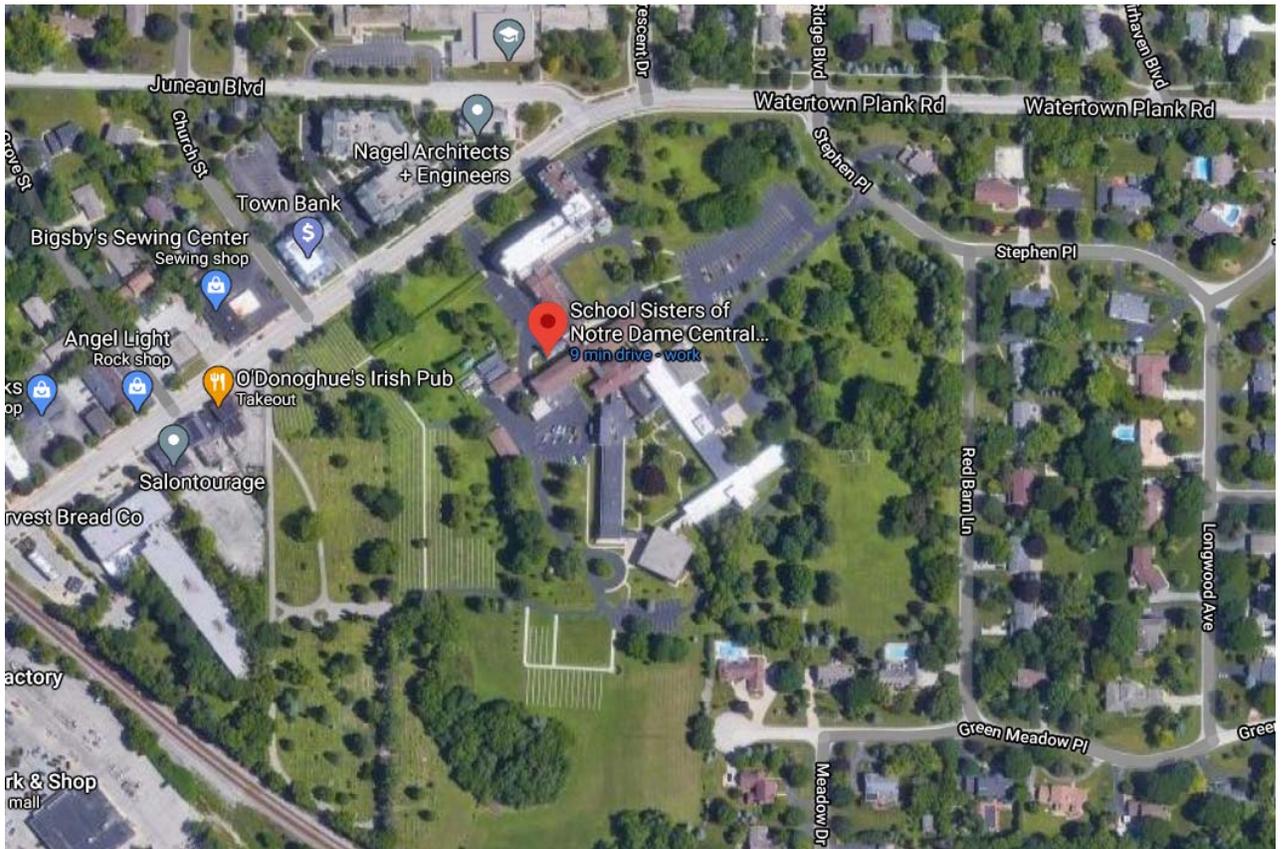


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## Draft Storm Water Management Report School Sisters of Notre Dame Apartment Development



Submitted To:  
Mr. Thomas Harrigan  
Village of Elm Grove

CONCEPTUAL STORMWATER MANAGEMENT REPORT

SCHOOL SISTERS OF NOTRE DAME DEVELOPMENT  
ELM GROVE, WI

December 21, 2020 (First Submittal)

April 27, 2021 (Second Submittal)

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PROJECT #40380

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## Section I. Introduction

### 1.1 Project Overview

K. Singh & Associates, Inc. (KSingh) was retained to provide Civil Engineering design services for the planned School Sisters of Notre Dame development located off Watertown Plank Road in the Village of Elm Grove. The site is currently used by the School Sisters of Notre. Please refer to Appendix A for a project overview, proposed site plan and Plat of Survey.

