

FINAL STORM DRAINAGE ANALYSIS

SCHNUCKS NORTH SUBDIVISION

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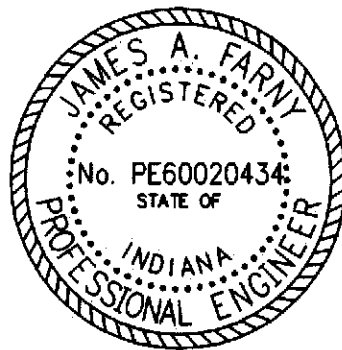
US 41 North at Boonville-New Harmony Road

Evansville, Indiana

BLA Project No.: 107-0141-BPD

Prepared for:

The Desco Group
25 N. Brentwood Blvd.
St. Louis, MO 63105



A handwritten signature in black ink, appearing to read "James A. Farny".

By:



6200 Vogel Road, Evansville, Indiana 47715
PHONE: 812.479.6200 • TOLL FREE: 800.423.7411

Revised
January 23, 2015

RECEIVED BY THE
VANDERBURGH COUNTY
SURVEYOR'S OFFICE
1/27/15
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SCHNUCKS NORTH SUBDIVISION DRAINAGE PLAN

Summary of plan, variances and conditions of approval

The site is located at the Northeast Corner of the intersection of US Highway 41 and Boonville New Harmony Road. The submitted drainage plan is for the combined Schnucks North Subdivision, which is an 8 lot subdivision plus the Schnucks North Minor Subdivision, which is a 1 lot minor subdivision immediately north of the major subdivision. The western portion of the Schnucks North Subdivision is located in the north 3 lots of the Grant Hills Commercial Park. This subdivision contains an existing detention pond that, as part of this drainage plan, will be modified.

The Preliminary Drainage Plan for the Schnucks North Major Subdivision was approved on August 19, 2014. The Final Drainage Plan submittal includes the entire Schnucks North Major Subdivision as well as the 1.7 acre Schnucks North Minor Subdivision immediately north of the major subdivision.

This final drainage plan was initially submitted on December 23, 2014, with a revised document submitted January 27, 2015 and two revised drawings submitted on February 3, 2015.

The submittal for approval consists of the revised document dated January 27, 2015, revised drawings Appendix Drawing A-3 dated February 2, 2015 and Appendix Drawing A-4 dated February 2, 2015 and a variance request letter dated February 2, 2015.

The drainage plan was submitted by the Lochmueller Group for their client The Desco Group, 25 North Brentwood Blvd, St. Louis, MO 63105 which is the entity who will be responsible for accomplishing the project for which the drainage plan is developed.

The drainage plan meets the requirements of the Drainage Code with the following engineering alteration noted. The velocities of two internal pipes that empty into the east basin have velocities that exceed the code. The developer will provide energy dissipation structures at the outlets of those two pipes.

In addition, Schnucks is requesting via a letter a variance from the Drainage Board to allow an 8" pipe where it empties a French Drain and variances to the east basin. These variances consist of allowing a couple of retaining walls along one area of the basin due to space requirements and to allow temporary water storage during the 25 year storm event above the 4' maximum depth that is specified in the Vanderburgh County Drainage Code. As a result of the variances to basin, Schnucks suggested placement of a fence around the basin. In order to insure that the fence is installed, Schnucks has agreed that the projected cost of the fence will be included in the letter of credit for this project.

The project site includes a drained pond and outlet ditch that have been identified as a regulated stream by USCOE. According to the submitted plan an offsite mitigation site has been developed. Also the west pond (just

north of the onsite German American Bank) drains to US Highway 41. In addition a small area in the Schnucks North Minor Subdivision Area also drains to US Highway 41.

Approval of the Final Drainage Plan by the Drainage Board does not alleviate the Developer from the responsibility of acquiring permits with USCOE for the wetlands, permitting for the discharge to US 41 with INDOT, if required, or any other permits that may be required for the site.

APPROVED

FEB 03 2015

**VANDERBURGH COUNTY
DRAINAGE BOARD**



6200 Vogel Road, Evansville, Indiana 47715
PHONE: 812.479.6200 • TOLL FREE: 800.423.7411

February 2, 2015

Via email: jmueller@vanderburghsurveyor.com

Mr. Jeffrey D. Mueller, P.E.
Vanderburgh County Surveyor
1 NW ML King Blvd. – Room 325
Evansville, IN 47708

RE: Schnucks North Subdivision
Drainage Board Approval
Our Project #107-0141-BPD

Dear Jeff,

In order to receive Drainage Board approval for the Final Storm Drainage Analysis dated *revised January 23, 2015* for the above referenced project, we do hereby request the following variances on behalf of our client, Schnucks Supermarket, under City of Evansville/Vanderburgh County Drainage Ordinance 13.04.025 "The Board's Right to Discretionary Decisions".

The East Basin requires temporary storage of 45,915 cubic feet for a 25 year storm which, due to the configuration of the basin, would have approximately 7 feet of temporary storage during that storm event. For the most part the basin has 4:1 slopes per code with the exception of an area on the east end of the basin where two small retaining walls are to be constructed. Schnucks is requesting that the basin be allowed as proposed with these with these two variance requests:

- a. Because the temporary storage exceeds the maximum height (by ordinance) of 4 feet, Schnucks proposes that a six (6) foot fence be constructed around the basin to keep individuals out of the subject basin ponding area and away from the retaining walls.
- b. Schnucks requests that the pipe between Structures 119 and 120 be allowed as 8" pipe because it empties a trench drain and most pre-manufactured trench drains do not accommodate pipes sizes 12" and larger.

Thank you for your consideration.

Respectfully submitted,


James A. Farny, PE, PLS
Senior Project Engineer

jaf/tac

APPROVED

FEB 03 2015

**VANDERBURGH COUNTY
DRAINAGE BOARD**

cc: Dave Fontana (via email dfontana@schnucks.com)
Carol Bartolo (via email carol.bartolo@brrrarch.com)
Darryl Vandever (via email dvandever@descogroup.com)
John Stoll (via email jstoll@vanderburghgov.org)
File

SCHNUCKS NORTH SUBDIVISION DRAINAGE PLAN

SUBMITTED 12-23-2014 Revisions submitted 1-27-2015

REVIEWED BY Jeffrey D. Mueller and John Stoll Initial Revision Completed 1-13-2015 Revisions reviewed 1-28-2015

Responses by James A. Farny, P.E. on January 21, 2015 shown in green Additional revisions supplied on 2-3-2015

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 on December 23, 2014.**
- 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.**
- 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. **Certified by Indiana Professional Engineer**
- 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.
- 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. **The Desco Group, 25 North Brentwood Blvd, St. Louis, MO 63105**

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. See comment under Section 13.04.130

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. **Please describe if all facilities will be constructed prior to the construction of any buildings or if the project is to be phased. If the project is to be phased, please describe what facilities will be constructed prior to proceeding forward.**

Site grading and installation of storm sewers will be done under one contract. This contract will be awarded at the end of this month. The actual building construction of the Schnucks building will begin in the months to follow.

The outlots will be built up in the future when the lots are sold.

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: **See Final Drainage plan submittal**

1. The extent and area of each watershed affecting the design of the drainage facilities for the project; **Provided except for offsite. The area of Golden Hill Subdivision is addressed on the outflow calculations regarding the lake in front of these homes. There is no information regarding the offsite drainage from the area directly north of the minor subdivision.**

Directly to the north of the minor subdivision, there is a ridge running north/south. From this ridge, the water flows west to US 41 and east to Old State Road. Provided

2. The soil types based on the most current information available from the SWCD; **See note in Final Drainage Plan contents**
3. Zone "A" floodplain based on the current FIRM panels.
4. The existing man-made and natural waterways, ponds, basins, pipes, culverts, and other drainage facilities or features within or affecting the project; **Provided**
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;

6. The existing streams, floodways, and floodplains to be maintained, and new channels to be constructed, their locations, cross sections, profiles, and materials used;

7. The proposed culverts and bridges to be built, with the specific materials to be used, elevations, waterway openings, and the basis of their design;

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; **The west basin already exists-is this basin to be modified?**

Yes, the west basin that originally served both the Bank of Evansville (German American) site and all of the original Grant Hills located north of it has been reduced in size for all of the water north of the Bank of Evansville (German American), except for the area immediately surrounding the basin will be rerouted to the east basin. Provided

9. The estimated depth and amount of storage required of the basins and ponds, and their available freeboards; **Provided**

10. The estimated location and percentage of impervious surface existing and expected to be constructed at completion of the project;

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

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. **Provided**

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 recommended to the drainage board by their technical advisors 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. **Submitted plan is for Final Approval**

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. Preliminary plan for Schnucks North Major approved on August 19, 2014. This submittal also includes a minor subdivision of 1.7 acres immediately north of the subdivision.

13.04.165 Contents of the 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, however the area that contains the minor is not included on the map.**

The soil on the minor plat parcel is HoB2 which is shown in Appendix "G". Provided

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. **Provided**

C. Contour Intervals.

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

2. 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; **Report states that no portion of the site lies within the 100 year Zone A**

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

4. The location of exiting regulated drains, farm drains, inlets and outfalls; **Not addressed**

We believe all water from the site exits through the ditch along the east side of Riley Drive. We are not aware of any farm drains, inlets and outfalls other than this ditch. The ditch is to be filled in and piped. The remainder of the ditch, along with the original pond located in the path of the old ditch, have been permitted and mitigated. All storm water from north of this project will be piped through this site. Provided

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

6. Wells, septic tank systems, and outfalls, if any; **Not addressed**

We are not aware of any wells, septic tanks that are located on the site being platted. The minor subdivision lot has a residential house and septic system that are to be demolished.

See notes on attached ALTA/ASCM Land Title Survey dated 4/2/2014. There is also a well located on this lot. This too will be lowered and capped as part of the project. **Provided**

7. Seeps, springs, sinkholes, caves, shafts, faults, or other such geological features visible, or of record; **Not addressed**

We are not aware of any seeps, springs, sinkholes, caves, shafts, faults or other geological features visible, or of record. Provided

8. The limits of the entire proposed project and the limits of the expected extent of land disturbance required to accomplish the project; **Is entire project site is to be disturbed?**

Nearly 90% of the subject property will be disturbed. Provided

9. The location of the streets, lot lines, and easements; **No drainage easements are shown for storm sewers.**

We will be adding storm sewer easements to the plat for those sewers that cross other lots from each source to the detention basin.

10. A scale, preferably one inch equals fifty (50) feet; **Scales are shown on maps and vary. Scales are sufficient.**

11. An arrow indicating North. ; **Provided**

D. On-Site Bench Mark Required. A benchmark determined by "Mean Sea Level Datum 1929," is required to be located within the project limits. **Not provided.**

Benchmark (BM45A) has been added to Appendix A-3 – Storm Sewer Plan. Provided

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 between structure 119 and 120 is only 8" in diameter. Please change size to 12" minimum per code. There is no information regarding the pipe between structure 113 and 114. The storm sewer template lists structures 97 and 98 but these could not be found on the Appendix drawing A-**
3. **There is no information regarding pipes between structures 149, 150, 148, 151 and 114. What is the velocity of the pipe between structures 152 and 153 (outlet of the west basin)?**

Some interior pipes show velocities greater than 15 fps which exceeds allowable velocity in the code (13.04.230 Storm sewer grade). Though this not considered a major issue for the interior pipes, there is concern for any pipes that outflow, specifically at outlet structures 140 and 146 due to potential erosion issues in the basin. Please address at these two locations.

Pipe between 119 and 120 is only 8" because it empties a trench drain in a loading dock. Most pre-manufactured trench drains do not accommodate pipe size 12" and larger. We would ask for a variance for this reason.

Pipe between 113 and 114 is a 30" RCP as shown in the Structure Data Table (Appendix A-4) on the line for Str. 113. It is also called out on the Storm Sewer Plan (Appendix A-3) under Str. 113 as 170' of 30" RCP.

Str. Nos. less than 100 on the template sheet are dummy nodes put into the program where multiple pipes enter the same point. It is necessary for the program to get the routing correct.

Structures 149, 150, 148 are existing structures that are to remain in place. The only work on these structures is to raise the castings to the new road elevation. No new piping is required.

Structures 114 and 151 are also existing structures with simple modifications to them. In Appendix A-3 you should note that all piping leaving these structures is shown dashed (existing piping).

Structures 152 and 153 outlet velocity is 8 cfs. We do not believe this to be a problem for it discharges to riprap that will dissipate this energy; furthermore, the flow is not that significant. We do not believe this requires INDOT approval for it is replacing a pipe located to the north that was previously INDOT approved and further, only accounts for undeveloped runoff that always entered INDOT right-of-way.

At Str. 139 the outlet velocity at outlet Str. 140 is 18.6 feet/second. It will discharge onto a concrete apron that is curbed on both sides and sodded beyond the curb,

At Str. 145 outlet velocity at Str. No. 146 is 27 feet/second. We can deepen the upstream Str. two feet, but this only drops the velocity to 24 feet/second. If required, we can look into some sort of energy dissipater at the outlet.

Str. 140 and 146 will be changed to headwalls with energy dissipaters built into them. Either very large riprap or actual concrete poured energy dissipation barriers at the outlet. Headwalls will be constructed to address your concern for velocity at these locations.

Structures 140 and 146 to have energy dissipation structures as shown on Appendix Sheet A-4

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;
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, **One open channel that conveys water from the north is to rerouted into a storm sewer behind the proposed Schnucks store.**
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; **One existing basin is on site from previous development. An as built drawing will be required and the estimated cost will be included in the letter of credit. Unclear if this basin is being altered; will the existing concrete liner, the 18" pipe running north onto lot #5, and the existing inlet be removed?**
Basin is being made smaller as previously mentioned. The 18" pipe to the north is to be removed, for this basin now only serves the German American parcel.
7. The location and percentage of impervious surfaces existing and expected to be constructed; **c factor of 0.78 for the Schnucks store with remaining areas of 0.7-no back up data on how these were determined.**

The value of 0.78 for the Schnucks is an actual weighted value. It should have been in Appendix B but was inadvertently left out. It is now included. Provided

The value of 0.70 for the outlot development area is an assumed value based on what we have seen in the past for smaller outlot development. When these lots are developed, the designer will then calculate the actual weighted value. These "c" values usually run between 0.65 to 0.70. We used what we believe to be a conservative value.

The overall drainage routing plan (Appendix A-7) shows that the minor subdivision lot is included as runoff assigned and routed to the east basin.

A supplemental worksheet that shows this area in question routed through Str. 124, as shown on the Storm Sewer Plan (Appendix A-3), was not included in the Final report, but is attached and included for your use as part of the Storm Sewer Analysis (Appendix F).

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; **Provided-see comments in basin design section regarding open spillways.**

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; **Storage volumes with corresponding water elevations provided. Outflow rates shown for estimated storm depths.**

11. The location of any applicable "impacted drainage areas" or other areas designated to remain totally undisturbed, natural, or for common and/or recreational use. **The area is not within an "impacted drainage area" as defined in the Vanderburgh County Drainage Code. The discussion states that a drained pond on site and outlet ditch on the property were deemed to be regulated under USCOE. The discussion states that an offsite mitigation site was constructed.**

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. **Non Applicable-area is significantly higher than 100 year flood zone.**

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; **No anticipated problems mentioned-plan submitted to meet Vanderburgh County Code**

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. The proposed design of the drainage control system; **Provided**

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

F. 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; **Additional information required per other comments.**

G. Maps showing individual drainage areas within the project subdivided for use in the analysis thereof. **Map of drainage areas shows that Lot 2 is outside any proposed retention areas. Is a drainage plan with retention for this lot to be submitted when the lot is developed? How is drainage being handled on the one lot minor; it appears that this will be allowed to sheet flow to highway 41; the map of the drainage areas shows all of lots 5-9 draining to the east basin; will the far west side of lots 5-9 drain to the basin, or will those areas flow onto the US 41 r/w?**

All of the increased runoff from lots 5 through 9 and the minor subdivision lot 1 will be directed through the basin. The entire area for these lots is included in the detention basin calculation. There will, however, be the small lawn area between the improvements and the lot line that may escape which is always difficult to address.

13.04.180 Typical cross sections of the drainage facilities.

One or more typical cross sections must be provided for each existing and proposed channel, basin, pond, or other open drainage facility, which cross sections: **Need a cross section for each pond.**

Attached is Appendix "H" – cross sections for each dry basin. **East basin has two retaining walls which will be addressed in a letter to the Drainage Board.**

- A. Must show the elevation of the existing land immediately adjacent to all drainage facilities;
- B. Must show the high water elevations adjacent to all waterways and impoundments as expected from the one hundred (100) year storm in relationship to permanent structures

13.04.440 General detention/retention basin design requirements.

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

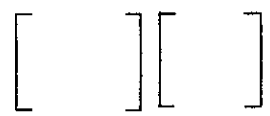
- A. Duration of Storage. The maximum volume of water stored and subsequently released at the design release rate shall not result in a storage duration in excess of forty-eight (48) hours, unless additional storms occur within the period. **Information not provided**

East Basin

Max. storage 50 year storm = 61,677.44
With Release Rate of 17.77 cfs
Time to empty =

$$61,677 \text{ cfs} \left[\frac{1 \text{ sec}}{17.77 \text{ cft}} \right] \left[\frac{\text{min}}{60 \text{ sec}} \right] \left[\frac{\text{hr.}}{60 \text{ min}} \right] = 0.96 \text{ hrs.}$$

Assuming average allowable outflow = 8.88 cfs



$$61,677 \text{ cfs} \frac{1 \text{ sec}}{8.88 \text{ cft}} \frac{\text{min}}{60 \text{ sec}} \frac{\text{hr.}}{60 \text{ min}} = 1.92 \text{ (use 2 hrs)}$$

$$61,677 \text{ cfs} \left[\begin{array}{c} ? \\ \end{array} \right] \left[\begin{array}{c} \text{min} \\ 60 \text{ sec} \end{array} \right] \left[\begin{array}{c} \text{hr.} \\ 60 \text{ min} \end{array} \right] = 48 \text{ hrs.}$$

Over the entire 48 hour period, the outflow rate would be reduced to 0.36 cfs.

East Basin

Max. storage 50 year storm = 5,013 cfs

With Release Rate of 2.15 cfs

Time to empty =

$$5,013 \text{ cfs} \left[\begin{array}{c} \text{sec} \\ 2.15 \text{ cfs} \end{array} \right] \left[\begin{array}{c} \text{min} \\ 60 \text{ sec} \end{array} \right] \left[\begin{array}{c} \text{hr.} \\ 60 \text{ min} \end{array} \right] = 0.64 \text{ hrs.}$$

At average of 1 cubic foot

$$5,013 \text{ cfs} \left[\begin{array}{c} 1 \text{ sec} \\ 1.0 \text{ cfs} \end{array} \right] \left[\begin{array}{c} \text{min} \\ 60 \text{ sec} \end{array} \right] \left[\begin{array}{c} \text{hr.} \\ 60 \text{ min} \end{array} \right] = 1.39$$

Or at 48 hours

$$5,013 \text{ cfs} \left[\begin{array}{c} ? \\ \end{array} \right] \left[\begin{array}{c} \text{min} \\ 60 \text{ sec} \end{array} \right] \left[\begin{array}{c} \text{hr.} \\ 60 \text{ min} \end{array} \right] = 48 \text{ hrs.} = 0.03 \text{ cfs}$$

Over the entire 48 hour period, the outflow rate would be reduced to 0.03 cfs.

Mathematically these values work if there is no inflow after the rain event stops. However, water will continue to enter the pond which will somewhat lengthen the time to empty. Because there is so much time difference, we do not believe that either facility will begin to approach 48 hours in length. **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. **West basin, utilizing a 50 year storm due to discharge on Highway requires storage of 5,013 ft³ which is under 4'. East Basin for a 25 year storm requires storage of 45,915 ft³ which is approximately 7' of storage. A fence is proposed for this basin. If developer agrees to install fence per the plans, than County Surveyor will recommend approval of this basin. A request to the Drainage Board under a separate letter requesting this variance under Section 1**

3.04.025, Boards rights to discretionary decisions should be submitted addressing this request.

We will have the owner submit this request. Request provided

C. Basin Distance From Dwellings. All stormwater detention facilities shall be separated by not less than fifty (50) feet from any building or structure to be occupied by humans. **Not Applicable-no dwellings**

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. **Dry Basins, Need cross section to verify**

All basins have slopes not exceeding 4:1 (See attached Cross Section – Appendix H-Dry Basin sections)

E. Riprap Side Slopes 2:1 Maximum Steepness for Basins. Wet retention basins with riprap armored side slopes shall have slopes no steeper than two horizontal units of measurements to one vertical unit of measurement (2:1) at any point in the side slope. **Dry Basins, 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. **Dry Basins, 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 measurements from a point two vertical feet below permanent pool, thence downward. **Dry Basins, not applicable**

H. Minimum Depth of Riprap Application. Riprap side slope armor shall be a minimum twelve (12) inches in depth at all points of application. **Not applicable**

I. Drain Recommended for Maintenance of Wet Basins. If possible, a drain should be installed to lower the pool of wet basins to a level sufficient to repair any wave action erosion along the waterline, and to perform other periodic maintenance. **Not provided nor is it required**

J. Safety Ledges and/or Fencing of Wet Basins. Safety fencing surrounding the basin, and/or shallow safety ledges shall be provided if deemed necessary by the design engineer or the board. **Dry Basins, however, East Basin shows a fence which due to the calculated amount of storm water drainage will be required. The estimated cost of the fence on the east basin must be included on the letter of credit.**

Fencing will be included in L.O.C. To be noted in approval and supplied to APC

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

L. **Designed Water Level Control Required.** A controlled positive outlet shall be required to maintain the designed water level in wet basins, and provide the required detention storage above the designed low water level. **Dry Basins, not applicable**

M. **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. **Not provided**

See attached Emergency Concrete Apron (Appendix A-4).

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.

N. **Automatically Operating Emergency Spillway Required.** The emergency overflow spillway shall be designed so that it operates openly, automatically, does not require manual attention, and will pass all the one hundred (100) year return period storm flow with a one-half foot vertical minimum above the one hundred (100) year return storm flow to the lowest dirt elevation in the surrounding earthwork. **Outlet pipes are utilized for all storms. An open channel/swale in the impoundment needs to be shown should the pipe system become clogged or fail.**

See attached Emergency Spillway Concrete Apron (Appendix A-4).

