

MAGNOLIA RIDGE FINAL DRAINAGE PLAN

As Approved by the Drainage Board

October 30, 2018



**CASH WAGNER
& ASSOCIATES, PC**
CONSULTING ENGINEERS • LAND SURVEYORS

DATE: 10.30.18
PROJECT NO.: 18-3339
REFERENCE: Magnolia Ridge
YOUR FILE NO.:

ATTENTION: Jeff Mueller
COMPANY: Vanderburgh County Surveyor
ADDRESS: Civic Center Complex – Room 325
CITY, ST, ZIP: Evansville, IN 47708
PHONE:

THE FOLLOWING ITEMS:

| COPIES: | ORIG./LAST REV. DATE: | DESCRIPTION: |
|---------|-----------------------|------------------------------|
| 1 | 10.24.18 | Revised Final Drainage Plans |
| 1 | 10.29.18 | Revised Road Plans & Details |

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COMMENTS:

If you have any questions or comments, please give me a call. Thank you

414 CITADEL CIRCLE
SUITE B
EVANSVILLE, IN 47715
PH: 812.401.5561
FAX: 812.401.5563
[GMERITT@CASHWAGNER.COM](mailto:gmeritt@cashwagner.com)

FROM:

GLEN MERITT, JR., P.E.

cc: File

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VANDERBURGH COUNTY
SURVEYOR'S OFFICE
10-30-18

MAPS

C-101

C-102

Mueller, Jeffrey

From: Glen Meritt <GMeritt@cashwaggner.com>
Sent: Thursday, October 25, 2018 2:40 PM
To: Mueller, Jeffrey
Cc: Stoll, John
Subject: RE: Magnolia

**** This is an EXTERNAL email. Exercise caution. DO NOT open attachments or click links from unknown senders or unexpected email. ****

Jeff,

See my comments below in purple. I called your office and missed you. Can you call me when you get a minute? I have a couple of questions about Magnolia and Browning Manor.

Glen Meritt Jr.

Project Engineer

CASH WAGGNER & ASSOCIATES, PC

414 Citadel Circle, Suite B

Evansville, IN 47715

Main: 812-401-5561 Cell: 812-774-2988



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From: Mueller, Jeffrey <jmueller@vanderburghsurveyor.com>
Sent: Thursday, October 25, 2018 1:59 PM
To: Glen Meritt <GMeritt@cashwaggner.com>
Cc: Stoll, John <JStoll@vanderburghgov.org>
Subject: Magnolia

Glen,

John will need to review his comments but from my point here is where I am.

First-an easy one-is there a developed basin 21-if not this question is answered. No... Sub-basin #21 was removed

Jeffrey D Mueller, PE
Vanderburgh County Surveyor
1 NW ML King Jr Blvd
Civic Center Room 325
Evansville, IN 47708
812-435-5117



**CASH WAGNER
& ASSOCIATES, PC**
CONSULTING ENGINEERS • LAND SURVEYORS

DATE: 10.24.18

ATTENTION: Jeff Mueller

PROJECT NO.: 18-3339

COMPANY: Vanderburgh County
Surveyor

REFERENCE: Magnolia Ridge

ADDRESS: Civic Center Complex –
Room 325

YOUR FILE NO.:

CITY, ST, ZIP: Evansville, IN 47708

PHONE:

THE FOLLOWING ITEMS:

| COPIES: | ORIG./LAST REV. DATE: | DESCRIPTION: |
|---------|-----------------------|---------------------------------------|
| 1 | 10.24.18 | Revised Final Drainage Plan & Details |
| 1 | 10.24.18 | Revised Sub-basin Exhibits |
| 1 | 10.24.18 | Revised Final Drainage Report |

LETTER OF TRANSMITTAL

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COMMENTS:

Please review the attached final drainage plan & report. If you have any questions or comments, please give me a call. Thank you

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FROM:


GLEN MERITT, JR., P.E.

cc: File

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CASH WAGGNER

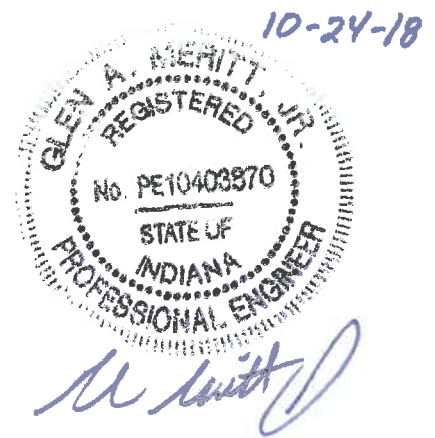
& ASSOCIATES, PC

CONSULTING ENGINEERS • LAND SURVEYORS

October 24, 2018

Mr. Jeff Mueller
Vanderburgh County Surveyor
Room 325 Civic Center - 1 NW Martin Luther King Jr. Blvd.
Evansville, IN 47708

**RE: Final Drainage Report
Magnolia Ridge
North Green River Road
Our Project #: 18-3339**



Mr. Mueller:

Below is a summary of the drainage calculations for the above-referenced project.

SITE DESCRIPTION

This development will consist of 156 single family residential lots and their associated improvements (i.e. roads, utilities). This development is located on a 67.13-acre parcel that lies on the west side of North Green River Road approximately 2,200 feet south of the North Green River Road and Petersburg Road intersection. This project will be constructed and platted in multiple phases. Section 1 of this development will consist of 25.33-acres that is all the property located north of the existing ditch that divides the property. The majority of the property will be disturbed during construction of the subdivision. The existing ditch running west to east across the center of property will remain undisturbed except for the road and utility crossings.

No known wells or septic tank systems are located on this site. The septic system field bed for the property located at 13620 N. Green River Road is located on the north side of the parcel. The field bed outlet pipe extends roughly 100' north of the parcel boundaries and lies within the limits of the Magnolia Ridge Subdivision. There have been preliminary discussions between this adjoiner and the developer on how to extend the future sanitary sewer system from this development to service the adjoining property but no agreement is in place. Based on the current sanitary sewer design for Magnolia Ridge, a 125' sewer extension will be required in order to provide sewer service to this property at the sole expense of the adjoining property owner. No seeps, springs, sinkholes, caves, shafts, faults or other such geological features are visible or of record on this site.

The proposed sanitary sewer and water mains will be public and will be maintained by EW&SU.

The developer will be utilizing Repair Fund "B" for the maintenance and repair of all storm water drainage systems and facilities outside the county accepted road right-of-ways. Upon the completion of the earthwork activities and utility construction, Tenbarge - Green Alliance seed mixture will be used for permanent seeding all green

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space areas and the earthen side slopes of all three basins. No tree limbs, refuse from legally burnt vegetation, nor construction waste, demolition materials or other man-made material may be buried within detention basin #1, #2 or #3.

The following statements will be included on the recorded plat for Magnolia Ridge – Section 1:

The individual lot owners shall be responsible, including financially, for maintaining that part of the storm water system and its easements which exist on his or her property in proper working order including:

1. Mowing grass, controlling weeds and maintaining the designed cover of waterways, storage basins and easements in accordance with all applicable ordinances.
2. Keeping all parts of the storm water system operating as designed and as constructed and free of all trash, debris and obstructions to the flow of water.
3. Keeping the channels, embankments, shorelines and bottoms of waterways and basins free from erosion and sedimentation.
4. Maintaining that part of the storm water system which lies on his or her property in accordance with the conditions described on the approved street and/or drainage plans on file in the County Surveyor's Office and/or in the County Engineer's Office and in compliance with the County Drainage Ordinance.
5. Maintaining the paved side ditches on Lots 25, 106 & 107 and also financially responsible for repairing/replacing the paved side ditches.

The plat for the section that contains lot 87 and 88 will need to state that gutters/swimming pool outlets will not discharge directly into the farm field to the south.

DRAINAGE PATTERNS

The existing site is rolling with a ditch flowing west to east across the center of the site. Ground cover for the entire site is a cultivated field. UN-1 consists of 23.28-acres located on the north side of the existing ditch. Runoff sheet flows to the south to the existing ditch that flows east off-site. UN-2 consists of 2.06-acres located at the northeast corner of the site. Runoff sheet flows east to an existing roadside ditch that flows south to an existing 36" RCP culvert that flows east across Green River Road. UN-3 consists of 4.33-acres located on the east side of the site. Runoff sheet flows east to the existing roadside ditch that flows north off-site. UN-4 consists of 12.88-acres located in the southwest corner of the site. Runoff sheet flows south to an existing ditch that is located along the south property line. This ditch flows south off-site. UN-5 consists of 4.29-acres located in the southeast corner of the site. Runoff sheet flows south to an existing ditch that is located along the south property line. This ditch flows south off-site to an existing pond. UN-6 consists of 20.30-acres located on the south side of the existing ditch. Runoff sheet flows to the north to the existing ditch that flows east off-site. See the attached Undeveloped Sub-basin Exhibit for the locations of each sub-basin.



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The 25-year and 100-year flows were calculated for the entire 67.13-acre development. This development was divided into 10 developed sub-basins and nine off-site sub-basins. Sub-basin #1, OS-3 and OS-8 will be collected by Detention Basin #1. Sub-basin #2 and OS-9 will be collected by Detention Basin #2. Sub-basin #3 will be collected by Detention Basin #3. Sub-basins #4, #5 and #8 will sheet flow off-site undetained to the east to the existing roadside ditch along Green River Road. Sub-basins #6, #7 and #10 will flow off-site undetained to the existing ditch that divides the property. Sub-basin #9 will sheet flow off-site undetained to the south. See the attached Developed Sub-basin and Off-Site Sub-basin Exhibits for the locations of each sub-basin.

A drainage swale and storm sewer network will be installed within the development to capture the storm water runoff and convey it to detention basins #1, #2 and #3. Storm sewers will be constructed with reinforced concrete pipe. The primary outlet and emergency spillway of Detention Basin #1 and #2 will discharge to the existing ditch that is located along the center of the property and flow east. The primary outlet and emergency spillway of Detention Basin #3 will discharge south to the existing ditch that flows south off-site. All runoff ultimately discharges to Bluegrass Creek and/or Schlensker Ditch.

CALCULATIONS

The Rational Method and HERPICC Manual were utilized in performing the drainage calculations for this project. All storm sewers and swales were designed to carry the 25-year developed runoff. The outlet structures for all three detention basins were sized for the 25-year design storm event while allowing a discharge rate less than the undeveloped 10-year storm event from the system. Detention basin #1 stores the 100-year storm and also contains an additional storage volume of 18,382 CF which is roughly 20% extra storage. Therefore I don't feel the emergency spillway needs the additional 0.5' of freeboard above the 100-year flow when the basin stores more than the 100-year storm.

