Operation and Maintenance Manual for Hybrid Ditches

City of Indianapolis

200 E. Washington St.

Suite 2460

Indianapolis, Indiana 46204

Rev. November 2021

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Owner's Information

Owner:	City of Indianapolis
Owner Representative:	Department of Public Works
Owner Address:	200 E. Washington St., Suite 2460 Indianapolis, IN 46204
Phone Number:	(317) 327-4000

Hybrid Ditch Description

Purpose

Hybrid ditches are a stormwater management system that allows for drainage in areas with flat terrain where traditional storm sewer systems would be ineffective. In general, they are placed in the right of way between driveways. The hybrid ditch is planted with turf grass and consists of a layered subsurface that allows rainwater to be captured on-site and slowly released through a perforated subsurface drain pipe. The benefits of these ditches are that they can store and absorb rainwater that may cause flooding or ponding otherwise, while treating stormwater runoff for the removal of Total Suspended Solids (TSS) and other pollutants. Hybrid ditches are constructed with an overflow structure to help prevent overtopping during large rain events.

Components

Vegetation – Turf grass is typically used in hybrid ditches to blend in with surrounding residential property.

Infiltration medium – A mixture of sand and organic material that encourages infiltration and further removes suspended solids. This layer supports vegetation growth and acts as a filter for the stormwater and impacts the water quality of the stormwater leaving the system. Suspended solids are either removed via sedimentation or filtration. The sedimentation that occurs at the surface level traps a large percentage of the particles. This layer is typical 18" deep but may be reduced to 12" minimum when shallow conditions require it.

Filter fabric or confinement layer – This layer protects the drainage aggregate beneath it from the migration of the infiltration medium into its voids. Geotextiles have traditionally been used in bioretention installations; however, as cities have owned and operated bioretention cells they are finding that the fabric gets clogged over time, reducing permeability of the geotextile. In lieu of the geotextile fabric, a confinement layer of washed 3/8" gravel (INDOT No. 11 gradation) is recommended. Filter fabric is used along the bottom and sides of trench to protect the aggregate backfill layers.

Aggregate – The drainage aggregate is typically washed INDOT No. 8 stone. This aggregate is used as storage medium for stormwater and as a pipe bed for the perforated underdrain.

Perforated Pipe – Typically a 12" HDPE perforated pipe used for the conveyance of stormwater. Smaller diameter HDPE perforated pipe is not typical but may be encountered when shallow conditions require it.

Overflow Structure – Typically a PVC pipe catch basin with a cast iron grate but can be a concrete catch basin or similar structure. The overflow structure is set above a determined elevation based on the contributing drainage area to prevent flooding of the surrounding area. Stormwater ponding beneath the structure casting will infiltrate through the subsurface medium and be treated for water quality. Water that flows directly into the overflow structure does not receive the benefit of suspended solids removal.

See Appendix A for Hybrid Ditch Standard Drawings. (Note: In situ conditions may differ from standard detail)

Inspections

The City of Indianapolis is responsible to inspect the ditches. Ditches are recommended to be inspected annually and required to be inspected once per five-year period. Record the inspection in Infor PS and forward inspection results, including maintenance deficiencies to DPW Operations.

Maintenance and Repair Responsibilities

Hybrid ditch systems are intended to be low maintenance systems not requiring scheduled maintenance or cleaning. General upkeep of the ditch via mowing and debris collection is the responsibility of adjacent private property owners (where applicable) and DPW is responsible for repairing failing and non-functioning portions of the system.

The City of Indianapolis Department of Public Works (DPW) Operations Division is responsible for maintenance activities as described below and for recording those activities in Infor PS.

Illicit Discharges

If at any time an illicit discharge is found, notify Indianapolis DPW Dispatch by email at DPWdispatch@indy.gov or call (317) 327-1620.

Under no circumstances shall non-DPW personnel participate in maintenance activities involving confined space entry or which could result in bodily injury.

Maintenance Activities and Responsibilities

CITY OF INDIANAPOLIS DPW RESPONSIBILITY

Maintenance/Inspection Item	Recommended Frequency
Visual inspection of ditch	Annually (Minimum once per five year)
Repair structures with corrosion, cracks, and/or broken parts	As needed
Repair eroded ditch sections	As needed
Repair clogged infiltration media	As needed
Repair broken or sagging underdrain	As needed
Hydro-jet clogged pipes and tree roots	As needed

PROPERTY OWNER RESPONSIBILITY

Maintenance/Inspection Item	Recommended Frequency
Mow to maintain grass height between 4" and 8"	As needed
Keep ditch and inlets free of trash, pet waste, debris and illicit discharges	As needed
Re-establish grass with INDOT Seed Mixture U* in worn or eroded areas of the ditch.	As needed

** This seed mixture shall be applied at the rate of 200 lb/ac consisting of 100 lb/ac of a 4-way blend of turf type Tall Fescue, 50 lb/ac Creeping Red Fescue, 45 lb/ac Perennial Ryegrass and 5 lb/ac White Dutch Clover.*

Maintenance and Repair Standards

Visual inspection of ditch:

Visual inspection of the ditch is recommended to be performed annually, and at a minimum once per five years. Inspect the ditch for signs of rutting, erosion, clogging, dead vegetation, broken structures, and sinking infrastructure. The ideal time for inspection is approximately 24 to 48 hours after a rain event greater than ½" so that infiltration performance can be evaluated. Deficient maintenance by adjacent property owner should be noted and the property owner informed of their responsibilities.

Repair Structures with corrosion, spalling, cracks and/or broken parts:

Overflow structure castings may be replaced in kind without replacing the structure if the structure is structurally sound and no cracks or failures are observed. Casting elevation should not be changed from design values.

To replace a structure, remove adjacent soil and gravel layers to a point below the bottom of structure. Take care to stabilize the structure during excavation so it does not tip and adversely affect pipe alignment. If geotextile was used for confinement, it should but cut to facilitate structure removal. Disconnect pipe from structure and remove structure (this step may require cutting pipe). Compact the base aggregate under each structure and supplement with additional washed INDOT #8 if needed.

Place pipe bedding to maintain required pipe invert and support pipe connection to manhole. If a pipe was cut to remove the structure, a flexible coupling with corrosion resistant bands should be used to reconnect or extend pipe to the structure. Backfill with washed INDOT #8 aggregate until the existing choke layer

elevation is reached. If geotextile was used for the confinement layer, replacement geotextile shall be in accordance with INDOT Standard Specifications 918.02 (b) "Geotextile Properties for Underdrains and Drainage Applications," Type 1A and 2A (non-woven). Install geotextile patch with a minimum 18 in. overlap at seams. If aggregate was used for the choke layer, install washed INDOT #11 gradation (3/8" gravel) to a depth of 3 in. Topsoil, sand, borrow or similar material shall not be used as pipe bedding or backfill below the choke layer.

