FINAL DRAINAGE REPORT
for
Eleanor's Place Subdivision
Vanderburgh County, Indiana

Project No.: 11822.4.001-B
April 26, 2022

APPROVED
APR 2 6 2022
VANDERBURGH COUNTY DRAINAGE BOARD

Prepared For:
New Residential Development, LLC
304 E State Road 68
Haubstadt, IN 47639

Prepared By:
Morley
4800 Rosebud Ln.
Newburgh, IN 47630
Office: 812.464.9585
Fax: 812.464.2514

JAMES E. MORLEY
REGISTERED
No. 10100250
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Benchmarks rcd 4/26/2022 via email 2:35 pm

Some revisions Subm. Hard copy 4/26/2022 3:00 pm Hard copy Same email 2:35 pm

4/26/2022

Received by the Vanderburgh County Surveyor's Office

APR 2 6 2022

Time 10:00AM Initials AR

MORLEY
ARCHITECTS | ENGINEERS | SURVEYORS

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

APPLICANT INFORMATION FORM 801

Project Name:	Eleanor's Place
Approximate Location:	13800 N Green River Road Evansville, IN 47725
Applicant Name:	New Residential Development LLC
Applicant is (check one)	☐Individual (s) ☒Partnership or legal LLC ☐Corporation
Applicant Address:	304 E. State Road 68
City:	Haubstadt
State:	IN
Zip Code:	47639
Email:	phil@reinbrechthomes.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 11/30/21

Printed Name Phil Reinbrecht

Signature _____ Date 11/30/21

Printed Name Sky Epperson

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 _____

Printed Name _____

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

MORLEY
ARCHITECTS | ENGINEERS | SURVEYORS

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

Letter of Transmittal

Regarding: Final Drainage
Eleanor's Place

To: Linda Freeman
Vanderburgh County Surveyor
Civic Center Complex-Room 325
Evansville, IN 47708

Project No: 11822.4.001-B

Date: April 26, 2022

We are sending you by: Messenger

We are sending:

COPIES	DOC. DATE	DESCRIPTION
1	4/26/2022	Final Drainage Report
1	4/26/2022	Road and Drainage Plan/Details

These are transmitted: For Approval Choose an item.

Remarks:

Please call if you have any questions.

Copies to: FILE

Received by the Vanderburgh County Surveyor's Office

APR 26 2022

Time 10:00 AM Initials AR

Signed:

Cody R Simpson

Cody Simpson, EI

MORLEY
ARCHITECTS | ENGINEERS | SURVEYORS

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

April 26, 2022

Attn: Linda Freeman
Vanderburgh County Drainage Board
1 NW Martin L King Jr Blvd #325
Evansville, IN 47708

Re: Eleanor's Place – Bench Mark Data
Morley Project No: 11822.4.001-B

Dear Linda,

Please see the Bench Mark Data below for Eleanor's Place.

TBM #1 - South head bolt of fire hydrant located on the West side of Green River Road approximately 1,235' South of Spanish Moss Boulevard.
Elevation = 422.74' (NAVD 1988)

TBM #2 - Chiseled "X" on the most Northwest head bolt of fire hydrant located at the Southeast corner of Spanish Moss Boulevard and Persimmon Lane.
Elevation = 411.90' (NAVD 1988)

If you have any questions, feel free to contact our office.

Sincerely,

James E. Morley, P.E., P.S.
President

CC: John Stoll
Jessee Swain
File

Received by the
Vanderburgh County
Surveyor's Office

APR 26 2022

Time 2:35p Initials
Via email

General Information

Parcel Number
82-04-11-009-073.019-030

Local Parcel Number
07-040-09-073-019

Tax ID:

Routing Number
S-8

Property Class 511
1 Family Dwell - Unplatted (0 to 9.9

Year: 2021

Location Information

County
Vanderburgh

Township
SCOTT TOWNSHIP

District 030 (Local 007)
SCOTT

School Corp 7995
EVANSVILLE-VANDERBURGH

Neighborhood 70801-030
SCOTT 70801

Section/Plat

Location Address (1)
13450 N GREEN RIVER RD
EVANSVILLE, IN 47725-9721

Zoning

Subdivision

Lot

Market Model
70801-030 - Residential

Characteristics

Topography	Flood Hazard
Level	☐
Public Utilities	**ERA**
Gas, Electricity	☐
Streets or Roads	**TIF**
Paved	☐

Neighborhood Life Cycle Stage
Other

Printed Saturday, May 8, 2021
Review Group 2024

Ownership

WALTERS, E LON & MARGARET T T/
524 S RUNNYMEADE AVE
EVANSVILLE, IN 47714

Legal

PT SE 11-5-10 1.0 A

Transfer of Ownership

Date	Owner	Doc ID	Code	Book/Page	Adj Sale Price	V/I
10/15/2009	WALTERS, E LON &		WD	09/27634	$30,000	I
01/01/1900	SMALL DONALD W &		WD	/	$0	I

Notes

Res

Valuation Records (Work In Progress values are not certified values and are subject to change)

2021	Assessment Year	2021	2020	2019	2018	2017
WIP	Reason For Change	AA	AA	AA	AA	AA
02/26/2021	As Of Date	04/09/2021	05/01/2020	04/05/2019	05/18/2018	09/16/2017
Indiana Cost Mod	Valuation Method	Indiana Cost Mod	Indiana Cost Mod	Indiana Cost Mod	Indiana Cost Mod	Indiana Cost Mod
1.0000	Equalization Factor	1.0000	1.0000	1.0000	1.0000	1.0000
	Notice Required	☐	☑	☐	☑	☑
$25,000	**Land**	**$25,000**	**$25,000**	**$25,000**	**$25,000**	**$25,000**
$25,000	Land Res (1)	$25,000	$25,000	$25,000	$25,000	$25,000
$0	Land Non Res (2)	$0	$0	$0	$0	$0
$0	Land Non Res (3)	$0	$0	$0	$0	$0
$31,400	**Improvement**	**$31,400**	**$36,000**	**$36,000**	**$36,000**	**$35,500**
$31,200	Imp Res (1)	$31,200	$35,800	$35,800	$35,800	$35,300
$0	Imp Non Res (2)	$0	$0	$0	$0	$0
$200	Imp Non Res (3)	$200	$200	$200	$200	$200
$56,400	**Total**	**$56,400**	**$61,000**	**$61,000**	**$61,000**	**$60,500**
$56,200	Total Res (1)	$56,200	$60,800	$60,800	$60,800	$60,300
$0	Total Non Res (2)	$0	$0	$0	$0	$0
$200	Total Non Res (3)	$200	$200	$200	$200	$200

Land Data (Standard Depth: Res 100', CI 100' Base Lot: Res 0' X 0', CI 0' X 0')

Land Type	Pricing Method	Soil ID	Act Front.	Size	Factor	Rate	Adj. Rate	Ext. Value	Infl. %	Res Elig %	Market Factor	Value
9	A		0	1.0000	1.00	$25,000	$25,000	$25,000	0%	100%	1.0000	$25,000

Property adjacent + South of Eleanors Place

Land Computations

Calculated Acreage	1.00
Actual Frontage	0
Developer Discount	☐
Parcel Acreage	1.00
81 Legal Drain NV	0.00
82 Public Roads NV	0.00
83 UT Towers NV	0.00
9 Homesite	1.00
91/92 Acres	0.00
Total Acres Farmland	0.00
Farmland Value	$0
Measured Acreage	0.00
Avg Farmland Value/Acre	0.0
Value of Farmland	$0
Classified Total	$0
Farm / Classifed Value	$0
Homesite(s) Value	$25,000
91/92 Value	$0
Supp. Page Land Value	
CAP 1 Value	$25,000
CAP 2 Value	$0
CAP 3 Value	$0
Total Value	**$25,000**

Data Source N/A **Collector** 08/05/1993 JR/EW **Appraiser** 01/01/1900

Introduction

Eleanor's Place is a proposed single-family detached residential subdivision. The site is located at the extension of Persimmon Lane south of Magnolia Ridge Section 1. The site is within Section 11, Township 5 South, Range 10 West located in Scott Township, Vanderburgh County. Please refer to the location map provided within this report for further details.

Existing Conditions

Site Conditions

The 41.79-acre (original tract) site was originally included in Magnolia Ridge primary plat approval from 2018, prepared by Cash Waggner & Associates PC for The Oakridge Group LLC.

The original tract includes Parcels 2 & 3 from Magnolia Parcelization (PAR-2018-016).

A primary plat for the proposed 132 lot residential subdivision was filed and approved at the March 3, 2022 Area Plan Commission meeting.

The current conditions of the 41.79-acre tract is cultivated row crop fields with rolling terrain and mild slopes. Water and sewer are available to the site by extension.

Soils Information

The Soil Survey of Vanderburgh County indicates the soils to be Hosmer silt loam (HoA) with 0 to 2 percent slopes, Hosmer silt loam (HoB2) with 2 to 5 percent slopes, Hosmer silt loam (HoC3) with 5 to 10 percent slopes, severely eroded, and Stendal silt loam (St). Please refer to the attached soils map.

Floodplain Information

The property lies within Zone X. The site was scaled on the Flood Insurance Rate Map (FIRM) for Vanderburgh County, Indiana, Community Panel Number 18163C0130D, dated March 17, 2011. Please refer to the enclosed excerpt from this map.

Proposed Development

The proposed project contains 132 residential lots. Lots are generally 0.20 acres or larger. This development includes typical elements of a single-family detached subdivision: houses, driveways, streets, landscaping, and a storm sewer system. The expected total impervious surface included within the development is approximately 653,500 SF, or 36% of the total project site.

The proposed design of the drainage control system

The storm system is designed to closely replicate the existing drainage patterns while capturing a large portion of the runoff created from the site, and discharging only a minimal amount of runoff undetained. Only a small portion along the north and south edges of the subdivision are expected to leave the site undetained to the north and south, respectively. Generally, these areas follow these drainage patterns in the existing condition.

The storm system is comprised of swales, inlets and storm sewer that work together to direct runoff to the proposed basins throughout the project. In general, runoff from an individual lot will be directed either to the gutter of the streets and enter the storm sewer through curb inlets, or to a backyard swale that will either enter the storm sewer through a flared end section, or will discharge directly into the proposed basin.

The proposed project will consist of 4 separate basins, all onsite. The 4 separate basins will function independently, with each basin reducing the amount of post-developed runoff leaving the site to the allowable release rate, as determined by the associated pre-developed subbasins.

Assumptions or Special Conditions

In the analysis of the drainage control system, any assumptions made are for the purpose of being conservative. As with most single-family developments, certain assumptions must be made. The following assumptions were used during the analysis:

- Each lot has 3,500 SF of impervious area, typically split evenly between what drains to the front yard and what drains to the back yard.
    - 2,500 SF of which is assumed to be rooftop
    - 500 SF is assumed in both the front and rear yards for things such as driveways, decks, patios, etc.

Results of the Analysis

Analysis of the pre-developed site delineated 4 subbasins, as shown on the pre-developed subbasin exhibit. For the pre-developed site, the runoff coefficient for cultivated (2%-5%) and cultivated (5%-10%) were used. The Time of Concentration calculations and Q_{10} values are shown for each of the pre-developed subbasins. Detailed calculations are included as an attachment.

Pre-Developed Subbasin 1:

- Area = 19.97 acres
- C = 0.425
- T_c = 21.93 mins
- Q_{10} = 30.15 CFS

Pre-Developed Subbasin 2:

- Area = 4.22 acres
- C = 0.35
- T_c = 19.92 mins
- Q_{10} = 5.59 CFS

Pre-Developed Subbasin 3:

- Area = 12.93 acres
- C = 0.35
- T_c = 22.8 mins
- Q_{10} = 15.65 CFS

Pre-Developed Subbasin 4:

- Area = 4.15 acres
- C = 0.35
- T_c = 22.72 mins
- Q_{10} = 5.03 CFS

Once the project is fully developed, 55 new sub-basins will be created resulting in a total drainage area of approximately 41.60 acres. The weighted runoff coefficient, C, was calculated for each individual post-developed subbasin based on the aforementioned impervious area assumptions for each individual lot.

Developed Sub-basin Summary:

- Sub-basins 2, 4, 5 and 7-22 will be collected and detained in the North basin.
    - Offsite Sub-basins B and C will be collected and passed through the North basin.
- Sub-basins 23-25 and 38-39 will be collected and detained in the Northeast basin.
    - Offsite Sub-basins E and F will be collected and passed through the Northeast basin.
- Sub-basins 26-37 and 42-46 will be collected and detained in the South basin
- Sub-basins 40, 41, 47, and 49 will be collected and detained in the Southeast basin.
    - Offsite Sub-basin D will be collected and passed through the southeast basin.
- Sub-basins 1, 3 and 6 will release undetained to the north to the existing ditch.
    - Offsite Sub-basin A will release undetained to the north to the existing ditch.
- Sub-basin 48 will release undetained to the south to the existing ditch.

The following analysis is provided using the Techincal Memorandum for undetained drainage areas.

Subbasin 1

- Area = 0.75 acres
- C = 0.5433

Subbasin 3

- Area = 0.48 acres
- C = 0.5891

Subbasin 6

- Area = 0.28 acres
- C = 0.55

Subbasin 48

- Area = 0.82
- C = 0.4564

Criteria #1

- 0.75 Ac. + 0.48 Ac. + 0.28 Ac. + 0.82 Ac. = 2.33 Ac. < 41.79 Ac. * 0.1 = 4.179 Ac.

Criteria # 2

- Pre-Developed Subbasin 1
  - 0.75 Ac. + 0.48 Ac. + 0.28 Ac. = 1.59 Ac. < 19.97 Ac.
- Pre-Developed Subbasin 4
  - 0.82 Ac. < 4.15 Ac.

Criteria #3

- Pre-Developed Subbasin 1
  - $A * c_u = 8.49$
  - $A * c_d = 0.84$
  - Therefore, $A * c_d < A * c_u$

- Pre-Developed Subbasin 4
  - $A * c_u = 1.45$
  - $A * c_d = 0.37$
  - Therefore, $A * c_d < A * c_u$

Details for each of the proposed retention basins are provided below. All 4 basins are proposed wet retention basins, with an outlet pipe as the discharge mechanism, and an earthen weir as the emergency overflow.

