OPERATION & MAINTENANCE MANUAL

DFI No.: D00169
Facility Type: Water Quality Biofiltration Swale

JUNE, 2011

INDEX

1. Identification

Drainage Facility ID (DFI):	**D00169**
Facility Type:	Water Quality Biofiltration Swale
Construction Drawings:	(V-File Number) 37V-041
Location:	District: 2B (Old 2A)
	Highway No.: 047
	Mile Post: 66.44; 66.52 (beg./end)
	Description: This facility is located on the south side of US 26 (Hwy 047). Access to the facility can be obtained from US 26 (Hwy 047).

2. Facility Contact Information

Contact the Engineer of Record, Region Technical Center, or Geo-Environmental's Senior Hydraulics Engineer for:

- Operational clarification
- Maintenance clarification
- Repair or restoration assistance

Engineering Contacts:

Region Technical Center Hydro Unit Manager

Or

Geo-Environmental Senior Hydraulics Engineer (503) 986-3365.

3. Construction

Engineer of Record:	ODOT Designer – Region 1 Tech Center, Bruce S. Council, (503) 731-8319
Facility construction:	2004
Contractor:	Mowatt Construction Company

4. Storm Drain System and Facility Overview

A water quality swale is a flat-bottomed open channel designed to treat stormwater runoff from highway pavement areas. This type of facility is lined with grass. Treatment by trapping sedimentation occurs when stormwater runoff flows through the grass.

This swale is approximately 145 feet in length, and is located on the south side of US 26 (Hwy 047). Access to the swale can be obtained from US26 (Hwy 047). The swale treats drainage received from the roadway for approximately 250 feet to the east. The swale is part of a group of several swales placed in series and laid out in a linear fashion to one another.

This swale is considered an offline facility where only water quality flows are diverted towards the facility for water quality treatment, while the higher flows are bypassed around the swale within the adjacent stormwater piping conveyance system. The high flows are directed into a 4-ft diameter detention pipe (DFI D00170) before being discharged into a downstream manhole, which this swale also discharges into. Two inlets feed the swale and serve as high-low split flow structures; see the Operational Plan, Appendix A; points A and B). Beneath and adjacent to the water quality facility is an 18-inch storm pipe that receives flow from another nearby water quality facility (DFI D00168).

The water is treated by the swale and then collected by a ditch inlet and conveyed into the same conveyance system as both the nearby water quality biofiltration swale (DFI D00168) and detention tank/pipe (DFI D00170), before discharging into a nearby wetland.

Photo 1: Water quality swale looking east.

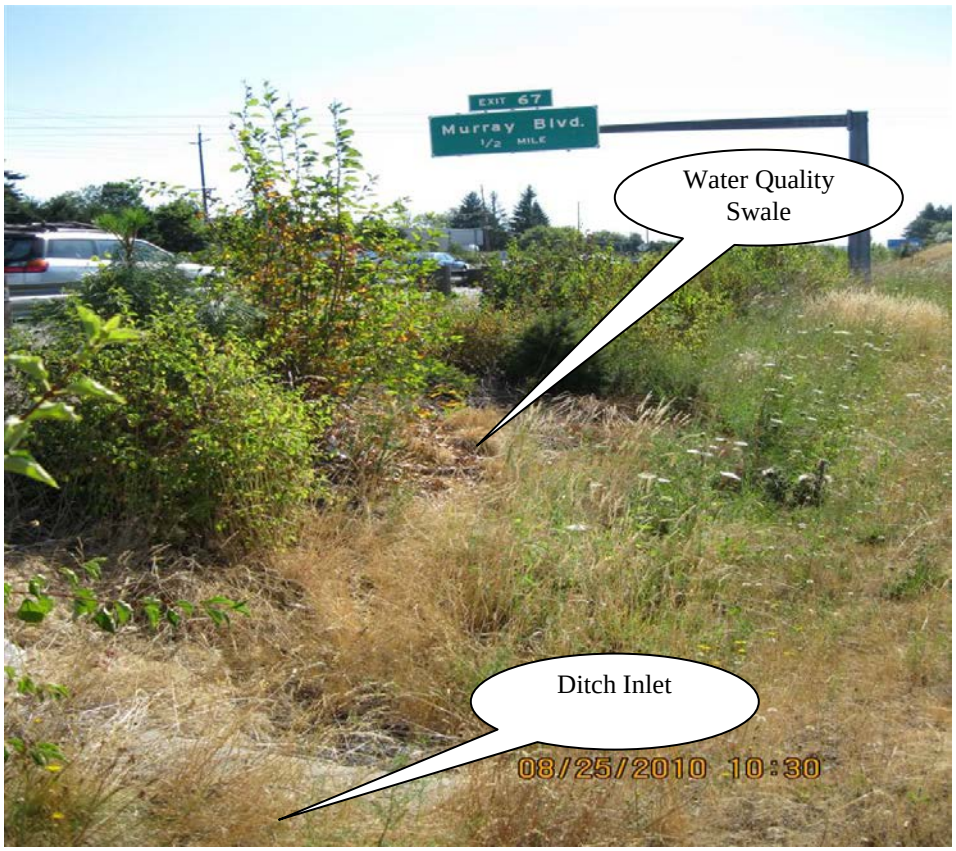


Photo 2: Water quality swale looking east.

Photo 3: Ditch inlet serving as swale outlet (Point E).

Photo 4: Inlet B to water quality swale.

Photo 5: Water quality swale looking east.

For further information and details regarding the system refer to Appendix A for the Operational Plan and Appendix B for the Construction Project Plan sheets.

A. Maintenance equipment access:
The facility can be accessed for maintenance from the eastbound shoulder of US 26 (Hwy 047).

B. Heavy equipment access into facility:

☒ Allowed (no limitations)
☐ Allowed (with limitations)
☐ Not allowed

C. Special Features:

☒ Amended Soils
☐ Porous Pavers
☐ Liners
☒ Underdrains – 1-4-inch diameter perforated pipe the length of the swale.

5. Facility Haz Mat Spill Feature(s)

The water quality biofiltration swale can be used to store a volume of liquid by blocking the 18-inch outlet pipe located at the outlet of the water quality biofiltration swale. This pipe is noted at point E in photo 3.

6. Auxiliary Outlet (High Flow Bypass)

Auxiliary Outlets are provided if the primary outlet control structure can not safely pass the projected high flows. Broad-crested spillway weirs and over flow risers are the two most common auxiliary outlets used in stormwater treatment facility design. The auxiliary outlet feature is either a part of the facility or an additional storm drain feature/structure.

The auxiliary outlet feature for this facility is:

☐ Designed into facility

☒Other, as noted –The facility is considered an offline facility where high flows are bypassed around the facility. The two inlets serving the facility act as high-low flow spitters by directing the low flow (or water quality flow) to the facility. There are no auxiliary outlet features within the facility.

7. Maintenance Requirements

Routine maintenance table for non-proprietary stormwater treatment and storage/detention facilities have been incorporated into ODOT's Maintenance Guide. These tables summarize the maintenance requirements for ponds, swales, filter strips, bioslopes, and detention tanks and vaults. Special maintenance requirements in addition to the routine requirements are noted below when applicable.

The ODOT Maintenance Guide can be viewed at the following website:

http://www.oregon.gov/ODOT/HWY/OOM/MGuide.shtml

Maintenance requirements for proprietary structures, such as underground water quality manholes and/or vaults with filter media are noted in Appendix C when applicable.

The following stormwater facility maintenance table (See ODOT Maintenance Guide) should be used to maintain the facility outlined in this Operation and Maintenance Manual or follow the Maintenance requirements outlined in Appendix C when proprietary structure is selected below:

☒ Table 1 (general maintenance)
☐ Table 2 (stormwater ponds)
☒ Table 3 (water quality or biofiltration swales)
☐ Table 4 (water quality filter strips)
☐ Table 5 (water quality bioslopes)
☐ Table 6 (detention tank)
☐ Table 7 (detention vault)
☐ Appendix C (proprietary structure)
☐ Special Maintenance requirements:

Note: Special maintenance Requirements Require Concurrence from ODOT SR Hydraulics Engineer.