Reuse the removed infiltration medium or replace the infiltration layer with approved soil per DPW standard detail slightly compacted to no greater than 85% maximum dry density per ASTM standard proctor testing. Hand compaction in multiple lifts is recommended if a proctor is not available. Finish with 4" of similarly compacted engineered soil and seed with INDOT Seed Mixture U.

Repair eroded ditch sections:
Scarify eroded sections and replace the eroded area with approved soil per the DPW standard detail slightly compacted to no greater than 85% maximum dry density per ASTM standard proctor testing. Hand compaction in multiple lifts is recommended if a proctor is not available. Finish with 4" of similarly compacted engineered soil and seed with INDOT Seed Mixture U.

Repair clogged infiltration media:
The most common reasons for poor infiltration are over compacted infiltration layer and a clogged choke layer. A clogged choke layer is primarily the result of sediment deposits in the geotextile separation fabric.

To alleviate an over compacted infiltration layer, remove the in situ soil leaving the choke layer in place. Re-lay the soil, compacting to no greater than 85% maximum dry density per ASTM standard proctor testing. Hand compaction in multiple lifts is recommended if a proctor is not available. Finish with 4" of similarly compacted topsoil and seed with INDOT Seed Mixture U.

If a geotextile choke layer spot repair is required, the infiltration layer should be carefully removed to the limits of poor drainage with some over-excavation to lay the geotextile seams. Cut and remove the existing geotextile. Replacement geotextile shall be in accordance with INDOT Standard Specifications 918.02 (b) "Geotextile Properties for Underdrains and Drainage Applications," Type 1A and 2A (non-woven). Install geotextile patch with a minimum 18 in. overlap at seams. If feasible, the geotextile separation layer should be removed completely and replaced with a 3 in. thick aggregate choke layer, which has a longer performance period compared to geotextiles. Removal of side wall or below-the-pipe geotextile is not required. Replace the infiltration layer per the method described above.

Repair broken or sagging underdrain:
Remove infiltration and gravel layers to a point below the bottom of pipe. Evaluate pipe bedding for washout and repair as needed. If geotextile was used for confinement, it should but cut to facilitate pipe removal. New pipe should utilize existing joints as much as possible, but flexible couplings with corrosion resistant bands will often be required.

Place pipe bedding to maintain required pipe invert and support pipe. Install new pipe with gaskets and couplings as needed and backfill with washed INDOT #8 aggregate until the existing choke layer elevation is reached. If geotextile was used for the choke layer, replacement geotextile shall be in accordance with

INDOT Standard Specifications 918.02 (b) "Geotextile Properties for Underdrains and Drainage Applications," Type 1A and 2A (non-woven). Install geotextile patch with a minimum 18 in. overlap at seams. If aggregate was used for the choke layer, install washed INDOT #11 gradation (3/8" gravel) at a depth of 3 in. Topsoil, sand, borrow or similar material shall not be used as pipe bedding or backfill below the choke layer.

Reuse the removed infiltration medium or replace the infiltration layer with approved soil per DPW standard detail slightly compacted to no greater than 85% maximum dry density per ASTM standard proctor testing. Hand compaction in multiple lifts is recommended if proctor is not available. Finish with 4" of similarly compacted topsoil and seed with INDOT Seed Mixture U.

Hydro-jet clogged pipes and tree roots:
Hydro-jetting pressure should not exceed 1500 psi. If tree roots need to be cleared from the pipe, a water jet cutter should be used rather than a saw or spiral cutter that would damage the pipe.

Mow to maintain grass height between 4" and 8":
Grass should be mowed regularly to maintain a height between 4 and 8 inches. During hot summer months it is preferable to keep grass a little bit longer, with a lower blade height in the fall through the final cut before winter.

Keep ditch and inlets free of trash, pet waste, debris and illicit discharges:
Accumulated trash, leaves, and other debris can prevent stormwater from properly infiltrating and block the overflow structures, leading to flooding. Check the ditch regularly and clean as needed.

Re-establish grass with INDOT Seed Mixture U in worn or eroded areas of the ditch:
Established turf keeps the ditch from eroding and provides benefits to the water quality of the system. If bare or thinning turf spots are observed, over seed with a INDOT Seed Mixture U and water as required to re-establish healthy turf.

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Hybrid Ditch Inspection Form

Post-Construction Inspection and Maintenance Checklist		
Location: _____		**Inspector Name: _____** **Date and Time:**
Inspection Item	**Y/N/NA**	**Comments**
O&M Manual attached to asset in InforPS?		**NOTE: Add to INFOR (Remove only after this document has been added to INFOR)**
Are the inlet grates free of cracks or defects and securely attached to their respective outlet structures?		
Are the inlet grates free of debris and able to flow freely?		Note debris removed:
Are the structures free of corrosion, spalling, cracks, broken parts and otherwise functional?		
Is the basin free of unwanted vegetation species?		Note debris removed:
Is there adequate vegetation that is generally free of erosion and rutting throughout the hybrid ditch? Is it properly mowed 4″ to 8″ tall?		
Note amount of rainfall preceding inspection. Does the ditch infiltrate its storage volume within 24 to 48 hours of the event ending?		
Is the ditch free of animal burrows, waste, and obstructions?		
Is the hybrid ditch free of illicit discharges such as sewage, oily sheen, discoloration, odors, etc.?		
Is ditch free of open voids (cave-ins) or subsiding soils that may indicate a subsurface drainage failure?		
Is ditch free of rutting, road shoulder build-up or other grading issues that may impact drainage or ditch function?		
Other Problems:		

If any of the above items were answered "No," list work orders written and dates completed below:

Item above	Work Order Number	Date Completed

Inspection-Record Keeping Instructions

INFOR: Uploading Completed Inspection as an attachment

All completed inspection forms will be uploaded and saved in INFOR as inspections of the assets. INFOR provides a method by which people can both access and monitor inspections. Inspections are uploaded into INFOR by the following method.

