 - Linear Sand Filter
 - Emerging Technologies



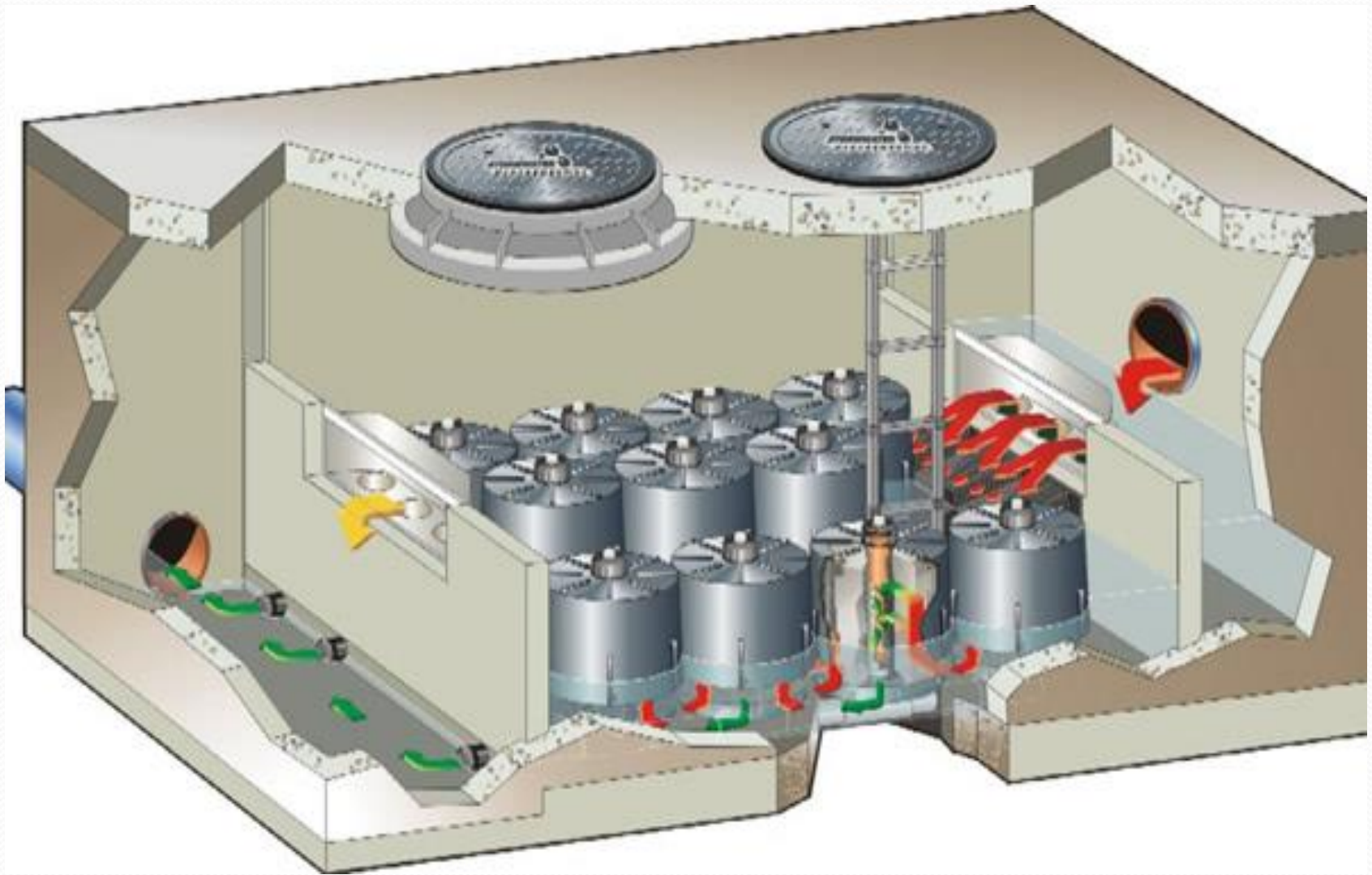
Coalescing Plate Oil Water Separator

Water Quality – Phosphorus Treatment

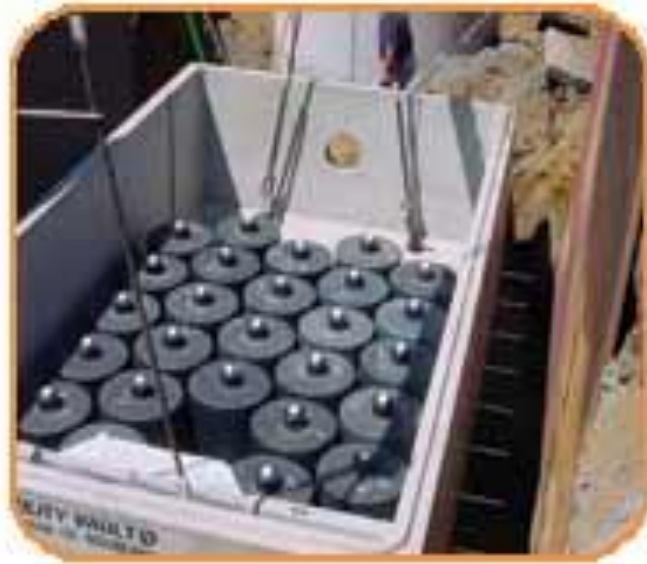
- Phosphorus Treatment – Targets Total Phosphorus
 - Infiltration with Pretreatment
 - Large Sand Filter
 - Amended Sand Filter
 - Large Wetpond
 - Biofiltration Swale + Sand Filter
 - Filter Strip + Linear Sand Filter
 - Linear Sand Filter + Filter Strip
 - Wetvault + Sand Filter
 - Wetpond + Sand Filter
 - Combined Detention Wetpool + Sand Filter
 - Stormwater Treatment Wetland + Basic Sand Filter
 - Emerging Technologies

Emerging Technologies (Proprietary Devices)

- Ecology TAPE Page:
<http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html>
 - Contains use level designations for various proprietary devices. Use level designations describe how facility must be designed and constructed. Check every time, these are constantly updated.
- Approved equivalent technologies:
<https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies>



Media Filter (Stormfilter®)



Media Filtration Configurations (Stormfilter®)



Dirty StormFilter



Bioretention
Plant/Soil/Microbe Complex
Removes Pollutants, TSS,
Phosphorous, Nitrogen, Heavy
Metals, Hydrocarbons, etc.

New or Existing
Catch Basin, Curb Cut
or Other Means of
Overflow Relief

Curb and
Gutter

Filterra® Flow Line at
Higher Elevation than
Bypass Flow Line

High Flow
Bypass

Plant/Tree

Tree Grate

Clean-out

3" Mulch

Root Uptake



Engineered
Media

Biodegradation



Storm Water Inflow
("First Flush")

Concrete
Filterra®
Container

Roadway/Parking Lot

Treated Stormwater
Underdrain System



filterra®

A Growing Idea in Stormwater Filtration.

U.S. Patent #6,277,374
#6,568,325

Media Filtration (filterra®)