The development includes razing of eleven structures, remodeling of the Notre Dame and Maria Halls, and construction of three new buildings with below grade parking. The project also includes a central courtyard with amenities surrounded by a roadway loop. The cemetery grounds to the west of the site will remain in place. The land along the east side of the site adjacent to Stephen Place and Red Barn Lane are planned for single family home lots. Land at the south end abutting the railroad right of way is planned as a single-family home neighborhood. Connections to Watertown Plank Road and Green Meadow serve as vehicle access points for the site.

This report is being prepared as an update to the Village after the April 2021 Public Works Committee Meeting. This is a second draft of the storm water report and a final report will be submitted based on review and feedback from the Village of Elm Grove on this second updated submittal.

### 1.2 Code Compliance

This project is a new development of a vacant site. Please see below for a summary of the proposed site activities:

- Total area of property(once certified survey map is recorded) = 29.56 acres
- Total area of stormwater analysis = 29.56 acres
- Impervious area before construction = 6.14 acres
- Impervious after construction = 8.79 acres

The following storm water-related permits / requirements are triggered:

- Village of Elm Grove Review
- MMSD Chapter 13 (via Village of Elm Grove)
- WDNR WRAPP (60% TSS Reduction Goal)
- DSPS Review of Private Exterior Site Plumbing
- Within 5 miles of Timmerman Airport (dry ponds designed to drain within 24-hours)

The Village Review technical requirements are as follows:

- Peak Discharge
  - MMSD Chapter 13 Requirements
- Total Suspended Solids
  - 60% Reduction

Please refer to the Appendix B for SWMP-1 to view the existing conditions drainage areas. Please refer to Appendix C for SWMP-2 which includes the proposed conditions drainage areas. Appendix D includes the WinSLAMM results.

### 1.3 Legal Description of the Property and Owner Information

- A Plat of Survey with legal description by Chaput Land Surveys can be found in Appendix A
- The Owner for this development is SSND Apartments, LLC

### 1.4 Report Organization

The following information presented in this report details the design assumptions, computations, conclusions, and recommendations for the proposed development. This report is organized into three sections. Section I provides an introduction for the proposed development. Section II provides a narrative of the stormwater management methodology for the development. Section III provides a certification of the site investigation, plans, designs, computations, and drawings.

### 1.5 Limitations of Assessment

The existing conditions were developed using a Plat of Survey dated May 4, 2020 by Chaput Land Surveys. Please refer to Appendix A for the Plat.

The analysis and report were prepared using data from the Geotechnical Engineering Report dated June 3, 2020 by GZA GeoEnvironmental, Inc (GZA). GZA subsequently provided an infiltration memorandum dated February 4, 2021. Please refer to Appendix E for the report and memorandum.-

## Section II. Project Narrative

### 2.1 Pre-development Conditions

#### 2.1.1 Pre-development Watershed Description

The existing site is currently a partially developed site used by the School Sisters of Notre Dame for residential purposes. The remainder of the site is comprised of cemetery grounds, wooded/landscaped areas, parking lots, and walking paths. The total watershed area considered was 29.56 acres. Please refer to SWMP-1 in Appendix B for more details on the breakdown of the existing drainage areas.

#### 2.1.2 Topography and Surface Water Drainage

The existing surface elevation of the site ranges from 775' in the northeastern portion of the site to 731 on the south end of the property. The overall topography of the site has a relatively significant relief from north to south. Drainage patterns are predominantly north to south and the outlet points are two existing depressed areas on the southwest and southeast corners of the site. These depressed areas are noted in NRCS Soil Survey Maps as "Gravel Pits". It is assumed that these areas were excavated for gravel previously and were never reclaimed or filled back to adjacent grade. Please refer to Appendix A for the NRCS Soil Survey Map, the Plat of Survey and refer to Appendix B for SWMP-1 showing the existing drainage areas.