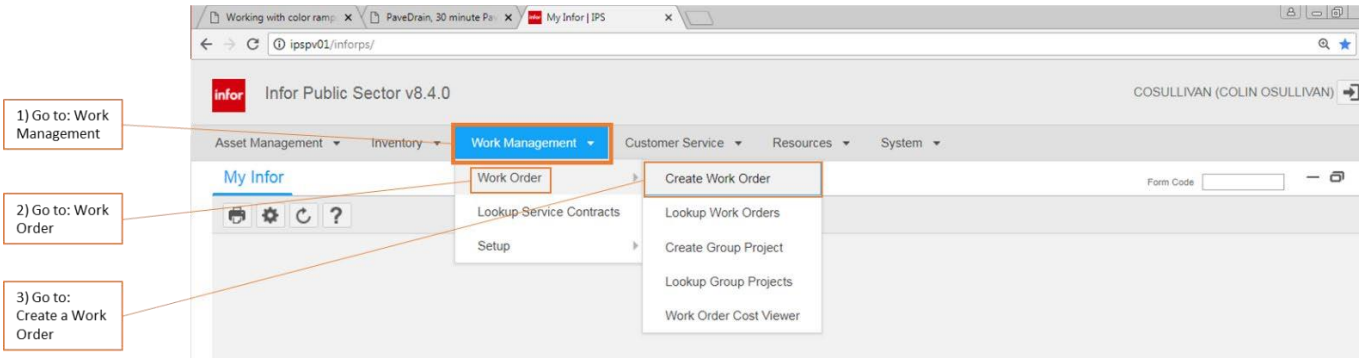
Go To: http://ipspv01/inforps/

Enter your Log In information

Go to: 1. Work Management →

2. Work Order →

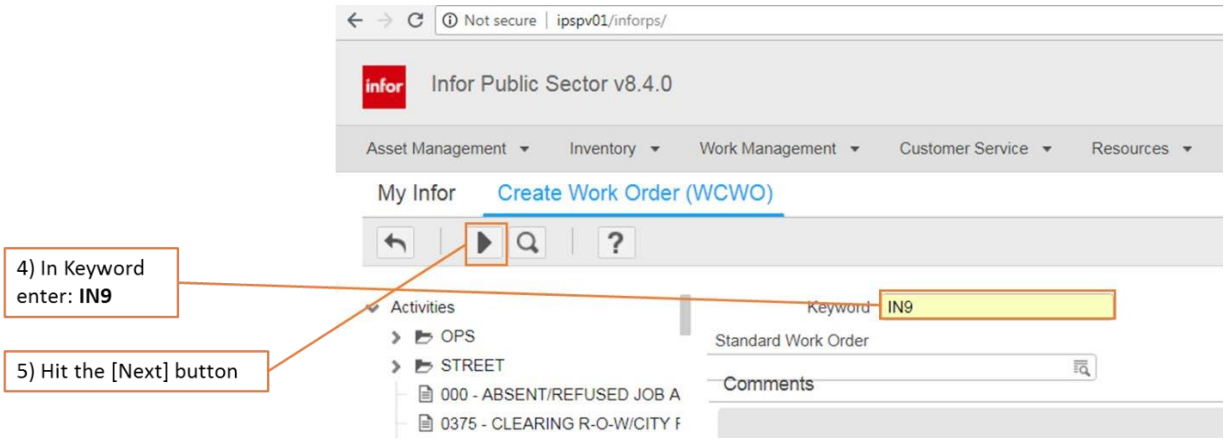
3. Create a Work Order →



Enter the Activity Code for inspections: **IN9**

Go to: 4) Under Keyword type the activity code for inspection: **IN9**

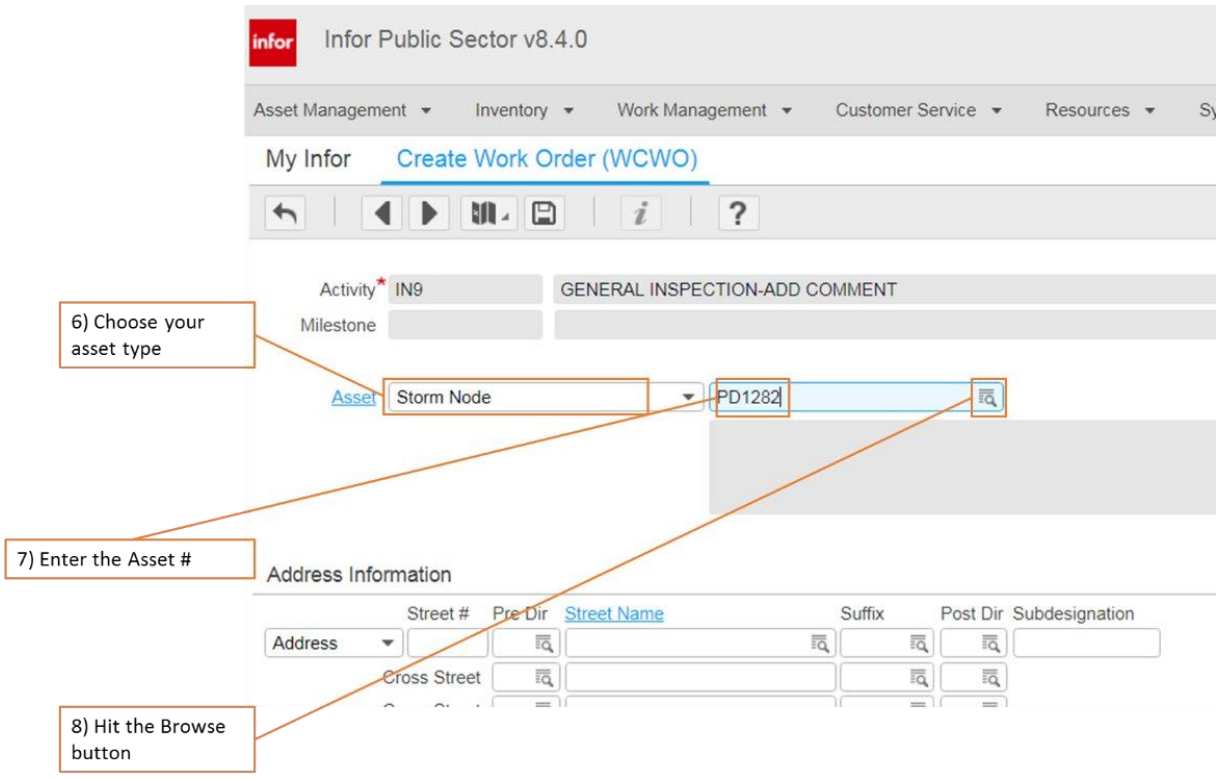
→ 5) Hit the [Next] button



6) Choose Asset type

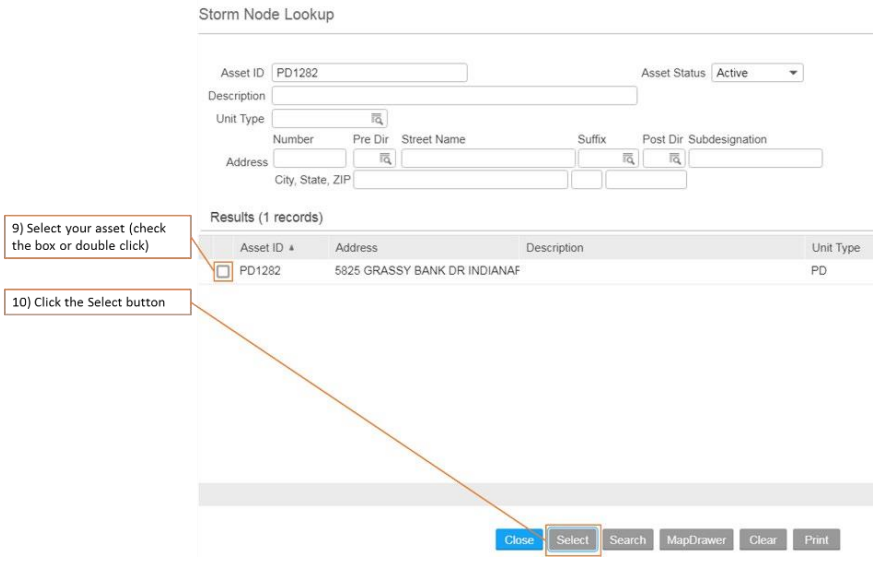
7) If you know your asset number, enter the [Asset #] in the space to the left, if you need to you can browse the assets by hitting the browse option on the right (See browse window below)