Below is a summary of the detention basin design elements:

| Detention Basin #1 | | NOTES |
|--------------------------------------|-------------|-----------------------------------|
| Detention Basin #1 Developed Q(25) | 28.47 - cfs | #9 - #15 |
| Detention Basin #1 Developed Q(100) | 34.64 - cfs | #9 - #15 |
| Detention Basin #1 Undeveloped Q(10) | 32.02 - cfs | UN-1 |
| Undetained Developed Q(25) | 39.33 - cfs | #1 - #8, #16, #17, #18, #20 & #22 |
| Off-Site Developed Q(25) | 18.92 - cfs | OS-3 & OS-8A |
| 25-year Req'd Storage Volume | 55,293 - cf | |
| 25-year Provided Storage Volume | 93,923 - cf | |



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| | | |
|---|--------------------------------|---|
| Allowable Detention Basin #1 Release Rate | 11.61 - cfs | Undeveloped Q(10) - Undetained Developed Q(25) + Off-Site Developed Q(25) |
| <i>Proposed Detention Basin #1 Release Rate</i> | <i>3.70 - cfs</i> | <i>Detention Basin #1 Primary Spillway</i> |
| <i>Outlet Structure</i> | <i>34-LF of 12" R.C.P.</i> | <i>P-531</i> |
| Outlet I.E. | 402.86 | |
| 25-year Storage Vol. Elev. | 404.19 | |
| 100-year Storage Vol. Elev. | 404.67 | |
| Min. F.F. elevation adjacent basin | 406.67 | |
| HW (25-yr. elev. - I.E.) | 1.33 - ft. | |
| Minimum Top/Bank | 405.86 | |

| Detention Basin #2 | | NOTES |
|---|--------------------------------|---|
| Detention Basin #2 Developed Q(25) | 45.42 - cfs | #24 - #37 |
| Detention Basin #2 Developed Q(100) | 55.67 - cfs | #24 - #37 |
| Detention Basin #2 Undeveloped Q(10) | 30.23 - cfs | UN-6 |
| Undetained Developed Q(25) | 8.10 - cfs | #19 & #23 |
| Off-Site Developed Q(25) | 3.86 - cfs | OS-9A & OS-9B |
| 25-year Req'd Storage Volume | 79,336 - cf | |
| 25-year Provided Storage Volume | 136,762 - cf | |
| Allowable Detention Basin #2 Release Rate | 25.99 - cfs | Undeveloped Q(10) - Undetained Developed Q(25) + Off-Site Developed Q(25) |
| <i>Proposed Detention Basin #2 Release Rate</i> | <i>2.62 - cfs</i> | <i>Detention Basin #2 Primary Spillway</i> |
| <i>Outlet Structure</i> | <i>60-LF of 12" R.C.P.</i> | <i>P-589</i> |
| Outlet I.E. | 412.00 | |
| 25-year Storage Vol. Elev. | 413.03 | |
| 100-year Storage Vol. Elev. | 413.36 | |
| Min. F.F. elevation adjacent basin | 415.36 | |
| HW (25-yr. elev. - I.E.) | 1.03 - ft. | |
| Minimum Top/Bank | 414.75 | |
| Detention Basin #3 | | NOTES |
| Detention Basin #3 Developed Q(25) | 35.66 - cfs | #38 - #46 |
| Detention Basin #3 Developed Q(100) | 43.47 - cfs | #38 - #46 |
| Detention Basin #3 Undeveloped Q(10) | 18.23 - cfs | UN-4 |



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| | | |
|---|-----------------------|---|
| Undetained Developed Q(25) | 5.20 - cfs | #49 |
| Off-Site Developed Q(25) | 0.00 - cfs | |
| 25-year Req'd Storage Volume | 48,578 - cf | |
| 25-year Provided Storage Volume | 101,665 - cf | |
| Allowable Detention Basin #3 Release Rate | 13.03 - cfs | Undeveloped Q(10) - Undetained Developed Q(25) + Off-Site Developed Q(25) |
| Proposed Detention Basin #3 Release Rate | 1.88 - cfs | Detention Basin #3 Primary Spillway |
| Outlet Structure | 48-LF of 10" H.D.P.E. | P-617 |
| Outlet I.E. | 414.00 | |
| 25-year Storage Vol. Elev. | 414.99 | |
| 100-year Storage Vol. Elev. | 415.32 | |
| Min. F.F. elevation adjacent Basin | 417.32 | |
| HW (25-yr. elev. - I.E.) | 0.99 - ft. | |
| Minimum Top/Bank | 417.00 | |

| Runoff discharging to the existing ditch on the west side of Green River Road | | NOTES |
|---|------------|-------------------------|
| Undeveloped Q(10) | 4.14 - cfs | UN-2 |
| Undetained Developed Q(25) | 4.11 - cfs | #51, #51A & #51B |
| Undeveloped Q(10) | 5.84 - cfs | UN-3 |
| Undetained Developed Q(25) | 5.43 - cfs | #50A, #50B, #52A & #52B |
| Undeveloped Q(10) | 7.25 - cfs | UN-5 |
| Undetained Developed Q(25) | 7.10 - cfs | #47 & #48 |



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DETENTION FACILITY DESIGN VOLUME CALCULATIONS

PROJECT: **Magnolia Ridge
Detention Basin #3**

DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS

RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA: 10.83 ACRES
DEVELOPED RUNOFF COEFFICIENT (C_d): 0.574

| STORM DURATION T _d (HRS) | RAINFALL INTENSITY I _d (INCH/HR) | INFLOW RATE I(T _d) (C _d *I _d *A) (CFS) | OUTFLOW RATE O (C _u *I _u *A) (CFS) | STORAGE RATE ΔS I(T _d)-O (CFS) | REQUIRED STORAGE S _d (I(T _d)-O)*T _d /12 (ACRE-FT) |
|---|---|---|---|---|--|
| 0.08 | 7.810 | 48.55 | 1.88 | 46.67 | 0.324 |
| 0.17 | 6.320 | 39.29 | 1.88 | 37.41 | 0.520 |
| 0.25 | 5.240 | 32.57 | 1.88 | 30.69 | 0.639 |
| 0.33 | 4.597 | 28.57 | 1.88 | 26.69 | 0.742 |
| 0.42 | 3.953 | 24.58 | 1.88 | 22.70 | 0.788 |
| 0.50 | 3.310 | 20.58 | 1.88 | 18.70 | 0.779 |
| 0.58 | 3.083 | 19.17 | 1.88 | 17.29 | 0.840 |
| 0.67 | 2.857 | 17.76 | 1.88 | 15.88 | 0.882 |
| 0.75 | 2.630 | 16.35 | 1.88 | 14.47 | 0.904 |
| 0.83 | 2.403 | 14.94 | 1.88 | 13.06 | 0.907 |
| 0.92 | 2.177 | 13.53 | 1.88 | 11.65 | 0.890 |
| 1.00 | 1.950 | 12.12 | 1.88 | 10.24 | 0.854 |
| 1.25 | 1.805 | 11.22 | 1.88 | 9.34 | 0.973 |
| 1.50 | 1.660 | 10.32 | 1.88 | 8.44 | 1.055 |
| 1.75 | 1.515 | 9.42 | 1.88 | 7.54 | 1.099 |
| 2.00 | 1.370 | 8.52 | 1.88 | 6.64 | 1.106 |
| 3.00 | 1.020 | 6.34 | 1.88 | 4.46 | 1.115 |

| | |
|---------------------------------|---------------|
| PEAK STORAGE (ACRE/FT): | 1.12 |
| PEAK STORAGE (CUBIC FT): | 48,578 |

Magnolia Ridge

Detention Basin #3

PROPOSED 25-YR DESIGN RELEASE RATE

CALCULATIONS FOR PIPE FLOWING FULL

(Pressure Conditions)

SOLVE FOR Q

$\emptyset = 0.833$ FT.
 $h' = 1.9$ IN.
 $h = 0.5765$ FT.
 $K_e = 0.5$
 $K_o = 1$
 $n = 0.012$
 $L = 48$ FT.
 $HW = 0.993$ FT.

 $Q = 1.88$ CFS

\emptyset = diameter of orifice (pipe) $h = h' + \emptyset/2$
 K_e = entrance coefficient h' = ht. of water
 K_o = outfall coefficient above orifice
 n = manning's 'n' $HW = h' + \emptyset$
 L = length of orifice (pipe)
 Q = allowable release rate

DETENTION FACILITY DESIGN VOLUME CALCULATIONS

PROJECT: **Magnolia Ridge**
Detention Basin #3

DETENTION FACILITY DESIGN RETURN PERIOD: 100 YRS

RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA: **10.83 ACRES**
 DEVELOPED RUNOFF COEFFICIENT (C_d): **0.574**

| STORM DURATION T_d (HRS) | RAINFALL INTENSITY I_d (INCH/HR) | INFLOW RATE $I(T_d)$ ($C_d * I_d * A$) (CFS) | OUTFLOW RATE O ($C_u * I_u * A$) (CFS) | STORAGE RATE ΔS $I(T_d) - O$ (CFS) | REQUIRED STORAGE S_d ($(I(T_d) - O) * T_d / 12$) (ACRE-FT) |
|----------------------------------|--|---|---|---|---|
| 0.08 | 9.950 | 61.85 | 2.36 | 59.49 | 0.413 |
| 0.17 | 8.050 | 50.04 | 2.36 | 47.68 | 0.662 |
| 0.25 | 6.680 | 41.53 | 2.36 | 39.17 | 0.816 |
| 0.33 | 5.857 | 36.41 | 2.36 | 34.05 | 0.946 |
| 0.42 | 5.033 | 31.29 | 2.36 | 28.93 | 1.004 |
| 0.50 | 4.210 | 26.17 | 2.36 | 23.81 | 0.992 |
| 0.58 | 3.935 | 24.46 | 2.36 | 22.10 | 1.074 |
| 0.67 | 3.660 | 22.75 | 2.36 | 20.39 | 1.133 |
| 0.75 | 3.385 | 21.04 | 2.36 | 18.68 | 1.168 |
| 0.83 | 3.110 | 19.33 | 2.36 | 16.97 | 1.179 |
| 0.92 | 2.835 | 17.62 | 2.36 | 15.26 | 1.166 |
| 1.00 | 2.560 | 15.91 | 2.36 | 13.55 | 1.130 |
| 1.25 | 2.380 | 14.80 | 2.36 | 12.44 | 1.295 |
| 1.50 | 2.200 | 13.68 | 2.36 | 11.32 | 1.415 |
| 1.75 | 2.020 | 12.56 | 2.36 | 10.20 | 1.487 |
| 2.00 | 1.840 | 11.44 | 2.36 | 9.08 | 1.513 |

| | |
|---------------------------------|---------------|
| PEAK STORAGE (ACRE/FT): | 1.51 |
| PEAK STORAGE (CUBIC FT): | 65,908 |

Magnolia Ridge

Detention Basin #3

PROPOSED 100-YR DESIGN RELEASE RATE

CALCULATIONS FOR PIPE FLOWING FULL

(Pressure Conditions)

SOLVE FOR Q

\emptyset = 0.8333 FT.
h'= 5.9 IN.
h= 0.9083 FT.
Ke= 0.5
Ko= 1
n= 0.012
L= 48 FT.
HW= 1.325 FT.

Q= 2.36 CFS

\emptyset = diameter of orifice (pipe) h= h' + \emptyset /2
Ke= entrance coefficient h'= ht. of water
Ko= outfall coefficient above orifice
n= manning's 'n' HW= h' + \emptyset
L= length of orifice (pipe)
Q= allowable release rate

Magnolia Ridge

Detention Basin #3

PROVIDED DETENTION VOLUMES

(per ACAD)

| | <u>Elevation</u> | <u>Area</u> <u>(s.f.)</u> | <u>Avg. Area</u> <u>(s.f.)</u> | <u>Inc. Vol.</u> <u>(c.f.)</u> | <u>Cumulative Vol.</u> <u>(c.f.)</u> |
|--------|-------------------------|--|---|---|---|
| Pool | 414.00 | 47,244 | | | |
| | 415.00 | 50,807 | 49,026 | 49,026 | 49,026 |
| E.O.S. | 416.00 | 54,471 | 52,639 | 52,639 | 101,665 |
| T.B. | 417.00 | 58,235 | 56,353 | 56,353 | 158,018 |

Detention volume provided at Elev. 416.00 = 101,665 c.f.

Total, required 25-YR detention volume = 48,578 c.f.

25-YR Req'd detention volume provided @ Elev. = 414.99 ft.

Req'd HW= 0.99 ft.

Detention volume provided at Elev. 417.00 = 158,018 c.f.

Total, required 100-YR detention volume = 65,908 c.f.

100-YR Req'd detention volume provided @ Elev. = 415.32 ft.

Req'd HW= 1.32 ft.

