

**ST. JOSEPH COUNTY SURVEYOR
ST. JOSEPH COUNTY INDIANA**

**STORM WATER DRAINAGE STUDY
KNOLLWOOD PARK VILLAS**

January 2021



LAWSON-FISHER ASSOCIATES P.C.
CONSULTING ENGINEERS

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**ST. JOSEPH COUNTY SURVEYOR
ST. JOSEPH COUNTY, INDIANA**

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KNOLLWOOD PARK VILLAS**

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ST. JOSEPH COUNTY, INDIANA**

STORM WATER DRAINAGE STUDY

KNOLLWOOD PARK VILLAS

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1. PURPOSE

This Storm Water Drainage Study has been prepared by Lawson-Fisher Associates P.C. (LFA) to evaluate the storm water conveyance and storage requirements for The Knollwood Park Villas Subdivision. The subdivision is privately-owned and located southwest of the intersection of Adams Road and Gumwood Road in unincorporated Granger, St. Joseph County, Indiana. Figure 1 shows the location of the Drainage Study.

In 2007, it was determined that there was inadequate storage provided in the existing retention basin. Since 2007, the County constructed a separate retention basin south of Retention Pond #1 to handle stormwater runoff from the expanded Gumwood Road to the east. The design of the Gumwood Road Retention Basin incorporated an emergency overflow from Retention Pond #1 into the Gumwood Road Retention Basin.

In addition to the inadequacy of Retention Basin #1, there have been recent reports of flooding in the rear yard of Lot #19. There are three inlets at the intersection of Kings Crossing and Oak Hill Boulevard that drains to a drywell in the rear yard of Lot #19. This drainage configuration does not appear on the approved drainage plan from 1984. To alleviate the flooding, the County installed a plug on the pipe in the inlet that connects to the drywell to direct stormwater runoff to Retention Pond #1 in 2020.

The scope of work included evaluation of existing storm water infrastructure capacity and identification of potential solutions to address these known drainage issues. One potential solution discussed is the expansion of the Gumwood Road Retention Basin in order to increase the capacity to provide sufficient storage to The Knollwood Park Villas Subdivision to bring it into compliance with current County Drainage Standards.

The Scope of Work tasks included:

- Review the Drainage Plan for Knollwood Park Villas Subdivision, existing conditions and perform drainage calculations including an analysis to evaluate the Lot #19 drywell operation, both plugged and unplugged.
- Perform field survey to verify existing drainage patterns and assist in evaluation of possible improvements.
- Evaluate the required storage volume according to current County standards.
- Provide a written report summarizing the tasks performed above. The report will discuss the current drainage issue and recommendations.

2. ENGINEERING EVALUATION

A. The Knollwood Park Villas Drainage Review

This evaluation includes a review of the following documentation:



- Drainage Plan for The Knollwood Park Villas Subdivision, prepared by Valley Engineering Consultants, Inc., dated January 1984. It should be noted that the Knollwood Park Villas Subdivision plans pre-date the current St. Joseph County Engineering Design Standards.
- Storm Water Drainage Study for The Knollwood Park Villas, prepared by Lawson-Fisher Associates P.C., dated May 2007.
- Geotechnical Exploration, Gumwood Road Improvements, prepared by Weaver Boos Consultants, LLC, dated March 4, 2009.
- Gumwood Road Improvements – Phase 2 Plans, prepared by Ken Herceg and Associates, Inc., dated June 2013.

LFA's previous study from 2007 evaluated the need for additional storage due to Retention Pond #1 being undersized. In that Study, the required retention storage volume for Pond #1 was calculated to be 341,914 cubic feet (7.8 acre-feet), with 6% added for siltation, and recommended alternatives to create a pond that would accommodate the storage deficiency within The Knollwood Park Villas Subdivision. The current study expands upon the 2007 study to incorporate the storm water conveyance network and other ponds in The Knollwood Park Villas Subdivision, along with the improvements and additional storage associated with the Gumwood Road Expansion Project.

In 2009, a geotechnical exploration was performed in the area of a proposed retention basin for the Gumwood Road Expansion project. The geotechnical report offered two recommendations for the retention basin:

- *The silty clay loam and sandy loam soils contain a moderate amount of fines (silt and clay) and, in our opinion, are not free-draining. Therefore, it is our opinion that undercutting these soils and replacing them with relatively clean, free draining granular soil or placing a drain reaching through the sandy loam into the underlying relatively clean, free draining sand would help to facilitate drainage.*
- *The sandy loam soils are also considered to be very erodible. Such erosion can give the water contained in the pond a murky appearance and will eventually result in the filling-in of the bottom of the basin. Therefore, to prevent erosion and seasonal sloughing of the sides of the basin, especially near the water's edge, erosion protection should be established immediately following construction of the basin side slopes.*

Based on the 2013 design plans and the current conditions at the Gumwood Road Retention Pond, it does not appear that these recommendations were implemented.



B. Field Investigation

A field survey was conducted in September 2020 throughout the subdivision to confirm drainage patterns. Detailed data was gathered for the existing storm manholes and inlets in the subdivision. Data collected includes rim elevation, invert elevation, pipe size, and material. Field observation of the Lot #19 drywell indicate it is located in an area that is not conducive to flow as it is lower than the storm water detention easement swale, effectively ponding excess storm water that exceeds the drywell capacity.

The Gumwood Retention Pond has a riprap channel, approximately 56-feet long, which receives overflow from Retention Pond #1 in Knollwood Park Villas. This riprap does not appear to be performing as intended due to erosion. See accompanying photographs in Appendix C. The day of the field survey, the water level in Retention Pond #1 was 794.3-feet with a vegetation line equivalent to 794.8-feet. The riprap channel water level was 791.9-feet with a vegetation line at 792.4-feet. Retention Pond #1 and the riprap channel leading to the Gumwood Road Retention Pond left little storage available according to vegetation lines and actual water lines. The riprap section had heavy brush covering the path and erosion as shown in the survey photographs in Appendix C. The Gumwood Road Retention Pond was shown as partially full and had partially flowed through the boundary fence to hold the water contained. Anecdotal data from a nearby resident indicated that the Gumwood Road Retention Pond is always at the same level as shown in Photograph 6 of Appendix C and does not fluctuate dramatically. Preceding the LFA survey, was a sunny day without precipitation.

C. Engineering Analysis

An XPSWMM hydrologic and hydraulic model was developed for the subdivision, utilizing the publicly available topography, soils, and land usage. This was supplemented with collected survey field data for the storm sewer conveyance network. The hydrologic parameters used in developing this model are included in Tables A1 and A2 in Appendix A and are depicted in Figures 1 through 7.

Retention Pond #1 located across Lots #14 and #15 has a storage volume of approximately 24,600 cubic-feet, compared with the required storage volume of 341,914 cubic-feet, as reported in LFA's 2007 study. According to the XPSWMM model, the volume of overflow from Retention Pond #1 into the Gumwood Road Retention Pond is 444,970 cubic-feet. Additionally, the volume of runoff contributing to the Gumwood Road Retention Pond from the Gumwood Road Expansion plus the offsite agricultural area is 227,140 cubic-feet. According to the 2013 plans, the 100-year high water level for the Gumwood Road Retention Pond is 795.91-feet, which corresponds to an available capacity of 543,618 cubic-feet (12.48 acre-feet), and a depth of 6.91-feet. Combined with the overflow from The Knollwood Park Villas Subdivision predicted by the XPSWMM model, the total volume required to capture the 100-year 24-hour excess runoff is 672,110 cubic-feet. This results in a high-water level in the existing pond of 796.74-feet, at a depth of 7.74-feet. This elevation is above the high-water level of the 2013 plans, which results in a freeboard of 1.17-feet (less than the 2-feet required), but still within the



existing boundaries of the retention basin. In order for the freeboard requirement to be met, the Gumwood Road Retention Pond would need to be expanded by 128,500 cubic-feet. See Table 1 below.