O. **All Permanent Pools Require Water Quality Provisions.** Designers of basins with permanent pools shall consult available manuals from the soil and water conservation district, and incorporate provisions therefrom for maintaining water quality, safety, and soil stability. **Dry Basins, not applicable**

P. **Dry Basin Cover and Maintenance.** Dry basins shall be planted and maintained in vegetative cover equal to that of residential lawns. **Provide information regarding seeding (mixture, soil amendments if any and application); provide information regarding maintenance schedule on water quality unit in east basin**

Basins will be sodded for permanent stabilization after construction is complete. After the area has been prepared for sod, fertilizer shall be applied at the rate of 400lbs/ac. with an analysis of 12-12-12.

Permanent surface stabilization other than basin shall be achieved by the use of a seeding mixture, along with mulching material and fertilizer. This seed mixture shall be applied at the rate of 150 lb/ac consisting of 95 lb/ac. of a 4-way blend of turf type tall fescues such as Tribute, Rebel II, Trailblazer or approved equal, 20 lb/ac Jasper Red

Fescue or approved equal, and 35 lb/ac certified fine bladed perennial ryegrass such as Regal, Blazer, or approved equal. Fertilizer shall be applied at a rate of 600 lbs/acre of 12-12-12 analysis, or equivalent. Mulching Material (clean grain straw or hay) shall be applied at a rate of 2 ton/acre.

Water Quality Unit: Recommended inspections and maintenance schedules vary with each manufacturer, but in general structures need to be inspected quarterly and cleaned out accordingly. Maintenance involves using a vacuum truck to remove accumulated oil, floatables, and sediment. Polluted water and sediment removed from this device should be properly handled and disposed of in accordance with local, state and federal regulations.

THIS INFORMATION IS INCLUDED IN THE CONSTRUCTION PLANS.

Q. Side Slopes to Remain Stable. All side slopes of a basin shall be constructed stable and shall be maintained in a stable condition by the same criteria as specified herein for open channels. **Should be addressed in maintenance plan (mowing schedule/requirements)**

Basin: Mowing (as needed during growing season), repair undercut or eroded areas (as needed), clear debris from inlet & outlet structures to ensure they are operational (quarterly), remove sediment from the permanent pool when volumes are reduced (Every 20 to 25 years).

THIS INFORMATION IS INCLUDED IN THE CONSTRUCTION PLANS.

R. Wet Basin Cover and Maintenance. The earthen side slopes of wet basins shall be provided with grass cover above the low water elevation, which shall be maintained equal to turfed residential lawns, and in no case shall the cover growth exceed twelve (12) inches in height, or the most current county standard. **Dry Basins, not applicable**

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

T. Maintenance Easement for Basins. An easement dedicated for the purpose of accessing and maintaining the basin and its appurtenances shall be provided, and the easement shall be configured so that it includes the entire basin, the entire earthwork encompassing the basin, the maintenance pathways into and around the basin, and all inletting and outletting appurtenances of the basin. **Provided**

U. 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;

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

3. Such restrictions shall be shown to exist prior to the board's final approval of the drainage plan for a project whose plans include a basin. **The drainage plan is being prior to final plat. The drainage plan states which lots shall be responsible for maintenance for the two dry basins. See note under 13.04.460.**

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

W. **Elevation of Dry Basin Bottom Marked.** A continuous concrete liner at least equal in characteristics to that described in Section 13.04.315F shall be installed in all dry basins from the point of inflow of each channel entering a basin to the point of outflow from the basin. The concrete liner shall be installed at an elevation slightly lower than the earthen floor of the basin, so that it may serve as a trickle trough or low flow liner. **It appears on the site drawings that a liner is proposed. If that is the case, please label and also provide a detail on one of the plan sheets.**

Yes, there is a paved side ditch located in the basin-see detail in Appendix A-4 **Side ditch is a different but a better design than what is shown in the code and meets the requirement that it shall be at least equal to what is described in Section 13.04.315F. .**

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. **The proposed plat states that the owners of lots 5,6,7,8 and 9 will be responsible for the maintenance of the west basin while the submitted drainage plan states that the responsibility for the west basin will be the owner of lot 4a; please clarify.**

The new plan calls for all of the green area (Appendix A-7) to be routed to the East Basin. Therefore, maintenance of the basin for all of this area is shifted to Schnucks (Owner of Lot 1). Only the Bank of Evansville (German American Bank) will utilize the West Basin and therefore, either Lot 4 or Lots 4 and Lot 5 combined should maintain this basin until such time that any reassignment is made between the parties.

Other comments

The preliminary drainage plan had originally had discrepancies regarding whether the pass through drainage from the north was 9 or 14 cfs. The approved preliminary plan stated that the pass through drainage was 9 cfs. Page 3 of the discussion states that the pass through is 14 cfs but when added to 17.77 the total shows only 26.77 cfs. Please correct. This error is also on page 5.

This has been corrected on pages 3 and 5 of this report—it should have been 9 cfs. Provided

The drawings in Appendix Sheet A-6 have different pipe sizes and flow directions between the two drawings shown.

Local supplier no longer has WQU originally shown on Appendix A-6—we have replaced with a different manufacturer's product. Provided

The plans state that the outflow from Box 109 is being restricted to 9 cfs. How is that being accomplished; is a restriction plate being installed?

See Appendix D-3-Outlet Control Structure Analysis (3rd page)—15" pipe will pass required 9 cfs. Therefore, no orifice plate is required. Provided

The West Basin discharge requires additional detail—it is stated that the outflow is being controlled by an orifice plate; please show location on the plans. The outlet pipe on Appendix Sheet A-3 shows this pipe to only be 8"; an 8" pipe would require a waiver from the required minimum diameter of 12"

See detail on Appendix A-5-Inlet type A5 Provided

The discharge from the basin is to Indiana State Highway right-of-way and may require a permit from this agency. Please provide information on the status of any submittals with INDOT regarding drainage.

The small amount of runoff from the site that will pass through 18" pipe has always been runoff directed into the highway drainage system. There is no proposed increase with proposed 8" pipe. We believe that it therefore does not require INDOT approval.

It should be noted that Drainage Plan submittals will be required for the individual lots to show that they comply with the assumptions of the approved drainage plan as well as detail on site drainage design.

We concur.

If lot 6 is developed independently from lot 5 or lot 7, how will runoff from lot 6 be conveyed to the storm sewer system? There is no storm sewer running along lot 6.

All piping to outlots will be installed ahead of individual lot development. Easements on plat will allow passing of storm water across lot lines.

Provide details showing how the retaining walls will be constructed over the storm sewers.

See detail for retaining wall on Appendix A-5 Provided

Details sheet A-4 shows bedding details for HDPE and PVC. If flexible pipe is used on this project, mandrel testing will be required as stated in 13.04.300.F. This should be noted on the details for the flexible pipe.

Added note for mandrel testing to Appendix A-4 Provided

In order to connect to the storm sewer system, lots 7-9 and lot 1 in the minor sub will have to extend pipes across the sanitary sewer running along the east side of each of these lots. No elevation data was provided on the sanitary sewer, so has it been confirmed that each of these lots can connect to the storm sewer with no conflicts with the sanitary?

Yes, we have checked all possible pipe crossing conflicts. Provided



6200 Vogel Road, Evansville, Indiana 47715
PHONE: 812.479.6200 • TOLL FREE: 800.423.7411

January 26, 2015

Hand Delivered

Mr. Jeffrey Mueller
Vanderburgh County Surveyor
Room 325 Civic Center Complex
Evansville, IN 47708

RE: Schnucks North Subdivision
Storm Drainage Analysis – Revised 1/23/2015
Lochmueller Project No. 107-0141-DPD

Dear Jeff,

Attached hereto is the revised Storm Drainage Analysis for the above referenced project. We have included the review comments made by you and John Stoll dated 1-_-2015. Our responses to these comments appear in green. These comments/responses are bound into the analysis in front of the Introduction.

All revised drawings show a revision date of 1/23/2015. Revisions to the drainage report narrative (Introduction) comments are also shown in green. We have also added Appendix H – Dry Basin Cross Sections and Appendix I – Alta/ASCM Land Title Survey.

Please review and, if approved, recommend for approval by the Vanderburgh County Drainage Board during the February 3, 2015 meeting.

Regards,

A handwritten signature in black ink, appearing to read "James A. Farny", is written over a large, stylized circular scribble.

James A. Farny, P.E., P.L.S.
Senior Project Engineer

jaf/tac

cc: Mr. John Stoll (w/report)
File

APPROVED

FEB 03 2015

**VANDERBURGH COUNTY
DRAINAGE BOARD**

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REVIEW COMMENTS BY JEFF MUELLER AND JOHN STOLL

RESPONSES BY JAMES A. FARNY, P.E.

SCHNUCKS NORTH SUBDIVISION DRAINAGE PLAN

SUBMITTED 12-23-2014

REVIEWED BY Jeffrey D. Mueller and John Stoll Initial Revision Completed 1-_-2015

Responses by James A. Farny, P.E. on January 21, 2015 shown in green

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 on December 23, 2014.**
- 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.**
- 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. **Certified by Indiana Professional Engineer**
- 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.
- 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. **The Desco Group, 25 North Brentwood Blvd, St. Louis, MO 63105**

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. **See comment under Section 13.04.130**

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. **Please describe if all facilities will be constructed prior to the construction of any buildings or if the project is to be phased. If the project is to be phased, please describe what facilities will be constructed prior to proceeding forward.**

Site grading and installation of storm sewers will be done under one contract. This contract will be awarded at the end of this month. The actual building construction of the Schnucks building will begin in the months to follow.

The outlots will be built up in the future when the lots are sold.

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: **See Final Drainage plan submittal**

1. The extent and area of each watershed affecting the design of the drainage facilities for the project; **Provided except for offsite. The area of Golden Hill Subdivision is addressed on the outflow calculations regarding the lake in front of these homes. There is no information regarding the offsite drainage from the area directly north of the minor subdivision.**

Directly to the north of the minor subdivision, there is a ridge running north/south. From this ridge, the water flows west to US 41 and east to Old State Road.

2. The soil types based on the most current information available from the SWCD; **See note in Final Drainage Plan contents**

3. Zone "A" floodplain based on the current FIRM panels.

4. The existing man-made and natural waterways, ponds, basins, pipes, culverts, and other drainage facilities or features within or affecting the project; **Provided**

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;

6. The existing streams, floodways, and floodplains to be maintained, and new channels to be constructed, their locations, cross sections, profiles, and materials used;

7. The proposed culverts and bridges to be built, with the specific materials to be used, elevations, waterway openings, and the basis of their design;

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; **The west basin already exists-is this basin to be modified?**

Yes, the west basin that originally served both the Bank of Evansville (German American) site and all of the original Grant Hills located north of it has been reduced in size for all of the water north of the Bank of Evansville (German American), except for the area immediately surrounding the basin will be rerouted to the east basin.

9. The estimated depth and amount of storage required of the basins and ponds, and their available freeboards; **Provided**

10. The estimated location and percentage of impervious surface existing and expected to be constructed at completion of the project;

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

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. **Provided**

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 recommended to the drainage board by their technical advisors 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. **Submitted plan is for Final Approval**

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. **Preliminary plan for Schnucks North Major approved on August 19, 2014. This submittal also includes a minor subdivision of 1.7 acres immediately north of the subdivision.**

13.04.165 Contents of the 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, however the area that contains the minor is not included on the map.**

The soil on the minor plat parcel is HoB2 which is shown in Appendix G.

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. **Provided**

C. Contour Intervals.

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

2. 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; **Report states that no portion of the site lies within the 100 year Zone A**

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

4. The location of exiting regulated drains, farm drains, inlets and outfalls; **Not addressed**

We believe all water from the site exits through the ditch along the east side of Riley Drive. We are not aware of any farm drains, inlets and outfalls other than this ditch. The ditch is to be filled in and piped. The remainder of the ditch, along with the original pond located in the path of the old ditch, have been permitted and mitigated. All storm water from north of this project will be piped through this site.

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

6. Wells, septic tank systems, and outfalls, if any; **Not addressed**

We are not aware of any wells, septic tanks that are located on the site being platted. The minor subdivision lot has a residential house and septic system that are to be demolished. See notes on attached ALTA/ASCM Land Title Survey dated 4/2/2014 (Appendix I). There is also a well located on this lot. This too will be lowered and capped as part of the project.

7. Seeps, springs, sinkholes, caves, shafts, faults, or other such geological features visible, or of record; **Not addressed**

We are not aware of any seeps, springs, sinkholes, caves, shafts, faults or other geological features visible, or of record.

8. The limits of the entire proposed project and the limits of the expected extent of land disturbance required to accomplish the project; **Is entire project site is to be disturbed?**

Nearly 90% of the subject property will be disturbed.

9. The location of the streets, lot lines, and easements; **No drainage easements are shown for storm sewers.**

We will be adding storm sewer easements to the plat for those sewers that cross other lots from each source to the detention basin.

10. A scale, preferably one inch equals fifty (50) feet; **Scales are shown on maps and vary. Scales are sufficient.**

11. An arrow indicating North. ; **Provided**

D. On-Site Bench Mark Required. A benchmark determined by "Mean Sea Level Datum 1929," is required to be located within the project limits. **Not provided.**

Benchmark (BM45A) has been added to Appendix A-3 – Storm Sewer Plan.

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 between structure 119 and 120 is only 8" in diameter. Please change size to 12" minimum per code. There is no information regarding the pipe between structure 113 and 114. The storm sewer template lists structures 97 and 98 but these could not be found on the Appendix drawing A-3. There is no information regarding pipes between structures 149, 150, 148, 151 and 114. What is the velocity of the pipe between structures 152 and 153 (outlet of the west basin)? Some interior pipes show velocities greater than 15 fps which exceeds allowable velocity in the code (13.04.230 Storm sewer grade). Though this not considered a major issue for the interior pipes, there is concern for any pipes that outflow, specifically at outlet structures**

140 and 146 due to potential erosion issues in the basin. Please address at these two locations.

Pipe between 119 and 120 is only 8" because it empties a trench drain in a loading dock. Most pre-manufactured trench drains do not accommodate pipe size 12" and larger. We would ask for a variance for this reason.

Pipe between 113 and 114 is a 30" RCP as shown in the Structure Data Table (Appendix A-4) on the line for Str. 113. It is also called out on the Storm Sewer Plan (Appendix A-3) under Str. 113 as 170' of 30" RCP.

Str. Nos. less than 100 on the template sheet are dummy nodes put into the program where multiple pipes enter the same point. It is necessary for the program to get the routing correct.

Structures 149, 150, 148 are existing structures that are to remain in place. The only work on these structures is to raise the castings to the new road elevation. No new piping is required.

Structures 114 and 151 are also existing structures with simple modifications to them. In Appendix A-3 you should note that all piping leaving these structures is shown dashed (existing piping).

Structures 152 and 153 outlet velocity is 8 cfs. We do not believe this to be a problem for it discharges to riprap that will dissipate this energy; furthermore, the flow is not that significant. We do not believe this requires INDOT approval for it is replacing a pipe located to the north that was previously INDOT approved and further, only accounts for undeveloped runoff that always entered INDOT right-of-way.

At Str. 139 the outlet velocity at outlet Str. 140 is 18.6 feet/second. It will discharge onto a concrete apron that is curbed on both sides and sodded beyond the curb.

At Str. 145 outlet velocity at Str. No. 146 is 27 feet/second. We can deepen the upstream Str. two feet, but this only drops the velocity to 24 feet/second. If required, we can look into some sort of energy dissipater at the outlet.

Str. 140 and 146 will be changed to headwalls with energy dissipaters built into them. Either very large riprap or actual concrete poured energy dissipation barriers at the outlet. Headwalls will be constructed to address your concern for velocity at these locations.

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;

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, **One open channel that conveys water from the north is to rerouted into a storm sewer behind the proposed Schnucks store.**

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; **One existing basin is on site from previous development. An as built drawing will be required and the estimated cost will be included in the letter of credit. Unclear if this basin is being altered; will the existing concrete liner, the 18" pipe running north onto lot #5, and the existing inlet be removed?**

Basin is being made smaller as previously mentioned. The 18" pipe to the north is to be removed, for this basin now only serves the German American parcel.

7. The location and percentage of impervious surfaces existing and expected to be constructed; **c factor of 0.78 for the Schnucks store with remaining areas of 0.7-no back up data on how these were determined.**

The value of 0.78 for the Schnucks is an actual weighted value. It should have been in Appendix B but was inadvertently left out. It is now included.

The value of 0.70 for the outlot development area is an assumed value based on what we have seen in the past for smaller outlot development. When these lots are developed, the designer will then calculate the actual weighted value. These "c" values usually run between 0.65 to 0.70. We used what we believe to be a conservative value.

The overall drainage routing plan (Appendix A-7) shows that the minor subdivision lot is included as runoff assigned and routed to the east basin.

A supplemental worksheet that shows this area in question routed through Str. 124, as shown on the Storm Sewer Plan (Appendix A-3), was not included in the Final report, but is attached and included for your use as part of the Storm Sewer Analysis (Appendix F).

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; **Provided-see comments in basin design section regarding open spillways.**

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; **Storage volumes with corresponding water elevations provided. Outflow rates shown for estimated storm depths.**

11. The location of any applicable "impacted drainage areas" or other areas designated to remain totally undisturbed, natural, or for common and/or recreational use. **The area is not within an "impacted drainage area" as defined in the Vanderburgh County Drainage Code. The discussion states that a drained pond on site and outlet ditch on the property were deemed to be regulated under USCOE. The discussion states that an offsite mitigation site was constructed.**

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. **Non Applicable-area is significantly higher than 100 year flood zone.**

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; **No anticipated problems mentioned-plan submitted to meet Vanderburgh County Code**

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. The proposed design of the drainage control system; **Provided**

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

F. 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; **Additional information required per other comments.**

See "Other comments"

G. Maps showing individual drainage areas within the project subdivided for use in the analysis thereof. **Map of drainage areas shows that Lot 2 is outside any proposed retention areas. Is a drainage plan with retention for this lot to be submitted when the lot is developed? How is drainage being handled on the one lot minor; it appears that this will be allowed to sheet flow to highway 41; the map of the drainage areas shows all of lots 5-9 draining to the east basin; will the far west side of lots 5-9 drain to the basin, or will those areas flow onto the US 41 r/w?**

All of the increased runoff from lots 5 through 9 and the minor subdivision lot 1 will be directed through the basin. The entire area for these lots is included in the detention basin calculation. There will, however, be the small lawn area between the improvements and the lot line that may escape which is always difficult to address.

13.04.180 Typical cross sections of the drainage facilities.

One or more typical cross sections must be provided for each existing and proposed channel, basin, pond, or other open drainage facility, which cross sections: **Need a cross section for each pond.**

Attached is Appendix H – Dry Basin Cross Sections

- A. Must show the elevation of the existing land immediately adjacent to all drainage facilities;
- B. Must show the high water elevations adjacent to all waterways and impoundments as expected from the one hundred (100) year storm in relationship to permanent structures

13.04.440 General detention/retention basin design requirements.

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

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

East Basin

Max. storage 50 year storm = 61,677.44

With Release Rate of 17.77 cfs

Time to empty =

$$61,677 \text{ cfs} \left[\frac{1 \text{ sec}}{17.77 \text{ cfs}} \right] \left[\frac{\text{min}}{60 \text{ sec}} \right] \left[\frac{\text{hr.}}{60 \text{ min}} \right] = 0.96 \text{ hrs.}$$

Assuming average allowable outflow = 8.88 cfs

$$61,677 \text{ cfs} \frac{1 \text{ sec}}{8.88 \text{ cfs}} \left[\frac{\text{min}}{60 \text{ sec}} \right] \left[\frac{\text{hr.}}{60 \text{ min}} \right] = 1.92 \text{ (use 2 hrs)}$$

$$61,677 \text{ cfs} \left[\begin{array}{c} ? \\ \end{array} \right] \left[\begin{array}{c} \text{min} \\ 60 \text{ sec} \end{array} \right] \left[\begin{array}{c} \text{hr.} \\ 60 \text{ min} \end{array} \right] = 48 \text{ hrs.}$$

Over the entire 48 hour period, the outflow rate would be reduced to 0.36 cfs.

East Basin

Max. storage 50 year storm = 5,013 cfs

With Release Rate of 2.15 cfs

Time to empty =

$$5,013 \text{ cfs} \left[\begin{array}{c} \text{sec} \\ 2.15 \text{ cfs} \end{array} \right] \left[\begin{array}{c} \text{min} \\ 60 \text{ sec} \end{array} \right] \left[\begin{array}{c} \text{hr.} \\ 60 \text{ min} \end{array} \right] = 0.64 \text{ hrs.}$$

At average of 1 cubic foot

$$5,013 \text{ cfs} \left[\begin{array}{c} 1 \text{ sec} \\ 1.0 \text{ cfs} \end{array} \right] \left[\begin{array}{c} \text{min} \\ 60 \text{ sec} \end{array} \right] \left[\begin{array}{c} \text{hr.} \\ 60 \text{ min} \end{array} \right] = 1.39$$

Or at 48 hours

$$5,013 \text{ cfs} \left[\begin{array}{c} ? \\ \end{array} \right] \left[\begin{array}{c} \text{min} \\ 60 \text{ sec} \end{array} \right] \left[\begin{array}{c} \text{hr.} \\ 60 \text{ min} \end{array} \right] = 48 \text{ hrs.} = 0.03 \text{ cfs}$$

Over the entire 48 hour period, the outflow rate would be reduced to 0.03 cfs.

Mathematically these values work if there is no inflow after the rain event stops. However, water will continue to enter the pond which will somewhat lengthen the time to empty. Because there is so much time difference, we do not believe that either facility's time to empty will begin to approach 48 hours in length.

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. **West basin, utilizing a 50 year storm due to discharge on Highway requires storage of 5,013 ft³ which is under 4'. East Basin for a 25 year storm requires storage of 45,915 ft³ which is approximately 7' of storage. A fence is proposed for this basin. If developer agrees to install fence per the plans, than County Surveyor will recommend approval of this basin. A request to the Drainage Board under a separate letter requesting this variance under Section 1**

3.04.025, Boards rights to discretionary decisions should be submitted addressing this request.

