FINAL DRAINAGE REPORT
for
New Convenience Store
11901 Petersburg Road
Evansville, Indiana 47725

Project No.: 11060.1.002-A
October 23, 2020

RECEIVED
OCT 26 2020
Vanderburgh County Engineering

Prepared For:
Devparth Inc.
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APPLICANT INFORMATION FORM 801

Project Name:	New C-Store for: Devparth Inc.
Approximate Location:	11901 Petersburg Road Evansville, IN 47725
Applicant Name:	Devparth Inc.
Applicant is (check one)	☐Individual (s) ☐Partnership or legal LLC ☒Corporation
Applicant Address: City: State: Zip Code:	11901 Petersburg Road Evansville Indiana 47725
Email:	Victor_patel_78@yahoo.com

For Individual (s)

I (we) do hereby certify that the Information contained on this application is to true and correct. I (we) further understand that upon completion of the project that an as built drawing or certification statement as required by the Vanderburgh County Code will be submitted as required and that failure to provide such certification could result in fines under Section 13.04.110 and/or make me (us) ineligible for future drainage plan approvals until such time as an as built drawing or certification is submitted.

Signature _____ Date _____

Signature _____ Date _____

For Partnership (s)

I (we) do hereby certify that the Information contained on this application is to true and correct. I (we) further understand that upon completion of the project that an as built drawing or certification statement as required by the Vanderburgh County Code will be submitted as required and that failure to provide such certification could result in fines under Section 13.04.110 and/or make me (us) ineligible for future drainage plan approvals until such time as an as built drawing or certification is submitted.

Signature of Senior or Managing Partner _____

Printed Name _____

Date _____

If partnership does not have a Senior or Managing Partner than signatures of all partners

Signature _____ Date _____

Printed Name _____

Signature _____ Date _____

Printed Name _____

Signature _____ Date _____

Printed Name _____

Signature _____ Date _____

Printed Name _____

Signature _____ Date _____

Printed Name _____

For Corporation

I do hereby certify that the Information contained on this application is to true and correct. I further understand that upon completion of the project that an as built drawing or certification statement as required by the Vanderburgh County Code will be submitted as required and that failure to provide such certification could result in fines under Section 13.04.110 and/or make the corporation ineligible for future drainage plan approvals until such time as an as built drawing or certification is submitted.

Signature _____ Date 8/31/2020

Printed Name Victor Patel

Title President (note if not a vice president or above of applicant company, than attached a Delegation of Authority)

New Convenience Store for Devparth Inc.
11901 Petersburg Road

13.04.085 Request by applicant for plan review and approval.

A. All requests for drainage plan approval shall be made by the applicant to the drainage board through the county surveyor's office by the presentation to the surveyor of the drainage plan and the supporting data, all in duplicate, by the close of the business day two full weeks prior to the meeting at which approval of the drainage plan shall be sought.

Drainage Plan submitted with this report on 10-16-2020

C. Included with the Drainage Plan shall be the following information regarding the applicant that shall be provided on FORM 801.

☐ 1. For an individual(s), legal name, current mailing address, email address, name of project and general location of the project. The application must be signed by the individual(s) making such application.

2. For a partnership, corporation or other private entity the legal name of the partnership, corporation or other private entity, mailing address, email address, name of project and general location of the project. For a partnership, the application must be signed by the managing or senior partner or if none exists by all partners. For a Limited Liability Company (LLC), the application must be signed by the manager, or senior member or if one does not exist, by all members. For a corporation, the application must be signed by;

☑ i) the President or Vice-President of the corporation or

☐ ii) by a person whose authority has been delegated to sign such application. If the signature is by a person with a delegation of authority, a copy of such delegation must be included with the application.

D. In all cases the person signing the application will affirm that;

i) the information provided on the application FORM 801 is true and correct and

ii) that the applicant is committing with their signature that an as built plan or record drawing or certification statement will be provided upon completion of the project and that failure to provide an as built plan or record drawing or certification could result in fines under Section 13.04.110 and/or declaring the applicant ineligible for future drainage plan approvals for any project within the County Drainage Board's jurisdiction until such time as an as built drawing or certification is submitted. The County Surveyor or other Technical Advisors to the Board will inform the Drainage Board of any applicants that are not in compliance with submittal of an as built drawing or certification statement prior to any action being taken against such applicant.

13.04.095 Conditions of drainage plan approval.
In order for an applicant to obtain approval of a final drainage plan, the following requirements must be met:

A. The applicant shall be eligible under the terms of this chapter to apply for and obtain drainage plan approval.

B. The drainage plan and supporting submittals required by this chapter shall have been prepared and submitted in a timely and proper manner in accordance with the provisions of this chapter.

Drainage Plan submitted with this report on 10-16-2020

C. The drainage plan and supporting submittals shall reflect compliance with the requirements of this chapter, and compliance with any conditions of approval applied to the plan by the drainage board.

D. The submitted data shall be gathered, analyzed, assembled into the drainage plan and supporting submittals; and shall be certified, and presented to the drainage board all by a civil engineer or land surveyor regularly engaged in stormwater drainage design, and registered to practice in the state of Indiana. ☑

E. An easement has been dedicated to house any off-site drainage facilities if such facilities are required to serve the project's stormwater drainage system.

This project does not contain any off-site drainage facilities that necessitate an easement to be dedicated.

F. The person, persons, partnership, corporation, or other entity to whom approval of the drainage plan is granted must be the person, persons, partnership, corporation, or entity who will be responsible for accomplishing the project for which the drainage plan is developed.

Devparth Inc.

13.04.125 Building permits conditioned.
The Vanderburgh County building commissioner shall not allow construction of buildings, or other impervious structures or facilities to commence at the site of a project requiring final drainage plan approval until:

A. Such approval has been expressed by the drainage board;

B. And all storm drainage facilities are constructed.

13.04.130 Phased development of large projects allowed.
Large projects may be divided into phases for the purpose of constructing drainage facilities and obtaining permits in accordance with the requirements of this chapter.

This project will be phased.

13.04.140 Information submittal and review schedule.

The required drainage plan and supporting data shall be submitted and reviewed by a schedule as follows:

H. For all new major subdivisions as defined in Title 16 of this code, which major subdivisions are shown to discharge an amount of stormwater in addition to that which is discharged prior to new development and all minor subdivisions, C-0 Through M-3, as defined in Title 16 of this code, which minor subdivisions are zoned for commercial use, the applicant shall notify all adjoining landowners and Registered Neighborhood Associations within 1/2 mile of any development of the proposed Drainage Plan.

This project is not a major subdivision.

13.04.165 Contents of the final drainage plan.

A. Soils Map. The soil types based on the most current information available from the SWCD. A soils map indicating soils names and their hydrologic classification must be provided for a proposed project.

See Appendix A of Drainage Report.

B. Location and Topographic Map. In addition, a location and topographic map must be provided showing the land to be developed, and such adjoining land whose location and topography may affect or be affected by the layout or drainage of the project. The map must also identify all adjoining landowners.

See Grading and Drainage Plans submitted with this report.

C. Contour Intervals.

1. The contour intervals shown on the topographic map shall be two and one-half feet for slopes less than four percent; and five feet for slopes four percent or greater; or best available;

Contour intervals are every one foot.

2. Zone "A" floodplain based on the current FIRM panels. The location of streams and other stormwater conveyance channels, both natural and man-made; and the vertical and horizontal limits of the one hundred (100) year floodplain, according to FIRM panels, and/or the building commissioner; all properly identified;

See Appendix A of Drainage Report.

3. The normal shoreline of lakes, ponds, swamps, and basins, their floodplains, and lines of inflow and outflow;

See Grading and Drainage Plans submitted with this report.

4. The location of exiting regulated drains, farm drains, inlets and outfalls;

See Grading and Drainage Plans submitted with this report.

5. Storm, sanitary, and combined sewers, and outfalls;

See Grading and Drainage Plans submitted with this report.

6. Wells, septic tank systems, and outfalls, if any;

There will be no wells, septic tank systems, or outfalls on this project.

7. Seeps, springs, sinkholes, caves, shafts, faults, or other such geological features visible, or of record;

No visible geological features are present at this project site.

8. The limits of the entire proposed project and the limits of the expected extent of land disturbance required to accomplish the project;

See Grading and Drainage Plans submitted with this report.

9. The location of the streets, lot lines, and easements;

See Grading and Drainage Plans submitted with this report.

10. A scale, preferably one inch equals fifty (50) feet; ☑

11. An arrow indicating North.; ☑

D. On-Site Bench Mark Required. A benchmark determined by "Mean Sea Level Datum 1929," is required to be located within the project limits.

See Grading and Drainage Plans submitted with this report.

13.04.170 Final drainage plan layout (Includes information from preliminary).

A. In addition to the requirements listed for a preliminary drainage plan, the final drainage plan shall depict the following:

1. The extent and area of each watershed affecting the design of the drainage facilities for the project; The extent and area of each watershed tributary to the drainage facilities within the project; The existing man-made and natural waterways, ponds, basins, pipes, culverts, and other drainage facilities or features within or affecting the project.

See Appendix B of the Drainage Report for watershed exhibits.

2. The final layout and design of proposed storm sewers, their inlet and outfall locations and elevations, the receiving streams or channels; all with the basis of their design;

See Grading and Drainage Plans and Appendix B of this Drainage Report.

3. The location and design of the proposed street system, including depressed pavements used to convey or detain overflow from storm sewers and over-the-curb runoff resulting from heavier rainstorms, and the outlets for such overflows; all with their designed elevations;

See Grading and Drainage Plans submitted with this report.

4. The locations, cross sections, and profiles of existing streams, floodways, and floodplains to be maintained, and the same for all new channels to be constructed;

No existing streams to be maintained are present at this project site.

5. The materials, elevations, waterway openings, size, and basis for design of the proposed culverts and bridges;

See Grading and Drainage Plans and Appendix B of this Drainage Report

6. Existing ponds and basins to be altered, enlarged, filled, or maintained; and new ponds, basins, swales, to be built, and the basis of their design;

See Grading and Drainage Plans and Appendix B of this Drainage Report.

7. The location and percentage of impervious surfaces existing and expected to be constructed;

See Appendix B for location and percentage of impervious surfaces existing and expected to be constructed.

8. The material types, sizes, slopes, grades and other details of all the stormwater drainage facilities;

See Grading and Drainage Plans submitted with this report.

9. The estimated depth and amount of storage required in the new ponds or basins, the freeboard above the normal pool and highwater pool of wet basins, and details of the emergency overflows from the basins;

See Grading and Drainage Plans submitted with this report.

10. For all controlled release basins, a plot or tabulation of the storage volumes with corresponding water surface elevations, and a plot or tabulation of the basin outflow rates for those water surface elevations;

See Grading and Drainage Plans submitted with this report.

11. The location of any applicable "impacted drainage areas" or other areas designated to remain totally undisturbed, natural, or for common and/or recreational use.

There are no "impacted drainage areas" near the project site.

B. Protection of Structures From One Hundred Year Flooding. All structures to be occupied as residences or businesses shall have finished floor elevations two feet above the high water calculated to occur during a one hundred (100) year return period storm for the subject building site; and the required floor elevations shall be depicted on the plan drawings for such affected sites.

All structures are above the 100 year floodplain shown on plans. Plans also show building floor elevations.

13.04.175 Submittal of a written drainage design report. ☑

13.04.180 Typical cross sections of the drainage facilities.
One or more typical cross sections must be provided for each existing and proposed channel, basin, pond, or other open drainage facility, which cross sections:

See Grading and Drainage Plans submitted with this report.

13.04.440 General detention/retention basin design requirements.
The following design principles shall be observed for detention and retention basins:

Provided — A. Duration of Storage. The maximum volume of water stored and subsequently released at the design release rate shall not result in a storage duration in excess of forty-eight (48) hours, unless additional storms occur within the period.

Provided — B. Depth of Stored Water. The maximum depth of stormwater to be stored, without a permanent pool shall not exceed four feet; and the maximum depth of stormwater to be stored above a permanent pool shall not exceed four feet.

Provided — C. Finished Floor Elevations Adjacent to Basins. The lowest floor of any building or structure occupied by humans must be at least two (2) feet above the one-hundred (100) year storm water elevation of detention/retention basins.

Provided — D. Earthen Side Slopes 4:1 Maximum Steepness for Basins. All detention and retention basins with grassed, earthen side slopes shall have side slopes no steeper than four horizontal units of measurement to one vertical unit of measurement (4:1) to the base of dry basins, and to the typical low waterline of wet basins.

N/A

E. Riprap Side Slopes 2:1 Maximum Steepness for Basins. Wet retention basins with riprap armored side slopes shall have slopes no steeper than two horizontal units of measurements to one vertical unit of measurement (2:1) at any point in the side slope.

N/A

F. Riprap to Extend Two Vertical Feet Below Waterline. The armored portion of the side slope must extend to a minimum depth below the permanent pool elevation of two vertical feet.

N/A

G. Underwater Earthen Side Slopes 2:1 Maximum Steepness. Nonarmored earthen side slopes shall have slopes no steeper than two horizontal units of measurement to one vertical unit of measurements from a point two vertical feet below permanent pool, thence downward.

N/A

H. Minimum Depth of Riprap Application. Riprap side slope armor shall be a minimum twelve (12) inches in depth at all points of application.

N/A

I. Drain Recommended for Maintenance of Wet Basins. If possible, a drain should be installed to lower the pool of wet basins to a level sufficient to repair any wave action erosion along the waterline, and to perform other periodic maintenance.

N/A

J. Safety Ledges and/or Fencing of Wet Basins. Safety fencing surrounding the basin, and/or shallow safety ledges shall be provided if deemed necessary by the design engineer or the board.

Provided

K. Outlet Controls to Operate Automatically. Outlet control structures shall be designed to operate as simply as possible, and shall require little or no maintenance for proper operation.

N/A

L. Designed Water Level Control Required. A controlled positive outlet shall be required to maintain the designed water level in wet basins, and provide the required detention storage above the designed low water level. Wet basins shall have a minimum depth of 6 feet over 50% of the basin area and no extensive shallow areas shall be allowed except as required for the safety ledge.

M. Emergency Spillway Requirements.

Provided

1. An emergency overflow spillway shall be provided for the release of storm runoffs exceeding the designed maximum detention volume, or all overflow volumes in emergency conditions, should the normal discharge devices become totally or partially inoperative.

Provided

2. A minimum freeboard of one-half foot above the calculated elevation of the design storm detention high water level to the elevation of the spillway flowline peak is required as a safety factor for all basins.

Provided

N. Automatically Operating Emergency Spillway Required. The emergency overflow spillway shall be designed so that it operates openly, automatically, does not require manual attention, and will pass all the one hundred (100) year return period storm flow with a one-half foot vertical minimum above the one hundred (100) year return storm flow to the lowest dirt elevation in the surrounding earthwork.

N/A

O. All Permanent Pools Require Water Quality Provisions. Designers of basins with permanent pools shall consult available manuals from the soil and water conservation district, and incorporate provisions therefrom for maintaining water quality, safety, and soil stability.

Provided

P. Dry Basin Cover and Maintenance. Dry basins shall be planted and maintained in vegetative cover equal to that of residential lawns.

Provided

Q. Side Slopes to Remain Stable. All side slopes of a basin shall be constructed stable and shall be maintained in a stable condition by the same criteria as specified herein for open channels.

N/A

R. Wet Basin Cover and Maintenance. The earthen side slopes of wet basins shall be provided with grass cover above the low water elevation, which shall be maintained equal to turfed residential lawns, and in no case shall the cover growth exceed twelve (12) inches in height, or the most current county standard.

Provided

S. Maintenance Pathway for Basins. A flat pathway with a minimum width of ten (10) feet shall be constructed completely around the top of the embankment of all detention/retention basins.

N/A

T. Maintenance Easement for Basins. An easement dedicated for the purpose of accessing and maintaining the basin and its appurtenances shall be provided, and the easement shall be configured so that it includes the entire basin, the entire earthwork encompassing the basin, the maintenance pathways into and around the basin, and all inletting and outletting appurtenances of the basin. The basins and maintenance easements shall not be located with the right of way of any county, state or federal road or highway.

U. Maintenance Report Required for Basin.

See Report

1. A brief and concise report shall be prepared, by the design engineer, consisting of a description of the location, intended function of all parts appurtenant to the basin, together with a description of the ways in which the basin and its appurtenances should be maintained, all worded in language easily understood by residential or commercial property owners; and;

See Report

2. The report shall be attached to the restrictions for the property on which the basin and its parts are located.

See Report

3. Such restrictions shall be shown to exist prior to the board's final approval of the drainage plan for a project whose plans include a basin.

N/A

V. Copy of Report Must be Submitted With the As-Builts. A copy of the maintenance report described above shall be included with the as-built plans required to be submitted hereinabove.