Table 1: Required Storage

Scenario	Required Storage (CF)
Knollwood Subdivision	444,970
Gumwood Expansion	227,140
Existing Storage	543,618
Total Model Required Storage	672,110

According to the Gumwood Road Improvements – Phase 2 Geotechnical Report, prepared by Weaver Boos Consultants, LLC, dated March 2009, the 2013 Retention Pond boring location indicated the soils to exhibit low infiltration rates. This is consistent with the 2007 LFA report and the publicly available Soil Survey of St. Joseph County indicating the soils in the area near the Gumwood Road Retention Pond to be of the Troxel and Oshtemo series. The Troxel series has a fairly low infiltration rate of 0.6-2.0-inches per hour, while the Oshtemo series has a higher permeability rate of 2.0-6.0-inches per hour. As mentioned previously, it appears that recommendations from the Geotechnical Investigation may not have been implemented in the design and construction.

D. Results

The existing Gumwood Road Expansion Pond, has sufficient storage capacity to retain the excess storm water flows from The Knollwood Park Villas Subdivision, as designed, combined with excess runoff flows from the Gumwood Road Expansion, however, the Gumwood Road Retention Pond is not infiltrating effectively and a 2-foot freeboard requirement would not be met with excess storm water flows. While it is uncertain why the drywell was installed in the rear of Lot #19, the modeling indicates that plugging the pipe leading to this drywell may resolve flooding concerns. It should also be noted that according to the model, the rest of the storm water conveyance network within the subdivision, including the ponds, appear to be performing adequately. There is no predicted surcharging of the storm sewers for the 10-year storm, no flooding above the rim elevation for the 50-year storm, and all overflows from ponds appear to be directed to Retention Basin #1 and ultimately to the Gumwood Road Retention Basin.

See photos in Appendix C depicting the existing conditions described above.

3. RECOMMENDATIONS

Based on the results of the engineering analysis, the following are recommendations to resolve drainage issues:



- Plug storm sewer that flows to drywell at Lot #19 (in inlet at intersection of Kings Crossing and Oak Hill Boulevard.).
- Expand Gumwood Road Retention Basin by approximately 128,500 cubic-feet.
- Basin improvements to promote infiltration and drainage.

Current St. Joseph County Drainage Standards were utilized in the development of the recommendations. Drainage calculations are included in Appendix A. No allowance for infiltration was included in the storage volume calculations to provide a conservative design.

Based on the modeling results, it is recommended to plug the existing storm sewer that conveys flow to the drywell on Lot #19 to block runoff from entering the drywell and alleviate flooding. This option will cause a slightly higher runoff to flow to Retention Pond #1 and subsequently overflow to the Gumwood Road Retention Pond. If this storm sewer were to be left in operation, flooding would continue to occur on Lot #19. Furthermore, the drywell does not appear to offer any considerable storm water conveyance or storage benefit. Additionally, the soil type in the area of the drywell does not provide adequate infiltration capacity for the drywell to drain thereby minimizing storage capacity for future storms and causing flooding.

Table 2 summarizes the existing pond capacity compared to the modeled pond performance with the recommended improvements. While the Gumwood Road Retention Pond appears to have sufficient storage capacity to retain runoff from the 100-year, 24-hour storm for the contributing areas of The Knollwood Park Villas Subdivision and Gumwood Road, the 2-foot freeboard allowance is not being met. An expansion of the Gumwood Road Retention Pond by approximately 128,500 cubic-feet is recommended in order to meet current County standards. Graphs 1 through 4 in Appendix D show the differences in pond elevations for the 100-year, 24-hour storm both with and without the drywell plugged.

Table 2: Existing vs. Modeled Conditions

Scenario	Volume (CF)	High-Water Level (ft)
Available/Existing	543,618	795.91
Modeled Storm	672,110	796.74

Additionally, the following improvements are recommended for the Gumwood Road Retention Basin:

- Install three new drywells at the bottom of the basin, penetrating through to the sandy soils, to allow infiltration and draining of the pond
- Install an 18-inch-thick layer of riprap for erosion control on the side slopes around the perimeter of the basin and around the top perimeter of the new drywells in the bottom of the basin.



These recommendations are based on the Geotechnical Report by Weaver Boos Consultants, as they do not appear to have been properly implemented for the Gumwood Road Retention Basin.

The estimated cost for the above recommendations is \$519,380. A detailed cost estimate is included in Appendix B. The conceptual layout of the recommended improvements is depicted in Figure 8.

4. SUMMARY

The current study has evaluated the existing storm water infrastructure capacity and identified recommendations to address drainage issues for The Knollwood Park Villas Subdivision. The recommendations include:

- Plug storm sewer that flows to drywell at Lot #19 (in inlet at intersection of Kings Crossing and Oak Hill Boulevard).
- Expand Gumwood Road Retention Basin by approximately 128,500 cubic-feet.
- Install three new drywells at the bottom of the basin, penetrating through to the sandy soils, to allow infiltration and draining of the Gumwood Road Retention Pond.
- Install an 18-inch-thick layer of riprap for erosion control on the side slopes around the perimeter of the basin and around the top perimeter of the new drywell in the bottom of the basin.

