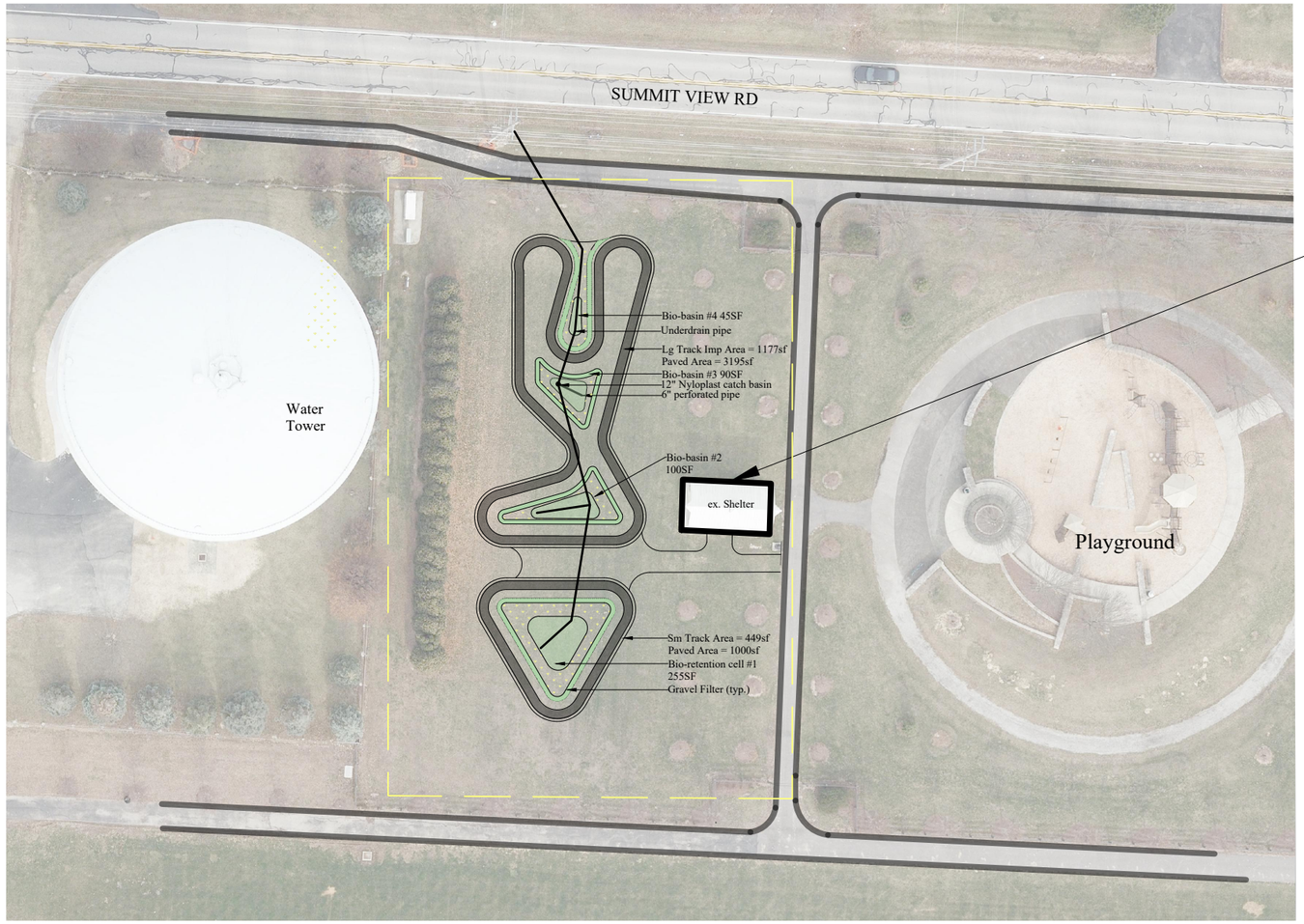
Emerald Fields Bicycle Pump Track

Parks & Recreation
City of Dublin, Ohio

Notes



Sheet Index

GRAPHIC SCALE

10 5 0 10 20

scale feet

SCALE: 1"=50'

CITY OF DUBLIN - Emerald Fields Bicycle Pump Track

Department of Parks and Recreation
City of Dublin

1 AUG 2021

Title

MJH

L 00

SUMMIT VIEW RD

938.5

940

942

941

Water Tower

Bio-basin #4 45SF
Underdrain pipe
Lg Track Imp Area = 1177sf
Paved Area = 3195sf
Bio-basin #3 90SF
12" Nyloplast catch basin
6" perforated pipe

Bio-basin #2
100SF

ex. Shelter

Sm Track Area = 449sf
Paved Area = 1000sf
Bio-retention cell #1
255SF
Gravel Filter (typ.)

Playground

GRAPHIC SCALE
10 5 0 10 20
scale feet
SCALE: 1"=30'

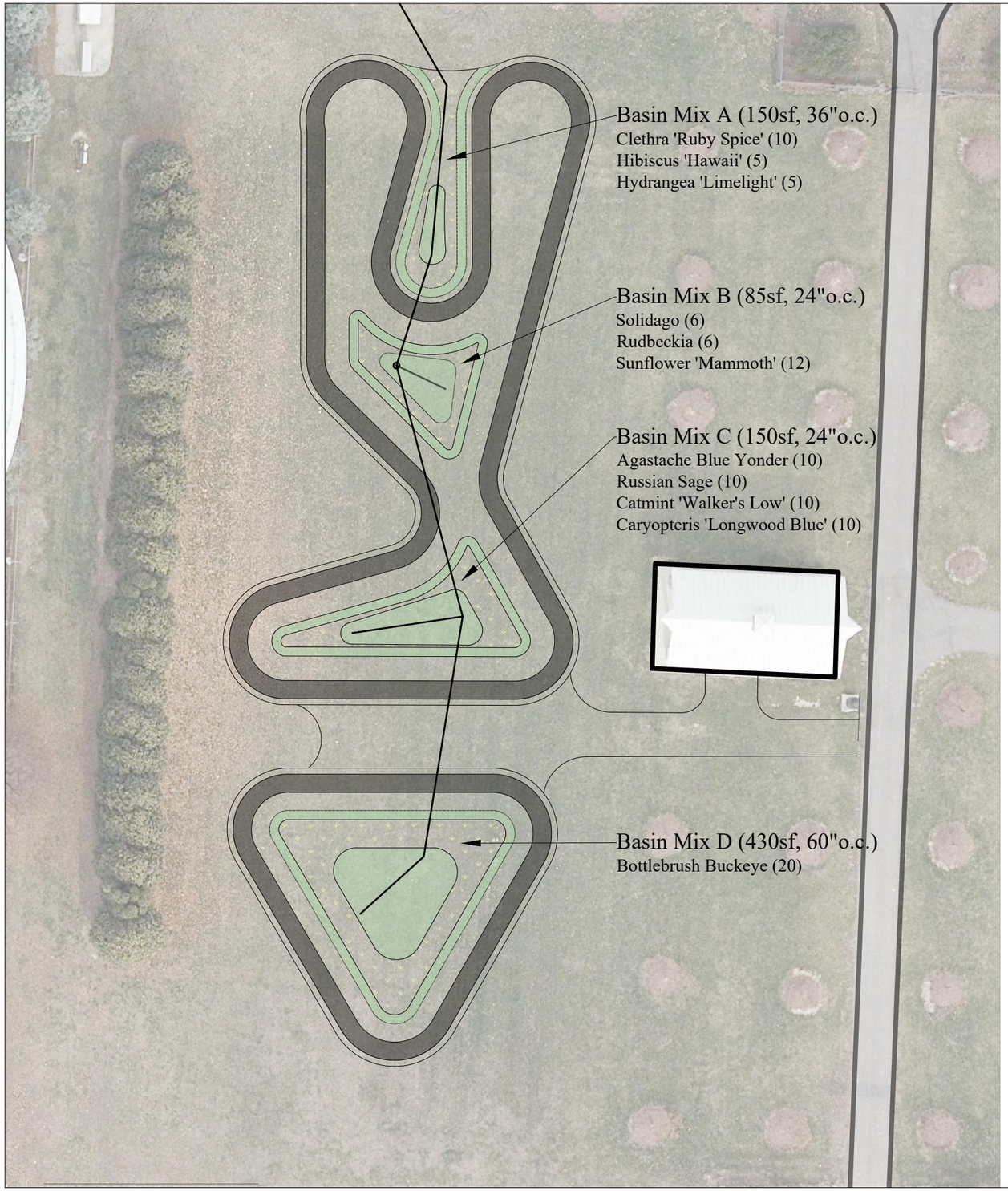
CITY OF DUBLIN - Emerald Fields Bicycle Pump Track

Department of Parks and Recreation
City of Dublin

1 AUG 2021

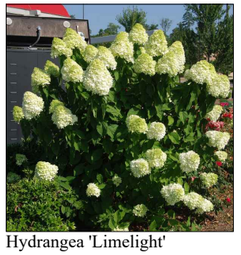
Drawn: MJH

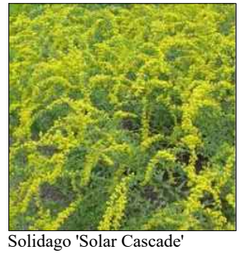
L 1.0 Grading




Clethra 'Ruby Spice'


Hibiscus 'Hawaii'


Hydrangea 'Limelight'


Solidago 'Solar Cascade'


Rudbeckia


Sunflower 'Mammoth'


Agastache 'Blue Yonder'


Russian Sage


Catmint 'Walker's Low'


Caryopteris 'Longwood Blue'


Bottlebrush Buckeye

GRAPHIC SCALE

10 5 0 10 20

scale feet

SCALE: 1"=30'

CITY OF DUBLIN - Emerald Fields Bicycle Pump Track

Department of Parks and Recreation
City of Dublin

1 AUG 2021

Drawn: MJH

L 2.0 Planting

July 26, 2021
2021085.04

Michael Hiatt
Parks & Recreation at City of Dublin
Landscape Designer
6555 Shier Rings Road
Dublin, Ohio 43016

Emerald Fields Modular Bike Pump Track | DRAFT Stormwater BMP Analysis

The City of Dublin is proposing to construct a Bike Pump Track at their Emerald Fields Metro Park. The construction will include converting an open space lawn area located off Summit Road near the City's water tower and the playground area into an active use recreational feature (**Figure 4**). GPD was contracted to assist the City of Dublin (City) with review and analysis of stormwater best management practices (BMPs) to be implemented in conjunction with the bike pump track. Stormwater calculations were performed in accordance with the *City of Dublin Stormwater Management Design Manual (v2019)*, *National Engineering Handbook Part 630*, and Ohio General Permit Ohio EPA General Permit for Construction Activities (OHC000005).

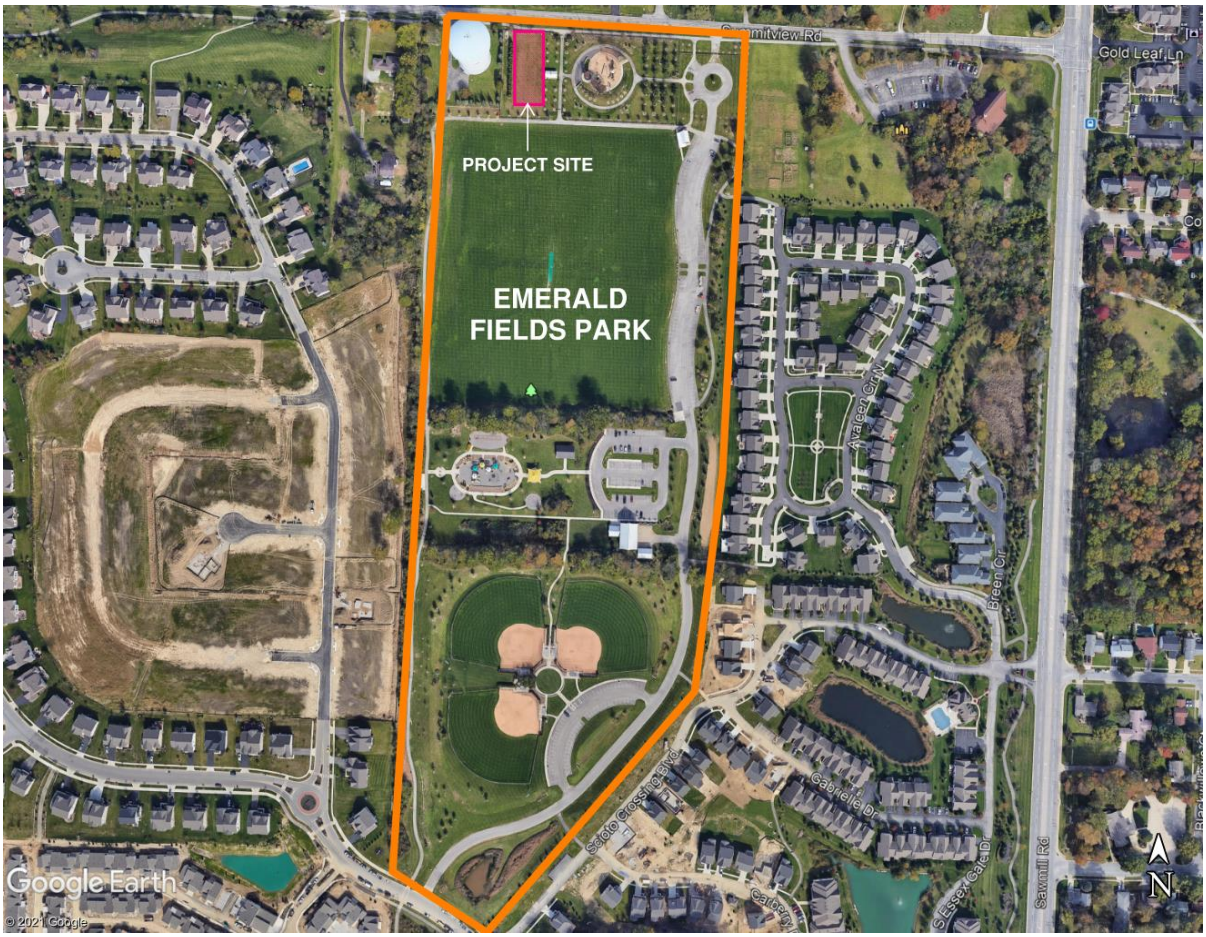


Figure 1. Project Location Map

Pre-Development Conditions

The project is located within Emerald Fields Park which totals 34.18-acres. The Park features various amenities, including a playground, baseball fields, walking paths, parking, etc. An open field near the north end of the park off Summit View Road was selected as the project site. According to USDA Web Soil Survey, this area consists of Blount and Glenwood soils, which have a hydraulic soils group (HSG) rating of "D" (see **Figure 2**) which indicates the presence of soils with very little infiltration capacity.

Figure 2. Soil Data

Land use maps provided on the City's Zoning Map & GIS website indicated this was an urban development area classified as open space for recreational use. Therefore, this site was assumed to meet the criteria for open space, in "good condition", grass area exceeding 75-percent. Using NEH Part 630 Table 9-5, the curve number (CN) for the pre-developed site equals 80.

A review of the City's Stormwater Management drainage maps indicates this area is within the Billingsley Creek sub-watershed and outside of any flood zone. According to the website, the City has allocated allowable discharge rates to each sub-basin that has allowed them to maintain or improve stream bank erosion, deficient storm sewers, culvert overtopping or structural flooding in this area.

The existing condition basemap was compiled from LiDAR information obtained from the Ohio Geographically Referenced Information Program (OGRIP). Data was imported and processed using AutoCAD Civil 3D 2020 software. Slope over the project area was approximately 1.18-percent. Drainage area was delineated using the watershed assessment tool within the software with minor modifications based on best engineering judgement. Based on this information it was determined that the total drainage area for this site is approximately 0.5-acres (see **Figure 3**), with no off-site areas contributing.

