

**FINAL DRAINAGE REPORT
for
Nevayah Place**

**Evansville, Indiana
Project No.: 10390.4.001 B
June 14, 2019**

**Prepared For:
Anlene LLC
2166 Eaglewood Drive
Newburgh, IN 47630**

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



James E. Morley
6-14-19

**RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE**
6-14-19 *DA*



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

Neveyah Place-Final Drainage Plan

The final drainage plan was submitted on June 14th, 2019 with revisions submitted June 28th, 2019 and August 13th, 2019 and August 19th, 2019. The plan that is requested to be approved consists of the submitted document and revisions on the respective submitted dates along with the following drawings.

Drawings submitted June 14th, 2019

- G-100
- G-101 (those portions that are applicable to the Drainage Plan-Notes regarding EWSU, Sanitary Sewer and Water for reference only)

Drawings submitted August 19th, 2019

- C-100
- C-101
- C-102
- C-500

Road plans for Reference Only

- C-501

NEVAYAH PLACE-FINAL DRAINAGE PLAN

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.

C. Included with the Drainage Plan shall be the following information regarding the applicant that shall be provided on FORM 801. **Provided in preliminary plan**

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. **Submitted June 14, 2019, Revisions June 28, 2019**

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. **Required Revisions are shown in red. (Blue-meets requirements on initial submittal, red need response or does not meet requirement, purple-addresses requirements upon submittal of revisions) Italics are comments from preliminary plan review and have not changed**

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. **Provided**

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. ***Two pipes in offsite Drainage Easements- the final drainage plan will need to address the maintenance. Provide with the submittal previously obtained documentation regarding approval to place outlet pipes on adjacent property. Provided with Preliminary Plan***

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. **Alene LLC, 2166 Eaglewood Drive, Newburgh, IN 47630**

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. **To be developed in one phase**

13.04.140 Information submittal and review schedule.

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, and all single parcel commercial and industrial parcels zoned C-0 through M-3 of 2 acres in size or greater that are adjacent to agriculture land use or single family homes, the applicant shall notify all adjoining landowners of the proposed drainage plan. The notification shall also be sent to any Registered Neighborhood Association within 1/4 mile of the proposed development and shall meet the criteria of notification. **Notices were sent as part of Preliminary Plan**

- 1. The notification shall consist of the following language.

“Notice is hereby given that a Drainage Plan for _____ with a location of _____ has been submitted to the Vanderburgh County Surveyors Office, Room 325, Civic Center, Evansville, IN. The submitted Drainage Plan will be heard for approval or disapproval before the Drainage Board meeting on (date and time) at Room 301 of the Civic Center. A copy of the Drainage Plan is available for review in the County Surveyor’s Office during normal business hours.”

- 2. Also included in the notice shall be the name of the developer, name of the landowner where the development is to occur and the name of the engineer/engineering firm that has developed the Drainage Plan.

- 3. The notification shall occur by certified mail, delivery using approved overnight services providing that the overnight services provide a receipt of delivery or by use of United States Postal Service Certificate of Mailing. All mailings must be made at least 7 days in advance of the scheduled Drainage Board meeting in which the Drainage Plan is to be heard.

4. For new subdivisions in which approval of a preliminary plan is sought under Section 13.04.150 to satisfy certain requirements of the Area Plan Commission (APC), the mailing shall give notice of the preliminary plan. Once noticed for a preliminary plan, notice will not be required for hearing of the final Drainage Plan unless stated by the Drainage Plan as a condition for approval of the preliminary Drainage Plan.

5. Any required notice under this section may be done in conjunction with notice requirements by the Area Plan Commission provided that the required notice is sent at least 7 days in advance of the scheduled Drainage Board meeting in which the Drainage Plan is to be heard.

13.04.150 Preliminary drainage plan allowed.

Presentation of a preliminary form of the final drainage (Preliminary Drainage Plan) plan may be allowed when the applicant is in need of approval of a preliminary drainage plan to satisfy certain requirements of the Area Plan Commission, and it can be shown that the complexity of the project prohibits the submittal of the final drainage plan within the time limits set by the Area Plan Commission for plan submittals.

For the Preliminary Drainage Plan the notices required under Section 13.04.140 H shall be sent as part of the preliminary plan process. As part of the approval of the preliminary drainage plan the Drainage Board shall determine whether additional notifications shall be required with the submittal of the final drainage plan. **Very little input received from adjoining property owners in Preliminary Plan process; therefore no notice is recommended for the final plan.**

13.04.160 Contents of preliminary drainage plan.

A. The contents of the preliminary drainage plan shall include a map based on the most current county planimetric maps, or a topographic map prepared from a more recent aerial photo reconnaissance that provides more accurate data, complete with contour lines, and showing the following:

1. The extent and area of each watershed affecting the design of the drainage facilities for the project; ***Undeveloped shown on Predeveloped Subbasins. For Developed, area assumed to be single area with storage roughly split between two basins. However, because P108 carries the water from CI 109 to the north basin, the entire street plus the front yards of the south lots will drain to the north basin. If the assumption of the split is to be used than CI 109 must drain to the south basin or the basins must be sized based upon their actual final watershed split. Engineer recognizes this issue and is requesting that final drainage plan address either resizing or movement of pipes. As this is a preliminary drainage plan and there is sufficient basin area and the ability to add additional piping the plan meets the criteria of being workable.***
2. The soil types based on the most current information available from the SWCD; ***Provided-soils are a mix of various silt loams, mainly Hosmer <2%***
3. Zone "A" floodplain based on the current FIRM panels; ***Provided-none of the area within Zone A***

4. The existing man-made and natural waterways, ponds, basins, pipes, culverts, and other drainage facilities or features within or affecting the project; ***Area is currently a cultivated field that will drain to the east into an existing drainage easement.***

5. The preliminary layout and design of the streets, and all stormwater drainage facilities, including depressed pavements used to convey or temporarily store overflow from the heavier storms, and all outlets for the storm water drainage facilities; ***Provided, locations of pipes and inlets shown.***

6. The existing streams, floodways, and floodplains to be maintained, and new channels to be constructed, their locations, cross sections, profiles, and materials used; ***No channels or streams proposed. Lots 9 & 10 show flowing offsite undetained into an existing erosion area. A swale will need to be constructed to capture and route the flow into one of the two dry detention basins. The revised plan shows grading to the north and south. This will be addressed in detail on whether an easement will be required and how the existing outflow from the farm ground will be addressed.***

7. The proposed culverts and bridges to be built, with the proposed materials to be used; ***No bridges, single culvert to be located at entrance to subdivision***

8. Existing detention basins or ponds within the project, or outside the project but affecting it, to be maintained, enlarged, or otherwise altered, together with any new basins or ponds to be built; and their basis of design; ***Two new dry basins are planned. SEE Comment under 13.04.160 A1***

9. The estimated depth and amount of storage required of the basins and ponds, and their available freeboards; ***Storage and depth provided. All freeboards will be checked with Section 440 during final review***

10. The estimated location and percentage of impervious surface existing and expected to be constructed at completion of the project; ***Estimates of total impervious provided-final drainage plan should address in more detail. Street locations shown.***

11. Any interim plan which is to be incorporated into the project pending its completion according to the final Drainage Plan. ***None proposed***

12. A copy of the Notice of Public Hearing as required by the Area Plan Commission and under Section 13.04.140 H of the Vanderburgh County Drainage Code with a copy of the returned receipts from all certified mailings or proof of Certificate of Mailing. ***Certificate of Mailings or copy of Green Cards will need to be provided Provided***

B. Notations and Explanations on the Preliminary Plan. All notations necessary to indicate the existing conditions, and the proposed functions of the various features shown thereon; and shall include the following.

C. Geographic Orientation Required. A north arrow, scale, location insert, and other information necessary for geographic clarification shall be included on a preliminary plan. **All provided. Scale at 1"=30'**

D. Data Required to Accompany Preliminary Plan. Descriptive data sufficient to support the feasibility of the preliminary drainage plan with regard to the requirements of this chapter, including calculations of the predevelopment and post development runoff rates using rainfall data supplied herein shall accompany a preliminary drainage plan. **Provided**

E. Recommendation of Preliminary Plans Restricted. No preliminary drainage plan shall be deemed to meet the requirements of the drainage code by the technical advisors to the Drainage Board unless the preliminary drainage plan shall be a workable plan according to the same criteria as, and capable of being incorporated into, a final drainage plan. **Area is small and all drains in same direction. Plan appears workable as the existing topography is flat.**

F. Determination of Sufficiency. The drainage board shall decide the sufficiency of the preliminary drainage plan, and any conditions or additional requirements to be applied to the preliminary drainage plan.

OTHER COMMENTS-These Comments do not need to be addressed for the Preliminary Plan

Design for outlet culverts in Final Drainage Plan should utilize true elevations in culvert report. Emergency spillway calculations will need to be performed to see if erosion control material will be required along existing channel where these flows discharged Provided

On Drawing C102, it is not clear if there is a ribbon from FES 103 to FES 102. Please clarify on the drawing for the final drainage plan. Addressed in revised drawing

13.04.165 Contents of final drainage plan.

The contents of the final Drainage Plan shall include all the items listed above for a preliminary drainage plan, plus:

A. Soils Map. A soils map indicating soils names and their hydrologic classification must be provided for a proposed project; **Provided in Preliminary**

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. **Provided** 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; **1'**

C. 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; **Provided in Preliminary**

D. The normal shoreline of lakes, ponds, swamps, and basins, their floodplains, and lines of inflow and outflow; **No lakes or pond-basins will be dry so there will be no shorelines**

E. The location of existing regulated drains, farm drains, inlets and outfalls; **No regulated drains**

F. The location of the following existing storm and water features: **All easements shown on Drainage Plan Drawings**

1. Storm sewers and easements;
2. Sanitary sewers and easements;
3. Combined sewers and easements;
4. Water lines and easements;

and outfalls to any of the above as applies;

G. Wells, septic tank systems, and outfalls, if any; **Per submittal "There will be no wells, septic tank systems or outfalls on this project." This project lies at on the site of an old farmhouse-are there any known cisterns or septic tanks located on the site?** Per comments the owner stated that the existing septic tank and well were removed and abandoned during the demolition of the old farmhouse.

H. Seeps, springs, sinkholes, caves, shafts, faults, or other such geological features visible, or of record; **Per submittal, "No Visible geological features are present at this project site."**

I. The limits of the entire proposed project and the limits of the expected extent of land disturbance required to accomplish the project; **States see Appendix A, but not addressed Disturbed limits map provided**

J. The location of the streets, lot lines, and easements; **Provided**

K. A scale, preferably one inch equals fifty (50) feet **1"=30 and 1"=100'**

L. An arrow indicating North. **Provided**

M. On-Site Bench Mark Required. A benchmark is required to be located within the project limits. Approved datum shall be found within the most recently approved Technical Memorandum. **Provided**

N. For all non residential Major Subdivisions and all Minor Subdivisions C-0 through M-3 (**Not Applicable-Residential Subdivision**)

13.04.170 Final drainage plan layout.

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 tributary to the drainage facilities within the project; **Provided**
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; **The pipe numbers in the chart in Appendix B do not match the numbers shown on the drawings. Corrected and submitted 6/28/2019**
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; **Explain what grading notes #1 and #2 mean relative to this project? Won't all grades be constructed as shown on the street plans? If so, why are these notes on the plans? Also it is unclear as to the meaning of the notes and may cause issues with a contractor using these statements as a basis to justify doing something contrary to what is shown elsewhere in your plans.**
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; **Swale Capacity Chart shows the bottom width of all swales at 2' wide but typical cross sections on drawing C-500 shows the bottom width at 1' Corrected and submitted 6/28/2019**
5. The materials, elevations, waterway openings, size, and basis for design of the proposed culverts and bridges; **Provided**
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; **Two Detention ponds designed using Rational. Individual watershed areas were not shown but total area was divided. Need to design basins utilizing Post-Developed basins as provided in Appendix B. Separate Form 800 needs to be provided for each basin to insure basins (especially south basin) has adequate storage. Provided Since the outlet for each basin is an 8" pipe without any orifice plate why was equation 6.3.2 utilized versus a pipe equation? Revised**

It is the understanding that this field discharges to the east in the large existing ditch. It appears from the "Pre Developed Subbasin" drawing that the Time of Concentration was calculated with the line going north. Please address and show calculations for time of concentration utilizing methodology required under 13.04.205 C10 which requires utilizing methodology in US Department of Agriculture, Natural Resources Conservation Service TR-55. Revised

7. The location and percentage of impervious surfaces existing and expected to be constructed; **Need to tie impervious surfaces to the drainage watersheds (post sub 1-6) and basins that they are located (basin 1-2,3 & 4, basin 2-1,5 & 6). Provided**
 8. The material types, sizes, slopes, grades and other details of all the stormwater drainage facilities; **Provided**
 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; **Pending revisions-see 13.04.170 A 6 Provided**
 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; **Pending revisions-see 13.04.170 A 6 Provided**
 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. **Per submittal-no impacted areas**
 12. The location of Drainage Easements for retention/detention basins, drainage ditches/swales, storm sewers, junction boxes, inlets, or manholes outside of any county right of way. Easements dimensions must be shown on each individual lot to the extent that they can be recreated in the field within the lot boundaries of said lot. **Provided**
- 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. **Not within one year flood plain. See 13.04.440C regarding requirements for homes adjacent to basins.**

13.04.175 Submittal of a written drainage design report. Pending resubmittal of basins and addressing other review comments see comments

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

- A. Any significant stormwater drainage problems existing or anticipated to be associated with the project; **None noted**
- B. The analysis procedure used to identify and evaluate the drainage problems associated with the project; **Rational**
- C. Any assumptions or special conditions associated with the use of the procedures, especially hydrologic or hydraulic methods, used to identify and evaluate drainage problems associated with the project; **Provided**

D. Discussion of any permits applications submitted or proposed to be submitted to state and/or federal agencies that will affect the timing and/or construction of the Drainage Plan such as but not limited to United States Corp of Engineers 404 permits (both individual and nationwide), Indiana Department of Environmental permits (401 Water Certification and others), Indiana Department of Natural Resource Permits (Construction in Floodway) and any approvals that may be required to discharge to Indiana State Highways. The report should state the status of the application of such permits. For permits that have been approved, copies of the approval document shall be included with the Drainage Design Report including any conditions on approved permits that could affect the implementation of the Drainage Plan; **Per submittal, “not applicable”**.

E. The proposed design of the drainage control system; **The response needs to be proof read and resubmitted Revised**

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

G. 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; **Provided**

H. Maps showing individual drainage areas within the project subdivided for use in the analysis thereof. **Provided**

13.04.180 Typical cross sections of 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:

A. For existing and proposed detention and retention basins and ponds, a minimum of two cross sections per basin with the cross sections being 90 degrees from each other. The cross sections shall show the following: **Pending revisions-see 13.04.170 A 6 Provided**

Minimum bottom of the basin, Pool Elevation (wet basins), side slope of the basins including above and below normal pool elevation for wet basins, elevation of water at designed storm, elevation of water at 100 year storm, elevation (bottom) of emergency spillway and elevation of outflow of 100 year storm within emergency spillway, elevation of existing land immediately adjacent to the basin, proposed surrounding topography including required maintenance pathway of new basins, fencing (if provided) and any easements or obstructions that are intersected by the cross section.

B. For existing ditches and streams – sufficient typical cross sections that capture the existing channel throughout the project area. The cross sections shall show the existing configuration and existing land immediately adjacent to all drainage facilities as well as any easements, property lines or obstructions that are intersected by the cross section. For all existing ditches a bottom profile line must also be provided. The profile line shall also show any existing structures (culverts, bridges, and other crossings),

location of crossing utilities or other obstructions within the ditches or streams. **No existing streams or ditches**

C. For new channels and swales – sufficient typical cross sections that capture the proposed configuration of new channels and swales throughout the project area. The cross sections shall show the proposed configuration of the channels and swales and existing land immediately adjacent to all drainage facilities as well as any easements, property lines or obstructions that are intersected by the cross section. Also a bottom profile line must also be provided. The profile line shall also show any existing structures (culverts, bridges, and other crossings), location of crossing utilities or other obstructions within the ditches or streams. **No new channels-typicals provided for swales**

D. For large projects and subdivisions which will contain multiple swales, a typical cross section of the swale may be provided combined with a swale table listing each swale. The swale table shall include the slope of each swale (in lieu of profile), depth of water at designed storm and type of erosion control to be utilized on the channel bottom and side slopes. **Provided**

E. Typical Cross sections shall be provided in the following situations where proposed excavation is proposed against no controlled properties: **Not Applicable**

- 1) for any cut that is proposed within 15' of a property line and the cut is 4' or greater and where such cut is not part of an excavation for a channel or swale.
- 2) the location of any proposed retaining walls greater than 4' within 15' of a property line.