Flow Control BMPs

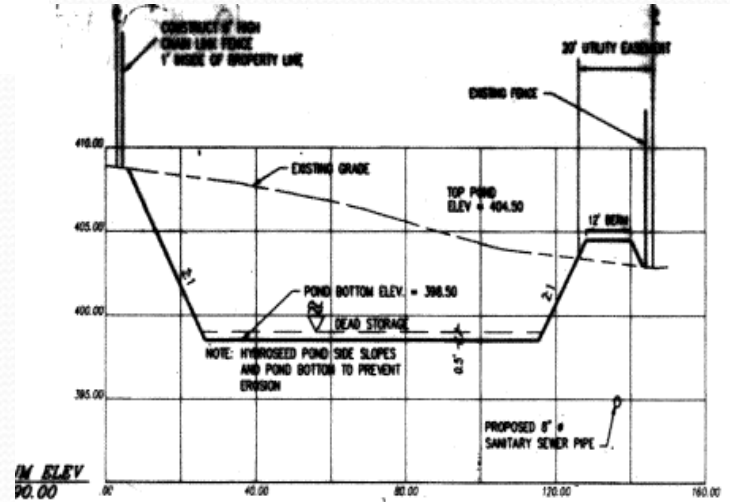
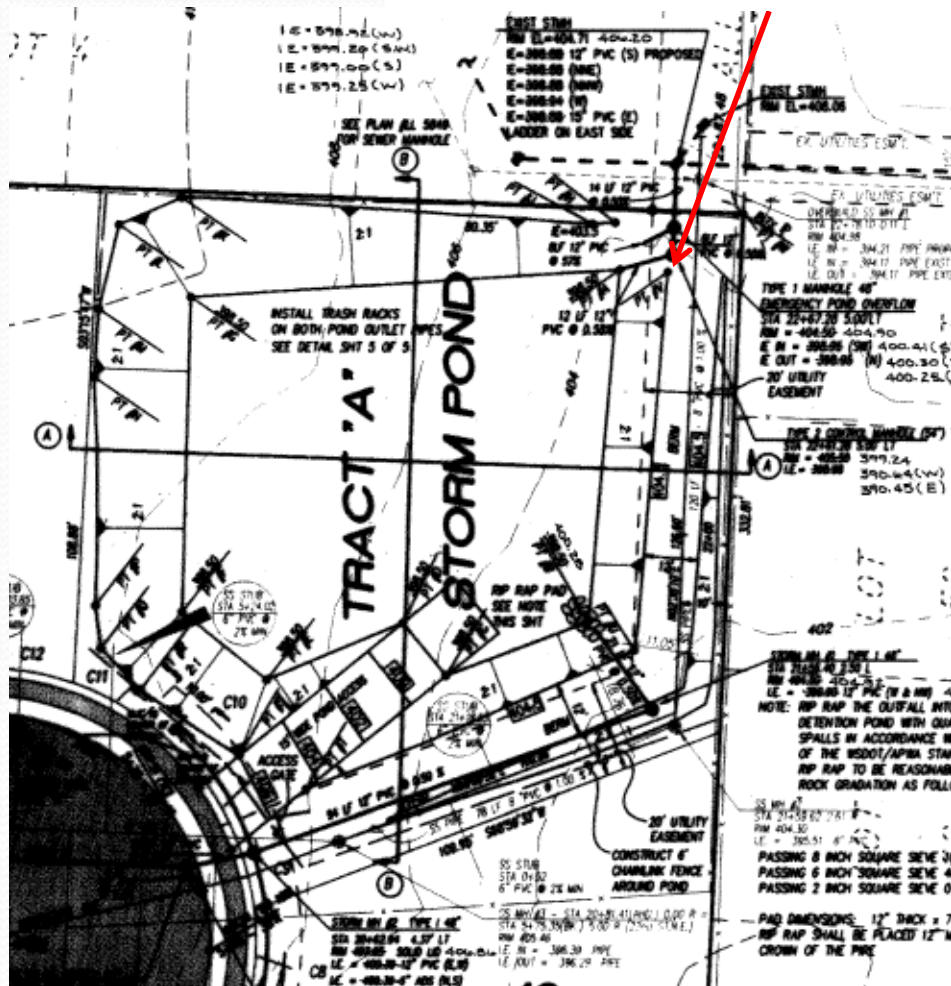
- Regulate (slow down) stormwater flows.
- Flow control requirements depend on location in the City and final discharge location.
- (See Minimum Requirement #7)
 - Detain to Forested Condition
 - Detain to Existing Condition