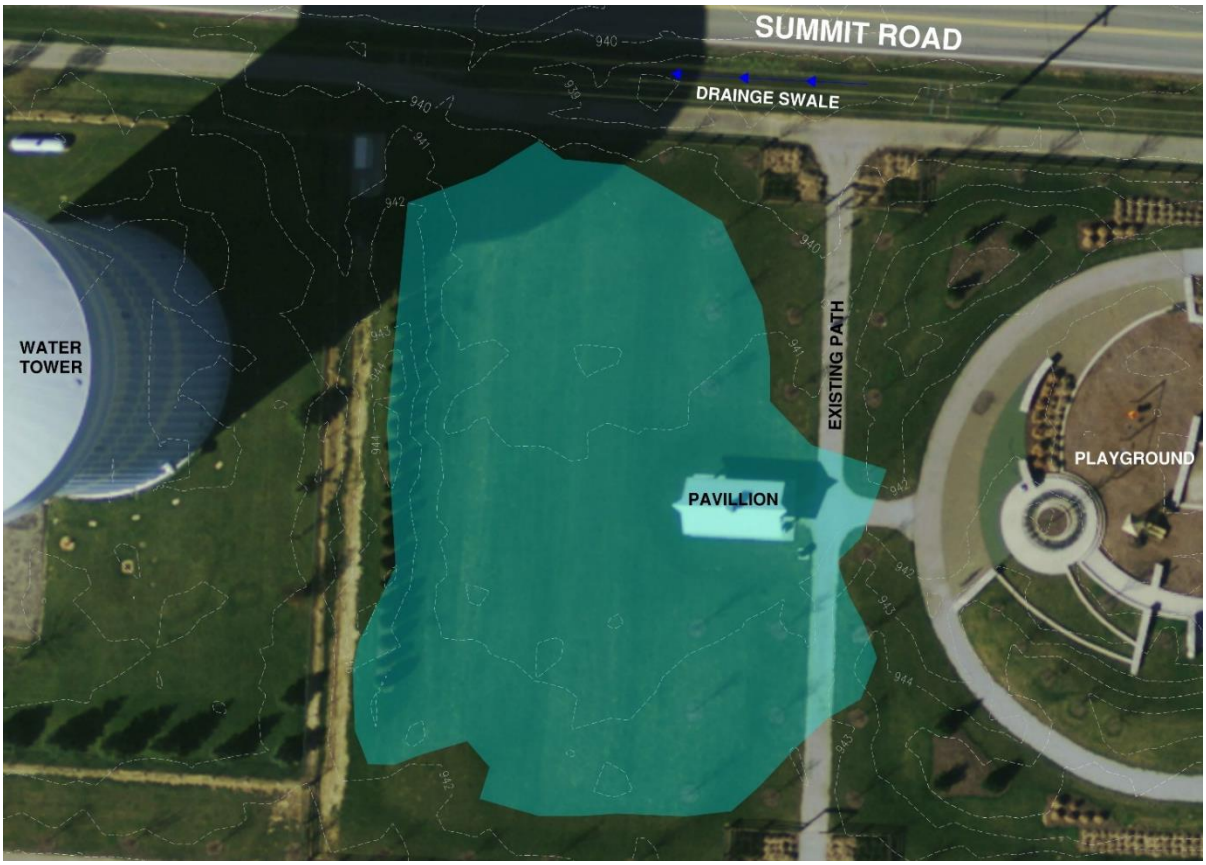


Figure 3. Drainage Area

Proposed Post-Development Conditions

The proposed bike pump track facility will impact approximately 0.15-acres of green space, adding 0.04-acres of impervious surface for the bike track and 0.11-acres of pervious asphalt pavement (see **Figure 4**). A composite CN was developed for post-development conditions using **Equation 1** (NEH Part 630 Eqn. 9-1). Impervious surfaces include those areas within the entire drainage area and excluded pervious surfaces (i.e., pervious pavement and vegetated areas). Based on this equation, the post-development CN equals 82.

$$CN_C = CN_P + \left(\frac{P_{imp}}{100}\right)(98 - CN_P) \quad Eqn.1$$

where: P = *Percent impervious (in)*
CN_p = *Pervious Run-off Curve Number*
CN_c = *Composite Run-off Curve Number*

According to the *City of Dublin's Stormwater Management Design Manual*, post-development run-off volume shall be compared to the 1-yr pre-development run-off volume to determine the Critical Storm. The run-off to Billingsley Creeks has been maintained at or less than the pre-developed run-off rates for this sub-watershed since this area was previously developed. Disturbances associated with this project are assumed minimal. No additional storage volume was accounted for when sizing the BMP as notation in the provided AutoCAD files indicated that stormwater management had already been provided for the area.

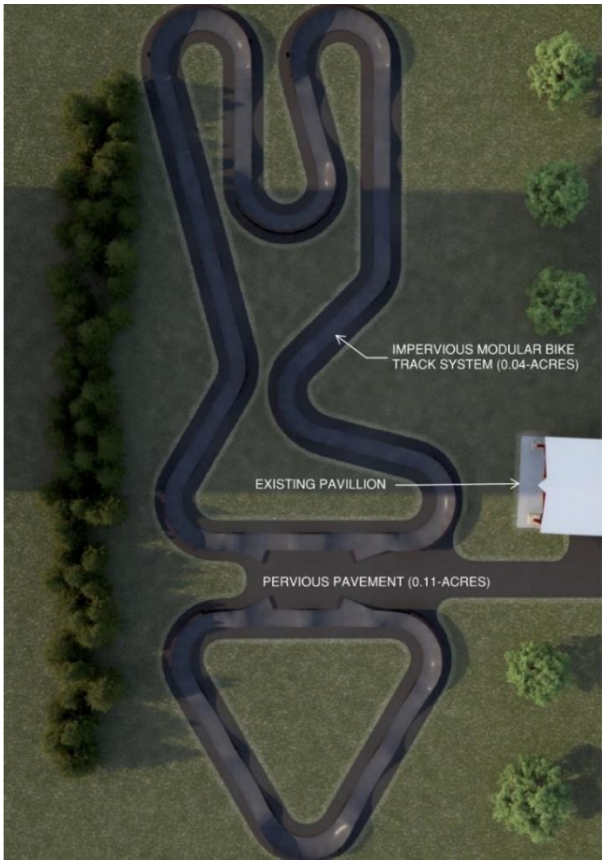


Figure 4. Proposed Site Plan

BMP Calculations and Analysis

It should be noted that the calculations and values equated to meet site requirements are based on a preliminary design and may be subject to change as the design is modified to meet site specific requirements.

WQ_v Requirements

The water quality volume is based on a depth of rainfall of 0.9-inches based on the latest Ohio EPA General Permit for Construction Activities (OHC000005). As mentioned above, site analysis indicated a total contributing drainage area of 0.5-acres. Given proposed and existing site conditions the total impervious surface area equaled 0.05-acres. This includes the existing pavilion and asphalt path, as well as the bike pump track but excluded proposed pervious surfaces such as the pervious asphalt pavement. These values were inputted into **Equations 2 through 4** shown below to obtain a required total water quality volume (WQ_V) equal to **229-cubic feet**.

$$WQ_V = \frac{PR_V A_d}{12} \; Eqn. 2$$

$$R_V = 0.05 + 0.9i \; Eqn. 3 \qquad i = \frac{A_i}{A_d} \; Eqn. 4$$

where: P = *Depth of Rainfall (in)*
RV = *Runoff Coefficient*
i = *Percent Impervious*
Ai = *Impervious Area (acres)*
Ad = *Drainage Area (acres)*

BMP Sizing

Per the latest *Ohio EPA General Construction Permit* a BMP should be sized to account for a 20-percent volume reduction due sediment accumulation over its lifecycle. Therefore, **275-cubic feet** of storage would be required. Filter bed area and total BMP area were calculated using various ponding depths,

assuming a minimum free board of 0.5-feet and a 4:1 tie-out slope. Proposed designated BMP areas will utilize approximately 1,900-square feet of space confined to the inner track area. The calculated sizes were implemented in accordance with *Ohio Rainwater and Land Development Manual* which has a suggested length to width ratio equal to 2:1 for the pond area and a minimum width of 10-feet. **Table 1** presented below summarizes sizing calculations.

Table 1. BMP Sizing and Filter Bed Area

Ponding Depth* (FT)	Filter Bed Area (SF)	Width (FT)	Length (FT)	BMP Area (SF)
0.5	458	15	30	1,134
1.0	229	10.5	21	980.5

*0.5-feet recommended to minimize impacts to permeable asphalt based on current design.

Approximate elevations and depths for each of the proposed bioretention basin depths are provided in **Attachment B**. Please note that the elevations are based on LiDAR and should be verified with field survey. Total storage volume through the entire system equated to 244-cubic feet, which exceeds WQ_v requirements. The rims of the overflow risers could be set 0.1-ft higher than the WQ elevation to provide the additional storage volume necessary for sediment storage. However, this site is primarily vegetated with and likely will have minimal sedimentation once complete. For that reason, the additional sediment storage volume may not be necessary. Per *Ohio Rainwater and Land Development Manual*, the ponding area is to draw down within 24-hours. If the proper planting media is installed, the bioretention cells will infiltrate much quicker than 24-hours.

Design Discharge

Per notation provided in the AutoCAD file provided by the City, it was assumed that stormwater management did not have to be accounted for as part of these design calculations. Therefore, no water quantity analysis was completed.

Design discharges are summarized in Table 2. Discharges are based on the 24-hour storm utilizing an SCS Type II distribution and the rainfall values provided in *Table 2-4* in the *City of Dublin Stormwater Management Design Manual*. As mentioned previously in the report, the pre-development CN is 80 and the post-development CN is 82. As the site is small, a time of concentration of 10-minutes was assumed for both the pre and post-developed conditions. The peak flow calculations are provided in **Attachment B**.

Table 2. Design Discharge Rates

Storm Event	Q_{pre} (cfs)	q_{post} (cfs)
1	0.48	0.56
2	**0.70**	**0.78**
5	1.03	1.13
10	1.32	1.43
25	1.74	1.86
50	2.10	2.23
100	2.48	2.61

Flow and Drainage Calculations

Flow calculations were performed assuming an "in-line" system when the underdrain outlet is free draining and not subject to tailwater conditions (i.e., underdrain outlet would be fully or partially submerged). It should be noted that to accommodate the shallow slope and elevation drop over the entire project area, upturn elbows within the bioretention cells will likely be required.

Underdrain System

Equation 5 was used to confirm that a 6-inch perforated pipe would suffice as the underdrain within the filter bed media. Total length of perforated underdrain pipe assumed for the project is 50-ft. Based on that length and a 6-inch perforated pipe with an open area equal to minimum 0.0072-square feet per foot , the proposed underdrain system can handle approximately 1.3-cfs. Therefore, a 6-inch perforated pipe is recommended.

$$Q = LBC_d A\sqrt{2gh} \quad Eqn.5$$

where: L = *Length of perforated pipe (ft)*
B = *Clogging factor (0.5 used for matured installation)*
C_d = *Coefficient of discharge (typ. 0.61)*
A = *Total open area per unit length of pipe (ft^2/ft)*
g = *acceleration due to gravity (ft/s^2)*
h = *Total head of water within bioretention components over the perforated pipe (ft)*

Conveyance Piping

Pipe size was determined based on the allowable design discharge rate, area of pipe and **Equation 6**. Slope was determined over the entire length of pipe to 0.005-feet per foot based on the required basin elevations shown in **Attachment B**. A Manning N-value of 0.013 was used for a smooth pipe. Calculations indicate that a 12-inch diameter pipe would have 2.52-cfs capacity at a velocity of 3.2-fps, which is in excess of the 100-year storm. Dublin requires the minimum inside diameter of storm sewers be 12-inches.

$$v = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \quad Eqn.6$$

where: v = *Velocity (fps)*
s = *Slope (ft/ft)*
r = *Hydraulic Radius (ft)*
n = *Manning N-value*

Overflow Structures

To accommodate the conveyance piping, it is recommended that two 12-inch Nyloplast, or equivalent, structures be strategically placed within Basin 1 and 3. Elevations should be set a few inches below the elevation of the bike track. The overflow structures will allow flows in excess of the BMPs capacity to be routed to the drainage swale that runs along Summit View Road.

Design Layout and Details

To implement a bioretention basin on-site the *Ohio Rainwater and Land Development Manual* suggests a minimum head loss of 3.5-feet over the entire site. Assuming an end elevation of 938.5-feet (NAVD88), top of filter bed media would need to set at an elevation of 942-feet (NAVD88). LiDAR data indicates that the maximum elevation near the south end of the proposed bike track is approximately 942. The calculations presented herein assume the site will have four bioretention cells. To meet head loss requirements the given elevation shall apply to the upstream basin. Estimated elevations and pipe invert information is provided in **Attachment B**.

Pipe alignment has been modified to accommodate optimal perforated underdrain locations and overflow structures. Overall BMP area was confined based on the given limits of the bike pump track system and extent of pervious pavement indicated in the provided AutoCAD files. It should be noted that the *Rainwater and Land Development* manual recommends stormwater be pretreated before it is conveyed to the bioretention cells. Recommended pretreatment options area not feasible at this site due to the small area. Given the low-impact that this project is anticipated to have and the short travel distance of stormwater over impervious surface, pretreatment may be optional. However, layout shows an optional gravel filter strip to help dissipate flow and capture some sediment before flow is conveyed to the bioretention cells. Landscaping within the bioretention cell should be restricted to plants capable of withstanding full sun and frequent inundation within the filter bed area and grass or low lying ground cover along the banks. See **Attachment A** for layout and details.

Should you have any further questions or concerns feel free to email reply or follow up directly via phone.

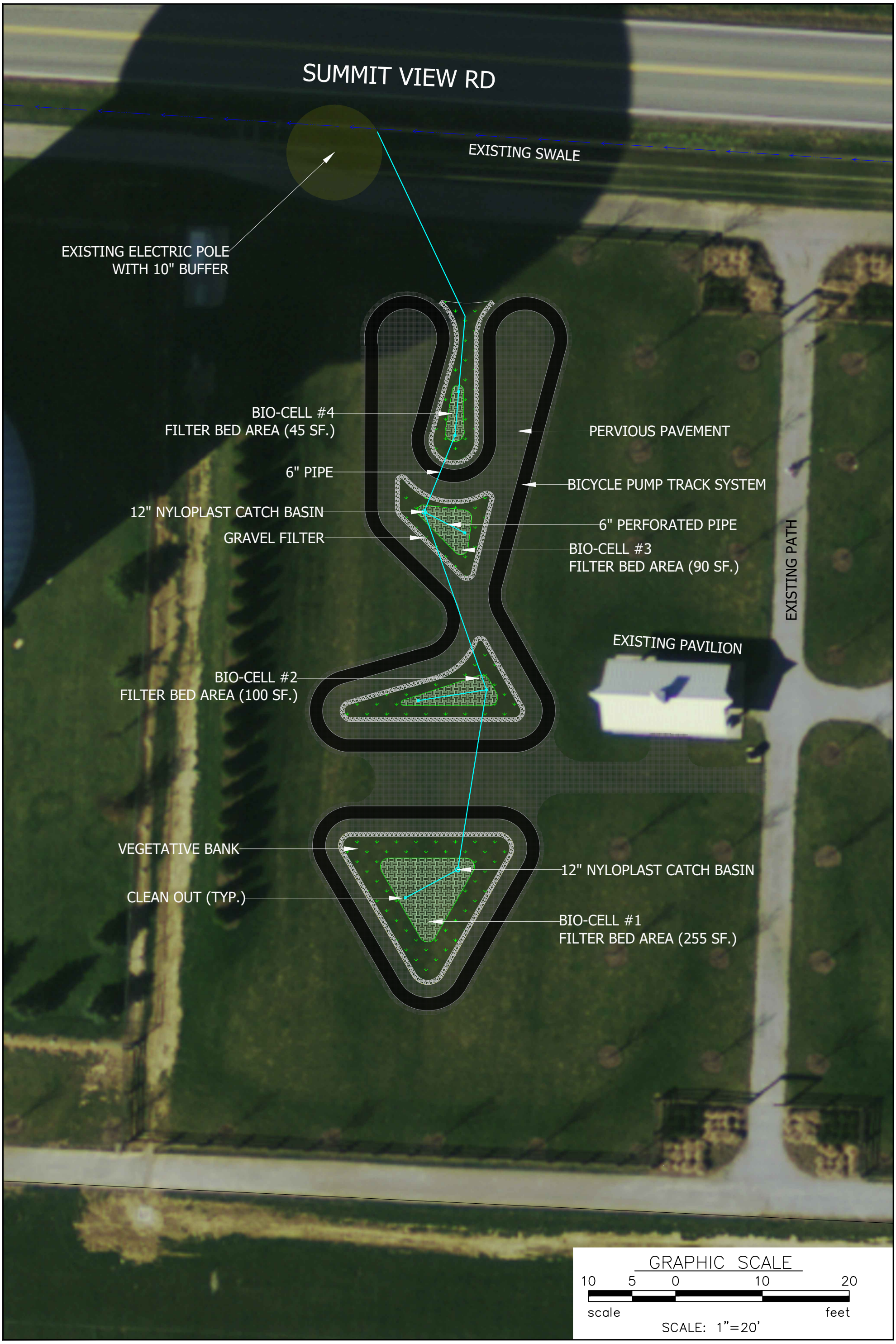
Sincerely,

GPD Group

Angela Short, PLA
Project Manager

Jesse Rufener, PE, CFM
Task Lead / Project Manager

Attachment A



N	JKL (GPD)	PLAN-1		2021 07 21

CITY OF DUBLIN - Emerald Fields Bicycle Pump Track Site

Department of Parks and Recreation
City of Dublin

BIORETENTION NOTES:

1. PLANTING BIORETENTION SOIL MEDIA ATTRIBUTES:

   1.1. TEXTURE CLASS: LOAMY SAND HAVING NO LESS THAN 80% SAND AND NO GREATER THAN 10% CLAY CONSIDERING ONLY THE MINERAL FRACTION OF THE SOIL

   1.2. PH RANGE: 5.2 - 7.0

   1.3. SOLUBLE SALTS: 500 PPM (MAXIMUM)

   1.4. DECOMPOSED ORGANIC MATTER: 3 - 5% (BY WEIGHT)

   1.5. PHOSPHOROUS: < 30 MG/KG AS DETERMINED BY THE MEHLICH III TEST

   1.6. SAND: SHALL BE CLEAN AND MEET AASHTO M-6 OR ASTM C-33 WITH GRAIN SIZE OF 0.02 - 0.04"

   1.7. TO MEET THE ABOVE SOIL MEDIA CRITIERIA THE FOLLOWING MIX (BY VOLUME) IS RECOMMENDED:

      SAND: 7.5 PARTS - CLEAN SAND

      NATIVE SOIL: 1.5 PART - LOAM, SILT LOAM OR CLAY LOAM TEXTURE

      DECOMPOSED ORGANIC MATTER: 1 PART - LEAF COMPOST, PINE BARK FINES,MULCHES FINES ETC.

