Stormwater Calculations

Johnson County Coroner's Office
Hospital Road and Drake Road
Franklin, Indiana

Submitted:
October 6, 2022

By:

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SECTION 1: STORMWATER CALCULATIONS SUMMARY

PRE-DEVELOPMENT CONDITIONS

The project site is located on the northeast corner of the intersection of Hospital Road and Drake Road in the City of Franklin, Johnson County, Indiana (see Exhibit 1 – Location and Vicinity Map). The existing site is a ±1.83-acre site consisting of grassed area. By graphic plotting, the project site lies within Zone 'X', areas outside of the 0.2% annual chance floodplain, as shown on the Flood Insurance Rate Map (FIRM) for Johnson County, Indiana, Community Panel No. 18081C0227E, dated January 29, 2021.

Under pre-development conditions, runoff generally drains from the north to the south to an existing roadside ditch on the north side of Hospital Road then to an existing culvert that crosses underneath Hospital Road to the south. Runoff is ultimately conveyed to Youngs Creek to the south (see Exhibit 2 – Pre-Development Watershed Map). There are no potential wetland areas located within the project site, nor shall any potential wetland areas be disturbed as a result of construction.

POST-DEVELOPMENT CONDITIONS

This project involves the construction of a ±14,487 sft. health department and coroner's office for the Johnson County Health Department. All curbs, sidewalks, and parking areas necessary for the development shall be constructed with the proposed coroner's office. All stormwater runoff shall be collected via a storm sewer network and directed towards a proposed underground detention system located underneath the proposed parking lot on the south half of the project site that will treat for both water quantity and water quality. Stormwater quality shall be achieved by isolator rows per the underground detention system and sized per the City of Franklin's requirements. The treated runoff will be piped from the underground detention and discharge to the existing roadside ditch on the north side of Hospital Road, crossing under Hospital Road via the existing culvert and ultimately draining to Young's Creek located south of the project site (see Exhibit 3 – Post-Developed Watershed Map).

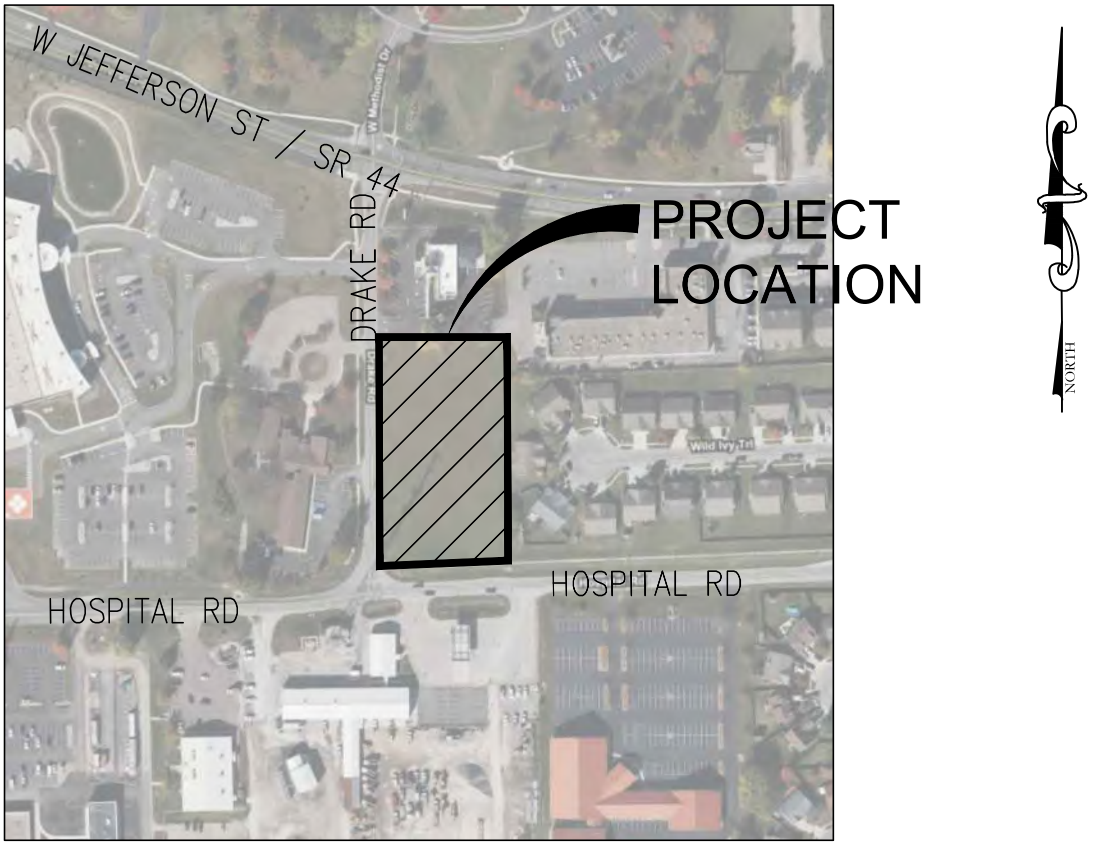
To achieve water quantity detention standards, the underground detention and outlet structure will be sized to restrict the peak discharge rate of the 10-year post-developed storm for the entire site to the peak 2-year pre-developed rate. Likewise, the peak discharge rate of the 100-year post-developed storm for the entire site will be restricted to the peak 10-year pre-developed rate for north pre-development watershed basin only.

In addition to water quantity, the underground detention will also be designed to detain, for over 24 hours after the peak runoff from a 24-hour storm, at least 20% of the runoff from either a 1-1/4 inch rainfall depth storm or 1/2 inch direct runoff, whichever is greater, for water quality treatment. The minimum water quality outlet orifice shall be two (2) inches in diameter. The underground detention facility will also be designed to include an emergency overflow spillway that is sufficient to convey 1.25 times the peak discharge resulting from the 100-year post-developed design storm. The underground detention facility shall be designed to meet the requirements of Section 6.19, G and H of the Franklin SCO.

STORM SEWER DESIGN

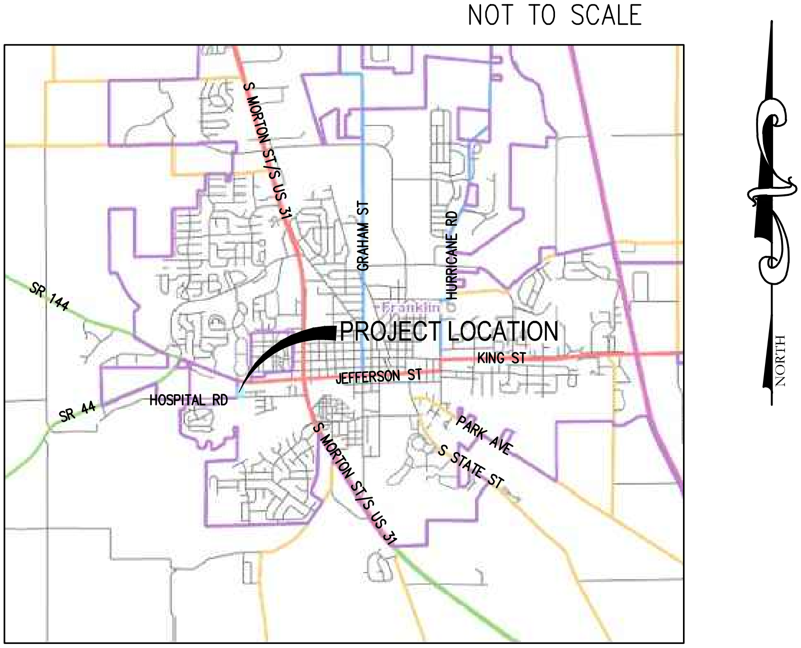
The proposed storm sewer network is designed to accommodate a 10-year storm event. The Rational Method was used to perform the storm sewer pipe sizing calculations. Structures and grates in the parking lot were designed and placed so that the depth of ponding above the inlet does not exceed 9 inches with the inlet grate 50% plugged.

JOHNSON COUNTY CORONER'S OFFICE
HOSPITAL ROAD AND DRAKE ROAD
EXHIBIT 1 - LOCATION AND VICINITY MAPS



LOCATION MAP

NOT TO SCALE



VICINITY MAP

NOT TO SCALE

CROSSROAD ENGINEERS, PC
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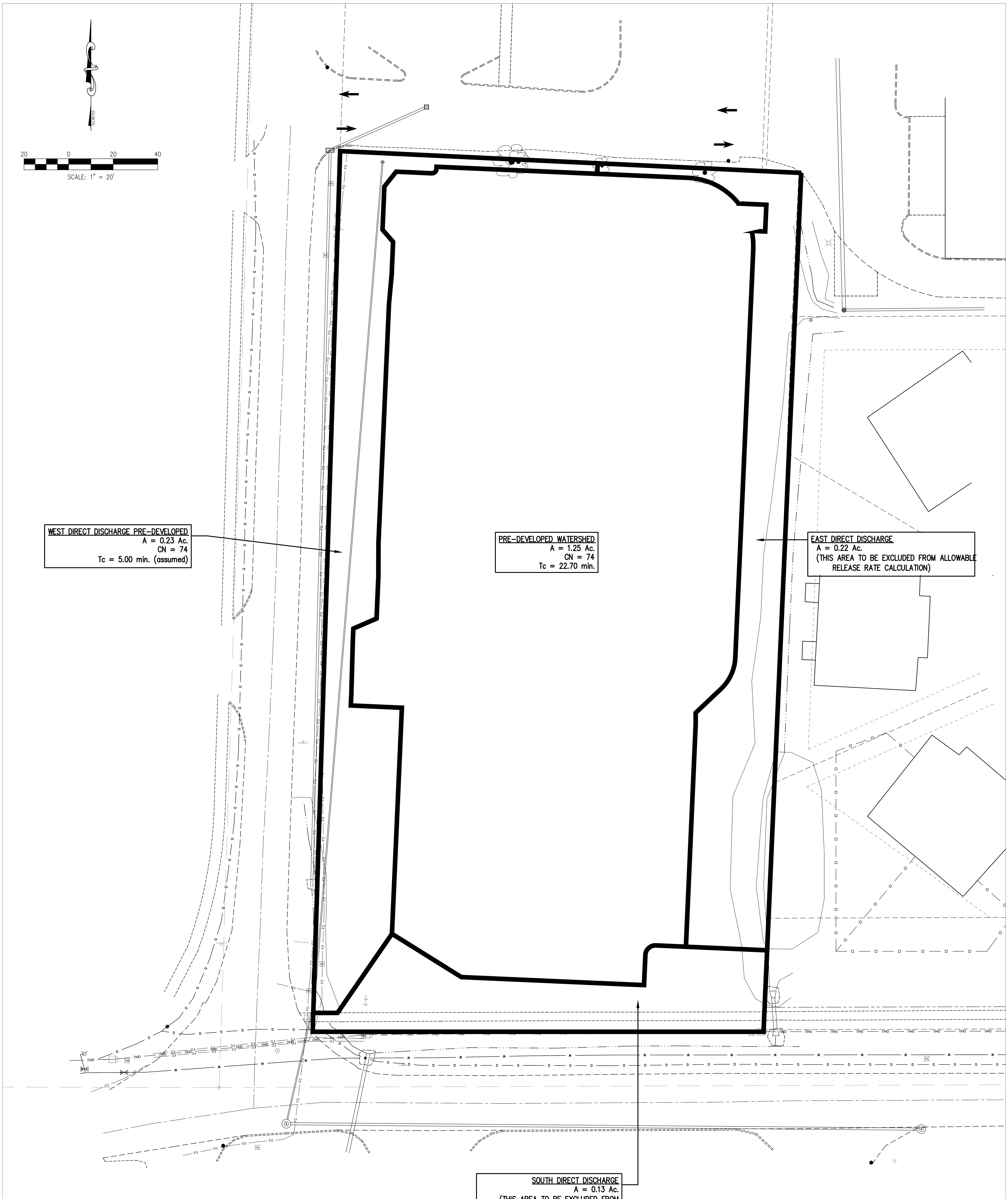
FEBRUARY 28, 2022

