

STANDARD OPERATION MANUAL

For

Stormwater Ponds

Implemented: Month/Year

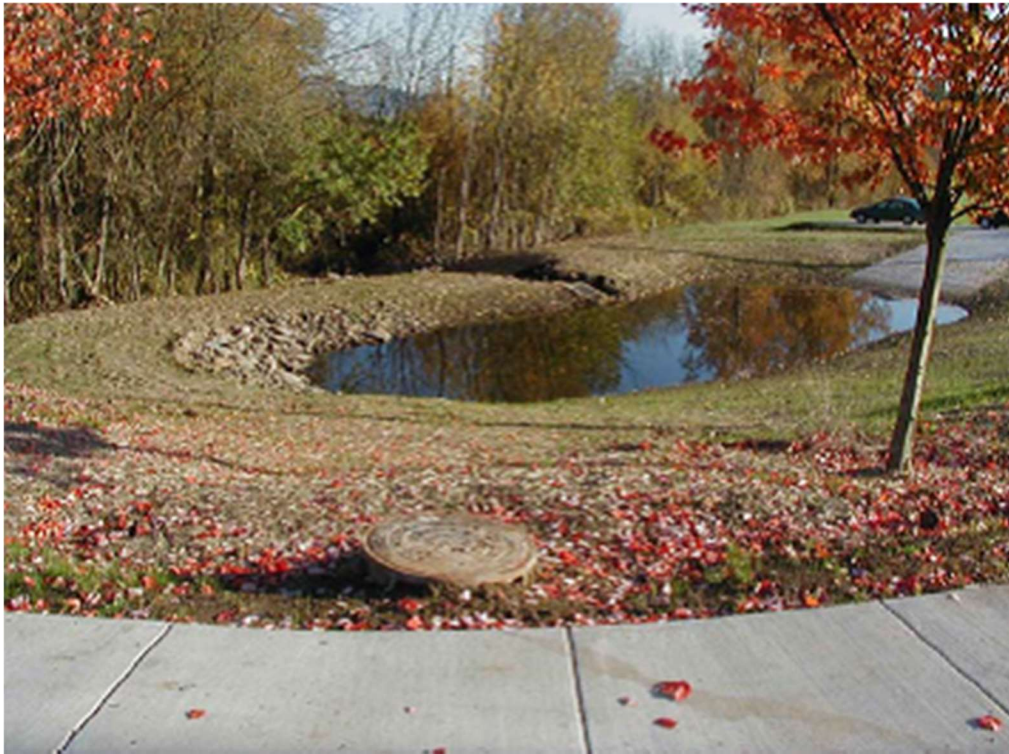


Figure 1: General footprint example of a detention pond

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1. Introduction and Purpose

The purpose of this manual is to:

- Define detention ponds
- Identify four types of ponds
- Describe the operation of detention ponds

2. Definitions

Drainage Facility Identification (DFI) – A unique number assigned to ODOT stormwater treatment and storage facilities. The DFI is used to link the stormwater facility to an O&M manual and asset management systems. The lead of ODOT's Geo-Environmental Hydraulic Engineering Program assigns DFI numbers.

Detention Pond – An above ground basin that detains the peak runoff flows and releases them at a slower rate. Detention ponds can be designed to be both “dry” and “wet” ponds. ODOT utilizes mostly “Dry” Ponds. Not all detention ponds are considered stand-alone water quality facilities and may require pre-treatment to meet permit standards.

“Dry” Pond – Dry detention ponds are detention ponds that are wet during storm events and then dry out or drain completely during periods of no precipitation.

“Wet” Pond – Wet detention ponds function the same as dry ponds with the exception, that a constant presence of water remains year round in a wet pond. The portion that remains wet would not be included with the storage volume calculation of the pond during storm events.

Water Quality Extended Detention Dry Pond – A detention pond that detains stormwater for a longer period of time to allow suspended solids and attached pollutants to settle out.

Water Quality Bioretention Pond – A detention pond that infiltrates stormwater runoff through a water quality mix to remove pollutants through a variety of physical, biological and chemical treatment processes.

Water Quality Pond/Biofiltration Swale Combo (Pond/Swale Combo) – A swale is designed into the bottom of the pond and functions as a biofiltration swale during low flows but has capacity to function as a detention pond during high flow conditions

Water Quality Infiltration Pond – Infiltration ponds are a form of detention pond in which infiltration of the stormwater into the ground is the primary outlet of the facility. These types of facilities may contain an auxiliary outlet to a drainage system such as a ditch or storm pipe system.

Pond Inlet – The upstream point/location where stormwater flows into the pond.

Sediment Basin/Forebay – A pretreatment sediment basin designed to slow the flow of stormwater before entering the primary treatment facility allowing coarse sediment and debris to settle out prior to entering the treatment/detention area. The sediment basin and pond area are usually separated by a shallow berm.

Pond Outlet – The pond point/location where treated stormwater flows out from the pond to an “outfall”. This structure is usually a flow control structure.

Flow Control Structure – Flow control structures are designed to limit the amount of flow out of the pond to pre-construction flow rates. Flow control structures can include flow control manholes and outlet control structures.

Outfall – The point/location where stormwater runoff exits the outlet pipe or channel and drains into a waterbody, ditch, or storm drain system

3. Overview

What is a Stormwater Pond?

The main function of a stormwater pond is to detain stormwater runoff. ODOT utilizes four main types of ponds to provide storage and/or treatment for stormwater runoff. All ponds provide storage for stormwater runoff during wet weather and can function as a detention pond. The four main types of ponds are detention ponds, bioretention ponds, extended detention dry ponds, and pond/swale combos. Of the four main pond types only the basic detention pond can be designed as either a “wet” or “dry” pond. The main reason for the use of a “wet” pond would be for retention of a portion of the runoff for aesthetic purposes.

There are other, more uncommon types of ponds such as retention ponds, which have no outlet, infiltration ponds, where the primary pond outlet is infiltration into the natural subsurface soils. All pond types may include Hazmat control features in the event of an oil or chemical spill to prevent contaminants from entering the downstream drainage system.

The typical ground cover is usually grass for western Oregon ponds. The ground cover can be grass, river rock, and/or plantings for central and eastern Oregon installations. The Oregon Climate Zone map (Appendix B, Figure B-10) would be used to determine specific vegetation types to use at a facility depending on the geographic location.

What is a Detention Pond?

The basic detention pond is not considered a water quality facility; the primary function is detaining the increased stormwater runoff to a rate which closely matches the pre-development flow rates. Basic detention ponds require an additional water quality

facility to meet full treatment needs. This may include a pre-treatment or a proprietary water quality manhole or possibly a water quality swale. Detention ponds are typically designed to empty within a 6-12 hour period.

What is a WQ Extended Detention Dry Pond?

The main function of a WQ extended detention dry pond is to provide water quality treatment. Stormwater runoff is detained for longer periods of time to allow suspended particles and attached pollutants to settle. Stormwater infiltrating into the ground is incidental and is not a primary treatment function. The pond's outflow is more restricted than other ponds to ensure adequate detention and treatment time, usually 36-48 hours. This is achieved with an outlet control structure with smaller controls to release runoff at slower/smaller rates.

What is a WQ Bioretention Pond?

The main function of a WQ bioretention pond is to provide water quality treatment by way of stormwater runoff infiltration through a water quality mix to remove pollutants through a variety of physical, biological and chemical treatment processes.

What is a Pond/Swale Combo?

The main functions of a pond/swale combo are act as a swale during low flows and have a surrounding pond structure to provide detention/treatment during larger storm events.

How to identify a pond?

ODOT's Geo-Environmental Section maintains a stormwater facility inventory. Facilities locations are listed by highway and milepost. Constructed ponds should be field marked with metal paddles (see Figure 2). The paddle is white with a blue stripe and the drainage facility identification (DFI) number.

Reference the **standard operational plan for ponds** provided in Appendix A for assistance identifying pond components and the **field marker figures** in Appendix B for additional field marking details.



Figure 2: Type S2 Stormwater facility marker

TransGIS may also be used to locate ponds. TransGIS is a web-based, interactive mapping tool. The facility location (highway, mile point, district, region), type of facility, DFI number, and electronic copy of O&M manuals can be viewed from TransGIS. Anyone with access to the internet can use TransGIS.

How to locate water quality facilities using TransGIS

TransGIS may be used to locate water quality facilities. TransGIS is a web-based, interactive mapping service available to all internet users. The facility location (highway, milepost, district, region), type of facility, DFI number, and an electronic version of the O&M manual can be viewed using TransGIS.

Link to TransGIS: <https://gis.odot.state.or.us/transgis/>

How to view O&M Manuals in TransGIS

- Select “Drainage” from the Layer Catalog menu on the left
- Select “Stormwater Management Facilities”
- Click “Apply” on the bottom left of the screen
- Select the “Identify Features”  button on the toolbar above the map
- Click on any facility  button on the map to identify features
- A dialog box appears with facility information and links to the O&M manual and maintenance tables

4. How Detention Ponds Operate

Detention pond's primary function is to detain stormwater runoff and release flow at a slower rate. They provide storage and allow for suspended particulates and attached pollutants to settle out within a 6-12 hour period.

Stormwater runoff is collected from paved areas using catch basins, roadside ditches, or pipes and then routed to the pond inlet.

Pre-treatment structures:

Pre-treatment structures have been recommended in all ODOT pond designs since 2009. Forebays are a common type of pre-treatment structure located at the pond's inlet while pre-treatment manholes may be placed separately upstream of the inlet. These facilities are designed to slow the flow of stormwater before entering the primary treatment facility to allow coarse sediment and debris to settle out prior to entering the treatment/detention area. In forebay design, a shallow berm is usually installed to separate the forebay from the treatment area of the pond (See Figure 3).

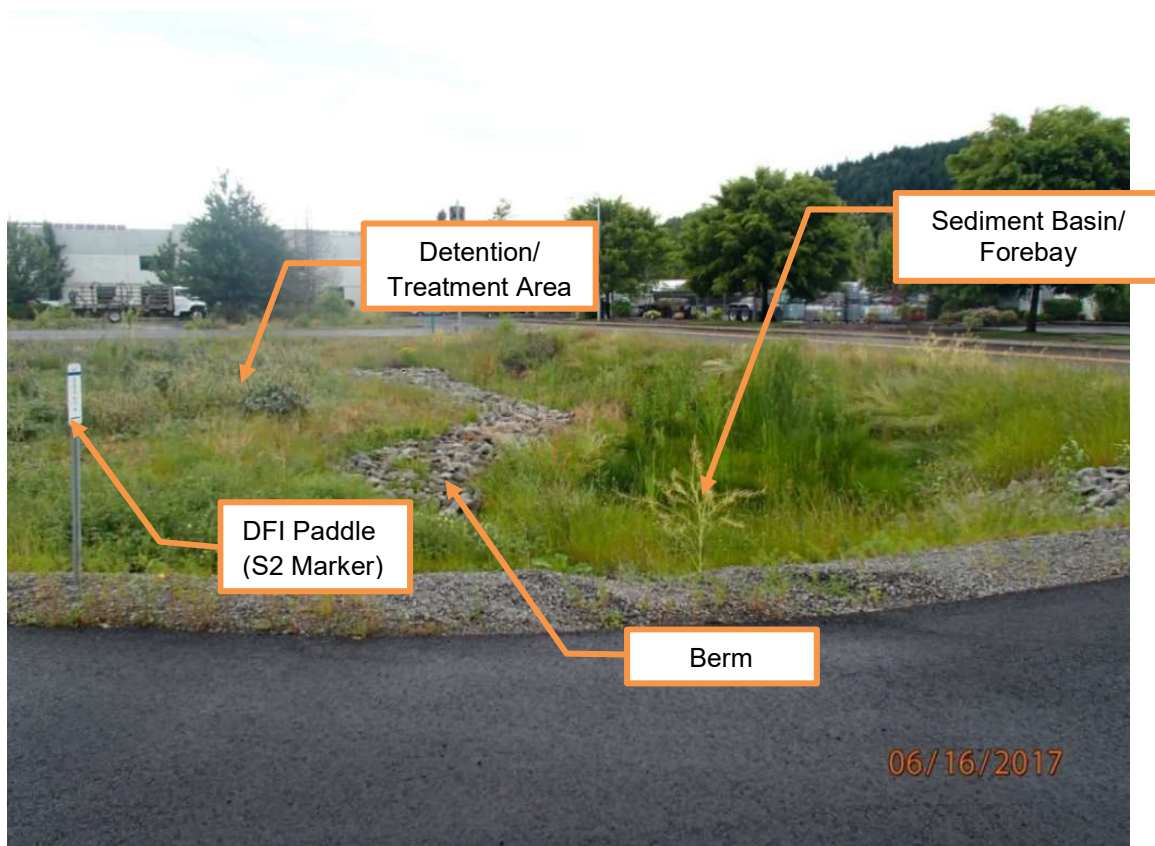


Figure 3: Forebay and berm example

Pollution control manholes are also common pre-treatment structures. These manholes allow for coarse sediment, oils, and debris to be captured in the sump rather than draining into the pond. Pre-treatment structures extend the service life and efficiency of the pond. Not every pond will have a pre-treatment structure.

Flow control structures:

Flow control structures are generally located at the downstream or outlet end of all types of ponds. The flow control structure should have a built in high flow bypass component (See Figure 4, Figure 5, and Figure 6). Flow control structures usually include a manhole that is equipped with a primary control, a secondary control, and an auxiliary or high flow bypass. These controls are usually built into a vertical pipe system within the manhole. An outlet control structure is a form of flow control structure that is constructed within the pond. An outlet control structure usually consists of two catch basin or inlets that are equipped with primary and secondary flow control devices.