Weighted c calculations for sub-basins captured by Detention Basin #3

| DEVELOPED WEIGHTED c CALCULATIONS | | | |
|--|-----------------|----------|--------------------------|
| | | | Total Area = 10.83 Acres |
| Sub-basin | Area (A) | c | c x A |
| #38 | 1.23 Ac. | 0.492 | 0.056 |
| #39 | 0.75 Ac. | 0.619 | 0.043 |
| #40 | 0.55 Ac. | 0.598 | 0.030 |
| #41 | 0.87 Ac. | 0.604 | 0.049 |
| #42 | 0.79 Ac. | 0.641 | 0.047 |
| #43 | 1.29 Ac. | 0.364 | 0.043 |
| #44 | 0.93 Ac. | 0.607 | 0.052 |
| #45 | 1.02 Ac. | 0.590 | 0.056 |
| #46 | 3.40 Ac. | 0.631 | 0.198 |

Weighted c = 0.574

Open Channel Flow Calculations

Swale #: **Emergency
Spillway
Basin #1**

Side slope = 4
 Bottom width = 24
 Manning's coefficient = 0.035
 Slope of channel = 0.0062

| Depth (ft) | Wetted Perimeter (ft) | Area (ft ²) | Hydraulic Radius (ft) | Hydraulic Depth (ft) | Flowrate (cfs) | Velocity (ft/s) | F value |
|------------|-----------------------|-------------------------|-----------------------|----------------------|----------------|-----------------|---------|
| 0.0 | 24.00 | 0.00 | 0.00 | 0.00 | 0.00 | #DIV/0! | 1.0 |
| 0.1 | 24.82 | 2.44 | 0.10 | 0.10 | 1.74 | 0.71 | 1.1 |
| 0.2 | 25.65 | 4.96 | 0.19 | 0.19 | 5.56 | 1.12 | 1.2 |
| 0.30 | 26.47 | 7.56 | 0.29 | 0.29 | 10.99 | 1.45 | 1.3 |
| 0.4 | 27.30 | 10.24 | 0.38 | 0.38 | 17.85 | 1.74 | 1.4 |
| 0.5 | 28.12 | 13.00 | 0.46 | 0.46 | 26.05 | 2.00 | 1.5 |
| 0.6 | 28.95 | 15.84 | 0.55 | 0.55 | 35.52 | 2.24 | 1.6 |
| 0.7 | 29.77 | 18.76 | 0.63 | 0.63 | 46.22 | 2.46 | 1.7 |
| 0.8 | 30.60 | 21.76 | 0.71 | 0.72 | 58.12 | 2.67 | 1.8 |

Open Channel Flow Calculations

Swale #: **Emergency
Spillway**
Lot 4 & 5

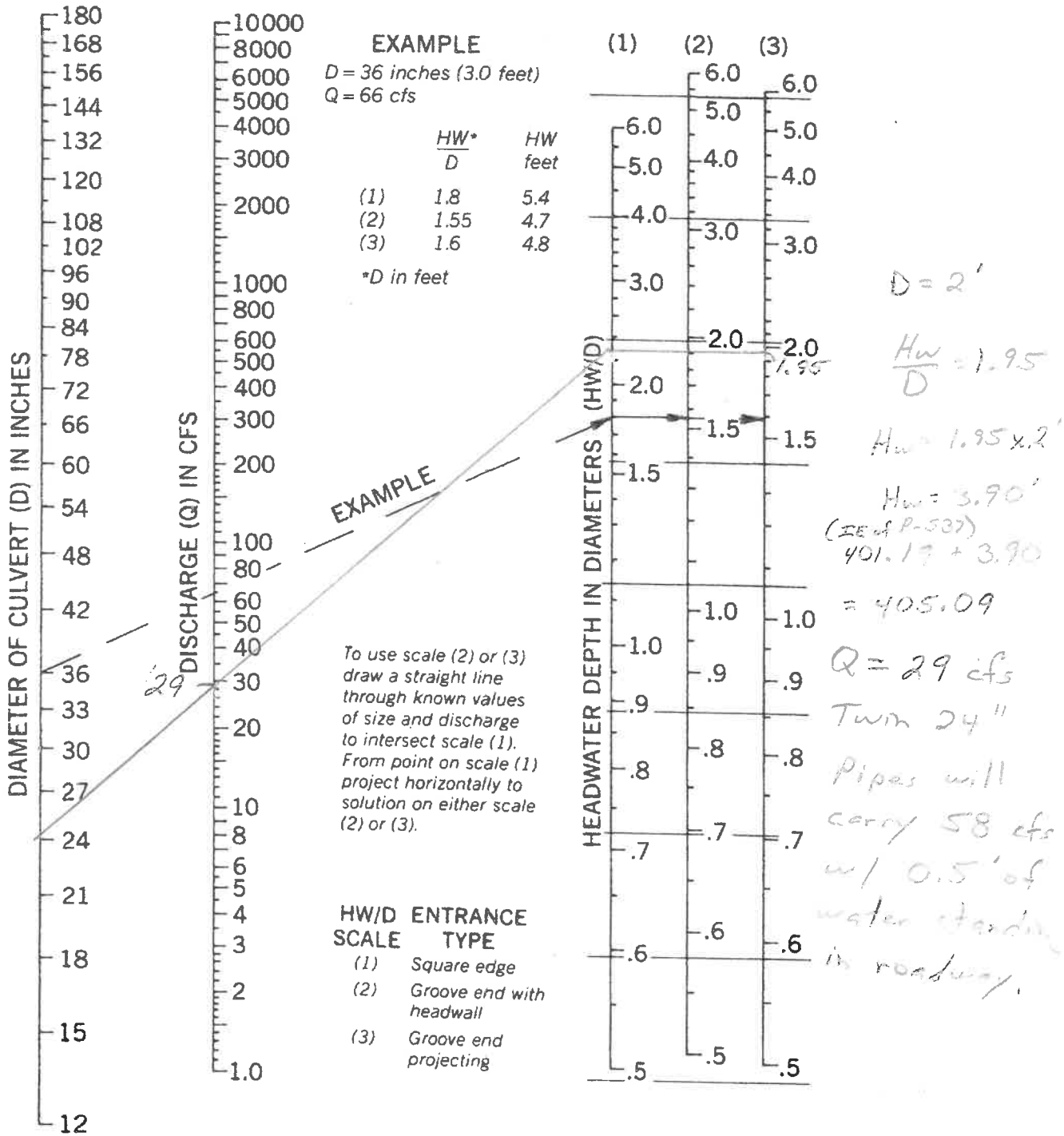
Side slope = 3
 Bottom width = 10
 Manning's coefficient = 0.035
 Slope of channel = 0.0105

| Depth (ft) | Wetted Perimeter (ft) | Area (ft ²) | Hydraulic Radius (ft) | Hydraulic Depth (ft) | Flowrate (cfs) | Velocity (ft/s) | F value |
|------------|-----------------------|-------------------------|-----------------------|----------------------|----------------|-----------------|---------|
| 0.0 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | #DIV/0! | 1.0 |
| 0.1 | 10.63 | 1.03 | 0.10 | 0.10 | 0.95 | 0.92 | 1.1 |
| 0.2 | 11.26 | 2.12 | 0.19 | 0.19 | 3.04 | 1.43 | 1.2 |
| 0.30 | 11.90 | 3.27 | 0.27 | 0.28 | 6.03 | 1.84 | 1.3 |
| 0.4 | 12.53 | 4.48 | 0.36 | 0.36 | 9.84 | 2.20 | 1.4 |
| 0.5 | 13.16 | 5.75 | 0.44 | 0.44 | 14.44 | 2.51 | 1.5 |
| 0.6 | 13.79 | 7.08 | 0.51 | 0.52 | 19.80 | 2.80 | 1.6 |
| 0.7 | 14.43 | 8.47 | 0.59 | 0.60 | 25.91 | 3.06 | 1.7 |
| 0.8 | 15.06 | 9.92 | 0.66 | 0.67 | 32.76 | 3.30 | 1.8 |
| 0.90 | 15.69 | 11.43 | 0.73 | 0.74 | 40.36 | 3.53 | 1.9 |
| 1.0 | 16.32 | 13.00 | 0.80 | 0.81 | 48.72 | 3.75 | 2.0 |
| 1.1 | 16.96 | 14.63 | 0.86 | 0.88 | 57.84 | 3.95 | 2.1 |

Figure 33

P-537 (24" RCP)

HEADWATER DEPTH FOR CIRCULAR CONCRETE PIPE CULVERTS WITH INLET CONTROL



DEVELOPED DRAINAGE BASIN CALCULATIONS

| Basin No.: | | 39 | | Total Area = | | 32,800 S.F. | |
|--------------|------|----|-------------|--------------|------------|-------------|----------|
| | | | | | | 0.75 Acres | |
| Surface | | | | | | C | N |
| Structures | 2.75 | @ | 3000 | = | 8,250 S.F. | = | 0.19 Ac. |
| Pavement | | | | = | 5,945 S.F. | = | 0.14 Ac. |
| Drives | 5.5 | @ | 700 | = | 3,850 S.F. | = | 0.09 Ac. |
| Patios | 0 | @ | 100 | = | 0 S.F. | = | 0.00 Ac. |
| Sidewalks | | | | = | 0 S.F. | = | 0.00 Ac. |
| Lawn (0-2%) | | | 0 S.F. | = | 0 S.F. | = | 0.00 Ac. |
| Lawn (2-5%) | | | 14,755 S.F. | = | 0.34 Ac. | = | 0.25 Ac. |
| Lawn (5-10%) | | | 0 S.F. | = | 0.00 Ac. | = | 0.40 Ac. |
| Lawn (>10%) | | | 0 S.F. | = | 0.00 Ac. | = | 0.55 Ac. |
| Water | | | 0 S.F. | = | 0.00 Ac. | = | 1.00 Ac. |
| Misc. | | | 0 S.F. | = | 0.00 Ac. | = | 0.92 Ac. |

| | |
|----------------------------------|---|
| Weighted c = | 0.619 |
| Weighted N = | 0.191 |
| Sheet Flow | |
| L = | 300 Ft. |
| H = | 3.6 Ft. |
| S = | 0.0120 Ft./Ft. |
| t1 = | 15.37 Minutes (Min. 5 minutes) |
| Shallow Concentrated Flow | |
| L = | 117 Ft. |
| H = | 2.7 Ft. |
| S = | 0.0233 Ft./Ft. |
| v = | 3.10 Ft./sec. (From HERPICC Figure 3.4.5) |
| t2 = | 0.63 Minutes |
| tc = | 16.00 Minutes |
| I(10) = | in./Hr. |
| I(25) = | 4.940 in./Hr. |
| I(50) = | in./Hr. |
| I(100) = | 6.088 in./Hr. |
| Q(10) = | 0.00 CFS |
| Q(25) = | 2.30 CFS |
| Q(50) = | 0.00 CFS |
| Q(100) = | 2.84 CFS |

DEVELOPED DRAINAGE BASIN CALCULATIONS

| Basin No.: | | 40 | | Total Area = | | 24,088 S.F. | |
|--------------|-----|----|-------------|--------------|------------|-------------|----------|
| | | | | | | 0.55 Acres | |
| Surface | | | | | | C | N |
| Structures | 1.5 | @ | 3000 | = | 4,500 S.F. | = | 0.10 Ac. |
| Pavement | | | | = | 5,907 S.F. | = | 0.14 Ac. |
| Drives | 3 | @ | 700 | = | 2,100 S.F. | = | 0.05 Ac. |
| Patios | 0 | @ | 100 | = | 0 S.F. | = | 0.00 Ac. |
| Sidewalks | | | | = | 0 S.F. | = | 0.00 Ac. |
| Lawn (0-2%) | | | 0 S.F. | = | 0.00 Ac. | = | 0.15 Ac. |
| Lawn (2-5%) | | | 11,581 S.F. | = | 0.27 Ac. | = | 0.25 Ac. |
| Lawn (5-10%) | | | 0 S.F. | = | 0.00 Ac. | = | 0.40 Ac. |
| Lawn (>10%) | | | 0 S.F. | = | 0.00 Ac. | = | 0.55 Ac. |
| Water | | | 0 S.F. | = | 0.00 Ac. | = | 1.00 Ac. |
| Misc. | | | 0 S.F. | = | 0.00 Ac. | = | 0.92 Ac. |

| | |
|----------------------------------|---|
| Weighted c = | 0.598 |
| Weighted N = | 0.203 |
| Sheet Flow | |
| L = | 300 Ft. |
| H = | 3.5 Ft. |
| S = | 0.0117 Ft./Ft. |
| t1 = | 15.90 Minutes (Min. 5 minutes) |
| Shallow Concentrated Flow | |
| L = | 121 Ft. |
| H = | 2.8 Ft. |
| S = | 0.0233 Ft./Ft. |
| v = | 3.10 Ft./sec. (From HERPICC Figure 3.4.5) |
| t2 = | 0.65 Minutes |
| tc = | 16.55 Minutes |
| I(10) = | in./Hr. |
| I(25) = | 4.890 in./Hr. |
| I(50) = | in./Hr. |
| I(100) = | 6.030 in./Hr. |
| Q(10) = | 0.00 CFS |
| Q(25) = | 1.62 CFS |
| Q(50) = | 0.00 CFS |
| Q(100) = | 1.99 CFS |