JOHNSON CO. HEALTH DEPARTMENT
S DRAKE ROAD
EXHIBIT 2 - PRE-DEVELOPED WATERSHED MAP



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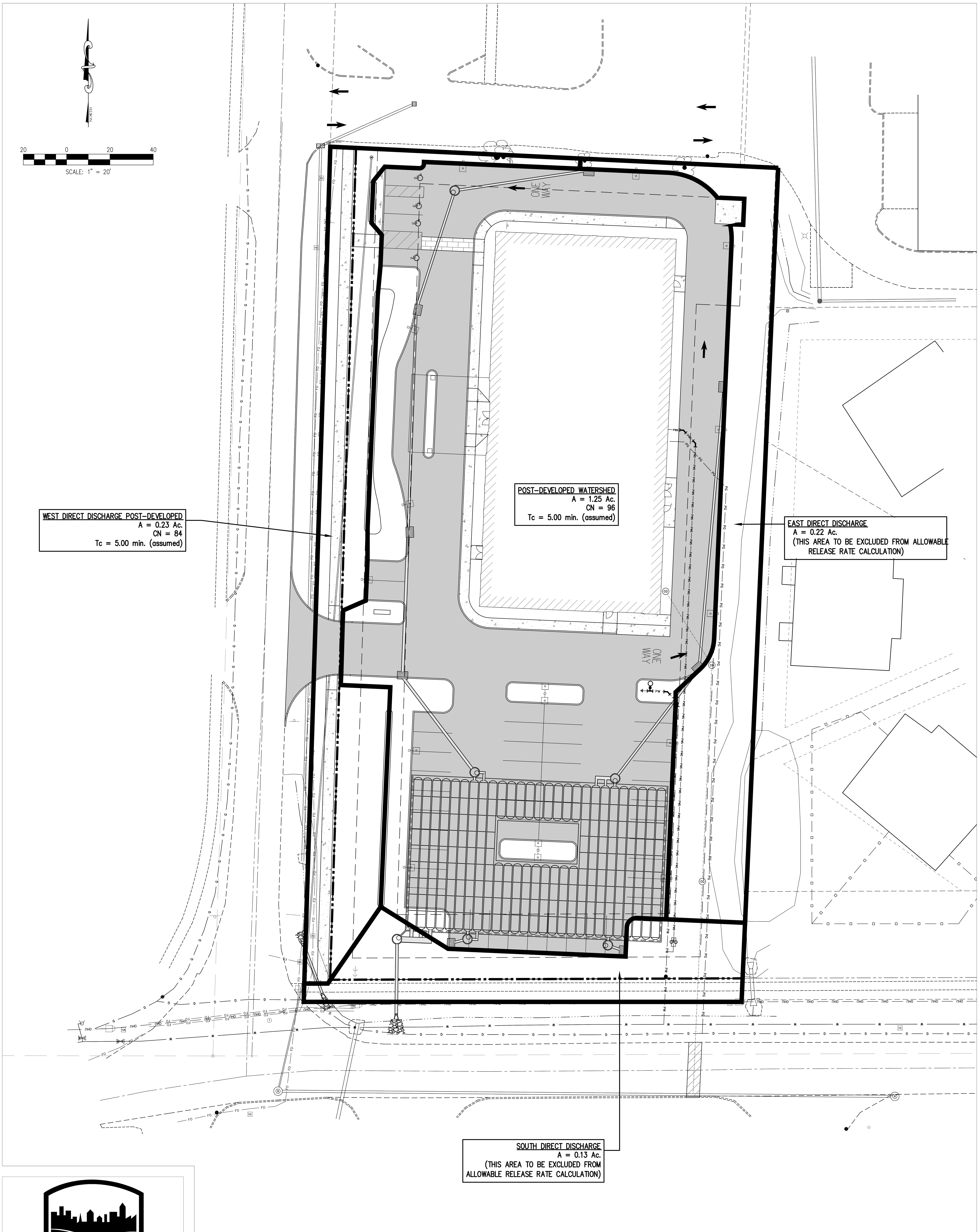
OCTOBER 6, 2022

JOHNSON CO. HEALTH DEPARTMENT
S DRAKE ROAD
EXHIBIT 3 - POST-DEVELOPED WATERSHED MAP



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OCTOBER 6, 2022

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Indiana State Plane East Zone (FIPS zone 1301). The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from the 2005 Indiana Orthophotography (IndianaMap Framework Data www.indianamap.org). This information was photogrammetrically compiled at a scale of 1:2400 from aerial photography dated spring 2005. Aerial Photography shown on the FIRM is from 2018 provided by Johnson County.

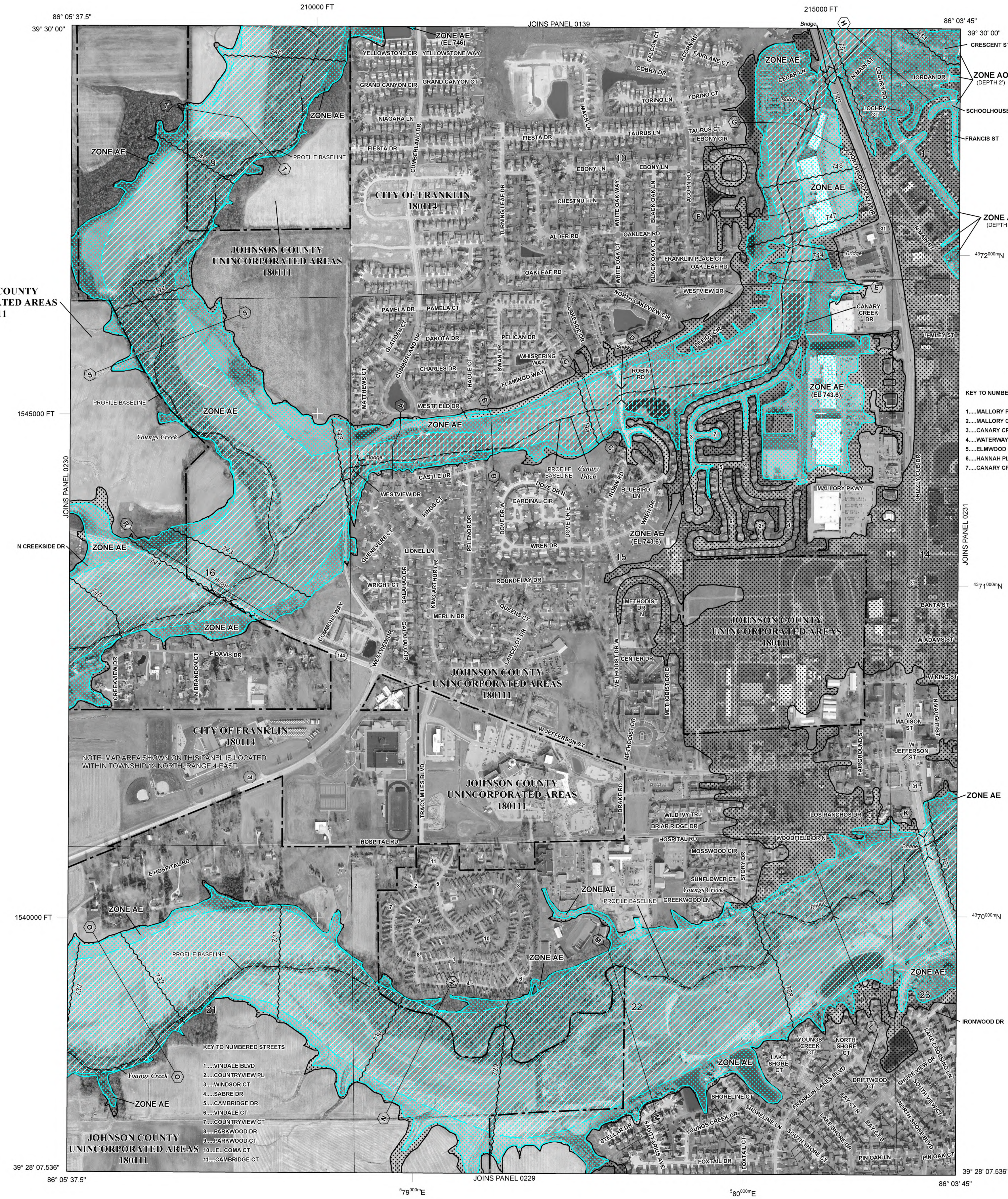
The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A Cross section line

23 - - - - 23 Transect line

Culvert

Bridge

45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

3100000 FT — 5000-foot ticks: Indiana State Plane East Zone (FIPS Zone 1301), Transverse Mercator projection

$^{49}89^{000m}$ N — 1000-meter Universal Transverse Mercator grid values, zone 16

DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
August 2, 2007

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
January 29, 2021 - to increase Base Flood Elevations and to change Special Flood Hazard Areas.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

N

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0227E

FIRM
FLOOD INSURANCE RATE MAP
JOHNSON COUNTY, INDIANA
AND INCORPORATED AREAS

PANEL 227 OF 352
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FRANKLIN, CITY OF	180114	0227	E
JOHNSON COUNTY	180111	0227	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
18081C0227E

MAP REVISED
JANUARY 29, 2021

Federal Emergency Management Agency

SECTION 2: HYDROLOGIC MODELING CALCULATIONS

All drainage calculations were completed using Autodesk Storm and Sanitary Analysis software. The SCS Curvilinear method utilizing SCS II rainfall distribution was used to calculate the hydrographs. The TR-55 Method was used to calculate times of concentration. Curve numbers were computed based on the applicable cover for fully developed urban areas and the percentage by area of each hydrologic soil type obtained from the USDA Web Soils Survey for the project area. Per Section 6.19.C.6 of the City of Franklin SCO, pre-developed runoff rates shall be based on pasture, meadow, brush, or woods ground cover in good hydrologic conditions. As the existing site is predominately grassed area, the existing ground cover for the entire site will be considered to be pasture cover in good hydrologic condition.

SOIL HYDROLOGIC GROUP PERCENTAGE CALCULATIONS

Table 1
Soil Hydrologic Group Percentage Calculations

Soil Type	Hydrologic Group – C/D (acres)
Urban land-Crosby silt loam complex, UcfA	0.02 ac.
Crosby silt loam, fine-loamy subsoil-Urban land complex, YclA	1.81 ac.
Totals	1.83 ac.
Percentages of Hydrologic Groups	**100.00%**

RUNOFF CURVE NUMBER CALCULATIONS

PRE-DEVELOPMENT CONDITIONS

Table 2
Pre-Development Watershed Runoff Curve Number Calculations

Land Use Description	Runoff Curve No. For Hydrologic Group – C/D		Average Runoff Curve Number	Land Use Area	Overall Weighted Curve No.
	Percentage Used*	***100.00%***			
Pasture/Open Space	74		74	1.83 ac.	**74**

*See Soil Hydrologic Group Percentage Calculations, Table 1.

There are ±0.58 acres of total direct discharge area along the eastern, southern, and western property lines that were not able to be captured and directed towards the proposed underground detention. Since the ±0.58 acres of direct discharge are not being captured and detained, this area will be excluded from the allowable release rate calculation, which will be discussed in further detail later in this report. The allowable release rate calculation will be based on only ±1.25 acres (1.83 ac. – 0.58 ac. = 1.25 acres) that represents the project site area minus the direct discharge area.

Table 3 reflects the overall weighted curve number calculation used in pre-developed conditions for only the area included in the allowable release rate calculation (±1.25 acres) that excludes the direct discharge area.

Table 3 Pre-Development Watershed Runoff Curve Number Calculations (to be used in allowable release rate calculation)					
Land Use Description	**Runoff Curve No. For Hydrologic Group – C/D**		**Average Runoff Curve Number**	**Land Use Area**	**Overall Weighted Curve No.**
	Percentage Used*	***100.00%***			
Pasture/Open Space	74		74	1.25 ac.	**74**

*See Soil Hydrologic Group Percentage Calculations, Table 1.

As discussed later in the report, it is this 1.25-acre area that will be the basis for determining the allowable release rate.

As a conservative measure, it was assumed that the entire site in pre-developed conditions was a Type C HSG and a curve number of 74 was used to determine the pre-development runoff calculations for the 2-year and 10-year scenarios.

As identified above, the total direct discharge area includes area along the southern, eastern, and western property lines. The eastern and southern areas will remain pervious in post-developed conditions and these areas will simply be excluded from the allowable release rate calculation. The western direct discharge area will increase in runoff from pre-developed to post-developed conditions due to added impervious surface from the proposed drive and sidewalk. In addition to this western direct discharge area being excluded from the allowable release rate calculation, this increase in runoff will also be subtracted from the calculated allowable release rate to offset the increase in runoff caused by the additional impervious area added within this direct discharge area.

Table 4 reflects the overall weighted curve number calculation used in pre-developed conditions for only the western direct discharge area used to calculate the increase in runoff from this area between pre-developed and post-developed conditions.

Table 4 Pre-Development Western Direct Discharge Watershed Runoff Curve Number Calculations					
Land Use Description	**Runoff Curve No. For Hydrologic Group – C/D**		**Average Runoff Curve Number**	**Land Use Area**	**Overall Weighted Curve No.**
	Percentage Used*	***100.00%***			
Pasture/Open Space	74		74	0.23 ac.	**74**

*See Soil Hydrologic Group Percentage Calculations, Table 1.

POST-DEVELOPMENT CONDITIONS

Table 5 Post-Development Runoff Curve Number Calculations Onsite Watershed			
Land Use Description	**Runoff Curve No. for Hydrologic Group – C/D**		**Average Runoff Curve Number**
	Percentage Used*	100.00%	
Impervious (Building, Pavement, Pond)	98		98
Open space, Good condition (grass cover > 75%)	80		80

*See Soil Hydrologic Group Percentage Calculations, Table 1.

Table 6 Post-Development Runoff Curve Number Calculations On-Site Watershed				
Land Use Description	**Land Use Curve Number**	**Land Use Area**	**Percentage of Total Area**	**Weighted Curve Number**
Impervious (Building, Pavement, Pond)	98	1.09 ac	87.2%	85.46
Open space, Good condition (grass cover > 75%)	80	0.16 ac	12.8%	10.24
Total		**1.25 ac.**		**95.7 → Use 96**

As identified above, the total direct discharge area includes area along the southern, eastern, and western property lines. The eastern and southern areas will remain pervious in post-developed conditions and these areas will simply be excluded from the allowable release rate calculation. The western direct discharge area will increase in runoff from pre-developed to post-developed conditions due to added impervious surface from the proposed drive and sidewalk. In addition to this western direct discharge area being excluded from the allowable release rate calculation, this increase in runoff will also be subtracted from the calculated allowable release rate to offset the increase in runoff caused by the additional impervious area added within this direct discharge area.

Table 4 reflects the overall weighted curve number calculation used in post-developed conditions for only the western direct discharge area used to calculate the increase in runoff from this area between pre-developed and post-developed conditions.

Table 7 Post-Development Runoff Curve Number Calculations Western Direct Discharge Watershed				
Land Use Description	**Land Use Curve Number**	**Land Use Area**	**Percentage of Total Area**	**Weighted Curve Number**
Impervious (Building, Pavement, Pond)	98	0.05 ac	21.74%	21.31
Open space, Good condition (grass cover > 75%)	80	0.18 ac	78.26%	62.61
Total		**0.23 ac.**		**83.92 → Use 84**

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 II rainfall distribution.

There are ±0.58 acres of total direct discharge area along the eastern, southern, and western property lines that were not able to be captured and directed towards the proposed underground detention. Since the ±0.58 acres of direct discharge are not being captured and detained, this area will be excluded from the allowable release rate calculation, which will be discussed in further detail later in this report. The allowable release rate calculation will be based on only ±1.25 acres (1.83 ac. – 0.58 ac. = 1.25 acres) that represents the project site area minus the direct discharge area.