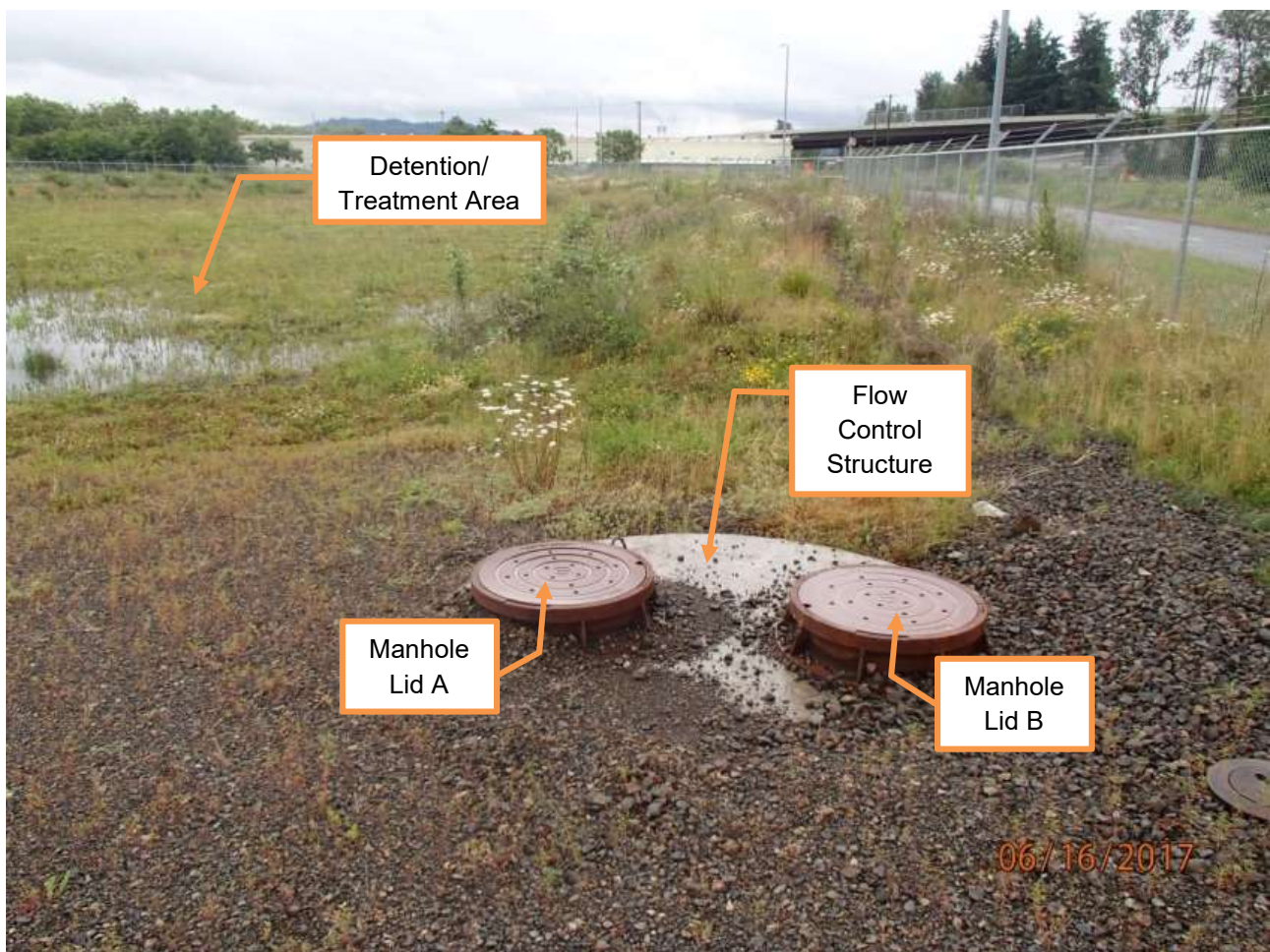


Figure 4: Flow control structure

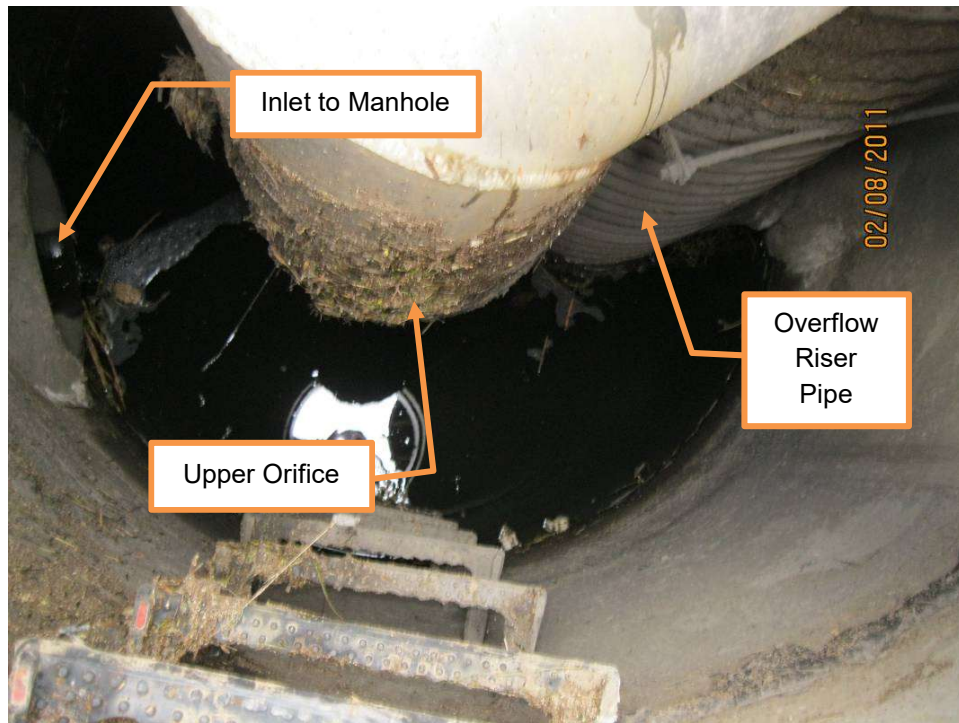


Figure 5: Inside view of flow control manhole lid A

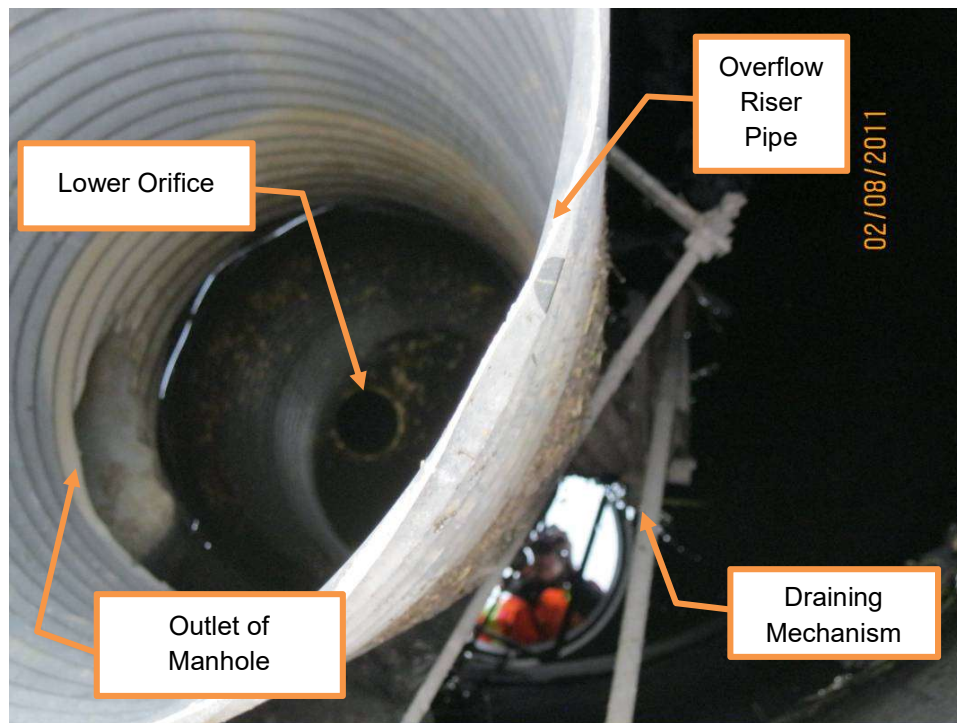


Figure 6: Inside view of flow control manhole lid B

How does a Water Quality Extended detention dry pond operate?

Extended detention dry ponds operate similar to detention ponds. The difference is the flow control structure is designed to release lower flow rates to create a longer period of detention than a standard pond.

The flow control structure is designed to release flow rates based on storage time whereas in other pond designs, the flow control structure is designed to reduce peak flow rates (See Figure 7).

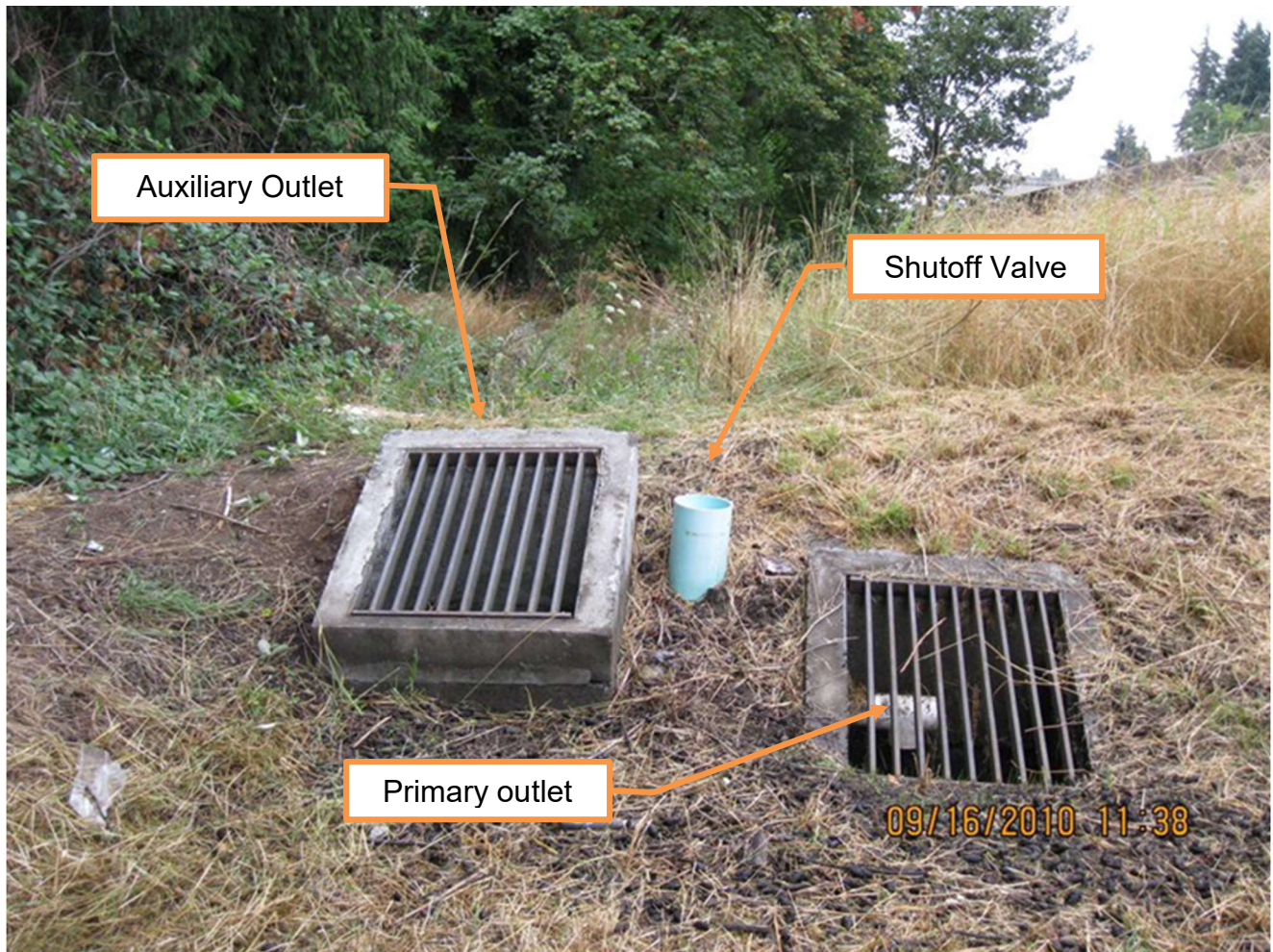


Figure 7: Outlet control structure

The outlet control structure has a smaller primary outlet for low flows and an auxiliary outlet for higher flows. The primary outlet contains a small orifice that meters the rate at which water leaves the pond. This detains the water for an extended amount of time (See Figure 8).

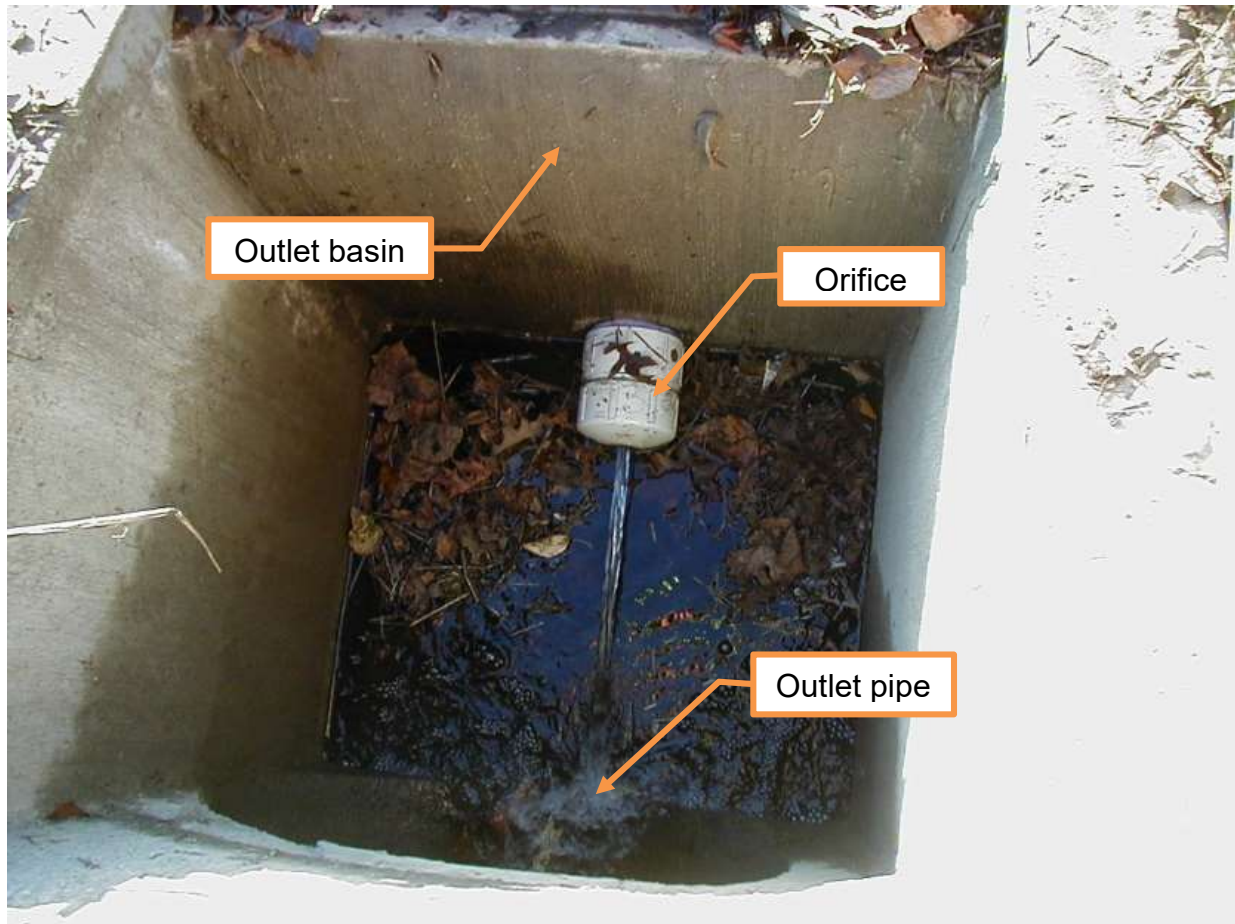


Figure 8: Inside view of an extended detention dry pond's outlet control structure

How does a Water Quality Bioretention pond operate?

Bioretention ponds operate similar to a detention pond. They both have a flow control structure at the outlet. The bioretention pond's primary function is to provide water quality treatment by way of stormwater runoff infiltration through a blanket layer of water quality mix at the pond's bottom. Pollutants are removed through a variety of treatments that may include: physical, biological and chemical processes (See Figure 9).

The stormwater runoff is treated as it flows down through the water quality mix and then either infiltrates into the underlying soils or flows out of the pond using a perforated underlying pipe system placed between the native soil and the water quality mix.



Figure 9: Water quality bioretention pond example

How does a Water Quality pond/swale combo operate?

The biofiltration swale portion of this combo is designed as if it was a separate facility and consists of a grassy-lined design element with a flat trapezoidal cross section and gradual slope. Treatment is provided through sedimentation and filtration processes. If the soils are amended with water quality mix, additional treatment is obtained through infiltration.

During high flows, the treatment flow through the swale component of the combo is exceeded and the pond/swale combo facility provides detention. Detention is required during high flows to mitigate the addition of impervious area, reduce peak flood levels downstream and optimize sedimentation time during high flow treatment (See Figure

10). The facility is designed to store and attenuate stormwater by gradually releasing treated stormwater over time. This is done by way of a flow control structure.

