STORMWATER CALCULATIONS

JOHNSON COUNTY TRAINING FACILITY
2023 BUILDING ADDITION AND RENOVATION
1081 HOSPITAL ROAD
FRANKLIN, INDIANA

DRAINAGE SUBMITTAL:
JUNE 8, 2023

Prepared By:

CrossRoad Engineers, PC
115 N. 17th Avenue
Beech Grove, IN 46107
Phone No.: (317) 780-1555
Email: info@crossroadengineers.com

Table of Contents

SECTION 1: STORMWATER CALCULATIONS SUMMARY

PRE-DEVELOPMENT CONDITIONS

The existing site consists of a developed +/-26.7-acre parcel with infrastructure and buildings to the north and a shooting range to the south. The project site is situated on the Johnson County Sheriff's complex located at 1081 Hospital Road, Franklin, Indiana (See Exhibit 1 – Location and Vicinity Map). As described above, the existing land use is built out about the northern portions and contains a shooting range to the south. The existing drainage sheet flows from west to northeast into storm inlets before discharging directly into Young's Creek. Portions of the subject property lie within Flood Hazard Zones X; Shaded X; and AE as plotted by hand on the Federal Emergency Management Agency Flood Insurance Rate Map for Johnson County, Indiana, community panel number 18081C0227E, which bears an effective date of January 29, 2021.

Under pre-developed conditions, runoff exits the site in two different locations. Runoff from the parking area north of the range and the existing storm sewer inlets flow north directly into Young's Creek. Runoff east and southeast of the existing training facility flow east directly into Young's Creek (see Exhibit 2 – Pre-Developed Watershed Map). For the runoff and detention analysis, the calculations focus solely on the watershed captured by the existing inlets and the areas where the impervious improvements will be made. The existing parking area and training center building will not be included in the post-development calculations.

POST-DEVELOPMENT CONDITIONS

The proposed improvements in this phase of the project include the renovation of the existing training facility and various site improvements in preparation for a future building addition. These improvements will also include the underground detention basin required to detain the runoff created by the new building addition and access road that will be built in phase 2 of this project. Along with those improvements, utility relocations, new storm sewer, modifications to the gun range, and various site grading to prepare for the future building addition will also be included. The proposed site grading results in runoff sheet flowing from west to east and from west to northeast into the proposed storm network west of the existing training center building. The proposed underground detention system will provide stormwater quantity and quality treatment in accordance with Section 6.19 of the City of Franklin Subdivision Control Ordinance (see Exhibit 3 – Post-Developed Watershed Map).

As described in the Pre-Development Conditions above, only the areas captured by the existing inlets, as well as the new impervious areas created by the building addition and access road will drain into the proposed underground detention system. The underground detention system will then discharge directly into Young's Creek. To achieve water quantity detention standards, the detention system and outlet structure will be sized to restrict the peak discharge rate of the 10-year post-developed storm for the site to the peak 2-year pre-developed rate. Additionally, the peak discharge rate of the 100-year post-developed storm will be restricted to the peak 10-year pre-development discharge rate.

The proposed underground detention system will also be designed to detain at least 20% of the runoff from either the 1.25” rainfall depth storm or 0.5” of direct runoff, whichever is greater, for 24 hours after the peak runoff from a 24-hour storm for water quality treatment. The outlet structure of the underground detention system will be designed to include an emergency overflow spillway that is sufficient to convey 1.25 times the peak discharge from the 100-year post-development storm. The underground detention system will be designed to meet the requirement of Section 6.19, G and H of the City of Franklin Subdivision Control Ordinance.

STORM SEWER DESIGN

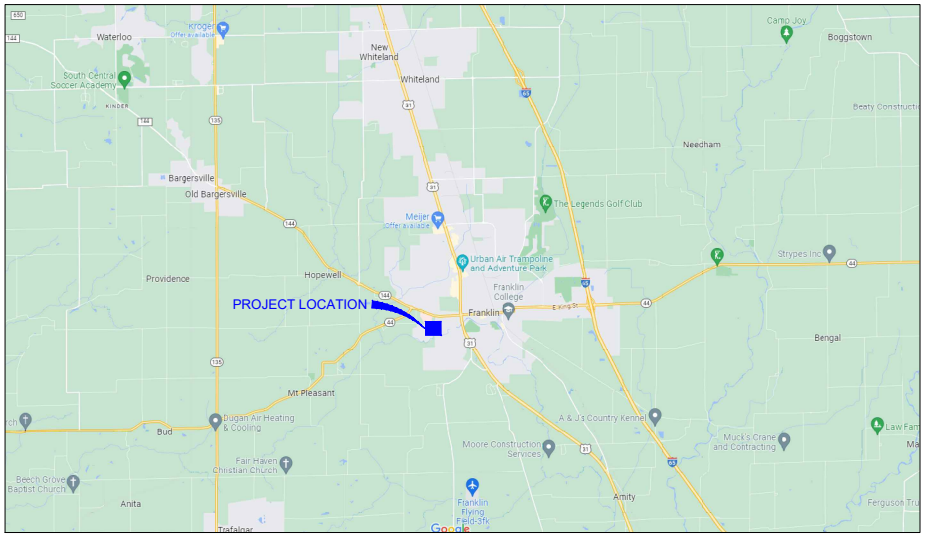
The proposed storm sewer network is designed to accommodate the 10-year storm event. The Rational Method was used to perform the storm sewer pipe sizing calculations. The structures and grates in the paved areas were designed so that the depth of ponding above the inlet does not exceed 6 inches when the grate is 50% plugged. Inlets within grass areas were designed so that the depth of ponding above the inlet does not exceed 9 inches when the grate is 50% plugged.

EXHIBIT 1 - LOCATION AND VICINITY MAPS

JOHNSON COUNTY TRAINING CENTER
1081 HOSPITAL ROAD, FRANKLIN, IN

LOCATION MAP

NOT TO SCALE



VICINITY MAP

NOT TO SCALE

NORTH

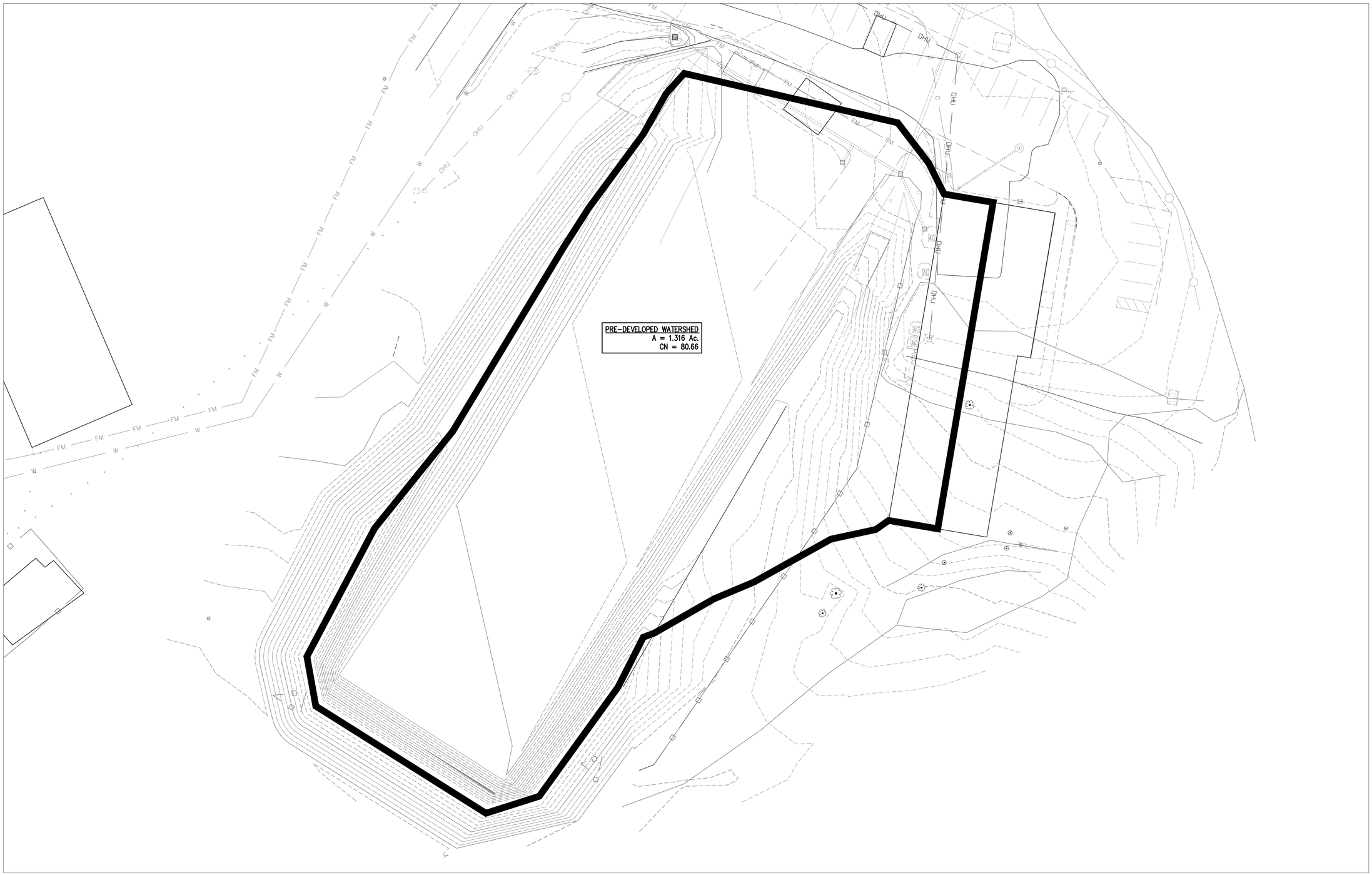
PREPARED BY:

CROSSROAD ENGINEERS, PC

Transportation & Development Consultants

JUNE 8, 2023

EXHIBIT 2 - PRE-DEVELOPMENT WATERSHED MAP
JOHNSON COUNTY TRAINING FACILITY
1081 HOSPITAL ROAD



NORTH

20 0 20 40

SCALE: 1" = 20'

PREPARED BY:

