

Drainage Report

Wolfe Addition No. 2

Demars Construction

September 16, 2022

Submitted by:

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Certification

Drainage Report

For

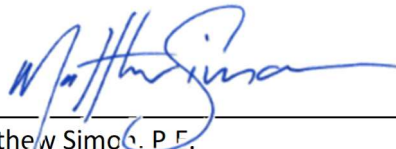
Wolfe Addition No. 2

Demars Construction
0M1.127338

September 16, 2022

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

By:



Matthew Simon, P.E.
License No. 57832

Date: September 16, 2022

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I. Introduction

Demars Construction will be developing the Wolfe Addition No. 2 property which will include constructing and extending Turnberry Drive and Excel Drive as part of a mixed commercial and private development plan. The project boundaries consist of: Power Drive to the east, N Victory Drive to the south, existing residential housing along Cypress Drive to the north, and Firestone Drive to the west. The proposed site development is planned to include a commercial warehouse, private townhome development, commercial condominium site, self-storage facility, and 2 parcels for future development. Bolton & Menk has completed the design for the Turnberry Drive & Excel Drive extension project and the private townhome development and is under contract to design the commercial condominium site, self-storage facility and the commercial warehouse with the preliminary layouts completed. This drainage report serves to outline the proposed stormwater management design for the entire Wolfe Addition No. 2 property.

II. Analysis

To understand the drainage conditions of the project area and guide the proposed stormwater management design, a hydrologic and hydraulic model was developed using Autodesk's Storm & Sanitary Analysis (SSA). SSA uses the Soil Conservation Service (SCS) Technical Release (TR-20) methodology to route watershed runoff through the system using a rainfall hydrograph. NOAA Atlas 14 rainfall depths were used along with the NRCS's MSE 3, 24-hour rainfall distribution. The rainfall depths used for the 2, 10, and 100-Year rainfall events were 2.87", 4.28" and 7.20", respectively. Time of concentrations were calculated using the NRCS's TR-55 methodology. Drainage areas were delineated using a combination of LiDAR data and survey data where available. Soil types within the project area are dominated by clay loams characterized by the hydrological soil group type D.

III. Existing Conditions

Land use in the project area currently is all straight-row cropland. There is existing storm sewer along Power Drive that flows north and discharges into a large swale on the northeast side of Power Drive. Excess runoff from Power Drive continues to flow north and enters the storm system on Fieldcrest Drive. Much of the runoff currently generated within the project area sits in low points in the row crop farmland. There is also runoff from the project area that flows southward to existing storm sewer along N Victory Drive at the intersection with Excel Drive. The site for "The Pickle Barn" lies southeast of the proposed project area and is currently under construction. The site has its own stormwater management, including treatment on site. Four wetlands were delineated within the site area, all of which will require mitigation.

Figure 1: Existing Drainage Area Map can be found in Appendix A which shows the delineated wetlands, existing storm sewer layout, drainage areas, and flow directions.

IV. Proposed Design

The proposed stormwater management system has been designed to meet the MPCA's NPDES Construction Stormwater Permit requirements and the City of Mankato Grading Manual design standards. Along with the necessary catch basins and storm sewer, the proposed stormwater management system will consist of: two filtration basin designed to serve the warehouse, storage facility and a portion of Excel Drive, and two wet sedimentation basins to serve the commercial condominium site, and the proposed townhomes on the north side of the project. The proposed project has two primary outfalls. The first outfall is the existing swale northeast of the project,

east of the Power Drive and Dogleg St intersection and the second outfall is the existing 30" storm pipe at Excel Drive that connects into the N Victory Drive storm system.

Storm sewer for the project has been sized based on four different design storm events. For sizing backyard storm systems, the 2-Year rainfall event was used. For the private townhome development, the 5-Year rainfall event. Lastly, per section 3.2.3 of the City of Mankato Grading Manual the City streets were designed for the 10-Year rainfall event and the 2-Year, 24-hour rainfall event with no soil infiltration.

Per section 3.2.3 of the City of Mankato Grading Manual, allowable gutter spread for a Non-State aid road is to maintain at least 1 driving lane 12 feet in width for every 2 driving lanes free from inundation. The proposed catch basins on City streets for this project has been designed to meet this standard

Figure 2: Proposed Drainage Area Map (North) & Figure 3: Proposed Drainage Area Map (South) can be found in Appendix A, and show the proposed storm sewer layout, treatment basins and drainage areas.

A. Water Quality Requirements

The proposed project has been designed to meet the more stringent water quality requirements of the City of Mankato Grading Manual Sec. 3.2.4.2.B., which states a permanent stormwater treatment basin is required for treatment of 1.1" of runoff over the new impervious surfaces. This exceeds the 1" requirement of the MPCA NPDES Construction Stormwater Permit. This requirement will be met through the construction of two filtration basins, and two wet sedimentation basins with water quality volumes set to meet this standard based upon the total proposed impervious area(s) that each basin serves.