8) Hit the Browse button



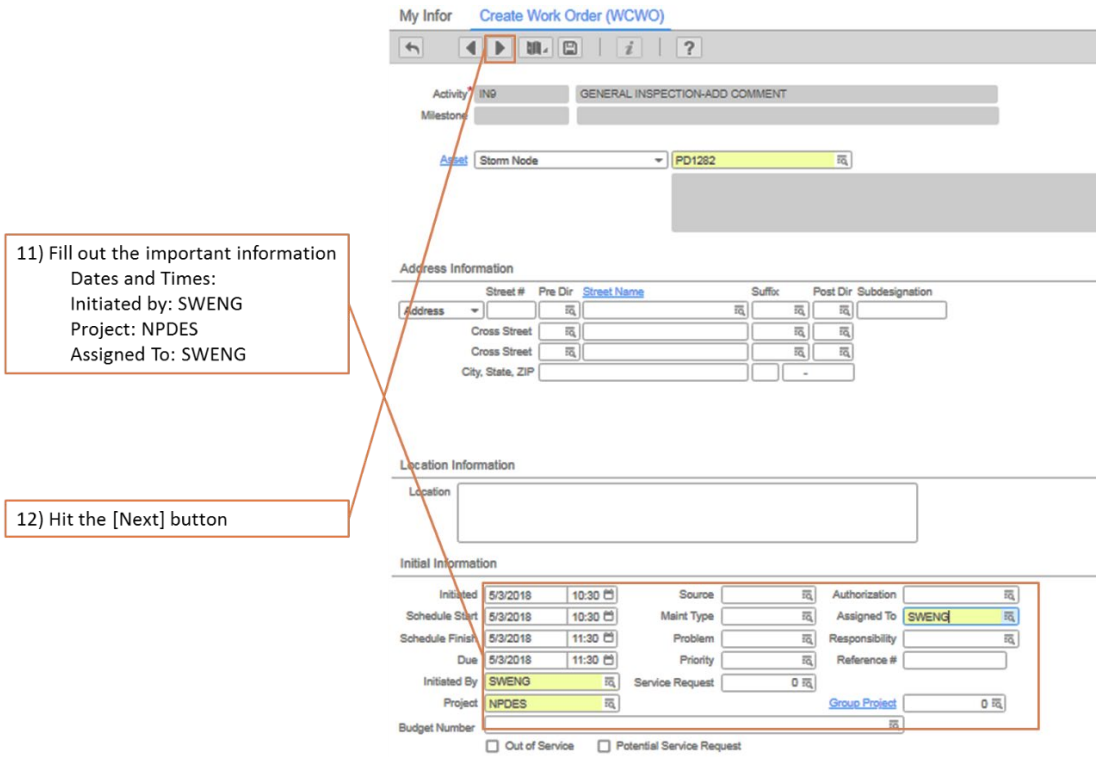
9) This window allows you to select your asset, either check the box or double click your asset

10) Click the [Select] button



11) Fill out all pertinent information, Time & Date, Initiated By: SWENG, Project: NPDES, and Assigned To: SWENG

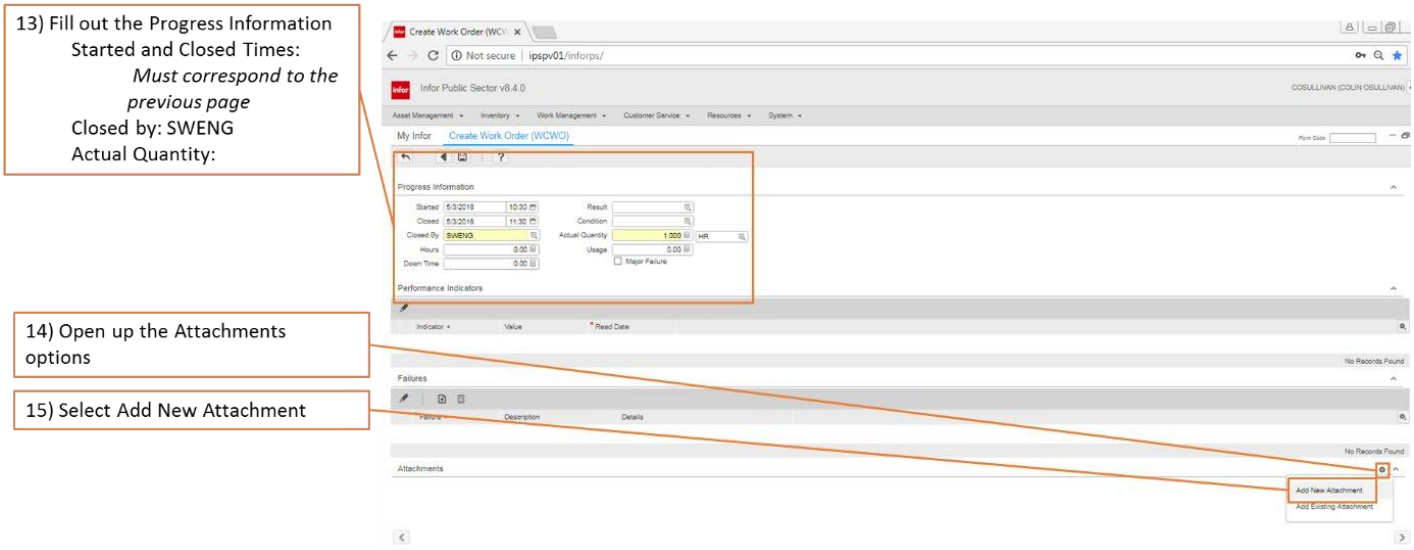
12) Hit the [Next] button



13) Fill out Progress Information, need to make sure information correlates to the previous page and the Actual Hours are correct