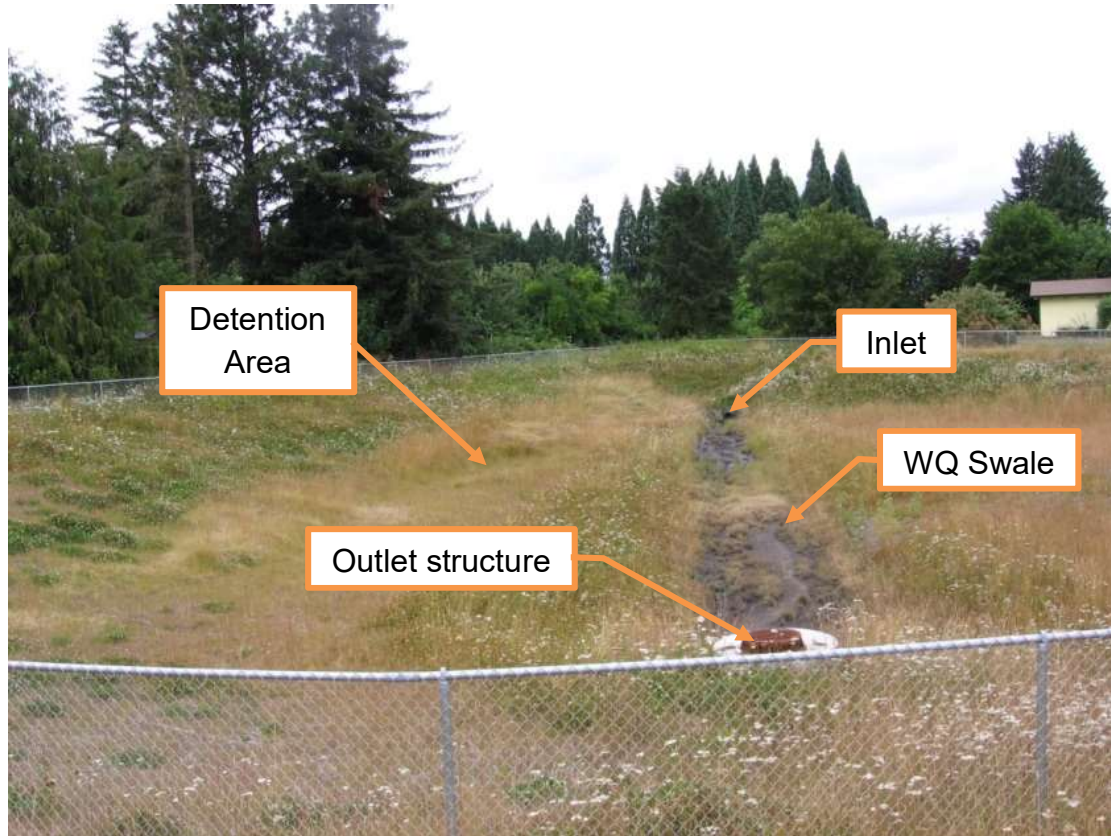


Figure 10: Water quality pond/swale combo example

All four types of ponds may be equipped with hazardous material (hazmat) containment features. These three features are explained below.

Hazardous material (Hazmat) containment features:

Hazmat containment features in a pond can be used to store or isolate a volume of liquid in the event of a hazardous material spill. Ponds with this feature usually have a hazmat control valve and or diversion box (See Figure 11). The hazmat control valve is typically located at the outlet in order to contain the hazardous material within the facility. If the facility has a diversion box, there may be a hazmat control valve at the inlet to convey the hazmat to the diversion box. In the event of a hazmat spill, the pond's respective hazmat control valve(s) should be closed immediately to prevent release or contamination of the contained liquid. The hazmat control valve(s) are only reopened after the hazmat spill has been properly cleaned.

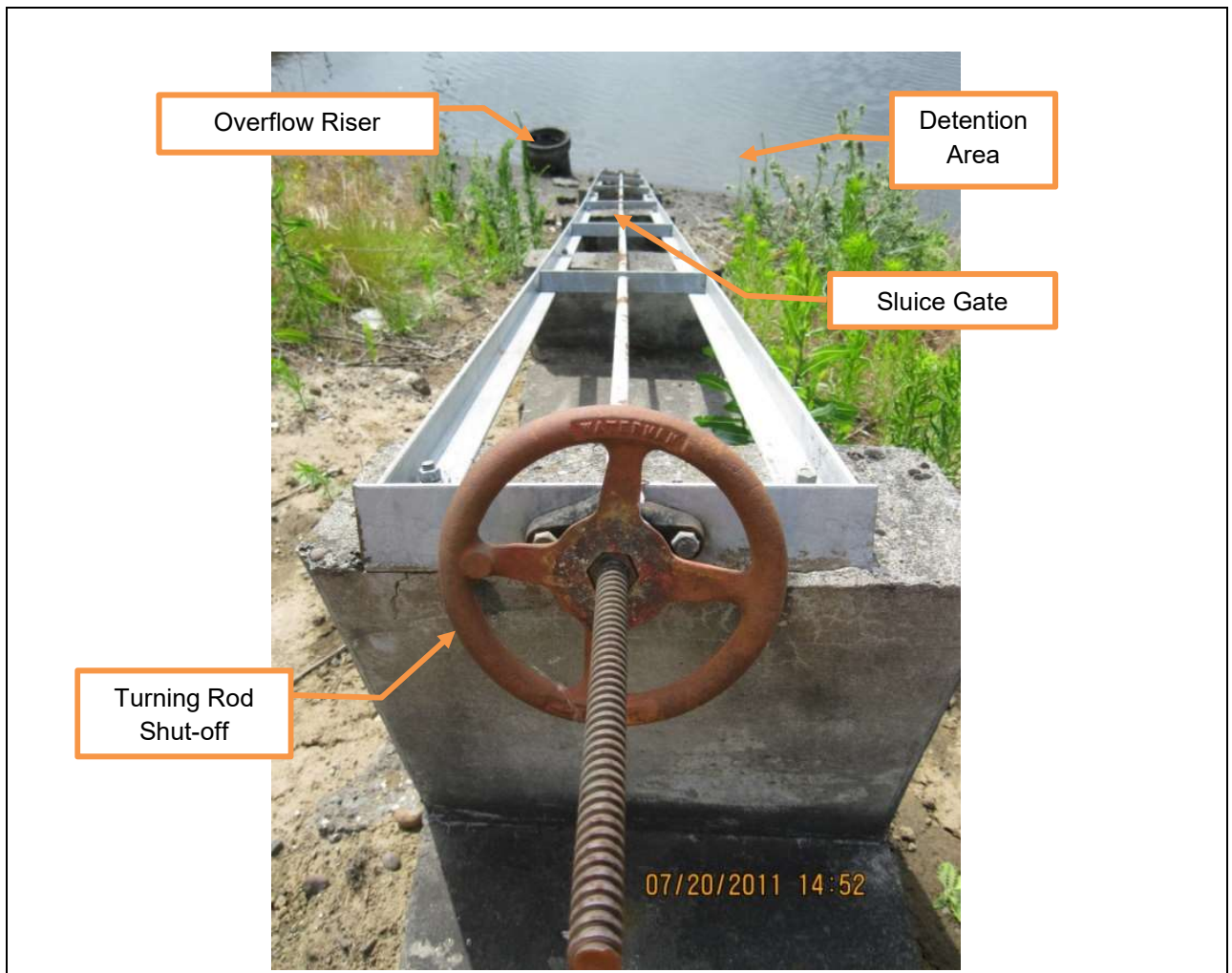


Figure 11: Hazmat control valve

How does a Water Quality Infiltration pond operate?

The WQ infiltration ponds are designed the same way as any other detention facility with the exception of the outlet structure. An infiltration pond is usually designed without an outlet structure but utilizes natural infiltration into the ground as the means of getting rid of the stormwater runoff. These facilities are more of a retention system as the outlet flow is limited to the permeability of the natural soil.

5. Facility Components

The following summary outlines the common pond facility components that are used to help with:

- Removal of sediments, metals, and other pollutants from stormwater,
- Conveyance, and

- Reduce flow velocities to minimize erosion.

An “ID” number is assigned to each facility component and is used to identify and specify these components

The pond components are organized by the following sub-categories:

- (1) Upstream Manholes/Structures
- (2) Pond Inlet
- (3) Ground Cover
- (4) Underground Components
- (5) Flow Spreader
- (6) Pond Outlet
- (7) Outfall Type
- (8) Outfall Components.

All components are defined below along with an example/figure and/or noted on the operational plans provided in Appendix A.

Table 1: Manholes/Structures

Facility Component	ID #	Description
Upstream Manhole/Structures		
Pre-treatment Manholes	P1	A manhole with a sump is placed upstream of the swale. The purpose of the manhole sump is to allow for coarse sediment and debris to be captured in the sump rather than draining into the pond or swale. ODOT's primarily uses a pollution control manhole for this purpose.
Water Quality Manholes	P2	Several types of water quality manholes that meet the requirements for standalone water quality structures. These ODOT approved proprietary facilities are: Use these ID#'s for water quality manholes: • (P2-A) "Continuous Deflective Separation" (CDS) by CONTECH • (P2-B) "Stormceptor " by Rinker Materials • (P2-C) "Downstream Defender" Hydro International
Flow Splitter Manhole (Weir/Orifice Type)	P3	A manhole installed before the pond inlet with built in components to route water in multiple directions. The splitter routes low/small flows into a water quality facility but allows High flows to enter the pond and control the high flow outlet rates. A flow splitter is only used when a pond is designed to be an "offline" facility
Standard Manhole	P4	A concrete structure provided to access a storm drainage system for inspection and maintenance. A standard manhole is circular, a minimum of 4 feet in diameter, and a cast iron lid/cover. Typically used when two or more storm drain pipes come together, change in pipe sizes, and changes to horizontal and/or vertical alignments
Sediment Basin/Forebay	P5	A sediment basin, also known as a forebay, is a pretreatment component that slows the flow of stormwater enough to allow coarse sediment and debris to settle out before entering the primary treatment area of the pond. They can be adjacent to the pond or placed further upstream The beginning of the facility's maintenance area is defined by where the untreated storm water enters the basin. A sediment basin is usually separated from the primary treatment area by a riprap covered berm with a single channel level with the bottom of the treatment area.
Forebay Dewatering Riser Pipe	P6	A perforated pipe that can be opened via an upstream valve to drain the sediment basin for maintenance

Table 2: Facility Inlet

Facility Component	ID #	Description
Pond Inlet		
Pavement Sheet Flow	P7	Pavement runoff can drain directly into a pond from the adjacent and nearby roadside pavement. There is usually no storm drain piping system that collects and drains runoff into the pond.
Inlet Pipe(s)	P8	One or more storm drain pipes that serve multiple inlets are used to drain pavement runoff into the pond. The inlet pipe will generally drain into the forebay or swale, if present.
Open Channel Inlet	P9	It is the component that transports stormwater runoff from a drainage ditch or other facility into the pond.
Riprap Pad (Energy Dissipater)	P10	Riprap rock placed at the end of a storm drain pipe or along the bottom of a drainage channel to reduce water flow velocities and minimize soil erosion. The riprap pad shape is usually square or rectangular. The length and depth of the riprap pad depends on ground slope, water flow velocity, and size of rock used to create the rock pad

Table 3: Ground Cover

Facility Component	ID #	Description
Ground Cover		
Grass bottom	P11	Grass is a critical pond component. The grass blades slow stormwater flow and facilitate the filtration of suspended solids. Also, continuous grass coverage minimizes erosion of the underlying soil. Grass is used in all western Oregon installations or climate zones 1, 2, 3, and 4. Grass ponds may sometimes be used in eastern Oregon. Examples of this component are provided in Operational Plan B, C, and D.
Grass side slopes	P12	See Grass Bottom (P11) above An example of this component is provided in Operational Plan B, C, and D.
Granular drain rock	P13	Granular drain rock may be used around perforated pipes to facilitate stormwater entering the underdrain. Grass is a critical pond component but there are climate zones in Oregon with little rainfall to support grass growth. Therefore, in the dry climate zones 5, 6, 7, 8, and 9. Granular drain rock can be used along the pond bottom and side slopes An example of this component is provided in Operational Plan A.
Plantings	P14	Plantings are sometimes used along the pond bottom and side slopes in ponds installed in the dry climate zones 5, 6, 7, 8, and 9. Plantings may sometimes be used in western Oregon

Table 4: Underground Components

Facility Component	ID #	Description
Underground Components		
Geotextile Fabric	P15	Woven or non-woven fabric. It is wrapped around the water quality mix to keep it in place It may also be wrapped around perforated pipe to prevent sediment accumulation in the pipe.
Impermeable Liner	P16	Plastic liner that prevents water from infiltrating into the ground below the pond. Used mainly in areas where groundwater is protected, contaminated soils may exist, or a high probability of hazardous spills may occur.
Water Quality Mix	P17	At least 18-inches deep of fine graded soil blended with compost. Pollutants are removed from stormwater runoff infiltrating through the water quality mix. Blend the medium compost and soil so that the mixture is composed of 20-25% medium compost material and 75-80% soil material
Perforated Pipe	P18	A perforated pipe has small holes along the pipe that allows groundwater to enter the pipe and drains it away from the area below the pond Some ponds have networks of perforated pipes.
Porous Pavers (access grid)	P19	Either a concrete ribbon or porous pavers can be used to indicate the bottom of the pond. Porous pavers are an open cell grid system made of durable plastic or concrete. They prevent soil erosion and can support wheel loads to prevent sinking of maintenance equipment.

Table 5: Flow Spreader

Facility Component	ID #	Description
Flow Spreader		
Anchored board	P20	Used only in pond/swale combos. A component used on the bottom of the swale to increase treatment efficiency by reducing erosion and channeling. An anchored board is typically used along the swale to help keep the water evenly spread as it drains along and through the swale
Other	P21	Other flow spreader components could be used as long as it is coordinated between the District, Region, and Geo-Environmental.

Table 6: Facility Outlet/Flow Control

Facility Component	ID #	Description
Pond Outlet		
Catch Basin with Grate	P22	Stormwater runoff from a pond will drain into a catch basin with grate installed at the outlet. The catch basin is connected to an outlet pipe that will convey the water to a flow control structure.
Storm Drain Outlet Pipe	P23	It is the component that transports stormwater runoff from the pond to an outfall. An outlet pipe is used most of the time but an open channel outlet can also be used to transport runoff from the pond to an outfall. An outlet pipe may also be designed as a bypass pipe to transport high flows around a pond and directly to the outfall.
Outlet/Flow Control Structure	P24	The flow control structure is a type of manhole that controls flow out of any pond. This manhole has at least one orifice in the main riser pipe to allow drainage, but may have an additional orifice to drain high flows. The riser pipe is open at the top and acts as an overflow bypass The outlet control structure controls the volume of outflow for extended detention dry ponds. Typically consists of a manhole, one primary type D catch basin, a flow control device (i.e. orifice or weir), and a high flow bypass (auxiliary outlet catch basin). Outlet Control Structure can be identified by a small orifice The flow control manhole typically contains a drain that can be used to lower water in the manhole for maintenance, and is operated by a control rod.
Auxiliary Outlet	P25	A secondary outlet (i.e. catch basin, riprap spillway, etc.) that catches or directs high flows past the outlet if stormwater exceeds a facility's capacity. Also known as a high flow bypass.
Hazmat Control Valve	P26	Typically a valve or sluice gate built into the outlet structure or flow control manhole that can be shut in the event of a hazardous spill. This keeps the hazardous materials within the facility.

Table 7: Outfall Type

Facility Component	ID #	Description
Outfall Type		
Waterbody	P27	Stormwater draining from a pond can drain directly into a waterbody. The waterbody can be a creek, lake or ocean (See Error! Reference source not found. in Appx. B).
Ditch	P28	Stormwater draining from a pond can drain directly into a nearby ditch. The nearby ditch could be an existing ODOT ditch or an adjacent property ditch as long as ODOT's runoff has always drained into the neighboring ditch.
Storm Drain System	P29	Stormwater draining from a pond can drain directly into an ODOT storm drain system and in some cases into a local agency storm drain system.

Table 8: Outfall Components

Facility Component	ID #	Description
Outfall Components		
Riprap Pad	P30	Riprap rock placed at the end of a storm drain pipe or along the bottom of a drainage channel to reduce water flow velocities and minimize soil erosion. The riprap pad shape is usually square or rectangular. The length and depth of the riprap pad depends on ground slope, water flow velocity, and size of rock used to create the rock pad.
Riprap Bank Protection	P31	The storm drain outlet pipe or open channel outlet would end and outfall onto the side bank of a creek or stream. Riprap rock is placed all around the pipe end or channel end to prevent erosion.

6. Operational Plan

A standard operational plan for each of the four types of ponds is provided in Appendix A. These are the most common installations.

1. Operational Plan A: Illustrates an online* Detention Pond
2. Operational Plan B: Illustrates an offline* Water Quality Bioretention Pond
3. Operational Plan C: Illustrates an online* Water Quality Extended Detention Dry Pond
4. Operational Plan D: Illustrates an online* Detention Pond/Water Quality Biofiltration Swale Combo

The purpose of an operational plan is to illustrate and provide the following general information:

- Typical footprint configuration (access road, berm, sediment basin, side slopes, etc.)
- standard pond components used to treat stormwater, minimize erosion, or convey stormwater
- general field marking types and where they are placed, and
- how stormwater drains into, along, and out of a swale

Notes are included on each sheet to help explain how the pond operates.