Detention Pond

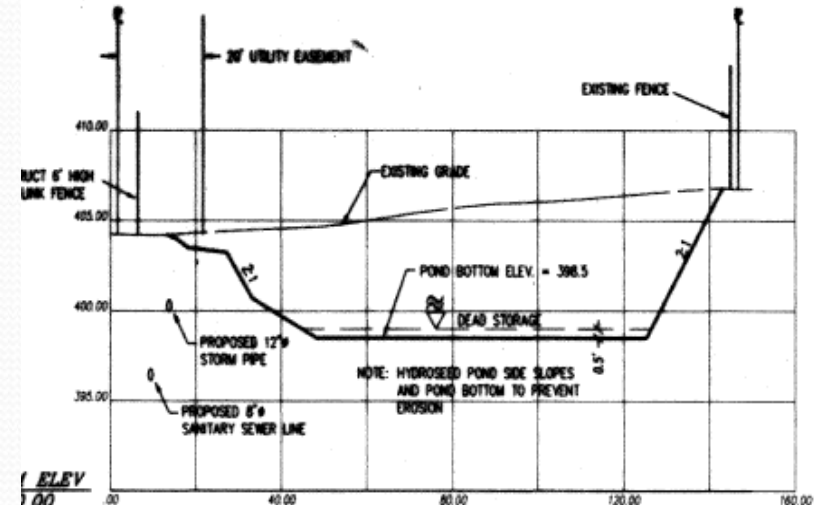


Detention Pond Plans

Control Structure Manhole



POND SECTION AA

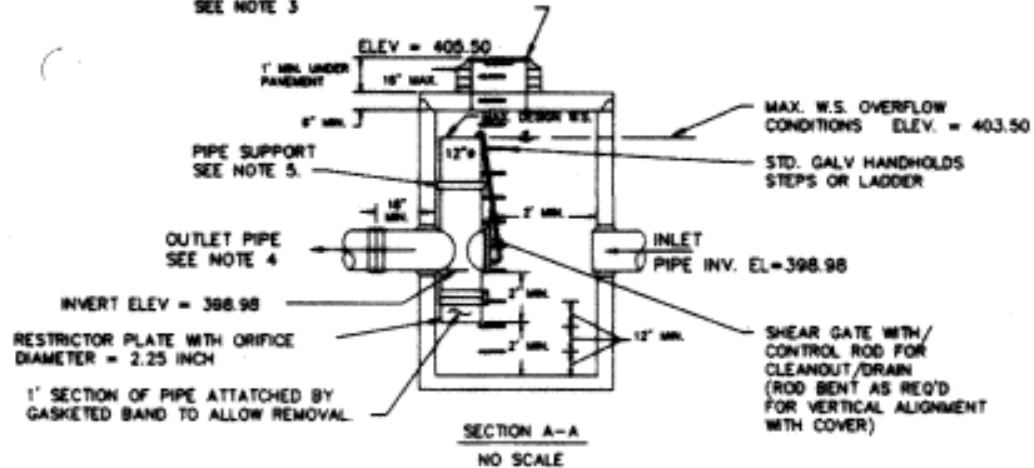


Detention Pond Plans



ISOMETRIC
NO SCALE

FRAME, GRATE & ROUND SOLID COVER
MARKED "DRAIN" WITH LOCKING BOLTS
SEE NOTE 3



SECTION A-A
NO SCALE

NOTES:

1. USE MIN. 48" DIA. CATCH BASIN TYPE 1.
2. METAL PARTS: CORROSION RESISTANT. GALVANIZED PIPE PARTS TO HAVE ASPHALT TREATMENT 1.
3. FRAME & LADDER OR STEPS OFFSET SO:
 - A. CLEANOUT GATE IS MIDDLE FROM TOP.
 - B. CLIMB DOWN SPACE IS CLEAR OF RISER AND CLEANOUT GATE.
 - C. FRAME IS CLEAR OF CURB.
4. IF METAL OUTLET PIPE CONNECTS TO CEMENT CONCRETE PIPE: OUTLET PIPE TO HAVE SMOOTH O.D. EQUAL TO CONCRETE PIPE I.D. LESS 1/4".
5. PROVIDE AT LEAST ONE 3" X 800 GAGE SUPPORT BRACKET ANCHORED CONCRETE WALL (MAX 3'-0")