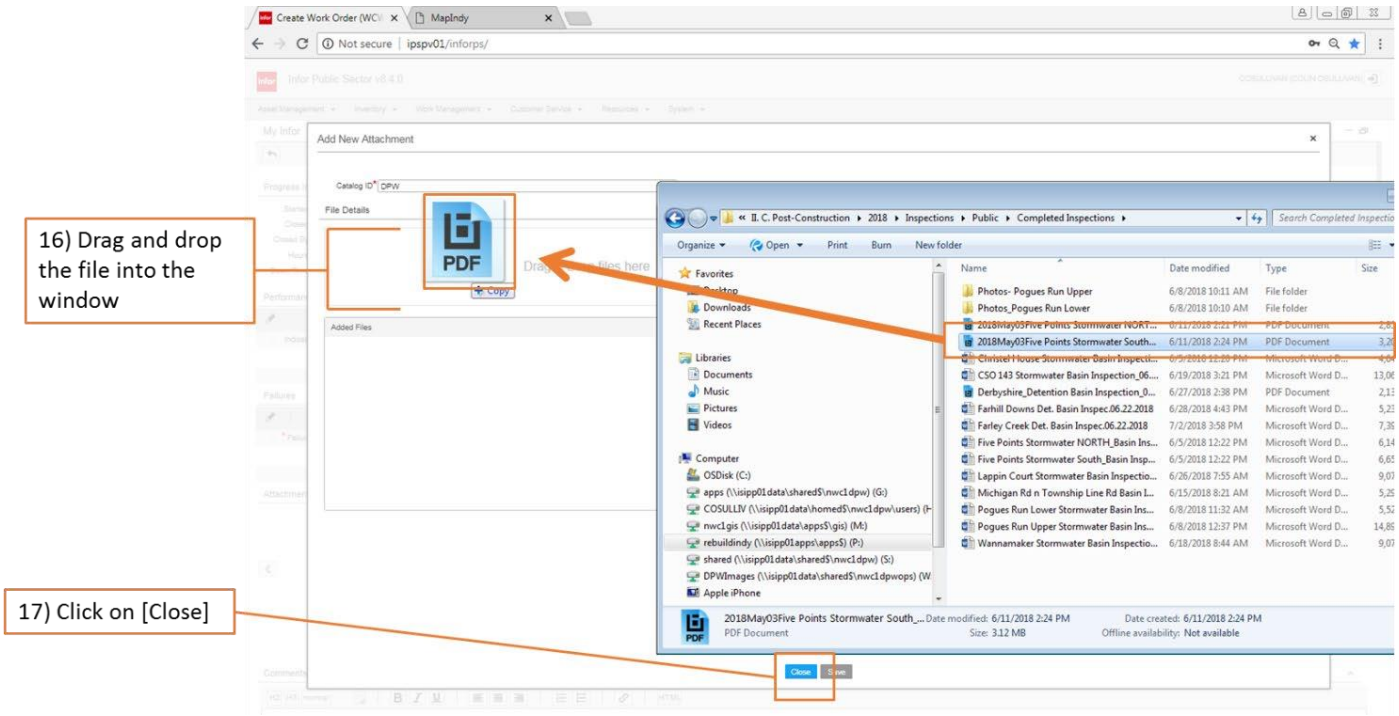
14) Hit the gear icon for Attachments

15) Select [Add New Attachment]



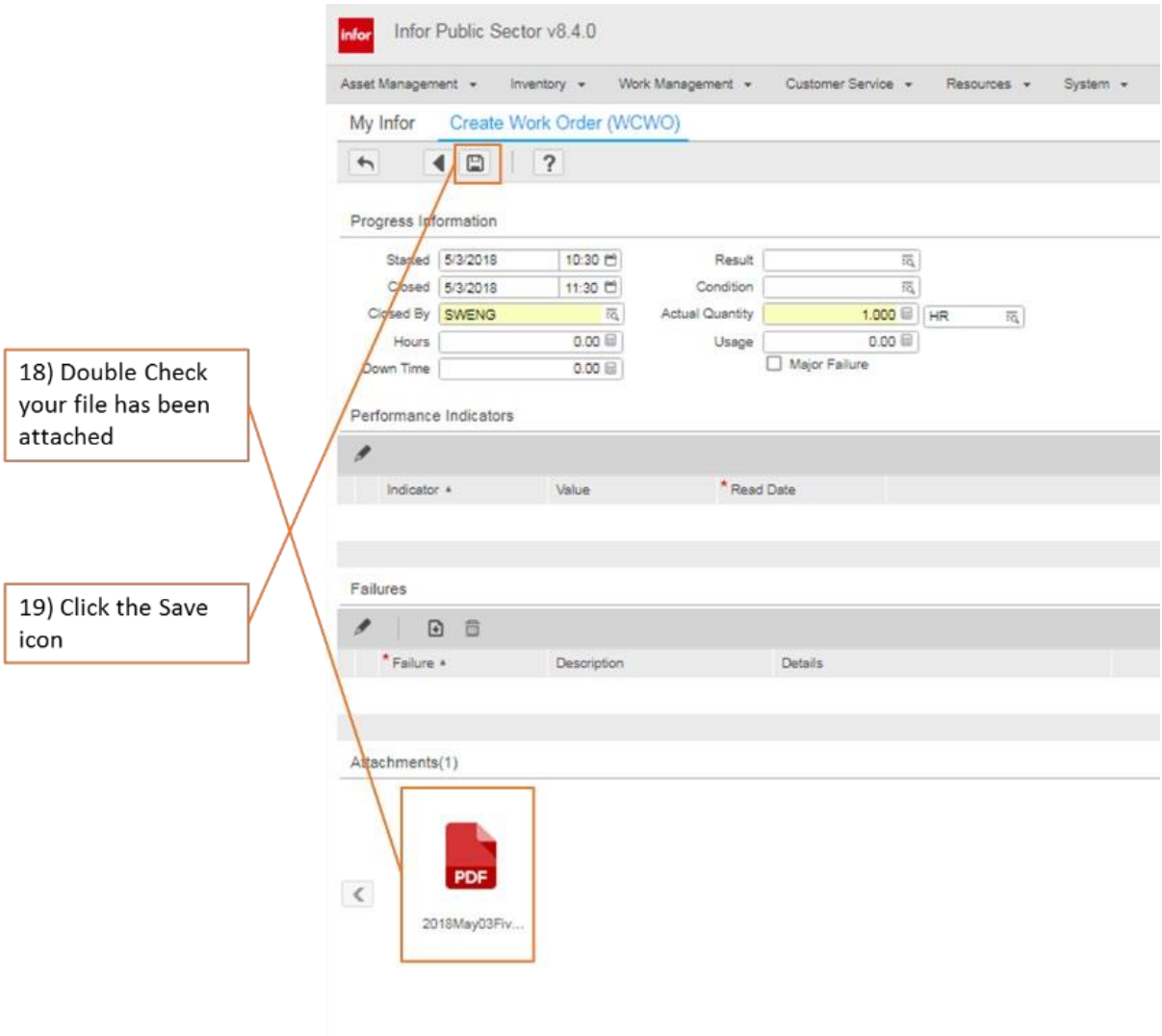
16) Drag and drop the file into the window