Provided

W. Elevation of Dry Basin Bottom Marked. A continuous concrete liner at least equal in characteristics to that described in Section 13.04.315F shall be installed in all dry basins from the point of inflow of each channel entering a basin to the point of outflow from the basin. The concrete liner shall be installed at an elevation slightly lower than the earthen floor of the basin, so that it may serve as a trickle trough or low flow liner.

N/A

X. No tree limbs, trunks, refuse from legally burnt vegetation, nor construction waste, demolition materials, or other man made material may be buried within the area in which an impounding structure will be located. Notice shall be placed on construction drawings noting the prohibition to the burying of any such materials. Certain natural materials such as large rocks may be located in the bottom of wet basins in order to provide fish habitat or habitat breeding areas provided that such materials are not included within the calculations for required storage volumes and will not block outlet structures.

N/A

Y. For small sites of less than 5 acres, infiltration trenches may be utilized instead of a wet or dry basin. In utilizing an infiltration trench, the storage volume is equal to the void ratio multiplied by the total volume of the trench. Information must be provided in advance validating the void ratio as well as testing proposal to validate the void ratio. The infiltration trench must have an outlet that restricts the flow per code provisions.

N/A

Z. No retention basin shall be allowed within the flowline of a Regulated Drain of Vanderburgh County. The Drainage Board cannot use its rights to discretionary decisions granted under Section 13.04.025 to exempt this restriction.

Other comments:

13.04.175 Submittal of a written drainage design report.

The final drainage plan shall be accompanied by a written report containing the following:

A. Any significant stormwater drainage problems existing or anticipated to be associated with the project;

There are no known or anticipated storm water drainage problems. However, the existing use is a gas station and removal/replacement of nderground tanks is an inherent risk for erosion and environmental problems, but that is beyond the scope of this report.

B. The analysis procedure used to identify and evaluate the drainage problems associated with the project;

Runoff conditions from a 10-year pre-developed and 25-year post-developed storm were analyzed using the Rational Method. The Rational Method is appropriate for estimating peak discharges for small drainage areas of up to 50 acres. The design of stormwater detention facilities is based on a return period of 25 years. The design of the emergency spillway is based on the depth of flow of the 100 year return period storm flow (assuming that the normal discharge device becomes totally inoperative).

Runoff coefficients used were those found in the Vanderburgh County Technical Memorandum #1 of the Vanderburgh County Drainage Ordinance, effective January 1 2018. These show on the subbasin drainage calculations in Appendix B.

The Rational Method was also used to appropriately size the storm pipe network. Pipes were sized to a 25 year return period, and assumed a Manning's Roughness, n, equal to 0.010 for HDPE storm sewer pipes.

The Form 800 was used to size the on-site detention basin in accordance with the Vanderburgh County Drainage Ordinance. The form is attached in Appendix B

C. Any assumptions or special conditions associated with the use of the procedures, especially hydrologic or hydraulic methods, used to identify and evaluate drainage problems associated with the project;

All assumptions for peak discharge estimates were based on runoff coefficients found in the Vanderburgh County Technical Memorandum #1 of the Vanderburgh County Drainage Ordinance, effective January 1 2018. These show on the subbasin drainage calculations in Appendix B.

D. The proposed design of the drainage control system;

The proposed drainage control system revolves around the use of storm inlets and HDPE storm pipes to convey runoff to the proposd detention basin. Storm water runoff will sheet flow over pavement into the proposed area drains and/or curb inlets, which will carry the water to the detention basin. Storm sewer components were analyzed per the procedures outlined in Appendix B of this report.

E. The results of the analysis of the proposed drainage control system showing that it does solve the project's identified and anticipated drainage problems;

The analysis of the undeveloped site shows 2.84 CFS of storm water runoff during a 10-year pre-developed storm event. Once developed, the analysis suggests the site will create 9.44 CFS of storm water runoff during a 25-year post-developed storm event. The excess storm water runoff

will be detained in the proposed detention basin and discharge the allowable release rate. Form 800 calculations show a peak storage of 3,559 cu. ft. of storage for Basin #1. Adding 10% for sedimentation brings the total required storage volume to 3,915 cu. ft. for Basin #1.

F. Descriptive data sufficient to support the feasibility of the drainage plan including calculations of the predevelopment and post development runoff rates using rainfall data supplied herein. A detailed description, depiction, and log of all hydrologic and hydraulic calculations or modeling, and the results obtained thereby; together with the input and output files for all computer runs;

Appendix B shows a log of all calculations and modeling to estimate the pre-developed and post-developed runoff rates. The pre-developed site has a 10-year runoff rate of 2.84 CFS and the post-developed site has a 25-year runoff rate of 9.44 CFS.

G. Maps showing individual drainage areas within the project subdivided for use in the analysis thereof.

Appendix B contains exhibits showing the individual drainage areas within the project subdivided for the use in the analysis thereof.

APPENDIX 'A'

Site Location Map A.01
USDA Soil Survey A.02
Flood Insurance Rate Map (FIRM) A.03
Wetlands Inventory Map A.04


Cascade Dr
Kenar Dr
Stoney Lake Dr
Trailstone Dr
Crater Dr
Tempsford D
Grassme
Earle
Project Site
E Boonville-New Harmony Rd
Silverthorne Dr
Heard St
Sawmill Dr
Burke Dr
Lameys Ln
Ray Nell Acres Lake
Seib Rd
Petersburg Rd
Google Earth
© 2020 Google
N
2000 ft

Soil Map—Vanderburgh County, Indiana
(11901 Petersburg Road)

Map Scale: 1:1,000 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

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: Vanderburgh County, Indiana
Survey Area Data: Version 20, Jun 11, 2020

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

Date(s) aerial images were photographed: Feb 12, 2016—Mar 9, 2017

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
HoB2	Hosmer silt loam, 2 to 5 percent slopes, eroded	2.5	86.8%
HoC3	Hosmer silt loam, 5 to 10 percent slopes, severely eroded	0.4	13.2%
Totals for Area of Interest		**2.9**	**100.0%**

National Flood Hazard Layer FIRMette

FEMA

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
- 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 7/14/2020 at 3:27 PM 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.

U.S. Fish and Wildlife Service

National Wetlands Inventory

11901 Petersburg Road

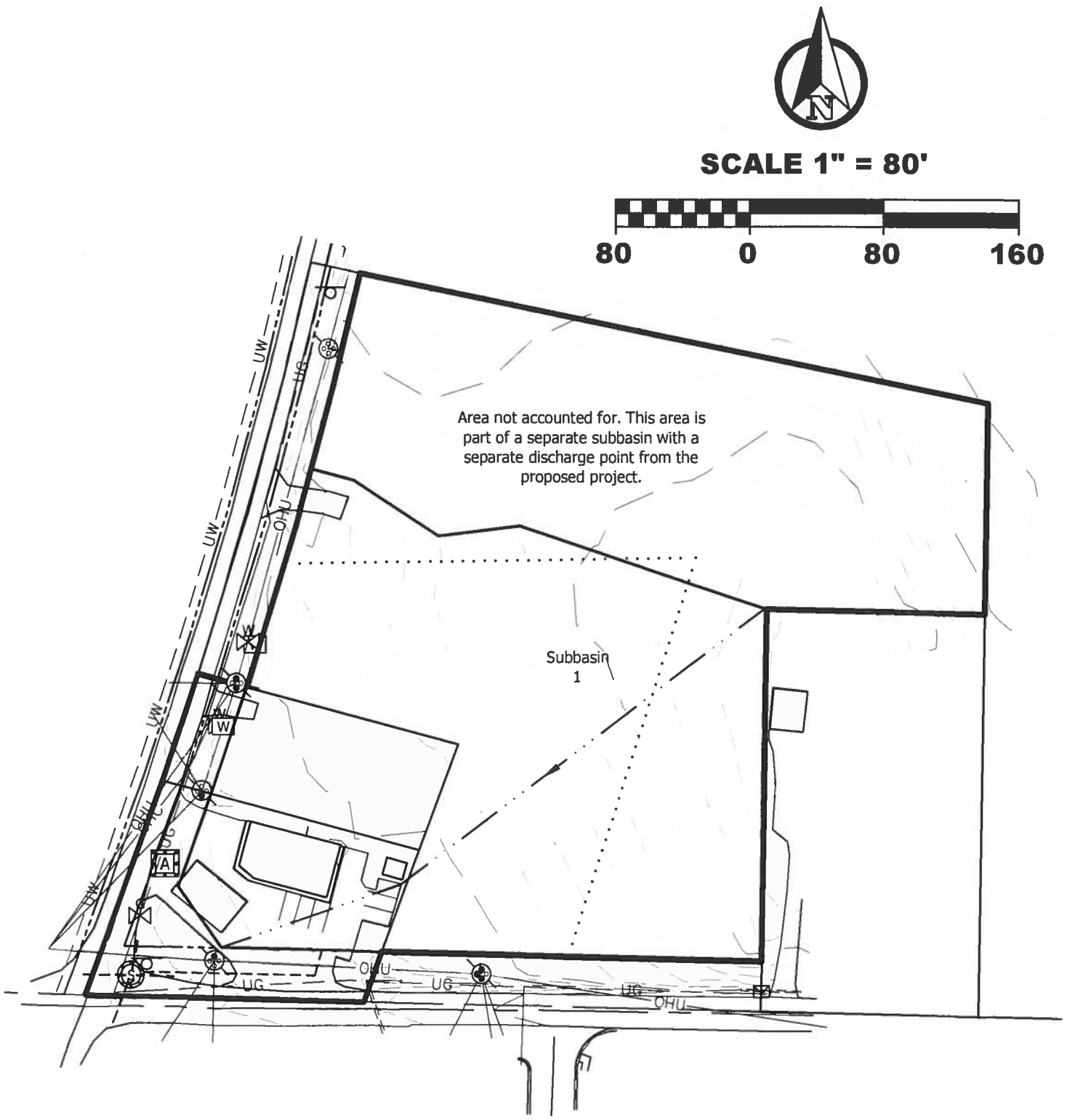
July 14, 2020

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

APPENDIX 'B'
Final Drainage Plan

Pre-Developed Drainage Information B.01
Developed Drainage Information B.02
Form 800 B.03
Drainage Calculations B.04



MORLEY ARCHITECTS | ENGINEERS | SURVEYORS	4800 Rosebud Ln. Newburgh, IN 47630 812.464.9585 Phone 812.464.2514 Fax morleycorp.com	**Pre-Developed Subbasins** 11901 Petersburg Road Evansville, IN 47725	Designed By: JEM Drawn By: CRS Filename: 11060 Civil Base	Job Number: 11060.1.002-A Date: 10.23.2020

Peak Runoff Calculation

SUB-BASIN #1 Pre-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = **1.81** **Area (Sf) =** **78,725**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)	5,500	S.F.	=	0.13	AC.	0.92	0.12
Structures & Pavement (2-5%)		S.F.	=	0.00	AC.	0.94	0.00
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	5,000	S.F.	=	0.11	AC.	0.98	0.11
Gravel (10 yr Storm)	2,000	S.F.	=	0.05	AC.	0.50	0.02
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	66,225	S.F.	=	1.52	AC.	0.25	0.38
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC.	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	78,725			1.81			0.63

Wc = **0.3495**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	100	feet	t_o =	Overland Flow Tc
Slope, S (ft/ft)		=	0.024		t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240		t_o =	13.06 min
$P_{2/24}$		=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	unpaved	=	175	feet	V	=	16.1345*(S0.5)	
Slope, S		=	2.40%			=	2.500 ft/s =	149.97 ft/min
Velocity, V		=	2.50	ft/sec	t_s	=	Shallow Flow Tc	
					t_s	=	(L/V) = 1.17	min

Shallow Flow

Length, L (Paved or Unpaved)	paved	=	115	feet	V	=	20.3282*(S0.5)	
Slope, S		=	2.10%			=	2.946 ft/s =	176.75
Velocity, V		=	2.95	ft/sec	t_s	=	Shallow Flow Tc	
					t_s	=	(L/V) = 0.65	min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 14.88 (Min 5 Minutes)

0.25 Hour

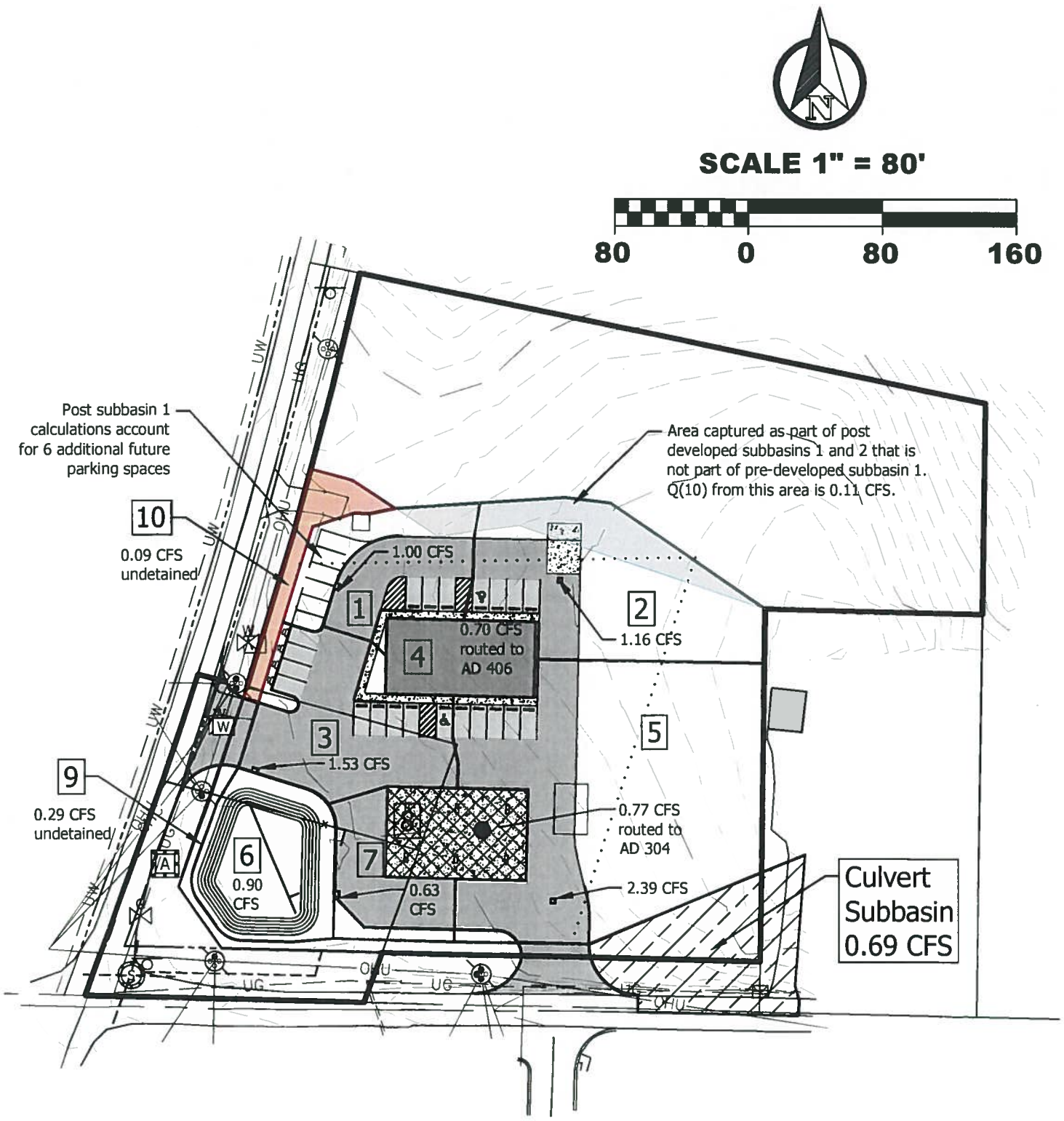
Intensity (Vanderburgh Co.)

I_2 =	**3.39**	**in/hr**
I_5 =	**3.98**	**in/hr**
I_{10} =	**4.49**	**in/hr**
I_{25} =	**5.27**	**in/hr**
I_{50} =	**5.95**	**in/hr**
I_{100} =	**6.71**	**in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2 =	**2.14**	**cfs**
Q_5 =	**2.51**	**cfs**
Q_{10} =	**2.84**	**cfs**
Q_{25} =	**3.33**	**cfs**
Q_{50} =	**3.76**	**cfs**
Q_{100} =	**4.24**	**cfs**



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Post-Developed Subbasins
11901 Petersburg Road
Evansville, IN 47725

Designed By: JEM	Job Number: 11060.1.002-A
Drawn By: CRS	Date: 10.23.2020
Filename: 11060 Civil Base	

Peak Runoff Calculation

SUB-BASIN #1 Post-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.16** **Area (Sf) =** **7,175**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	5,500	S.F.	=	0.13	AC.	0.94	0.12
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC.	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	1,675	S.F.	=	0.04	AC.	0.25	0.01
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC.	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	7,175			0.16			0.13

Wc = **0.7789**

Time of Concentration

Overland Flow

Length, L (max 100ft)	=	85	feet	t_o = Overland Flow Tc
Slope, S (ft/ft)	=	0.02		t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n	=	0.011		t_o = 1.05 min
$P_{2/24}$	=	3.3		

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 1.05 (Min 5 Minutes)

0.02 Hour

Intensity (Vanderburgh Co.)