8. Waste Material Handling

Material removed from the facility is defined as waste by DEQ. Refer to the roadwaste section of the ODOT Maintenance Yard Environmental Management System (EMS) Policy and Procedures Manual for disposal options: http://egov.oregon.gov/ODOT/HWY/OOM/EMS.shtml

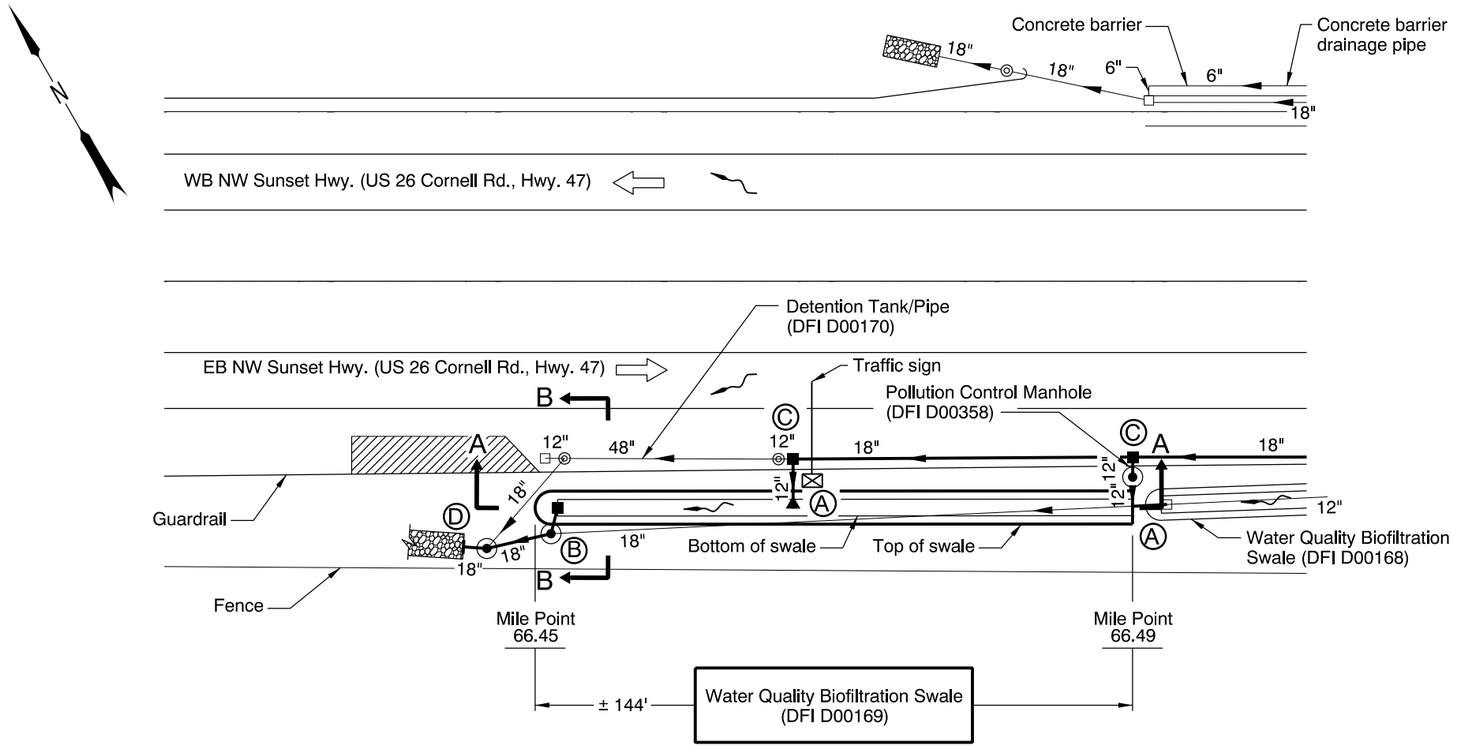
Contact any of the following for more detailed information about management of waste materials found on site:

ODOT Clean Water Unit	(503) 986-3008
ODOT Statewide Hazmat Coordinator	(503) 229-5129
ODOT Region Hazmat Coordinator	(503) 731-8304
ODEQ Northwest Region Office	(503) 229-5263

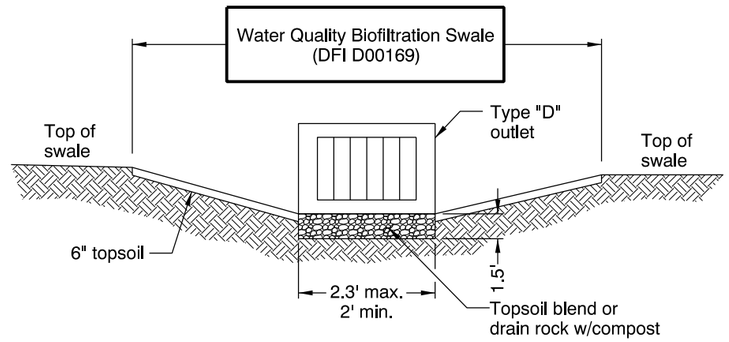
Appendix A

Content:

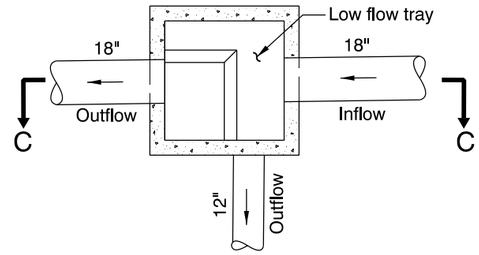
- **Operational Plan and Profile Drawing(s)**



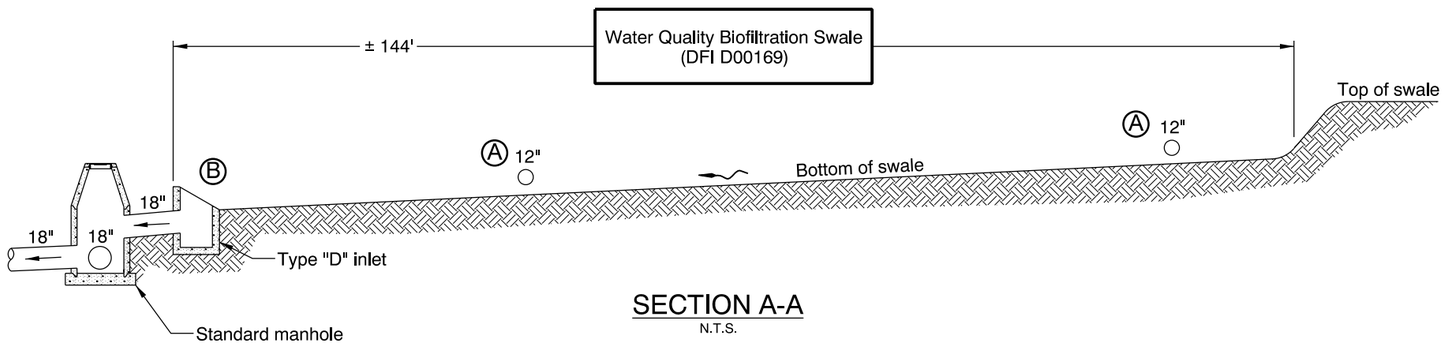
PLAN
N.T.S.



SECTION B-B
N.T.S.



LOW FLOW SPLITTER/DIVERSION PLAN AT POINT Ⓒ
N.T.S.



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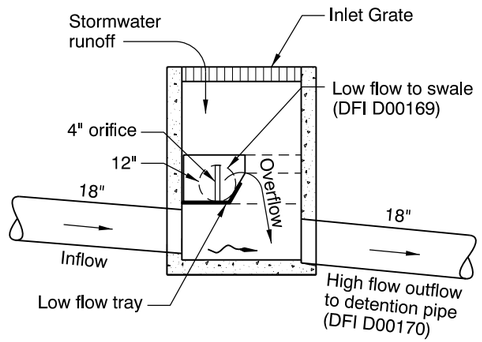


SECTION C-C
N.T.S.