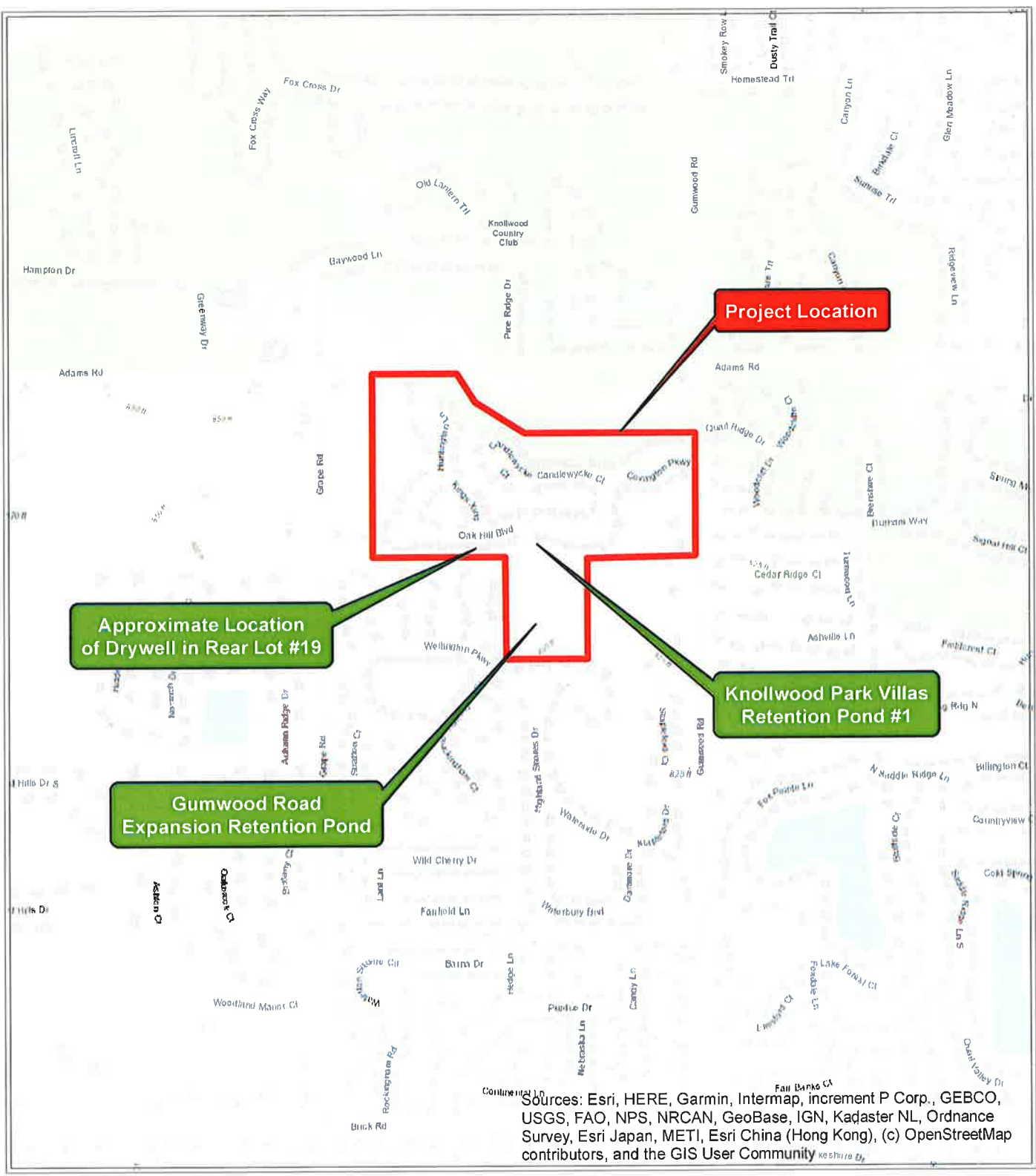
The estimated cost for the above recommendations is \$519,380. A detailed cost estimate is included in Appendix B.

The recommendations and cost estimate contained in this report are based on the best information available at the time of the report and will be subject to change during the final design process as more detailed information is gathered.



FIGURES

Path: U:\2020\202029 SJC-Knollwood\GIS\MXD\Figure 1 - Project Location Map.mxd
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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Figure 1

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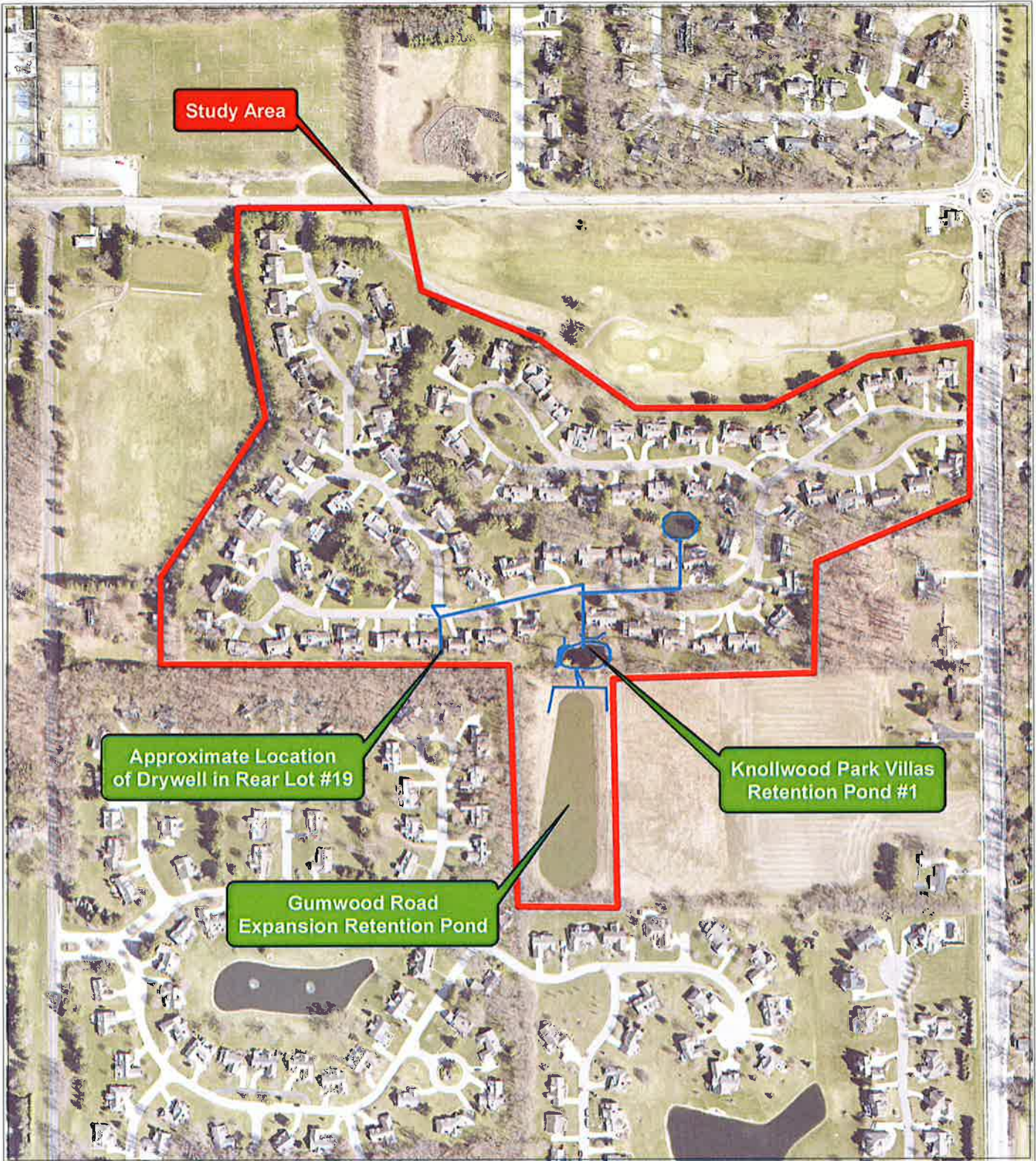
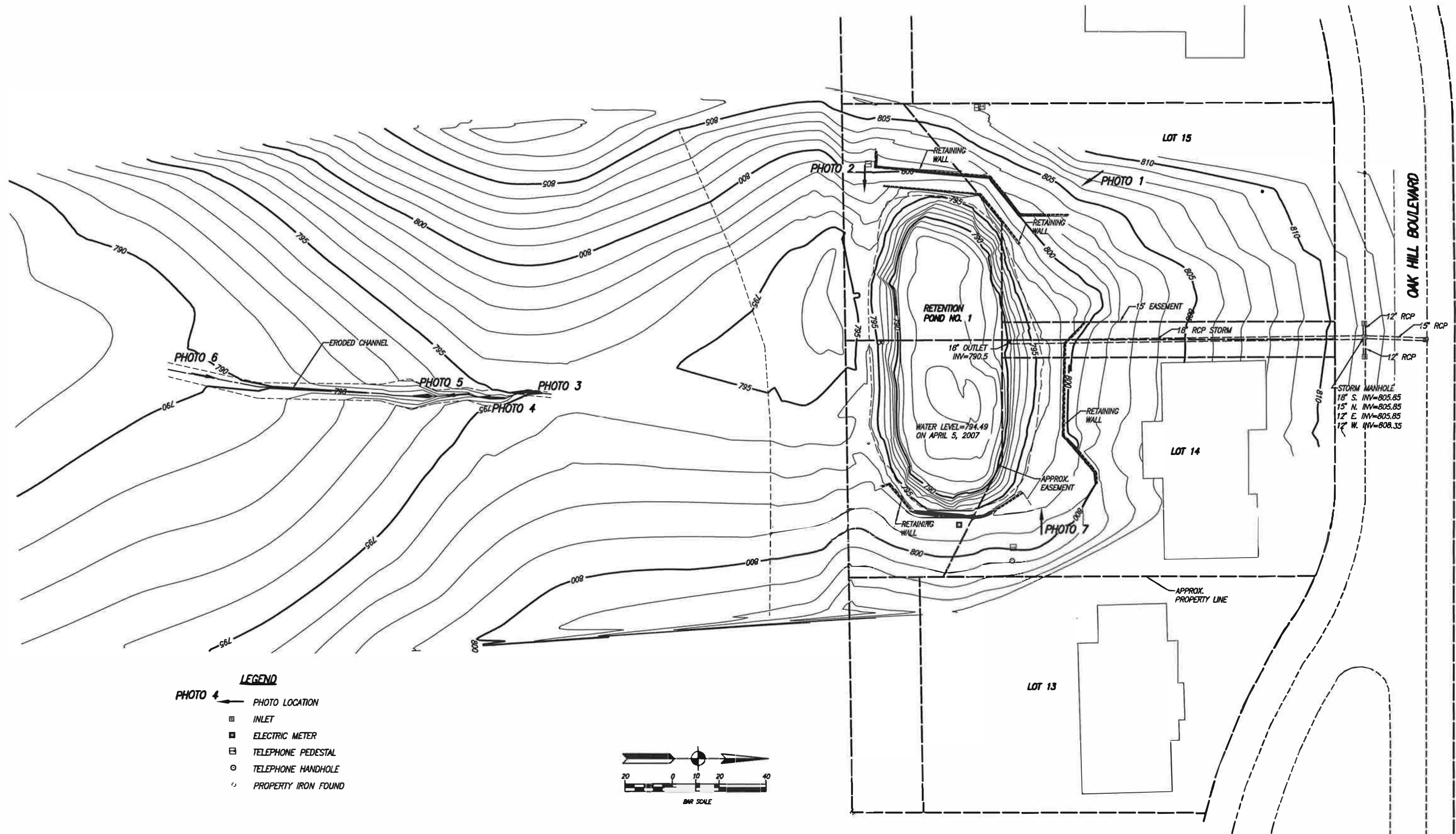