We will have the owner submit this request.

C. Basin Distance From Dwellings. All stormwater detention facilities shall be separated by not less than fifty (50) feet from any building or structure to be occupied by humans. **Not Applicable-no dwellings**

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. **Dry Basins, Need cross section to verify**

All basins have slopes not exceeding 4:1 (See attached Appendix H – Dry Basin Cross Sections)

E. Riprap Side Slopes 2:1 Maximum Steepness for Basins. Wet retention basins with riprap armored side slopes shall have slopes no steeper than two horizontal units of measurements to one vertical unit of measurement (2:1) at any point in the side slope. **Dry Basins, 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. **Dry Basins, 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 measurements from a point two vertical feet below permanent pool, thence downward. **Dry Basins, not applicable**

H. Minimum Depth of Riprap Application. Riprap side slope armor shall be a minimum twelve (12) inches in depth at all points of application. **Not applicable**

I. Drain Recommended for Maintenance of Wet Basins. If possible, a drain should be installed to lower the pool of wet basins to a level sufficient to repair any wave action erosion along the waterline, and to perform other periodic maintenance. **Not provided nor is it required**

J. Safety Ledges and/or Fencing of Wet Basins. Safety fencing surrounding the basin, and/or shallow safety ledges shall be provided if deemed necessary by the design engineer or the board. **Dry Basins, however, East Basin shows a fence which due to the calculated amount of storm water drainage will be required. The estimated cost of the fence on the east basin must be included on the letter of credit.**

Fencing will be included in L.O.C.

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

L. Designed Water Level Control Required. A controlled positive outlet shall be required to maintain the designed water level in wet basins, and provide the required detention storage above the designed low water level. **Dry Basins, not applicable**

M. 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. **Not provided**

See attached Emergency Spillway Concrete Apron (Appendix A-4).

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.

N. Automatically Operating Emergency Spillway Required. The emergency overflow spillway shall be designed so that it operates openly, automatically, does not require manual attention, and will pass all the one hundred (100) year return period storm flow with a one-half foot vertical minimum above the one hundred (100) year return storm flow to the lowest dirt elevation in the surrounding earthwork. **Outlet pipes are utilized for all storms. An open channel/swale in the impoundment needs to be shown should the pipe system become clogged or fail.**

See attached Emergency Spillway Concrete Apron (Appendix A-4).

O. All Permanent Pools Require Water Quality Provisions. Designers of basins with permanent pools shall consult available manuals from the soil and water conservation district, and incorporate provisions therefrom for maintaining water quality, safety, and soil stability. **Dry Basins, not applicable**

P. Dry Basin Cover and Maintenance. Dry basins shall be planted and maintained in vegetative cover equal to that of residential lawns. **Provide information regarding seeding (mixture, soil amendments if any and application); provide information regarding maintenance schedule on water quality unit in east basin**

Basins will be sodded for permanent stabilization after construction is complete. After the area has been prepared for sod, fertilizer shall be applied at the rate of 400lbs/ac. with an analysis of 12-12-12.

Permanent surface stabilization other than basin shall be achieved by the use of a seeding mixture, along with mulching material and fertilizer. This seed mixture shall be applied at the rate of 150 lb/ac consisting of 95 lb/ac. of a 4-way blend of turf type tall fescues such as Tribute, Rebel II, Trailblazer or approved equal, 20 lb/ac Jasper Red Fescue or approved equal, and 35 lb/ac certified fine bladed perennial ryegrass such as Regal, Blazer, or approved equal. Fertilizer shall be applied at a rate of 600 lbs/acre of 12-12-12 analysis, or equivalent. Mulching Material (clean grain straw or hay) shall be applied at a rate of 2 ton/acre.

Water Quality Unit: Recommended inspections and maintenance schedules vary with each manufacturer, but in general structures need to be inspected quarterly and cleaned

out accordingly. Maintenance involves using a vacuum truck to remove accumulated oil, floatables, and sediment. Polluted water and sediment removed from this device should be properly handled and disposed of in accordance with local, state and federal regulations.

THIS INFORMATION IS INCLUDED IN THE CONSTRUCTION PLANS.

Q. Side Slopes to Remain Stable. All side slopes of a basin shall be constructed stable and shall be maintained in a stable condition by the same criteria as specified herein for open channels. **Should be addressed in maintenance plan (mowing schedule/requirements)**

Basin: Mowing (as needed during growing season), repair undercut or eroded areas (as needed), clear debris from inlet & outlet structures to ensure they are operational (quarterly), remove sediment from the permanent pool when volumes are reduced (Every 20 to 25 years).

THIS INFORMATION IS INCLUDED IN THE CONSTRUCTION PLANS.

R. Wet Basin Cover and Maintenance. The earthen side slopes of wet basins shall be provided with grass cover above the low water elevation, which shall be maintained equal to turfed residential lawns, and in no case shall the cover growth exceed twelve (12) inches in height, or the most current county standard. **Dry Basins, not applicable**

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

T. Maintenance Easement for Basins. An easement dedicated for the purpose of accessing and maintaining the basin and its appurtenances shall be provided, and the easement shall be configured so that it includes the entire basin, the entire earthwork encompassing the basin, the maintenance pathways into and around the basin, and all inletting and outletting appurtenances of the basin. **Provided**

U. 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;
2. The report shall be attached to the restrictions for the property on which the basin and its parts are located.
3. Such restrictions shall be shown to exist prior to the board's final approval of the drainage plan for a project whose plans include a basin. **The drainage plan is being prior to final plat. The**

drainage plan states which lots shall be responsible for maintenance for the two dry basins. See note under 13.04.460.

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

W. Elevation of Dry Basin Bottom Marked. A continuous concrete liner at least equal in characteristics to that described in Section 13.04.315F shall be installed in all dry basins from the point of inflow of each channel entering a basin to the point of outflow from the basin. The concrete liner shall be installed at an elevation slightly lower than the earthen floor of the basin, so that it may serve as a trickle trough or low flow liner. **It appears on the site drawings that a liner is proposed. If that is the case, please label and also provide a detail on one of the plan sheets.**

Yes, there is a paved side ditch located in the basin – see detail in Appendix A-4.

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. **The proposed plat states that the owners of lots 5,6,7,8 and 9 will be responsible for the maintenance of the west basin while the submitted drainage plan states that the responsibility for the west basin will be the owner of lot 4a; please clarify.**

The new plan calls for all of the green area (Appendix A-7) to be routed to the East Basin. Therefore, maintenance of the basin for all of this area is shifted to Schnucks (Owner of Lot 1). Only the Bank of Evansville (German American Bank) will utilize the West Basin and therefore, either Lot 4 or Lots 4 and Lot 5 combined should maintain this basin until such time that any reassignment is made between the parties.

Other comments

The preliminary drainage plan had originally had discrepancies regarding whether the pass through drainage from the north was 9 or 14 cfs. The approved preliminary plan stated that the pass through drainage was 9 cfs. Page 3 of the discussion states that the pass through is 14 cfs but when added to 17.77 the total shows only 26.77 cfs. Please correct. This error is also on page 5.

This has been corrected on pages 3 and 5 of this report—it should have been 9 cfs.

The drawings in Appendix Sheet A-6 have different pipe sizes and flow directions between the two drawings shown.

Local supplier no longer has WQU originally shown on Appendix A-6—we have replaced with a different manufacturer's product.

The plans state that the outflow from Box 109 is being restricted to 9 cfs. How is that being accomplished; is a restriction plate being installed?

See Appendix D-3-Outlet Control Structure Analysis (3rd page)—15" pipe will pass required 9 cfs. Therefore, no orifice plate is required.

The West Basin discharge requires additional detail—it is stated that the outflow is being controlled by an orifice plate; please show location on the plans. The outlet pipe on Appendix Sheet A-3 shows this pipe to only be 8"; an 8" pipe would require a waiver from the required minimum diameter of 12"

See detail on Appendix A-5 – Inlet type A5

The discharge from the basin is to Indiana State Highway right-of-way and may require a permit from this agency. Please provide information on the status of any submittals with INDOT regarding drainage.

The small amount of runoff from the site that will pass through 8" pipe has always been runoff directed into the highway drainage system. There is no proposed increase with proposed 8" pipe. We believe that it therefore does not require INDOT approval.

It should be noted that Drainage Plan submittals will be required for the individual lots to show that they comply with the assumptions of the approved drainage plan as well as detail on site drainage design.

We concur.

If lot 6 is developed independently from lot 5 or lot 7, how will runoff from lot 6 be conveyed to the storm sewer system? There is no storm sewer running along lot 6.

All piping to outlots will be installed ahead of individual lot development. Easements on plat will allow passing of storm water across lot lines.

Provide details showing how the retaining walls will be constructed over the storm sewers.

See detail for retaining wall on Appendix A-5.

Details sheet A-4 shows bedding details for HDPE and PVC. If flexible pipe is used on this project, mandrel testing will be required as stated in 13.04.300.F. This should be noted on the details for the flexible pipe.

Added note for mandrel testing to Appendix A-4

In order to connect to the storm sewer system, lots 7-9 and lot 1 in the minor sub will have to extend pipes across the sanitary sewer running along the east side of each of these lots. No

elevation data was provided on the sanitary sewer, so has it been confirmed that each of these lots can connect to the storm sewer with no conflicts with the sanitary?

Yes, we have checked all possible pipe crossing conflicts.

INTRODUCTION

The proposed development of Schnucks North subdivision (**Appendix A-8a**) and Schnucks North Minor subdivision (**Appendix A-8b**) is to be constructed along the Highway 41 North Corridor at the northeast quadrant of the intersection of Boonville-New Harmony Road and US Highway 41 North in Evansville, Indiana. The westerly portion of this subject area is currently known as Grant Hills Commercial Park, as recorded in Plat Book R, page 89 (**Appendix A-9**), which received final drainage approval June 23, 2003. The easterly portion has never been platted and, consequently, has not received final drainage approval. However, the entire site, as it is depicted in **Appendix A-8a** received Preliminary Drainage approval on August 19, 2014.

Contained in the final drainage report for Grant Hills Commercial Park are drainage basin requirements (for the large Schnucks parcel) for the westerly outlots in this development which front on U.S. 41, the German American Bank (formerly the Bank of Evansville) lot and the lot east of German American Bank. In the Preliminary Drainage Report for Schnucks North Subdivision, the outlots along US 41 including the German American Bank lot were to drain to a basin constructed north of the German American Bank lot. The lot east of German American Bank was to drain to a basin located at the northeast corner of the lot. For this Final Drainage Report, the German American Bank lot is currently drained into the West Basin and will continue to do so. The westerly 200 feet (+/-) of the original Lot 1 of Grant Hills Commercial Park will be developed as outlots and the storm water from this area will be rerouted to the East Basin. The newly purchased lot north of Schnucks North Subdivision will also drain to the East Basin, as well as all of the remainder of the property that had previously routed to the East Basin (see attached **Appendix A-7 – Overall Drainage Routing Plan**).

As reported in the Preliminary Drainage Report, no portion of this site falls within the 100 year Zone "A", as noted on Community Panel No. 180256 0015 C of the Flood Insurance Rate Maps dated August 5, 1991. The proposed commercial development is situated on dormant fields with slopes ranging from 2% to 5%. The soils are predominantly silt loams. The entire tract

drains from north to south and is divided by a ridge traveling the same direction. This ridge divides the proposed development into a west and east watershed as previously described. There is currently a drained pond and outlet ditch that have been identified as a regulated stream by the U.S. Army Corps of Engineers. A mitigation site has been constructed at another location to replace this stream. The pond has been drained and will be filled along with the outlet ditch to accommodate this development. There is a drainage easement having a centerline as shown on the subdivision plat that will handle the runoff from north of the site that will be installed behind the Schnucks store.

This drainage report will address the storm detention requirements for this development of the proposed Schnucks North Subdivision in accordance with the current Vanderburgh County Drainage Ordinance. This ordinance states that a 10 year undeveloped condition should be compared to a 25 year developed condition and the quantitative difference in runoff experienced under these conditions shall be temporarily detained onsite in a retention or detention basin. Both basins will be sized to handle no less than a 50 year storm should the need arise.

On this project storm retention will be handled in two separate dry basins. They are described as follows:

1. **East Basin** (shown in green on the Overall Drainage Routing Plan – **Appendix A-7**-containing 16.135 acres). A new basin constructed on the land east of the original Grant Hills Commercial Park will be designed to accommodate the Schnucks site lying on the remainder of Lot 1 of the original Grant Hills Commercial Park and all of the additional land lying east of Grant Hills Commercial Park, west of Old State Road and north of Boonville-New Harmony Road, excepting a corner lot at the intersection of Old State Road and Boonville-New Harmony Road which is not a part of this proposed development. Located north of this onsite drainage area is an area outside of the subject development that drains through the site. The release of stormwater from this area north of the subject property is routed through the drained pond on this site as discussed above. The outflow from this pond is controlled with a 15 inch diameter outlet pipe. This pipe,

when emptying the pond to its fullest capacity, generates a headwater of approximately four feet. At this headwater the pipe will convey up to 9 cfs. Therefore, the outlet pipe for the pond will be sized to allow for up to 14 cfs to pass through freely. This 9 cfs outflow combined with the 17.77 cfs outfall allowed for the onsite drainage will produce a combined total outflow of approximately 26.77 cfs. This will be used to convey the water through the second outlet only. The primary outlet will be sized for the onsite drainage area only (17.77 cfs), which will result in a very conservative design for the basin.

2. **West Basin** (shown in blue on the Overall Drainage Routing Plan – Appendix A-7- containing 4.490 acres). An existing basin constructed near the southwest corner of Lot No. 1 of Grant Hills Commercial Park and also partially on the north end of Lot 2 of Grant Hills Commercial Park will address the needs of the German American Bank lot located at the intersection of US 41 and Boonville-New Harmony Road. The allowable outflow from this basin will be reduced to 2.15 cfs. The outlet structure and piping will be reworked to accommodate this smaller release rate.

These two basins will act independently of each other, each satisfying the required stormwater retention without support from the other basins.

METHOD

For both of these drainage areas the Rational Method ($Q = cia$) will be used to compute the 10 year undeveloped flows. The undeveloped flow from each of these watersheds will be used as the allowable outflow rates for the developed site.

“c” = Runoff Coefficient (undeveloped) - The existing land slopes from north to south. The soils are silt loams. The area is currently dormant and was previously reported as low density residential and cultivated fields ranging from 2% to 5% in slope. Table 3.2.1 of the drainage ordinance suggests an undeveloped runoff coefficient of 0.36 be used. For this report, we will utilize the same value as previously reported.

“c” = Developed (runoff coefficient) - In addition, a developed “c” factor of 0.78 will be used on the proposed land use and anticipated East Basin (Schnucks) surface improvements. For the East Basin and the West Basin a slightly smaller value of 0.70 will be used, for the outlot development will not be as impervious.

“i” = Intensity – Kerby’s Formula will be used to determine the time of concentration for the undeveloped site and the corresponding 10 year intensity will be calculated. For the area flowing from the north to south and west toward US 41, the previous report used a value of 24 minutes. The resulting 10 year intensity was 3.34 (see **Appendix B – Time of Concentration/Intensity**). This report will utilize the same values.

For the East Basin (all land east of Grant Hills Commercial Park) no previous analysis was performed. For this report, a time of concentration of 27 minutes was calculated; the resulting 10 year intensity being 3.06 (See **Appendix B – Time of Concentration**).

“a” = Area - The contributory area flowing into each basin from the proposed site was measured as follows:

East Basin = 16.135 acres. Increased from the Preliminary Drainage Report to include the outlots along US 41 North and the newly acquired property along US 41 North, north of the Schnucks North Subdivision.

West Basin = 4.490 acres previously – for this report is reduced to 1.79 acres, with the remainder of the 4.490 acres now being routed to the East Basin.

To the product of the developed “c” value and the area “a”, a range of intensity values for different duration storms having a 25 year and 100 year specified return rate will be multiplied to compute expected inflow rates.

The difference between the inflow rates and outflow rates for each interval will establish the

required storage for that interval. From this data a curve can be generated and the peak or largest value attained will be used as the required storage basin capacity.

A dry detention basin will be constructed for each watershed area to provide for the necessary storm water storage. The outflow for each basin will be sized to limit the outflow from this increased runoff. A summary of the allowable outflow rates are as follows:

For the East Basin an outflow rate of 17.77 cfs was calculated using the existing 10 year undeveloped condition. $Q = CIA = (.36)(3.06)(16.135) = 17.77 \text{ cfs (primary outlet)}$.

For the contributory area outside the subject property, 9 cfs will be added making the outflow rate for the secondary pipe in the two-stage outlet = 26.77 cfs.

For the West Basin an outflow rate of 2.15 cfs was calculated using the existing 10 year undeveloped condition. $Q = CIA = (.36)(3.34)(1.79) = 2.15 \text{ cfs}$

RESULTS

A summary of the Results for each analysis of the two individual basins is as follows:

East Basin

The available storage in the designated dry basin from elevation 437.00 to 445.00 is 55,667 cubic feet (See **Appendix E** – Basin Volume Data).

The required 25 year storage is 45,915 cubic feet and 50 year storage is 61,677 cubic feet. The available storage meets these requirements. The allowable 10 year outflow rate used to arrive at the required storage rates is 17.77 cfs. The pass through flow from the adjoining subdivision is 9 cfs. The total outflow is 26.77. The allowable outflow rate and storage requirements were derived as shown in **Appendix C** – Storage Volume Output. A dual stage outlet control structure (**Appendix D** – Outlet Control Structure Analysis) is recommended with the primary 15 inch diameter outlet pipe set at 436.35 and the secondary outlet control being through a casting set in the top of the structure being set at elevation 443.22,

approximately 6.87 feet above the primary outlet pipe, which exceeds the head necessary to attain the maximum allowable outlet flow and is also at or above the stormwater storage elevation necessary to achieve the required storage. The 50 year storm will be attained at elevation 443.46 with the required volume of 61,677 cubic feet.

Note: *Because we were unable to store a 100 year storm in the basin, the secondary outlet will be a 30 inch diameter pipe to insure no overtopping will occur.*

West Basin

The available storage in the designated dry basin from elevation 444.27 to 448.00 is 7,608 cubic feet (See **Appendix E** – Basin Volume Data).

The required 25 year storage is 4,115 cubic feet for this 1.79 acre area, down from 4.490 acres previously reported (*with revised formula*) and 50 year storage is 5,014 cubic feet (*with revised formula*). The available storage exceeds these requirements. The allowable 10 year outflow rate used to arrive at the required storage rates was 5.39 cfs and now is 2.15 cfs, again reduced due to the lesser area of 2.15 acres. This allowable outflow rate and storage requirements were derived as shown in **Appendix C** – Storage Volume Output Data. An ~~—dual stage~~ outlet control structure is recommended with the primary 12" diameter outlet pipe set at 444.27, having an orifice plate with an 8" hole. The required 50 year storage will raise the water elevation to elevation 447.30. Based on the basin geometry the required 100 year volume of 7,029 cubic feet will occur at elevation 447.85.

SUMMARY

The stormwater runoff will be detained in two separate basins located on the property. The owner Lot 4 will assume maintenance of the proposed storm water facility referred to as the West Basin. The owner of Lot 1, the large Schnucks complex north of the east basin will assume maintenance of the proposed storm water facility referred to as the East Basin.

The runoff from all paved areas and roof tops constructed on all of the lots will be routed through one of the basins.

As previously stated, each basin has enough capacity to exceed the 50 year stormwater storage requirement.

By providing dual outlet structures, storms of lesser frequencies could be detained if necessary by further restricting the primary outlet pipe and relying more frequently on the secondary outlet pipe to release the storm runoff prior to the runoff overtopping the basin.