*All ponds can be built either online or offline. To save space, each pond was only shown in this manual with one configuration.

A Appendix A – Standard Operational Plans

This appendix contains a standard operational plan for each of the four types of ponds defined in Sections 2 and Section 3 of this manual. The operational plans in this appendix will also contain many of the identified components listed in Section 4.

Figure A-1: Operational Plan A.....	A-3
Figure A-2: Operational Plan B.....	A-5
Figure A-3: Operational Plan C.....	A-7
Figure A-4: Operational Plan D.....	A-9

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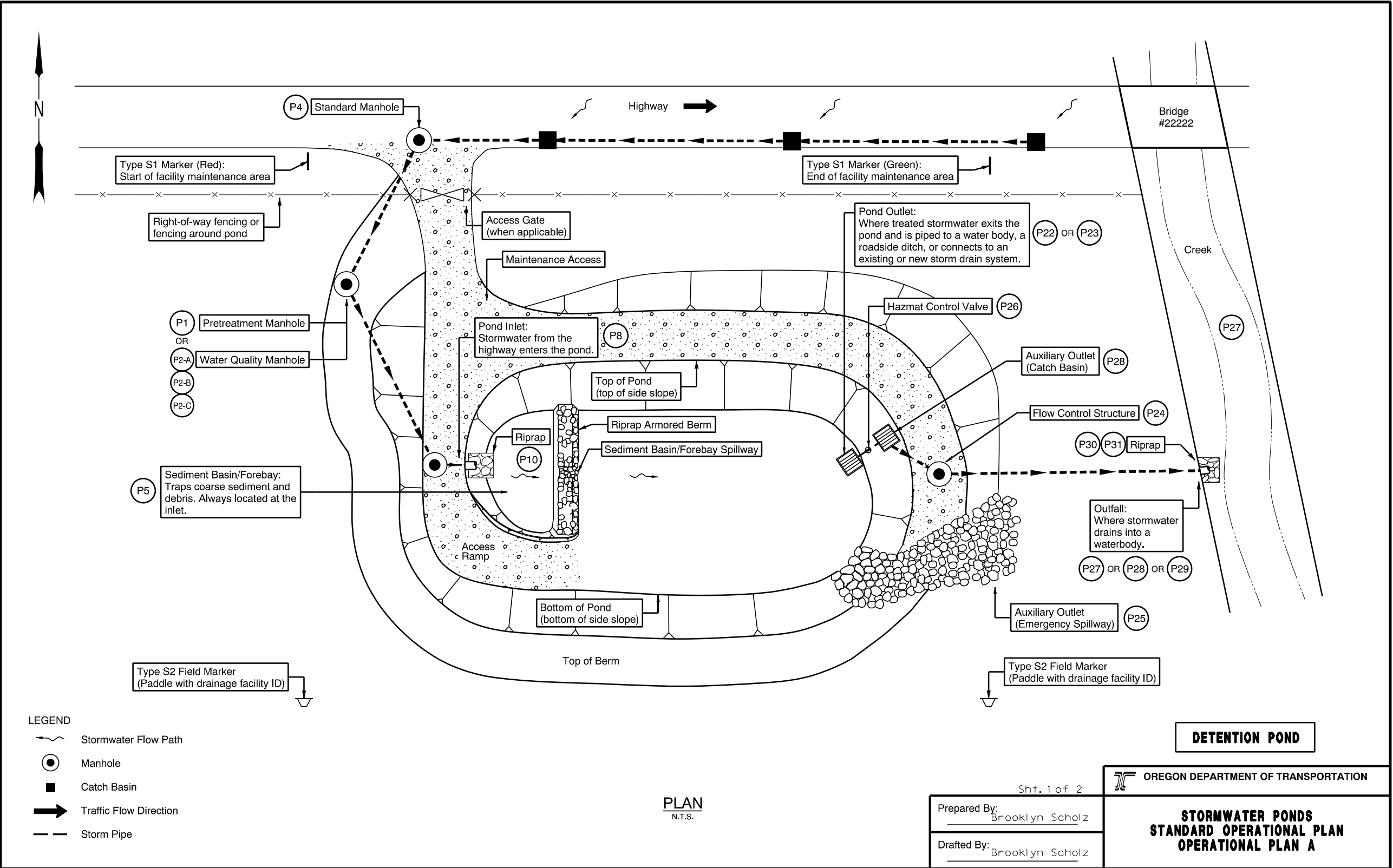
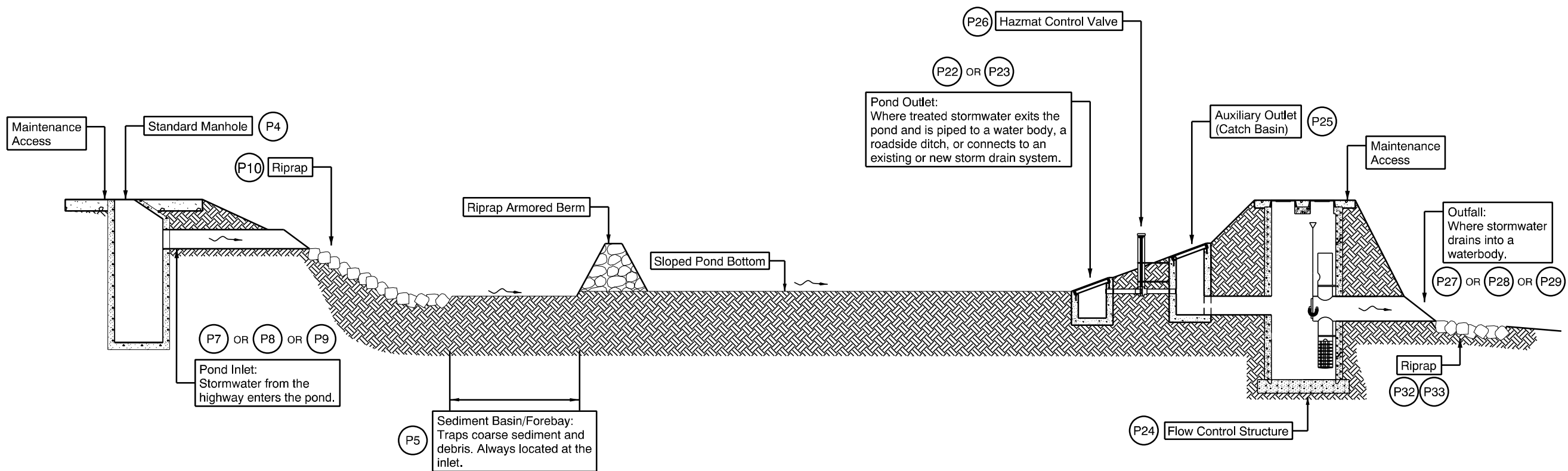


Figure A-1: Operational Plan A



PROFILE
N.T.S.

DETENTION POND

Sht. 2 of 2

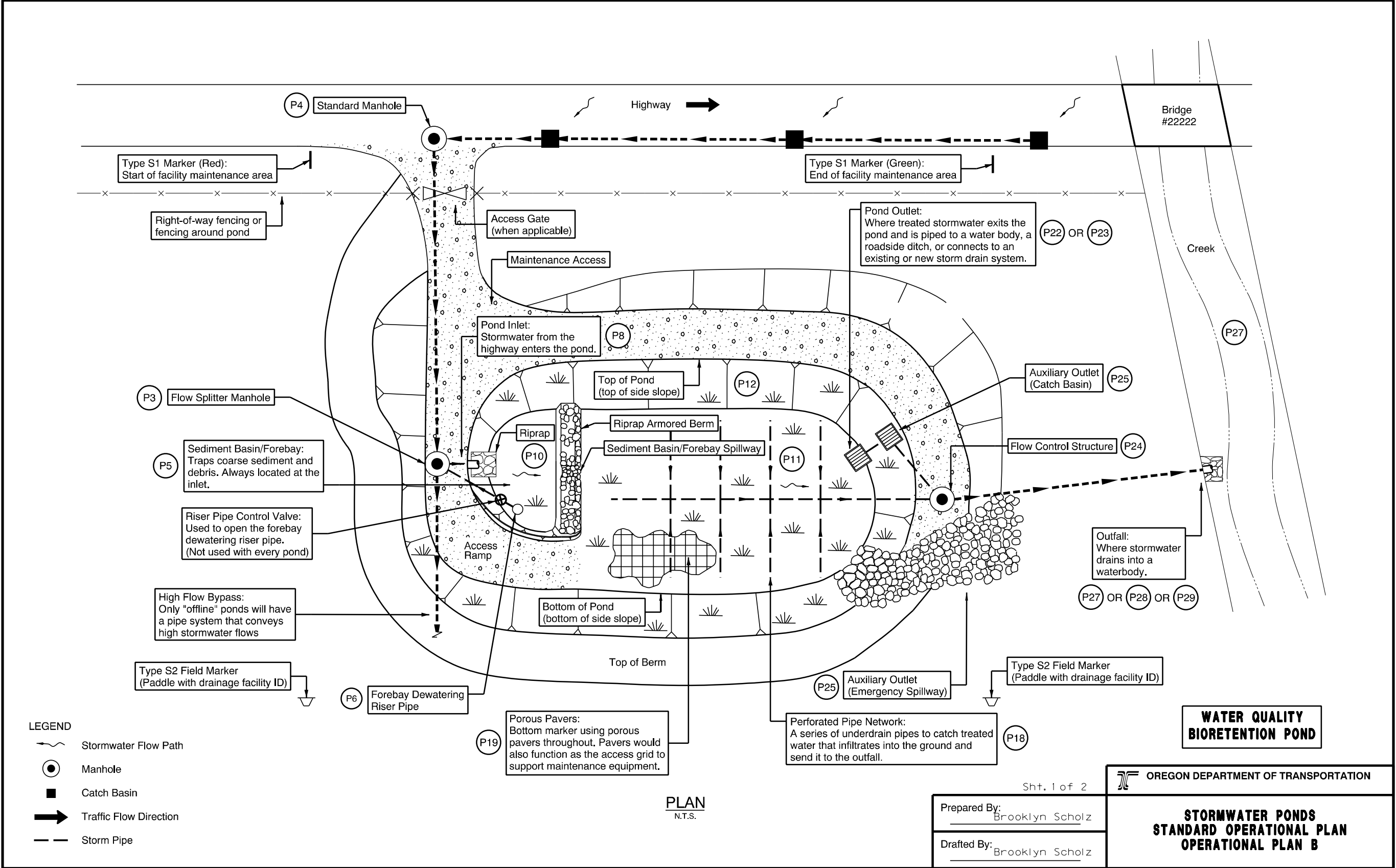
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Prepared By: Brooklyn Scholz

Drafted By: Brooklyn Scholz

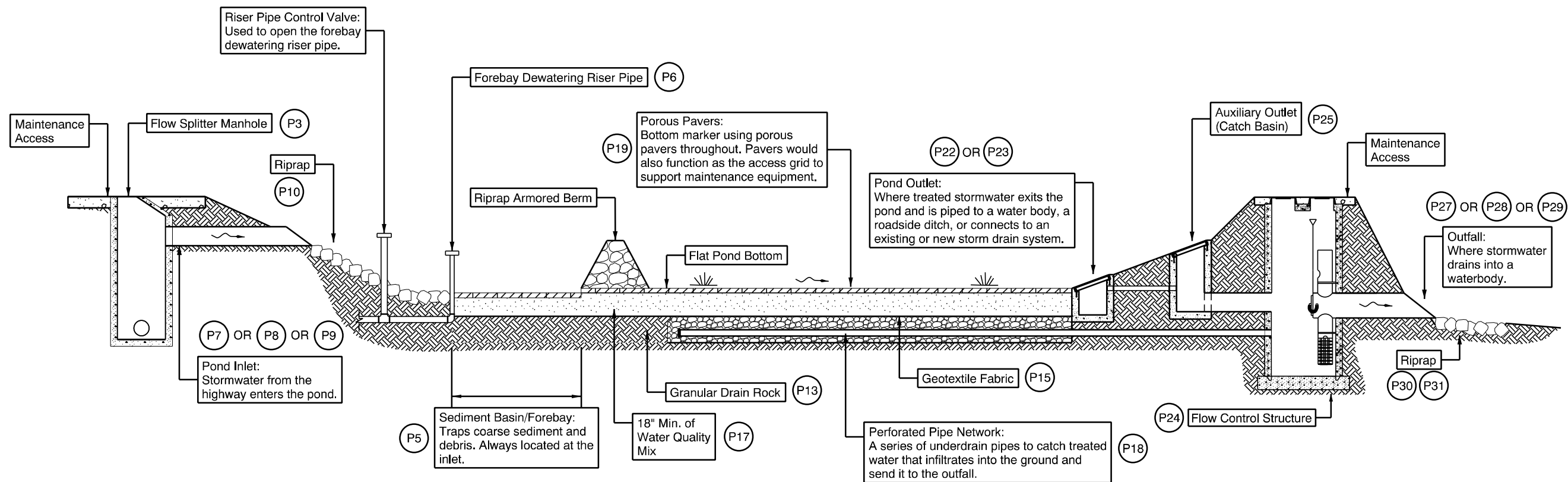
**STORMWATER PONDS
STANDARD OPERATIONAL PLAN
OPERATIONAL PLAN A**

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Figure A-2: Operational Plan B



PROFILE
N.T.S.

**WATER QUALITY
BIORETENTION POND**

Sht. 2 of 2

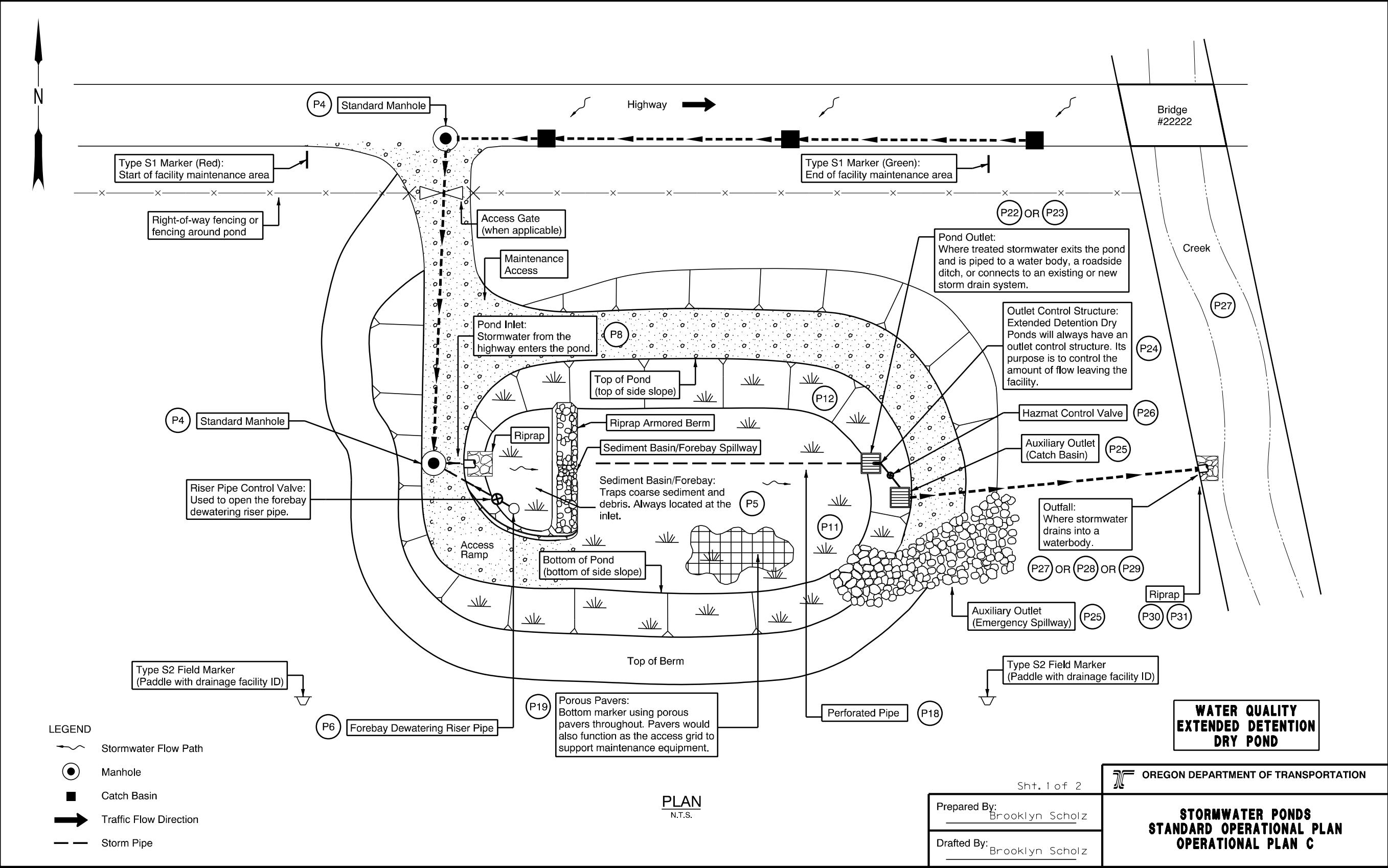
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Prepared By: Brooklyn Scholz