2. FILTER LAYER 3" OF CLEAN CONCRETE SAND (ASTM C-33) OVER 3" OF #8 STONE

3. GRAVEL LAYER AND UNDERDRAIN SYSTEM GRAVEL BED SHALL CONSISTS OF #57 WASHED STONE

BIORETENTION CONSTRUCTION NOTES:

1. TIMING OF CONSTRUCTION: CONSTRUCTION SHALL TAKE PLACE AFTER LAND GRADING IS COMPLETE AND THE CONTRIBUTING DRAINAGE AREA HAS BEEN STABILIZED TO THE SATISFACTION OF THE ENGINEER.

2. CONTRACTOR SHALL ADHERE TO THE FOLLOWING RESTRICTIONS:

   2.1. CONSTRUCTION SHALL NOT TAKE PLACE DURING PERIODS OF PRECIPITATION SINCE CLOGGING OF SOILS, BEDDING, FILTER OR PLANTING SOIL MAY OCCUR.
   2.2. CONSTRUCTED BIORETENTION CELL(S) SHALL NOT BE USED AS TEMPORARY SEDIMENT CONTROL FACILITIES DURING CONSTRUCTION.
   2.3. CONTRACTOR SHALL NOT OPERATE HEAVY EQUIPMENT WITHIN THE PERIMETER OF A BIORETENTION FACILITY DURING EXCAVATION, UNDERDRAIN PLACEMENT, BACKFILLING OR PLANTING OF THE FACILITY.

3. EXCAVATION, SOILS AND LINERS:
   3.1. EXCAVATE THE BIORETENTION CELL TO PLAN DIMENSIONS BEING CAREFUL TO PROTECT IN-SITU SOILS BY AVOIDING COMPACTION OF THE BIORETENTION CELL WITH EQUIPMENT AND FOOT TRAFFIC. MEET THE REQUIREMENTS SPECIFIED.
   3.2. DOCUMENTATION OF CERTIFICATION/TESTING SHALL BE AVAILABLE ON-SITE FOR INSPECTOR REVIEW. THE SOIL MEDIA SHALL BE PLACED IN 12" LIFTS AND LIGHTLY SETTLED BY GENTLE SOAKING WITH WATER. THE SOIL MEDIA SHALL BE INSTALLED 4" HIGHER THAN PROPOSED GRADE TO ALLOW FOR SETTLING.
   3.3. USE ALL SUITABLE EXCAVATED MATERIAL IN THE WORK. ALTERNATIVELY, LEGALLY USE, RECYCLE, OR DISPOSE OF ALL EXCAVATED MATERIALS ACCORDING TO ODOT CMS ITEMS 105.16 AND 105.17.

4. UNDERDRAIN SYSTEM:
   4.1. PLACE THE GRANULAR BACKFILL MATERIAL TO THE INVERT OF THE UNDERDRAIN. ENSURE A MINIMUM OF 3" OF GRANULAR COVER OVER THE UNDERDRAIN PRIOR TO PLACEMENT OF THE BIORETENTION SOIL

   4.2. PLACE OBSERVATION WELLS AND CLEANOUTS WHERE SHOWN IN THE PLANS. CONNECT THE WELLS/CLEANOUTS TO THE PERFORATED UNDERDRAIN WITH THE APPROPRIATE MANUFACTURED CONNECTIONS. THE WELLS/CLEANOUTS SHALL EXTEND 6 INCHES ABOVE THE TOP ELEVATION OF THE BIORETENTION FACILITY. CAP THE WELLS/CLEANOUTS WITH A THREADED SCREW CAP. CAP THE ENDS OF UNDERDRAIN PIPES NOT TERMINATING IN AN OBSERVATION WELL/CLEANOUT OR CONNECTED TO OTHER CONDUITS.

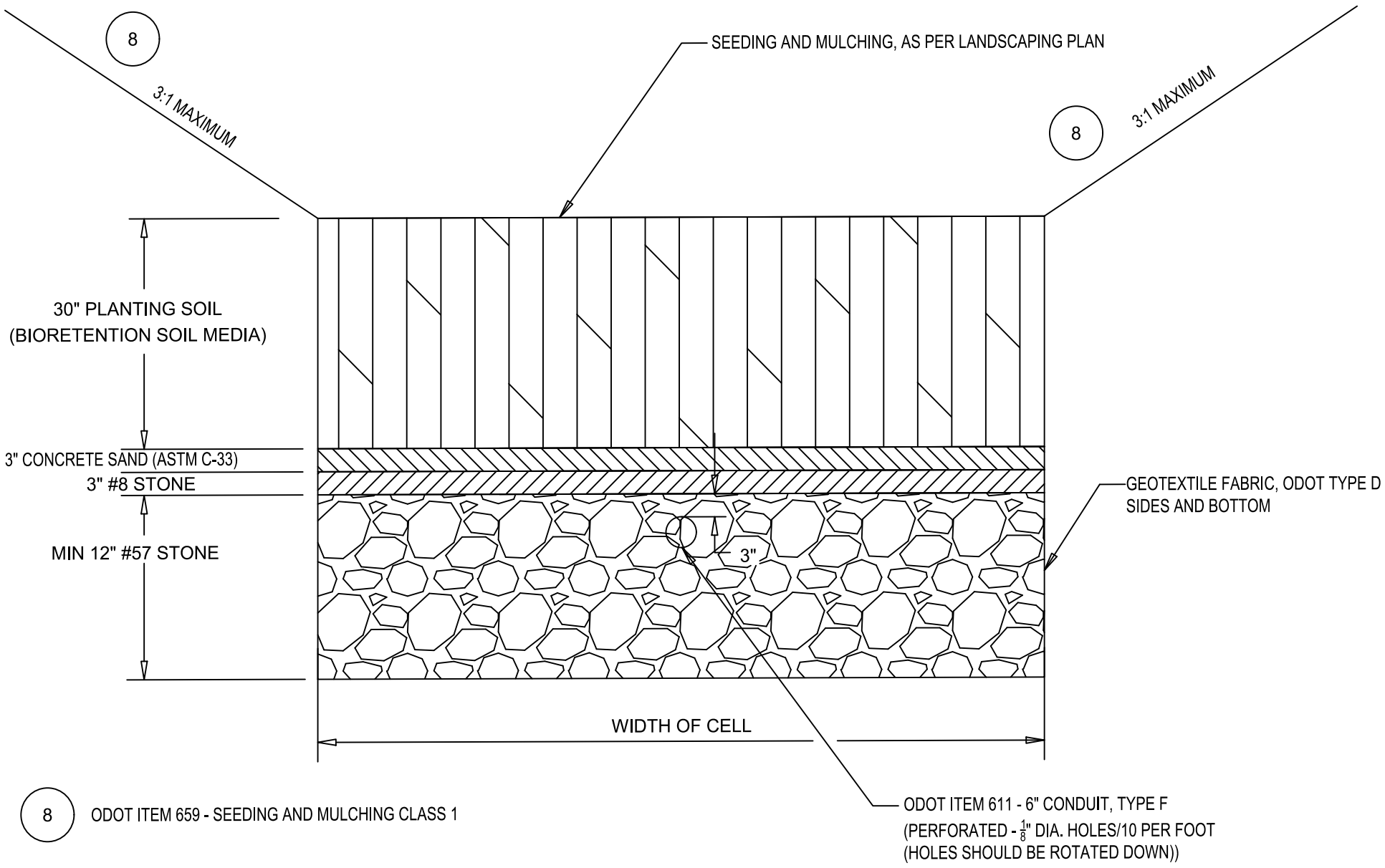
5. BIORETENTION CELLS WILL BE PAID FOR UNDER "POST-CONSTRUCTION BIORETENTION CELL - COMPLETE INCLUDING UNDERDRAINS" AT THE CONTRACT BID PRICE PER SF. THE PAYMENT WILL BE FULL COMPENSATION (EXCAVATION, GRAVEL/SAND, SOIL MEDIA, UNDERDRAINS, OBSERVATION/ CLEANOUTS, SEEDING AND MULCHING, TIED CONCRETE BLOCK MAT, TYPE 1, ETC...) FOR ALL APPLICABLE INCIDENTALS NECESSARY TO SATISFACTORILY COMPLETE THE WORK.

6. PLANTING SOIL:
   6.1. BIORENTENTION SOIL MEDIA SHALL BE A UNIFORM MIX THAT IS FREE OF STONES, STUMPS, ROOTS, OR ANY OTHER OBJECT THAT IS LARGER THAN TWO INCHES. THE SOIL MAY CONSIST OF EXISTING SOIL, FURNISHED SOIL, OR A COMBINATION OF BOTH PROVIDED THAT IT MEETS THE REQUIREMENTS AS SPECIFIED ABOVE.

   6.2. THOROUGHLY MIX THE BIORENTENTION SOIL MEDIA PRIOR TO PLACEMENT. TEST AND ADJUST THE PH AS NEEDED.

7. VEGETATION:
   7.1. PRETREATMENT AREAS/GRASS FILTER AREA SHALL BE SEEDED PER THE CONTRACT DOCUMENTS.
   7.2. THE SIDE SLOPES AND DITCHES SHALL BE WELL ESTABLISHED BEFORE CONSTRUCTION OF THE BIORETENTION CELLS BEGINS. THE MWCD/ENGINEER SHALL CONFIRM THAT THE SIDE SLOPES AND DITCHES HAVE NECESSARY ESTABLISHMENT TO BEGIN CONSTRUCTION OF THE CELL(S).
   7.3. NO PESTICIDES, HERBICIDES, AND/OR FERTILIZERS SHALL BE APPLIED DURING PLANTING, ESTABLISHMENT, OR MAINTENANCE, UNDER ANY CIRCUMSTANCES.

8. PLANT MATERIALS WILL BE MEASURED AND PAID FOR UNDER "BIORETENTION SEED MIX" AT THE CONTRACT BID PRICE PER SY.



BIORETENTION CELL CROSS SECTION

N.T.S.

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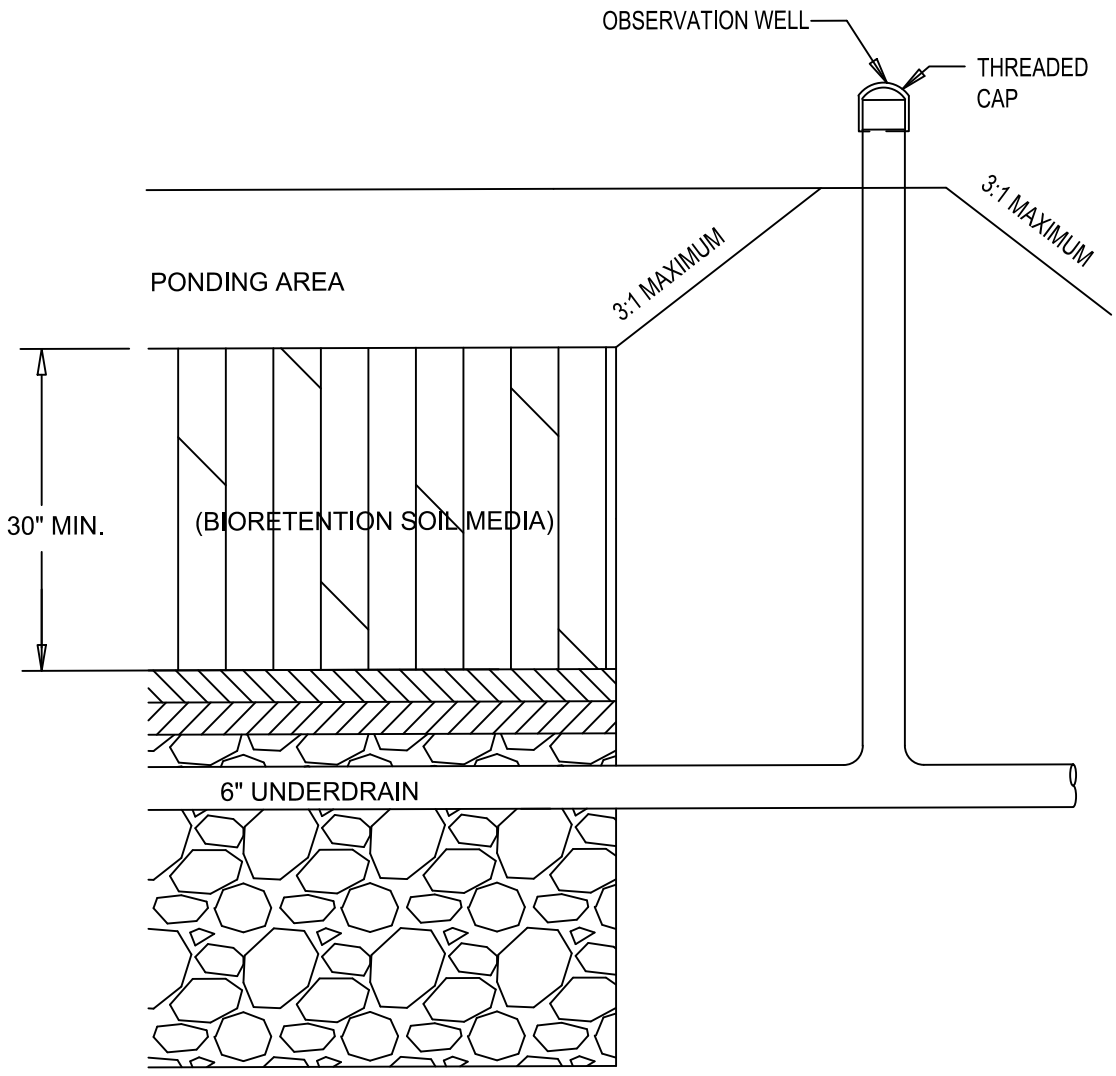

BIORETENTION OUTLET DETAIL

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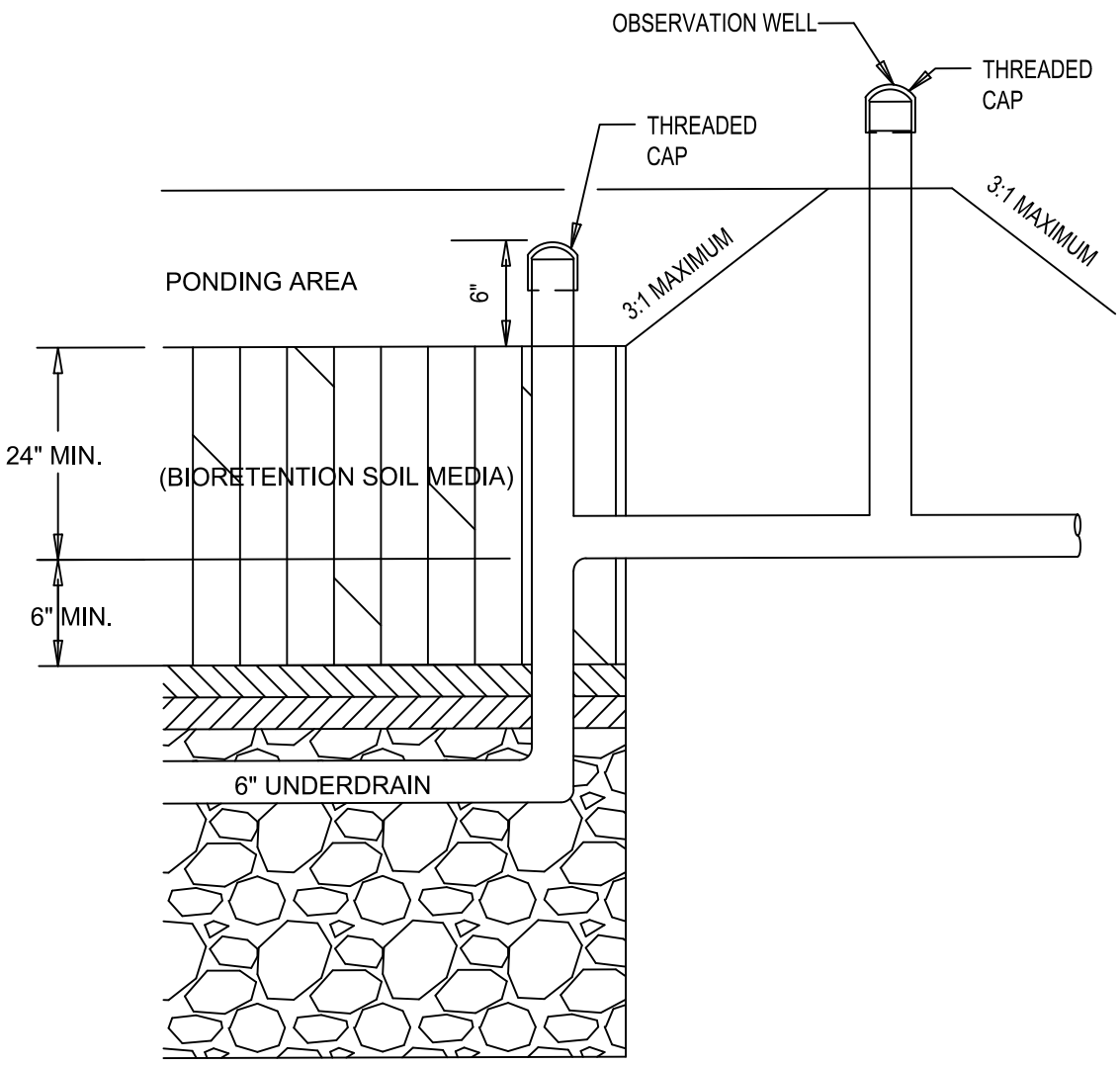

ALTERNATIVE BIORETENTION OUTLET DETAIL

N.T.S.