13.04.350 Grass mix matched to site conditions.

The choice of grass mixture for stabilizing open channels shall be based upon specific site conditions such as shade and sun tolerance, velocity tolerance, and waterway maintenance requirements. The proposed seed mixture to be utilized for stabilizing open channels shall be included in the approved Drainage Plan. **Provided**

13.04.420 Allowable release rate.

A. The allowable post development peak release rate of stormwater from a project during a twenty-five (25) year return period storm shall not exceed the pre-development peak release rate from the same land area during a ten (10) year return period storm. **10/25 see comment under 13.04.170A6 addressed in revisions**

B. Inadequate Downstream Drainage or Restrictions.

1. If the downstream channel or storm sewer system is not adequate to accommodate the release rate provided above, then the release rate shall be reduced to that rate permitted by the capacity of the receiving channel or storm sewer system; and additional detention shall be required to store that rate of runoff exceeding the capacity of the receiving stormwater drainage facilities (limiting restriction).

2. If more than one basin is involved in the development of the area upstream of the limiting restriction, the allowable release rate from any one basin shall be in direct proportion to the ratio of its drainage area to the drainage area of the entire watershed upstream of the restriction.

C. As development continues within Impacted Areas as defined in Section 13.04.015 the Board on a project by project basis may decrease the allowable post development controlled peak release rate of stormwater to not exceed a five (5) or two (2) year return period storm from the same land area prior to its development for those areas that lie within those impacted areas. **Not Applicable**

D. Certain areas within the project may be allowed to leave undetained due to the layout of a project combined with the natural topography. In order for areas to leave undetained the undetained areas must meet the criteria of the most current Vanderburgh County Technical Memorandum. **0.13 acres to leave undetained-Meets Criteria**

E. Allowable release rates from basins utilized for erosion control during construction shall be designed to meet the criteria any Indiana Department of Environmental Management standards as addressed in the Technical Memorandum including standards required to meet any NPDES General Permit.

13.04.440 General detention/retention basin design requirements.

The following design principles shall be observed for detention and retention basins: **Portions of this section will not be reviewed pending resubmittal of basin information as addressed under 13.04.170 A 6 Reviewed and noted below**

A. Dry detention facilities designed to become a permanent part of the stormwater drainage system shall be installed with an additional ten (10) percent capacity to allow for sediment accumulation resulting from development, and to permit the pond to function for reasonable periods between cleanings. **See Chart-Meets code**

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. **See Basin Design Chart**

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. **See Basin Design Chart-no elevations provided 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. **Meets code**

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 measurement to one vertical unit of measurement (2:1) at any point in the side slope. **Dry Basin**

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. **Dry Basin**

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 measurement from a point two vertical feet below permanent pool, thence downward. **Dry Basin**

H. 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 developer. **County will not comment on this issue-developer needs to determine if this should be required**

I. 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. **Pipe and open spillway**

J. 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 with greater than 0.5 acres of surface area at normal pool 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. **Dry Basin**

K. Emergency Spillway Requirements.

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. **Meets code**

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. **Meets code**

3. The emergency overflow spillway shall be clearly marked with a defined weir, either grass, rip rap or paved. The emergency overflow spillway velocities shall be calculated and the necessary erosion control materials shall be specified and utilized in the construction of the overflow spillway and receiving stream. Energy dissipation measures must be employed where required.

L. 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. **Meets code**

M. Dry Detention Basin Criteria. **Meets code**

1. Dry basins shall be planted and maintained in vegetative cover equal to that of residential lawns.
2. 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 and have a minimum slope of 0.5%.
3. Dry Basins shall be constructed to eliminate potential wet areas that are difficult to mow and conducive to the invasion of wetland species of plant growth. Basins shall be sloped to the outfall point with a minimum slope of 0.5% over the bottom of the basin towards the concrete liner and the concrete liner shall be sloped at a similar minimum slope.

N. 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. **Tenbarge Green Alliance**

O. 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. **Dry Basin**

P. 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. **Provided**

Q. 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 within the right of way of any county, state or federal road or highway. For all basins at least one easement of at least 10' in width must be provided to access the basin from a public roadway for the purpose of maintaining the basin. For subdivisions in which no public roadway is to be dedicated the easement must be to the nearest private road or public road. **Provided**

R. Maintenance Report Required for Basin.

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 **Is lot owner 8 responsible for maintaining the portion of the Basin that is located on Lot 7; also a similar situation exists on Basin 2 for lots 11 for lots 10 and 12? Revised**

2. The maintenance report for all subdivisions or summary of the report shall be included on the plat or shall be referenced on the plat to its location as part of the drainage plan.

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

T. 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. **Not noted on plans Noted on C-100**

U. 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. **Not Applicable**

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

BASIN DESIGN CHART-Review		Basin 1	Basin 2
1	Design Capacity	3020	3828
2	(Section A) Dry detention facilities designed to become a permanent part of the stormwater drainage system shall be installed with an additional ten (10) percent capacity to allow for sediment accumulation resulting from development, and to permit the pond to function for reasonable periods between cleanings; (#1 x 1.1)	3322	4111
3	Normal Pool Elevation or dry basin bottom elevation	404	404.5
4	Storage elevation at 25 year storm (50 year for State Highway 100 year for impacted area)	<406	<406.5
5	(Section 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. (#4-#3)	<2'	<2'
6	Elevation of emergency spillway	406.5	407
7	Q100	9	10.14
8	Depth of flow through emergency spillway at 100 year storm	0.41	0.44
9	Flow line at 100 year storm #6 +#8	406.91	407.44
10	(Section K2) 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. #9-#4 ≥ 0.5	.91	.94
11	Elevation of top of bank	407.5	408
12	(Section L) 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. (#11-#9 $\geq 0.5'$)	0.59	0.54
13	Elevation of home adjacent to basin	410	410
	(Section 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. (#13-#9 $\geq 2'$)	3.09	2.54

13.04.460 Responsibility for drainage facility maintenance.

The installation, maintenance, repair, and replacement of all stormwater drainage facilities, and erosion and siltation control measures for a project during the period of construction, and until final approval by the county engineer, shall be the responsibility of the land developer(s), and/or the property owner(s) of record.

The assignment of responsibility for the maintenance and repair of all stormwater drainage systems and facilities outside of county accepted road rights-of-way after the completion of the project, and final approval thereof by the county engineer, shall be determined before the final drainage plan is approved; and shall be documented by appropriate covenants and restrictions applied to the subdivision and to the property deeds thereof, and shall be printed clearly upon all recorded plats of the project.

Other Comments

Outlet pipes from basins show a 45 degree angle pipe which is not to code. Outlet pipe should have an end section. **Provided Provide detail on the outlet pipe as to any proposed erosion control. Provided Pipe changed and shows cast-in-place end section. No issues with this proposal however need details (size, depth of casting, anchoring and proposed reinforcing if any)**

Why do lots 9 & 10 not have swales to capture water to divert to basins? If no swale can be constructed what assurances will be provided by developer that the areas will drain as designed? Will the letter of credit address this potential? How will drainage (gutter down drains, etc be routed so that they will not discharge directly to the ditch? See 13.06.160A6. Squiggly line shown but no defined swale, please address with location of swale and drainage easement.

It is not clear why the County should allow this variance as it appears that a Homeowners Association could address the maintenance of the pipes and that there is no provision in the Code for individual landowners to be responsible for the maintenance of pipes. Per the County Attorney "All options within the drainage code must be utilized and good cause must be shown to go outside the code. No cause has been shown as to why they must deviate outside the code." A variance letter was provided with the 6/28/2019 revisions, however, it is not clear why a Homeowners Association cannot be created and therefore this request should be denied.

Revised Drawing 100 was submitted showing revised contours to reflect revisions in basin sizing. Drawing 101 that was submitted with original submittal still has contours that reflect basins before resizing. A revised drawing 101 needs to be submitted to reflect corrections.

A note needs to be added on the overflow swale shown on sheet C102 indicating the swale must meet the typical swale cross section shown on sheet C500.



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

August 19, 2019

Vanderburgh County Surveyor
Attn: Jeff Mueller
1 NW MLK Jr. Blvd.
Room 325 Civic Center Complex
Evansville, IN 47708

**Re: Nevayah Place
Final Drainage Plan Approval
Morley Project #10390.4.001-B**

Jeff,

This letter summarizes the required changes made to the drainage plan and applicable details. These revisions are attached for your approval of the final drainage plan. If approved, please include this matter in the agenda for the next scheduled Drainage Board Meeting.

Final Drainage Plan – Other Comments:

- Detail for outlet pipe provided on sheet C500.
- Swales defined on Lots 9 and 10. A portion of the backyard was provided as an easement where the swale will meet county standards. High point of the swale and elevations shown on sheet C100.
- Per owner, the subdivision will have a Homeowners Association. The subdivision will use Plan A to maintain and repair all pipes outside county right-of-way.
- Sheet C101 is attached showing updated contours.
- Per John Stoll's comment, a note was added on sheet C100 and C102 indicating that the overflow swale must meet typical swale cross section shown on sheet C500.
- Grading Notes on sheet C100 revised per John Stoll's comment.

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

Sincerely,

A handwritten signature in blue ink that reads 'Alejandro Mojica'.

Alejandro Mojica
Civil Staff Engineer

Encl: As Stated

cc: Walid Fehme, John Stoll P.E., Vanderburgh County Engineer



Letter of Transmittal

Regarding: Nevayah Place
Final Drainage Plan and Report

To: Vanderburgh County Surveyor
Attn: Jeff Mueller
1 NW MLK Jr. Blvd.
Room 325 Civic Center Complex
Evansville, IN 47708

Project No: 10390.4.001-A

Date: August 19, 2019

We are sending you by: Messenger

We are sending:

COPIES	DOC. DATE	DESCRIPTION
1	8-19-19	Civil Plans (C100, C101, C102, C500)
1	8-19-19	Response to Comments Letter

These are transmitted: For Approval

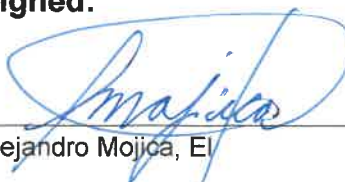
Remarks: Jeff,

Please review the attached information and place on the next available Drainage Board Meeting agenda. If you should have any questions or need further information, please contact our office as soon as possible.

Thank you.

Copies to:
WALID FEHME; FILE

Signed:


Alejandro Mojica, EI

RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE
8-19-19
EA



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

August 13, 2019

Vanderburgh County Surveyor
Attn: Jeff Mueller
1 NW MLK Jr. Blvd.
Room 325 Civic Center Complex
Evansville, IN 47708

**Re: Nevayah Place
Final Drainage Plan Approval
Morley Project #10390.4.001-B**

Jeff,

This letter summarizes the required changes made to the drainage plan and applicable details as well as changes to the drainage report. These revisions are attached for your approval of the final drainage plan. If approved, please include this matter in the agenda for the next scheduled Drainage Board Meeting.

Final Drainage Plan – Other Comments:

- Detail for outlet pipe provided on sheet C500.
- Swales defined on Lots 9 and 10. A portion of the backyard was provided as an easement where the swale will meet county standards. High point of the swale and elevations shown on sheet C100.
- Per owner, the subdivision will have a Homeowners Association which will be responsible for the maintenance and repair of the outlet pipes. All lots within the subdivision will be equally responsible, including financially, for the maintenance of the outlet pipes. *REVISED BY 8/19/2019 SUBMITTAL - PLAN A*
- Sheet 101 is attached showing updated contours.
- Per John Stoll's comment, a note was added on sheet C100 and C102 indicating that the overflow swale must meet typical swale cross section shown on sheet C500.
- Grading Notes on sheet C100 revised per John Stoll's comment.

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

Sincerely,

Alejandro Mojica
Civil Staff Engineer

RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE
8-13-19
[Signature]

Encl: As Stated cc: Walid Fehme, John Stoll P.E., Vanderburgh County Engineer



Letter of Transmittal

Regarding: Nevayah Place
Road Plans
Final Drainage Plan and Report

To: Vanderburgh County Engineer's
Office
Attn: John Stoll
Old Courthouse, Suite 307
201 NW 4th Street
Evansville, IN 47708

Project No: 10390.4.001-A

Date: August 13, 2019

We are sending you by: Messenger

We are sending:

COPIES	DOC. DATE	DESCRIPTION
1	8-13-19	Civil Plans (C100, C101, C500)
1	8-13-19	Letter addressing comments from County Surveyor

These are transmitted: For Approval

Remarks: John,

Please review the attached information for road plan approval and final drainage approval.

If you should have any questions or need further information, please contact our office as soon as possible. Thank you.

Copies to:
WALID FEHME; FILE

Signed:


Alejandro Mojica, EI

RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE
8-13-19
EA

Letter of Transmittal

Regarding: Nevayah Place
Final Drainage Plan and Report

To: Vanderburgh County Surveyor
Attn: Jeff Mueller
1 NW MLK Jr. Blvd.
Room 325 Civic Center Complex
Evansville, IN 47708

Project No: 10390.4.001-A

Date: June 14, 2019

We are sending you by: Messenger

We are sending:

COPIES	DOC. DATE	DESCRIPTION
1	6-14-19	Infrastructure/Drainage Plan and Details (C-100, C-500)
1	6-14-19	Final Drainage Report
1	6-14-19	Variance Letter

These are transmitted: For Approval

Remarks: Jeff,

Please review the attached information and place on the next available date for drainage board review. If you should have any questions or need further information, please contact our office as soon as possible.

Thank you.

Copies to:
WALID FEHME; FILE

Signed:

RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE
6-14-19
EA



Neveyah Place-Final Drainage Plan

The final drainage plan was submitted on June 14th, 2019 with revisions submitted June 28th, 2019 and August 13th, 2019 and August 19th, 2019. The plan that is requested to be approved consists of the submitted document and revisions on the respective submitted dates along with the following drawings.

Drawings submitted June 14th, 2019

- G-100
- G-101 (those portions that are applicable to the Drainage Plan-Notes regarding EWSU, Sanitary Sewer and Water for reference only)

Drawings submitted August 19th, 2019

- C-100
- C-101
- C-102
- C-500

Road plans for Reference Only

- C-501

NEVAYAH PLACE-FINAL DRAINAGE PLAN

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.

C. Included with the Drainage Plan shall be the following information regarding the applicant that shall be provided on FORM 801. **Provided in preliminary plan**

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. **Submitted June 14, 2019, Revisions June 28, 2019 and August 13, 2019 and August 19, 2019**

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. **Required Revisions are shown in red. (Blue-meets requirements on initial submittal, red need response or does not meet requirement, purple-addresses requirements upon submittal of revisions) Italics are comments from preliminary plan review and have not changed**

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. **Provided**

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. ***Two pipes in offsite Drainage Easements- the final drainage plan will need to address the maintenance. Provide with the submittal previously obtained documentation regarding approval to place outlet pipes on adjacent property. Provided with Preliminary Plan***

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. **Alene LLC, 2166 Eaglewood Drive, Newburgh, IN 47630**

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. **To be developed in one phase**

13.04.140 Information submittal and review schedule.

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, and all single parcel commercial and industrial parcels zoned C-0 through M-3 of 2 acres in size or greater that are adjacent to agriculture land use or single family homes, the applicant shall notify all adjoining landowners of the proposed drainage plan. The notification shall also be sent to any Registered Neighborhood Association within 1/4 mile of the proposed development and shall meet the criteria of notification. **Notices were sent as part of Preliminary Plan**

- 1. The notification shall consist of the following language.

“Notice is hereby given that a Drainage Plan for _____ with a location of _____ has been submitted to the Vanderburgh County Surveyors Office, Room 325, Civic Center, Evansville, IN. The submitted Drainage Plan will be heard for approval or disapproval before the Drainage Board meeting on (date and time) at Room 301 of the Civic Center. A copy of the Drainage Plan is available for review in the County Surveyor’s Office during normal business hours.”

- 2. Also included in the notice shall be the name of the developer, name of the landowner where the development is to occur and the name of the engineer/engineering firm that has developed the Drainage Plan.