Figure 2

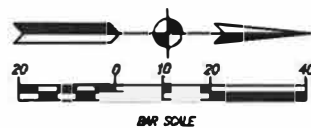
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St. Joseph County, Indiana
The Knollwood Park Villas Drainage Study
202029.00
Study Area
January, 2021

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- LEGEND**
- PHOTO 4 ← PHOTO LOCATION
 - ▣ INLET
 - ELECTRIC METER
 - ⊞ TELEPHONE PEDESTAL
 - TELEPHONE HANDHOLE
 - PROPERTY IRON FOUND



Note: Topography from 2007 Field Survey by LFA.

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SIGNATURE	DATE

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 KNOLLWOOD PARK VILLAS SUBDIVISION
 STORM WATER DRAINAGE STUDY

FIGURE 3
 RETENTION POND #1 TOPOGRAPHY

REVISIONS	HORIZONTAL SCALE 1" = 20'	PROJECT NUMBER 202029.00
	VERTICAL SCALE NONE	SHEETS 1 OF 1
DRAWN: SLR	SURVEY BOOK	
CHECKED: PCT	DATE JAN. 2021	

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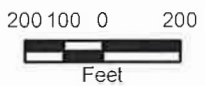
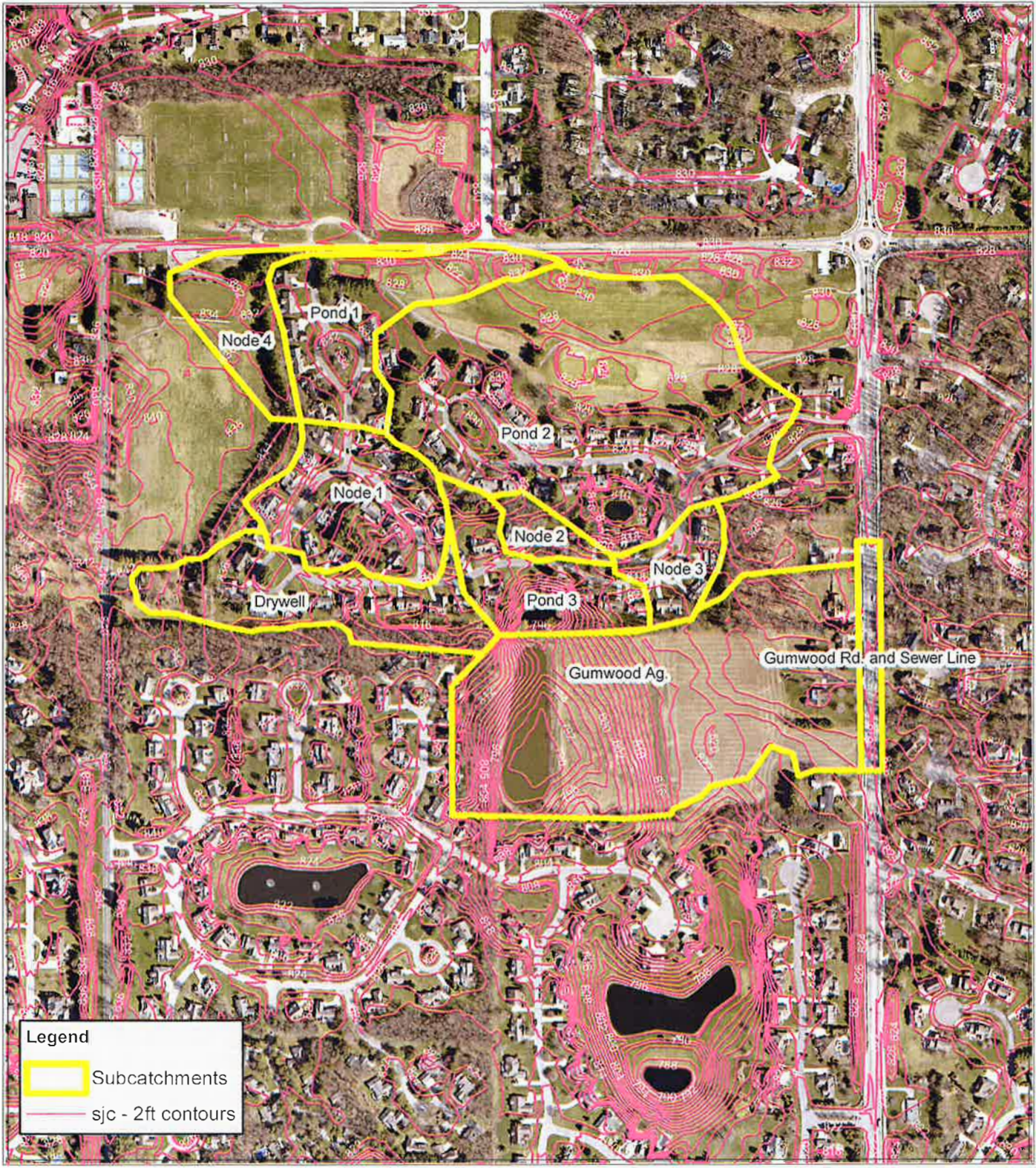