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JKL (GPD)

PLAN-1

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CITY OF DUBLIN - Emerald Fields Bicycle Pump Track Site

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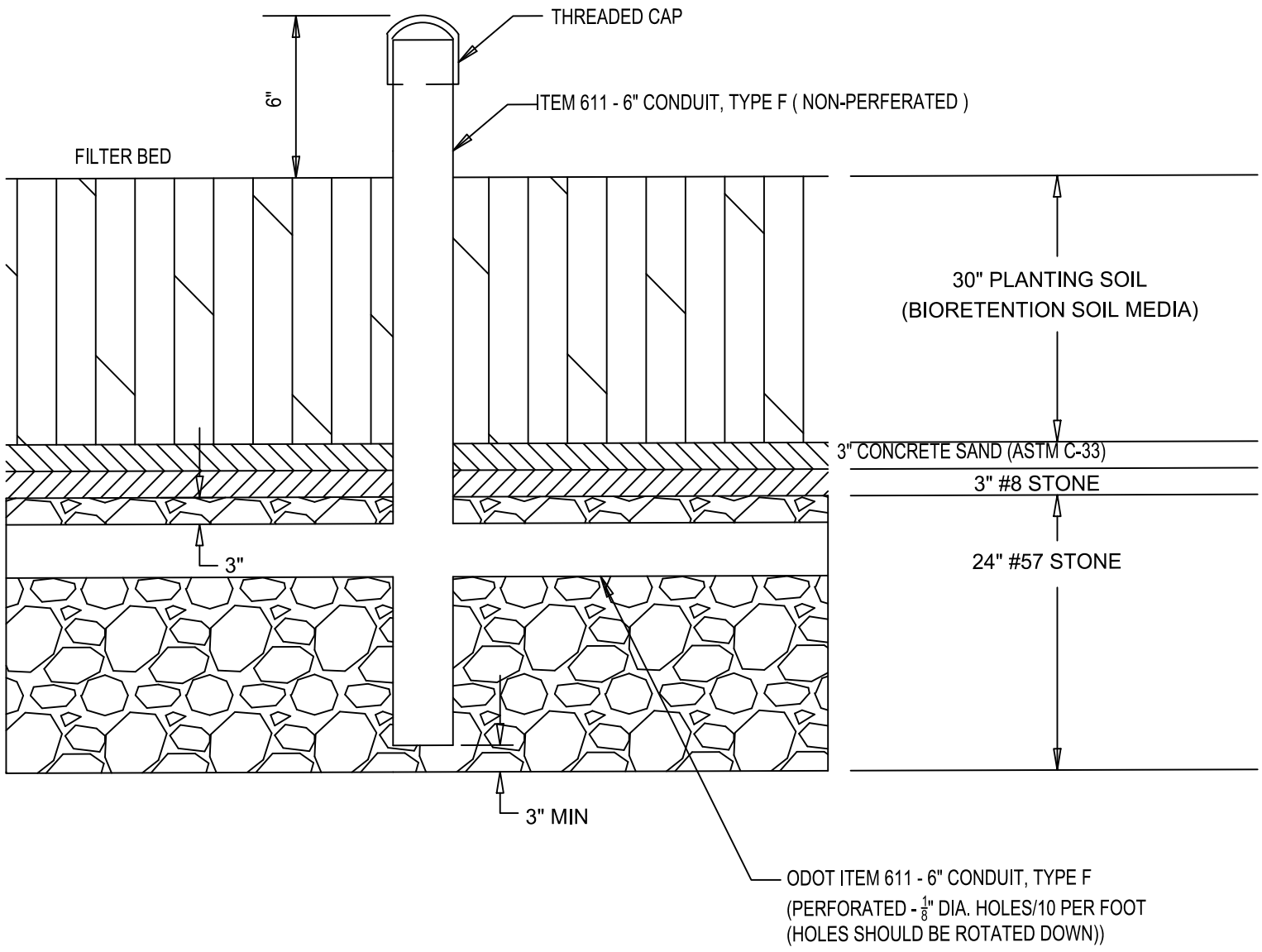
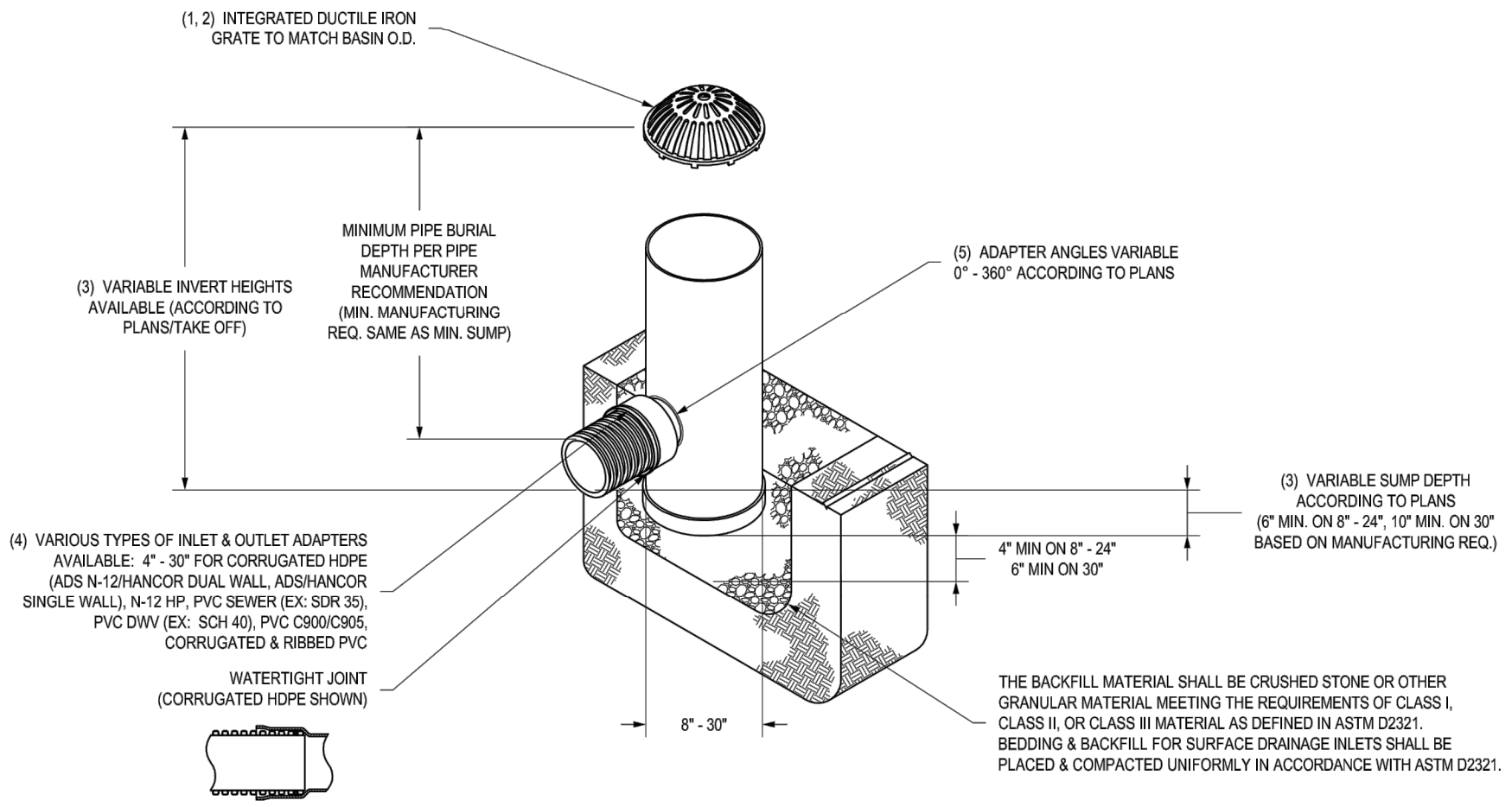
City of Dublin



BIORETENTION CELL GROUNDWATER OBSERVATION WELL/CLEAN-OUT

N.T.S.

NYLOPLAST DRAIN BASIN WITH DOME GRATE



1 - 8" - 30" DOME GRATES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05.
2 - 8" & 10" DOME GRATES FIT ONTO THE DRAIN BASINS WITH THE USE OF A PVC BODY TOP. SEE DRAWING NO. 7001-110-045.
3 - DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS. RISERS ARE NEEDED FOR BASINS OVER 84" DUE TO SHIPPING RESTRICTIONS. SEE DRAWING NO. 7001-110-065.
4 - DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS N-12/HANCOR DUAL WALL), N-12 HP, & PVC SEWER (4" - 24").
5 - ADAPTERS CAN BE MOUNTED ON ANY ANGLE 0° TO 360°. TO DETERMINE MINIMUM ANGLE BETWEEN ADAPTERS SEE DRAWING NO. 7001-110-012.
6 - 8" - 30" DOME GRATES HAVE NO LOAD RATING.

DRAWN BY EBC	MATERIAL	Nyloplast	3130 VERONA AVE BUFORD, GA 30518 PHN (770) 932-2443 FAX (770) 932-2490 www.nyloplast-us.com
DATE 03-25-10			
REVISED BY NMH	PROJECT NO./NAME	TITLE	DRAIN BASIN WITH DOME GRATE QUICK SPEC INSTALLATION DETAIL
DATE 03-11-16			
DWG SIZE A	SCALE 1:40 SHEET 1 OF 1	DWG NO. 7001-110-397	REV D

18" NYLOPLAST YARD DRAIN

N.T.S.

Attachment B

Existing Grade Elevation @ Upstream Basin	941.50
Existing Grade Elevation @ Drainage Swale	938.50

	Basin Component	Top Elevation	Thickness (in)	Inlet Invert	Length	Slope	Outlet Invert		
Basin 1	Overflow Structure	941.10							
	Surface storage (assuming 0.5-ft freeboard)	941.00	6						
	Growing Layer	940.50	20						
	Sand Filter Layer	938.83	3						
	Stone Filter Layer	938.58	3						
	Drainage Layer	938.33	12						
		Underdrain Pipe (6" dia perforated PVC)		937.58	13.5	0.01	937.45		
		Upturned Elbow (6" dia PVC)		939.39					
	Native Material	937.33							
		Conveyance Pipe (12" dia)		939.39	42	0.005	939.18		
Basin 2	Overflow Structure	941.08							
	Surface storage	940.98	6						
	Growing Layer	940.48	18						
	Sand Filter Layer	938.98	3						
	Stone Filter Layer	938.73	3						
	Drainage Layer	938.48	12						
		Underdrain Pipe (6" dia, on-center)		937.73	16	0.01	937.57		
		Upturned Elbow (6" dia PVC)		939.18					
	Native Material	937.48							
		Conveyance Pipe (12" dia)		939.18	42	0.005	938.97		
Basin 3	Overflow Structure	940.67							
	Surface storage	940.57	6						
	Growing Layer	940.07	12						
	Sand Filter Layer	939.07	3						
	Stone Filter Layer	938.82	3						
	Drainage Layer	938.57	12						
		Underdrain Pipe (6" dia, on-center)		937.82	16	0.01	937.66		
		Upturned Elbow (6" dia PVC)		938.97					
	Native Material	937.57							
		Conveyance Pipe (12" dia)		938.97	42	0.005	938.76		
Basin 4	Overflow Structure	940.49							
	Surface storage	940.39	6						
	Growing Layer	939.89	12						
	Sand Filter Layer	938.89	3						
	Stone Filter Layer	938.64	3						
	Drainage Layer	938.39	12						
		Underdrain Pipe (6" dia, on-center)		937.64	10	0.01	937.54		
		Upturned Elbow (6" dia PVC)		938.76					
	Native Material	937.39							
		Conveyance Pipe (12" dia)		938.76	51	0.005	**938.50**	**=**	**938.50**

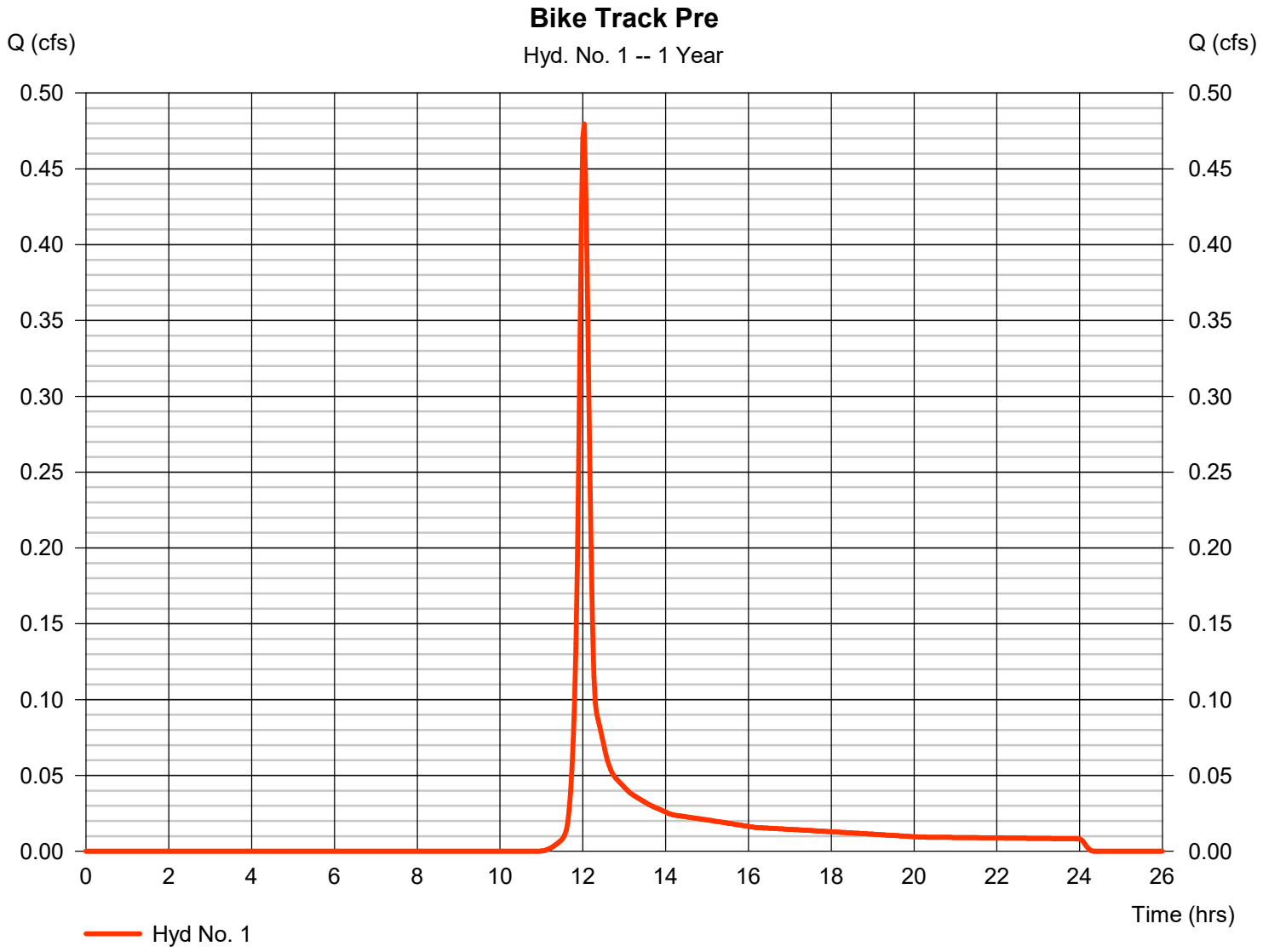
Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4 Monday, 07 / 26 / 2021

Hyd. No. 1

Bike Track Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 0.480 cfs
Storm frequency	= 1 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 1,288 cuft
Drainage area	= 0.500 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.20 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