I_2 = 5.02 in/hr

I_5 = 5.90 in/hr

I_{10} = 6.66 in/hr

I_{25} = 7.81 in/hr

I_{50} = 8.82 in/hr

I_{100} = 9.95 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 0.64 cfs

Q_5 = 0.76 cfs

Q_{10} = 0.85 cfs

Q_{25} = 1.00 cfs

Q_{50} = 1.13 cfs

Q_{100} = 1.28 cfs

Peak Runoff Calculation

SUB-BASIN #2 Post-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.29** **Area (Sf) =** **12,800**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	4,000	S.F.	=	0.09	AC.	0.94	0.09
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC.	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	7,025	S.F.	=	0.16	AC.	0.25	0.04
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)	1,775	S.F.	=	0.04	AC.	0.55	0.02
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	12,800			0.29			0.15

Wc = **0.5072**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 100 feet — t_o = Overland Flow Tc

Slope, S (ft/ft) = 0.025 — $t_o = [0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.011 — t_o = 1.09 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) paved = 30 feet — V = 20.3282*(S0.5)

Slope, S = 2.00% = 2.875 ft/s = 172.49 ft/min

Velocity, V = 2.87 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.17 min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 1.27 (Min 5 Minutes)

0.02 Hour

Intensity (Vanderburgh Co.)

I_2 = 5.02 in/hr

I_5 = 5.90 in/hr

I_{10} = 6.66 in/hr

I_{25} = 7.81 in/hr

I_{50} = 8.82 in/hr

I_{100} = 9.95 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 0.75 cfs

Q_5 = 0.88 cfs

Q_{10} = 0.99 cfs

Q_{25} = 1.16 cfs

Q_{50} = 1.31 cfs

Q_{100} = 1.48 cfs

Peak Runoff Calculation

SUB-BASIN #3 Post-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.22** **Area (Sf) =** **9,375**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	8,975	S.F.	=	0.21	AC.	0.94	0.19
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC.	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	400	S.F.	=	0.01	AC.	0.25	0.00
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC.	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	9,375			0.22			0.20

Wc = **0.9106**

Time of Concentration

Overland Flow

Length, L (max 100ft)	=	100	feet	t_o =	Overland Flow Tc
Slope, S (ft/ft)	=	0.025		t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n	=	0.011		t_o =	1.09 min
$P_{2/24}$	=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	paved	=	30	feet	V =	20.3282*(S0.5)
Slope, S		=	2.50%		=	3.214 ft/s = 192.85 ft/min
Velocity, V		=	3.21	ft/sec	t_s =	Shallow Flow Tc
					t_s =	(L/V) = 0.16 min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 1.25 (Min 5 Minutes)

0.02 Hour

Intensity (Vanderburgh Co.)

I_2 =	**5.02**	**in/hr**
I_5 =	**5.90**	**in/hr**
I_{10} =	**6.66**	**in/hr**
I_{25} =	**7.81**	**in/hr**
I_{50} =	**8.82**	**in/hr**
I_{100} =	**9.95**	**in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2 =	**0.98**	**cfs**
Q_5 =	**1.16**	**cfs**
Q_{10} =	**1.31**	**cfs**
Q_{25} =	**1.53**	**cfs**
Q_{50} =	**1.73**	**cfs**
Q_{100} =	**1.95**	**cfs**

Peak Runoff Calculation

SUB-BASIN #4 Post-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.09** **Area (Sf) =** **4,005**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)		S.F.	=	0.00	AC	0.94	0.00
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)	4,005	S.F.	=	0.09	AC	0.98	0.09
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)		S.F.	=	0.00	AC	0.25	0.00
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water		S.F.	=	0.00	AC	1.00	0.00
	4,005			0.09			0.09

Wc = **0.9800**

Time of Concentration

Overland Flow

Length, L (max 100ft)	=	50	feet	t_o = Overland Flow Tc
Slope, S (ft/ft)	=	0.1		t_o = $[0.42*(L^{0.8})*(n^{0.6})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n	=	0.011		t_o = 0.36 min
$P_{2/24}$	=	3.3		

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 0.36 (Min 5 Minutes)

0.01 Hour

Intensity (Vanderburgh Co.)

I_2 = 5.02 in/hr

I_5 = 5.90 in/hr

I_{10} = 6.66 in/hr

I_{25} = 7.81 in/hr

I_{50} = 8.82 in/hr

I_{100} = 9.95 in/hr

Peak Runoff Rate

$Q_{yr} = CIA$

Q_2 = 0.45 cfs

Q_5 = 0.53 cfs

Q_{10} = 0.60 cfs

Q_{25} = 0.70 cfs

Q_{50} = 0.79 cfs

Q_{100} = 0.90 cfs

Peak Runoff Calculation

SUB-BASIN #5 Post-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = 0.58 **Area (Sf) =** 25,450

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	8,975	S.F.	=	0.21	AC.	0.94	0.19
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC.	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	13,875	S.F.	=	0.32	AC.	0.25	0.08
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)	2,600	S.F.	=	0.06	AC.	0.55	0.03
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	25,450			0.58			0.31

Wc = 0.5240

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	100	feet	t_o	=	Overland Flow Tc
Slope, S (ft/ft)		=	0.03		t_o	=	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5}*(S^{0.4})]$
Manning Coefficient, n		=	0.011		t_o	=	1.01 min
$P_{2/24}$		=	3.3				

Shallow Flow

Length, L (Paved or Unpaved)	unpaved	=	70	feet	V	=	16.1345*(S0.5)		
Slope, S		=	5.70%			=	3.852 ft/s =	231.12	ft/min
Velocity, V		=	3.85	ft/sec	t_s	=	Shallow Flow Tc		
					t_s	=	(L/V) = 0.30 min		

Shallow Flow

Length, L (Paved or Unpaved)	paved	=	20	feet	V	=	20.3282*(S0.5)		
Slope, S		=	1.20%			=	2.227 ft/s =	133.61	ft/min
Velocity, V		=	2.23	ft/sec	t_s	=	Shallow Flow Tc		
					t_s	=	(L/V) = 0.15 min		

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 1.47 (Min 5 Minutes)

0.02 Hour

Intensity (Vanderburgh Co.)

I_2	=	**5.02** in/hr
I_5	=	**5.90** in/hr
I_{10}	=	**6.66** in/hr
I_{25}	=	**7.81** in/hr
I_{50}	=	**8.82** in/hr
I_{100}	=	**9.95** in/hr

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2	=	**1.54** cfs
Q_5	=	**1.81** cfs
Q_{10}	=	**2.04** cfs
Q_{25}	=	**2.39** cfs
Q_{50}	=	**2.70** cfs
Q_{100}	=	**3.05** cfs

Peak Runoff Calculation

SUB-BASIN #6 Post-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = 0.16 **Area (Sf) =** 7,125

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)		S.F.	=	0.00	AC	0.94	0.00
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)	1,950	S.F.	=	0.04	AC	0.25	0.01
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)	1,475	S.F.	=	0.03	AC	0.55	0.02
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water	3,700	S.F.	=	0.08	AC	1.00	0.08
	7,125			0.16			0.11

Wc = 0.7016

Time of Concentration

Overland Flow

Length, L (max 100ft) = 15 feet — t_o = Overland Flow Tc

Slope, S (ft/ft) = 0.033 — $t_o = [0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 — t_o = 2.52 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) unpaved = 10 feet — V = 16.1345*(S0.5)

Slope, S = 25.00% = 8.067 ft/s = 484.04 ft/min

Velocity, V = 8.07 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.02 min

Shallow Flow

Length, L (Paved or Unpaved) paved = 70 feet — V = 20.3282*(S0.5)

Slope, S = 0.60% = 1.575 ft/s = 94.48 ft/min

Velocity, V = 1.57 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.74 min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 3.28 (Min 5 Minutes)

0.05 Hour

Intensity (Vanderburgh Co.)

I_2 = 5.02 in/hr

I_5 = 5.90 in/hr

I_{10} = 6.66 in/hr

I_{25} = 7.81 in/hr

I_{50} = 8.82 in/hr

I_{100} = 9.95 in/hr

Peak Runoff Rate

$Q_{pr} = CiA$

Q_2 = 0.58 cfs

Q_5 = 0.68 cfs

Q_{10} = 0.76 cfs

Q_{25} = 0.90 cfs

Q_{50} = 1.01 cfs

Q_{100} = 1.14 cfs

Peak Runoff Calculation

SUB-BASIN #7 Post-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.10** **Area (Sf) =** **4,200**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	3,550	S.F.	=	0.08	AC.	0.94	0.08
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC.	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	650	S.F.	=	0.01	AC.	0.25	0.00
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC.	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	4,200			0.10			0.08

Wc = **0.8332**

Time of Concentration

Overland Flow

Length, L (max 100ft)	=	95	feet	t_o = Overland Flow Tc
Slope, S (ft/ft)	=	0.026		t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n	=	0.011		t_o = 1.03 min
$P_{2/24}$	=	3.3		

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 1.03 (Min 5 Minutes)

0.02 Hour

Intensity (Vanderburgh Co.)

I_2	=	**5.02**	**in/hr**
I_5	=	**5.90**	**in/hr**
I_{10}	=	**6.66**	**in/hr**
I_{25}	=	**7.81**	**in/hr**
I_{50}	=	**8.82**	**in/hr**
I_{100}	=	**9.95**	**in/hr**

Peak Runoff Rate

Q_{yr} = CiA

Q_2	=	**0.40**	**cfs**
Q_5	=	**0.47**	**cfs**
Q_{10}	=	**0.54**	**cfs**
Q_{25}	=	**0.63**	**cfs**
Q_{50}	=	**0.71**	**cfs**
Q_{100}	=	**0.80**	**cfs**

Peak Runoff Calculation

SUB-BASIN #8 Post-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.10** **Area (Sf) =** **4,550**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)	4,550	S.F.	=	0.10	AC	0.94	0.10
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)		S.F.	=	0.00	AC	0.25	0.00
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water		S.F.	=	0.00	AC	1.00	0.00
	4,550			0.10			0.10

Wc = **0.9400**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 50 feet t_o = Overland Flow Tc

Slope, S (ft/ft) = 0.01 $t_o = [0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.011 t_o = 0.90 min

$P_{2/24}$ = 3.3

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 0.90 (Min 5 Minutes)

0.02 Hour

Intensity (Vanderburgh Co.)

I_2 = 5.02 in/hr

I_5 = 5.90 in/hr

I_{10} = 6.66 in/hr

I_{25} = 7.81 in/hr

I_{50} = 8.82 in/hr

I_{100} = 9.95 in/hr

Peak Runoff Rate

$Q_{yr} = CIA$

Q_2 = 0.49 cfs

Q_5 = 0.58 cfs

Q_{10} = 0.65 cfs

Q_{25} = 0.77 cfs

Q_{50} = 0.87 cfs

Q_{100} = 0.98 cfs

Peak Runoff Calculation

SUB-BASIN #9 Post-Dev.
Undetained

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.13** **Area (Sf) =** **5,790**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	750	S.F.	=	0.02	AC.	0.94	0.02
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC.	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	5,040	S.F.	=	0.12	AC.	0.25	0.03
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC.	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	5,790			0.13			0.05

Wc = **0.3394**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	100	feet	t_o =	Overland Flow Tc
Slope, S (ft/ft)		=	0.048		t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240		t_o =	9.90 min
$P_{2/24}$		=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	unpaved	=	20	feet	V =	16.1345*(S0.5)
Slope, S		=	4.80%		=	3.535 ft/s = 212.09 ft/min
Velocity, V		=	3.53	ft/sec	t_s =	Shallow Flow Tc
					t_s =	(L/V) = 0.09 min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 9.99 (Min 5 Minutes)

0.17 Hour

Intensity (Vanderburgh Co.)

I_2 =	**4.07**	**in/hr**
I_5 =	**4.77**	**in/hr**
I_{10} =	**5.39**	**in/hr**
I_{25} =	**6.32**	**in/hr**
I_{50} =	**7.13**	**in/hr**
I_{100} =	**8.05**	**in/hr**

Peak Runoff Rate

$Q_r = CiA$

Q_2 =	**0.18**	**cfs**
Q_5 =	**0.22**	**cfs**
Q_{10} =	**0.24**	**cfs**
Q_{25} =	**0.29**	**cfs**
Q_{50} =	**0.32**	**cfs**
Q_{100} =	**0.36**	**cfs**

Peak Runoff Calculation

SUB-BASIN #10 Post-Dev.
Undetained

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.05** **Area (Sf) =** **2,130**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)		S.F.	=	0.00	AC	0.94	0.00
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)	2,130	S.F.	=	0.05	AC	0.25	0.01
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water		S.F.	=	0.00	AC	1.00	0.00
	2,130			0.05			0.01

Wc = **0.2500**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 55 feet t_o = Overland Flow Tc

Slope, S (ft/ft) = 0.038 $t_o = [0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 t_o = 6.74 min

$P_{2/24}$ = 3.3

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 6.74 (Min 5 Minutes)

0.11 Hour

Intensity (Vanderburgh Co.)

I_2 = 4.69 in/hr

I_5 = 5.51 in/hr

I_{10} = 6.22 in/hr

I_{25} = 7.29 in/hr

I_{50} = 8.23 in/hr

I_{100} = 9.29 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 0.06 cfs

Q_5 = 0.07 cfs

Q_{10} = 0.08 cfs

Q_{25} = 0.09 cfs

Q_{50} = 0.10 cfs

Q_{100} = 0.11 cfs

Peak Runoff Calculation

Add'l Area Included Post - Subbasins 1 & 2

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.09** **Area (Sf) =** **3,875**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)		S.F.	=	0.00	AC	0.94	0.00
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)	3,875	S.F.	=	0.09	AC	0.25	0.02
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water		S.F.	=	0.00	AC	1.00	0.00
	3,875			0.09			0.02

Wc = **0.2500**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	100	feet	t_o =	Overland Flow Tc
Slope, S (ft/ft)		=	0.026		t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240		t_o =	12.65 min
$P_{2/24}$		=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	unpaved	=	55	feet	V =	16.1345*(S0.5)
Slope, S		=	2.60%		=	2.602 ft/s = 156.10 ft/min
Velocity, V		=	2.60	ft/sec	t_s =	Shallow Flow Tc
					t_s =	(L/V) = 0.35 min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 13.00 (Min 5 Minutes)

0.22 Hour

Intensity (Vanderburgh Co.)