DEVELOPED DRAINAGE BASIN CALCULATIONS

| Basin No.: | | 45 | | Total Area = | | 44,451 S.F. | |
|--------------|------|----|------|--------------|-------------|-------------|----------|
| | | | | | | 1.02 Acres | |
| Surface | | | | C | N | | |
| Structures | 3.25 | @ | 3000 | = | 9,750 S.F. | = | 0.22 Ac. |
| Pavement | | | | = | 8,593 S.F. | = | 0.20 Ac. |
| Drives | 6 | @ | 700 | = | 4,200 S.F. | = | 0.10 Ac. |
| Patios | 0 | @ | 100 | = | 0 S.F. | = | 0.00 Ac. |
| Sidewalks | | | | = | 0 S.F. | = | 0.00 Ac. |
| Lawn (0-2%) | | | | = | 0 S.F. | = | 0.00 Ac. |
| Lawn (2-5%) | | | | = | 21,908 S.F. | = | 0.50 Ac. |
| Lawn (5-10%) | | | | = | 0 S.F. | = | 0.00 Ac. |
| Lawn (>10%) | | | | = | 0 S.F. | = | 0.00 Ac. |
| Water | | | | = | 0 S.F. | = | 0.00 Ac. |
| Misc. | | | | = | 0 S.F. | = | 0.00 Ac. |

| | |
|----------------------------------|----------------|
| Weighted c = | 0.590 |
| Weighted N = | 0.207 |
| Sheet Flow | |
| L = | 300 Ft. |
| H = | 3.3 Ft. |
| S = | 0.0110 Ft./Ft. |
| t1 = | 16.31 Minutes |
| Shallow Concentrated Flow | |
| L = | 102 Ft. |
| H = | 0.7 Ft. |
| S = | 0.0071 Ft./Ft. |
| v = | 1.70 Ft./sec. |
| t2 = | 1.00 Minutes |
| tc = | 17.3 Minutes |
| I(10) = | In./Hr. |
| I(25) = | 4.820 In./Hr. |
| I(50) = | In./Hr. |
| I(100) = | 5.950 In./Hr. |
| Q(10) = | 0.00 CFS |
| Q(25) = | 2.90 CFS |
| Q(50) = | 0.00 CFS |
| Q(100) = | 3.58 CFS |

(Min. 5 minutes)

(From HRPICC Figure 3.4.5)

DEVELOPED DRAINAGE BASIN CALCULATIONS

| Basin No.: | | 45 | | Total Area = | | 148,295 S.F. | |
|--------------|----|----|------|--------------|-------------|--------------|----------|
| | | | | | | 3.40 Acres | |
| Surface | | | | C | N | | |
| Structures | 6 | @ | 3000 | = | 18,000 S.F. | = | 0.41 Ac. |
| Pavement | | | | = | 0 S.F. | = | 0.00 Ac. |
| Drives | 0 | @ | 700 | = | 0 S.F. | = | 0.00 Ac. |
| Patios | 12 | @ | 100 | = | 1,200 S.F. | = | 0.03 Ac. |
| Sidewalks | | | | = | 0 S.F. | = | 0.00 Ac. |
| Lawn (0-2%) | | | | = | 0 S.F. | = | 0.00 Ac. |
| Lawn (2-5%) | | | | = | 41,444 S.F. | = | 0.95 Ac. |
| Lawn (5-10%) | | | | = | 26,467 S.F. | = | 0.61 Ac. |
| Lawn (>10%) | | | | = | 13,940 S.F. | = | 0.32 Ac. |
| Water | | | | = | 47,244 S.F. | = | 1.08 Ac. |
| Misc. | | | | = | 0 S.F. | = | 0.00 Ac. |

| | |
|--------------------------|----------------|
| Weighted c = | 0.631 |
| Weighted N = | 0.223 |
| Sheet Flow | |
| L = | 95 Ft. |
| H = | 2.1 Ft. |
| S = | 0.0222 Ft./Ft. |
| t1 = | 8.38 Minutes |
| Open Channel Flow | |
| L = | 350 Ft. |
| H = | 3.3 Ft. |
| S = | 0.0094 Ft./Ft. |
| v = | 2.68 Ft./sec. |
| t2 = | 2.17 Minutes |
| tc = | 10.55 Minutes |
| I(10) = | In./Hr. |
| I(25) = | 5.827 In./Hr. |
| I(50) = | In./Hr. |
| I(100) = | 7.024 In./Hr. |
| Q(10) = | 0.00 CFS |
| Q(25) = | 12.51 CFS |
| Q(50) = | 0.00 CFS |
| Q(100) = | 15.08 CFS |

(Min. 5 minutes)

DEVELOPED DRAINAGE BASIN CALCULATIONS

| Basin No.: | | 49 | | Total Area = | | 79,236 S.F. | |
|--------------|---|----|--------|--------------|------------|-------------|--------------------|
| | | | | | | 1.82 Acres | |
| Surface | | | | C | N | | |
| Structures | 3 | @ | 3000 | = | 9,000 S.F. | = | 0.21 Ac. 0.92 0.02 |
| Pavement | | | | = | 3,439 S.F. | = | 0.08 Ac. 0.92 0.02 |
| Drives | 0 | @ | 700 | = | 0 S.F. | = | 0.00 Ac. 0.92 0.02 |
| Patios | 4 | @ | 100 | = | 400 S.F. | = | 0.01 Ac. 0.92 0.02 |
| Sidewalks | | | | = | 0 S.F. | = | 0.00 Ac. 0.92 0.02 |
| Lawn (0-2%) | | | 0 | S.F. | = | 0.00 Ac. | 0.15 0.40 |
| Lawn (2-5%) | | | 14,634 | S.F. | = | 0.34 Ac. | 0.25 0.40 |
| Lawn (5-10%) | | | 3,768 | S.F. | = | 0.09 Ac. | 0.40 0.40 |
| Lawn (>10%) | | | 47,995 | S.F. | = | 1.10 Ac. | 0.55 0.40 |
| Water | | | 0 | S.F. | = | 0.00 Ac. | 1.00 0.00 |
| Misc. | | | 0 | S.F. | = | 0.00 Ac. | 0.92 0.02 |

| | | |
|----------------------------------|--------------|--------------------------------------|
| Weighted c = | 0.547 | |
| Weighted N = | 0.338 | |
| Sheet Flow | | |
| L = | 175 | Ft. |
| H = | 3.4 | Ft. |
| S = | 0.0194 | Ft./Ft. |
| t1 = | 13.96 | Minutes (Min. 5 minutes) |
| Shallow Concentrated Flow | | |
| L = | 0 | Ft. |
| H = | 0.0 | Ft. |
| S = | #DIV/0! | Ft./Ft. |
| v = | 0.00 | Ft./sec. (From HERPICC Figure 3.4.5) |
| t2 = | 0.00 | Minutes |
| tc = | 13.96 | Minutes |
| I(10) = | | In./Hr. |
| I(25) = | 5.218 | In./Hr. |
| I(50) = | | In./Hr. |
| I(100) = | 6.388 | In./Hr. |
| Q(10) = | 0.00 | CFS |
| Q(25) = | 5.20 | CFS |
| Q(50) = | 0.00 | CFS |
| Q(100) = | 6.36 | CFS |

DEVELOPED DRAINAGE BASIN CALCULATIONS

| Basin No.: | | 50A | | Total Area = | | 58,102 S.F. | |
|--------------|---|-----|--------|--------------|------------|-------------|--------------------|
| | | | | | | 1.33 Acres | |
| Surface | | | | C | N | | |
| Structures | 3 | @ | 3000 | = | 9,000 S.F. | = | 0.21 Ac. 0.92 0.02 |
| Pavement | | | | = | 4,707 S.F. | = | 0.11 Ac. 0.92 0.02 |
| Drives | 3 | @ | 700 | = | 2,100 S.F. | = | 0.05 Ac. 0.92 0.02 |
| Patios | 3 | @ | 100 | = | 300 S.F. | = | 0.01 Ac. 0.92 0.02 |
| Sidewalks | | | | = | 0 S.F. | = | 0.00 Ac. 0.92 0.02 |
| Lawn (0-2%) | | | 0 | S.F. | = | 0.00 Ac. | 0.15 0.40 |
| Lawn (2-5%) | | | 41,995 | S.F. | = | 0.96 Ac. | 0.25 0.40 |
| Lawn (5-10%) | | | 0 | S.F. | = | 0.00 Ac. | 0.40 0.40 |
| Lawn (>10%) | | | 0 | S.F. | = | 0.00 Ac. | 0.55 0.40 |
| Water | | | 0 | S.F. | = | 0.00 Ac. | 1.00 0.00 |
| Misc. | | | 0 | S.F. | = | 0.00 Ac. | 0.92 0.02 |

| | | |
|----------------------------------|--------------|--------------------------------------|
| Weighted c = | 0.436 | |
| Weighted N = | 0.295 | |
| Sheet Flow | | |
| L = | 300 | Ft. |
| H = | 3.5 | Ft. |
| S = | 0.0117 | Ft./Ft. |
| t1 = | 18.96 | Minutes (Min. 5 minutes) |
| Shallow Concentrated Flow | | |
| L = | 182 | Ft. |
| H = | 4.7 | Ft. |
| S = | 0.0259 | Ft./Ft. |
| v = | 3.20 | Ft./sec. (From HERPICC Figure 3.4.5) |
| t2 = | 0.95 | Minutes |
| tc = | 19.91 | Minutes |
| I(10) = | | In./Hr. |
| I(25) = | 4.579 | In./Hr. |
| I(50) = | | In./Hr. |
| I(100) = | 5.675 | In./Hr. |
| Q(10) = | 0.00 | CFS |
| Q(25) = | 2.66 | CFS |
| Q(50) = | 0.00 | CFS |
| Q(100) = | 3.30 | CFS |