Table 1 below shows the total change in impervious surfaces for the proposed project site.

Table 1 – Impervious Calculation	
	AREA (ac)
Existing	0.0
Proposed	23.11
Difference	+23.11

Therefore, the project will be required to treat 2.1 ac-ft (~92,300 cf) of runoff. This treatment volume requirement excludes the two lots reserved for future development west and east of the Excel Drive and N Victory Drive intersection.

B. Filtration Basins

Two filtration basins were designed for the site denoted as "Pond B" and "Pond D" on the Proposed Drainage Area Map. Pond B was designed to treat runoff from Excel Drive south of the gas easement intersecting the site, while Pond D was designed to serve the proposed storage facility and commercial warehouse sites. Pond B will be maintained by the City of Mankato and Pond D will be privately maintained. The filtration basins were designed per the City of Mankato Grading Manual requirements outlined in section 3.2.4. Both filtration basins will be served by an 8" and 12" perforated underdrain pipe that has been sized so that the basins will draw down within 48 hours. The trench detail for the perforated pipe within the filtration basin has been designed using coarse filter aggregate based on specific recommendations from the City of Mankato staff.

Additionally, Pond B has been designed to provide above the required treatment volume to account for the two lots reserved for future development west and east of the Excel Drive and

N Victory Drive intersection.

C. Wet Sedimentation Basins

A wet sedimentation basin was designed for the project that will serve the townhome development and the northern portion of Excel Drive. This basin is denoted as “Pond C” and will lie between Power Drive and the townhome development. All runoff from the proposed development north of Turnberry Drive will ultimately route through this basin. A second detention basin, “Pond A”, has been designed to serve and lie north of the commercial condominium site, west of Excel Drive. The wet sedimentation basins were designed per the MPCA NPDES Construction Stormwater Permit and MN Stormwater Manual best recommendations for allowable discharge rate and dead storage requirements.

D. Water Quality Provided

Table 2 below shows the designed water quality volume provided for each Pond. In Appendix B, detailed water quality worksheets can be viewed.

Table 2 – Water Quality Summary			
BASIN	NWL/BOTTOM (ft)	WQ ELEVATION (ft)	WQ VOLUME (ac-ft)
Pond A	1005.0	1006.5	0.30
Pond B	1004.0	1005.5	0.81
Pond C	1000.0	1001.0	0.67
Pond D	1004.0	1006.0	1.15
TOTAL WQ Prov.			2.93
TOTAL WQ Req.			2.11

V. Model Results

Table 3 below shows that the proposed design will reduce discharge rates to the Farmland west of the proposed project.

Table 3 – Discharge Rates (CFS) to Farmland West of Site			
	2-YEAR (2.87")	10-YEAR (4.28")	100-YEAR (7.20")
Existing	11.8	21.3	47.5
Proposed	6.8	11.6	23.4
Difference	-5.0	-9.7	-24.1

Table 4 below shows that the proposed design will reduce discharge rates to the existing Storm System on Fieldcrest Drive.

Table 4 – Discharge Rates (CFS) to Existing Fieldcrest Drive Storm System			
	2-YEAR (2.87")	10-YEAR (4.28")	100-YEAR (7.20")
Existing	10.3	15.4	16.8
Proposed	7.7	12.0	16.3
Difference	-2.6	-3.4	-0.5

Table 5 below shows that the proposed design will reduce the overall incoming discharge rates to the existing swale east of Power Drive for the 2-Year and the 10-Year rainfall event, while showing a minor increase for the 100-Year Rainfall event.

Table 5 – Discharge Rates (CFS) to Power Drive Swale			
	2-YEAR (2.87")	10-YEAR (4.28")	100-YEAR (7.20")*
Existing	34.8	100.6	154.0
Proposed	30.2	89.9	158.6
Difference	-4.6	-10.7	+4.6

*Note: Though the proposed discharge rate to the existing swale east of Power Drive for the 100-Year event is slightly higher than the existing discharge, the high-water level (HWL) does not change.

Table 6 below shows the overall proposed design reduces discharge rates leaving the site for all rainfall events.

Table 6 – Overall Project Discharge Rates (CFS)			
	2-YEAR (2.87")	10-YEAR (4.28")	100-YEAR (7.20")*
Existing	56.9	137.3	218.3
Proposed	44.7	113.5	198.3
Difference	-12.2	-23.8	-20.0

Table 7 below shows the basin characteristics and model results for the proposed basins.

Table 7 – Proposed Treatment Basins						
Basin	BASIN CHARACTERISTICS			2-YEAR (2.87")	10-YEAR (4.28")	100-YEAR (7.20")
	BOTTOM	NWL	EOF	HWL (ft)	HWL (ft)	HWL (ft)
Pond A	1000.0	1005.0	1009.0	1006.9	1007.4	1008.6
Pond B	1004.0	-	1009.0	1005.2	1006.1	1008.1
Pond C	996.0	1000.0	1006.0	1001.8	1003.0	1004.5
Pond D	1004.0	-	1009.0	1006.3	1007.0	1008.2

Table 8 below shows the existing and proposed high-water levels in the existing Power Drive Swale.