I_2 =	**3.65**	**in/hr**
I_5 =	**4.28**	**in/hr**
I_{10} =	**4.84**	**in/hr**
I_{25} =	**5.67**	**in/hr**
I_{50} =	**6.40**	**in/hr**
I_{100} =	**7.23**	**in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2 =	**0.08**	**cfs**
Q_5 =	**0.10**	**cfs**
Q_{10} =	**0.11**	**cfs**
Q_{25} =	**0.13**	**cfs**
Q_{50} =	**0.14**	**cfs**
Q_{100} =	**0.16**	**cfs**

Morley and Associates Inc.
Storm Sewer Design Sheet - Rational Method

Project: Bonkerz C-Store
Our Project #: 11060.1.002-A
Mannings n: 0.010
County: Vanderburgh
Date: 10/23/2020
Design Period: 25 Years
Equivalent Elliptical if shaded

Line Number	Upstream Structure		Pipe # or Swale	Downstream Structure		Length (ft)	Subbasin no.	Cj	Aj (ac.)	CjAj	Sum CjAj	Tj (min) (5.0)	Tcum (min) (5.0)	I(25) (in/hr)	Q(25) (cfs)	Pipe Diameter (in) Or Swale Depth (Ft)	Pipe Slope (ft/ft)	Pipe or Swale Cap (cfs)	Velocity (ft/sec) at Capacity	Travel Time (min)	% Of Capacity	Upstream FG
1	FES	102	101	100	FES	105.00	Q(25) = Culvert Subbasin Runoff [Q(25)=0.69 CFS] + Upstream Culvert Capacity [4.20 CFS] =								4.89	18	0.21%	6.26	3.54	0.49	0.78	
			Downspouts	304	AD	106.32	8	0.94	0.10	0.10	0.10	5.00	5.00	7.81	0.77	8	1.00%	1.57	4.50	0.39	0.49	
3	AD	304	303	302	CI	129.50	5	0.52	0.58	0.30	0.40	5.00	5.39	7.69	3.07	18	0.50%	9.65	5.47	0.39	0.32	
3	CI	302	301	300	FES	18.25	7	0.83	0.10	0.08	0.48	5.00	5.79	7.57	3.63	18	0.50%	9.65	5.47	0.06	0.38	
			Downspouts*	406	AD	70.00	4	0.98	0.05	0.05	0.05	5.00	5.00	7.81	0.35	8	1.00%	1.57	4.50	0.26	0.22	
4	AD	406	405	404	CI	133.33	2	0.51	0.29	0.15	0.19	5.00	5.26	7.73	1.50	12	0.50%	3.27	4.17	0.53	0.46	
4			Downspouts*	404	CI	72.81	4	0.98	0.05	0.05	0.05	5.00	5.00	7.81	0.35	8	1.00%	1.57	4.50	0.27	0.22	
4	CI	404	403	402	CI	120.18	1	0.78	0.16	0.13	0.32	5.00	5.79	7.57	2.44	15	0.50%	5.94	4.84	0.41	0.41	
4	AD	402	401	400	FES	18.52	3	0.91	0.22	0.20	0.52	5.00	6.21	7.45	3.88	15	0.50%	5.94	4.84	0.06	0.65	

*It is assumed that the downspout pipes tying into AD 406 and CI 404 each carry half of the runoff from Post Subbasin 4

BASIN #1

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800
PROPOSED CONDITIONS

PROJECT: **New Convenience Store Evansville, IN** DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS

DESIGNER: MORLEY (JEM) RELEASE RATE RETURN PERIOD: 10 YRS

UNDEVELOPED WATERSHED AREA (Au)	1.81	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED)	14.88	MINUTES
RAINFALL INTENSITY (Iu):	4.49	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	0.35	
UNDEVELOPED RUNOFF RATE (Q = Cu*Iu*A):	2.84	CFS
DEVELOPED WATERSHED AREA (Ad)	1.90	ACRES
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.64	
UNDETAINED DEVELOPED RUNOFF RATE	0.36	CFS
OFF-SITE PASS THROUGH RATE	0.00	CFS
ALLOWABLE PIPE RELEASE RATE	2.48	CFS
ACTUAL DISCHARGE PIPE OUTFLOW	2.45	CFS

STORM DURATION Td (HRS)	RAINFALL INTENSITY Id 25-Year (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*Ad) (CFS)	OUTFLOW RATE Q (Cu*Iu*Au) (CFS)	STORAGE RATE I(Td)-Q (CFS)	REQUIRED STORAGE (I(Td)-Q)*Td/12 (ACRE.FT)
0.08	7.810	9.50	2.45	7.05	0.049
0.17	6.320	7.69	2.45	5.24	0.073
0.25	5.240	6.37	2.45	3.92	0.082
0.33	4.430	5.39	2.45	2.94	0.081
0.42	3.800	4.62	2.45	2.17	0.076
0.50	3.310	4.02	2.45	1.57	0.066
0.75	2.310	2.81	2.45	0.36	0.022
1.00	1.950	2.37	2.45	-0.08	-0.007
1.50	1.670	2.03	2.45	-0.42	-0.052
2.00	1.370	1.67	2.45	-0.78	-0.131
3.00	1.020	1.24	2.45	-1.21	-0.302
4.00	0.820	1.00	2.45	-1.45	-0.484
5.00	0.690	0.84	2.45	-1.61	-0.671

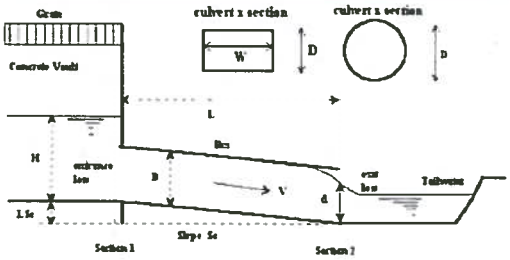
PEAK STORAGE (ACRE.FT):	0.082
PEAK STORAGE (CUBIC FT):	3,559

Retention Basin Storage Volume:

Elevation (ft)	Incremental Depth (ft)	Incremental Area (sf)	Incremental Volume (cf)	Total Volume (cf)	
451.50	0.5	0		0	
452.00	0.5	2,838	710	710	
452.50	0.5	3,256	1,524	2,233	
453.00	0.5	3,699	1,739	3,972	Exceeds 25 Year Storage
453.50	0.5	4,167	1,967	5,938	Flowline Emergency Overflow
454.00	0.5	4,660	2,207	8,145	Exceeds 100 Year Flood Elevatio
454.50	0.5	5,179	2,460	10,605	Top of Bank

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Bonkerz C-Store (11901 Petersburg Road) Morley Proj. No. 11060.1.002-A
Basin ID: Outlet Structure
Status:



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	10	inches
	Inlet Edge Type (choose from pull-down list)		1 5 1 Beveled Edge	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =		ft
	Barrel Width (Span) in Feet	Width (Span) =		ft
	Inlet Edge Type (choose from pull-down list)		Square Edge w/ 30-78 deg Flared Wingwall	
	Number of Barrels	No =	1	
	Inlet Elevation at Culvert Invert	Inlet Elev =	451 5	ft. elev
	Outlet Elevation at Culvert Invert OR Slope of Culvert (ft v /ft h.)	Outlet Elev =	451 3	ft. elev
	Culvert Length in Feet	L =	57 32	ft
	Manning's Roughness	n =	0 011	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0 20
Friction Loss Coefficient	K_f =	1 63
Sum of All Loss Coefficients	K_s =	2 83
Orifice Inlet Condition Coefficient	C_d =	1 03
Minimum Energy Condition Coefficient	KE_{low} =	-0.0635

Calculations of Culvert Capacity (output):

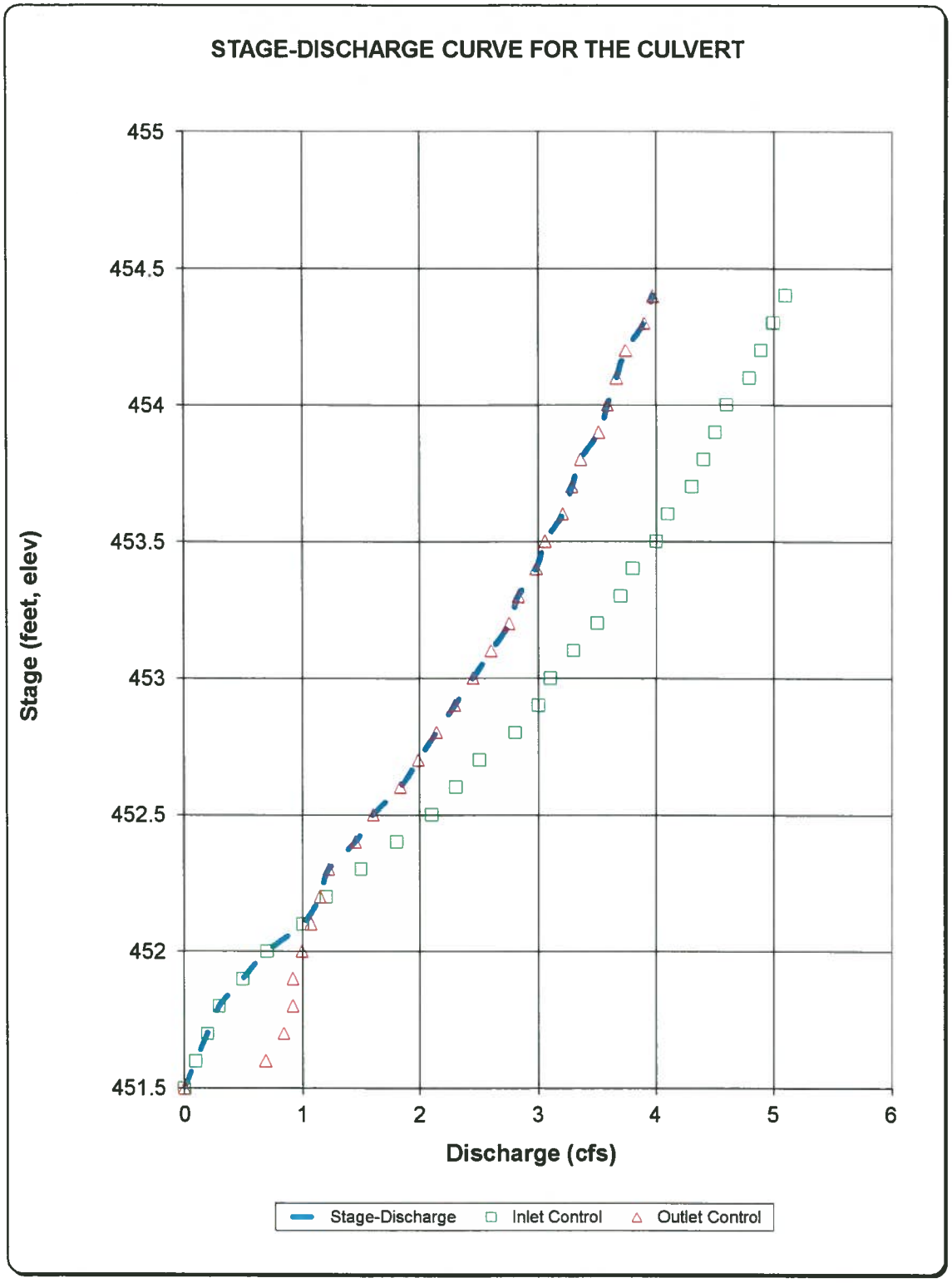
25-year Storm Elevation

Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
451.50	451.16	0.00	0.00	**0.00**	No Flow (WS < inlet)	N/A
451.60	451.16	0.10	0.69	**0.10**	Min. Energy. Eqn.	INLET
451.70	451.16	0.20	0.84	**0.20**	Min. Energy. Eqn.	INLET
451.80	451.16	0.30	0.92	**0.30**	Min. Energy. Eqn.	INLET
451.90	451.16	0.50	0.92	**0.50**	Min. Energy. Eqn.	INLET
452.00	451.16	0.70	0.99	**0.70**	Regression Eqn.	INLET
452.10	451.16	1.00	1.07	**1.00**	Regression Eqn.	INLET
452.20	451.16	1.20	1.15	**1.15**	Regression Eqn.	OUTLET
452.30	451.16	1.50	1.22	**1.22**	Regression Eqn.	OUTLET
452.40	451.16	1.80	1.45	**1.45**	Regression Eqn.	OUTLET
452.50	451.16	2.10	1.61	**1.61**	Regression Eqn.	OUTLET
452.60	451.16	2.30	1.84	**1.84**	Regression Eqn.	OUTLET
452.70	451.16	2.50	1.99	**1.99**	Regression Eqn.	OUTLET
452.80	451.16	2.80	2.14	**2.14**	Regression Eqn.	OUTLET
452.90	451.16	3.00	2.29	**2.29**	Regression Eqn.	OUTLET
453.00	451.16	3.10	2.45	**2.45**	Regression Eqn.	OUTLET
453.10	451.16	3.30	2.60	**2.60**	Regression Eqn.	OUTLET
453.20	451.16	3.50	2.75	**2.75**	Regression Eqn.	OUTLET
453.30	451.16	3.70	2.83	**2.83**	Regression Eqn.	OUTLET
453.40	451.16	3.80	2.98	**2.98**	Regression Eqn.	OUTLET
453.50	451.16	4.00	3.06	**3.06**	Regression Eqn.	OUTLET
453.60	451.16	4.10	3.21	**3.21**	Regression Eqn.	OUTLET
453.70	451.16	4.30	3.29	**3.29**	Regression Eqn.	OUTLET
453.80	451.16	4.40	3.36	**3.36**	Regression Eqn.	OUTLET
453.90	451.16	4.50	3.52	**3.52**	Regression Eqn.	OUTLET
454.00	451.16	4.60	3.59	**3.59**	Regression Eqn.	OUTLET
454.10	451.16	4.80	3.67	**3.67**	Orifice Eqn.	OUTLET
454.20	451.16	4.90	3.75	**3.75**	Orifice Eqn.	OUTLET
454.30	451.16	5.00	3.90	**3.90**	Orifice Eqn.	OUTLET
454.40	451.16	5.10	3.98	**3.98**	Orifice Eqn.	OUTLET

Processing Time 00 82 Seconds

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Bonkerz C-Store (11901 Petersburg Road) Morley Proj. No. 11060.1.002-A
Basin ID: Outlet Structure



Weir Report

Emergency Overflow
Permanent Basin #1

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Oct 8 2020

<Name>

Trapezoidal Weir

Crest	= Sharp
Bottom Length (ft)	= 12.00
Total Depth (ft)	= 1.00
Side Slope (z:1)	= 4.00

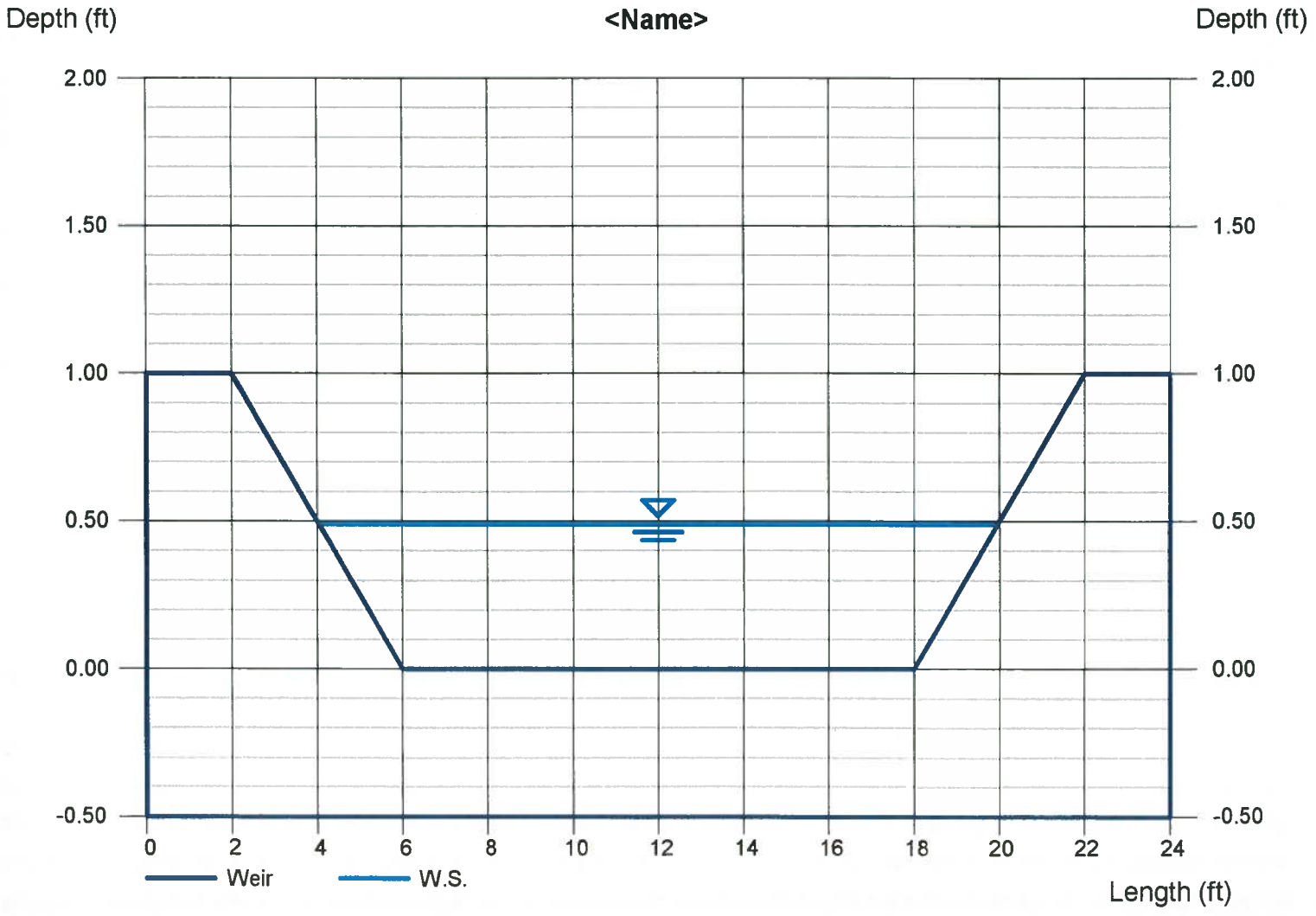
Calculations

Weir Coeff. Cw	= 2.60
Compute by:	Known Q
Known Q (cfs)	= 12.00

Q(100) = 11.58 CFS

Highlighted

Depth (ft)	= 0.49
Q (cfs)	= 12.00
Area (sqft)	= 6.84
Velocity (ft/s)	= 1.75
Top Width (ft)	= 15.92



MORLEY
ARCHITECTS | ENGINEERS | SURVEYORS

812.464.9585 Office 812.464.2514 Fax
4800 Rosebud Ln., Newburgh, IN 47630
morleycorp.com

October 23, 2020

Devparth Inc.
Attn: Victor Patel
11901 Old Petersburg Road
Evansville, IN 47725

Re: New Convenience Store
Basin Design and Maintenance Report
Morley Project # 11060.1.002-A

Victor,

This brief report will highlight the dry detention basin's design and maintenance in accordance with the latest Vanderburgh County Drainage Ordinance Section 13.04.440, Technical Memorandums and supplements. The dry basin will have a 10-feet wide maintenance path, and a 12-feet wide 1-foot deep emergency overflow weir located on the south side of the dry basin. The dry basin's 10-inch diameter outlet pipe is located at the southeast corner of the basin. Per the approved drainage plan, the outlet pipe will serve to discharge excess storm water stored in the basin at a controlled rate. The emergency overflow weir will act as an automatic spillway should the outlet pipe be obstructed, or capacity exceeded.