17) Click on [Close]



18) Double check that your file has been attached

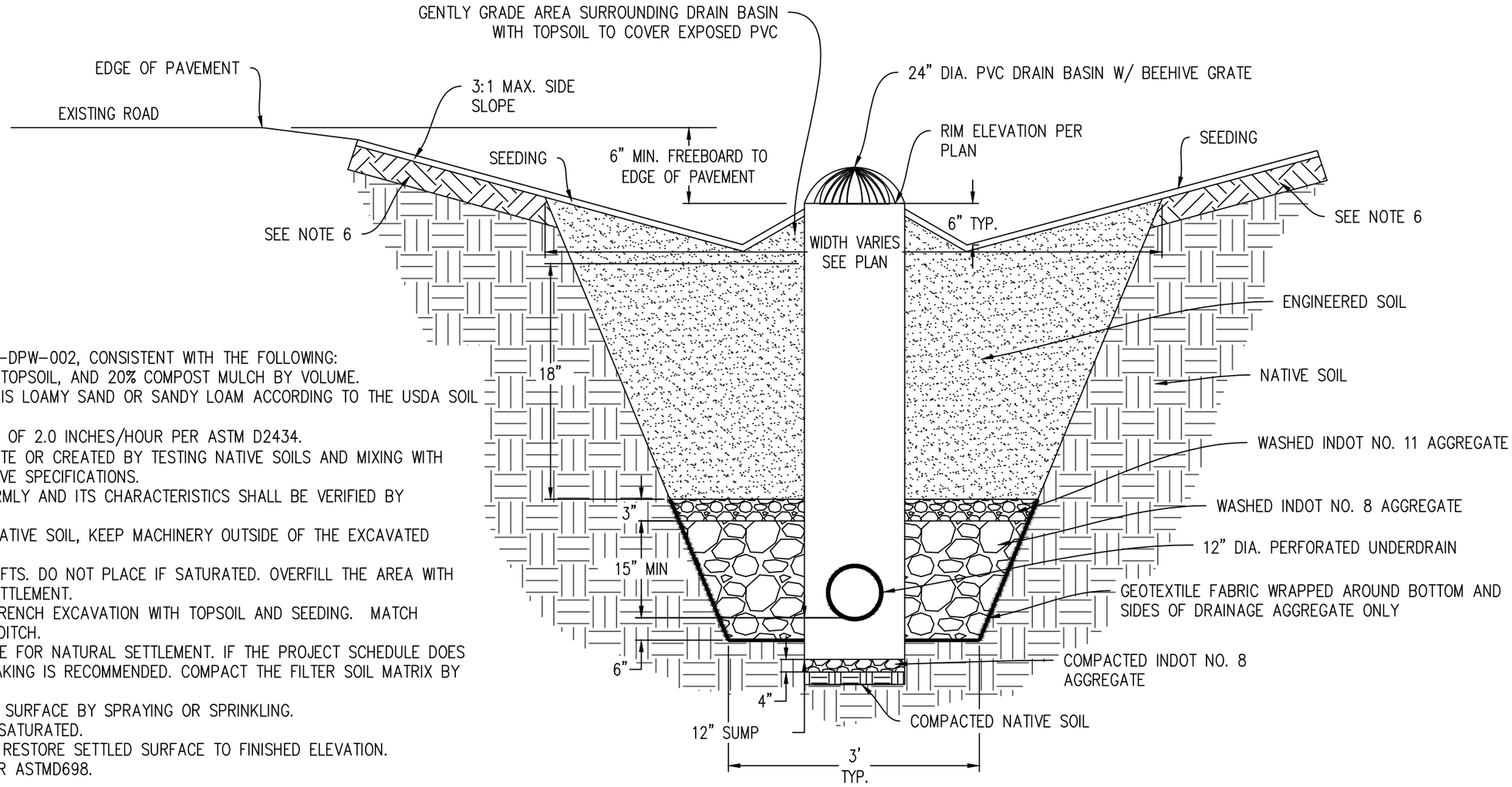
19) Click the Save icon



APPENDIX A

For reference only, see DPW website for latest revisions

DPW Standard Details for Hybrid Ditch Systems (Rev. October 2021)