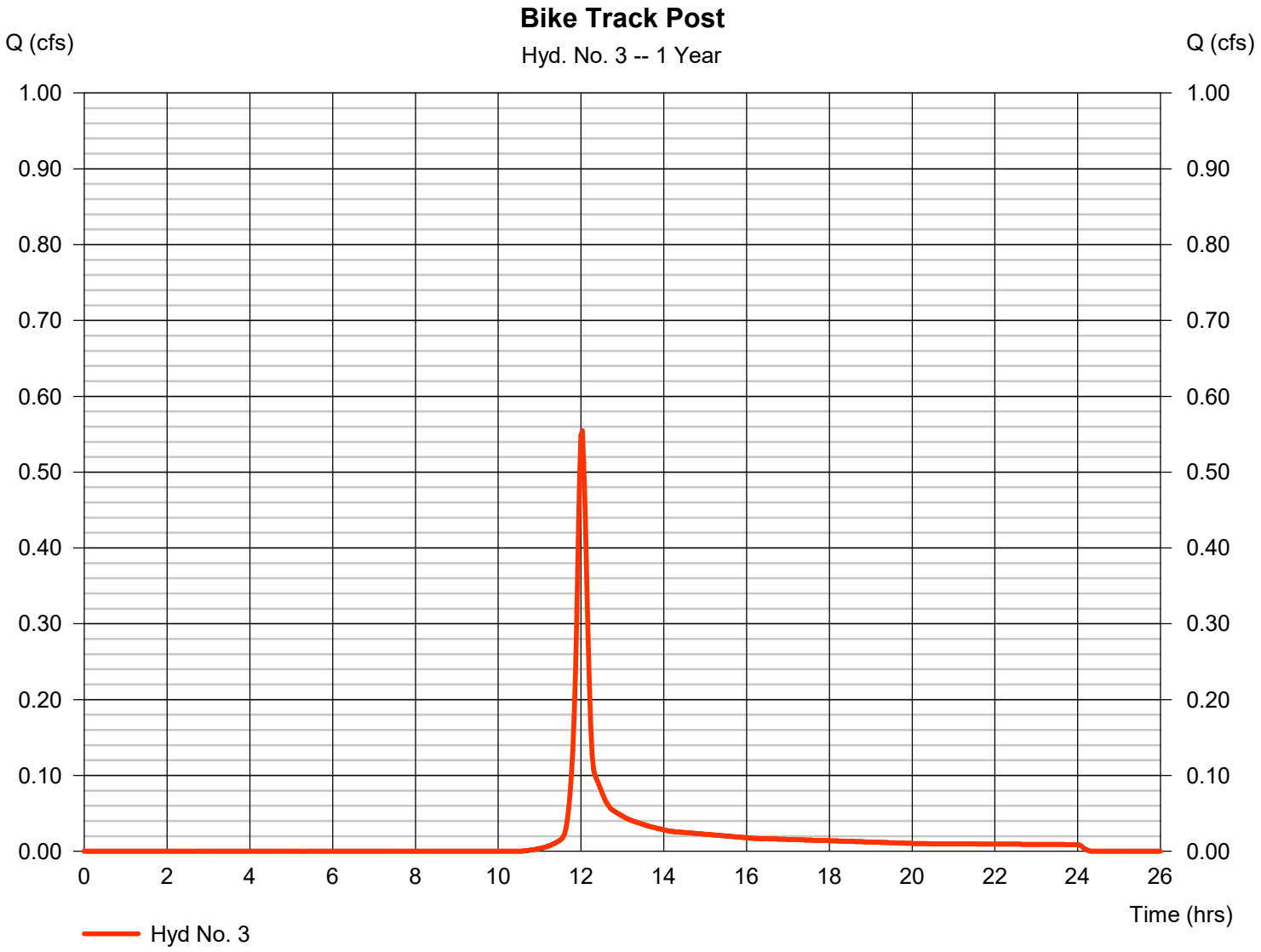


Hydrograph Report

Hyd. No. 3

Bike Track Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	0.555 cfs
Storm frequency	=	1 yrs	Time to peak	=	12.03 hrs
Time interval	=	2 min	Hyd. volume	=	1,467 cuft
Drainage area	=	0.500 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	2.20 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

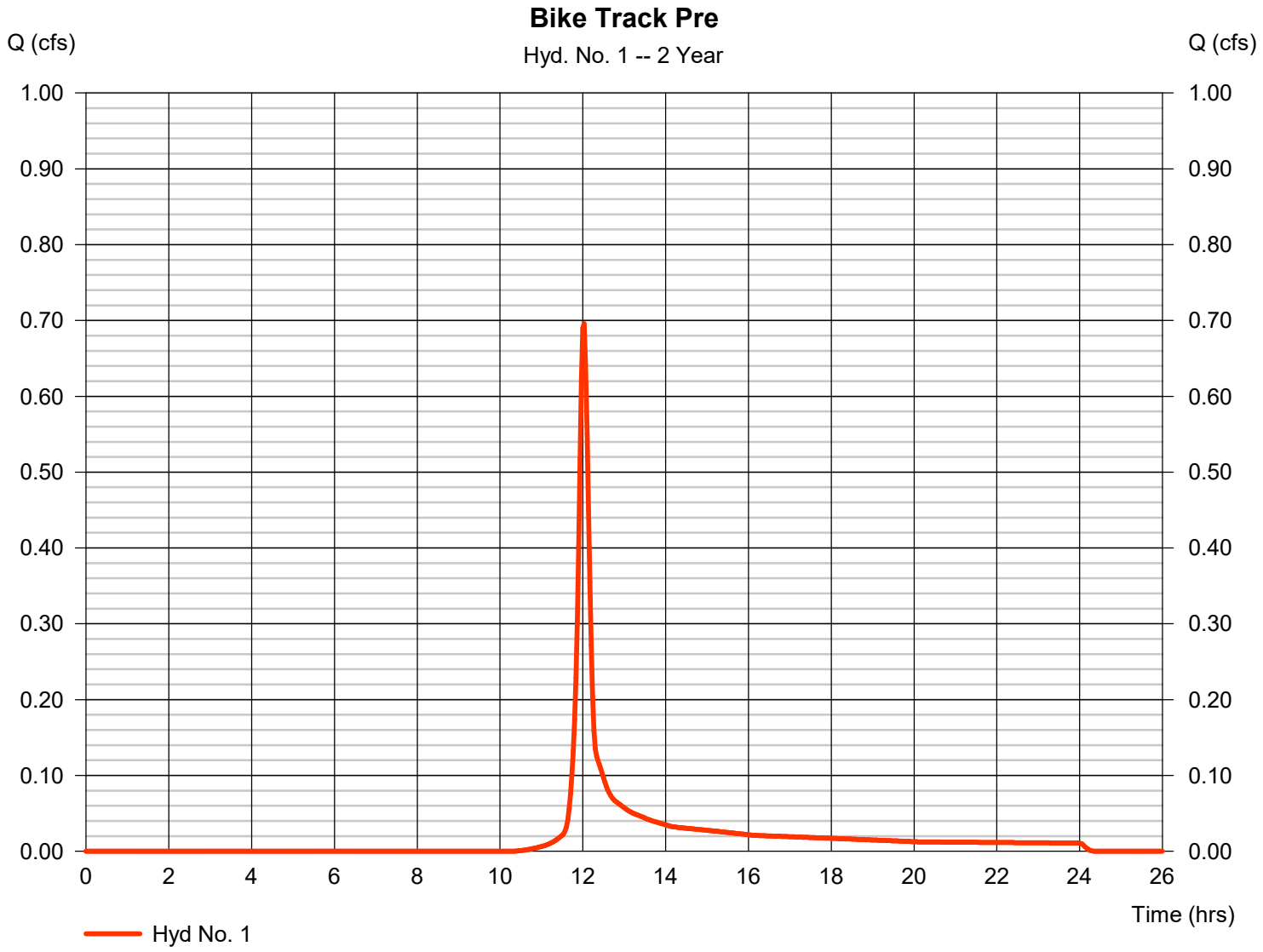


Hydrograph Report

Hyd. No. 1

Bike Track Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 0.696 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 1,834 cuft
Drainage area	= 0.500 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.63 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

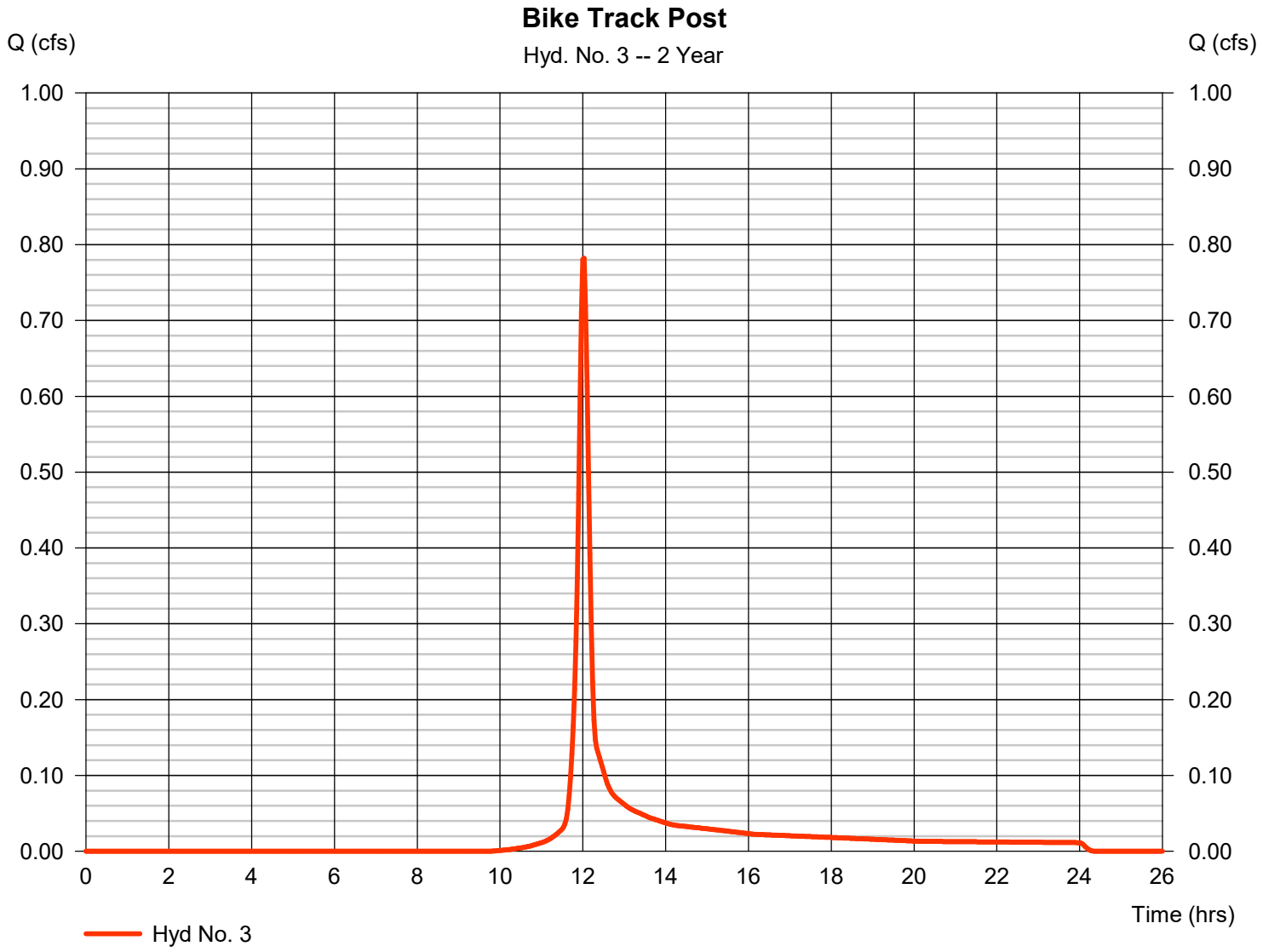


Hydrograph Report

Hyd. No. 3

Bike Track Post

Hydrograph type	= SCS Runoff	Peak discharge	= 0.782 cfs
Storm frequency	= 2 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 2,049 cuft
Drainage area	= 0.500 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.63 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

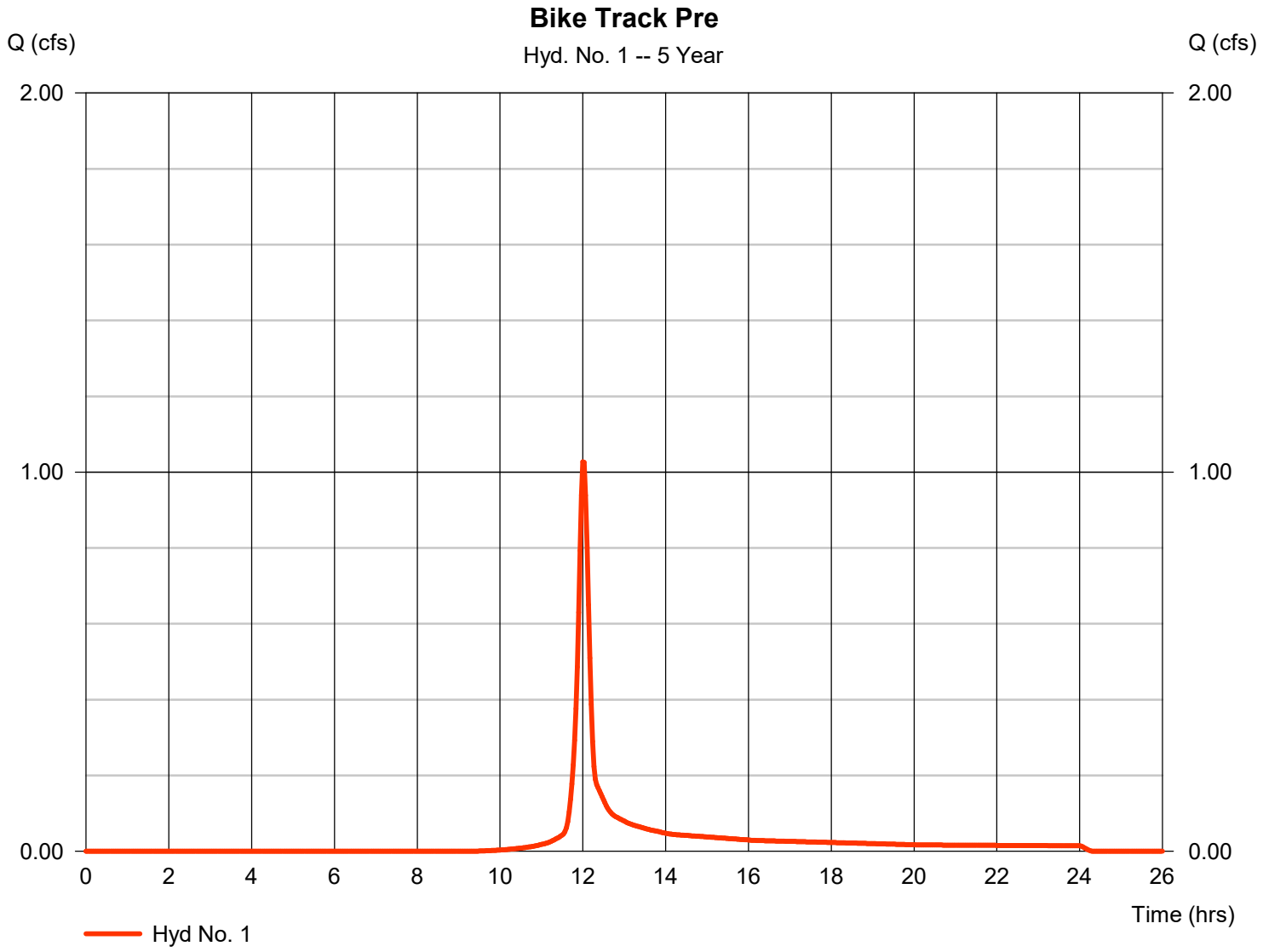


Hydrograph Report

Hyd. No. 1

Bike Track Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 1.027 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 2,682 cuft
Drainage area	= 0.500 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