North Basin Details:

- Pool Elevation = 402.50
- 25-Yr Storage Elevation = 404.75
- Emergency Overflow = 405.25
  - Depth of Flow through spillway = 9"
- 24" Discharge
- Q_{25} Release = 19.98 CFS

Northeast Basin Details:

- Outlet Elevation = 412.00
- 25-Yr Storage Elevation = 413.50
- Emergency Overflow = 414.00
  - Depth of Flow through spillway = 6"
- 12" Discharge
- Q_{25} Release = 3.33 CFS

South Basin Details:

- Pool Elevation = 410.50
- 25-Yr Storage Elevation = 412.75
- Emergency Overflow = 413.25
  - Depth of Flow through spillway = 9"
- 18" Discharge
- Q_{25} Release = 11.19 CFS

Southeast Basin Details:

- Pool Elevation = 412.65
- 25-Yr Storage Elevation = 414.50
- Emergency Overflow = 415.00
    - Depth of Flow through spillway = 6"
- 12" Discharge w/ 7" Orifice
- Q_{25} Release = 1.63 CFS

Permitting

The ditch along the northern property line is assumed to be jurisdictional and we are actively pursuing permits.

Curb Inlet Calculations

Curb inlet capacity calculations were performed using LTAP Chapter 5.3 – Flow in Inlets.

A summary of the calculations is provided below:

i. Minimum Capacity for inlets on a continuous grade = 2.65 CFS
    a. Equation 5.3.1 LTAP
ii. Minimum Capacity for sump inlets (single inlet) = 2.76 CFS
    a. Equation 5.3.2 LTAP
iii. Minimum Capacity for sump inlets (double inlet) = 4.15 CFS
    a. Equation 5.3.2 LTAP
iv. Minimum Capacity for curb opening at sump inlets (single inlet) = 1.06 CFS
    a. Equation 5.3.8 LTAP
v. Minimum Capacity for curb opening at sump inlets (double inlet) = 2.13 CFS
    a. Equation 5.3.8 LTAP

Per Vanderburgh County Code, the inlets were sized for the 10-year storm event. In general, the capacities i-iii above were used to size the inlets throughout the site. These capacities only take into account the gutter inlets and ignore flow through the curb opening, which will provide additional capacity if the gutter inlets become overwhelmed for any reason.

In one unique scenario, DCI-318, the double curb inlet was selected, although the Q(10) for that subbasin was calculated to be 4.59 CFS. Through discussion with the County Engineer's office and County Surveyor's office, it was determined that the double curb inlet would be sufficient,

because the curb opening at the back of the double curb inlet will provide additional capacity. Therefore, for DCI-318, the capacity of the double curb inlet is taken to be 6.28 CFS.

Northern Boundary Line

The existing ditch along the northern boundary line was examined in further detail. A brief summary of the analysis is provided in the appendix along with the supporting documentation. The peak runoff for the 50-year storm was calculated to be 75 CFS. Proposed Subbasins 1, 3 and OS-A enter the existing ditch upstream of the proposed Culvert P141 via sheet flow, or Swale S-1. Therefore, the 50-year runoff from Subbasins 1, 3 and OS-A were added to the 75 CFS to size P141. Q(50) for P141 was calculated to be 89 CFS. Using HY-8, an 8' x 4' box culvert, 20% buried, passes the 50-year peak runoff under gravity flow conditions.

Additionally, the existing ditch cross-sections were examined under the 100-year peak flow. Two cases were considered separately, upstream of P141 and downstream of P141. Upstream of P141, the same analysis was performed to calculate the 100-year peak runoff from the upstream, off-site watersheds. The 100-year runoff from Subbasins 1, 3, and OS-A were added to find the total 100-year peak flow in the existing ditch. An average of the most upstream and most downstream cross section of this section of the ditch along the northern property line was used when comparing to the 100-year peak flow. It was determined that the 100-year peak flow can pass at the TOB of the existing stream. Best practices would recommend that homes adjoining the existing ditch be constructed at least 2' above the 100-year peak flow, in this case the existing TOB. Below are the 100-year water elevations at each lot adjoining the stream, upstream of P-141

Magnolia Ridge 100-Year Water Elevation:

Lot 50 = 411.93

Lot 51 = 410.18

Lot 64 = 408.93

Eleanor's Place 100-Year Water Elevation:

Lot 29 MFF = 408.93

Lot 30 MFF = 408.93

Lot 31 MFF = 409.30

Lot 32 MFF = 411.93

not on ff gm 4/26/2022

Downstream of P141, additional runoff was added to the 100-year peak flow that was calculated upstream of P141. The North Basin of Eleanor's Place and Post Subbasin 6 both release directly to the existing ditch. Basin 1 from Magnolia Ridge along with Post Subbasins 16, 17, and 22 all release downstream off P-141 and were considered during the 100-year peak flow through the existing ditch. An average of the most upstream and most downstream cross

section of this section of the ditch along the northern property line was used when comparing to the 100-year peak flow. It was determined that the 100-year peak flow can pass at 0.9' above the TOB of the existing stream. Best practices would recommend that homes adjoining the existing ditch be constructed at least 2' above the 100-year peak flow, in this case 0.9' above the existing TOB. Below are the 100-year water elevations at each lot adjoining the stream, upstream of P-141

Magnolia Ridge 100-Year Water Elevation:

Lot 1 = 404.27

Lot 2 = 404.62

Lot 3 = 404.88

Lot 4 = 405.22

Lot 5 = 405.50

Lot 6 = 405.78

Lot 7 = 406.64

Lot 8 = 406.64

Lot 9 = 407.04

Lot 10 = 407.04

Lot 11 = 408.11

Eleanor's Place 100-Year Water Elevation:

Lot 12 = 405.50

Lot 13 = 405.78

Lot 14 = 405.78

Lot 15 = 406.64

Lot 16 = 406.64

Lot 17 = 407.04

Lot 18 = 407.04

Lot 19 = 407.04

Lot 28 = 408.11

Southeastern Adjoiner —82-04-11-009-073.019-030

The adjoiner directly south of the Southeast basin was taken into consideration when designing the emergency overflow weir for the southeast basin. The finish floor of the house, 415.44, and the lowest adjacent grade, 413.76, were located in the field on 4/22/2022. An elevation two feet below the finish floor elevation, 413.44, was used as the governing elevation for the 100-yr flow through the emergency overflow at the downstream elevation of the overflow channel.

Basin Maintenance Report

This brief report will highlight the wet retention basins' design and maintenance in accordance with the latest Vanderburgh County Drainage Ordinance Section 13.04.440, Technical Memorandums and supplements. The wet basin will have a maintenance path, slopes leading to the water's edge, emergency overflow weir, and outlet pipe. 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 wet 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.

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.

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

All calculations, logs, exhibits, and modeling are enclosed within this report.

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

All calculations, logs, exhibits, and modeling are enclosed within this report.

Summary

The proposed development is a 132-lot detached single family home residential subdivision. This report has provided analysis and proposed conditions which ultimately lessen the overall drainage impact of the project site and its downstream adjoiners.

Total Pre-Developed Release Q_{10} = 56.42 CFS

Onsite Basins Developed Release Q_{25} = 34.39 CFS

Undetained Sub-Basins #1, 3, 6, and 48 Developed Release Q_{25} = 8.52 CFS

Total Developed Release Q_{25} = 42.91 CFS

Overall, the developed project will release less stormwater runoff during the 25-year storm than it's pre-developed area during the 10-year storm.

Eleanor's Place

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 on 04-26-2022

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 on 04-26-2022

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.

New Residential Development LLC

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 developed in phases.

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 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 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 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 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 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;

See Grading and Drainage Plans submitted with this report.

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

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

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

See Appendix 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 Appendix of the Drainage 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.

The site is not located in any applicable "impacted drainage areas".

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.

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.

N/A — 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.

Provided

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.

Provided

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.

N/A

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.

Provided

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.

See Plan

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.

Provided

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;

Provided

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

Provided

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.

N/A

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.

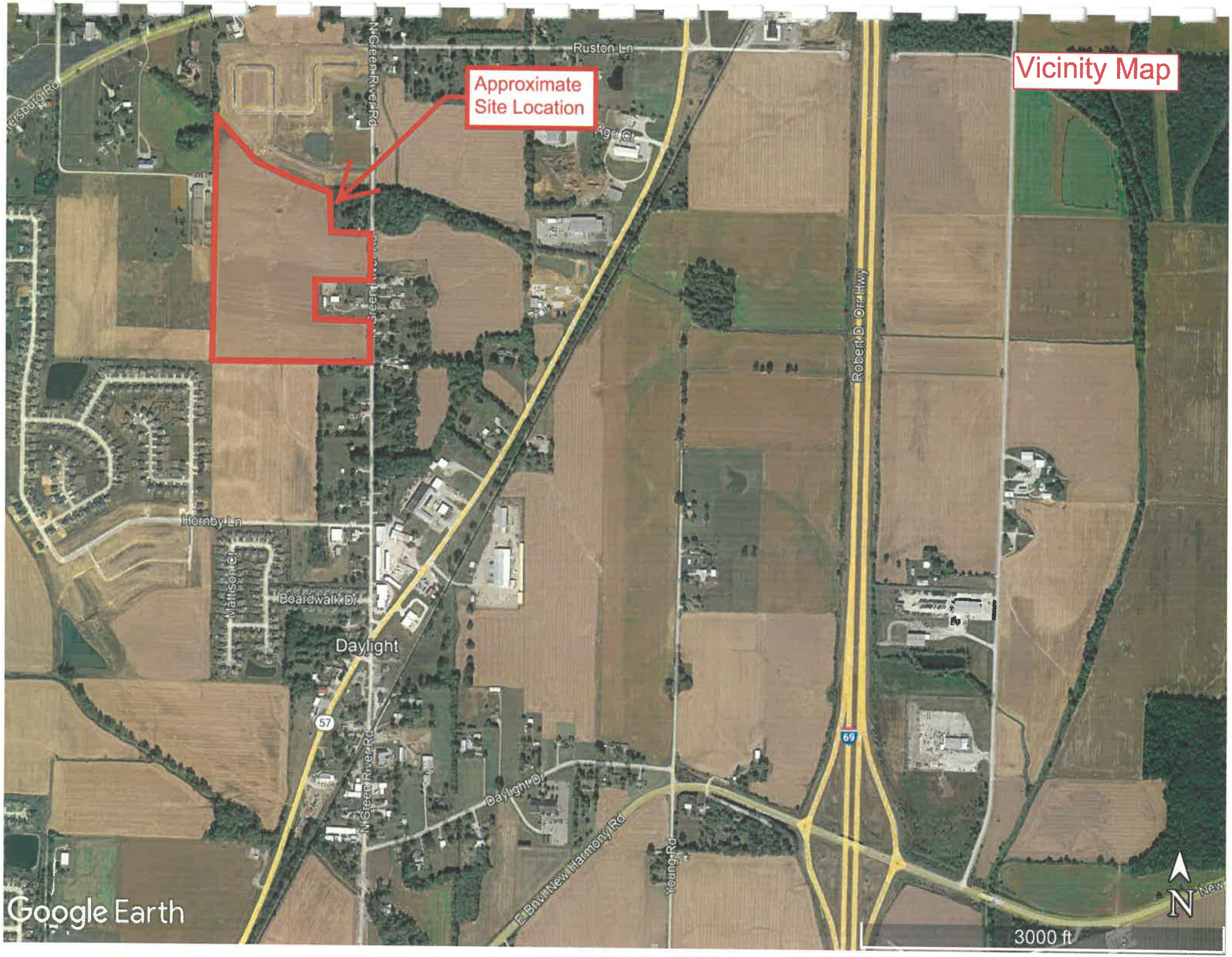
N/A

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.

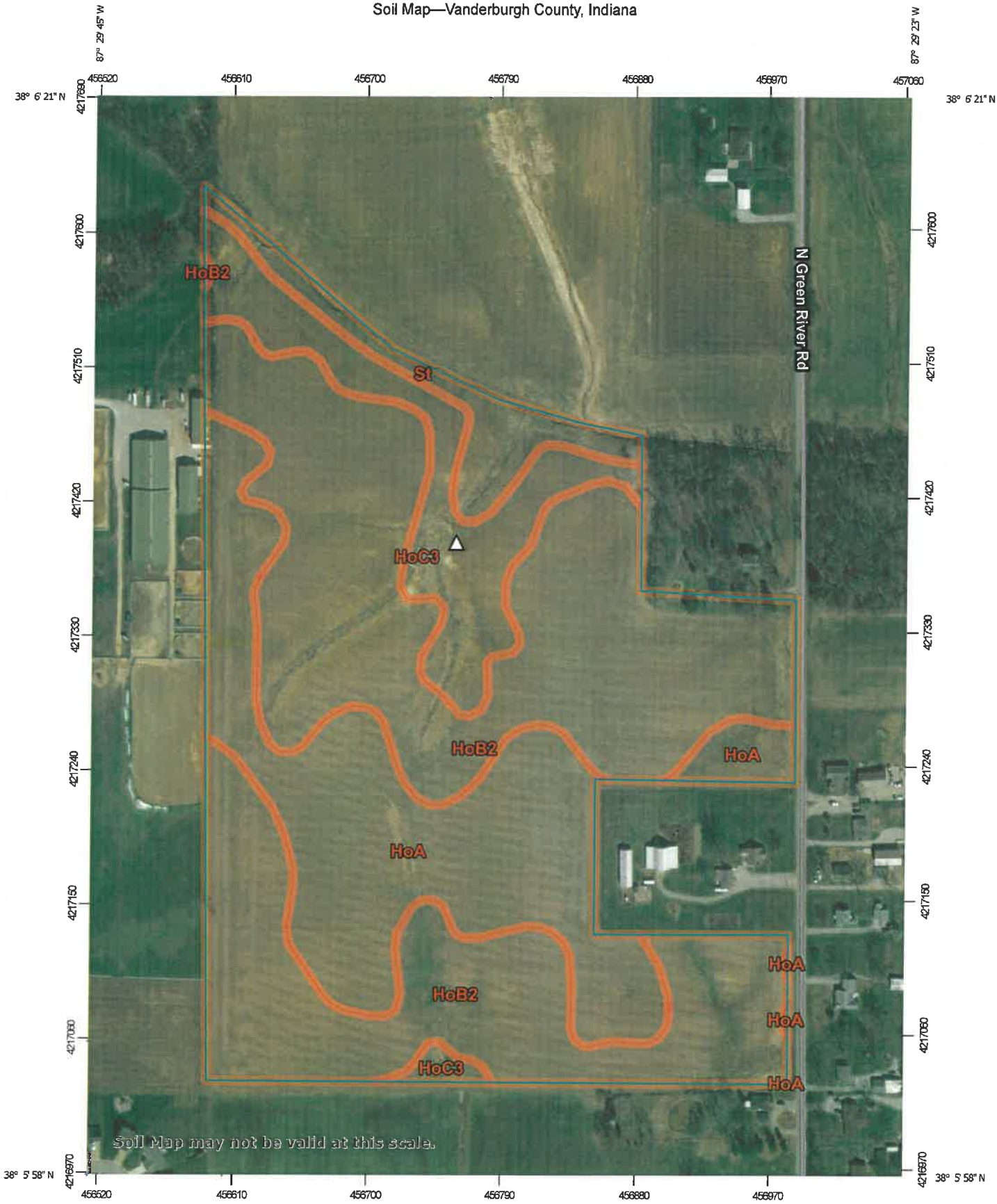
Other comments:

APPENDIX 'A'

Vicinity Map A.01
USDA Soil Survey A.02
Flood Insurance Rate Map (FIRM) A.03
HUC 14 Map A.04
Wetlands Inventory Map A.05


Vicinity Map
Approximate Site Location
Ruston Ln
N Green River Rd
Robert D Orr Hwy
Hornby Ln
Mattson Ct
Boardwalk Dr
Daylight
Daylight Dr
E Bay Hill New Harmony Rd
Young Rd
57
69
Google Earth
N
3000 ft

Soil Map—Vanderburgh County, Indiana



Map Scale: 1:3,520 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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 21, Sep 9, 2021

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.

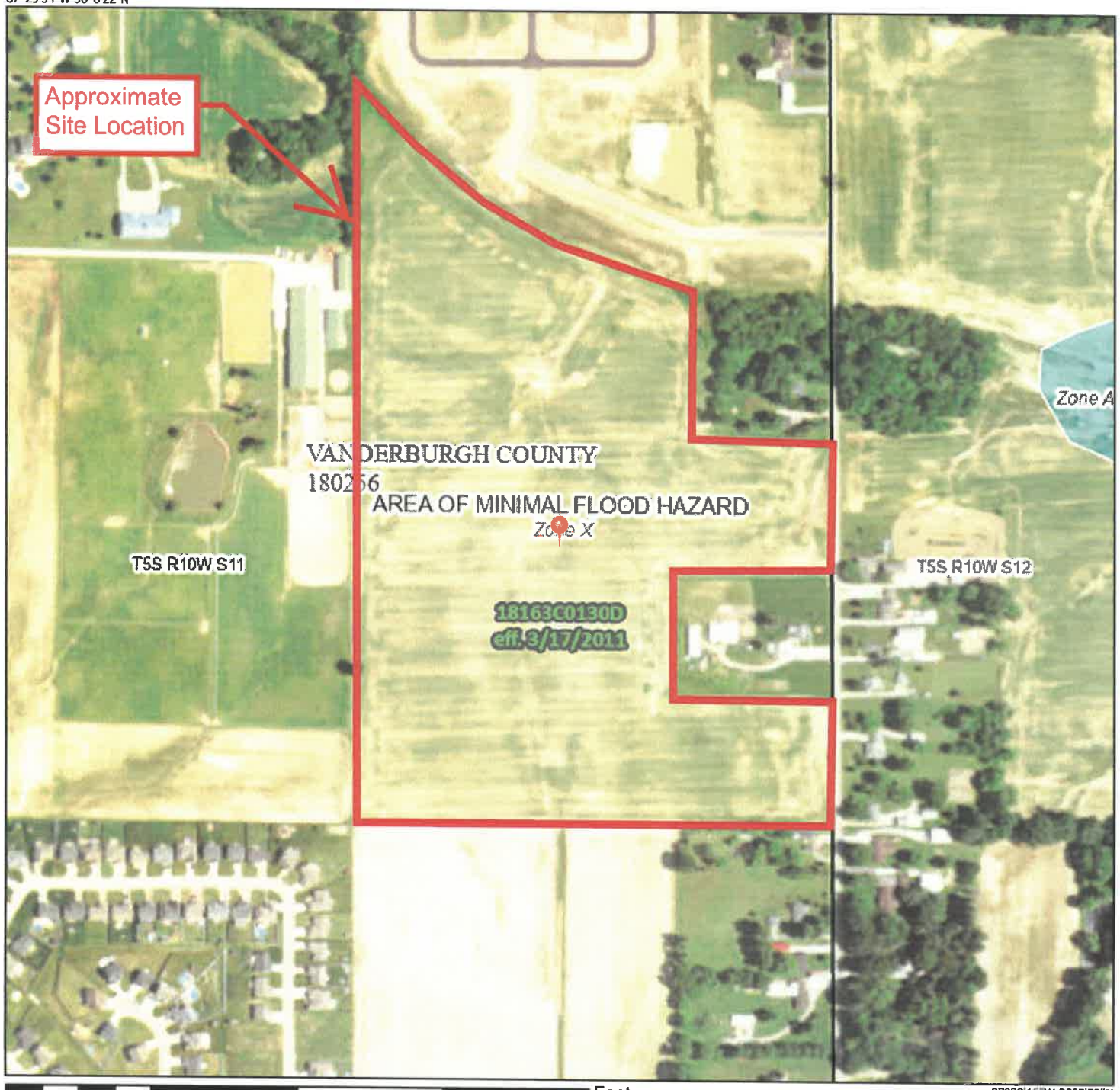
Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HoA	Hosmer silt loam, 0 to 2 percent slopes	11.0	27.0%
HoB2	Hosmer silt loam, 2 to 5 percent slopes, eroded	23.1	56.8%
HoC3	Hosmer silt loam, 5 to 10 percent slopes, severely eroded	4.7	11.5%
St	Stendal silt loam	1.9	4.7%
Totals for Area of Interest		**40.8**	**100.0%**

National Flood Hazard Layer FIRMette

FEMA

87°29'54"W 38°6'22"N



87°29'16"W 38°5'53"N

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, Area of 1% annual chance flood with average depth less than one foot or with drainag 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*

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

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

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

N

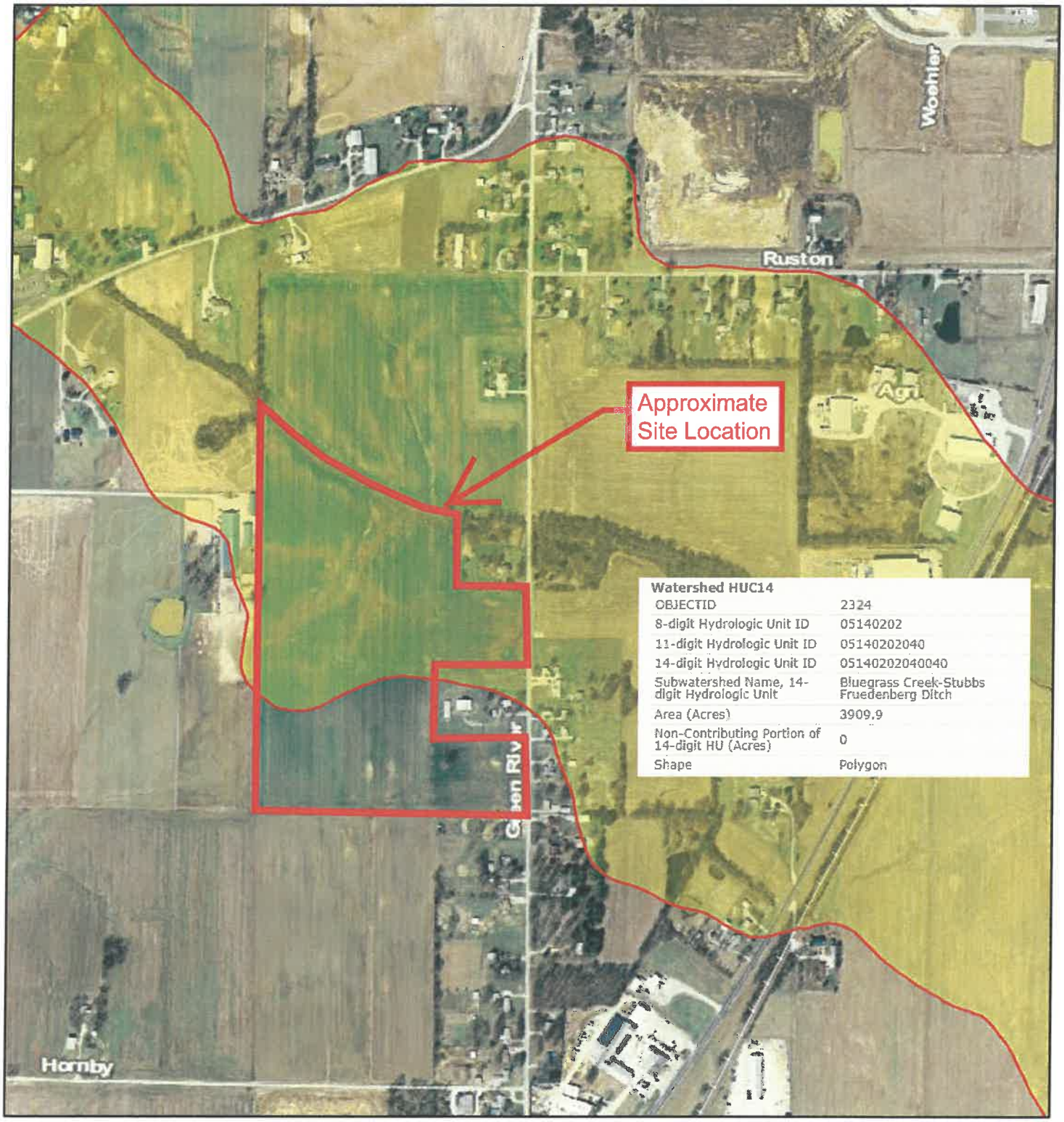
The pin displayed on the map is an approximate point selected by the user and does not represe an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/8/2022 at 3:59 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.