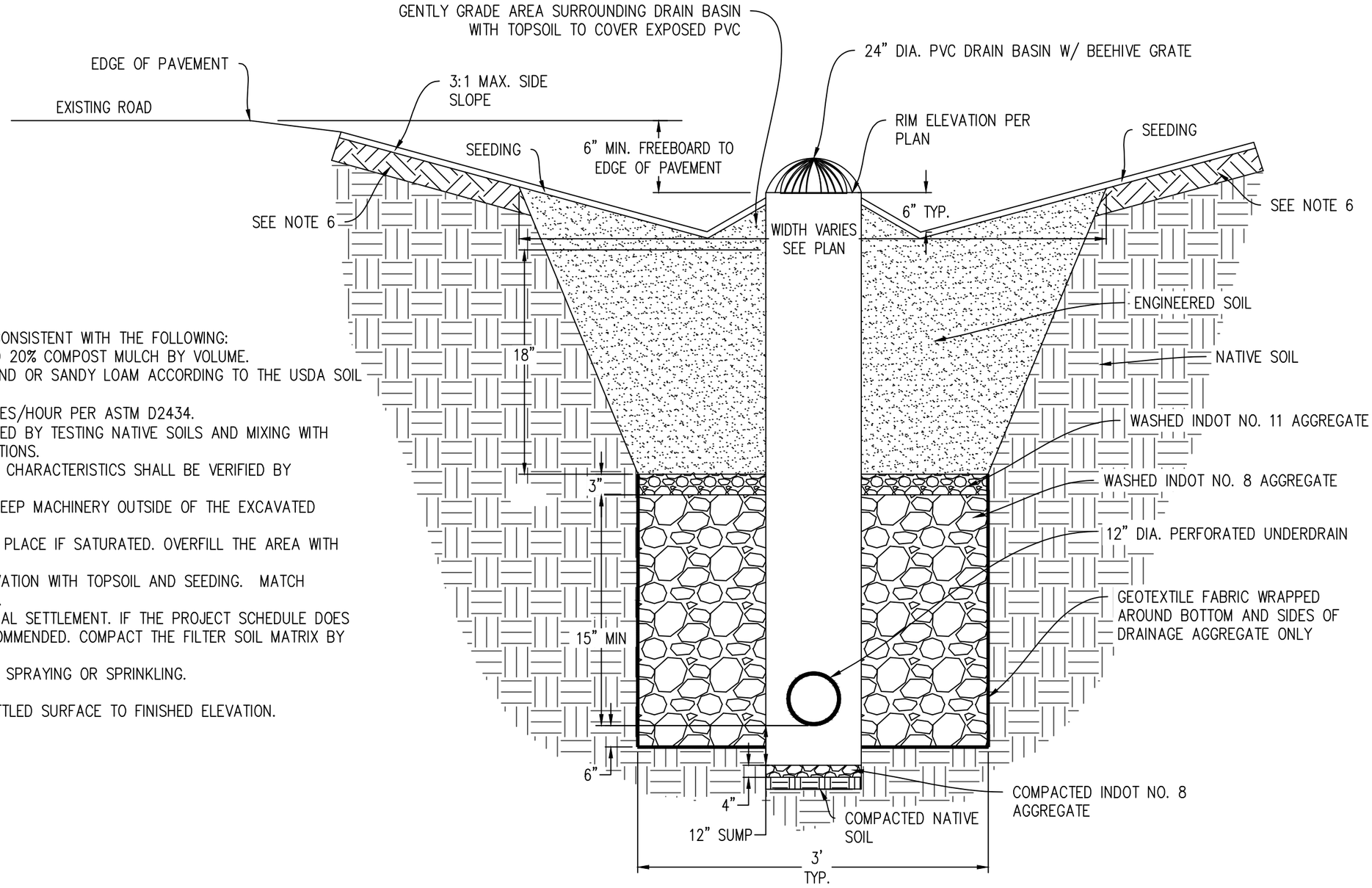


ENGINEERED SOIL SPECIFICATION

1. ENGINEERED SOIL MIX WILL ADHERE TO 621-DPW-002, CONSISTENT WITH THE FOLLOWING:
   A. 60% WASHED INDOT NO. 23 SAND, 20% TOPSOIL, AND 20% COMPOST MULCH BY VOLUME.
   B. THE TEXTURE OF THE ENGINEERED SOIL IS LOAMY SAND OR SANDY LOAM ACCORDING TO THE USDA SOIL CLASSIFICATION SYSTEM.
   C. MINIMUM LONG-TERM INFILTRATION RATE OF 2.0 INCHES/HOUR PER ASTM D2434.
2. ENGINEERED SOIL MAY BE OBTAINED OFF SITE OR CREATED BY TESTING NATIVE SOILS AND MIXING WITH IMPORTED MATERIALS AS NEEDED TO ACHIEVE SPECIFICATIONS.
3. ENGINEERED SOIL SHOULD BE MIXED UNIFORMLY AND ITS CHARACTERISTICS SHALL BE VERIFIED BY MATERIALS TESTING PRIOR TO PLACEMENT.
4. TO PRESERVE INFILTRATION CAPACITY OF NATIVE SOIL, KEEP MACHINERY OUTSIDE OF THE EXCAVATED HYBRID DITCH AREA.
5. PLACE UNSATURATED SOIL IN 8-12 INCH LIFTS. DO NOT PLACE IF SATURATED. OVERFILL THE AREA WITH ENGINEERED SOIL BY 5% TO ALLOW FOR SETTLEMENT.
6. RESTORE DISTURBED AREAS BEYOND THE TRENCH EXCAVATION WITH TOPSOIL AND SEEDING. MATCH GRADES AND PROVIDE POSITIVE SLOPE TO DITCH.
7. AVOID OVER COMPACTION BY ALLOWING TIME FOR NATURAL SETTLEMENT. IF THE PROJECT SCHEDULE DOES NOT ALLOW FOR THIS, COMPACTION BY SOAKING IS RECOMMENDED. COMPACT THE FILTER SOIL MATRIX BY SOAKING AS DESCRIBED BELOW:
   A. APPLY WATER TO UNIFORMLY SATURATE SURFACE BY SPRAYING OR SPRINKLING.
   B. ENSURE ENTIRE HYBRID DITCH AREA IS SATURATED.
   C. ADD ENGINEERED SOIL AS REQUIRED TO RESTORE SETTLED SURFACE TO FINISHED ELEVATION.
   D. COMPACT TO 85% MAXIMUM DENSITY PER ASTMD698.