| | A | B | C | D | E | F | G | H | I |
|----|--|----------------|---|---|-------------|------------------------|-------------|-----------------|---|
| 1 | Trapezoidal Riprap-Lined Waterway Design.xlsm | | | | | | | | |
| 2 | Landowner | Magnolia Ridge | | County | Vanderburgh | | | V 1.2015 | |
| 3 | Computed By | Glen Meritt | | Date | 10/23/2018 | | | 1/15/2015 | |
| 4 | Checked by | Swale #10 | | Date | | | | | |
| 5 | <i>Note: Macros must be enabled in this spreadsheet in order for the "Solve" button to work.</i> | | | | | | | | |
| 6 | Design flow, Q= | 8 cfs | | | | WW horiz. Length= | 35.0 ft | | |
| 7 | Slope, S= | 0.1326 ft/ft = | | 7.54 :1 | | U/S WW F.L. elev= | 409.5 ft | | |
| 8 | Bottom Width, W= | 1 ft | | | | D/S WW F.L. elev= | 404.9 ft | | |
| 9 | Side slope, Z= | 3 :1 | | | | Waterway drop= | 4.6 ft | | |
| 10 | Safety factor= | 1 | | Typically 1.2 | | WW length along slope= | 35.3 ft | | |
| 11 | Rock shape = | Angular | | | | | | | |
| 12 | Min. req'd D50= | 8.99 in | | Spreadsheet formatting key: | | | | | |
| 13 | D50 used= | 12.00 in | | XXX =Input cells | | | | | |
| 14 | n= | 0.050 | | X.XX =Output from "Solve" button | | | | | |
| 15 | Freeboard= | 0.00 ft | | X.XX =Other computed output | | | | | |
| 16 | | | | Red text =Instructions, warnings, info | | | | | |
| 17 | Flow depth, d= | 0.57 ft | | Calculated | | | | | |
| 18 | Critical depth, d _c = | 0.70 ft | | | | | | | |
| 19 | Critical slope, S _c = | 0.052 ft/ft | | 0.7S _c = | | 0.0364 ft/ft | | | |
| 20 | | | | 1.3S _c = | | 0.0676 ft/ft | | | |
| 21 | Design slope, S= | 0.1326 ft/ft | | Design slope OK. Flow is Supercritical. | | | | | |
| 22 | Velocity= | 5.19 fps | | | | Est. riprap unit wt= | 1.4 Tons/CY | | |
| 23 | | | | Rock shape = Angular | | Rock Gs = | | 2.65 | |
| 24 | Required riprap gradation for D50 selected | | | | | | | | |
| 25 | | | | % | | Rock dia., inches | | Rock weight, lb | |
| 26 | | | | Smaller | min. | max. | min. | max. | |
| 27 | | | | 100 | 18.0 | 24.0 | 425 | 1007 | |
| 28 | | | | 85 | 15.6 | 21.6 | 277 | 734 | |
| 29 | | | | 50 | 12.0 | 18.0 | 126 | 425 | |
| 30 | | | | 10 | 9.6 | 15.6 | 64 | 277 | |
| 31 | | | | | | | | | |
| 32 | | | | | | | | | |
| 33 | | | | | | | | | |
| 34 | | | | | | | | | |
| 35 | | | | | | | | | |
| 36 | Quantities: | | | | | | | | |
| 37 | Riprap volume= | 36.5 CY | | | | | | | |
| 38 | Approx. weight= | 51.2 Tons | | | | | | | |
| 39 | Geotextile area= | 145.3 SY* | | | | | | | |
| 40 | | | | | | | | | |
| 41 | | | | | | | | | |
| 42 | *Geotextile area | | | | | | | | |
| 43 | includes actual covered | | | | | | | | |
| 44 | surfaces only (no extra | | | | | | | | |
| 45 | for laps or anchorage) | | | | | | | | |
| 46 | | | | | | | | | |

MAPS

2

3

C-120

C-123

C-124

CS1

CS2

Mueller, Jeffrey

From: Driscoll Farid, Aileen <ADriscol@idem.IN.gov>
Sent: Friday, September 28, 2018 12:10 PM
To: Mike Steiner
Subject: Magnolia Ridge

Mike,

The RGP for Magnolia Ridge has been approved with IDEM ID # 2018-640-82-ADF-X. Have a good weekend!

Best,

Aileen Driscoll
Wetlands Project Manager
Office of Water Quality
Indiana Department of Environmental Management
Phone: 317-234-0953
adriscol@idem.in.gov



**CASH WAGGNER
& ASSOCIATES, PC**

CONSULTING ENGINEERS • LAND SURVEYORS

DATE: 09.26.18

ATTENTION: Jeff Mueller

PROJECT NO.: 18-3339

COMPANY: Vanderburgh County Surveyor

REFERENCE: Magnolia Ridge

ADDRESS: Civic Center Complex – Room 325

YOUR FILE NO.:

CITY, ST, ZIP: Evansville, IN 47708

PHONE:

THE FOLLOWING ITEMS:

| COPIES: | ORIG./LAST REV. DATE: | DESCRIPTION: |
|---------|-----------------------|--|
| 1 | 09.21.18 | Final Drainage Plan, Road Profiles & Details |
| 1 | 09.21.18 | Sub-basin Exhibits |
| 1 | 09.19.18 | Final Drainage Report |

LETTER OF TRANSMITTAL

ARE TRANSMITTED:

- PER YOUR REQUEST
- FOR YOUR FILES
- FOR REVIEW & COMMENT
- OTHER

FOR YOUR:

- APPROVAL
- USE
- INFORMATION
- OTHER

VIA:

- COURIER
- FOR PICK UP
- USPS
- NEXT DAY
- FED EX
- UPS
- DHL
- SATURDAY DELIVERY
- TRACKING # _____
- OTHER DELIVERED


COMMENTS:

Please review the attached final drainage plan & report. If you have any questions or comments, please give me a call. Thank you

414 CITADEL CIRCLE
SUITE B
EVANSVILLE, IN 47715
PH: 812.401.5561
FAX: 812.401.5563
GMRITT@CASHWAGGNER.COM

FROM:


GLEN MERITT, JR., P.E.

RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE
9-27-18 



CASH WAGGNER
& ASSOCIATES, PC
CONSULTING ENGINEERS • LAND SURVEYORS

September 19, 2018

Mr. Jeff Mueller
Vanderburgh County Surveyor
Room 325 Civic Center - 1 NW Martin Luther King Jr. Blvd.
Evansville, IN 47708

**RE: Final Drainage Report
Magnolia Ridge
North Green River Road
Our Project #: 18-3339**



Mr. Mueller:

Below is a summary of the drainage calculations for the above-referenced project.

SITE DESCRIPTION

This development will consist of 156 single family residential lots and their associated improvements (i.e. roads, utilities). This development is located on a 67.13-acre parcel that lies on the west side of North Green River Road approximately 2,200 feet south of the North Green River Road and Petersburg Road intersection. This project will be constructed and platted in multiple phases. Section 1 of this development will consist of 25.33-acres that is all the property located north of the existing ditch that divides the property. The majority of the property will be disturbed during construction of the subdivision. The existing ditch running west to east across the center of property will remain undisturbed except for the road and utility crossings.

No known wells or septic tank systems are located on this site. The septic system field bed for the property located at 13620 N. Green River Road is located on the north side of the parcel. The field bed outlet pipe extends roughly 100' north of the parcel boundaries and lies within the limits of the Magnolia Ridge Subdivision. There have been preliminary discussions between this adjoiner and the developer on how to extend the future sanitary sewer system from this development to service the adjoining property. No seeps, springs, sinkholes, caves, shafts, faults or other such geological features are visible or of record on this site.

The proposed sanitary sewer and water mains will be public and will be maintained by EW&SU.

The developer will be utilizing Repair Fund "B" for the maintenance and repair of all storm water drainage systems and facilities outside the county accepted road right-of-ways. Upon the completion of the earthwork activities and utility construction, Tenbarga - Green Alliance seed mixture will be used for permanent seeding all green space areas and the earthen side slopes of all three basins. No tree limbs, refuse from legally burnt vegetation, nor construction waste, demolition materials or other man-made material may be buried within detention basin #1, #2 or #3.

The following statements will be included on the recorded plat for Magnolia Ridge – Section 1:

The individual lot owners shall be responsible, including financially, for maintaining that part of the storm water system and its easements which exist on his or her property in proper working order including:

1. Mowing grass, controlling weeds and maintaining the designed cover of waterways, storage basins and easements in accordance with all applicable ordinances.
2. Keeping all parts of the storm water system operating as designed and as constructed and free of all trash, debris and obstructions to the flow of water.
3. Keeping the channels, embankments, shorelines and bottoms of waterways and basins free from erosion and sedimentation.
4. Maintaining that part of the storm water system which lies on his or her property in accordance with the conditions described on the approved street and/or drainage plans on file in the County Surveyor's Office and/or in the County Engineer's Office and in compliance with the County Drainage Ordinance.

DRAINAGE PATTERNS

The existing site is rolling with a ditch flowing west to east across the center of the site. Ground cover for the entire site is a cultivated field. UN-1 consists of 23.28-acres located on the north side of the existing ditch. Runoff sheet flows to the south to the existing ditch that flows east off-site. UN-2 consists of 2.06-acres located at the northeast corner of the site. Runoff sheet flows east to an existing roadside ditch that flows south to an existing 36" RCP culvert that flows east across Green River Road. UN-3 consists of 4.33-acres located on the east side of the site. Runoff sheet flows east to the existing roadside ditch that flows north off-site. UN-4 consists of 12.88-acres located in the southwest corner of the site. Runoff sheet flows south to an existing ditch that is located along the south property line. This ditch flows south off-site. UN-5 consists of 4.29-acres located in the southeast corner of the site. Runoff sheet flows south to an existing ditch that is located along the south property line. This ditch flows south off-site to an existing pond. UN-6 consists of 20.30-acres located on the south side of the existing ditch. Runoff sheet flows to the north to the existing ditch that flows east off-site. See the attached Undeveloped Sub-basin Exhibit for the locations of each sub-basin.

The 25-year and 100-year flows were calculated for the entire 67.13-acre development. This development was divided into 10 developed sub-basins and nine off-site sub-basins. Sub-basin #1, OS-3 and OS-8 will be collected by Detention Basin #1. Sub-basin #2 and OS-9 will be collected by Detention Basin #2. Sub-basin #3 will be collected by Detention Basin #3. Sub-basins #4, #5 and #8 will sheet flow off-site undetained to the east to the existing roadside ditch along Green River Road. Sub-basins #6, #7 and #10 will flow off-site undetained to the existing ditch that divides the property. Sub-basin #9 will sheet flow off-site undetained to the south. See the attached Developed Sub-basin and Off-Site Sub-basin Exhibits for the locations of each sub-basin.



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A drainage swale and storm sewer network will be installed within the development to capture the storm water runoff and convey it to detention basins #1, #2 and #3. Storm sewers will be constructed with reinforced concrete pipe. The primary outlet and emergency spillway of Detention Basin #1 and #2 will discharge to the existing ditch that is located along the center of the property and flow east. The primary outlet and emergency spillway of Detention Basin #3 will discharge south to the existing ditch that flows south off-site. All runoff ultimately discharges to Bluegrass Creek and/or Schlensker Ditch.

CALCULATIONS

The Rational Method and HERPICC Manual were utilized in performing the drainage calculations for this project. All storm sewers and swales were designed to carry the 25-year developed runoff. The outlet structures for all three detention basins were sized for the 25-year design storm event while allowing a discharge rate less than the undeveloped 10-year storm event from the system.