HUC 14 - 1



April 8, 2022

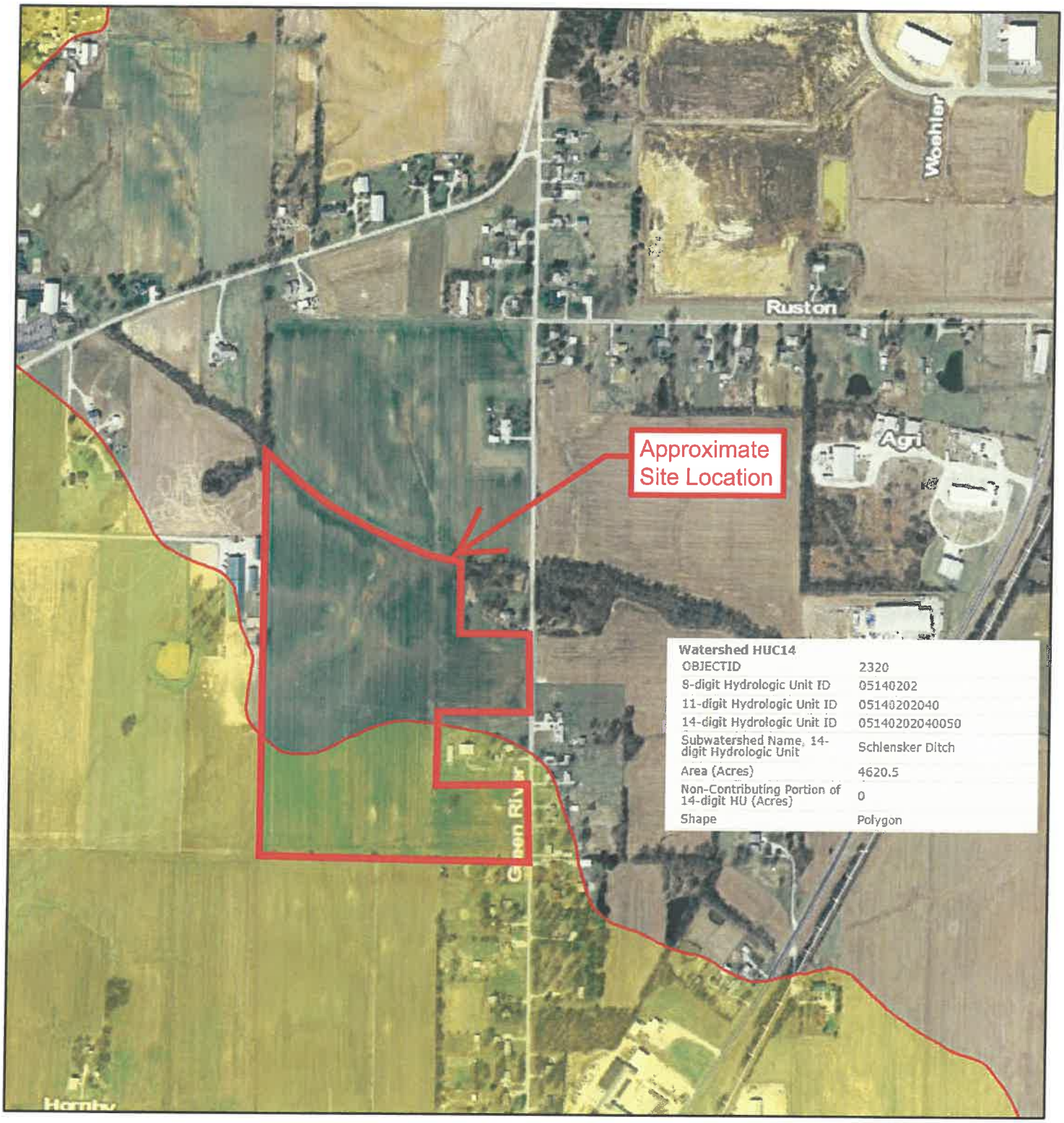
1:8,000

0 0.05 0.1 0.2 mi

0 0.1 0.2 0.4 km

Indiana Spatial Data Portal, UITS, ESRI

HUC 14 - 2



April 8, 2022

1:8,000

0 0.05 0.1 0.2 mi

0 0.1 0.2 0.4 km

Indiana Spatial Data Portal, UITS, ESRI

U.S. Fish and Wildlife Service

National Wetlands Inventory

Wetlands Map

April 8, 2022

Wetlands

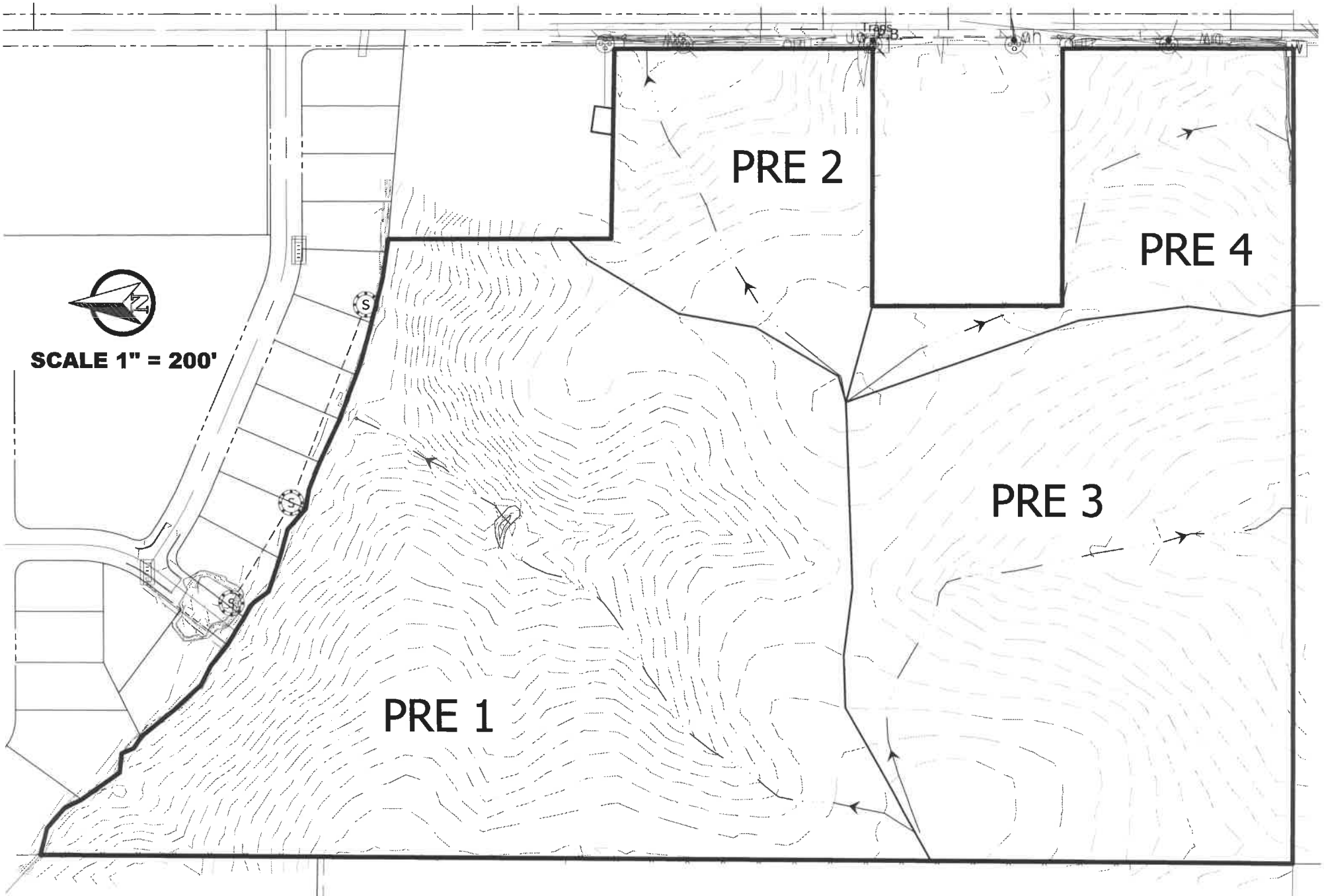
- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

APPENDIX 'B'

Pre-Developed Drainage Information B.01
Developed Drainage Information B.02
Drainage Calculations B.03
Form 800 B.04
Detention Calculations B0.5



MORLEY
ARCHITECTS | ENGINEERS | SURVEYORS

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Newburgh, IN 47630
812.464.9585 Phone
812.464.2514 Fax
morleycorp.com

Pre-Developed Subbasins

Eleanor's Place
13800 N Green River Road

Designed By:	Job Number:
JEM	11822
Drawn By:	Date:
CRS	4.26.2022
Filename:	
11822 Civil Base	

Peak Runoff Calculation

SUB-BASIN #1 Pre-Dev.

Project 11822

Area (Ac) = 19.97 **Area (Sf) =** 869,784

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%)		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%)	434,892	S.F.	=	9.98	AC.	0.35	3.49
Cultivated (5-10%)	434,892	S.F.	=	9.98	AC.	0.50	4.99
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
	869,784			19.97			8.49

Wc = 0.4250

Time of Concentration

Overland Flow

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

Slope, S = 1.07% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.170 Cultivated — t_o = 13.70 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 1081 feet — V = 16.1345*(S0.5)

Slope, S = 1.84% — = 2.189 ft/s = 131.32 ft/min

Velocity, V = 2.19 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 8.23 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 21.93 (Min 5 Minutes)

0.37 Hour

Intensity (Vanderburgh Co.)

I_2	**2.68**	**in/hr**
I_5	**3.15**	**in/hr**
I_{10} =	**3.55**	**in/hr**
I_{25}	**4.17**	**in/hr**
I_{50} =	**4.71**	**in/hr**
I_{100} =	**5.31**	**in/hr**

Peak Runoff Rate

Q_{yr} = CiA

Q_2	**22.76**	**cfs**
Q_5	**26.71**	**cfs**
Q_{10} =	**30.15**	**cfs**
Q_{25} =	**35.38**	**cfs**
Q_{50} =	**39.94**	**cfs**
Q_{100} =	**45.08**	**cfs**

Peak Runoff Calculation

SUB-BASIN #2 Pre-Dev.

Project 11822

Area (Ac) = 4.22 **Area (Sf) =** 183,753

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%)		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%)	183,753	S.F.	=	4.22	AC.	0.35	1.48
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
	183,753			4.22			1.48

Wc = 0.3500

Time of Concentration

Overland Flow

Length, L (max 100ft)	=	100	feet	t_o =	Overland Flow Tc	
Slope, S	=	0.73%		t_o =	$[0.42*(L^{0.8})*(n^{0.5})]/[P^{0.5})*(S^{0.4})]$	
Manning Coefficient, n	=	0.170	Cultivated	t_o =	15.96	min
$P_{2/24}$	=	3.3				

Shallow Flow

Length, L (Paved or Unpaved)	Unpaved	=	561	feet	V =	16.1345*(S0.5)		
Slope, S		=	2.14%		=	2.360 ft/s =	141.62	ft/min
Velocity, V		=	2.36	ft/sec	t_s =	Shallow Flow Tc		
					t_s =	(L/V) = 3.96	min	

Channel Flow

Length, L	=		feet	V =	$(1.49/n)*R^{0.67}*S^{0.5}$		
Difference in Elevation	=	0	to 0	=	ft/s =		ft/min
Slope, S	=			t_c =	Channel Flow Tc		
Manning Coefficient, n	=	0.000		t_c =	(L/V) = 0.00	min	
Wetted Perimeter, Wp	=	0	feet				
Area, A	=	0	sqft				
Hydraulic Radius, R	=						
Velocity, V	=		ft/s				

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 19.92 (Min 5 Minutes)

0.33 Hour

Intensity (Vanderburgh Co.)

I_2	**2.86**	**in/hr**
I_5	**3.35**	**in/hr**
I_{10} =	**3.78**	**in/hr**
I_{25}	**4.44**	**in/hr**
I_{50} =	**5.01**	**in/hr**
I_{100} =	**5.66**	**in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		**4.22**	**cfs**
Q_5		**4.95**	**cfs**
Q_{10}	=	**5.59**	**cfs**
Q_{25}	=	**6.56**	**cfs**
Q_{50}	=	**7.40**	**cfs**
Q_{100}	=	**8.35**	**cfs**

Peak Runoff Calculation

SUB-BASIN #3 Pre-Dev.

Project 11822

Area (Ac) = 12.93 **Area (Sf) =** 563,162

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%)		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%)	563,162	S.F.	=	12.93	AC.	0.35	4.52
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
	563,162			12.93			4.52

Wc = 0.3500

Time of Concentration

Overland Flow

Length, L (max 100ft)	=	100	feet	t_o =	Overland Flow Tc	
Slope, S	=	0.77%		t_o =	$[0.42*(L^{0.5})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$	
Manning Coefficient, n	=	0.170	Cultivated	t_o =	15.62	min
$P_{2/24}$	=	3.3				

Shallow Flow

Length, L (Paved or Unpaved)	Unpaved	=	893	feet	V =	16.1345*(S0.5)		
Slope, S		=	1.65%		=	2.073 ft/s =	124.35	ft/min
Velocity, V		=	2.07	ft/sec	t_s =	Shallow Flow Tc		
					t_s =	(L/V) = 7.18	min	

Channel Flow

Length, L	=		feet	V =	$(1.49/n)*R^{0.67}*S^{0.5}$		
Difference in Elevation	=	0	to 0	=	ft/s =		ft/min
Slope, S	=			t_c =	Channel Flow Tc		
Manning Coefficient, n	=	0.000		t_c =	(L/V) = 0.00	min	
Wetted Perimeter, Wp	=	0	feet				
Area, A	=	0	sqft				
Hydraulic Radius, R	=						
Velocity, V	=		ft/s				

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 22.80 (Min 5 Minutes)

0.38 Hour

Intensity (Vanderburgh Co.)

I_2		**2.61 in/hr**
I_5		**3.06 in/hr**
I_{10}	=	**3.46 in/hr**
I_{25}		**4.06 in/hr**
I_{50}	=	**4.58 in/hr**
I_{100}	=	**5.17 in/hr**

Peak Runoff Rate

Q_{yr} = CiA

Q_2		**11.81 cfs**
Q_5		**13.87 cfs**
Q_{10}	=	**15.65 cfs**
Q_{25}	=	**18.37 cfs**
Q_{50}	=	**20.73 cfs**
Q_{100}	=	**23.40 cfs**

Peak Runoff Calculation

SUB-BASIN #4 Pre-Dev.

Project 11822

Area (Ac) = 4.15 **Area (Sf) =** 180,685

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%)		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%)	180,685	S.F.	=	4.15	AC.	0.35	1.45
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
				4.15			1.45

Wc = 0.3500

Time of Concentration

Overland Flow

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

Slope, S = 0.75% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.170 Cultivated — t_o = 15.79 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 830 feet — V = 16.1345*(S0.5)

Slope, S = 1.53% — = 1.996 ft/s = 119.74 ft/min

Velocity, V = 2.00 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 6.93 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **22.72** **(Min 5 Minutes)**

0.38 **Hour**

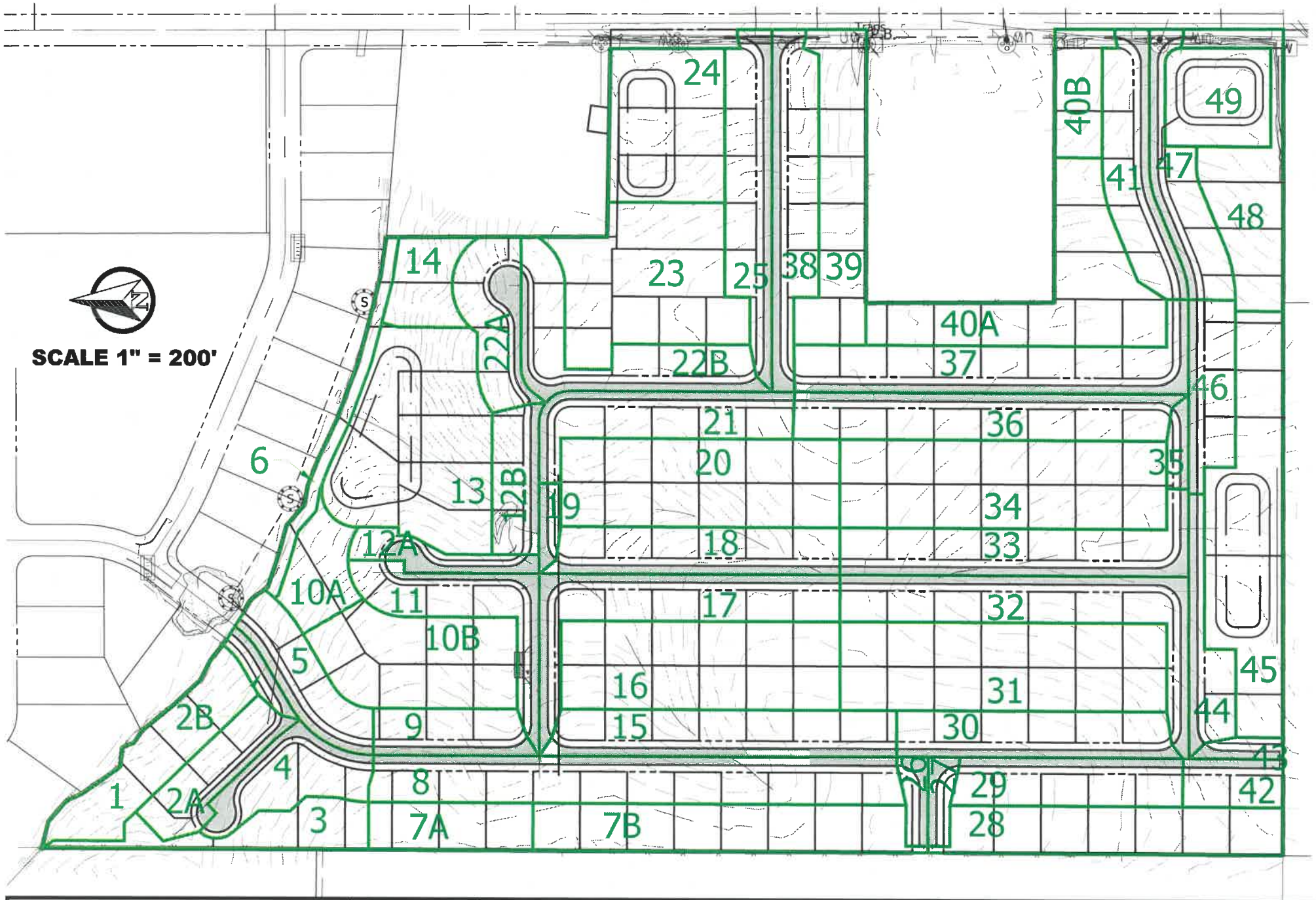
Intensity (Vanderburgh Co.)