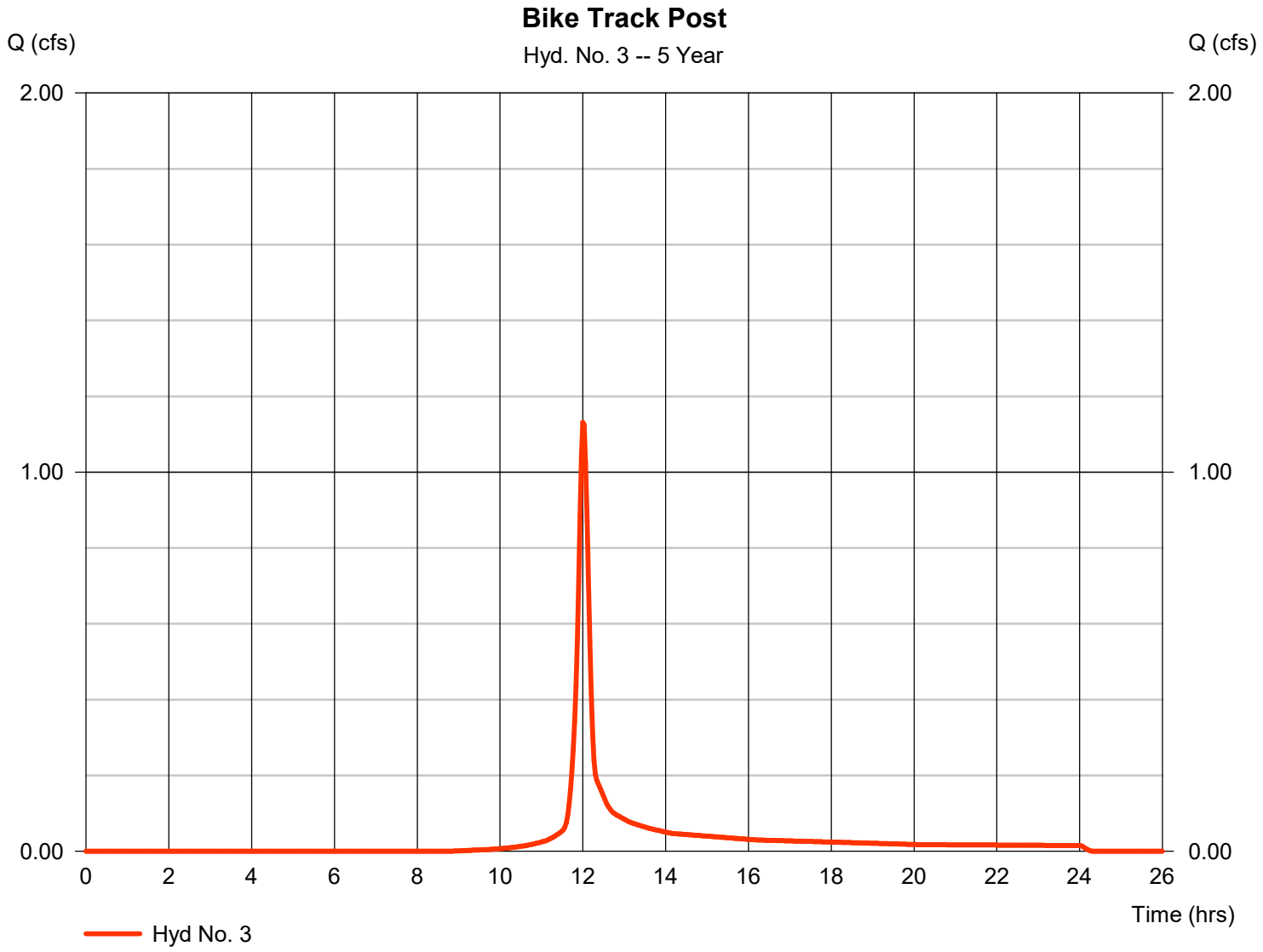


Hydrograph Report

Hyd. No. 3

Bike Track Post

Hydrograph type	= SCS Runoff	Peak discharge	= 1.132 cfs
Storm frequency	= 5 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 2,939 cuft
Drainage area	= 0.500 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.24 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

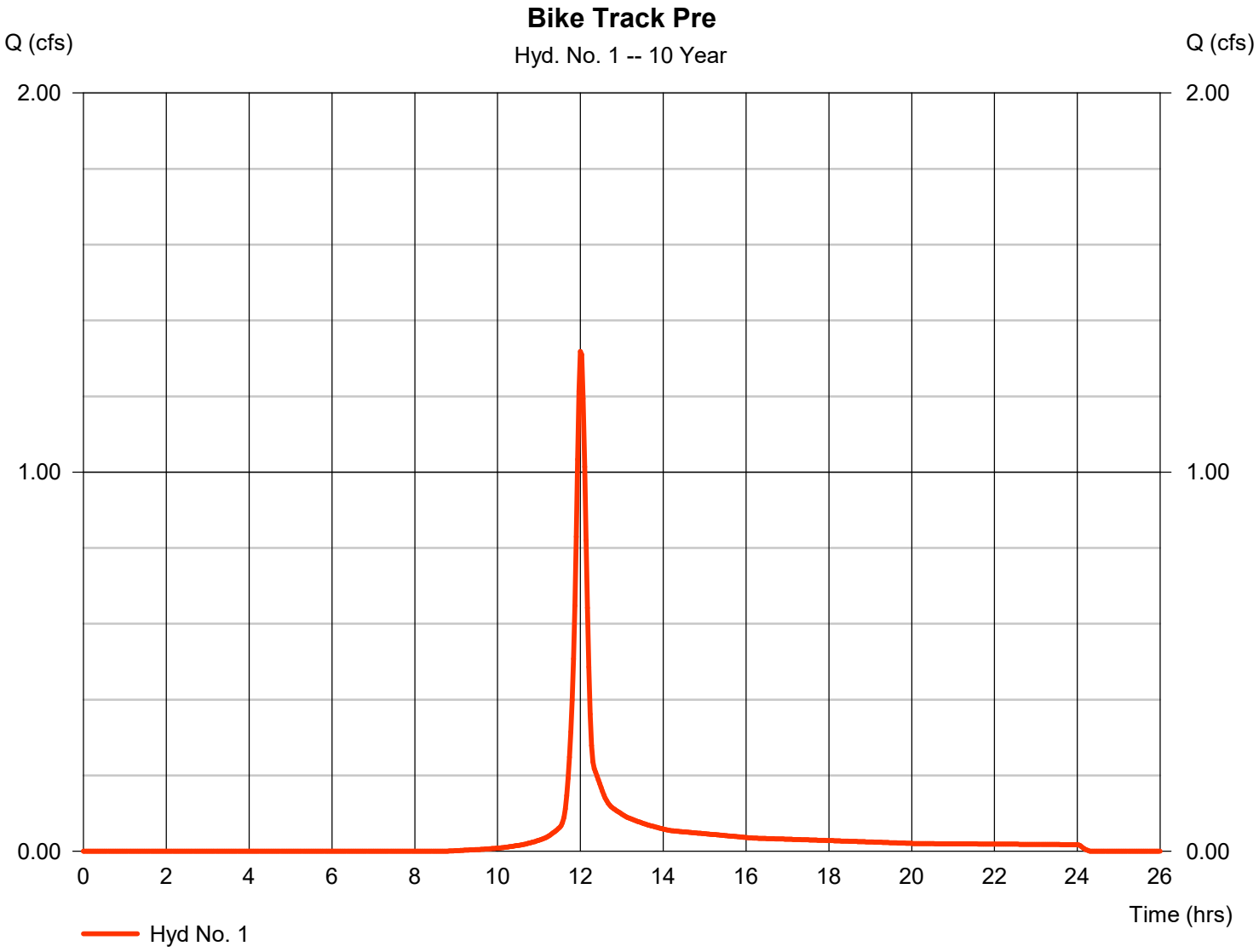


Hydrograph Report

Hyd. No. 1

Bike Track Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 1.318 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 3,423 cuft
Drainage area	= 0.500 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.74 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

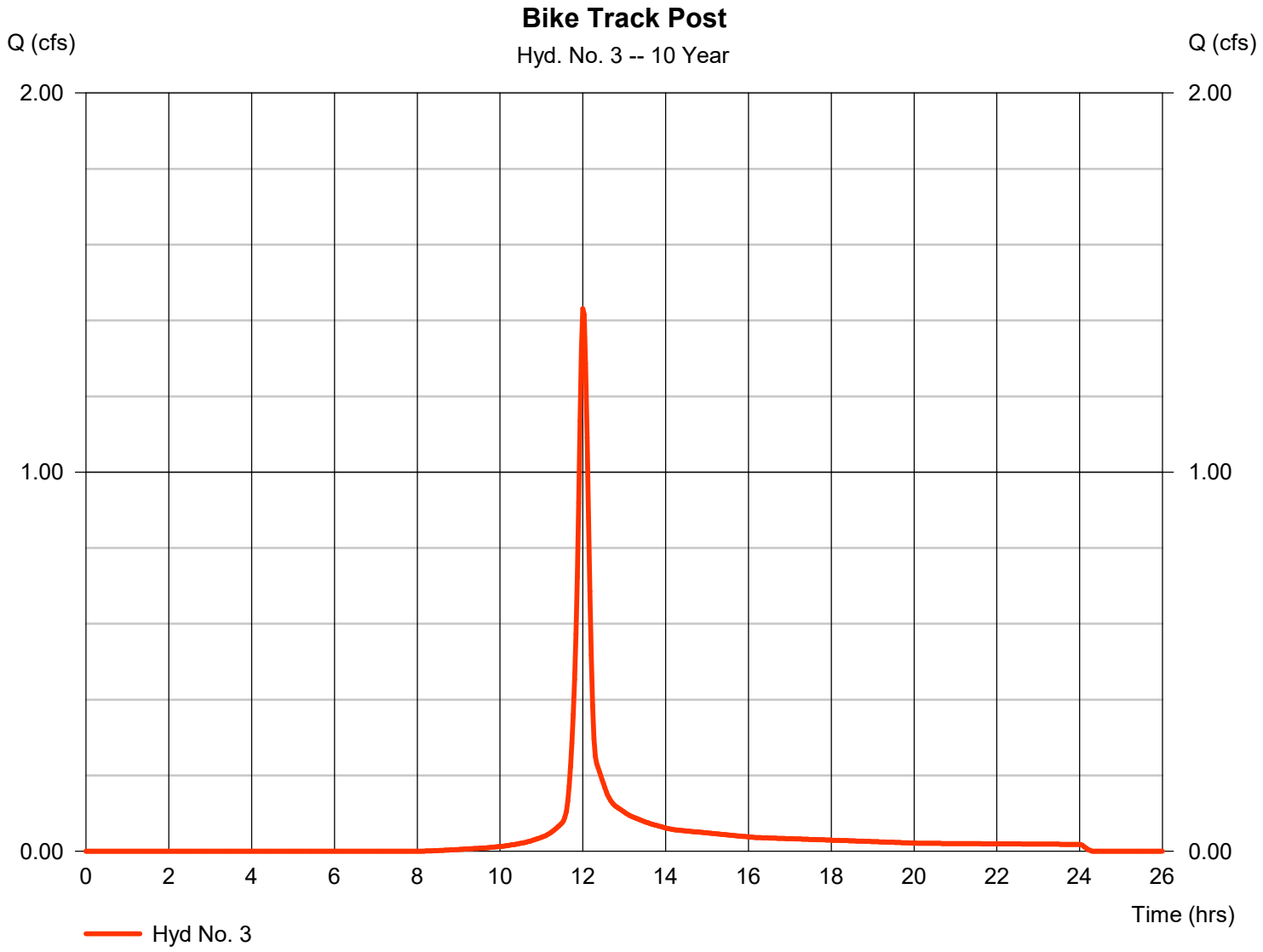


Hydrograph Report

Hyd. No. 3

Bike Track Post

Hydrograph type	= SCS Runoff	Peak discharge	= 1.431 cfs
Storm frequency	= 10 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 3,711 cuft
Drainage area	= 0.500 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.74 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

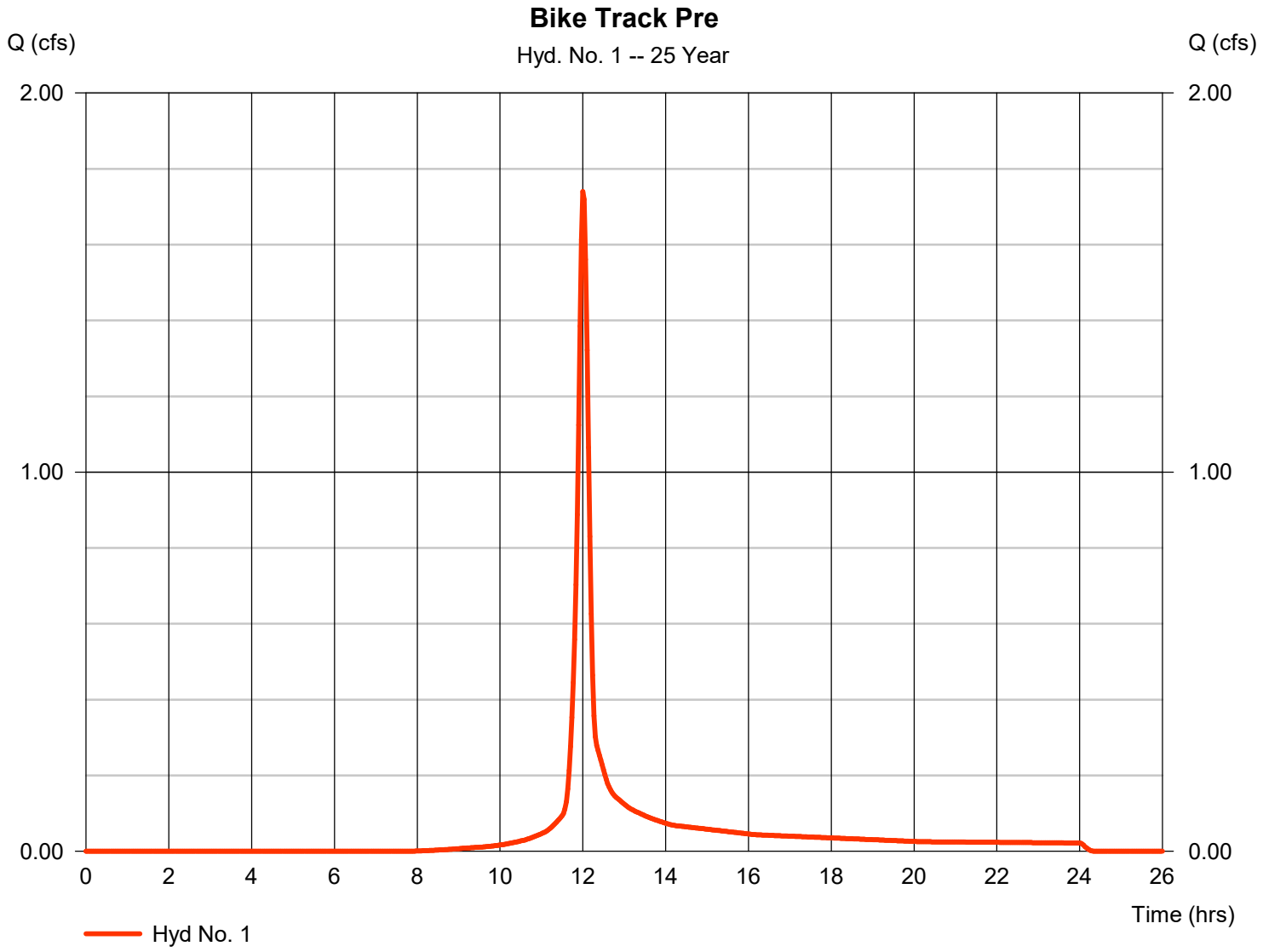


Hydrograph Report

Hyd. No. 1

Bike Track Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 1.740 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 4,512 cuft
Drainage area	= 0.500 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 4.44 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

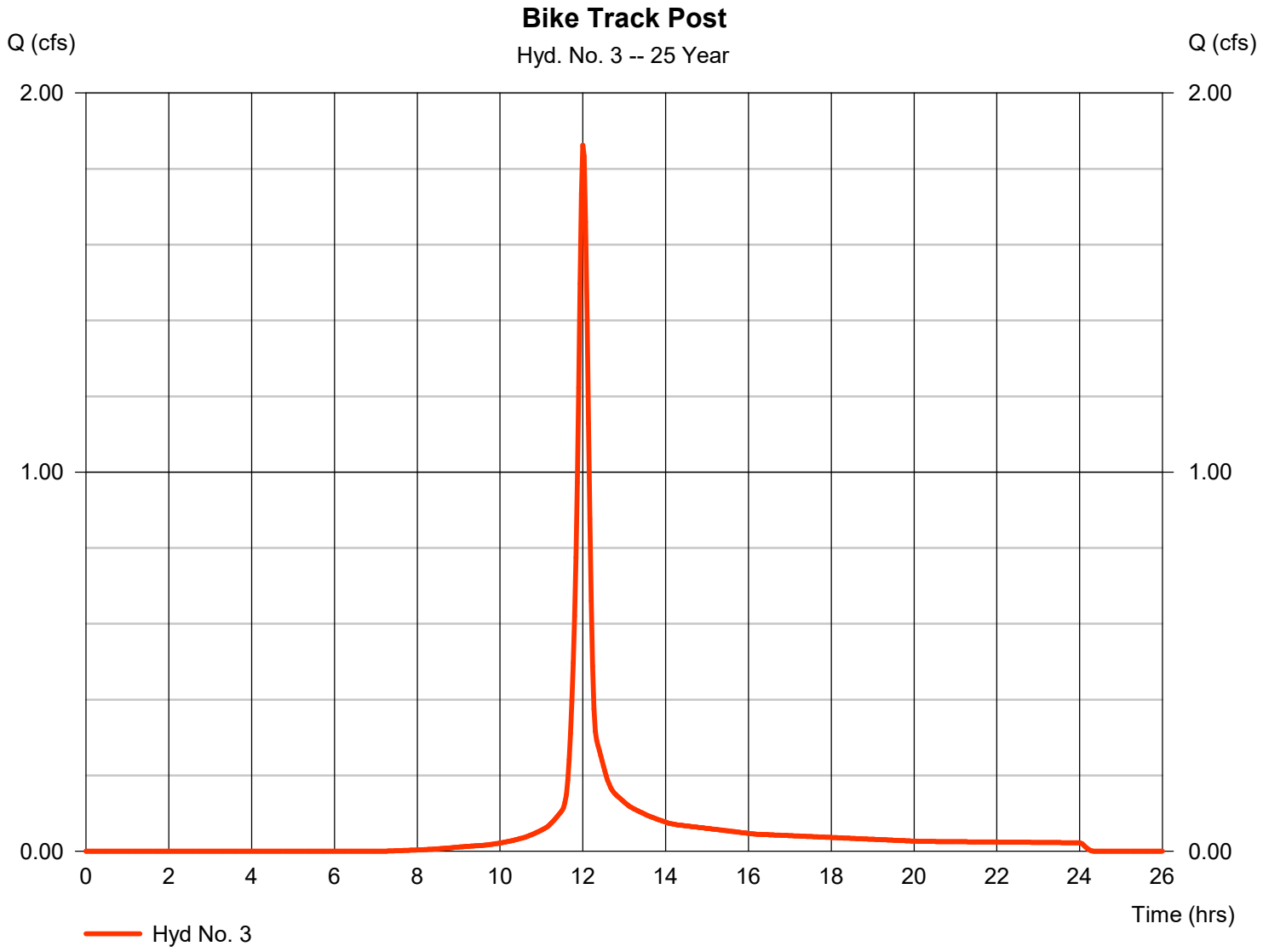


Hydrograph Report

Hyd. No. 3

Bike Track Post

Hydrograph type	= SCS Runoff	Peak discharge	= 1.862 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 4,836 cuft
Drainage area	= 0.500 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 4.44 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