Below is a summary of the detention basin design elements:

| Detention Basin #1 | | NOTES |
|---|----------------------------|---|
| Detention Basin #1 Developed Q(25) | 28.47 - cfs | #9 - #15 |
| Detention Basin #1 Developed Q(100) | 34.56 - cfs | #9 - #15 |
| Detention Basin #1 Undeveloped Q(10) | 32.02 - cfs | UN-1 |
| Undetained Developed Q(25) | 35.34 - cfs | #1 - #8, #18, #20 & #22 |
| Off-Site Developed Q(25) | 18.92 - cfs | OS-3 & OS-8A |
| 25-year Req'd Storage Volume | 55,293 - cf | |
| 25-year Provided Storage Volume | 93,923 - cf | |
| Allowable Detention Basin #1 Release Rate | 15.39 - cfs | Undeveloped Q(10) - Undetained Developed Q(25) + Off-Site Developed Q(25) |
| <i>Proposed Detention Basin #1 Release Rate</i> | <i>3.70 - cfs</i> | <i>Detention Basin #1 Primary Spillway</i> |
| <i>Outlet Structure</i> | <i>34-LF of 12" R.C.P.</i> | <i>P-531</i> |
| Outlet I.E. | 402.86 | |
| 25-year Storage Vol. Elev. | 404.19 | |
| HW (25-yr. elev. - I.E.) | 1.33 - ft. | |
| Minimum Top/Bank | 405.86 | |

| Detention Basin #2 | | NOTES |
|------------------------------------|-------------|--------------|
| Detention Basin #2 Developed Q(25) | 45.42 - cfs | #24 - #37 |



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| | | |
|---|------------------------------|---|
| Detention Basin #2 Developed Q(100) | 55.67 - cfs | #24 - #37 |
| Detention Basin #2 Undeveloped Q(10) | 30.23 - cfs | UN-6 |
| Undetained Developed Q(25) | 8.10 - cfs | #19 & #23 |
| Off-Site Developed Q(25) | 3.86 - cfs | OS-9A & OS-9B |
| 25-year Req'd Storage Volume | 79,336 - cf | |
| 25-year Provided Storage Volume | 136,762 - cf | |
| Allowable Detention Basin #2 Release Rate | 25.99 - cfs | Undeveloped Q(10) - Undetained Developed Q(25) + Off-Site Developed Q(25) |
| <i>Proposed Detention Basin #2 Release Rate</i> | <i>2.62 - cfs</i> | <i>Detention Basin #2 Primary Spillway</i> |
| <i>Outlet Structure</i> | <i>60-LF of 12" R.C.P.</i> | <i>P-589</i> |
| Outlet I.E. | 412.00 | |
| 25-year Storage Vol. Elev. | 413.03 | |
| HW (25-yr. elev. - I.E.) | 1.03 - ft. | |
| Minimum Top/Bank | 414.75 | |
| Detention Basin #3 | | NOTES |
| Detention Basin #3 Developed Q(25) | 35.66 - cfs | #38 - #46 |
| Detention Basin #3 Developed Q(100) | 43.47 - cfs | #38 - #46 |
| Detention Basin #3 Undeveloped Q(10) | 18.23 - cfs | UN-4 |
| Undetained Developed Q(25) | 1.75 - cfs | #49 |
| Off-Site Developed Q(25) | 0.00 - cfs | |
| 25-year Req'd Storage Volume | 52,398 - cf | |
| 25-year Provided Storage Volume | 101,665 - cf | |
| Allowable Detention Basin #3 Release Rate | 16.48 - cfs | Undeveloped Q(10) - Undetained Developed Q(25) + Off-Site Developed Q(25) |
| <i>Proposed Detention Basin #3 Release Rate</i> | <i>1.98 - cfs</i> | <i>Detention Basin #3 Primary Spillway</i> |
| <i>Outlet Structure</i> | <i>48-LF of 10" H.D.P.E.</i> | <i>P-617</i> |
| Outlet I.E. | 414.00 | |
| 25-year Storage Vol. Elev. | 415.06 | |
| HW (25-yr. elev. - I.E.) | 1.06 - ft. | |
| Minimum Top/Bank | 417.00 | |

| | | |
|--|------------|------------------|
| Runoff discharging to the existing ditch on the west side of Green River Road | | NOTES |
| Undeveloped Q(10) | 4.14 - cfs | UN-2 |
| Undetained Developed Q(25) | 4.11 - cfs | #51, #51A & #51B |

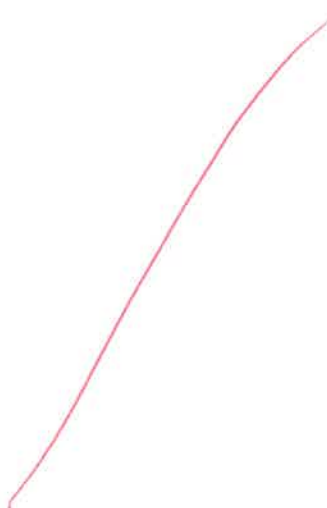


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| | | |
|----------------------------|------------|-------------------------|
| Undeveloped Q(10) | 5.84 - cfs | UN-3 |
| Undetained Developed Q(25) | 5.43 - cfs | #50A, #50B, #52A & #52B |
| Undeveloped Q(10) | 7.25 - cfs | UN-5 |
| Undetained Developed Q(25) | 7.10 - cfs | #47 & #48 |



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DETENTION FACILITY DESIGN VOLUME CALCULATIONS

PROJECT: **Magnolia Ridge
Detention Basin #1**

DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS

RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA: 20.94 ACRES
DEVELOPED RUNOFF COEFFICIENT (C_d): 0.391

| STORM DURATION T _d (HRS) | RAINFALL INTENSITY I _d (INCH/HR) | INFLOW RATE I(T _d) (C _d *I _d *A) (CFS) | OUTFLOW RATE O (C _u *I _u *A) (CFS) | STORAGE RATE ΔS I(T _d)-O (CFS) | REQUIRED STORAGE S _d (I(T _d)-O)*T _d /12 (ACRE-FT) |
|---|---|---|---|---|--|
| 0.08 | 7.810 | 63.94 | 3.70 | 60.24 | 0.418 |
| 0.17 | 6.320 | 51.75 | 3.70 | 48.05 | 0.667 |
| 0.25 | 5.240 | 42.90 | 3.70 | 39.20 | 0.817 |
| 0.33 | 4.597 | 37.64 | 3.70 | 33.94 | 0.943 |
| 0.42 | 3.953 | 32.37 | 3.70 | 28.67 | 0.995 |
| 0.50 | 3.310 | 27.10 | 3.70 | 23.40 | 0.975 |
| 0.58 | 3.083 | 25.24 | 3.70 | 21.54 | 1.047 |
| 0.67 | 2.857 | 23.39 | 3.70 | 19.69 | 1.094 |
| 0.75 | 2.630 | 21.53 | 3.70 | 17.83 | 1.115 |
| 0.83 | 2.403 | 19.68 | 3.70 | 15.98 | 1.110 |
| 0.92 | 2.177 | 17.82 | 3.70 | 14.12 | 1.079 |
| 1.00 | 1.950 | 15.97 | 3.70 | 12.27 | 1.022 |
| 1.25 | 1.805 | 14.78 | 3.70 | 11.08 | 1.154 |
| 1.50 | 1.660 | 13.59 | 3.70 | 9.89 | 1.236 |
| 1.75 | 1.515 | 12.40 | 3.70 | 8.70 | 1.269 |
| 2.00 | 1.370 | 11.22 | 3.70 | 7.52 | 1.253 |
| 3.00 | 1.020 | 8.35 | 3.70 | 4.65 | 1.163 |

| | |
|---------------------------------|---------------|
| PEAK STORAGE (ACRE/FT): | 1.27 |
| PEAK STORAGE (CUBIC FT): | 55,293 |

Magnolia Ridge

Detention Basin #1

PROPOSED 25-YR DESIGN RELEASE RATE

CALCULATIONS FOR PIPE FLOWING FULL

(Pressure Conditions)

SOLVE FOR Q

\emptyset = 1 FT.
h'= 4.0 IN.
h= 0.83 FT.
Ke= 0.5
Ko= 1
n= 0.012
L= 34 FT.
HW= 1.33 FT.

Q= 3.70 CFS

\emptyset = diameter of orifice (pipe) h= h' + \emptyset /2
Ke= entrance coefficient h'= ht. of water
Ko= outfall coefficient above orifice
n= manning's 'n' HW= h' + \emptyset
L= length of orifice (pipe)
Q= allowable release rate

DETENTION FACILITY DESIGN VOLUME CALCULATIONS

PROJECT: **Magnolia Ridge
Detention Basin #1**

DETENTION FACILITY DESIGN RETURN PERIOD: 100 YRS

RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA: **20.94 ACRES**
DEVELOPED RUNOFF COEFFICIENT (C_d): **0.391**

| STORM DURATION T _d (HRS) | RAINFALL INTENSITY I _d (INCH/HR) | INFLOW RATE I(T _d) (C _d *I _d *A) (CFS) | OUTFLOW RATE O (C _u *I _u *A) (CFS) | STORAGE RATE ΔS I(T _d)-O (CFS) | REQUIRED STORAGE S _d (I(T _d)-O)*T _d /12 (ACRE-FT) |
|---|---|---|---|---|--|
| 0.08 | 9.950 | 81.47 | 4.66 | 76.81 | 0.533 |
| 0.17 | 8.050 | 65.91 | 4.66 | 61.25 | 0.851 |
| 0.25 | 6.680 | 54.69 | 4.66 | 50.03 | 1.042 |
| 0.33 | 5.857 | 47.95 | 4.66 | 43.29 | 1.203 |
| 0.42 | 5.033 | 41.21 | 4.66 | 36.55 | 1.269 |
| 0.50 | 4.210 | 34.47 | 4.66 | 29.81 | 1.242 |
| 0.58 | 3.935 | 32.22 | 4.66 | 27.56 | 1.340 |
| 0.67 | 3.660 | 29.97 | 4.66 | 25.31 | 1.406 |
| 0.75 | 3.385 | 27.71 | 4.66 | 23.05 | 1.441 |
| 0.83 | 3.110 | 25.46 | 4.66 | 20.80 | 1.445 |
| 0.92 | 2.835 | 23.21 | 4.66 | 18.55 | 1.417 |
| 1.00 | 2.560 | 20.96 | 4.66 | 16.30 | 1.358 |
| 1.25 | 2.380 | 19.49 | 4.66 | 14.83 | 1.544 |
| 1.50 | 2.200 | 18.01 | 4.66 | 13.35 | 1.669 |
| 1.75 | 2.020 | 16.54 | 4.66 | 11.88 | 1.732 |
| 2.00 | 1.840 | 15.07 | 4.66 | 10.41 | 1.734 |

| | |
|---------------------------------|---------------|
| PEAK STORAGE (ACRE/FT): | 1.73 |
| PEAK STORAGE (CUBIC FT): | 75,541 |

Magnolia Ridge

Detention Basin #1

PROPOSED 100-YR DESIGN RELEASE RATE

CALCULATIONS FOR PIPE FLOWING FULL

(Pressure Conditions)

SOLVE FOR Q

\emptyset = 1 FT.
h'= 9.7 IN.
h= 1.3117 FT.
Ke= 0.5
Ko= 1
n= 0.012
L= 34 FT.
HW= 1.8117 FT.

Q= 4.66 CFS

\emptyset = diameter of orifice (pipe) h= h' + \emptyset /2
Ke= entrance coefficient h'= ht. of water
Ko= outfall coefficient above orifice
n= manning's 'n' HW= h' + \emptyset
L= length of orifice (pipe)
Q= allowable release rate

Magnolia Ridge

Detention Basin #1

PROVIDED DETENTION VOLUMES

(per ACAD)

| | <u>Elevation</u> | <u>Area (s.f.)</u> | <u>Avg. Area (s.f.)</u> | <u>Inc. Vol. (c.f.)</u> | <u>Cumulative Vol. (c.f.)</u> |
|--------|-------------------------|-------------------------------|------------------------------------|------------------------------------|--|
| Pool | 402.86 | 39,138 | | | |
| | 403.86 | 42,336 | 40,737 | 40,737 | 40,737 |
| E.O.S. | 405.06 | 46,307 | 44,322 | 53,186 | 93,923 |
| T.B. | 405.86 | 49,035 | 47,671 | 38,137 | 132,060 |

Detention volume provided at Elev. 405.06 = 93,923 c.f.

Total, required 25-YR detention volume = 55,293 c.f.

25-YR Req'd detention volume provided @ Elev. = 404.19 ft.

Req'd HW= 1.33 ft.

Detention volume provided at Elev. 405.86 = 132,060 c.f.

Total, required 100-YR detention volume = 75,541 c.f.

100-YR Req'd detention volume provided @ Elev. = 404.67 ft.

Req'd HW= 1.81 ft.