HYBRID DITCH TYPICAL SECTION UP TO 5' DEPTH

Scale: NONE



HYBRID DITCH TYPICAL SECTION > 5' DEPTH

Scale: NONE

ENGINEERED SOIL SPECIFICATION

1. ENGINEERED SOIL MIX WILL ADHERE TO 621-DPW-002, CONSISTENT WITH THE FOLLOWING:
   A. 60% WASHED INDOT NO. 23 SAND, 20% TOPSOIL, AND 20% COMPOST MULCH BY VOLUME.
   B. THE TEXTURE OF THE ENGINEERED SOIL IS LOAMY SAND OR SANDY LOAM ACCORDING TO THE USDA SOIL CLASSIFICATION SYSTEM.
   C. MINIMUM LONG-TERM INFILTRATION RATE OF 2.0 INCHES/HOUR PER ASTM D2434.
2. ENGINEERED SOIL MAY BE OBTAINED OFF SITE OR CREATED BY TESTING NATIVE SOILS AND MIXING WITH IMPORTED MATERIALS AS NEEDED TO ACHIEVE SPECIFICATIONS.
3. ENGINEERED SOIL SHOULD BE MIXED UNIFORMLY AND ITS CHARACTERISTICS SHALL BE VERIFIED BY MATERIALS TESTING PRIOR TO PLACEMENT.
4. TO PRESERVE INFILTRATION CAPACITY OF NATIVE SOIL, KEEP MACHINERY OUTSIDE OF THE EXCAVATED HYBRID DITCH AREA.
5. PLACE UNSATURATED SOIL IN 8-12 INCH LIFTS. DO NOT PLACE IF SATURATED. OVERFILL THE AREA WITH ENGINEERED SOIL BY 5% TO ALLOW FOR SETTLEMENT.
6. RESTORE DISTURBED AREAS BEYOND THE TRENCH EXCAVATION WITH TOPSOIL AND SEEDING. MATCH GRADES AND PROVIDE POSITIVE SLOPE TO HYBRID DITCH.
7. AVOID OVER COMPACTION BY ALLOWING TIME FOR NATURAL SETTLEMENT. IF THE PROJECT SCHEDULE DOES NOT ALLOW FOR THIS, COMPACTION BY SOAKING IS RECOMMENDED. COMPACT THE FILTER SOIL MATRIX BY SOAKING AS DESCRIBED BELOW:
   A. APPLY WATER TO UNIFORMLY SATURATE SURFACE BY SPRAYING OR SPRINKLING.
   B. ENSURE ENTIRE HYBRID DITCH AREA IS SATURATED.
   C. ADD ENGINEERED SOIL AS REQUIRED TO RESTORE SETTLED SURFACE TO FINISHED ELEVATION.
   D. COMPACT TO 85% MAXIMUM DENSITY PER ASTMD698.

APPENDIX B

For reference only, see DPW website for latest revisions

DPW Technical Specification for Engineered Soil, 621-DPW-002 (Rev. October 2021)
DPW Technical Specification for Hybrid Ditch, 715-DPW-003 (Rev. October 2021)

621-DPW-002 SOIL, ENGINEERED

Description: This work shall consist of providing and placing Engineered Soil for the purpose of constructing the bioretention indicated on the plans. This work shall include the preservation from injury or defacement of all vegetation and objects designated to remain.

Materials: Engineered Soil shall consist of the following components, mixed by the Supplier prior to delivery to the project site:

1) 20% Topsoil (INDOT 914.01)
2) 60% Coarse Sand (INDOT 903.01)
3) 20% Compost Mulch (INDOT 914.05)

General Requirements: Engineered soil shall be protected from all sources of additional moisture at the Supplier, in covered conveyance, and at the Project Site until incorporated into the Work. Soil placement and compaction will not be allowed when the ground is frozen or excessively wet, or when the weather is too wet.

Submittals:

1) Supplier's Certificate verifying contents of mixed Bioretention Soil.
2) Modified Proctor compaction testing of mixed Bioretention Soil, performed in accordance with ASTM D 1557

Construction Requirements:

At the locations shown on the Drawings, excavate, grade, and shape to the contours indicated to accommodate placing of Engineered Soil to the thicknesses required. Dispose of excavated soil or reuse elsewhere as the Contract or Engineer will allow. Scarify the subgrade soil a minimum of 2 inches deep where slopes allow, as determined by the Engineer prior to placing Engineered Soil.

Mixing or placing Engineered Soil will not be allowed if the area receiving Engineered soil is wet or saturated or has been subjected to more than ½-inch of precipitation within 48-hours prior to mixing or placement.

Engineer shall have final authority to determine if wet or saturated conditions exist. Place Engineered Soil in loose lifts not exceeding 6 inches.

Compact Engineered Soil to a relative compaction of 85 percent of Modified maximum dry density (ASTM D 1557).

Method of Measurement: Measurement for Engineered Soil will be by the cubic yard.

Basis of Payment: The accepted quantity of engineered soil will be paid for at the contract unit price per cubic yard.

Payment will be made under:

Pay Item	Pay Unit Symbol
SOIL, ENGINEERED ……	CYS

The cost for all work necessary to furnish, place, compact, excavate, grade, shape, mix, dispose of, and necessary incidentals shall be included in the cost of this work.

715-DPW-003 HYBRID DITCH

Description

This work shall consist of the construction of hybrid ditches in accordance with the general conditions, plans and these specifications.

Material

Materials shall be in accordance with the following:

Course Sand	903.01
Coarse Aggregate, Class E or Higher, Size No. 8	904
Coarse Aggregate, Size No.11	904
Geotextile for Underdrains	918.03
Compost	914.05
Topsoil	914.01

Pipe material shall be HDPE and/or PVC in accordance with the City of Indianapolis Storm Water Design and Construction Manual for Class I pipe and INDOT Standard Specifications for type 4 pipe.

Engineered soil shall be 20% topsoil, 60% coarse sand, and 20% compost mulch by volume. Topsoil shall consist of loose easily pulverized soil, free of debris, stumps, large roots, rocks over 1/2 inch in diameter, brush, weeds, or other material which would be detrimental to the proper development of vegetative growth. Topsoil shall have a pH value of 6.2 to 7.4. Compost shall be used to supplement topsoil for organic matter requirements.

Construction Requirements

Construction requirements shall be in accordance with the applicable sections of the City of Indianapolis Stormwater Design and Construction Specifications Manual and INDOT Standard Specifications.

Method of Measurement

Hybrid ditch, regardless of depth, will be measured by the linear foot, complete in place. Measurement will be made along the centerline of the perforated pipe from the centerline of structure to the centerline of structure. No deduction will be made for manholes, inlets, catch basins, street crossings, drive approaches or on street parking over the pipe.

Excavation above the trench bottom elevation shown on the plans will not be measured for payment. Additional excavation below the proposed trench bottom elevation required to install the pipe at a lower elevation or to remove rock or unsuitable material will be measured in accordance with 203.27(b)

Pipe will not be measured.

B-borrow will not be measured.

Engineered soil mix will not be measured.

Aggregate will not be measured.

Geotextile used to wrap backfill material will not be measured.

Basis of Payment

The acceptable quantities of hybrid ditch will be paid for at the contract unit price per linear foot of hybrid ditch complete in place regardless of depth.

Depth of hybrid ditch to be measured from overflow structure rim elevation to the invert of the discharge pipe.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Hybrid Ditch, Up To 5 FT Depth	LFT
Hybrid Ditch, Greater Than 5 FT Depth	LFT

The cost of all labor, equipment, excavation, backfill, transportation of materials, disposal of surplus materials required to furnish and install the hybrid ditch and all other necessary incidentals shall be included in the cost of the pay items.