LEGEND:

- Photo Location / Direction
- Ⓐ Swale Inlet
- Ⓑ Swale Outlet
- Ⓒ Flow Splitter / Diversion Inlet
- Ⓓ Outfall Riprap
- ◉ and/or ◎ Manhole
- ■ and/or □ Inlet
- Storm Pipe (Facility)
- Storm Pipe
- Conveyance Direction
- Pavement / Facility Flow Path
- Maintenance Access

Sht. 1 of 1

OREGON DEPARTMENT OF TRANSPORTATION

Prepared By: Craig Fox

Drafted By: M. Bunde/D.Claycomb

DFI D00169
MAINTENANCE DISTRICT 2B HWY 47
WATER QUALITY BIOFILTRATION SWALE
SUNSET HIGHWAY MP 66.45-66.49
WASHINGTON COUNTY

Appendix B

Content:

- **ODOT Project Plan Sheets**
  - ***Cover/Title Sheet***
  - ***Water Quality/Detention Plan Sheets***
  - ***Other Details***

37V-41

INDEX OF SHEETS	
SHEET NO.	DESCRIPTION
1	Title Sheet
1A, 1A-2	Index Of Sheets Cont'd.
1A-3	Std. Drg. Nos.
1B	Sheet Layout
2, 2A, 2A-2 Thru 2A-65 Incl.	Typical Sections
2B, 2B-2 Thru 2B-18 Incl.	Details
2C, 2C-2	Traffic Control Details
2CA, 2CA-2, 2CA-2A, 2CA-3 Thru 2CA-57 Incl.	Traffic Control Plans - Murray Work Area
2CB, 2CB-2 Thru 2CB-12 Incl.	Traffic Control Plans - Cornell Work Area
2D, 2D-2, Thru 2D-12, Incl.	Pipe Data Sheet

STATE OF OREGON

DEPARTMENT OF TRANSPORTATION

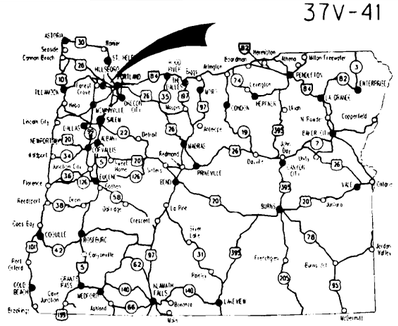
PLANS FOR PROPOSED PROJECT

GRADING, DRAINAGE, STRUCTURES, PAVING, SIGNING, ILLUMINATION, SIGNALS, & ROADSIDE DEVELOPMENT

US26: CORNELL RD. - OR217 (BEAVERTON) SEC.

SUNSET HIGHWAY

WASHINGTON COUNTY
MARCH 2004

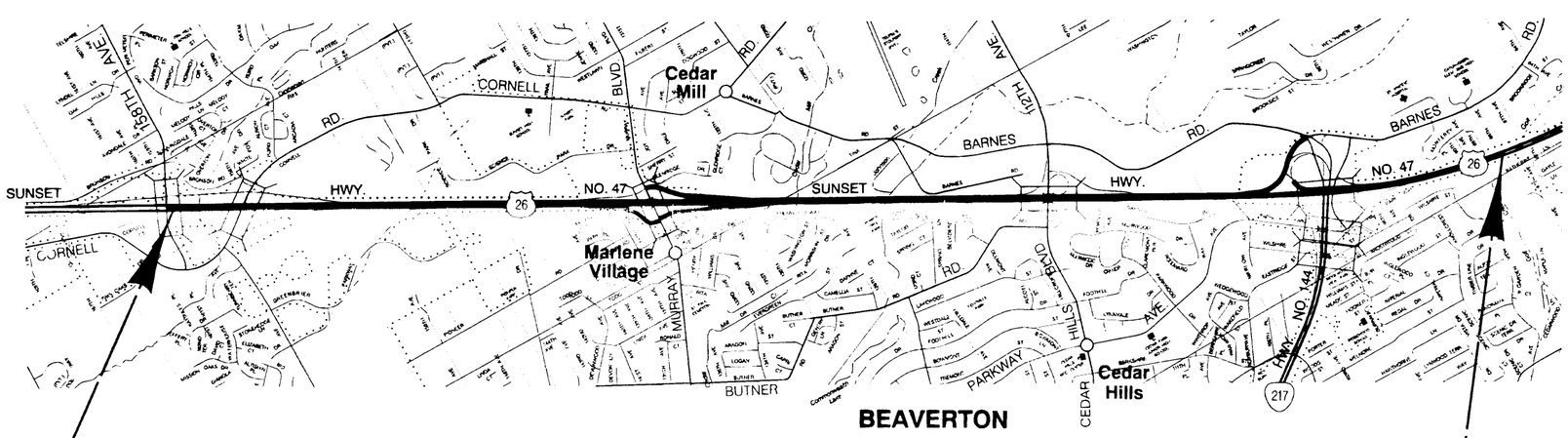


Overall Length Of Project - 6.51 km (4.05 Miles)

ATTENTION:
Oregon Law Requires You To Follow Rules Adopted By The Oregon Utility Notification Center. Those Rules Are Set Forth In OAR 952-001-0010 Through OAR 952-001-0090. You May Obtain Copies Of The Rules By Calling The Center. (Note: The Telephone Number For The Oregon Utility Center Is (503) 232-1987.)

OTIA
OREGON TRANSPORTATION INVESTMENT ACT

LET'S ALL WORK TOGETHER TO MAKE THIS JOB SAFE



BEGINNING OF PROJECT
NH-OTIA-S047(052)
STA. "LW" 91+660.00 (M.P. 65.68)

END OF PROJECT
NH-OTIA-S047(052)
STA. "L" 98+160.00 (M.P. 69.73)

OREGON TRANSPORTATION COMMISSION

Stuart Foster	CHAIRMAN
Gail L. Achterman	COMMISSIONER
Mike Nelson	COMMISSIONER
Randall Papé	COMMISSIONER
John Russell	COMMISSIONER
Bruce A. Warner	DIRECTOR OF TRANSPORTATION

REGISTERED PROFESSIONAL ENGINEER
13,704
OREGON
JULY 16, 1987
CATHERINE M. NELSON
Expires Dec. 31, 2004

Catherine M. Nelson
TECHNICAL SERVICES MANAGING ENGINEER

METRIC

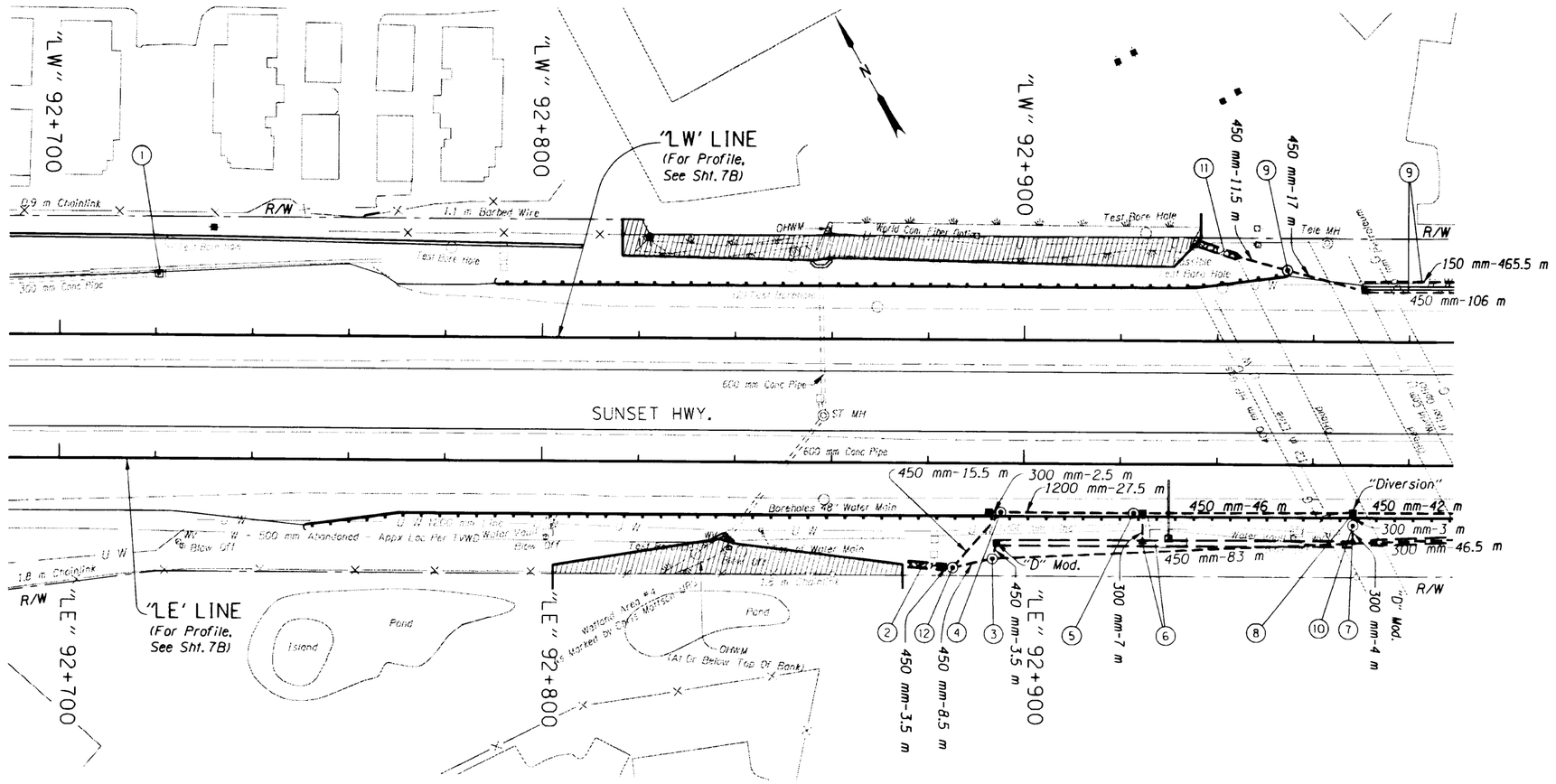
US26: CORNELL RD. - OR217 (BEAVERTON) SEC.
SUNSET HIGHWAY
WASHINGTON COUNTY

FEDERAL HIGHWAY ADMINISTRATION	PROJECT NUMBER	SHEET NO.
OREGON DIVISION	NH-OTIA-S047(052)	1

PE000656/C0341403-011

F:\ODOT DATA\Projects\13459 Cornell 217\13459r1.tsl 1/16/2004 1:19:56 PM bwve07p

Sec. 32, T. 1N, R. 1W, W.M.