APPENDICES INDEX

Appendix A-1	-	Grading Plan
Appendix A-2	-	Grading Plan with Elevations
Appendix A-3	-	Storm Sewer Plan
Appendix A-4	-	Structure Data Table/Storm Details
Appendix A-5	-	Storm Details
Appendix A-6	-	Storm Details
Appendix A-7	-	Overall Drainage Routing Plan
Appendix A-8a	-	Proposed Schnucks North Subdivision
Appendix A-8b		Proposed Schnucks North Minor Subdivision
Appendix A-9	-	Grant Hills Commercial Park Recorded Plat
Appendix B	-	Time of Concentration/Intensity
Appendix C	-	Storage Volume Output Data
Appendix D	-	Outlet Control Structure Analysis
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Appendix F	-	Storm Sewer Analysis
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Appendix H	-	Dry Basin Cross Sections
Appendix I		ALTA/ASCM Land Title Survey

APPENDIX B

TIME OF CONCENTRATION/ INTENSITY

TIME OF CONCENTRATIONFLAT SHEET FLOW (Kirby's Formula)**West Basin**

$$TC = .827 \left[\frac{(N)(L)}{\sqrt{S}} \right]^{.467}$$

N = 0.4 Coefficient Pasture/Grass

L = Length = 700'

H = 475 - 447 = 28'

S = Slope = .0400

$$TC = .827 \left[\frac{(0.2)(700)}{\sqrt{0.01}} \right]^{.467} = 24.36 \text{ minutes} \\ \cong 24 \text{ minutes}$$

INTENSITY**West Basin**

$$I_{10} = \frac{C(T)^{\alpha}}{(T_c+d)^{\beta}}$$

Factors for Evansville / Newburgh Area

C = 1.9533

T = duration

α = 0.1747

T_c = Time of Concentration (10 yr. undeveloped)

d = 0.522

β = 1.6408

$$I_{10} = \frac{1.9533(10)^{0.1747}}{(24/60+0.522)^{1.6408}} = I_{10} = \frac{2.9206}{0.8752} = 3.34$$

TIME OF CONCENTRATIONFLAT SHEET FLOW (Kirby's Formula)

East Basin

$$TC = .827 \left[\frac{(N)(L)}{\sqrt{S}} \right]^{.467}$$

N = 0.4 Coefficient Pasture/Grass

L = Length = 900'

H = 475 - 439 = 36'

S = Slope = .0400

$$TC = .827 \left[\frac{(0.2)(900)}{\sqrt{0.01}} \right]^{.467} = 27 \text{ minutes}$$

INTENSITY

East Basin

$$I_{10} = \frac{C(T)^\alpha}{(Tc+d)^\beta}$$

Factors for Evansville / Newburgh Area

C = 1.9533

T = duration

α = 0.1747

Tc = Time of Concentration (10 yr. undeveloped)

d = 0.522

β = 1.6408

$$I_{10} = \frac{1.9533(10)^{0.1747}}{(27/60+0.522)^{1.6408}} = I_{10} = \frac{2.9206}{0.9545} = 3.06$$

RUNOFF COEFFICIENTS

UNDEVELOPED "C" FACTOR = 0.36 (TABLE 803)

WEIGHTED "C" VALUES

Building	73,561 SF	(0.95)	=	69,882
Parking Lot	267,132 SF	(0.90)	=	240,418
Turf	101,136 SF	(0.30)	=	30,341
Water Temp. in Basin	9,906 SF	(0.1)	=	9,906
Total Area	451,735 SF			350,547
	350,547/451,735		"c" =	0.78

Remainder—Outlots

Assumed Developed Runoff Coefficient = 0.70

APPENDIX C

STORAGE

VOLUME

OUTPUT

DATA

PROJECT: schnucks area 1 East Basin
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 12/15/14

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100 16.135
 TIME OF CONCENTRATION UNDEV. (min): 27
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.0598923 2.4028857
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 17.77
 DEVELOPED RUNOFF COEFFICIENT: 0.78

25 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	7.88	99.20	17.77	81.42	0.543
0.17	6.27	78.92	17.77	61.15	0.866
0.25	5.24	65.96	17.77	48.18	1.004
0.33	4.46	56.10	17.77	38.33	1.054
0.42	3.78	47.58	17.77	29.81	1.043
0.50	3.31	41.62	17.77	23.85	0.994
0.58	2.92	36.78	17.77	19.01	0.919
0.67	2.57	32.34	17.77	14.56	0.813
0.75	2.31	29.07	17.77	11.29	0.706
0.83	2.09	26.30	17.77	8.53	0.590
0.92	1.88	23.66	17.77	5.89	0.451
1.00	1.72	21.65	13.96	7.70	0.641
1.25	1.88	23.71	13.96	9.75	1.016
1.50	1.67	20.99	13.96	7.03	0.879
1.75	1.50	18.88	13.96	4.92	0.717
2.00	1.37	17.19	13.96	3.23	0.538
2.50	1.16	14.64	13.96	0.68	0.142
3.00	1.02	12.80	13.96	-1.15	-0.289
4.00	0.82	10.32	13.96	-3.64	-1.213
6.00	0.60	7.56	13.96	-6.40	-3.200
10.00	0.40	5.06	13.96	-8.90	-7.414

STORAGE (ACRE/FT): 1.05
 STORAGE (CUBIC FT): 45,914.88

PROJECT: schnucks area 1 East Basin DATE: 12/15/14
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

5\10\25\100
 RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 16.135
 TIME OF CONCENTRATION UNDEV. (min): 27
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.0598923 2.4028857
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 17.77
 DEVELOPED RUNOFF COEFFICIENT: 0.78

100 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	10.04	126.38	17.77	108.60	0.724
0.17	7.99	100.55	17.77	82.78	1.173
0.25	6.68	84.03	17.77	66.26	1.380
0.33	5.68	71.48	17.77	53.70	1.477
0.42	4.82	60.62	17.77	42.85	1.500
0.50	4.21	53.03	17.77	35.26	1.469
0.58	3.72	46.86	17.77	29.09	1.406
0.67	3.27	41.20	17.77	23.42	1.308
0.75	2.94	37.03	17.77	19.26	1.204
0.83	2.66	33.51	17.77	15.73	1.088
0.92	2.40	30.14	17.77	12.37	0.948
1.00	2.19	27.59	13.96	13.63	1.136
1.25	2.54	32.01	13.96	18.06	1.881
1.50	2.25	28.34	13.96	14.38	1.798
1.75	2.03	25.49	13.96	11.53	1.681
2.00	1.84	23.20	13.96	9.25	1.541
2.50	1.57	19.77	13.96	5.81	1.210
3.00	1.37	17.29	13.96	3.33	0.832
4.00	1.11	13.93	13.96	-0.03	-0.009
6.00	0.81	10.20	13.96	-3.75	-1.877
10.00	0.54	6.83	13.96	-7.12	-5.936

STORAGE (ACRE/FT): 1.88
 STORAGE (CUBIC FT): 81,927.91

PROJECT: schnucks area 1 East Basin DATE: 12/15/14
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

5\10\25\100
 5\10\25\100
 RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 16.135
 TIME OF CONCENTRATION UNDEV. (min): 27
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.0598923 2.4028857
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 17.77
 DEVELOPED RUNOFF COEFFICIENT: 0.78

50 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	8.90	111.96	17.77	94.19	0.628
0.17	7.08	89.08	17.77	71.31	1.010
0.25	5.92	74.45	17.77	56.67	1.181
0.33	5.03	63.33	17.77	45.55	1.253
0.42	4.27	53.71	17.77	35.93	1.258
0.50	3.73	46.98	17.77	29.21	1.217
0.58	3.30	41.52	17.77	23.74	1.148
0.67	2.90	36.50	17.77	18.73	1.046
0.75	2.61	32.81	17.77	15.04	0.940
0.83	2.36	29.68	17.77	11.91	0.824
0.92	2.12	26.71	17.77	8.93	0.685
1.00	1.94	24.44	13.96	10.48	0.874
1.25	2.19	27.55	13.96	13.59	1.416
1.50	1.94	24.39	13.96	10.43	1.304
1.75	1.74	21.93	13.96	7.98	1.163
2.00	1.59	19.97	13.96	6.01	1.002
2.50	1.35	17.01	13.96	3.05	0.636
3.00	1.18	14.88	13.96	0.92	0.230
4.00	0.95	11.99	13.96	-1.97	-0.656
6.00	0.70	8.78	13.96	-5.18	-2.588
10.00	0.47	5.88	13.96	-8.08	-6.730

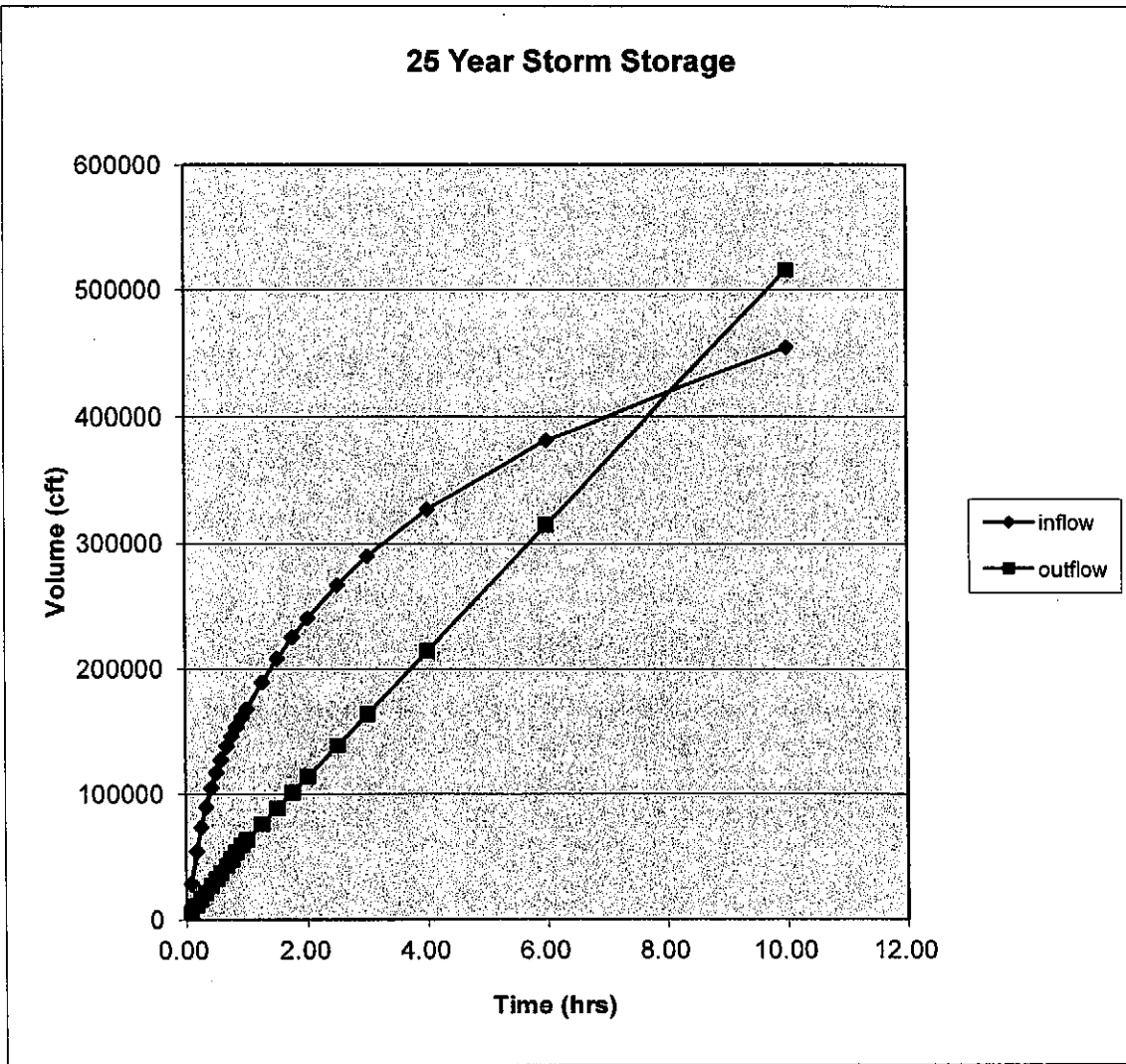
PEAK STORAGE (ACRE/FT): 1.42
 PEAK STORAGE (CUBIC FT): 61,677.44

PROJECT: schnucks area 1 East Basin
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 12/15/14

5\10\25\100
 5\10\25\100
 RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 16.135
 TIME OF CONCENTRATION UNDEV. (min): 27
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.0598923 2.4028857
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 17.77
 DEVELOPED RUNOFF COEFFICIENT: 0.78

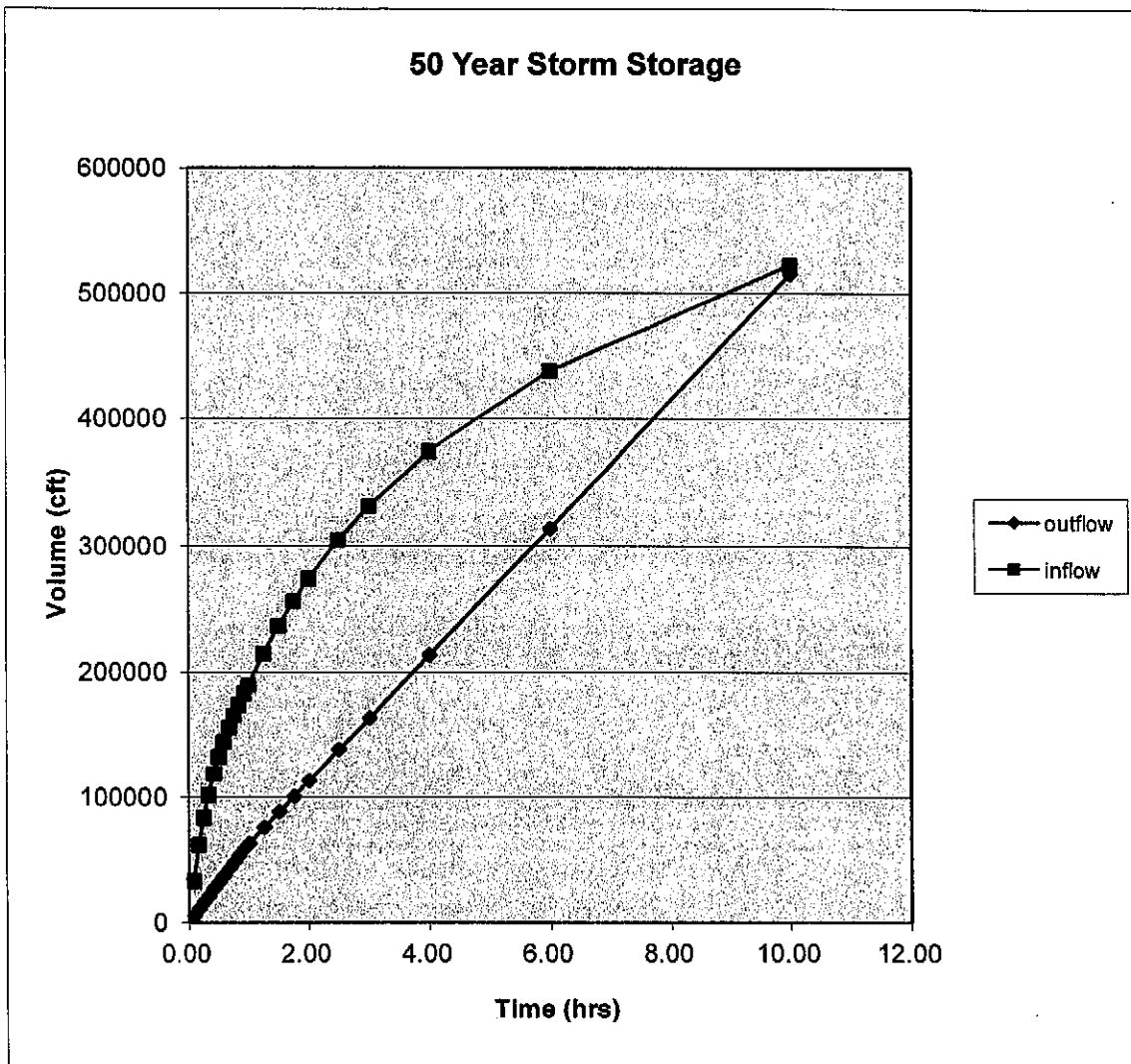
25 Year Storm Storage



PROJECT: schnucks area 1 East Basin
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 12/15/14

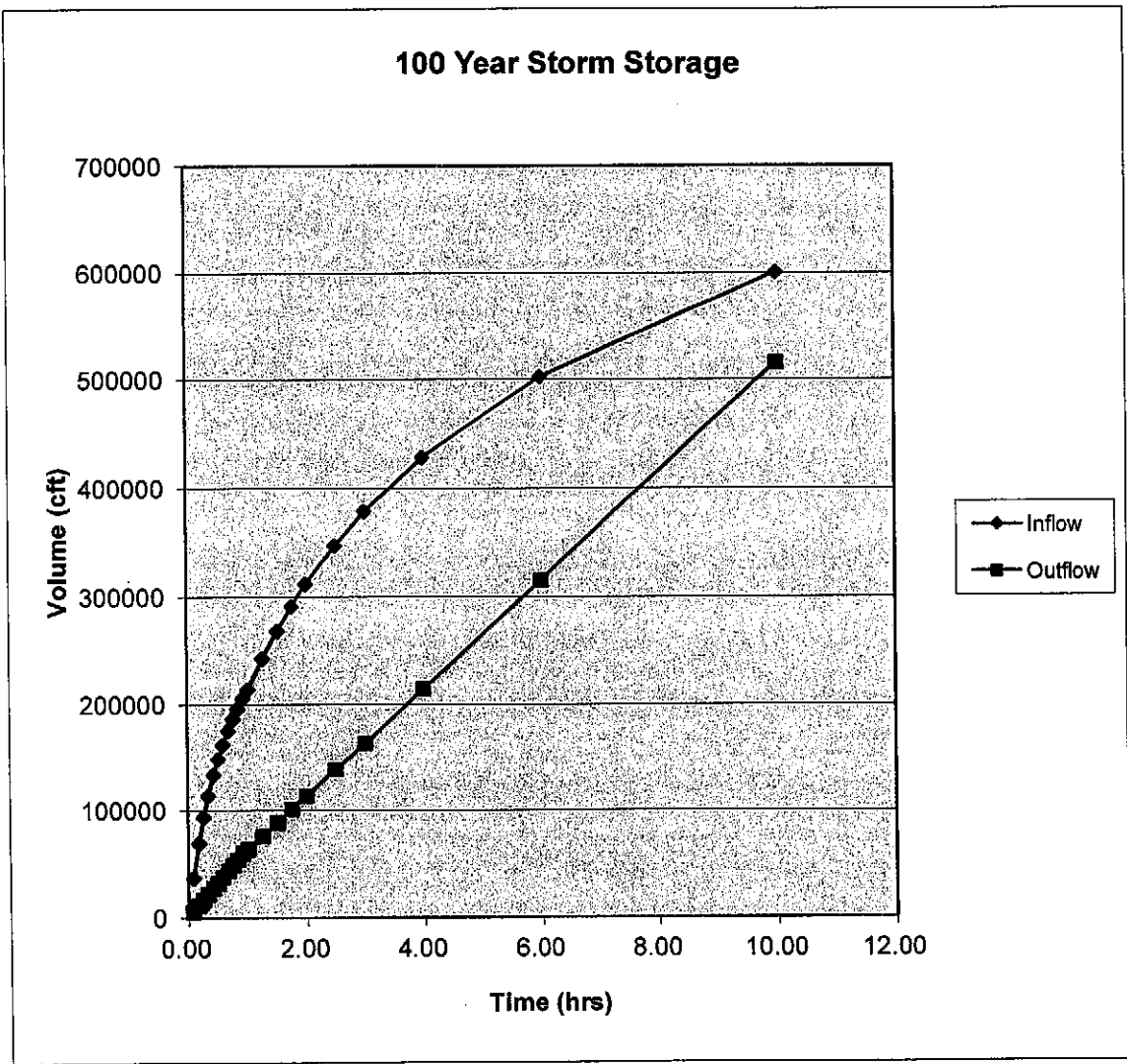
RELEASE RATE PERIOD: 5\10\25\100
 5\10\25\100
 WATERSHED AREA (ACRES): 16.135
 TIME OF CONCENTRATION UNDEV. (min): 27
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.0598923 2.4028857
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 17.77
 DEVELOPED RUNOFF COEFFICIENT: 0.78



PROJECT: schnucks area 1 East Basin
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 12/15/14

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 16.135
 TIME OF CONCENTRATION UNDEV. (min): 27
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.0598923 2.4028857
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 17.77
 DEVELOPED RUNOFF COEFFICIENT: 0.78



PROJECT: schnucks area 2 West Basin
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 12/15/14

RELEASE RATE PERIOD: 5\10\25\100
 5\10\25\100
 WATERSHED AREA (ACRES): 1.79
 TIME OF CONCENTRATION UNDEV. (min): 24
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.3368636 2.541939
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 2.15
 DEVELOPED RUNOFF COEFFICIENT: 0.7

25 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	7.88	9.88	2.15	7.73	0.052
0.17	6.27	7.86	2.15	5.71	0.081
0.25	5.24	6.57	2.15	4.42	0.092
0.33	4.46	5.59	2.15	3.44	0.094
0.42	3.78	4.74	2.15	2.59	0.091
0.50	3.31	4.14	2.15	1.99	0.083
0.58	2.92	3.66	2.15	1.51	0.073
0.67	2.57	3.22	2.15	1.07	0.060
0.75	2.31	2.89	2.15	0.74	0.046
0.83	2.09	2.62	2.15	0.47	0.032
0.92	1.88	2.36	2.15	0.21	0.016
1.00	1.72	2.16	1.64	0.52	0.043
1.25	1.88	2.36	1.64	0.72	0.075
1.50	1.67	2.09	1.64	0.45	0.056
1.75	1.50	1.88	1.64	0.24	0.035
2.00	1.37	1.71	1.64	0.07	0.012
2.50	1.16	1.46	1.64	-0.18	-0.038
3.00	1.02	1.27	1.64	-0.36	-0.091
4.00	0.82	1.03	1.64	-0.61	-0.204
6.00	0.60	0.75	1.64	-0.89	-0.443
10.00	0.40	0.50	1.64	-1.13	-0.945

STORAGE (ACRE/FT): 0.09
 STORAGE (CUBIC FT): 4,115.25

PROJECT: schnucks area 2 West Basin DATE: 12/15/14
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

5\10\25\100
 5\10\25\100
 RELEASE RATE PERIOD:
 WATERSHED AREA (ACRES): 1.79
 TIME OF CONCENTRATION UNDEV. (min): 24
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.3368636 2.541939
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 2.15
 DEVELOPED RUNOFF COEFFICIENT: 0.7

100 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	10.04	12.58	2.15	10.43	0.070
0.17	7.99	10.01	2.15	7.86	0.111
0.25	6.68	8.37	2.15	6.22	0.129
0.33	5.68	7.12	2.15	4.97	0.137
0.42	4.82	6.04	2.15	3.89	0.136
0.50	4.21	5.28	2.15	3.13	0.130
0.58	3.72	4.67	2.15	2.52	0.122
0.67	3.27	4.10	2.15	1.95	0.109
0.75	2.94	3.69	2.15	1.54	0.096
0.83	2.66	3.34	2.15	1.19	0.082
0.92	2.40	3.00	2.15	0.85	0.065
1.00	2.19	2.75	1.64	1.11	0.092
1.25	2.54	3.19	1.64	1.55	0.161
1.50	2.25	2.82	1.64	1.18	0.148
1.75	2.03	2.54	1.64	0.90	0.131
2.00	1.84	2.31	1.64	0.67	0.112
2.50	1.57	1.97	1.64	0.33	0.069
3.00	1.37	1.72	1.64	0.08	0.021
4.00	1.11	1.39	1.64	-0.25	-0.084
6.00	0.81	1.02	1.64	-0.62	-0.311
10.00	0.54	0.68	1.64	-0.96	-0.798

STORAGE (ACRE/FT): 0.16
 STORAGE (CUBIC FT): 7,029.59

PROJECT: schnucks area 2 West Basin DATE: 12/15/14
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 5\10\25\100
 WATERSHED AREA (ACRES): 1.79
 TIME OF CONCENTRATION UNDEV. (min): 24
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.3368636 2.541939
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 2.15
 DEVELOPED RUNOFF COEFFICIENT: 0.7