- 3. The notification shall occur by certified mail, delivery using approved overnight services providing that the overnight services provide a receipt of delivery or by use of United States Postal Service Certificate of Mailing. All mailings must be made at least 7 days in advance of the scheduled Drainage Board meeting in which the Drainage Plan is to be heard.

4. For new subdivisions in which approval of a preliminary plan is sought under Section 13.04.150 to satisfy certain requirements of the Area Plan Commission (APC), the mailing shall give notice of the preliminary plan. Once noticed for a preliminary plan, notice will not be required for hearing of the final Drainage Plan unless stated by the Drainage Plan as a condition for approval of the preliminary Drainage Plan.

5. Any required notice under this section may be done in conjunction with notice requirements by the Area Plan Commission provided that the required notice is sent at least 7 days in advance of the scheduled Drainage Board meeting in which the Drainage Plan is to be heard.

13.04.150 Preliminary drainage plan allowed.

Presentation of a preliminary form of the final drainage (Preliminary Drainage Plan) plan may be allowed when the applicant is in need of approval of a preliminary drainage plan to satisfy certain requirements of the Area Plan Commission, and it can be shown that the complexity of the project prohibits the submittal of the final drainage plan within the time limits set by the Area Plan Commission for plan submittals.

For the Preliminary Drainage Plan the notices required under Section 13.04.140 H shall be sent as part of the preliminary plan process. As part of the approval of the preliminary drainage plan the Drainage Board shall determine whether additional notifications shall be required with the submittal of the final drainage plan. **Very little input received from adjoining property owners in Preliminary Plan process; therefore no notice is recommended for the final plan.**

13.04.160 Contents of preliminary drainage plan.

A. The contents of the preliminary drainage plan shall include a map based on the most current county planimetric maps, or a topographic map prepared from a more recent aerial photo reconnaissance that provides more accurate data, complete with contour lines, and showing the following:

1. The extent and area of each watershed affecting the design of the drainage facilities for the project; ***Undeveloped shown on Predeveloped Subbasins. For Developed, area assumed to be single area with storage roughly split between two basins. However, because P108 carries the water from CI 109 to the north basin, the entire street plus the front yards of the south lots will drain to the north basin. If the assumption of the split is to be used than CI 109 must drain to the south basin or the basins must be sized based upon their actual final watershed split. Engineer recognizes this issue and is requesting that final drainage plan address either resizing or movement of pipes. As this is a preliminary drainage plan and there is sufficient basin area and the ability to add additional piping the plan meets the criteria of being workable.***

2. The soil types based on the most current information available from the SWCD; ***Provided-soils are a mix of various silt loams, mainly Hosmer <2%***

3. Zone "A" floodplain based on the current FIRM panels; ***Provided-none of the area within Zone A***

4. The existing man-made and natural waterways, ponds, basins, pipes, culverts, and other drainage facilities or features within or affecting the project; ***Area is currently a cultivated field that will drain to the east into an existing drainage easement.***
 5. The preliminary layout and design of the streets, and all stormwater drainage facilities, including depressed pavements used to convey or temporarily store overflow from the heavier storms, and all outlets for the storm water drainage facilities; ***Provided, locations of pipes and inlets shown.***
 6. The existing streams, floodways, and floodplains to be maintained, and new channels to be constructed, their locations, cross sections, profiles, and materials used; ***No channels or streams proposed. Lots 9 & 10 show flowing offsite undetained into an existing erosion area. A swale will need to be constructed to capture and route the flow into one of the two dry detention basins. The revised plan shows grading to the north and south. This will be addressed in detail on whether an easement will be required and how the existing outflow from the farm ground will be addressed.***
 7. The proposed culverts and bridges to be built, with the proposed materials to be used; ***No bridges, single culvert to be located at entrance to subdivision***
 8. Existing detention basins or ponds within the project, or outside the project but affecting it, to be maintained, enlarged, or otherwise altered, together with any new basins or ponds to be built; and their basis of design; ***Two new dry basins are planned. SEE Comment under 13.04.160 A1***
 9. The estimated depth and amount of storage required of the basins and ponds, and their available freeboards; ***Storage and depth provided. All freeboards will be checked with Section 440 during final review***
 10. The estimated location and percentage of impervious surface existing and expected to be constructed at completion of the project; ***Estimates of total impervious provided-final drainage plan should address in more detail. Street locations shown.***
 11. Any interim plan which is to be incorporated into the project pending its completion according to the final Drainage Plan. ***None proposed***
 12. A copy of the Notice of Public Hearing as required by the Area Plan Commission and under Section 13.04.140 H of the Vanderburgh County Drainage Code with a copy of the returned receipts from all certified mailings or proof of Certificate of Mailing. ***Certificate of Mailings or copy of Green Cards will need to be provided Provided***
- B. Notations and Explanations on the Preliminary Plan. All notations necessary to indicate the existing conditions, and the proposed functions of the various features shown thereon; and shall include the following.

C. Geographic Orientation Required. A north arrow, scale, location insert, and other information necessary for geographic clarification shall be included on a preliminary plan. **All provided. Scale at 1"=30'**

D. Data Required to Accompany Preliminary Plan. Descriptive data sufficient to support the feasibility of the preliminary drainage plan with regard to the requirements of this chapter, including calculations of the predevelopment and post development runoff rates using rainfall data supplied herein shall accompany a preliminary drainage plan. **Provided**

E. Recommendation of Preliminary Plans Restricted. No preliminary drainage plan shall be deemed to meet the requirements of the drainage code by the technical advisors to the Drainage Board unless the preliminary drainage plan shall be a workable plan according to the same criteria as, and capable of being incorporated into, a final drainage plan. **Area is small and all drains in same direction. Plan appears workable as the existing topography is flat.**

F. Determination of Sufficiency. The drainage board shall decide the sufficiency of the preliminary drainage plan, and any conditions or additional requirements to be applied to the preliminary drainage plan.

OTHER COMMENTS-These Comments do not need to be addressed for the Preliminary Plan

Design for outlet culverts in Final Drainage Plan should utilize true elevations in culvert report. Emergency spillway calculations will need to be performed to see if erosion control material will be required along existing channel where these flows discharged Provided

On Drawing C102, it is not clear if there is a ribbon from FES 103 to FES 102. Please clarify on the drawing for the final drainage plan. Addressed in revised drawing

13.04.165 Contents of final drainage plan.

The contents of the final Drainage Plan shall include all the items listed above for a preliminary drainage plan, plus:

A. Soils Map. A soils map indicating soils names and their hydrologic classification must be provided for a proposed project; **Provided in Preliminary**

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. **Provided** 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; **1'**

C. 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; **Provided in Preliminary**

D. The normal shoreline of lakes, ponds, swamps, and basins, their floodplains, and lines of inflow and outflow; **No lakes or pond-basins will be dry so there will be no shorelines**

E. The location of existing regulated drains, farm drains, inlets and outfalls; **No regulated drains**

F. The location of the following existing storm and water features: **All easements shown on Drainage Plan Drawings**

1. Storm sewers and easements;
2. Sanitary sewers and easements;
3. Combined sewers and easements;
4. Water lines and easements;

and outfalls to any of the above as applies;

G. Wells, septic tank systems, and outfalls, if any; **Per submittal "There will be no wells, septic tank systems or outfalls on this project." This project lies at on the site of an old farmhouse-are there any known cisterns or septic tanks located on the site? Per comments the owner stated that the existing septic tank and well were removed and abandoned during the demolition of the old farmhouse.**

H. Seeps, springs, sinkholes, caves, shafts, faults, or other such geological features visible, or of record; **Per submittal, "No Visible geological features are present at this project site."**

I. The limits of the entire proposed project and the limits of the expected extent of land disturbance required to accomplish the project; **States see Appendix A, but not addressed Disturbed limits map provided**

J. The location of the streets, lot lines, and easements; **Provided**

K. A scale, preferably one inch equals fifty (50) feet **1"=30 and 1"=100'**

L. An arrow indicating North. **Provided**

M. On-Site Bench Mark Required. A benchmark is required to be located within the project limits. Approved datum shall be found within the most recently approved Technical Memorandum. **Provided**

N. For all non residential Major Subdivisions and all Minor Subdivisions C-0 through M-3 (**Not Applicable-Residential Subdivision**)

13.04.170 Final drainage plan layout.

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 tributary to the drainage facilities within the project; **Provided**
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; **The pipe numbers in the chart in Appendix B do not match the numbers shown on the drawings. Corrected and submitted 6/28/2019**
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; **Explain what grading notes #1 and #2 mean relative to this project? Won't all grades be constructed as shown on the street plans? If so, why are these notes on the plans? Also it is unclear as to the meaning of the notes and may cause issues with a contractor using these statements as a basis to justify doing something contrary to what is shown elsewhere in your plans. Notes have been revised**
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; **Swale Capacity Chart shows the bottom width of all swales at 2' wide but typical cross sections on drawing C-500 shows the bottom width at 1' Corrected and submitted 6/28/2019**
5. The materials, elevations, waterway openings, size, and basis for design of the proposed culverts and bridges; **Provided**
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; **Two Detention ponds designed using Rational. Individual watershed areas were not shown but total area was divided. Need to design basins utilizing Post-Developed basins as provided in Appendix B. Separate Form 800 needs to be provided for each basin to insure basins (especially south basin) has adequate storage. Provided Since the outlet for each basin is an 8" pipe without any orifice plate why was equation 6.3.2 utilized versus a pipe equation? Revised**

It is the understanding that this field discharges to the east in the large existing ditch. It appears from the "Pre Developed Subbasin" drawing that the Time of Concentration was calculated with the line going north. Please address and show calculations for time of concentration utilizing methodology required under 13.04.205 C10 which requires utilizing methodology in US Department of Agriculture, Natural Resources Conservation Service TR-55. Revised

7. The location and percentage of impervious surfaces existing and expected to be constructed; **Need to tie impervious surfaces to the drainage watersheds (post sub 1-6) and basins that they are located (basin 1-2,3 & 4, basin 2-1,5 & 6). Provided**
8. The material types, sizes, slopes, grades and other details of all the stormwater drainage facilities; **Provided**
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; **Pending revisions-see 13.04.170 A 6 Provided**
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; **Pending revisions-see 13.04.170 A 6 Provided**
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. **Per submittal-no impacted areas**
12. The location of Drainage Easements for retention/detention basins, drainage ditches/swales, storm sewers, junction boxes, inlets, or manholes outside of any county right of way. Easements dimensions must be shown on each individual lot to the extent that they can be recreated in the field within the lot boundaries of said lot. **Provided**

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. **Not within one year flood plain. See 13.04.440C regarding requirements for homes adjacent to basins.**

13.04.175 Submittal of a written drainage design report. Pending resubmittal of basins and addressing other review comments see comments

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

- A. Any significant stormwater drainage problems existing or anticipated to be associated with the project; **None noted**
- B. The analysis procedure used to identify and evaluate the drainage problems associated with the project; **Rational**
- C. Any assumptions or special conditions associated with the use of the procedures, especially hydrologic or hydraulic methods, used to identify and evaluate drainage problems associated with the project; **Provided**

D. Discussion of any permits applications submitted or proposed to be submitted to state and/or federal agencies that will affect the timing and/or construction of the Drainage Plan such as but not limited to United States Corp of Engineers 404 permits (both individual and nationwide), Indiana Department of Environmental permits (401 Water Certification and others), Indiana Department of Natural Resource Permits (Construction in Floodway) and any approvals that may be required to discharge to Indiana State Highways. The report should state the status of the application of such permits. For permits that have been approved, copies of the approval document shall be included with the Drainage Design Report including any conditions on approved permits that could affect the implementation of the Drainage Plan; **Per submittal, "not applicable"**.

E. The proposed design of the drainage control system; **The response needs to be proof read and resubmitted Revised**

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

G. 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; **Provided**

H. Maps showing individual drainage areas within the project subdivided for use in the analysis thereof. **Provided**

13.04.180 Typical cross sections of 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:

A. For existing and proposed detention and retention basins and ponds, a minimum of two cross sections per basin with the cross sections being 90 degrees from each other. The cross sections shall show the following: **Pending revisions-see 13.04.170 A 6 Provided**

Minimum bottom of the basin, Pool Elevation (wet basins), side slope of the basins including above and below normal pool elevation for wet basins, elevation of water at designed storm, elevation of water at 100 year storm, elevation (bottom) of emergency spillway and elevation of outflow of 100 year storm within emergency spillway, elevation of existing land immediately adjacent to the basin, proposed surrounding topography including required maintenance pathway of new basins, fencing (if provided) and any easements or obstructions that are intersected by the cross section.

B. For existing ditches and streams – sufficient typical cross sections that capture the existing channel throughout the project area. The cross sections shall show the existing configuration and existing land immediately adjacent to all drainage facilities as well as any easements, property lines or obstructions that are intersected by the cross section. For all existing ditches a bottom profile line must also be provided. The profile line shall also show any existing structures (culverts, bridges, and other crossings),

location of crossing utilities or other obstructions within the ditches or streams. **No existing streams or ditches**

C. For new channels and swales – sufficient typical cross sections that capture the proposed configuration of new channels and swales throughout the project area. The cross sections shall show the proposed configuration of the channels and swales and existing land immediately adjacent to all drainage facilities as well as any easements, property lines or obstructions that are intersected by the cross section. Also a bottom profile line must also be provided. The profile line shall also show any existing structures (culverts, bridges, and other crossings), location of crossing utilities or other obstructions within the ditches or streams. **No new channels-typicals provided for swales**

D. For large projects and subdivisions which will contain multiple swales, a typical cross section of the swale may be provided combined with a swale table listing each swale. The swale table shall include the slope of each swale (in lieu of profile), depth of water at designed storm and type of erosion control to be utilized on the channel bottom and side slopes. **Provided**

E. Typical Cross sections shall be provided in the following situations where proposed excavation is proposed against no controlled properties: **Not Applicable**

- 1) for any cut that is proposed within 15' of a property line and the cut is 4' or greater and where such cut is not part of an excavation for a channel or swale.
- 2) the location of any proposed retaining walls greater than 4' within 15' of a property line.

13.04.350 Grass mix matched to site conditions.

The choice of grass mixture for stabilizing open channels shall be based upon specific site conditions such as shade and sun tolerance, velocity tolerance, and waterway maintenance requirements. The proposed seed mixture to be utilized for stabilizing open channels shall be included in the approved Drainage Plan. **Provided**

13.04.420 Allowable release rate.

A. The allowable post development peak release rate of stormwater from a project during a twenty-five (25) year return period storm shall not exceed the pre-development peak release rate from the same land area during a ten (10) year return period storm. **10/25 see comment under 13.04.170A6 addressed in revisions**

B. Inadequate Downstream Drainage or Restrictions.

1. If the downstream channel or storm sewer system is not adequate to accommodate the release rate provided above, then the release rate shall be reduced to that rate permitted by the capacity of the receiving channel or storm sewer system; and additional detention shall be required to store that rate of runoff exceeding the capacity of the receiving stormwater drainage facilities (limiting restriction).

2. If more than one basin is involved in the development of the area upstream of the limiting restriction, the allowable release rate from any one basin shall be in direct proportion to the ratio of its drainage area to the drainage area of the entire watershed upstream of the restriction.

C. As development continues within Impacted Areas as defined in Section 13.04.015 the Board on a project by project basis may decrease the allowable post development controlled peak release rate of stormwater to not exceed a five (5) or two (2) year return period storm from the same land area prior to its development for those areas that lie within those impacted areas. **Not Applicable**

D. Certain areas within the project may be allowed to leave undetained due to the layout of a project combined with the natural topography. In order for areas to leave undetained the undetained areas must meet the criteria of the most current Vanderburgh County Technical Memorandum. **0.13 acres to leave undetained-Meets Criteria**

E. Allowable release rates from basins utilized for erosion control during construction shall be designed to meet the criteria any Indiana Department of Environmental Management standards as addressed in the Technical Memorandum including standards required to meet any NPDES General Permit.