As identified above, the total direct discharge area includes area along the southern, eastern, and western property lines. The eastern and southern areas will remain pervious in post-developed conditions and these areas will simply be excluded from the allowable release rate calculation. The western direct discharge area will increase in runoff from pre-developed to post-developed conditions due to added impervious surface from the proposed drive and sidewalk. In addition to this western direct discharge area being excluded from the allowable release rate calculation, this increase in runoff will also be subtracted from the calculated allowable release rate to offset the increase in runoff caused by the additional impervious area added within this direct discharge area.

Table 8 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. As mentioned above, there are ±0.58 acres of direct discharge along the eastern, southern, and western property lines that is not captured and directed towards the underground detention. The ±0.58 acres of direct discharge are excluded from the total ±1.83 acres of the project site in the allowable release rate calculation. Runoff rates were only calculated for the pre-developed watershed as the allowable release rates will be determined based on the pre-developed watershed with only an area of ±1.25 acres. See Appendix 'A' for the pre-development hydrograph and peak storm event analysis results.

Table 8 **Pre-Development On-Site Watershed Hydrograph Peak Runoff Rate Summary**	
Return Period (years)	**Storm Duration**
	24 Hours
2	**0.78 cfs**
10	**2.00 cfs**

Table 9 and 10 summarizes the peak runoff rates (cfs) resulting from the hydrologic modeling of the Pre-Development and Post-Development Western Direct Discharge Watershed which is representative of the western direct discharge watershed area in the existing and proposed conditions, respectively. The western direct discharge area will increase in runoff from pre-developed to post-developed conditions due to added impervious surface from the proposed drive and sidewalk. In addition to this western direct discharge area being excluded from the allowable release rate calculation, this increase in runoff will also be subtracted from the calculated allowable release rate to offset the increase in runoff caused by the additional impervious area added within this direct discharge area. See Appendix 'A' for the pre-development hydrograph and peak storm event analysis results.

Table 9 **Pre-Development Western Direct Discharge Watershed Hydrograph Peak Runoff Rate Summary**	
Return Period (years)	**Storm Duration**
	24 Hours
10	**0.59 cfs**
100	**1.16 cfs**

Table 10 Post-Development Western Direct Discharge Watershed Hydrograph Peak Runoff Rate Summary	
Return Period (years)	**Storm Duration**
	24 Hours
2	**0.89 cfs**
10	**1.50 cfs**

The 10-year and 100-year pre-developed flow for the western direct discharge area is 0.59 cfs and 1.16 cfs, respectively. The 10-year and 100-year post-developed flow for the western direct discharge area is 0.89 cfs and 1.50 cfs, respectively. The increase in runoff from pre-developed conditions to post-developed conditions in the 10-year and 100-year flow is 0.30 cfs and 0.34 cfs, respectively.

Basin Allowable Discharge:

Allowable discharge for the critical 10-year post-development storm=
Pre-Development 2-year Peak – Increase in Western Direct Discharge Area
0.78 cfs – 0.30 cfs = 0.48 cfs

Allowable discharge for the critical 100-year post-development storm=
Pre-Development 10-year Peak – Increase in Western Direct Discharge Area
2.00 cfs – 0.34 cfs = 1.66 cfs

POST-DEVELOPMENT CONDITIONS

Table 11 summarizes the peak runoff rates (cfs) resulting from the hydrologic modeling of the Post-Development Watershed Basin. See Appendix ‘B’ for the post-development hydrographs and peak storm event analysis results.

Table 11 Post-Development On-Site Watershed Hydrograph Peak Runoff Rate Summary	
Return Period (years)	**Storm Duration**
	24 Hours
10	**6.51 cfs**
100	**9.72 cfs**

The peak runoff rates (cfs) resulting from the hydrologic modeling of the Western Direct Discharge Watershed in post-developed conditions can be found in Table 10. See Appendix ‘B’ for the post-development hydrographs and peak storm event analysis results

Hydrologic Soil Group—Johnson County, Indiana
(JoCo Coroner's Office Soils Map)

Map Scale: 1:693 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 10, 20, 40, 60

Feet: 0, 30, 60, 120, 180

N

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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 29, Sep 8, 2021

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

Date(s) aerial images were photographed: Oct 22, 2020—Nov 12, 2020

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
UcfA	Urban land-Crosby silt loam complex, fine-loamy subsoil, 0 to 2 percent slopes		0.0	1.3%
YclA	Crosby silt loam, fine-loamy subsoil-Urban land complex, 0 to 2 percent slopes	C/D	1.8	98.7%
Totals for Area of Interest			**1.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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 either 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 and 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 = **3,889 ft^3 = 0.089 ac.-ft.**

Volume of Runoff from 0.5" Direct Runoff,

V_2 = 1.25 ac. * (0.5"/12) = 0.052 ac.-ft. → 2,269 ft^3

Water Quality Volume, WQ_v = 20% * V_1 = 0.2 * 0.089 ac.-ft. = 0.018 ac.-ft. → 784 ft^3

At a time of 24 hours after the peak runoff rate of the inflow hydrograph, the detention pond must have at least 0.018 ac.-ft. or 784 ft^3 remaining in the basin.

ROUTED WATER QUALITY STORM HYDROGRAPH

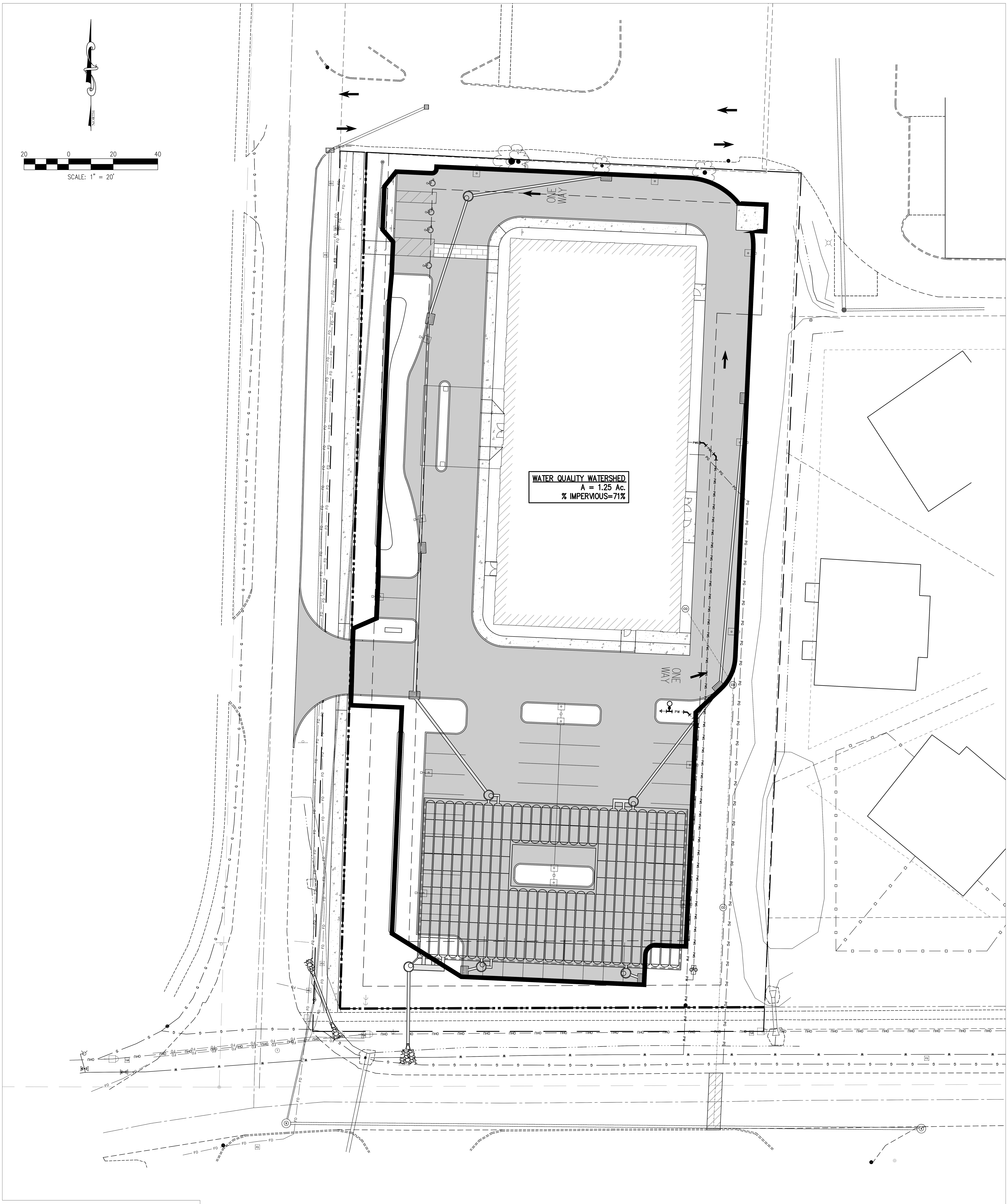
The 1 ¼" storm event is routed through the proposed detention pond with a 2.0" diameter circular water quality orifice. The Routed 1.25" Storm Event Hydrograph (see following page) is used to verify the water quality volume, WQ_v, is remaining after 24 hours after peak runoff.

Table 7
Water Quality Volume Summary

	Time	Volume
Time to Peak	13.3333 hours	2,288 ft^3
Maximum Time where WQv is Detained	24.8333 hours	788 ft^3
Storage Volume at Time of 24 hours Past Peak Runoff	37.3333 hours	148 ft^3

The minimum 2.0" 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 11.5 hours utilizing a 2.0" water quality orifice.

JOHNSON CO. HEALTH DEPARTMENT
S DRAKE ROAD
EXHIBIT 4 - WATER QUALITY WATERSHED MAP



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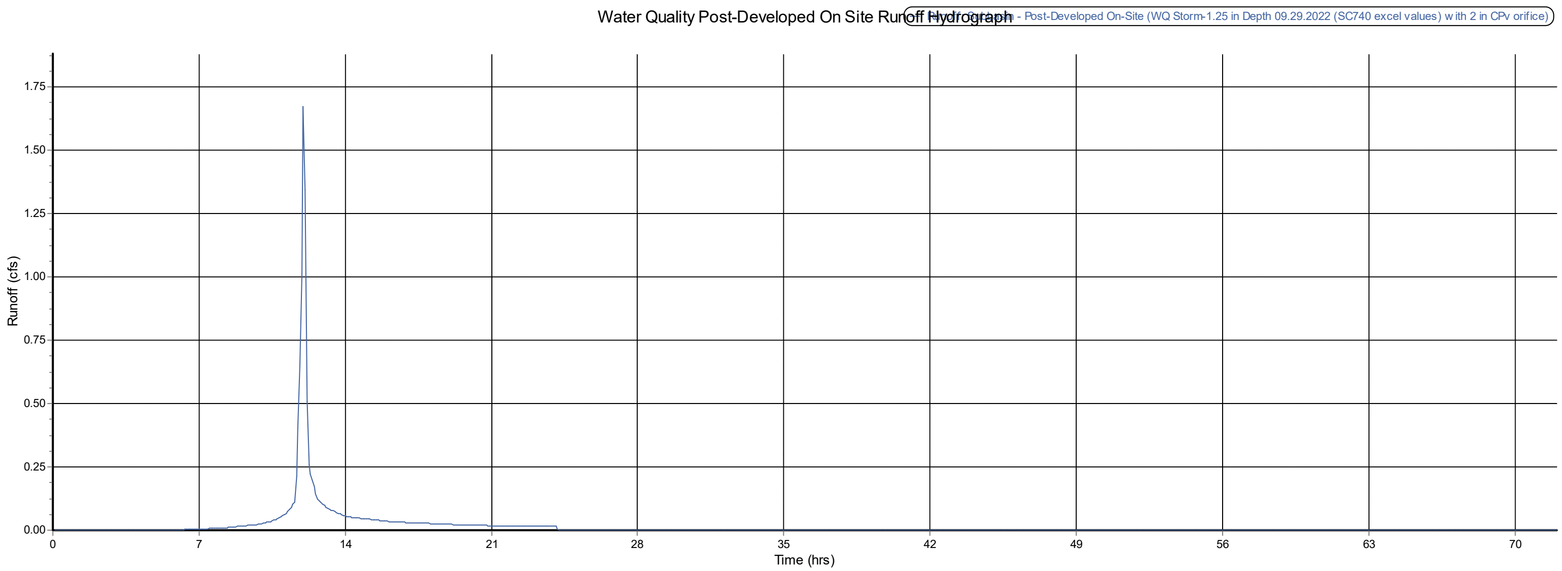
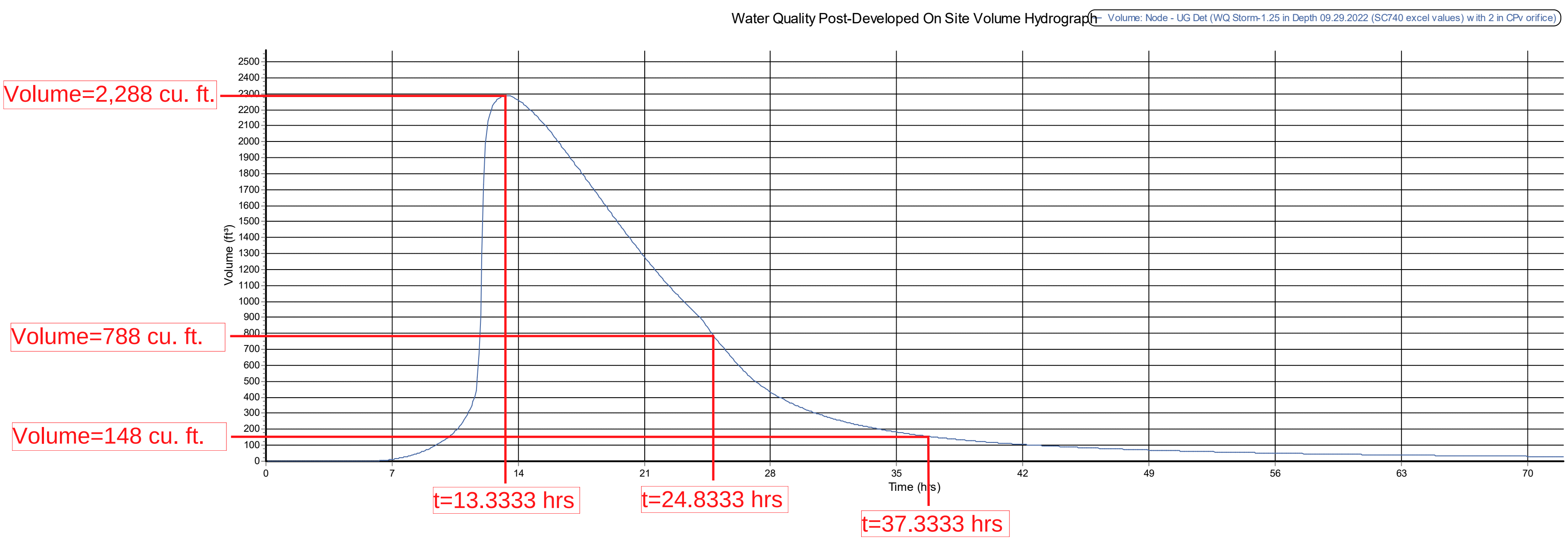
OCTOBER 6, 2022