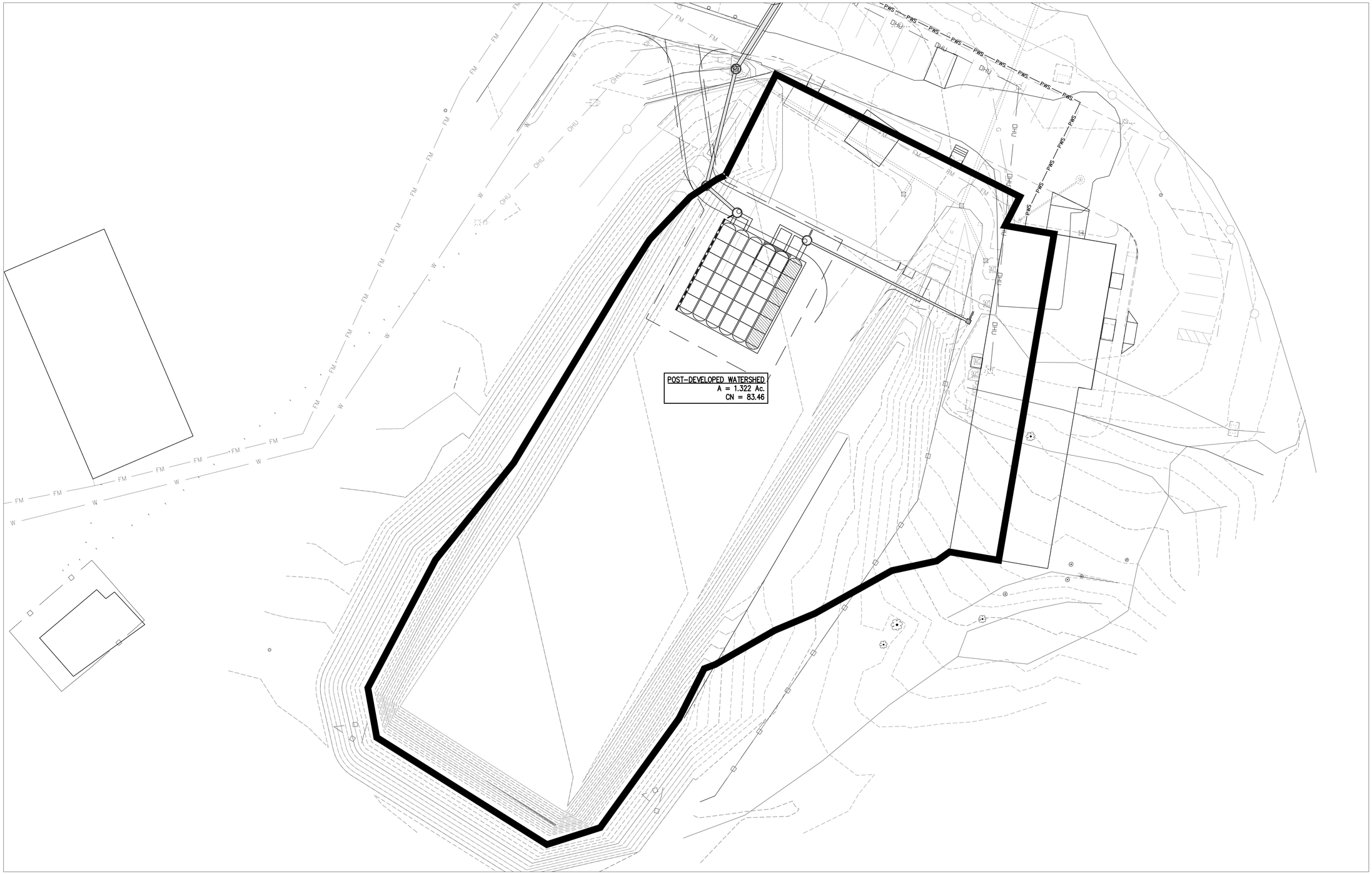
CROSSROAD ENGINEERS, PC

Transportation & Development Consultants

115 N. 17th AVENUE, BEECH GROVE, IN 46107 (317) 780-1555

JUNE 8, 2023

EXHIBIT 3 - POST-DEVELOPMENT WATERSHED MAP
JOHNSON COUNTY TRAINING FACILITY
1081 HOSPITAL ROAD



20 0 20 40
SCALE: 1" = 20'

PREPARED BY:

CROSSROAD ENGINEERS, PC
Transportation & Development Consultants
115 N. 17th AVENUE, BEECH GROVE, IN 46107 (317) 780-1555

JUNE 8, 2023

National Flood Hazard Layer FIRMette

FEMA

86°4'49"W 39°28'46"N

0 250 500 1,000 1,500 2,000 Feet 1:6,000

86°4'12"W 39°28'18"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/7/2023 at 8:26 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

SECTION 2: HYDROLOGIC MODELING CALCULATIONS

As previously noted, all stormwater calculations were completed using rational method. The time of concentration for each inlet was calculated using the TR-55 method. Curve numbers were computed based on the applicable cover for fully developed urban areas and the percentage area of each hydrologic soil type obtained from the USDA Web Soils Survey for the project area.

Soil Hydrologic Group Percentage Calculations:

Table 1
Soil Hydrologic Group Percentage Calculations – Pre-Developed

Soil Type	Hydrologic Group – B (acres)	Hydrologic Group – C (acres)
Crosby, YcIA	--	0.541
Miami Silt, YmsB2	--	0.588
Miami Silt, YmsC2	--	0.187
Totals	--	1.316
Percentages of Hydrologic Groups	**0%**	**100%**

Table 2
Soil Hydrologic Group Percentage Calculations – Post-Developed

Soil Type	Hydrologic Group – B (acres)	Hydrologic Group – C (acres)
Crosby, YcIA	--	0.543
Miami Silt, YmsB2	--	0.592
Miami Silt, YmsC2	--	0.187
Totals	--	1.322
Percentages of Hydrologic Groups	**0%**	**100%**

Pre-Development Conditions

Table 3
Pre-Development Runoff Curve Number Calculations

Land Use Description	Runoff Curve No. For Hydrologic Group – B		Runoff Curve No. For Hydrologic Group – C		Average Runoff Curve Number	Land Use Area	Overall Weighted Curve No.
	*Percentage Used**	*0%*	*Percentage Used**	*100%*			
Pavement	98		98		98	0.365 Ac.	**80.66**
Open Space	61		74		74	0.951 Ac.	

*See Soil Hydrologic Group Percentage Calculations, Table 1.

Post-Development Conditions

Table 4
Post-Development Runoff Curve Number Calculations

Land Use Description	Runoff Curve No. For Hydrologic Group – B		Runoff Curve No. For Hydrologic Group – C		Average Runoff Curve Number	Land Use Area	Overall Weighted Curve No.
	*Percentage Used**	*0%*	*Percentage Used**	*100%*			
Pavement	98		98		98	0.521 Ac.	**83.46**
Open Space	61		74		74	0.801 Ac.	

*See Soil Hydrologic Group Percentage Calculations, Table 2.

HYDROLOGIC MODELING RUNOFF SUMMARY

PRE-DEVELOPMENT CONDITIONS

The City of Franklin Subdivision Control Ordinance requires a detention design that outlets stormwater at the following rates:

Post-Development:		Pre-Development:
Post 10-yr Q	≤	Pre 2-yr Q
Post 100-yr Q	≤	Pre 10-yr Q

The City of Franklin requires that the 10-year and 100-year post-development rain events shall be limited to the pre-developed 2-year and 10-year rain events, respectively. The City of Franklin Subdivision Control Ordinance requires that the storm events are calculated at durations of 1, 2, 3, 6, 12, and 24 hours to identify the critical storm events which are to be used for the respective limiting pre-development rates; however, only the 24-hour storm was calculated, as it is customary that the peak runoff is generated during the 24-hour event using the SCS Type II rainfall distribution. Table 3 summarizes the peak runoff rates (cfs) resulting from the hydrologic modeling of the Pre-Development Watershed Basin which is representative of the contributing watershed area in the existing condition. Runoff rates were only calculated for the areas collected by the existing storm sewer system as the allowable release rates will be determined based on that watershed only. See Appendix A for the pre-developed hydrograph and peak storm event analysis results.

Table 3
Pre-Development Watershed Hydrograph Peak Runoff Rate Summary

Return Period (years)	Storm Duration
	24 Hours
2	**1.92 cfs**
10	**3.38 cfs**

Basin Allowable Discharge:

Allowable discharge for the critical 10-year post-development storm=
Pre-Development 2-year Peak = 1.92 cfs

Allowable discharge for the critical 100-year post-development storm=
Pre-Development 10-year Peak = 3.38 cfs

POST-DEVELOPMENT CONDITIONS

Table 4 summarizes the peak runoff rates resulting from the hydrologic modeling of the Post-Development Watershed Basin which is representative of the contributing watershed area in the proposed condition. See Appendix B for the post-development hydrographs and peak storm event analysis results.

Table 4
Post-Development Watershed Hydrograph Peak Runoff Rate Summary

Return Period (years)	Storm Duration
	24 Hours
10	**4.15 cfs**
100	**6.92 cfs**

Map Scale: 1:735 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Johnson County, Indiana
Survey Area Data: Version 30, Sep 3, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 15, 2022—Jun 21, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
YclA	Crosby silt loam, fine-loamy subsoil-Urban land complex, 0 to 2 percent slopes	0.5	41.1%
YmsB2	Miami silt loam-Urban land complex, 2 to 6 percent slopes, eroded	0.6	44.7%
YmsC2	Miami silt loam-Urban land complex, 6 to 12 percent slopes, eroded	0.2	14.2%
Totals for Area of Interest		**1.3**	**100.0%**

Map Scale: 1:739 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Johnson County, Indiana
Survey Area Data: Version 30, Sep 3, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 15, 2022—Jun 21, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
YclA	Crosby silt loam, fine-loamy subsoil-Urban land complex, 0 to 2 percent slopes	0.5	41.0%
YmsB2	Miami silt loam-Urban land complex, 2 to 6 percent slopes, eroded	0.6	43.7%
YmsC2	Miami silt loam-Urban land complex, 6 to 12 percent slopes, eroded	0.2	15.3%
Totals for Area of Interest		**1.3**	**100.0%**

SECTION 3: WATER QUALITY CALCULATIONS

The City of Franklin Subdivision Control Ordinance requires all paved areas to be routed through a water quality detention system. The water quality detention system shall be designed to detain, for over 24 hours after peak runoff, at least 20% of the volume of runoff from a 1 ¼" rainfall depth storm or 0.5" of direct runoff, whichever is greater. The minimum water quality outlet shall be 2" in diameter. See Appendix B for the water quality hydrograph results, additional water quality data, routed water quality hydrograph, and Exhibit 4 – Water Quality Watershed Map.

WATER QUALITY VOLUME

Volume of Runoff from 1 ¼" Rainfall Depth Storm, V_1 = 1,237 ft^3 = 0.028 ac.-ft
Volume of Runoff from 0.5" Direct Runoff,

V_2 = 1.32 ac. * (0.5"/12) = **0.055 ac.-ft**

Water Quality Volume, WQ_v = 20% * V_2 = 0.2 * 0.055 ac.-ft = **0.011 ac.-ft → 480 ft^3**

At a time of 24 hours after the peak runoff rate of the inflow hydrograph, the detention system must have at least 0.011 ac.-ft or 480 ft^3 remaining in the basin.

ROUTED WATER QUALITY STORM HYDROGRAPH

The 0.5" direct runoff storm event is routed through the proposed detention system with a 2" diameter circular water quality orifice. The Routed 0.5" Storm Event Hydrograph is used to verify the water quality volume, WQ_v, remaining after 24 hours past peak runoff.

Table 7
Water Quality Volume Summary

	Time	Volume
Time to Peak	12.83 hours	935 ft^3
Maximum Time where WQv is Detained	16.00 hours	487 ft^3
Storage Volume at Time of 24 hours Past Peak Runoff	36.83 hours	5 ft^3

The minimum 2" diameter water quality orifice is not small enough to detain the required water quality volume for the minimum 24 hours. The water quality volume can be detained for 3.17 hours utilizing the 2" water quality orifice.