13.04.440 General detention/retention basin design requirements.

The following design principles shall be observed for detention and retention basins: **Portions of this section will not be reviewed pending resubmittal of basin information as addressed under 13.04.170 A 6 Reviewed and noted below**

A. Dry detention facilities designed to become a permanent part of the stormwater drainage system shall be installed with an additional ten (10) percent capacity to allow for sediment accumulation resulting from development, and to permit the pond to function for reasonable periods between cleanings. **See Chart-Meets code**

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. **See Basin Design Chart**

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. **See Basin Design Chart-no elevations provided 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. **Meets code**

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 measurement to one vertical unit of measurement (2:1) at any point in the side slope. **Dry Basin**

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. **Dry Basin**

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 measurement from a point two vertical feet below permanent pool, thence downward. **Dry Basin**

H. 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 developer. **County will not comment on this issue-developer needs to determine if this should be required**

I. 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. **Pipe and open spillway**

J. 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 with greater than 0.5 acres of surface area at normal pool 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. **Dry Basin**

K. Emergency Spillway Requirements.

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. **Meets code**

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. **Meets code**

3. The emergency overflow spillway shall be clearly marked with a defined weir, either grass, rip rap or paved. The emergency overflow spillway velocities shall be calculated and the necessary erosion control materials shall be specified and utilized in the construction of the overflow spillway and receiving stream. Energy dissipation measures must be employed where required.

L. 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. **Meets code**

M. Dry Detention Basin Criteria. Meets code

1. Dry basins shall be planted and maintained in vegetative cover equal to that of residential lawns.
2. 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 and have a minimum slope of 0.5%.
3. Dry Basins shall be constructed to eliminate potential wet areas that are difficult to mow and conducive to the invasion of wetland species of plant growth. Basins shall be sloped to the outfall point with a minimum slope of 0.5% over the bottom of the basin towards the concrete liner and the concrete liner shall be sloped at a similar minimum slope.

N. 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. **Tenbarge Green Alliance**

O. 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. **Dry Basin**

P. 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. **Provided**

Q. 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 within the right of way of any county, state or federal road or highway. For all basins at least one easement of at least 10' in width must be provided to access the basin from a public roadway for the purpose of maintaining the basin. For subdivisions in which no public roadway is to be dedicated the easement must be to the nearest private road or public road. **Provided**

R. Maintenance Report Required for Basin.

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 **Is lot owner 8 responsible for maintaining the portion of the Basin that is located on Lot 7; also a similar situation exists on Basin 2 for lots 11 for lots 10 and 12? Revised**

2. The maintenance report for all subdivisions or summary of the report shall be included on the plat or shall be referenced on the plat to its location as part of the drainage plan.

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

T. 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. **Not noted on plans Noted on C-100**

U. 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. **Not Applicable**

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

13.04.460 Responsibility for drainage facility maintenance.

The assignment of responsibility for the maintenance and repair of all stormwater drainage systems and facilities outside of county accepted road rights-of-way after the completion of the project, and final approval thereof by the county engineer, shall be determined before the final drainage plan is approved; and shall be documented by appropriate covenants and restrictions applied to the subdivision and to the property deeds thereof, and shall be printed clearly upon all recorded plats of the project. **Plan A (Homeowners Association) to be utilized**

BASIN DESIGN CHART-Review		Basin 1	Basin 2
1	Design Capacity	3020	3828
2	(Section A) Dry detention facilities designed to become a permanent part of the stormwater drainage system shall be installed with an additional ten (10) percent capacity to allow for sediment accumulation resulting from development, and to permit the pond to function for reasonable periods between cleanings; (#1 x 1.1)	3322	4111
3	Normal Pool Elevation or dry basin bottom elevation	404	404.5
4	Storage elevation at 25 year storm (50 year for State Highway 100 year for impacted area)	<406	<406.5
5	(Section 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. (#4-#3)	<2'	<2'
6	Elevation of emergency spillway	406.5	407
7	Q100	9	10.14
8	Depth of flow through emergency spillway at 100 year storm	0.41	0.44
9	Flow line at 100 year storm #6 +#8	406.91	407.44
10	(Section K2) 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. #9-#4 ≥ 0.5	.91	.94
11	Elevation of top of bank	407.5	408
12	(Section L) 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. (#11-#9 $\geq 0.5'$)	0.59	0.54
13	Elevation of home adjacent to basin	410	410
	(Section 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. (#13-#9 $\geq 2'$)	3.09	2.54

13.04.460 Responsibility for drainage facility maintenance.

The installation, maintenance, repair, and replacement of all stormwater drainage facilities, and erosion and siltation control measures for a project during the period of construction, and until final approval by the county engineer, shall be the responsibility of the land developer(s), and/or the property owner(s) of record.

The assignment of responsibility for the maintenance and repair of all stormwater drainage systems and facilities outside of county accepted road rights-of-way after the completion of the project, and final approval thereof by the county engineer, shall be determined before the final drainage plan is approved; and shall be documented by appropriate covenants and restrictions applied to the subdivision and to the property deeds thereof, and shall be printed clearly upon all recorded plats of the project.

Other Comments

Outlet pipes from basins show a 45 degree angle pipe which is not to code. Outlet pipe should have an end section. **Provided** Provide detail on the outlet pipe as to any proposed erosion control. **Provided** Pipe changed and shows cast-in-place end section. No issues with this proposal however need details (size, depth of casting, anchoring and proposed reinforcing if any) **Provided**

Why do lots 9 & 10 not have swales to capture water to divert to basins? If no swale can be constructed what assurances will be provided by developer that the areas will drain as designed? Will the letter of credit address this potential? How will drainage (gutter down drains, etc be routed so that they will not discharge directly to the ditch? See 13.06.160A6. Squiggly line shown but no defined swale, please address with location of swale and drainage easement. **Provided**

It is not clear why the County should allow this variance as it appears that a Homeowners Association could address the maintenance of the pipes and that there is no provision in the Code for individual landowners to be responsible for the maintenance of pipes. Per the County Attorney "All options within the drainage code must be utilized and good cause must be shown to go outside the code. No cause has been shown as to why they must deviate outside the code." A variance letter was provided with the 6/28/2019 revisions, however, it is not clear why a Homeowners Association cannot be created and therefore this request should be denied. **Developer to Utilize Plan A and create a Homeowners Association**

Revised Drawing 100 was submitted showing revised contours to reflect revisions in basin sizing. Drawing 101 that was submitted with original submittal still has contours that reflect basins before resizing. A revised drawing 101 needs to be submitted to reflect corrections. **Revised Drawing C101 Submitted 8/19/2019**

A note needs to be added on the overflow swale shown on sheet C102 indicating the swale must meet the typical swale cross section shown on sheet C500. **Added to C100 and C102**



MORLEY

ARCHITECTS | ENGINEERS | SURVEYORS

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

June 14, 2019

Vanderburgh County Surveyor
Attn: Jeff Mueller
1 NW MLK Jr. Blvd.
Room 325 Civic Center Complex
Evansville, IN 47708

**Re: Nevayah Place
Final Drainage Plan Approval
Morley Project # 10390.4.001-B**

Jeff,

This letter is in regards to the final drainage report for Nevayah Place in Evansville IN. We are requesting a variance to allow Lot 8 and Lot 11 of Nevayah Place to maintain and to assume repair responsibility of the outlet pipes of the dry basins. All other storm drainage facilities and systems outside of the County accepted road right-of-way shall be maintained following the guidelines of Plan B in 13.04.460 B of the Vanderburgh County Code.

The owners of Lot 8 and Lot 11 will be able to access the pipe through a proposed Lake Maintenance and Storm Drainage Easement in Nevayah Place and an existing Drainage Easement in Stonecrest Section 3. Lot 8 will be responsible for maintaining and, if needed, repairing the outlet pipe of Basin 1. Lot 11 will be responsible for maintaining and, if needed, repairing the outlet pipe of Basin 2.

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

Sincerely,

James E. Morley, PE, PS
Managing Engineer

cc: Walid Fehme, John Stoll

J:\10000s\10300-10399\10390\Civil 3D\Drainage\Letter to Vand Co Surveyor.docx

RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE
6-14-19 *EF*



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 County 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 and Report submitted 6/14/19.

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. **Provided as part of Preliminary Drainage Plan**

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:

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.

Drainage Plan and Report submitted 6/14/19.

D. The submitted data shall be gathered, analyzed, assembled into the drainage plan and supporting submittals; and shall be certified in accordance with 864 IAC 1.1-7-3 Application of seal; signature, 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. James E. Morley P.E., 10100250

E. An easement has been dedicated to house any off-site drainage 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. Should the person, persons, partnership, corporation, or other entity to which approval of the Drainage Plan is granted is no longer responsible for accomplishing the project for which the Drainage Plan is developed, then the person, persons, partnership, corporation or other entity that assumes or acquires a project with an approved Drainage Plan must immediately apply to the Drainage Board for approval to transfer the obligations of the previously approved Drainage Plan by submitting to the Drainage Board a FORM 801 with the information required under Section 13.04.085. Anlene 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 not 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, and all single parcel commercial and industrial parcels zoned C-0 through M-3 of 2 acres in size or greater that are adjacent to agriculture land use or single family homes, the applicant shall notify all adjoining landowners of the proposed drainage plan. The notification shall also be sent to any Registered Neighborhood Association within 1/4 mile of the proposed development and shall meet the criteria of notification. **Drainage Plan shows all adjoining. Notices were sent 5/23/19 as part of the Preliminary Drainage Plan approval process and the certified mail receipts were submitted on 5/29/19.**

13.04.160 Contents of preliminary drainage plan. (As Applicable to Final Drainage Plan)

A. The contents of the preliminary drainage plan shall include a map based on the most current county planimetric maps, or a topographic map prepared from a more recent aerial photo reconnaissance that provides more accurate data, complete with contour lines, and showing the following:

1. The extent and area of each watershed affecting the design of the drainage facilities for the project;

12. A copy of the Notice of Public Hearing as required by the Area Plan Commission and under Section 13.04.140 H of the Vanderburgh County Drainage Code with a copy of the returned receipts from all certified mailings or proof of Certificate of Mailing. **Notices were sent 5/23/19 as part of the Preliminary Drainage Plan approval process and the certified mail receipts were submitted on 5/29/19.**

D. Data Required to Accompany Preliminary Plan. Descriptive data sufficient to support the feasibility of the preliminary drainage plan with regard to the requirements of this chapter, including calculations of the predevelopment and post development runoff rates using rainfall data supplied herein shall accompany a preliminary drainage plan.

F. Determination of Sufficiency. The drainage board shall decide the sufficiency of the preliminary drainage plan, and any conditions or additional requirements to be applied to the preliminary drainage plan. Sufficient with the following conditions

13.04.165 Contents of final drainage plan.

The contents of the final Drainage Plan shall include all the items listed above for a preliminary drainage plan, plus:

A. Soils Map. A soils map indicating soils names and their hydrologic classification must be provided for a proposed project; [See Appendix A of Drainage Report.](#)

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

C. 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 Drainage Plan.](#)

D. The normal shoreline of lakes, ponds, swamps, and basins, their floodplains, and lines of inflow and outflow; [None](#)

E. The location of existing regulated drains, farm drains, inlets and outfalls; [None](#)

F. The location of the following existing storm and water features: [See Drainage Plan.](#)

1. Storm sewers and easements;
2. Sanitary sewers and easements;
3. Combined sewers and easements;
4. Water lines and easements;
and outfalls to any of the above as applies;

G. Wells, septic tank systems, and outfalls, if any; Per owner, the existing septic tank and well within the project site were removed and abandoned during the demolition of the old farmhouse. There will be no wells, septic tank systems, or outfalls on this project.

H. 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.

I. The limits of the entire proposed project and the limits of the expected extent of land disturbance required to accomplish the project; See Appendix A of Drainage Report.

J. The location of the streets, lot lines, and easements; See Drainage Plan.

K. A scale, preferably one inch equals fifty (50) feet; Provided

L. An arrow indicating North. Provided

M. On-Site Bench Mark Required. A benchmark is required to be located within the project limits. Approved datum shall be found within the most recently approved Technical Memorandum. See Drainage Plan.

N. For all non residential Major Subdivisions and all Minor Subdivisions C-0 through M-3 that per Section 13.04.015 meet the requirements for storage and controlled release of excess stormwater, in which the retention will be achieved by utilizing shared detention and or retention facilities between two or more parcels, a table must be provided with following additional information for each lot. None

1) the assumed weighted Developed C value for each lot;

2) the proposed basin(s) that will be utilized for retention of the excess runoff for each lot; and

3) the designated lots in which any excess retention capacity will be allocated and the quantity of excess capacity that will be allocated to those designated lots.

13.04.170 Final drainage plan layout.

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

6/28/2019

G. Wells, septic tank systems, and outfalls, if any; **There will be no wells, septic tank systems, or outfalls on this project.**

H. 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.**

I. The limits of the entire proposed project and the limits of the expected extent of land disturbance required to accomplish the project; **See Appendix A of Drainage Report.**

J. The location of the streets, lot lines, and easements; **See Drainage Plan.**

K. A scale, preferably one inch equals fifty (50) feet; **Provided**

L. An arrow indicating North. **Provided**

M. On-Site Bench Mark Required. A benchmark is required to be located within the project limits. Approved datum shall be found within the most recently approved Technical Memorandum. **See Drainage Plan.**

N. For all non residential Major Subdivisions and all Minor Subdivisions C-0 through M-3 that per Section 13.04.015 meet the requirements for storage and controlled release of excess stormwater, in which the retention will be achieved by utilizing shared detention and or retention facilities between two or more parcels, a table must be provided with following additional information for each lot. **None**

1) the assumed weighted Developed C value for each lot;

2) the proposed basin(s) that will be utilized for retention of the excess runoff for each lot; and

3) the designated lots in which any excess retention capacity will be allocated and the quantity of excess capacity that will be allocated to those designated lots.

13.04.170 Final drainage plan layout.

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

*REVISED BY
6/28 SUBMITTAL*

1. The extent and area of each watershed tributary to the drainage facilities within the project; [See Appendix B of Drainage Report.](#)
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 Drainage Plan.](#)
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 Drainage Plan.](#)
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 Drainage Plan.](#)
5. The materials, elevations, waterway openings, size, and basis for design of the proposed culverts and bridges; [Not Applicable.](#)
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 Drainage Plan.](#)
7. The location and percentage of impervious surfaces existing and expected to be constructed; [68,784 SF of proposed impervious surface.](#)
8. The material types, sizes, slopes, grades and other details of all the stormwater drainage facilities; [See Drainage Plan.](#)
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 Drainage Plan and Appendix B of the Drainage 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 B 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. [There are no "impacted drainage areas" near the project site.](#)

12. The location of Drainage Easements for retention/detention basins, drainage ditches/swales, storm sewers, junction boxes, inlets, or manholes outside of any county right of way. Easements dimensions must be shown on each individual lot to the extent that they can be recreated in the field within the lot boundaries of said lot. See Drainage Plan.

Drainage Easements will not be required for retention/detention basins, drainage ditches/swales, storm sewers, junction boxes, inlets, or manholes in the following situations: None

a) The submitted Drainage Plan is for a single lot subdivision and there is no common or shared drainage with any adjoining lot, parcel or other lands or

b) The submitted Drainage Plan is for a multiple lot commercial or industrial subdivision and the retention/detention basins, drainage ditches/swales, storm sewers, junction boxes, inlets, or manholes are contained within a single lot and the retention/detention basins, drainage ditches/swales, storm sewers, junction boxes, inlets, or manholes serve the drainage needs of the specific lot only.

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. Provided

13.04.175 Submittal of a written drainage design report.

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

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

None.

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

Analysis of runoff conditions from a 10-year undeveloped and 25-year developed storm event were analyzed using the Rational Method. The Rational Method is appropriate for estimating peak discharges for small drainage areas of up to 50 acres. The design of storm water detention facilities is based on a return period of once in 25 years.

Runoff coefficients used were those found from the latest Technical Memorandum of the Vanderburgh County Drainage Ordinance. These are shown on the sub-basin drainage calculations in Appendix B.

The Rational Method was also used to appropriately size the storm pipe network. Pipes were sized to a 25 year return period, and assumed a Manning's Roughness, n, equal to 0.011 for Reinforced Concrete Pipe.

The Form 800 was used to size the detention storage in accordance with the Vanderburgh County Drainage Ordinance and latest Technical Memorandum. The Form is attached in Appendix B.

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

All assumptions for peak discharge estimates were based on runoff coefficients found from and latest Technical Memorandum of the Vanderburgh County Drainage Ordinance. These are shown on the subbasin drainage calculations in Appendix B.