(1) *Adjust Inlet*
Const. Open Grade HMAC Mod. Inlet

(2) *Sta. "LE" 92+882.236, 21.425 m Rt.*
Const. Ditch
0.6 m Flat Bottom, 1:2 Slopes
Inst. 450 mm Storm Sew. Pipe - 3.5 m
1.5 m Depth
Const. Paved End Slope - 4.3 m²
Const. Loose Riprap (Class 25) - 31 MG
Riprap Geotextile Matl., Type "1" - 49 m²
Dt. Exc. - 23 m³
(For Details, See Sht. GHJ-8)

(3) *Sta. "LE" 92+893.492, 19.724 m Rt.*
Const. Manhole
Const. Type "D" Mod. Inlet - 2
Const. Water Quality Swale "WC2A"
0.6 m Flat Bottom
Inst. 450 mm Storm Sew. Pipe - 86.5 m
1.5 m Depth
(For Details, See Sht. GHJ-35)

(4) *Sta. "LE" 92+895.233, Rt.*
Const. Detention Manhole, Large, 2400 mm Dia.
Const. Type "G-2" Open Grade HMAC Inlet
Inst. 300 mm Storm Sew. Pipe - 2.5 m
1.5 m Depth
Inst. 1200 mm Storm Sew. Pipe - 27.5 m
3 m Depth
(For Details, See Sht. GHJ-11)

(5) *Sta. "LE" 92+922.789, Rt.*
Const. Manhole, Large, 2400 mm Dia.
Const. Type "G-2" Open Grade HMAC
Diversion Mod. Inlet
Inst. 450 mm Storm Sew. Pipe - 46.0 m
1.5 m Depth
(For Details, See Sht. GHJ-14)

(6) *Sta. "LE" 92+922.787, 16.504 m Rt.*
Const. Paved End Slope - 3.1 m²
Const. Water Quality Swale "WC2B"
Inst. 300 mm Storm Sew. Pipe - 7.0 m
1.5 m Depth
(For Details, See Shts. R-28 & GHJ-36)

(7) *Sta. "LE" 92+968.367, 16.341 m Rt..*
Inst. 300 mm Storm Sew. Pipe - 4.0 m
1.5 m Depth
Const. Paved End Slope - 3.1 m²

(8) *Sta. "LE" 92+968.400, Rt.*
Const. Type "G-2" Open Grade HMAC Diversion Mod. Inlet
Inst. 450 mm Storm Sew. Pipe - 42.0 m
3 m Depth
(For Details, See Sht. GHJ-14)

(9) *Sta. "LW" 92+967.593, 14.937 m Lt.*
Const. Pollution Control Manhole
Const. Type "G-2" Open Grade HMAC Inlet - 5
Inst. 300 mm Storm Sew. Pipe - 256.5 m
1.5 m Depth
Inst. 450 mm Storm Sew. Pipe - 123.0 m
1.5 m Depth
Const. Conc. Barrier Drain - 465.5 m
(For Details, See Sht. GHJ-1)

(10) *Sta. "LE" 92+968.387, 12.435 m Rt.*
Const. Pollution Control Manhole
Inst. 300 mm Storm Sew. Pipe - 3.0 m
1.5 m Depth
(For Details, See Sht. GHJ-31)

(11) *Sta. "LW" 92+964.843, 15.383 m Lt.*
Const. Ditch
0.6 m Flat Bottom , 1:2 Slopes
Inst. 450 mm Storm Sew. Pipe - 11.5 m
1.5 m Depth
Const. Paved End Slope - 4.3 m²
Const. Loose Riprap (Class 25) - 33 MG
Riprap Geotextile Matl., Type "1" - 51 m²
Dt. Exc. - 24 m³
(For Details, See Sht. GHJ-8)

(12) *Sta. "LE" 92+885.229, 21.626 m Rt.*
Const. Manhole
Inst. 450 mm Storm Sew. Pipe - 8.5 m
1.5 m Depth
Inst. 450 mm Storm Sew. Pipe - 15.5 m
3 m Depth

Wetland Area No Work Zone, Shown Thus:

REGISTERED PROFESSIONAL ENGINEER
19156
S. Council
OREGON
JULY 15, 1997
BRUCE S. COUNCIL
Expires Dec. 31, 2005

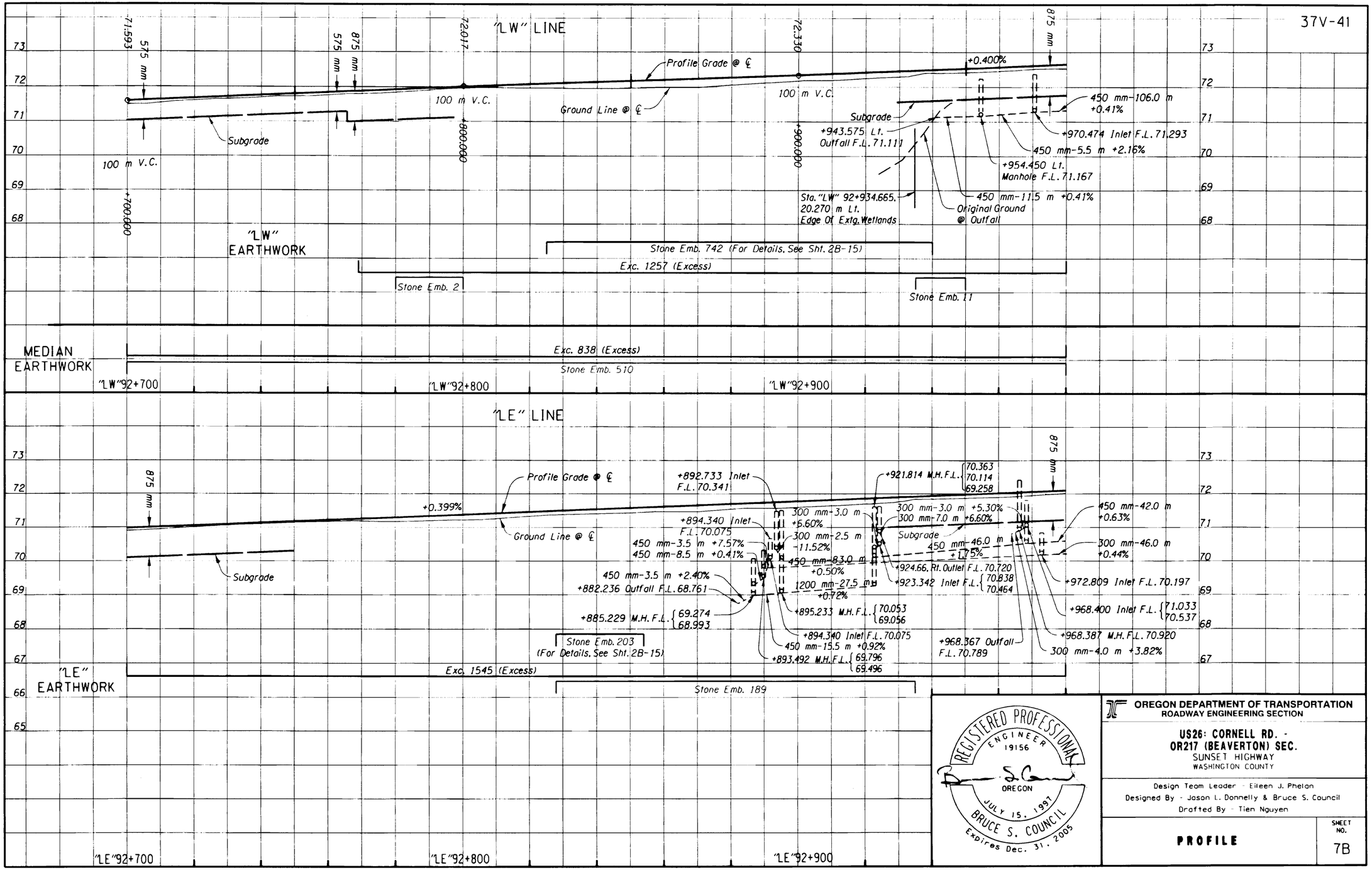
OREGON DEPARTMENT OF TRANSPORTATION
ROADWAY ENGINEERING SECTION

US26: CORNELL RD. - OR217 (BEAVERTON) SEC.
SUNSET HIGHWAY
WASHINGTON COUNTY

Design Team Leader - Eileen J. Phelan
Designed By - Bruce S. Council
Drafted By - Tien Nguyen