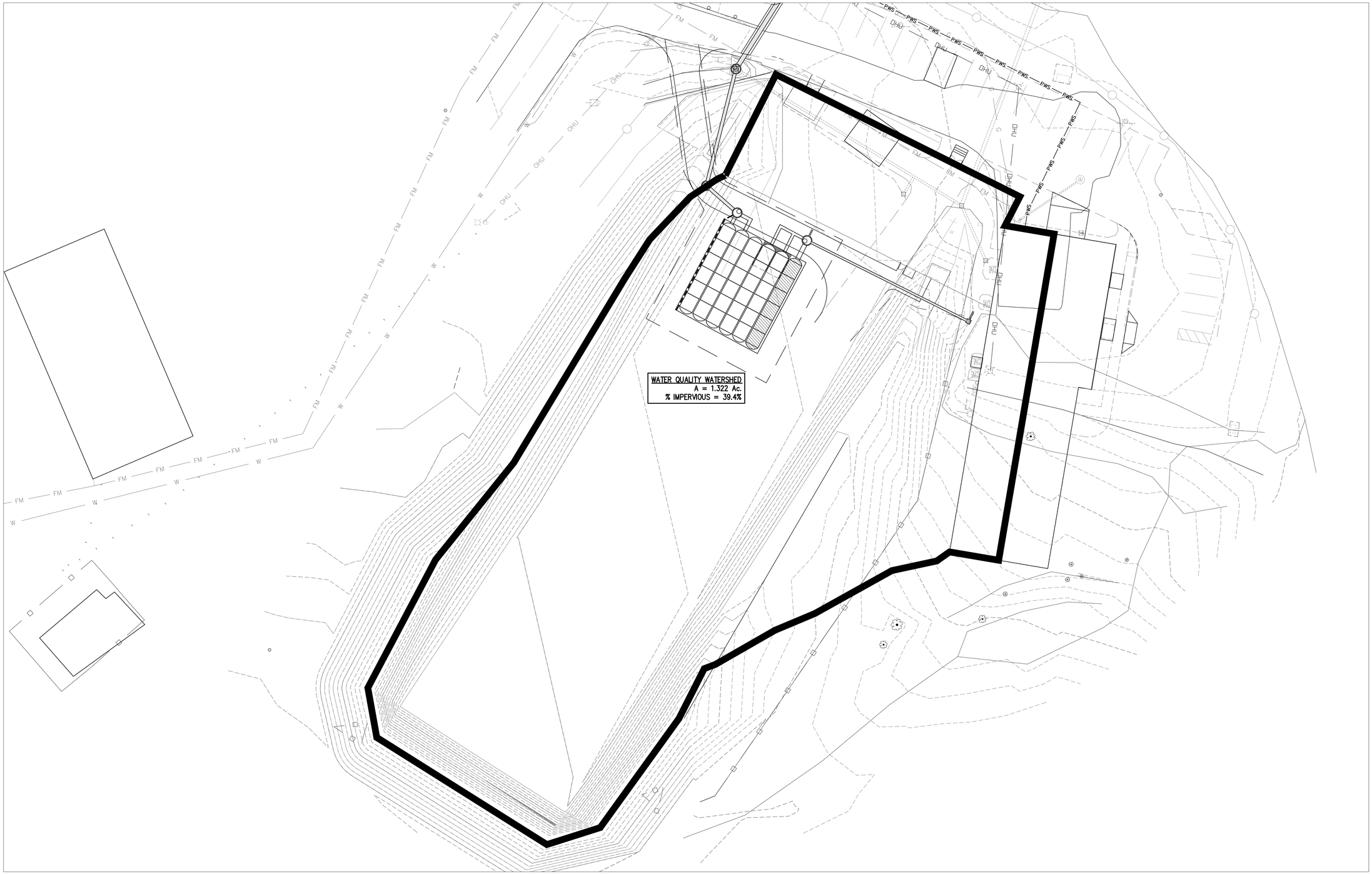
SUPPLEMENTAL WATER QUALITY INFORMATION

Since the proposed detention system is an underground system, more information has been provided on the function and water quality treatment the proposed isolator rows provide. Per literature available from ADS Stormtech's website, the Isolator Row Plus has been tested and NJCAT verified to remove 81% Total Suspended Solids. The minimum 80% TSS removal is achieved by sizing the Isolator Row Plus to treat the water quality at a specific flow rate per chamber floor area using a single layer of ADS PLUS fabric. The design flow rate for a StormTech MC-3500 chamber is 0.40 cfs / chamber. Each MC-3500 chamber can treat a flow rate of 0.40 cfs.

Using the 0.5” direct runoff storm event, the water quality flow rate generated is 0.79 cfs. In order to meet the minimum 80% TSS removal rate, a minimum of 2 chambers in the isolator rows are required. With the one isolator row, 6 chambers are provided which correlates to a treated flow rate of 2.40 cfs.

The Summary of Testing literature can be found within this section.

EXHIBIT 4 - WATER QUALITY WATERSHED MAP
JOHNSON COUNTY TRAINING FACILITY
1081 HOSPITAL ROAD



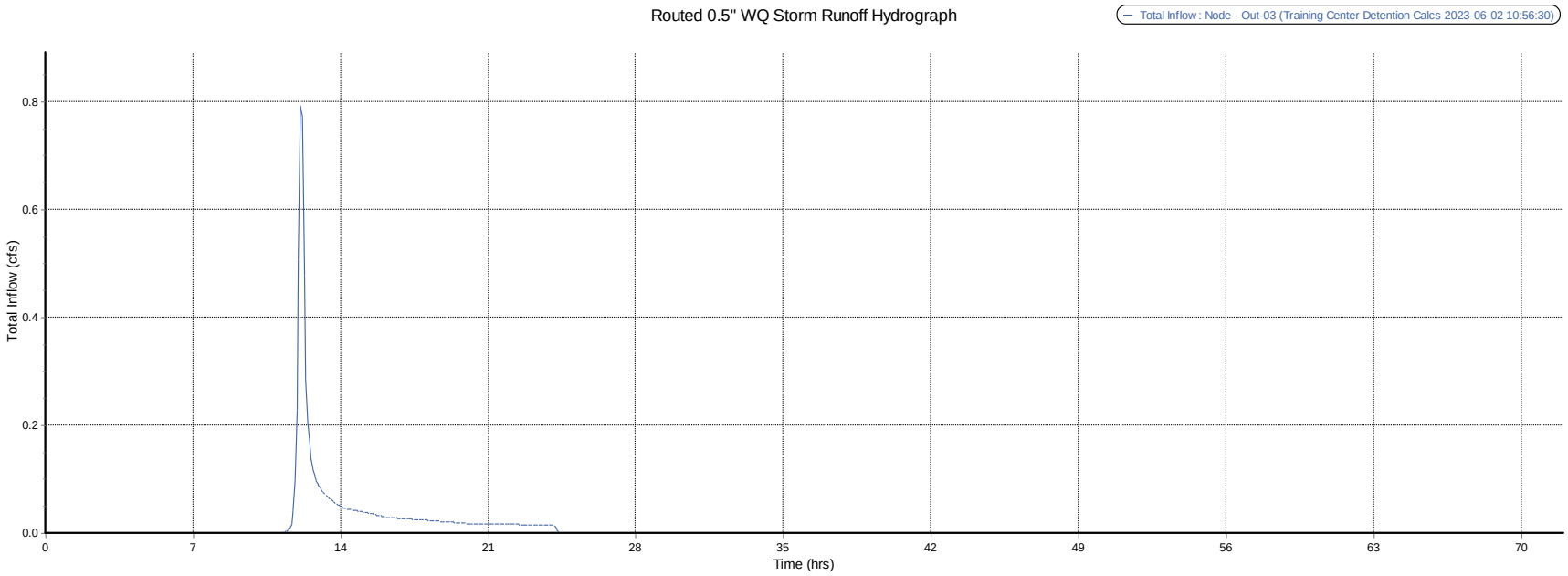
20 0 20 40
SCALE: 1" = 20'

PREPARED BY:

CROSSROAD ENGINEERS, PC
Transportation & Development Consultants
115 N. 17th AVENUE, BEECH GROVE, IN 46107 (317) 780-1555

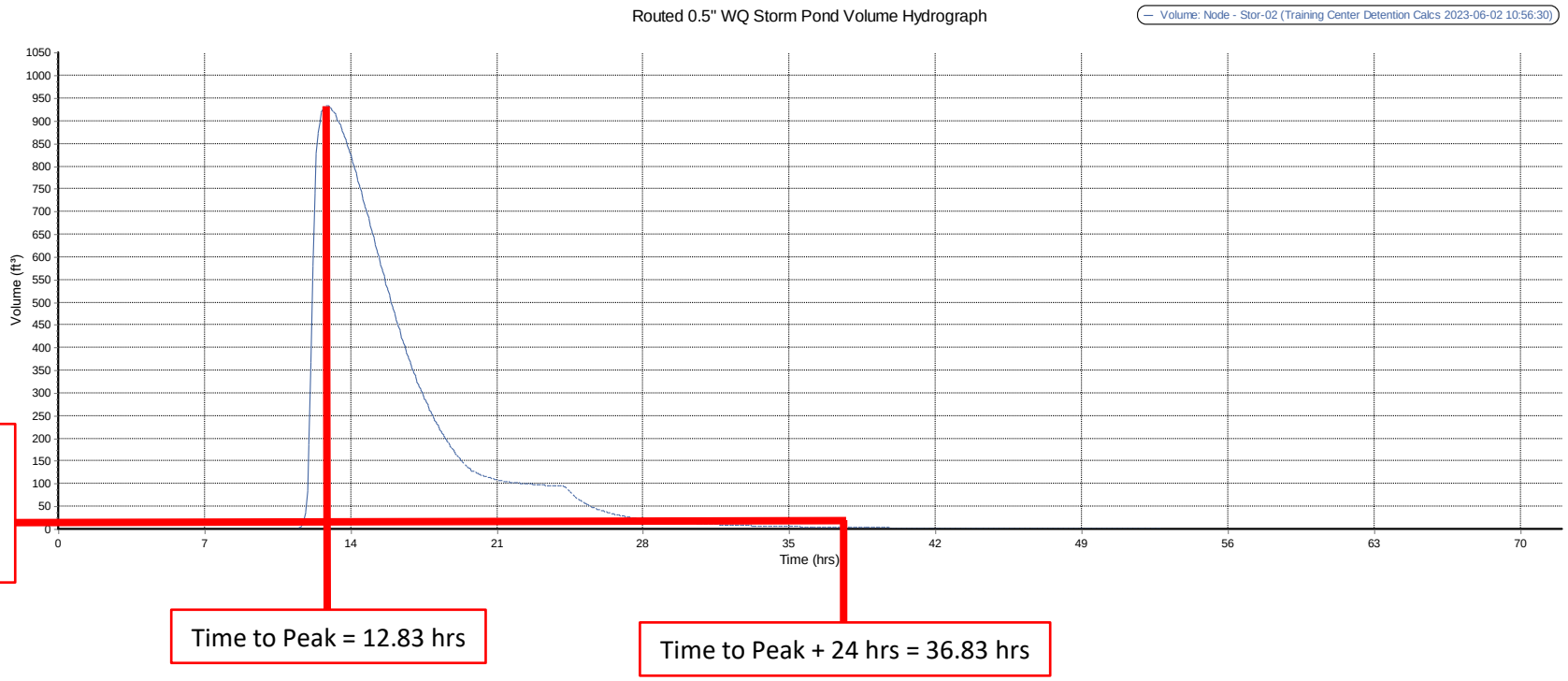
JUNE 8, 2023

Routed 0.5” WQ Storm Runoff Hydrograph and Results



Element ID	Out-03
Maximum Total Inflow (cfs)	0.79
Minimum Total Inflow (cfs)	0.00
Event Mean Total Inflow (cfs)	0.01
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft³)	N/A
Volume of Deficit (ft³)	N/A
Total Inflow Volume (ft³)	**2399.44**
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

Routed 0.5” WQ Storm Pond Volume Hydrograph and Results



Volume at Time to Peak + 24 hrs = 5 cu. Ft.

Time to Peak = 12.83 hrs

Time to Peak + 24 hrs = 36.83 hrs

Element ID	Stor-02
Maximum Volume (ft³)	934.35
Minimum Volume (ft³)	0.00
Event Mean Volume (ft³)	66.91
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Exceedance	0
Deficit	0

Summary of Testing

StormTech® Isolator® Row Plus – Pollutant Removal

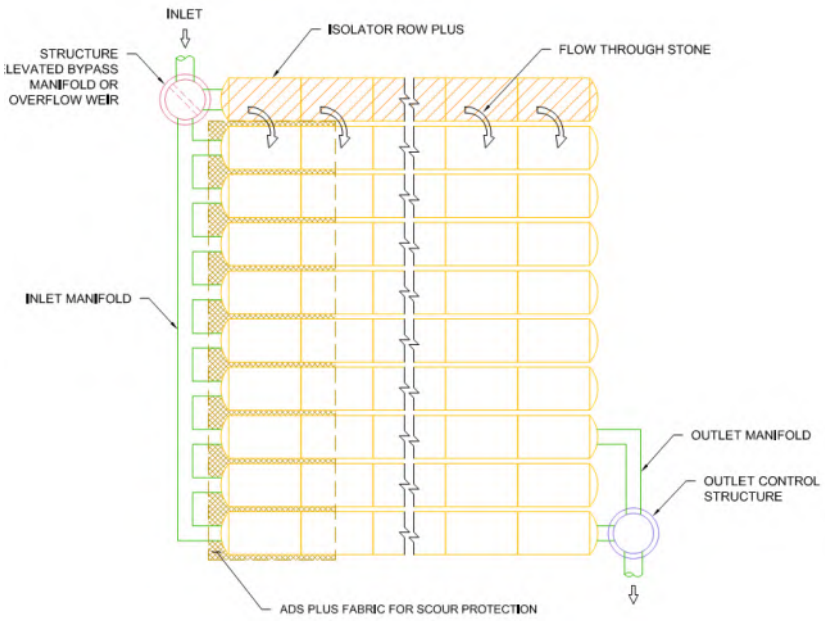
The following information is intended to provide a general overview of the pollutant removal capability of the StormTech Isolator Row Plus, which is a patented filtration type BMP manufactured by StormTech, LLC. The StormTech Isolator Row Plus is covered under several US and International patents.