Water Quality Storm Post-Developed On Site Runoff Hydrograph and Results



Element ID	Water Quality Post-Developed On Site
Maximum Runoff (cfs)	**1.67**
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 (ft³)	N/A
Volume of Deficit (ft³)	N/A
Total Runoff (ft³)	**3888.57**
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

Water Quality Storm Post-Developed On Site Volume Hydrograph and Results



Element ID	Water Quality Post-Developed On Site
Maximum Volume (ft³)	2288.02
Minimum Volume (ft³)	0.00
Event Mean Volume (ft³)	392.19
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

SECTION 4: DETENTION CALCULATIONS

Per ordinance, stormwater detention is addressed by restricting the release rate of runoff as 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 rate of runoff from the post-development 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 – Increase in Western Direct Discharge Area
0.78 cfs – 0.30 cfs = <u>0.48 cfs</u>

Allowable discharge for the critical 100-year post-development storm=
Pre-Development 10-year Peak – Increase in Western Direct Discharge Area
2.00 cfs – 0.34 cfs = <u>1.66 cfs</u>

POST-DEVELOPMENT PEAK FLOWRATE (SEE SECTION 2: HYDROLOGIC MODELING CALCULATIONS, HYDROLOGIC MODELING RUNOFF SUMMARY)

Q_{10} = 6.51 cfs
Q_{100} = 9.72 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 2.0" diameter orifice to meet the water quality requirements, one (1) circular 3.75" diameter orifice to meet allowable discharge requirements 10-year critical storm events, and one (1) 13.75" (W) x 4" (H) rectangular orifice to meet the detention and allowable discharge requirements for 100-year critical storm event. Discharge will be conveyed to the existing roadside ditch on the north side of Hospital Drive via a proposed 15" diameter outlet pipe leaving the outlet control structure.

ROUTED STORM HYDROGRAPHS (SEE APPENDIX C: POST-DEVELOPMENT RUNOFF & ROUTED STORM DATA)

Peak 10 Year Post-Development Discharge Rate = **0.48 cfs** ≤ 0.48 cfs (allowable)
Peak Water Surface Elevation = **736.80** < 737.29 (top of emergency spillway)

Peak 100 Year Post-Development Discharge Rate = **1.66 cfs** ≤ 1.66 cfs (allowable)
Peak Water Surface Elev. (North Pond) = **737.29** < 737.29 (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 peak water surface elevation below the maximum detention pond 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 the existing roadside ditch on the north side of Hospital Drive. Below are calculations for the emergency spillway:

Q_{100} Inflow = 9.72 cfs
1.25 x Q_{100} Inflow= 12.15 cfs
Length of Weir = 6 ft.
Top of Detention Basin Elevation = 738.84
Spillway Crest Elevation = 737.29
Water Surface Elevation = 738.01
Freeboard = 738.84 – 758.01 = 0.83 ft.

H = $[(1.25*Q100) / (3.3*L)]^{2/3} = [12.15 / (3.3*6)]^{2/3}$ = **0.72'**

The head needed to convey the required flowrate is **0.72'**. The corresponding elevation is **738.01**, which still allows for **0.83'** of freeboard above the high-water elevation through the emergency spillway.

SECTION 5: STORM SEWER SIZING CALCULATIONS

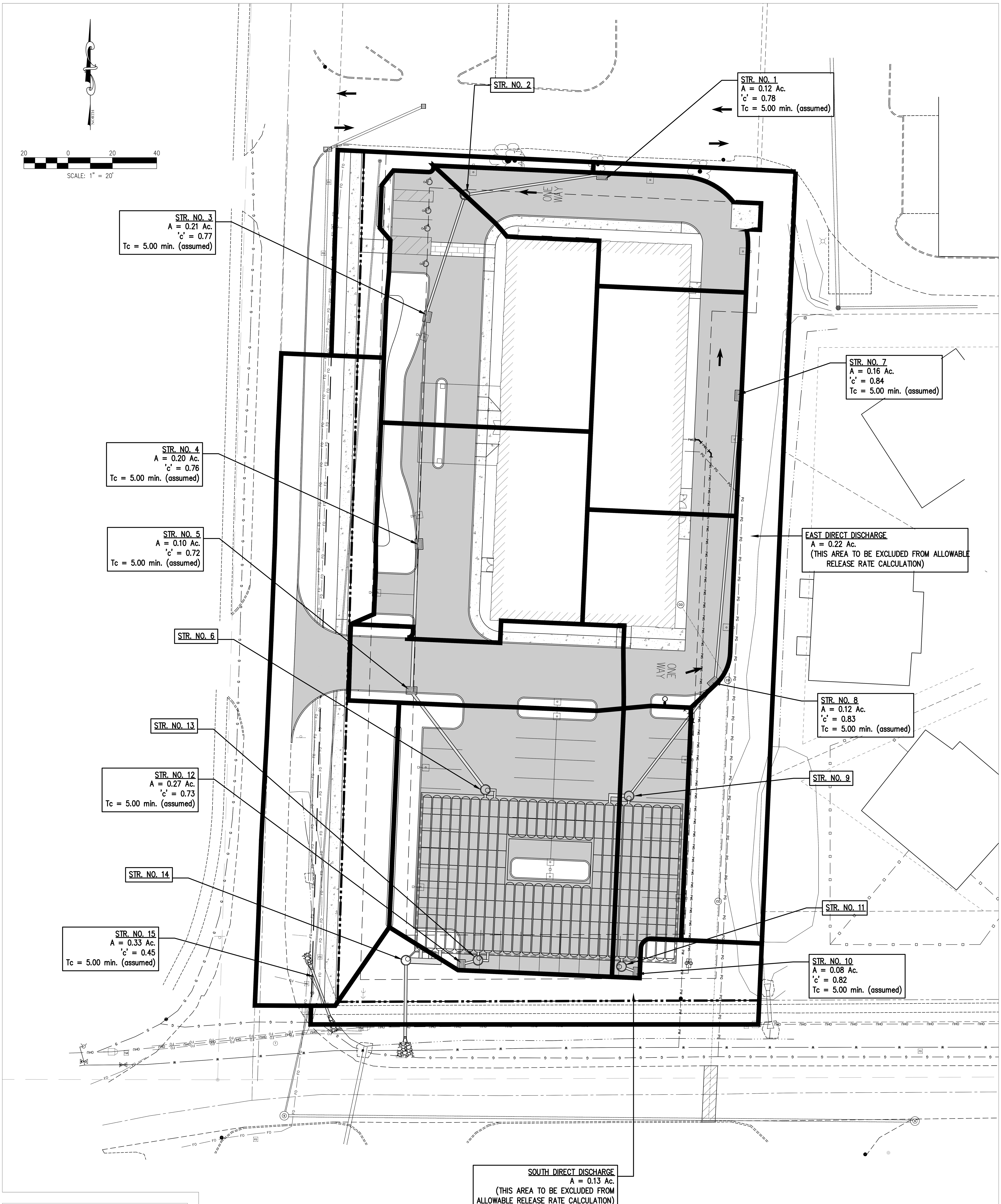
STORM SEWER SIZING SUMMARY

The Rational Method was used to size the pipes to convey the peak runoff from the 10-year storm. The Time of Concentration was assumed to be 5 minutes for all proposed structures. Pipe sizing calculations and the inlet basin map (Exhibit 5 – Inlet Watershed Map) are included within this section.

Johnson County Health Department and Coroner's Office
Pipe and Inlet Sizing Calculations

	Pipe Data						Inlet Watershed Data												Contributing Watershed Data						Pipe Analysis		
Structure	Downstream Structure	Length (ft)	Pipe Diameter (in)	Pipe Material	Invert Slope (%)	Mannings Number n	Catchment Area (ac) Roof	Runoff Coefficient C Roof	Catchment Area (ac) Grass	Runoff Coefficient C Grass	Catchment Area (ac) Impervious	Runoff Coefficient C Impervious	Total Area A (ac)	Composite Coefficient C	Tc (min)	Rainfall Intensity (i) in/hr	Manual Input Flow Q (cfs)	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 Pipe Flow (cfs)	Pipe Capacity Qmax (cfs)	Pipe Velocity (ft/s)	% of Full Flow Capacity
STR. 1	STR. 2	62	12	RCP	0.35	0.013	0.02	0.90	0.02	0.20	0.08	0.85	0.12	0.78	5.00	7.27	--	0.67	0.12	0.78	N/A	5.00	7.27	0.67	2.10	2.68	32%
STR. 2	STR. 3	58	12	RCP	0.35	0.013	NO INLET												0.12	0.78	0.39	5.39	7.14	0.65	2.10	2.68	31%
STR. 3	STR. 4	103	12	RCP	0.35	0.013	0.10	0.90	0.03	0.20	0.08	0.85	0.21	0.77	5.00	7.27	--	1.20	0.33	0.77	0.36	5.75	7.02	1.80	2.10	2.68	86%
STR. 4	STR. 10	66	15	RCP	0.35	0.013	0.10	0.90	0.04	0.20	0.07	0.85	0.20	0.76	5.00	7.27	--	1.11	0.53	0.77	0.64	6.39	6.81	2.79	3.82	3.11	73%
STR. 5	STR. 6	57	15	RCP	0.35	0.013	0.00	0.90	0.02	0.20	0.08	0.85	0.10	0.72	5.00	7.27	--	0.52	0.63	0.76	0.35	6.74	6.69	3.21	3.82	3.11	84%
STR. 6	DET	3	15	RCP	0.35	0.013	NO INLET												0.63	0.76	0.30	7.04	6.60	3.17	3.82	3.11	83%
STR. 7	STR. 8	130	12	RCP	0.35	0.013	0.10	0.90	0.01	0.20	0.05	0.85	0.16	0.84	5.00	7.27	--	0.95	0.16	0.84	N/A	5.00	7.27	0.95	2.10	2.68	45%
STR. 8	STR. 9	65	12	RCP	0.35	0.013	0.05	0.90	0.01	0.20	0.06	0.85	0.12	0.83	5.00	7.27	--	0.70	0.27	0.83	0.81	5.81	7.00	1.58	2.10	2.68	75%
STR. 9	DET	3	12	RCP	0.35	0.013	NO INLET												0.27	0.83	0.40	6.21	6.87	1.55	2.10	2.68	74%
STR. 10	STR. 11	8	12	RCP	0.35	0.013	0.00	0.90	0.00	0.20	0.08	0.85	0.08	0.82	5.00	7.27	--	0.47	0.08	0.82	N/A	5.00	7.27	0.47	2.10	2.68	22%
STR. 11	DET	3	12	RCP	0.35	0.013	NO INLET												0.08	0.82	0.05	5.05	7.25	0.47	2.10	2.68	22%
STR. 12	STR. 13	8	12	RCP	0.35	0.013	0.00	0.90	0.05	0.20	0.22	0.85	0.27	0.73	5.00	7.27	--	1.44	0.27	0.73	N/A	5.00	7.27	1.44	2.10	2.68	69%
STR. 13	DET	3	15	RCP	0.35	0.013	0.00	0.90	0.08	0.20	0.14	0.85	0.21	0.61	5.00	7.27	--	0.95	0.49	0.68	0.05	5.05	7.25	2.39	3.82	3.11	63%
STR. 14	DITCH	37	15	RCP	0.23	0.013	--	--	--	--	--	--	--	--	--	--	1.66	--	--	--	--	--	--	1.66	3.09	2.52	54%
STR. 15	DITCH	27	12	RCP	3.77	0.013	0.00	0.90	0.20	0.20	0.13	0.85	0.33	0.45	5.00	7.27	--	1.10	0.33	0.45	N/A	5.00	7.27	1.10	6.90	8.79	16%

JOHNSON CO. HEALTH DEPARTMENT
S DRAKE ROAD
EXHIBIT 5 - INLET WATERSHED MAP



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SECTION 6: STORM INLET/GRATE CALCULATIONS

STORM INLET SUMMARY

Storm inlets were placed throughout the site to ensure that sag inlets will be adequate to pass the design 10-year flow with 50% of the sag inlet clogged with the maximum depth of water not exceeding six (6) inches.