Drafted By: Brooklyn Scholz

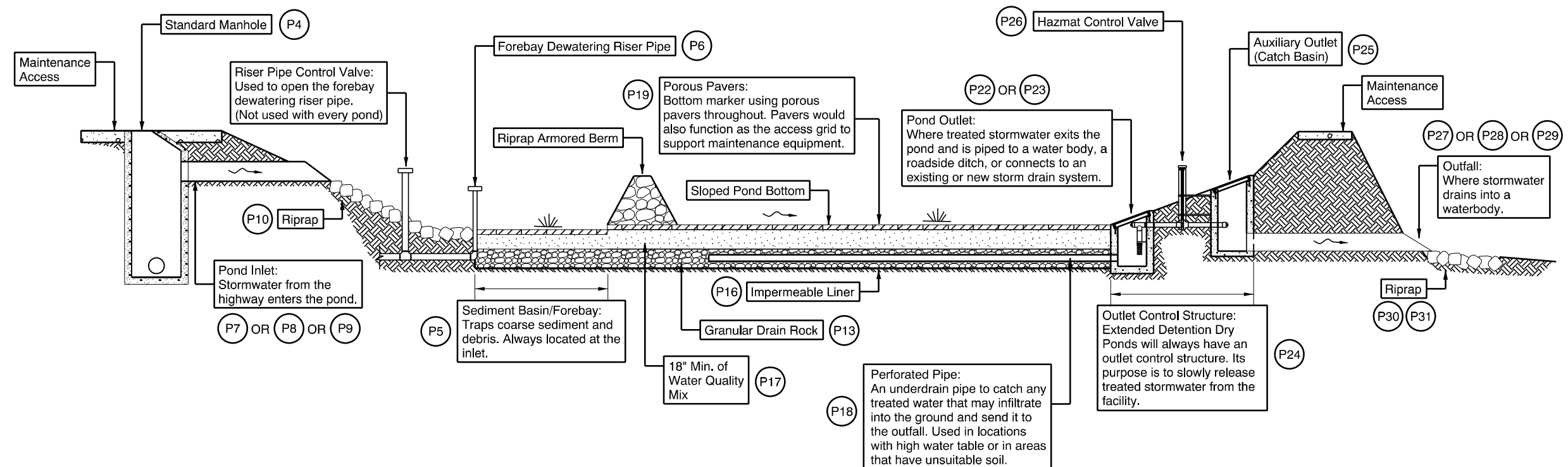
**STORMWATER PONDS
STANDARD OPERATIONAL PLAN
OPERATIONAL PLAN B**

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Figure A-3: Operational Plan C



PROFILE
N.T.S.

**WATER QUALITY
EXTENDED DETENTION
DRY POND**

Sht. 2 of 2

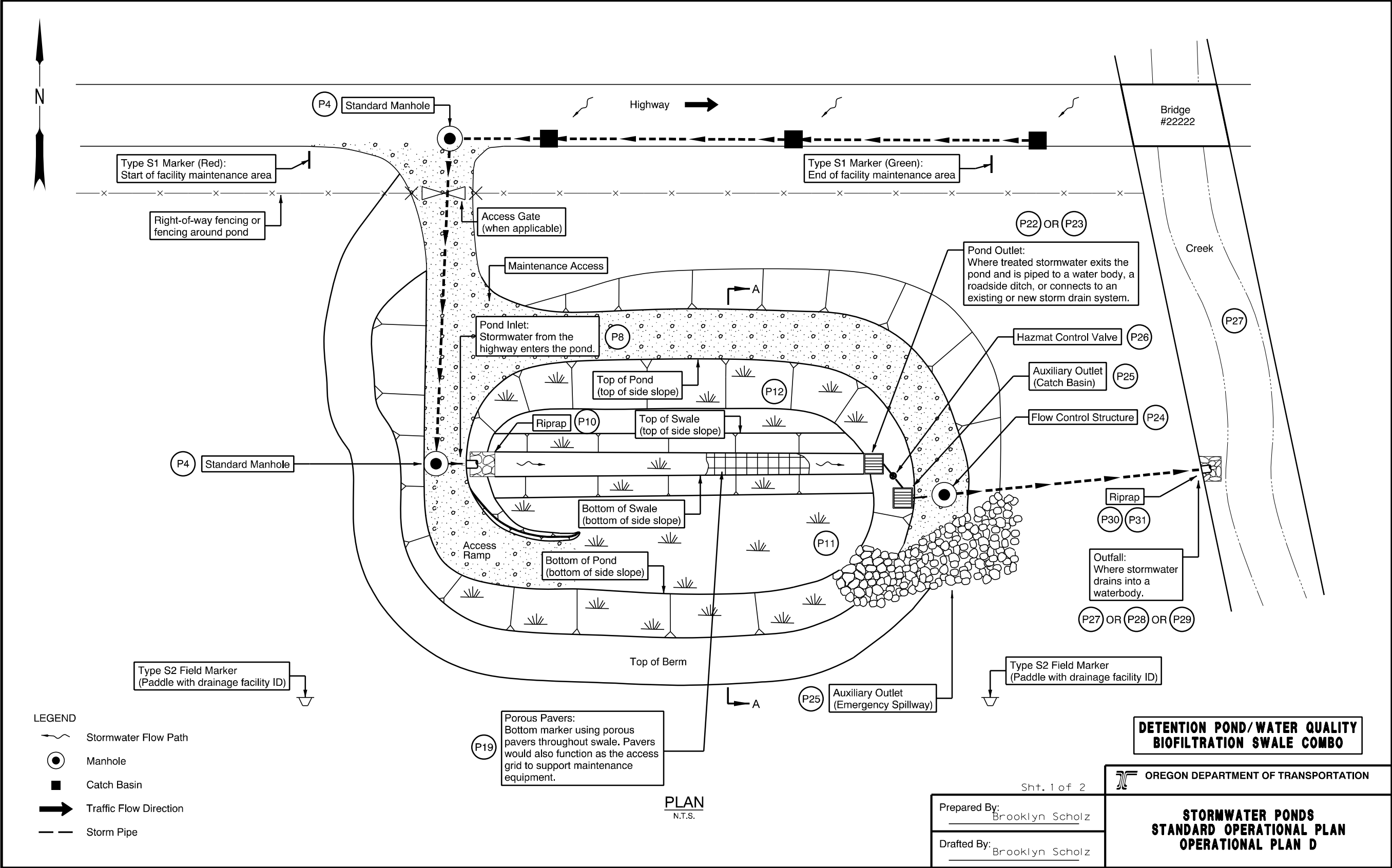
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Brooklyn Scholz

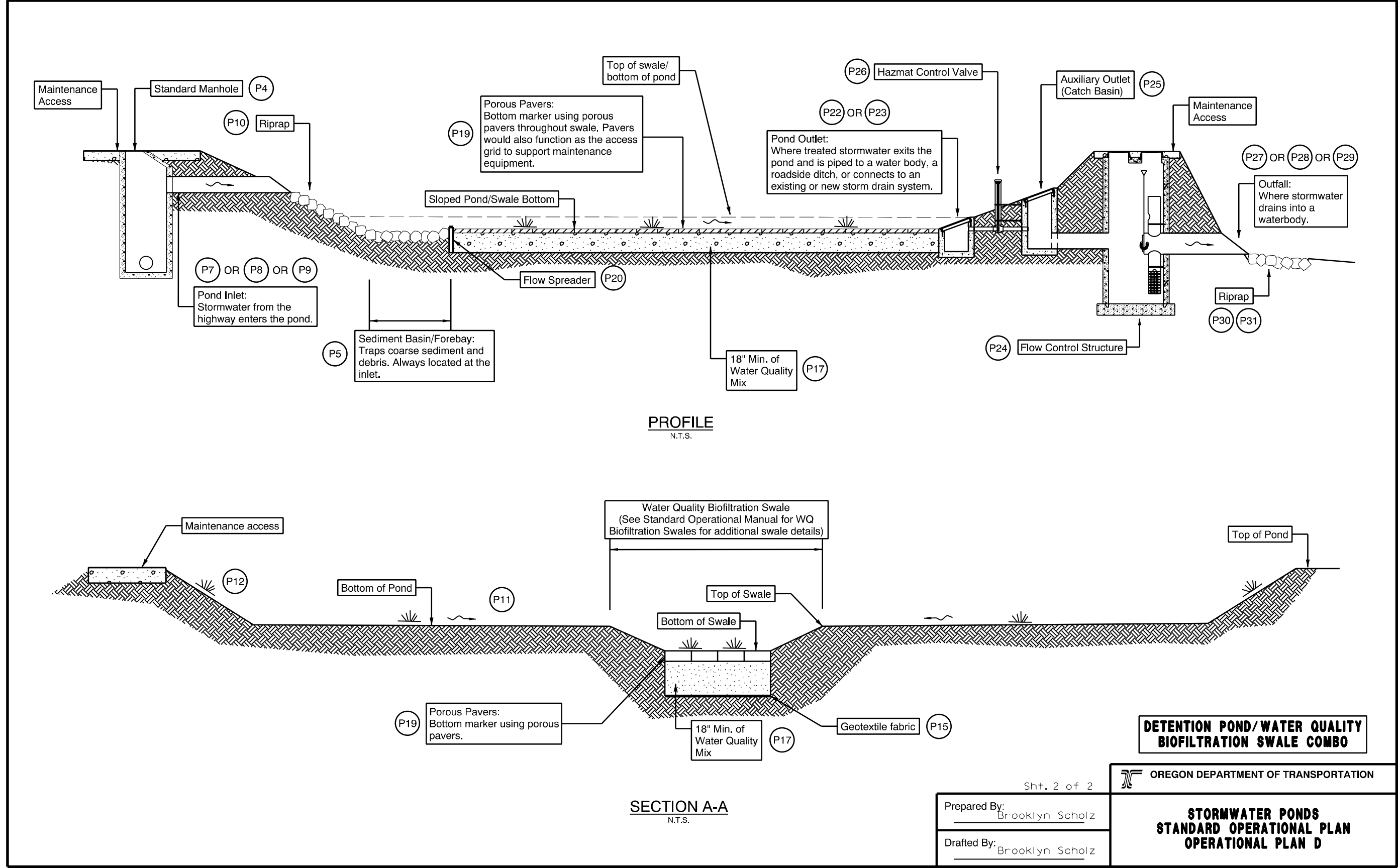
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Brooklyn Scholz

**STORMWATER PONDS
STANDARD OPERATIONAL PLAN
OPERATIONAL PLAN C**

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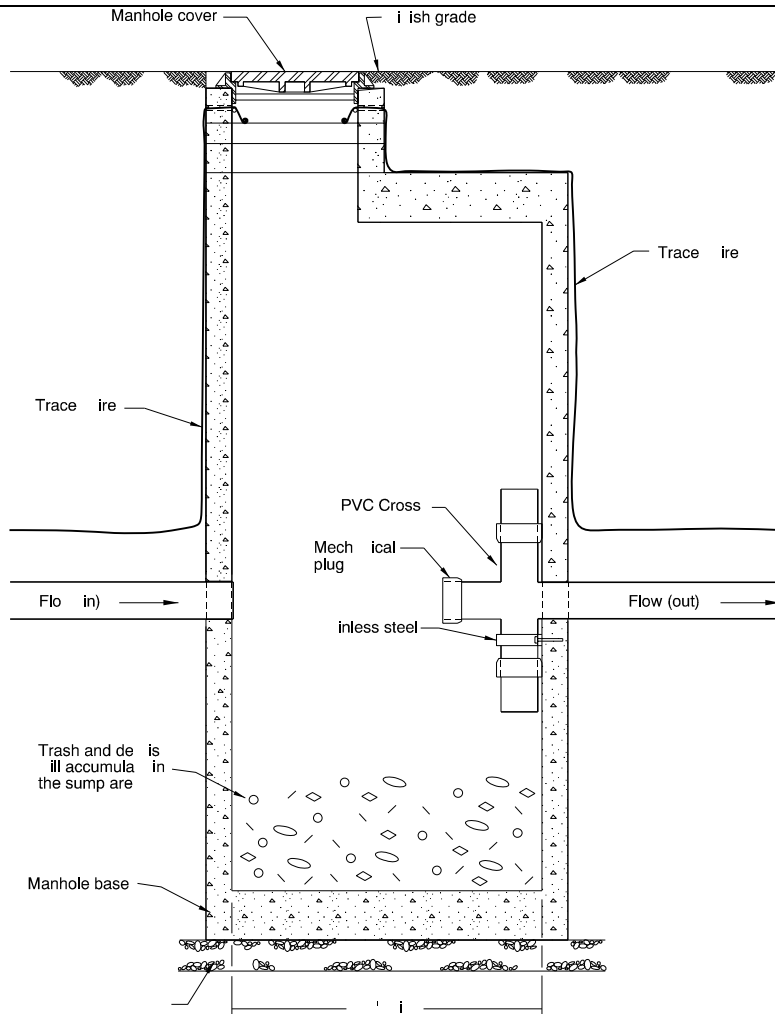
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B Appendix B – Facility Component Details

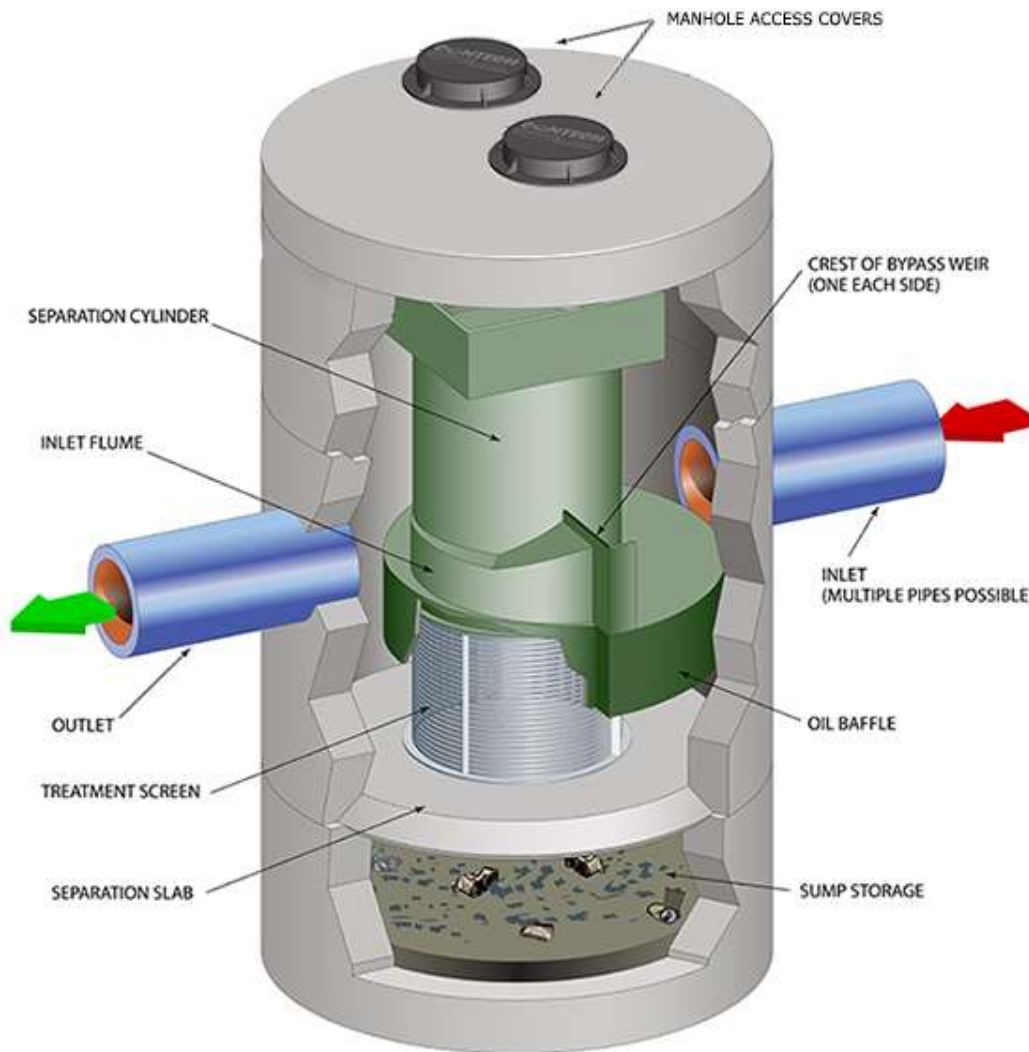
This appendix contains details and descriptions of the facility components.