I_2		**2.62** in/hr
I_5		**3.07** in/hr
I_{10}	=	**3.47** in/hr
I_{25}		**4.07** in/hr
I_{50}	=	**4.59** in/hr
I_{100}	=	**5.18** in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2		**3.80** cfs
Q_5		**4.46** cfs
Q_{10}	=	**5.03** cfs
Q_{25}	=	**5.91** cfs
Q_{50}	=	**6.67** cfs
Q_{100}	=	**7.53** cfs



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Post-Developed Subbasins

Eleanor's Place
13800 N Green River Road

Designed By:	Job Number:
JEM	11822
Drawn By:	Date:
CRS	4.26.2022
Filename:	
11822 Civil Base	

Peak Runoff Calculation

SUB-BASIN #1

Post-Developed **Project 11822**

Area (Ac) = **0.75** **Area (Sf) =** **32,485**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	2,000	S.F.	=	0.05	AC.	0.94	0.04
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)		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%)	20,985	S.F.	=	0.48	AC.	0.40	0.19
Lawn (>10%)	4,500	S.F.	=	0.10	AC.	0.55	0.06
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
	32,485			0.75			0.41

Wc = **0.5433**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 76 feet — t_o = Overland Flow Tc

Slope, S = 10.00% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 5.93 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 0 feet — V = 16.1345*(S0.5)

Slope, S = 0.00% — = 0.000 ft/s = 0.00 ft/min

Velocity, V = 0.00 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.00 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 5.93 (Min 5 Minutes)

0.10 Hour

Intensity (Vanderburgh Co.)

I_2 = 4.82 in/hr

I_5 = 5.66 in/hr

I_{10} = 6.39 in/hr

I_{25} = 7.49 in/hr

I_{50} = 8.46 in/hr

I_{100} = 9.55 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 1.95 cfs

Q_5 = 2.29 cfs

Q_{10} = 2.59 cfs

Q_{25} = 3.04 cfs

Q_{50} = 3.43 cfs

Q_{100} = 3.87 cfs

Peak Runoff Calculation

SUB-BASIN #2

Post-Developed **Project 11822**

Area (Ac) = **0.59** **Area (Sf) =** **25,860**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	7,500	S.F.	=	0.17	AC.	0.94	0.16
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	4,375	S.F.	=	0.10	AC.	0.98	0.10
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%)	13,985	S.F.	=	0.32	AC.	0.25	0.08
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
	25,860			0.59			0.34

Wc = **0.5736**

Time of Concentration

Overland Flow

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

Slope, S = 5.00% t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass t_o = 9.74 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Paved = 360 feet V = 20.3282*(S0.5)

Slope, S = 5.00% = 4.546 ft/s = 272.73 ft/min

Velocity, V = 4.55 ft/sec t_s = Shallow Flow Tc

t_s = (L/V) = 1.32 min

Channel Flow

Length, L = feet V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 = ft/s = ft/min

Slope, S = t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 11.06 (Min 5 Minutes)

0.18 Hour

Intensity (Vanderburgh Co.)

I_2 = 3.90 in/hr

I_5 = 4.58 in/hr

I_{10} = 5.17 in/hr

I_{25} = 6.06 in/hr

I_{50} = 6.84 in/hr

I_{100} = 7.73 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 1.33 cfs

Q_5 = 1.56 cfs

Q_{10} = 1.76 cfs

Q_{25} = 2.06 cfs

Q_{50} = 2.33 cfs

Q_{100} = 2.63 cfs

Peak Runoff Calculation

SUB-BASIN #2A

Post-Developed

Project 11822

Area (Ac) = 0.47 **Area (Sf) =** 20,688

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	6,000	S.F.	=	0.14	AC.	0.94	0.13
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	3,500	S.F.	=	0.08	AC.	0.98	0.08
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%)	11,188	S.F.	=	0.26	AC.	0.25	0.06
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
	20,688			0.47			0.27

Wc = 0.5736

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	65	feet		t_o =	Overland Flow Tc
Slope, S		=	5.00%			t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240	Grass		t_o =	6.90 min
$P_{2/24}$		=	3.3				

Shallow Flow

Length, L (Paved or Unpaved)	Paved	=	85	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) = 0.49 min

Channel Flow

Length, L		=		feet		V =	$(1.49/n)*R^{0.67}*S^{0.5}$
Difference in Elevation		=	0	to	0	=	ft/s = ft/min
Slope, S		=				t_c =	Channel Flow Tc
Manning Coefficient, n		=	0.000			t_c =	(L/V) = 0.00 min
Wetted Perimeter, Wp		=	0	feet			
Area, A		=	0	sqft			
Hydraulic Radius, R		=					
Velocity, V		=		ft/s			

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **7.39** **(Min 5 Minutes)**

0.12 **Hour**

Intensity (Vanderburgh Co.)

I_2		**4.52** **in/hr**
I_5		**5.31** **in/hr**
I_{10}	=	**5.99** **in/hr**
I_{25}		**7.03** **in/hr**
I_{50}	=	**7.94** **in/hr**
I_{100}	=	**8.96** **in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		**1.23** **cfs**
Q_5		**1.45** **cfs**
Q_{10}	=	**1.63** **cfs**
Q_{25}	=	**1.92** **cfs**
Q_{50}	=	**2.16** **cfs**
Q_{100}	=	**2.44** **cfs**

Peak Runoff Calculation

SUB-BASIN #2B

Post-Developed **Project 11822**

Area (Ac) = **0.12** **Area (Sf) =** **5,172**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	1,500	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%)	875	S.F.	=	0.02	AC.	0.98	0.02
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%)	2,797	S.F.	=	0.06	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
	5,172			0.12			0.07

Wc = **0.5736**

Time of Concentration

Overland Flow

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

Slope, S = 5.00% — t_o = $[0.42*(L^{0.6})*(n^{0.6})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.011 Grass — t_o = 0.83 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Paved = 45 feet — V = 20.3282*(S0.5)

Slope, S = 5.00% — = 4.546 ft/s = 272.73 ft/min

Velocity, V = 4.55 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.16 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **5.00** **(Min 5 Minutes)**

0.08 **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	**0.34**	**cfs**
Q_5	**0.40**	**cfs**
Q_{10} =	**0.45**	**cfs**
Q_{25} =	**0.53**	**cfs**
Q_{50} =	**0.60**	**cfs**
Q_{100} =	**0.68**	**cfs**

Peak Runoff Calculation

SUB-BASIN #3

Post-Developed **Project 11822**

Area (Ac) = **0.48** **Area (Sf) =** **20,745**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	1,500	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%)	3,750	S.F.	=	0.09	AC.	0.98	0.08
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%)	9,245	S.F.	=	0.21	AC.	0.40	0.08
Lawn (>10%)	6,250	S.F.	=	0.14	AC.	0.55	0.08
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
	20,745			0.48			0.28

Wc = **0.5891**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 80 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.6})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 8.15 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 0 feet — V = 16.1345*(S0.5)

Slope, S = 0.00% — = 0.000 ft/s = 0.00 ft/min

Velocity, V = 0.00 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.00 min

Channel Flow

Length, L = 520 feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 405.2 to 400 — = 3.027 ft/s = 181.59 ft/min

Slope, S = 1.00% — t_c = Channel Flow Tc

Manning Coefficient, n = 0.035 — t_c = (L/V) = 2.86 min

Wetted Perimeter, Wp = 8.32 feet

Area, A = 5 sqft

Hydraulic Radius, R = 0.60

Velocity, V = 3.03 ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 11.01 (Min 5 Minutes)

0.18 Hour

Intensity (Vanderburgh Co.)

I_2 = 3.91 in/hr

I_5 = 4.59 in/hr

I_{10} = 5.18 in/hr

I_{25} = 6.08 in/hr

I_{50} = 6.86 in/hr

I_{100} = 7.74 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 1.10 cfs

Q_5 = 1.29 cfs

Q_{10} = 1.45 cfs

Q_{25} = 1.70 cfs

Q_{50} = 1.92 cfs

Q_{100} = 2.17 cfs

Peak Runoff Calculation

SUB-BASIN #4

Post-Developed

Project 11822

Area (Ac) = **0.55** **Area (Sf) =** **23,965**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	7,500	S.F.	=	0.17	AC.	0.94	0.16
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	3,125	S.F.	=	0.07	AC.	0.98	0.07
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%)	13,340	S.F.	=	0.31	AC.	0.25	0.08
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
	23,965			0.55			0.31

Wc = **0.5611**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 60 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 6.47 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Paved = 130 feet — V = 20.3282*(S0.5)

Slope, S = 5.00% — = 4.546 ft/s = 272.73 ft/min

Velocity, V = 4.55 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.48 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 6.95 (Min 5 Minutes)

0.12 Hour

Intensity (Vanderburgh Co.)

I_2		**4.61 in/hr**
I_5		**5.41 in/hr**
I_{10}	=	**6.11 in/hr**
I_{25}		**7.17 in/hr**
I_{50}	=	**8.09 in/hr**
I_{100}	=	**9.13 in/hr**

Peak Runoff Rate

Q_{yr} = CiA

Q_2		**1.42 cfs**
Q_5		**1.67 cfs**
Q_{10}	=	**1.89 cfs**
Q_{25}	=	**2.21 cfs**
Q_{50}	=	**2.50 cfs**
Q_{100}	=	**2.82 cfs**

Peak Runoff Calculation

SUB-BASIN #5

Post-Developed

Project 11822

Area (Ac) = 0.51 **Area (Sf) =** 22,015

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	6,100	S.F.	=	0.14	AC.	0.94	0.13
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	3,750	S.F.	=	0.09	AC.	0.98	0.08
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%)	12,165	S.F.	=	0.28	AC.	0.40	0.11
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
	22,015			0.51			0.33

Wc = **0.6484**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	60	feet	t_o	=	Overland Flow Tc
Slope, S		=	5.00%		t_o	=	$[0.42*(L^{0.8})*(n^{0.5})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240	Grass	t_o	=	6.47 min
$P_{2/24}$		=	3.3				

Shallow Flow

Length, L (Paved or Unpaved)	Unpaved	=	300	feet	V	=	16.1345*(S0.5)
Slope, S		=	5.00%			=	3.608 ft/s = 216.47 ft/min
Velocity, V		=	3.61	ft/sec	t_s	=	Shallow Flow Tc
					t_s	=	(L/V) = 1.39 min

Channel Flow

Length, L		=		feet	V	=	$(1.49/n)*R^{0.67}*S^{0.5}$
Difference in Elevation		=	0	to 0		=	ft/s = ft/min
Slope, S		=			t_c	=	Channel Flow Tc
Manning Coefficient, n		=	0.000		t_c	=	(L/V) = 0.00 min
Wetted Perimeter, Wp		=	0	feet			
Area, A		=	0	sqft			
Hydraulic Radius, R		=					
Velocity, V		=		ft/s			

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 7.86 (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}		6.90	in/hr
I_{50}	=	7.79	in/hr
I_{100}	=	8.79	in/hr

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		1.45	cfs
Q_5		1.71	cfs
Q_{10}	=	1.93	cfs
Q_{25}	=	2.26	cfs
Q_{50}	=	2.55	cfs
Q_{100}	=	2.88	cfs

Peak Runoff Calculation

SUB-BASIN #6

Post-Developed

Project 11822

Area (Ac) = 0.28 **Area (Sf) =** 12,135

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%)		S.F.	=	0.00	AC.	0.25	0.00
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)	12,135	S.F.	=	0.28	AC.	0.55	0.15
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
	12,135			0.28			0.15

Wc = 0.5500

Time of Concentration

Overland Flow

Length, L (max 100ft) = 20 feet — t_o = Overland Flow Tc

Slope, S = 10.00% — t_o = $[0.42*(L^{0.8})*(n^{0.6})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 2.04 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 0 feet — V = 16.1345*(S0.5)

Slope, S = 0.00% — = 0.000 ft/s = 0.00 ft/min

Velocity, V = 0.00 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.00 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **5.00 (Min 5 Minutes)**

0.08 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	0.77	cfs
Q_5	0.90	cfs
Q_{10} =	1.02	cfs
Q_{25} =	1.20	cfs
Q_{50} =	1.35	cfs
Q_{100} =	1.52	cfs

Peak Runoff Calculation

SUB-BASIN #7 (7A+7B)

Post-Developed **Project 11822**

Area (Ac) = **1.48** **Area (Sf) =** **64,665**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	5,750	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%)	14,375	S.F.	=	0.33	AC.	0.98	0.32
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%)	33,790	S.F.	=	0.78	AC.	0.25	0.19
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)	10,750	S.F.	=	0.25	AC.	0.55	0.14
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
	64,665			1.48			0.78

Wc = **0.5235**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	85	feet		t_o	=	Overland Flow Tc
Slope, S		=	5.00%			t_o	=	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240	Grass		t_o	=	8.55 min
$P_{2/24}$		=	3.3					

Shallow Flow

Length, L (Paved or Unpaved)	Unpaved	=	0	feet		V	=	16.1345*(S0.5)		
Slope, S		=	0.00%				=	0.000 ft/s =	0.00	ft/min
Velocity, V		=	0.00	ft/sec		t_s	=	Shallow Flow Tc		
						t_s	=	(L/V) = 0.00 min		

Channel Flow

Length, L		=	545	feet		V	=	$(1.49/n)*R^{0.67}*S^{0.5}$		
Difference in Elevation		=	405.45	to	400		=	3.027 ft/s =	181.59	ft/min
Slope, S		=	1.00%			t_c	=	Channel Flow Tc		
Manning Coefficient, n		=	0.035			t_c	=	(L/V) = 3.00 min		
Wetted Perimeter, Wp		=	8.32	feet						
Area, A		=	5	sqft						
Hydraulic Radius, R		=	0.60							
Velocity, V		=	3.03	ft/s						

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 11.55 (Min 5 Minutes)

0.19 Hour

Intensity (Vanderburgh Co.)