Weighted c calculations for sub-basins captured by Detention Basin #1

| DEVELOPED WEIGHTED c CALCULATIONS | | | |
|--|-----------------|----------|--------------------------|
| | | | Total Area = 20.94 Acres |
| Sub-basin | Area (A) | c | c x A |
| #9 | 0.47 Ac. | 0.526 | 0.012 |
| #10 + OS-8A | 12.34 Ac. | 0.313 | 0.184 |
| #11 | 1.31 Ac. | 0.581 | 0.036 |
| #12 | 0.96 Ac. | 0.602 | 0.028 |
| #13 + OS-3 | 4.49 Ac. | 0.485 | 0.104 |
| #14 | 0.84 Ac. | 0.609 | 0.024 |
| #15 | 0.53 Ac. | 0.550 | 0.014 |

Weighted c = 0.391

Open Channel Flow Calculations

Swale #: **Emergency
Spillway
Basin #1**

Side slope = 4
 Bottom width = 20
 Manning's coefficient = 0.035
 Slope of channel = 0.0085

| Depth (ft) | Wetted Perimeter (ft) | Area (ft ²) | Hydraulic Radius (ft) | Hydraulic Depth (ft) | Flowrate (cfs) | Velocity (ft/s) | F value |
|------------|-----------------------|-------------------------|-----------------------|----------------------|----------------|-----------------|---------|
| 0.0 | 20.00 | 0.00 | 0.00 | 0.00 | 0.00 | #DIV/0! | 1.0 |
| 0.1 | 20.82 | 2.04 | 0.10 | 0.10 | 1.70 | 0.83 | 1.1 |
| 0.2 | 21.65 | 4.16 | 0.19 | 0.19 | 5.44 | 1.31 | 1.2 |
| 0.30 | 22.47 | 6.36 | 0.28 | 0.28 | 10.76 | 1.69 | 1.3 |
| 0.4 | 23.30 | 8.64 | 0.37 | 0.37 | 17.50 | 2.03 | 1.4 |
| 0.5 | 24.12 | 11.00 | 0.46 | 0.46 | 25.58 | 2.33 | 1.5 |
| 0.6 | 24.95 | 13.44 | 0.54 | 0.54 | 34.93 | 2.60 | 1.6 |
| 0.7 | 25.77 | 15.96 | 0.62 | 0.62 | 45.51 | 2.85 | 1.7 |
| 0.8 | 26.60 | 18.56 | 0.70 | 0.70 | 57.31 | 3.09 | 1.8 |

Open Channel Flow Calculations

Swale #: **Emergency Spillway**
Lot 4 & 5

Side slope = 3
Bottom width = 10
Manning's coefficient = 0.035
Slope of channel = 0.0078

| Depth (ft) | Wetted Perimeter (ft) | Area (ft ²) | Hydraulic Radius (ft) | Hydraulic Depth (ft) | Flowrate (cfs) | Velocity (ft/s) | F value |
|------------|-----------------------|-------------------------|-----------------------|----------------------|----------------|-----------------|---------|
| 0.0 | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | #DIV/0! | 1.0 |
| 0.1 | 10.63 | 1.03 | 0.10 | 0.10 | 0.82 | 0.79 | 1.1 |
| 0.2 | 11.26 | 2.12 | 0.19 | 0.19 | 2.62 | 1.23 | 1.2 |
| 0.30 | 11.90 | 3.27 | 0.27 | 0.28 | 5.20 | 1.59 | 1.3 |
| 0.4 | 12.53 | 4.48 | 0.36 | 0.36 | 8.49 | 1.89 | 1.4 |
| 0.5 | 13.16 | 5.75 | 0.44 | 0.44 | 12.45 | 2.16 | 1.5 |
| 0.6 | 13.79 | 7.08 | 0.51 | 0.52 | 17.06 | 2.41 | 1.6 |
| 0.7 | 14.43 | 8.47 | 0.59 | 0.60 | 22.33 | 2.64 | 1.7 |
| 0.8 | 15.06 | 9.92 | 0.66 | 0.67 | 28.24 | 2.85 | 1.8 |
| 0.90 | 15.69 | 11.43 | 0.73 | 0.74 | 34.79 | 3.04 | 1.9 |
| 1.0 | 16.32 | 13.00 | 0.80 | 0.81 | 41.99 | 3.23 | 2.0 |
| 1.1 | 16.96 | 14.63 | 0.86 | 0.88 | 49.85 | 3.41 | 2.1 |
| 1.2 | 17.59 | 16.32 | 0.93 | 0.95 | 58.37 | 3.58 | 2.2 |

DETENTION FACILITY DESIGN VOLUME CALCULATIONS

PROJECT: **Magnolia Ridge
Detention Basin #2**

DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS

RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA: 20.75 ACRES
DEVELOPED RUNOFF COEFFICIENT (C_d): 0.468

| STORM DURATION T _d (HRS) | RAINFALL INTENSITY I _d (INCH/HR) | INFLOW RATE I(T _d) (C _d *I _d *A) (CFS) | OUTFLOW RATE O (C _u *I _u *A) (CFS) | STORAGE RATE ΔS I(T _d)-O (CFS) | REQUIRED STORAGE S _d (I(T _d)-O)*T _d /12 (ACRE-FT) |
|---|---|---|---|---|--|
| 0.08 | 7.810 | 75.84 | 2.62 | 73.22 | 0.508 |
| 0.17 | 6.320 | 61.37 | 2.62 | 58.75 | 0.816 |
| 0.25 | 5.240 | 50.89 | 2.62 | 48.27 | 1.006 |
| 0.33 | 4.597 | 44.64 | 2.62 | 42.02 | 1.167 |
| 0.42 | 3.953 | 38.39 | 2.62 | 35.77 | 1.242 |
| 0.50 | 3.310 | 32.14 | 2.62 | 29.52 | 1.230 |
| 0.58 | 3.083 | 29.94 | 2.62 | 27.32 | 1.328 |
| 0.67 | 2.857 | 27.74 | 2.62 | 25.12 | 1.396 |
| 0.75 | 2.630 | 25.54 | 2.62 | 22.92 | 1.432 |
| 0.83 | 2.403 | 23.34 | 2.62 | 20.72 | 1.439 |
| 0.92 | 2.177 | 21.14 | 2.62 | 18.52 | 1.415 |
| 1.00 | 1.950 | 18.94 | 2.62 | 16.32 | 1.360 |
| 1.25 | 1.805 | 17.53 | 2.62 | 14.91 | 1.553 |
| 1.50 | 1.660 | 16.12 | 2.62 | 13.50 | 1.688 |
| 1.75 | 1.515 | 14.71 | 2.62 | 12.09 | 1.763 |
| 2.00 | 1.370 | 13.30 | 2.62 | 10.68 | 1.781 |
| 3.00 | 1.020 | 9.91 | 2.62 | 7.29 | 1.821 |

| | |
|---------------------------------|---------------|
| PEAK STORAGE (ACRE/FT): | 1.82 |
| PEAK STORAGE (CUBIC FT): | 79,336 |

Magnolia Ridge

Detention Basin #2

PROPOSED 25-YR DESIGN RELEASE RATE

CALCULATIONS FOR PIPE FLOWING FULL

(Pressure Conditions)

SOLVE FOR Q

\emptyset = 1 FT.
h'= 0.4 IN.
h= 0.5333 FT.
Ke= 0.5
Ko= 1
n= 0.012
L= 60 FT.
HW= 1.0333 FT.

Q= 2.62 CFS

\emptyset = diameter of orifice (pipe) h= h' + \emptyset /2
Ke= entrance coefficient h'= ht. of water
Ko= outfall coefficient above orifice
n= manning's 'n' HW= h' + \emptyset
L= length of orifice (pipe)
Q= allowable release rate

DETENTION FACILITY DESIGN VOLUME CALCULATIONS

PROJECT: **Magnolia Ridge
Detention Basin #2**

DETENTION FACILITY DESIGN RETURN PERIOD: 100 YRS

RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA: 20.75 ACRES
DEVELOPED RUNOFF COEFFICIENT (C_d): 0.468

| STORM DURATION T _d (HRS) | RAINFALL INTENSITY I _d (INCH/HR) | INFLOW RATE I(T _d) (C _d *I _d *A) (CFS) | OUTFLOW RATE O (C _u *I _u *A) (CFS) | STORAGE RATE ΔS ⁻ I(T _d)-O (CFS) | REQUIRED STORAGE S _d (I(T _d)-O)*T _d /12 (ACRE-FT) |
|---|---|---|---|--|--|
| 0.08 | 9.950 | 96.62 | 3.32 | 93.30 | 0.648 |
| 0.17 | 8.050 | 78.17 | 3.32 | 74.85 | 1.040 |
| 0.25 | 6.680 | 64.87 | 3.32 | 61.55 | 1.282 |
| 0.33 | 5.857 | 56.87 | 3.32 | 53.55 | 1.488 |
| 0.42 | 5.033 | 48.88 | 3.32 | 45.56 | 1.582 |
| 0.50 | 4.210 | 40.88 | 3.32 | 37.56 | 1.565 |
| 0.58 | 3.935 | 38.21 | 3.32 | 34.89 | 1.696 |
| 0.67 | 3.660 | 35.54 | 3.32 | 32.22 | 1.790 |
| 0.75 | 3.385 | 32.87 | 3.32 | 29.55 | 1.847 |
| 0.83 | 3.110 | 30.20 | 3.32 | 26.88 | 1.867 |
| 0.92 | 2.835 | 27.53 | 3.32 | 24.21 | 1.849 |
| 1.00 | 2.560 | 24.86 | 3.32 | 21.54 | 1.795 |
| 1.25 | 2.380 | 23.11 | 3.32 | 19.79 | 2.062 |
| 1.50 | 2.200 | 21.36 | 3.32 | 18.04 | 2.256 |
| 1.75 | 2.020 | 19.62 | 3.32 | 16.30 | 2.377 |
| 2.00 | 1.840 | 17.87 | 3.32 | 14.55 | 2.425 |

| | |
|---------------------------------|----------------|
| PEAK STORAGE (ACRE/FT): | 2.42 |
| PEAK STORAGE (CUBIC FT): | 105,620 |

Magnolia Ridge

Detention Basin #2

PROPOSED 100-YR DESIGN RELEASE RATE

CALCULATIONS FOR PIPE FLOWING FULL

(Pressure Conditions)

SOLVE FOR Q

\emptyset = 1 FT.
h'= 4.3 IN.
h= 0.86 FT.
Ke= 0.5
Ko= 1
n= 0.012
L= 60 FT.
HW= 1.36 FT.

Q= 3.32 CFS

\emptyset = diameter of orifice (pipe) h= h' + \emptyset /2
Ke= entrance coefficient h'= ht. of water
Ko= outfall coefficient above orifice
n= manning's 'n' HW= h' + \emptyset
L= length of orifice (pipe)
Q= allowable release rate

Magnolia Ridge

Detention Basin #2

PROVIDED DETENTION VOLUMES

(per ACAD)

| | <u>Elevation</u> | <u>Area</u> <u>(s.f.)</u> | <u>Avg. Area</u> <u>(s.f.)</u> | <u>Inc. Vol.</u> <u>(c.f.)</u> | <u>Cumulative Vol.</u> <u>(c.f.)</u> |
|--------|-------------------------|--|---|---|---|
| Pool | 412.00 | 74,206 | | | |
| | 412.75 | 77,565 | 75,886 | 56,914 | 56,914 |
| E.O.S. | 413.75 | 82,131 | 79,848 | 79,848 | 136,762 |
| T.B. | 414.75 | 86,798 | 84,465 | 84,465 | 221,227 |

Detention volume provided at Elev. 413.75 = 136,762 c.f.

Total, required 25-YR detention volume = 79,336 c.f.

25-YR Req'd detention volume provided @ Elev. = 413.03 ft.

Req'd HW= 1.03 ft.

Detention volume provided at Elev. 414.75 = 221,227 c.f.

Total, required 100-YR detention volume = 105,620 c.f.

100-YR Req'd detention volume provided @ Elev. = 413.36 ft.

Req'd HW= 1.36 ft.