Figure 4

LFA
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St. Joseph County, Indiana
The Knollwood Park Villas Drainage Study
202029.00
Watershed Area
January, 2021

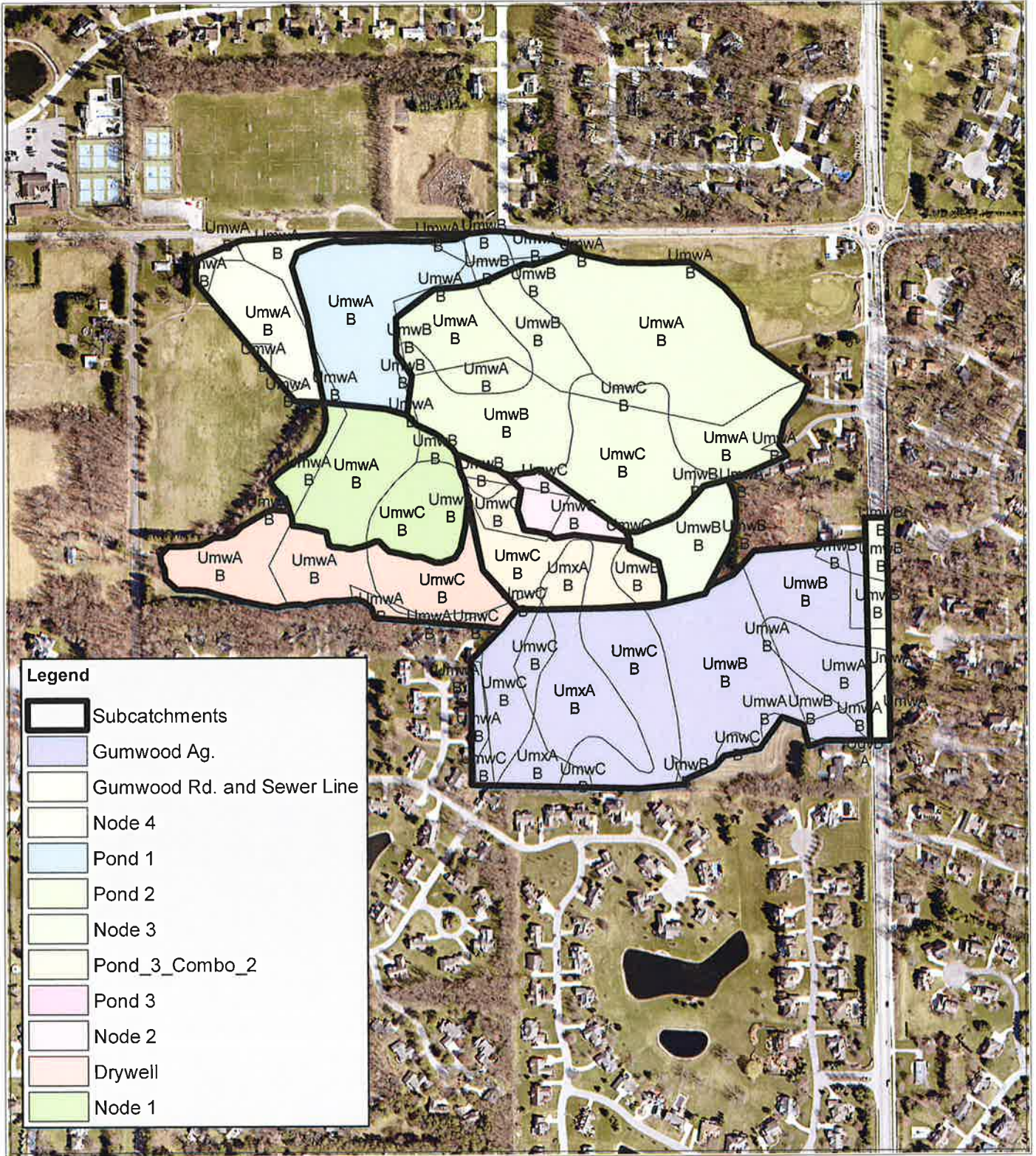


Figure 5

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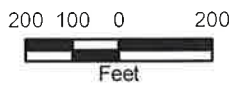
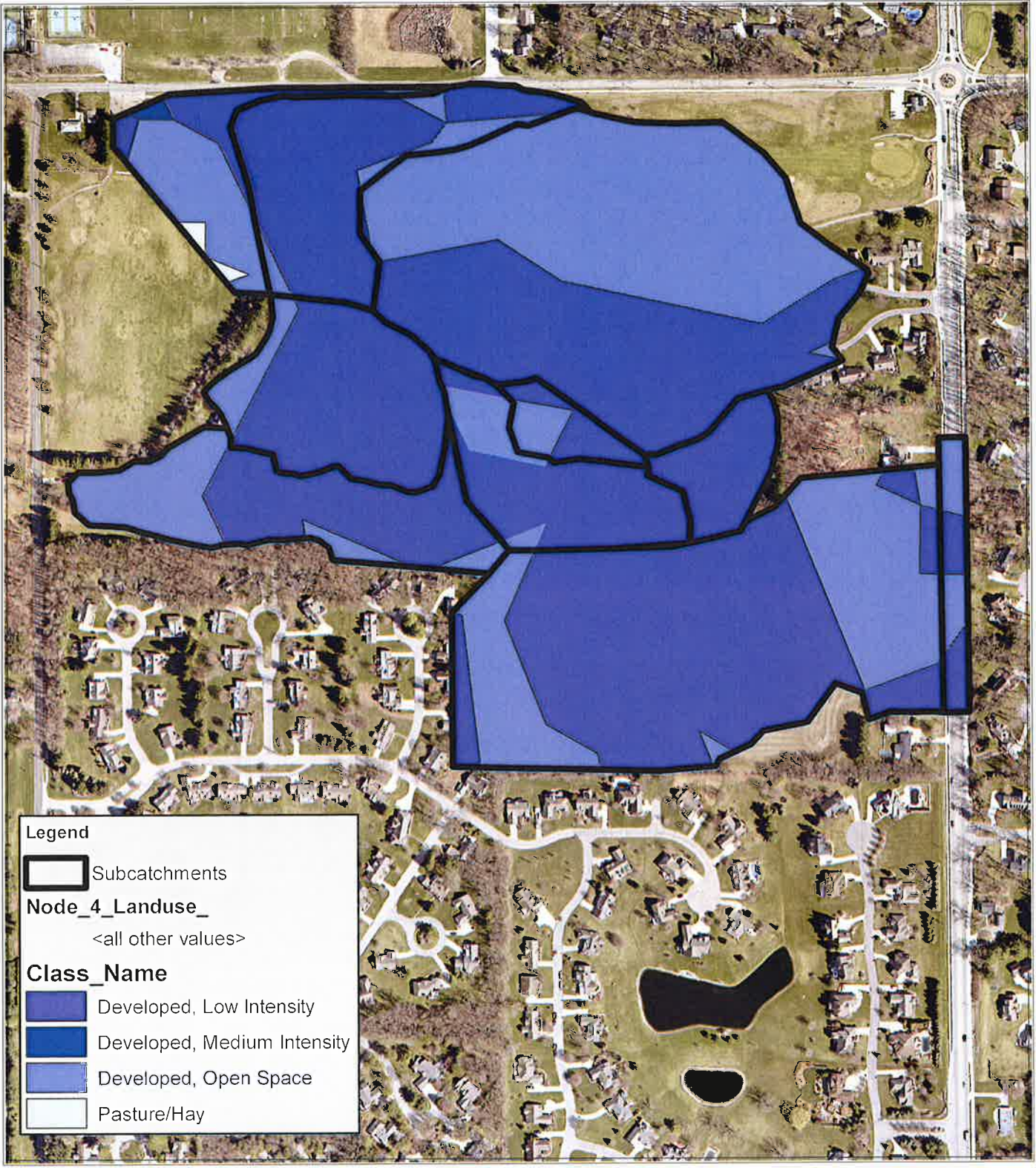