50 Year Storm

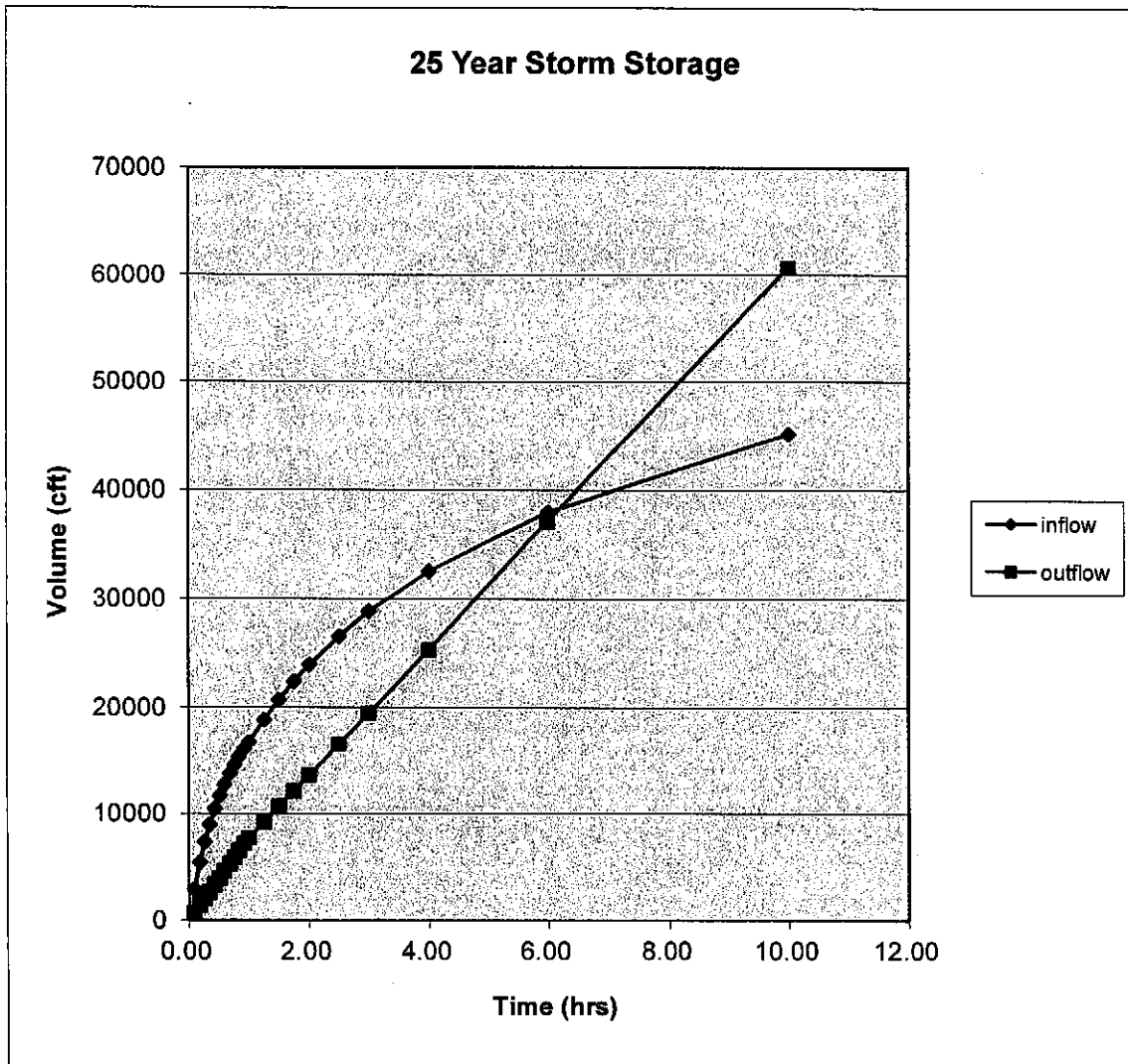
STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	8.90	11.15	2.15	9.00	0.060
0.17	7.08	8.87	2.15	6.72	0.095
0.25	5.92	7.41	2.15	5.26	0.110
0.33	5.03	6.30	2.15	4.15	0.114
0.42	4.27	5.35	2.15	3.20	0.112
0.50	3.73	4.68	2.15	2.53	0.105
0.58	3.30	4.13	2.15	1.98	0.096
0.67	2.90	3.63	2.15	1.48	0.083
0.75	2.61	3.27	2.15	1.12	0.070
0.83	2.36	2.96	2.15	0.81	0.056
0.92	2.12	2.66	2.15	0.51	0.039
1.00	1.94	2.43	1.64	0.80	0.066
1.25	2.19	2.74	1.64	1.10	0.115
1.50	1.94	2.43	1.64	0.79	0.099
1.75	1.74	2.18	1.64	0.55	0.080
2.00	1.59	1.99	1.64	0.35	0.058
2.50	1.35	1.69	1.64	0.06	0.012
3.00	1.18	1.48	1.64	-0.16	-0.039
4.00	0.95	1.19	1.64	-0.44	-0.148
6.00	0.70	0.87	1.64	-0.76	-0.382
10.00	0.47	0.59	1.64	-1.05	-0.877

PEAK STORAGE (ACRE/FT): 0.12
 PEAK STORAGE (CUBIC FT): 5,013.45

PROJECT: schnucks area 2 West Basin
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 12/15/14

RELEASE RATE PERIOD: 5\10\25\100
 5\10\25\100
 WATERSHED AREA (ACRES): 1.79
 TIME OF CONCENTRATION UNDEV. (min): 24
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.3368636 2.541939
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 2.15
 DEVELOPED RUNOFF COEFFICIENT: 0.7

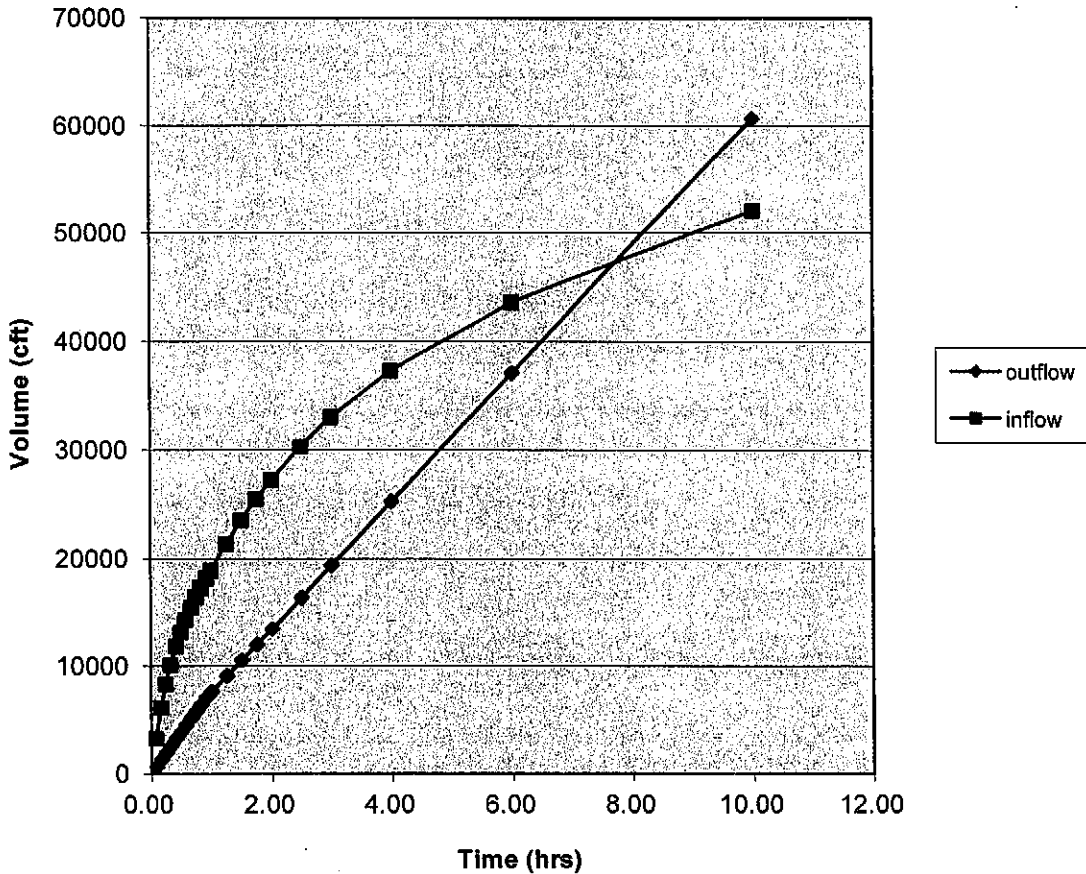


PROJECT: schnucks area 2 West Basin
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 12/15/14

5\10\25\100
 5\10\25\100
 RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 1.79
 TIME OF CONCENTRATION UNDEV. (min): 24
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.3368636 2.541939
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 2.15
 DEVELOPED RUNOFF COEFFICIENT: 0.7

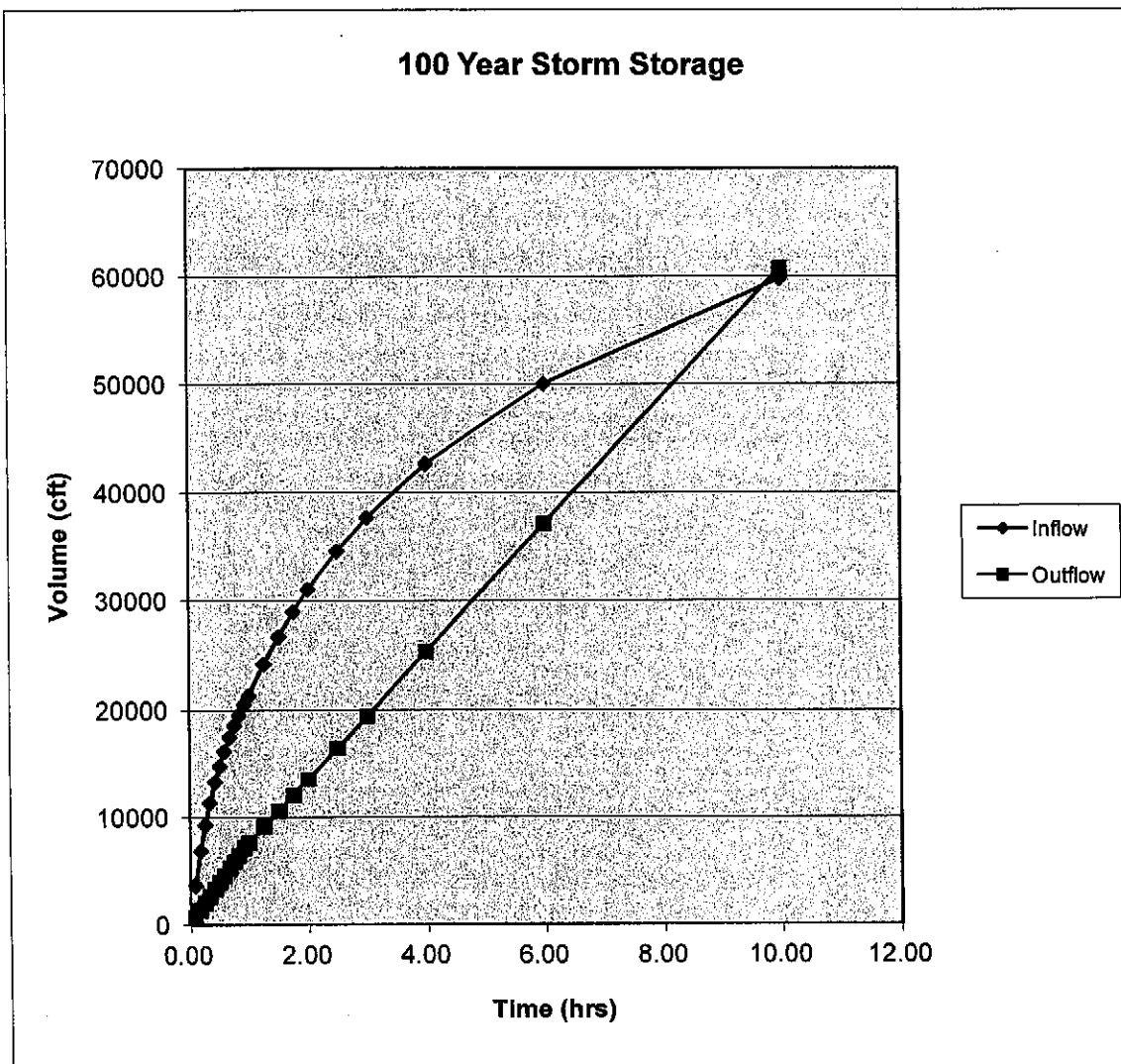
50 Year Storm Storage



PROJECT: schnucks area 2 West Basin
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 12/15/14

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 1.79
 TIME OF CONCENTRATION UNDEV. (min): 24
 RAINFALL INTENSITY (INCHES/HR): 100.00 3.3368636 2.541939
 UNDEVELOPED RUNOFF COEFFICIENT: 0.36
 UNDEVELOPED RUNOFF RATE (CFS): 2.15
 DEVELOPED RUNOFF COEFFICIENT: 0.7



APPENDIX D

OUTLET CONTROL STRUCTURE ANALYSIS

OUTLET CONTROL STRUCTUREORIFICE EQUATIONPrimary Outlet Sizing – East Basin

$$cd = Cc \times Cv = (.62)(.97) = .60$$

$$Q = cdA \sqrt{2gh}$$

$$\text{Allowable Outflow } Q = cia = (0.36)(3.06)(16.135) = 17.77 \text{ cfs}$$

$$c = 0.36$$

$$l = 3.06$$

$$a = 16.135 \text{ acres}$$

$$\text{Allowable HW} = \text{Top Box to invert of Pipe} - 443.22 - 436.35 = 6.87$$

$$(17.77) = Q = (.60)(A) \sqrt{2(32.2)(6.87)}$$

$$A = \frac{17.77}{12.62} = 1.408 = \frac{\pi(d)^2}{4}$$

$$d = 1.33 \text{ feet} \cong 16 \text{ inch or for standard pipe size use 15 inch}$$

Use a 15 inch diameter outlet pipe

OUTLET CONTROL STRUCTURE**ORIFICE EQUATION****Primary Outlet Sizing – West Basin**

$$cd = C_c \times C_v = (.62)(.97) = .60$$

$$Q = cdA \sqrt{2gh}$$

$$\text{Allowable Outflow } Q = cia = (0.36)(3.33)(1.79) = 2.15 \text{ cfs}$$

$$c = 0.36$$

$$i = 3.33$$

$$a = 1.79 \text{ acres}$$

$$\text{Allowable HW} = \text{Top Box to springline of Pipe} - 447.31 - 444.27 = 3.04$$

$$(2.15) = Q = (.60)(A) \sqrt{2(32.2)(3.04)}$$

$$A = \frac{2.15}{7.58} = 0.2561 = \frac{\pi(d)^2}{4}$$

$$d = .5710 \text{ feet} \cong 7 \text{ inch}$$

Use a 12 inch diameter outlet pipe with 7 inch orifice plate

HY-8 Culvert Analysis Report

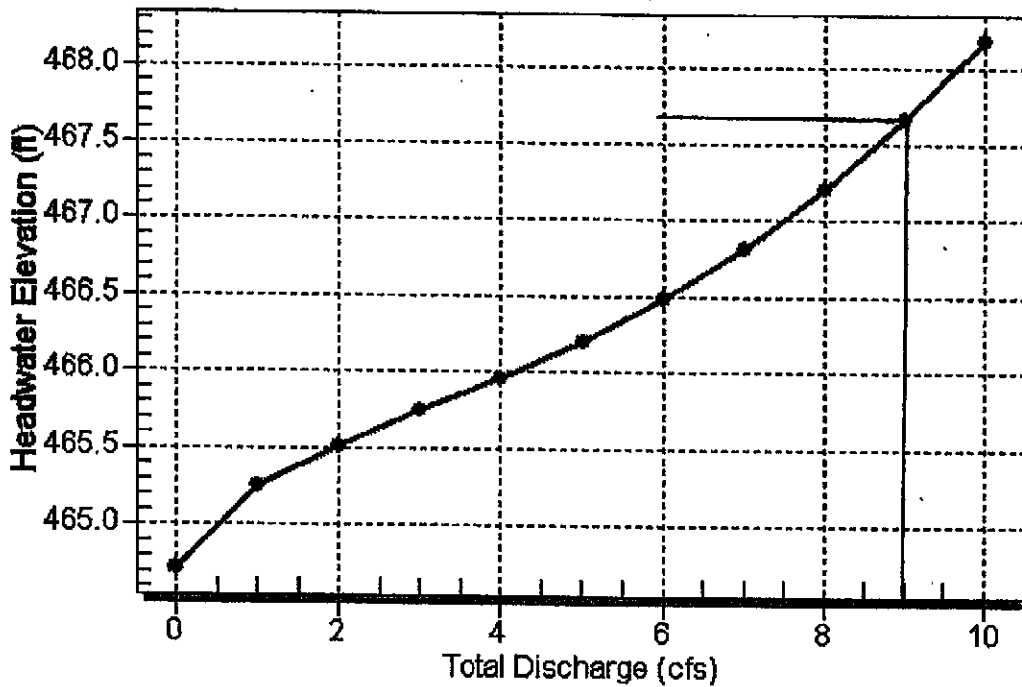
Table 1 - Summary of Culvert Flows at Crossing: Crossing 1

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
464.72	0.00	0.00	0.00	1
465.25	1.00	1.00	0.00	1
465.51	2.00	2.00	0.00	1
465.74	3.00	3.00	0.00	1
465.96	4.00	4.00	0.00	1
466.20	5.00	5.00	0.00	1
466.48	6.00	6.00	0.00	1
466.82	7.00	7.00	0.00	1
467.21	8.00	8.00	0.00	1
467.66	9.00	9.00	0.00	1
468.17	10.00	10.00	0.00	1
470.00	12.87	12.87	0.00	Overtopping

MAX HW
Allow

$$\begin{array}{r}
 467.66 \\
 - 464.72 \\
 \hline
 2.94 \approx 3'
 \end{array}$$

Rating Curve Plot for Crossing: Crossing 1

Total Rating Curve
Crossing: Crossing 1

Note: Max Flow ^{Existing} 15" PIPE

① MAX HW = 467.40 = 9 cfs.

Given Existing pipe & slope.

∴

9 cfs will represent
Allowable outflow Rates
or pass thru a point.

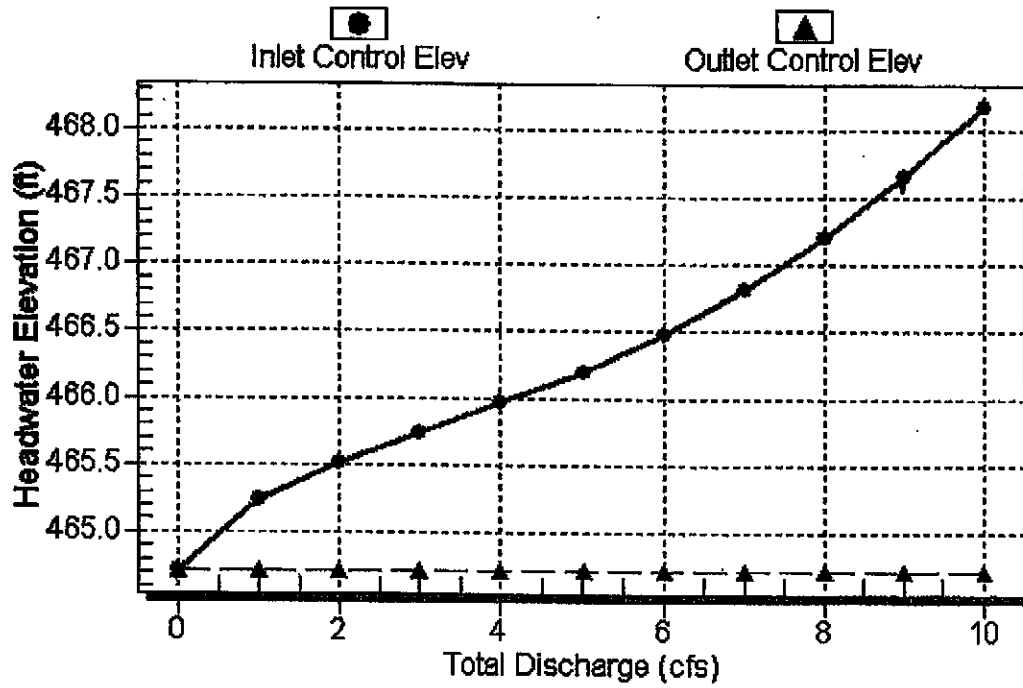
Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	464.72	0.000	0.000	0-NF	0.000	0.000	0.000	0.100	0.000	0.000
1.00	1.00	466.26	0.527	0.000	1-S2n	0.225	0.391	0.230	0.100	8.371	0.000
2.00	2.00	465.51	0.794	0.000	1-S2n	0.321	0.560	0.329	0.100	7.686	0.000
3.00	3.00	465.74	1.024	0.000	1-S2n	0.399	0.694	0.403	0.100	6.830	0.000
4.00	4.00	465.96	1.242	0.000	1-S2n	0.465	0.806	0.489	0.100	6.486	0.000
5.00	5.00	466.20	1.481	0.000	5-S2n	0.527	0.904	0.528	0.100	10.169	0.000
6.00	6.00	466.48	1.782	0.000	5-S2n	0.584	0.989	0.631	0.100	9.657	0.000
7.00	7.00	466.82	2.097	0.000	5-S2n	0.641	1.052	0.696	0.100	9.973	0.000
8.00	8.00	467.21	2.492	0.000	5-S2n	0.695	1.112	0.767	0.100	10.293	0.000
9.00	9.00	467.66	2.944	0.000	5-S2n	0.749	1.171	0.820	0.100	10.555	0.000
10.00	10.00	468.17	3.451	0.000	5-S2n	0.805	1.231	0.874	0.100	10.811	0.000

 Inlet Elevation (invert): 464.72 ft, Outlet Elevation (invert): 463.40 ft
 Culvert Length: 38.02 ft, Culvert Slope: 0.0367