I_2		**3.83 in/hr**
I_5		**4.49 in/hr**
I_{10}	=	**5.07 in/hr**
I_{25}		**5.95 in/hr**
I_{50}	=	**6.72 in/hr**
I_{100}	=	**7.58 in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		**2.97 cfs**
Q_5		**3.49 cfs**
Q_{10}	=	**3.94 cfs**
Q_{25}	=	**4.62 cfs**
Q_{50}	=	**5.22 cfs**
Q_{100}	=	**5.89 cfs**

Peak Runoff Calculation

SUB-BASIN #7A

Post-Developed **Project 11822**

Area (Ac) = 0.45 **Area (Sf) =** 19,400

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	1,725	S.F.	=	0.04	AC.	0.94	0.04
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	4,313	S.F.	=	0.10	AC.	0.98	0.10
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%)	10,137	S.F.	=	0.23	AC.	0.25	0.06
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)	3,225	S.F.	=	0.07	AC.	0.55	0.04
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
	19,400			0.45			0.23

Wc = **0.5235**

Time of Concentration

Overland Flow

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

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.5})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 8.55 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 0 feet — V = 16.1345*(S0.5)

Slope, S = 0.00% — = 0.000 ft/s = 0.00 ft/min

Velocity, V = 0.00 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.00 min

Channel Flow

Length, L = 265 feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 423.08 to 421.7 — = 2.184 ft/s = 131.04 ft/min

Slope, S = 0.52% — t_c = Channel Flow Tc

Manning Coefficient, n = 0.035 — t_c = (L/V) = 2.02 min

Wetted Perimeter, Wp = 8.32 feet

Area, A = 5 sqft

Hydraulic Radius, R = 0.60

Velocity, V = 2.18 ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **10.58** **(Min 5 Minutes)**

0.18 **Hour**

Intensity (Vanderburgh Co.)

I_2	**3.97**	**in/hr**
I_5	**4.66**	**in/hr**
I_{10} =	**5.27**	**in/hr**
I_{25}	**6.18**	**in/hr**
I_{50} =	**6.97**	**in/hr**
I_{100} =	**7.87**	**in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

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 #7B

Post-Developed **Project 11822**

Area (Ac) = **1.04** **Area (Sf) =** **45,266**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	4,025	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%)	10,063	S.F.	=	0.23	AC.	0.98	0.23
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%)	23,653	S.F.	=	0.54	AC.	0.25	0.14
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)	7,525	S.F.	=	0.17	AC.	0.55	0.10
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
	45,266			1.04			0.54

Wc = **0.5235**

Time of Concentration

Overland Flow

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

Slope, S = 5.00% — t_o = $[0.42*(L^{0.5})*(n^{0.5})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 8.55 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 0 feet — V = 16.1345*(S0.5)

Slope, S = 0.00% — = 0.000 ft/s = 0.00 ft/min

Velocity, V = 0.00 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.00 min

Channel Flow

Length, L = 545 feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 423.32 to 421.7 — = 1.650 ft/s = 99.00 ft/min

Slope, S = 0.30% — t_c = Channel Flow Tc

Manning Coefficient, n = 0.035 — t_c = (L/V) = 5.50 min

Wetted Perimeter, Wp = 8.32 feet

Area, A = 5 sqft

Hydraulic Radius, R = 0.60

Velocity, V = 1.65 ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 14.06 (Min 5 Minutes)

0.23 Hour

Intensity (Vanderburgh Co.)

I_2 = 3.49 in/hr

I_5 = 4.09 in/hr

I_{10} = 4.62 in/hr

I_{25} = 5.42 in/hr

I_{50} = 6.12 in/hr

I_{100} = 6.91 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 1.90 cfs

Q_5 = 2.23 cfs

Q_{10} = 2.51 cfs

Q_{25} = 2.95 cfs

Q_{50} = 3.33 cfs

Q_{100} = 3.76 cfs

Peak Runoff Calculation

SUB-BASIN #8

Post-Developed

Project 11822

Area (Ac) = 1.45 **Area (Sf) =** 63,375

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	17,900	S.F.	=	0.41	AC.	0.94	0.39
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	14,375	S.F.	=	0.33	AC.	0.98	0.32
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%)	31,100	S.F.	=	0.71	AC.	0.25	0.18
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
	63,375			1.45			0.89

Wc = 0.6105

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	65	feet	t_o =	Overland Flow Tc	
Slope, S		=	5.00%		t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$	
Manning Coefficient, n		=	0.240	Grass	t_o =	6.90	min
$P_{2/24}$		=	3.3				

Shallow Flow

Length, L (Paved or Unpaved)	paved	=	720	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) = 4.17	min	

Channel Flow

Length, L		=		feet	V =	$(1.49/n)*R^{0.67}*S^{0.5}$		
Difference in Elevation		=	0	to 0	=	ft/s =		ft/min
Slope, S		=			t_c =	Channel Flow Tc		
Manning Coefficient, n		=	0.000		t_c =	(L/V) = 0.00	min	
Wetted Perimeter, Wp		=	0	feet				
Area, A		=	0	sqft				
Hydraulic Radius, R		=						
Velocity, V		=		ft/s				

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 11.08 (Min 5 Minutes)

0.18 Hour

Intensity (Vanderburgh Co.)

I_2	3.90	in/hr
I_5	4.57	in/hr
I_{10} =	5.16	in/hr
I_{25}	6.06	in/hr
I_{50} =	6.84	in/hr
I_{100} =	7.72	in/hr

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2	3.46	cfs
Q_5	4.06	cfs
Q_{10} =	4.59	cfs
Q_{25} =	5.38	cfs
Q_{50} =	6.08	cfs
Q_{100} =	6.86	cfs

Peak Runoff Calculation

SUB-BASIN #9

Post-Developed **Project 11822**

Area (Ac) = **0.42** **Area (Sf) =** **18,350**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	5,350	S.F.	=	0.12	AC.	0.94	0.12
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	3,750	S.F.	=	0.09	AC.	0.98	0.08
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%)	9,250	S.F.	=	0.21	AC.	0.25	0.05
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
	18,350			0.42			0.25

Wc = **0.6004**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 65 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.5})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 6.90 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 250 feet — V = 16.1345*(S0.5)

Slope, S = 2.00% — = 2.282 ft/s = 136.91 ft/min

Velocity, V = 2.28 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 1.83 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 8.73 (Min 5 Minutes)

0.15 Hour

Intensity (Vanderburgh Co.)

I_2	**4.28**	**in/hr**
I_5	**5.02**	**in/hr**
I_{10} =	**5.67**	**in/hr**
I_{25}	**6.65**	**in/hr**
I_{50} =	**7.51**	**in/hr**
I_{100} =	**8.48**	**in/hr**

Peak Runoff Rate

Q_{yr} = CiA

Q_2	**1.08**	**cfs**
Q_5	**1.27**	**cfs**
Q_{10} =	**1.43**	**cfs**
Q_{25} =	**1.68**	**cfs**
Q_{50} =	**1.90**	**cfs**
Q_{100} =	**2.14**	**cfs**

Peak Runoff Calculation

SUB-BASIN #10 (10A+10B)
Post-Developed

Project 11822

Area (Ac) = **1.44** **Area (Sf) =** **62,560**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	5,000	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%)	12,500	S.F.	=	0.29	AC.	0.98	0.28
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%)	39,960	S.F.	=	0.92	AC.	0.40	0.37
Lawn (>10%)	5,100	S.F.	=	0.12	AC.	0.55	0.06
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
	62,560			1.44			0.82

Wc = **0.5713**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	85	feet		t_o	=	Overland Flow Tc
Slope, S		=	5.00%			t_o	=	$[0.42*(L^{0.6})*(n^{0.6})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240	Grass		t_o	=	8.55 min
$P_{2/24}$		=	3.3					

Shallow Flow

Length, L (Paved or Unpaved)	Unpaved	=	0	feet		V	=	16.1345*(S0.5)
Slope, S		=	0.00%				=	0.000 ft/s = 0.00 ft/min
Velocity, V		=	0.00	ft/sec		t_s	=	Shallow Flow Tc
						t_s	=	(L/V) = 0.00 min

Channel Flow

Length, L		=	390	feet		V	=	$(1.49/n)*R^{0.67}*S^{0.5}$
Difference in Elevation		=	403.9	to	400		=	3.027 ft/s = 181.59 ft/min
Slope, S		=	1.00%			t_c	=	Channel Flow Tc
Manning Coefficient, n		=	0.035			t_c	=	(L/V) = 2.15 min
Wetted Perimeter, Wp		=	8.32	feet				
Area, A		=	5	sqft				
Hydraulic Radius, R		=	0.60					
Velocity, V		=	3.03	ft/s				

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 10.70 (Min 5 Minutes)

0.18 Hour

Intensity (Vanderburgh Co.)

I_2		**3.96**	**in/hr**
I_5		**4.64**	**in/hr**
I_{10}	=	**5.24**	**in/hr**
I_{25}		**6.15**	**in/hr**
I_{50}	=	**6.94**	**in/hr**
I_{100}	=	**7.83**	**in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		**3.25**	**cfs**
Q_5		**3.81**	**cfs**
Q_{10}	=	**4.30**	**cfs**
Q_{25}	=	**5.04**	**cfs**
Q_{50}	=	**5.69**	**cfs**
Q_{100}	=	**6.43**	**cfs**

Peak Runoff Calculation

SUB-BASIN #10A

Post-Developed

Project 11822

Area (Ac) = 0.39 **Area (Sf) =** 16,891

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	1,350	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%)	3,375	S.F.	=	0.08	AC.	0.98	0.08
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%)	10,789	S.F.	=	0.25	AC.	0.40	0.10
Lawn (>10%)	1,377	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		S.F.	=	0.00	AC.	1.00	0.00
	16,891			0.39			0.22

Wc = 0.5713

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	80	feet		t_o	=	Overland Flow Tc
Slope, S		=	2.00%			t_o	=	$[0.42*(L^{0.8})*(n^{0.5})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240	Grass		t_o	=	11.75 min
$P_{2/24}$		=	3.3					

Shallow Flow

Length, L (Paved or Unpaved)	Unpaved	=	20	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) = 0.04 min		

Channel Flow

Length, L		=		feet		V	=	$(1.49/n)*R^{0.67}*S^{0.5}$	
Difference in Elevation		=	0	to	400		=	ft/s =	ft/min
Slope, S		=				t_c	=	Channel Flow Tc	
Manning Coefficient, n		=	0.000			t_c	=	(L/V) = 0.00 min	
Wetted Perimeter, Wp		=	0	feet					
Area, A		=	0	sqft					
Hydraulic Radius, R		=							
Velocity, V		=		ft/s					

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 11.80 (Min 5 Minutes)

0.20 Hour

Intensity (Vanderburgh Co.)

I_2		**3.79 in/hr**
I_5		**4.45 in/hr**
I_{10}	=	**5.02 in/hr**
I_{25}		**5.89 in/hr**
I_{50}	=	**6.65 in/hr**
I_{100}	=	**7.51 in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		**0.84 cfs**
Q_5		**0.99 cfs**
Q_{10}	=	**1.11 cfs**
Q_{25}	=	**1.31 cfs**
Q_{50}	=	**1.47 cfs**
Q_{100}	=	**1.66 cfs**

Peak Runoff Calculation

SUB-BASIN #10B

Post-Developed

Project 11822

Area (Ac) = 1.05 **Area (Sf) =** 45,669

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	3,650	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%)	9,125	S.F.	=	0.21	AC.	0.98	0.21
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%)	29,171	S.F.	=	0.67	AC.	0.40	0.27
Lawn (>10%)	3,723	S.F.	=	0.09	AC.	0.55	0.05
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
	45,669			1.05			0.60

Wc = 0.5713

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	85	feet		t_o	=	Overland Flow Tc	
Slope, S		=	5.00%			t_o	=	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$	
Manning Coefficient, n		=	0.240	Grass		t_o	=	8.55	min
$P_{2/24}$		=	3.3						

Shallow Flow

Length, L (Paved or Unpaved)	Unpaved	=	0	feet		V	=	16.1345*(S0.5)	
Slope, S		=	0.00%				=	0.000 ft/s =	0.00 ft/min
Velocity, V		=	0.00	ft/sec		t_s	=	Shallow Flow Tc	
						t_s	=	(L/V) = 0.00	min

Channel Flow

Length, L		=	285	feet		V	=	$(1.49/n)*R^{0.67}*S^{0.5}$	
Difference in Elevation		=	412.28	to	410		=	2.707 ft/s =	162.42 ft/min
Slope, S		=	0.80%			t_c	=	Channel Flow Tc	
Manning Coefficient, n		=	0.035			t_c	=	(L/V) = 1.75	min
Wetted Perimeter, Wp		=	8.32	feet					
Area, A		=	5	sqft					
Hydraulic Radius, R		=	0.60						
Velocity, V		=	2.71	ft/s					

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 10.31 (Min 5 Minutes)

0.17 Hour

Intensity (Vanderburgh Co.)