Figure 6

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St. Joseph County, Indiana
The Knollwood Park Villas Drainage Study
202029.00
Land Use
January, 2021

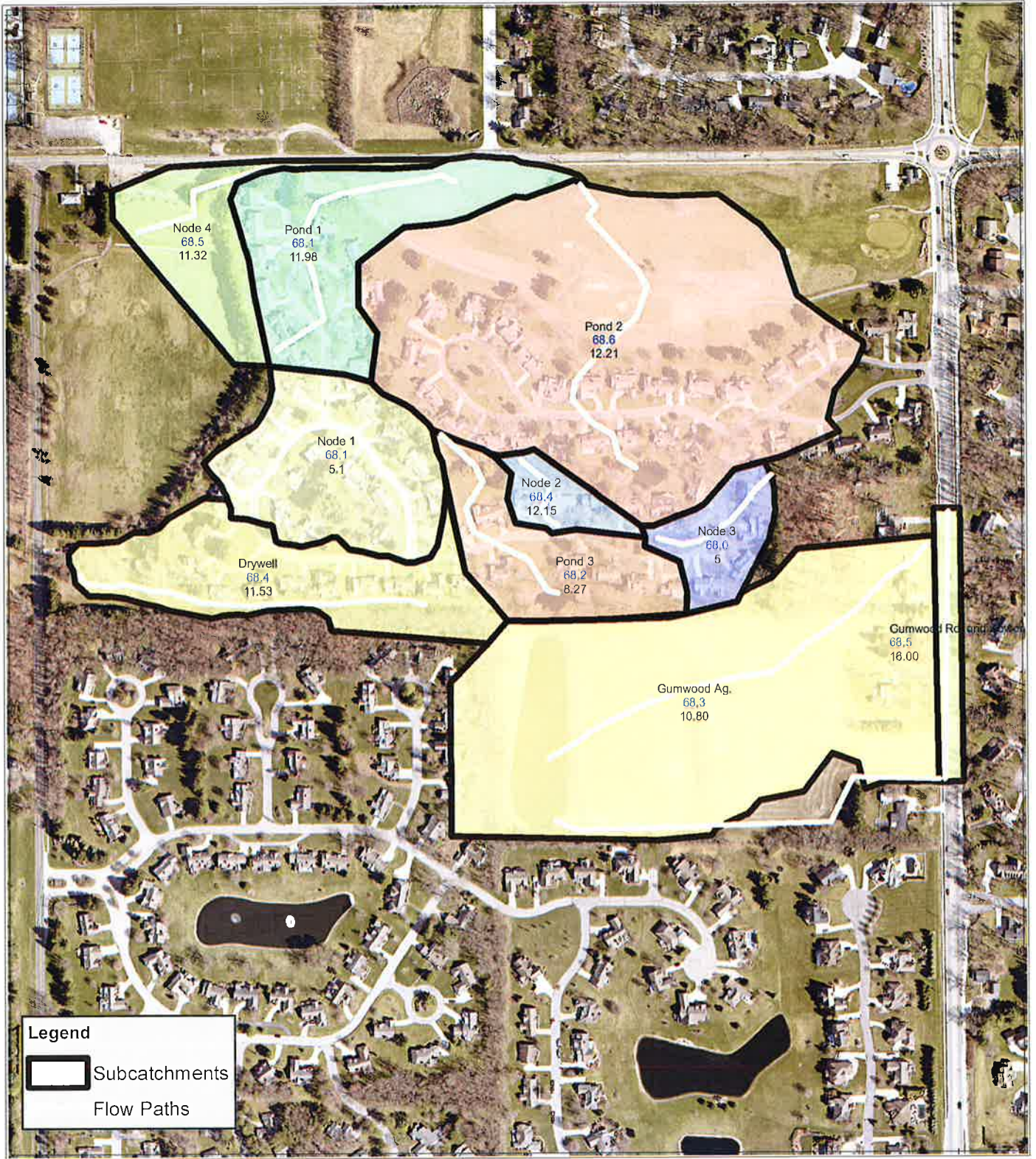
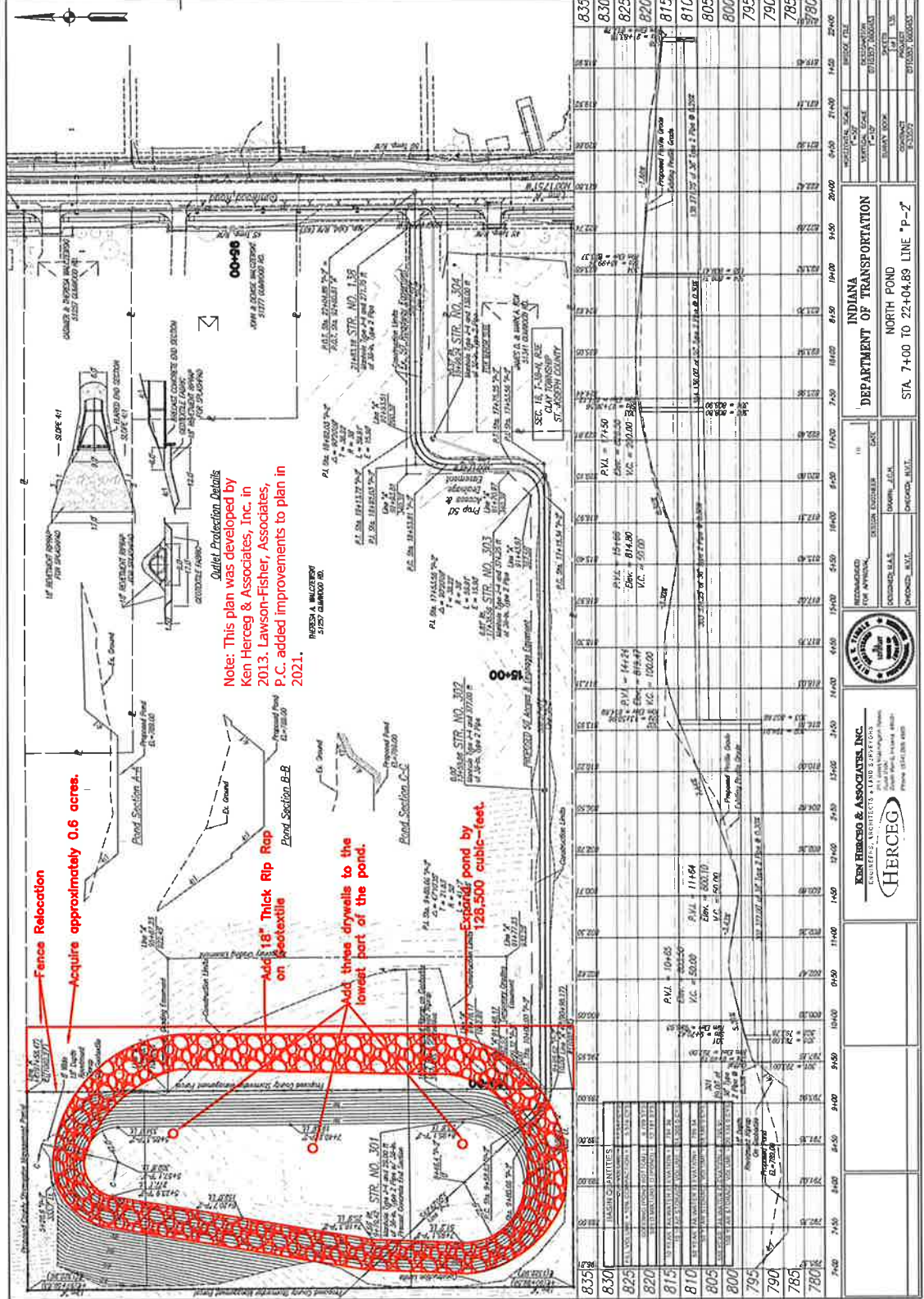