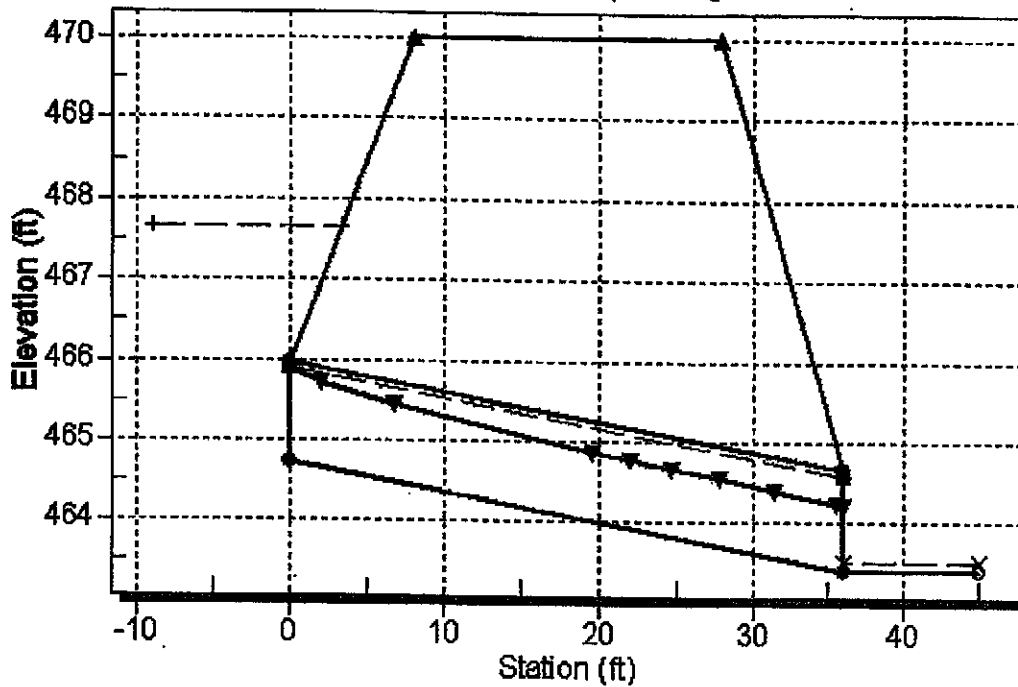
Culvert Performance Curve Plot: Culvert 1

Performance Curve
Culvert: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1

Crossing - Crossing 1, Design Discharge - 9.0 cfs
 Culvert - Culvert 1, Culvert Discharge - 9.0 cfs

**Site Data - Culvert 1**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 464.72 ft

Outlet Station: 36.00 ft

Outlet Elevation: 463.40 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

- Barrel Diameter: 1.25 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Crossing 1)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	463.50	0.10
1.00	463.50	0.10
2.00	463.50	0.10
3.00	463.50	0.10
4.00	463.50	0.10
5.00	463.50	0.10
6.00	463.50	0.10
7.00	463.50	0.10
8.00	463.50	0.10
9.00	463.50	0.10
10.00	463.50	0.10

Tailwater Channel Data - Crossing 1

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 463.50 ft

Roadway Data for Crossing: Crossing 1

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 470.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

APPENDIX E

BASIN VOLUME DATA

BASIN VOLUME**Project: SCHNUCKS EAST BASIN****Date: 12/15/2014**

ELEVATION	SURFACE AREA (square feet)	Incremental Volume (cubic feet)	Accumulated Volume (cubic feet)	Accumulated Volume (acre/feet)
436.35	5	0	0	0
437.00	1,447	472	472	0.01
438.00	3,490	2,469	2,940	0.07
439.00	6,234	4,862	7,802	0.18
440.00	7,544	6,889	14,691	0.34
441.00	8,872	8,208	22,899	0.53
442.00	10,191	9,532	32,431	0.74
443.00	11,528	10,860	43,290	0.99
444.00	12,850	12,189	55,479	1.27
445.00	14,162	13,506	68,985	1.58

BASIN VOLUME**Project: SCHNUCKS WEST BASIN****Date: 12/15/2014**

ELEVATION	SURFACE AREA (square feet)	Incremental Volume (cubic feet)	Accumulated Volume (cubic feet)	Accumulated Volume (acre/feet)
444.27	5	0	0	0
445.00	770	283	283	0.01
446.00	1,709	1,240	1,522	0.03
447.00	2,964	2,337	3,859	0.09
448.00	4,534	3,749	7,608	0.17
449.00	6,373	5,454	13,061	0.30

APPENDIX F

STORM SEWER ANALYSIS

50 YEAR STORM SEWER DESIGN-RATIONAL METHOD

RAINFALL INTENSITY CURVES
 YEAR: 50 Yr.
 REGION: evll
 (INDY,SBND,EVLL,FTWY)

PROJECT: SCHNUCKS #NAME?
 ENGINEER bla
 FILENAME:

DATE: 01/23/15
 MANNINGS n= 0.013

S:\PROJECTS\107-0141-OPD

STORM SEWER DESIGN TEMPLATE-ENGLISH UNITS

LINE NUMBER	UPSTREAM MANHOLE	UPSTREAM INVERT	DOWNSTREAM MANHOLE	DOWNSTREAM INVERT	STREAM LENGTH (FT)	C	A (ACRES)	CxA	SUM CxA	Tc (MIN)	Local Tc (MIN)	Tc(cum) (MIN)	I (IN/HR)	Q (CFS)	PIPE DIA. (INCHES)	PIPE SLOPE	PIPE CAPACITY	VELOCITY (FT/SEC)	TRAVEL TIME(MIN)
1.00	115	451.50	117	450.80	44.00	0.98	0.27	0.24	0.24	5.00	5.00	5.00	8.82	2.1	12	1.59	4.5	5.74	0.13
2.00	116	451.50	117	450.80	24.00	0.45	0.18	0.08	0.08	15.00	15.00	15.00	5.92	0.5	12	2.92	6.1	7.77	0.05
1.01	117	451.50	118	450.80	160.00	0.90	0.01	0.01	0.33	6.00	6.00	6.00	8.43	2.8	15	0.44	4.3	3.49	0.76
3.00	119	453.25	120	453.00	6.00	0.45	0.04	0.02	0.02	5.00	5.00	5.00	8.82	0.2	8	4.17	2.5	7.09	0.01
3.01	120	453.00	118	449.00	115.00	0.50	0.43	0.22	0.23	10.00	10.00	10.00	7.13	1.7	12	3.48	6.7	8.48	0.23
1.02	118	449.00	121	448.00	120.00	0.87	0.80	0.70	1.26	8.00	8.00	10.23	7.08	8.9	18	0.83	9.6	5.44	0.37
4.00	126	455.50	127	455.20	28.00	0.50	0.78	0.39	0.39	10.00	10.00	10.00	7.13	2.8	12	1.07	3.7	4.71	0.10
5.00	124	455.50	127	455.20	52.00	0.75	0.81	0.61	0.81	15.00	15.00	15.00	5.92	3.6	15	0.58	4.9	4.01	0.22
4.01	127	455.20	a127	451.00	70.00	0.85	0.07	0.06	1.06	5.00	5.00	10.10	7.11	7.5	12	6.00	8.8	11.14	0.10
6.00	125	451.70	a127	451.00	70.00	0.75	0.89	0.67	0.67	15.00	15.00	15.00	5.92	3.9	15	1.00	6.5	5.28	0.22
4.02	a127	451.00	121	447.75	117.00	0.85	0.02	0.02	1.74	5.00	5.00	10.20	7.08	12.3	18	2.78	17.6	9.93	0.20
1.03	121	447.75	a121	447.73	1.00	0.85	0.00	0.00	3.00	5.00	5.00	10.59	6.98	20.9	21	2.00	22.5	9.34	0.00
7.00	122	450.00	a121	447.73	40.00	0.85	0.10	0.09	0.09	5.00	5.00	5.00	8.82	0.7	12	5.67	8.5	10.84	0.06
1.04	a121	447.73	130	446.50	49.00	0.85	0.72	0.61	3.70	5.00	5.00	10.60	6.98	25.8	24	2.51	35.9	11.44	0.07
8.00	128	450.50	129	450.00	30.00	0.75	0.58	0.44	0.44	13.50	13.50	13.50	6.25	2.7	12	1.67	4.6	5.87	0.09
8.01	129	450.00	123	447.25	42.00	0.75	0.08	0.06	0.50	5.00	5.00	13.59	6.23	3.1	12	6.55	9.1	11.64	0.06
1.05	123	447.25	130	446.40	55.00	0.89	0.17	0.15	4.34	6.00	6.00	13.65	6.22	27.0	24	1.55	28.2	8.98	0.10
9.00	a130	450.50	130	446.40	74.00	0.75	0.36	0.27	0.27	15.00	15.00	15.00	5.92	1.6	12	5.54	8.4	10.71	0.12
1.06	130	446.40	131	441.50	305.00	0.89	0.74	0.66	5.27	8.00	8.00	13.75	6.20	32.7	27	1.61	39.4	9.90	0.51
10.00	132	451.75	133	450.50	100.00	0.75	0.91	0.68	0.68	16.00	16.00	16.00	5.72	3.9	12	1.25	4.0	5.09	0.33
10.01	133	450.50	134	446.90	140.00	0.75	0.44	0.33	1.01	16.00	16.33	16.33	5.66	5.7	12	2.57	5.7	7.29	0.32
10.02	134	446.90	131	446.00	55.00	0.83	0.15	0.12	1.14	9.00	9.00	16.65	5.59	6.4	15	1.64	8.3	6.75	0.14
1.07	131	441.50	135	438.00	145.00	0.89	1.34	1.19	7.60	9.00	9.00	16.78	5.57	42.3	27	2.41	48.2	12.13	0.20
11.00	136	443.00	137	442.00	54.00	0.99	0.05	0.04	0.04	5.00	5.00	5.00	8.82	0.4	12	1.85	4.9	6.19	0.15
12.00	98	442.10	137	442.00	8.00	0.90	0.01	0.01	0.01	5.00	5.00	5.00	8.82	0.1	12	1.25	4.0	5.09	0.03
11.01	137	442.00	138	441.40	55.00	0.79	1.39	1.10	1.15	18.00	18.00	18.00	5.34	6.2	15	1.09	6.8	5.51	0.17
11.02	138	441.40	135	441.00	30.00	0.85	0.06	0.05	1.20	5.00	5.00	18.17	5.31	6.4	15	1.33	7.5	6.09	0.08
1.08	135	438.00	97	437.98	0.50	0.85	0.01	0.01	8.81	5.00	5.00	18.25	5.30	46.7	27	4.00	62.1	15.62	0.00
12.00	139	446.00	97	441.00	30.00	0.75	0.09	0.07	0.08	5.00	5.00	5.00	8.82	0.7	12	16.67	14.6	18.57	0.03

50 YEAR STORM SEWER DESIGN-RATIONAL METHOD

RAINFALL INTENSITY CURVES
 YEAR : 50 Yr.
 REGION : evll
 (INDY,SBND,EVLL,FTWY)

PROJECT: SCHNUCKI RUN4
 ENGINEER: bia
 FILENAME:

S:\PROJECTS\107-0141-OPD

DATE: 01/20/15
 MANNINGS n= 0.013

STORM SEWER DESIGN TEMPLATE-ENGLISH UNITS

LINE NUMBER	UPSTREAM MANHOLE	UPSTREAM INVERT	DOWNSTREAM MANHOLE	DOWNSTREAM INVERT	STREAM LENGTH (FT)	C	A (ACRES)	CxA	SUM CxA	Tc (MIN)	Tc(gum) (MIN)	I (IN/HR)	Q (CFS)	PIPE DIA. (INCHES)	PIPE SLOPE	PIPE CAPACITY	VELOCITY (FT/SEC)	TRAVEL TIME(MIN)
1.00	141	453.50	142	452.00	150.00	0.90	0.11	0.10	0.10	5.00	5.00	8.82	0.8	12	1.00	3.6	4.55	0.55
2.00	143	453.00	142	452.00	48.00	0.90	0.11	0.10	0.10	5.00	5.00	8.82	0.8	12	2.08	5.2	6.57	0.12
1.01	142	452.00	144	449.80	70.00	0.90	0.11	0.10	0.29	5.00	5.55	8.58	2.5	12	3.14	6.3	8.06	0.14
3.00	154	450.00	144	449.80	98.00	0.90	0.10	0.09	0.09	5.00	8.00	7.74	0.7	12	0.20	1.6	2.05	0.79
1.02	144	449.80	145	448.50	92.00	0.90	0.34	0.31	0.88	5.00	5.69	8.52	5.8	15	1.41	7.7	6.27	0.24
1.03	145	446.50	146	438.00	40.00	0.90	0.13	0.12	0.80	5.00	5.94	8.41	6.7	15	21.25	29.9	24.33	0.03
0.00	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	5.00	5.00	8.82	0.0	12	###	#DIV/0!	#DIV/0!	#DIV/0!
0.00	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	5.00	5.00	8.82	0.0	12	###	#DIV/0!	#DIV/0!	#DIV/0!
0.00	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	5.00	5.00	8.82	0.0	12	###	#DIV/0!	#DIV/0!	#DIV/0!
0.00	0	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	5.00	5.00	8.82	0.0	12	###	#DIV/0!	#DIV/0!	#DIV/0!

50 YEAR STORM SEWER DESIGN-RATIONAL METHOD

RAINFALL INTENSITY CURVES
 YEAR : 50 Yr.
 REGION : evil
 (INDY,SBND,EVLL,FTWY)

PROJECT: SCHNUCKS-RUN1
 ENGINEER: bla
 FILENAME:

S:\PROJECTS\107-0141-OPD

DATE: 12/17/14
 MANNINGS n: 0.013

STORM SEWER DESIGN TEMPLATE-ENGLISH UNITS

LINE NUMBER	UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH (FT)	C	A (ACRES)	CxA	SUM CxA	Local Tc (MIN)	Tc(gum) (MIN)	f (IN/HR)	Q (CFS)	PIPE DIA. (INCHES)	PIPE SLOPE	PIPE CAPACITY	VELOCITY (FT/SEC)	TRAVEL TIME(MIN)
1.00	99	100	60.00	0.60	4.00	2.40	2.40	15.00	15.00	5.92	14.2	18	2.08	15.2	8.60	0.12
1.01	100	101	38.00	0.45	0.25	0.11	2.51	10.00	15.12	5.89	14.8	18	7.24	28.3	16.03	0.04
2.00	98	102	50.00	0.90	0.46	0.41	0.41	5.00	5.00	8.82	3.6	15	1.00	6.5	5.28	0.16
2.01	102	101	2.00	0.88	0.24	0.21	0.63	5.00	5.16	8.77	5.5	12	7.50	9.8	12.46	0.00
1.02	101	103	226.00	0.45	0.01	0.00	3.14	5.00	15.16	5.88	18.5	24	0.88	21.3	6.79	0.55
3.00	104	105	25.00	0.90	0.85	0.77	0.77	5.00	5.00	8.82	6.8	15	8.00	18.3	14.93	0.03
3.01	105	103	2.00	0.70	0.20	0.14	0.90	5.00	5.03	8.81	8.0	15	12.50	22.9	18.66	0.00
1.03	103	108	202.00	0.50	0.01	0.01	4.05	5.00	15.71	5.78	23.4	24	1.49	27.6	8.80	0.38
4.00	107	108	50.00	0.90	0.06	0.06	0.06	5.00	5.00	8.82	0.5	12	1.50	4.4	5.57	0.15
4.01	108	106	2.00	0.78	0.20	0.15	0.21	5.00	5.15	8.77	1.8	12	7.50	9.8	12.46	0.00
1.04	106	109	174.00	0.45	0.00	0.00	4.26	5.00	16.09	5.70	24.3	24	5.75	54.4	17.31	0.17
1.05	109	113	431.75	0.50	0.01	0.01	4.27	5.00	16.26	5.67	24.2	15	1.93	9.0	7.34	0.50

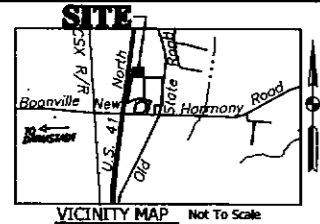
APPENDIX G

SOILS INFORMATION

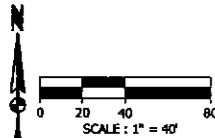
Map Unit Legend

Vanderburgh County, Indiana (IN163)			
Map Unit Symbol	Map Unit Name	Acres In AOI	Percent of AOI
HoB2	Hosmer silt loam, 2 to 6 percent slopes, eroded	22.2	48.8%
HoB3	Hosmer silt loam, 2 to 6 percent slopes, severely eroded	4.1	8.9%
St	Stendal silt loam	2.7	5.9%
W	Water	1.2	2.6%
WeE2	Wellston silt loam, 18 to 25 percent slopes, eroded	0.9	1.9%
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	14.2	31.2%
ZaD3	Zanesville silt loam, 12 to 18 percent slopes, severely eroded	0.3	0.6%
Totals for Area of Interest		45.5	100.0%

SCHNUCKS NORTH MINOR



VICINITY MAP Not To Scale



GENERAL NOTES

Flood Plain Data: Per F.E.R.M. parcel number 181630D106D, Vanderburgh County, Indiana, dated March 17, 2011. No portion of the subdivision lies within the designated 100 year flood zone.

Building Setbacks: All buildings shall be setback a minimum of 50' from the lot line which is adjacent to the street. Any variance to a setback must be approved in writing by the building review committee. In no case can the front yard building setback be relaxed to a distance less than required by the zoning code.

Minimum First Floor Elevations: Will be established by the Vanderburgh County Building Commissioner. Basements: Any basements must be approved by the Vanderburgh County Building Commissioner.

Utilities: Water service and sanitary sewers are available at the site and needs to be extended to serve the Lot. Gas, electric and telephone are on or will be extended to the site.

Access: Access to Lot 1 will be by way of an Ingress/Egress Easement located on said Lot 1. The Frontage Road to be constructed in the US 41 Ingress/Egress easement shall be constructed at an existing opening in the US 41 North Corridor. US 41 North is a limited access facility and no curb outs will be allowed directly onto this State Route.

Internal Roads: All roads within the subdivision will be located in the Ingress/Egress easements. All roads shall remain private roads and shall be maintained by the owner of Lot 1 of Schnucks North Subdivision which adjoins this plat to the south.

Road Grades: Maximum road grades shall not exceed 10%.

Temporary Erosion Control: A Storm Water Pollution Prevention Plan must be submitted according to Vanderburgh County Code Title 13.05 "Construction Site Storm Water Runoff Control". Temporary erosion control measures must be implemented as described in the storm water pollution prevention plan for the project site. At a minimum, temporary or permanent stabilization as described in section 13.05.11.C.16 of the Vanderburgh County Code must be provided if unvegetated areas are scheduled or likely to be left inactive for 15 days or more.

Site Topography: The Site has a rolling terrain sloping in general from north to south. The elevations throughout range from 465' to 483'.

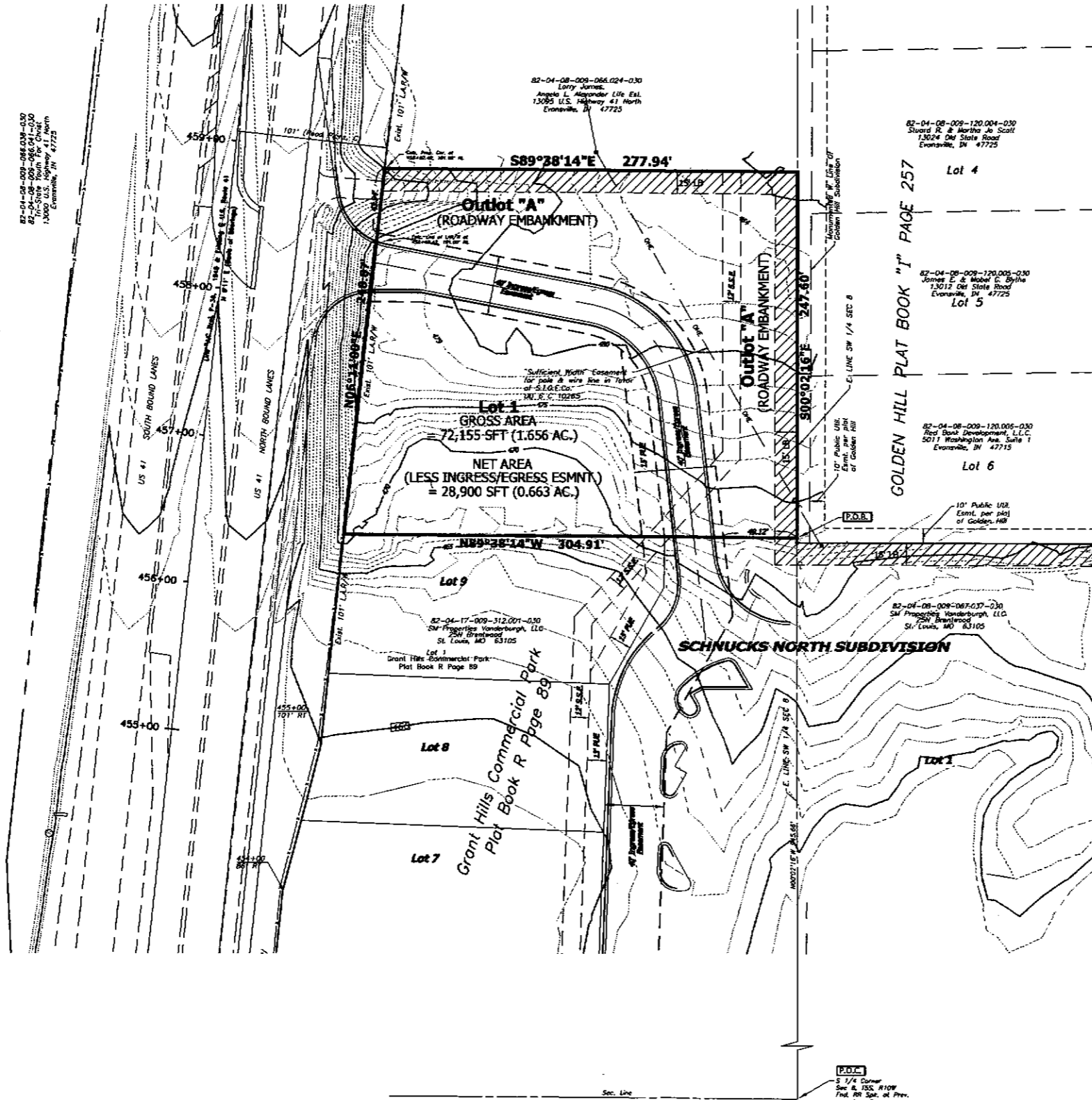
Monuments: Monuments have been set at all boundary and lot corners. Monuments set as a part of this plat are: 3/4" x 30" rebar w/cap stamped BIA Firm 0030.