DRAINAGE & UTILITIES

SHEET NO. 7A



REGISTERED PROFESSIONAL ENGINEER 19156 OREGON JULY 15, 1997 BRUCE S. COUNCIL Expires Dec. 31, 2005

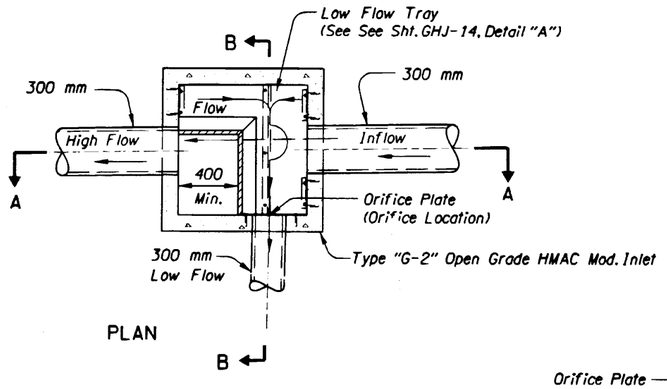
OREGON DEPARTMENT OF TRANSPORTATION
ROADWAY ENGINEERING SECTION

US26: CORNELL RD. - OR217 (BEAVERTON) SEC.
SUNSET HIGHWAY
WASHINGTON COUNTY

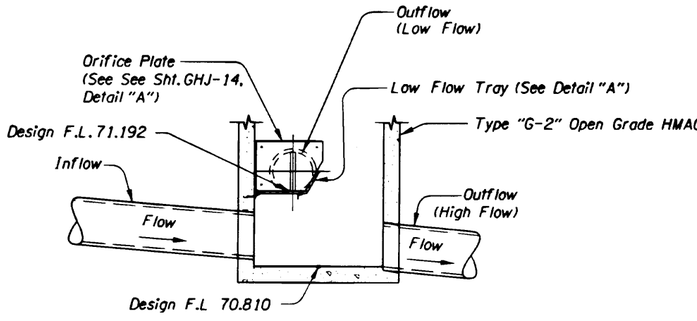
Design Team Leader - Eileen J. Phelan
Designed By - Jason L. Donnelly & Bruce S. Council
Drafted By - Tien Nguyen

PROFILE

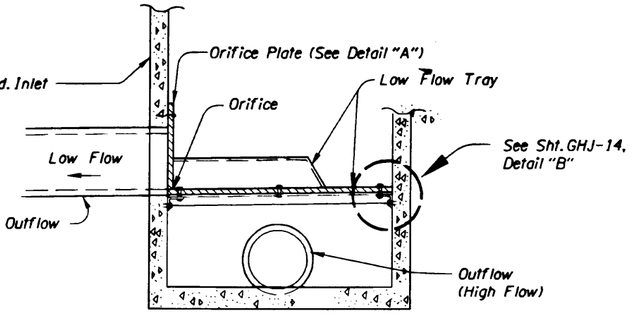
SHEET NO. 7B



PLAN



SECTION A-A



SECTION B-B

(For Details Not Shown, See Sht. GHJ-20)

DIVERSION "G-2" INLET "HIGH-LOW", LOW FLOW TO SIDE

Sta. "LE" 93+009.95, Rt.

SECTION B-B

REGISTERED PROFESSIONAL ENGINEER 19156 OREGON JULY 15, 1997 BRUCE S. COUNCIL Expires Dec. 31, 2005

OREGON DEPARTMENT OF TRANSPORTATION

US26: CORNELL RD. - OR217 (BEAVERTON) SEC.
SUNSET HIGHWAY
WASHINGTON COUNTY

Project Leader - Naveen Chandra
Designed By - Bruce S. Council
Drafted By - Martin G. Casillas

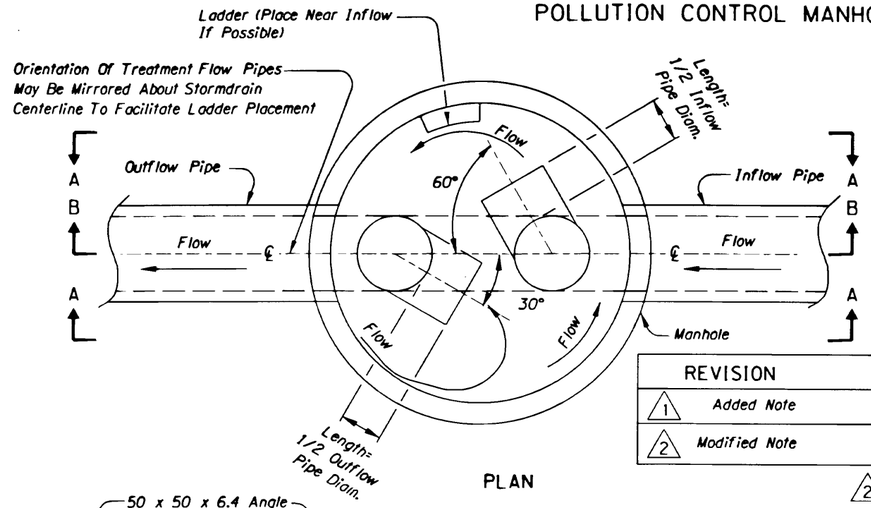
WATER QUALITY DETAILS

SHEET NO. GHJ-16

1:1000 - 4

THIS IS THE FILE NAME LOCATION \\scrsp\wwp66c\ODOT_DATA\projects\0602_wq\V3453wq_revl.dtll 1/16/2004 8:14:02 AM

POLLUTION CONTROL MANHOLE GENERAL DETAILS



PLAN

REVISION	DATE	BY
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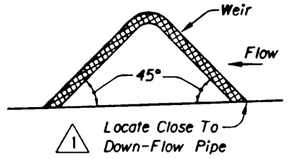
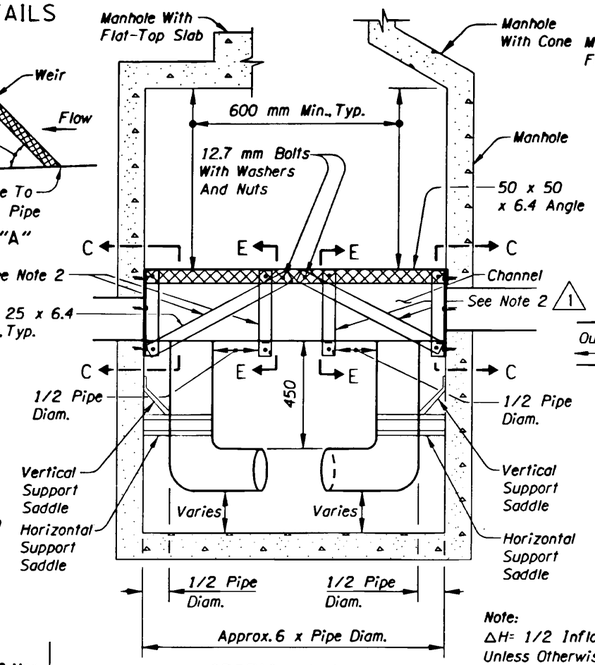
2 Modified Note	2-19-04	HMA