- D. Discussion of any permits applications submitted or proposed to be submitted to state and/or federal agencies that will affect the timing and/or construction of the Drainage Plan such as but not limited to United States Corp of Engineers 404 permits (both individual and nationwide), Indiana Department of Environmental permits (401 Water Certification and others), Indiana Department of Natural Resource Permits (Construction in Floodway) and any approvals that may be required to discharge to Indiana State Highways. The report should state the status of the application of such permits. For permits that have been approved, copies of the approval document shall be included with the Drainage Design Report including any conditions on approved permits that could affect the implementation of the Drainage Plan;

Not Applicable

- E. The proposed design of the drainage control system;

The proposed drainage control system will convey storm water runoff to the proposed dry detention basins by using sheet flow over ground surfaces to swales and proposed storm structures. The dry detention basins will outlet through 8" HDPE pipes sized at the 25 year return period. Storm sewer components were analyzed per the procedures outlined in Section B and C of this report. The owners of Lots 7-12 are responsible for maintaining the portion of dry detention basin within their property. The outlet pipes will be maintained by Lot 11 and Lot 8.

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

Appendix B shows a log of all calculations and modeling to estimate the predevelopment and post development runoff rates. The pre-developed site has a 10 year runoff rate of 4.92 CFS while the post developed site has a 25 year runoff rate of 18.80 CFS. The post development release rate will be reduced to 4.54 CFS (4.23 CFS from dry basins and 0.31 CFS undetained) by the use of two dry detention basins and constricted outlet pipes.

The Rational Method was also used to appropriately size the storm pipe network. Pipes were sized to a 25 year return period, and assumed a Manning's Roughness, n , equal to 0.011 for Reinforced Concrete Pipe.

The Form 800 was used to size the detention storage in accordance with the Vanderburgh County Drainage Ordinance and latest Technical Memorandum. The Form is attached in Appendix B.

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

All assumptions for peak discharge estimates were based on runoff coefficients found from and latest Technical Memorandum of the Vanderburgh County Drainage Ordinance. These are shown on the subbasin drainage calculations in Appendix B.

D. Discussion of any permits applications submitted or proposed to be submitted to state and/or federal agencies that will affect the timing and/or construction of the Drainage Plan such as but not limited to United States Corp of Engineers 404 permits (both individual and nationwide), Indiana Department of Environmental permits (401 Water Certification and others), Indiana Department of Natural Resource Permits (Construction in Floodway) and any approvals that may be required to discharge to Indiana State Highways. The report should state the status of the application of such permits. For permits that have been approved, copies of the approval document shall be included with the Drainage Design Report including any conditions on approved permits that could affect the implementation of the Drainage Plan;

Not Applicable

E. The proposed design of the drainage control system;

The proposed drainage control system will convey storm water runoff to the proposed dry detention basins by using sheet flow over ground surfaces to swales and proposed storm structures. The dry detention basins will outlet through 8" PVC pipes sized at the 25 year return period. Storm sewer components were analyzed per the procedures outlined in Section B and C of this report. The owner is to maintain the wet retention basins.

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

Appendix B shows a log of all calculations and modeling to estimate the predevelopment and post development runoff rates. The pre-developed site has a 10 year runoff rate of 4.54 CFS while the post developed site has a 25 year runoff rate of 12.31 CFS. The post development release rate will be reduced to 4.50 CFS (4.20 CFS from dry basins and 0.30 CFS undetained) by the use of two dry detention basins and constricted outlet pipes.

G. 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;

REVISED BY
6/28/2019
SUBMITTED

None

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

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

13.04.180 Typical cross sections of 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: **Provided**

A. For existing and proposed detention and retention basins and ponds, a minimum of two cross sections per basin with the cross sections being 90 degrees from each other. The cross sections shall show the following:

Minimum bottom of the basin, Pool Elevation (wet basins), side slope of the basins including above and below normal pool elevation for wet basins, elevation of water at designed storm, elevation of water at 100 year storm, elevation (bottom) of emergency spillway and elevation of outflow of 100 year storm within emergency spillway, elevation of existing land immediately adjacent to the basin, proposed surrounding topography including required maintenance pathway of new basins, fencing (if provided) and any easements or obstructions that are intersected by the cross section. **Provided.**

B. For existing ditches and streams – sufficient typical cross sections that capture the existing channel throughout the project area. The cross sections shall show the existing configuration and existing land immediately adjacent to all drainage facilities as well as any easements, property lines or obstructions that are intersected by the cross section. For all existing ditches a bottom profile line must also be provided. The profile line shall also show any existing structures (culverts, bridges, and other crossings), location of crossing utilities or other obstructions within the ditches or streams. **Not Applicable**

C. For new channels and swales – sufficient typical cross sections that capture the proposed configuration of new channels and swales throughout the project area. The cross sections shall show the proposed configuration of the channels and swales and existing land immediately adjacent to all drainage facilities as well as any easements, property lines or obstructions that are intersected by the cross section. Also a bottom profile line must also be provided. The profile line shall also show any existing structures (culverts, bridges, and other crossings), location of crossing utilities or other obstructions within the ditches or streams. **Not Applicable. This project is a subdivision and we are showing typical cross section with swale data table.**

D. For large projects and subdivisions which will contain multiple swales, a typical cross section of the swale may be provided combined with a swale table listing each swale. The swale table shall include the

slope of each swale (in lieu of profile), depth of water at designed storm and type of erosion control to be utilized on the channel bottom and side slopes. **Provided**

E. Typical Cross sections shall be provided in the following situations where proposed excavation is proposed against no controlled properties: **Not Applicable.**

1) for any cut that is proposed within 15' of a property line and the cut is 4' or greater and where such cut is not part of an excavation for a channel or swale.

2) the location of any proposed retaining walls greater than 4' within 15' of a property line.

13.04.185 A site plan required.

A site plan must be provided, drawn to scale, showing the overall site dimensions with existing and proposed drainage facilities, streets, parking lots, buildings and other existing or proposed improvements. **Provided.**

13.04.225 Minimum pipe sizing.

A. The minimum pipe size for all storm sewers shall be twelve (12) inches inside diameter, except as noted in Section B below. **Provided.**

B. Small Diameter Pipes, Orifice Plates and Flow-Limiting Devices. **Provided.**

1. Where a twelve (12) inch pipe will not limit the rate of release to that rate required to meet detention storage requirements, a ten (10) inch or an eight (8) inch outlet pipe shall be utilized. Where a ten (10) inch or eight (8) inch outlet pipe is utilized, the overall length of such outlet pipe shall not be longer than 60'.

2. Where an eight (8) inch pipe will not limit the rate of release to that rate required to meet the detention storage requirements an orifice plate, or other device subject to the approval of the drainage board, shall control the rate of release.

3. If a controlling device less than eight inches on a side, or in diameter is required to restrict the release rate, the controlling device shall be installed above ground, and in a place easily accessible for maintenance, and protected from tampering.

4. A device may be installed in basins utilized for erosion control that further limit the release rate in order to meet requirements for any National Pollutant Discharge Elimination System (NPDES) General Permit. Design Criteria of such devices shall be addressed in the Technical Memorandum.

13.04.350 Grass mix matched to site conditions.

The choice of grass mixture for stabilizing open channels shall be based upon specific site conditions such as shade and sun tolerance, velocity tolerance, and waterway maintenance requirements. The proposed seed. [See Drainage Plan](#)

13.04.420 Allowable Release Rate

A. The allowable post development peak release rate of stormwater from a project during a twenty-five (25) year return period storm shall not exceed the pre-development peak release rate from the same land area during a ten (10) year return period storm. (13.04.210-Culverts shall be capable of accommodating peak runoff from a fifty (50) year return period storm when draining an area greater than one square mile, or when crossing under a road which is part of the INDOT urban or rural functional classification system, and is classified as a principal or minor arterial, major or minor collector road). [Provided](#)

B. Inadequate Downstream Drainage or Restrictions.

1. If the downstream channel or storm sewer system is not adequate to accommodate the release rate provided above, then the release rate shall be reduced to that rate permitted by the capacity of the receiving channel or storm sewer system; and additional detention shall be required to store that rate of runoff exceeding the capacity of the receiving stormwater drainage facilities (limiting restriction).

2. If more than one basin is involved in the development of the area upstream of the limiting restriction, the allowable release rate from any one basin shall be in direct proportion to the ratio of its drainage area to the drainage area of the entire watershed upstream of the restriction.

C. As continues development continues within Impacted Areas as defined in Section 13.04.015 the Board on a project by project basis may decrease the allowable post development controlled peak release rate of stormwater to not exceed a five (5) or two (2) year return period storm from the same land area prior to its development for those areas that lie within those impacted areas.

D. Certain areas within the project may be allowed to leave undetained due to the layout of a project combined with the natural topography, In order for areas to leave undetained the undetained areas must meet the criteria of the most current Vanderburgh County Technical Memorandum. [0.13 acres will leave the site undetained \(Post Sub Basin 1 and Post Sub Basin 2\). Each undetained sub basin is less than of their respective pre-developed drainage areas. The total combined undetained areas are less than 10% of the total project area. Each undetained area multiplied by their weighted "c" values is less than their respective pre-developed areas multiplied by the pre-developed "c" values. Thus all undetained areas can go undetained. See Appendix B for the area and "c" value calculations.](#)

13.04.425 Upstream flow through drainage system.

A. For Watersheds One Square Mile or Less. Drainage systems serving a project shall have adequate capacity to convey the stormwater runoff from tributary areas totaling one square mile or less through the project under consideration, and within drainage easements, for a twenty-five (25) year return period storm calculated on the basis of upstream land in its existing condition. **Not applicable**

13.04.440 General detention/retention basin design requirements.

The following design principles shall be observed for detention and retention basins:

A. Dry detention facilities designed to become a permanent part of the stormwater drainage system shall be installed with an additional ten (10) percent capacity to allow for sediment accumulation resulting from development, and to permit the pond to function for reasonable periods between cleanings.

Provided

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

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

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

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 measurement to one vertical unit of measurement (2:1) at any point in the side slope. **Not Applicable**

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. **Not Applicable**

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 measurement from a point two vertical feet below permanent pool, thence downward. **Not Applicable**

H. 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 developer. **Not Applicable**

I. 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**

J. 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 with greater than 0.5 acres of surface area at normal pool 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. **Not Applicable**

K. Emergency Spillway Requirements.

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**

3. The emergency overflow spillway shall be clearly marked with a defined weir, either grass, rip rap or paved. The emergency overflow spillway velocities shall be calculated and the necessary erosion control materials shall be specified and utilized in the construction of the overflow spillway and receiving stream. Energy dissipation measures must be employed where required. **Provided**

L. 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. **Provided**

M. Dry Detention Basin Criteria **Provided**

1. Dry basins shall be planted and maintained in vegetative cover equal to that of residential lawns.
2. 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 and have a minimum slope of 0.5%.
3. Dry Basins shall be constructed to eliminate potential wet areas that are difficult to mow and conducive to the invasion of wetland species of plant growth. Basins shall be sloped to the outfall point with a minimum slope of 0.5% over the bottom of the basin towards the concrete liner and the concrete liner shall be sloped at a similar minimum slope.

N. 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**

O. 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.
Not Applicable

P. 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. **Provided**

Q. 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. For all basins at least one easement of at least 10' in width must be provided to access the basin from a public roadway for the purpose of maintaining the basin. For subdivisions in which no public roadway is to be dedicated the easement must be to the nearest private road or public road. **Provided**

R. Maintenance Report Required for Basin. **See Appendix B**

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
2. The maintenance report for all subdivisions or summary of the report shall be included on the plat or shall be referenced on the plat to its location as part of the drainage plan.

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

T. 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.

U. 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.

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

13.04.460 Responsibility of drainage facility maintenance.

The assignment of responsibility for the maintenance and repair of all stormwater drainage systems and facilities outside of county accepted road rights-of-way after the completion of the project, and final approval thereof by the county engineer, shall be determined before the final drainage plan is approved; and shall be documented by appropriate covenants and restrictions applied to the subdivision and to the property deeds thereof, and shall be printed clearly upon all recorded plats of the project.

Other comments:

APPENDIX 'A'

10390 Nevayah Place

Legend

Site



Google Earth

© 2018 Google

Earle

Grassmere Ln

1000 ft

Tempsford

Canyon Rd

E Boonville-New Harmony Rd

Petersburg Rd

Crater Dr

Trailstone Dr

Stoney Lake Dr

Birch Bay Dr

Cold Water Dr

Kena Dr

Cascade Dr

Charlestown Ct

Langston Dr

Avalon Dr

Silverton Cr

Bailey Ln

Lost Creek Dr

Pondella Dr

Balboa Dr

Ellerston Dr

Cricket Trce

Benson Dr

Thornhill Dr

Whitow Dr





































Soil Map—Vanderburgh County, Indiana



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

MAP LEGEND

 Area of Interest (AOI)	 Spoil Area
 Soils	 Stony Spot
 Soil Map Unit Polygons	 Very Stony Spot
 Soil Map Unit Lines	 Wet Spot
 Soil Map Unit Points	 Other
Special Point Features	Special Line Features
 Blowout	 Streams and Canals
 Borrow Pit	Transportation
 Clay Spot	 Rails
 Closed Depression	 Interstate Highways
 Gravel Pit	 US Routes
 Gravelly Spot	 Major Roads
 Landfill	 Local Roads
 Lava Flow	Background
 Marsh or swamp	 Aerial Photography
 Mine or Quarry	
 Miscellaneous Water	
 Perennial Water	
 Rock Outcrop	
 Saline Spot	
 Sandy Spot	
 Severely Eroded Spot	
 Sinkhole	
 Slide or Slip	
 Sodic Spot	

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 17, Sep 13, 2017

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
Ba	Bartle silt loam	0.6	13.5%
HoA	Hosmer silt loam, 0 to 2 percent slopes	3.9	85.0%
HoB2	Hosmer silt loam, 2 to 5 percent slopes, eroded	0.0	0.3%
St	Stendal silt loam	0.1	1.2%
Totals for Area of Interest		4.6	100.0%

Vanderburgh County, Indiana

Ba—Bartle silt loam

Map Unit Setting

National map unit symbol: 5gbg
Elevation: 340 to 700 feet
Mean annual precipitation: 40 to 46 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 170 to 210 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Bartle and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bartle

Setting

Landform: Stream terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over loamy alluvium

Typical profile

Ap - 0 to 11 inches: silt loam
BE - 11 to 17 inches: silt loam
Bt - 17 to 30 inches: silty clay loam
Btx - 30 to 55 inches: silt loam
BC - 55 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 24 to 40 inches to fragipan
Natural drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Other vegetative classification: Trees/Timber (Woody Vegetation)

Hydric soil rating: No

Minor Components

Peoga

Percent of map unit: 3 percent

Landform: Depressions

Other vegetative classification: Trees/Timber (Woody Vegetation)

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Vanderburgh County, Indiana

Survey Area Data: Version 17, Sep 13, 2017

Vanderburgh County, Indiana

HoA—Hosmer silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2x06I
Elevation: 330 to 820 feet
Mean annual precipitation: 41 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 170 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Hosmer and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hosmer

Setting

Landform: Loess hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluvium
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over gritty loess

Typical profile

Ap - 0 to 10 inches: silt loam
BE - 10 to 17 inches: silt loam
Bt - 17 to 32 inches: silt loam
Btx - 32 to 68 inches: silt loam
2Bt - 68 to 79 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: C/D
Hydric soil rating: No

Minor Components

Iva

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Vanderburgh County, Indiana
Survey Area Data: Version 17, Sep 13, 2017

Vanderburgh County, Indiana

HoB2—Hosmer silt loam, 2 to 5 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2x06n
Elevation: 330 to 850 feet
Mean annual precipitation: 38 to 48 inches
Mean annual air temperature: 52 to 59 degrees F
Frost-free period: 170 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Hosmer, eroded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hosmer, Eroded

Setting

Landform: Loess hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loess over gritty loess

Typical profile

Ap - 0 to 7 inches: silt loam
Bt - 7 to 29 inches: silt loam
Btx - 29 to 65 inches: silt loam
2Bt - 65 to 79 inches: silt loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: 17 to 33 inches to fragipan
Natural drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D

Hydric soil rating: No

Minor Components

Alford, eroded

Percent of map unit: 10 percent

Landform: Loess hills

Landform position (two-dimensional): Shoulder, summit, backslope

Landform position (three-dimensional): Interfluvium

Down-slope shape: Convex

Across-slope shape: Linear

Hydric soil rating: No

Data Source Information

Soil Survey Area: Vanderburgh County, Indiana

Survey Area Data: Version 17, Sep 13, 2017

Vanderburgh County, Indiana

St—Stendal silt loam

Map Unit Setting

National map unit symbol: 5gcl

Elevation: 340 to 700 feet

Mean annual precipitation: 40 to 46 inches

Mean annual air temperature: 52 to 57 degrees F

Frost-free period: 170 to 210 days

Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Stendal and similar soils: 97 percent