Figure 7



Fence Relocation
Acquire approximately 0.6 acres.

Gate Protection Details
Note: This plan was developed by Ken Herceg & Associates, Inc. in 2013. Lawson-Fisher, Associates, P.C. added improvements to plan in 2021.

18" Thick Rip Rap on Seewall

Add three dyewalls to the lowest part of the pond.

Expand pond by 128,500 cubic-feet.

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PH. (574) 234-5167

PROJECT NUMBER: 202029.00

SHEETS: 1 of 1

DATE: JAN, 2021

NOT FOR CONSTRUCTION

HERCEG & ASSOCIATES, INC.
ENGINEERS, ARCHITECTS & ENVIRONMENTAL PLANNERS
1000 N. WASHINGTON ST., SUITE 200
SOUTH BEND, INDIANA 46601
PHONE: (574) 336-8888

INDIANA
DEPARTMENT OF TRANSPORTATION
NORTH POND
STA. 7+00 TO 22+04.89 LINE *P-2

RECOMMENDED SCALE: HORIZONTAL SCALE: 1" = 40'

VERTICAL SCALE: 1" = 10'

DESIGNER: HERCEG & ASSOCIATES, INC.

CHECKER: JAMES W. WILSON

REVISIONS:

NO. 1: DATE: 01/20/2021 BY: JMW/BJW

LAWSON-FISHER, ASSOCIATES, P.C.
KNOLLWOOD PARK VILLAS SUBDIVISION
STORM WATER DRAINAGE STUDY
FIGURE 8
RECOMMENDED CONCEPTUAL IMPROVEMENTS



***APPENDIX A
DRAINAGE CALCULATIONS***



Table A1: Curve Numbers

Sub Watershed	Land Use	Soil Type	CN
Drywell	Developed, Open Space; Developed, Low Intensity; Pasture/Hay	B	68
Node 1	Developed, Low Intensity; Developed, Open Space	B	68
Node 2	Developed, Low Intensity; Developed, Open Space	B	68
Node 3	Developed, Low Intensity; Developed, Open Space	B	68
Node 4	Developed, Open Space; Developed, Low Intensity; Developed, Medium Intensity	B	69
Pond 1	Developed, Low Intensity; Developed, Open Space	B	68
Pond 2	Developed, Open Space; Developed, Low Intensity	B	69
Pond 3	Developed, Low Intensity; Developed, Open Space	B	68
Gumwood Ag. Area	Developed, Open Space; Developed, Low Intensity	B	68
Gumwood Rd.	Developed, Low Intensity; Developed, Open Space	B	69



Table A2: Time of Concentration (TR-55 Methodology)

Sub Watershed	Travel Length (feet)	Tc (minutes)
Drywell	1,025	12
Node 1	854	5
Node 2	1,067	12
Node 3	411	5
Node 4	609	11
Pond 1	938	12
Pond 2	1,163	12
Pond 3	662	8
Gumwood Ag. Area	1,293	11
Gumwood Rd. Total Combined + 5 min.	2704	16

Table A3: Peak Volume in Gumwood Road Expansion Project Retention Pond

Gumwood Road Retention Pond Scenario	Volume (CF)	Volume (Acre-Feet)
Plugged Drywell	672,100	15.43
Unplugged Drywell	669,160	15.36



APPENDIX B
PRELIMINARY COST ESTIMATE



PRELIMINARY COST ESTIMATE FOR RECOMMENDED IMPROVEMENTS

Expand Pond, Plug Pipe to Drywell, and Implement 2009 Geotechnical Recommendations

ITEM NO.	DESCRIPTION	QTY	UNIT	UNIT PRICE	EXTENSION
1	Land Acquisition	0.6	AC	\$21,300.00	\$12,780.00
2	Construction Engineering	1	LS	\$11,410.00	\$11,410.00
3	Mobilization and Demobilization	1	LS	\$19,010.00	\$19,010.00
4	Drywell Structure (New)	3	EA	\$4,000.00	\$12,000.00
5	Rip Rap	1760	TON	\$50.00	\$88,000.00
6	8" Plug for Drywell	1	EA	\$850.00	\$850.00
7	Excavation	7000	CY	\$25.00	\$175,000.00
8	Dewatering	1	LS	\$85,000.00	\$85,000.00
9	Geotextile	1720	SY	\$10.00	\$17,200.00
10	Mulched Seeding	210	SY	\$10.00	\$2,100.00
SUBTOTAL:					\$410,570.00