I. Description:

The StormTech Isolator Row Plus is a row or rows of thermoplastic chambers that sit on a layer of ADS Plus fabric and are connected to a closely located structure for easy access. The chambers provide for settling and filtration of sediment and other contaminants as stormwater rises in the Isolator Row Plus and ultimately passes through the fabric. The open-bottom chambers allow stormwater to flow out of the chambers. Sediment is captured in the Isolator Row Plus, protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

The StormTech Isolator Row Plus is designed to capture the “first flush” and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator Row but includes a high low/concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row bypass through a manifold to the other chambers. This is achieved with either a high-flow weir or an elevated manifold. This creates a differential between the Isolator Row Plus and the manifold, thus allowing for settlement time in the Isolator Row Plus.

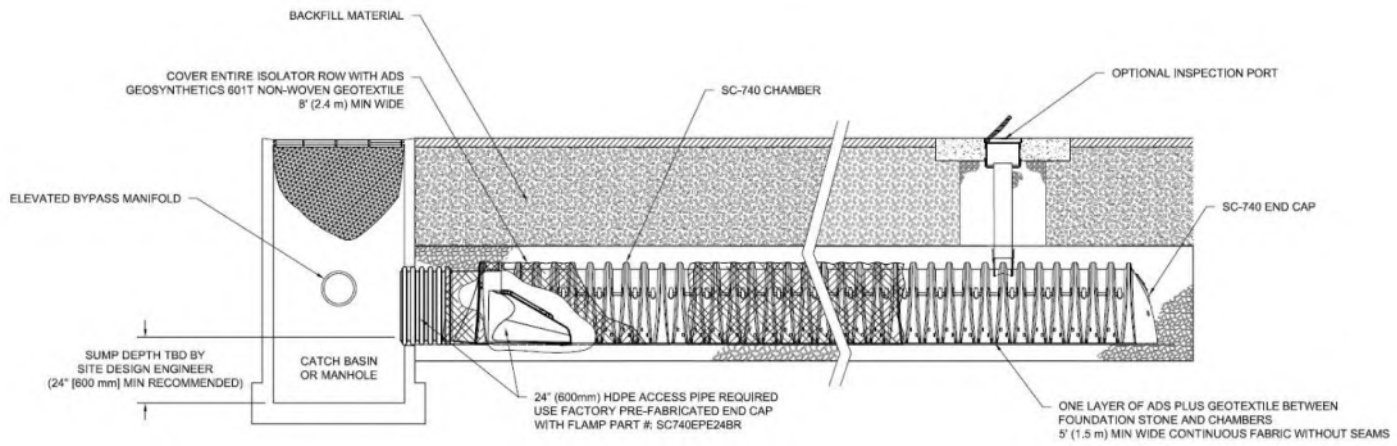
Figure 1: Schematic of the StormTech Isolator Row Plus System



Some of the unique features of the Isolator Row that contribute to its effectiveness and practicality include:

- Vast filtration surface area
- Large sediment storage volume
- Easily maintainable by most pipe and sewer maintenance companies
- Large network of ADS personnel that can help with designs and provide onsite guidance
- A state-of-the-art structural design that meets ASTM standards and incorporates AASHTO safety factors for both live loads and permanent dead loads

Figure 2: Isolator Row Plus Cross Section Detail



II. Applicable Sites:

The Isolator Row Plus can be effectively used for essentially all developed sites. The most common applications are highly impervious sites such as paved parking areas, roads as well as developed sites that include grassy or other landscaped areas. It is not intended to be used for construction sediments.

III. StormTech System & Isolator Row Testing:

October 2006 – Tennessee Tech University's Civil and Environmental Department prepared the "Performance Evaluation of Sediment Removal Efficiency – StormTech Isolator Row". Testing on a full-scale Isolator Row in a laboratory was done to determine the sediment removal efficiency with two different silica-water slurries in accordance with NJCAT protocols. In August of 2007, the technology was verified by NJCAT. Results are shown in Table 1.

September 2010 – The University of New Hampshire Stormwater Center released the "Final Report on Field Verification Testing of the StormTech Isolator Row Treatment Unit". Testing consisted of determining the water quality performance for multiple stormwater pollutants in accordance with TARP Tier II protocol. Testing was done for a system only consisting of the StormTech Isolator Row. Data was recorded for 23 storm events. Results are shown in Table 1.

January 2020 – BaySaver Technologies prepared the "NJCAT Technology Verification of Isolator Row Plus". Testing on a full-scale Isolator Row Plus in a laboratory was done to determine the sediment removal efficiency with a silica-water slurry in accordance with the updated NJCAT protocols. In July of 2020, the technology was verified by NJCAT. Results are shown in Table 1.

June 2020 – North Carolina State University Department of Biological and Agricultural Engineering prepared the technical report "An Evaluation of the StormTech Isolator Row and Subsurface Stormwater Management System at Capital Oaks Retirement Resort, Raleigh, North Carolina". 14 months of monitoring and over 73 precipitation events were completed to study the hydrologic and water quality performance of a StormTech MC-4500 system in Raleigh, NC. Results are shown in Table 1.

Table 1: StormTech Isolator Row 3rd Party Pollutant Removal Efficiency Data

Pollutant	University of New Hampshire (Isolator Row Only) Median	Raleigh, North Carolina (StormTech system with Isolator Row)	Tennessee Tech University (Isolator Row Only)	NJCAT Verification (Isolator Row Plus only)
Total Suspended Solids	83%*	91%*	84%*	81%**
Total Phosphorus	33%	68%	Not Tested	Not Tested
Total Nitrogen	Not Tested	35%	Not Tested	Not Tested
Total Zinc	81%	Not Tested	Not Tested	Not Tested
Total Petroleum Hydrocarbons	91%	Not Tested	Not Tested	Not Tested

*Based on a flow rate of 2.5 gpm/sf (1.70 L/s/m^2) (Isolator Row)
** Based on a flow rate of 4.1 gpm/sf (2.78 L/s/m^2) (Isolator Row Plus)

IV. Product Performance and Design:

Minimum 80% TSS removal is achieved by sizing the Isolator Row PLUS to treat the water quality at a specific flow rate per chamber floor area using a single layer of ADS Plus fabric. The design flow rates for each chamber size are listed below.

Model	Specific Flow Rate	Bottom Area	Flow Per Model
StormTech SC-160LP	4.1 gpm/sf (2.78 L/s/m^2)	11.45 sf (1.06 m^2)	0.11 cfs (3.11 L/s)
StormTech SC-310	4.1 gpm/sf (2.78 L/s/m^2)	17.7 sf (1.64 m^2)	0.16 cfs (4.53 L/s)
StormTech SC-740	4.1 gpm/sf (2.78 L/s/m^2)	27.8 sf (2.58 m^2)	0.26 cfs (7.36 L/s)
StormTech DC-780	4.1 gpm/sf (2.78 L/s/m^2)	27.8 sf (2.58 m^2)	0.26 cfs (7.36 L/s)
StormTech MC-3500	4.1 gpm/sf (2.78 L/s/m^2)	42.9 sf (3.99 m^2)	0.40 cfs (11.33 L/s)
StormTech MC-4500	4.1 gpm/sf (2.78 L/s/m^2)	30.1 sf (2.80 m^2)	0.28 cfs (7.93 L/s)
StormTech MC-7200	4.1 gpm/sf (2.78 L/s/m^2)	50.0 sf (4.65 m^2)	0.45 cfs (12.74 L/s)

V. StormTech Isolator Row Approvals:

The StormTech Isolator Row and Isolator Row Plus have been approved on a project by project basis for tens of thousands of projects around the world. Following are some examples:

- The Isolator Row Plus is a verified filtration manufactured treatment device by the New Jersey Corporation for Advanced Testing (NJCAT) in accordance with NJDEP Filter Protocols.
- In Ohio, the Isolator Row is approved per the Ohio EPA as a pretreatment to underground storage and can be used for both storage volume and pretreatment as the water quality volume all passes through the Isolator Row.
- The Metropolitan St. Louis Sewer District (MSD) has approved the StormTech Isolator Row as a standalone post-construction stormwater Best Management Practice.
- In Massachusetts, approvals for the State DEP requirement of 80% TSS removal on an annual load basis are issued at the Conservation Commission level, and the Isolator Row is commonly used to meet these criteria.
- In Oregon, the Rogue Valley Storm Water Advisory Team (SWAT) has incorporated the StormTech Isolator Row into their Stormwater Design Manual as a pre-approved proprietary device for stormwater quality treatment.
- The Kansas City Metro Chapter of the American Public Works have included the StormTech Isolator Row wit a value rating of 3.0 in their Manual of Best Management Practices for Stormwater Quality.
- Maine DEP has approved the Isolator Row pollutant removal efficiency based on laboratory testing of 110 micron (US Silica OK-110) particle size
- In Texas, the City of Houston PWE as well as Harris county, has recognized the Isolator Row as an official water quality device.
- Under the New Environmental Technology Evaluation program, the Ontario (Canada) Ministry of the Environment has evaluated the Isolator row and issued a Certificate of Technology Assessment
- The Isolator Row Plus has been evaluated and approved for Canadian Environment Technology Verification (ETV) by VerifiGlobal.

V. Isolator Row Maintenance:

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location, based upon site-specific variables. The type of land use (i.e. industrial, commercial, public, residential), anticipated pollutant load, percent imperviousness, climate, rainfall data, etc., all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection schedule should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If, upon visual inspection, it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediment to just one row, costs are dramatically reduced by eliminating the need to clean out

each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout.

Maintenance is accomplished with the jetvac process. The jetvac process utilizes a high-pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediment. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/jetvac combination vehicles. Selection of an appropriate jetvac nozzle will improve maintenance efficiency.

Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear-facing jets with an effective spread of at least 45” are best. Most jetvac reels have 200 feet of hose, allowing maintenance of an Isolator Row up to 50 chambers long. The jetvac process shall only be performed on StormTech Isolator Rows that have fabric specified by StormTech over their angular base stone.

Complete details of the design, operation, and maintenance of the Isolator Row Plus can be found in the StormTech Isolator Row and Isolator Row Plus O&M Manuals.

SECTION 4: DETENTION CALCULATIONS

Per ordinance, stormwater detention is addressed by restricting the release rates of runoff previously described in Section 2: Hydrologic Modeling Calculations. The following information is provided as verification that the proposed wet detention ponds and outlet structure are capable of detaining and restricting the release rates of runoff from the post-developed site.

Allowable Discharge Rate (see Section 2: Hydrologic Modeling Calculations, Hydrologic Modeling Runoff Summary)

Allowable discharge for the critical 10-year post-development storm =
Pre-Development 2-year Peak = **1.92 cfs**

Allowable discharge for the critical 100-year post-development storm =
Pre-Development 10-year Peak = **3.38 cfs**

Post-Development Peak Flowrate (see Section 2: Hydrologic Modeling Calculations, Hydrologic Modeling Runoff Summary)

Post-Development Watershed:
Q_{10} = 4.15 cfs
Q_{100} = 6.92 cfs

Outlet Structure Summary (see Appendix C: Post-Development Runoff & Routed Storm Data)

The proposed outlet structure shall utilize a Modified Inlet Type "E" with one (1) circular 2" diameter orifice to meet the water quality requirements, one (1) circular 7.00" diameter orifice to meet allowable discharge requirements for 10-year critical storm events, and one (1) 3" x 6" rectangular orifice to meet the detention and allowable discharge requirements for 100-year critical storm events. Discharge will be conveyed directly into Young's Creek to the north via a proposed 18" diameter outlet pipe leaving the outlet control structure.