Castings located in the parking lot are either Neenah R-3287-10V. Castings located in grassed areas are Neenah R-4215-C. The perimeter and open area of each inlet grate are as follows:

- R-3287-10V → Perimeter = 5.5 ft. and Open Area = 2.1 ft.^{2}

To simulate a clogged inlet, the dimensions are reduced by 50%. The perimeter and open area used for inlet grate calculations for a R-3287-10V casting is 2.75 ft and 2.1 ft.^{2}, respectively. For small ponding depths over grate, the casting will function in weir flow and for larger depths over grate, the casting will function in orifice flow. There will also be a portion of depth where the flow is transitioning from weir flow to orifice flow, also known as transitional flow. This depth is generally around 0.3' in depth. The weir and orifice equations are shown below:

Weir Equation

$Q = 3.3P(h)^{1.5}$

Where P = perimeter of the grate, ft.
h = head above the casting, ft.
Q = Capacity, cfs

Orifice Equation

$Q = 0.6A(2gh)^{0.5}$

Where A = free open area of grate in, ft^2
g = 32.2 ft/sec^2
h = head above casting, ft.
Q = Capacity, cfs

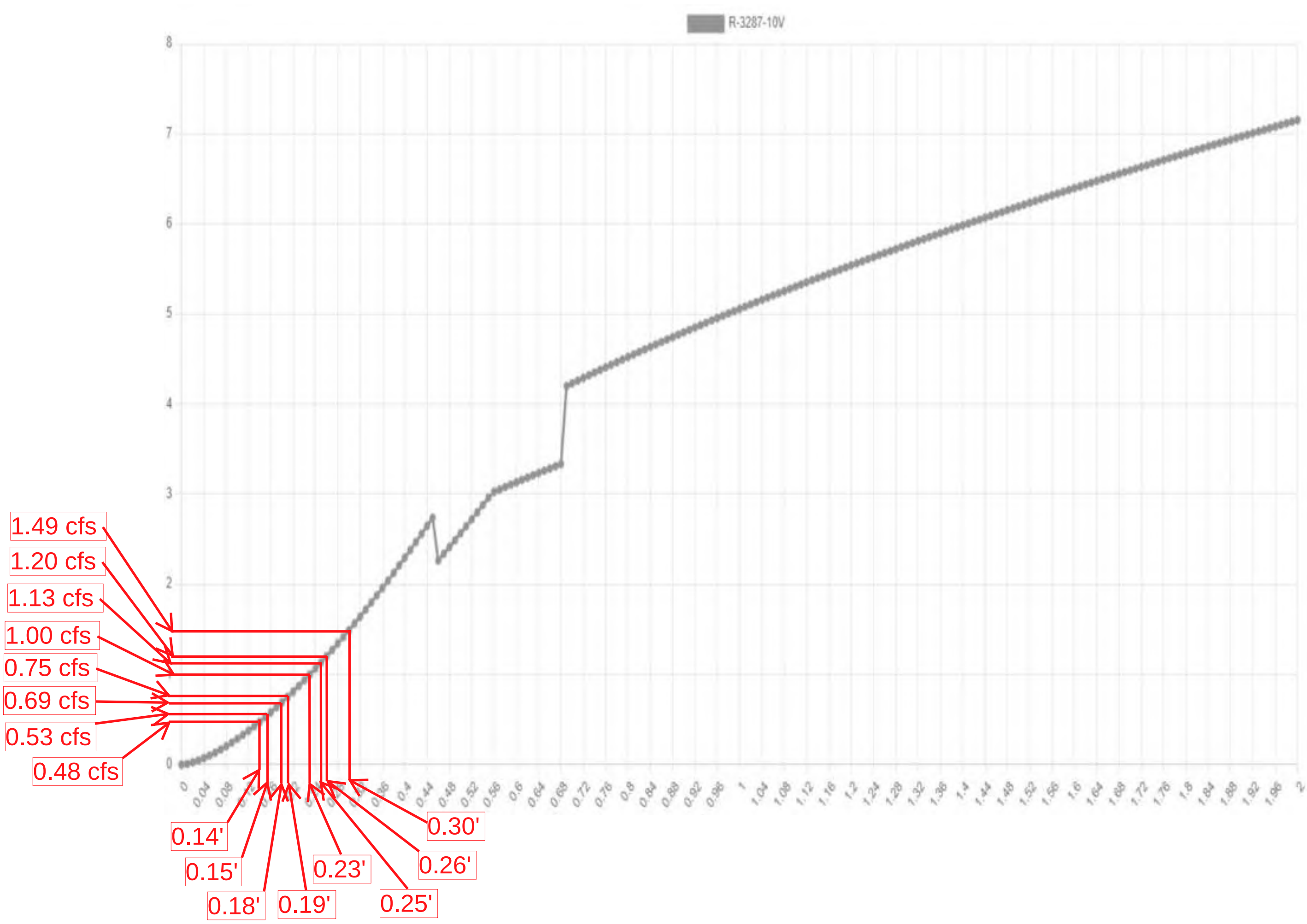
The following table indicates the inlet capacity assuming a 50% clogged condition with associated depths over grate to convey the required flow. The attached discharge vs. depth over grate charts are provided by Neenah Foundry Company using their Weir Orifice Calculator. The Please refer to Exhibit 4 – Inlet Basin Watershed Map for additional information.

Structure No.	Casting Type	Inlet Basin Watershed Runoff	Depth Over Grate	Grate Capacity @ 50% Clogged
1	R-3287-10V	0.67 cfs	0.18'	0.69 cfs
3	R-3287-10V	1.20 cfs	0.26'	1.20 cfs
4	R-3287-10V	1.11 cfs	0.25'	1.13 cfs
5	R-3287-10V	0.52 cfs	0.15'	0.53 cfs
7	R-3287-10V	0.95 cfs	0.23'	1.00 cfs
8	R-3287-10V	0.70 cfs	0.19'	0.75 cfs
10	R-3287-10V	0.47 cfs	0.14'	0.48 cfs
12	R-3287-10V	1.44 cfs	0.30'	1.49 cfs

WEIR ORIFICE CALCULATOR

GRATE TYPE	OPEN AREA (SF)	PERIMETER
R-3287-10V	**1.05**	**2.75**

SUMP CONDITION CAPACITY CHART



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)	Rain Gage ID	Peak Rate Factor
1	Post-Developed Western Direct Discharge		0.23	Out-06	84.00	0 00:05:00	*	0
2	Post-Developed On-Site		1.25	UG Det	96.00	0 00:05:00	*	0
3	Pre-Developed Western Direct Discharge		0.23	Out-05	74.00	0 00:05:00	*	0
4	Pre-Developed On-Site		1.25	Out-01	74.00	0 00:22:42	*	484

TIME OF CONCENTRATION or TRAVEL TIME WORKSHEET

Project: JC HEALTH DEPT. AND CORONERS OFFICE

Designer: MSK **Date:** 9-Mar-22

Str. No.: Existing Onsite Basin

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	100.00 ft.	0.00 ft.	40.00 ft.
4.	Two-yr 24-hr Rainfall, (P2)	2.64 in.	2.64 in.	2.64 in.
5.	Land Slope, (s)	0.0160 ft./ft.	0.0150 ft./ft.	0.0090 ft./ft.
6.	Travel Time, (Tt) (Tt = [0.007(nL)^0.8]/[P2^0.5*s^0.4])	0.217 hr +	0.000 hr +	0.131 hr

Shallow Concentrated Flow

7.	Surface Description (paved or unpaved)	unpaved	paved	unpaved
8.	Flow Length, (L)	275.00 ft.	n/a ft.	0.00 ft.
9.	Watercourse Slope, (s)	0.0160 ft./ft.	0.0050 ft./ft.	0.0038 ft./ft.
10.	Average Velocity, (V) (Vp = 20.3282(s)^0.5) (Vup = 16.1345(s)^0.5)	2.571 ft./s	0.000 ft./s	0.995 ft./s
11.	Travel Time, (Tt) (Tt = L/3600V)	0.030 hr +	0.000 hr +	0.000 hr

Watershed or Subarea Tc or Tt =

0.378 hr

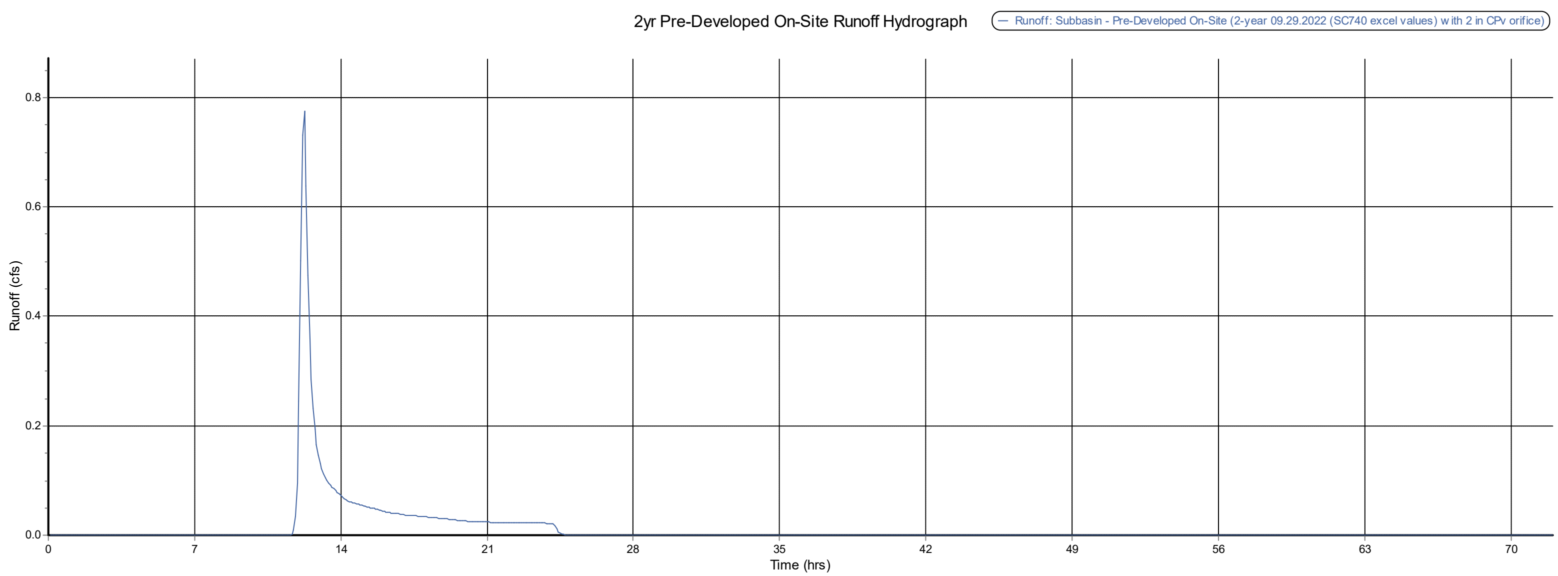
or

22.70 min

Channel Flow

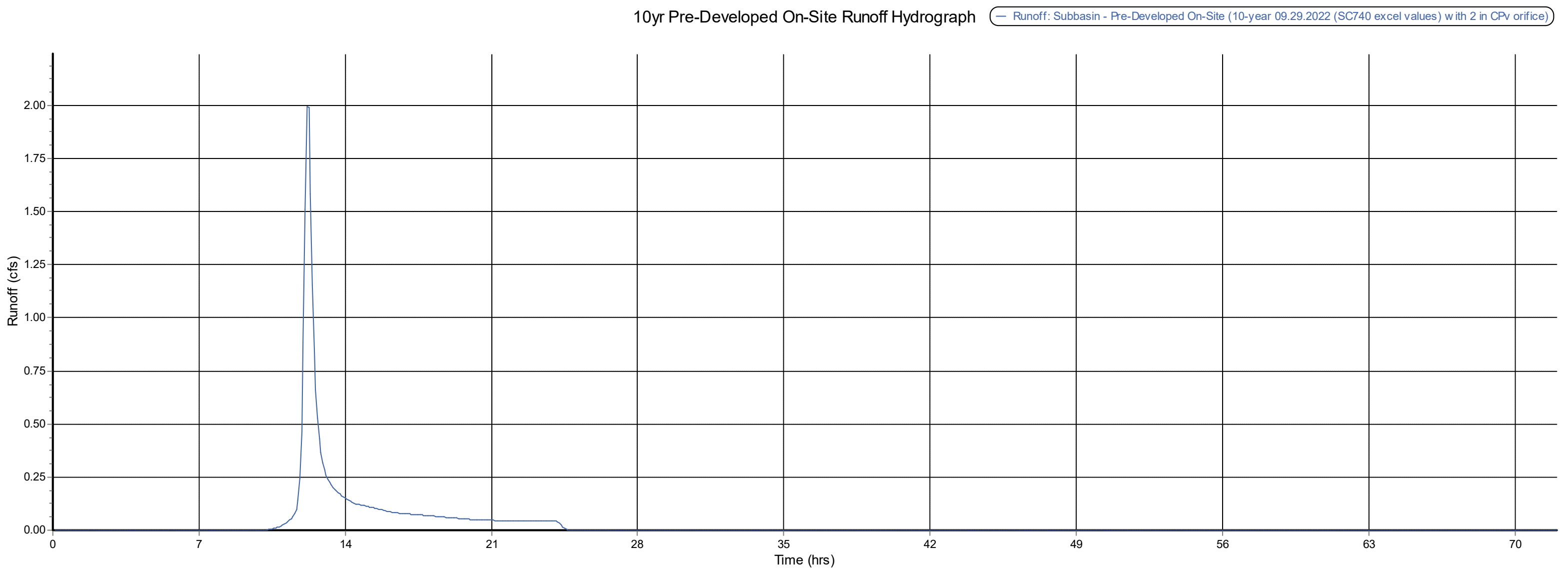
12.	Cross Sectional Flow Area, (a)	0.32 ft.^2	7.07 ft.^2	20.20 ft.^2
13.	Wetted Perimeter, Pw	1.68 ft.	4.71 ft.	18.20 ft.
14.	Hydraulic Radius, (r) (r = a/Pw)	0.189 ft.	1.501 ft.	1.110 ft.
15.	Channel Slope, (s)	0.0038 ft./ft.	0.0120 ft./ft.	0.0050 ft./ft.
16.	Manning's Roughness Coeff., (n)	0.170	0.170	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 On-Site Runoff Hydrograph and Results