I_2		**4.02 in/hr**
I_5		**4.71 in/hr**
I_{10}	=	**5.32 in/hr**
I_{25}		**6.24 in/hr**
I_{50}	=	**7.05 in/hr**
I_{100}	=	**7.96 in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		**2.41 cfs**
Q_5		**2.82 cfs**
Q_{10}	=	**3.19 cfs**
Q_{25}	=	**3.74 cfs**
Q_{50}	=	**4.22 cfs**
Q_{100}	=	**4.76 cfs**

Peak Runoff Calculation

SUB-BASIN #11

Post-Developed **Project 11822**

Area (Ac) = **0.64** **Area (Sf) =** **28,005**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	9,150	S.F.	=	0.21	AC.	0.94	0.20
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	4,375	S.F.	=	0.10	AC.	0.98	0.10
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%)	14,480	S.F.	=	0.33	AC.	0.25	0.08
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
	28,005			0.64			0.38

Wc = **0.5895**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 58 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.6})*(n^{0.5})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 6.30 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Paved = 230 feet — V = 20.3282*(S0.5)

Slope, S = 1.00% — = 2.033 ft/s = 121.97 ft/min

Velocity, V = 2.03 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 1.89 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 8.19 (Min 5 Minutes)

0.14 Hour

Intensity (Vanderburgh Co.)

I_2 = 4.38 in/hr

I_5 = 5.14 in/hr

I_{10} = 5.80 in/hr

I_{25} = 6.80 in/hr

I_{50} = 7.68 in/hr

I_{100} = 8.67 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 1.66 cfs

Q_5 = 1.95 cfs

Q_{10} = 2.20 cfs

Q_{25} = 2.58 cfs

Q_{50} = 2.91 cfs

Q_{100} = 3.29 cfs

Peak Runoff Calculation

SUB-BASIN #12 (12A+12B)

Post-Developed **Project 11822**

Area (Ac) = **0.68** **Area (Sf) =** **29,495**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	9,100	S.F.	=	0.21	AC.	0.94	0.20
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	3,750	S.F.	=	0.09	AC.	0.98	0.08
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%)	16,645	S.F.	=	0.38	AC.	0.25	0.10
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
	29,495			0.68			0.38

Wc = **0.5557**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 58 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.6})*(n^{0.6})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 6.30 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Paved = 325 feet — V = 20.3282*(S0.5)

Slope, S = 1.00% — = 2.033 ft/s = 121.97 ft/min

Velocity, V = 2.03 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 2.66 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 8.96 (Min 5 Minutes)

0.15 Hour

Intensity (Vanderburgh Co.)

I_2		**4.24 in/hr**
I_5		**4.97 in/hr**
I_{10}	=	**5.62 in/hr**
I_{25}		**6.59 in/hr**
I_{50}	=	**7.44 in/hr**
I_{100}	=	**8.40 in/hr**

Peak Runoff Rate

Q_{yr} = CiA

Q_2		**1.59 cfs**
Q_5		**1.87 cfs**
Q_{10}	=	**2.11 cfs**
Q_{25}	=	**2.48 cfs**
Q_{50}	=	**2.80 cfs**
Q_{100}	=	**3.16 cfs**

Peak Runoff Calculation

SUB-BASIN #12A

Post-Developed **Project 11822**

Area (Ac) = 0.41 **Area (Sf) =** 17,697

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	5,460	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%)	2,250	S.F.	=	0.05	AC.	0.98	0.05
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%)	9,987	S.F.	=	0.23	AC.	0.25	0.06
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
	17,697			0.41			0.23

Wc = 0.5557

Time of Concentration

Overland Flow

Length, L (max 100ft) = 35 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.5})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 4.21 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Paved = 250 feet — V = 20.3282*(S0.5)

Slope, S = 0.70% — = 1.701 ft/s = 102.05 ft/min

Velocity, V = 1.70 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 2.45 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 6.66 (Min 5 Minutes)

0.11 Hour

Intensity (Vanderburgh Co.)

I_2 = 4.67 in/hr

I_5 = 5.48 in/hr

I_{10} = 6.19 in/hr

I_{25} = 7.26 in/hr

I_{50} = 8.19 in/hr

I_{100} = 9.25 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 1.05 cfs

Q_5 = 1.24 cfs

Q_{10} = 1.40 cfs

Q_{25} = 1.64 cfs

Q_{50} = 1.85 cfs

Q_{100} = 2.09 cfs

Peak Runoff Calculation

SUB-BASIN #12B

Post-Developed **Project 11822**

Area (Ac) = **0.27** **Area (Sf) =** **11,798**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	3,640	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%)	1,500	S.F.	=	0.03	AC.	0.98	0.03
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%)	6,658	S.F.	=	0.15	AC.	0.25	0.04
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
	11,798			0.27			0.15

Wc = **0.5557**

Time of Concentration

Overland Flow

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

Slope, S = 4.00% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.011 Pavement — t_o = 0.90 min

$P_{2/24}$ = 3.3

Shallow Flow

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

Slope, S = 4.00% — = 4.066 ft/s = 243.94 ft/min

Velocity, V = 4.07 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.29 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 5.00 (Min 5 Minutes)

0.08 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 = 0.76 cfs

Q_5 = 0.89 cfs

Q_{10} = 1.00 cfs

Q_{25} = 1.18 cfs

Q_{50} = 1.33 cfs

Q_{100} = 1.50 cfs

Peak Runoff Calculation

SUB-BASIN #13
Post-Developed

Project 11822

Area (Ac) = 1.72 **Area (Sf) =** 75,060

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	2,500	S.F.	=	0.06	AC.	0.94	0.05
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	6,250	S.F.	=	0.14	AC.	0.98	0.14
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%)	48,310	S.F.	=	1.11	AC.	0.40	0.44
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	18,000	S.F.	=	0.41	AC.	1.00	0.41
	75,060			1.72			1.05

Wc = 0.6102

Time of Concentration

Overland Flow

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

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 9.74 min

$P_{2/24}$ = 3.3

Shallow Flow

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

Slope, S = 5.00% — = 3.608 ft/s = 216.47 ft/min

Velocity, V = 3.61 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.32 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 10.06 (Min 5 Minutes)

0.17 Hour

Intensity (Vanderburgh Co.)

I_2	4.06	in/hr
I_5	4.76	in/hr
I_{10} =	5.37	in/hr
I_{25}	6.31	in/hr
I_{50} =	7.12	in/hr
I_{100} =	8.03	in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2	4.26	cfs
Q_5	5.00	cfs
Q_{10} =	5.65	cfs
Q_{25} =	6.63	cfs
Q_{50} =	7.48	cfs
Q_{100} =	8.45	cfs

Peak Runoff Calculation

SUB-BASIN #14

Post-Developed **Project 11822**

Area (Ac) = **0.35** **Area (Sf) =** **15,340**

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%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	3,610	S.F.	=	0.08	AC.	0.98	0.08
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%)	10,730	S.F.	=	0.25	AC.	0.40	0.10
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
	15,340			0.35			0.20

Wc = **0.5717**

Time of Concentration

Overland Flow

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

Slope, S = 10.00% — t_o = $[0.42*(L^{0.8})*(n^{0.5})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 7.38 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 40 feet — V = 16.1345*(S0.5)

Slope, S = 10.00% — = 5.102 ft/s = 306.13 ft/min

Velocity, V = 5.10 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.13 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **7.51** **(Min 5 Minutes)**

0.13 **Hour**

Intensity (Vanderburgh Co.)

I_2 **4.50 in/hr**

I_5 **5.28 in/hr**

I_{10} = **5.96 in/hr**

I_{25} **7.00 in/hr**

I_{50} = **7.90 in/hr**

I_{100} = **8.92 in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2 **0.91 cfs**

Q_5 **1.06 cfs**

Q_{10} = **1.20 cfs**

Q_{25} = **1.41 cfs**

Q_{50} = **1.59 cfs**

Q_{100} = **1.80 cfs**

Peak Runoff Calculation

SUB-BASIN #15

Post-Developed **Project 11822**

Area (Ac) = **0.95** **Area (Sf) =** **41,235**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	11,775	S.F.	=	0.27	AC.	0.94	0.25
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	8,750	S.F.	=	0.20	AC.	0.98	0.20
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%)	20,710	S.F.	=	0.48	AC.	0.25	0.12
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
	41,235			0.95			0.57

Wc = **0.6019**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 65 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.5})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 6.90 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 550 feet — V = 16.1345*(S0.5)

Slope, S = 2.00% — = 2.282 ft/s = 136.91 ft/min

Velocity, V = 2.28 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 4.02 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **10.92** **(Min 5 Minutes)**

0.18 **Hour**

Intensity (Vanderburgh Co.)

I_2	**3.92**	**in/hr**
I_5	**4.60**	**in/hr**
I_{10} =	**5.20**	**in/hr**
I_{25}	**6.10**	**in/hr**
I_{50} =	**6.88**	**in/hr**
I_{100} =	**7.77**	**in/hr**

Peak Runoff Rate

Q_{yr} = CiA

Q_2	**2.23**	**cfs**
Q_5	**2.62**	**cfs**
Q_{10} =	**2.96**	**cfs**
Q_{25} =	**3.47**	**cfs**
Q_{50} =	**3.92**	**cfs**
Q_{100} =	**4.43**	**cfs**

Peak Runoff Calculation

SUB-BASIN #16

Post-Developed **Project 11822**

Area (Ac) = **1.43** **Area (Sf) =** **62,300**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	6,000	S.F.	=	0.14	AC.	0.94	0.13
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	15,000	S.F.	=	0.34	AC.	0.98	0.34
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%)	35,975	S.F.	=	0.83	AC.	0.25	0.21
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)	5,325	S.F.	=	0.12	AC.	0.55	0.07
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
	62,300			1.43			0.74

Wc = **0.5179**

Time of Concentration

Overland Flow

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

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 8.55 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 0 feet — V = 16.1345*(S0.5)

Slope, S = 0.00% — = 0.000 ft/s = 0.00 ft/min

Velocity, V = 0.00 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.00 min

Channel Flow

Length, L = 385 feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 403.85 to 400 — = 3.027 ft/s = 181.59 ft/min

Slope, S = 1.00% — t_c = Channel Flow Tc

Manning Coefficient, n = 0.035 — t_c = (L/V) = 2.12 min

Wetted Perimeter, Wp = 8.32 feet

Area, A = 5 sqft

Hydraulic Radius, R = 0.60

Velocity, V = 3.03 ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 10.67 (Min 5 Minutes)

0.18 Hour

Intensity (Vanderburgh Co.)

I_2 = 3.96 in/hr

I_5 = 4.65 in/hr

I_{10} = 5.25 in/hr

I_{25} = 6.16 in/hr

I_{50} = 6.95 in/hr

I_{100} = 7.84 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2 = 2.93 cfs

Q_5 = 3.44 cfs

Q_{10} = 3.88 cfs

Q_{25} = 4.56 cfs

Q_{50} = 5.15 cfs

Q_{100} = 5.81 cfs

Peak Runoff Calculation

SUB-BASIN #17

Post-Developed **Project 11822**

Area (Ac) = **0.97** **Area (Sf) =** **42,420**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	14,200	S.F.	=	0.33	AC.	0.94	0.31
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	7,500	S.F.	=	0.17	AC.	0.98	0.17
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%)	20,720	S.F.	=	0.48	AC.	0.25	0.12
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
	42,420			0.97			0.59

Wc = **0.6100**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 65 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.6})*(n^{0.6})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 6.90 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Paved = 455 feet — V = 20.3282*(S0.5)

Slope, S = 1.00% — = 2.033 ft/s = 121.97 ft/min

Velocity, V = 2.03 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 3.73 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 10.63 (Min 5 Minutes)

0.18 Hour

Intensity (Vanderburgh Co.)

I_2		**3.97 in/hr**
I_5		**4.65 in/hr**
I_{10}	=	**5.25 in/hr**
I_{25}		**6.17 in/hr**
I_{50}	=	**6.96 in/hr**
I_{100}	=	**7.86 in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		**2.36 cfs**
Q_5		**2.77 cfs**
Q_{10}	=	**3.12 cfs**
Q_{25}	=	**3.66 cfs**
Q_{50}	=	**4.13 cfs**
Q_{100}	=	**4.67 cfs**

Peak Runoff Calculation

SUB-BASIN #18

Post-Developed **Project 11822**

Area (Ac) = **0.78** **Area (Sf) =** **34,055**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	10,000	S.F.	=	0.23	AC.	0.94	0.22
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	7,500	S.F.	=	0.17	AC.	0.98	0.17
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%)	16,555	S.F.	=	0.38	AC.	0.25	0.10
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
	34,055			0.78			0.48

Wc = **0.6134**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 65 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 6.90 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Paved = 455 feet — V = 20.3282*(S0.5)

Slope, S = 1.00% — = 2.033 ft/s = 121.97 ft/min

Velocity, V = 2.03 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 3.73 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 10.63 (Min 5 Minutes)

0.18 Hour

Intensity (Vanderburgh Co.)