In addition to the existing depressed areas on the south portion of the site, there is a gravel infiltration area in the southeast corner of the site that receives a large sheet flow area and a 12-inch CMP from the northern campus area. This gravel area was installed to prevent conveyance of storm water from the SSND site to existing ditches between homes north of Green Meadow Place. This is a key drainage pattern that has been adjusted in the proposed plan. The proposed plan has swales, a berm and pipe systems to convey upstream run-off from the northern areas to the dry ponds on the interior of the site, and ultimately to the existing southeast basin.

#### 2.1.3 Site Geology and Hydrogeology

The subsurface soil conditions of the site are described using geologic data gathered from twenty-one soil borings performed at the site. The Geotechnical Engineering Report can be found in Appendix E. Based on the report Type C soils were used when selecting curve numbers. Based on the report, ground water was reported at an elevation of 17-18 feet below ground surface (bgs).

Infiltration tests have been conducted and the Geotechnical Engineering Consultant has completed the field tests (double ring infiltrometer testing). Please refer to Appendix E for the infiltration test locations and results.

#### 2.1.4 Wetlands & Floodplain

There are no floodplains present on site indicated by research on FEMA FIRM Panel Mapping. There are no mapped wetlands on site based on the WDNR Surface Water Data Viewer; however, there are wetland indicator soils on-site. Please refer to Appendix A for more information.

### 2.2 Post-development Conditions

#### 2.2.1 Post-development Watershed Description

The total analysis area for the site is 29.56 acres. Of that, 8.79 acres are impervious leaving 20.77 acres of pervious area. Of the total analysis area, only 0.63 acres are flowing off-site and this is primarily due to the feasibility

of match slope conditions to the surrounding land. Please refer to Appendix C, SWMP-2, for a visual representation and breakdown of the proposed site impervious and open space areas.

### 2.2.2 Method of Analysis

The analysis of the pre and post-developed site was performed utilizing HydroCAD® Storm Water Analysis version 10.00. The analysis uses TR-55 methodology for hydrologic and hydraulic analysis. Please refer to Appendix C for the detailed hydrologic output for sizing the swales & ponds.

### 2.2.3 Topography and Surface Water Drainage

The onsite overall drainage patterns flow from north to south. Within the courtyard there is underground storage.. The underground storage is used to reduce peak flows from the buildings and roadways. The underground storage system is in the process of being selected. Two vendors have been contacted to provide pricing and plan details. Please refer to Appendix F for plan details from ADS which are shown for reference. It should be noted that ADS' system provides full live storage while also reducing TSS. Once a final system is selected, the WinSLAMM model will be updated accordingly. For the purposes of this submittal, the underground storage system is only being used for peak flow reduction at this time.

Throughout the site, storm water is conveyed using storm piping and overland flow to swales located on the eastern and western edges of the site. The swales convey the stormwater to the ponds south of the buildings. The ponds outlet to different locations. Please refer to SWMP-2 for the outlet locations. The capacity of the swales exceeds the 100-year inflows. The majority of the pipes will be sized for the 10-year, 24-hour event; however, there are instances where pipes will be sized for the 100-year event. The 100-year pipes are identified on SWMP-2 and are oversized based on restrictions in overland flow paths based on adjacent land constraints.