Minor components: 3 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stendal

Setting

Landform: Flood plains

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Interfluvium

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Acid silty alluvium

Typical profile

Ap - 0 to 11 inches: silt loam

B - 11 to 41 inches: silt loam

Cg - 41 to 60 inches: stratified silt loam to silty clay loam to loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Somewhat poorly drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: About 6 to 24 inches

Frequency of flooding: Frequent

Frequency of ponding: None

Available water storage in profile: Very high (about 12.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: B/D

Other vegetative classification: Trees/Timber (Woody Vegetation)

Hydric soil rating: No

Minor Components

Bonnie

Percent of map unit: 3 percent

Landform: Backswamps, flood plains

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Interfluve

Down-slope shape: Concave

Across-slope shape: Linear

Other vegetative classification: Trees/Timber (Woody Vegetation)

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Vanderburgh County, Indiana

Survey Area Data: Version 17, Sep 13, 2017

JOINS PANEL 0107

2830000 FT



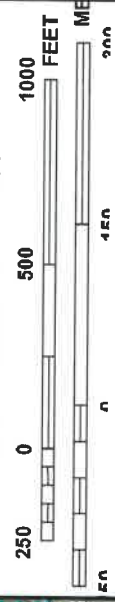
Project Site

NOTE: MAP AREA SHOWN ON THIS
MAP IS LOCATED WITHIN TOWNSHIP
5 SOUTH, RANGE 10 WEST

Vanderburgh County
Unincorporated Area
180256



MAP SCALE 1" = 500'



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0109D

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

PANEL 109 OF 275
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:
COMMUNITY: VANDERBURGH COUNTY
NUMBER: 180256
SUFFIX: D

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

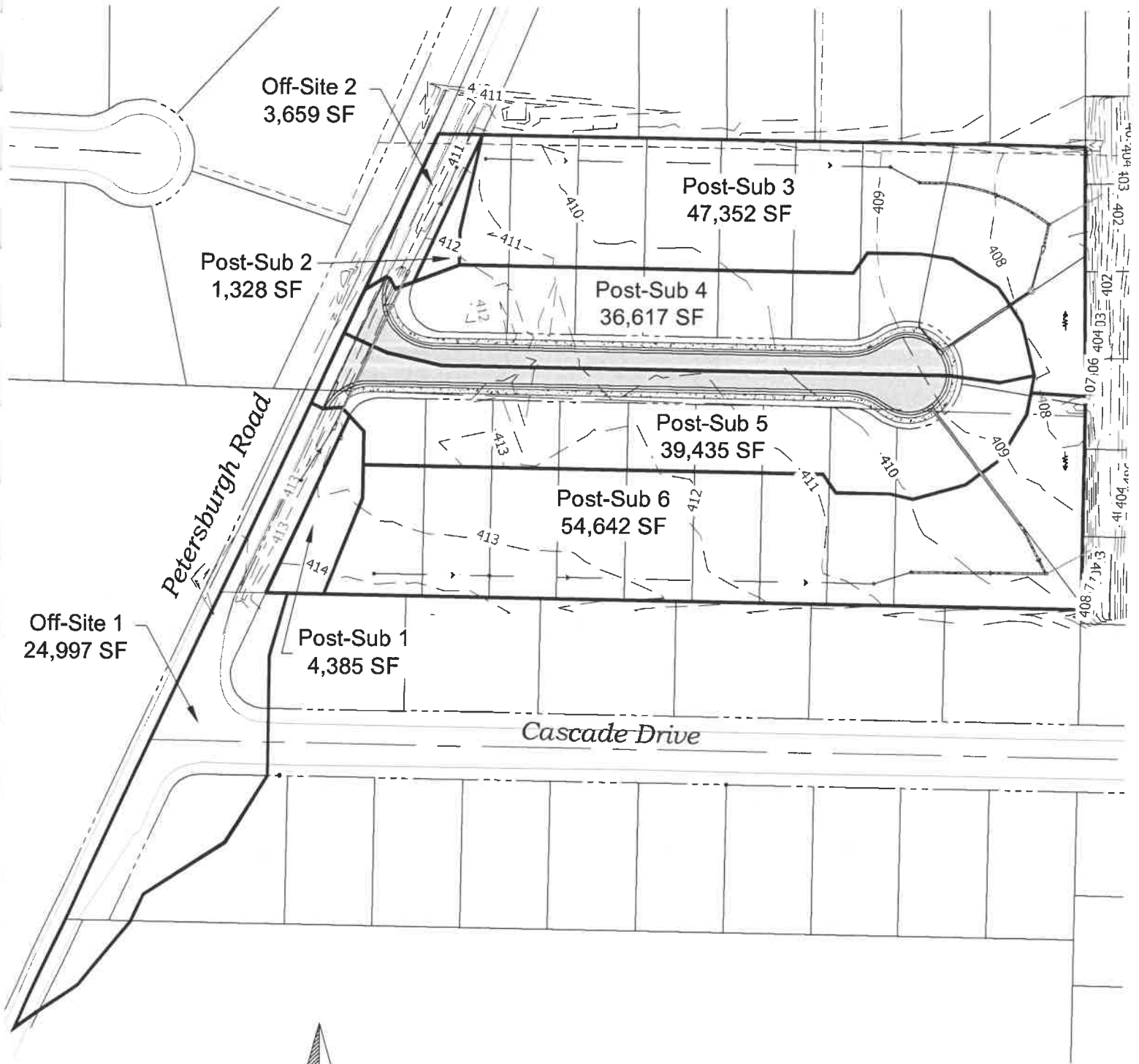
MAP NUMBER
18163C0109D

EFFECTIVE DATE
MARCH 17, 2011

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT Oh-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.mec.fema.gov

APPENDIX 'B'



SCALE 1" = 100'



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

Post-Developed Subbasin
Nevayh Place
Evansville, IN

Designed By: JEM	Job Number: 10390.4.001-B
Drawn By: AMC	Date: 06/14/19
Filename: 10390 Civil Base	



Total Project Area = 4.20 acres
 10% of Total Project Area = 0.42 acres
 Total Undetained Area = 0.13 acres

Pre-Sub 2 x Pre-Sub 2 C_d = 0.25 Ac. * 0.268 = 0.067

(Post-Sub 1 & Post Sub 2) x
 (Post-Sub 1 C_d & Post-Sub 2 C_d) = 0.13 Ac. * 0.300 = 0.039

10% of Total Area > Total Undetained Area
 Total Pre-Sub 2 (0.42 Ac.) > Total Undetained Area (0.13 Ac.)
 Pre-Sub 2 (Area x C_d) > Post-Sub 1 & 2 (Post-Sub 1 C_d & Post-Sub 1 C_d)

Legend



Undetained Watershed



Scale: 1" = 100'

	4800 Rosebud Ln. Newburgh, IN 47630 812.464.9585 Phone 812.464.2514 Fax morleycorp.com	Undetained Areas Exhibit Nevayh Place Evansville, IN		Designed By: JEM	Job Number: 10390.4.001-B
				Drawn By: AMC	Date: 06/14/19
		Filename: 10390 Civil Base			

Letter of Transmittal

Regarding: Nevayah Place
Final Drainage Plan and Report

To: Vanderburgh County Surveyor
Attn: Jeff Mueller
1 NW MLK Jr. Blvd.
Room 325 Civic Center Complex
Evansville, IN 47708

Project No: 10390.4.001-A

Date: June 28, 2019

We are sending you by: Messenger

We are sending:

COPIES	DOC. DATE	DESCRIPTION
1	6-28-19	Infrastructure/Drainage Plan and Details (C-100, C-500)
1	6-28-19	Final Drainage Report Revisions
1	6-28-19	Response to Comments Letter

These are transmitted: For Approval

Remarks: Jeff,

Please review the attached information and place on the next available date for drainage board review. If you should have any questions or need further information, please contact our office as soon as possible.

Thank you.

Copies to:
WALID FEHME; FILE

Signed:



RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE

6/28/2019
m
4pm



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

June 28, 2019

Vanderburgh County Surveyor
Attn: Jeff Mueller
1 NW MLK Jr. Blvd.
Room 325 Civic Center Complex
Evansville, IN 47708

**Re: Nevayah Place
Final Drainage Plan Approval
Morley Project #10390.4.001-B**

Jeff,

This letter summarizes the required changes made to the drainage plan and applicable details as well as changes to the drainage report. These revisions are attached for your approval of the final drainage plan.

Preliminary Drainage Plan – Other Comments:

- Design for outlet culverts is attached with true elevations in culvert report.
- Emergency spillway calculations are attached.

13.04.165 G – Per owner, the existing septic tank and well within the project site were removed and abandoned during the demolition of the old farmhouse. See attached revised Page 5 of Drainage Report.

13.01.165 I – Disturbed Area Limits exhibit is attached.

13.04.170 A2 – Pipe numbers in the chart in appendix B were revised to show matching numbers with drawings.

13.04.170 A4 – Typical cross section on drawing C-500 revised to show bottom width at 2'.

13.04.170 A6 – Basins were designed utilizing Post-Developed basins as provided in Appendix B. Separate Form 800 are attached for each basin with stage storage analysis. Basin 2 was expanded to provide adequate storage. Equation 6.3.2 can be utilized not only for orifice but also for inlet control. The preliminary report was submitted using a pipe equation because the slope was 0.50% which made it outlet control. In the first submittal of the final drainage plan, the outlet pipes had slopes greater than 2% which made it inlet control. For this submittal, we raised the downstream invert elevation of the outlet pipes by 1'. We want at least 1' between invert elevation and the toe of slope of the existing ditch to prevent silt from plugging the pipe. Raising the downstream invert elevation of the discharge pipes yielded slopes of 0.50% which made it outlet control again. Therefore, the pipe equation was used to analysis the outlet pipes. See attached culvert reports.



6/28/2019 RECEIVED BY THE VANDERBURGH COUNTY SURVEYOR'S OFFICE 4pm

The "Pre Develop Subbasin" drawing was revised to show the path to the east of the property. The previous line was drawn for the preliminary drainage plan and was never updated. Calculations for time of concentration utilizing methodology required under 13.04.205 C10 are attached.

13.04.170 A7 – Impervious surfaces are tied to Post-Sub 1-6. The distribution of impervious areas is shown in the attached "Post-Developed Subbasin" table. Each basin was sized to adequately storage runoff from the Post-Developed Subbasin.

13.04.175 E – Response proof read and revised. See attached Page 8.

13.04.440 C – Finished Floor elevation adjacent to basins provided on attached Drainage Plan sheet C100.

13.04.440 R1 – Maintenance report revised. Please see attached report.

13.04.440 T – Noted on Drainage Plan sheet C100

Final Drainage Plan – Other Comments:

- 45 degree angle pipe removed. Outlet pipe detail provided on sheet C500 shown proposed erosion control measures
- Per design, Lots 9 and 10 have a swale in the backyard that drains their lot and future gutter down drains to the dry basins on site
- Per owner, the small subdivision will not have a Homeowners Association. The restrictive covenant that will be recorded with the plat will address the maintenance of the outlet pipes. All lots within the subdivision will be equally responsible, including financially, for the maintenance of the outlet pipes. Therefore, we would like to request for a variance to allow all lot owners to be responsible for the maintenance of the pipe. See attached variance letter.

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

Sincerely,



Alejandro Mojica
Civil Staff Engineer

Encl: As Stated

cc: Walid Fehme, John Stoll P.E., Vanderburgh County Engineer

J:\10000s\10300-10399\10390\Civil 3D\Drainage\FINAL DRAINAGE PLAN\2019.6.28 2nd Submittal\Letter to Vand Co Surveyor.docx





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

June 28, 2019

Vanderburgh County Surveyor
Attn: Jeff Mueller
1 NW MLK Jr. Blvd.
Room 325 Civic Center Complex
Evansville, IN 47708

**Re: Nevayah Place
Final Drainage Plan Approval
Morley Project # 10390.4.001-B**

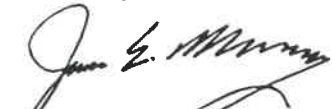
Jeff,

This letter is in regards to the final drainage report for Nevayah Place in Evansville IN. We are requesting a variance to allow all lots, Lot 1-19, of Nevayah Place to be equally responsible, including financially, for the maintenance of the outlet pipes of Basin 1 and Basin 2. Since the subdivision will not have a Homeowners Association, the maintenance of the outlet pipes will be addressed in the restrictive covenant which will be recorded with the plat. All other storm drainage facilities and systems outside of the County accepted road right-of-way shall be maintained following the guidelines of Plan B in 13.04.460 B of the Vanderburgh County Code.

The owners of Lots 1-19 will be able to access the pipe through a proposed Lake Maintenance and Storm Drainage Easement in Nevayah Place and an existing Drainage Easement in Stonecrest Section 3. All lots within the subdivision will be responsible for maintaining and, if needed, repairing the outlet pipes of Basin 1 and Basin 2.

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

Sincerely,



James E. Morley, PE, PS
Managing Engineer

cc: Walid Fehme, John Stoll

J:\10000s\10300-10399\10390\Civil 3D\Drainage\FINAL DRAINAGE PLAN\2019.6.28 2nd Submittal\Variance Letter to Vand Co Surveyor.docx






Legend

 Disturbed Area Limits



SCALE 1" = 100'

MORLEY
ARCHITECTS | ENGINEERS | SURVEYORS

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

Disturbed Area Limits
Nevayah Place
Evansville, IN

Designed By: JEM	Job Number: 10390.4.001-B
Drawn By: AMC	Date: 06/28/19
Filename: 10390 Civil Base1	



MORLEY

ARCHITECTS | ENGINEERS | SURVEYORS

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

Basin Design and Maintenance Report Nevayah Place

This brief report will highlight the dry retention basin design and maintenance in accordance with the latest Vanderburgh County Drainage Ordinance Section 13.04.440, Technical Memorandums and supplements of Basin 1 and Basin 2. The dry basins will have a 10-foot wide maintenance path, slopes leading to the bottom of the dry basins, and 10-foot wide 1-foot deep emergency overflow weir located on the eastside of the dry basins. The 8-inch diameter outlet pipe of Basin 1 is located at the southeast corner of the dry basin all within Lot 8 of Nevayah Place and Lot 256 of Stonecrest Section 3. The 8-inch diameter outlet pipe of Basin 2 is located at the southeast corner of the dry basin within Lot 10 and 11 of Nevayah Place and Lot 260 of Stonecrest Section 3. Per the approved drainage plan, the outlet pipe will serve to discharge at a control rate excess storm water stored in the dry basin. The emergency overflow weir will act as an automatic spillway should the outlet pipe be obstructed or capacity exceeded.

Maintenance of the dry basins 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. Basin 1 shall be maintained by Lots 7-9. Each lot owner of Lots 7-9 shall be responsible for maintaining the portion of Basin 1 within their property. Basin 2 shall be maintained by Lots 10-12. Each lot owner of Lots 10-12 shall be responsible for maintaining the portion of Basin 2 within their property. All lots within the subdivision will be equally responsible, including financially, for the maintenance of the outlet pipes. Over time the dry basin's bottom will fill up with sediment. This excess sediment will need to be removed as directed by the latest Vanderburgh County Drainage Ordinance or as needed.