Table 8 – Power Drive Swale					
	BASIN CHARACTERISTICS		2-YEAR (2.87")	10-YEAR (4.28")	100-YEAR (7.20")
	BOTTOM	EOF	HWL (ft)	HWL (ft)	HWL (ft)
Existing	995.0	1004.0	998.0	999.0	1000.8
Proposed	994.0	1004.0	997.7	999.0	1000.8

Model results show that the proposed stormwater management design is providing a net benefit to the area with high-water levels and discharge rates improved or matched compared to the existing conditions, with the exception of a very minor increase in runoff rates to the Existing Power Drive Swale for the 100-Year rainfall event. The proposed project is providing a water quality treatment volume in excess of the requirements of the City and treatment in an area today that has no stormwater management.

VI. Summary

The Wolfe Addition No. 2 project is intended to bring multiple land uses to a growing area of Mankato, and achieves that through well laid-out properties and an effectively designed and placed stormwater management system. The proposed storm system, highlighted in this report, has been designed to properly manage the stormwater runoff that the developed parcels will produce, while minimizing any down-stream effects on the surrounding storm systems already in place. The proposed design meets the MPCA NPDES Construction Stormwater Permit and the Mankato Grading manual requirements and all impacted wetlands will be mitigated for.

This report is being provided along with the proposed construction plans for the Turnberry & Excel Drive Extension project. Please refer to the plan for additional design details.

Please feel free to contact me with any questions or comments about this report at Matthew.Simon@Bolton-Menk.com or by phone at (507) 625-4171, x3295. You may also reach out to the the lead project engineer Alec Pietz at Alec.Pietz@Bolton-Menk.com or by phone at (507) 766-3283, x3310.

Appendix A: Figures







Appendix B: Water Quality Spreadsheets

Demars Construction Wolfe Addition No.2 BMI Project No. 0M1.127338			
Subbasin Details			
INLET	AREA (AC)	CURVE NUMBER	TIME OF CONCENTRATION (MIN.)
C-11A	0.71	93.68	07
E-4	0.74	87.96	11
E-6	0.27	85.67	10
Out-02	2.73	88.36	12
C-11B	0.40	92.43	09
C-11D	0.39	93.87	07
64	0.26	93.39	07
POND-A	1.84	83.95	28
POND-A	2.40	98.00	12
B-3A	0.17	86.61	08
B-2	0.11	93.27	07
B-5B	0.46	85.50	12
B-5D	0.30	90.10	09
A-1A	0.18	93.38	07
EX18	0.19	98.00	07
EX19	0.18	98.00	07
A-3	0.74	90.33	09
A-1B	0.53	94.22	08
Out-05	0.14	79.00	09
A-3	1.12	87.48	09
A-3	0.31	91.63	09
EX23	3.34	86.10	15
A-4	3.07	89.38	12
A-4	1.73	88.27	12
64	0.78	98.00	07
B-5C	1.23	96.39	09
POND-B	6.26	84.00	25
POND-A	1.41	89.00	34
64	2.25	89.35	20
EX11	0.80	88.08	08
POND-D	6.27	98.00	18
Stor-EX	12.43	91.14	19
EX17	6.65	90.91	18
B-5A	0.25	88.61	08
POND-D	1.13	98.00	09
64	0.13	91.59	09
64	0.13	89.25	09
64	0.19	90.29	07
13A	0.26	92.70	10
14B	0.09	92.00	07
14C	0.98	87.34	19
14D	0.17	87.20	15
C-5B	0.98	89.68	21
64	0.33	93.83	08
64	0.18	93.73	07
64	0.12	87.52	07
64	0.04	98.00	07
64	0.04	91.37	07
D-1	0.80	90.51	15
D-2	0.37	83.58	12
D-3	0.23	90.75	07
EX20	0.17	92.79	07
EX9	0.13	98.00	07
EX14	0.59	95.57	07
EX6	0.49	87.30	08
E-1A	0.93	84.89	19
E-1	0.05	92.00	10
E-2	0.49	87.62	18
C-3	0.22	93.92	07
C-5A	0.63	93.80	11
E-3	0.76	87.92	14
F-1A	0.15	84.67	09
F-2	0.23	92.00	23
C-11C	0.47	95.04	08
POND-C/P-2	2.35	81.33	13
C-2	0.54	91.12	07
64	0.28	93.29	07
64	0.32	93.85	07
64	0.17	89.60	07
1A	0.13	93.25	07
F-3	0.69	92.00	15
F-3	0.86	82.52	24
E-5	0.18	86.65	19
EX21	0.10	98.00	07
1B	0.09	93.90	07
64	0.93	98.00	07
64	0.59	98.00	07
POND-D	1.71	80.00	21
64	0.04	98.00	07
EX10	2.04	90.05	21
A-4	0.44	92.28	12
E-4A	0.39	83.96	30

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