### 2.2.4 Proposed Drainage Patterns

The details of where each catchment drains can be found in a table on SWMP-2 for proposed drainage patterns. Below is a summary of the drainage patterns proposed for the development:

- Major Catchment Area Routing
  - Portion of Building Roofs and Interior Courtyard Drain to Underground Storage 1 located in the courtyard
  - Building 1 Roof not captured by Underground Storage 1 is conveyed to the captured via storm sewer pipe and routed to Dry Pond 1
  - Building 2 Roof not captured by Underground Storage 1 is conveyed to the eastern swale
  - Building 3 Roof not captured by Underground Storage 1 is conveyed to Dry Pond 1
  - Eastern Single Family Lots conveyed to eastern swale and to Dry Pond 1
  - Southern Eastern Family Lots (3 to the south) are routed to a front yard rain garden
  - Existing Cemetery Grounds and Expanded Parking Lot conveyed to Infiltration Basin 1
  - Preserved tree area (Area I in SWMP-2) follows existing contours / drainage pattern south to north face of berm where a ditch conveys it west into Dry Pond 2
  - South Campus is conveyed to Existing Southeast Basin via roadside swales along the proposed Green Meadow Extension and is routed through Dry Pond 3 before outletting to the Existing Southeast Basin

- BMP Routing
  - Underground Storage 1 outlet is one pipe over the parking garage between Buildings 1 and 3 ultimately to Dry Pond 1
  - Infiltration Basin 1 has freeboard at the 100-year event but has an overland flow route via weir that is outletted to a swale along the west and southern boundaries of the site which outlets to Dry Pond 3 and ultimately discharged to Existing Southeast Basin
  - Dry Pond 1 and Dry Pond 2 both outlet to pipes which discharge to South Campus swale on the southeastern portion of the site
  - Dry Pond 3 outlets to pipe which discharges to Existing Southeast Basin

A summary of existing and proposed discharges to the site outlets is provided in the Table below:

**Table 1 – Ultimate Discharge Points Existing vs Proposed Flows at 100-Yr**

Site Discharge Point	Existing Flow (cfs)	Proposed Flow (cfs)
Existing Southeast Basin	15.17	4.53
Off-site Untreated	56.84	3.92

Please note an analysis of the existing Southeast Basin using field measurement data and LiDAR data.. The water surface elevations at the 1, 2, 10, and 100 year event are contained in the Southeast Basin in the proposed conditions. The Southeast Basin can be referenced in Appendix B for Existing Conditions and Appendix C for Proposed conditions.

### 2.3 Site Hydrologic and Hydraulic Characteristics

Hydrologic and hydraulic analyses were required to determine peak storm water runoff rates from the site for existing and proposed post-developed conditions.

The following tables summarize the results of the analysis:

**Table 2 – Storm Event Rainfall  
Depths**

Storm Event (year)	Rainfall (inches) *
1	2.40
2	2.70
10	3.81
100	6.18

\*Rainfall data is based on NRCS runoff modeling methodology volume 8 of Atlas 14, published by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, 2013.

**Table 3 – Overall Site Existing vs. Proposed Peak Flows\***

Storm Event (Year)	Existing (cfs)**	Proposed – With Detention (cfs)***	Proposed – Off-site Undetained****
1	17.17	0.67	0.68
2	22.17	0.90	0.90
10	39.77	1.88	1.79
100	80.70	4.53	3.92

\*includes all sub-basins in Table 3

\*\*Peak flows shown take into account infiltration prior to flowing offsite. Shown are to total quantities of water flowing offsite after infiltration (cfs-cubic feet per second).

\*\*\*Peak flows shown are from areas releasing at Existing Southeast Basin. Detained areas going to Southeast Basin are fully infiltrated at the 100-year storm event.

\*\*\*\*Peak Flows shown are un-detained areas flowing offsite

The unit release rate method is being utilized for the site and a breakdown of that is below:

**Table 4 – Unit Release Rate Results**

Storm Event (Year)	Required Release Rate (cfs)	Proposed – Release Rates (cfs)
2	4.43	0.90
100	14.78	3.92

\*Unit release rate requirement determined by multiplying total site area by MMSD requirements (0.15 cfs/acre for 2 year, and 0.5 cfs/acre)