Storm Drainage plans were approved by the Vanderburgh County Drainage Board on:

Sanitary Sewer Construction Plans were approved by the Evansville Water and Sewer Utility on:

Traffic Impact Study & all related improvements permitted by INDOT under two separate permits:
Permit #02VCD0111, May 21, 2002
Permit #02VD9002, August 21, 2002

82-04-08-009-066.024-030
Lorry James
Angela L. Alexander LSE Est.
13095 U.S. Highway 41 North
Evansville, IN 47725



Date: Dec 09, 2014, 10:23am User Name: rjp
File: C:\Programs\107-0141\Sub\SCHNUCKS_PLAT_OUTLOT.DWG

DULY ENTERED FOR REVISION SUBJECT TO FINAL ACCEPTANCE FOR TRANSFER JOE GRIES AUDITOR	RECEIVED FOR RECORD DATE _____ AM PLAT BOOK "T" _____ PAGE _____ INSTR. 2014R Z TULEY RECORDER VANDERBURGH COUNTY
---	---

BOUNDARY DESCRIPTION
Part of the Southwest Quarter of Section 8, Township 5 South, Range 10 West, Scott Township, Vanderburgh County, Indiana, described as follows:
Commencing at a point on the east line of said Quarter Section North 0 degrees 02 minutes 16 seconds West 945.66 feet from the Southeast corner of said Quarter Section to the Point Of Beginning; thence parallel with the south line of said Quarter Section North 89 degrees 38 minutes 14 seconds West 304.91 feet; thence along said boundary of U.S. Route 41 North 6 degrees 11 minutes 00 seconds East 248.87 feet; thence parallel with the south line of said Quarter Section South 89 degrees 38 minutes 14 seconds East 277.94 feet to the east line of said Quarter Section; thence South 0 degrees 02 minutes 16 seconds East 247.60 feet along said quarter section line to the point of beginning, and containing 1.65 acres, more or less.

SURVEYOR'S CERTIFICATE
I, James A. Farry, hereby certify that I am a land surveyor, licensed in compliance with the laws of the State of Indiana, and further certify that this plat correctly represents a survey completed by me on Sept. 28, 2015.

AFFIRMATION STATEMENT
I affirm, under the penalties for perjury, that I have taken reasonable care to reflect each social security number in this document, unless it is required by law.

Witness my hand and seal this _____ day of _____, 2015.

James A. Farry
Indiana Registration No. LS 80040551



OWNERS CERTIFICATE
The undersigned owners of the real estate shown and described hereon do hereby plat and subdivide said real estate as shown and designate the same as SCHNUCKS NORTH MINOR. All roads shown within the platted boundary shall remain private and shall be maintained by the Owner of Lot No. 1.

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.

LANDSCAPING BUFFER: Strips or areas of land marked as "LB" (Landscaping Buffer), are hereby dedicated for the purposes as stipulated within the Use and Development Commitment recorded in the Office of the Recorder of Vanderburgh County, Indiana on 10/15/2014 as Instrument No. 2014R00023152. No structure, other than landscaping, fencing or other forms of buffering, shall be constructed within fifteen (15) feet of the property lines of the subject property adjoining residential property.

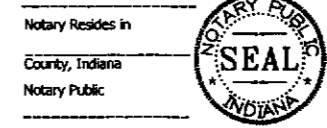
Strips or areas of land, of the dimensions shown on this plat and marked "P.U.E." (Public Utility Easement), are hereby dedicated for the installation, maintenance, operation, enlargement and repair of utility facilities, whether above ground or below ground, with the right to trim or remove, at the discretion of the public utility, trees, overhanging branches, bushes, underbrush and obstructions. No structures other than such utility facilities shall be located within said areas of land and any fence located within said areas of land is subject to removal by a public utility, without liability, in the use of said easements by said utility.

Mark J. Schnuck, President of the DESCO Group, Inc.
Sole Manager of SM Properties Darmstadt, L.L.C.
25 N. Brentwood Blvd.
St. Louis, MO 63105
(Owner of Lot 1)
[Excepting a parcel located in SW corner (____SFT)]

Mark J. Schnuck, President of the DESCO Group, Inc.
Sole Manager of SM Properties Vanderburgh, L.L.C.
25 N. Brentwood Blvd.
St. Louis, MO 63105
(Owner of Lot 1)
[Triangular parcel located in SW corner Lot 1 (____SFT)]

NOTARY CERTIFICATE
STATE OF MISSOURI, COUNTY OF ST. LOUIS) ss:
Before me, the undersigned Notary Public in and for said County and State, personally appeared the said Owner(s) and Subdividers(s), who acknowledge the execution of the foregoing plat with the dedications and restrictions thereon, express to be their voluntary act and deed for the uses and purposes therein set forth.

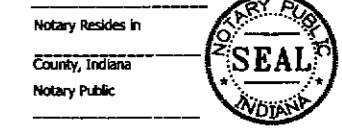
Witness my hand and seal the _____ day of _____, 2015
My Commission Expires:



(typed or printed name)

NOTARY CERTIFICATE
STATE OF INDIANA, COUNTY OF VANDERBURGH) ss:
Before me, the undersigned Notary Public in and for said County and State, personally appeared the said Owner(s) and Subdividers(s), who acknowledge the execution of the foregoing plat with the dedications and restrictions thereon, express to be their voluntary act and deed for the uses and purposes therein set forth.

Witness my hand and seal the _____ day of _____, 2015
My Commission Expires:



(typed or printed name)

AREA PLAN COMMISSION CERTIFICATE

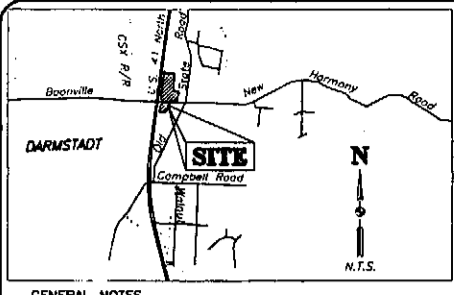
Under the authority provided by the Acts of 1981, Public Law #309, and enacted by the General Assembly of the State of Indiana, this plat has been given Primary Approval by the Area Plan Commission Of Evansville and Vanderburgh County at a meeting held on _____.

President _____
Attest Executive Director _____
Secondary Plat complies with the Ordinance and is released for recording.
Executive Director _____
PLAT RELEASE DATE: _____



PRIMARY PLAT
Prepared by:
LOCHMUELLER GROUP
6200 Vogel Road Evansville, Indiana 47715 Phone: 812-479-6200 Fax: 812-479-7111
LOCHMUELLER GROUP PROJECT NO. 107-0141

GRANT HILLS COMMERCIAL PARK



GENERAL NOTES

Flood Plain Data: Per F.I.R.M. panel number 180256 0015 C dated August 5, 1991, Vanderburgh County, Indiana, no portion of the subdivision lies within the designated 100 year flood zone.

Building Setbacks: All buildings shall be setback a minimum of 30' from the lot line which is adjacent to the street. Any variance to a setback must be approved in writing by the building review committee. In no case can the front yard building setback be relaxed to a distance less than required by the zoning code.

Minimum First Floor Elevations: Will be established by the Vanderburgh County Building Commissioner.

Basements: Any basements must be approved by the Vanderburgh County Building Commissioner.

Utilities: Water service and sanitary sewers are available at the site. Gas, electric and telephone are on or will be extended to the site.

Access: Access to lots 1, 2, & 3 will be by way of Riley Drive & Dixie Lane. No direct access to Boomville-New Harmony Road will be allowed from lots 1, 2, & 3. Lot No. 4 will be allowed only one drive cut onto Boomville-New Harmony Road at a location near the Northeast Corner of said lot.

Road Grades: Maximum road grades shall not exceed 10%.

Temporary Erosion Control: Slopes of 0% - 5% shall be mulched and seeded with a cover crop, i.e., rye, red top, or wheat, within forty-five (45) days of disturbance of soil, which must remain in place until final grading and seeding. Slopes of more than 5% shall be mulched and seeded and shall have straw bales and/or erosion control blankets in place within (5) days of disturbance of soil which must remain in place until final grading and seeding.

Site Topography: The Site has a rolling terrain sloping in general from north to south. The elevations throughout range from 470' to 423'.

Erosion Control for Ditches: Slopes of 0% - 2% shall be mulched and seeded within 45 day of disturbance. Slopes of 2% - 8% shall be sodded or stabilized with an erosion control mat at completion of ditch grading. Slopes over 8% require rip rap or other approved stabilization at completion of ditch grading if the total ditch length at that point is greater than 100 feet.

Buffer: Owner/Developer commits to the implementation and installation of a buffer along the eastern boundary of Lot #4 and along the eastern and northern boundary of Lot #1 for the benefit of adjoining residential property. The buffer shall be constructed within fifteen (15) feet of the property lines of the subject property and shall consist of a fence, trees or a berm with a minimum of six (6) feet in height from the existing grade of the subject property so as to provide adequate screening for the benefit of the adjacent residential property. All landscaping on the Real Estate shall be maintained in an aesthetically pleasing manner. No structures, other than landscaping, fencing or other forms of buffering, shall be constructed within fifteen (15) feet of the property lines of the subject property adjoining residential property. In the event that any parcel of the adjoining property shall no longer be zoned residential or comes under common ownership with the subject property, this provision shall become null and void with respect to said parcel. Maintenance of the buffer areas shall be the responsibility of the individual property owners of Lot #1 and Lot #4 respectively.

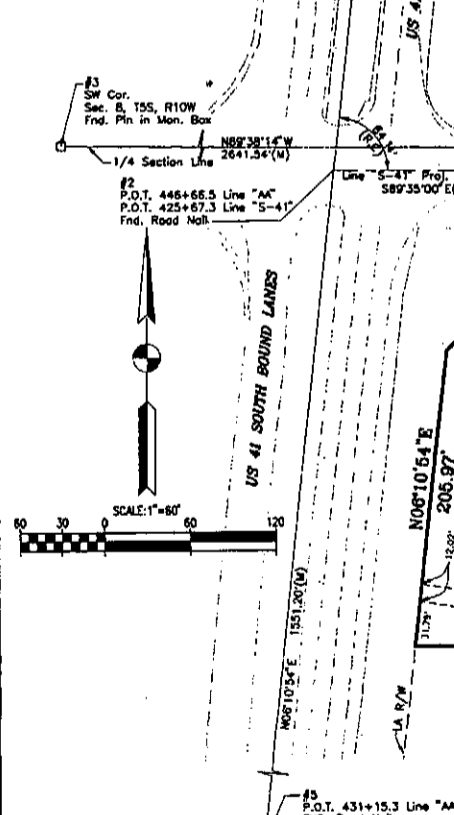
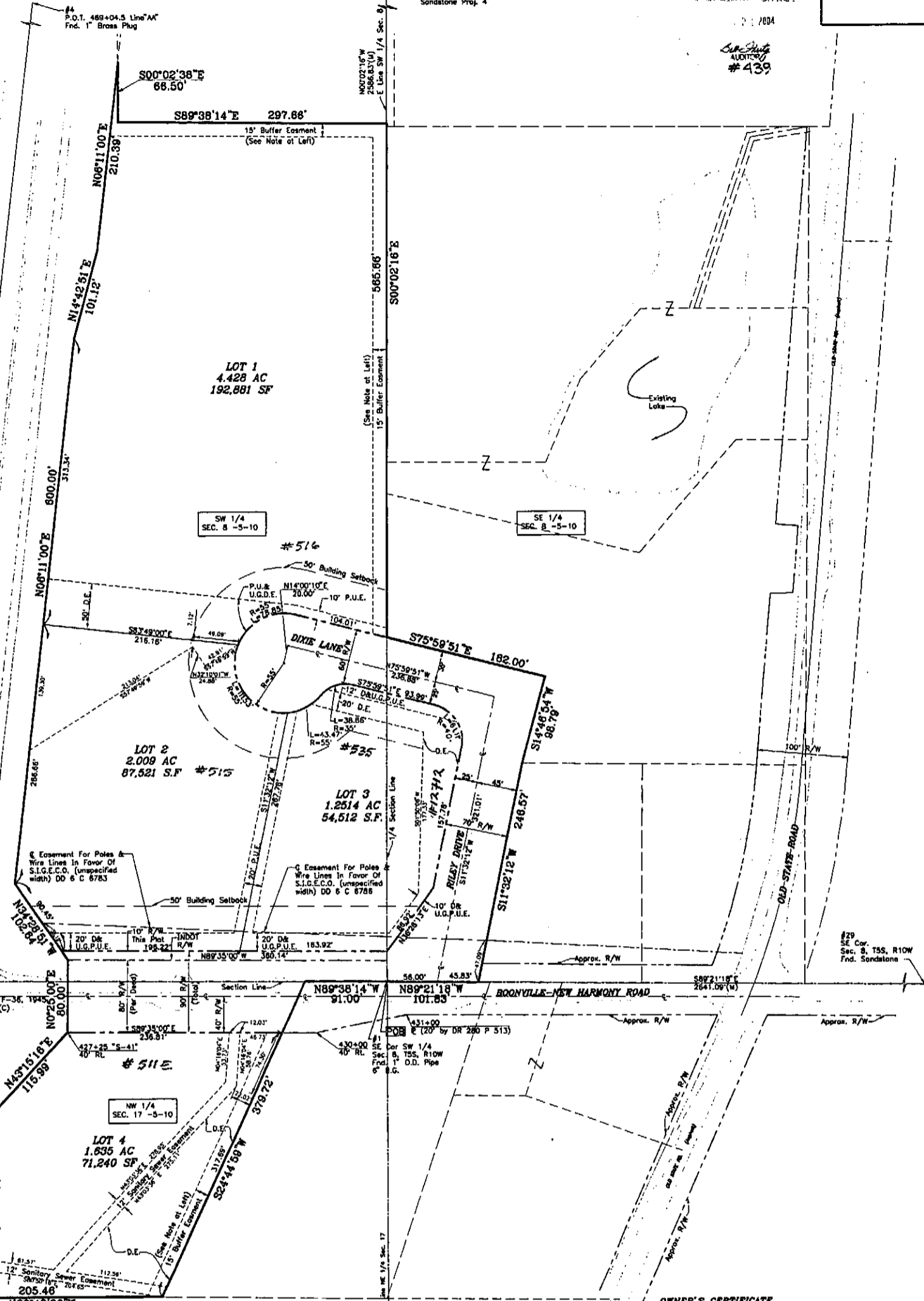
Monuments: Monuments have been set at all boundary and lot corners. Monuments set as a part of this plat are: 3/4" x 30" rebar w/cop stamped BIA Firm 0030.

Storm Drainage plans were approved by the Vanderburgh County Drainage Board on: 8/23/03.

Sanitary Sewer Construction Plans were approved by the Evansville Water and Sewer Utility on: 8/5/02.

Road construction plans were approved by the Vanderburgh County Commissioners on: 8/26/02.

Traffic Impact Study & all related improvements permitted by INDOT under two separate permits: Permit #02VCO0111, May 21, 2002. Permit #02V99002, August 21, 2002.



BOUNDARY DESCRIPTION

A part of the Southwest Quarter of the Southeast Quarter and part of the Southwest Quarter of Section 8, Township 5 South, Range 10 West and also part of the Northwest Quarter of Section 17, Township 5 South, Range 10 West of the Second Principal Meridian, Scott Township, Vanderburgh County, Indiana, more particularly described as follows:

Beginning at the southeast corner of the Southwest Quarter of Section 8, Township 5 South, Range 10 West; thence North 89 degrees 14 minutes 14 seconds West 91.00 feet along the south line of said quarter section; thence South 24 degrees 44 minutes 59 seconds West 379.72 feet; thence North 89 degrees 43 minutes 36 seconds West 205.48 feet to a point on the Limited Access Right-of-Way (LA R/W) for U.S. 41 North; thence North 06 degrees 10 minutes 54 seconds East 205.97 feet along said LA R/W; thence North 43 degrees 15 minutes 16 seconds East 115.99 feet along said LA R/W to a point where said LA R/W joins the right-of-way for Boomville New Harmony Road; thence North 00 degrees 25 minutes 00 seconds East 80.00 feet across said Boomville New Harmony Road right-of-way to a point on the north side of Boomville New Harmony Road right-of-way where it intersects the LA R/W for U.S. 41 North; thence North 34 degrees 28 minutes 51 seconds East 102.64 feet along said LA R/W; thence North 06 degrees 11 minutes 00 seconds East 600.00 feet along said LA R/W; thence North 14 degrees 42 minutes 51 seconds East 101.12 feet along said LA R/W; thence North 06 degrees 11 minutes 00 seconds East 210.39 feet along said LA R/W; thence South 00 degrees 02 minutes 38 seconds East 58.50 feet; thence South 89 degrees 38 minutes 14 seconds East 257.66 feet; thence South 00 degrees 02 minutes 16 seconds East 565.66 feet; thence South 75 degrees 59 minutes 51 seconds East 182.00 feet; thence South 14 degrees 48 minutes 54 seconds West 98.79 feet; thence South 11 degrees 32 minutes 12 seconds West 246.57 feet to a point on the south line of the Southwest Quarter of Section 8, Township 5 South, Range 10 West; thence North 89 degrees 21 minutes 18 seconds West 101.83 feet along the south line of the Southwest Quarter of said Section to the point of beginning, containing 11.01 acres (479,570 square feet).

SURVEYOR'S CERTIFICATE

I, James A. Farry, hereby certify that I am a professional registered land surveyor licensed in compliance with the laws of the State of Indiana and further certify that the plat correctly represents a survey completed by me on July 17, 2004 and that all monuments shown exist at the locations as noted.

Witness my hand and seal the 22nd day of July, 2004.



James A. Farry
Indiana Registration No. 50531
Bernardin Lochmuller & Assoc., Inc.
6200 Vogel Rd.
Evansville, IN 47715

NOTARY CERTIFICATE

STATE OF INDIANA, COUNTY OF VANDERBURGH) ss:
Before me, the undersigned Notary Public in and for said County and State, personally appeared the said Owner(s) and Subdivider(s), who acknowledged the execution of the foregoing plat with the dedications and restrictions thereon, express to be their voluntary act and deed for the uses and purposes therein set forth.

Witness my hand and seal the 22nd day of July, 2004

My Commission Expires: 2-11-08

Notary Public
Vanderburgh County, Indiana
Terry Campbell
(typed or printed name)



OWNER'S CERTIFICATE

The undersigned owners of the real estate shown and described hereon do hereby plat and subdivide said real estate as shown and designate the same as GRANT HILLS COMMERCIAL PARK. All roads shown and not previously dedicated are hereby dedicated to public use.

Strips or areas of land, of the dimensions shown on this plat and marked "P.U.E." (Public Utility Easement), are hereby dedicated for the installation, maintenance, operation, enlargement and repair of utility facilities, whether above ground or below ground, with the right to trim or remove, at the discretion of the public utility, trees, overhanging branches, bushes, underbrush and obstructions. No structures other than such utility facilities shall be located within said areas of land and any fence located within said areas of land is subject to removal by a public utility, without liability, in the use of said easements by said utility.

Strips or areas of land, of the dimensions shown on this plat and marked "D.E." (Drainage Easement) are dedicated for conveyance of surface water and/or subsurface water; provided however, that public utilities are hereby permitted to cross such Drainage Easements with utility water and further provided that such facilities are not placed in such manner as to impede the flow of water and further provided that such Drainage Easements may be used for ingress, egress and temporary staging areas for work by public utility so long as any damage caused to a drainage facility is repaired by the utility company. The property owner is responsible for maintenance and erosion control of said easements and shall not place landscaping, earth berms, fences or other obstructions that impede or reduce the flow of water.

Strips or areas of land, of the dimensions shown on this plat and marked "D.U.G.P.U.E." (Drainage & Underground Public Utility Easement) are dedicated for conveyance of surface water and/or subsurface water drainage and for the maintenance and operation of underground portions of public utility facilities, including flush with surface level manholes and vaults that do not impede drainage flow, access along the easement, or mowing and maintenance of the easement. No structures other than such utility facilities or drainage ways or systems shall be located within said areas of land and any fence located within said areas of land is subject to removal by the Drainage Board or a public utility without liability in the use of said easements.