Contingency (15%): \$61,590.00

Total Estimated Construction Cost: \$472,160.00

Engineering, Surveying (10%): \$47,220.00

Total Estimated Project Cost: \$519,380.00



***APPENDIX C
PHOTOGRAPHS***

**KNOLLWOOD PARK VILLAS
PHOTOGRAPHS**



Photograph 1: Lot #19 Drywell



Photograph 2: Drywell Location in Swale

**KNOLLWOOD PARK VILLAS
PHOTOGRAPHS**



**Photograph 3: Beginning of Rip Rap Overflow from
Retention Pond #1 to Gumwood Road Retention Pond**



**Photograph 4: Rip Rap Lined Overflow from
Retention Pond #1 to Gumwood Road Retention Pond**

**KNOLLWOOD PARK VILLAS
PHOTOGRAPHS**



Photograph 5: Overflow into Gumwood Road Retention Pond



Photograph 6: Gumwood Road Retention Pond Water Level



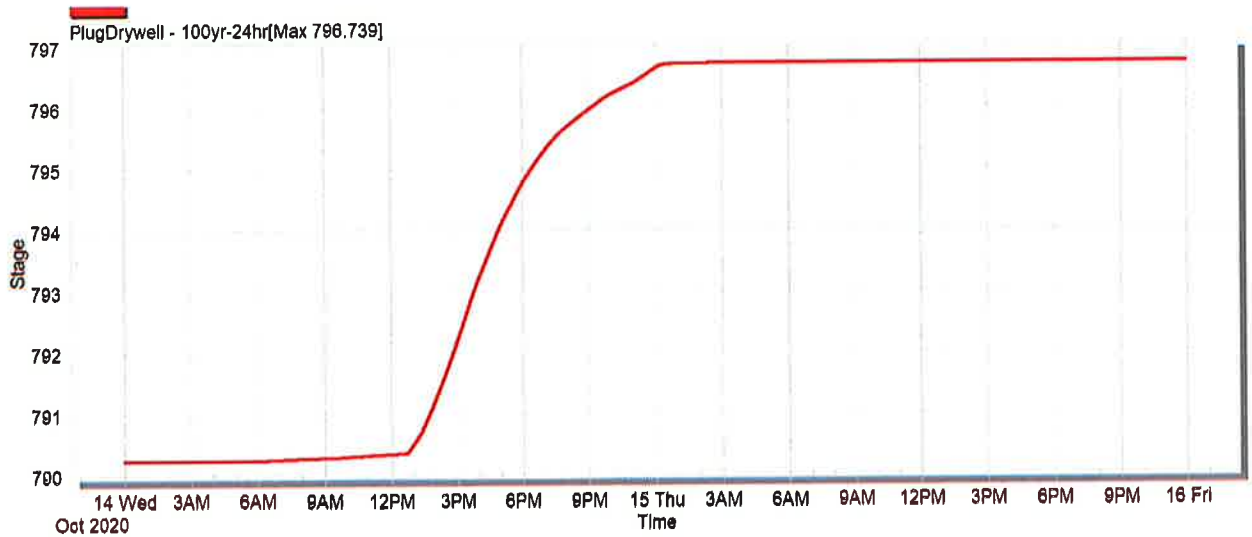
***APPENDIX D
XPSWMM MODEL
OUTPUT GRAPHS***



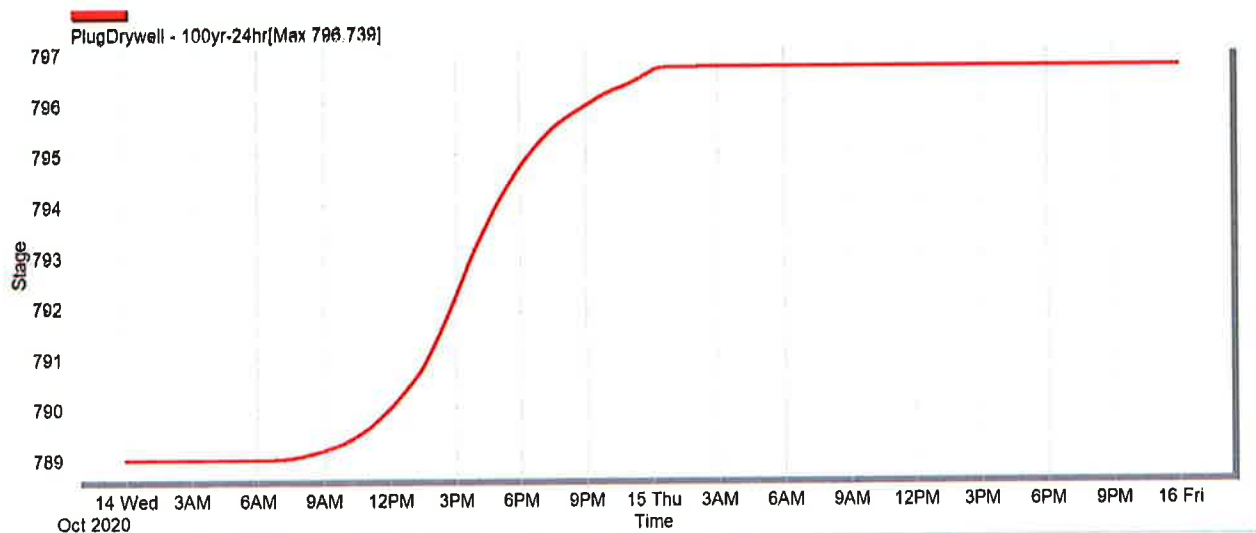
KNOLLWOOD PARK VILLAS STORM WATER DRAINAGE STUDY

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Graph 1: Plug Pipe to Drywell, Retention Pond #1



Graph 2: Plug Pipe to Drywell, Gumwood Road Retention Pond

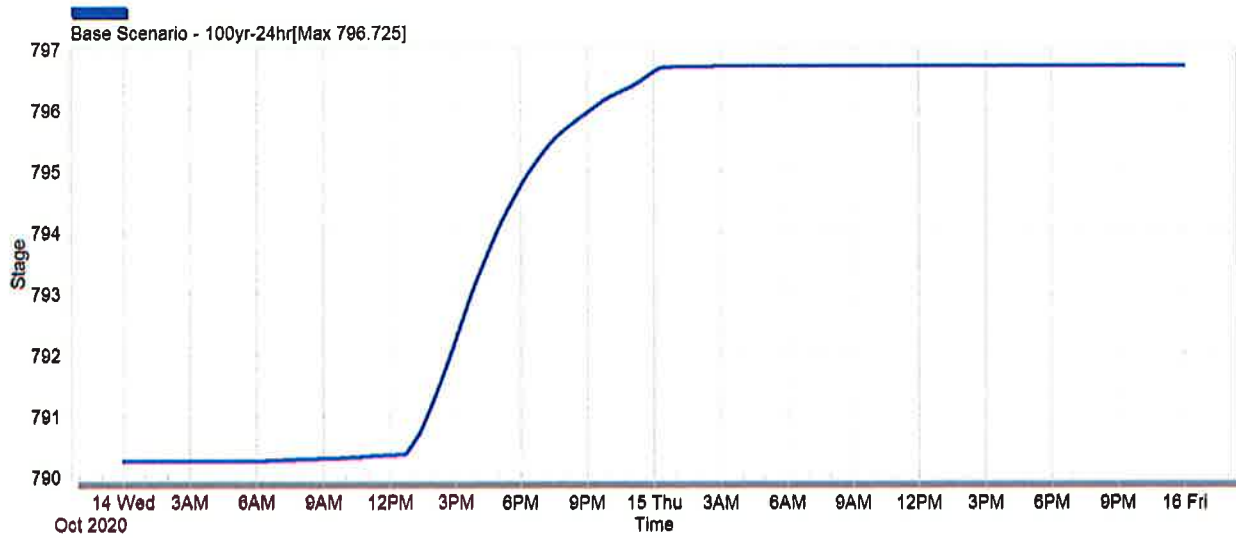




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Graph 3: Leave Pipe to Drywell As-Is – Un-Plugged, Retention Pond #1



Graph 4: Leave Pipe to Drywell As-Is – Un-Plugged, 2013 Retention Pond