Routed Storm Hydrographs (see Appendix C: Post-Developed Runoff & Routed Storm Data)

Peak 10-Year Post-Development Discharge Rate = **1.72 cfs** ≤ 1.92 cfs (allowable)
Peak Water Surface Elevation = **727.87** < 729.65 (top of emergency spillway)

Peak 100-Year Post-Development Discharge Rate = **3.37 cfs** ≤ 3.38 cfs (allowable)
Peak Water Surface Elevation = **729.65** < 729.65 (top of emergency spillway)

All post-development storms are discharged at a flowrate less than their respective allowable discharge rates. All post-development storms produce a water surface elevation below the maximum detention system elevation.

Emergency Scenario

An emergency overflow weir will be constructed inside of the outlet control structure in the event that the control orifices become clogged and inoperable. The emergency weir was designed to convey 1.25 x Q_{100} where Q_{100} equals the peak 100-year inflow to the basin from the entire contributing watershed. The spillway will ultimately discharge into Young's Creek north of the site. Below are calculations for the emergency spillway:

Q_{100} Inflow = 6.92 cfs
1.25 x Q_{100} Inflow = 8.65 cfs
Length of Weir = 4.5 ft. (min.)
Top of Detention Basin Elevation = 730.70
Spillway Crest Elevation = 729.65
Water Surface Elevation = 730.35

$H = [(1.25 * Q100) / (3.3 * L)]^{2/3} = [8.65 / (3.3 * 4.5)]^{2/3} = 0.70'$

The head needed to convey the required flowrate is 0.70'. The corresponding elevation is 730.35, which means the emergency elevation is still contained within the limits of the detention system. It does not exceed the elevation of the top of the stone and will not cause any surcharging of the outlet structure or any structures upstream.

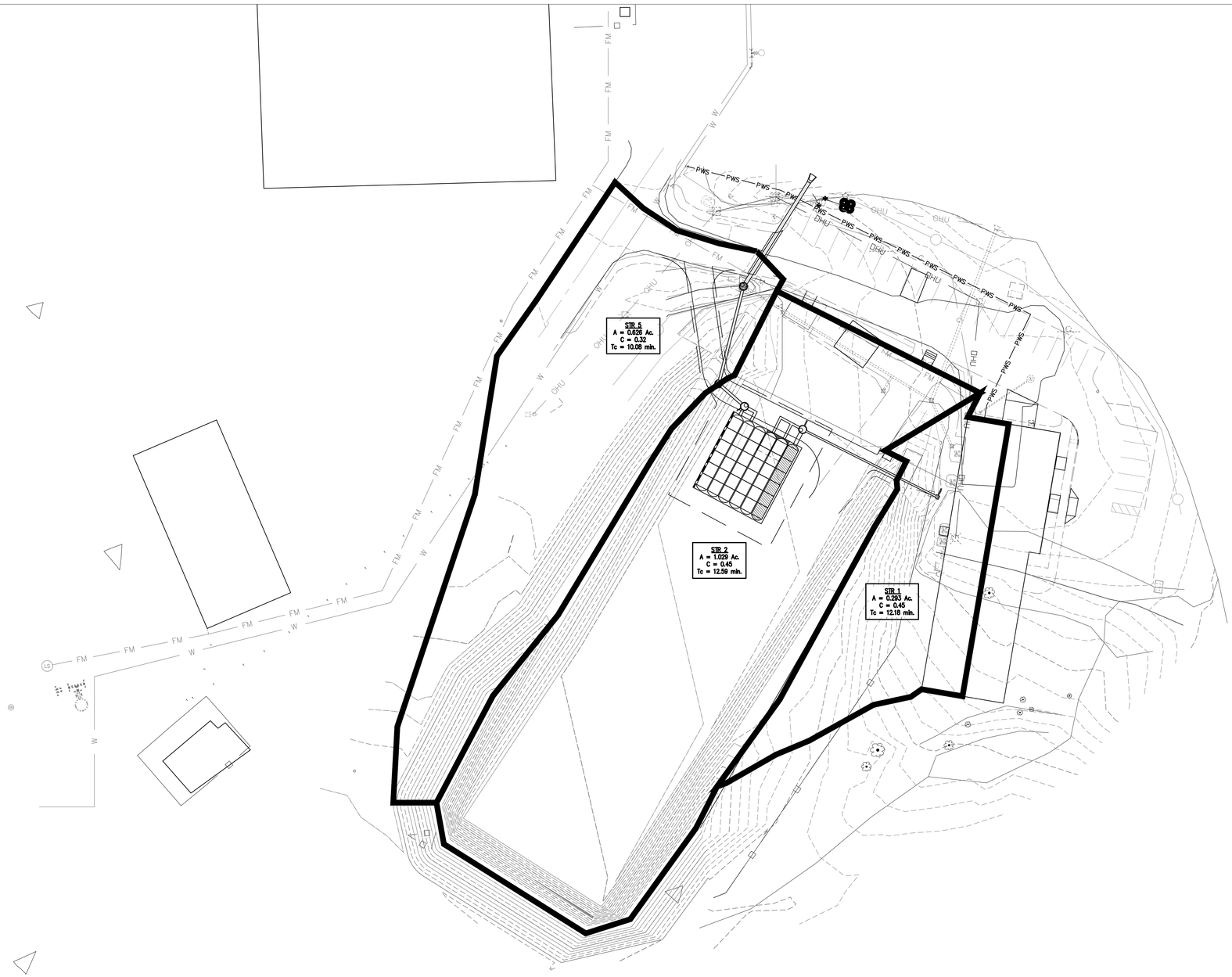
SECTION 5: STORM SEWER PIPE SIZING CALCULATIONS

The storm sewer was designed to convey via gravity the peak runoff from the 10-year storm event. Additionally, the storm sewer was designed such that the hydraulic grade line resulting from the 100-year storm event does not surcharge above the rim elevation at the storm structures. However, as an additional measure of protection, the pipes downstream of the detention system's outlet structure were sized to convey the 100-year flow leaving the detention system. All drainage calculations were completed using the Rational Method. The time of concentration was calculations and composite runoff coefficient calculations are also included in Appendix A.

Runoff & Pipe SizingSpreadsheet **Project** Johnson County Training Facility **Computed By:** BTV **Date** 6/8/2023

Structure	Pipe Data						Inlet Watershed Data												Contributing Watershed Data						Pipe Analysis		
	Downstream Structure	Length (ft)	Pipe Diameter (in)	Pipe Material	Invert Slope (%)	Mannings Number n	Catchment Area (ac) Conc/Roof	Runoff Coefficient C Conc/Roof	Catchment Area (ac) Asphalt	Runoff Coefficient C Asphalt	Catchment Area (ac) Grass	Runoff Coefficient C Grass	Total Area A (ac)	Composite Coefficient C	Tc (min)	Rainfall Intensity (i) in/hr	Manual Input Flow Q (cfs)	10-yr Q=CiA (cfs)	Total Area A (ac)	Runoff Coefficient C	Time in Upstream Pipe (min)	Total Time of Concentration Tc (min)	Intensity I (in/hr)	Total 10-yr Pipe Flow (cfs)	Pipe Capacity Qmax (cfs)	Full Flow Pipe Velocity (ft/s)	% of Full Flow Capacity
1	2	83	12	RCP	0.25	0.013	0.110	0.85	0.000	0.82	0.182	0.20	0.293	0.45	12.18	5.13	0	0.67	0.29	0.45	--	12.18	5.13	0.67	1.90	2.55	35.23%
2	3	--	15	RCP	0.36	0.013	0.131	0.85	0.279	0.82	0.619	0.20	1.029	0.45	12.59	5.05	0	2.34	1.32	0.45	0.54	12.72	5.03	2.99	7.00	3.06	42.67%
3	4	19	18	RCP	0.63	0.013	0.000	0.85	0.000	0.82	0.000	0.20	0.000	--	--	--	0	8.65	1.32	--	--	--	--	8.65	8.89	5.30	97.34%
4	5	56	18	RCP	0.65	0.013	0.000	0.85	0.000	0.82	0.000	0.20	0.000	--	--	--	0	8.65	1.32	--	--	--	--	8.65	9.03	5.39	95.83%
5	ES	73	24	RCP	0.30	0.013	0.000	0.85	0.117	0.82	0.509	0.20	0.626	0.32	10.08	5.55	8.65	1.10	0.63	0.32	0.17	10.25	5.52	9.74	13.21	4.43	73.75%

EXHIBIT 5 - INLET WATERSHED MAP
JOHNSON COUNTY TRAINING FACILITY
1081 HOSPITAL ROAD



NORTH

30 0 30 60

SCALE: 1" = 30'

PREPARED BY:

CROSSROAD ENGINEERS, PC

Transportation & Development Consultants

115 N. 17th AVENUE, BEECH GROVE, IN 46107 (317) 780-1555

JUNE 8, 2023

SECTION 6: STORM INLET/GRATE CALCULATIONS

Storm inlets were placed throughout the site to ensure that the sag inlets will be adequate to pass the design 10-year flow with 50% of the inlet clogged and with the maximum depth of water not exceeding six (6) inches in paved areas and nine (9) inches in swales/yard areas. The castings used for this project are listed in the table below (Table 5) along with the inlet grate perimeter and open area dimensions per the Neenah Foundry catalog.

The following table (Table 5) indicates the maximum inlet/grate capacity for all inlets in this development. Refer to Appendix A for the grate capacity calculations.

Table 5: Grate Capacity

Structure No.	Casting Type	Watershed Runoff	Max. Allowable Ponding Depth	Total Flow Intercepted	Max. Grate Capacity @ 50% Clogged
1	R-4215-C	0.67 cfs	9”	0.67 cfs	6.99 cfs
2	R-3405	2.34 cfs	6”	2.34 cfs	2.59 cfs
5	R-4215-C	1.10 cfs	9”	1.48 cfs	6.99 cfs

Sag Inlet Capacity Worksheet **Project:** **Johnson County Training Facility** **Computed By:** **BTV** **Date:** **6/8/2023**

Inlet Casting Information					
Type	Width (ft)	Length (ft)	P (ft)	A (sq. ft.)	Depression (in)
R-3405	1.97	1.97	7.9	1.5	N/A
R-4215-C	2.83	2.83	11.3	3.3	N/A

Inlet Grate Design Parameters		
Type	Max. Spread (ft)	Max. Ponding Depth (ft)
Sag Inlet	N/A	0.50

0.75

SAG INLETS

Structure	Casting Type	10-yr Inlet Watershed Flow (cfs)	50% Wetted Perimeter (ft.)	50% Open Area (sq. ft.)	Max. Allowable Ponding (ft)	Max. Allowable Flow w/50% Clogged (cfs)	10-yr Actual Ponding (Weir Equ)	10-yr Actual Ponding (Orifice Equ)	Check Casting
1	R-4215-C	0.67	5.65	1.65	0.75	6.99	0.12	0.01	ok
2	R-3405	2.34	3.95	0.75	0.50	2.59	0.34	0.41	ok
5	R-4215-C	1.10	5.65	1.65	0.75	6.99	0.16	0.02	ok

APPENDIX A: PRE-DEVELOPMENT RUNOFF DATA

SUB-BASIN INPUT SUMMARY						
SN	**Element ID**	**Description**	**Area (acres)**	**Drainage Node ID**	**Weighted Curve Number**	**Time of Concentration (days hh:mm:ss)**
1	Post-Dev Basin		1.322	Stor-02	83.46	0 00:12:35
2	Pre-Dev Basin		1.316	Out-01	80.66	0 00:16:29

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: Johnson County Training Center

Designer: BTV **Date:** 8-Jun-23

Str. No.: Pre-Dev ToC

Sheet Flow

1.	Surface Description	grass			pavement			grass	
2.	Manning's Roughness Coeff., (n)	0.170			0.011			0.170	
3.	Flow Length, (L) **total L<= 300 ft	17.05	ft.		0.00	ft.		82.56	ft.
4.	Two-yr 24-hr Rainfall, (P2)	2.93	in.		2.92	in.		2.92	in.
5.	Land Slope, (s)	0.3300	ft./ft.		0.0200	ft./ft.		0.0100	ft./ft.
6.	Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.015	hr	+	0.000	hr	+	0.214	hr