Weighted c calculations for sub-basins captured by Detention Basin #2

| DEVELOPED WEIGHTED c CALCULATIONS | | | |
|--|-----------------|----------|--------------------------|
| | | | Total Area = 20.75 Acres |
| Sub-basin | Area (A) | c | c x A |
| #24 + OS-9A | 1.73 Ac. | 0.514 | 0.043 |
| #25 | 0.41 Ac. | 0.549 | 0.011 |
| #26 | 0.86 Ac. | 0.627 | 0.026 |
| #27 | 0.50 Ac. | 0.581 | 0.014 |
| #28 | 2.92 Ac. | 0.364 | 0.051 |
| #29 | 1.65 Ac. | 0.520 | 0.041 |
| #30 | 0.53 Ac. | 0.542 | 0.014 |
| #31 | 2.37 Ac. | 0.328 | 0.037 |
| #32 + OS-9B | 2.38 Ac. | 0.567 | 0.065 |
| #33 | 0.75 Ac. | 0.606 | 0.022 |
| #34 | 0.58 Ac. | 0.531 | 0.015 |
| #35 | 0.91 Ac. | 0.603 | 0.026 |
| #36 | 0.70 Ac. | 0.620 | 0.021 |
| #37 | 4.46 Ac. | 0.378 | 0.081 |

Weighted c = 0.468

Open Channel Flow Calculations

Swale #: **Emergency
Spillway
Basin #2**

Side slope = 4
 Bottom width = 20
 Manning's coefficient = 0.035
 Slope of channel = 0.05

| Depth (ft) | Wetted Perimeter (ft) | Area (ft ²) | Hydraulic Radius (ft) | Hydraulic Depth (ft) | Flowrate (cfs) | Velocity (ft/s) | F value |
|---------------|--------------------------|----------------------------|--------------------------|-------------------------|-------------------|--------------------|---------|
| 0.0 | 20.00 | 0.00 | 0.00 | 0.00 | 0.00 | #DIV/0! | 1.0 |
| 0.1 | 20.82 | 2.04 | 0.10 | 0.10 | 4.13 | 2.02 | 1.1 |
| 0.2 | 21.65 | 4.16 | 0.19 | 0.19 | 13.19 | 3.17 | 1.2 |
| 0.30 | 22.47 | 6.36 | 0.28 | 0.28 | 26.10 | 4.10 | 1.3 |
| 0.4 | 23.30 | 8.64 | 0.37 | 0.37 | 42.45 | 4.91 | 1.4 |
| 0.5 | 24.12 | 11.00 | 0.46 | 0.46 | 62.03 | 5.64 | 1.5 |

DETENTION FACILITY DESIGN VOLUME CALCULATIONS

PROJECT: **Magnolia Ridge
Detention Basin #3**

DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS

RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA: 11.89 ACRES
DEVELOPED RUNOFF COEFFICIENT (C_d): 0.560

| STORM DURATION T _d (HRS) | RAINFALL INTENSITY I _d (INCH/HR) | INFLOW RATE I(T _d) (C _d *I _d *A) (CFS) | OUTFLOW RATE O (C _u *I _u *A) (CFS) | STORAGE RATE ΔS I(T _d)-O (CFS) | REQUIRED STORAGE S _d (I(T _d)-O)*T _d /12 (ACRE-FT) |
|---|---|---|---|---|--|
| 0.08 | 7.810 | 52.00 | 1.98 | 50.02 | 0.347 |
| 0.17 | 6.320 | 42.08 | 1.98 | 40.10 | 0.557 |
| 0.25 | 5.240 | 34.89 | 1.98 | 32.91 | 0.686 |
| 0.33 | 4.597 | 30.61 | 1.98 | 28.63 | 0.795 |
| 0.42 | 3.953 | 26.32 | 1.98 | 24.34 | 0.845 |
| 0.50 | 3.310 | 22.04 | 1.98 | 20.06 | 0.836 |
| 0.58 | 3.083 | 20.53 | 1.98 | 18.55 | 0.902 |
| 0.67 | 2.857 | 19.02 | 1.98 | 17.04 | 0.947 |
| 0.75 | 2.630 | 17.51 | 1.98 | 15.53 | 0.971 |
| 0.83 | 2.403 | 16.00 | 1.98 | 14.02 | 0.974 |
| 0.92 | 2.177 | 14.49 | 1.98 | 12.51 | 0.956 |
| 1.00 | 1.950 | 12.98 | 1.98 | 11.00 | 0.917 |
| 1.25 | 1.805 | 12.02 | 1.98 | 10.04 | 1.046 |
| 1.50 | 1.660 | 11.05 | 1.98 | 9.07 | 1.134 |
| 1.75 | 1.515 | 10.09 | 1.98 | 8.11 | 1.182 |
| 2.00 | 1.370 | 9.12 | 1.98 | 7.14 | 1.190 |
| 3.00 | 1.020 | 6.79 | 1.98 | 4.81 | 1.203 |

PEAK STORAGE (ACRE/FT): 1.20
PEAK STORAGE (CUBIC FT): 52,398

REVISION

Magnolia Ridge

Detention Basin #3

PROPOSED 25-YR DESIGN RELEASE RATE

CALCULATIONS FOR PIPE FLOWING FULL

(Pressure Conditions)

SOLVE FOR Q

\emptyset = 0.833 FT.
h'= 2.7 IN.
h= 0.6415 FT.
Ke= 0.5
Ko= 1
n= 0.012
L= 48 FT.
HW= 1.058 FT.

Q= 1.98 CFS

\emptyset = diameter of orifice (pipe) h= h' + \emptyset /2
Ke= entrance coefficient h'= ht. of water
Ko= outfall coefficient above orifice
n= manning's 'n' HW= h' + \emptyset
L= length of orifice (pipe)
Q= allowable release rate

DETENTION FACILITY DESIGN VOLUME CALCULATIONS

PROJECT: **Magnolia Ridge
Detention Basin #3**

DETENTION FACILITY DESIGN RETURN PERIOD: 100 YRS

RELEASE RATE RETURN PERIOD: 10 YRS

WATERSHED AREA: **11.89 ACRES**
DEVELOPED RUNOFF COEFFICIENT (C_d): **0.560**

| STORM DURATION T _d (HRS) | RAINFALL INTENSITY I _d (INCH/HR) | INFLOW RATE I(T _d) (C _d *I _d *A) (CFS) | OUTFLOW RATE O (C _u *I _u *A) (CFS) | STORAGE RATE ΔS I(T _d)-O (CFS) | REQUIRED STORAGE S _d (I(T _d)-O)*T _d /12 (ACRE-FT) |
|---|---|---|---|---|--|
| 0.08 | 9.950 | 66.25 | 2.48 | 63.77 | 0.443 |
| 0.17 | 8.050 | 53.60 | 2.48 | 51.12 | 0.710 |
| 0.25 | 6.680 | 44.48 | 2.48 | 42.00 | 0.875 |
| 0.33 | 5.857 | 39.00 | 2.48 | 36.52 | 1.014 |
| 0.42 | 5.033 | 33.51 | 2.48 | 31.03 | 1.078 |
| 0.50 | 4.210 | 28.03 | 2.48 | 25.55 | 1.065 |
| 0.58 | 3.935 | 26.20 | 2.48 | 23.72 | 1.153 |
| 0.67 | 3.660 | 24.37 | 2.48 | 21.89 | 1.216 |
| 0.75 | 3.385 | 22.54 | 2.48 | 20.06 | 1.254 |
| 0.83 | 3.110 | 20.71 | 2.48 | 18.23 | 1.266 |
| 0.92 | 2.835 | 18.88 | 2.48 | 16.40 | 1.253 |
| 1.00 | 2.560 | 17.05 | 2.48 | 14.57 | 1.214 |
| 1.25 | 2.380 | 15.85 | 2.48 | 13.37 | 1.392 |
| 1.50 | 2.200 | 14.65 | 2.48 | 12.17 | 1.521 |
| 1.75 | 2.020 | 13.45 | 2.48 | 10.97 | 1.600 |
| 2.00 | 1.840 | 12.25 | 2.48 | 9.77 | 1.629 |

| | |
|---------------------------------|---------------|
| PEAK STORAGE (ACRE/FT): | 1.63 |
| PEAK STORAGE (CUBIC FT): | 70,941 |

Magnolia Ridge

Detention Basin #3

PROPOSED 100-YR DESIGN RELEASE RATE

CALCULATIONS FOR PIPE FLOWING FULL

(Pressure Conditions)

SOLVE FOR Q

\emptyset = 0.8333 FT.
h'= 7.1 IN.
h= 1.0083 FT.
Ke= 0.5
Ko= 1
n= 0.012
L= 48 FT.
HW= 1.425 FT.

Q= 2.48 CFS

\emptyset = diameter of orifice (pipe) h= h' + $\emptyset/2$
Ke= entrance coefficient h'= ht. of water
Ko= outfall coefficient above orifice
n= manning's 'n' HW= h' + \emptyset
L= length of orifice (pipe)
Q= allowable release rate

Magnolia Ridge

Detention Basin #3

PROVIDED DETENTION VOLUMES

(per ACAD)

| | <u>Elevation</u> | <u>Area</u> <u>(s.f.)</u> | <u>Avg. Area</u> <u>(s.f.)</u> | <u>Inc. Vol.</u> <u>(c.f.)</u> | <u>Cumulative Vol.</u> <u>(c.f.)</u> |
|--------|-------------------------|--|---|---|---|
| Pool | 414.00 | 47,244 | | | |
| | 415.00 | 50,807 | 49,026 | 49,026 | 49,026 |
| E.O.S. | 416.00 | 54,471 | 52,639 | 52,639 | 101,665 |
| T.B. | 417.00 | 58,235 | 56,353 | 56,353 | 158,018 |

Detention volume provided at Elev. 416.00 = 101,665 c.f.

Total, required 25-YR detention volume = 52,398 c.f.

25-YR Req'd detention volume provided @ Elev. = 415.06 ft.

Req'd HW= 1.06 ft.

Detention volume provided at Elev. 417.00 = 158,018 c.f.

Total, required 100-YR detention volume = 70,941 c.f.

100-YR Req'd detention volume provided @ Elev. = 415.42 ft.

Req'd HW= 1.42 ft.

Weighted c calculations for sub-basins captured by Detention Basin #3

| DEVELOPED WEIGHTED c CALCULATIONS | | | |
|--|-----------------|----------|--------------|
| Total Area = 11.89 Acres | | | |
| Sub-basin | Area (A) | c | c x A |
| #38 | 1.23 Ac. | 0.492 | 0.051 |
| #39 | 0.89 Ac. | 0.614 | 0.046 |
| #40 | 0.69 Ac. | 0.603 | 0.035 |
| #41 | 0.87 Ac. | 0.604 | 0.044 |
| #42 | 0.79 Ac. | 0.641 | 0.043 |
| #43 | 1.29 Ac. | 0.364 | 0.039 |
| #44 | 0.93 Ac. | 0.607 | 0.047 |
| #45 | 1.02 Ac. | 0.590 | 0.051 |
| #46 | 4.18 Ac. | 0.579 | 0.204 |

Weighted c = 0.560

Open Channel Flow Calculations

Swale #: **Emergency
Spillway
Basin #3**

Side slope = 4
 Bottom width = 15
 Manning's coefficient = 0.035
 Slope of channel = 0.05

| Depth (ft) | Wetted Perimeter (ft) | Area (ft ²) | Hydraulic Radius (ft) | Hydraulic Depth (ft) | Flowrate (cfs) | Velocity (ft/s) | F value |
|---------------|--------------------------|----------------------------|--------------------------|-------------------------|-------------------|--------------------|---------|
| 0.0 | 15.00 | 0.00 | 0.00 | 0.00 | 0.00 | #DIV/0! | 1.0 |
| 0.1 | 15.82 | 1.54 | 0.10 | 0.10 | 3.10 | 2.01 | 1.1 |
| 0.2 | 16.65 | 3.16 | 0.19 | 0.19 | 9.93 | 3.14 | 1.2 |
| 0.30 | 17.47 | 4.86 | 0.28 | 0.28 | 19.71 | 4.08 | 1.3 |
| 0.4 | 18.30 | 6.64 | 0.36 | 0.36 | 32.16 | 4.84 | 1.4 |
| 0.5 | 19.12 | 8.50 | 0.44 | 0.45 | 47.13 | 5.54 | 1.5 |