2' MIN. CLEARANCE TO ANY PORTION OF PROP-T



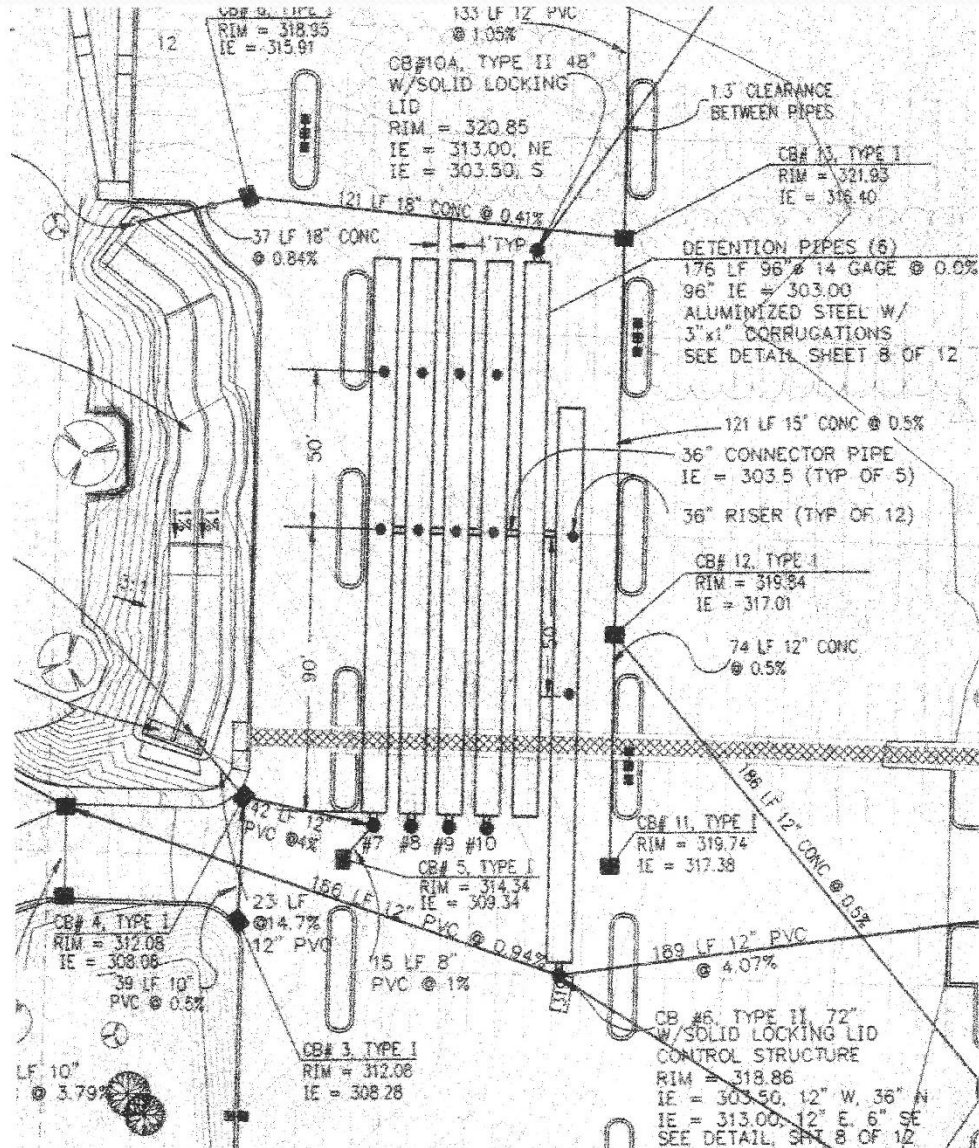
PLAN VIEW
NO SCALE

CONTROL STRUCTURE

N.T.S.

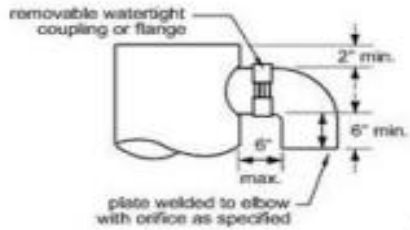


Stormwater Detention Tank



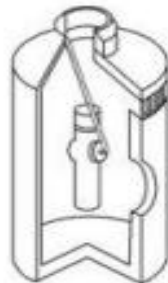
Types of Flow Control

- Flow Restrictors (typically inside a manhole or other structure)
 - Weir Type
 - Orifice Type
 - Pipes of Different Diameters and Invert Elevations