Figure B- 1: Pre-treatment Manhole (P1).....	B-2
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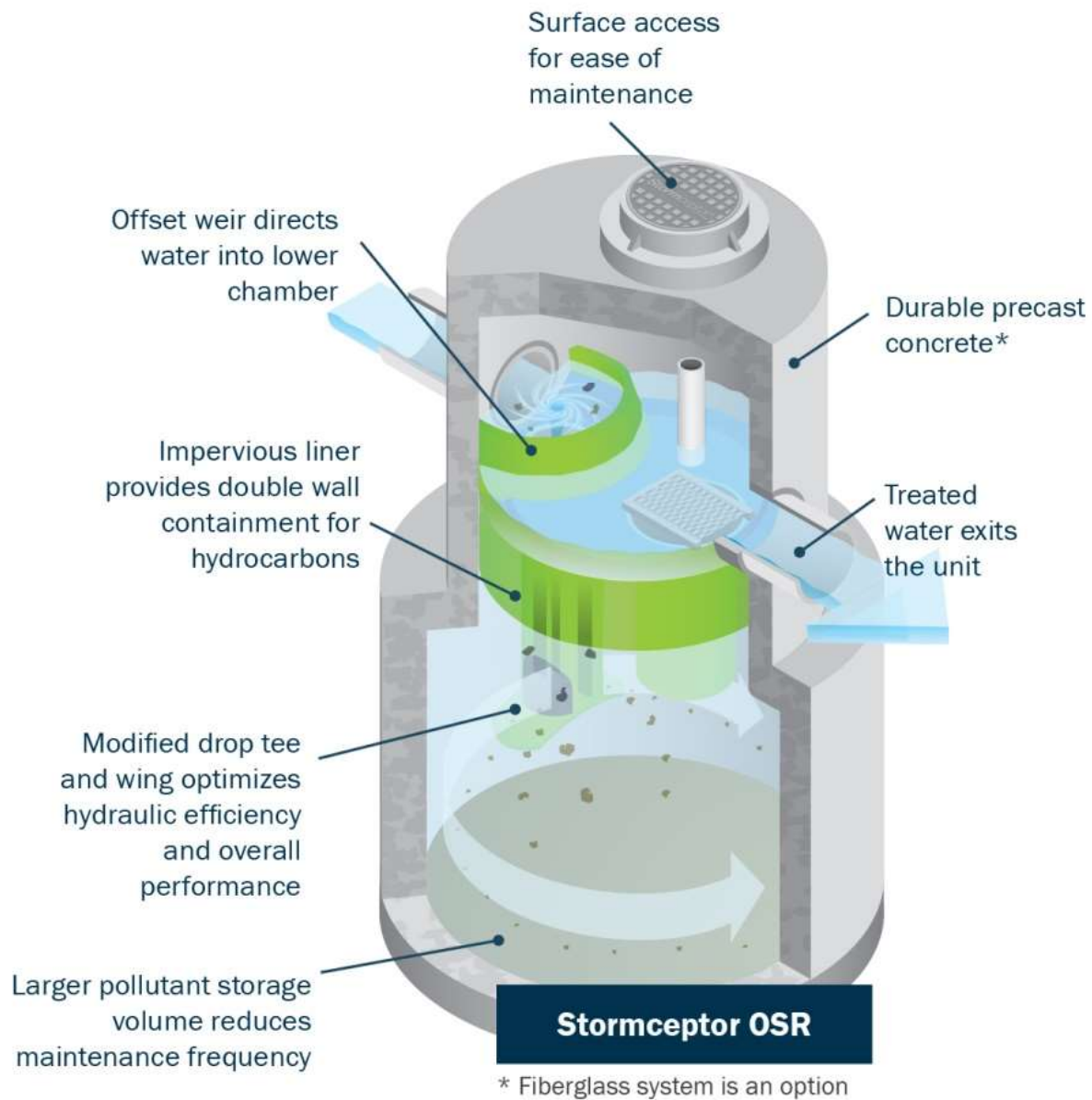
A pre-treatment (pollution control) manhole is used to remove coarse sediment and debris transported by stormwater runoff before the water enters the facility. A pre-treatment facility extends the service life and efficiency of the facility. Not every facility will have a pretreatment structure. These manholes are not assigned a DFI because they are combined with the facility DFI. This structure is **NOT** considered a water quality structure.

Figure B- 1: Pre-treatment Manhole (P1)



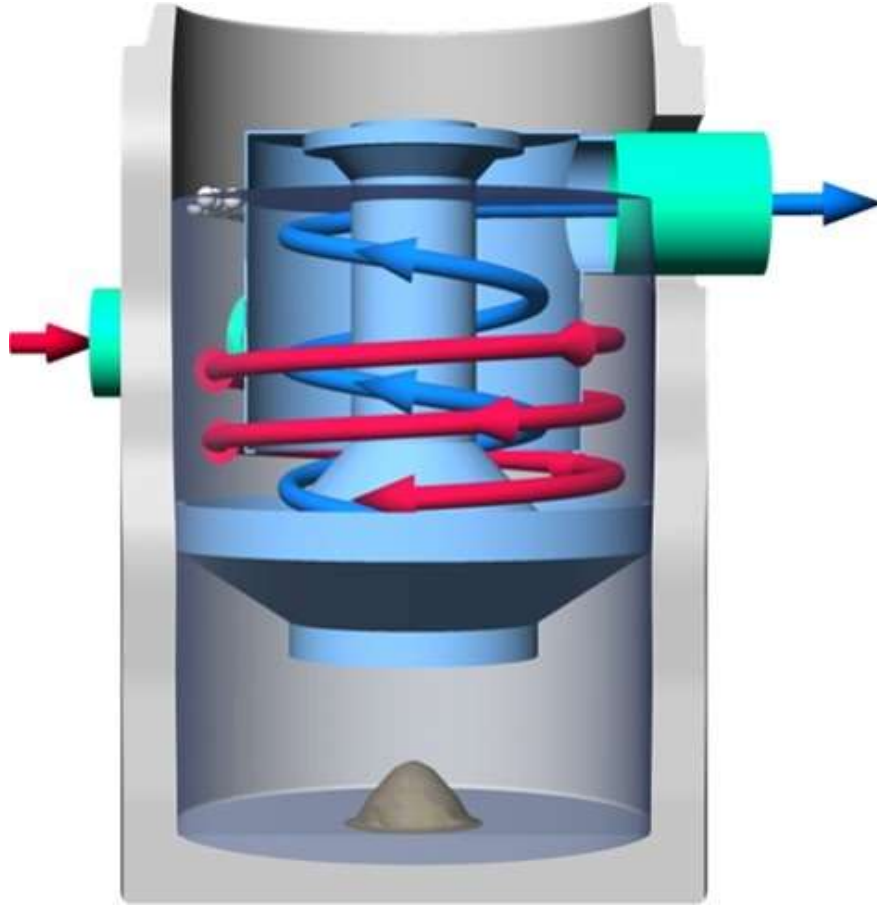
The “CDS” System by CONTECH is proprietary structure used to remove coarse sediment, debris, and oil transported by stormwater runoff before the water enters a pond. These structures are produced and sold under exclusive legal right of the inventor or maker. Proprietary structures are assigned a DFI and a separate O&M manual would be provided to explain how the structure operates and details the maintenance actions.

Figure B- 2: Water Quality Manhole (P2-A) CDS



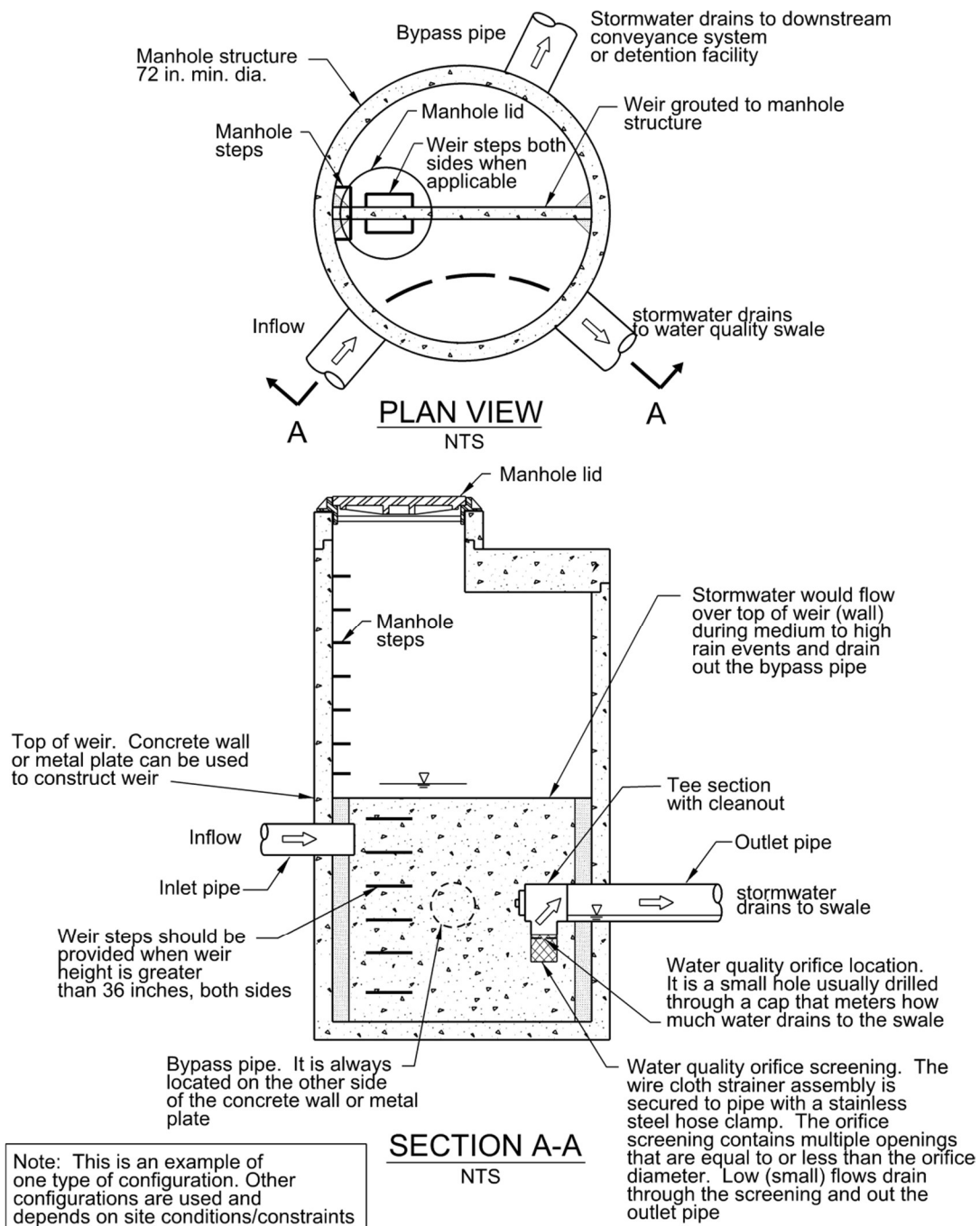
The “Stormceptor” System by Rinker Materials is proprietary structure used to remove coarse sediment, debris, and oil transported by stormwater runoff before the water enters a pond. Proprietary structures are assigned a DFI and a separate O&M manual would be provided to explain how the structure operates and details the maintenance actions.

Figure B- 3: Water Quality Manhole (P2-B) Stormceptor



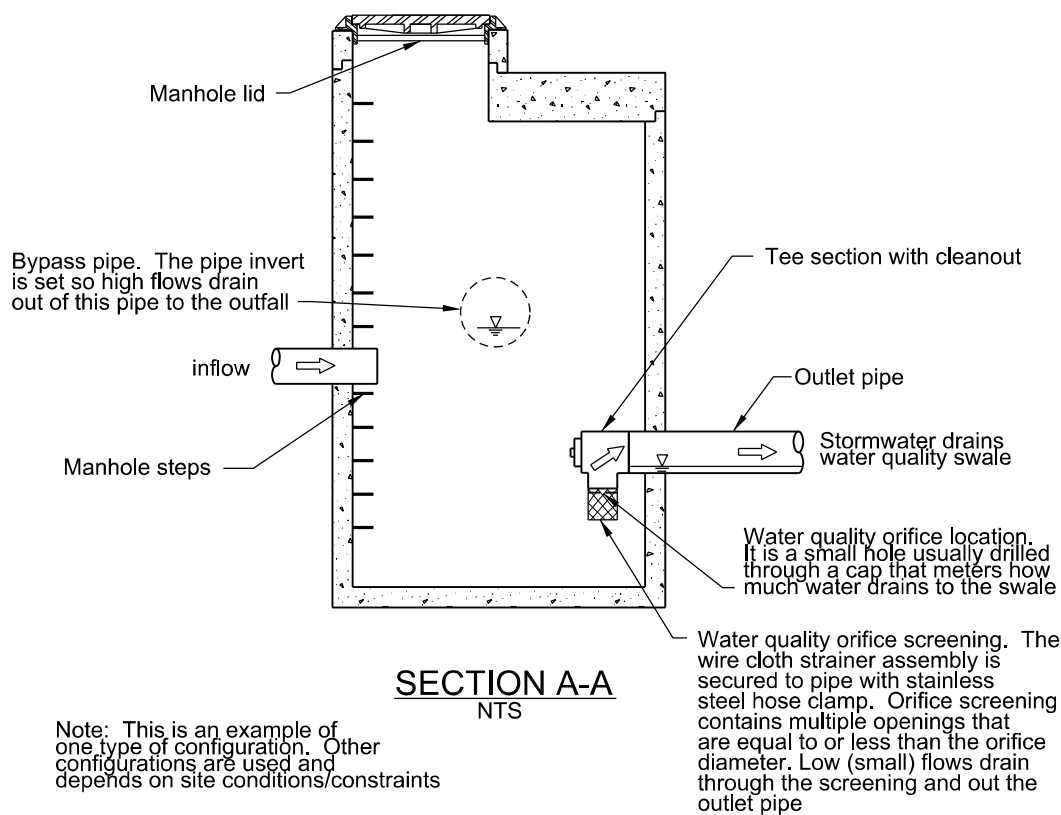
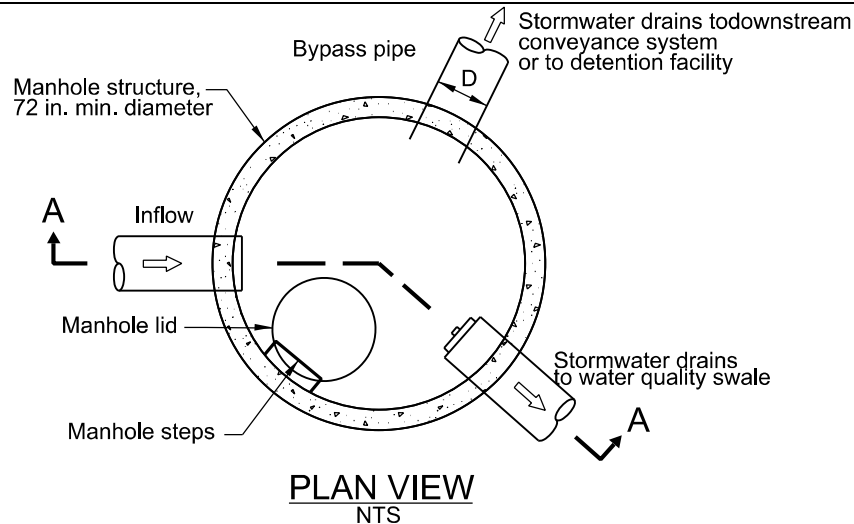
The “Downstream Defender” proprietary structure is used to remove coarse sediment and debris transported by stormwater runoff before the water enters a pond. Proprietary structures are assigned a DFI and a separate O&M manual would be provided to explain how the structure operates and details the maintenance actions.