I_2		**3.97 in/hr**
I_5		**4.65 in/hr**
I_{10}	=	**5.25 in/hr**
I_{25}		**6.17 in/hr**
I_{50}	=	**6.96 in/hr**
I_{100}	=	**7.86 in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		**1.90 cfs**
Q_5		**2.23 cfs**
Q_{10}	=	**2.52 cfs**
Q_{25}	=	**2.96 cfs**
Q_{50}	=	**3.34 cfs**
Q_{100}	=	**3.77 cfs**

Peak Runoff Calculation

SUB-BASIN #19

Post-Developed **Project 11822**

Area (Ac) = **0.10** **Area (Sf) =** **4,330**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	2,100	S.F.	=	0.05	AC.	0.94	0.05
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%)	2,230	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
	4,330			0.10			0.06

Wc = **0.5846**

Time of Concentration

Overland Flow

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

Slope, S = 2.00% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.011 Pavement — t_o = **1.19** min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 0 feet — V = 16.1345*(S0.5)

Slope, S = 0.00% — = 0.000 ft/s = 0.00 ft/min

Velocity, V = 0.00 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.00 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **5.00** **(Min 5 Minutes)**

0.08 **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		**0.29** **cfs**
Q_5		**0.34** **cfs**
Q_{10}	=	**0.39** **cfs**
Q_{25}	=	**0.45** **cfs**
Q_{50}	=	**0.51** **cfs**
Q_{100}	=	**0.58** **cfs**

Peak Runoff Calculation

SUB-BASIN #20

Post-Developed **Project 11822**

Area (Ac) = **1.43** **Area (Sf) =** **62,300**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	6,000	S.F.	=	0.14	AC.	0.94	0.13
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	15,000	S.F.	=	0.34	AC.	0.98	0.34
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%)	35,975	S.F.	=	0.83	AC.	0.25	0.21
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)	5,325	S.F.	=	0.12	AC.	0.55	0.07
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
	62,300			1.43			0.74

Wc = **0.5179**

Time of Concentration

Overland Flow

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

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.5})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 8.55 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 0 feet — V = 16.1345*(S0.5)

Slope, S = 0.00% — = 0.000 ft/s = 0.00 ft/min

Velocity, V = 0.00 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.00 min

Channel Flow

Length, L = 385 feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 403.85 to 400 — = 3.027 ft/s = 181.59 ft/min

Slope, S = 1.00% — t_c = Channel Flow Tc

Manning Coefficient, n = 0.035 — t_c = (L/V) = 2.12 min

Wetted Perimeter, Wp = 8.32 feet

Area, A = 5 sqft

Hydraulic Radius, R = 0.60

Velocity, V = 3.03 ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **10.67** **(Min 5 Minutes)**

0.18 **Hour**

Intensity (Vanderburgh Co.)

I_2	**3.96**	**in/hr**
I_5	**4.65**	**in/hr**
I_{10} =	**5.25**	**in/hr**
I_{25}	**6.16**	**in/hr**
I_{50} =	**6.95**	**in/hr**
I_{100} =	**7.84**	**in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2	**2.93**	**cfs**
Q_5	**3.44**	**cfs**
Q_{10} =	**3.88**	**cfs**
Q_{25} =	**4.56**	**cfs**
Q_{50} =	**5.15**	**cfs**
Q_{100} =	**5.81**	**cfs**

Peak Runoff Calculation

SUB-BASIN #21

Post-Developed **Project 11822**

Area (Ac) = **0.69** **Area (Sf) =** **29,865**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	9,300	S.F.	=	0.21	AC.	0.94	0.20
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	5,625	S.F.	=	0.13	AC.	0.98	0.13
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%)	14,940	S.F.	=	0.34	AC.	0.25	0.09
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
	29,865			0.69			0.41

Wc = **0.6024**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 65 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.6})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 6.90 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Paved = 510 feet — V = 20.3282*(S0.5)

Slope, S = 1.00% — = 2.033 ft/s = 121.97 ft/min

Velocity, V = 2.03 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 4.18 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 11.08 (Min 5 Minutes)

0.18 Hour

Intensity (Vanderburgh Co.)

I_2		**3.90 in/hr**
I_5		**4.57 in/hr**
I_{10}	=	**5.16 in/hr**
I_{25}		**6.06 in/hr**
I_{50}	=	**6.84 in/hr**
I_{100}	=	**7.72 in/hr**

Peak Runoff Rate

Q_{yr} = CiA

Q_2		**1.61 cfs**
Q_5		**1.89 cfs**
Q_{10}	=	**2.13 cfs**
Q_{25}	=	**2.50 cfs**
Q_{50}	=	**2.82 cfs**
Q_{100}	=	**3.19 cfs**

Peak Runoff Calculation

SUB-BASIN #22 (22A+22B)

Post-Developed **Project 11822**

Area (Ac) = **1.38** **Area (Sf) =** **59,975**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	16,325	S.F.	=	0.37	AC.	0.94	0.35
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	11,390	S.F.	=	0.26	AC.	0.98	0.26
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%)	32,260	S.F.	=	0.74	AC.	0.25	0.19
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
	59,975			1.38			0.79

Wc = **0.5765**

Time of Concentration

Overland Flow

Length, L (max 100ft) = 65 feet — t_o = Overland Flow Tc

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 6.90 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Paved = 600 feet — V = 20.3282*(S0.5)

Slope, S = 1.00% — = 2.033 ft/s = 121.97 ft/min

Velocity, V = 2.03 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 4.92 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 11.82 (Min 5 Minutes)

0.20 Hour

Intensity (Vanderburgh Co.)

I_2		3.79 in/hr
I_5		4.45 in/hr
I_{10}	=	5.02 in/hr
I_{25}		5.89 in/hr
I_{50}	=	6.65 in/hr
I_{100}	=	7.50 in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2		3.01 cfs
Q_5		3.53 cfs
Q_{10}	=	3.98 cfs
Q_{25}	=	4.67 cfs
Q_{50}	=	5.28 cfs
Q_{100}	=	5.96 cfs

Peak Runoff Calculation

SUB-BASIN #22A

Post-Developed **Project 11822**

Area (Ac) = **0.55** **Area (Sf) =** **23,990**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	6,530	S.F.	=	0.15	AC.	0.94	0.14
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	4,556	S.F.	=	0.10	AC.	0.98	0.10
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%)	12,904	S.F.	=	0.30	AC.	0.25	0.07
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
	23,990			0.55			0.32

Wc = **0.5765**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	65	feet	t_o =	Overland Flow Tc
Slope, S		=	5.00%		t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240	Grass	t_o =	6.90 min
$P_{2/24}$		=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	Paved	=	600	feet	V =	20.3282*(S0.5)
Slope, S		=	0.70%		=	1.701 ft/s = 102.05 ft/min
Velocity, V		=	1.70	ft/sec	t_s =	Shallow Flow Tc
					t_s =	(L/V) = 5.88 min

Channel Flow

Length, L		=		feet	V =	$(1.49/n)*R^{0.67}*S^{0.5}$
Difference in Elevation		=	0	to 0	=	ft/s = ft/min
Slope, S		=			t_c =	Channel Flow Tc
Manning Coefficient, n		=	0.000		t_c =	(L/V) = 0.00 min
Wetted Perimeter, Wp		=	0	feet		
Area, A		=	0	sqft		
Hydraulic Radius, R		=				
Velocity, V		=		ft/s		

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 12.78 (Min 5 Minutes)

0.21 Hour

Intensity (Vanderburgh Co.)

I_2		**3.65 in/hr**
I_5		**4.29 in/hr**
I_{10}	=	**4.84 in/hr**
I_{25}		**5.68 in/hr**
I_{50}	=	**6.41 in/hr**
I_{100}	=	**7.24 in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		**1.16 cfs**
Q_5		**1.36 cfs**
Q_{10}	=	**1.54 cfs**
Q_{25}	=	**1.80 cfs**
Q_{50}	=	**2.04 cfs**
Q_{100}	=	**2.30 cfs**

Peak Runoff Calculation

SUB-BASIN #22B

Post-Developed

Project 11822

Area (Ac) = **0.83** **Area (Sf) =** **35,985**

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	9,795	S.F.	=	0.22	AC.	0.94	0.21
Structures & Pavement (5-10%)		S.F.	=	0.00	AC.	0.96	0.00
Structures & Pavement (>10%)	6,834	S.F.	=	0.16	AC.	0.98	0.15
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%)	19,356	S.F.	=	0.44	AC.	0.25	0.11
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
	35,985			0.83			0.48

Wc = **0.5765**

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	65	feet		t_o =	Overland Flow Tc
Slope, S		=	5.00%			t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240	Grass		t_o =	6.90 min
$P_{2/24}$		=	3.3				

Shallow Flow

Length, L (Paved or Unpaved)	Paved	=	210	feet		V =	20.3282*(S0.5)
Slope, S		=	0.70%			=	1.701 ft/s = 102.05 ft/min
Velocity, V		=	1.70	ft/sec		t_s =	Shallow Flow Tc
						t_s =	(L/V) = 2.06 min

Channel Flow

Length, L		=		feet		V =	$(1.49/n)*R^{0.67}*S^{0.5}$
Difference in Elevation		=	0	to	0	=	ft/s = ft/min
Slope, S		=				t_c =	Channel Flow Tc
Manning Coefficient, n		=	0.000			t_c =	(L/V) = 0.00 min
Wetted Perimeter, Wp		=	0	feet			
Area, A		=	0	sqft			
Hydraulic Radius, R		=					
Velocity, V		=		ft/s			

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 8.96 (Min 5 Minutes)

0.15 Hour

Intensity (Vanderburgh Co.)

I_2		**4.24 in/hr**
I_5		**4.98 in/hr**
I_{10}	=	**5.62 in/hr**
I_{25}		**6.59 in/hr**
I_{50}	=	**7.44 in/hr**
I_{100}	=	**8.40 in/hr**

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		**2.02 cfs**
Q_5		**2.37 cfs**
Q_{10}	=	**2.67 cfs**
Q_{25}	=	**3.14 cfs**
Q_{50}	=	**3.54 cfs**
Q_{100}	=	**4.00 cfs**

Peak Runoff Calculation

SUB-BASIN #23

Post-Developed

Project 11822

Area (Ac) = 1.39 **Area (Sf) =** 60,605

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%)	10,000	S.F.	=	0.23	AC.	0.98	0.22
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%)	41,805	S.F.	=	0.96	AC.	0.25	0.24
Lawn (5-10%)		S.F.	=	0.00	AC.	0.40	0.00
Lawn (>10%)	4,800	S.F.	=	0.11	AC.	0.55	0.06
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
	60,605			1.39			0.61

Wc = 0.4398

Time of Concentration

Overland Flow

Length, L (max 100ft)		=	90	feet	t_o =	Overland Flow Tc
Slope, S		=	5.00%		t_o =	$[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$
Manning Coefficient, n		=	0.240	Grass	t_o =	8.95 min
$P_{2/24}$		=	3.3			

Shallow Flow

Length, L (Paved or Unpaved)	Unpaved	=	0	feet	V =	16.1345*(S0.5)
Slope, S		=	0.00%		=	0.000 ft/s = 0.00 ft/min
Velocity, V		=	0.00	ft/sec	t_s =	Shallow Flow Tc
					t_s =	(L/V) = 0.00 min

Channel Flow

Length, L		=	325	feet	V =	$(1.49/n)*R^{0.67}*S^{0.5}$
Difference in Elevation		=	403.25	to 400	=	3.027 ft/s = 181.59 ft/min
Slope, S		=	1.00%		t_c =	Channel Flow Tc
Manning Coefficient, n		=	0.035		t_c =	(L/V) = 1.79 min
Wetted Perimeter, Wp		=	8.32	feet		
Area, A		=	5	sqft		
Hydraulic Radius, R		=	0.60			
Velocity, V		=	3.03	ft/s		

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = 10.74 (Min 5 Minutes)

0.18 Hour

Intensity (Vanderburgh Co.)

I_2		3.95 in/hr
I_5		4.63 in/hr
I_{10}	=	5.23 in/hr
I_{25}		6.14 in/hr
I_{50}	=	6.93 in/hr
I_{100}	=	7.82 in/hr

Peak Runoff Rate

$Q_{yr} = CiA$

Q_2		2.42 cfs
Q_5		2.84 cfs
Q_{10}	=	3.20 cfs
Q_{25}	=	3.76 cfs
Q_{50}	=	4.24 cfs
Q_{100}	=	4.79 cfs

Peak Runoff Calculation

SUB-BASIN #24

Post-Developed **Project 11822**

Area (Ac) = 1.04 **Area (Sf) =** 45,200

Weighted Runoff Coefficient

Surface	Area					c	A*c
Structures & Pavement (<2%)		S.F.	=	0.00	AC.	0.92	0.00
Structures & Pavement (2-5%)	1,500	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%)	3,750	S.F.	=	0.09	AC.	0.98	0.08
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%)	27,950	S.F.	=	0.64	AC.	0.40	0.26
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	12,000	S.F.	=	0.28	AC.	1.00	0.28
	45,200			1.04			0.65

Wc = 0.6253

Time of Concentration

Overland Flow

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

Slope, S = 5.00% — t_o = $[0.42*(L^{0.8})*(n^{0.8})]/[P^{0.5})*(S^{0.4})]$

Manning Coefficient, n = 0.240 Grass — t_o = 9.74 min

$P_{2/24}$ = 3.3

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 0 feet — V = 16.1345*(S0.5)

Slope, S = 0.00% — = 0.000 ft/s = 0.00 ft/min

Velocity, V = 0.00 ft/sec — t_s = Shallow Flow Tc

t_s = (L/V) = 0.00 min

Channel Flow

Length, L = feet — V = $(1.49/n)*R^{0.67}*S^{0.5}$

Difference in Elevation = 0 to 0 — = ft/s = ft/min

Slope, S = — t_c = Channel Flow Tc

Manning Coefficient, n = 0.000 — t_c = (L/V) = 0.00 min

Wetted Perimeter, Wp = 0 feet

Area, A = 0 sqft

Hydraulic Radius, R =

Velocity, V = ft/s

t = Total Time of Concentration

t = Σto + Σts + Σtc

t = **9.74** **(Min 5 Minutes)**

0.16 **Hour**

Intensity (Vanderburgh Co.)

I_2	4.11	in/hr
I_5	4.82	in/hr
I_{10} =	5.44	in/hr
I_{25}	6.39	in/hr
I_{50} =	7.21	in/hr
I_{100} =	8.14	in/hr

Peak Runoff Rate

Q_{yr} = CiA

Q_2	2.67	cfs
Q_5	3.13	cfs
Q_{10} =	3.53	cfs
Q_{25} =	4.14	cfs
Q_{50} =	4.68	cfs
Q_{100} =	5.28	cfs