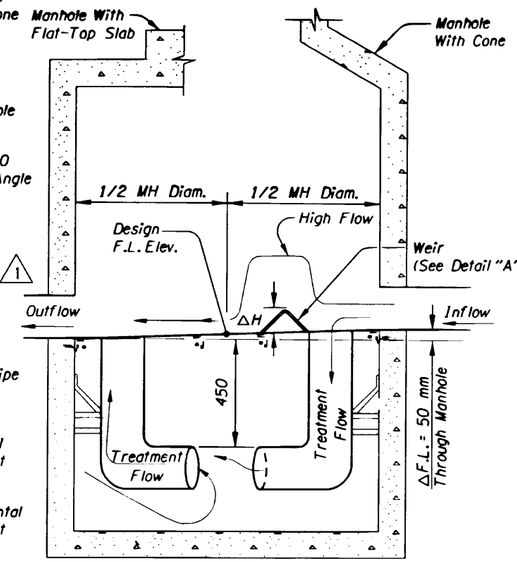


1 Locate Close To Down-Flow Pipe

DETAIL "A"

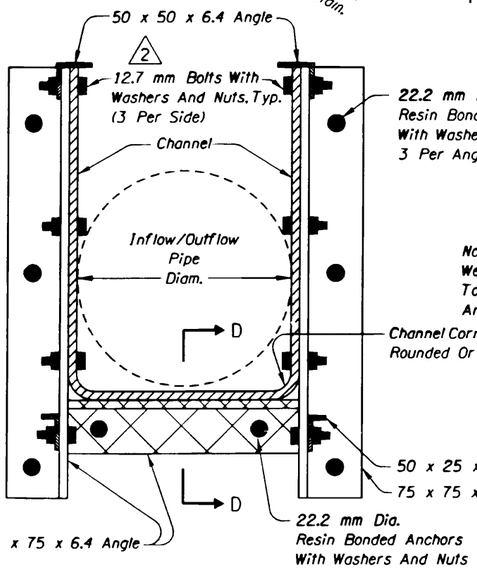


SECTION A-A

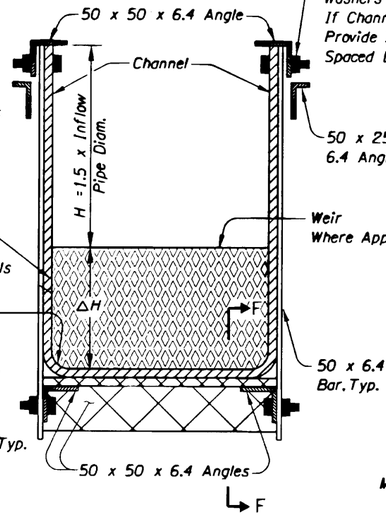


Note:
ΔH = 1/2 Inflow Pipe Diam. Unless Otherwise Specified

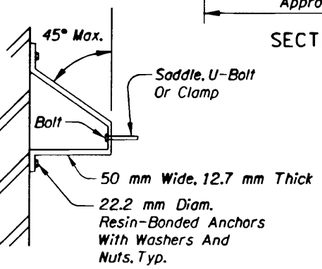
INSIDE SECTION B-B



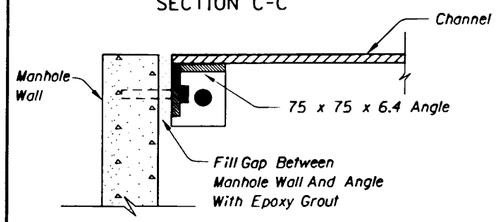
SECTION C-C



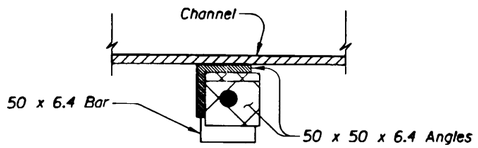
SECTION E-E



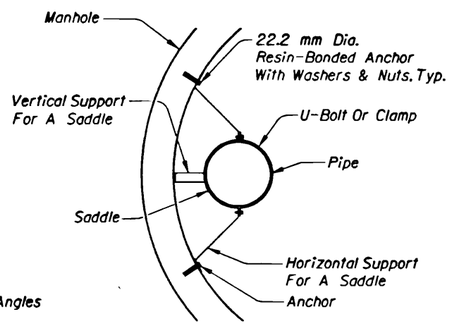
ELEVATION
VERTICAL PIPE SUPPORT



SECTION D-D
(Typ. Both Sides)



SECTION F-F
(Typ. Both Sides)



PLAN
HORIZONTAL PIPE SUPPORT

Notes:
1. Channel And Weir To Be Made Of 12.7 mm Thick HDPE Or 4.8 mm Thick. Min., Stainless Steel. Any Joints In Channel To Be Permanent, Strong And Watertight.
2. Angles And Bars Shall Be A36 Steel Or Stronger. Vertical And Diagonal Supports For Channel Span Not Necessary If Channel Is Steel.
3. Pipes Within Manhole To Be Corrugated HDPE, HDPE SDR26, PVC Sch. 40 Or 3.2 mm Min. Thick Stainless Steel. Flanges (12 Bolts) To Be Of These Materials.
4. Pipes And Channel Must Have Water Tight Joints And Smooth Interior Walls With Manning's "n" ≤ 0.013
5. Fasten Pipes To Wall Using 50 mm Wide By 12.7 mm Thick Straps With 22 mm Diameter U-Bolts Or Clamps.
6. Vertical Pipes To Be Set Away From Wall So That There Is A Clear Space Between The Manhole Wall And The Outside Pipe Wall Equal To At Least , But Not Much More Than, 1/2 Pipe Diameter.
7. Provide Permanent Watertight Seals Between Channel End And Manhole Wall, Between Channel Floor And Pipes Within The Manhole And Between The Weir And Channel.
8. All Hardware Shall Be Stainless Steel Or Hot-Dipped Galvanized.
9. For Resin-Bonded Anchors, Use Steel Threaded Rods.
10. Embed Resin-Bonded Anchors 100 mm, Min. Into Concrete. Use High Or Low Strength Resin From ODOT's Qualified Products List, Suitable For Wet Or Submerged Locations.
11. Dimensional Relationships, Ratios, And Pipe Rotation Angles Shown Are Typical For All Pollution Control Manholes Except Where Otherwise Noted At Specific Location(s).
12. For Other Details Not Shown, See Sht. GHJ-20 And Drawing No. RD340.
13. All Dimensions Are In Millimeters (mm) Unless Otherwise Noted.