Maintenance of the basin shall include but is not limited to: mowing, removing debris and obstructions; removal of overgrown vegetation, mitigating erosion, and any other requirements set forth by the Vanderburgh County Drainage Board. Over time the dry basin's bottom will fill up with sediment. This excess sediment will need to be removed as directed by the latest Vanderburgh County Drainage Ordinance or as needed. Additionally, silt shall be removed manually, as necessary, from the surface of the concrete liner. Such silt shall be placed on site with seed/straw in an area that will not directly discharge to the storm sewer network or leave the site.

If you have any questions or comments, don't hesitate to contact me.

Sincerely,

James E. Morley, PE, PS
Managing Engineer

cc: Jeff Mueller, Vanderburgh County Surveyor; John Stoll P.E., Vanderburgh County Engineer

J:\11000s\11000-11099\11060\Civil 3D\Drainage\Redesign\Report\20201019 Submittal\11060 Basin Maintenance Report Rev 01.docx

Peak Runoff Calculation

CULVERT SUB-BASIN Post-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = 0.18 **Area (Sf) =** 8,000

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	1,000	S.F.	=	0.02	AC.	0.94	0.02
Structures & Pavement (5-10%)	1,000	S.F.	=	0.02	AC.	0.96	0.02
Structures & Pavement (>10%)		S.F.	=	0.00	AC.	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)		S.F.	=	0.00	AC.	0.25	0.00
Lawn (5-10%)	5,500	S.F.	=	0.13	AC.	0.40	0.05
Lawn (>10%)	500	S.F.	=	0.01	AC.	0.55	0.01
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	8,000			0.18			0.10

Wc = **0.5469**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	100	feet	t_o =	Overland Flow Tc
Slope, S (ft/ft)		=	0.08		t_o =	$[0.42*(L^{0.8})*(n^{0.6})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240		t_o =	8.07 min
$P_{2/24}$		=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	paved	=	20	feet	V =	20.3282*(S0.5)
Slope, S		=	8.00%		=	5.750 ft/s = 344.98 ft/min
Velocity, V		=	5.75	ft/sec	t_s =	Shallow Flow Tc
					t_s =	(L/V) = 0.06 min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 8.13 (Min 5 Minutes)

0.14 Hour

Intensity (Vanderburgh Co.)

I_2 = 4.43 in/hr

I_5 = 5.19 in/hr

I_{10} = 5.87 in/hr

I_{25} = 6.88 in/hr

I_{50} = 7.76 in/hr

I_{100} = 8.76 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 0.44 cfs

Q_5 = 0.52 cfs

Q_{10} = 0.59 cfs

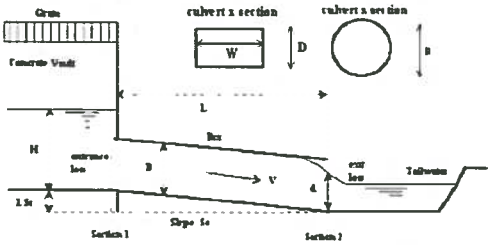
Q_{25} = 0.69 cfs

Q_{50} = 0.78 cfs

Q_{100} = 0.88 cfs

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Bonkerz C-Store (11901 Petersburg Road) Morley Proj. No. 11060.1.002-A
Basin ID: Culvert immediately upstream of proposed driveway culvert.
Status:



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches	D =	12	inches
Inlet Edge Type (choose from pull-down list)		Grooved End with Headwall	
OR:			
Box Culvert: Barrel Height (Rise) in Feet	Height (Rise) =		ft.
Barrel Width (Span) in Feet	Width (Span) =		ft.
Inlet Edge Type (choose from pull-down list)		Square Edge w/ 30-78 deg. Flared Wingwall	
Number of Barrels	No =	1	
Inlet Elevation at Culvert Invert	Inlet Elev =	455.85	ft. elev
Outlet Elevation at Culvert Invert OR Slope of Culvert (ft v./ft h.)	Outlet Elev =	455.32	ft. elev
Culvert Length in Feet	L =	35.6	ft.
Manning's Roughness	n =	0.011	
Bend Loss Coefficient	K_b =	0	
Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	0.79
Sum of All Loss Coefficients	K_s =	1.99
Orifice Inlet Condition Coefficient	C_d =	0.99
Minimum Energy Condition Coefficient	KE_{low} =	-0.0898

Calculations of Culvert Capacity (output):

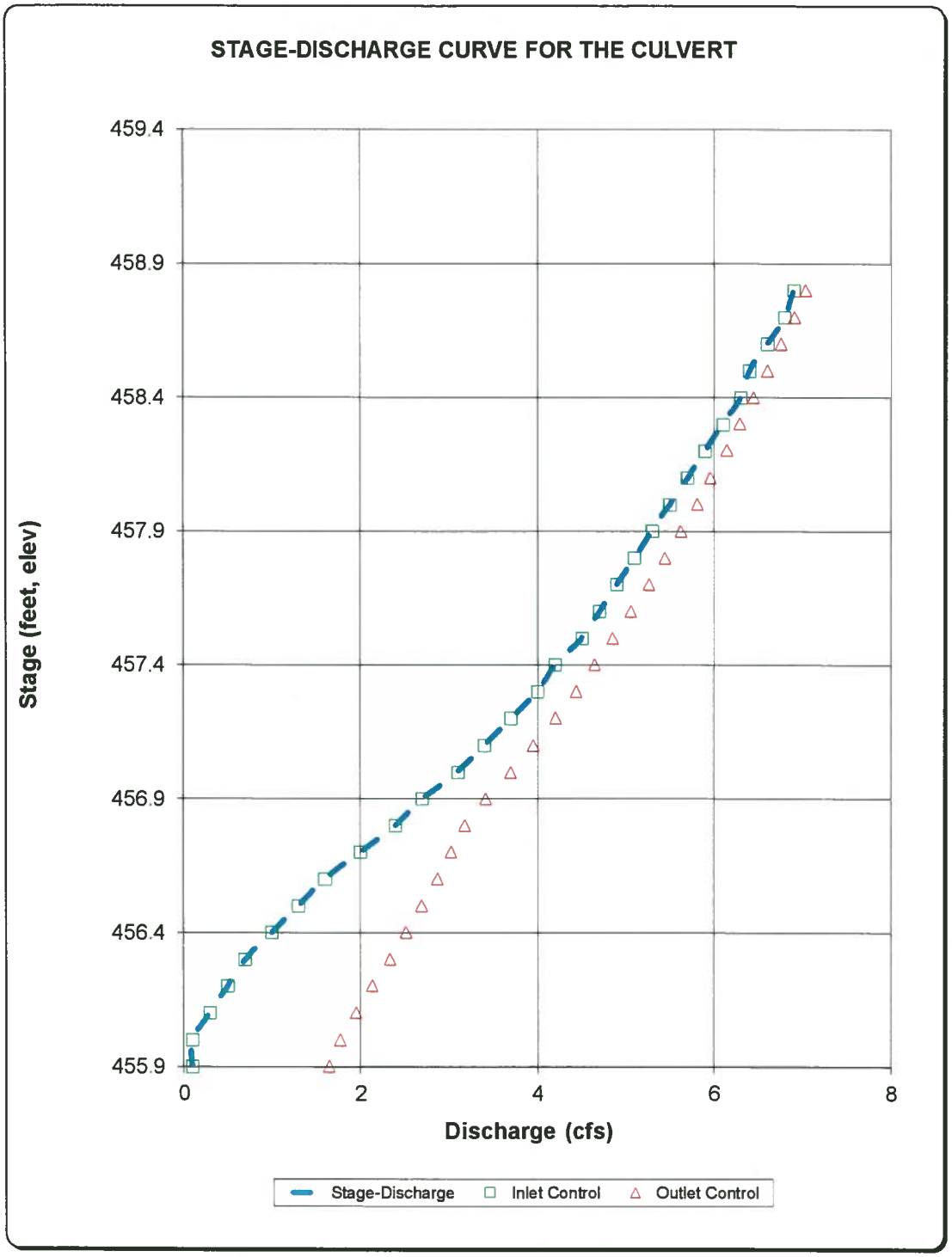
Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
455.90	455.32	0.10	1.64	**0.10**	Min. Energy. Eqn.	INLET
456.00	455.32	0.10	1.77	**0.10**	Min. Energy. Eqn.	INLET
456.10	455.32	0.30	1.95	**0.30**	Min. Energy. Eqn.	INLET
456.20	455.32	0.50	2.13	**0.50**	Min. Energy. Eqn.	INLET
456.30	455.32	0.70	2.34	**0.70**	Min. Energy. Eqn.	INLET
456.40	455.32	1.00	2.52	**1.00**	Regression Eqn.	INLET
456.50	455.32	1.30	2.70	**1.30**	Regression Eqn.	INLET
456.60	455.32	1.60	2.88	**1.60**	Regression Eqn.	INLET
456.70	455.32	2.00	3.03	**2.00**	Regression Eqn.	INLET
456.80	455.32	2.40	3.19	**2.40**	Regression Eqn.	INLET
456.90	455.32	2.70	3.42	**2.70**	Regression Eqn.	INLET
457.00	455.32	3.10	3.70	**3.10**	Regression Eqn.	INLET
457.10	455.32	3.40	3.96	**3.40**	Regression Eqn.	INLET
457.20	455.32	3.70	4.21	**3.70**	Regression Eqn.	INLET
457.30	455.32	4.00	4.44	**4.00**	Regression Eqn.	INLET
457.40	455.32	4.20	4.65	**4.20**	Regression Eqn.	INLET
457.50	455.32	4.50	4.86	**4.50**	Regression Eqn.	INLET
457.60	455.32	4.70	5.06	**4.70**	Regression Eqn.	INLET
457.70	455.32	4.90	5.27	**4.90**	Regression Eqn.	INLET
457.80	455.32	5.10	5.45	**5.10**	Regression Eqn.	INLET
457.90	455.32	5.30	5.63	**5.30**	Regression Eqn.	INLET
458.00	455.32	5.50	5.81	**5.50**	Regression Eqn.	INLET
458.10	455.32	5.70	5.96	**5.70**	Regression Eqn.	INLET
458.20	455.32	5.90	6.14	**5.90**	Regression Eqn.	INLET
458.30	455.32	6.10	6.29	**6.10**	Regression Eqn.	INLET
458.40	455.32	6.30	6.45	**6.30**	Regression Eqn.	INLET
458.50	455.32	6.40	6.60	**6.40**	Regression Eqn.	INLET
458.60	455.32	6.60	6.76	**6.60**	Regression Eqn.	INLET
458.70	455.32	6.80	6.91	**6.80**	Regression Eqn.	INLET
458.80	455.32	6.90	7.04	**6.90**	Regression Eqn.	INLET

Processing Time 00.87 Seconds

Water would overtop drive at 457.40

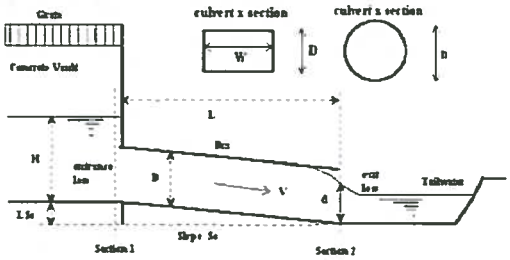
CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Bonkerz C-Store (11901 Petersburg Road) Morley Proj. No. 11060.1.002-A
Basin ID: Culvert immediately upstream of proposed driveway culvert.



CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Bonkerz C-Store (11901 Petersburg Road) Morley Proj. No. 11060.1.002-A
Basin ID: Proposed Driveway Culvert (Q25 = 4.20 CFS + 0.69 CFS)
Status:



Design Information (Input):

Circular Culvert:	Barrel Diameter in Inches	D =	18	inches
	Inlet Edge Type (choose from pull-down list)		1.5 : 1 Beveled Edge	
OR:				
Box Culvert:	Barrel Height (Rise) in Feet	Height (Rise) =		ft.
	Barrel Width (Span) in Feet	Width (Span) =		ft.
	Inlet Edge Type (choose from pull-down list)		Square Edge w/ 30-78 deg. Flared Wingwall	
	Number of Barrels	No =	1	
	Inlet Elevation at Culvert Invert	Inlet Elev =	452.8	ft. elev.
	Outlet Elevation at Culvert Invert OR Slope of Culvert (ft v /ft h.)	Outlet Elev =	452.58	ft. elev.
	Culvert Length in Feet	L =	105	ft.
	Manning's Roughness	n =	0.012	
	Bend Loss Coefficient	K_b =	0	
	Exit Loss Coefficient	K_x =	1	

Design Information (calculated):

Entrance Loss Coefficient	K_e =	0.20
Friction Loss Coefficient	K_f =	1.62
Sum of All Loss Coefficients	K_s =	2.82
Orifice Inlet Condition Coefficient	C_d =	1.03
Minimum Energy Condition Coefficient	KE_{low} =	-0.0860

Calculations of Culvert Capacity (output):