Shallow Concentrated Flow

7.	Surface Description (paved or unpaved)	unpaved			paved			unpaved	
8.	Flow Length, (L)	222.40	ft.		44.80	ft.		0.00	ft.
9.	Watercourse Slope, (s)	0.0120	ft./ft.		0.0100	ft./ft.		0.0102	ft./ft.
10.	Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	1.767	ft./s		1.613	ft./s		1.630	ft./s
11.	Travel Time, (Tt) (Tt = L/3600V)	0.035	hr	+	0.008	hr	+	0.000	hr

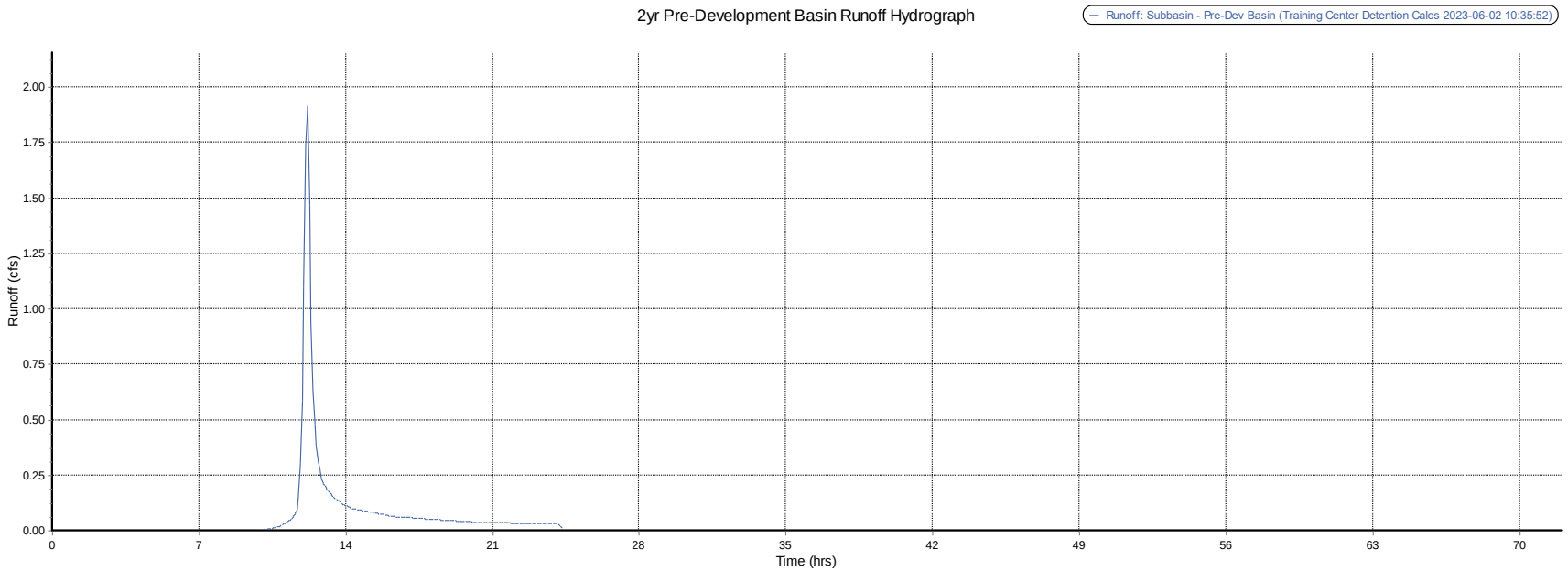
Watershed or Subarea Tc or Tt = **0.271 hr**

or **16.29 min**

Channel Flow

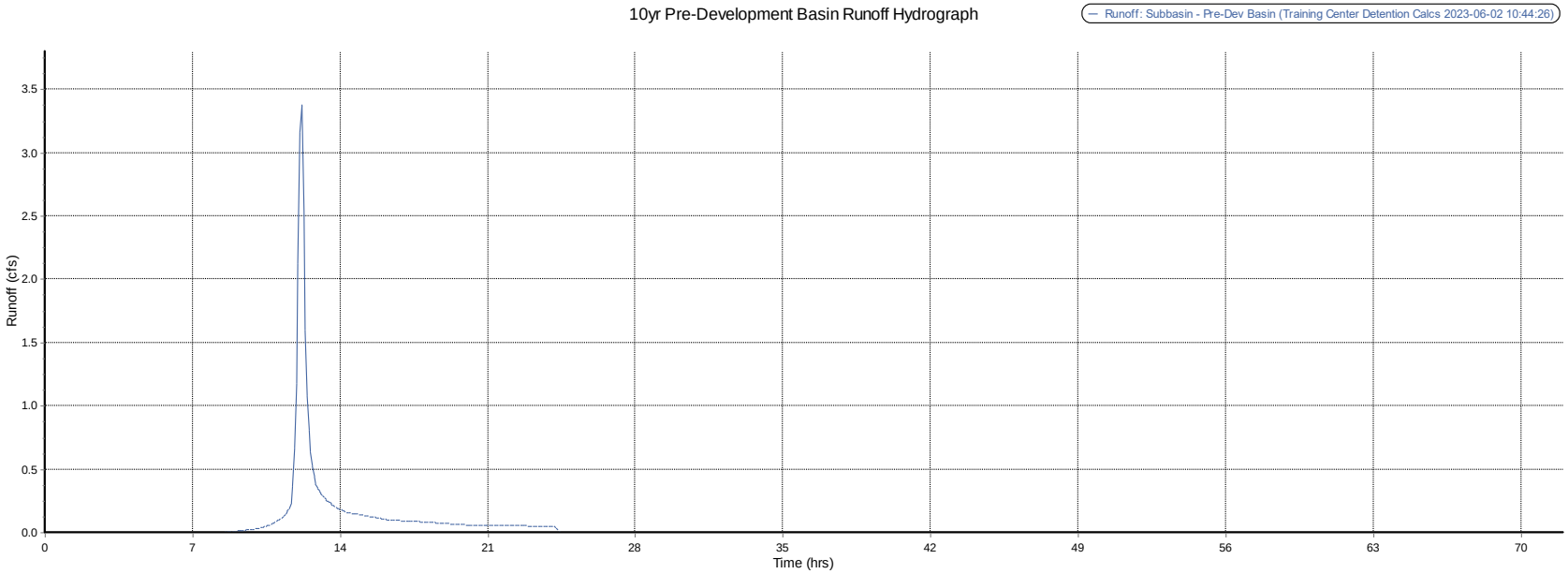
12.	Cross Sectional Flow Area, (a)	0.32	ft.^2		7.07	ft.^2		20.20	ft.^2
13.	Wetted Perimeter, Pw	1.68	ft.		4.71	ft.		18.20	ft.
14.	Hydraulic Radius, (r) (r = a/Pw)	0.189	ft.		1.501	ft.		1.110	ft.
15.	Channel Slope, (s)	0.0038	ft./ft.		0.0120	ft./ft.		0.0050	ft./ft.
16.	Manning's Roughness Coeff., (n)	0.170			0.170			0.060	
17.	Velocity, (V) (V = [1.49*r^0.67*s^0.5]/n)	0.177	ft./s		1.260	ft./s		1.883	ft./s
18.	Flow Length, (L)	0.00	ft.		0.00	ft.		0.00	ft.
19.	Travel Time, (Tt) (Tt = L/3600V)	0.000	hr	+	0.000	hr	+	0.000	hr

2yr Pre-Development Basin Runoff Hydrograph and Results



Element ID	Pre-Dev Basin
Maximum Runoff (cfs)	**1.92**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (cfs)	0.02
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft^3)	N/A
Volume of Deficit (ft^3)	N/A
Total Runoff (ft^3)	5926.73
Detention Storage (ft^3)	N/A
Exceedance	0
Deficit	0

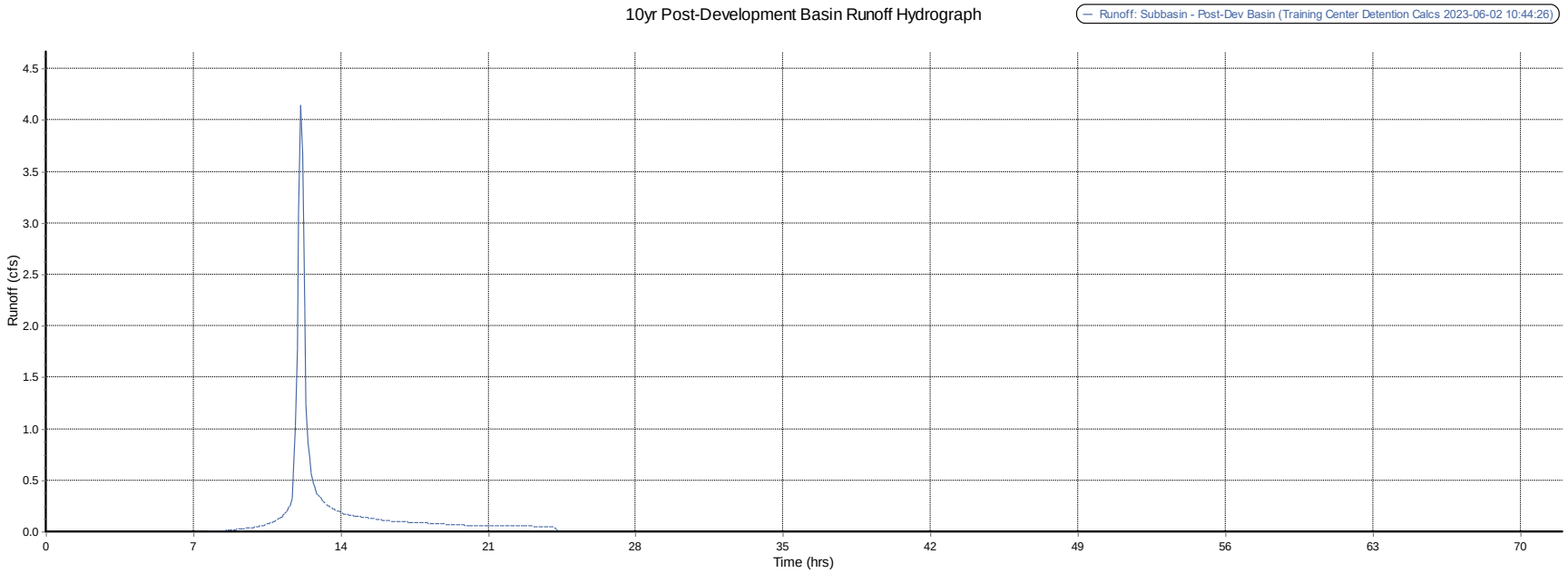
10yr Pre-Development Basin Runoff Hydrograph and Results



Element ID	Pre-Dev Basin
Maximum Runoff (cfs)	**3.38**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (cfs)	0.04
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft^3)	N/A
Volume of Deficit (ft^3)	N/A
Total Runoff (ft^3)	10423.61
Detention Storage (ft^3)	N/A
Exceedance	0
Deficit	0