Figure B- 4: Water Quality Manhole (P2-C) Downstream Defender



A manhole installed before the detention facility inlet with built-in weir to route water in multiple directions. The splitter routes design high flows into the detention facility but allows low flows to bypass (drain around) the detention facility through a storm drainage system into a water quality facility.

Figure B- 5: Weir Type Flow Splitter Manhole (P3)

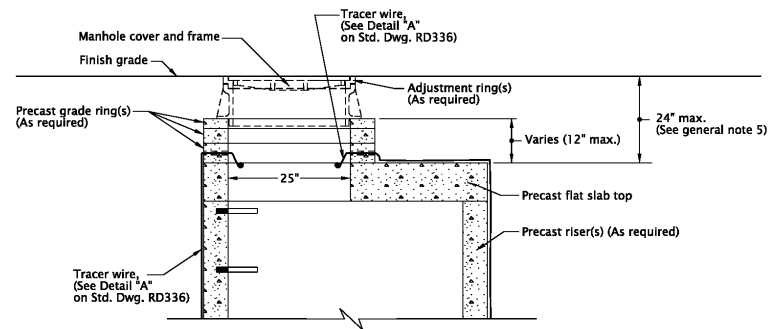
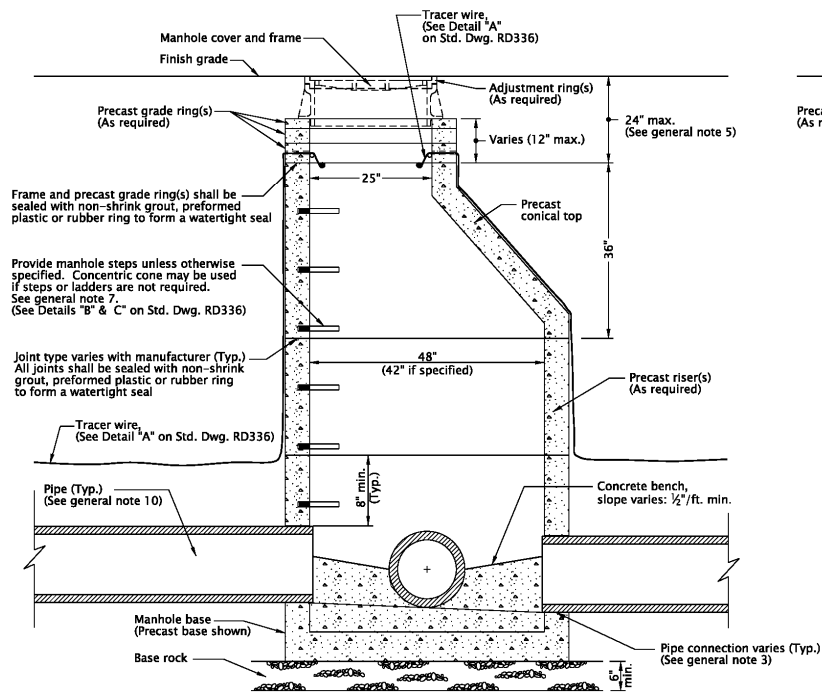


A manhole installed before the swale inlet with built in components to route water in multiple directions. The splitter routes low/small flows into the swale but allow High flows to bypass (drain around) the swale through a storm piping system. A flow splitter is only used when a swale is designed to be an “offline” facility. This structure is NOT considered a water quality structure.

Figure B- 6: Orifice Type Flow Splitter Manhole (P3)

RD335.dgn 25-JUL-2017

RD335



GENERAL NOTES FOR ALL DETAILS:

1. All precast products shall conform to requirements of ASTM C478.
2. Standard precast manhole section diameter shall be 48". Use 42" if specified by the Engineer.
3. See Std. Dwg. RD345 for pipe to manhole connections.
4. See Std. Dwg. RD344 for manhole base section.
5. Adjust 24" maximum.
6. All connecting pipes shall have a tracer wire, or approved alternate.
7. See Std. Dwg. RD336 for manhole steps.
8. See Std. Dwg. RD336 for details not shown.
9. See Std. Dwg. RD356 for manhole covers and frames, manhole adjustment rings, etc.
10. Max. pipe diameter varies with pipe material.
11. See Std. Dwg. RD342 for shallow manholes.
12. Location, elevation, diameter, slope, and number of pipe(s) varies, see project plans.

CALL: BOOK NO. N/A

BASIS: REPORT DATE: 25-JUL-2017

NOTE: All material and workmanship shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

STANDARD
STORM SEWER MANHOLE

2018

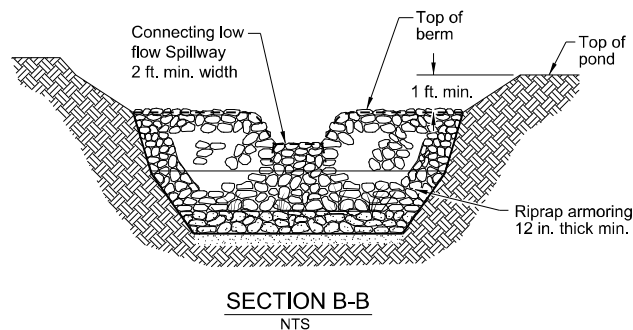
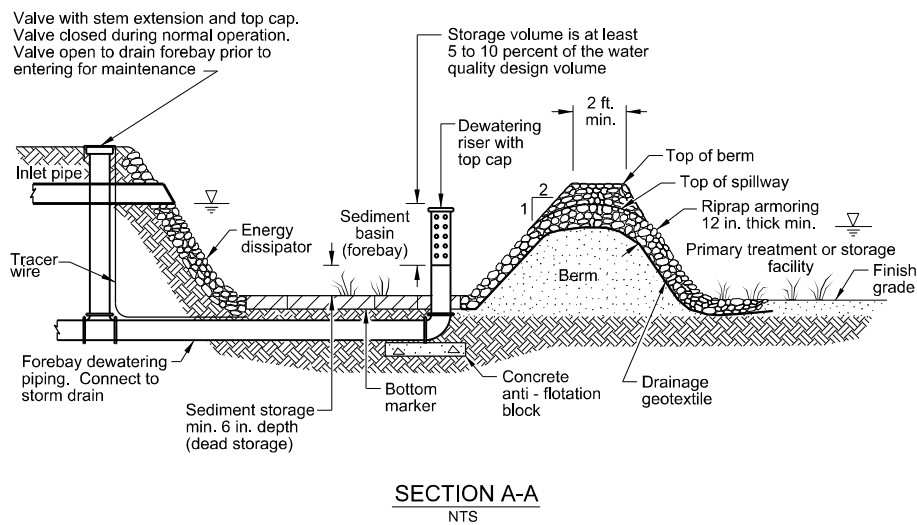
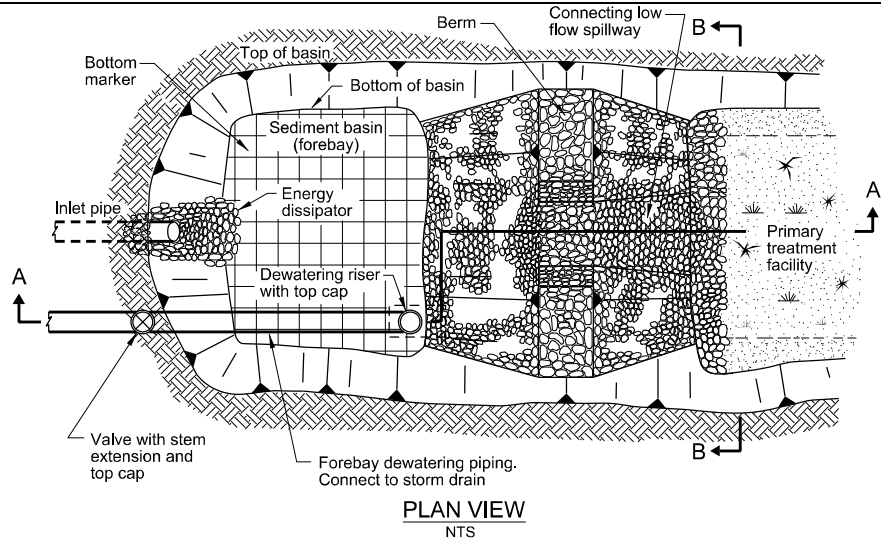
DATE	REVISION DESCRIPTION

Effective Date: December 1, 2017 – May 31, 2018

RD335

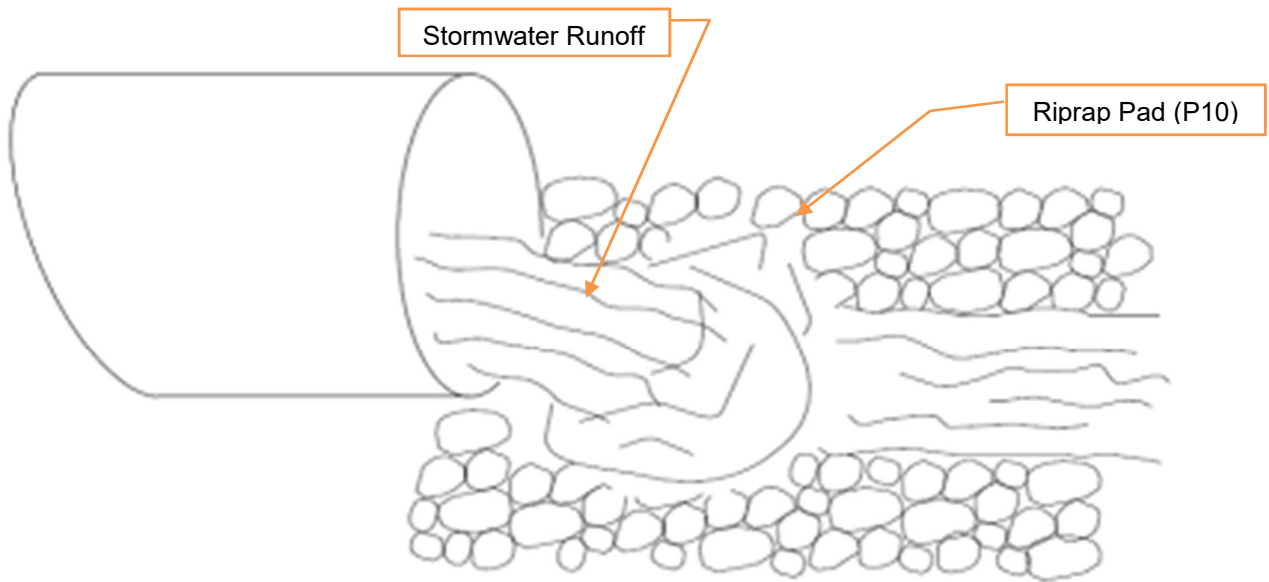
A concrete structure provided to access a storm drainage system for inspection and maintenance. A standard manhole is circular, 4 feet in diameter, and a cast iron lid/cover. Typically used when two or more storm drain pipes come together, change in pipe sizes, and changes to horizontal alignments.

Figure B- 7: Standard Manhole (P4)



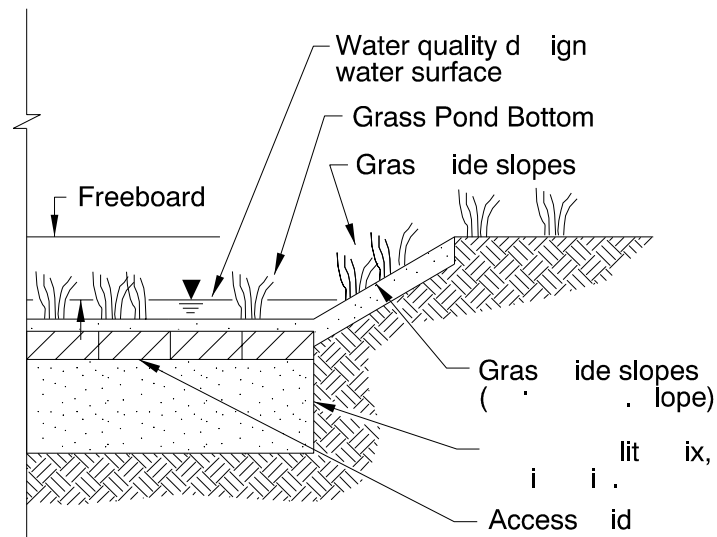
A sediment basin, also known as a forebay, is a pre-treatment component that slows the flow of stormwater enough to allow coarse sediment and debris to settle out before entering the primary treatment area of the pond.

Figure B- 8: Sediment Basin/Forebay (P5 & P6)



Riprap rock placed at the end of a storm drain pipe or along the bottom of a drainage channel to reduce water flow velocities and minimize soil erosion. The length and depth of the riprap pad depends on ground slope, water flow velocity, and size of rock used to create the rock pad.

Figure B- 9: Inlet Pile w/ Riprap Pad (P8 & P10)



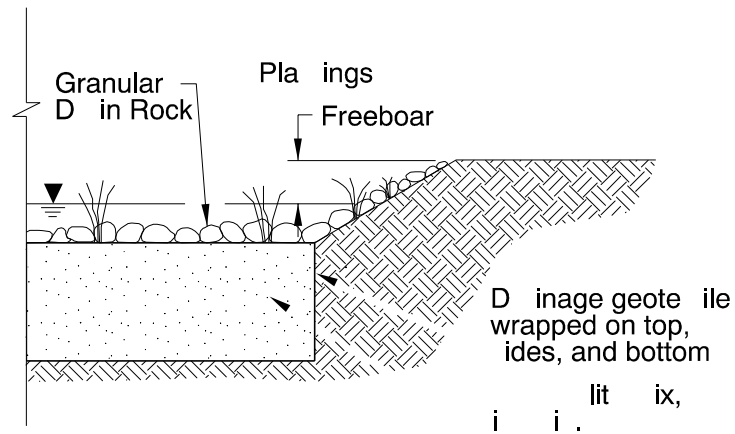
Cross Section

NTS

(Typical cross section in Oregon climate zones 1, 2, 3, and 4)

Grass is used in most western Oregon installations or climate zones 1, 2, 3, and 4 as noted in Figure 1. Grass ponds may sometimes be used in eastern Oregon.