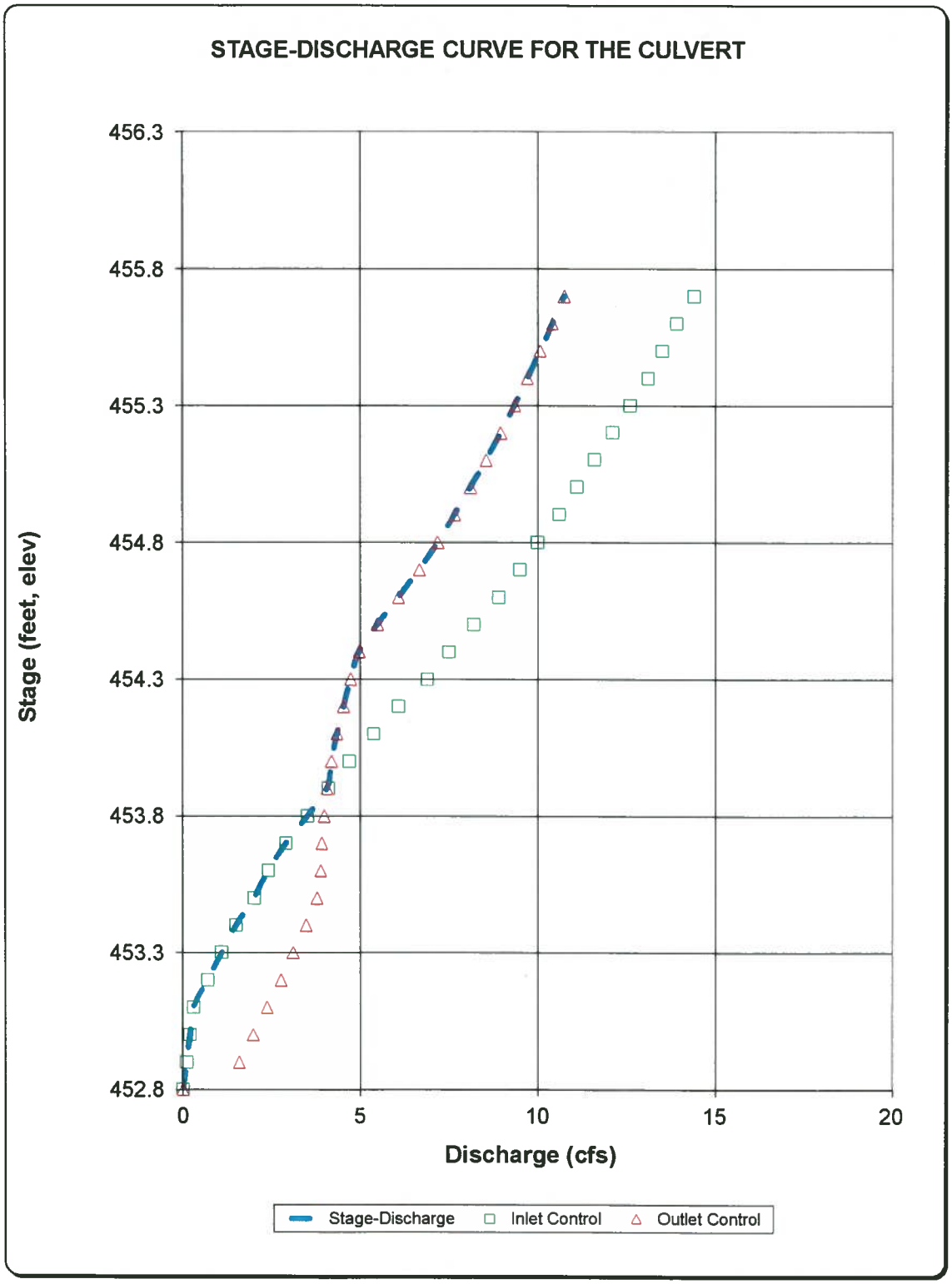
Water Surface Elevation (ft., linked)	Tailwater Surface Elevation ft	Culvert Inlet-Control Flowrate cfs	Culvert Outlet-Control Flowrate cfs	Controlling Culvert Flowrate cfs (output)	Inlet Equation Used:	Flow Control Used
452.80	452.50	0.00	0.00	**0.00**	No Flow (WS < inlet)	N/A
452.90	452.50	0.10	1.59	**0.10**	Min. Energy. Eqn.	INLET
453.00	452.50	0.20	1.98	**0.20**	Min. Energy. Eqn.	INLET
453.10	452.50	0.30	2.37	**0.30**	Min. Energy. Eqn.	INLET
453.20	452.50	0.70	2.76	**0.70**	Min. Energy. Eqn.	INLET
453.30	452.50	1.10	3.10	**1.10**	Min. Energy. Eqn.	INLET
453.40	452.50	1.50	3.46	**1.50**	Min. Energy. Eqn.	INLET
453.50	452.50	2.00	3.78	**2.00**	Min. Energy. Eqn.	INLET
453.60	452.50	2.40	3.88	**2.40**	Regression Eqn.	INLET
453.70	452.50	2.90	3.91	**2.90**	Regression Eqn.	INLET
453.80	452.50	3.50	3.98	**3.50**	Regression Eqn.	INLET
453.90	452.50	4.10	4.06	**4.06**	Regression Eqn.	OUTLET
454.00	452.50	4.70	4.19	**4.19**	Regression Eqn.	OUTLET
454.10	452.50	5.40	4.35	**4.35**	Regression Eqn.	OUTLET
454.20	452.50	6.10	4.53	**4.53**	Regression Eqn.	OUTLET
454.30	452.50	6.90	4.74	**4.74**	Regression Eqn.	OUTLET
454.40	452.50	7.50	4.97	**4.97**	Regression Eqn.	OUTLET
454.50	452.50	8.20	5.50	**5.50**	Regression Eqn.	OUTLET
454.60	452.50	8.90	6.09	**6.09**	Regression Eqn.	OUTLET
454.70	452.50	9.50	6.67	**6.67**	Regression Eqn.	OUTLET
454.80	452.50	10.00	7.19	**7.19**	Regression Eqn.	OUTLET
454.90	452.50	10.60	7.66	**7.66**	Regression Eqn.	OUTLET
455.00	452.50	11.10	8.10	**8.10**	Regression Eqn.	OUTLET
455.10	452.50	11.60	8.54	**8.54**	Regression Eqn.	OUTLET
455.20	452.50	12.10	8.96	**8.96**	Regression Eqn.	OUTLET
455.30	452.50	12.60	9.35	**9.35**	Regression Eqn.	OUTLET
455.40	452.50	13.10	9.71	**9.71**	Regression Eqn.	OUTLET
455.50	452.50	13.50	10.08	**10.08**	Regression Eqn.	OUTLET
455.60	452.50	13.90	10.42	**10.42**	Regression Eqn.	OUTLET
455.70	452.50	14.40	10.76	**10.76**	Regression Eqn.	OUTLET

Water would overtop drive at 455.70

Processing Time 00 39 Seconds

CULVERT STAGE-DISCHARGE SIZING (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: Bonkerz C-Store (11901 Petersburg Road) Morley Proj. No. 11060.1.002-A
Basin ID: Proposed Driveway Culvert (Q25 = 4.20 CFS + 0.69 CFS)



APPENDIX 'C'
Phase 1 Drainage Plan

MORLEY
ARCHITECTS | ENGINEERS | SURVEYORS

812.464.9585 Office 812.464.2514 Fax
4800 Rosebud Ln., Newburgh, IN 47630
morleycorp.com

October 23, 2020

Phased Drainage Plan Description

In order to meet drainage ordinance and to minimize the amount of downtime for the existing convenience store, we are submitting this phased drainage plan, that will allow for a portion of the site to be constructed initially, prior to the construction of the permanent detention basin, by diverting runoff to two separate temporary detention basins.

The pre-developed subbasin for Phase 1 is the final pre-developed subbasin without the portion of the existing development that will remain during Phase 1 of construction. This subbasin was used to determine the pre-developed runoff rate for the 10-year storm, which was calculated to be 2.21 CFS.

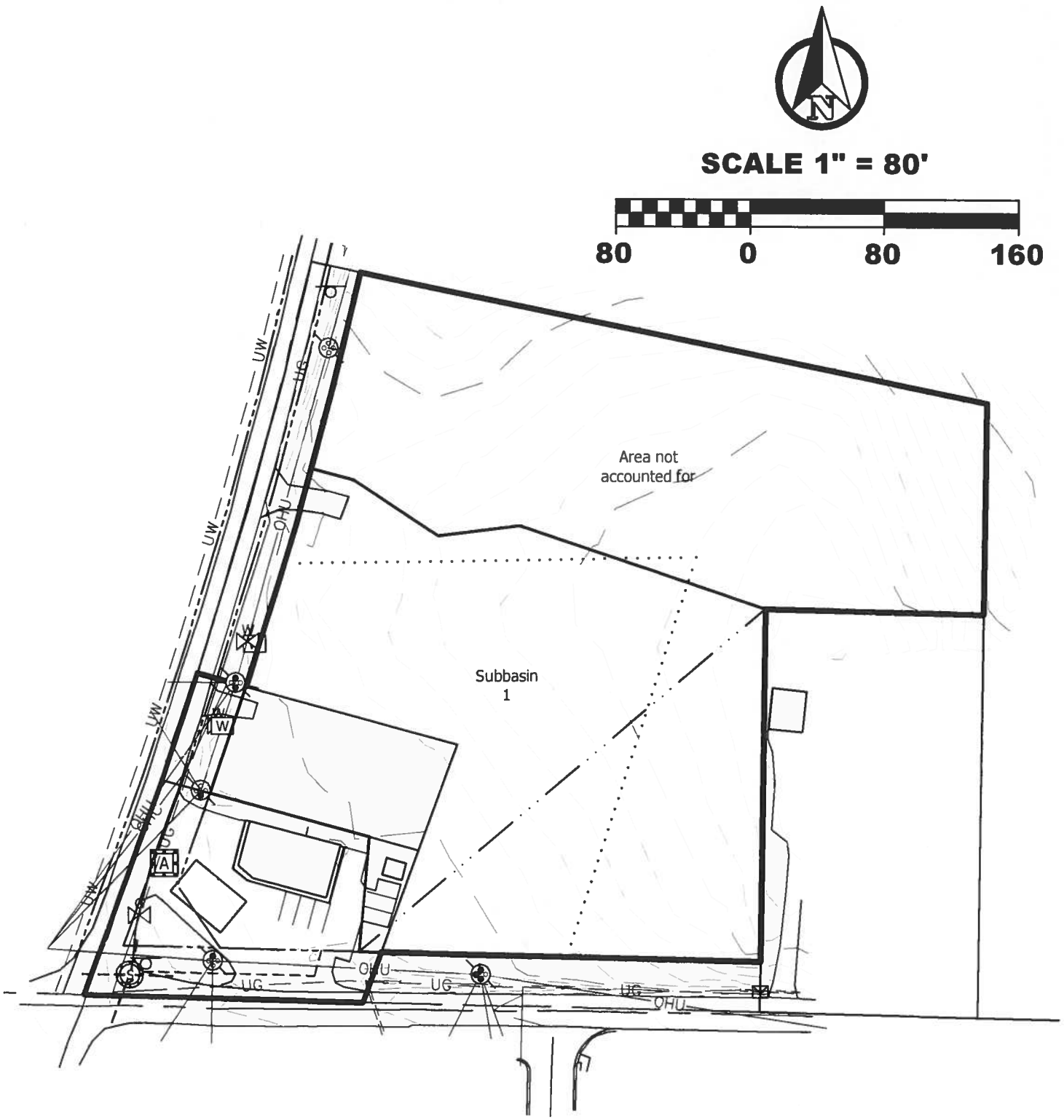
From there, Phase 1 Post Developed Subbasins were determined and that data is attached. Thus, the post-developed acreages and weighted coefficients were calculated, and the basins were sized as shown.

The total 25-year storm release rate from all undetained subbasins and temporary detention basins is lower than the pre-developed 10-year storm runoff rate. Temporary Basin 1 will release 0.83 CFS and Temporary Basin 2 will release 0.62 CFS. Subbasin 8 will release 0.23 CFS undetained, Subbasin 9 will release 0.16 CFS undetained, and Subbasin 10 will release 0.24 CFS undetained, for a total post-developed Phase 1 release rate of 2.08 CFS.

All temporary drainage features shall remain in place until such time that all permanent drainage facilities have been installed, inspected, and as-builts/certifications have been submitted. Temporary detention basins are specified to meet code requirements for dry detention basins. However, a waiver is requested to omit the requirements of a concrete liner since the basins are temporary.

The portions of the site, including the permanent storm water features, that are proposed as part of Phase 1 are shown on the Phase 1 Grading Plan submitted with this Drainage Report.

Additionally, a variance is requested to allow the use of the Urban Drainage and Flood Control District of Denver, Colorado Culvert Hydraulics Spreadsheet, Version 3.05, Released November 2017 for culvert calculations throughout all sections of this report.



MORLEY ARCHITECTS | ENGINEERS | SURVEYORS	4800 Rosebud Ln. Newburgh, IN 47630 812.464.9585 Phone 812.464.2514 Fax morleycorp.com	**Pre-Developed Subbasins** **Phase 1** 11901 Petersburg Road Evansville, IN 47725	Designed By: JEM Drawn By: CRS Filename: 11060 Civil Base	Job Number: 11060.1.002-A Date: 10.16.2020

Peak Runoff Calculation

SUB-BASIN #1 Pre-Dev.

Project 11060.1.002-B New Convenience Store

Area (Ac) = **1.62** **Area (Sf) =** **70,525**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)	825	S.F.	=	0.02	AC.	0.92	0.02
Structures & Pavement (2-5%)		S.F.	=	0.00	AC.	0.94	0.00
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	2,500	S.F.	=	0.06	AC.	0.98	0.06
Gravel (10 yr Storm)	2,000	S.F.	=	0.05	AC.	0.50	0.02
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	65,200	S.F.	=	1.50	AC.	0.25	0.37
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC.	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	70,525			1.62			0.47

Wc = **0.2908**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	100	feet	t_o =	Overland Flow Tc
Slope, S (ft/ft)		=	0.027		t_o =	$[0.42*(L^{0.8})*(n^{0.5})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240		t_o =	12.46 min
$P_{2/24}$		=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	unpaved	=	215	feet	V	=	16.1345*(S0.5)	
Slope, S		=	2.70%			=	2.651 ft/s =	159.07 ft/min
Velocity, V		=	2.65	ft/sec	t_s	=	Shallow Flow Tc	
					t_s	=	(L/V) = 1.35	min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 13.81 (Min 5 Minutes)

0.23 Hour

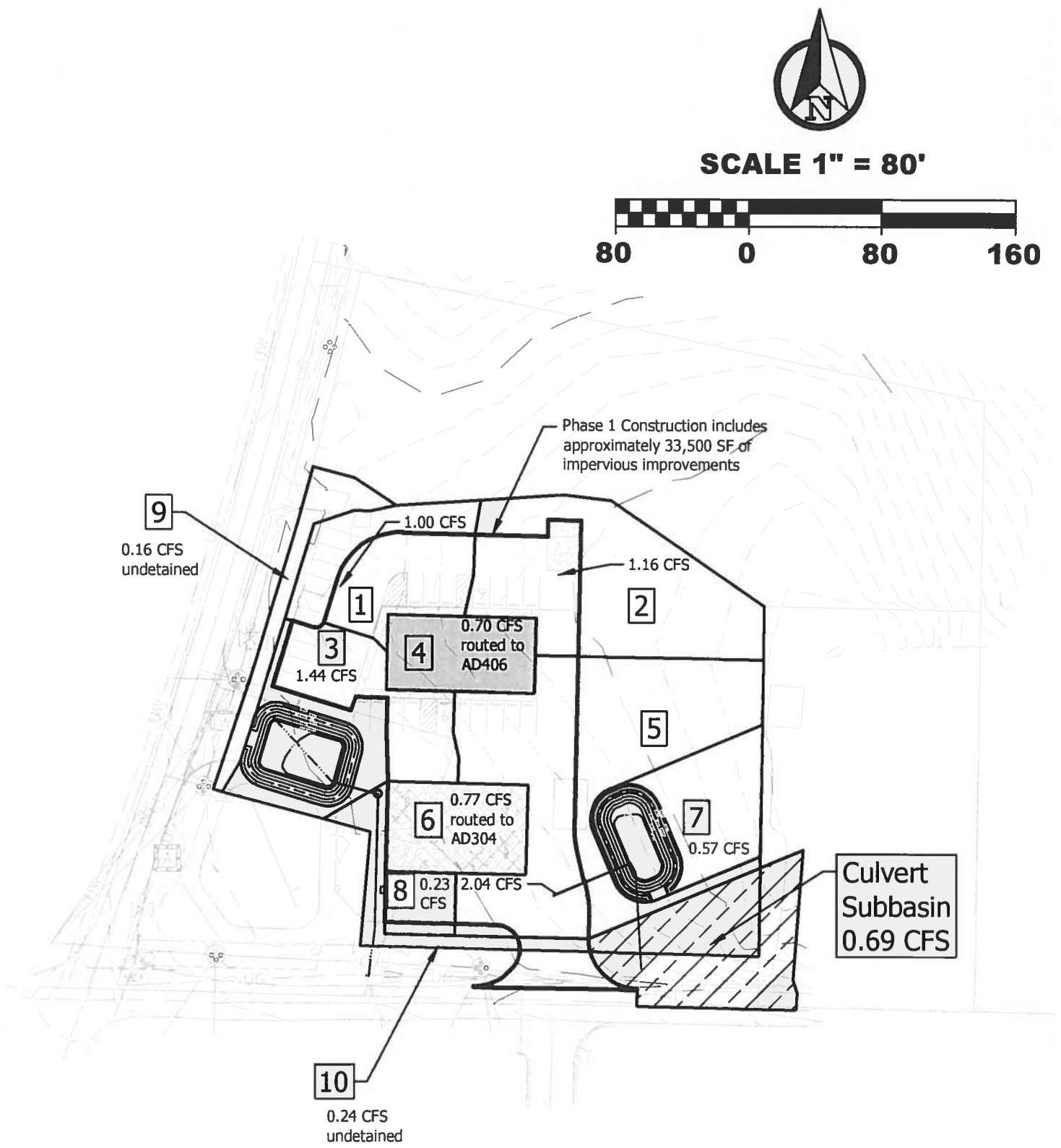
Intensity (Vanderburgh Co.)

I_2	=	**3.54**	**in/hr**
I_5	=	**4.15**	**in/hr**
I_{10}	=	**4.69**	**in/hr**
I_{25}	=	**5.50**	**in/hr**
I_{50}	=	**6.21**	**in/hr**
I_{100}	=	**7.00**	**in/hr**

Peak Runoff Rate

Q_{yr} = CiA

Q_2	=	**1.66**	**cfs**
Q_5	=	**1.95**	**cfs**
Q_{10}	=	**2.21**	**cfs**
Q_{25}	=	**2.59**	**cfs**
Q_{50}	=	**2.92**	**cfs**
Q_{100}	=	**3.30**	**cfs**



MORLEY ARCHITECTS | ENGINEERS | SURVEYORS	4800 Rosebud Ln. Newburgh, IN 47630 812.464.9585 Phone 812.464.2514 Fax morleycorp.com	**Post-Developed Subbasins** **Phase 1** 11901 Petersburg Road Evansville, IN 47725	Designed By: JEM Drawn By: CRS Filename: 11060 Civil Base	Job Number: 11060.1.002-A Date: 10.16.2020

Peak Runoff Calculation

SUB-BASIN #1 Post-Dev.

Phase 1

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.16** **Area (Sf) =** **7,175**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)	5,475	S.F.	=	0.13	AC	0.94	0.12
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)	1,700	S.F.	=	0.04	AC	0.25	0.01
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water		S.F.	=	0.00	AC	1.00	0.00
	7,175			0.16			0.13

Wc = **0.7765**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 85 feet t_o = Overland Flow Tc

Slope, S (ft/ft) = 0.02 $t_o = [0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.011 t_o = 1.05 min

$P_{2/24}$ = 3.3

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 1.05 (Min 5 Minutes)

0.02 Hour

Intensity (Vanderburgh Co.)