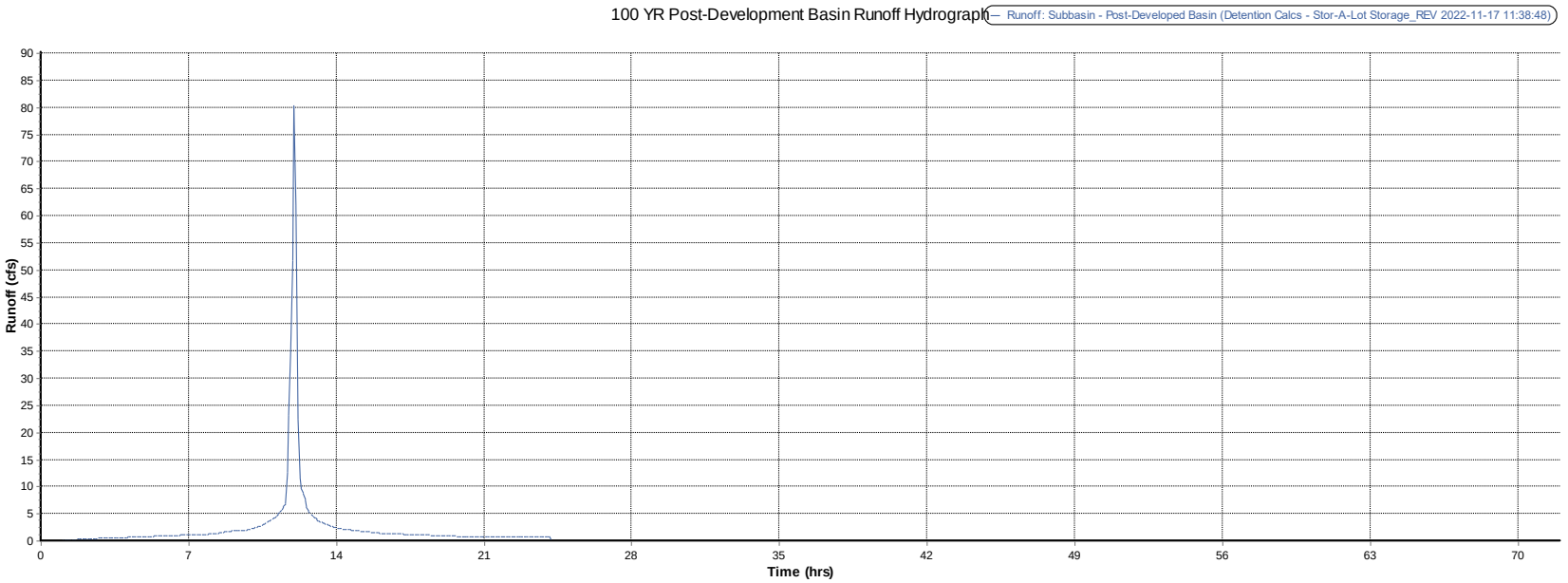
APPENDIX B: POST-DEVELOPMENT RUNOFF AND WATER QUALITY CALCULATIONS DATA

10yr Post-Development Basin Runoff Hydrograph and Results



Element ID	Post-Dev Basin
Maximum Runoff (cfs)	**4.15**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (cfs)	0.04
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft^3)	N/A
Volume of Deficit (ft^3)	N/A
Total Runoff (ft^3)	11602.88
Detention Storage (ft^3)	N/A
Exceedance	0
Deficit	0

100yr Post-Development Basin Runoff Hydrograph and Results



Element ID	Post-Dev Basin
Maximum Runoff (cfs)	**6.92**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (cfs)	0.08
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft^3)	N/A
Volume of Deficit (ft^3)	N/A
Total Runoff (ft^3)	19603.67
Detention Storage (ft^3)	N/A
Exceedance	0
Deficit	0

APPENDIX C: PROPOSED POND DATA

Project: **Johnson County Training Center**

StormTech
Detention • Retention • Water Quality
A division of ADS

Chamber Model -	MC-3500	
Units -	**Imperial**	Click Here for Metric
Number of Chambers -	36	
Number of End Caps -	12	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	725.20	ft
Amount of Stone Above Chambers -	12	in
Amount of Stone Below Chambers -	9	in
Amount of Stone Between Chambers -	6	in
Area of system -	2000	sf

☑ Include Perimeter Stone in Calculations

Min. Area - 1980 sf min. area

StormTech MC-3500 Cumulative Storage Volumes

Height of System *(inches)*	Incremental Single Chamber *(cubic feet)*	Incremental Single End Cap *(cubic feet)*	Incremental Chambers *(cubic feet)*	Incremental End Cap *(cubic feet)*	Incremental Stone *(cubic feet)*	Incremental Ch, EC and Stone *(cubic feet)*	Cumulative System (cubic feet)	Elevation (feet)
66	0.00	0.00	0.00	0.00	66.67	66.67	6882.54	730.70
65	0.00	0.00	0.00	0.00	66.67	66.67	6815.88	730.62
64	0.00	0.00	0.00	0.00	66.67	66.67	6749.21	730.53
63	0.00	0.00	0.00	0.00	66.67	66.67	6682.54	730.45
62	0.00	0.00	0.00	0.00	66.67	66.67	6615.88	730.37
61	0.00	0.00	0.00	0.00	66.67	66.67	6549.21	730.28
60	0.00	0.00	0.00	0.00	66.67	66.67	6482.54	730.20
59	0.00	0.00	0.00	0.00	66.67	66.67	6415.88	730.12
58	0.00	0.00	0.00	0.00	66.67	66.67	6349.21	730.03
57	0.00	0.00	0.00	0.00	66.67	66.67	6282.54	729.95
56	0.00	0.00	0.00	0.00	66.67	66.67	6215.88	729.87
55	0.00	0.00	0.00	0.00	66.67	66.67	6149.21	729.78
54	0.06	0.00	2.09	0.00	65.83	67.92	6082.54	729.70
53	0.19	0.02	6.99	0.29	63.76	71.03	6014.62	729.62
52	0.29	0.04	10.58	0.45	62.25	73.29	5943.59	729.53
51	0.40	0.05	14.53	0.62	60.61	75.76	5870.30	729.45
50	0.69	0.07	24.74	0.81	56.45	82.00	5794.55	729.37
49	1.03	0.09	37.02	1.06	51.44	89.51	5712.55	729.28
48	1.25	0.11	44.98	1.29	48.16	94.43	5623.04	729.20
47	1.42	0.13	51.20	1.52	45.58	98.30	5528.61	729.12
46	1.57	0.14	56.63	1.73	43.32	101.69	5430.31	729.03
45	1.71	0.16	61.46	1.95	41.30	104.71	5328.63	728.95
44	1.83	0.18	65.83	2.18	39.46	107.47	5223.91	728.87
43	1.94	0.20	69.76	2.41	37.80	109.97	5116.44	728.78
42	2.04	0.22	73.47	2.62	36.23	112.32	5006.48	728.70
41	2.13	0.23	76.85	2.82	34.80	114.47	4894.16	728.62
40	2.22	0.25	80.07	3.01	33.44	116.51	4779.69	728.53
39	2.31	0.27	83.04	3.19	32.17	118.41	4663.17	728.45
38	2.38	0.28	85.85	3.36	30.98	120.19	4544.77	728.37
37	2.46	0.29	88.53	3.53	29.84	121.90	4424.58	728.28
36	2.53	0.31	91.01	3.69	28.78	123.49	4302.68	728.20
35	2.59	0.32	93.37	3.85	27.78	125.00	4179.18	728.12
34	2.66	0.33	95.62	4.01	26.81	126.45	4054.18	728.03
33	2.72	0.35	97.74	4.16	25.90	127.81	3927.74	727.95
32	2.77	0.36	99.77	4.32	25.03	129.12	3799.92	727.87
31	2.82	0.37	101.69	4.47	24.20	130.36	3670.81	727.78
30	2.88	0.38	103.52	4.61	23.42	131.54	3540.45	727.70
29	2.92	0.40	105.27	4.75	22.66	132.68	3408.90	727.62
28	2.97	0.41	106.92	4.89	21.94	133.75	3276.22	727.53
27	3.01	0.42	108.45	5.02	21.28	134.75	3142.47	727.45
26	3.05	0.43	109.92	5.16	20.64	135.71	3007.72	727.37
25	3.09	0.44	111.39	5.28	20.00	136.67	2872.01	727.28
24	3.13	0.45	112.70	5.41	19.42	137.53	2735.34	727.20
23	3.17	0.46	113.96	5.53	18.87	138.36	2597.80	727.12
22	3.20	0.47	115.18	5.65	18.34	139.16	2459.44	727.03
21	3.23	0.48	116.32	5.76	17.83	139.92	2320.28	726.95
20	3.26	0.49	117.41	5.87	17.35	140.64	2180.36	726.87
19	3.29	0.50	118.45	5.98	16.90	141.32	2039.73	726.78
18	3.32	0.51	119.45	6.08	16.46	141.98	1898.41	726.70
17	3.34	0.51	120.39	6.17	16.04	142.60	1756.42	726.62
16	3.37	0.52	121.27	6.27	15.65	143.19	1613.82	726.53
15	3.39	0.53	122.13	6.35	15.27	143.76	1470.63	726.45
14	3.41	0.54	122.92	6.44	14.92	144.28	1326.87	726.37
13	3.44	0.54	123.73	6.52	14.57	144.82	1182.59	726.28
12	3.46	0.55	124.48	6.59	14.24	145.31	1037.77	726.20
11	3.48	0.56	125.23	6.66	13.91	145.80	892.46	726.12
10	3.51	0.59	126.18	7.14	13.34	146.66	746.66	726.03
9	0.00	0.00	0.00	0.00	66.67	66.67	600.00	725.95
8	0.00	0.00	0.00	0.00	66.67	66.67	533.33	725.87
7	0.00	0.00	0.00	0.00	66.67	66.67	466.67	725.78
6	0.00	0.00	0.00	0.00	66.67	66.67	400.00	725.70
5	0.00	0.00	0.00	0.00	66.67	66.67	333.33	725.62
4	0.00	0.00	0.00	0.00	66.67	66.67	266.67	725.53
3	0.00	0.00	0.00	0.00	66.67	66.67	200.00	725.45
2	0.00	0.00	0.00	0.00	66.67	66.67	133.33	725.37
1	0.00	0.00	0.00	0.00	66.67	66.67	66.67	725.28

Storage Node Input Summary Table											
SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Max (Rim) Elevation (ft)	Max (Rim) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Ponded Area (ft^2)	Evaporation Loss
1	Stor-02	2123.91	3344.35		725.20	732.00	6.80	725.20	0.00	0.00	0.00

Orifice Input Summary Table															
SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	From (Inlet) Node Invert Elevation (ft)	To (Outlet) Node Invert Elevation (ft)	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (inches)	Rectangular Orifice Height (ft)	Rectangular Orifice Width (ft)	Orifice Invert Elevation (ft)	Orifice Invert Offset (ft)	Orifice Coefficient
1	100-YR Orifice		Stor-02	Outlet Structure	725.20	725.20	SIDE	RECT_CLOSED	NO		0.25	0.50	727.87	2.67	0.6260
2	10-YR Orifice		Stor-02	Outlet Structure	725.20	725.20	SIDE	CIRCULAR	NO	7.00			726.15	0.95	0.6140
3	WQ Orifice		Stor-02	Outlet Structure	725.20	725.20	SIDE	CIRCULAR	NO	2.00			725.20	0.00	0.6140

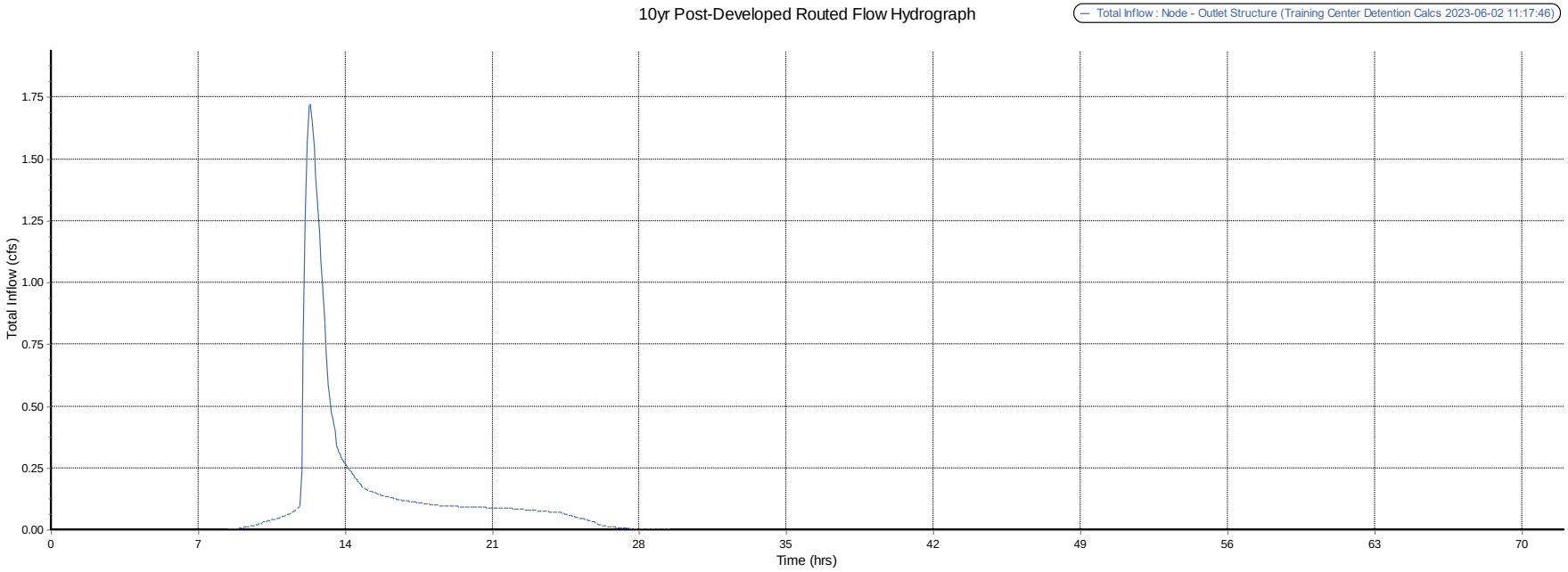
JUNCTION INPUT SUMMARY TABLE													
SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (inches)
1	Outlet Structure	3111.74	3353.33		725.20	734.50	9.30	725.20	0.00	0.00	734.50	0.00	0.00