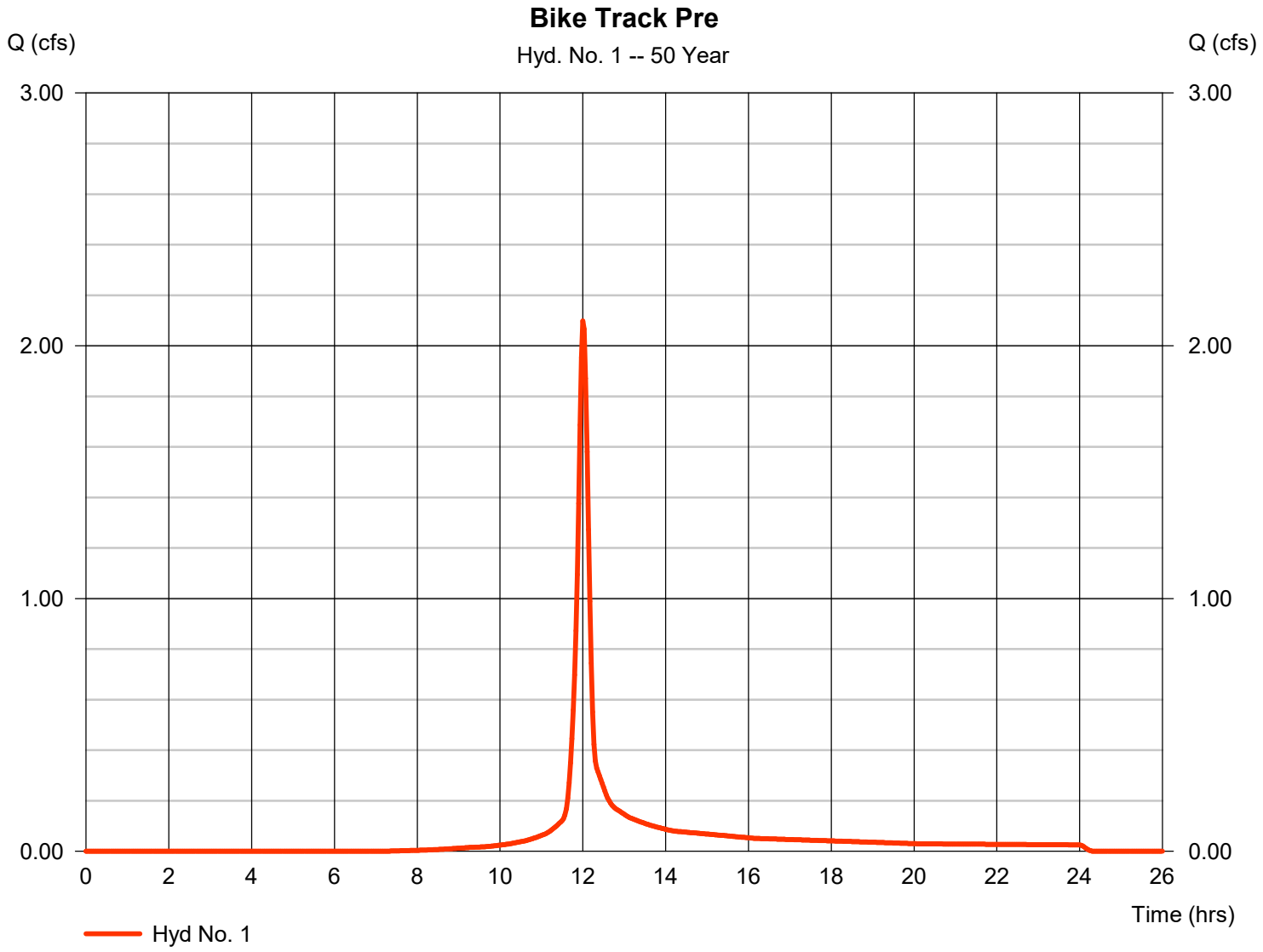


Hydrograph Report

Hyd. No. 1

Bike Track Pre

Hydrograph type	= SCS Runoff	Peak discharge	= 2.098 cfs
Storm frequency	= 50 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 5,447 cuft
Drainage area	= 0.500 ac	Curve number	= 80
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.02 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

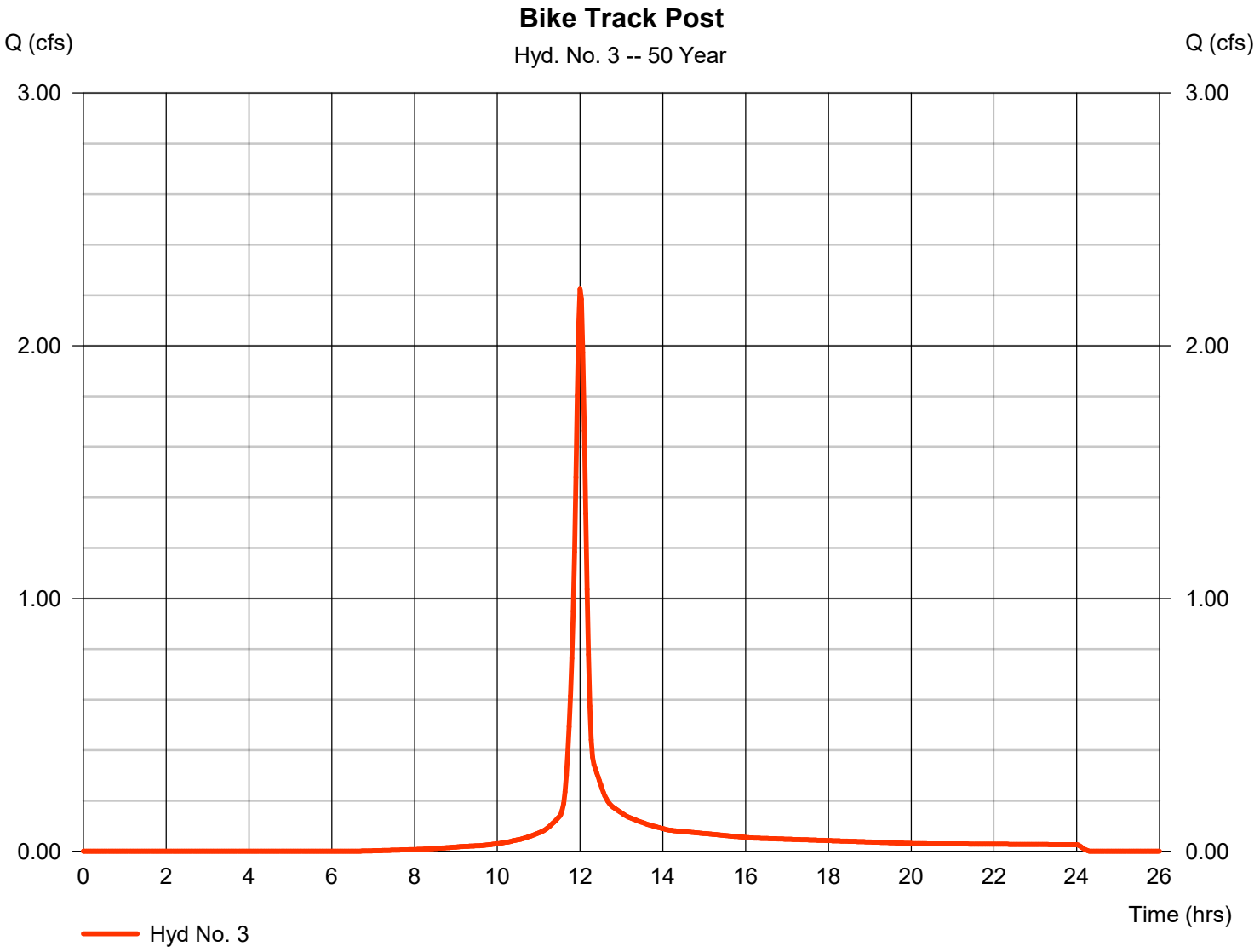


Hydrograph Report

Hyd. No. 3

Bike Track Post

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.225 cfs
Storm frequency	=	50 yrs	Time to peak	=	12.00 hrs
Time interval	=	2 min	Hyd. volume	=	5,797 cuft
Drainage area	=	0.500 ac	Curve number	=	82
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.02 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

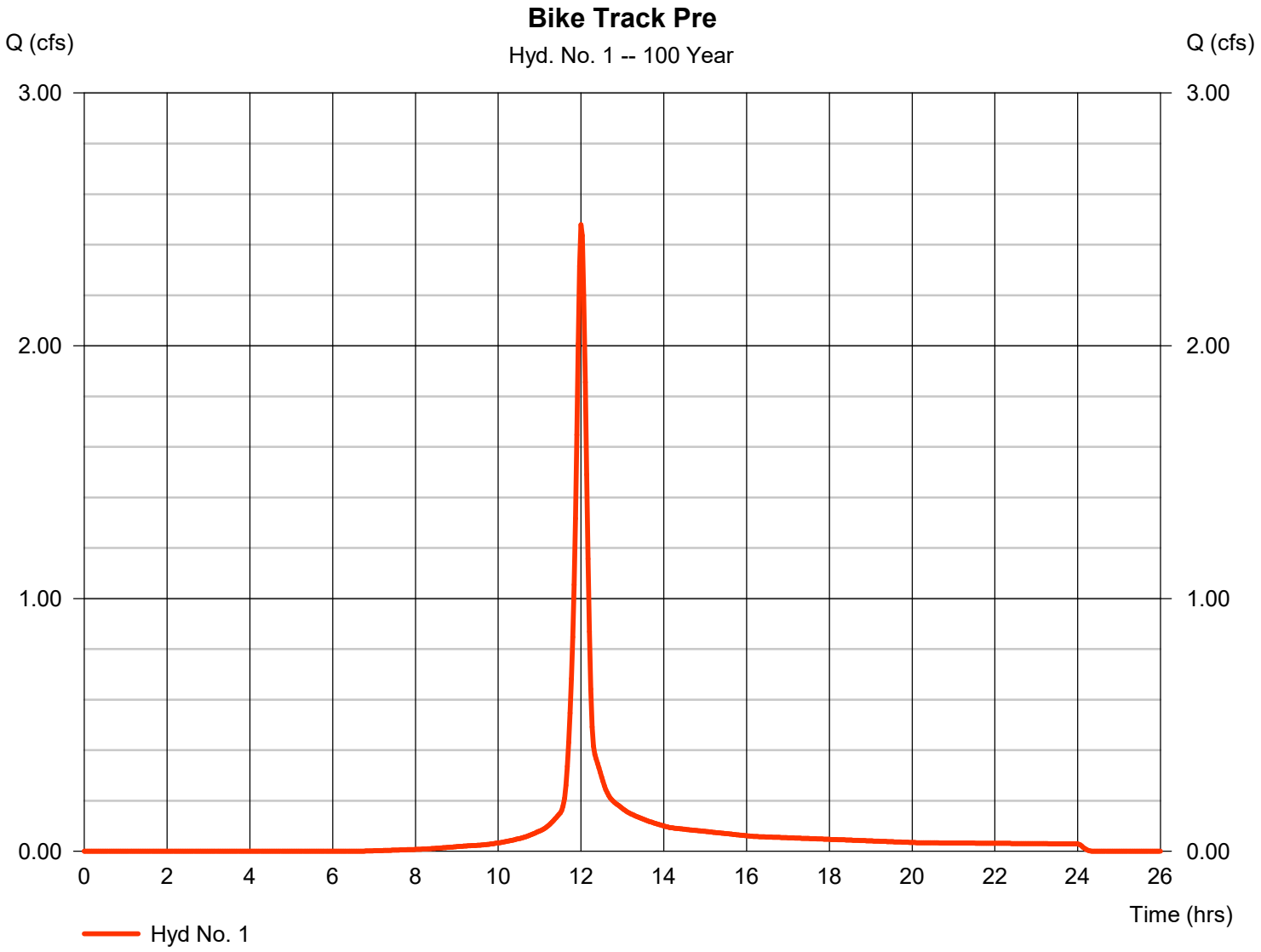


Hydrograph Report

Hyd. No. 1

Bike Track Pre

Hydrograph type	=	SCS Runoff	Peak discharge	=	2.479 cfs
Storm frequency	=	100 yrs	Time to peak	=	12.00 hrs
Time interval	=	2 min	Hyd. volume	=	6,456 cuft
Drainage area	=	0.500 ac	Curve number	=	80
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	User	Time of conc. (Tc)	=	10.00 min
Total precip.	=	5.63 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484

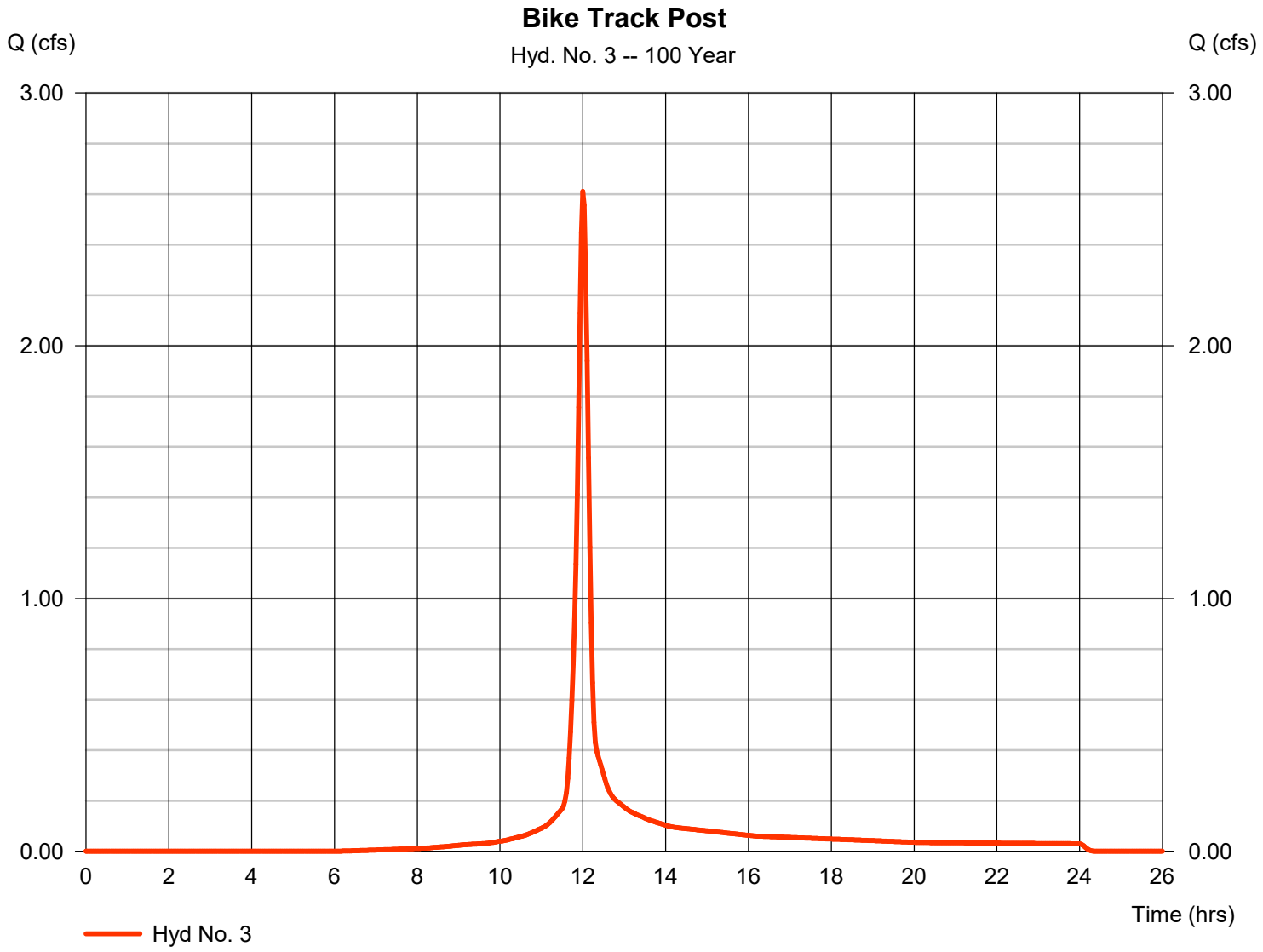


Hydrograph Report

Hyd. No. 3

Bike Track Post

Hydrograph type	= SCS Runoff	Peak discharge	= 2.610 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 6,828 cuft
Drainage area	= 0.500 ac	Curve number	= 82
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.63 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	69.8703	13.1000	0.8658	--------
3	0.0000	0.0000	0.0000	--------
5	79.2597	14.6000	0.8369	--------
10	88.2351	15.5000	0.8279	--------
25	102.6072	16.5000	0.8217	--------
50	114.8193	17.2000	0.8199	--------
100	127.1596	17.8000	0.8186	--------