I_2 = 5.02 in/hr

I_5 = 5.90 in/hr

I_{10} = 6.66 in/hr

I_{25} = 7.81 in/hr

I_{50} = 8.82 in/hr

I_{100} = 9.95 in/hr

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2 = 0.64 cfs

Q_5 = 0.75 cfs

Q_{10} = 0.85 cfs

Q_{25} = 1.00 cfs

Q_{50} = 1.13 cfs

Q_{100} = 1.27 cfs

Peak Runoff Calculation

SUB-BASIN #2 Post-Dev.

Phase 1 **Project 11060.1.002-B New Convenience Store**

Area (Ac) = **0.29** **Area (Sf) =** **12,800**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)	4,000	S.F.	=	0.09	AC	0.94	0.09
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)	7,025	S.F.	=	0.16	AC	0.25	0.04
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)	1,775	S.F.	=	0.04	AC	0.55	0.02
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water		S.F.	=	0.00	AC	1.00	0.00
	12,800			0.29			0.15

Wc = **0.5072**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	100	feet	t_o =	Overland Flow Tc
Slope, S (ft/ft)		=	0.025		t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.011		t_o =	1.09 min
$P_{2/24}$		=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	paved	=	30	feet	V =	20.3282*(S0.5)
Slope, S		=	2.00%		=	2.875 ft/s = 172.49 ft/min
Velocity, V		=	2.87	ft/sec	t_s =	Shallow Flow Tc
					t_s =	(L/V) = 0.17 min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 1.27 (Min 5 Minutes)

0.02 Hour

Intensity (Vanderburgh Co.)

I_2 = 5.02 in/hr

I_5 = 5.90 in/hr

I_{10} = 6.66 in/hr

I_{25} = 7.81 in/hr

I_{50} = 8.82 in/hr

I_{100} = 9.95 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 0.75 cfs

Q_5 = 0.88 cfs

Q_{10} = 0.99 cfs

Q_{25} = 1.16 cfs

Q_{50} = 1.31 cfs

Q_{100} = 1.48 cfs

Peak Runoff Calculation

SUB-BASIN #3 Post-Dev.

Phase 1 **Project 11060.1.002-B New Convenience Store**

Area (Ac) = 0.24 **Area (Sf) =** 10,650

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	4,900	S.F.	=	0.11	AC.	0.94	0.11
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC.	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	1,450	S.F.	=	0.03	AC.	0.25	0.01
Lawn (5-10%)	1,200	S.F.	=	0.03	AC.	0.40	0.01
Lawn (>10%)	1,125	S.F.	=	0.03	AC.	0.55	0.01
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water	1,975	S.F.	=	0.05	AC.	1.00	0.05
	10,650			0.24			0.18

Wc = **0.7551**

Time of Concentration

Overland Flow

Length, L (max 100ft)	=	55	feet	t_o	=	Overland Flow Tc
Slope, S (ft/ft)	=	0.016		t_o	=	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n	=	0.011		t_o	=	0.81 min
$P_{2/24}$	=	3.3				

Shallow Flow

Length, L (Paved or Unpaved)	unpaved	=	11	feet	V	=	16.1345*(S0.5)	
Slope, S		=	25.00%			=	8.067 ft/s = 484.04	ft/min
Velocity, V		=	8.07	ft/sec	t_s	=	Shallow Flow Tc	
					t_s	=	(L/V) = 0.02	min

Shallow Flow

Length, L (Paved or Unpaved)	unpaved	=	40	feet	V	=	16.1345*(S0.5)	
Slope, S		=	0.50%			=	1.141 ft/s = 68.45	ft/min
Velocity, V		=	1.14	ft/sec	t_s	=	Shallow Flow Tc	
					t_s	=	(L/V) = 0.58	min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 1.42 (Min 5 Minutes)

0.02 Hour

Intensity (Vanderburgh Co.)

I_2	=	**5.02 in/hr**
I_5	=	**5.90 in/hr**
I_{10}	=	**6.66 in/hr**
I_{25}	=	**7.81 in/hr**
I_{50}	=	**8.82 in/hr**
I_{100}	=	**9.95 in/hr**

Peak Runoff Rate

$Q_{pk} = CiA$

Q_2	=	**0.93 cfs**
Q_5	=	**1.09 cfs**
Q_{10}	=	**1.23 cfs**
Q_{25}	=	**1.44 cfs**
Q_{50}	=	**1.63 cfs**
Q_{100}	=	**1.84 cfs**

Peak Runoff Calculation

SUB-BASIN #4 Post-Dev.

Phase 1

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.09** **Area (Sf) =** **4,005**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)		S.F.	=	0.00	AC.	0.94	0.00
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	4,005	S.F.	=	0.09	AC.	0.98	0.09
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)		S.F.	=	0.00	AC.	0.25	0.00
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC.	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	4,005			0.09			0.09

Wc = **0.9800**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 50 feet t_o = Overland Flow Tc

Slope, S (ft/ft) = 0.1 $t_o = [0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.011 t_o = 0.36 min

$P_{2/24}$ = 3.3

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 0.36 (Min 5 Minutes)

0.01 Hour

Intensity (Vanderburgh Co.)

I_2 = 5.02 in/hr

I_5 = 5.90 in/hr

I_{10} = 6.66 in/hr

I_{25} = 7.81 in/hr

I_{50} = 8.82 in/hr

I_{100} = 9.95 in/hr

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2 = 0.45 cfs

Q_5 = 0.53 cfs

Q_{10} = 0.60 cfs

Q_{25} = 0.70 cfs

Q_{50} = 0.79 cfs

Q_{100} = 0.90 cfs

Peak Runoff Calculation

SUB-BASIN #5 Post-Dev.

Phase 1 **Project 11060.1.002-B New Convenience Store**

Area (Ac) = 0.42 **Area (Sf) =** 18,175

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)	9,000	S.F.	=	0.21	AC	0.94	0.19
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)	7,175	S.F.	=	0.16	AC	0.25	0.04
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)	2,000	S.F.	=	0.05	AC	0.55	0.03
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water		S.F.	=	0.00	AC	1.00	0.00
	18,175			0.42			0.28

Wc = **0.6247**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 100 feet t_o = Overland Flow Tc

Slope, S (ft/ft) = 0.03 t_o = $[0.42*(L^{0.8})*(n^{0.6})]/[P^{0.5}*(S^{0.4})]$

Manning Coefficient, n = 0.011 t_o = 1.01 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) unpaved = 70 feet V = 16.1345*(S0.5)

Slope, S = 5.70% = 3.852 ft/s = 231.12 ft/min

Velocity, V = 3.85 ft/sec t_s = Shallow Flow Tc

t_s = (L/V) = 0.30 min

Shallow Flow

Length, L (Paved or Unpaved) paved = 20 feet V = 20.3282*(S0.5)

Slope, S = 1.20% = 2.227 ft/s = 133.61 ft/min

Velocity, V = 2.23 ft/sec t_s = Shallow Flow Tc

t_s = (L/V) = 0.15 min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 1.47 (Min 5 Minutes)

0.02 Hour

Intensity (Vanderburgh Co.)

I_2 = 5.02 in/hr

I_5 = 5.90 in/hr

I_{10} = 6.66 in/hr

I_{25} = 7.81 in/hr

I_{50} = 8.82 in/hr

I_{100} = 9.95 in/hr

Peak Runoff Rate

Q_p = CiA

Q_2 = 1.31 cfs

Q_5 = 1.54 cfs

Q_{10} = 1.74 cfs

Q_{25} = 2.04 cfs

Q_{50} = 2.30 cfs

Q_{100} = 2.59 cfs

Peak Runoff Calculation

SUB-BASIN #6 Post-Dev.

Phase 1 **Project 11060.1.002-B New Convenience Store**

Area (Ac) = **0.10** **Area (Sf) =** **4,550**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)	4,550	S.F.	=	0.10	AC	0.94	0.10
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)		S.F.	=	0.00	AC	0.25	0.00
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water		S.F.	=	0.00	AC	1.00	0.00
	4,550			0.10			0.10

Wc = **0.9400**

Time of Concentration

Overland Flow

Length, L (max 100ft)	=	50	feet	t_o = Overland Flow Tc
Slope, S (ft/ft)	=	0.05		t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[(P^{0.5})*(S^{0.4})]$
Manning Coefficient, n	=	0.011		t_o = 0.48 min
$P_{2/24}$	=	3.3		

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 0.48 (Min 5 Minutes)

0.01 Hour

Intensity (Vanderburgh Co.)

I_2 =	**5.02**	**in/hr**
I_5 =	**5.90**	**in/hr**
I_{10} =	**6.66**	**in/hr**
I_{25} =	**7.81**	**in/hr**
I_{50} =	**8.82**	**in/hr**
I_{100} =	**9.95**	**in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2 =	**0.49**	**cfs**
Q_5 =	**0.58**	**cfs**
Q_{10} =	**0.65**	**cfs**
Q_{25} =	**0.77**	**cfs**
Q_{50} =	**0.87**	**cfs**
Q_{100} =	**0.98**	**cfs**

Peak Runoff Calculation

SUB-BASIN #7 Post-Dev.

Phase 1 — **Project 11060.1.002-B New Convenience Store**

Area (Ac) = 0.17 **Area (Sf) =** 7,300

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)		S.F.	=	0.00	AC	0.94	0.00
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)	3,725	S.F.	=	0.09	AC	0.25	0.02
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)	2,050	S.F.	=	0.05	AC	0.55	0.03
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water	1,525	S.F.	=	0.04	AC	1.00	0.04
	7,300			0.17			0.08

Wc = 0.4909

Time of Concentration

Overland Flow

Length, L (max 100ft)	=	65	feet	t_o =	Overland Flow Tc
Slope, S (ft/ft)	=	0.04		t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5}*(S^{0.4})]$
Manning Coefficient, n	=	0.240		t_o =	7.55 min
$P_{2/24}$	=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	unpaved	=	30	feet	V =	16.1345*(S0.5)		
Slope, S		=	25.00%		=	8.067 ft/s =	484.04	ft/min
Velocity, V		=	8.07	ft/sec	t_s =	Shallow Flow Tc		
					t_s =	(L/V) = 0.06	min	

Shallow Flow

Length, L (Paved or Unpaved)	unpaved	=	32	feet	V =	16.1345*(S0.5)		
Slope, S		=	0.50%		=	1.141 ft/s =	68.45	ft/min
Velocity, V		=	1.14	ft/sec	t_s =	Shallow Flow Tc		
					t_s =	(L/V) = 0.47	min	

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 8.07 (Min 5 Minutes)

0.13 Hour

Intensity (Vanderburgh Co.)

I_2 =	4.44	in/hr
I_5 =	5.21	in/hr
I_{10} =	5.88	in/hr
I_{25} =	6.89	in/hr
I_{50} =	7.78	in/hr
I_{100} =	8.78	in/hr

Peak Runoff Rate

$Q_x = CiA$

Q_2 =	0.36	cfs
Q_5 =	0.43	cfs
Q_{10} =	0.48	cfs
Q_{25} =	0.57	cfs
Q_{50} =	0.64	cfs
Q_{100} =	0.72	cfs

Peak Runoff Calculation

SUB-BASIN #8 Post-Dev.
Phase 1 (Undetained)

Project 11060.1.002-B New Convenience Store

Area (Ac) = 0.04 **Area (Sf) =** 1,575

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC	0.92	0.00
Structures & Pavement (2-5%)	1,300	S.F.	=	0.03	AC	0.94	0.03
Structures & Pavement (5-10%)		S.F.	=	0.00	AC	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC	0.15	0.00
Lawn (2-5%)	275	S.F.	=	0.01	AC	0.25	0.00
Lawn (5-10%)		S.F.	=	0.00	AC	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC	0.65	0.00
Bare Soil		S.F.	=	0.00	AC	0.72	0.00
Water		S.F.	=	0.00	AC	1.00	0.00
	1,575			0.04			0.03

Wc = **0.8195**

Time of Concentration

Overland Flow

Length, L (max 100ft)	=	50	feet	t_o = Overland Flow Tc
Slope, S (ft/ft)	=	0.026		t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n	=	0.011		t_o = 0.62 min
$P_{2/24}$	=	3.3		

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 0.62 (Min 5 Minutes)

0.01 Hour

Intensity (Vanderburgh Co.)

I_2 =	**5.02**	**in/hr**
I_5 =	**5.90**	**in/hr**
I_{10} =	**6.66**	**in/hr**
I_{25} =	**7.81**	**in/hr**
I_{50} =	**8.82**	**in/hr**
I_{100} =	**9.95**	**in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2 =	**0.15**	**cfs**
Q_5 =	**0.17**	**cfs**
Q_{10} =	**0.20**	**cfs**
Q_{25} =	**0.23**	**cfs**
Q_{50} =	**0.26**	**cfs**
Q_{100} =	**0.29**	**cfs**

Peak Runoff Calculation

SUB-BASIN #9 Post-Dev.
Phase 1 (Undetained)

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.06** **Area (Sf) =** **2,700**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	375	S.F.	=	0.01	AC.	0.94	0.01
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC.	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	2,325	S.F.	=	0.05	AC.	0.25	0.01
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC.	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	2,700			0.06			0.02

Wc = **0.3458**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 55 feet t_o = Overland Flow Tc

Slope, S (ft/ft) = 0.038 $t_o = [0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 t_o = 6.74 min

$P_{2/24}$ = 3.3

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **6.74** **(Min 5 Minutes)**

0.11 **Hour**

Intensity (Vanderburgh Co.)

I_2 = 4.69 in/hr

I_5 = 5.51 in/hr

I_{10} = 6.22 in/hr

I_{25} = 7.29 in/hr

I_{50} = 8.23 in/hr

I_{100} = 9.29 in/hr

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2 = 0.10 cfs

Q_5 = 0.12 cfs

Q_{10} = 0.13 cfs

Q_{25} = 0.16 cfs

Q_{50} = 0.18 cfs

Q_{100} = 0.20 cfs

Peak Runoff Calculation

SUB-BASIN #10 Post-Dev.
Phase 1 (Undetained)

Project 11060.1.002-B New Convenience Store

Area (Ac) = **0.13** **Area (Sf) =** **5,530**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	375	S.F.	=	0.01	AC.	0.94	0.01
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)		S.F.	=	0.00	AC.	0.98	0.00
Gravel (10 yr Storm)		S.F.	=	0.00	AC.	0.50	0.00
Gravel (25 yr Storm)		S.F.	=	0.00	AC.	0.60	0.00
Gravel (50-100 yr Storm)		S.F.	=	0.00	AC.	0.65	0.00
Lawn (<2%)		S.F.	=	0.00	AC.	0.15	0.00
Lawn (2-5%)	5,155	S.F.	=	0.12	AC.	0.25	0.03
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)		S.F.	=	0.00	AC.	0.55	0.00
Woodland Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Woodland Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Woodland Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Woodland Hilly (10-30%)		S.F.	=	0.00	AC.	0.48	0.00
Pasture Flat (<2%)		S.F.	=	0.00	AC.	0.12	0.00
Pasture Flat (2-5%)		S.F.	=	0.00	AC.	0.24	0.00
Pasture Rolling (5-10%)		S.F.	=	0.00	AC.	0.36	0.00
Pasture Hilly (>10%)		S.F.	=	0.00	AC.	0.48	0.00
Cultivated (<2%)		S.F.	=	0.00	AC.	0.20	0.00
Cultivated (2-5%)		S.F.	=	0.00	AC.	0.35	0.00
Cultivated (5-10%)		S.F.	=	0.00	AC.	0.50	0.00
Cultivated (>10%)		S.F.	=	0.00	AC.	0.65	0.00
Bare Soil		S.F.	=	0.00	AC.	0.72	0.00
Water		S.F.	=	0.00	AC.	1.00	0.00
	5,530			0.13			0.04

Wc = **0.2968**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	100	feet	t_o =	Overland Flow Tc
Slope, S (ft/ft)		=	0.048		t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240		t_o =	9.90 min
$P_{2/24}$		=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	unpaved	=	20	feet	V =	16.1345*(S0.5)
Slope, S		=	4.80%		=	3.535 ft/s = 212.09 ft/min
Velocity, V		=	3.53	ft/sec	t_s =	Shallow Flow Tc
					t_s =	(L/V) = 0.09 min

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 9.99 (Min 5 Minutes)

0.17 Hour

Intensity (Vanderburgh Co.)