ELBOW RESTRICTOR DETAIL

NTS

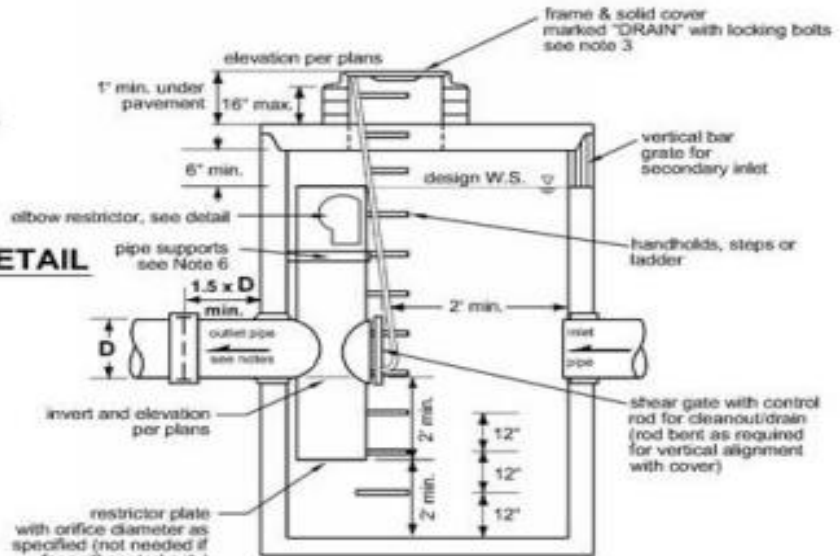


ISOMETRIC

NTS

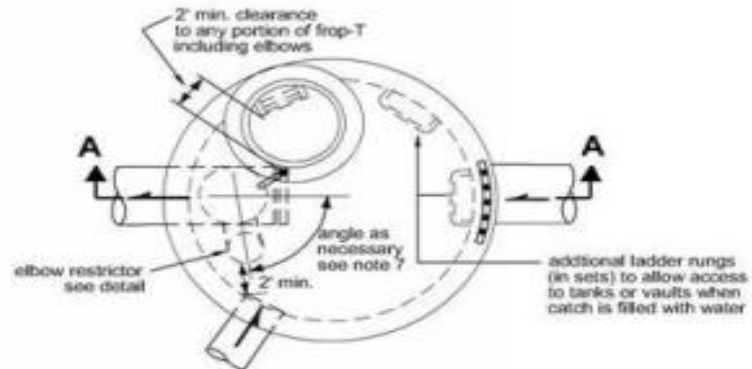
NOTES:

1. Use a minimum of a 54" diameter type 2 catch basin. (Type 3 manhole)
2. Outlet Capacity: 100-Year developed peak flow.
3. Metal Parts: Corrosion resistant. Non-Galvanized parts preferred. Galvanized pipe parts to have asphalt treatment 1.
4. Frame and ladder or steps offset so:
 - A. Cleanout gate is visible from top.
 - B. Climb-down space is clear of riser and cleanout gate.
 - C. Frame is clear of curb.
5. If metal outlet pipe connects to cement concrete pipe: outlet pipe to have smooth



SECTION A-A

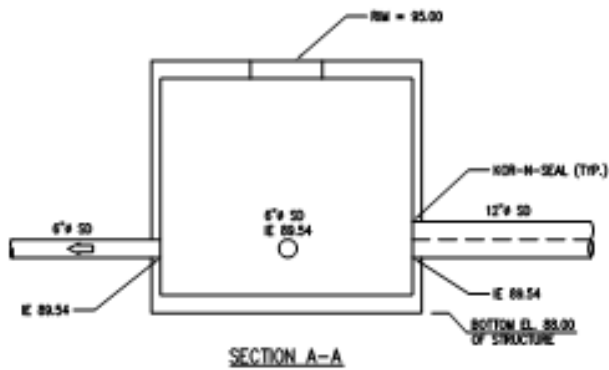
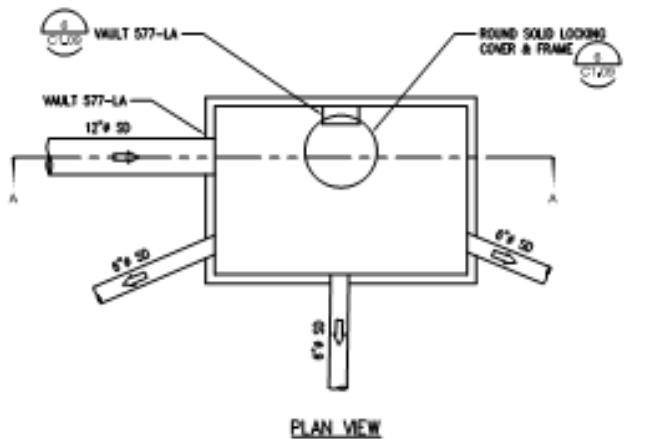
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PLAN VIEW