Figure B- 10: Grass Bottom (P11 & P12)



Cross Section

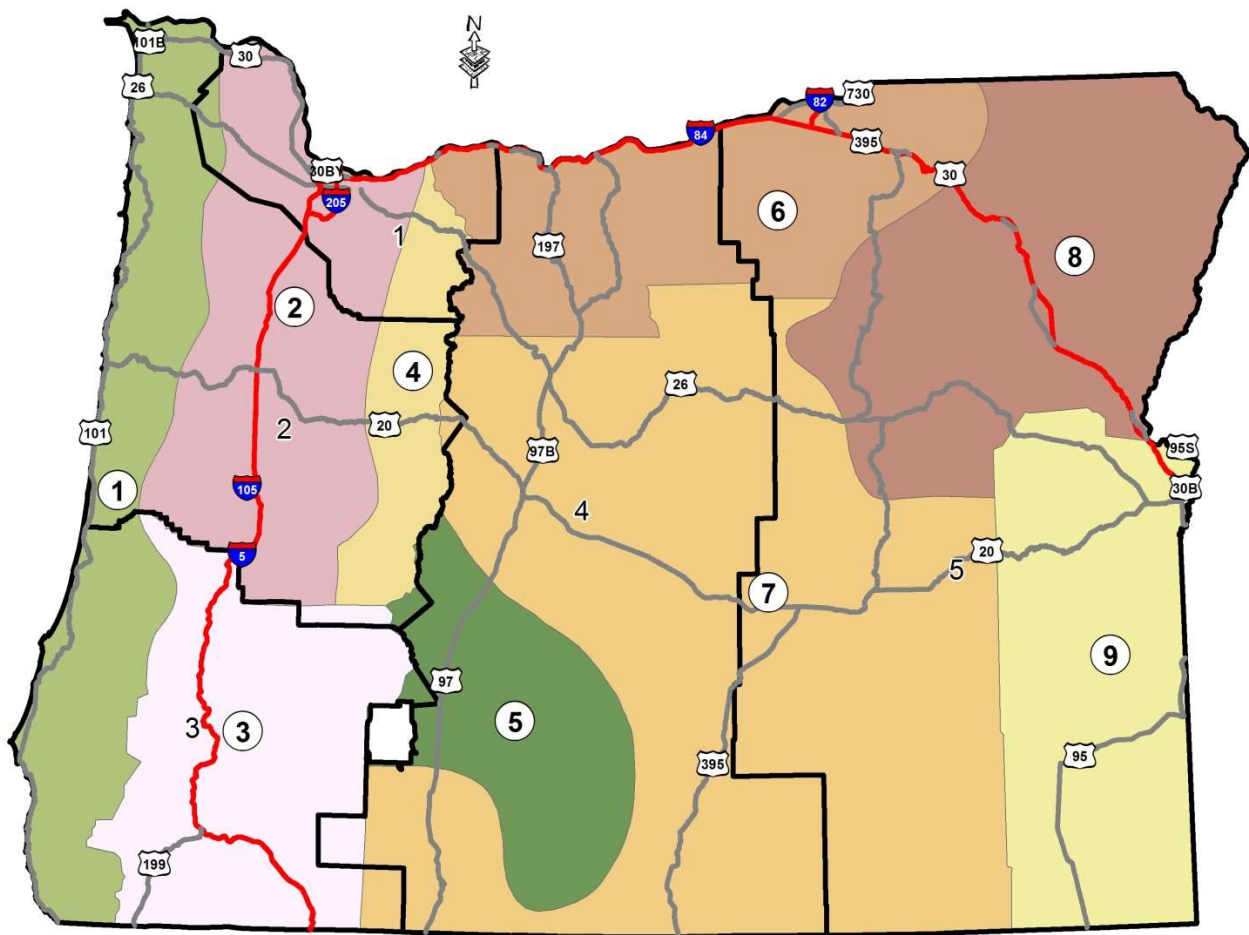
NTS

(Typical cross section in Oregon climate zones 5, 6, 7, 8, and 9)

Plantings are sometimes used along the pond bottom and side slopes in ponds installed in the dry climate zones 5, 6, 7, 8, and 9.

Plantings may sometimes be used in western Oregon

Figure B- 11: Granular Drain Rock/ Plantings (P13 & P14)



Major U.S. Highways **ODOT Regions** **Climate Zones**

— Interstate Highway 1 1 Coastal Area 3 Southwestern Valleys 5 High Plateau 7 South Central 9 Southeast

— U.S. Highway 2 Willamette Valley 4 Northern Cascades 6 North Central 8 Northeast

Oregon Planting Climate Zones

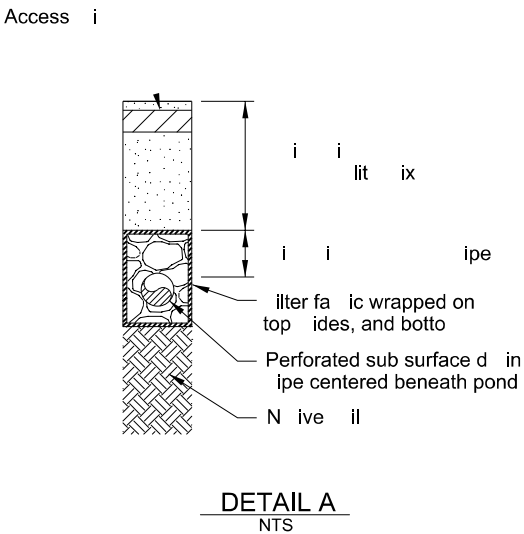
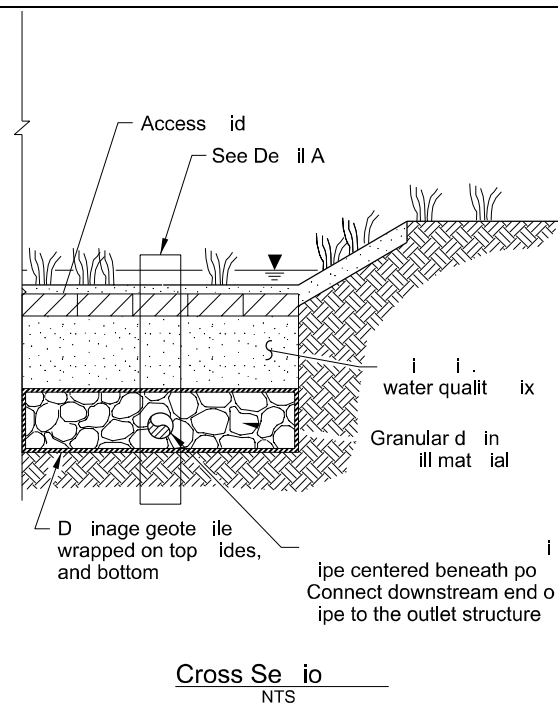


Figure B- 12: Geotextile Fabric (P15)



Plastic Liners are along the bottom of the pond and prevent infiltration into the underlying soil.

Figure B- 13: Impermeable Liner (P16)



At least 18-inches deep of fine graded soil blended with compost. Pollutants are removed from stormwater runoff infiltrating through the water quality mix.

Figure B- 14: Water Quality Mix (P17)



Figure B- 15: Perforated Pipe (P18)



(concrete pavers)



(plastic pavers)

Figure B- 16: Porous Pavers (P19)

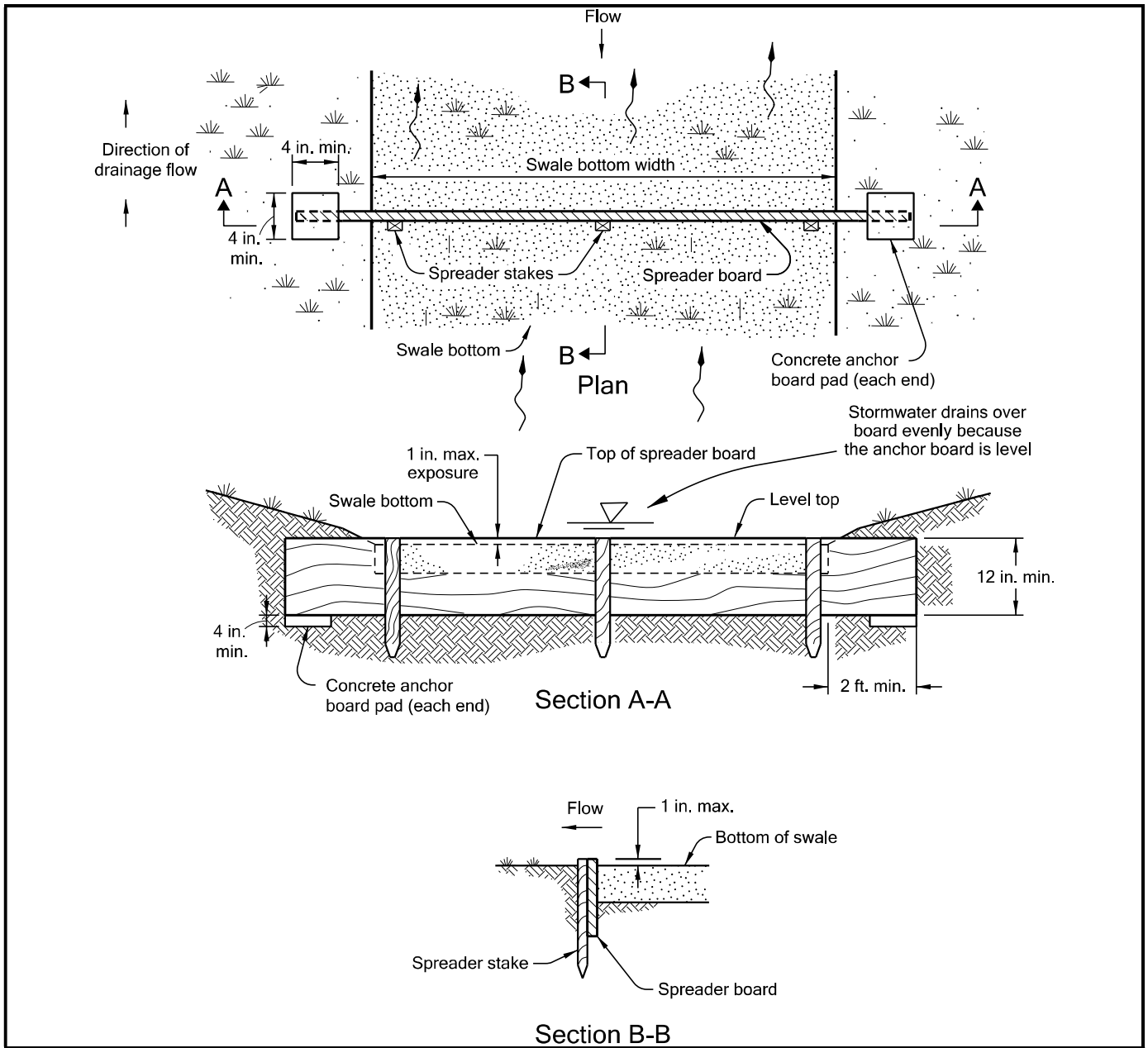
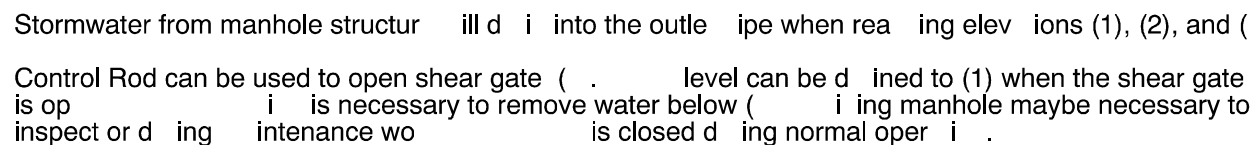


Figure B- 17: Anchor Board Flow Spreader (P20)



B-10

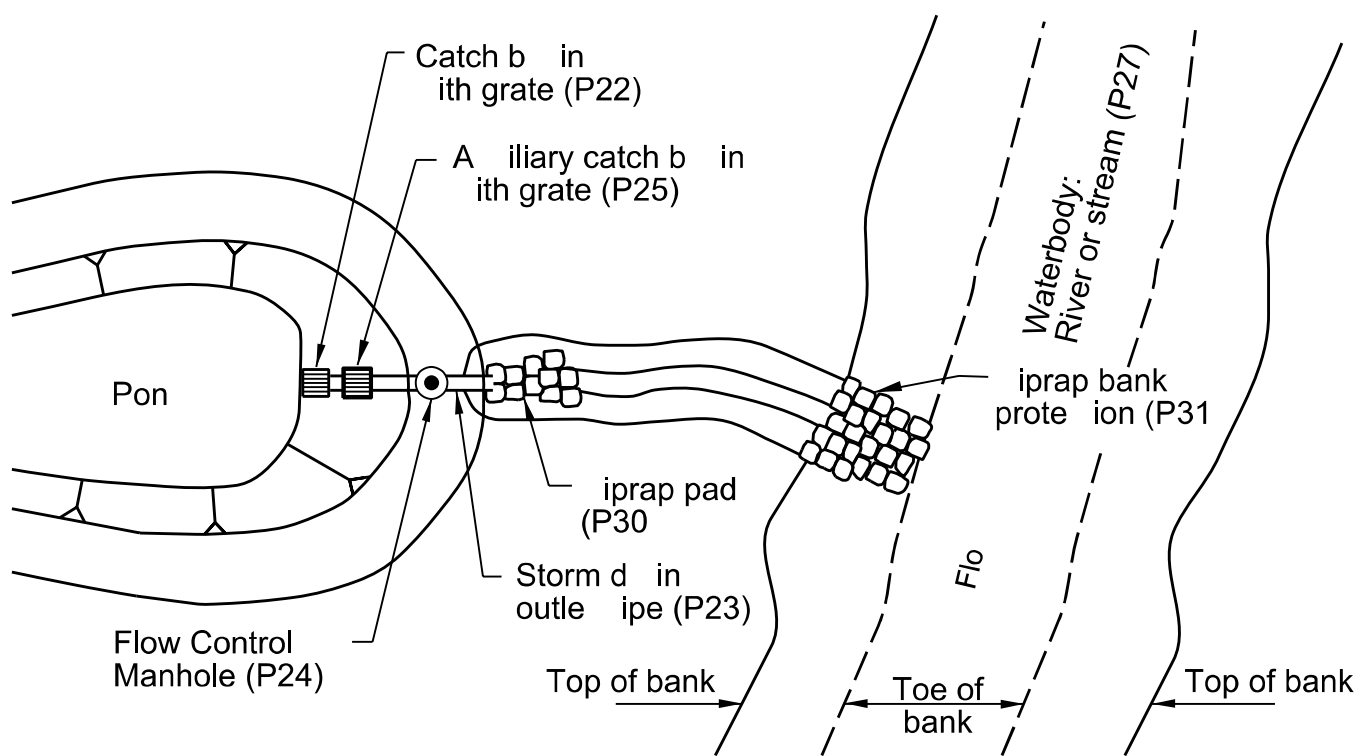
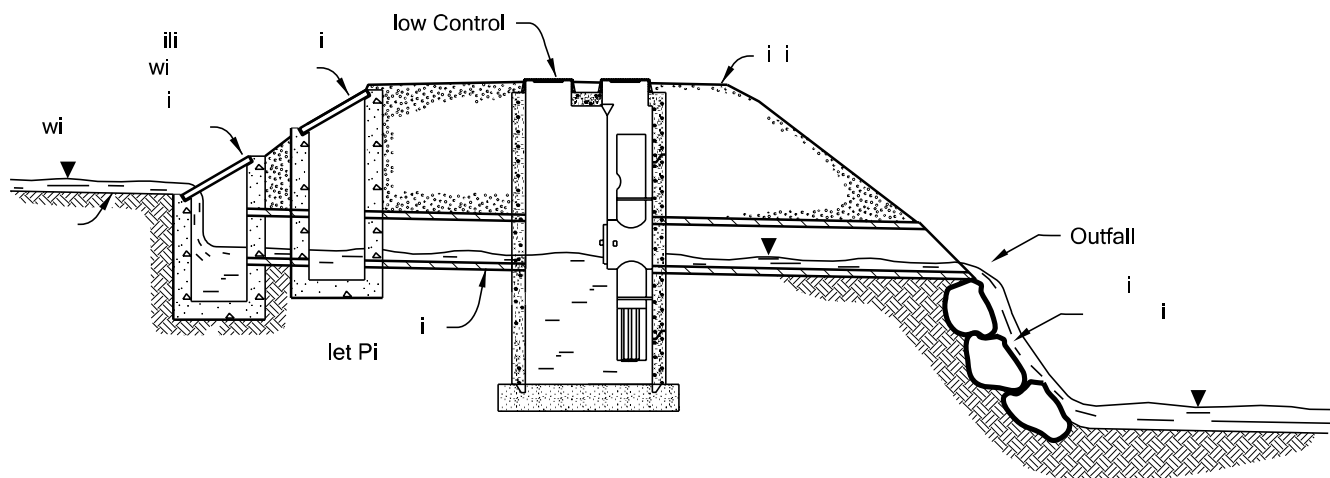


Figure B- 21: Example of Outlet, Flow Control, and Outfall components

C Appendix C – Manufacturer’s Operation & Maintenance Manuals

This appendix contains the Operation & Maintenance Manual for any proprietary structures.