I_2 = 4.07 in/hr
I_5 = 4.77 in/hr
I_{10} = 5.39 in/hr
I_{25} = 6.32 in/hr
I_{50} = 7.13 in/hr
I_{100} = 8.05 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 0.15 cfs
Q_5 = 0.18 cfs
Q_{10} = 0.20 cfs
Q_{25} = 0.24 cfs
Q_{50} = 0.27 cfs
Q_{100} = 0.30 cfs

Morley and Associates Inc.
Storm Sewer Design Sheet - Rational Method

Project: Bonkerz C-Store
Our Project #: 11060.1.002-A
Mannings n: 0.010
County: Vanderburgh
Date: 10/23/2020
Design Period: 25 Years
Equivalent Elliptical if shaded

Line Number	Upstream Structure		Pipe # or Swale	Downstream Structure		Length (ft)	Subbasin no.	Cj	Aj (ac.)	CjAj	Sum CjAj	Tj (min) (5.0)	Tcum (min) (5.0)	I(25) (in/hr)	Q(25) (cfs)	Pipe Diameter (in) Or Swale Depth (Ft)	Pipe Slope (ft/ft)	Pipe or Swale Cap. (cfs)	Velocity (ft/sec) at Capacity	Travel Time (min)	% Of Capacity	Upstream FG
			Temp Outlet 1				Outflow determined by basin orifice								0.62	12	0.20%	2.07	2.64	0.00	0.30	
			Temp Outlet 2				Outflow determined by basin orifice								0.83	12	0.20%	2.07	2.64	0.00	0.40	
1	FES	102	101	100	FES	105.00	Q(25) = Culvert Subbasin Runoff [Q(25)=0.69 CFS] + Upstream Culvert Capacity [4.20 CFS] + Temp Basin 2 Release Rate [0.62 CFS] = 5.51 CFS								5.51	18	0.21%	6.26	3.54	0.49	0.88	
			Downspouts	304	AD	106.32	6	0.94	0.10	0.10	0.10	5.00	5.00	7.81	0.77	8	1.00%	1.57	4.50	0.39	0.49	
			Temp Pipe				5	0.62	0.42	0.26	0.36	5.00	5.39	7.69	2.76	12	0.45%	3.11	3.96	0.00	0.89	
			Downspouts*	406	AD	70.00	4	0.98	0.05	0.05	0.05	5.00	5.00	7.81	0.35	8	1.00%	1.57	4.50	0.26	0.22	
4	AD	406	405	404	CI	133.33	2	0.51	0.29	0.15	0.19	5.00	5.26	7.73	1.50	12	0.50%	3.27	4.17	0.53	0.46	
			Downspouts*	404	CI	72.81	4	0.98	0.05	0.05	0.05	5.00	5.00	7.81	0.35	8	1.00%	1.57	4.50	0.27	0.22	
4	CI	404	403	402	CI	91.00	1	0.78	0.16	0.13	0.32	5.00	5.79	7.57	2.44	15	0.50%	5.94	4.84	0.31	0.41	

*It is assumed that the downspout pipes tying into AD 406 and CI 404 each carry half of the runoff from Post Subbasin 4

BASIN #1

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800
PROPOSED CONDITIONS

PROJECT:	**New Convenience Store Evansville, IN**	DETENTION FACILITY DESIGN RETURN PERIOD:	25 YRS
DESIGNER:	MORLEY (JEM)	RELEASE RATE RETURN PERIOD:	10 YRS

UNDEVELOPED WATERSHED AREA (Au)	-	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED)	-	MINUTES
RAINFALL INTENSITY (Iu):	-	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	-	
UNDEVELOPED RUNOFF RATE (Q = Cu*Iu*A):	-	CFS
DEVELOPED WATERSHED AREA (Ad)	0.86	ACRES
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.67	
UNDETAINED DEVELOPED RUNOFF RATE	0.16	CFS
OFF-SITE PASS THROUGH RATE	0.00	CFS
ALLOWABLE PIPE RELEASE RATE	-	CFS
ACTUAL DISCHARGE PIPE OUTFLOW	0.83	CFS

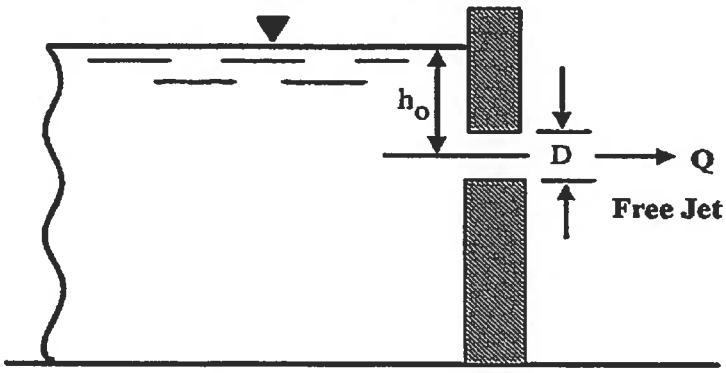
STORM DURATION Td (HRS)	RAINFALL INTENSITY Id 25-Year (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*Ad) (CFS)	OUTFLOW RATE Q (Cu*Iu*Au) (CFS)	STORAGE RATE I(Td)-Q (CFS)	REQUIRED STORAGE (I(Td)-Q)*Td/12 (ACRE.FT)
0.08	7.810	4.50	0.83	3.67	0.025
0.17	6.320	3.64	0.83	2.81	0.039
0.25	5.240	3.02	0.83	2.19	0.046
0.33	4.430	2.55	0.83	1.72	0.047
0.42	3.800	2.19	0.83	1.36	0.048
0.50	3.310	1.91	0.83	1.08	0.045
0.75	2.310	1.33	0.83	0.50	0.031
1.00	1.950	1.12	0.83	0.29	0.024
1.50	1.670	0.96	0.83	0.13	0.017
2.00	1.370	0.79	0.83	-0.04	-0.007
3.00	1.020	0.59	0.83	-0.24	-0.061
4.00	0.820	0.47	0.83	-0.36	-0.119
5.00	0.690	0.40	0.83	-0.43	-0.180

PEAK STORAGE (ACRE.FT):	0.048
PEAK STORAGE (CUBIC FT):	2,073

Retention Basin Storage Volume:

Elevation (ft)	Incremental Depth (ft)	Incremental Area (sf)	Incremental Volume (cf)	Total Volume (cf)	
451.75	0.25	0		0	
452.00	0.25	784	98	98	
452.25	0.25	1,365	269	367	
452.50	0.5	1,513	360	726	
453.00	0.5	1,829	836	1,562	
453.50	0.5	2,170	1,000	2,562	Exceeds 25 Year Storage
454.00	0.5	2,537	1,177	3,738	Flowline Emergency Overflow
454.50	0.5	2,928	1,366	5,105	Exceeds 100 Year Flood Elevatic
455.00	0.5	3,345	1,568	6,673	Top of Bank

Basin Outflow Pipe, Orifice Plate, Inlet Control



Basin #1

Outflow Pipe

Flow Characteristics

Pipe Dia. (inch)	12		
D (inch)	5.00	→	Orifice diameter
A_o (s.f.)	0.14	→	Area of orifice
g (f/s^2)	32.2	→	Acceleration due to gravity
H (ft)	1.75	→	Head at Inlet
h_o (ft)	1.54	→	Head at center of orifice
C_d	0.61	→	Discharge coefficient for sharp edged orifice plate

Equation 6.3.2 in HERPICC Stormwater Drainage Manual - Revised July 1994

$$Q = C_d * A_o \sqrt{2 * g * h_o}$$

Q = 0.83 cfs

BASIN #2

VANDERBURGH COUNTY DRAINAGE BOARD
FORM 800
PROPOSED CONDITIONS

PROJECT:	**New Convenience Store Evansville, IN**	DETENTION FACILITY DESIGN RETURN PERIOD:	25 YRS
DESIGNER:	MORLEY (JEM)	RELEASE RATE RETURN PERIOD:	10 YRS

UNDEVELOPED WATERSHED AREA (Au)	-	ACRES
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED)	-	MINUTES
RAINFALL INTENSITY (Iu):	-	INCHES/HR
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	-	
UNDEVELOPED RUNOFF RATE (Q = Cu*Iu*A):	-	CFS
DEVELOPED WATERSHED AREA (Ad)	0.85	ACRES
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.60	
UNDETAINED DEVELOPED RUNOFF RATE	0.47	CFS
OFF-SITE PASS THROUGH RATE	0.00	CFS
ALLOWABLE PIPE RELEASE RATE	-	CFS
ACTUAL DISCHARGE PIPE OUTFLOW	0.62	CFS

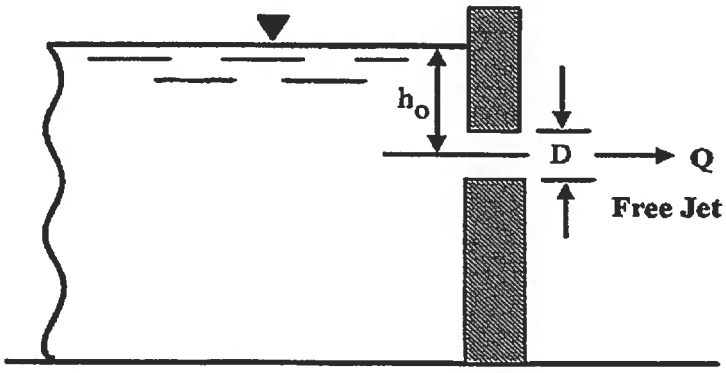
STORM DURATION Td (HRS)	RAINFALL INTENSITY Id 25-Year (INCH/HR)	INFLOW RATE I(Td) (Cd*Id*Ad) (CFS)	OUTFLOW RATE Q (Cu*Iu*Au) (CFS)	STORAGE RATE I(Td)-Q (CFS)	REQUIRED STORAGE (I(Td)-Q)*Td/12 (ACRE.FT)
0.08	7.810	3.98	0.62	3.36	0.023
0.17	6.320	3.22	0.62	2.60	0.036
0.25	5.240	2.67	0.62	2.05	0.043
0.33	4.430	2.26	0.62	1.64	0.045
0.42	3.800	1.94	0.62	1.32	0.046
0.50	3.310	1.69	0.62	1.07	0.045
0.75	2.310	1.18	0.62	0.56	0.035
1.00	1.950	0.99	0.62	0.37	0.031
1.50	1.670	0.85	0.62	0.23	0.029
2.00	1.370	0.70	0.62	0.08	0.013
3.00	1.020	0.52	0.62	-0.10	-0.025
4.00	0.820	0.42	0.62	-0.20	-0.067
5.00	0.690	0.35	0.62	-0.27	-0.112

PEAK STORAGE (ACRE.FT):	0.046
PEAK STORAGE (CUBIC FT):	2,009

Retention Basin Storage Volume:

Elevation (ft)	Incremental Depth (ft)	Incremental Area (sf)	Incremental Volume (cf)	Total Volume (cf)	
452.92	0.28	0		0	
453.20	0.3	686	96	96	
453.50	0.5	909	239	335	
454.00	0.5	1,167	519	854	
454.50	0.5	1,450	654	1,509	
454.75	0.25	1,601	763	2,271	Exceeds 25 Year Storage
455.00	0.25	1,759	420	2,691	
455.25	0.5	1,922	460	3,151	Flowline Emergency Overflow
455.75	0.5	2,178	1,025	4,176	Exceeds 100 Year Flood Elevatio
456.25	0.5	2,454	1,158	5,334	Top of Bank

Basin Outflow Pipe, Orifice Plate, Inlet Control



Basin #2

Outflow Pipe

Flow Characteristics

Pipe Dia. (inch)	12		
D (inch)	4.25	→	Orifice diameter
A_o (s.f.)	0.10	→	Area of orifice
g (f/s^2)	32.2	→	Acceleration due to gravity
H (ft)	1.83	→	Head at Inlet
h_o (ft)	1.65	→	Head at center of orifice
C_d	0.61	→	Discharge coefficient for sharp edged orifice plate

Equation 6.3.2 in HERPICC Stormwater Drainage Manual - Revised July 1994

$$Q = C_d * A_o \sqrt{2 * g * h_o}$$

Q = 0.62 cfs

Weir Report

Emergency Overflow
Temporary Basin #1

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Oct 8 2020

<Name>

Trapezoidal Weir

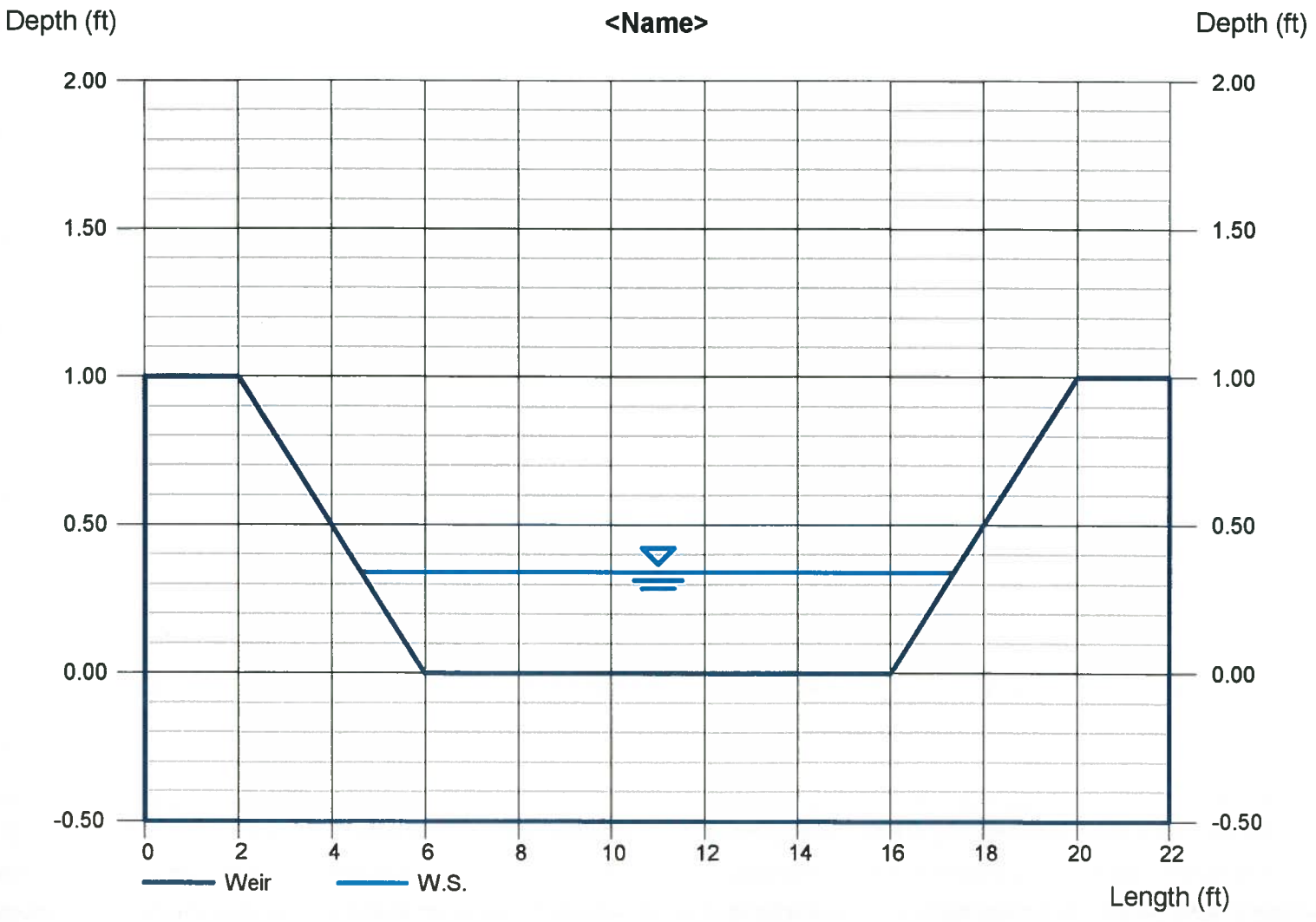
Crest	= Sharp
Bottom Length (ft)	= 10.00
Total Depth (ft)	= 1.00
Side Slope (z:1)	= 4.00

Calculations

Weir Coeff. Cw	= 2.60
Compute by:	Known Q
Known Q (cfs)	= 5.52

Highlighted Q(100) = 5.52 CFS

Depth (ft)	= 0.34
Q (cfs)	= 5.520
Area (sqft)	= 3.86
Velocity (ft/s)	= 1.43
Top Width (ft)	= 12.72



Weir Report

Emergency Overflow
Temporary Basin #2

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Oct 8 2020

<Name>

Trapezoidal Weir

Crest	= Sharp
Bottom Length (ft)	= 10.00
Total Depth (ft)	= 1.00
Side Slope (z:1)	= 4.00

Calculations

Weir Coeff. Cw	= 2.60
Compute by:	Known Q
Known Q (cfs)	= 5.52

Q(100) = 4.34 CFS

Highlighted

Depth (ft)	= 0.34
Q (cfs)	= 5.520
Area (sqft)	= 3.86
Velocity (ft/s)	= 1.43
Top Width (ft)	= 12.72