REGISTERED PROFESSIONAL ENGINEER
62,609
OREGON
MAY 9, 2000
HENRY MINTON ALLEN
Expires Dec. 31, 2005

OREGON DEPARTMENT OF TRANSPORTATION
GEO / HYDRO SECTION

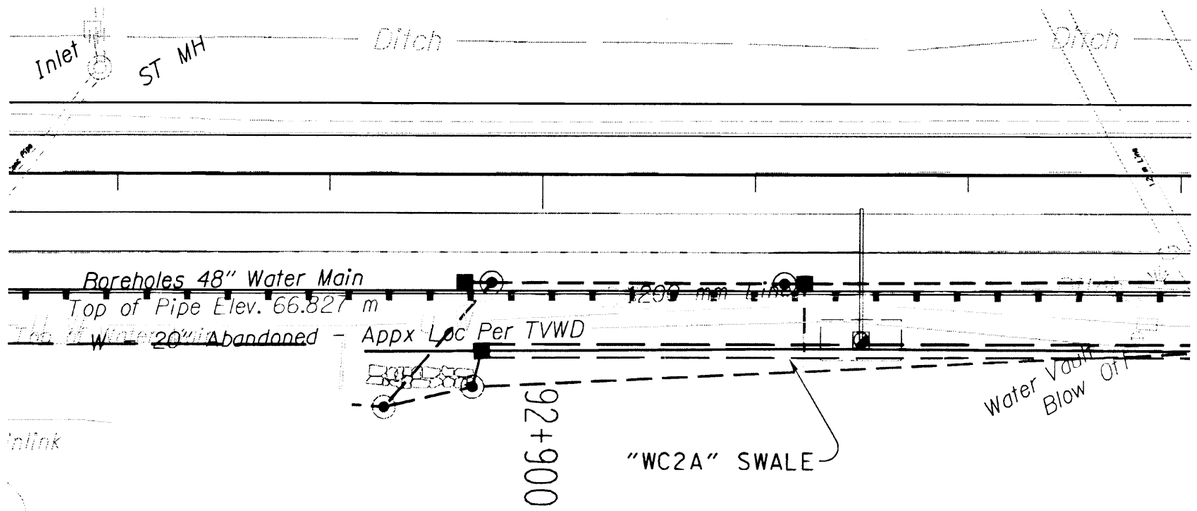
US26: CORNELL RD. - OR217 (BEAVERTON) SEC.
SUNSET HIGHWAY
WASHINGTON COUNTY

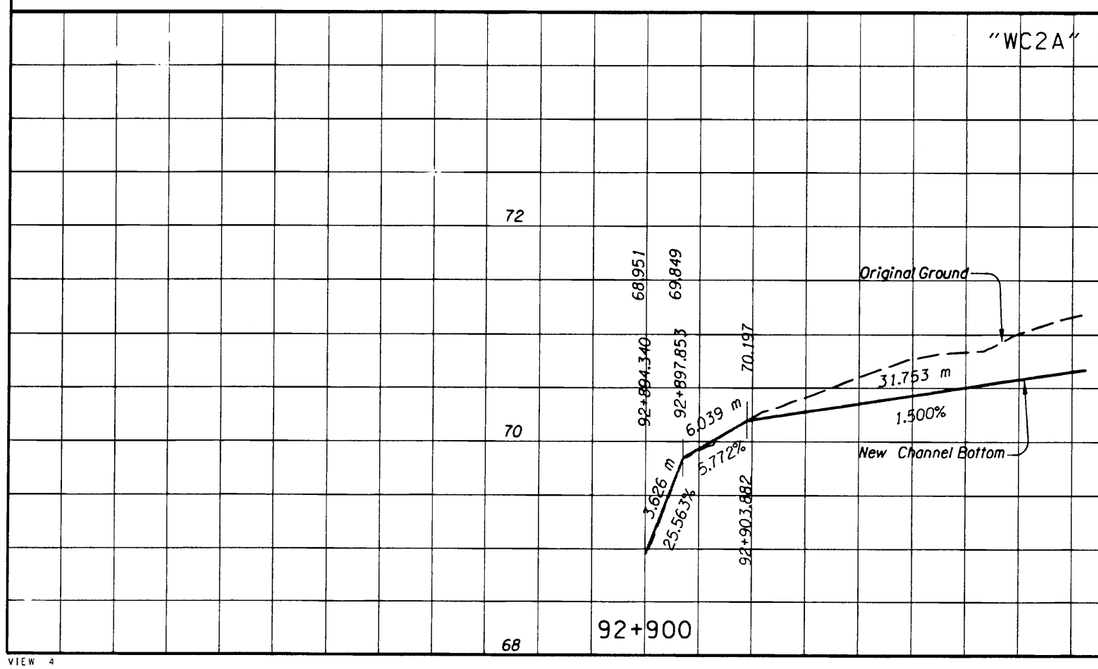
Project Leader - Naveen Chandra
Designed By - Henry M. Allen
Drafted By - Martin G. Casillas

WATER QUALITY DETAILS

SHEET NO. GHJ-31

VIEW





Notes:
1. *All Dimensions Are In Meters (m) Unless Otherwise Noted.*
2. *For Details, See Shts. GHJ-48 & GHJ-49*

REGISTERED PROFESSIONAL ENGINEER
19156
OREGON
JULY 15, 1997
BRUCE S. COUNCIL
Expires Dec. 31, 2005

OREGON DEPARTMENT OF TRANSPORTATION
ROADWAY ENGINEERING SECTION

US26: CORNELL RD. - OR217 (BEAVERTON) SEC.
SUNSET HIGHWAY
WASHINGTON COUNTY

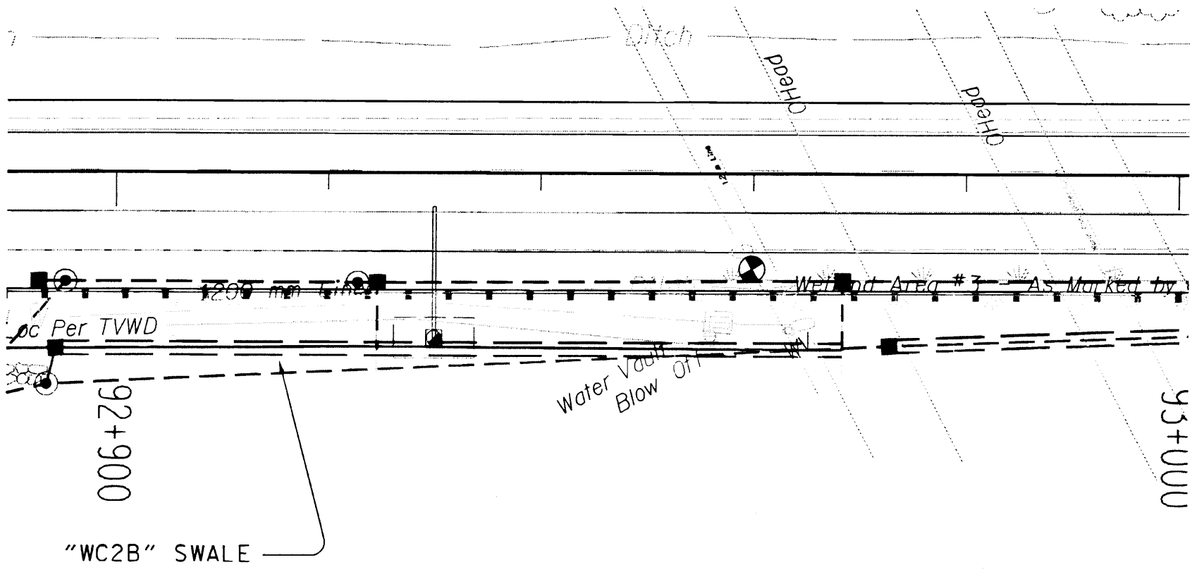
Project Leader - Naveen Chandra
Designed By - Bruce S. Council
Drafted By - Martin G. Casillas

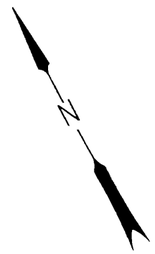
WATER QUALITY PLAN

SHEET NO. GHJ-35

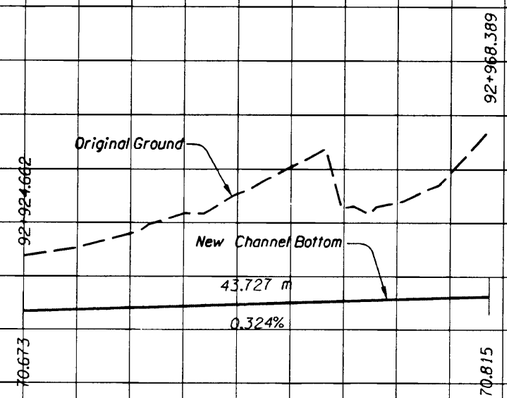
1:1000

VIEW 4





"WC2B" LINE



Notes:
1. All Dimensions Are In Meters (m) Unless Otherwise Noted.
2. For Details, See Shts. GHJ-48 & GHJ-49

REGISTERED PROFESSIONAL ENGINEER
19156
OREGON
JULY 15, 1997
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OREGON DEPARTMENT OF TRANSPORTATION
ROADWAY ENGINEERING SECTION

US26: CORNELL RD. - OR217 (BEAVERTON) SEC.
SUNSET HIGHWAY
WASHINGTON COUNTY

Project Leader - Naveen Chandra
Designed By - Bruce S. Council
Drafted By - Martin G. Casillas

WATER QUALITY PLAN

SHEET NO. GHJ-36

1.1000

VIEW 3

VIEW 1

WATER QUALITY SWALES
SITE SPECIFIC INFORMATION

Notes:
1) U-S= Upstream, D-S= Downstream
2) See Site Plans For Pipe Inverts At Inlets.
3) "C-T Blend" = Compost-Topsoil Blend,
"Rock+C-T" = Drain Rock With Compost-Topsoil Blend.