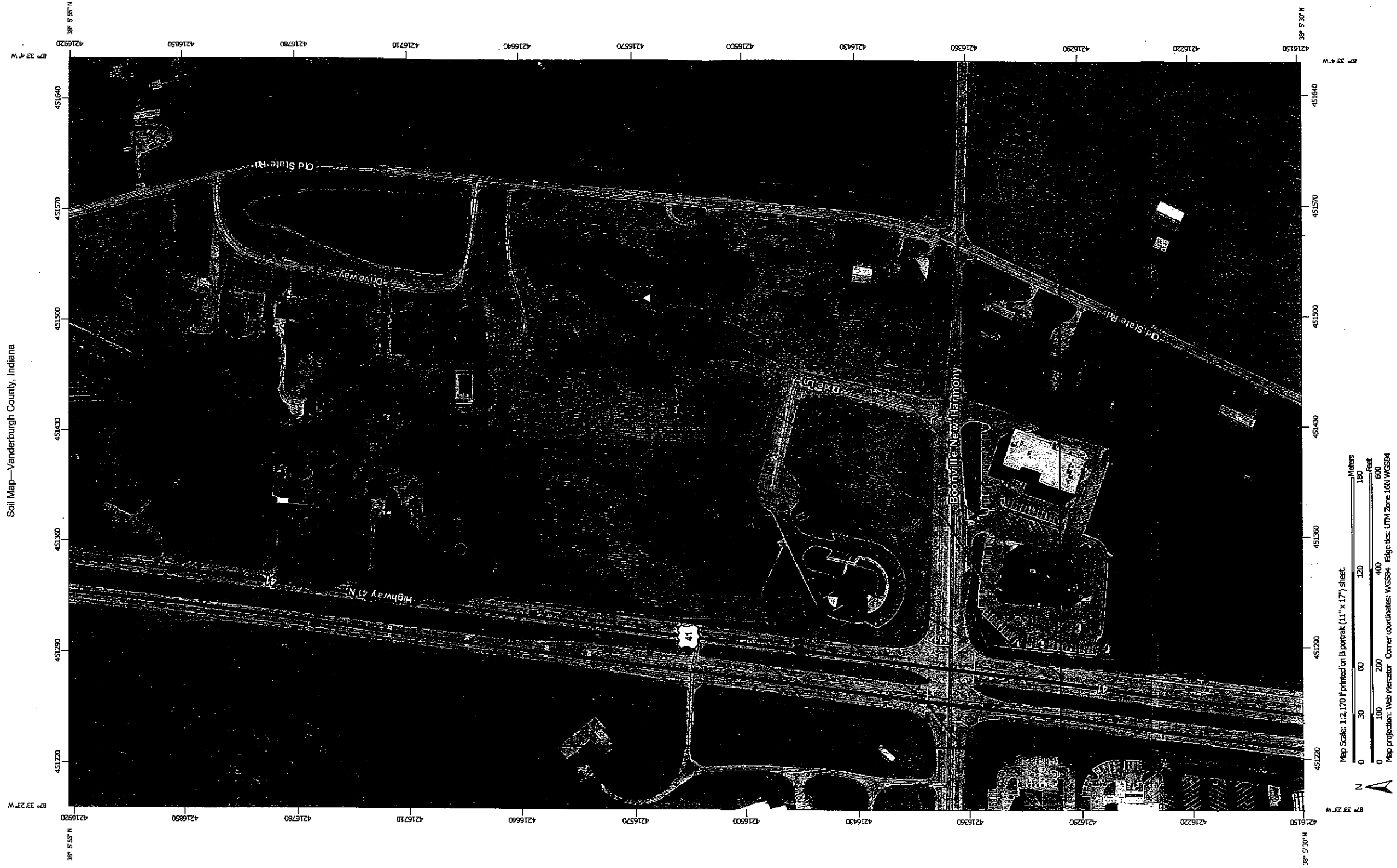
AREA PLAN COMMISSION CERTIFICATE

Under the authority provided by the Acts of 1981, Public Law #309, and enacted by the General Assembly of the State of Indiana, this plat has been given Primary Approval by the Area Plan Commission of Evansville and Vanderburgh County at a meeting held on October 3, 2004.

President
Attest Executive Director
Secondary Plat complies with the Ordinance, and is released for recording.
Executive Director

PLAT RELEASE DATE: Jan. 21, 2004

Soil Map—Vanderburgh County, Indiana



NOTES CORRESPONDING TO ALTA/ACSM TABLE A ITEMS

The following comments are in reference to the items referred to in Table A of the 2011 Minimum Standard Detail Requirements for ALTA/ACSM Land Title Surveys:

Item 1 (Monuments placed): Monuments were found (from previous surveys) or set of corners of the subject property, as shown hereon.

Item 2 (Address): The address of the subject property as shown in County tax records is 13051 Highway 41 N.

Item 3 (Flood Zone Designation): No portion of the subject property lies within Flood Hazard Zone "A" as plotted by scale from the document entitled "Federal Emergency Management Agency, National Flood Insurance Program, Flood Insurance Rate Map, Map Number 18163C01060, Effective Date March 17, 2017. The entire property lies within Zone "X" (Unshaded) as shown on said document.

Item 4 (Gross Land Area): The calculated area of the property as surveyed is 1.63 acres.

Items 5a, 5b (Zoning, setback, height, floor space restrictions): No zoning, setback, or space restrictions were reported by the insurer. However, the property is shown on the Evansville-Vanderburgh Area Plan Commission website (www.vanderburghpa.com) as having a zoning classification of "A", with adjoining properties being zoned "A", "R-1", or "C-4". Table A of the Vanderburgh County Zoning Code (available at www.vanderburghpa.com) lists the following standards for Principal Buildings on individual lots for a zoning:

- Maximum Height = 35 feet
- Minimum Lot Size = 6000 square feet
- Minimum Lot Width = 60 feet
- Minimum front yard = 25 feet
- Minimum side yard = 5 feet
- Minimum rear yard = 10 feet
- Maximum lot coverage = (30%)

Item 5c (Building square footage): Square footage of existing buildings are shown hereon as measured at the exterior footprints. The square footage of the existing house includes the attached garage and aluminum sided building addition.

Item 6 (Substantial, visible improvements): As shown, no additional comments.

Item 7 (Planting): Concrete and crushed-stone driveways/parking areas are shown hereon. There are no striped parking spaces on the property.

Item 11b (Location of Utilities): Underground utilities are shown hereon as indicated by observation, or by markings of the utility companies or their locating services in response to a locate request submitted March 31, 2014. Plans provided by the Evansville Water and Sewer Utility indicate an EWSU sewer line near the subject and the nearest EWSU water main to be on the western side of U.S. 41. No surface evidence of a septic system was observed on the property (with the possible exception of a 4" PVC pipe of unknown origin which outlets onto the southern adjoining property).

Item 13 (Adjoining owners): As shown, information taken from the Vanderburgh County Assessor's GIS data (www.vanderburghpa.com).

Item 14 (Distance to nearest intersection): The existing driveway providing access from the subject property to U.S. 41 is approximately 1200 feet northerly of the intersection of U.S. 41 and Booneville-New Harmony Road.

Item 15 (Evidence of earth moving, etc.): No evidence was observed of earth moving, building construction or building additions within recent months on the subject property.

Item 17 (Changes in street rights-of-way): No proposed changes in road rights-of-way along U.S. 41 adjoining the subject property were reported by the Indiana Department of Transportation. No evidence was observed of recent road construction or repairs.

Item 18 (Evidence of use as dump or landfill): No evidence was observed of the site being used as a solid waste dump, sump, or sanitary landfill.

Item 19 (Wetland Areas): No wetland areas were delineated on the U.S. Fish & Wildlife Service National Wetlands Inventory Wetlands Mapper (www.fws.gov/ecology/Data/Mapper.html) on March 18, 2014. Wetlands were not investigated further as part of this survey.

Item 20a, 20b (Offsite Easements): No offsite easements benefiting the surveyed property were disclosed in the documents provided. The plot of Grant Hills Commercial Park established a 15-foot buffer easement benefiting the subject property, and adjoining the southern portion of the subject property, which is shown hereon.

SURVEYOR'S CERTIFICATE

To SM Properties Darmstadt, L.L.C., a Missouri Limited Liability Company; Fidelity National Title Insurance Company; and St. Louis Title, LLC, as agent for Fidelity National Title Insurance Company;

This is to certify that this map or plot and the survey on which it is based were made in accordance with the "Minimum Standard Detail Requirements for ALTA/ACSM Land Title Surveys," jointly established and adopted by ALTA and NSPS in 2005, and includes Items 1, 2, 3, 4, 6(a), 6(b), 7(b), 8, 9, 11(b), 13, 14, 15, 17, 18, 19, 20(a), and 20(b) of Table A thereof. Pursuant to the accuracy standards as adopted by ALTA and NSPS and in effect on the date of this certification, undersigned further certifies that in my professional opinion, as a land surveyor registered in the State of Indiana, the Relative Positional Accuracy of this survey does not exceed that which is specified therein.

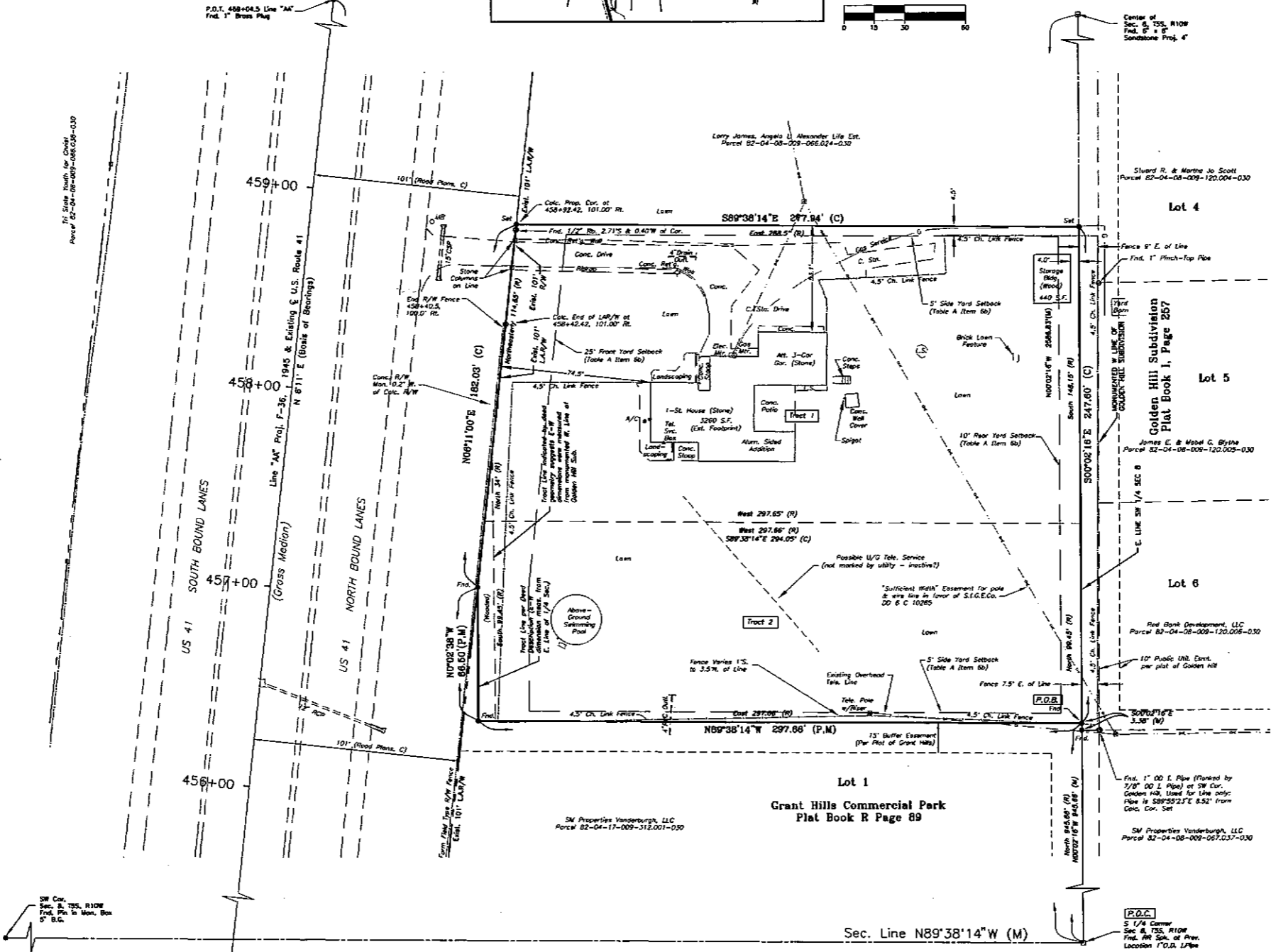
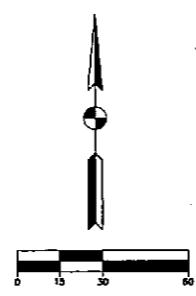
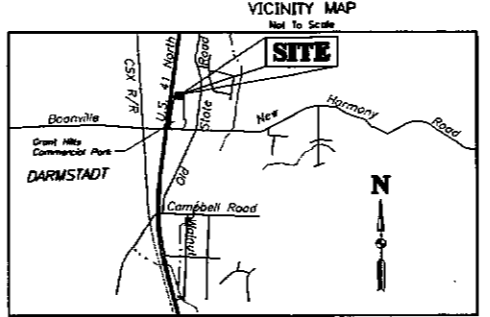
In addition, I do hereby certify that this plot and the survey upon which it was based were made under my direction and to the best of my knowledge and belief this report and plot were executed in accordance with the provisions of Title 36S, Article 1, Chapter 12 of the Indiana Administrative Code.

Date of Field Survey: April 2, 2014
Certified: June 16, 2014
Perry E. Jones, R.L.S.
Indiana Registration No. 9600016



- Legend: 3/4" x 3/4" REBAR N/C CAP STAMPED 'BLA TIRM 0037' (FOUND FROM PREVIOUS SURVEYS or SET THIS SURVEY, AS NOTED)
AREA DALET
UTILITY POLE
TELEPHONE POLE
MEASURED DIMENSION
RECORDED DEED DIMENSION
PLAT DIMENSION FROM PLAT BOOK R, PAGE 89
CALCULATED DIMENSION
POINT OF COMMENCEMENT
POINT OF BEGINNING

SOCIAL SECURITY REDACTION STATEMENT
I affirm, under the penalties for perjury, that I have taken reasonable care to redact each social security number in this document, unless required by law.
Perry E. Jones



SURVEYOR'S REPORT

PROJECT NO.: 107-0141-05V
CLIENT: Jessica Gronau
OWNER OF RECORD: Jacqueline D. Gronau
RECORD DEED: Deed Drawn 10, Cord 4201
TAX PARCEL NUMBER: 82-04-08-009-066.033-030

GENERAL DESCRIPTION: Part of the Southeast Quarter of Section 8, Township 5 South, Range 10 West, in Scott Township, Vanderburgh County, Indiana.

PURPOSE: The purpose of this survey was to perform a boundary retracement and ALTA/ACSM survey of the property described in the Title Commitment referenced herein, being the same property described in the above-referenced record deed.

Field measurements for this survey were made in accordance with specifications for Urban Surveys as outlined in the Indiana Administrative Code (36S IAC 1-12 'Rule 12'), with a 'Relative Positional Accuracy' of plus or minus 0.07 feet plus 50 parts per million. The 'Relative Positional Accuracy' relates to the accuracy limitations of the measurements made this survey (including the cumulative effects of measurement errors).

In addition to measurement uncertainties, the surveyed boundaries are subject to uncertainties relating to the availability and condition of reference monuments, inconsistencies in occupation lines, and discrepancies or ambiguities in the record descriptions or plots. The following paragraphs include observations and opinions relating to these uncertainties, and outline the methods used in retracing the boundaries.

The surveyed property abuts Grant Hills Commercial Park, which was a subdivision of land shown on a survey performed by the undersigned and recorded 3/10/2003 in Document 2003RD0010614. The eastern boundary of Grant Hills abuts the southern line and a portion of the western line of the subject property. Document 2003RD0010614 includes comments regarding uncertainties in the outer boundary of Grant Hills, the most significant of which related to the quarter section line which defines the east line of the subject property (described further below). The uncertainty of said quarter section line, being on the order of 8 to 10 feet east-west, also affects the western line of the subject property. The east, south, and west lines of the subject property were held as re-established on the 2003 survey and as shown on the plot of Grant Hills. The eastern boundary of U.S. 41 was also held as calculated for the 2003 survey. The north line of the subject property was calculated using record deed dimensions. The northern adjacent deed was reviewed and there were no apparent discrepancies.

Original survey control points, subdivision boundary monuments, and lot corner monuments were recovered from the 2003 survey; re-establishment uncertainties relative to Grant Hills Commercial Park are therefore considered negligible.

The following four paragraphs, quoted from the 2003 survey, describe uncertainties which relate to the subject property:

'Monuments were found in place marking the southeast corner, the southeast corner, the south quarter-corner, and the center of Section 8, T5S, R10W. The monuments were consistent with the Vanderburgh County Surveyor's corner records.

A survey dated February 14, 1861, shown in Survey Book 'B' page 191 in the County Surveyor's office, shows a 7.03-chain x 14.28-chain tract surveyed and monumented by stores in the southwest corner of the Southeast Quarter of Section 8, the northwest corner of this tract being the southwest corner of the tract later surveyed as Golden Hill Subdivision (Plat Book 'C', page 257). The plot of Golden Hill did not indicate a deflection in the quarter section line at this point, but did show a deflection of a pre-existing stone located approximately 777 feet south of the center of the section (no evidence of this stone was found this survey, and no record of the stone was found in the old County Surveyor books). It appears that various more recent surveys have assumed a deflection of the southeast corner of Golden Hill, using the monument found there to define the line.

The quarter section line was run this survey as a straight line between the center of the section and the south quarter corner (without either deflection). The resulting uncertainty in the quarter section line ranges from 0' at the south quarter corner, to 8.8' at the southwest corner of Golden Hill, and up to 10' at the deflection point shown on the Golden Hill plat.

Monuments found along the west line of Golden Hill introduce an additional uncertainty in the position of the south quarter corner of Section 8, as they indicate a position approximately 6.5' East and 2.9' South of the 1" iron pipe found.

The 1" iron pipe described on the 2003 survey of the south quarter-corner of Section 8 had since been destroyed by road construction and was replaced with a railroad spike during a previous survey by the undersigned.

Fences and monuments found around the perimeter of the subject property reflect the above-described boundary uncertainties (generally on the order of 3' north-south and 10' east-west). No other evidence of occupation was observed in conflict with the surveyed boundaries.

ACCESS NOTE

The subject property has access to U.S. Highway 41, a paved 4-lane divided public roadway, via an existing concrete driveway. The present U.S. 41 lane configuration provides for right-turn only access to and from the north-bound lanes of U.S. 41 (i.e. no median cross-over exists in front of the existing drive).

1 thru 3. Observed evidence is shown of apparent occupation, possible easements, and possible encroachments; otherwise these are not survey matters.

4 thru 8, and 12. Not survey matters, or 'Intentionally Omitted' from Title Commitment.

10. The restrictive covenants set forth in Warranty Deed from Clarence Ritchey and Ernie Ritchey to Elmer H. Johnson and Katherine Johnson dated June 19, 1950 and recorded May 8, 1952 in Deed Record 335, page 524 affect Tract 1, but are not otherwise addressed by this survey.

11. The extinguishment of rights of ingress and egress for the purpose of creating a limited access facility as set forth in Warranty Deed to the State of Indiana dated October 15, 1975 and recorded December 22, 1975 in Deed Record 824, page 389 establishing access along all of the eastern highway frontage of the subject property except the northern 50 feet thereof (50 feet derived by comparing the described access control line with the record description of the property), and is noted hereon as 'LAW'. See also Deed Record 824, page 389.

13. Ordinance re/Darmstadt sewer system dated August 8, 1988 and recorded July 27, 1989 in Misc. Drawer 3, Cord 1534 deals with sewer system requirements when the Town of Darmstadt 'septic tank effluent pumping sewer system' is available. The ordinance was not addressed by this survey, and the availability of the described Darmstadt facilities was not investigated.

14. The Easement for Right-of-Way granted Southern Indiana Gas and Electric Company dated May 26, 1949 and recorded December 17, 1991, in Deed Drawers 6, Cord 10263 depicts graphically an easement of unspecified width. An existing overhead electric line is plotted hereon which follows approximately the alignment shown on said easement.

15. Refers to a previous issue of this survey.

RECORD BOUNDARY DESCRIPTION
(Quoted from Fidelity National Title Insurance Company Commitment No. 14-007768/125551/Revision 4 with an effective date of April 04, 2014):

(Tract 1 of this Survey)
Part of the Southeast Quarter of Section Eight (8), Township Five (5) South, Range Ten (10) West in Vanderburgh County, Indiana, more particularly described as follows:
Commencing at a point on the East line of said Quarter Section One Thousand Forty-five and Sixty-six Hundredths (1,045.66) feet North of the Southeast corner thereof; thence West and parallel to the South line of said Quarter Section a distance of Two Hundred Ninety-seven and Sixty-five Hundredths (297.65) feet; thence North and parallel to the East line of said Quarter Section a distance of Ninety-four (94) feet to a point on the right of way of U.S. Highway 41; thence Northeastwardly along said right of way a distance of One Hundred Fourteen and Sixty-five Hundredths (114.65) feet; thence East and parallel to the South line of said Quarter Section a distance of Two Hundred Eighty-eight and Five Tenths (288.85) feet to a point on the East line of said Quarter Section, a distance of One Hundred Forty-eight and Fifteen Hundredths (148.15) feet North of the place of beginning; thence South a distance of One Hundred Forty-eight and Fifteen Hundredths (148.15) feet North of the place of beginning.

SURVEY BOUNDARY DESCRIPTION
(The following description is provided to account for discrepancies between record and surveyed dimensions along the eastern boundary of the subject property, apparently resulting from inconsistencies between the quarter section line as surveyed and the monumented west line of Golden Hill Subdivision.)
Part of the Southeast Quarter of Section 8, Township 5 South, Range 10 West, Scott Township, Vanderburgh County, Indiana, described as follows:
Beginning at a point on the east line of said Quarter Section North 0 degrees 02 minutes 16 seconds West 945.66 feet from the Southeast corner of said Quarter Section (beginnings in this description are based on the Plot of Grant Hills Commercial Park, recorded in Plat Record R, page 89 in the office of the Recorder of said County); thence parallel with the south line of said Quarter Section North 89 degrees 38 minutes 14 seconds West 297.66 feet; thence North 0 degrees 02 minutes 38 seconds West 66.50 feet (133.43 feet deduced from Deed Drawer 10, Cord 4201 in the office of said Recorder) to the eastern boundary of U.S. Route 41; thence along said boundary of U.S. Route 41 North 5 degrees 11 minutes 00 seconds East 182.03 feet (114.65 feet by said Deed Drawer 10, Cord 4201); thence parallel with the south line of said Quarter Section South 89 degrees 38 minutes 14 seconds East 277.94 feet (297.66 feet by said Deed Drawer 10, Cord 4201) to the east line of said Quarter Section; thence South 0 degrees 02 minutes 16 seconds East 247.60 feet along said quarter section line to the point of beginning, and containing 1.63 acres, more or less.

APPENDIX I

ALTA/ACSM Land Title Survey
13051 Highway 41 North, Evansville, IN
Part of the SW 1/4 of Sec. 8, T5S, R10W, Scott Township, Vanderburgh County, IN
Owner of Record: Jacqueline D. Gronau
BERNARDIN LOCHMUELLER & ASSOC., INC.
4/2/2014