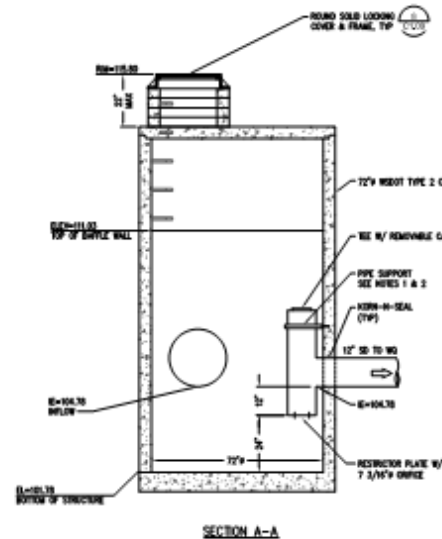
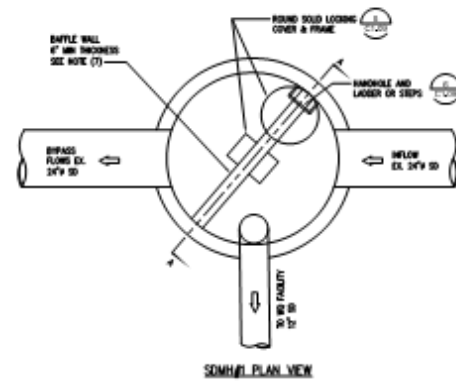
NTS

Riser Type Flow Restrictor



SDMH #5
SCALE: 1/2"=1'-0"

Flow Splitter



SDMH #1, FLOW SPLITTER
SCALE: NTS

Weir Type



Pipe Elevation and Diameter
Create Flow Control

01/07/2010



Riser Orifice Type

01/21/2009 09:14

Flow Restrictor

Inspection and Review

- The size and elevation of flow restrictors must match plans exactly
- Riser pipe must have a water-tight connection with the outlet opening
- Notches must be correct length and height
- Invert elevations of pipes entering and leaving must match exactly

Flow Control During Construction

- Flow control is required throughout construction.
(Volume 2 – Permit Requirement)
- No uncontrolled discharges.

Source Control – Volume 4

- Operational BMPs
 - Good Housekeeping
 - Sweeping
 - Integrated Pest Management
 - Operating Under Cover
 - Cleaning up spills and fixing leaks
 - Maintaining Records
 - BMPs for Homeowners
- Structural BMPs
 - Berms
 - Secondary Containment
 - Additional BMPs as needed to ensure clean site

Source Control – Volume 4

- All sites must provide source control measures to ensure pollutants do not discharge to the City stormwater system and waters of the state.
- Tacoma Municipal Code 12.08 provides authority to Environmental Services to require ongoing source control.
 - Environmental Compliance provides education and if needed progressive enforcement actions.
 - If you see pollutants, call the Source Control Pager: 253.502.2222.

BMPs for Homeowners

- Car Washing
 - Don't Wash Car in Street
- Pet Waste
 - Clean Up After Your Pets
- Automobile Maintenance
 - Don't Maintain Cars in Streets
 - Don't Dump Waste
- Swimming Pool/Spa Maintenance
 - Don't Discharge Pool Water to Street or Storm Drains
- Storage of Materials
 - Properly store hazardous materials inside or under cover



Bad or No Source Control



Bad or No Source Control



Documentation

- Written report and photos from all site visits!
- AccessES Stormwater Facility Layer

Thanks for Coming!

- Call us with any questions you might have about stormwater BMPs, the Stormwater Management Manual or NPDES Phase I Permit.
 - **Merita Trohimovich – 253.502.2103**
 - **Mieke Hoppin – 253.502.2105**