File name: SampleFHA.idf

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.69	4.61	3.89	3.38	2.99	2.69	2.44	2.24	2.07	1.93	1.81	1.70
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.57	5.43	4.65	4.08	3.65	3.30	3.02	2.79	2.59	2.42	2.27	2.15
10	7.24	6.04	5.21	4.59	4.12	3.74	3.43	3.17	2.95	2.77	2.60	2.46
25	8.25	6.95	6.03	5.34	4.80	4.38	4.02	3.73	3.48	3.26	3.07	2.91
50	9.04	7.65	6.66	5.92	5.34	4.87	4.49	4.16	3.88	3.65	3.44	3.25
100	9.83	8.36	7.30	6.50	5.87	5.36	4.94	4.59	4.29	4.03	3.80	3.60

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.20	2.63	0.00	3.24	3.74	4.44	5.02	5.63
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Hydraflow Table of Contents

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020.4 Monday, 07 / 26 / 2021

WQv

Drainage Area, A	0.5	acres			
Impervious Surface	0.05	acres			
Percent Impervious, i	10%				
Depth of Rainfall, P	0.9	in			
Runoff Coefficient, Rv	= 0.05+0.9i =		0.14		
Water Quality Vol, WQv	= PRvA/12 =		0.01	acre-ft	228.69 cubic feet

FILTER BED AREA

IMPERVIOUS AREA ≥ 25% OF DRAINAGE AREA			
Filter Bed Area	= A_{impv} × 5% =	**N/A**	sf

IMPERVIOUS AREA ≤ 25% OF DRAINAGE AREA			
Filter Bed Area	= WQv ÷ d_{POND} =	**228.69**	sf

BMP SIZING

Available Space		sf
WQv *1.2 (sedimentation)	274.428	cf

Ponding Depth* (FT)	Filter Bed Area (SF)	Width (FT)	Length (FT)	BMP Area (SF)
0.5	457.38	15	30	1,134
1	228.69	10.5	21	980.5

Basin 1

Filter Bed Area	253	sf
BMP Area	747	sf

Storage Volume	Thickness (inches)	Porosity, n (%)	Volume (cf)	Total Storage Vol (cf)	
Ponding Layer	6	100	126.50	126.50	Above
Growing Layer	20	35	147.58		
Sand Filter Layer	3	35	22.14		
Stone Filter Layer	3	40	25.30		
Drainage Layer	12	40	101.20	296.22	Below
Native Material					
				422.72	Total

Drawn Down Time, Td	24	hours	
Required Infiltration Rate of Planting Media	= WQv / (Td x Abed x 12) =	0.0031	inches per hour

Average Discharge Rate			
Q_{PIPE}	= L B Cd A(2Gh)^1/2 =	0.36	CFS

where	L	13.5	FT
	B	0.5	
	Cd	0.61	
	A	0.0072	FT2/FT
	G	32.17	FT/S2
	h	2.25	FT

Basin 2

Filter Bed Area	100	sf
BMP Area	334	sf

Storage Volume	Thickness (inches)	Porosity, n (%)	Volume (cf)	Total Storage Vol (cf)	
Ponding Layer	6	100	50.00	50.00	Above
Growing Layer	20	35	58.33		
Sand Filter Layer	3	35	8.75		
Stone Filter Layer	3	40	10.00		
Drainage Layer	12	40	40.00	117.08	Below
Native Material					
				167.08	Total

Drawn Down Time, Td	24	hours	
Required Infiltration Rate of Planting Media	= WQv / (Td x Abed x 12) =	0.0079	inches per hour

Average Discharge Rate			
Q_{PIPE}	= L B Cd A(2Gh)^1/2 =	0.42	CFS

where	L	16	FT
	B	0.5	
	Cd	0.61	
	A	0.0072	FT2/FT
	G	32.17	FT/S2
	h	2.25	FT

Basin 3

Filter Bed Area	90	sf
BMP Area	225	sf

Storage Volume	Thickness (inches)	Porosity, n (%)	Volume (cf)	Total Storage Vol (cf)	
Ponding Layer	6	100	45.00	45.00	Above
Growing Layer	20	35	52.50		
Sand Filter Layer	3	35	7.88		
Stone Filter Layer	3	40	9.00		
Drainage Layer	12	40	36.00	105.38	Below
Native Material					
				150.38	Total

Drawn Down Time, Td	24	hours	
Required Infiltration Rate of Planting Media	= WQv / (Td x Abed x 12) =	0.0088	inches per hour

Average Discharge Rate			
Q_{PIPE}	= L B Cd A(2Gh)^1/2 =	0.28	CFS

where	L	10.5	FT

B	0.5	
Cd	0.61	
A	0.0072	FT2/FT
G	32.17	FT/S2
h	2.25	FT

Basin 4

Filter Bed Area	45	sf
BMP Area	240	sf

Storage Volume	Thickness (inches)	Porosity, n (%)	Volume (cf)	Total Storage Vol (cf)	
Ponding Layer	6	100	22.50	22.50	Above
Growing Layer	20	35	26.25		
Sand Filter Layer	3	35	3.94		
Stone Filter Layer	3	40	4.50		
Drainage Layer	12	40	18.00	52.69	Below
Native Material					
				75.19	Total

Drawn Down Time, Td	24	hours	
Required Infiltration Rate of Planting Media	= WQv / (Td x Abed x 12) =	0.0176	inches per hour

Average Discharge Rate			
Q_{PIPE}	= L B Cd A(2Gh)^1/2 =	0.26	CFS

where				
	L	10	FT	
	B	0.5		
	Cd	0.61		
	A	0.0072	FT2/FT	
	G	32.17	FT/S2	0.122656
	h	2.25	FT	

WQv Provided **244.00 cf** **>** **228** **cf**

Progressive Bike Ramps | 601 S. McKinley | Joplin, MO 64801 | 417.288.4466
www.progressivebikeramps.com

FOB	Design #	Quote #
Dublin, OH	7167	Q24852

Obstacle	Height	Width	Length	Total
On/Offf Transitions	1.5’	6.5’	6.5’	4
Bump Half	1.5'	3.0'	6.5'	30
Gap 500	1.5'	3.0'	3.0'	7
Double Bump	1.5'	3.0'	6.5'	2
T1-L	2.5'	3.0'	3.5'	11
T1-R	2.5'	3.0'	3.5'	11
T2-L	3.0'	4.0'	4.0'	11
T2-R	3.0'	4.0'	4.0'	11
T3	3.0'	2.5'	4.5'	63

Subtotal	$144,374.96
Freight	FREE
Installation	$21,656.24
TOTAL	$166,031.20

Signature:_____ Date:_____

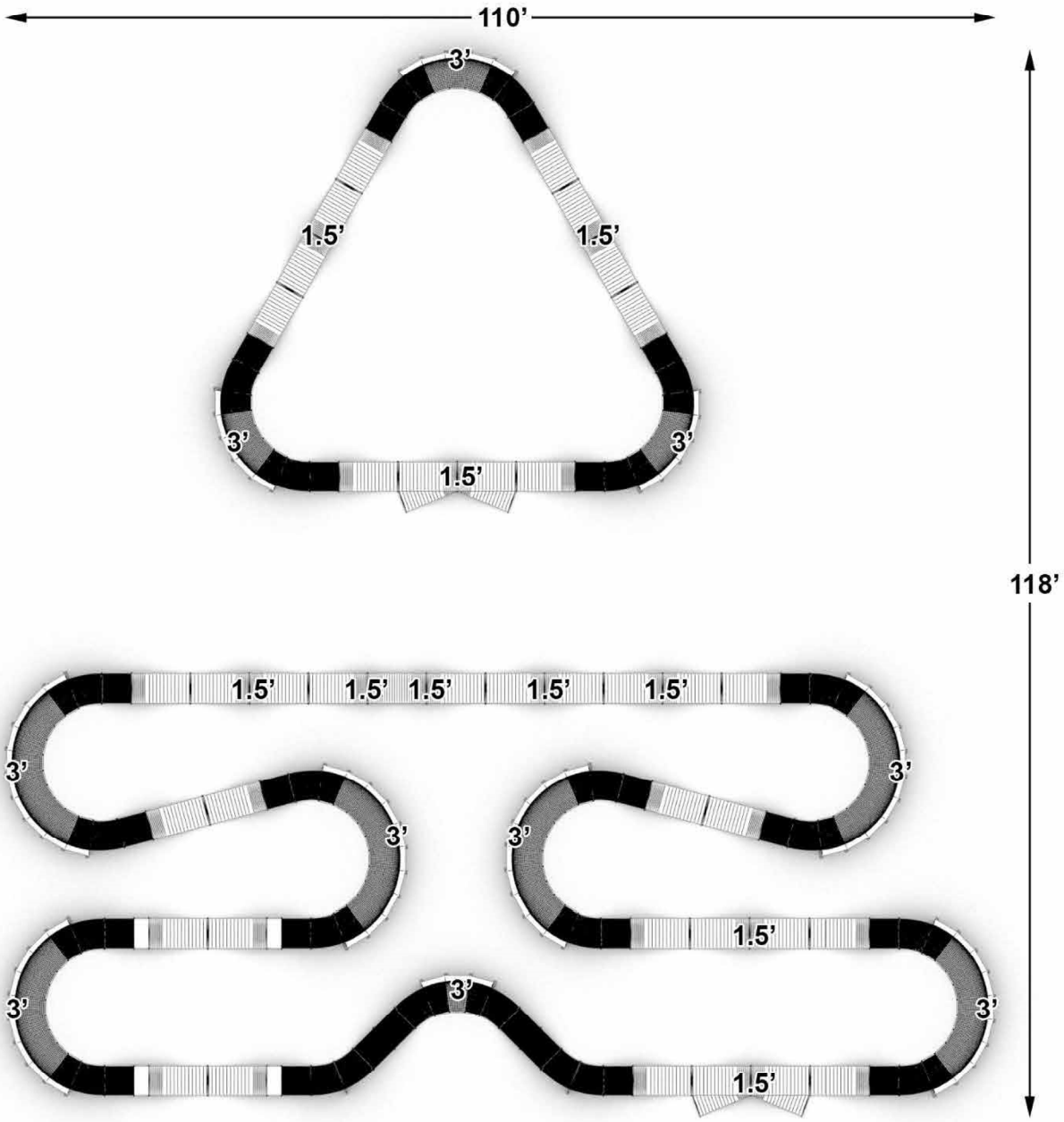
Notes:

- If your project is subject to prevailing wage, bonding requirements, or sales tax, call for revised quote.

Sourcewell
Formerly NJPA
Awarded Contract
#030117-ARC

Purchase through our competitively bid government Sourcewell contract.

WE LOOK FORWARD TO BUILDING YOU A GREAT PARK!



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WHAT IS A PUMPTRACK?

A Pumptrack is a progressive kind of structure that uses an up and down 'pumping' motion to propel the bicycle forward instead of pedaling.

Pumptracks are a perfect structure for practicing balance, learning skills and improving confidence on the bike. They are safe and fun to ride for all ages and skill levels. Pumptracks are suitable for bikes of all sizes, skateboards, rollerblades and scooters.

They create a community environment by bridging the generation gap between parents, small children and adolescents. Our structures are modular, flexible and movable to suit any type of terrain and land usage issues and can be made from various kinds of materials to suit the needs of the client and the surroundings.

CHECK OUT OUR LINEUP!

Lumberjack Series

The Lumberjack series has a substructure that is made from a marine grade lumber and is topped with our ultra grip composite surface. This surface has a texture to it that means that you can ride no matter what Mother Nature throws at you. Because of the modular design it can easily be rearranged or added to at anytime. This line is ideal for indoor settings, mobile setups, resorts, and bike shops and is easily stored, setup, and transported.

Blacksmith Series

The Blacksmith Series consists of an ultra-strength reinforced composite framework with the same ultra-grip composite surface as the Lumberjack Series. It can be permanently installed or expanded and reconfigured as desired. This line is ideal for re-purposing a tennis court, parking lot, or any other hard surface. It can also be dropped into an open space, park area, or in conjunction with a skatepark. Because of the completely composite design, it can be installed with surrounding landscape to create a beautifully natural aesthetic. Perfect for municipalities, resorts, camps or bike shops.

Mason Series

The Mason Series is constructed with high strength precast concrete. We manufacture these structures using precision molds that give you a perfect shape and riding surface. Each piece is the exact same size and shape as the Lumberjack and Blacksmith Series, meaning you get the same amazing ride in a more permanent aesthetically pleasing manner. The Mason Series can be used for repurposing a tennis court, parking lot or any other pad, or it can be placed as a standalone feature with added landscaping. While it is more difficult the Mason Series can be added to or reconfigured at a later date. The Mason Series is perfect for any municipality or resort that is looking for a worry free progressive biking structure.

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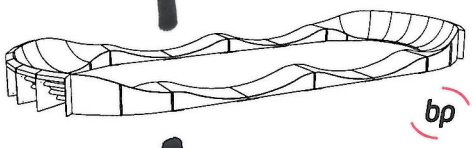
bikeparkitect ... ride it again

Lumberjack	Blacksmith	Mason

Speed Ring

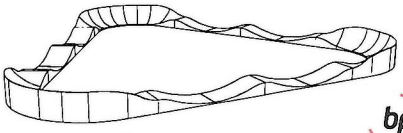
The Speed Ring is the entry level smallest possible track to build with only one possible layout. It is a great "starter" track as it can be added to over the years to become a larger track. This is a perfect track to learn how to ride pumptrack, or fine-tune your skills. Track Length 125'



$27,500	$35,000	$45,000

Triple Threat

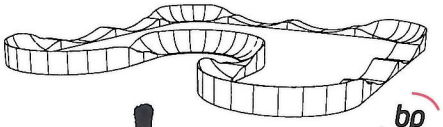
You will have a blast flying around the Triple Threat with its three 60 degree turns and equilateral triangle design. The speed you get from this configuration is where the real fun is at. Ride the Triple Threat clockwise or counter-clockwise to see which direction you are faster. Track Length 158'



$33,000	$42,000	$54,000

Sidewinder

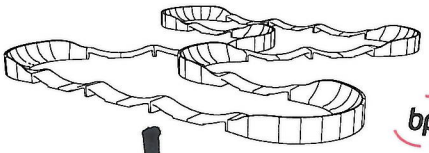
The Sidewinder delivers turning in both directions and offers multiple layout possibilities with over 200' of track. The Sidewinder is a great track for improving your agility in the corners. Track Length 215'



$53,000	$67,000	$86,000

Mach 6

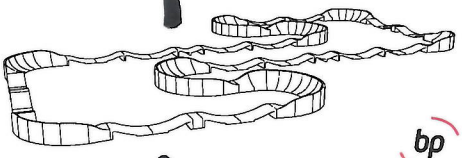
The Mach 6 is a pumped up version of The Sidewinder containing 6 berms, over 100' more of track and multiple configurations. Host a time trial and post the fastest times on our facebook page to see how your riders compare to others around the globe. Track Length 330'



$74,500	$94,500	$121,500

Grand Prix

The name really says it all, as the Grand Prix is the largest package we offer (of course if you want bigger we will be happy to oblige) being longer than a football field yet compact enough to fit in a 115'x88' space. The Grand Prix has numerous layout possibilities and enough parts to create two of our smaller tracks for head-to-head racing. Track Length 440'



$97,500	$124,000	$159,000

+5% FOR MANUFACTURER INITIAL INSTALL / TRAINING