PIPE INPUT SUMMARY TABLE

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Elevation Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (inches)	Pipe Width (inches)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate
1	Outfall Pipe		Outlet Structure	Out-02	73.00	724.75	0.00	724.50	0.00	0.25	0.3400	CIRCULAR	24.000	0.00	0.0150	0.5000	0.5000	0.0000	0.00	NO

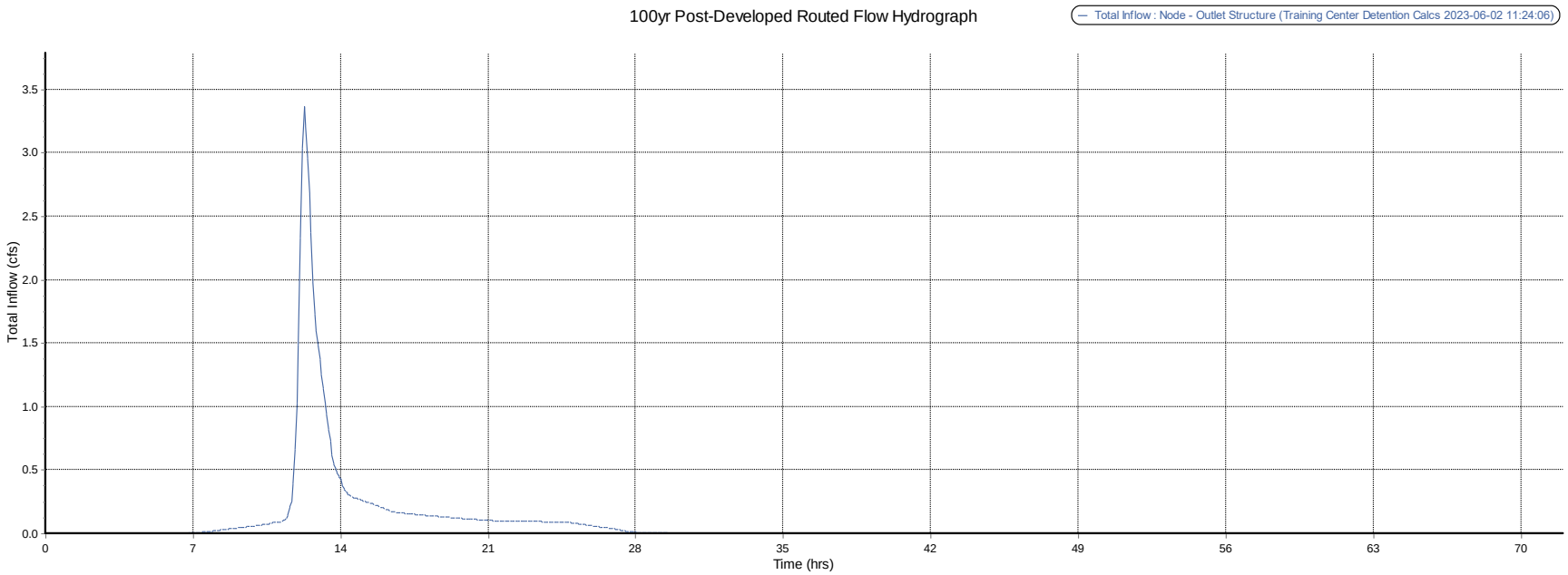
OUTFALL INPUT SUMMARY TABLE								
SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Boundary Type	Flap Gate	Fixed Water Elevation (ft)
1	Out-01	2258.43	6865.17		0.00	NORMAL	NO	
2	Out-02	3955.90	3362.31		724.50	NORMAL	NO	
3	Out-03	2999.66	478.62		0.00	NORMAL	NO	

10yr Post-Developed Routed Flow Hydrograph and Results



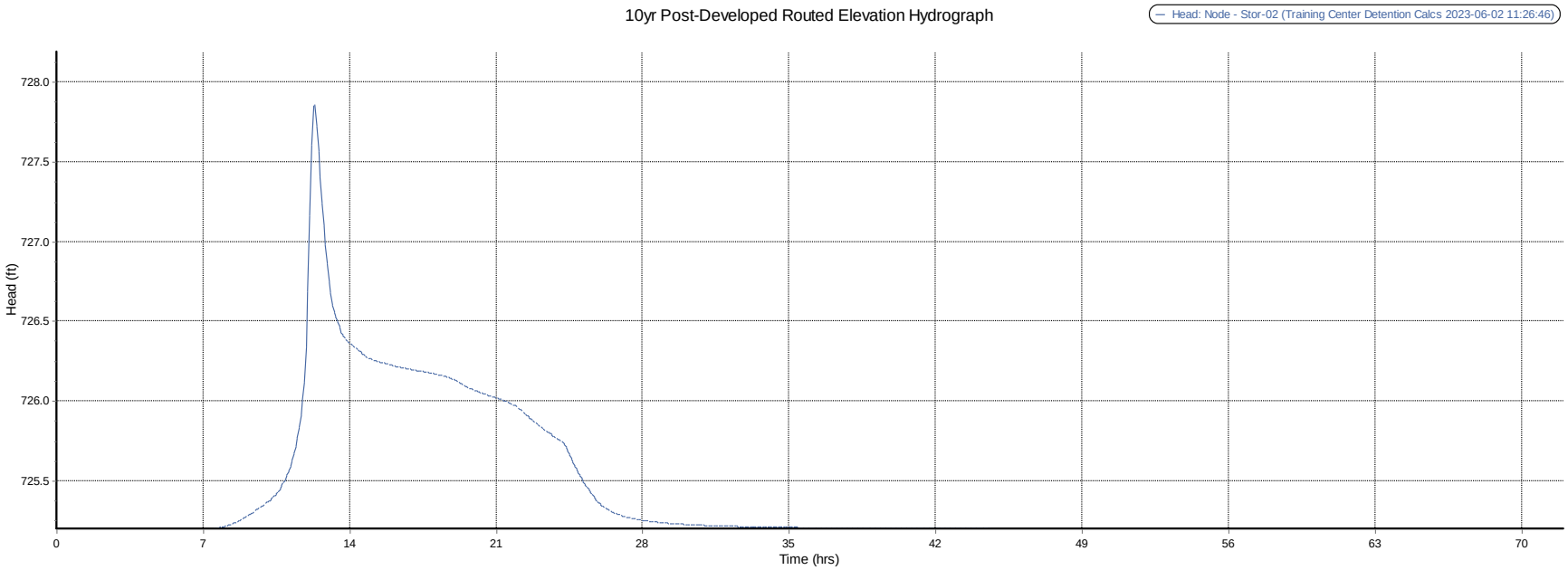
Element ID	Outlet Structure
Maximum Total Inflow (cfs)	**1.72**
Minimum Total Inflow (cfs)	0.00
Event Mean Total Inflow (cfs)	0.04
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft^3)	N/A
Volume of Deficit (ft^3)	N/A
Total Inflow Volume (ft^3)	11596.66
Detention Storage (ft^3)	N/A
Exceedance	0
Deficit	0

100yr Post-Developed Routed Flow Hydrograph and Results



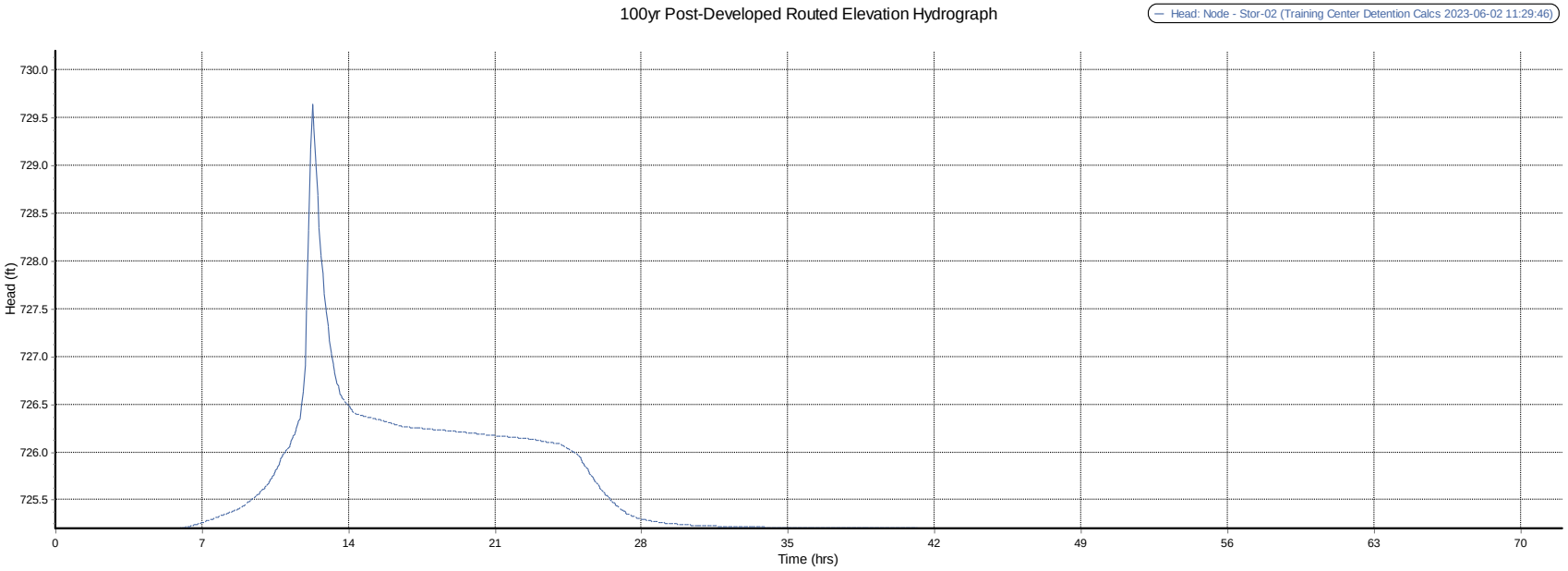
Element ID	Outlet Structure
Maximum Total Inflow (cfs)	**3.37**
Minimum Total Inflow (cfs)	0.00
Event Mean Total Inflow (cfs)	0.08
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft^3)	N/A
Volume of Deficit (ft^3)	N/A
Total Inflow Volume (ft^3)	19589.14
Detention Storage (ft^3)	N/A
Exceedance	0
Deficit	0

10yr Post-Developed Pond Routed Elevation Hydrograph and Results



Element ID	Stor-02
Maximum Head (ft)	**727.86**
Minimum Head (ft)	725.20
Event Mean Head (ft)	726.24
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Exceedance	0
Deficit	0

100yr Post-Developed Pond Routed Elevation Hydrograph and Results



Element ID	Stor-02
Maximum Head (ft)	**729.64**
Minimum Head (ft)	725.20
Event Mean Head (ft)	726.32
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Exceedance	0
Deficit	0