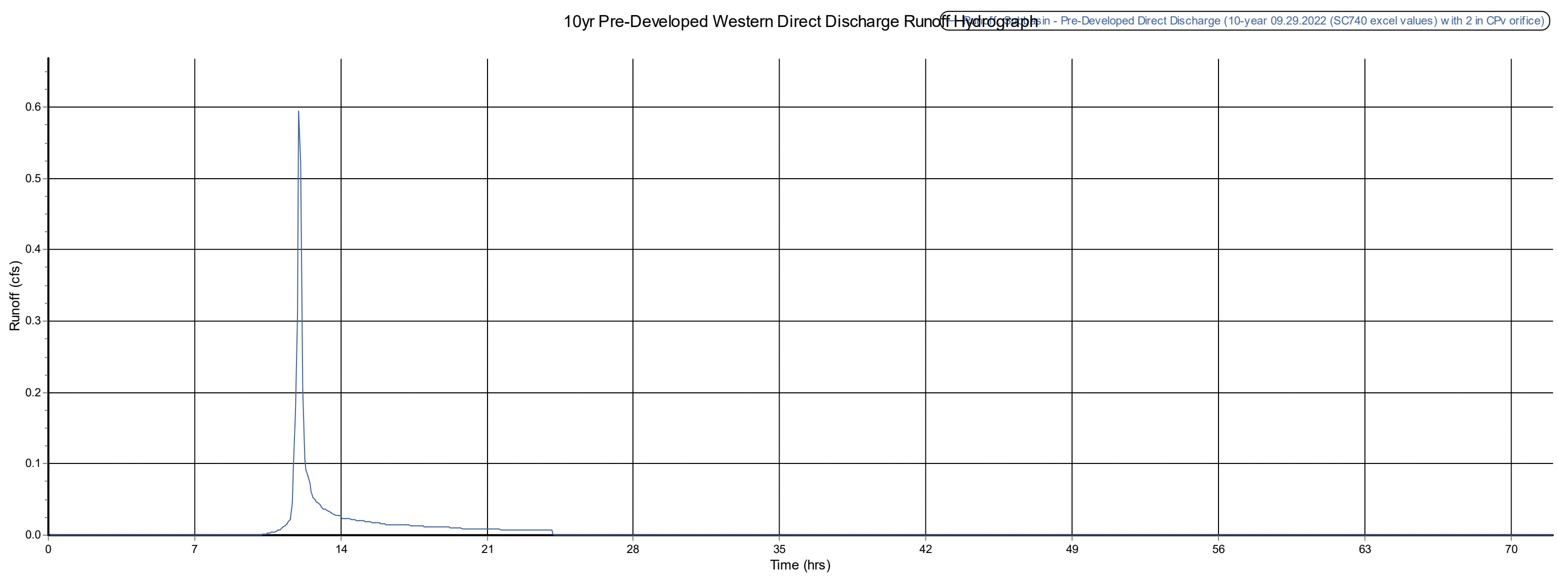
Element ID	Pre-Developed On-Site
Maximum Runoff (cfs)	**0.78**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (cfs)	0.01
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft³)	N/A
Volume of Deficit (ft³)	N/A
Total Runoff (ft³)	3071.96
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

10yr Pre-Development On-Site Runoff Hydrograph and Results



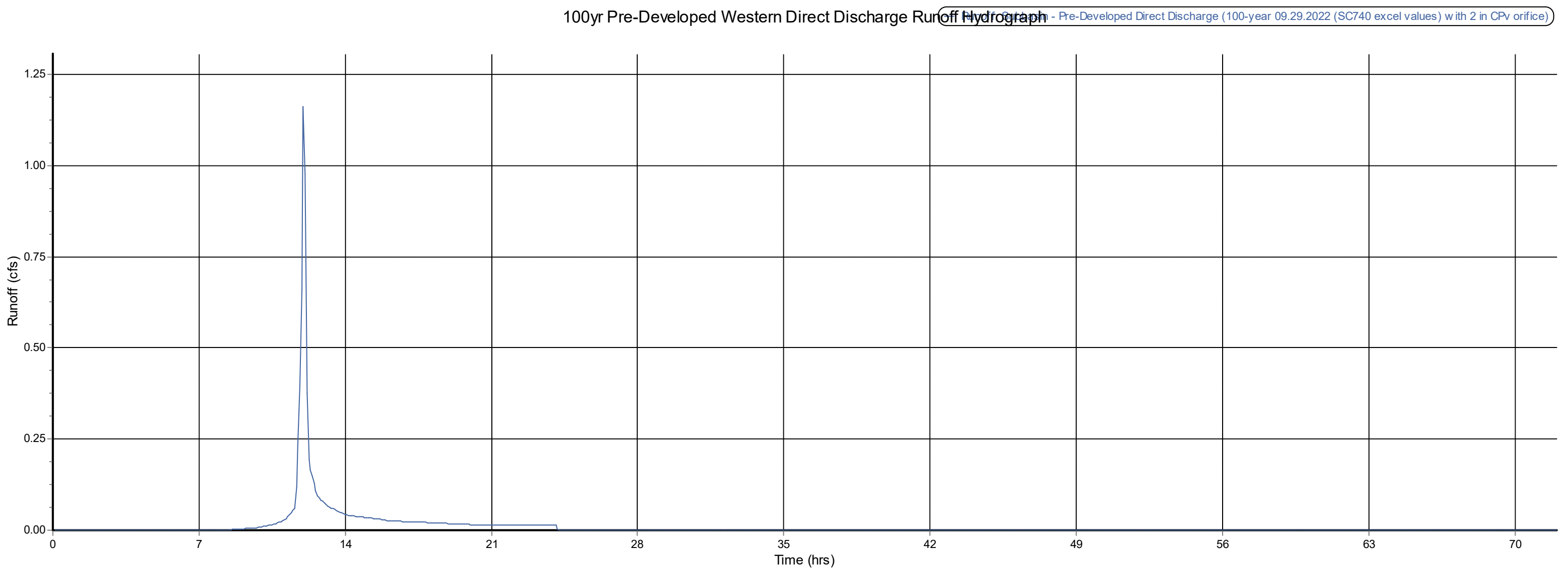
Element ID	Pre-Developed On-Site
Maximum Runoff (cfs)	**2.00**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (cfs)	0.03
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft³)	N/A
Volume of Deficit (ft³)	N/A
Total Runoff (ft³)	7383.93
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

10yr Pre-Development Western Direct Discharge Runoff Hydrograph and Results



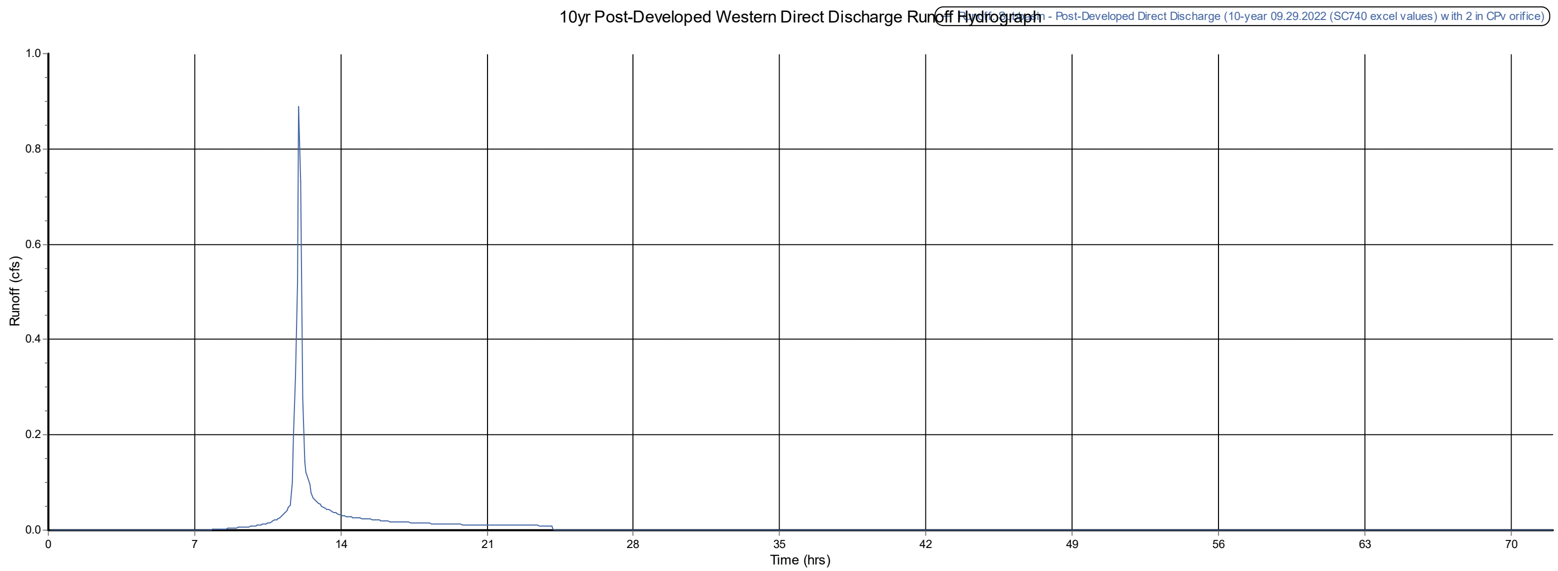
Element ID	Pre-Developed Western Direct Discharge
Maximum Runoff (cfs)	**0.59**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (cfs)	0.01
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft³)	N/A
Volume of Deficit (ft³)	N/A
Total Runoff (ft³)	1380.75
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

100yr Pre-Development Western Direct Discharge Runoff Hydrograph and Results



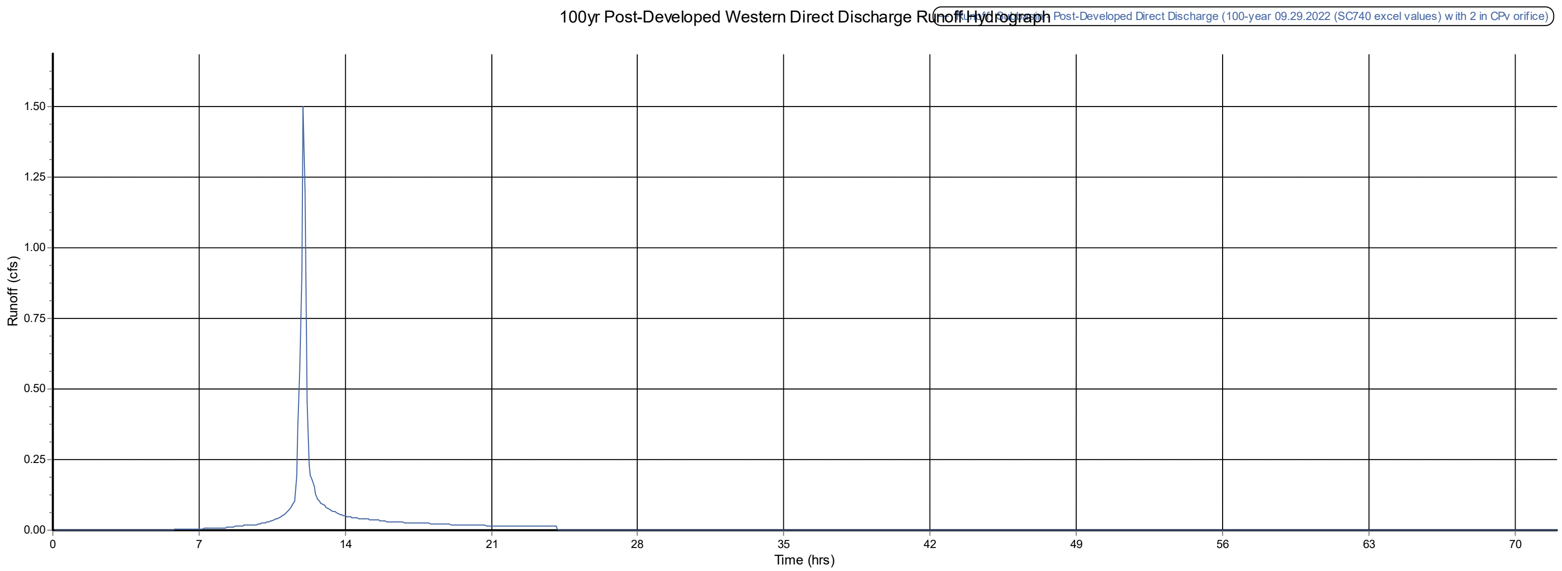
Element ID	Pre-Developed Western Direct Discharge
Maximum Runoff (cfs)	**1.16**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (cfs)	0.01
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft³)	N/A
Volume of Deficit (ft³)	N/A
Total Runoff (ft³)	2657.9
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

10yr Post-Development Western Direct Discharge Runoff Hydrograph and Results



Element ID	Post-Developed Western Direct Discharge
Maximum Runoff (cfs)	**0.89**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (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 Runoff (ft³)	2035.48
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