ARCHITECTS | ENGINEERS | SURVEYORS

Morley
Storm Sewer Design Sheet - Rational Method

Project: **Nevayah Place**
Our Project # **10390.4.001-B**
Mannings n **0.011**

County **Vanderburgh**
Date: **6/28/19**
Design Period: **25** Years

Line Number	Upstream Structure	Pipe # or Swale	Downstream Structure	Length (ft)	Subbasin no.	Cj	Aj (ac.)	Cj(A)	Sum Cj(A)	Tj (min) (5.0)	Tcum (min) (5.0)	I(25) (in/hr)	Q(25) (cfs)	Pipe Diameter (in) Or Swale Depth (Ft)	Pipe Slope (ft/ft)	Pipe or Swale Cap. (cfs)	Velocity (ft/sec) at Capacity	Travel Time (min)	% Of Capacity
100	CI 107	P 106	MH 105	81.00	Post-Sub 4	0.68	0.84	0.57	0.57	6.21	6.21	7.45	4.25	12	1.35%	4.89	6.23	0.22	0.87
	MH 105	P 104	FES 103	28.86				0.00	0.57	6.43	6.43	7.38	4.22	12	1.35%	4.89	6.23	0.08	0.86
200	CI 205	P 204	FES 203	105.00	Post-Sub 5	0.69	0.91	0.62	0.62	7.26	7.26	7.14	4.43	15	0.80%	6.83	5.57	0.31	0.65
300	FES 302	P 301	FES 300	120.00	Off-site 1 and 1	0.57	0.66	0.38	0.38	12.43	12.43	5.73	2.16	12	0.35%	2.49	3.17	0.63	0.87

Swale Capacity Table

Side slope = 4
Manning's Coefficient = 0.035

Swale	Subbasin no.	Q(25) cfs	Channel Capacity (cfs)	Full Depth Velocity (ft/s)	% of Capacity	Slope (ft/ft)	Slope (%)	Length (ft)	Channel Depth (ft)	Bottom Width (ft)	Wetted Perimeter (ft)	Area (ft ²)	Hydraulic Radius (ft)	Hydraulic Depth (ft)	Travel Time (min)	US Elev.	DS Elev.
S1-A	Post-Sub 3	3.11	58.13	9.69	0.05	0.106	10.57	25	1.00	2.00	10.25	6.00	0.59	0.60	0.04	407.10	404.50
S1-B	Post-Sub 3	3.11	16.00	2.67	0.19	0.008	0.80	300	1.00	2.00	10.25	6.00	0.59	0.60	1.87	409.50	407.10
S2-A	Post-Sub 6	3.68	55.21	9.20	0.07	0.095	9.54	28	1.00	2.00	10.25	6.00	0.59	0.60	0.05	407.67	405.00
S2-B	Post-Sub 6	3.68	17.88	2.96	0.21	0.010	1.00	285	1.00	2.00	10.25	6.00	0.59	0.60	1.59	410.52	407.67
S2-C	Post-Sub 6	3.68	15.96	2.66	0.23	0.008	0.80	85	1.00	2.00	10.25	6.00	0.59	0.60	0.53	411.20	410.52
S3	Off-site 1 and 1	2.16	30.69	5.12	0.07	0.029	2.95	45	1.00	2.00	10.25	6.00	0.59	0.60	0.15	412.06	410.73
S4	Post-Sub 2	0.07	9.75	1.63	0.01	0.003	0.30	84	1.00	2.00	10.25	6.00	0.59	0.60	0.86	410.29	410.04

Pre-Developed Subbasin

Nevayah Place



Sub-basin	Area (S.F.)	Structures & Pavements (>10%) (S.F.)	Gravel (25yr Storm) (S.F.)	Cultivated Flat (<2%) (S.F.)	Cultivated Rolling (2-5%) (S.F.)	Sub-basin	Area (ac.)	Weighted C	*Tc (minutes) (min 5.0)	I(10) (in/hr)	Q(10) (CFS)
Pre-Sub 1	172,088	800	3,500	92,283	75,505	Pre-Sub 1	3.95	0.278	15.89	4.37	4.79
Pre-Sub 2	10,697			5,883	4,814	Pre-Sub 2	0.25	0.268	12.06	4.95	0.32
Overall Site	182,785	800	3,500	98,167	80,318	Overall Site	4.20	0.277	17.17	4.23	4.92

Runoff Coefficients

Cultivated (<2%) 0.20
 Cultivated (2-5%) 0.35
 Structures & Pavements (>10%) 0.98
 Gravel (25yr Storm) 0.60

* Tc was calculated using TR-55, see attached sheets for calculations.

Pre-Sub 1

Time of Concentration

Overland Flow

Length, L (max 100ft) = 100 feet
Slope, S = 1.40%
Manning Coefficient, n = 0.170 cultivated field
 $P_{2/24}$ = 3.25

t_o = Overland Flow Tc
 $t_o = [0.42 \cdot (L^{0.8}) \cdot (n^{1.48})] / [P^{0.5} \cdot (S^{0.6})]$
 $t_o = 12.39$ min

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 400 feet
Slope, S = 1.40%
Velocity, V = 1.91 ft/sec

$V = 16.1345 \cdot (S^{0.5})$
 $= 1.909$ ft/s = 114.54 ft/min
 t_s = Shallow Flow Tc
 $t_s = (L/V) = 3.49$ min

t = Total Time of Concentration
 $t = \Sigma t_o + \Sigma t_s + \Sigma t_c$
 $t = 15.89$ (Min 5 Minutes)
 0.26 Hour

Pre-Sub 2

Time of Concentration

Overland Flow

Length, L (max 100ft) = 100 feet

Slope, S = 1.50%

Manning Coefficient, n = 0.170 Grass

$P_{2/24}$ = 3.25

t_o = Overland Flow Tc

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

$t_o = 12.06$ min

t = Total Time of Concentration

t = $\sum t_o + \sum t_s + \sum t_c$

t = 12.06 (Min 5 Minutes)
0.20 Hour

Intensity (Vanderburgh Co.)

$I_2 = 3.78$ in/hr

$I_5 = 4.44$ in/hr

$I_{10} = 5.01$ in/hr

$I_{25} = 5.88$ in/hr

$I_{50} = 6.63$ in/hr

$I_{100} = 7.49$ in/hr

Post-Developed Subbasin
Nevayah Place



Sub-basin	Area (S.F.)	Structures & Pavements (<2%) (S.F.)	Structures & Pavements (2-5%) (S.F.)	Structures & Pavements (>10%) (S.F.)	Lawn (<2%) (S.F.)	Lawn (2-5%) (S.F.)	Lawn (5-10%) (S.F.)	Lawn (>10%) (S.F.)	Sub-basin	Area (ac.)	Weighted C	*Tc (minutes) (min 5.0)	I(25) (in/hr)	Q(25) (CFS)	I(100) (in/hr)	Q(100) (CFS)
Off-site 1	24,997	10,000		600		7,199	7,199		Off-site 1	0.57	0.579	12.43	5.73	1.90	7.46	2.48
Off-site 2	3,659	1,235				1,212	1,212		Off-site 2	0.08	0.526	5.00	7.81	0.34	9.95	0.44
Post-Sub 1	4,385					2,923	1,462		Post-Sub 1	0.10	0.300	5.00	7.81	0.24	9.95	0.30
Post-Sub 2	1,328					885	443		Post-Sub 2	0.03	0.300	5.00	7.81	0.07	9.95	0.09
Post-Sub 3	47,352	900		9,000	9,886	19,771	3,295	4,500	Post-Sub 3	1.09	0.420	8.32	6.82	3.11	8.69	3.96
Post-Sub 4	36,617	8,200	5,670	9,000	4,124	8,661	962		Post-Sub 4	0.84	0.679	6.21	7.45	4.25	9.49	5.42
Post-Sub 5	39,435	8,714	6,300	10,000	4,326	9,085	1,009		Post-Sub 5	0.91	0.666	7.26	7.14	4.43	9.09	5.65
Post-Sub 6	54,642	1,000		10,000	9,793	19,585	3,264	11,000	Post-Sub 6	1.25	0.447	9.18	6.56	3.68	8.36	4.69

Combined Sub-basins

Overall Site	183,759	18,814	11,970	38,000	28,129	60,911	10,435	15,500	Overall Site	4.22	0.533	9.18	6.56	14.76	8.36	18.80
Off-site 1 and 1	28,656	11,235		600	8,411	8,411	8,411		Off-site 1 and 1	0.66	0.572	12.43	5.73	2.16	7.46	2.81
Basin 1 Watershed	85,297	9,100	5,670	18,000	14,010	29,317	4,700	4,500	Basin 1 Watershed	1.96	0.529	8.32	6.82	7.07	8.69	9.00
Basin 2 Watershed	98,462	9,714	6,300	20,000	14,119	31,594	5,735	11,000	Basin 2 Watershed	2.26	0.536	9.18	6.56	7.96	8.36	10.14

Runoff Coefficients

Structures & Pavements (<2%)	0.92
Structures & Pavements (2-5%)	0.94
Structures & Pavements (5-10%)	0.96
Structures & Pavements (>10%)	0.98
Lawn (<2%)	0.15
Lawn (2-5%)	0.25
Lawn (5-10%)	0.40
Lawn (>10%)	0.56

* Tc was calculated using TR-55, see attached sheets for calculations.

Off-site 1

Time of Concentration

Overland Flow

Length, L (max 100ft) = 60 feet
Slope, S = 1.54%
Manning Coefficient, n = 0.240 Grass
 $P_{2/24}$ = 3.25

t_o = Overland Flow Tc
 $t_o = [0.42 * (L^{0.8}) * (n^{0.5})] / [P^{0.5} * (S^{0.4})]$
 $t_o = 10.45$ min

Shallow Flow

Length, L (Paved or Unpaved) Paved = 140 feet
Slope, S = 1.54%
Velocity, V = 2.52 ft/sec

$V = 20.3282 * (S^{0.5})$
 $= 2.523$ ft/s = 151.36 ft/min
 t_s = Shallow Flow Tc
 $t_s = (L/V) = 0.92$ min

Channel Flow

Length, L = 140 feet
Difference in Elevation = 1 to 0
Slope, S = 0.71%
Manning Coefficient, n = 0.035
Wetted Perimeter, Wp = 8.32 feet
Area, A = 4 sqft
Hydraulic Radius, R = 0.48
Velocity, V = 2.20 ft/s

$V = (1.49/n) * R^{0.67} * S^{0.5}$
 $= 2.203$ ft/s = 132.16 ft/min
 t_c = Channel Flow Tc
 $t_c = (L/V) = 1.06$ min

t = Total Time of Concentration
t = $\Sigma t_o + \Sigma t_s + \Sigma t_c$
t = 12.43 (Min 5 Minutes)
0.21 Hour

Off-site 2

Time of Concentration

Overland Flow

Length, L (max 100ft) = 35 feet
Slope, S = 8.57%
Manning Coefficient, n = 0.240
 $P_{2/24}$ = 3.25

t_o = Overland Flow Tc
 $t_o = [0.42 * (L^{0.8}) * (n^{0.8})] / [P^{0.5} * (S^{0.4})]$
 $t_o = 3.42$ min

Channel Flow

(1' Flat Bottom, 4:1 Side Slopes, 1' Deep)

Length, L = 75 feet
Difference in Elevation = 0.5 to 0
Slope, S = 0.67%
Manning Coefficient, n = 0.035
Wetted Perimeter, Wp = 18.24 feet
Area, A = 5 sqft
Hydraulic Radius, R = 0.27
Velocity, V = 1.46 ft/s

$V = (1.49/n) * R^{0.67} * S^{0.5}$
 $V = 1.460$ ft/s = 87.63 ft/min
 t_c = Channel Flow Tc
 $t_c = (L/V) = 0.86$ min

t = Total Time of Concentration
 $t = \Sigma t_o + \Sigma t_s + \Sigma t_c$
 $t = 3.42$ (Min 5 Minutes)
 0.06 Hour

Post-Sub1

Time of Concentration

Overland Flow

Length, L (max 100ft)

= 20 feet

t_o = Overland Flow Tc

Slope, S

= 2.81%

$t_o = [0.42 * (L^{0.8}) * (n^{1.49})] / [P^{0.76} * (S^{0.4})]$

Manning Coefficient, n

= 0.240 Grass

$t_o = 3.41$ min

$P_{2/24}$

= 3.25

t = Total Time of Concentration

t = $\Sigma t_o + \Sigma t_s + \Sigma t_c$

t = 3.41 (Min 5 Minutes)
0.06 Hour

Post-Sub 2

Time of Concentration

Overland Flow

Length, L (max 100ft)

= 35 feet

t_o = Overland Flow Tc

Slope, S

= 8.57%

$t_o = [0.42 * (L^{0.8}) * (n^{1.48})] / [P^{0.7} * (S^{0.4})]$

Manning Coefficient, n

= 0.011 Gravel

$t_o = 0.29$ min

$P_{2/24}$

= 3.25

t = Total Time of Concentration

t = $\Sigma t_o + \Sigma t_s + \Sigma t_c$

t = 0.29 (Min 5 Minutes)
0.00 Hour

Post-Sub 3

Time of Concentration

Overland Flow

Length, L (max 100ft) = 60 feet
Slope, S = 6.67%
Manning Coefficient, n = 0.240 Grass
P_{2/24} = 3.25

t_o = Overland Flow Tc
t_o = $[0.42 * (L^{0.8}) * (n^{0.8})] / [P^{0.5} * (S^{0.4})]$
t_o = 5.81 min

Channel Flow

(1' Flat Bottom, 3:1 Side Slopes, 1' Deep)

Length, L = 400 feet
Difference in Elevation = 3.2 to
Slope, S = 0.80%
Manning Coefficient, n = 0.035
Wetted Perimeter, Wp = 10.25 feet
Area, A = 6 sqft
Hydraulic Radius, R = 0.59
Velocity, V = 2.66 ft/s

V = $(1.49/n) * R^{0.67} * S^{0.5}$
= 2.660 ft/s = 159.58 ft/min
t_c = Channel Flow Tc
t_c = (L/V) = 2.51 min

t = Total Time of Concentration
t = $\Sigma t_o + \Sigma t_s + \Sigma t_c$
t = 8.32 (Min 5 Minutes)
0.14 Hour

Post-Sub 4

Time of Concentration

Overland Flow

Length, L (max 100ft) = 30 feet
Slope, S = 6.67%
Manning Coefficient, n = 0.240 Grass
P_{2/24} = 3.25

t_o = Overland Flow Tc
t_o = $[0.42 * (L^{0.8}) * (n^{0.8})] / [P^{0.7} * (S^{0.4})]$
t_o = 3.34 min

Shallow Flow

Length, L (Paved or Unpaved) Paved = 350 feet
Slope, S = 1.00%
Velocity, V = 2.03 ft/sec

V = $20.3282 * (S^{0.5})$
= 2.033 ft/s = 121.97 ft/min
t_s = Shallow Flow Tc
t_s = (L/V) = 2.87 min

t = Total Time of Concentration
t = $\Sigma t_o + \Sigma t_s + \Sigma t_c$
t = 6.21 (Min 5 Minutes)
0.10 Hour

Post-Sub 5

Time of Concentration

Overland Flow

Length, L (max 100ft) = 30 feet
Slope, S = 6.67%
Manning Coefficient, n = 0.240 Grass
P_{2/24} = 3.25

t_o = Overland Flow Tc
t_o = $[0.42 \cdot (L^{0.8}) \cdot (n^{1.49})] / [P^{0.78} \cdot (S^{0.48})]$
t_o = 3.34 min

Shallow Flow

Length, L (Paved or Unpaved) Unpaved = 380 feet
Slope, S = 1.00%
Velocity, V = 1.61 ft/sec

V = $16.1345 \cdot (S^{0.5})$
= 1.613 ft/s = 96.81 ft/min
t_s = Shallow Flow Tc
t_s = (L/V) = 3.93 min

t = Total Time of Concentration
t = $\Sigma t_o + \Sigma t_s + \Sigma t_c$
t = 7.26 (Min 5 Minutes)
0.12 Hour

Post-Sub 6

Time of Concentration

Overland Flow

Length, L (max 100ft) = 60 feet
Slope, S = 5.67%
Manning Coefficient, n = 0.240 Grass
P_{2/24} = 3.25

t_o = Overland Flow Tc
t_o = $[0.42 \cdot (L^{0.8}) \cdot (n^{1.49})] / [P^{0.78} \cdot (S^{0.48})]$
t_o = 6.20 min

Channel Flow

(1' Flat Bottom, 3:1 Side Slopes, 1' Deep)

Length, L = 475 feet
Difference in Elevation = 3.8 to
Slope, S = 0.80%
Manning Coefficient, n = 0.035
Wetted Perimeter, Wp = 10.25 feet
Area, A = 6 sqft
Hydraulic Radius, R = 0.59
Velocity, V = 2.66 ft/s

V = $(1.49/n) \cdot R^{0.67} \cdot S^{0.5}$
= 2.660 ft/s = 159.58 ft/min
t_c = Channel Flow Tc
t_c = (L/V) = 2.98 min

t = Total Time of Concentration
t = $\Sigma t_o + \Sigma t_s + \Sigma t_c$
t = 9.18 (Min 5 Minutes)
0.15 Hour