WC2B Correction L=44m

Swale ID	L, m	W, m	F.L. U-S, m	F.L. D-S, m	Long. Slope, %	Centerline Curve Radius, m	Swale Sideslopes U-S	Left	Right	D-S	Freeboard Depth, m	Swale Bottom Medium	No. Under-Drain Segments	Under Drain Tie-In Location	Swale Outlet Facility
WCW	340	1.2	See GHJ-32	See GHJ-32	Varies	None	1:3	1:4	1:6	1:4	0.3	Rock+C-T	2	"G-2MA" Mod. Inlet	"G-2MA" Mod. Inlet
WCE	322	2.4	See GHJ-33	See GHJ-33	Varies	None	1:20	1:6	1:4	1:18	0.3	Rock+C-T	2	"G-2MA" Mod. Inlet	"G-2MA" Mod. Inlet
WC1	82	2.4	68.062	66.543	1.85	None	1:4	1:3	1:6	1:4	0.3	C-T Blend	2	"D" Mod. Inlet	"M-E" Mod. Inlet
WC2A	30	0.6	70.673	70.197	1.50	None	1:2	1:2	1:2	1:2	0.3	C-T Blend	1	"D" Mod. Inlet	"D" Mod. Inlet
WC2B	474	0.7	70.815	70.637	0.32	None	1:3	1:3	1:3	1:3	0.3	C-T Blend	1	"D" Mod. Inlet	"D" Mod. Inlet
WC2C	37	0.8	71.042	70.839	0.55	None	1:4	1:4	1:4	1:4	0.45	C-T Blend	1	"D" Mod. Inlet	"D" Mod. Inlet
WC2D	41	0.9	72.556	71.634	Varies	None	1:5	1:5	1:5	1:5	0.3	Rock+C-T	1	"D" Mod. Inlet	"D" Mod. Inlet
WC3A	50	2.4	70.195	69.961	0.5	None	1:4	Var.	Var.	1:4	.8	C-T Blend	2	"D" Mod. Inlet	"V"-Bottom Ditch
WC3B	50	2.4	74.408	74.158	0.5	80	1:4	1:4	1:6	1:4	0.45	C-T Blend	2	"D" Mod. Inlet	"M-E" Mod. Inlet
MA1	31.5	2.4	72.160	72.000	0.51	None	1:3	1:3	Var.	1:6	0.45	C-T Blend	None	N.A.	"M-E" Mod. Inlet
CBR	See GHJ-43	2.4	See GHJ-43	See GHJ-43	Varies	None	1:4	1:4	1:4	1:4	0.45	C-T Blend	None	N.A.	"D" Inlet
N1a	23	2.4	102.150	102.035	0.5	100	1:4	1:4	1:4	1:4	0.45	C-T Blend	None	N.A.	Riprap Basin
N1b	12.3	2.4	101.812	101.750	0.5	25	1:4	1:4	1:4	1:4	0.45	C-T Blend	None	N.A.	Channel
N2	36	2.4	102.750	102.570	0.5	100	1:4	1:4	1:4	1:4	0.45	C-T Blend	None	N.A.	Pipe
N3	36	2.4	103.350	103.170	0.5	100	1:4	1:4	1:4	1:4	0.45	C-T Blend	None	N.A.	Pipe
N4	36	2.4	103.850	103.670	0.5	100	1:4	1:4	1:4	1:4	0.45	C-T Blend	None	N.A.	Pipe
N5a	12.6	2.4	104.404	104.341	0.5	None	1:4	1:4	1:4	1:4	0.45	C-T Blend	None	N.A.	Channel
N5b	24	2.4	104.150	104.030	0.5	100	1:4	1:4	1:4	1:4	0.45	C-T Blend	None	N.A.	Pipe
S1	36	2.4	93.550	93.370	0.5	20, Each	1:4	1:4	1:4	1:4	0.45	C-T Blend	None	N.A.	Channel

All Dimensions Are In Millimeters (mm) Unless Otherwise Noted.

REGISTERED PROFESSIONAL ENGINEER 19156 OREGON JULY 15, 1997 BRUCE S. COUNCIL Expires Dec. 31, 2005

REGISTERED PROFESSIONAL ENGINEER 62,609 OREGON MAY 9, 2000 HENRY MINTON ALLEN Expires Dec. 31, 2005

OREGON DEPARTMENT OF TRANSPORTATION
GEO / HYDRO SECTION

US26: CORNELL RD. - OR217 (BEAVERTON) SEC.
SUNSET HIGHWAY
WASHINGTON COUNTY

Project Leader - Naveen Chandra
Designed By - Henry M. Allen
Drafted By - Martin G. Casillas

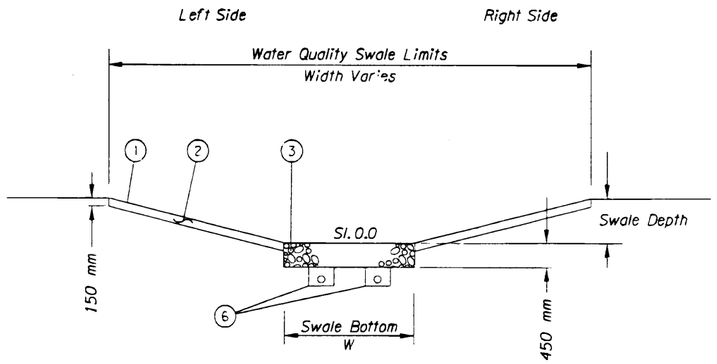
WATER QUALITY DETAILS

SHEET NO. GHJ-49

R O A D S I D E D E V E L O P M E N T

CEDAR MILL CREEK ENHANCEMENT AREA

12/02/03

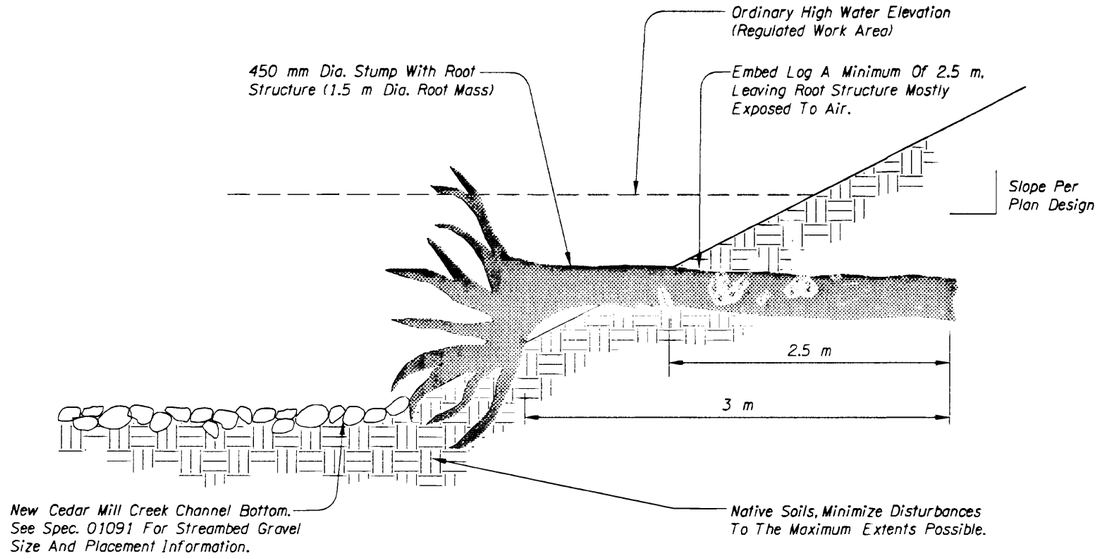


Min. Swale Length - 33 m
Min. (Max.) Longitudinal Swale Slope - .005 (0.5%)
Min. Swale Depth - 0.45 m

VEGETATED STORM WATER QUALITY SWALE

Detail Shown For Reference Only. Design By H. Allen (ODOT).

1. Provide And Install Jute Mat Per Specifications.
2. Provide And Place 150 mm Deep Topsoil Throughout Swale.
3. Swale Bottom Medium - Provide And Place 450 mm Deep Medium In Bottom Of Swale, Continuous Full Length Of Swale. Medium Composed Of Compost-Topsoil Blend Or Drain Rock With Compost-Topsoil Blend.
4. Not Used
5. Seed Swale Using Mix No. 4. See Specifications.
6. Under Drains, Where Recommended By The Engineer. Contact Henry Allen 503-731-8299.
7. For Details Not Shown, See Water-Quality Swale Details In GHJ Series Sheets.



STREAM BANK LOG WITH ROOT WAD

NOTE:
Recruit Log With Root Wad From Conifer Material Within Project Clearing Limits. See Specs.

The Log Must Be Anchored And/Or Ballasted To Maintain Design Placement. Details Of The Anchoring And/Or Ballast Will Be Provided By The Engineer At The Time Of Installation.

W&H PACIFIC
9755 SW Barnes Rd
Suite 300
Portland, Oregon
97225
(503)526-0455
(503)526-0775 Fax
whpacific.com

REGISTERED
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MICHAEL D. SMYTH
OREGON
4/4/94
LANDSCAPE ARCHITECT

OREGON DEPARTMENT OF TRANSPORTATION
ENVIRONMENTAL SECTION

US26: CORNELL RD. - OR217 (BEAVERTON) SEC.
SUNSET HIGHWAY
WASHINGTON COUNTY

Reviewed By - Mark A. Hadley
Designed By - Mike D. Smyth
Drafted By - Tammy J. Taggart

BIO-STABILIZATION DETAILS

SHEET NO. R28

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VIEW 2

VIEW 2