### 2.3.1 Proposed Condition Peak Flows & Infiltration

The proposed land slopes for the site will be 0.5% to 33%. The sizing of the ponds, five swales, infiltration basin and Existing Southeast Basin were modeled using direct routing in HydroCAD. The Existing Southeast Basin was modeled as a pond in HydroCAD by utilizing LiDAR contours of the existing area. Reach modeling requires sizing for the 100-year storm event in order to allow all inflow to pass through each reach. Please note for infiltration, rates in inches/hour were established based on infiltration test results, consultation with the Geotechnical Engineer, and review of the infiltration table in NR 151. Double-ring infiltrometer tests were performed in each of the 3 test pit locations. Infiltration tests were conducted in accordance with the Wisconsin Department of Natural Resources (WDNR) Technical standard 1002. The locations of the tests and results can be referenced in Appendix E. The test locations are in the dry ponds 1 and 2, and the infiltration basin. The table below shows a summary of test results and design infiltration rates used:

**Table 5 – Infiltration Summary**

Test Pit	Pond Designation	Approx. Ground Elevation (FT)	Approx. Test Elevation (FT)	Stabilized Test Infiltration Rate (in/hr)	Design Infiltration Rate (in/hr)
1	Dry Pond 1	753.8	750.0	12.9	6.0
2	Dry Pond 2	752.3	750.7	1.0	0.5
NA	Dry Pond 3	NA	NA	NA	1.0

3	Infiltration Basin 1	744.0	732.0	10.8	8.0
NA	Existing SE Basin	NA	NA	NA	5.0*

\*The same infiltration rate was used for the Existing Southeast Basin in existing and proposed conditions. Please refer to Appendix B for existing hydrologic inputs and output and Appendix C for the proposed hydrologic inputs and output. Tables 6-1 summarize the ponds, infiltration basin, Existing Southeast Basin and swale storage data:

**Table 6 – Underground Storage 1**

Storm Event	Discharge Rate (cfs)	Water Surface Elevation	BMP Top Elev.
1	0.61	753.50	755
2	0.82	753.59	
10	1.73	753.93	
100	2.87	754.80	

\*Weir to the infiltration basin not activated by the 100-yr storm.

**Table 7 – Dry Pond 1**

Storm Event	Outflow (cfs)	Water Surface Elevation	BMP Top Elev.
1	3.89	750.30	754
2	3.96	750.43	
10	4.29	751.02	
100	5.14	752.49	

\*Weir to the infiltration basin not activated by the 100-yr storm.

**Table 8 – Dry Pond 2**

Storm Event	Outflow (cfs)	Water Surface Elevation	BMP Top Elev.
1	0.13	749.50	752
2	0.14	749.68	
10	0.16	750.41	
100	1.19	751.63	

\*Weir to the infiltration basin not activated by the 100-yr storm.

**Table 9 – Dry Pond 3**

Storm Event	Outflow (cfs)	Water Surface Elevation	BMP Top Elev.
1	0.26	739.72	743
2	0.27	739.91	
10	0.83	740.45	
100	1.22	741.77	

\*Weir to the infiltration basin not activated by the 100-yr storm

**Table 9 – East Swale**

Storm Event	Outflow (cfs)	Average Flow Depth (ft)	Total Swale Depth
1	7.91	0.43	1-ft
2	9.99	0.49	
10	18.27	0.69	
100	37.20	1.00	

**Table 10 – West Swale**

Storm Event	Outflow (cfs)	Average Flow Depth (ft)	Total Swale Depth
1	2.67	0.06	1.33-ft
2	3.51	0.12	
10	7.12	0.32	
100	15.72	0.61	

**Table 11 – South Campus East Swale**

Storm Event	Outflow (cfs)	Average Flow Depth (ft)	Total Swale Depth
1	0.04	1.01	4-ft
2	0.04	1.36	
10	0.06	2.59	
100	1.84	3.67	

**Table 12 – South Campus West Swale**

Storm Event	Outflow (cfs)	Average Flow Depth (ft)	Total Swale Depth
1	0.45	0.25	1-ft
2	0.59	0.28	
10	1.20	0.37	
100	2.64	0.50	

**Table 13 – Infiltration Basin 1**

Storm Event	Infiltration (cfs)	Water Surface Elevation	BMP Top Elev.
1	0.65	738.16	745
2	0.77	738.85	
10	1.27	741.11	
100	2.30	744.61	

\*Detained areas going to infiltration basins are fully infiltrated at the 100-year storm event

**Table 14 – Existing Southeast Basin**

Storm Event	Ex. Water Surface Elevations	Prop. Water Surface Elevations	BMP Top Elev.
1	730.50	730.09	740
2	730.67	730.12	
10	731.28	730.39	
100	732.44	731.65	

\*Detained areas going to infiltration basins are fully infiltrated at the 100-year storm event.