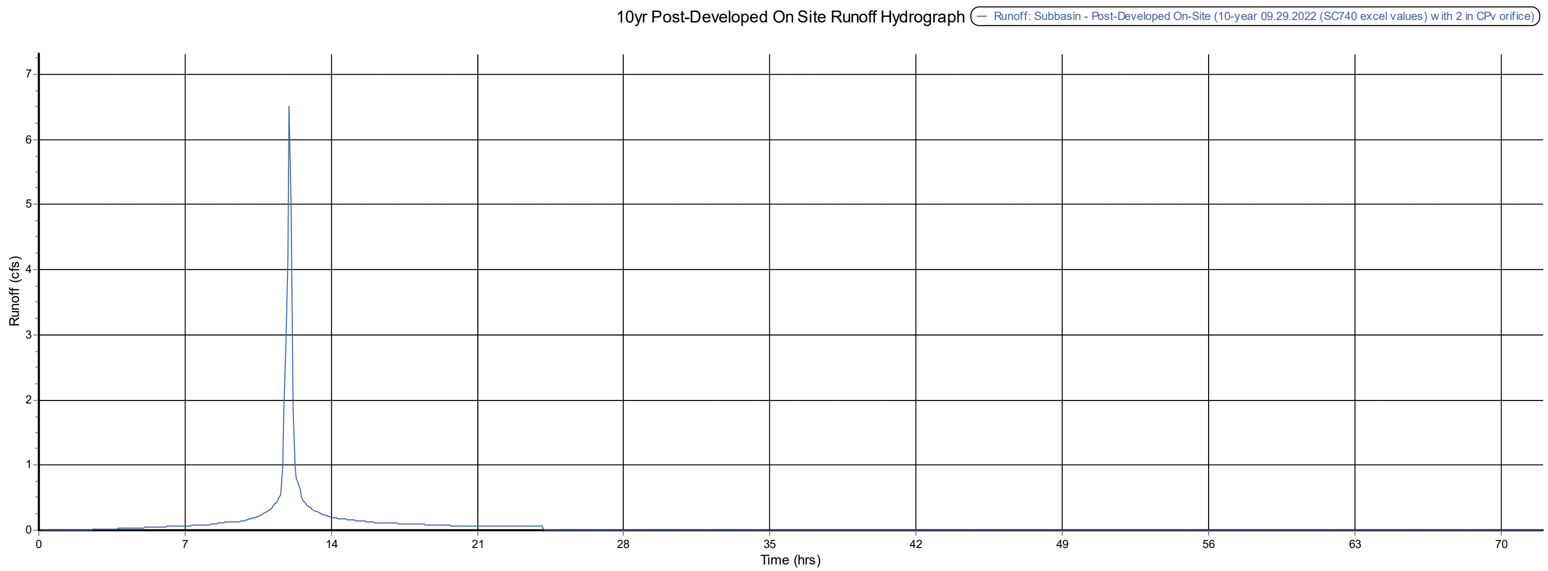
100yr Post-Development Western Direct Discharge Runoff Hydrograph and Results



Element ID	Post-Developed Western Direct Discharge
Maximum Runoff (cfs)	**1.50**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (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 Runoff (ft³)	3501
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

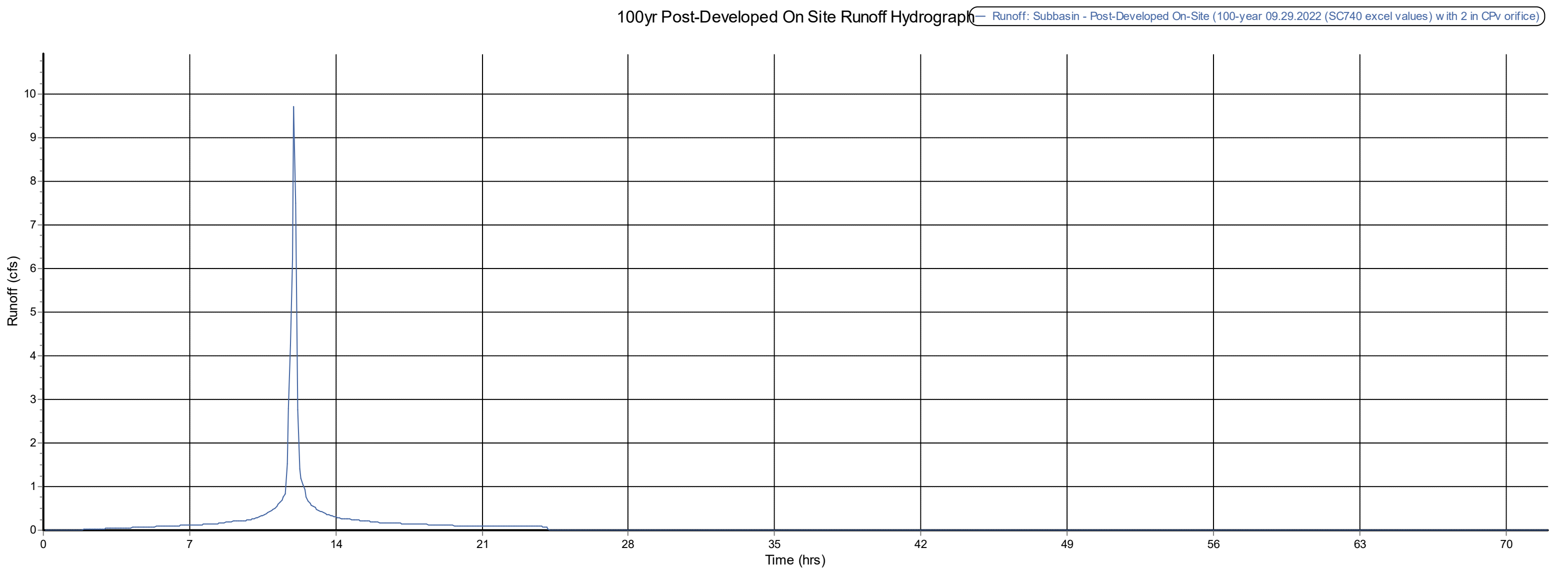
Appendix B: Post-Development Runoff Data

10yr Post-Development On-Site Runoff Hydrograph and Results



Element ID	Post-Developed On-Site
Maximum Runoff (cfs)	**6.51**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (cfs)	0.06
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 Runoff (ft³)	16364.58
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

100yr Post-Development On-Site Runoff Hydrograph and Results



Element ID	Post-Developed On-Site
Maximum Runoff (cfs)	**9.72**
Minimum Runoff (cfs)	0.00
Event Mean Runoff (cfs)	0.10
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 Runoff (ft³)	24992.7
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

Appendix C: Proposed Pond Data

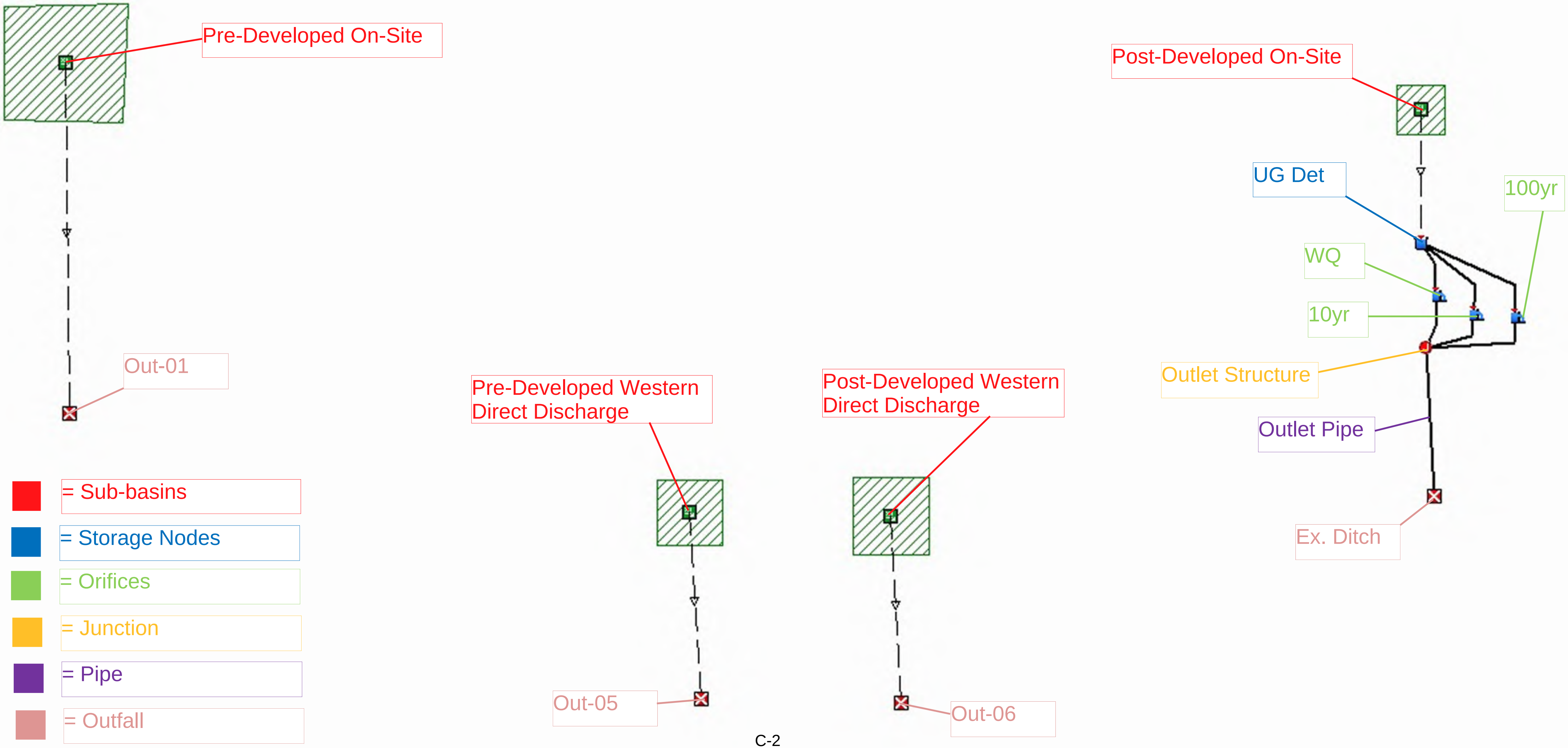
Project: **Johnson County Health Department and Coroners Office**

Chamber Model -	SC-740	
Units -	**Imperial**	Click Here for Metric
Number of chambers -	216	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	735.06	ft
Amount of Stone Above Chambers -	9	in
Amount of Stone Below Chambers -	6	in
Area of system -	7825	sf Min. Area - 7302 sf min. area

☑ Include Perimeter Stone in Calculations

StormTech SC-740 Cumulative Storage Volumes

Height of System *(inches)*	Incremental Single Chamber *(cubic feet)*	Incremental Total Chamber *(cubic feet)*	Incremental Stone *(cubic feet)*	Incremental Ch & St *(cubic feet)*	Cumulative Chamber *(cubic feet)*	Elevation *(feet)*
45	0.00	0.00	260.83	260.83	17692.73	738.81
44	0.00	0.00	260.83	260.83	17431.90	738.73
43	0.00	0.00	260.83	260.83	17171.06	738.64
42	0.00	0.00	260.83	260.83	16910.23	738.56
41	0.00	0.00	260.83	260.83	16649.40	738.48
40	0.00	0.00	260.83	260.83	16388.56	738.39
39	0.00	0.00	260.83	260.83	16127.73	738.31
38	0.00	0.00	260.83	260.83	15866.90	738.23
37	0.00	0.00	260.83	260.83	15606.06	738.14
36	0.05	11.88	256.08	267.96	15345.23	738.06
35	0.16	35.19	246.76	281.95	15077.27	737.98
34	0.28	60.90	236.47	297.37	14795.32	737.89
33	0.60	130.46	208.65	339.11	14497.95	737.81
32	0.80	173.17	191.57	364.74	14158.84	737.73
31	0.95	205.35	178.70	384.04	13794.11	737.64
30	1.07	232.10	168.00	400.09	13410.07	737.56
29	1.18	254.99	158.84	413.82	13009.97	737.48
28	1.27	273.38	151.48	424.86	12596.15	737.39
27	1.36	292.68	143.76	436.44	12171.29	737.31
26	1.45	314.09	135.20	449.28	11734.84	737.23
25	1.52	329.34	129.10	458.44	11285.56	737.14
24	1.58	341.78	124.12	465.90	10827.12	737.06
23	1.64	354.73	118.94	473.67	10361.22	736.98
22	1.70	367.10	114.00	481.09	9887.55	736.89
21	1.75	378.63	109.38	488.01	9406.46	736.81
20	1.80	389.41	105.07	494.48	8918.44	736.73
19	1.85	400.68	100.56	501.24	8423.96	736.64
18	1.89	408.91	97.27	506.18	7922.72	736.56
17	1.93	417.75	93.74	511.48	7416.55	736.48
16	1.97	426.60	90.19	516.79	6905.07	736.39
15	2.01	434.14	87.18	521.32	6388.27	736.31
14	2.04	441.72	84.15	525.86	5866.95	736.23
13	2.07	448.19	81.56	529.75	5341.09	736.14
12	2.10	454.66	78.97	533.63	4811.34	736.06
11	2.13	460.47	76.65	537.11	4277.71	735.98
10	2.15	465.23	74.74	539.97	3740.60	735.89
9	2.18	470.25	72.74	542.98	3200.62	735.81
8	2.20	474.85	70.90	545.74	2657.64	735.73
7	2.21	476.78	70.12	546.90	2111.90	735.64
6	0.00	0.00	260.83	260.83	1565.00	735.56
5	0.00	0.00	260.83	260.83	1304.17	735.48
4	0.00	0.00	260.83	260.83	1043.33	735.39
3	0.00	0.00	260.83	260.83	782.50	735.31
2	0.00	0.00	260.83	260.83	521.67	735.23
1	0.00	0.00	260.83	260.83	260.83	735.14


Pre-Developed On-Site
Out-01
Pre-Developed Western Direct Discharge
Out-05
Post-Developed Western Direct Discharge
Out-06
Post-Developed On-Site
UG Det
100yr
WQ
10yr
Outlet Structure
Outlet Pipe
Ex. Ditch
= Sub-basins
= Storage Nodes
= Orifices
= Junction
= Pipe
= Outfall

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	UG Det	5063.91	6677.86		735.09	738.84	3.75	735.09	0.00	0.00	0.00