Basin 1

VANDERBURGH COUNTY FORM 800 PROPOSED CONDITIONS					
PROJECT: Nevayah Place		DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS			
DESIGNER: Morley (JEM)		RELEASE RATE RETURN PERIOD: 10 YRS			
UNDEVELOPED WATERSHED AREA (Au)	1.96	ACRES			
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED)	15.89	MINUTES			
RAINFALL INTENSITY (Iu):	4.37	INCHES/HR			
UNDEVELOPED RUNOFF COEFFICIENT (Cu):	0.277				
UNDEVELOPED RUNOFF RATE (Q = Cu*Iu*Au):	2.37	CFS			
DEVELOPED RUNOFF COEFFICIENT (Cd):	0.529				
UNDEVELOPED RUNOFF RATE	0.07				
ALLOWABLE PIPE RELEASE RATE	2.30	CFS			
ACTUAL DISCHARGE PIPE OUTFLOW	2.10	CFS			
STORM DURATION Td (HRS)	RAINFALL INTENSITY Iu 25-Year (INCH/HR)	INFLOW RATE I(Td) (Cd*Iu*Au) (CFS)	OUTFLOW RATE Q (Cu*Iu*Au) (CFS)	STORAGE RATE I(Td)-Q (CFS)	REQUIRED STORAGE ((I(Td)-Q)*Td)/12 (ACRE.FT)
0.08	7.810	8.09	2.10	5.99	0.042
0.17	6.320	6.55	2.10	4.45	0.062
0.25	5.240	5.43	2.10	3.33	0.069
0.50	3.310	3.43	2.10	1.33	0.055
1.00	1.950	2.02	2.10	-0.08	-0.007
2.00	1.370	1.42	2.10	-0.68	-0.113
3.00	1.020	1.06	2.10	-1.04	-0.261
4.00	0.820	0.85	2.10	-1.25	-0.417
5.00	0.690	0.71	2.10	-1.39	-0.577
6.00	0.600	0.62	2.10	-1.48	-0.739
7.00	0.530	0.55	2.10	-1.55	-0.905
8.00	0.480	0.50	2.10	-1.60	-1.069
9.00	0.440	0.46	2.10	-1.64	-1.233
PEAK STORAGE (ACRE.FT):					0.069
PEAK STORAGE (CUBIC FT):					3,020

BASIN 1

Elevation	Storage Area (S.F.)	Storage Vol. (C.F.)	
404.00			Outlet Elevation
404.50	1,627	0	
405.00	2,161	947	
406.00	3,319	3,687	25-yr elevation
406.50			Emergency Overflow
407.50			Top of Bank

Total 25-yr Storage	3,687
----------------------------	--------------

Culvert Report

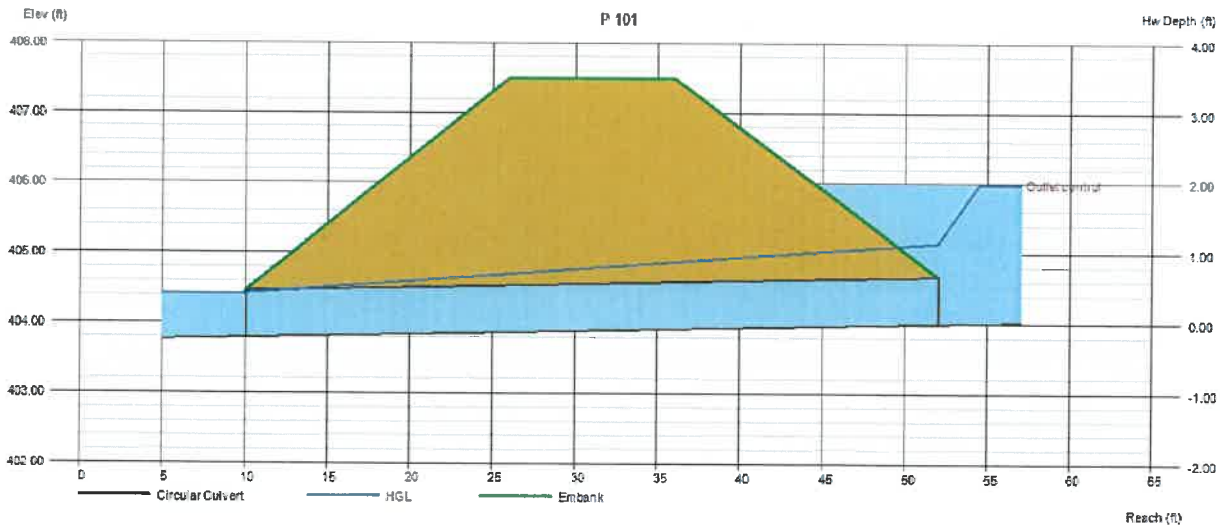
P 101

Invert Elev Dn (ft)	= 403.79
Pipe Length (ft)	= 42.00
Slope (%)	= 0.50
Invert Elev Up (ft)	= 404.00
Rise (in)	= 8.0
Shape	= Circular
Span (in)	= 8.0
No. Barrels	= 1
n-Value	= 0.010
Culvert Type	= Circular Culvert
Culvert Entrance	= Rough tapered inlet throat
Coeff. K,M,c,Y,k	= 0.519, 0.64, 0.021, 0.9, 0.5

Embankment	
Top Elevation (ft)	= 407.50
Top Width (ft)	= 10.00
Crest Width (ft)	= 10.00

Calculations	
Qmin (cfs)	= 2.00
Qmax (cfs)	= 3.00
Tailwater Elev (ft)	= Critical

Highlighted	
Qtot (cfs)	= 2.10
Qpipe (cfs)	= 2.10
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 6.13
Veloc Up (ft/s)	= 6.02
HGL Dn (ft)	= 404.42
HGL Up (ft)	= 405.15
Hw Elev (ft)	= 405.99
Hw/D (ft)	= 2.98
Flow Regime	= Outlet Control



Weir Report

Emergency Spillway Basin 1

Trapezoidal Weir

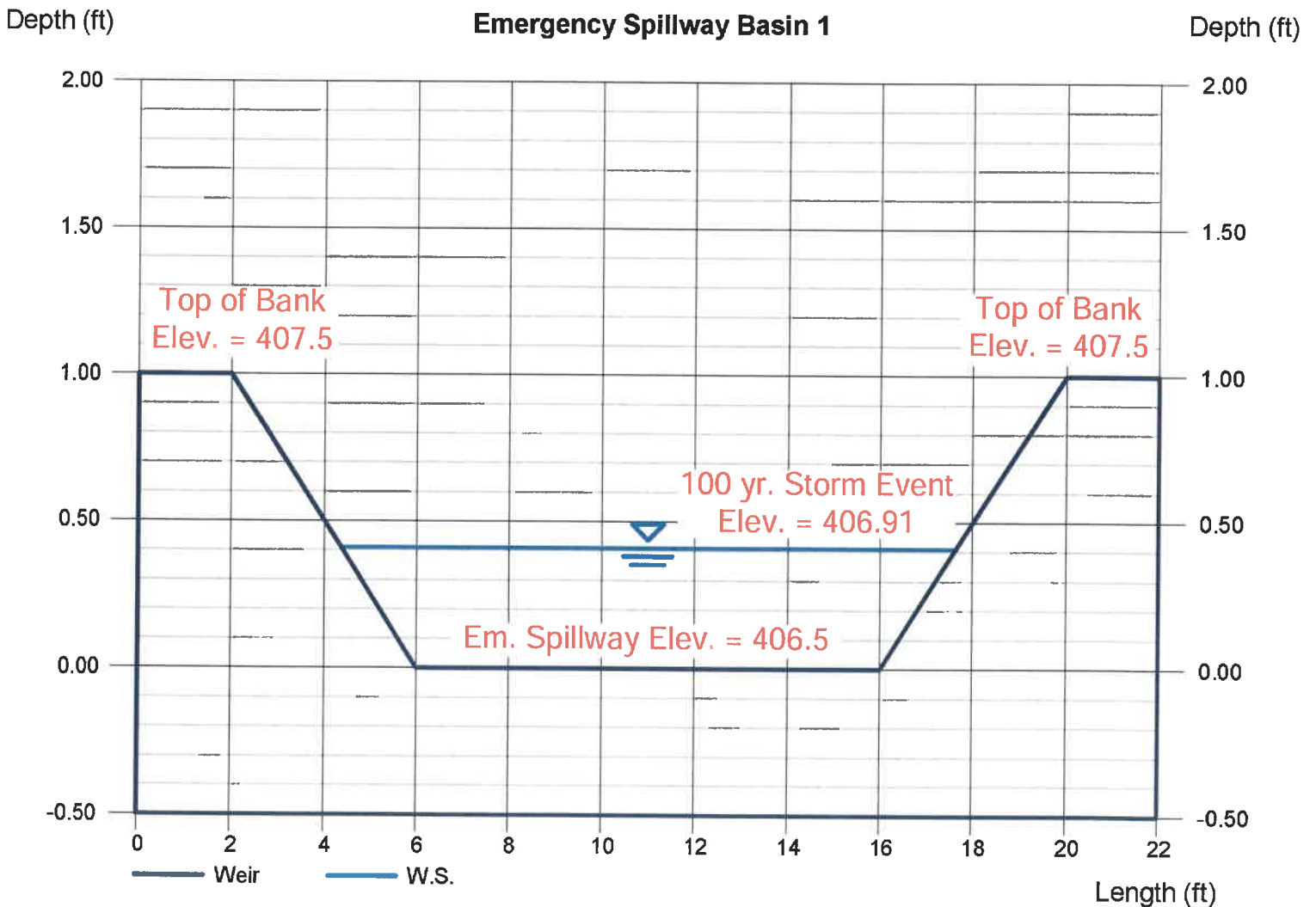
Crest = Sharp
Bottom Length (ft) = 10.00
Total Depth (ft) = 1.00
Side Slope (z:1) = 4.00

Highlighted

Depth (ft) = 0.41
Q (cfs) = 9.000
Area (sqft) = 4.77
Velocity (ft/s) = 1.89
Top Width (ft) = 13.28

Calculations

Weir Coeff. Cw = 3.10
Compute by: Known Q
Known Q (cfs) = 9.00



Basin 2

VANDERBURGH COUNTY FORM 800 PROPOSED CONDITIONS					
PROJECT: Navayah Place			DETENTION FACILITY DESIGN RETURN PERIOD: 25 YRS		
DESIGNER: Morley (JEM)			RELEASE RATE RETURN PERIOD: 10 YRS		
UNDEVELOPED WATERSHED AREA (Au)		2.26	ACRES		
TIME OF CONCENTRATION (UNDEVELOPED WATERSHED)		15.89	MINUTES		
RAINFALL INTENSITY (Iu):		4.37	INCHES/HR		
UNDEVELOPED RUNOFF COEFFICIENT (Cu):		0.277			
UNDEVELOPED RUNOFF RATE (Q = Cu*Iu*Au):		2.74	CFS		
DEVELOPED RUNOFF COEFFICIENT (Cd):		0.536			
UNDEVELOPED RUNOFF RATE		0.24			
ALLOWABLE PIPE RELEASE RATE		2.50	CFS		
ACTUAL DISCHARGE PIPE OUTFLOW		2.13	CFS		
STORM DURATION Td (HRS)	RAINFALL INTENSITY Iu 25-Year (INCH/HR)	INFLOW RATE I(Td) (Cd*Iu*Au) (CFS)	OUTFLOW RATE Q (Cu*Iu*Au) (CFS)	STORAGE RATE I(Td)-Q (CFS)	REQUIRED STORAGE ((Td)-Q)*Td/12 (ACRE.FT)
0.08	7.810	9.46	2.13	7.33	0.051
0.17	6.320	7.66	2.13	5.53	0.077
0.25	5.240	6.35	2.13	4.22	0.088
0.50	3.310	4.01	2.13	1.88	0.078
1.00	1.950	2.36	2.13	0.23	0.019
2.00	1.370	1.66	2.13	-0.47	-0.078
3.00	1.020	1.24	2.13	-0.89	-0.224
4.00	0.820	0.99	2.13	-1.14	-0.379
5.00	0.690	0.84	2.13	-1.29	-0.539
6.00	0.600	0.73	2.13	-1.40	-0.702
7.00	0.530	0.64	2.13	-1.49	-0.868
8.00	0.480	0.58	2.13	-1.55	-1.032
9.00	0.440	0.53	2.13	-1.60	-1.198
PEAK STORAGE (ACRE.FT):					0.088
PEAK STORAGE (CUBIC FT):					3,828

BASIN 2

Elevation	Storage Area (S.F.)	Storage Vol. (C.F.)	
404.50			Outlet elevation
405.00	2,257	0	
405.50	2,844	1,275	
406.50	4,211	4,803	25-yr elevation
407.00			Emergency Overflow
408.00			Top of Bank

Total 25-yr Storage	4,803
----------------------------	--------------

Culvert Report

P 201

Invert Elev Dn (ft)	= 404.30
Pipe Length (ft)	= 39.00
Slope (%)	= 0.51
Invert Elev Up (ft)	= 404.50
Rise (in)	= 8.0
Shape	= Circular
Span (in)	= 8.0
No. Barrels	= 1
n-Value	= 0.010
Culvert Type	= Circular Culvert
Culvert Entrance	= Rough tapered inlet throat
Coeff. K,M,c,Y,k	= 0.519, 0.64, 0.021, 0.9, 0.5

Embankment

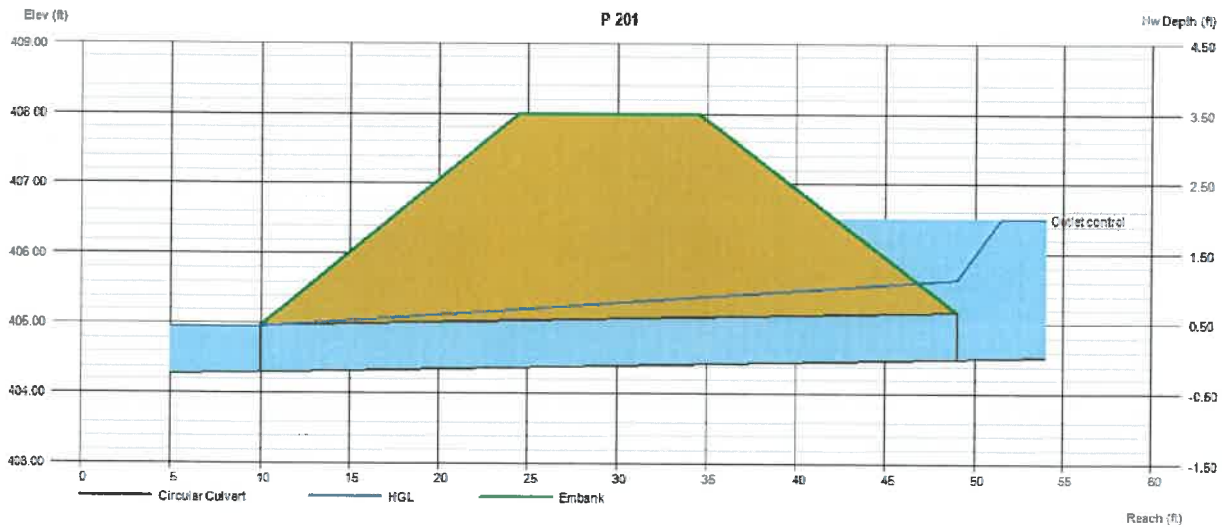
Top Elevation (ft)	= 408.00
Top Width (ft)	= 10.00
Crest Width (ft)	= 10.00

Calculations

Qmin (cfs)	= 2.00
Qmax (cfs)	= 3.00
Tailwater Elev (ft)	= (dc+D)/2

Highlighted

Qtot (cfs)	= 2.13
Qpipe (cfs)	= 2.13
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 6.14
Veloc Up (ft/s)	= 6.10
HGL Dn (ft)	= 404.95
HGL Up (ft)	= 405.64
Hw Elev (ft)	= 406.50
Hw/D (ft)	= 3.01
Flow Regime	= Outlet Control



Weir Report

Emergency Spillway Basin 2

Trapezoidal Weir

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

Highlighted

Depth (ft) = 0.44
Q (cfs) = 10.14
Area (sqft) = 5.17
Velocity (ft/s) = 1.96
Top Width (ft) = 13.52

Calculations

Weir Coeff. Cw = 3.10
Compute by: Known Q
Known Q (cfs) = 10.14