The existing southeast basin was modeled as a pond using survey data and LiDAR data. The existing area draining to the southeast basin is shown on SWMP-1, and the proposed drainage areas being routed to this area are shown on SWMP-2.

Also, please refer to Appendix F for Civil Plans. The Civil Plans now include plan and profiles for the swales, cross sections for the swales, and pond section details for the ponds and the infiltration basin.

**2.4 Storm Water Quality Analysis**

The existing site has a swale on the east side of the site, infiltration areas on the east side of the site, and storm sewer piping. There is also a cistern on site. On the south end of the site are two depressed areas that were formerly excavated gravel pits that were not reclaimed/filled to adjacent grades. These two low areas capture water from adjacent areas. Storm water quality was analyzed using WinSLAMM. For the proposed condition, total suspended solids were reduced 74.43% utilizing a combination of BMPs including underground storage, oversized manholes, and filters. Please refer to Appendix D for the WinSLAMM results.

Based on coordination with WDNR, and Village of Elm Grove ordinance for TSS reduction, the goal for this project is 60%. Up-FLO filters will be utilized in combination with other BMPs to achieve the required TSS reduction. The underground storage system details can be found in Appendix F.

**2.5 Pipe Capacities**

Pipe capacities were modeled using reaches as storm pipes during a 100-year storm event. The full storm system has not been laid out at this stage of the design. The non-100-year pipes will be sized for the 10-year, 24-hour event. The 100-year pipes are in place since they are part of the 100-year flow paths to BMPs. Please see Appendix F for the storm sewer pipe sizing HydroCAD® output. The 100-year storm pipes are shown on SWMP-2.

**Table 15 – Pipe Sizing Table for 100-Yr Sized Pipes**

Pipe Name	Pipe Size (in)	Slope (%)	Capacity (cfs)	100-Yr Flow (cfs)
P1	24	0.11	10.46	3.59
P2	24	1.19	34.39	16.82
P3	18	0.47	10.07	7.20

\*Pipe names can be found in Appendix C in the SWMP 2 Exhibit.

**2.6 Maintenance Agreement & Easements**

A Maintenance Agreement will be developed for this project as the design progresses. Prior to developing it, feedback on the conceptual storm water management report is needed since feedback could impact BMP selection and sizing which would impact the associated maintenance requirements. Easements for stormwater will be displayed on the final CSM. The current CSM contains key easement information related to stormwater.

## Section III. Certification of Plans, Designs, Computations, and Drawings

### 3.1 Certification of Report

All plans, designs, computations, and drawings are certified by a Wisconsin-licensed professional engineer prepared in accordance with accepted engineering practice and requirements of the ordinance.

## Section IV. References

1. Web Page: <http://hdsc.nws.noaa.gov/hdsc/pfds/> Location of "Precipitation Frequency Data Server"

*Please use the link at the bottom of this page to download the following appendices. Please note this was done to conserve paper.*

**Appendix A** Project Overview, Site Map & Plat of Survey, NRCS Soil Survey Map, FEMA & DNR Mapping

**Appendix B** Existing SWMP-1 and Hydrologic & Hydraulic Output

**Appendix C** Proposed SWMP-2 and Hydrologic & Hydraulic Output

**Appendix D** WinSLAMM Input & Output

**Appendix E** Geotechnical Investigation Report & Proposed Infiltration Test Locations

**Appendix F** Civil Plans, ADS Plans & Underground Storage Plans

\*Digital Model Files for HydroCAD and WinSLAMM are also included in this download link.