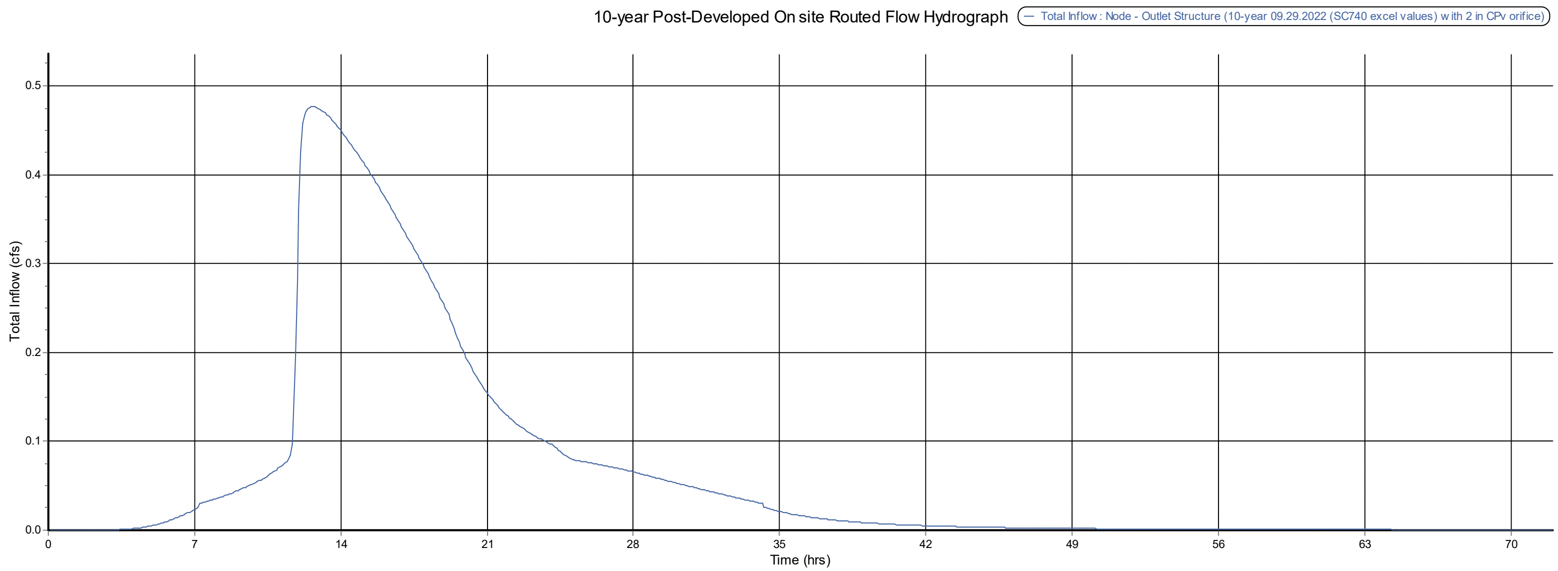
ORIFICE INPUT SUMMARY TABLE															
SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	From (Inlet) Node Invert Elevation (ft)	To (Outlet) Node Invert Elevation (ft)	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (inches)	Rectangular Orifice Height (ft)	Rectangular Orifice Width (ft)	Orifice Invert Elevation (ft)	Orifice Invert Offset (ft)	Orifice Coefficient
1	100yr		UG Det	Outlet Structure	735.09	735.09	SIDE	RECT_CLOSED	NO		0.33	1.15	736.80	1.71	0.6260
2	10yr		UG Det	Outlet Structure	735.09	735.09	SIDE	CIRCULAR	NO	3.75			735.77	0.68	0.6140
3	WQ		UG Det	Outlet Structure	735.09	735.09	SIDE	CIRCULAR	NO	2.00			735.09	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	5084.78	6239.59		735.09	741.50	6.41	735.09	0.00	0.00	-741.50	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 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	Outlet Pipe		Outlet Structure	Ex. Ditch	36.95	735.09	0.00	735.01	0.00	0.09	0.2300	CIRCULAR	15.000	0.00	0.0130	0.5000	0.5000	0.0000	0.00	NO

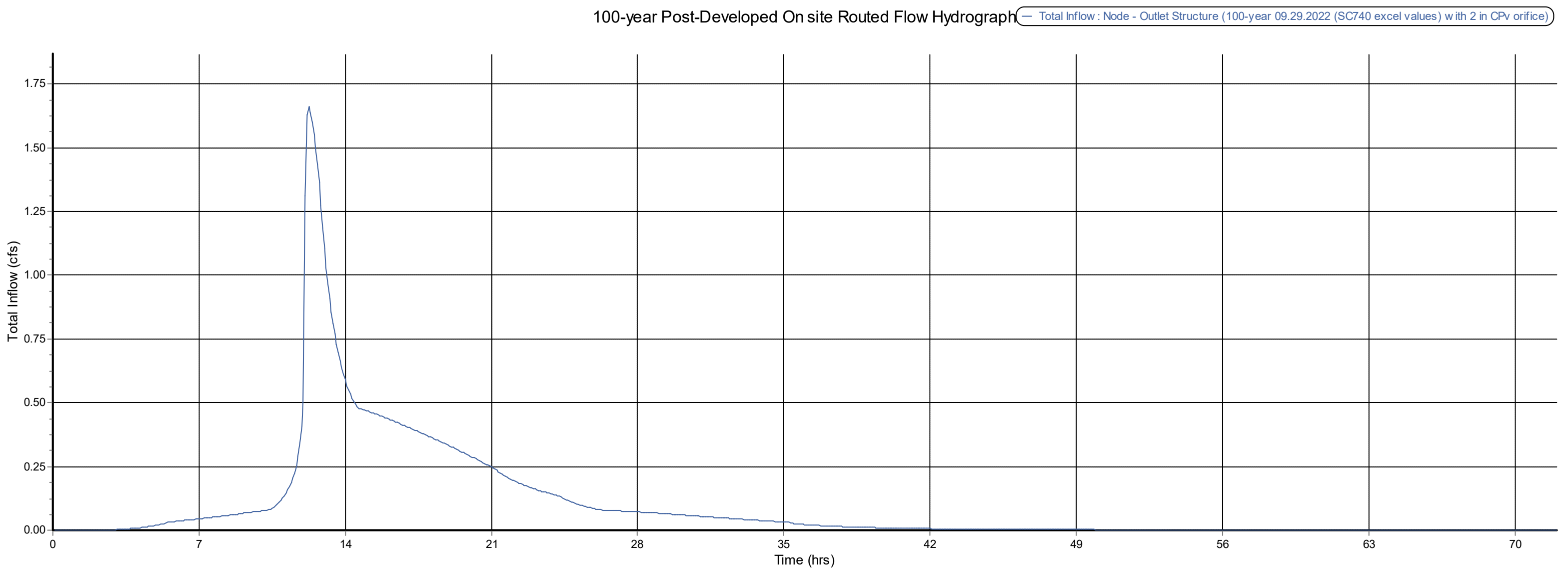
OUTFALL INPUT SUMMARY TABLE								
SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Boundary Type	Flap Gate	Fixed Water Elevation (ft)
1	Ex. Ditch	5121.30	5629.14		735.01	NORMAL	NO	
2	Out-01	-543.71	5970.15		0.00	NORMAL	NO	
3	Out-05	2080.65	4785.61		0.00	NORMAL	NO	
4	Out-06	2909.06	4769.48		0.00	NORMAL	NO	

10yr Post Developed Routed Flow Hydrograph and Results



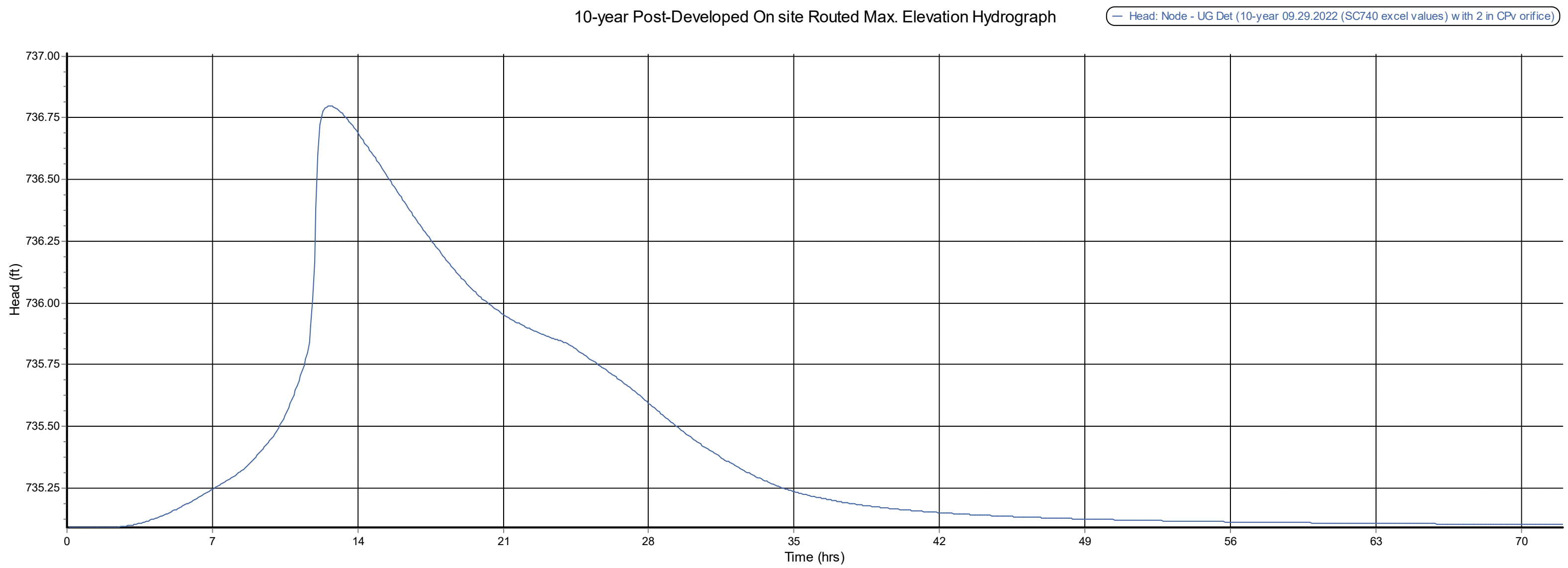
Element ID	Outlet Structure
Maximum Total Inflow (cfs)	**0.48**
Minimum Total Inflow (cfs)	0.00
Event Mean Total Inflow (cfs)	0.06
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft³)	N/A
Volume of Deficit (ft³)	N/A
Total Inflow Volume (ft³)	16327.76
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

100yr Post Developed Routed Flow Hydrograph and Results



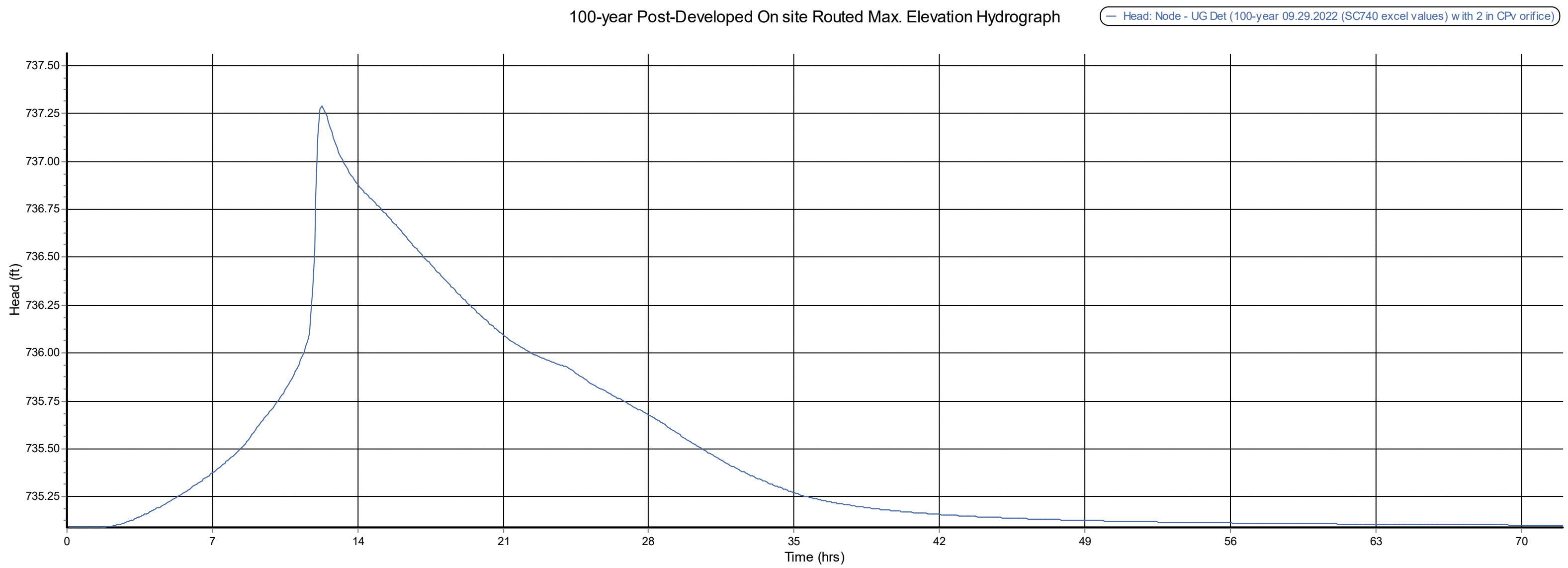
Element ID	Outlet Structure
Maximum Total Inflow (cfs)	**1.66**
Minimum Total Inflow (cfs)	0.00
Event Mean Total Inflow (cfs)	0.10
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft³)	N/A
Volume of Deficit (ft³)	N/A
Total Inflow Volume (ft³)	24952.96
Detention Storage (ft³)	N/A
Exceedance	0
Deficit	0

10yr Post Developed Routed Max. Elevation Hydrograph and Results



Element ID	UG Det
Maximum Head (ft)	**736.80**
Minimum Head (ft)	735.09
Event Mean Head (ft)	736.25
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 Routed Max. Elevation Hydrograph and Results



Element ID	PropPond
Maximum Head (ft)	**737.29**
Minimum Head (ft)	735.09
Event Mean Head (ft)	736.32
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